INTERNATIONAL STANDARD

IEC 60364-4-44

2001

AMENDMENT 2
2006-08

Amendment 2

Electrical installations of buildings –

Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE V

For price, see current catalogue

FOREWORD

This amendment has been prepared by IEC technical committee 64: Electrical installations and protection against electrical shock.

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

FDIS	Report on voting
64/1533/FDIS	64/1547/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

Page 9

440 Introduction

Replace the existing Introduction by the following new Introduction:

440 Introduction

Part 4-44 of IEC 60364 covers the protection of electrical installations and measures against voltage disturbances and electromagnetic disturbances.

The requirements are arranged into three sections as follows:

Clause 442 Protection of low-voltage installations against temporary overvoltages and faults between high-voltage systems and earth

Clause 443 Protection against overvoltages of atmospheric origin or due to switching

Clause 444 Measures against electromagnetic influences

Part 4-44 (2001) brings together these clauses, which were previously published separately.

Page 13

440.1 Scope

Replace the existing text by the following:

The rules of this part of IEC 60364 are intended to provide requirements for the safety of electrical installations in the event of voltage disturbances and electromagnetic disturbances generated for different specified reasons.

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 IEC 60364-1) although voltage and electromagnetic disturbances may be conducted or induced into electrical installations via these supply systems.

Page 13

440.2 Normative references

Delete the following normative reference:

IEC 60364-5-548

Insert the following new normative references:

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61558-2-1, *Safety of power transformers, power supply units and similar – Part 2: Particular requirements for separating transformers for general use*

IEC 61558-2-4, *Safety of power transformers, power supply units and similar – Part 2: Particular requirements for isolating transformers for general use*

IEC 61558-2-6, *Safety of power transformers, power supply units and similar – Part 2: Particular requirements for safety isolating transformers for general use*

IEC 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 62305 (all parts), *Protection against lightning*

Page 49

Clause 444

Replace the existing Clause 444 (with its subclauses and Figures 44L to 44P) by the following new Clause 444 (to Subclause 444.7.3.2):

444 Measures against electromagnetic influences

444.1 General

Clause 444 provides basic recommendations for the mitigation of electromagnetic disturbances. Electromagnetic Interference (EMI) may disturb or damage information technology systems or information technology equipment as well as equipment with electronic components or circuits. Currents due to lightning, switching operations, short-circuits and other electromagnetic phenomena may cause overvoltages and electromagnetic interference.

These effects are most severe

– where large metal loops exist; and
– where different electrical wiring systems are installed in common routes, e.g. for power supply and for signalling information technology equipment within a building.

The value of the induced voltage depends on the rate of rise (di/dt) of the interference current, and on the size of the loop.

Power cables carrying large currents with a high rate of rise of current (di/dt) (e.g. the starting current of lifts or currents controlled by rectifiers) can induce overvoltages in cables of information technology systems, which can influence or damage information technology equipment or similar electrical equipment.

In or near rooms for medical use, electric or magnetic fields associated with electrical installations can interfere with medical electrical equipment.

This clause provides information for architects of buildings and for designers and installers of electrical installations of buildings on some installation concepts that limit electromagnetic influences. Basic considerations are given here to mitigate such influences that may result in disturbance.

444.2 (void) NOTE This clause is reserved for future input.

444.3 Definitions

See IEC 60364-1 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 at frequencies from direct current (DC) to low radio frequency (RF)

[3.2.2 of ETS 300 253:1995]

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 this standard are connected to earth.

444.3.2
bonding ring conductor
BRC
an earthing bus conductor in the form of a closed ring

[3.1.3 of EN 50310:2000]

NOTE Normally the bonding ring conductor, as part of the bonding network, has multiple connections to the CBN that improves its performance.

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 equi-potentiality

[IEV 195-01-10]

444.3.5
earth-electrode network
ground-electrode network (US)
part of an earthing arrangement comprising only the earth electrodes and their inter-connections

[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 and may have the form of a mesh

[3.2.2 of ETS 300 253:1995]

NOTE The MESH-BN augments the CBN.

