



SLOVENSKI STANDARD

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Okoljski inženiring (EE) – Konfiguracija ozemljitev in povezav v telekomunikacijskih centrih

Environmental Engineering (EE); Earthing and bonding of telecommunication equipment in telecommunication centres

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**Environmental Engineering (EE);
Earthing and bonding configuration
inside telecommunications centres**

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE).

The present document has been produced within the framework of the following considerations:

- a) centralized telecommunication equipment is generally installed in telecommunication centres and held in racks, cabinets or other mechanical structures;
- b) the existing ITU-T and CCIR Recommendations and CENELEC standards in such matters do not ensure the required standardization at the equipment level;
- c) network operators and equipment providers agreed to standardize on a bonding configuration that facilitates:
 - compliance with functional requirements including Electromagnetic Compatibility (EMC) aspects of emission and immunity;
 - compatible building and equipment provisions;
 - installation of new telecommunication centres as well as expansion or replacement of installations in existing telecommunication centres with equipment coming from different suppliers;
 - a structured installation practice;
 - simple maintenance rules;
 - contracting on a common basis;
 - cost effectiveness in development, manufacturing, installation and operation.

National transposition dates

Date of adoption of this EN:	26 April 2002
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Introduction

The present document addresses earthing and bonding of telecommunication equipment in telecommunication centres in relation to safety, functional performance and EMC.

Information regarding the general principles on earthing for telecommunication sites has been published by the ITU-T in the handbook on "Earthing of telecommunication installations" (see bibliography). ITU-T Recommendation K.27 deals with bonding configurations and earthing inside a telecommunication building. One bonding configuration only is selected from ITU-T Recommendation K.27 (CBN/MESH-BN) and tailored to the present document.

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1 Scope

The present document applies in telecommunication centres and similar installations to the bonding network of the building, the bonding network of the equipment, and the interconnection between these two networks. It contributes to the standardization of telecommunication and datacom equipment installation.

It also co-ordinates with the pre-conditions of the installation to achieve the following targets:

- safety from electrical hazards;
- reliable signal reference;
- satisfactory Electromagnetic Compatibility (EMC) performance.

A defined bonding configuration down to the equipment level shall facilitate the installation, operation and maintenance of telecommunication centres in telecommunication buildings or similar installations independent of the equipment supplier.

The specification of telecommunication and datacom equipment and of the pre-conditions of installation are subject to agreement of the parties (e.g. the supplier and the purchaser). Annex A can be used in the procedure to achieve agreement.

The present document does not cover safety and EMC aspects of the equipment. Those aspects are covered by other relevant standards.

The present document does not apply to the installation of telecommunication and datacom equipment in locations other than telecommunication centres, e.g.:

- smaller telecommunication equipment inside a subscriber's building;
- subscriber line terminal equipment.

NOTE: Earthing and bonding of equipment installed in locations other than telecommunication building is covered by EN 50310 [8].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] CENELEC HD 384.4.41: "Electrical installation of buildings - Part 4: Protection for safety - Chapter 41: Protection against electric shock".
- [2] CENELEC HD 384.5.54: "Electrical installation of buildings - Part 5: Selection and erection of electrical equipment - Chapter 54: Earthing arrangements and protective conductors".
- [3] EN 60950: "Safety of information technology equipment".
- [4] EN 41003: "Particular safety requirements for equipment to be connected to telecommunication networks".
- [5] IEC 60050: "International Electrotechnical Vocabulary".
- [6] IEC 60050-604: "International Electrotechnical Vocabulary. Chapter 604: Generation, transmission and distribution of electricity - Operation".

- [7] IEC 60050-826: "International Electrotechnical Vocabulary. Electrical installations of buildings".
- [8] EN 50310: "Application of equipotential bonding and earthing in buildings with information technology equipment".
- [9] IEC 61024-1: "Protection of structures against lightning - Part 1: General principles".

3 Definitions and abbreviations

3.1 Definitions

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

The following definitions with respect to earthing and bonding are introduced by the IEC 60050 [5] and are used within the present document to maintain conformity.

3.1.1 IEC definitions (by IEC 60050 numbers)

NOTE: IEC 60050 [5] references are given in parentheses (see IEC 60050-604 [6] and IEC 60050-826 [7]).

earth (826-04-01): conductive mass of earth, whose electric potential at any point is conventionally taken as equal to zero

earthing conductor (826-04-07): protective conductor connecting the main earthing terminal or bar to the earth electrode

earth electrode (826-04-02): conductive part or a group of conductive parts in intimate contact with and providing an electrical connection with earth

earthing network (604-04-07): part of an earthing installation that is restricted to the earth electrodes and their interconnections

equipotential bonding (826-04-09): electrical connection putting various exposed conductive parts and extraneous conductive parts at a substantially equal potential

equipotential bonding conductor (826-04-10): protective conductor for ensuring equipotential bonding

IT: See IEC 60364-3.

main earthing terminal (826-04-08): 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

Neutral conductor (N) (826-01-03): conductor connected to the neutral point of a system and capable of contributing to the transmission of electrical energy

PEN conductor (826-04-06): earthed conductor combining the functions of both protective conductor and neutral conductor

Protective conductor (PE) (826-04-05): conductor required by some measures for protection against electric shock by 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.

