SLOVENSKI STANDARD
SIST EN 50310:2001

01-februar-2001

Nadomešča:
SIST EN 50310:2006

Application of equipotential bonding and earthing in buildings with information technology equipment

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Anwendung von Maßnahmen für Potentialausgleich und Erdung in Gebaüden mit Einrichtungen der Informationstechnik

Application de liaison équipotentielle et de la mise à la terre dans les locaux avec équipement de technologie de l'information

Ta slovenski standard je istoveten z: **EN 50310:2000**

ICS:

35.020	Informacijska tehnika in tehnologija na splošno	Information technology (IT) in general
91.140.50	Sistemi za oskrbo z elektriko	Electricity supply systems

SIST EN 50310:2001 **en**

EUROPEAN STANDARD **EN 50310**

NORME EUROPÉENNE

EUROPÄISCHE NORM August 2000

ICS 33.100;35.020;91.140.50

English version

Application of equipotential bonding and earthing in buildings with information technology equipment

Application de liaision équipotentielle et de la mise à la terre dans les locaux avec équipement de technologie de l'information

Anwendung von Maßnahmen für Potentialausgleich und Erdung in Gebaüden mit Einrichtungen der Informationstechnik

This European Standard was approved by CENELEC on 2000-08-01. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 50310 2000 E

Foreword

This European Standard has been prepared by CENELEC/TC 215/WG 4, which is composed of experts of both CENELEC/TC 215 and ETSI/TC EE/WG EE 2 (former ETSI/STC EE 2). The work started in Technical Committee Environmental Engineering (TC EE) of the European Telecommunications Standards Institute (ETSI) as sub-contracted work on behalf of Technical Committee CENELEC/TC 215 under mode 3, as agreed on the CENELEC-ETSI work repartition meeting held in 1992 and as approved by the ETSI/TA and CENELEC/BT at that time.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50310 on 2000-08-1.

The following dates were fixed.

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop) 2001-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow) 2003-08-01

Annexes designated „normative“ are part of the body of the standard. Annexes designated „informative“ are given for information only.
In this standard, Annex A is normative, Annexes B and C are informative.

This standard has been produced within the framework of the following considerations:

a) With the ongoing growth of the liberalised telecommunication market, the increasing advent of private telecommunication network operators, and the flourishing use of networking computers, the amount of Information Technology equipment installed in buildings and the complexity of these Information Technology installations are permanently growing.

b) Information Technology equipment is generally installed either as stand alone equipment (e. g. personal or network computers, small PBXs), or held in racks, cabinets or other mechanical structures (e. g. switching systems, transmission systems, mobile base stations).

c) The existing ITU-T and ITU-R recommendations in such matters do not ensure the required standardisation at the equipment level.

d) CENELEC/SC 64B „*Electrical installations of buildings: Protection against thermal effects*“ has decided during their meeting in November 1997 not to harmonize IEC 60364-5-548:1996 „*Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – Section 548: Earthing arrangements and equipotential bonding for information technology installations*“.

e) This European Standard shall give guidance to Network operators, equipment providers and building owners to agree on a standardised bonding configuration that facilitates:

- compliance of the Information Technology Equipment installation with functional requirements including Electromagnetic Compatibility (EMC) aspects of emission and immunity;
- compatible building installation and equipment provisions;
- installation of new equipment in buildings as well as expansion or replacement of installations in existing buildings with equipment coming from different suppliers;
- a structured installation practice;
- simple maintenance rules;
- contracting on a common basis;
- harmonisation in development, manufacturing, installation and operation.

Contents

Introduction

This standard addresses earthing and bonding of information technology equipment in buildings in relation to safety, functional and electromagnetic performance, taking into account that the draft does not specify another earthing and bonding system but selects out of the existing ones (specified in HD 384 series together with IEC 60364-5-548) the best suitable system to information technology needs (CBN, MESH-BN, TN-S system).

Information regarding the general principles on earthing for (small) telecommunication installations in buildings has been published in Recommendation ITU-T K.31.

Depending on the degree of complexity and the size of the information technology installation, different levels of earthing and bonding are required. Starting from basic requirements on earthing and bonding this standard defines the refinements necessary to operate information technology equipment. The underlined concepts of this standard are in harmony with ETS 300 253. Therefore large information technology installations in buildings, which may require special care to avoid damage or upset from electromagnetic sources can make use of the bonding configurations and earthing techniques of ETS 300 253.

