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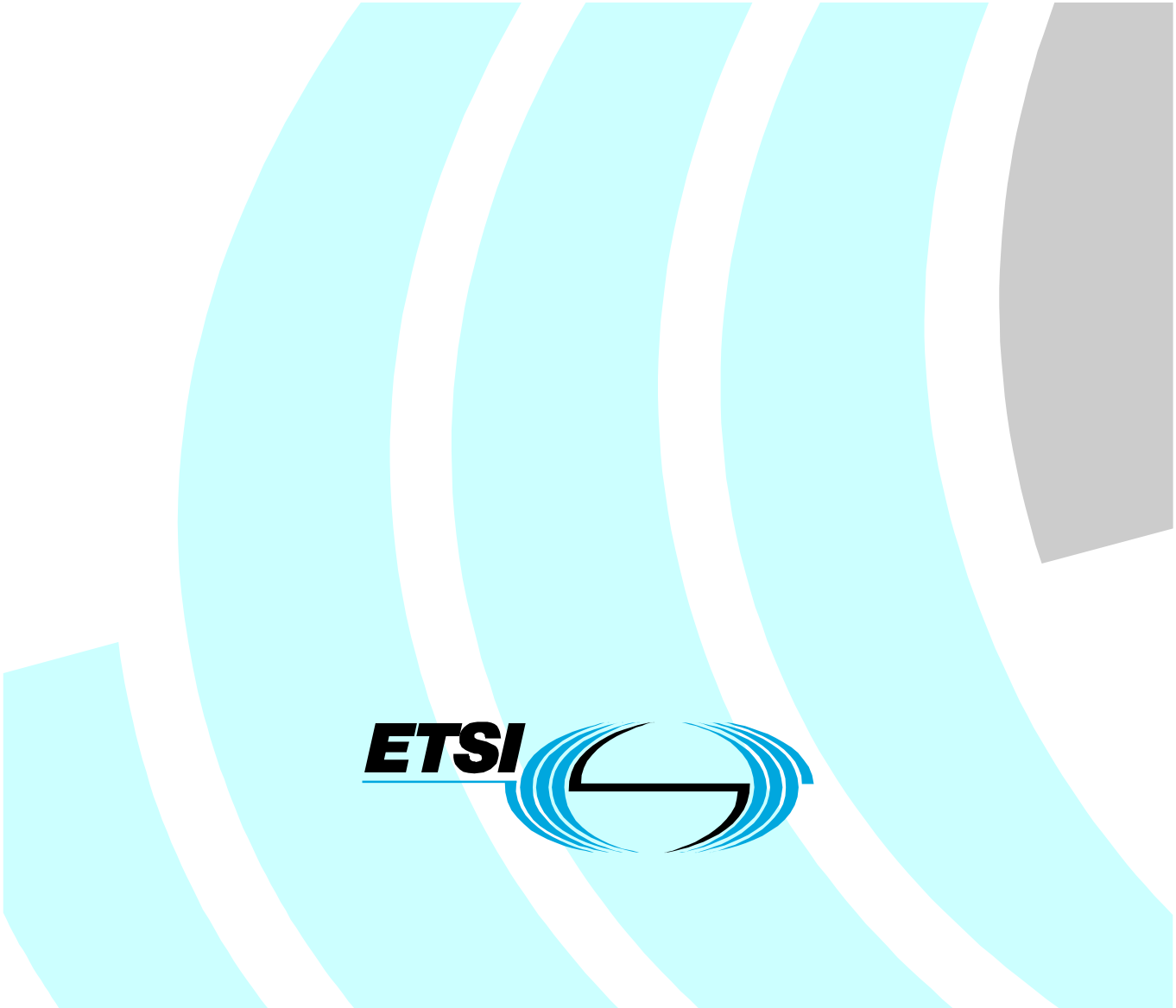
European Standard (Telecommunications series)

Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 3: Operated by rectified current source, alternating current source or direct current source up to 400 V



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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the Vote phase of the ETSI standards Two-step Approval Procedure.

The present document concerns the requirements for the interface between telecommunications equipment and its power supply and includes requirements relating to its stability and measurement. Various other references and detailed measurement and test arrangements are contained in informative annexes.

