STD.IEC TR 61312-4-ENGL 1998 ■ 4844891 0685643 738 ■

RAPPORT TECHNIQUE
TECHNICAL REPORT

CEI
IEC
61312-4

Première édition
First edition
1998-09

Protection contre l'impulsion électromagnétique générée par la foudre –

Partie 4: Protection des équipements dans les structures existantes

Protection against lightning electromagnetic impulse –

Part 4: Protection of equipment in existing structures

Numéro de référence
Reference number
CEI/IEC 61312-4:1998

STD.IEC TR 61312-4-ENGL 1998 ■ 4844891 0685645 500 ■

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE R

Pour prix, voir catalogue en vigueur
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROTECTION AGAINST LIGHTNING ELECTROMAGNETIC IMPULSE –

Part 4: Protection of equipment in existing structures

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- type 2, when the subject is still under technical development or where for any other reason there is the future but no immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

Technical reports of types 1 and 2 are subject to review within three years of publication to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

IEC 61312-4, which is a technical report of type 2, has been prepared by IEC technical committee 81: Lightning protection.

The text of this technical report is based on the following documents:

Committee draft	Report on voting
81/106/CDV	81/115/RVC

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

IEC 61312-4 forms part of a series of publications under the general title: Protection against lightning electromagnetic impulse.

This part 4 supplements part 1, which sets out general principles.

This document is being issued in the Technical Report (type 2) series of publications (according to subclause G.3.2.2 of part 1 of the *ISO/IEC Directives*) as a "prospective standard for provisional application" in the field of protection against lightning electromagnetic impulse because there is an urgent need for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an "International Standard". It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the IEC Central Office.

A review of this Technical Report (type 2) will be carried out not later than three years after its publication, with the options of either extension for another three years; conversion into an International Standard; or withdrawal.

INTRODUCTION

General principles of the protection against Lightning electromagnetic impulse (LEMP) are given in IEC 61312-1. However, the increasing use of complex electronic equipment in existing structures demands special care for protection against lightning and other electromagnetic disturbances. It should be borne in mind that in existing structures suitable counter-measures against lightning effects need to take into account the conditions of the structure, such as the construction elements, the existing power distribution and the existing information technology equipment (ITE).

The checklist in clause 2 helps to address specific points and to select the most economical measures for the hardening of equipment against LEMP. The checklist facilitates risk analysis and selection of the most suitable counter-measures.

For existing structures in particular, it is strongly recommended to set up a systematic layout governed by the zoning concept, set out in IEC 61312-1. This is respected when the measurements of figure 1 are applied.

PROTECTION AGAINST LIGHTNING ELECTROMAGNETIC IMPULSE –

Part 4: Protection of equipment in existing structures

1 General

1.1 Scope

This technical report gives guidelines for protection of information technology equipment (ITE) against LEMP effects in existing structures and includes methods suitable for new structures.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this technical report. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this technical report are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 61024-1:1990, *Protection of structures against lightning – Part 1: General principles*

IEC, 61024-1-2:1998, *Protection of structures against lightning – Part 1-2: General principles – Guide B – Design, installation, maintenance and inspection of lightning protection systems*

IEC 61312-1:1995, *Protection against lightning electromagnetic impulse – Part 1: General principles*

IEC 61662/TR:1995, *Assessment of the risk of damage due to lightning*
Amendment 1 (1996)

IEC 60364-4-444:1996, *Electrical installations of buildings – Part 4: Protection for safety – Section 444: Protection against electromagnetic interference (EMI) in installations of buildings*

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*

IEC 61000-4-9:1993, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 9: Pulse magnetic field immunity test. Basic EMC publication*

IEC 61000-4-10:1993, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 10: Damped oscillatory magnetic field immunity test. Basic EMC publication*

IEC 61000-5-2/TR:1997, *Electromagnetic compatibility (EMC) – Part 5: Installation and mitigation guidelines – Section 2: Earthing and cabling*

ITU-T Recommendation K.21:1996, *Resistibility of subscriber's terminal to overvoltages and overcurrents*

2 Checklist

The following checklist should be used in conjunction with IEC 61662 and its amendment 1 (especially elaborated for structures containing electronic systems), to determine whether protective measures for the electronic system are needed and, if so, to identify the most cost-effective protection measures for that equipment.

Additional information, not directly related to IEC 61662, but useful for the implementation of the protective measures for EMC or other reasons, is noted in table 4.

Table 1 – Structural characteristics and surroundings

Item	Questions	IEC 61662 Clause	IEC 61662 Amendment 1 Clause
2.1.1	Masonry, bricks, wood, reinforced concrete, steel frame structures?	2.3.3, table 6	C.3, table C.1
2.1.2	One single integrated structure or interconnected blocks with expansion joints?	2.2.3, table 6	C.3, table C.1
2.1.3	Flat and low or high-rise structures? (Dimensions of the structure)	2.2.1	C.2, see also limitation of scope of IEC 61024-1
2.1.4	Are reinforcing bars electrically connected throughout the structure?	–	C.3, table C.1
2.1.5	Metal facades electrically bonded or not?	–	C.3, table C.1
2.1.6	Window sizes?	–	C.3, table C.1
2.1.7	Structure equipped with an external LPS?	–	C.3, table C.1
2.1.8	Type and quality of this LPS?	–	C.3, table C.1
2.1.9	Nature of ground (rock, soil)?	2.2.2.1	C.2
2.1.10	Adjacent structures (height, distance) earth termination?	2.2.2.2	C.2

