



# SLOVENSKI STANDARD

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**Uninterruptible power systems (UPS) -- Part 1-1: General and safety requirements for UPS used in operator access areas**

Uninterruptible power systems (UPS) -- Part 1-1: General and safety requirements for UPS used in operator access areas

**iTeh STANDARD PREVIEW**

Unterbrechungsfreie Stromversorgungssysteme (USV) -- Teil 1-1: Allgemeine Anforderungen und Sicherheitsanforderungen für USV außerhalb abgeschlossener Betriebsräume

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Alimentations sans interruption (ASI) -- Partie 1-1: Prescriptions générales et règles de sécurité pour les ASI utilisées dans des locaux accessibles aux opérateurs

**Ta slovenski standard je istoveten z: EN 50091-1-1:1996**

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29.200

Usmerniki. Pretvorniki.  
Stabilizirano električno  
napajanje

Rectifiers. Convertors.  
Stabilized power supply

**SIST EN 50091-1-1:1999**

**en**

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**Uninterruptible power systems (UPS)  
Part 1-1: General and safety requirements for UPS  
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This European Standard was approved by CENELEC on 1996-07-02. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

**CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

This European Standard has been prepared by the CENELEC BTTF 60-4 according to the relevant decisions of the CENELEC Technical Board.

It is to be used in conjunction with EN 60950:1992 and its amendments A1:1993 and A2:1993, *Safety of information technology equipment including electrical business equipment*, which is referred to in this document by "RD".

NOTE : When any item is referred to RD by the phrase "The definitions or the provisions of item /RD apply", this phrase is intended to mean that the definitions or provisions in that item of EN 60950 apply, except any which are clearly inapplicable to uninterruptible power systems.

This Part 1-1 of EN 50091 deals with the general and safety requirements of uninterruptible power systems for use in operator access areas.

The relevant EMC and performance requirements are given in EN 50091-2:1995 and EN 50091-3 (in preparation) respectively.

The text of this European Standard results from the published EN 50091-1:1993 and the Unique Acceptance Procedure on a draft amendment (prA1). The combined text was approved by CENELEC as EN 50091-1-1 on 1996-07-02.

This European Standard replaces EN 50091-1:1993.

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The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-06-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-06-01

For products which have complied with EN 50091-1:1993 before 1997-06-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2002-06-01.

This European Standard covers the essential requirements of the Low-voltage directive 73/23/EEC.

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## 1 General

### 1.1 Scope

**1.1.1** This Standard applies to electronic indirect a.c. convertor systems with an electrical energy storage device in the d.c. link.

The primary function of the uninterruptible power system (UPS) covered by this Standard is to ensure continuity of an alternating power source. The uninterruptible power system may also serve to improve the quality of the power source by keeping it within specified characteristics.

This Standard is applicable to UPS which are movable, stationary, fixed or for building-in, for use on distribution systems up to 1000 V a.c.; and intended to be installed in any operator accessible area. It specifies requirements to ensure safety for the operator and layman who may come into contact with the equipment and, where specifically stated, for the service personnel.

This Standard is intended to ensure the safety of installed UPS, both as a single UPS unit or as a system of interconnected UPS units, subject to installing, operating and maintaining the UPS in the manner prescribed by the manufacturer.

This Standard does not cover d.c. supplied electronic ballasts (IEC 924 and IEC 925), UPS intended to be installed in separated electrical locations and UPS based on rotating machines.

NOTE 1: For UPS intended to be used in vehicles, on board ships or aircraft in tropical countries, or on elevations greater than 1000 m different requirements may be necessary.

NOTE 2: For UPS subject to transient overvoltages exceeding those for Overvoltage Category II according to IEC 664, additional protection might be necessary in the mains supply to the UPS.

NOTE 3: For UPS intended for use where ingress of water and foreign objects are possible, additional requirements may be necessary; for guidance on such requirements and for relevant testing, see annex H.