The present document is part 3 of a multi-part deliverable covering Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment, as identified below:

Part 1: "Operated by alternating current (ac) derived from direct current (dc) sources";

Part 2: "Operated by direct current (dc)";

Part 3: "Operated by rectified current source, alternating current source or direct current source up to 400 V".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document contains requirements for:

- the output performance of the power equipment at the interface A3;
- the input of the telecommunications equipment connected to interface A3.

The voltage at interface A3 may be the ac mains, a rectified voltage derived from ac three phase mains, a rectified voltage derived from ac single phase mains or a low voltage derived from a battery. The power supply equipment may incorporate a backup battery.

The present document aims at providing compatibility between the power supply equipment and both the telecommunications equipment, and the different load units connected to the same interface A3 (e.g. datacom equipment).

The requirements at interface A3 apply to:

- the output of the power supply equipment or power supply installation of telecommunications centres;
- the power supply input of telecommunications equipment and the datacom equipment installed at telecommunications centres;
- telecommunications equipment and the datacom equipment, installed in customer's premises, whose power interface A3 is also used by equipment requiring a supply to the present document.

The purpose of the present document is:

- to identify a power supply system with the same characteristics for all telecommunications and data communication equipment defined in the area of application;
- to facilitate interworking of different (types of) loads units;
- to facilitate the standardization of power supply systems for telecommunications and datacom equipment;
- to facilitate the installation, operation and maintenance in the same network of equipment and telecommunications and datacom systems from different origins.

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.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] IEC 60364-4-44: "Electrical installations of buildings - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances".

[2] IEC 60364-5-54: "Electrical installations of buildings - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors".

[3] CENELEC HD 472 S1: "Nominal voltage for low-voltage public electricity supply systems".

[4] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods Part 1: Radio disturbance and immunity measuring apparatus".

3 Definitions and abbreviations

3.1 Definitions

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

abnormal voltage range: range of steady-state voltages over which the equipment will not be expected to maintain normal service but will survive undamaged

customer premises: any location which is the sole responsibility of the customer

datacom equipment: information technology equipment

interface A3: interface, physical point, at which power supply is connected to the telecommunications and datacom equipment

load unit: power consuming equipment, that is part of a system block

nominal load conditions: set of values dedicated to a test performance

nominal voltage value: nominal value of the voltage that designates the type of supply

normal service: service mode where telecommunications equipment operates within its specification

normal service voltage range: range of the steady-state voltage over which the equipment will maintain normal service

power supply: power supply to which telecommunications equipment is intended to be connected

system block: functional group of equipment depending for its operation and performance on its connection to the same power supply

telecommunication centre: any location where telecommunications equipment is installed and is the sole responsibility of the operator

3.2 Abbreviations

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

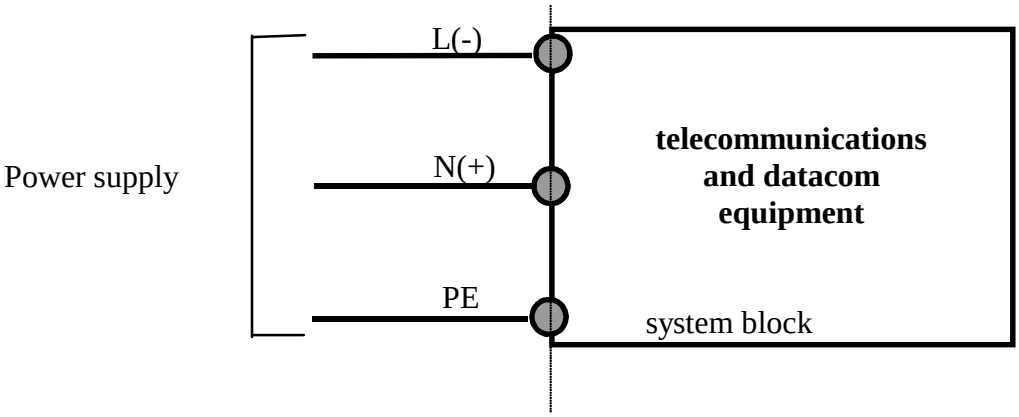
ac	alternating current (also when used as a suffix to units of measurement)
AMN	Artificial Mains Network
dc	direct current (also when used as a suffix to units of measurement)
EUT	Equipment Under Test
EMC	Electric Magnetic Compatibility
Im	maximum current
It	Instantaneous surge current
LISN	Line Impedance Stabilization Network
PE	Protective Earth
R	Resistance of resistive element of LISN
rms	root mean square (also when used as a suffix to units of measurement)
UPS	Uninterrupted Power Supply

4 Interface A3

The power supply interface, interface A3 of figure 1, is a physical point to which all the requirements are related.