444.3.7
by-pass equipotential bonding conductor/
parallel earthing conductor
PEC
earthing conductor connected in parallel with the screens of signal and/or data cables in order to limit the current flowing through the screens

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.

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,
– computers,
– rectifiers,
– choppers,
– frequency converters/regulators,
– lifts,
– transformers,
– switchgear,
– power distribution busbars.

444.4.2 Measures to reduce EMI

The following measures reduce electromagnetic interference.

a) For electrical equipment sensitive to electromagnetic influences, surge protection devices and/or filters are recommended to improve electromagnetic compatibility with regard to conducted electromagnetic phenomena.
b) Metal sheaths of cables should be bonded to the CBN.
c) Inductive loops should be avoided by selection of a common route 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 444.6.3).
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 convertors 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 IEC 62305-3;
   – metallic sheaths or shields of power and signal cables should be bonded in accordance with the requirements for lightning protection given in IEC 62305-3 and IEC 62305-4.
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 equipotential bonding conductor for screen reinforcement; see Figure 44.R1.

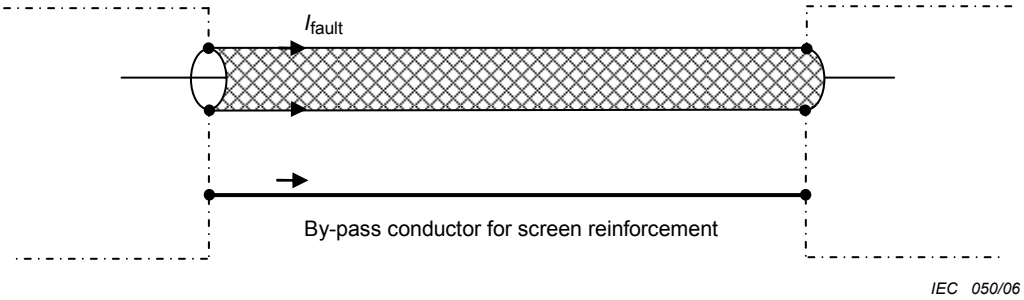


Figure 44.R1 – By-pass conductor for screen reinforcement to provide a common equipotential bonding system

NOTE 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 the EMC 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 mm^2 Cu or equivalent. The equivalent cross-sectional area shall be dimensioned in accordance with 544.1 of IEC 60364-5-54.

