EAD **120017-00-0106**

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European Assessment Document for

Wood and metal lighting columns

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

1.1.1 General

This EAD covers wood and metal composite lighting columns (hereinafter referred toas "lighting column(s)") which are composed of a hollow cross-section mast structure (intended to be used with or without brackets), composed of (see Figure 1.1.1):

1. A mast made of either a glued laminated timber or a solid wood (see Clause 1.1.2),
2. A metal base compartment (see Clause 1.1.1) that connects the lighting column to the ground and enables to reach electronic components via a door.

The electric cables are stored in the metal base compartment, go through the mast and can reach the lantern via a cable entry slot under the lantern.

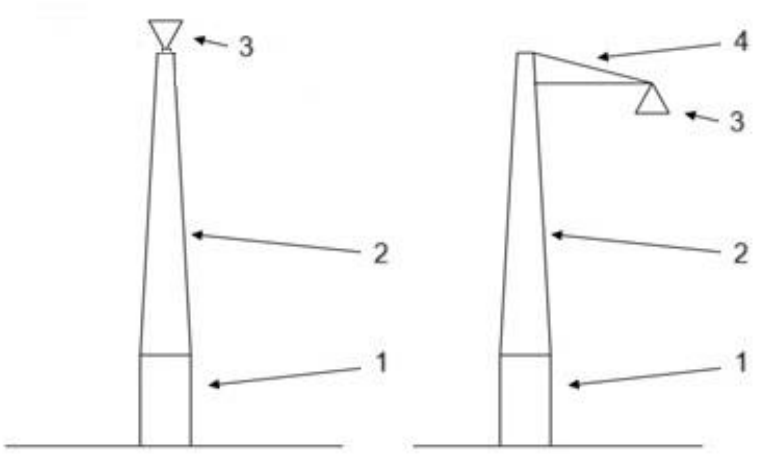
The connection between the mast and the metal base compartment is assembled by fitting: the connection is ensured by tight contact between the base compartment and the mast (see Figure 1.1.3, left). In addition, the following optional component may be included in the lighting column:

- Adhesives (see Figure 1.1.2 Clause 1.1.3) used to reinforce the mast structure (see Figure 1.1.2), or to reinforce the connection between the mast and the metal base compartment.
- Subsidiary metallic connectors such as metal dowel-type fasteners used to reinforce the mast structure (see Figure 1.1.2) (see Figure 1.1.3, centre).
- Base plate (see Clause 1.1.4) to connect the metal base compartment to the ground.

All cast metallic material's general dimensional and geometrical tolerances are in accordance with Clauses 7.2 and 7.3 of EN ISO 8062-3[1].

The lighting column's tolerance dimensions are in accordance with Clause 5 of EN 40-2.

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



Key:

1. Metal base compartment.
2. Mast structure.
3. Lantern (not part of the lighting column)
4. Bracket (not part of the lighting column)

Figure 1.1.1: Example of the lighting columns adding the lantern without and with bracket.

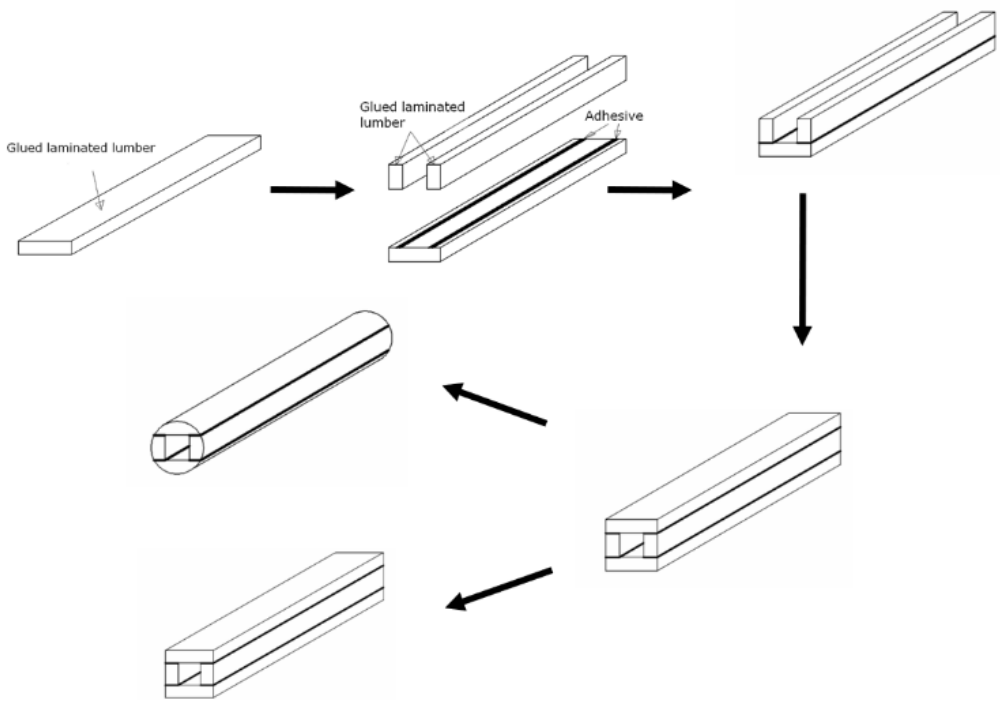


Figure 1.1.2: Mast description when reinforced with adhesives, with 2 examples of possible mast geometries (square or cylindrical masts). To each geometry of the mast, a single geometry of the cross section can be identified, defining a type of lightning column.

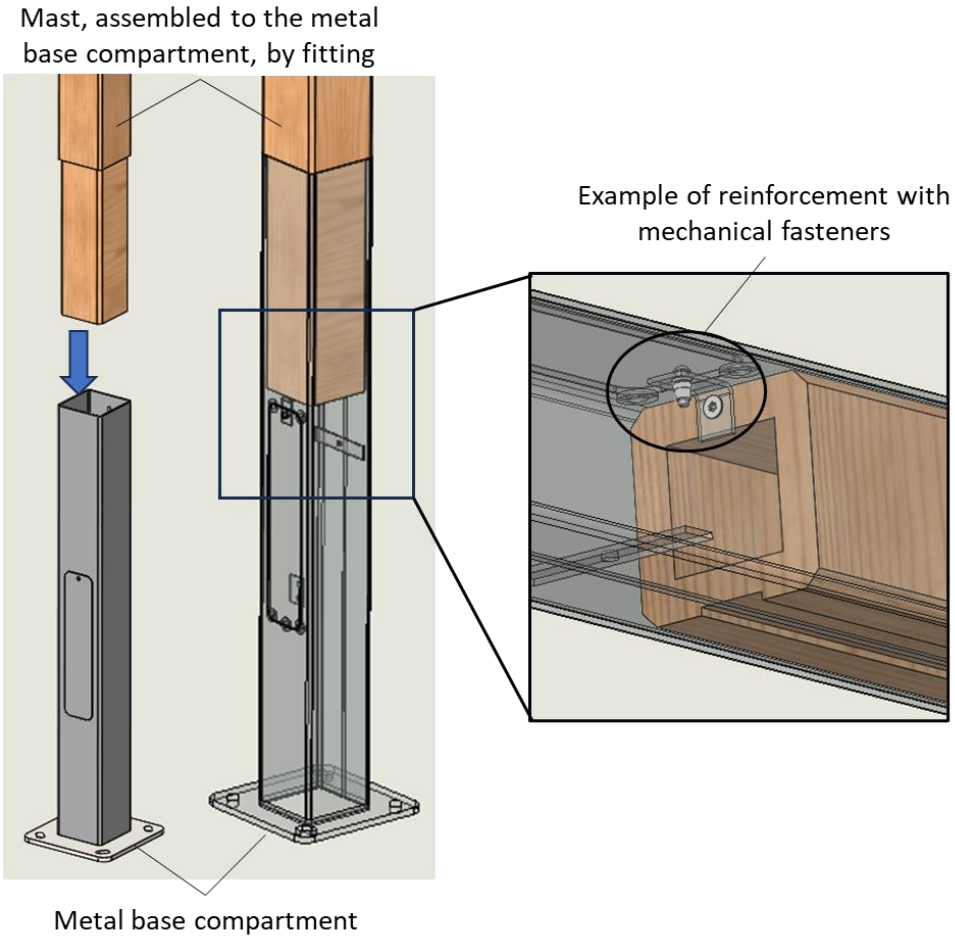


Figure 1.1.3: Example of mast assembly by fitting with the metal base compartment (left and centre) when reinforcing at the base with mechanical fasteners.