This point is situated between the power supply system(s) and the power consuming telecommunications equipment.

NOTE: Interface A3 is located at the power terminals of the telecommunications equipment. Subject to the installation preconditions, this point may be located at any other point between the power supply system and the telecommunications equipment by mutual agreement of the relevant parties.



L (-) = phase or negative pole.
N (+) = ac neutral or dc return conductor (see clause 6).
PE = Protective earth.

Figure 1: General identification of the interface A3

5 Requirements

The requirement of the alternating voltage for the public mains is defined in HD 472 S1 [3].

5.1 Nominal voltage

The telecommunication equipment connected to interface A3 shall be designed to operate with the following nominal voltage:

- 230 Vrms.

See clause A.1 for discussion on possible power supply.

5.2 Normal service voltages at interface A3

The normal service voltage range is as follows:

- maximum peak voltage: 375 V;
- minimum rms voltage: 188 V.

NOTE: The normal service range covers both cases of power supply derived from a single phase ac or three phase ac.

5.3 Nominal frequencies

The nominal frequency for interface A3 is defined as follows:

- if directly ac powered the frequency is 50 Hz;
- if a ripple is superimposed to the dc voltage, the frequency of the ripple is 300 Hz (rectified three phase) or 100 Hz (rectified single phase).

5.4 Abnormal service voltage ranges at interface A3

5.4.1 Abnormal service voltage under steady-state conditions

The telecommunications equipment shall be subjected to following fluctuations:

- $0 V < U < 188$ Vrms.

Following the restoration of the supply to the normal service voltage range, the equipment shall fulfil the following performance criteria:

- the equipment shall not suffer any damage when subjected to fluctuations mentioned above;
- the equipment shall then resume operation according to its specifications;
- the abnormal service voltage shall not lead to the disconnection of power supply units e.g. by causing circuit breakers, fuses or other such devices to operate.

5.4.2 Voltage dips, short interruptions and transients

Ac voltage dips, short interruptions and transient on ac line are covered by EMC standardization. The interface A3 shall be considered from EMC test like an ac main port.

Telecom and datacom equipment shall be in compliance with the relevant applicable EMC standards.

The power supply shall be designed in a way that any voltage interruption at interface A3 is shorter than 20 ms.

NOTE: An interruption of the voltage at interface A3 may be caused by the power supply equipment when switching in backup mode.

Performance criteria:

- the equipment in maximum configuration shall continue to function correctly when the duration of the interruption is within the above range.

5.5 Supply protection

The supply at interface A3 shall be protected, (when operating on ac, rectified ac, or dc current), by fuses or circuits breakers.

The energy content of the inrush current shall also be taken into account when specifying the power supply system up to interface A3.

5.6 Maximum current drain

The maximum current drain at any voltage in the normal and abnormal voltage range at interface A3 lasting for longer than 1 second shall not exceed 1,5 times the current drain at nominal voltage according to clause 5.1.

NOTE 1: The current should not exceed this level at any time.

NOTE 2: For shorter times see Inrush current graph (see figure 2).

5.7 Surge current on connection to interface A3

5.7.1 Limits

The ratio of the instantaneous surge current It to maximum current Im at interface A3, under any random sequence of switching operations, shall not exceed the limits shown in figure 2.

The parameters are defined as follows:

- It: inrush current (magnitude of instantaneous values);
- Im: maximum input current, stated by the manufacturer, for a fully-equipped and loaded system block behind interface A3.

