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Protection against lightning - Thunderstorm warning systems

Protection contre la foudre – Systèmes d'alerte aux orages

<u>IEC 62793:2016</u> https://standards.iteh.ai/catalog/standards/sist/f941c138-533d-40ea-935ce9b9b7737b54/iec-62793-2016





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INTERNATIONAL STANDARD

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Protection against lightning – Thunderstorm warning systems (standards.iteh.ai) Protection contre la foudre – Systèmes d'alerte aux orages

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROTECTION AGAINST LIGHTNING – THUNDERSTORM WARNING SYSTEMS

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International Standard IEC 62793 has been prepared by IEC technical committee 81: Lightning protection.

This bilingual version (2018-11) corresponds to the monolingual English version, published in 2016-05.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|-------------|------------------|
| 81/508/FDIS | 81/519/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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INTRODUCTION

Natural atmospheric electric activity and, in particular, cloud-to-ground lightning poses a serious threat to living beings and property. Every year severe injuries and even deaths of humans are caused as a result of direct or indirect lightning strikes.

Lightning:

- may affect sport, cultural and political events attracting large concentrations of people; events may have to be suspended and people evacuated in the case of a risk of thunderstorm;
- may affect industrial activities by creating power outages and unplanned interruptions of production processes;
- may interrupt all kinds of traffic (people, energy, information, etc.);
- has led to a steady increase in the number of accidents per year due to the wider use of electric components that are sensitive to the effects of lightning (in industry, transportation and communication);
- may be a hazard for activities with an environmental risk, for example handling of sensitive, inflammable, explosive or chemical products;
- may be a cause of fire.

During the last decades, technical systems including systems devoted to real-time monitoring of natural atmospheric electric activity and lightning, have experienced an extraordinary development. These systems can provide high quality and valuable information in real-time of the thunderstorm occurrence, making it possible to achieve information which can be extremely valuable if coordinated with a detailed plan of action.

EC 62793:2016

Although this information allows the user to adopt anticipated temporary preventive measures, it should be noted that all the measures to be taken based on monitoring information are the responsibility of the system user according to the relevant regulations. The effectiveness will depend largely on the risk involved and the planned decisions to be taken. This International Standard gives an informative list of possible actions.

Lightning and thunderstorms, as with many natural phenomena, are subject to statistical uncertainty. It is not possible therefore to achieve precise information on when and where lightning will strike.

Other lightning protection standards do not cover the use of thunderstorm warning systems.

PROTECTION AGAINST LIGHTNING – THUNDERSTORM WARNING SYSTEMS

1 Scope

This International Standard describes the characteristics of thunderstorm warning systems and evaluation of the usefulness of lightning real time data and/or storm electrification data in order to implement lightning hazard preventive measures.

This standard provides the basic requirements for sensors and networks collecting accurate data of the relevant parameters, giving real-time information of lightning tracks and range. It describes the application of the data collected by these sensors and networks in the form of warnings and historical data.

This standard applies to the use of information from thunderstorm warning systems (systems or equipment providing real-time information) on atmospheric electric activity in order to monitor preventive measures.

This standard includes:

- a general description of available lightning and storm electrification hazard warning systems;
- a classification of thunderstorm detection devices and properties;
- guidelines for alarming methods; IEC 62793:2016
- a procedure to determine the usefulness of thunderstorm-information 5c-
- some informative examples of possible preventive actions.

The following aspects are outside the scope of this standard:

- a) lightning protection systems; such systems are covered by the IEC 62305 series;
- b) other thunderstorm related phenomena such as rain, hail, wind;
- c) satellite and radar thunderstorm detection techniques.

A non-exhaustive list of situations to which this standard could be applicable is given below:

- people in open areas involved in activities such as maintenance, labour, sports, competitions, agriculture and fisheries or situations where large crowds gather;
- wind farms, large solar power systems, power lines;
- occupational health and safety prevention;
- sensitive equipment such as computer systems, emergency systems, alarms and safety equipment;
- operational and industrial processes;
- storage, processing and transportation of hazardous substances (e.g. flammable, radioactive, toxic and explosive substances);
- determined environments or activities with special danger of electrostatic discharges (e.g. space and flight vehicle operations);
- operations in which the continuity of the basic services is very important (e.g. telecommunications, the generation, transport and distribution of energy, sanitary services and emergency services);
- infrastructures: ports, airports, railroads, motorways and cableways;

- civil defense of the environment: forest fires, land slide and floods;
- wide networks (e.g. power lines, telecommunication lines) may also benefit from having early detection of thunderstorms.