This EAD applies to lighting columns of no more than 20 m in height when the lantern is directly fixed to the top of a mast, and of no more than 18 m in height when the lantern is fixed to a straight or curved bracket. This upper height limitation is introduced in order to be aligned with the current EN 40-5.

Lighting columns families are defined by:

- The type of section of the lighting columns (squared, cylindrical or conical), with a range of possible diameters and height,
- combined with one type of connection between the mast and the base compartment,
- combined with the material of the mast,
- combined with the material of the base compartment,
- and combined by the position of the door opening.

The lighting columns are described using, for each lighting column family:

- Nominal height of the lighting column in m.
- Geometry of the cross-section of the mast and the metal base compartment – at least each extremity shall be described, and at the location of any abrupt changes of dimensions.
- Geometry of the door opening.
- Geometry of the cable entry slot under the lantern.

- Geometry of the base plates (if any).
- Geometry of the base plate (if any).
- The sharpness and roughness of the edges of the lighting columns.

The lighting columns are to be erected in accordance with the Manufacturer's Product Installation Instructions (from now on MPII).

The electrical equipment (including lantern, wiring devices, electrical boxes or enclosures), as well as the foundations of the lightning column are not covered by the EAD.

Traffic signal masts are not covered by this EAD.

The lighting columns are not fully covered by the following harmonised technical specifications: EN 40-5, EN-40-6 and EAD 120003-00-0106, as they do not cover composite metal / wood lighting columns.

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.

1.1.2 Mast structure

The mast structure is a hollow cross-section, made of glued laminated timber (i.e., structural timber member composed by at least two essentially parallel laminations, for which the characteristic bending and tensile strength, as well as stiffness and density are in accordance with EN 14080), or made of solid wood (i.e., timber of one species or species combination and one source (origin or provenance of the timber) for which the strength, stiffness and density are in accordance with EN 338.

The mast structure is placed between the base compartment and the lantern.

1.1.3 Metal base compartment

The metal base compartment is the structure made of steel, stainless steel or aluminium, that connects the lighting column to the ground and enables to reach electronic components via a door.

The metal base compartment's form and dimensions are in accordance with Clauses 4.3 to 4.6 of EN 40-2.

The metal base compartment can be made of either:

- Raw steel tubes in accordance with EN10025-1 or EN 10029.
- Aluminium tubes in accordance with EN 755-1, EN 755-2 and EN 755-7.
- Stainless steel tubes in accordance with EN 10217-7 or EN 10088-1.
- Aluminium casting in accordance with EN 1706.
- Spheroidal graphite cast iron in accordance with EN 1563.
- Sheets of metal for reconstructed profiles in accordance with EN 10025-1 and EN 10149-2.

1.1.4 Adhesives

If used in the lighting columns, adhesives are of the Type I in accordance with EN 301.

1.1.5 Base plates

Base plates' dimension and tolerances are in accordance with EN 40-2, Clause 4.6.

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

1.2.1 Intended use(s)

This EAD covers lighting columns used as circulation fixtures placed in any public or private areas.

The lighting columns are intended to be used for the Load duration classes and Service classes in accordance with EN 1995-1-1 Clause 3.1.4 and for the Use classes in accordance with EN 335.

The lighting columns can be used with or without any foundation following the prescriptions of EN 40-2 Clauses 4.5.1, 4.5.2 and 4.6.

In alignment with EN 40-2, Clause 4.4.5, the protection level for the metallic base compartment is:

- Class IP 3X in accordance with EN 60529 for lighting columns independently of the height of the metallic base compartment;
- Class IP 3X in accordance with EN 60529 for lighting columns for which the door of the metallic base compartment is located between ground level and 2,5 meters high;
- Class IP 2X in accordance with EN 60529 for lighting columns for which the door of the metallic base compartment is located above 2,5 meters from the ground.

The lighting columns are intended to be used with a lantern, with or without brackets (wood or metal) used to support the lantern (see Figure 1.1.1) following the MPII.

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 lighting columns for the intended use of 25 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.

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the lighting column 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	Bending moment	2.2.1	level and description
2	Shear strength	2.2.2	Level and description
3	Torsion moment	2.2.3	Level and description
4	Durability (corrosion protection of metallic parts)	Clause 11 of EN 40-5	Description
Basic Works Requirement 2: Safety in case of fire			
5	Reaction to fire	2.2.4	Class
Basic Works Requirement 4: Safety and accessibility in use			
6	Protection against mechanical impact	2.2.5	Level
7	Performance under vehicle impact (passive safety)	2.2.6	Level

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

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

2.2.1 Bending moments

Purpose of the assessment

The assessment aims to determine the maximum force that the lighting column withstands due to the distributed forces acting on the mast lighting column (i.e., the wind pressure and weight of the lighting column).

Assessment method

The assessment of the lighting column shall be undertaken by structural calculations aided by testing in accordance with Annex A. The maximum force shall be expressed by means of bending moment.

Expression of results

For each lighting column family (see Clause 1.1) the calculated bending moment of the lighting column shall be stated in the ETA as M_k in [daN.m] in accordance with Annex A.

In addition, lighting column materials and materials properties considered in the assessment shall be stated in the ETA.

2.2.2 Shear strength

Purpose of the assessment

The assessment aims to determine the maximum shear strength of the lighting column.

Assessment method

The assessment of the lighting column shall be undertaken by structural calculations aided by testing in accordance with Annex A.

Expression of results

For each family (see Clause 1.1) the calculated shear strength of the lighting column, shall be stated in the ETA as V_k in [MPa].

In addition, lighting column materials and materials properties considered in the assessment shall be stated in the ETA.

2.2.3 Torsion moment

Purpose of the assessment

The assessment aims to determine the maximum torsion that the lighting column withstands in service.

Assessment method

The assessment of the lighting column shall be undertaken by structural calculations aided by testing in accordance with Annex B. The maximum torsion that the lighting column shall be expressed by means of torsion moments.

Expression of results

For each family (see Clause 1.1) the calculated torsion moments of the lighting column, shall be stated in the ETA as M_t (daN·m).

In addition, lighting column materials and materials properties considered in the assessment shall be stated in the ETA.

2.2.4 Reaction to fire

Purpose of the assessment

This assessment is intended to provide the reaction to fire of lighting columns by considering the reaction to fire of their components.

Assessment method

Reaction to fire of the lighting column shall be assessed by considering the most conservative reaction to fire class obtained from the reaction to fire class of their components: mast structure made of glued laminated timber or solid wood and, optionally, adhesive (see Figure 1.1.2), metal base compartment (see Clause 1.1.3) and metal base plates (see Clause 1.1.5).

The metal 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 2000/605/CE 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.

The mast structure (made of glued laminated timber without adhesive) is consider to satisfy the requirements of class D-s2, d0 of the reaction to fire performance in accordance with the Commission Decision 2005/610/EC (as amended by the Commission Decision, 2017/1227) 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.