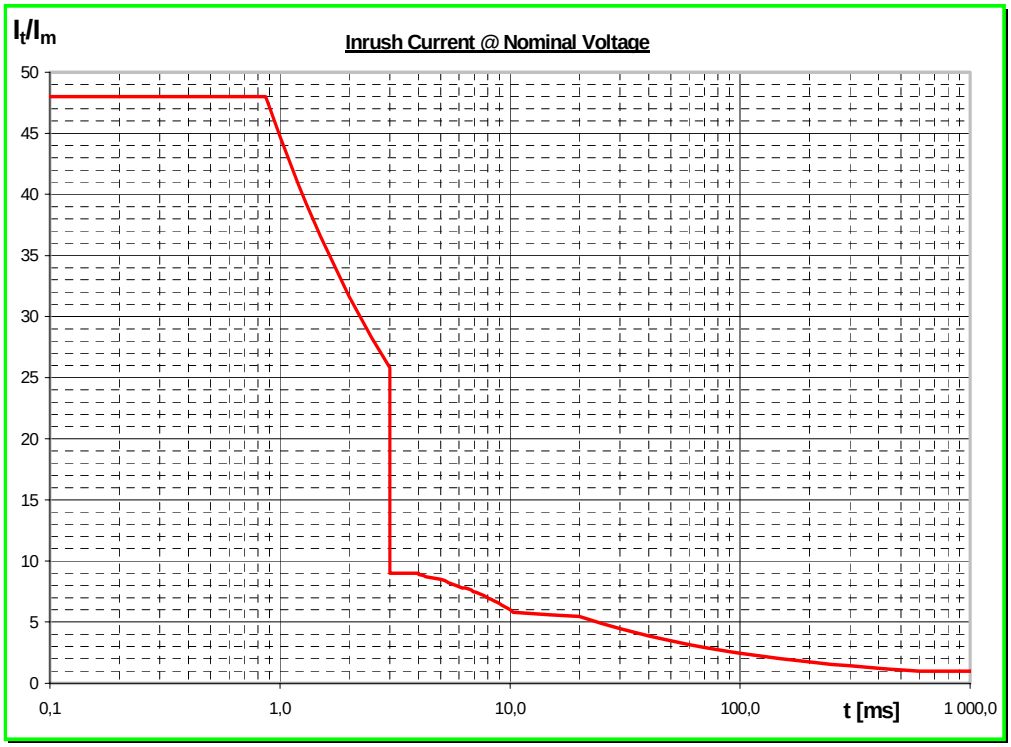
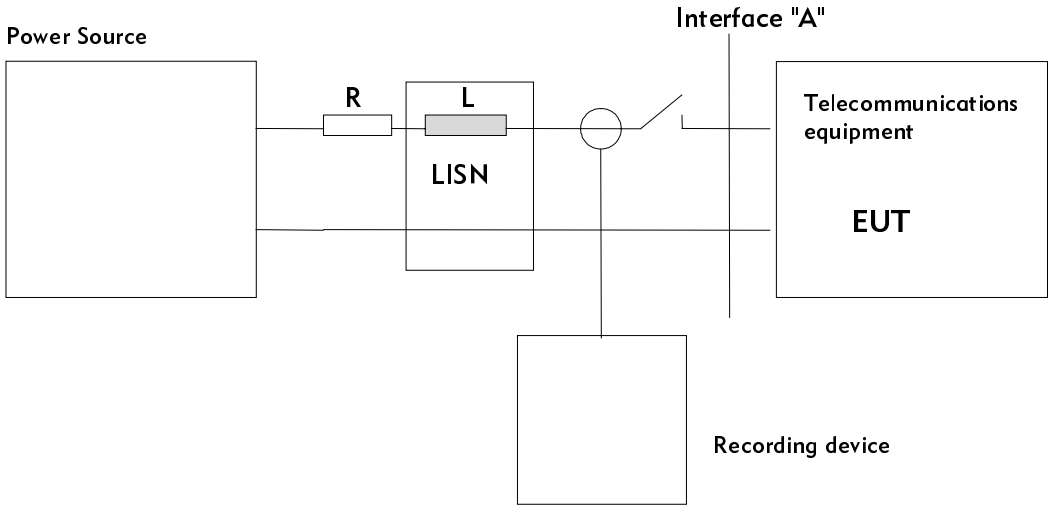


Figure 2: Maximum inrush current ratio characteristics for equipment at nominal voltage and maximum load

5.7.2 Measurements

The circuit for measuring the surge current drawn by the equipment shall be as shown in figure 3. The test circuit is designed to operate with a single switch as shown.