Table 2 – Installation characteristics

Item	Questions	IEC 61662 Clause	IEC 61662 Amendment 1 Clause
2.2.1	Incoming services (underground or overhead)?	2.2.2.2, tables 1 and 2	C.2
2.2.2	Aerials (antennas or other external devices)?	2.2.2.2	C.2
2.2.3	Type of electric power supply (high voltage, low voltage, overhead or underground)?	2.2.2.2, table 1	C.2, table C.3
2.2.4	Cable routing (numbers and locations of risers, ducts)?	–	C.3, table C.2
2.2.5	Use of metal cable trays?	–	C.3, table C.2
2.2.6	Are the electronics self-contained within the structure?	–	C.2, note
2.2.7	Metallic conductors to other structures?	2.2.2.2	C.2

Table 3 – Equipment characteristics

Item	Questions	IEC 61662 Clause	IEC 61662 Amendment 1 Clause	Other documents
2.3.1	Type of information technology equipment links (screened or unscreened multicore cables, coax cable, analog and/or digital, symmetrical and/or asymmetrical, fibre optic data lines)?	–	C.3, table C.2	–
2.3.2	Are the immunity levels against damage of the equipment specified?	1.2	–	ITU-T Recommendation K.21 IEC 61000-4-5 IEC 61000-4-9 IEC 61000-4-10

Table 4 – Other questions which need to be considered for the determination of a protection concept

Item	Questions	IEC 61662	Other documents
2.4.1	Frames of the windows electrically bonded or not?	–	–
2.4.2	Roof material metallic or not?	–	–
2.4.3	Configuration TN, TT or IT?	–	–
2.4.4	Location of the electronics?	–	IEC 61312-1, 1.3.8
2.4.5	Where are interconnections of functional earthing conductors of the electronics with the common bonding network (CBN)?	–	–

3 Protection measures influenced by the external LPS of the structure

Bearing in mind the risk analyses (IEC 61662) and depending on the result of the checklist, it can be decided whether an external LPS is required or not. In general, an external LPS is useful when it is designed according to IEC 61024-1-2 with special attention to clause 3. Concerning reinforced concrete structures, annex A of IEC 61024-1-2 should be considered.

The main task of the lightning protection expert is to find the trade-off between an upgraded external LPS and the remaining installation measures.

An upgrading of the external LPS. can be achieved by:

a) integrating existing metal facades and roofs into the LPS according to IEC 61024-1, 2.2.5 d);

b) using the reinforcing bars if the reinforcement is electrically interconnected from the topmost reinforced concrete roof down through the walls to the earth termination of the structure;

c) reducing the spacing of the downconductors, and reducing the mesh size of the air termination system (see IEC 61312-2, clause 3, and IEC 61662, amendment 1). Reasonable values are: distances between downconductors and mesh size 1 m to 5 m;

d) installation of bonding straps (flexible flat bonding conductors) across the expansion joints between adjacent but structurally separated blocks (see IEC 61024-1-2, figure A.12) The distance between the straps should be half the distance between the downconductors;

e) across expansion joints between a structure and a long corridor a cable route linking it to another block of the structure bonding should be provided. Typically, a bond should be provided at each corner of the corridor, and the bond straps should be as short as possible;

f) metallic roof fixtures which need protection against direct strikes (LPZ 0_B) should be provided e.g. with a local air termination which is bonded to the LPS (see IEC 61024-1-2, figure 48). Between such an air termination and the fixtures the safety distance *d* needs to be respected. (see IEC 61024-1, 3.2).

4 Protection measures influenced by the cable installation

Suitable cable routing and screening are effective measures to reduce overvoltages.

These measures become all the more important the smaller the shielding effect of an external LPS. Table B.1 of IEC 61024-1-2 shows this relationship. Examples of good cable routing and screening techniques are given in diagrams 3 and 4, respectively of that table.

Further details are shown in figures 26 and 27, as well as figures B.2, B.3 and B.4 of IEC 61024-1-2.

When special circumstances do not allow the installation of an external LPS (IEC 61024-1, 3.1.1), the techniques of fundamental principles shown in figure 1 provide very high protection against the effects of LEMP [1] [1].

Suitable separation between existing and new installations can be achieved by using double-insulated transformers or class II equipment which should be installed in order to avoid mainly 50/60 Hz interferences in TN-C installations of existing buildings (see explanations (1.2) and (1.3) in figure 1).

The installation concepts shown in figure 1 provide systematic layout recommendations for earthing, bonding and cable routing which comply with IEC 61312-1, 3.4. Figures 1a to 1d show each an example of possible zoning, depending of number, type and sensitivity of ITE:

- Figure 1a gives an example for the application of only LPZ 1 within the building. The measures (1.2) and (1.3) are still useful even within LPZ 1 in order to avoid low-frequency interference.
- Figure 1b shows a LPZ 2 area created to shelter all new installations. This requires upgraded SPDs at the boundary of LPZ 0 to LPZ 2.

