SLOVENSKI STANDARD
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Standardne lastnosti sistemov zaščite pred delovanjem strele

Lightning protection systems pure performance standard

Norme de performance pure des systèmes de protection contre la foudre

Ta slovenski standard je istoveten z: **prEN 50622:2013**

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Lightning protection systems pure performance standard

Norme de performance pure des systèmes de protection contre la foudre

To be completed

This draft European Standard is submitted to CENELEC members for CENELEC enquiry.
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It has been drawn up by CLC/TC 81X.

If this draft becomes a European Standard, CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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Comité Européen de Normalisation Electrotechnique
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Foreword

This document (prEN 50622:2013) has been prepared by CLC/TC 81X "Lightning protection".

This document is currently submitted to the Enquiry.

Introduction

In April 2010, the Technical Bureau (BT) of CENELEC asked the European Lightning Protection group (CLC/TC 81X) “to examine the possibility to establish a pure performance standard, independent from any technology and enabling the development of existing and future technologies on lightning protection systems and report back to BT” (D136/014).

In October 2011, BT approved by majority the **New Work Item** i.e. the future prEN 50622 “Lightning protection systems pure performance standard” (D139/044).

The aim of this standard is to describe a method to know and document the performance of an LPS. Taking into account that lightning phenomena cannot be fully reproduced in a laboratory and that testing in “field sites” is not representative from a statistical point of view, the performance of a LPS can only be established in real installations with a significant number of sites, representing the different climatic and geographical conditions around the world.

This commitment from the BT is a unique opportunity to go a step forward in the scientific and technologic developments in the field of lightning protection.

Only interception performance is considered in this document.

1 General

1.1 Object

The object of this standard is giving a method to measure the interception performance of lightning protection systems when they are installed in real conditions.

1.2 Scope

This standard provides the requirements to evaluate the performance, in terms of lightning interception attachment, of lightning protection systems (LPS) installed according to their reference standards or specifications.

2 Normative references

This is a Pure Performance Standard and therefore no indications about material, sizes or installation instructions are given. Nevertheless, the Lightning Protections Systems under monitoring should have been designed and installed according to documents that shall be public and shall contain all the characteristics of the LPS, such as installation instructions, materials, sizes and laboratory tests of the lightning protection components.

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1
Lightning Protection System
LPS
system intended to intercept lightning flashes, conduct lightning current and disperse it into the earth thus reducing physical damage caused by direct lightning flashes

3.2
Type of Lightning Protection Systems under monitoring
full set of characteristics of the Lightning Protection Systems which performance is being monitored

3.3
protected area
structure, object or open area that is under the protection of a lightning protection system and that should therefore not be struck by lightning

3.4
monitoring Degree
MD
number related to the information given by the set of measures taken for observing the performance of a Lightning Protection System

3.5
failure
missed interception by LPS in a protected area

3.6
damage
puncture, masonry breakage, fire or flash mark that has been caused by a direct lightning strike

3.7
efficiency of a LPS
E
accepted percentage of flashovers for an installed LPS, that must be clearly defined in the standards or specifications, indicating the type and characteristics of lightning flashes to which the protected area is exposed

3.8
performance factor
α
value of the number of failures within monitored protected areas relative to the total amount of flashes expected in those areas

3.9
flashover

4 Installations under monitoring

Any installation may be subjected to any type of monitoring defined in Clause 5, although it is advisable to monitor a heterogeneous set of structures (high and low flash density areas, different altitudes, different materials for the structure, etc.).

4.1 Lightning ground flash density N_g

The lightning ground flash density *Ng* is the number of lightning flashes per km² per year. This value is available from ground flash location networks in many areas of the world.

NOTE If a map of *N*g is not available, in temperate regions it may be estimated by:

$$Ng \approx 0{,}1\ Td$$

where Td is the thunderstorm days per year (which can be obtained from isokeraunic maps).

4.2 Collection area A_d

For isolated structures on flat ground, the collection area A_d is the area defined by the intersection between the ground surface and a straight line with 1/3 slope which passes from the upper parts of the structure (touching it there) and rotating around it. Determination of the value of A_d may be performed graphically or mathematically.

For an isolated rectangular structure with length *L*, width *W*, and height *H* on a flat ground, the collection area is then equal to

$$A_d = L \times W + 6 \times H \times (L + W) + 9 \times \pi \times (H)^2$$

with *L*, *W* and *H* expressed in meters.

4.3 Location factor C_d

The relative location of the structure, compensating for surrounding objects or an exposed location will be taken into account by a location factor C_d (see Table 1).