Normative references 2

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62305 (all parts), Protection against lightning

Terms, definitions and abbreviations 3

3.1 **Terms and definitions**

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

3.1.1

alarm

information indicating that the target or the surrounding area is likely to be affected by thunderstorms and the accompanying lightning related events VIEW

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3.1.2

cloud-to-ground lightning CG

electric discharge of atmospheric origin that is comprised of one or more cloud-to-ground lightning strokes that propagate from cloud to ground or vice versa and lead to a net transfer of charge between cloud and ground

3.1.3 coverage area

CA

area where a given warning equipment has a sufficient detection efficiency and/or accuracy to give a warning

3.1.4 detection efficiency

DE

percentage of cloud-to-ground discharges (flashes or strokes) that are detected and located by a sensor or a network

Note 1 to entry: As cloud-to-ground flashes are often composed of several strokes, there is a difference between flash detection efficiency and stroke detection efficiency. A flash is reported (detected) if at least one stroke (first or subsequent) is detected and therefore flash detection efficiency is always equal or higher than stroke detection efficiency.

3.1.5 dwell time DT time that an alarm is sustained after all warning criteria are no longer met

3.1.6 effective alarm FΔ

alarm where a lightning related event occurs in the surrounding area during the total alarm duration

3.1.7

time to clear

ттс

time between the occurrence of the last lightning related event in the monitoring area and the time when the alarm is released

3.1.8 failure to warn FTW

occurrence of a lightning related event in the surrounding area for which no alarm occurred

3.1.9 failure to warn ratio FTWR

ratio of failure to warn with respect to the total number of situations with lightning related events affecting the surrounding area

3.1.10 false alarm FA

alarm not followed by lightning-related events within the surrounding area

3.1.11 false alarm ratio false alarm rate FAR ratio of false alarms to the total human of alarms.iteh.ai)

3.1.12 IEC 62793:2016 field strength meterps://standards.iteh.ai/catalog/standards/sist/f941c138-533d-40ea-935c-FSM e9b9b7737b54/iec-62793-2016 device for continuous monitoring of the atmospheric electrostatic field associated with thunderstorms

EXAMPLE: Field mill.

3.1.13 cloud lightning

IC

discharge occurring within or among thunderclouds or between thunderclouds and air and which does not have a ground termination

3.1.14

lead time

LT

time between the start of an alarm and the effective occurrence of the first lightning related event in the target area

3.1.15

lightning flash

electric discharge of atmospheric origin consisting of one or more strokes

Note 1 to entry: This discharge may occur within or between clouds, between the clouds and air and between a cloud and the ground.

3.1.16 lightning related event LRE

CG lightning flash to or near the structure to be protected, or to or near a line connected to the structure to be protected

3.1.17

lightning stroke

single electric discharge in a lightning flash to earth

3.1.18 median location

median location accuracy

LA

median value of the distances between real stroke locations and the stroke locations given by the lightning location system

3.1.19 monitoring area MA

geographic area where the lightning activity is monitored in order to provide a valid warning for the target area

3.1.20

physical damage

damage to a structure (or to its contents) due to mechanical, thermal, chemical or explosive effects of lightning

3.1.21

preventive actions

actions of a temporary nature, taken on the basis of the preventive information and framed within the emergency plans of each organization which covers all that is required

3.1.22

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point of strike

point where a lightning flash strikes the <u>rearthyor</u> protruding objects (e.g. structure, lightning protection system, line;/tree)ards.iteh.ai/catalog/standards/sist/f941c138-533d-40ea-935c-

e9b9b7737b54/iec-62793-2016

Note 1 to entry: A lightning flash may have more than one point of strike.

3.1.23

surrounding area

SA

geographic area in which a lightning related event (LRE) causes a potential danger and which surrounds and includes the target area (TA)

Note 1 to entry: Any lightning related event occurring in the surrounding area is potentially dangerous. This area is used when evaluating a thunderstorm warning system to determine the false alarm ratio and other performance parameters.