The mast structure (made of solid wood without adhesive) is consider to satisfy the requirements of class D-s2, d0 of the reaction to fire performance in accordance with the Commission Decision 2003/43/EC (as amended by the Commission Decision 2003/593/EC, 2006/673/EC and 2007/348/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.

When the mast structure made of glued laminated timber or solid wood without adhesive does not meet with the conditions fulfilled in the Decisions given the paragraphs above, or when the mast structure includes adhesive, it shall be tested, using the method(s) relevant for the corresponding reaction to fire class in accordance with EN 13501-1. The mast structure shall be classified in accordance with the Commission Delegated Regulation (EU) No 2016/364 in connection with EN 13501-1.

For the SBI test (in accordance with EN 13823) mounting and fixing criteria given in Clause 5.8 of EN 14080 shall be considered. Panels for the test specimens to be tested shall be of the same material as the used for the mast structure. In the case of mast structure with adhesive, the panels for the test specimens in SBI test shall include the maximum proportion of adhesive as it is used for the mast structure.

For the single flame source test (in accordance with EN ISO 11925-2), the test specimen shall be of the same material as the used for the mast structure. In the case of mast structure with adhesive, the test specimens shall include the maximum proportion of adhesive as it is used for the mast structure.

The reaction to fire class of the lighting column shall be the reaction to fire class of the mast structure because comparing with the reaction to fire of the metal parts, it results the most conservative reaction to fire class.

Expression of results

The reaction to fire class of the lighting column shall be stated in the ETA.

In addition, reaction to fire class of the mast structure and metal parts of the lighting column may also be stated in the ETA.

2.2.5 Protection against mechanical impact

Purpose of the assessment

The assessment aims to determine the maximum deformation that the metallic base withstands after a mechanical impact.

Assessment method

The assessment of the lighting column shall be undertaken in accordance with EN 40-5, Clause 9, with the following modification: the test shall comply with an impact protection category of IK08 as specified in EN 62262 with the door fitted.

Expression of results

The indentation in [mm] after impact shall be stated in the ETA.

2.2.6 Performance under vehicle impact (passive safety)

Purpose of the assessment

The assessment aims at determining the passive safety properties of support structures such as lighting columns.

Assessment method

Performance under vehicle impact (passive safety) shall be assessed in accordance with EN 12767 and taking into account Clause 6.2.2 of EN 12767.

The impact speed of the vehicle used for the high-speed test and referred to into Table 2 of EN 12767, shall be selected taking into account the MPII.
The Backfill type used for the test referred to into Table A.1 of EN 12767, shall be selected taking into account the MPII.

Expression of results

The following performances shall be stated in the ETA, for each test conducted:

- Low speed test (applicable for an impact speed of 35 km/h in accordance with Clause 7.4 of EN 12767):
    - Vehicle exit speed [km/h]
    - Acceleration Severity Index [-]
    - Theoretical Head Impact Velocity [km/h]
    - Backfill type used for the test (description in accordance with Annex B of EN 12767)
    - Collapse mode (description in accordance with Clause A.5 of EN 12767)
    - Direction class (description in accordance with Clause A.6 of EN 12767)
    - Risk of roof indentation (description in accordance with Clause A.7 of EN 12767)

- High speed test (applicable for an impact speed test in accordance with Table 2 of Clause 7.4 of EN 12767)
    - Vehicle exit speed [km/h]
    - Acceleration Severity Index [-]
    - Theoretical Head Impact Velocity [km/h]
    - Backfill type (description in accordance with Annex B of EN 12767)
    - Collapse mode (description in accordance with Clause A.5 of EN 12767)
    - Direction class (description in accordance with Clause A.6 of EN 12767)
    - Risk of roof indentation (description in accordance with Clause A.7 of EN 12767)

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 96/579/EC, as amended by Commission Decision 1999/453/EC.

The system is 1.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control (i)
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Incoming materials					
1	Material characteristics of components	Documents of supplier	Conformity with the order	According to Control Plan	Each delivery
2	Geometry of components (form and dimensions)	Measuring (gauge) and visual check	Conformity with the order	According to Control Plan	Each delivery
3	Weld verification (if any)	3.4.1	According to Control Plan	According to Control Plan	Each delivery
4	Verification of corrosion protection of metallic parts (if relevant)	3.4.2	According to Control Plan	According to with Control Plan	Each delivery
Process					
5	Storage properties for timber components: humidity and temperature	hygrometer and thermometer	According to Control Plan	According to Control Plan	Each lot
6	Planning of the planks: geometry and quality aspect	Measuring (geometry check)	According to Control Plan	According to Control Plan	Each lot
		Visual inspection (Quality aspect)	According to Control Plan	100%	Each lot
7	Gluing	Weighting	According to Control Plan	1	Each day
8	Bonding shear strength	3.4.3	According to Control Plan	1	Each day
9	Dimensional verifications of assembled product	3.4.4	According to Control Plan	According to Control Plan	Each lot
10	Straightness verification	3.4.5	Conformity with the order	According to Control Plan	Each lot
Finished product					
11	Product identification	Presence of all necessary labels on the relevant component	According to Control Plan	100%	Each lighting column
12	Sharp edges and roughness of the assembled product	3.4.6	No rough edges on metallic parts	100%	Each lighting column

(i) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control.

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 product 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 "***Lighting column***".	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	2/year

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

3.4.1 Weld verification (if any)

Weld verification shall be done in accordance with Clause 13.6 of EN 40-5.

3.4.2 Verification of corrosion protection of metallic parts (if relevant)

The verification of corrosion protection of the metallic parts shall be done in accordance with Clause 13.8 of EN 40-5.

3.4.3 Bonding shear strength (in case of use of adhesives)

In case the glued laminated timber components are reinforced with adhesives as shown in Figure 3.4.1.1, the bonding quality of the mast shall be verified. The aim of the test is to verify the quality of the gluing of the mast.

The present test protocol provides the principles for a method to check the shear resistance of the adhesive joints of the masts, during the gluing process.

At least one specimen of mast representative of the production line in terms of wood class and glue used, shall be selected to be tested at the beginning of the gluing process (the first to undergo the gluing process).

The mast shall be cut in order to form 3 cross-section samples. The three samples of this mast shall undergo testing.

Particular care shall be taken for the preparation of the samples in order to ensure that the loaded surfaces are smooth, parallel relatively to each other and perpendicular to the wood fibre direction.

Example of geometry of the tested specimen is described in Figure 3.4.3.1, and characterised by the following:

- t_i is length the adhesive joint *i* (parallel to the fibre direction), it also corresponds to the length of sample.
- b_i is the width of the adhesive joint *i* [mm].

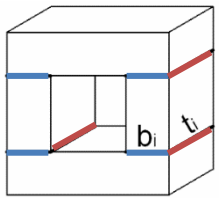


Figure 3.4.3.1: Example of sample for bond quality testing, highlighting the 4 shear planes of the type of cross-section considered.

The moisture content of the samples shall be between (12 ± 2) % by mass, measured in accordance with EN 322. The principle of the test shearing is described in Figure 3.4.3.2.

A load “F” is to be applied to a constant speed (1 mm/min to 2 mm/min is suggested but might vary given the test equipement used) until cohesive failure occurs. The shear strength of the glued joint shall be greater or equal to the shear strength of the wood (defined in accordance with EN 14080 and EN 14081-1). The break initiating point must never appear in the glue joint.

The maximum load shall be measured with an accuracy of ± 5 %.