Table 1 – Location factor C_d

Relative location	C_d
Object surrounded by higher objects or trees	0,25
Object surrounded by objects or trees of the same heights or smaller	0,5
Isolated object: no other objects in the vicinity	1
Isolated object on a hilltop or a knoll	2

4.4 Number of dangerous events N_D for a structure

For each installation, the expected number of direct strikes per year will be calculated as follows:

$$N_D = N_g \times A_d \times C_d \times 10^{-6}$$

where

N_g is the lightning ground flash density (1/km²/year) (see 4.1);

A_d is the collection area of the isolated structure (m²)(see 4.2);

C_d is the location factor of the structure (see Table A.5) (see 4.3).

4.5 Total number of expected dangerous events N_{DT}

The number of dangerous events N_D will be calculated individually for each protected area.

N_{DT} is the accumulated number of expected dangerous events within the monitored areas so it will be calculated by the summation of N_{Di}, being N_{Di} the expected frequency for each of the monitored installations.

The total number of expected dangerous events for calculating the performance factor α will be at least 500 ($N_{DT} \geq 500$).

5 Monitoring Degrees

Three Monitoring Degrees (MD) are defined:

MD1 - High quality control measures

MD1 includes all requirements of MD2.

The lightning protection system is provided with instruments that are able to measure if there has been a lightning strike at the place that should be protected and also if the characteristics of that lightning strike were such that the LPS should have intercepted it according to its defined efficiency.

This level is the best system to unambiguously determine lightning protection performance. Use and development of these systems is highly encouraged.

At least 10 % of the monitored installation should be provided with MD1.

MD2 - Medium quality control measures

MD2 includes all requirements of MD3.

For MD2 the lightning protection system will be provided with one or more counters recording at least the number of events. Counters measuring also peak current, date of the event, etc. are also included in this degree.

For the recorded counts, it can be discerned if it has caused or not damages to the structure. However, in case of damage it is not possible to know if there has been a failure of the LPS, since a low current lightning could have caused it.

This degree is recommended to be used in the maximum number of locations since it provides a compromise between cost and information.

At least 50 % of the monitored installations should be provided with MD2.

MD3 - Basic quality control measures

MD3 consists of periodical maintenance of the structure with visual inspection and incidents registration. Damage can be noted, but no information is collected about the events when the system has worked correctly. Only the inspection of the air terminal could bring information due to melting or any discharge indication of a lightning strike.

In case of damage it is not possible to know if there has been a failure of the LPS, since a low current lightning could have caused it.

6 Book of installation

For the purposes of performance verification, each LPS under control should be provided with a “Book of Installation”, which should be certified by an independent institution.

The book shall include the following points:

<u>Inspection according to standards or specifications.</u>

- Verification that the LPS is installed according to the standards or specifications, which should be written in a public document. Such published standards or specifications should also establish the points to be inspected.

<u>Data</u>

- Note any non-compliance or deviation from the standards or installation specifications.
- Note the place of installation (coordinates).
- Data for calculating the collection area of the structure. Location factor.
- Date of the latest control.

<u>Description of the LPS</u>

- Name of the Type of Lightning Protection Systems under monitoring.
- Selected LPL (or efficiency related to the LPS).
- General drawing of the structure and the air termination system, specifying distances from the air terminals to the corners.
- Type and material of the installed air terminals.
- Situation and description of the control systems that have been installed.
- Existing damages prior to installing the LPS (if any).

<u>Results</u>

- Note the number of strikes shown by the counters (if counters have been installed) and date of occurrences (if known);
- Note the results of the instruments recording lightning parameters (if they have been installed);
- In case of damage:
  - Describe the damages, with special attention to the path of the lightning current.
  - Measure and note the distance between the damage and the closest air terminal.
  - Verify and note the continuity between the air terminal and the earthing.

The user or owner of the structure where the LPS is installed shall agree, sign and have the possibility of commenting the report.

7 Failures

If damage was caused by improper installation, it should not be considered as a failure.

If a damage caused by a lightning strike has been observed at an installation with monitoring degree MD2 or MD3, then the number of failures should be multiplied by the efficiency of each monitored LPS.

- *a* is the number of failures observed at installations with monitoring degree MD1
- If *b* is the number of failures observed at installations with monitoring degree MD2, then $b' = \Sigma\, b_i \cdot E_i$, where E_i is the efficiency related to each LPS.
- If *c* is the number of failures observed at installations with monitoring degree MD3, then $c' = \Sigma\, c_i \cdot E_i$, where E_i is the efficiency related to each LPS.

The number of failures N_f will be then:

$$N_f = a + b' + c'$$