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Nizkonapetostne električne inštalacije - 4-444. del: Zaščitni ukrepi - Zaščita pred napetostnimi in elektromagnetnimi motnjami

Low-voltage electrical installations - Part 4-444: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances

Elektrische Anlagen von Gebäuden - Teil 4-444: Schutzmaßnahmen - Schutz gegen Störspannungen und elektromagnetische Störgrößen

Installations électriques à basse tension - Partie 4-444: Protection pour assurer la sécurité - Protection contre les perturbations de tension et les perturbations électromagnétiques

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ICS:

91.140.50 Sistemi za oskrbo z elektriko Electricity supply systems

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HARMONIZATION DOCUMENT

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English version

Low-voltage electrical installations - Part 4-444: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances

(IEC 60364-4-44:2007 (CLAUSE 444), modified)

Installations électriques à basse tension - Partie 4-444: Protection pour assurer la sécurité - Protection contre les perturbations de tension et les perturbations électromagnétiques (CEI 60364-4-44:2007 (CLAUSE 444), modifiée)

Errichten von Niederspannungsanlagen - Teil 4-444: Schutzmaßnahmen – Schutz bei Störspannungen und elektromagnetischen Störgrößen (IEC 60364-4-44:2007 (CLAUSE 444), modifiziert)

This Harmonization Document was approved by CENELEC on 2010-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document at national level.

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

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

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Foreword

The text of the International Standard IEC 60364-4-44:2007, Clause 444, prepared by IEC TC 64, Electrical installations and protection against electric shock, together with the common modifications prepared by CENELEC TC 64, Electrical installations and protection against electric shock, was submitted to the formal vote and was approved by CENELEC as HD 60364-4-444 on 2010-05-01.

This European Standard supersedes R064-004:1999.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

– latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement	(dop)	2011-05-01
– latest date by which the national standards conflicting with the HD have to be withdrawn	(dow)	2013-05-01

In this document, the common modifications are indicated by a vertical line at the left margin of the text.

Clauses, subclauses, notes, tables and figures which are additional to those of Clause 444 of IEC 60364-4-44:2007 are prefixed "Z".

444 Measures against electromagnetic influences

444.0 Introduction

Clause 444 provides requirements and recommendations to enable avoidance and reduction of electromagnetic disturbances.

The document, Clause 444, is intended for architects and for those involved in the design, installation and maintenance of electrical installations.

Electromagnetic Interference (EMI) disturbs or damages information technology systems (ICT), broadcast communication technologies (BCT), command, control and communication (CCCB), process monitoring, control and automation systems (PMCA). Currents due to lightning, switching operations, short-circuits and other electromagnetic phenomena may cause overvoltages and electromagnetic interference.

These effects can occur

- where large conductive loops exist,
- where different electrical wiring systems are installed in common routes, e.g. power supply, communication, control or signal cables.

Power cables carrying large currents with a high rate of rise of current (d*i*/d*t*) can induce overvoltages in command, control and communication cables of electrical installation systems, which can influence or damage the connected electrical equipment.

444.1 Scope

To provide requirements and recommendations for electrical installations in order to avoid or reduce the impact of electromagnetic disturbances.

The rules of this part do not apply to systems that are wholly or partly under the control of public power supply companies (see scope of HD 60364-1:2008) although voltage and electromagnetic disturbances may be conducted or induced into electrical installations via these supply systems.

444.2 Normative references

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

EN 50117-4-1:2008	Coaxial cables - Part 4-1: Sectional specification for cables for BCT cabling in accordance with EN 50173 - Indoor drop cables for systems operating at 5 MHz - 3 000 MHz
EN 50173-1:2007	Information technology - Generic cabling systems - Part 1: General requirements
EN 50174-2:2009	Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings
EN 50174-3:2003	Information technology - Cabling installation - Part 3: Installation planning and practices outside buildings
EN 50288 series	Multi-element metallic cables used in analogue and digital communication and control
EN 50310:2006	Application of equipotential bonding and earthing in buildings with information technology equipment
EN 60950-1	Information technology equipment - Safety - Part 1: General requirements (IEC 60950-1)