Figures 1c and 1d show possible variations of LPZ 2 designed according to IEC 61312-1, figure 4. Each LPZ 2 represents the volume within the ITE is less exposed to the effects of lightning and low frequency interference currents and fields. Shielded cables or interconnected cable traces may link two different LPZ 2 in order to reduce the number of SPDs.

There are two types of interfaces between LPZ 1 and LPZ 2:

a) Interface to the right hand side:

Direct bonding of the functional earthing conductor shall be established where the additional screening between the floors provides a low impedance path for all kinds of interference currents and a very low interference coupling into signal and power cables. In this case, the screen itself becomes the boundary between LPZ 1 and LPZ 2.

[1] Figures in square brackets refer to the bibliography.

b) Interface to the left hand side:

No direct bonding to the PEN-conductor or to other metallic parts connected to it is allowed, in order to avoid 50/60 Hz interference through the ITE.

The withstand voltage of the separation transformer or of the class II equipment against lightning induced overvoltages is already enhanced by the specific requirements for such apparatus. A withstand voltage of about 5 kV, 1,2/50 µs can be expected. Therefore indirect bonding – if needed – has to be performed by SPDs, which operate just below the withstand voltage. Otherwise, SPDs with much lower operating or limiting voltages may violate the safety requirements.

NOTE – If the old mains installation is used, it creates a large enclosed induction loop area, which will increase significantly the risk of insulation damage.

Explanations to figure 1

General

Existing mains supply in old structures are very often of the type TN-C, i.e. there are PEN-conductors installed throughout the structure, which may cause 50/60 Hz interference when connected to earthed data-lines. (Such interferences are known when for example a PC is connected by a 15 m long data cable (RS 232) to a printer but the PC and the printer are powered from different outlets.)

In order to impede such interference the counter-measure (1.2) or (1.3) should be applied, if only a small amount of information technology equipment (ITE) needs to be installed. The risk of damages due to lightning will be reduced by the application of SPDs (1.6) on the power supply (1.1).

However, a higher number of ITE may require an additional power supply. In this case, figure 1 shows the suitable cable routing (1.4) together with additional screening (1.5).

It is strongly recommended that the additional power supply be of type TN-S.

In order to avoid accidental galvanic connection of the equipment itself to an arbitrary site of the CBN, metallic equipment enclosures shall be isolated from the adjacent CBN. This is given in most of the situations, since ITE installed in private rooms or offices are linked to the earth references through their connection cables only.

Key to figure 1

(1.1) Existing mains supply (TN, TT, IT) to which a new installation has been added where circumstances require a new cable routing to be used.

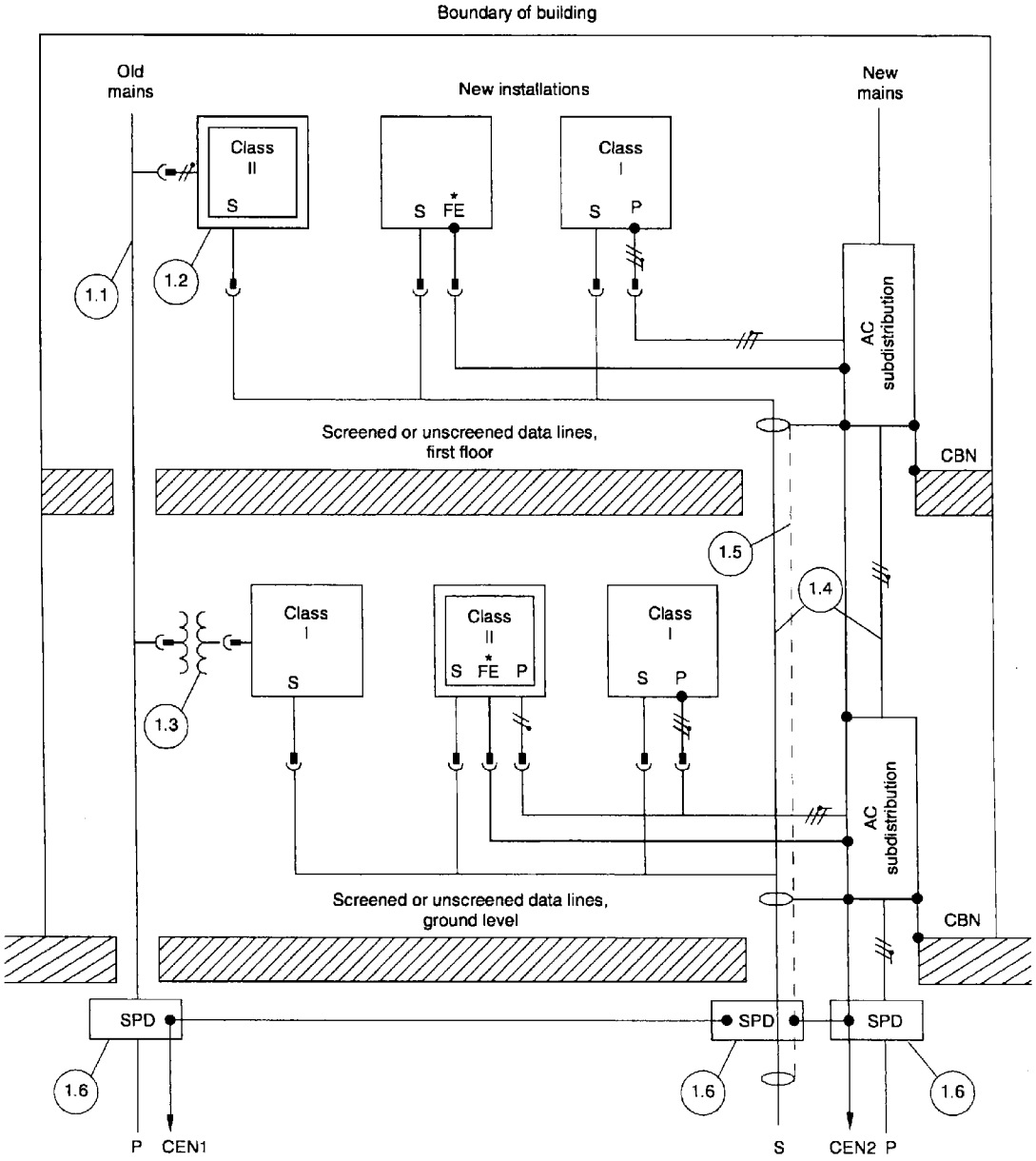
(1.2) Class II equipment (i.e. double insulation without PE-conductor) is installed in order to prevent low frequency interference currents through the equipment and its connected signal cables. These currents may be caused either by large loops or by the lack of a sufficiently low impedance common bonding network (CBN).