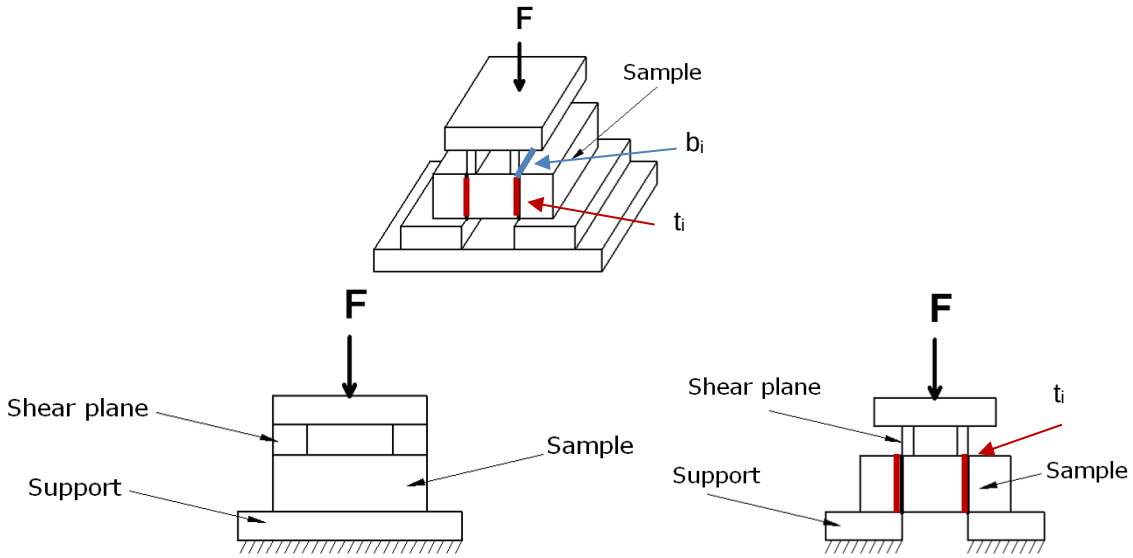


Figure 3.4.3.2: Shear test – principle. It is recommended that the distance between the steel plate transferring the load, and the shear plane is not superior to 1 mm.

3.4.4 Dimensional stability and tolerances

Measurement of the dimensions shall be carried out in horizontal position. The dimensions shall be checked using a meter-ribbon or a gauge, with the tolerances given in EN 40-5, Clause 13.

The following dimensions shall be assessed:

- Nominal height of the lighting column.
- Geometry of the cross-section – at each extremity and for abrupt changes of dimensions.
- Geometry of the door opening.
- Geometry of the cable entry slot.
- Geometry of the base plate.

In addition, all dimensional parameters specified in EN 40-2 and applicable to the base compartment shall be verified. A checklist is given in Clause 13.3 of EN 40-5 for steel materials and EN 40-6 for aluminium materials.

3.4.5 Straightness verification

The straightness verification shall be done in accordance with Clause 5.1 of EN 40-2. The measurement shall be carried out on the lighting column without charge, with the tolerances of ± 3%, given in Figure 10 of EN 40-2).

3.4.6 Sharp edges and roughness of surfaces

The verification of edges and surfaces shall be done in accordance with Clause 10 of EN 40-5.

4 REFERENCE DOCUMENTS

EAD 120003-00-0106	Steel lighting columns.
EN 10025-1:2004	Hot rolled lighting columns of structural steels – Part 1: general technical delivery conditions.
EN 10029:2010	Hot rolled steel plates 3 mm thick or above – Tolerances on dimensions, shape and mass.
EN 10088-1:2023	Stainless steels – Part 1: list of stainless steels.
EN 10217-7:2021	Welded steel tubes for pressure purposes – Technical delivery conditions – Part 7: Stainless steel tubes.
EN 10149-2:2013	Hot-rolled flat products made of high yield strength steels for cold forming - Part 2: technical delivery conditions for thermomechanically rolled steels
EN 12767:2019+A1:2024	Passive safety of support structures for road equipment – Requirements and test methods.
EN 13501-1:2018	Fire classification of construction lighting columns 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 14080:2013	Timber structures – Glued laminated timber and glued solid timber – Requirements.
EN 14081-1:2005+A1:2011	Timber structures – Strength graded structural timber with rectangular cross section – Part 1: general requirements.
EN 1563:2018	Founding – Spheroidal graphite cast irons.
EN 1706:2020+A1:2021	Aluminium and aluminium alloys – Castings – Chemical composition and mechanical properties.
EN 1991-1-4:2005 EN 1991-1-4:2005/A1:2010 EN 1991-1-4:2005/AC:2010	Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions.
EN 1995-1-1:2004 EN 1995-1-1:2004/AC:2006 EN 1995-1-1:2004/A1:2008 EN 1995-1-1:2004/A2:2014	Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings.
EN 301:2023	Adhesives, phenolic and aminoplastic, for load-bearing timber structures – Classification and performance requirements.
EN 322:1993	Wood-based panels. Determination of moisture content.
EN 335:2013	Durability of wood and wood-based lighting columns – Use classes: definitions, application to solid wood and wood-based lighting columns.
EN 338:2016	Structural timber – Strength classes.
EN 40-2: 2004	Lighting columns – Part 2: general requirements and dimensions
EN 40-3-2:2013	Lighting columns – Part 3-2: design and verification - Verification by testing
EN 40-5:2002	Lighting columns – Part 5: requirements for steel lighting columns.
EN 40-6:2002	Lighting columns – Part 6: requirements for aluminium lighting columns.

EN 60529:1991 EN 60529:1991/A1:2000 EN 60529:1991/A2:2013 EN 60529:1991/A2:2013/AC:2019-02 EN 60529:1991/AC:2016-12 EN 60529:1991/corrigendum May 1993	Degrees of protection provided by enclosures (IP Code).
EN 62262:2002 EN 62262:2002+A1:2021	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
EN 755-1:2016	Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 1: technical conditions for inspection and delivery.
EN 755-2:2025	Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 2: Mechanical properties.
EN 755-7:2016	Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 7: seamless tubes, tolerances on dimensions and form.
EN ISO 11925-2:2020	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test
EN ISO 8062-3:2023	Geometrical lighting column specifications (GPS) - Dimensional and geometrical tolerances for moulded parts - Part 3: general dimensional and geometrical tolerances and machining allowances for castings products

ANNEX A: BENDING MOMENTS AND SHEAR STRENGTH

The approach of the assessment is the following:

- First, the reference maximum bending moment (M_{k_ref}), maximum shear strength (V_{k_ref}), and maximum displacement (w_{k_ref}) of each lighting column family shall be calculated in accordance with Clause A.1 for the mechanically weakest configuration (the tallest specimen with the smallest diameter of the lighting column family) considering the MPII.

- Second, a test shall be performed on one specimen of each lighting column family, in the mechanically weakest configuration (the tallest specimen with the smallest diameter of the lighting column family). The test consists in applying a force on the lighting column, in steps, depending on the reference maximum bending moment (M_k), until the first crack happens, recording the actual force and the displacement of the specimen in the point where the force is applied for each loading and unloading cycle. The force to be applied in each loading cycle shall be obtained from the calculated reference maximum bending moment (see Clause A.1). In addition, the total number of test specimens depends on the displacement ratio obtained for the first test specimen (indicative test).

- Finally, the test results shall be used (see Clause A.2.3) for validating the calculation method. As such, it shall be used for other sizes of the same lighting column family.

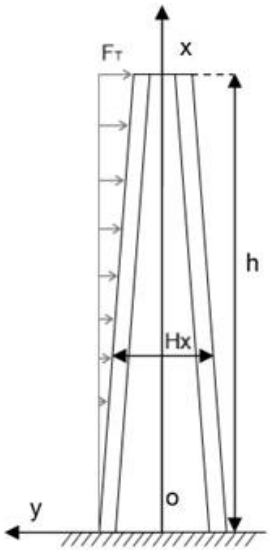
A.1 Calculation method for the bending moment, and the shear strength

The calculation is done taking into account the following parameters:

- the height (h) corresponds to the nominal height of the product (wooden mast + metallic base compartment)

- the calculation is done on the basis of wood characteristics (i.e., wood strength).