EN 61000-6-x series	Electromagnetic compatibility (EMC) - Part 6-x: Generic standards (IEC 61000-6-x series)
EN 61386 series	Conduit systems for cable management (IEC 61386 series)
EN 61558-2-1	Safety of power transformers, power supplies, reactors and similar products - Part 2-1: Particular requirements and tests for separating transformers and power supplies incorporating separating transformers for general applications (IEC 61558-2-1)
EN 61558-2-4	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers (IEC 61558-2-4)
EN 61558-2-6	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers (IEC 61558-2-6)
EN 61558-2-15	Safety of power transformers, power supply units and similar - Part 2-15: Particular requirements for isolating transformers for the supply of medical locations (IEC 61558-2-15)
EN 62305-3	Protection against lightning - Part 3: Physical damage to structures and life hazard (IEC 62305-3)
HD 60364-1:2008	Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions (IEC 60364-1:2005, mod)
HD 60364-4-41:2007	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock (IEC 60364-4-41:2005, mod.)
HD 60364-5-52:200X[1)]	Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems (IEC 60364-5-52:2009)
HD 60364-5-54:2007	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors (IEC 60364-5-54:2002, mod.)
IEC/TR 61000-2-5:1995	Electromagnetic compatibility (EMC) - Part 2: Environment - Section 5: Classification of electromagnetic environments. Basic EMC publication
ETSI EN 300 253:2002	Equipment Engineering (EE) - Earthing and bonding of telecommunication equipment in telecommunication centres

444.3 Definitions

See HD 60364-1:2008 for basic definitions. For the purposes of this document, the following definitions apply:

444.3.1
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)

NOTE The term “electromagnetic shield” denotes any structure used to divert, block or impede the passage of electromagnetic energy. In general, a BN does not need to be connected to earth but BN considered in the present document will have an earth connection

[3.1.2 of EN 50310:2006]

[1)] At draft stage.

444.3.2
bonding ring conductor, BRC
an earthing bus conductor which forms a closed connecting ring

[3.1.3 of EN 50310:2006]

NOTE Normally a bonding ring conductor has multiple connections to the CBN and therefore improves its quality.

444.3.3
common equipotential bonding system
common bonding network, CBN
equipotential bonding system providing both protective-equipotential-bonding and functional-equipotential-bonding
[IEV 195-02-25]

444.3.4
equipotential bonding
provision of electric connections between conductive parts, intended to achieve equipotentiality
[IEV 195-01-10]

444.3.5
earth-electrode network
part of an earthing arrangement comprising only the earth electrodes and their interconnections
[IEV 195-02-21]

444.3.6
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.

[3.1.2 of ETSI EN 300 253:2002-04]

NOTE The MESH-BN enhances the effect of the CBN.

444.3.7
by-pass conductor, PEC
conductor usually laid along the cable route to provide a low impedance connection between the earthing arrangements at the ends of the cable route

[IEV 195-02-29]

NOTE See Figure 44R1 of the present document

444.4 Mitigation of electromagnetic interference (EMI)

Consideration shall be given by the designer and installer of the electrical installation to the measures described below for reducing the electric and magnetic influences on electrical equipment.

Only electrical equipment, which meets the requirements in the appropriate EMC standards or the EMC requirements of the relevant product standard shall be used, see also 515.3.1.2.

444.4.1 Sources of EMI

Electrical equipment sensitive to electromagnetic influences should not be located close to potential sources of electromagnetic emission such as

- switching devices for inductive loads,
- electric motors,
- fluorescent lighting,
- welding machines,
- rectifiers,

– choppers,
– frequency converters (e.g. invertors) and regulators,
– power correction devices
– lifts,
– transformers,
– switchgear,
– power distribution bars.

444.4.2 Measures to reduce EMI

The following measures reduce electromagnetic interference.

a) The installation of surge protection devices and/or filters for equipment sensitive to electromagnetic influences is recommended to improve electromagnetic compatibility with regard to conducted electromagnetic phenomena.

b) Conductive sheaths (e.g. armouring, screens) of cables should be bonded to the CBN, if any.

c) Inductive loops should be avoided by selection of a common route (according to 444.6) for power, signal and data circuits wiring.

d) Power and signal cables should be kept separate and should, wherever practical, cross each other at right-angles (see 444.6.2).

e) Use of cables with concentric conductors to reduce currents induced into the protective conductor.