(1.3) If class II equipment is not available, a double-insulated transformer serves the same purpose or metal-free fibre optic cables for signal links interconnecting equipment can be recommended.

(1.4) Further large loops can be avoided by adjacent routing of electric power and information cables. It is recommended to use screened signal cables. The screen shall be bonded to the equipment at both ends (see figure 2).

(1.5) Additional screening for example bonded metal race ways or trunking – at least between the floors – also provides a lower impedance CBN. This measure is especially useful for high or extended structures or when the function of the equipment requires a high reliability. Additional information on cable screening and routing is given in figures 2 and 3.

(1.6) Preferred location of surge protection devices is at the interface LPZ 0/1; LPZ 0/1/2 respectively, located at the entry of the structure, (see IEC 61024-1-2, figure B.2).



COMPONENTS

CEN	common earth electrode network	3-wire power power cable: L, N and PE	///T
CBN	common bonding network	2-wire power cable: L, N	//
SPD	surge protective device(s)	Class I	standard insulation
P	power lines	Class II	double insulation without PE
S	signal lines for ITE (information technology equipment)	Old mains	power supply (TN-C, TT, IT)
FE	functional earthing conductor	New mains	power supply (TN-S, TN-CS, TT, IT)
*	optional for equipment using functional earthing conductor (FE)	•	protective earth or (FE) bonding points

NOTE – Care should be taken that metallic equipment enclosures do not have accidental galvanic connection to the CBN or to other metal parts. Galvanic connections should only be carried out according to the requirements of the bonding network.

Figure 1 – Measures to improve lightning protection and EMC for new installations in buildings with different mains power supply [1]