R = 6 V/(Im(@Vnom)).
L = 50 µH (the LISN (AMN) is specified in CISPR 16-1 [4], clause 11.3).
NOTE 1: Resistance R includes the resistance of inductor L.
NOTE 2: The intention of the additional resistance is to simulate a power network over which a voltage drop of 6 V will appear in case of nominal current.
NOTE 3: While carrying out the surge current test, the voltage of the power supply at the input of the LISN, as shown in figure 3, shall fall by no more than 12 V due to current limitation or internal impedance of the power source.

Figure 3: Inrush current test circuit

The test shall be made with different phase angles between the switching time and the rectified voltage. The values taken into account shall be the worst case (largest values) measured.

6 Earthing and bonding

The earthing and bonding of the telecommunications and datacom equipment in telecommunications centres is covered by IEC 60364-4-44 [1] and IEC 60364-5-54 [2].

The battery may be connected to earth at battery level or may be operated floating. Additional protection may be necessary for floating operation.

The neutral N shall be connected to earth at the source of the power system, as in TN-S or TT distribution systems.

7 Electrical safety requirements

The present document does not cover safety requirements, they are covered by the relevant safety standards.

8 EMC requirements

The present document does not cover EMC requirements, they are covered by the relevant EMC standards.

Annex A (informative): Power supply considerations

A.1 Possible power supply configurations

The increase of service and the new packet switching network has led to more equipment in the same existing telecommunication centres. The power consumption related to the standard phone services with equipment in 48 V decreases, but the power needed by these new services and packet networks increases and the power interface is generally ac voltage, the standard interface in the computer field.

Moreover, the density of electronic integration in telecommunication and computer fields increases, requiring more power density. Generally higher current is needed on the powering wire.

As a consequence, the nominal voltages proposed in the present document have been defined with consideration to the:

- need to unify the power supply of the Telecommunication Equipment and the Information Technology Equipment;
- desire to decrease the losses in the power distribution wire as well as copper cross-section;
- need to maintain a highly reliable power source for telecommunication centres.

The corresponding power supply can be based on a range of different configurations including:

- power supply is connected to an ac single phase sine wave source. The usual voltage at interface A3 is a 230 V rms voltage (50 Hz). When an ac input voltage failure occurs, the voltage is provided by a UPS;
- power supply is connected to an ac three phase sine wave source. The usual voltage at interface A3 is a rectified voltage with a ripple of 300 Hz (typical value 310 Vrms). When an ac input voltage failure occurs, the voltage is provided by a battery through an appropriate by-pass;
- power supply is connected to an ac single phase sine wave source. The usual voltage at interface A3 is, therefore, a rectified voltage with a ripple of 100 Hz (typical value 230 Vrms). When an ac input voltage failure occurs, the voltage is provided by a battery through an appropriate by-pass.

Other power supply configurations are possible:

- if a dc energy storage device (e.g. battery) is used, it shall be selected/designed to fit into the normal service voltage range defined in clause 5.2;
- selection shall take account of:
  - battery boost charging voltage (≤375 V);
  - battery end of discharge voltage and voltage drop in the distribution system (≥188 V).

A.2 Supply voltage waveforms

The voltage at interface A3 can have different wave shapes. Figures A.1 to A.5 represent these possible voltage wave shapes at the interface A3. All the equipment should accept to be supplied by this voltage.