NOTE 4: Manufacturers are reminded that some appliances are sensitive to a distorted waveform of the voltage or current and can be consequently overloaded; while the unsymmetrical or d.c. content can bring malfunction of earth leakage circuit breakers: therefore also the requirements of EN 50091-3 - *Performance requirements* have to be taken into account.

**1.1.2** Even if this Standard does not cover all types of UPS, it may be taken as a guide for such UPS. Requirements additional to those specified in this Standard may be necessary for specific applications, e.g.

- UPS intended for operation while exposed, for example, to extremes of temperature; to excessive dust, moisture, or vibration; to flammable gases; to corrosive or explosive atmospheres;
- electromedical applications with physical connections to the patient.

## 1.2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

### 1.2.1 European standards

Annex ZA/RD applies with the following additions:

|                                |                      |   |
|--------------------------------|----------------------|---|
| EN 50091-2                     | 1995                 | Uninterruptible power systems (UPS)<br>Part 2: EMC requirements   |
| EN 50091-3<br>(in preparation) |                      | Uninterruptible power systems (UPS)<br>Part 3: Performance requirements   |
| EN 60127                       | series               | Miniature links<br>(IEC 127 series)   |
| EN 60269-1                     | 1989                 | Low voltage fuses<br>(IEC 269 series)   |
| EN 60445                       | 1990                 | Specification for identification of equipment terminals and of terminations of certain designated conductors, including general rules for an alphanumeric systems<br>(IEC 445:1988) |
| EN 60529                       | 1991                 | Degree of protection provided by enclosures<br>(IEC 529:1989)   |
| EN 60924                       | 1991                 | D.C. supplied electronic ballasts for tubular fluorescent lamps<br>- General and safety requirements<br>(IEC 924:1990)  |
| EN 60925                       | 1991                 | D.C. supplied electronic ballasts for tubular fluorescent lamps<br>-Performance requirements<br>(IEC 925:1989)  |
| EN 60950<br>+A1<br>+A2         | 1992<br>1993<br>1993 | Safety of information technology equipment including electrical business equipment<br>(IEC 950:1991 + A1:1992 + A2:1993, modified)  |



|                                   |      |   |
|-----------------------------------|------|---|
| EN 61008-1<br>(+ Corr. Sept 1994) | 1994 | Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCB's); Part 1: General rules (IEC 1008-1:1990 + A1:1992, modified).      |
| EN 61009-1<br>(+ Corr. Sept 1994) | 1994 | Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCCB's); Part 1: General rules (IEC 1009-1:1991, modified).                   |
| ENV 61000-2-2                     | 1993 | Electromagnetic compatibility (EMC) -- Part 2: Environment Section 2: Compatibility levels for low frequency conducted disturbances and signalling in public low voltage power supply systems |

## 1.2.2 International standards

|                         |                      |  |
|-------------------------|----------------------|--|
| IEC 146-4               | 1986                 | Semi-conductor convertors<br>Part 4: Method of specifying the performance and test requirements of Uninterruptible power systems |
| IEC 755<br>+ A1<br>+ A2 | 1983<br>1988<br>1992 | General requirements for residual current operated protective devices  |

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## 1.3 Definitions

### 1.3.1 General

For the purpose of this Standard, the following definitions apply. Where the terms "voltage" and "current" are used, they imply the r.m.s values, unless otherwise specified.

NOTE: Care should be taken that measurement instruments give a true r.m.s. reading in the presence of non-sinusoidal signals. For other terms and definitions see also IEC 146-4.

#### 1.3.1.1 uninterruptible power system (UPS)

Combination of convertors, switches and energy storage devices, for example batteries, constituting a power system for maintaining continuity of load power in case of input power failure.

#### 1.3.1.2 continuity of load power

Load power with voltage and frequency within rated steady state and transient tolerance bands; and with distortion and interruptions within the limits specified for the load.