The specifications of EN 50310 are intended to provide optimum earthing and bonding conditions for buildings, where information technology installations are to be operated. EN 50310 should be applied at least in the case of newly constructed buildings and whenever possible in existing buildings (e. g. on the occasion of refurbishment). EN 50174-2 details the considerations for satisfactory installation and operation of information technology cabling within the environment of a building operating a low-voltage electricity distribution system (up to AC 1 000 V rms). For the relationship of EN 50310 and European standards on information technology cabling and their usage see Table 1.

Table 1 - Relationship between EN 50310 and European Standards dealing with information technology cabling

Building design phase	Cabling design phase	Planning phase	Implementation phase	Operation phase
EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S)	EN 50173 **or (and)** EN 50098-1 **or (and)** EN 50098-2 **or (and)** Other application standards	EN 50174-1 4: Specification considerations 5: Quality assurance 7: Cabling administration **and** EN 50174-2 4: Safety requirements 5: General installation practices for metallic and optical fibre cabling 6: Additional installation practice for metallic cabling 7: Additional installation practice for optical fibre cabling **and** EN 50174-3 **and** **(for equipotential bonding)** EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S)	EN 50174-1 6: Documentation 7: Cabling administration **and** EN 50174-2 4: Safety requirements 5: General installation practices for metallic and optical fibre cabling 6: Additional installation practice for metallic cabling 7: Additional installation practice for optical fibre cabling **and** EN 50174-3 **and** **(for equipotential bonding)** EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S)	EN 50174-1 5: Quality assurance 7: Cabling administration 8: Repair and maintenance

1 Scope

This European Standard applies to the equipotential bonding inside buildings in which information technology equipment is going to be installed. It contributes to the standardisation of information technology equipment and co-ordinates with the pre-requirements of the generic installation conditions as outlined in IEC 60364-5-548 to achieve the following targets:

a) safety from electrical hazards;

b) reliable signal reference within the entire information technology installation;

c) satisfactory electromagnetic performance of the entire information technology installation.

A defined bonding configuration down to the equipment level – independent of the equipment supplier – is intended to facilitate

- the installation, operation and maintenance of information technology installations in buildings;

- the interworking between different information technology equipment (interconnected by metallic links).

The specification of information technology equipment and of the pre-requirements of installation are subject to agreement of the parties (e. g. the equipment supplier and the purchaser or building owner).

This standard applies to buildings with information technology equipment or in which the installation of information technology equipment is intended. It does not apply to buildings which may be subject to a harsh electromagnetic environment, or rooms containing the generation, transmission or termination of voltages over AC 1 000 V. This standard does not address the specific requirements for telecommunication centres; these are specified in ETS 300 253.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 41003, *Particular safety requirements for equipment to be connected to telecommunication networks.*

EN 50174-2, *Information technology – Cabling installation – Part 2: Installation planning and practices inside buildings.*

EN 60950, *Safety of information technology equipment (IEC 60950:1999, modified).*

ETS 300 253, *Equipment Engineering (EE) – Earthing and bonding of telecommunication equipment in telecommunication centres.*

HD 384.2 S1, *International Electrotechnical Vocabulary – Chapter 826: Electrical installations of buildings (IEC 60050-826:1982).*

HD 384.3 S2, *Electrical installations of buildings – Part 3: Assessment of general characteristics of installations (IEC 60364-3:1993, modified).*

HD 384.4.41 S2, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against electric shock (IEC 60364-4-41:1992, modified).*

HD 384.5.54 S1, *Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – Chapter 54: Earthing arrangements and protective conductors (IEC 60364-5-54:1980, modified).*

IEC 60050-604, *International Electrotechnical Vocabulary – Chapter 604: Generation, transmission and distribution of electricity – Operation.*

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of this European standard, the following definitions apply.

NOTE 1 The definitions with respect to earthing and bonding are taken from series IEC 60050 and HD 384.2 S1, respectively. Furthermore, definitions specific to information technology installations given in ETS 300 253:1995 are used. Reference to these standards is indicated, where appropriate, in square brackets. These definitions are reproduced here to assist the reader of this standard.

NOTE 2 The concept of the various electricity distribution systems (TN-S, TN-C, TT and IT) is introduced in detail in HD 384.3 S2.