f) Use of symmetrical multicore cables (e.g. screened cables containing separate protective conductors) for the electrical connections between converters and motors, which have frequency controlled motor-drives.

g) Use of signal and data cables according to the EMC requirements of the manufacturer's instructions.

h) Where a lightning protection system is installed,

– power and signal cables shall be separated from the down conductors of lightning protection systems (LPS) by either a minimum distance or by use of screening. The minimum distance shall be determined by the designer of the LPS in accordance with EN 62305-3;

i) Where screened signal or data cables are used, care should be taken to limit the fault current from power systems flowing through the screens and cores of signal cables, or data cables, which are earthed. Additional conductors may be necessary, e.g. a by-pass conductor for screen reinforcement; see Figure 44.R1.

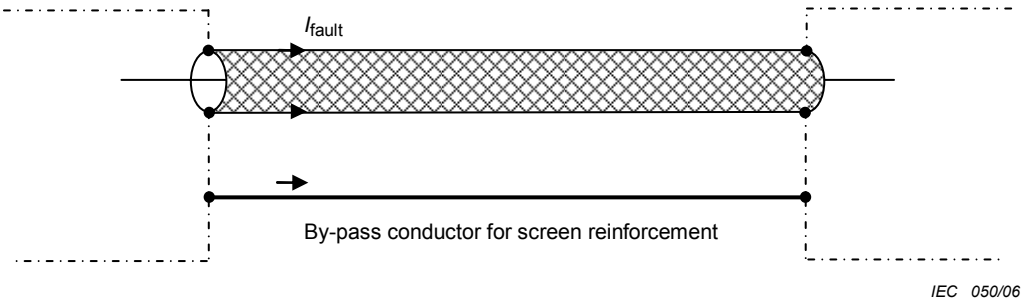


Figure 44.R1 - By-pass conductor for screen reinforcement to provide a common equipotential bonding system

NOTE 1 The provision of a by-pass conductor in proximity to a signal, or data, cable sheath also reduces the area of the loop associated with equipment, which is only connected by a protective conductor to earth. This practice considerably reduces for instances the effects of Lightning Electromagnetic Pulse (LEMP).

j) Where screened signal cables or data cables are common to several buildings supplied from a TT-system, a by-pass equipotential bonding conductor should be used; see Figure 44.R2. The by-pass conductor shall have a minimum cross-sectional area of 16 mm² Cu or equivalent. The equivalent cross-sectional area shall be dimensioned in accordance with 544.1 of HD 60364-5-54:2007.

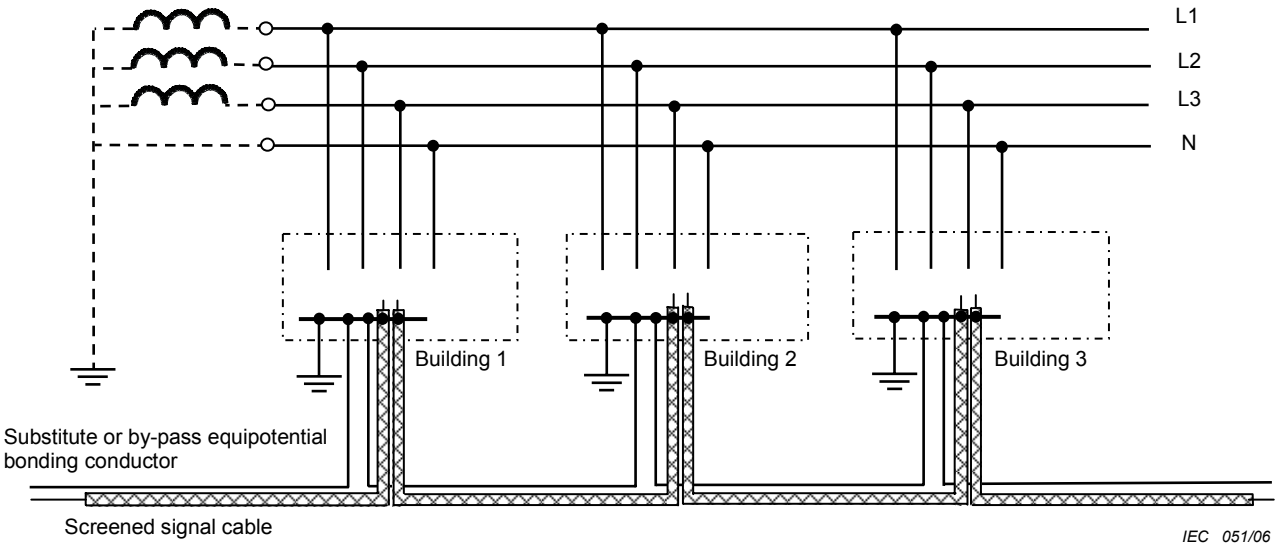


Figure 44.R2 - Example of a substitute or by-pass equipotential bonding conductor in a TT-system