Such hypothesis guarantees a conservative approach in the calculation since the steel strength is roughly ten times higher than the wood strength and would reinforce the resistance to the load action.



Key:

F_T = envisage horizontal load resulting from the wind load action.

h = nominal height of the lightning product (wooden mast and metallic base included).

Hx = width of the beam at point x.

o – x = vertical axis.

o – y = horizontal axis.

Figure A.1.1: Schema of the load distribution over the mast used for calculation (the example shows a conic cross-section but is applicable to all geometries). The figure does not represent the limit between the wooden mast and the metallic base, as the hypothesis for calculation is to take the entire height of the product as made of wood (conservative approach). F_T is the force distributed on the lighting column to produce the moment at the base of the lighting column.

The reference maximum bending moment M_{k_ref} shall be calculated in accordance with the Equation A.1.1 considering x = h_m as defined in Figure A.2.1.1. This value shall be used for defining the loading steps to be applied in the tests (see Clause A.2.2) and for the validation of the calculation method with respect to the test results (see Clause A.2.3).

The load distribution shall be distributed in accordance with Figure A.1.1.

$$M_{k\_ref} = \frac{f_{m,k} \cdot I(x)}{0{,}5 \cdot H_x} \quad \text{(A.1.1)}$$

Where:

- I(x) is the inertia of the beam in [m^4].
- H_x is the width of the beam at point x in [m].
- $f_{m,k}$ is the flexural strength in [N/m^2] in accordance with EN 14080 or EN 338 depending on the material considered.

The reference maximum shear strength V_{k_ref}, shall be calculated in accordance with the Equation A.1.2. This value shall be used for the validation of the calculation method with respect to the test results (see Clause A.2.3).

$$V_{k\_ref} = \frac{f_{vk} \cdot I(x)}{S_x} \quad \text{(A.1.2)}$$

Where:

- $f_{v,k}$ is the shear strength in [N/m^2] in accordance with EN 14080 or EN 338 depending on the material of the lighting column to be assessed.
- S_x is the cross-sectional area of the beam at point x in [m^2].

The reference maximum displacement (deflection) w_{k_ref}, shall be calculated in accordance with the Equation A.1.3 below. This value shall be used for the validation of the calculation method with respect to the test results (see Clause A.2.3).

$$w_{k\_ref} = \frac{-11.F_T.h^4}{120.E.\int_0^h l(x)} \quad \text{(A.1.3)}$$

Where:

- F_T in [N] is the envisage horizontal load resulting from the wind load action (in accordance with the EN 1991-1-4) in accordance with the maximum wind load foreseen by MPII.
- h is the nominal height of the product (wooden mast and metallic base included in [m]).
- I(x) is the inertia of the beam in [m^4].
- E = Elastic modulus of the wood in accordance with EN 338 in [N/m^2].

In case there are no MPII available, Equation (A.1.3) applies with F_T taken according to Equation (A.1.4):

$$F_T = \frac{3.M_{k\_ref}}{Hx^2} \quad \text{(A.1.4)}$$

A.2 Test method

A.2.1 Test setting

The principle of the test is to apply a force F_{test} on the lighting column in the worst configuration of the test specimen (meaning at the top of the mast). The test assesses the entire lighting column, which is the wooden mast and the metallic base compartment.

As a result, for each family lighting column, the tallest specimen with the smallest diameter shall be tested. The test shall be performed on the entire lighting column, which comprises the wooden mast and the metallic base.

The lighting column shall be conditioned at (20 ± 2) ºC and (65 ± 5) % of relative humidity in order to ensure a constant moisture content of the mast structure (wooden part) at the moment of the test.

The constant moisture content shall be considered when the difference between two consecutive weighing (carried out at least 2 hours apart) is less than 0,1% of the total weight.

Bending tests shall be carried out as described in Figure A.2.1.1, where the length of the wooden mast (h_w) shall be higher than to 4 times the height of the base compartment (h_m).

The lighting column may be tested vertically or horizontally The lighting column shall be attached rigidly with bolts on a flange plate for the test in accordance with MPII. If tested horizontally, the self-weight shall be taken into consideration.

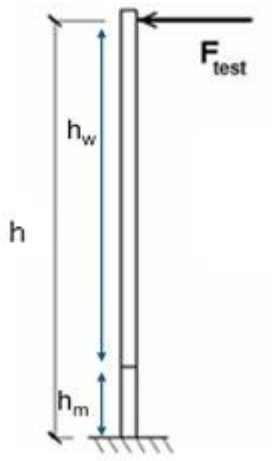


Figure A.2.1.1: Test setting, where h is the nominal height of the lighting column ($h = h_w + h_m$, where h_w is the wooden part of the column and h_m is the height of the metallic base compartment) and F_{test} is the force applied on the tested lighting column**.**

A.2.2 Indicative test

The test protocol is defined in accordance with to EN 40-3-2, Clause 8, with modification as specified below.

It consists in applying the force F_{test} obtained in accordance with the Equation (A.2.2.1), on the top of the mast, in 4 loading / unloading cycles reaching successively the values of 0,1 M_{k_test}, 0,4 M_{k_test}, M_{k_test} and 1,5 M_{k_test}.

$$F_{test} = M_{k\_test} / h \qquad (A.2.2.1)$$

Where:

- F_{test} is the force applied on the tested lighting column in [N] ;

- h the length of the mast in [m] (see Figure A.2.1.1) ;

- M_{k_test} shall be equal to M_{k_ref} (which shall be defined in accordance with Equation A.1.1.) when the failure does not occur before reaching 1,5 M_{k_test}. Otherwise, $M_{K\_test} = F_{test\_reduced} \cdot h$, $F_{test\_reduced}$ is defined at the end of this clause.

Note: it can happen that during a loading / unloading cycle, a residual deformation remains on the wooden part of the lighting column after the unloading step.

The loading and unloading execution of the test shall be performed at a similar speed, comprised between 10 mm/min to 20 mm/min.

Failure is defined by the first occurrence of a cracking in the wood part of the lighting column.

The failure mode shall be monitored on the last step of the test (1,5 M_{k_test}) by measuring the displacement and strength (force applied over $1{,}5 \cdot M_{k\_test}$), in order to produce a displacement versus strength diagram (see Figure A.2.2). The displacement shall be measured continuously.

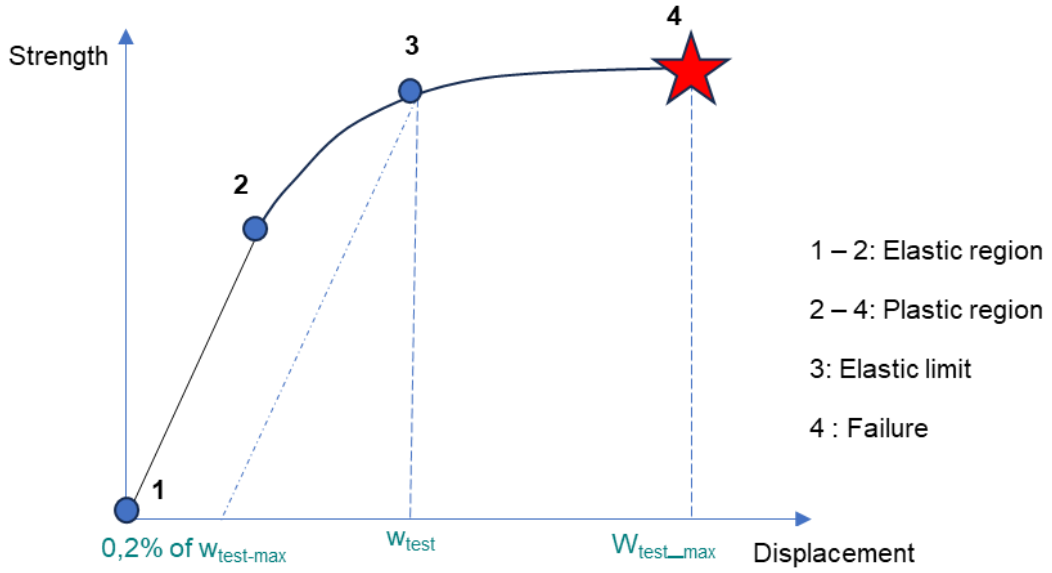


Figure A.2.3: Displacement versus strength diagram showing the limit between elastic and plastic behaviour which is identifiable by the change of slope of the curve on the graph. The elastic point is defined as the strength / displacement when the line 1-2 is offset by 0,2% of the displacement observed at failure.