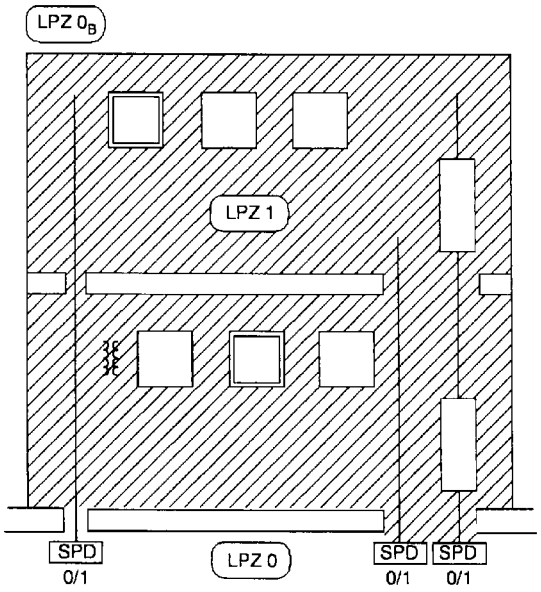


Figure 1a – Unshielded LZP 1 only

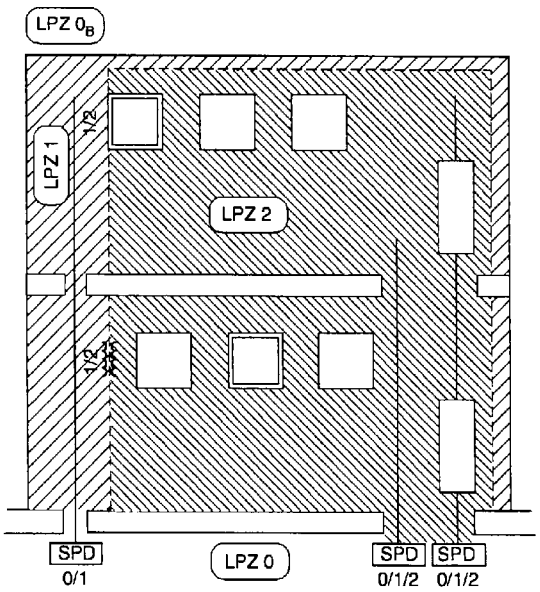


Figure 1b – Large LPZ 2 for all new installations

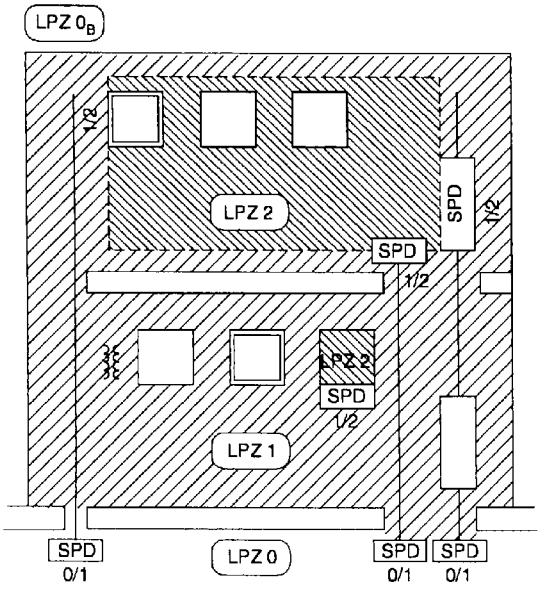


Figure 1c – Small local LPZ 2 for sensitive new installations

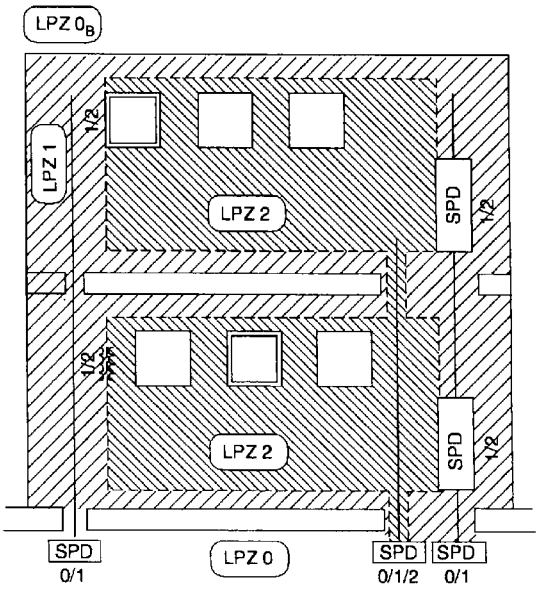
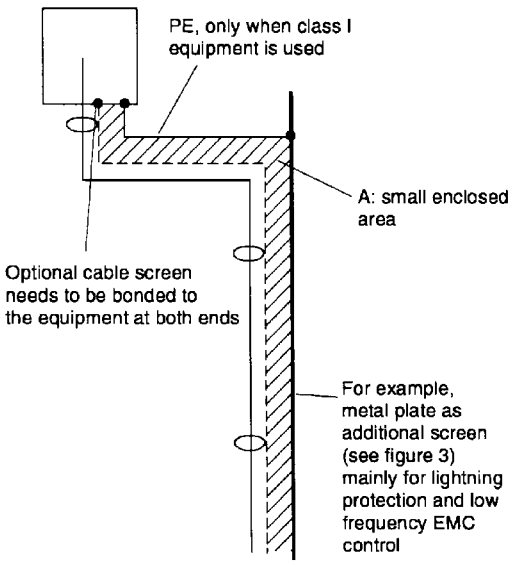


Figure 1d – Several local LPZ 2 for all new installations



NOTE – Owing to the small area A, the induced voltage between the cable screen and the metal plate is small. Such a cable routing allows for a flexible application of class I or class II equipment with or without bonding of the electronic ground of the circuit to the cable screen and/or to the PE-conductor.

Figure 2 – Reduction of the loop area by using a screened cable close to a bonded metal plate

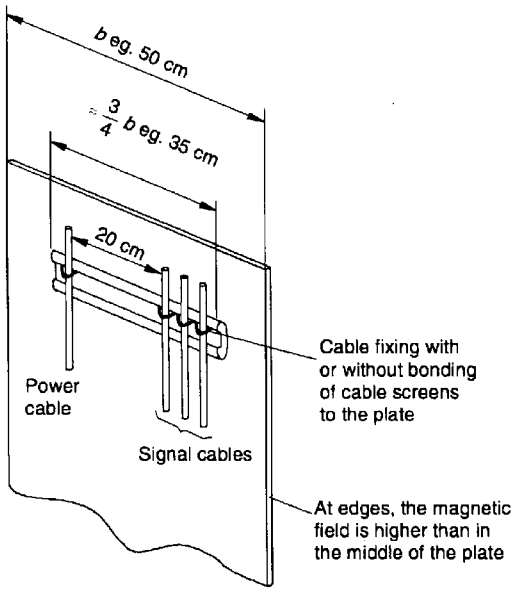


Figure 3 – Example of a metal plate for additional screening

Instead of metal plates, metallic cable trays with electrically well interconnected sections can be used. The connections have to be performed by bolting of overlapping parts or by the use of bonding straps. In order to keep the impedance of the tray low, several screws or strips have to be distributed homogeneously over the size of the tray (for more information see IEC 61000-5-2).