NOTE 2 Where the earthed shield is used as a signal return path, coaxial cables with multiple isolated screens may be used.

NOTE 3 It is recalled that if the consent according to 411.3.1.2 (last paragraph) cannot be obtained, it is the responsibility of the owners or operators to avoid any danger due to the exclusion of those cables from the connection to the main equipotential bonding.

NOTE 4 The problems of earth differential voltages on large public telecommunication networks are the responsibility of the network operator, who may employ other methods.

k) Equipotential bonding connections should have an impedance as low as possible

- by being as short as possible,
- by having a cross-section shape that results in low inductive reactance and impedance per metre of route, e.g. a bonding braid with a width to thickness ratio of five to one.

l) Where an earthing bar is intended (according to 444.5.7) to support the equipotential bonding system of a significant information technology installation in a building, it may be installed as a closed ring.

NOTE 5 This measure is preferably applied in buildings of the telecommunications industry.

444.4.3 TN-system

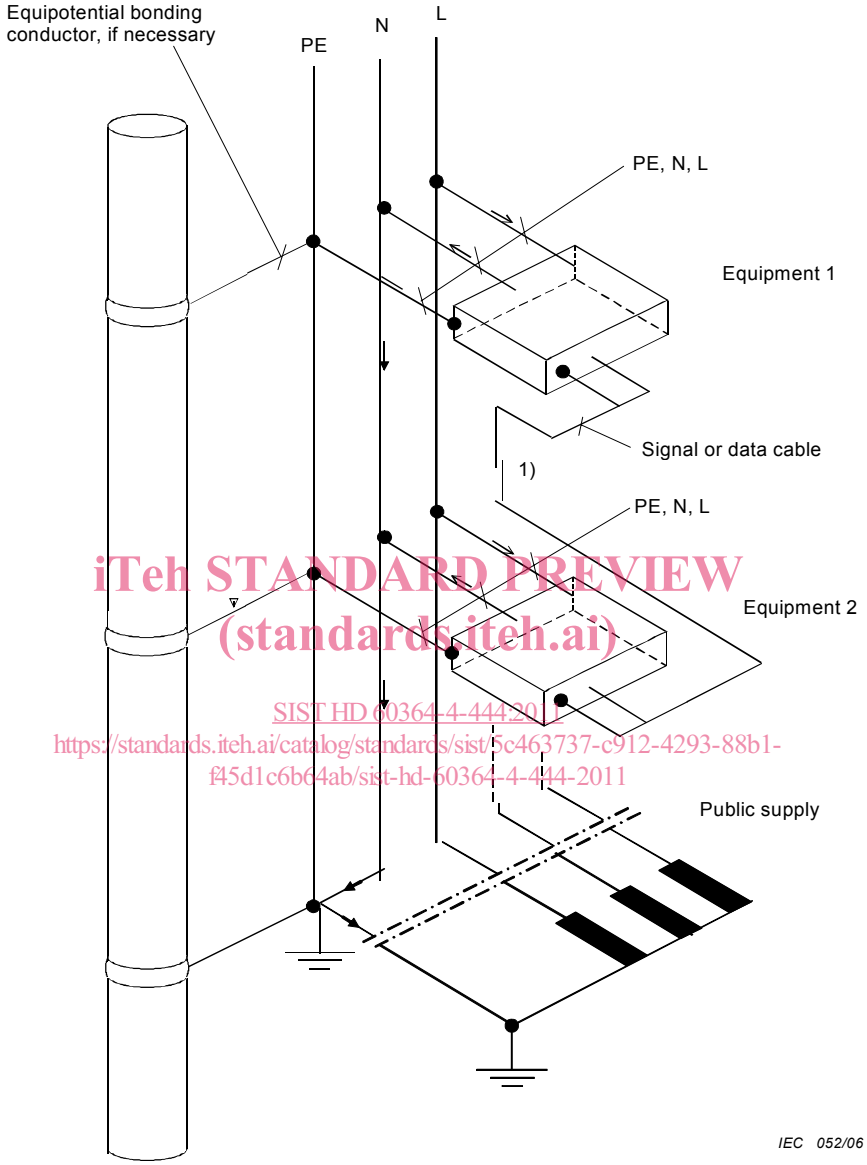
To minimize electromagnetic influences, the following subclauses apply.