### 1.3.1.3 functional unit

Basic unit, for example, a rectifier, an inverter or a UPS switch.

### 1.3.1.4 bypass

Power path alternative to the indirect a.c. convertor.

### 1.3.1.5 power failure

Any variation in power supply which can cause unacceptable performance of the load equipment.

### 1.3.1.6 primary power

Power normally continuously available which is usually supplied by an electrical utility company but sometimes by the user's own generator.

### 1.3.1.7 bypass power

Power supplied via the bypass. (standards.iteh.ai)

### 1.3.1.8 apparent output power

Permanent apparent power, the product of the r.m.s. output voltage and r.m.s. current. It is given for a load in VA or kVA, with a specified power factor.

### 1.3.1.9 active power

Sum of the electrical power at the fundamental frequency and the powers of each harmonic component from the output terminals, in W or kW.

### 1.3.1.10 load power factor

Characteristic of an a.c. load expressed as the ratio of active power to apparent power.

### 1.3.1.11 peak factor

Ratio of the peak value to the r.m.s. value in steady state.

### 1.3.1.12 rated voltage

The input or output supply voltage (for three-phase supply the phase-to-phase voltage) as declared by the manufacturer.

### 1.3.1.13 rated voltage range

The input or output supply voltage range as declared by the manufacturer, expressed by its lower and upper rated voltages.

### 1.3.1.14 rated current

The maximum input or output current of the UPS as declared by the manufacturer.

### 1.3.1.15 rated frequency

The input or output supply frequency as declared by the manufacturer.

### 1.3.1.16 rated frequency range

The input or output supply frequency range as declared by the manufacturer, expressed by its lower and upper rated frequencies.

### 1.3.1.17 rated apparent output power

Apparent output power as declared by the manufacturer.

### 1.3.1.18 rated active output power

Active output power as declared by the manufacturer.

### 1.3.1.19 backfeed

The condition where a proportion of the voltage or energy available within the UPS is fed back to any of the input terminals, either directly or by a leakage path.

## 1.3.2 Operating conditions

### 1.3.2.1 reference load

The mode of operation which approximates as close as possible the most severe conditions of normal use in accordance with the manufacturer's operating instructions. However, when the conditions of actual use can obviously be more severe than the maximum load conditions recommended by the manufacturer, a load shall be used that is representative of the maximum that can be applied.

NOTE: For examples of reference load conditions for UPS, see annex M.

### 1.3.2.2 linear load

A load where the current drawn from the supply is defined by the relationship:

$$I = U/Z$$

where: I is the load current;  
U is the supply voltage;  
Z is the load impedance.

### 1.3.2.3 non-linear load

A load where the parameter Z (load impedance) is no longer a constant but is a variable dependent on other parameters, such as voltage or time (see annex M).

### 1.3.2.4 stand-by power

The power intended to replace primary power in the event of primary power failure.

### 1.3.2.5 stored energy mode (standards.iteh.ai)

The operation of the UPS when supplied by the following conditions:

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- primary power is disconnected or is out of a given tolerance;
- battery is being discharged;
- load is within the given range;
- output voltage is within the given tolerance.

### 1.3.2.6 stored energy time

Minimum time during which the UPS will ensure continuity of load power, under specified service conditions when the primary power fails, starting with the energy storage means being charged according to 1.3.2.7 and at the commencement of its service life.

NOTE: Fully charged is intended as restored energy after a restores energy time recharge.

### 1.3.2.7 restored energy time

Maximum time required to recharge sufficiently the energy storage means of the UPS with the charging capacity installed (after a discharge as specified in 1.3.2.6 with the UPS operating under specified service conditions) to ensure another such a discharge.

NOTE: This period is the time taken after a stored energy time discharge to restore sufficient energy to repeat the stored energy time discharge.

### 1.3.3 Equipment mobility

The definitions of 1.2.3/RD apply.

### 1.3.4 Classes of UPS

The definitions of 1.2.4/RD apply.