5 Protection measures influenced by the electric power installation and the interconnections between information technology equipment (ITE)

In general the common bonding network (CBN) should not, under normal conditions, be used either as a power return path or as a signal return path.

Where economically reasonable, the TN-S principle should be applied for the electric power installation inside the building. If this is not possible, the measures described in clause 4 should be applied. These measures also mitigate interferences due to TN-C sections in the structure or in case of earth faults when TN-S is applied.

For signal interconnections of more than 10 m between electronic equipment in ordinary rooms, it is recommended to use balanced circuits, triaxial cables both with suitable galvanic separation at the ports e.g. by opto-coupler, by inductive or capacitive coupling (for more information see IEC 60364-4-444 and IEC 61000-5-2).

NOTE – Sufficient shielding in ordinary existing rooms by spatial shields, cable trays and cable shields is often difficult to achieve. In most cases, power cables are unshielded and much equipment is not made to be connected to shielded datalines. Further, plugs and/or sockets are unshielded. There are very often only "pig tail" connections available for shield bonding. For aesthetic reasons and in order to be flexible the use of electrically interconnected metallic ducts, etc. is not suitable.

5.1 **Surge protection devices** (see also IEC 61312-3 [2])

Lightning current arresters should be installed as close as possible to the entry of the cables to the volume to be protected and on all active conductors to prevent the main surge energy from entering the installations of the structure (boundary LPZ 0/1). Within the building, an uncontrolled application of SPDs may lead to malfunction or damage of the system, especially when overvoltage arresters or inbuilt SPDs of the equipment prevent the proper function of the lightning current arresters at the entrance (for more information see IEC 61643-2).

In order to maintain the quality of the measures against LEMP all SPDs need to be checked after a known lightning event. For this reason, it is necessary to know where such devices are installed following the maintenance instructions of IEC 61024-1-2, clause 6.

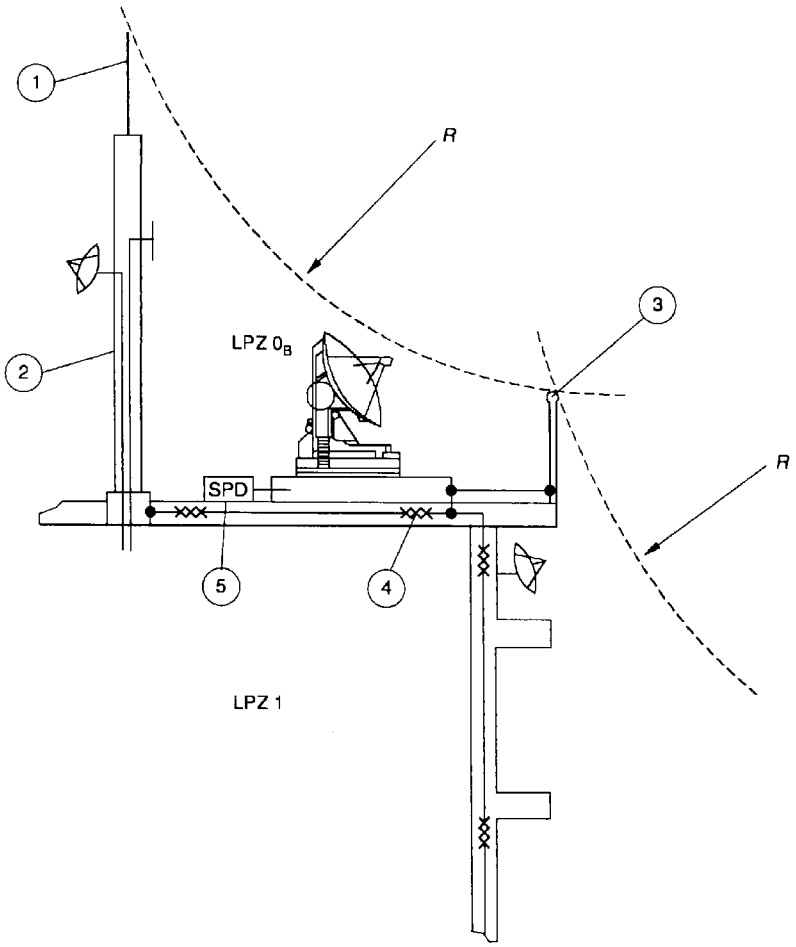
6 Protection measures when aerials and other equipment are installed

6.1 General

Examples of the equipment referred to are externally mounted sensors of any kind including aerials, meteorological sensors, surveillance TV cameras, exposed sensors on process plants (pressure, temperature, flow rate, valve position, etc.) and any other electrical/electronic/radio equipment on external positions on structures, masts, and process vessels.