The ratio between the displacement at failure and the displacement at the end of elastic behaviour obtained on the graphic at the change of slope, μ_y, shall be calculated in accordance with Equation A.2.2.2 below.

$$\mu_y = w_{test\text{-}max} / w_{test} \qquad \text{(A.2.2.2)}$$

where:

$w_{test\text{-}max}$ is the maximum displacement registered (i.e., displacement at failure) in [m] (see Figure A.2.3)

w_{test} maximum displacement at elastic limit in [m] (see Figure A.2.2.3)

If failure of the specimen does not occur before reaching 1,5 M_{k_test} then depending on the failure mode observed on the first test, the following applies:

- In case $\mu_y < 4$ (i.e., in case of brittle failure), 4 additional test specimens should be tested (5 test specimens in total).

- In case $\mu_y \geq 4$ (i.e., ductile behaviour), 2 additional test specimens should be tested (3 test specimens in total).

If the failure of the specimen occurs before reaching 1,5 M_{k_test}, the force to be applied in the test shall be reduced (using the same reduced factor for all the loading steps) and the test shall be performed again with the new reduced force ($F_{test\_reduced}$), until the criteria is met for all the tested specimens. For each test specimen tested, the maximum load ($F_{test\text{-}max}$ or $F_{test\_reduced\text{-}max}$) obtained at w_{test_max} displacement (see Figure A.2.3) shall be recorded. F_{test_min} shall be identified as the minimum value of the maximum loads obtained for one set of tested specimens (5 or 3 tested specimens depending on the failure mode, μ_y).

A.2.3 Validation of the calculation method

For the validation of the calculation method given in Clause A.1, all the following criteria shall be met:

1) The minimum bending moment of the tested specimens (5 or 3 tested specimens in accordance with Clause A.2.2), $M_{k\_test\_min}$, shall be higher than or equal to the reference calculated bending moment M_{k_ref} (see Equation A.1.1).

$$M_{k\_test\_min} = F_{test\_min} \,.\, h \geq M_{k\_ref} \quad \text{(A.2.3.1)}$$

2) The minimum shear strength of the tested specimens (5 or 3 tested specimens in accordance with Clause A.2.2), $V_{k\_test\_min}$ (which is equal to the minimum force applied in the test specimens, F_{test_min}) shall be higher than the reference calculated shear strength V_{k_ref} (see Equation A.1.2).

$$F_{test\_min} = V_{k\_test\_min} \geq V_{k\_ref} \quad \text{(A.2.3.2)}$$

3) The maximum displacement w_{test} at elastic limit (as defined on the graphic by the change of slope) of the tested specimens (5 or 3 tested specimens in accordance with Clause A.2.2) shall be lower than the reference calculated maximum displacement (deflection) w_{k_ref} (see Equation A.1.3).

$$w_{test} \leq w_{k,ref} \quad \text{(A.2.3.3)}$$

When all these criteria are met:

The maximum bending moment M_k shall be calculated using the Equation A.2.3.1 where $M_k = M_{k\_test\_min}$.

- The maximum shear strength V_k shall be calculated in accordance with the Equation A.2.3.2 where $V_k = V_{k\_test\_min}$.

If one of the criteria above is not met, the equations given Clause A.1 shall be corrected as follow:

- The maximum bending moment M_k shall be calculated in accordance with the Equation A.2.3.4:

$$M_k = \varphi_1 \cdot M_{k\_ref} = \varphi_1 \cdot \frac{f_{m,k} \,.\, I(x)}{0{,}5 \,.\, H_x} \quad \text{(A.2.3.4)}$$

$$\varphi_1 = \frac{F_{test\_min} \cdot h}{M_{k\_ref}} \text{ with } \varphi_1 < 1 \quad \text{(A.2.3.5)}$$

- The maximum shear strength V_k shall be calculated in accordance with the equation A.2.3.6:

$$V_k = \varphi_2 \cdot V_{k\_ref} = \varphi_2 \cdot \frac{f_{vk} \,.\, I(x)}{S_x} \quad \text{(A.2.3.6)}$$

$$\varphi_2 = \frac{F_{test\_min}}{V_{k\_ref}} \,/\, Sx \qquad \text{with } \varphi_2 < 1 \quad \text{(A.2.3.7)}$$

A.3 Calculation results

Once the calculation method has been validated by testing, the corresponding equations of the calculation method (see Clause A.2.3) shall be applied to the other sizes of the lighting column family (i.e., the same

calculation method can be applied for different heights of the lighting columns – but with the same mast cross-section shape and dimensions - see Clause 1.1). The shear strength V_k (in N) and bending moments M_k in [daN.m] for all lighting columns shall be calculated where the results obtained in N.m shall be converted in daN.m multiplying by 0,1 (1,0 N.m = 0,1 daN.m).

In addition, lighting column materials and materials properties considered in the assessment shall be stated in the calculation report.

ANNEX B: TORSION MOMENT

The approach of the assessment is the following:

- First, the reference maximum torsion moment (M_{t_ref}), of each lighting column family shall be calculated in accordance with Clause B.1 for the mechanically weakest configuration (torsion applied on the top of the mast, for the shortest specimen of the lighting column family) considering the MPII.

- Second, a test shall be performed on one specimen of each lighting column family, in the mechanically weakest configuration (the shortest specimen of the family lighting column). The test consists in applying several cycles of loading and unloading in torsion on the lighting column, depending on the reference maximum torsion moment (M_{t_ref}), until the first crack happens, recording the actual force and the displacement of the specimen in the point where the torsion is applied. The torsion to be applied in each loading cycle shall be obtained from the calculated reference maximum bending moment (see Clause B.1). In addition, the total number of test specimens depends on the displacement ratio obtained for the first test specimen (indicative test).

Finally, the test results shall be used (see Clause B.2.3) for validating the calculation method. As such, it shall be used for other sizes of the same lighting column family.

B.1 Calculation method of the torsion moments

The calculation is done taking into account the following parameters:

- the height (h) corresponds to the nominal height of the product (wooden mast + metal base compartment)

- the calculation is done taking wood characteristics (i.e., wood shear strength).

Such hypothesis guarantees a conservative approach in the calculation (which will be then validated by testing).

The load distribution is distributed in accordance with Figure B.1.1.