TN-C: See IEC 60364-3.

TN-S: See IEC 60364-3.

TT: See IEC 60364-3.

3.1.2 Telecommunication definitions

The following definitions, specific to telecommunication installations and not covered by the IEC 60050 [5], are used within the present document. Correspondence to ITU-T Recommendation K.27 (see bibliography) is indicated as appropriate.

bonding mat: essential means to provide a SRPP by a discernible, nearly regular mesh structure

NOTE: The bonding mat may be located either below or above a collection of equipment constituting a system block.

Bonding Network (BN), (ITU-T Recommendation K.27): 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)

NOTE: 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 the present document will have an earth connection.

Common Bonding Network (CBN), (ITU-T Recommendation K.27): principal means for effective bonding and earthing inside a telecommunication building

NOTE: 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, PE conductors, cable racks and bonding conductors. The CBN always has a mesh topology and is connected to the earthing network.

DC return conductor: (+) conductor of the -48 V or -60 V secondary DC supply

MESHed Bonding Network (MESH-BN), (ITU-T Recommendation K.27): 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

NOTE 1: Consequently, the MESH-BN augments the CBN

NOTE 2: See figure 1 of the present document.

MESHed Isolated Bonding Network (MESH-IBN), (ITU-T Recommendation K.27): type of IBN in which the components of the IBN (e.g. equipment frames) are interconnected to form a mesh-like structure

NOTE: This may, for example, be achieved by multiple interconnections between cabinet rows, or by connecting all equipment frames to a metallic grid (a "bonding mat") extending beneath the equipment. The bonding mat is, of course, insulated from the adjacent CBN. If necessary the bonding mat could include vertical extensions, resulting in an approximation to a Faraday cage. The spacing of the grid is chosen according to the frequency range of the electromagnetic environment.

power supply:

- **primary supply:** public mains or, under emergency conditions, a 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

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

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

System Reference Potential Plane (SRPP): conductive solid plane, as an ideal goal in potential equalizing, is approached in practice by horizontal or vertical meshes

NOTE 1: 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.

NOTE 2: The SRPP facilitates signalling with reference to a common potential.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating Current
BN	Bonding Network
CBN	Common Bonding Network
DC	Direct Current
EMC	ElectroMagnetic Compatibility
LPS	Lightning Protection System
MESH-BN	MESHed Bonding Network
MESH-IBN	MESHed Isolated Bonding Network
N	Neutral conductor
PE	Protective conductor
PEN	combined Protective conductor and Neutral conductor
RF	Radio Frequency
SRPP	System Reference Potential Plane

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4 General requirements

4.1 Safety from electrical hazards

To achieve safety it is required to design equipment to the standards EN 60950 [3], EN 41003 [4] and CENELEC HD 384.4.41 [1] and to perform the installation of PEs and equipotential bonding conductors, according to CENELEC HD 384.5.54 [2].

The conductors involved shall provide sufficiently high current conducting capability and low impedance according to the relevant safety standards to avoid electric shock, risk of fire, or damage to the equipment under normal or faulty operating conditions within an equipment or the distribution network, or due to the impact of induced voltage and current, e.g. by lightning.

4.2 Signal reference

Reliable signal reference shall be provided by a SRPP dedicated at least to a functional unit or a system block. To avoid undue functional distortion or risk of component failure, the SRPP shall provide sufficiently low impedance up to the highest frequency to be regarded by using a metal plane or a meshed configuration having adequate mesh dimensions, e.g. a bonding mat. The frequency band to be covered shall include the spectral components of transients caused by switching, short circuits and atmospheric discharges.

NOTE: Signal reference to the SRPP does not always imply signal return via the SRPP.

4.3 EMC performance

Measures to gain a satisfactory EMC performance shall be assisted by a SRPP. The SRPP shall provide sufficiently low impedance for efficient connection of filters, cabinets and cable shields. The requirement to avoid undue emission of, or susceptibility to electromagnetic energy under normal operating conditions may govern the properties of the SRPP ahead of what is required in clause 4.2. The EMC requirements addressed include the discharge of electrostatic energy.