6.2 **Protection of the equipment** (see figure 4)

Wherever possible, a lightning strike air termination should be placed so that the equipment is protected from a direct lightning strike (inside LPZ 0_B.) On tall structures, the rolling sphere method should be applied to equipment on the top and sides of the building to determine if a strike is possible, and air terminations placed accordingly. In many cases hand rails, ladders, pipes, etc. may well perform the function of an air termination satisfactorily. All equipment, except some forms of aerials, can be protected in this manner. Aerials sometimes have to be placed in exposed positions because their performance as radiating or receiving aerials is adversely affected by lightning conductors nearby. Some aerial designs are inherently self-protecting because only well earthed substantial conductors are exposed to lightning strike. Increasingly, aerial designs on the market have lightning protection built into them, and so can safely withstand a lightning strike. Other types, not so well protected, may need SPDs on their feed cables (e.g. spark gaps normally at the interface LPZ 0_B/1) to prevent excessive transients from flowing down the cable to the receiver or the transmitter. However when an external LPS, is available, the aerials support should be bonded to it.



Key

① Lightning rod

② Steel mast (tube) with antennas

③ Hand rails

④ Interconnected reinforcement, part of the LPS

⑤ SPD box

R Radius of the rolling sphere (see IEC 61024-1, table 1)

Figure 4 – Aerials and other equipment protection

6.3 Reduction of excessive induced voltages in feed cables and prevention of side flashing within equipment

High induced voltages can be prevented, as described in 7.3.2 for cables between structures, by bonded ducting, trunking, or metallic tubes to limit the current/voltage induced in them. All cables leading to the specific equipment which is connected to the aerial shall leave the cable tray at a single point. Maximum advantage should be taken of the inherent screening properties of the structure itself by running cables within tubular components if possible, or if not, as in the case of process vessels, on the outside but close to the structure and making most use of natural screening provided by metal pipes, steel rung ladders and any other well bonded conducting material (see figure 5). On masts which use L-shaped corner members (see figure 6) cables should be placed in the inside corner of the L for maximum structural protection. As a minimum it is recommended that an equipotential bonding conductor with a minimum cross-section of 6 mm^2 is installed close to the antenna cable. All of these techniques minimize the voltages induced in the loop formed between the cables and the structure and so minimize the risk of a side flash, that is, an arc formed inside the equipment between the electrical circuits and the structure, which results in heavy currents flowing down the feed cable.

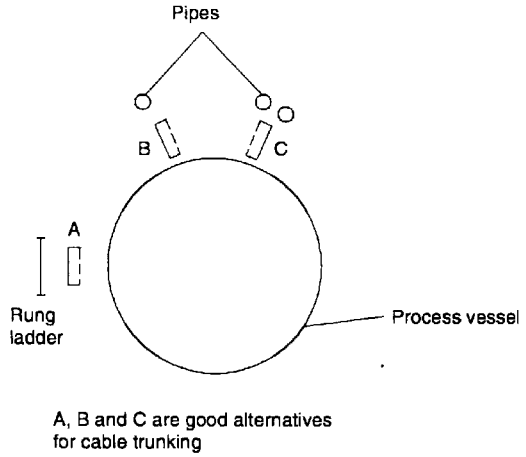


Figure 5 – Inherent screening provided by ladders and pipes on process vessels

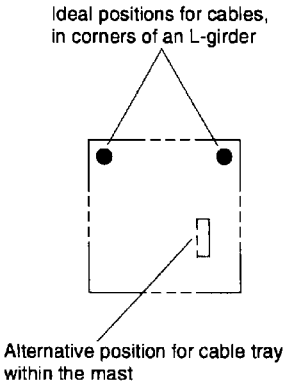


Figure 6 – Ideal positions for cables on a mast (cross-section of steel lattice mast)

7 Protection measures on data/telephone/instrumentation interconnections between structures

7.1 General

Interconnections comprise either metallic connections (e.g. wire pairs, wave guides, coaxial cables, multicores etc.) or fibre optic cables. Protection requirements depend on the type of cable, the number of interconnections, and whether the LPS systems of the structures are interconnected.

7.2 Fibre optic cables between structures

Fully insulated fibre optic cables (i.e. those without metal armouring, a moisture barrier foil or a steel internal draw wire) can be used safely between structures and no further protection measures are needed. This is the preferred method of data interconnections for complete freedom from EM interference.

Fibre optic cables with continuous metal components, however, should have the metal part bonded at the entry from the structure, and not taken right into the fibre optic receiver/transmitter unit. Between closely spaced structures where there is no interconnection between the LPSs, fully non-metallic fibre optic cables are preferred, in order to prevent excessive current from flowing in the metal part of the cable and overheating it, so leading to damage from over-heating or even rupture. Alternatively, fibre optic cables with metal components can be used if an LPS interconnection cable is used to shunt some of the current from the cable.

7.3 Conducting cables between structures

7.3.1 Copper or other conducting cables between structures without interconnections between the respective LPS

This situation is common and is the most severe interconnection problem. Such interconnections are very liable to damage at the interfaces at both ends of the cable owing to the flow of lightning currents between the structures along the cable. The cable forms a low impedance route to earth and will normally easily flash over any insulation at the two ends. Exposed cables above ground are even more susceptible and do not have the advantage that an overvoltage can flash over to ground more easily as in the case of underground cables. SPDs at each end are required, although, where possible, the preferred solution is to provide a bond between the two structures' lightning protection systems and place the cable in a closed bonded metallic ducting. This, in effect, produces the situation described below in 7.3.2.