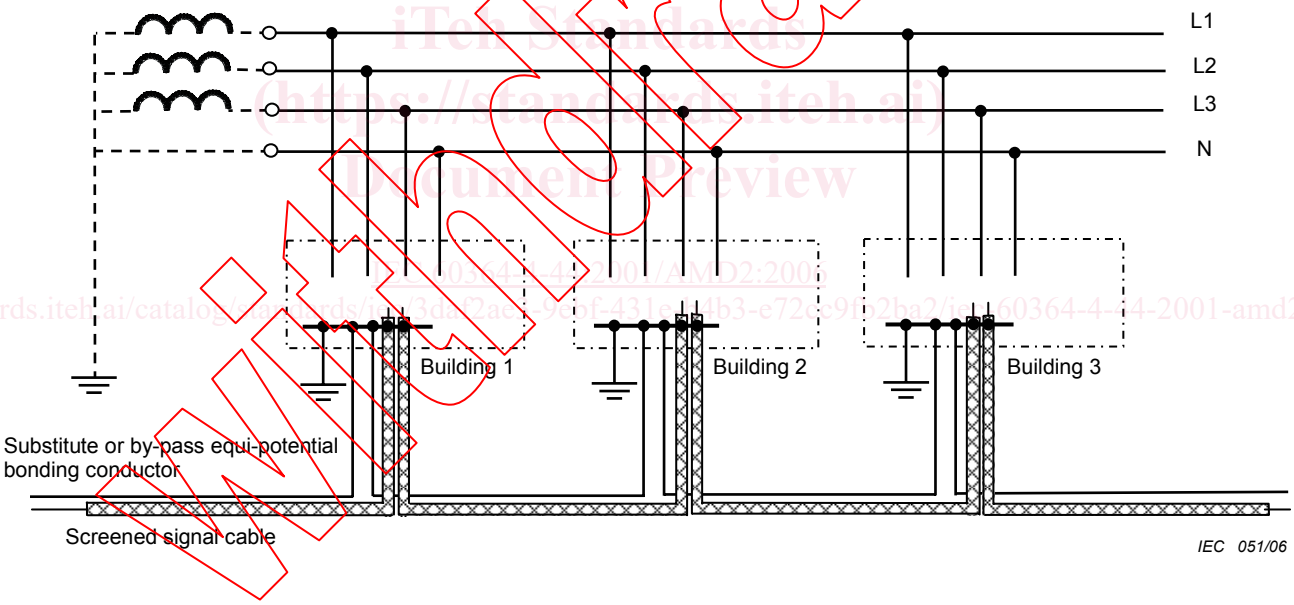


Figure 44.R2 – Example of a substitute or by-pass equipotential bonding conductor in a TT-system

NOTE 1 Where the earthed shield is used as a signal return path, a double-coaxial cable may be used.

NOTE 2 It is recalled that if the consent according to 413.1.2.1 (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 3 The problems of earth differential voltages on large public telecommunication networks are the responsibility of the network operator, who may employ other methods.

NOTE 4 In the Netherlands, a by-pass equipotential bonding conductor, connecting the earthing sytems of several TT installations together, is