### 1.3.5 Connections

The definitions of 1.2.5/RD apply together with the following:

#### 1.3.5.1 power cord

A flexible cord or cable for interconnection purposes.

### 1.3.6 Enclosures

The definitions of 1.2.6/RD apply.

### 1.3.7 Accessibility

The definitions of 1.2.7/RD apply.

### 1.3.8 Circuit characteristics

The definitions of 1.2.8/RD apply together with the following:

#### 1.3.8.1 hazardous voltage

A voltage exceeding 42,4 V peak, or 60 V d.c., existing in a circuit which does not meet the requirements for a limited current circuit.

### 1.3.9 Insulation

The definitions of 1.2.9/RD apply.

### 1.3.10 Creepage distances and clearances

The definitions of 1.2.10/RD apply.

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### 1.3.11 Components

The definitions of 1.2.11/RD apply.

### 1.3.12 Power distribution

The definitions of 1.2.12/RD apply.

### 1.3.13 Flammability

The definitions of 1.2.13/RD apply.

### 1.3.14 Miscellaneous

The definitions of 1.2.14/RD apply together with the following:

#### 1.3.14.1 touch current (standards.iteh.ai)

The current which flows into a network representing the impedance of the human body.

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#### 1.3.14.2 protective conductor current

The current in the protective conductor as measured by an ammeter of negligible impedance (see annex G).

NOTE: In the present Standard the term "earth leakage current" is used as equivalent.

#### 1.3.14.3 type test

The definition of 1.2.14.1/RD applies together with the following addition:

NOTE: Purchasers should note that for physically large units and/or power ratings adequate test facilities to demonstrate some of the type tests may not exist, or not be economically viable.

This situation also applies to some electrical tests for which no commercially test simulation equipment is available or require specialist test facilities beyond the scope of the manufacturers premises.

Where these conditions exist, the manufacturer may elect to either:

1. Use a certified Test House to carry out testing for compliance on his behalf. Evidence of third party certification shall be deemed sufficient to prove compliance with the relevant clauses.
2. Demonstrate that the design is compliant by calculation or by experience and/or testing of similar designs in similar conditions.

For testing of parameters other than those listed as routine, it shall be a matter of agreement between the manufacturer and the purchaser as a contract condition.

## 1.4 General requirements

### 1.4.1 UPS design and construction

A UPS shall be so designed and constructed that, under conditions of normal use and likely fault conditions, it protects against risks of personal injury from electric shock and other hazards, and against serious fire originating in the UPS or connected loads, within the meaning of this Standard.

*In general, compliance is checked by inspection and by the relevant tests.*

NOTE 1: Where the UPS involves safety situations not specifically covered, the design should provide a level of safety not less than that generally afforded by this Standard.

NOTE 2: The need for additional detailed requirements to cope with a new situation should be brought promptly to the attention of the appropriate committee.

**1.4.2** Sufficient information shall be provided to the user concerning any condition necessary to ensure that the equipment will not present a hazard within the meaning of this Standard when used as prescribed by the manufacturer (see clause 1.7).

*Compliance is checked by inspection.*

**1.4.3** Equipment is classified according to its protection from electric shock as:

Class I, or  
Class II

NOTE: Equipment containing ELV circuits or parts at hazardous voltage is Class I or Class II.

## 1.5 General conditions for tests

The provisions of 1.4.1/RD, 1.4.2/RD, 1.4.3/RD, 1.4.6/RD, 1.4.7/RD, 1.4.8/RD, 1.4.10/RD apply together with the following.

**1.5.1** Except where specific test conditions are stated elsewhere in the Standard and, where it is clear that there is a significant impact on the results of the test, the tests shall be carried out under the most unfavourable combination within the manufacturer's operating specifications of the following parameters:

- supply voltage;
- absence of supply voltage;
- supply frequency;
- charge condition of the battery;
- physical location of UPS and position of movable parts;
- operating mode;