444.4.3.1 TN-C-systems shall not be used in newly constructed buildings containing, or likely to contain, significant amounts of information technology equipment. It is recommended that TN-C systems should not be maintained in existing buildings containing, or likely to contain, significant amounts of information technology equipment.

NOTE It is probable that TN-C installations will have load or fault current diverted via equipotential bonding into metallic infrastructures (e.g. piping, beams) within a building.

444.4.3.2 In newly constructed buildings, TN-S systems shall be installed downstream of the origin of the installation; see Figure 44.R3A In existing buildings supplied from public low-voltage networks and which contain, or are likely to contain, significant amounts of information technology equipment, a TN-S system should be installed downstream of the origin of the installation; see Figure 44.R3A.

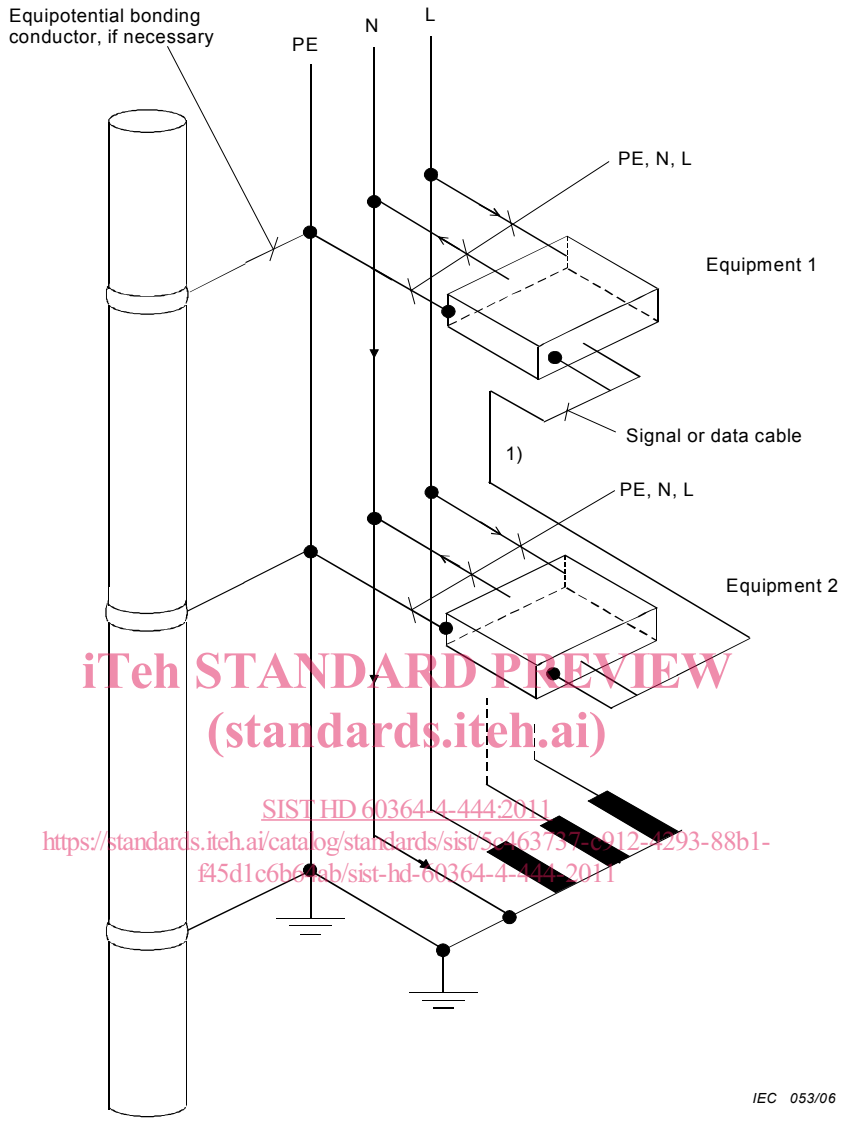
NOTE The effectiveness of a TN-S-system may be enhanced by use of a residual current monitoring device, RCM, complying with EN 62020:1998.