permitted only if fault protection, in accordance with 413.1.4, remains effective in the case of failure of any single RCD.

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 busbar is intended (according to 444.5.8) to support the equipotential bonding system of a significant information technology installation in a building, it may be installed as a closed ring.

NOTE 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 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.

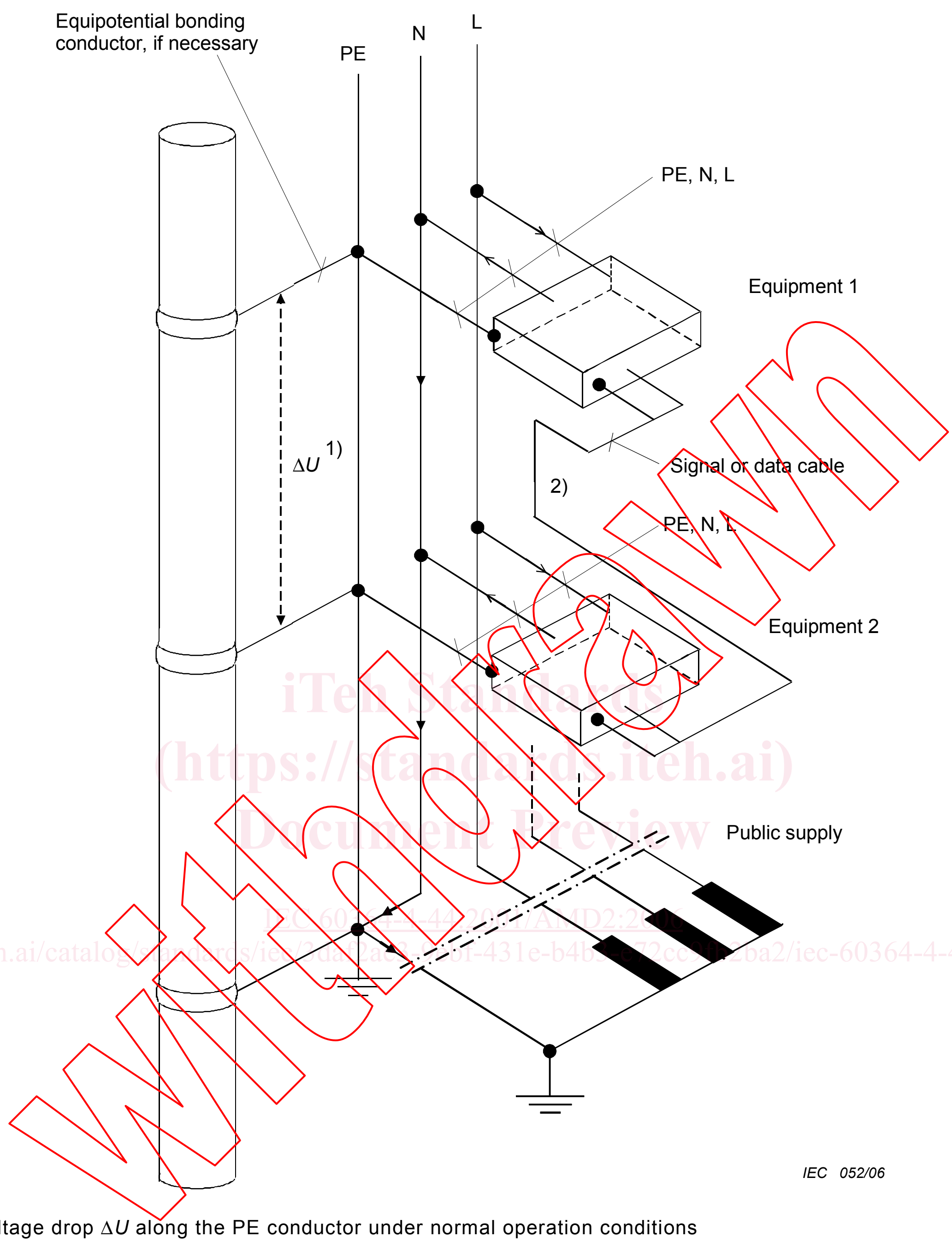
TN-C-systems shall not be used in newly constructed buildings containing, or likely to contain, significant amounts of information technology equipment.