7.3.2 Copper or other conducting cables between structures with interconnected LPS, forming a LPZ 1

Depending on the number of cables which pass between the structures, protection can comprise a bonded ducting for a few cables, or where there are many cables, as in a chemical process plant, the screening or armouring on the multicore instrumentation cables, if bonded to the interconnected earthing system at each end, will often be sufficient to provide the necessary screening, especially if a large number of cables share the current between them.

Bibliography

[1] Montandon, E., *Bonding and routing practice with respect on lightning protection and EMC*, Proceedings, 21st ICLP, Berlin, Sept 1992

[2] IEC 61312-2:—, *Protection against lightning electromagnetic impulse (LEMP) – Part 2: Shielding of structures, bonding inside structures and earthing* (under consideration)

[3] IEC 61312-3:—, *Protection against lightning electromagnetic impulse (LEMP) – Part 3: Requirements of surge protective devices (SPDs)* (under consideration)

[4] IEC 61643-2:—, *Surge protective devices connected to low-voltage power distribution systems – Part 2: Selection and application principles* (under consideration)

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Q1 Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

.....

Q2 Please tell us in what capacity(ies) you bought the standard *(tick all that apply)*. I am the/a:

- purchasing agent ❑
- librarian ❑
- researcher ❑
- design engineer ❑
- safety engineer ❑
- testing engineer ❑
- marketing specialist ❑
- other.....

Q3 I work for/in/as a: *(tick all that apply)*

- manufacturing ❑
- consultant ❑
- government ❑
- test/certification facility ❑
- public utility ❑
- education ❑
- military ❑
- other.....

Q4 This standard will be used for: *(tick all that apply)*

- general reference ❑
- product research ❑
- product design/development ❑
- specifications ❑
- tenders ❑
- quality assessment ❑
- certification ❑
- technical documentation ❑
- thesis ❑
- manufacturing ❑
- other.....

Q5 This standard meets my needs: *(tick one)*

- not at all ❑
- nearly ❑
- fairly well ❑
- exactly ❑

Q6 If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

- standard is out of date ❑
- standard is incomplete ❑
- standard is too academic ❑
- standard is too superficial ❑
- title is misleading ❑
- I made the wrong choice ❑
- other .....

Q7 Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

- timeliness.....
- quality of writing.....
- technical contents.....
- logic of arrangement of contents .....
- tables, charts, graphs, figures.....
- other .....

Q8 I read/use the: *(tick one)*

- French text only ❑
- English text only ❑
- both English and French texts ❑

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

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Q1 Veuillez ne mentionner qu'**UNE SEULE NORME** et indiquer son numéro exact: *(ex. 60601-1-1)*

.....

Q2 En tant qu'acheteur de cette norme, quelle est votre fonction? *(cochez tout ce qui convient)*
Je suis le/un:

- agent d'un service d'achat ❑
- bibliothécaire ❑
- chercheur ❑
- ingénieur concepteur ❑
- ingénieur sécurité ❑
- ingénieur d'essais ❑
- spécialiste en marketing ❑
- autre(s).....

Q3 Je travaille: *(cochez tout ce qui convient)*

- dans l'industrie ❑
- comme consultant ❑
- pour un gouvernement ❑
- pour un organisme d'essais/ certification ❑
- dans un service public ❑
- dans l'enseignement ❑
- comme militaire ❑
- autre(s).....

Q4 Cette norme sera utilisée pour/comme *(cochez tout ce qui convient)*

- ouvrage de référence ❑
- une recherche de produit ❑
- une étude/développement de produit ❑
- des spécifications ❑
- des soumissions ❑
- une évaluation de la qualité ❑
- une certification ❑
- une documentation technique ❑
- une thèse ❑
- la fabrication ❑
- autre(s).....

Q5 Cette norme répond-elle à vos besoins: *(une seule réponse)*

- pas du tout ❑
- à peu près ❑
- assez bien ❑
- parfaitement ❑

Q6 Si vous avez répondu PAS DU TOUT à Q5, c'est pour la/les raison(s) suivantes: *(cochez tout ce qui convient)*

- la norme a besoin d'être révisée ❑
- la norme est incomplète ❑
- la norme est trop théorique ❑
- la norme est trop superficielle ❑
- le titre est équivoque ❑
- je n'ai pas fait le bon choix ❑
- autre(s) .....

Q7 Veuillez évaluer chacun des critères ci-dessous en utilisant les chiffres
(1) inacceptable,
(2) au-dessous de la moyenne,
(3) moyen,
(4) au-dessus de la moyenne,
(5) exceptionnel,
(6) sans objet

- publication en temps opportun .....
- qualité de la rédaction.....
- contenu technique .....
- disposition logique du contenu .....
- tableaux, diagrammes, graphiques, figures .....
- autre(s) .....

Q8 Je lis/utilise: *(une seule réponse)*

- uniquement le texte français ❑
- uniquement le texte anglais ❑
- les textes anglais et français ❑

Q9 Veuillez nous faire part de vos observations éventuelles sur la CEI:

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