3.1.24 target area TA

IA

geographic area where a warning is needed in order to facilitate decision-making and to activate preventive actions before a lightning related event occurs in that area

3.1.25

thunderstorm

local storm produced by atmospheric activity and accompanied by lightning and thunder

3.1.26

thunderstorm detector

equipment capable of evaluating one or more parameters associated with the electrical characteristics of the thunderstorm

Note 1 to entry: Thunderstorm detectors may consist of a single detector or of a network of connected detectors.

3.1.27 thunderstorm warning system TWS

system composed of thunderstorm detectors able to monitor the thunderstorm activity in the monitoring area and means of processing the acquired data to provide a valid alarm (warning) related to the lightning related events for a defined target area

Note 1 to entry: Some countries refer to TWS as 'lightning warning systems'.

3.1.28 total alarm duration TAD time between triggering and the end of an alarm

3.1.29 percentage of alarms delivered POD_x

percentage of alarms delivered with a lead time of more than or equal to x minutes

EXAMPLE: POD₁₀ is the percentage of alarms delivered with a lead time of more than or equal to 10 min.

| 3.2 | Abbreviations | |
|------|--|--|
| CA | Coverage area | |
| CG | Cloud to ground | |
| DC | Direct current Teh STANDARD PREVIEW | |
| DE | Detection efficiency (standards.iteh.ai) | |
| DT | Dwell time | |
| EA | Effective alarm | |
| EMC | Electromagnetic compatibility/ Electromagnetic compatibility/ | |
| EMI | Electromagnetic interference | |
| FA | False alarm | |
| FAR | False alarm ratio | |
| FSM | Field strength meter | |
| FTW | Failure to warn | |
| FTWR | R Failure to warn ratio | |
| ΗV | High voltage | |
| IC | Intercloud, intracloud or cloud to air discharges | |
| IP | Index of protection | |
| LA | Location accuracy | |
| LF | Low frequencies | |
| LLS | Lightning location system | |
| LPS | Lightning protective system | |
| LT | Lead time | |
| LRE | Lightning related event | |
| MA | Monitoring area | |
| MCS | Mesoscale convective systems | |
| MDF | Magnetic duration finder | |
| OI | Optical imaging | |
| POD | Percentage of alarms delivered | |

POD_x Percentage of alarms delivered

- RFI Radio frequency interferometry
- RFM RF signal strength measurement
- RF Radio frequency
- SA Surrounding area
- TA Target area
- TAD Total alarm duration
- TOA Time of arrival
- TTC Time to clear
- TWS Thunderstorm warning system
- UV Ultraviolet
- VHF Very high frequencies
- VLF Very low frequencies

4 Thunderstorm phases and detectable phenomena for alarming

4.1 Introductory remark

Four distinct stages can be identified during the thunderstorm life time cycle regarding detectable phenomena:

- 1) initial phase; **iTeh STANDARD PREVIEW**
 - (standards.iteh.ai)
- growth phase;
 mature phase;
- 4) dissipation phase.

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4.2 Phase 1 – Initial phase (cumulus stage) -62793-2016

This is the phase of cloud electrification by means of electric charge separation within the cloud. The charges are distributed in regions within the cloud and produce a measurable electrostatic field at ground level. It is considered the first detectable phenomenon before a thunderstorm.

NOTE Electrostatic fields can produce potential dangers such as electrostatic discharges even in the case of no lightning activity.

4.3 Phase 2 – Growth phase

This phase, sometimes also called the development phase, is characterized by the occurrence of the first lightning discharge (IC or CG). The first intra-cloud (IC) flashes appear after a certain development of the charge regions in the cloud. However, in some situations there is no clear time delay between the first IC flash and the first CG flash.

NOTE IC flashes typically represent the majority of the total lightning activity generated by a thunderstorm. Significant variation in the IC/CG rate is observed for individual storms.

4.4 Phase 3 – Mature phase

This stage is characterized by the presence of both CG and IC flashes.

4.5 Phase 4 – Dissipation phase

This phase is characterized by the decaying of both IC and CG flash rates and the reduction of the electrostatic field to the fair weather level.