NOTE Any TN-C installation is likely to have load or fault current diverted via equipotential bonding into metallic services and structures within a building.

444.4.3.2 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.

In newly constructed buildings, TN-S systems shall 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 IEC 62020.

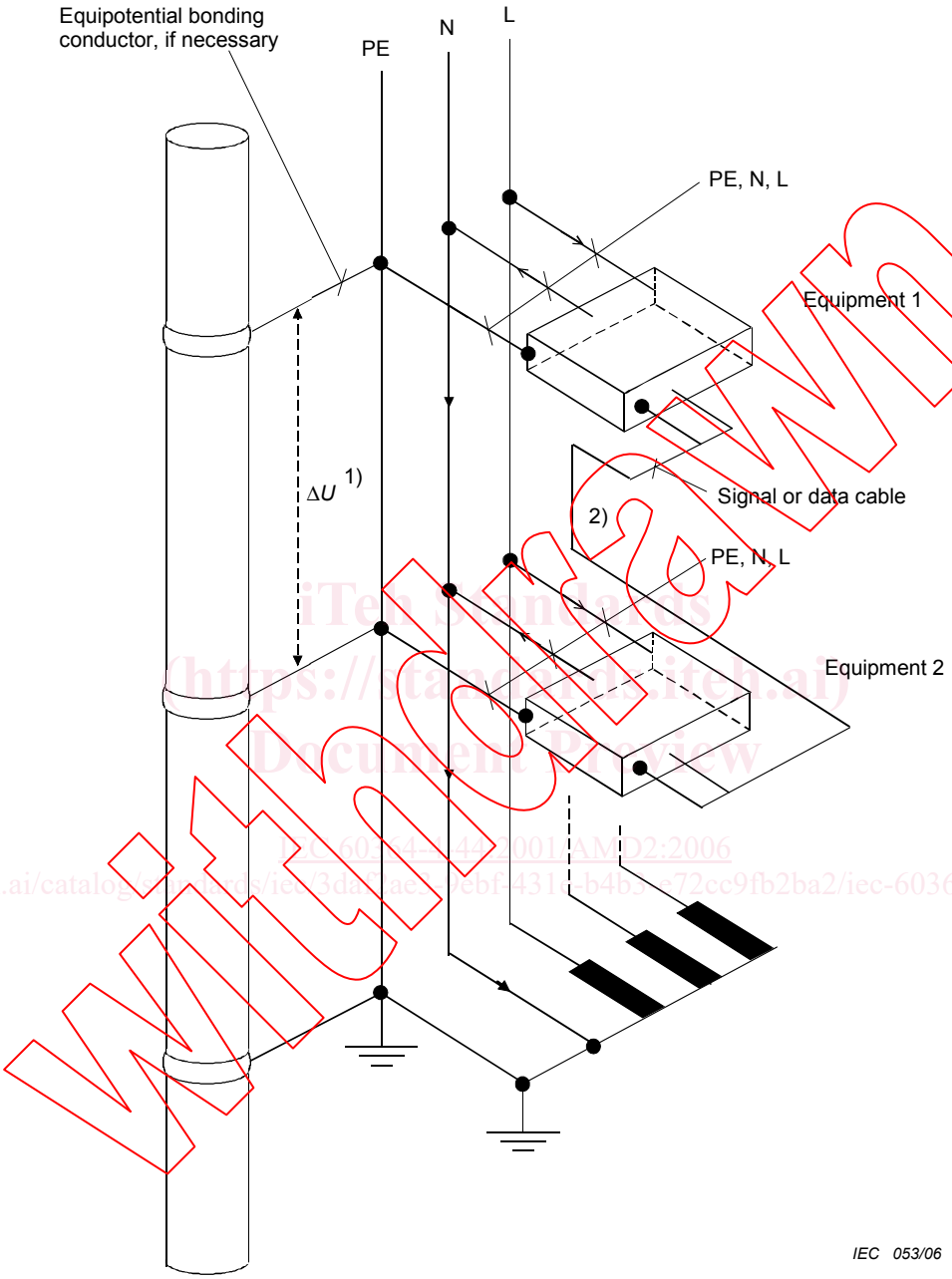


1) No voltage drop ΔU along the PE conductor under normal operation conditions

2) 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) No voltage drop ΔU along the PE conductor under normal operation conditions

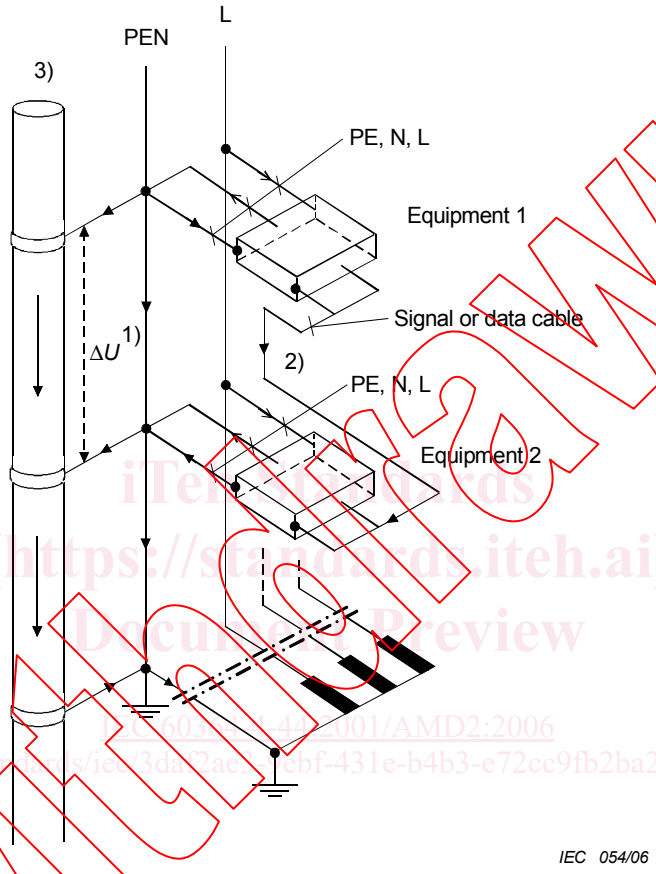
2) Loops of limited area formed by signal or data cables

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 data cable interconnections between different parts of the TN-S installation.



1) Voltage drop ΔU along PEN in normal operation

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