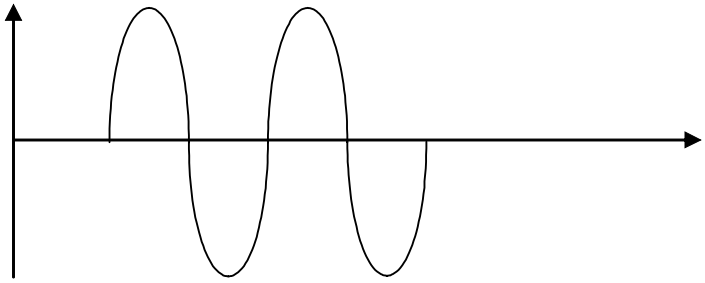


Figure A.1: Alternating voltage wave shape

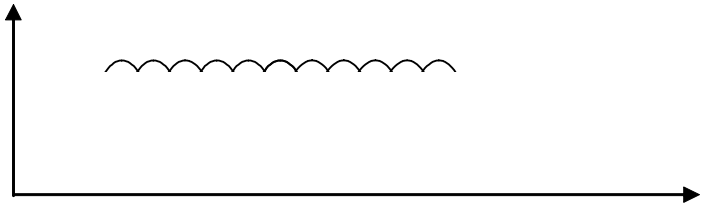


Figure A.2: Rectified three phase voltage wave shape

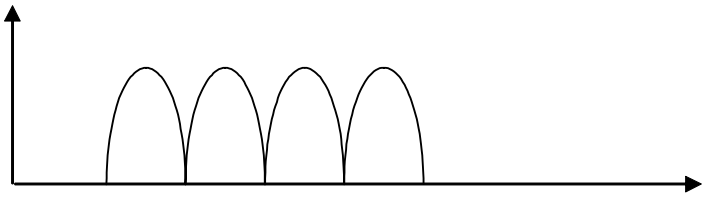


Figure A.3: Rectified single phase voltage wave shape

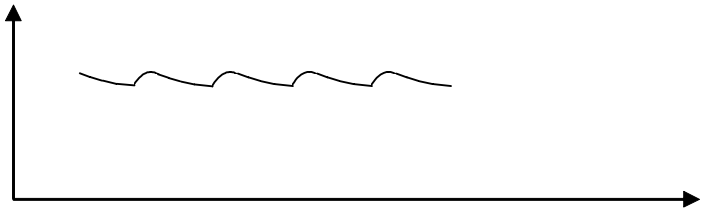


Figure A.4: Rectified and filtered single phase voltage wave shape

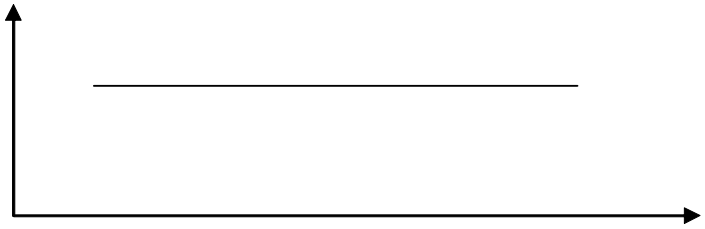
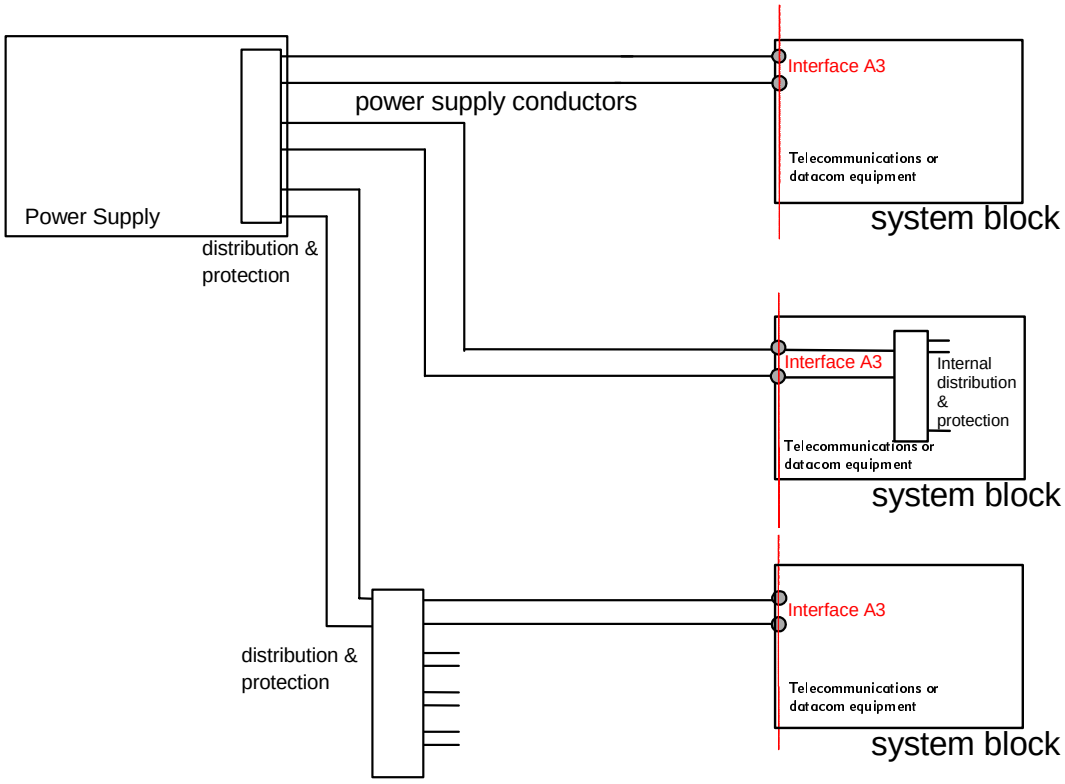