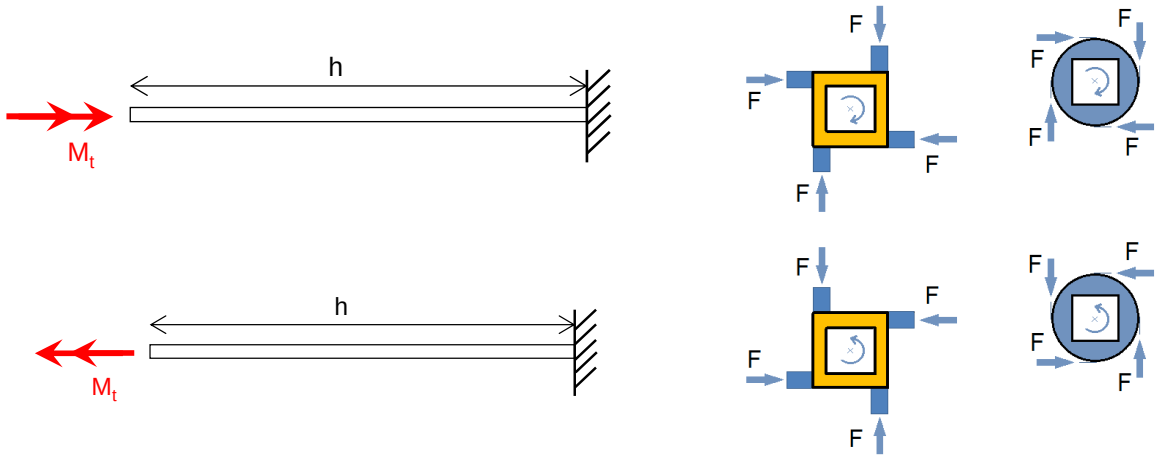


Figure B.1.1: Schema of the load distribution over the mast (here with horizontal testing), where h is the nominal height of the lighting column and F is the force applied, when the torque moment is in the clock direction (top) or opposite clock (bottom) direction, considering that the moment is applied at the top of the mast (i.e., its free end).

The reference maximum torsion moment M_{t_ref} shall be calculated in accordance with the Equations B.1.1.1, B.1.1.2 and B.1.1.3., for square cross-section masts, and in accordance with Equations B.1.2.1 and B.1.2.2 for circular cross-section masts. This value shall be used for defining the loading steps to be applied in the tests (see Clause B.2.2) and for the validation of the calculation method with respect to the test results (see Clause B.2.3).

B.1.1 Calculation method for square cross-sections masts

For square cross-section masts, the torsional moment of resistance $M_{t\text{-}ref}$ shall be calculated as follows :

$$M_{t-ref} = min \begin{cases} 2e(a-e)\left(a-e-\frac{p}{4}\right)f_{v,d} & B.1.1.1 \\ 2e(a-e)^2 f_{v,d} & B.1.1.2 \\ 2L_b e(a-e) f_{c,90,d} & B.1.1.3 \end{cases}$$

With:

- e is the thickness of the wooden parts constituting the hollow mast in [m].
- a is the width of the square section of the mast in [m].
- p is the opening of the door in [mm].
- $f_{v,d}$ is the shear strength of the wood in [N/m²], as defined in EN 338.
- $f_{c,90,d}$ is the transverse compressive strength of wood in [N/m²] as defined in EN 338.
- L_b is the length of the lever arm in [m]. For the calculation, the length shall be taken as the one to be used in the test in Clause B.2.

Equation B.1.1.1 allows the torsional moment to be calculated at the door (see Figure B.1.1.1).

Equation B.1.1.2 allows the torsional moment to be calculated at the base plate.

Equation B.1.1.3 allows the torsional moment to be calculated at the connexion between the mast and the base plate.

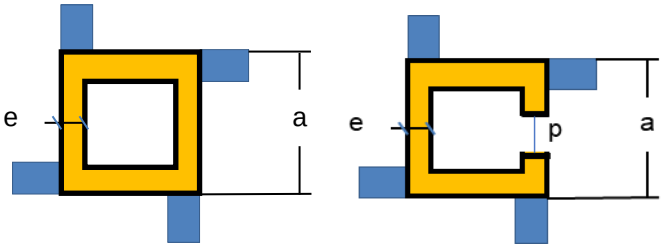


Figure B.1.1.1: Square section - force transfer at the base (left) and at the door (right).

B.1.2 Calculation of the characteristic torsion moments for circular-section masts

For circular-masts, the torsion moment $M_{t\text{-}ref}$ shall be calculated as follows (see Figure B.1.2.1):

(B.1.2.1)

$$M_{t-ref} = min \begin{cases} \frac{2I_0}{D} \cdot f_{v,d} \\ n.r.F_{v,Rd} \end{cases} \quad \text{(B.1.2.2)}$$

With:

- $f_{v,d}$ is the shear strength of the wood in [N/m²] as defined in EN 338.
- I_0 is the polar stiffness of the section in [m⁴], as defined in EN 338.
- D is the diameter of the mast in [m].
- r is the internal radius of the mast (as described in Figure B.1.2.1) in [m]
- $F_{v,Rd}$ is the shear strength of the mechanical fasteners between the mast and the metallic base in [N/m²], determined according to EN 14092.
- n the number of mechanical fasteners used.

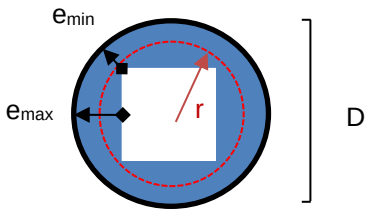


Figure B.1.2.1: Geometry of a circular mast cross-section.

B.2 Test method

B.2.1 Test setting

The principle of the test is to apply a torsion force F_{test} on the lighting column in the worst configuration of the test specimen (meaning at the top of the mast), by means of a lever arm, as shown in Figure B.2.1.1. The test assesses the entire lighting column, which comprises the wooden mast and the metallic base compartment.

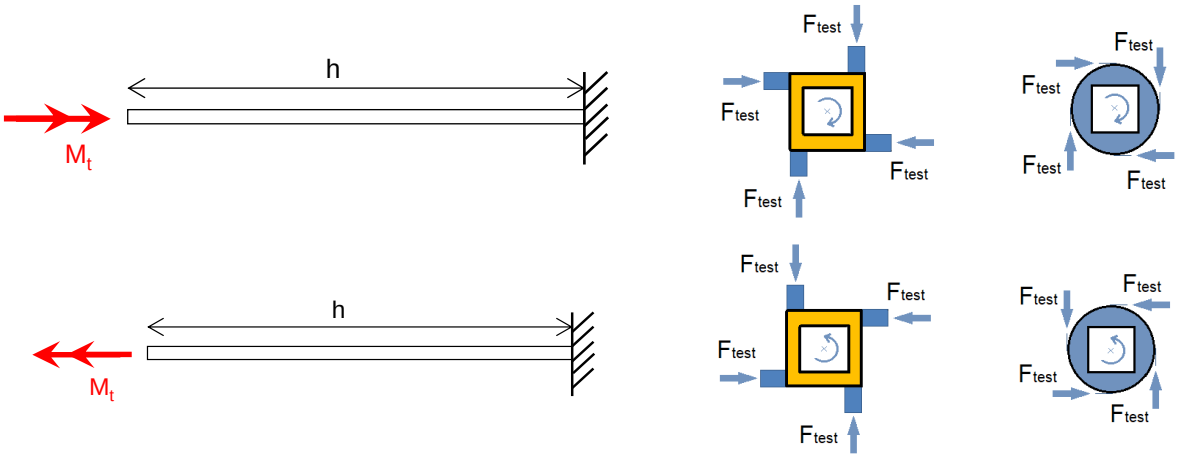


Figure B.2.1.1: Schema of the load distribution over the mast (here with horizontal testing), where h is the nominal height of the lighting column and F_{test} is the force applied, when the torque moment is in the clock direction (top) or opposite clock (bottom) direction, considering that the moment is applied at the extremity of the mast.

As a result, for each lighting column family , the specimen with the shortest nominal height shall be tested. The test shall be performed on the mast, without the metal base compartment and without the brackets.

The lighting column shall be conditioned in order to ensure a relative humidity of (12 ± 2) % within the mast at the moment of the test.