1) Loops of limited area formed by signal or data cables

Figure 44.R3A - Avoidance of neutral conductor currents in a bonded structure by using the TN-S system from the origin of the public supply up to and including the final circuit within a building

444.4.3.3 In existing buildings where the complete low-voltage installation including the transformer is operated only by the user and which contain, or are likely to contain, significant amounts of information technology equipment, TN-S systems should be installed; see Figure 44.R3B.



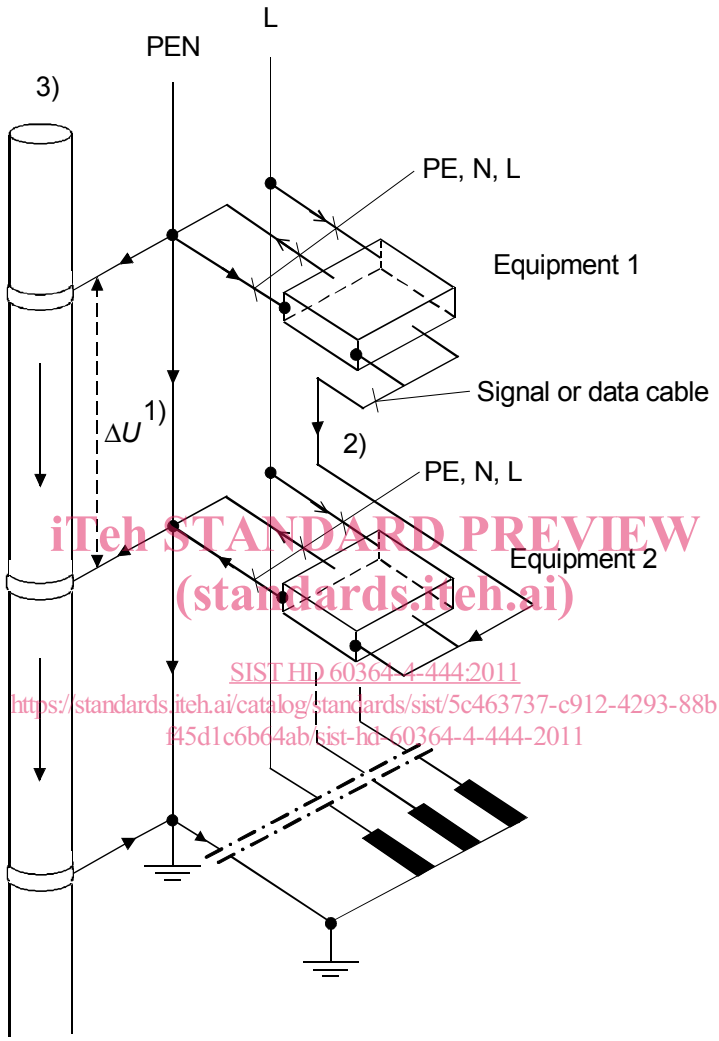
1) Loops of limited area formed by signal or data cables

Figure 44.R3B - Avoidance of neutral conductor currents in a bonded structure by using a TN-S system downstream of a consumer's private supply transformer

444.4.3.4 Where an existing installation is a TN-C-S system (see Figure 44.R4), signal and data cable loops should be avoided by

– changing all TN-C parts of the installation shown in Figure 44.R4 into TN-S, as shown in Figure 44.R3A, or

– where this change is not possible, by avoiding signal and/or data cable interconnections between different parts of the TN-S installation.



IEC 054/06

1) Voltage drop ΔU is non-zero under normal operation conditions

2) Loop of limited area formed from signal or data cables

3) Extraneous-conductive-part

NOTE In a TN-C-S system, the current, which in a TN-S system would flow only through the neutral conductor, flows also through the screens or reference conductors of signal cables, exposed-conductive-parts, and extraneous- conductive-parts such as structural metalwork.

Figure 44.R4 - TN-C-S system within an existing building installation