Figure A.5: Battery voltage wave shape

Annex B (informative): Identification of interface A3

Interface A3 is defined as the terminals at which the telecommunication or datacom equipment is connected to the power supply. This is shown in figure B.1.



NOTE: The figure is a drawing of the power system and does not show the PE conductor.

Figure B.1: Identification of interface A3 (three proposed examples)

Annex C (informative): Calculation of the extreme voltage nominal values at interface A3

The nominal value of the existing networks is 230 V (phase to neutral), that the tolerance of the nominal value is ±10 %, furthermore, taking into account that the telecommunication equipment can be installed in environment where harmonics exist (for example operation on a back up generator set with harmonic distortion), a provision of 5 % of the voltage is added to the maximum rectified voltage. The maximum rectified voltage is therefore equal to:
$230 \times 1{,}1 \times 1{,}05 \times \sqrt{2} = 375$ V.

The minimum value of the existing networks is 220 V, that the tolerance of the nominal value is ±10 %. Furthermore, harmonic distortion and losses on the power distribution may reduce of about 5 % this value The minimum rectified rms voltage is therefore equal to: $220 \times 0{,}9 \times 0{,}95 = 188$ V.

NOTE: According to the power supply configuration chosen the voltage range can cover both:

- Rectified voltage (three phase):
  - maximum peak voltage: 375 V;
  - minimum rms voltage: 253 V.
- Rectified voltage (single phase):
  - maximum peak voltage: 375 V;
  - minimum rms voltage: 188 V.
- Battery voltage
  - maximum voltage: 375 Vdc;
  - minimum voltage: 188 Vdc.

See clause A.2 for the voltage wave shapes.

Annex D (informative): Calculation of the extreme voltage nominal values at interface A3 in the case of using other nominal voltage

It is recognized that outside Europe other nominal voltage are used for the ac distribution system.

This present document only applies to a maximum rectified voltage of 375 V.

This annex give a guide on how calculate the extreme voltage in the cases that is used other nominal voltage.

- IEC 60038 states that the maximum value of the existing networks is 240 V (phase to neutral), that the tolerance of the nominal value is ±10 %, furthermore, taking into account that the telecommunication equipment can be installed in environment where harmonics exist (for example operation on a back up generator set with harmonic distortion), a provision of 5 % of the voltage is added to the maximum rectified voltage. The maximum rectified voltage is, therefore, equal to: $240 \times 1{,}1 \times 1{,}05 \times \sqrt{2} = 392$ V.
- IEC 60038 states that the minimum value of the existing networks is 220 V, that the tolerance of the nominal value is ±10 %. Furthermore, harmonic distortion and losses on the power distribution may reduce of about 5 % this value The minimum rectified rms voltage is, therefore, equal to: $220 \times 0{,}9 \times 0{,}95 = 188$ V.

Annex E (informative): Bibliography

- CENELEC HD 384: "Electrical installation of buildings".
- IEC 60038: "IEC standard voltage".
- IEC 60364-4-41: " Electrical installations of buildings - Part 4: Protection for safety - Chapter 41: Protection against electric shock ".
- EN 60950-1: "Safety of information technology equipment".
- ETSI EG 201 212 (V1.2.1):"Electrical safety; Classification of interfaces for equipment to be connected to telecommunication networks".

History

Document history				
V1.1.1	November 2002	Public Enquiry	PE 20030321:	2002-11-20 to 2003-03-21
V1.2.1	May 2003	Vote	V 20030725:	2003-05-26 to 2003-07-25