3.1.1
bonding mat
essential means to provide a SRPP by a discernible, nearly regular mesh structure. The bonding mat may be located either below or above a collection of equipment constituting a system block

[3.2.2 of ETS 300 253:1995]

3.1.2
bonding network (BN)
set of interconnected conductive structures that provides an „electromagnetic shield" for electronic systems and personnel at frequencies from direct current (DC) to low radio frequency (RF). The term „electromagnetic shield" denotes any structure used to divert, block or impede the passage of electromagnetic energy. In general, a BN need not be connected to earth but all BNs considered in this standard will have an earth connection

[3.2.2 of ETS 300 253:1995]

3.1.3
bonding ring conductor (BRC)
an earthing bus conductor which forms a closed connected ring. Normally a BRC has multiple connections to the CBN and therefore improves its quality

3.1.4
common bonding network (CBN)
principal means for effective bonding and earthing inside a telecommunication building. It is the set of metallic components that are intentionally or incidentally interconnected to form the principal BN in a building. These components include: structural steel or reinforcing rods, metallic plumbing, alternating current (AC) power conduit, protective conductors (PE), cable racks and bonding conductors. The CBN always has a mesh topology and is connected to the earthing network

[3.2.2 of ETS 300 253:1995]

3.1.5
DC return conductor
(+) conductor of the –48 V or –60 V secondary DC supply

[3.2.2 of ETS 300 253:1995]

3.1.6
earth
conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to zero

[826-04-01 of HD 384.2 S1:1986]

3.1.7
earth electrode
conductive part or group of conductive parts in intimate contact with and providing an electrical connection with earth

[826-04-02 of HD 384.2 S1:1986]

3.1.8
earthing conductor
protective conductor connecting the main earthing terminal or bar to the earth electrode

[826-04-07 of HD 384.2 S1:1986]

3.1.9
earthing network
part of an earthing installation which is restricted to the earth electrodes and their interconnections

[604-04-07 of IEC 60050-604:1989]

3.1.10
equipotential bonding
electrical connection putting various exposed conductive parts and extraneous conductive parts at a substantially equal potential

[826-04-09 of HD 384.2 S1:1986]

3.1.11
equipotential bonding conductor
protective conductor for ensuring equipotential bonding

[826-04-10 of HD 384.2 S1:1986]

3.1.12
main earthing terminal; main earthing bar
terminal or bar provided for the connection of protective conductors, including equipotential bonding conductors and conductors for functional earthing, if any, to the means of earthing

[826-04-08 of HD 384.2 S1:1986]

3.1.13
meshed bonding network (MESH-BN)
bonding network in which all associated equipment frames, racks and cabinets and usually the DC power return conductor, are bonded together as well as at multiple points to the CBN. Consequently, the MESH-BN augments the CBN

[3.2.2 of ETS 300 253:1995]

3.1.14
neutral conductor (N)
conductor connected to the neutral point of a system and capable of contributing to the transmission of electrical energy

[826-01-03 of HD 384.2 S1:1986]

3.1.15
PEN conductor
earthed conductor combining the functions of both protective conductor and neutral conductor

[826-04-06 of HD 384.2 S1:1986]

3.1.16
power supply

- **primary supply:** public mains or, under emergency conditions, locally generated AC supply
- **secondary supply:** supply to the telecommunication equipment, racks or system block, derived from the primary supply
- **tertiary supplies:** supplies to the telecommunication equipment, derived from the secondary supply

[3.2.2 of ETS 300 253:1995]

3.1.17
protective conductor (PE)
conductor required by some measures for protection against electric shock for electrically connecting any of the following parts:

- exposed conductive parts,
- extraneous conductive parts,
- main earthing terminal,
- earth electrode,
- earthed point of the source or artificial neutral

[826-04-05 of HD 384.2 S1:1986]

3.1.18
signalling earth conductor (SE)
conductor referring signalling circuits to earth potential. The signalling functions of such circuits may include signalling with earth return between different locations. A protective conductor (PE) may serve simultaneously as an SE if the characteristics of the signalling functions harmonize with the imposed safety requirements. The CBN (of which the PE is part) can provide the SE function

3.1.19
system
regularly interacting or interdependent group of items forming a unified whole

[3.2.2 of ETS 300 253:1995]

3.1.20
system block
functional group of equipment depending in its operation and performance on its connection to the same system reference potential plane, inherent to a MESH-BN

[3.2.2 of ETS 300 253:1995]

3.1.21
system reference potential plane (SRPP)
conductive solid plane, as an ideal goal in potential equalising, is approached in practice by horizontal or vertical meshes. The mesh width thereof is adapted to the frequency range to be considered. Horizontal and vertical meshes may be interconnected to form a grid structure approximating to a Faraday cage

[3.2.2 of ETS 300 253:1995]

NOTE The SRPP facilitates signalling with reference to a common potential.

3.2 Abbreviations

AC	alternating current
BN	bonding network
BRC	bonding ring conductor
CBN	common bonding network
DC	direct current
EMC	electromagnetic compatibility
FE	functional earthing conductor
L+	positive DC conductor
L–	negative DC conductor
LPS	lightning protection system
MDF	main distribution frame
MESH-BN	meshed bonding network
MET	main earthing terminal or bar
N	neutral conductor
NT	network termination