The lighting column may be tested vertically or horizontally depending on the test equipment.

During the test, the part of the lighting column shall be rigidly fixed, in order to ensure that the connexion between the mast and the ground will not break during the test. In case the lighting column includes a base plate it shall be attached rigidly in accordance with MPII. If tested horizontally, the self-weight shall be taken into consideration.

When tested, a lever arm shall be attached to the top of the mast and the force F_{test} (kN) shall be applied to the end of the lever arm in order to create the torsion moment. The connection between the lever arm and the top of the mast shall ensure that no rupture occurs during the test within the lever arm.

- The length of the lever arm is taken according to MPII. If MPII are not available, the length shall be taken as follows, in order to ensure that no deformation occurs in the lever arm during the test:
    - If the lighting column's height h is ≤ 6m, the lever arm shall be taken at 0.75 m
    - If the lighting column's height h is comprised between 6 m < h ≤ 8 m, the lever arm shall be taken at 1 m
    - If the lighting column's height h is comprised between 8 m < h ≤ 10 m, the lever arm shall be taken at 1.25 m
    - If the lighting column's height h is >10m, the lever arm shall be taken at 1.5 m.

The top of the mast shall be free to rotate, and bending shall be avoided. The minimal embedding length for the test shall be taken as follows:

- 1,5.D (where D is the diameter of the mast in [m]) for circular masts,
- 1,5.a (where a is the width of the square section of the mast in [m]) for square masts.

No shocks or impacts must occur. An accuracy of ± 2% is required for applied test loads.

B.2.2 Indicative test

The test protocol shall be applied in accordance with EN 40-3-2, Clause 8, with modification as specified below.

It consists in applying the force F_{test}, on the top of the mast, in 3 cycles:

- 1st step consists in applying a force at the extremity of the mast to 10% of $F_{test,}$ then unloading.
- 2nd step consists in applying a force at the extremity of the mast to 40% of F_{test} then unloading.
- 3rd step consists in applying a force at the extremity of the mast to F_{test} and to keep increasing the force until failure.

where the force F_{test} shall be calculated in accordance with the following equation:

$$F_{test} = M_{t\text{-}test} / L_b \quad \text{(B.2.1)}$$

Where:

- L_b = length of the lever arm in [m].
- F_{test} = the force applied on the lever arm in order to create the torsion on the mast in [kN] (see Figure B.2.1).

- $M_{t\text{-}test}$ shall be equal to $M_{t\text{-}ref}$ (obtained in Equations B.1.2.1 and B.1.2.2) when the failure does not occur before reaching the last step ($F_{test} = M_{t\text{-}ref} / L_b$). Otherwise, $M_{t\_test} = F_{test\_reduced} \cdot L_b$, $F_{test\_reduced}$ is defined at the end of this clause.

The loading and unloading execution of the test shall be performed at a similar speed, comprised between 10 mm/min to 20 mm/min.

Failure is defined by the first occurrence of a crack in the wood part of the lighting column.

The failure mode shall be monitored on the last cycle of the test by measuring the angular displacement and strength (force applied over M_{t_test}), in order to produce a angular displacement versus torque diagram (see Figure B.2.2). The angular displacement shall be measured continuously (i.e., the rotation angle of the tested mast cross-section).

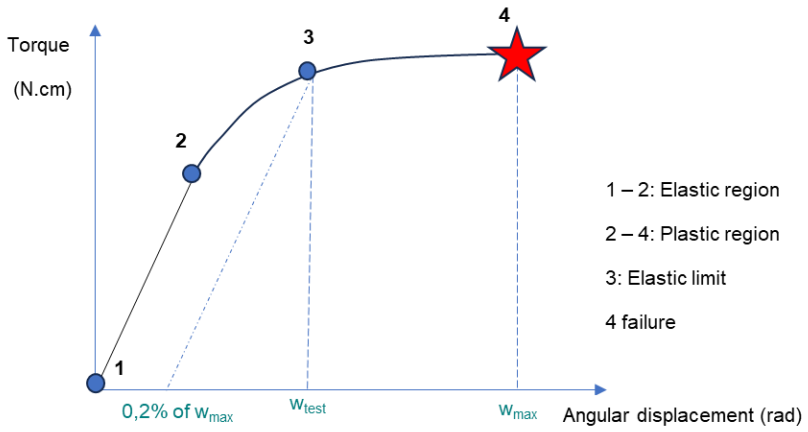


Figure B.2.2: Principle of an angular displacement versus torque diagram showing the limit between elastic and plastic behaviour. The elastic point is defined as the strength / displacement when the line 1-2 is offset by 0.2% of the displacement observed at failure

The ratio between the angular displacement (i.e., at failure) and the angular displacement at the end of elastic behaviour obtained on the graphic at the change of slope, μ_y, shall be calculated.

$$\mu_y = w_{max} / w_{test} \qquad \text{(B.2.2)}$$

where:

w_{max} is the maximum displacement registered (i.e. displacement at failure) in [m] (see Figure B.2.2)

w_{test} maximum displacement at elastic limit in [m] (see Figure B.2.2)

If failure of the specimen does not occur before reaching F_{test} then depending on the failure mode observed on the first test, the following applies:

- In case $\mu_y < 4$ (i.e., in case of brittle failure), 4 additional tests should be done (5 tests in total).
- In case $\mu_y \geq 4$ (i.e., ductile behaviour), 2 additional tests should be performed (3 tests in total).

If the failure of the specimen occurs before reaching M_{t_test}, the force to be applied in the test shall be reduced (using the same reduced factor for all the loading steps) and the test shall be performed again with the new reduced force ($F_{test\_reduced}$), until the criteria is met for all the tested specimens. For each test specimen tested, the maximum load ($F_{test\text{-}max}$ or $F_{test\_reduced\text{-}max}$) obtained at w_{max} angular displacement (see Figure B.2.2) shall be recorded. F_{test_min} shall be identified as the minimum value of the maximum loads obtained for one set of tested specimens (5 or 3 tested specimens depending on the failure mode, μ_y).

B.2.3 Validation of the calculation model

For the validation of the calculation method given in Clause B.1, the minimum torsion moment of the tested specimens (5 or 3 tested specimens in accordance with Clause B.2.2), $M_{t\_test\_min}$, shall be higher than or equal to the reference calculated bending moment M_{t_ref} (see equations of Clause B.1.1):

$$M_{t\_test\_min} = F_{test\_min} . L_b \geq M_{t\_ref} \quad \text{(B.2.3.1)}$$

Where M_{t_ref} is the value calculated in Clause B.1, in function of the geometry of the mast.

If the criteria above is met, the maximum torsion moment M_t shall be calculated using the Equation B.2.3.1 where $M_t = M_{t\_test\_min}$.

If the above criteria is not met, the maximum torsion moment M_t shall be calculated in accordance with the Equation B.2.3.2:

$$M_t = \varphi \cdot M_{t\_ref} \quad \text{(B.2.3.2)}$$

$$\text{Where } \varphi = \frac{F_{test\_min} \cdot L_b}{M_{t\_ref}} \text{ with } \varphi < 1 \quad \text{(B.2.3.3)}$$

B.3 Calculation results

Once the calculation method has been validated by testing, the corresponding equations of the calculation method (see Clause B.2.3) shall be applied to the other sizes of the lighting column family (i.e., the same calculation method can be applied for different heights of the lighting columns – but with the same mast cross-section shape and dimensions - see Clause 1.1). The torsion moment M_t in [daN.m] for all lighting columns shall be calculated where the results obtained in N.m shall be converted in daN.m multiplying by 0,1 (1,0 N.m = 0,1 daN.m).

In addition, lighting column materials and materials properties considered in the assessment shall be stated in the calculation report.