



# SLOVENSKI STANDARD SIST EN 50091-1:1995

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Uninterruptible power systems (UPS) -- Part 1: General and safety requirements

Unterbrechungsfreie Stromversorgungssysteme (USV) -- Teil 1: Allgemeine  
Anforderungen und Sicherheitsbestimmungen

Alimentations sans interruption (ASI) -- Partie 1: Prescriptions générales et règles de  
sécurité

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**Ta slovenski standard je istoveten z: EN 50091-1:1993**

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Rectifiers. Convertors.  
Stabilized power supply

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EUROPEAN STANDARD

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May 1993

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Descriptors: Power electronics, uninterruptible power supply, general requirements for uninterruptible power supplies, safety requirements for uninterruptible power supplies

## ENGLISH VERSION

Uninterruptible power systems (UPS)  
Part 1: General and safety requirements

Alimentations sans interruption  
(ASI)

Première Partie: Définitions et  
prescriptions générales

Unterbrechungsfreie Stromversorgung  
(USV)

Teil 1: Allgemeine Anforderungen  
und Sicherheitsbestimmungen

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This European Standard was approved by CENELEC on 1992-12-09. 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 list 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 CENELEC BTF 60-4 according to the relevant decisions of the CENELEC Technical Board.

It is to be used in conjunction with EN 60950: 1992, 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 of EN 50091 deals with the general and safety requirements of uninterruptible power systems. The relevant performance requirements will be given in EN 50091-2 (in preparation).

The text of this European Standard was submitted to formal vote in July 1992 and approved by CENELEC as EN 50091-1 on 1992-12-09.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-01-01
- latest date of withdrawal of conflicting national standards (dow) 1994-03-15

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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 movable, stationary, fixed and built in UPS for distribution systems up to 1000 V a.c.

This standard applies to UPS intended to be installed in any operator accessible area and specifies requirements to ensure safety for the operator and layman who may come into contact with the equipment and, where specifically stated, for service personnel.

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

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

Note 1: For equipment intended to be used in vehicles, on board of ships or aircrafts, in tropical countries or on elevations greater than 1000 m, different requirements may be necessary.

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

Note 3: For equipment 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 Appendix 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 50 091 Part 2: Performance Requirements have to be taken in account.

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

### 1.2.1 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 measuring 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.

- 1.2.1.1 *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.  
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- 1.2.1.2 *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.
- 1.2.1.3 *UPS functional unit*  
Functional unit, for example, a rectifier, an inverter or a UPS switch.
- 1.2.1.4 *bypass*  
Power path alternative to the indirect a.c. convertor.
- 1.2.1.5 *power failure*  
Any variation in power supply which can cause unacceptable performance of the load equipment.
- 1.2.1.6 *primary power*  
Power normally continuously available which is usually supplied by an electrical utility company but sometimes by the user's own generation.

- 1.2.1.7 *bypass power*  
Power supplied via the bypass.
- 1.2.1.8 *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.
- 1.2.1.9 *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.
- 1.2.1.10 *load power factor*  
Characteristic of an a.c. load expressed as the ratio of active power to apparent power.
- 1.2.1.11 *peak factor*  
Ratio of the peak value to the r.m.s. value in steady state.
- 1.2.1.12 *rated voltage*  
The input or output supply voltage (for three-phase supply, the phase-to-phase voltage) as declared by the manufacturer.
- 1.2.1.13 *rated voltage range*  
The input or output supply voltage range as declared by the manufacturer, expressed by its lower and upper rated voltages.
- 1.2.1.14 *rated current*  
The maximum input or output current of the equipment as declared by the manufacturer.
- 1.2.1.15 *rated frequency*  
The input or output supply frequency as declared by the manufacturer.
- 1.2.1.16 *rated frequency range*  
The input or output supply frequency range as declared by the manufacturer, expressed by its lower and upper rated frequencies.
- 1.2.1.17 *rated apparent output power*  
Apparent output power as declared by the manufacturer.
- 1.2.1.18 *rated active output power*  
Active output power as declared by the manufacturer.
- 1.2.1.19 *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.



## 1.2.2 OPERATING CONDITIONS

1.2.2.1 *normal 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 is used that is representative of the maximum that can be applied.

For examples of normal load conditions for UPS equipment, see Annex M.

1.2.2.2 *linear load*

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

$$I = U/Z$$

where:

I = load current  
U = supply voltage  
Z = constant impedance

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1.2.2.3 *non-linear load* (standards.iteh.ai)

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).

1.2.2.4 *stand-by power*

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

1.2.2.5 *stored energy mode*

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

- 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.

1.2.2.6 *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 1.2.2.7.

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

1.2.2.7 *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 1.2.2.6 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.

### 1.2.3 **EQUIPMENT MOBILITY**

The definitions of 1.2.3/RD apply.

### 1.2.4 **CLASSES OF EQUIPMENT**

The definitions of 1.2.4/RD apply.

### 1.2.5 **CONNECTIONS**

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

1.2.5.1 *power cord*  
A flexible cord or cable for interconnection purposes.

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### 1.2.6 **ENCLOSURES**

The definitions of 1.2.6/RD apply.

### 1.2.7 **ACCESSIBILITY**

The definitions of 1.2.7/RD apply.

### 1.2.8 **CIRCUIT CHARACTERISTICS**

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

1.2.8.1 *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.

**1.2.9 INSULATION**

The definitions of 1.2.9/RD apply.

**1.2.10 CREEPAGE DISTANCES AND CLEARANCES**

The definition of 1.2.10/RD apply

**1.2.11 COMPONENTS**

The definitions of 1.2.11/RD apply.

**1.2.12 POWER DISTRIBUTION**

The definitions of 1.2.12/RD apply.

**1.2.13 FLAMMABILITY**

The definitions of 1.2.13/RD apply.

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**1.2.14 MISCELLANEOUS (standards.iteh.ai)**

The definitions of 1.2.14/RD apply together with followings:

- 1.2.14.1 touch current**  
The current which flows into a network representing the impedance of the human body.
- 1.2.14.2 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 GENERAL REQUIREMENTS**

- 1.3.1** 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 equipment 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.

- 1.3.2 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 1.7)

*Compliance is checked by inspection.*

- 1.3.3 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.

#### 1.4 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 and 1.4.11/RD apply together with the followings:

- 1.4.1 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 unfavorable 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 equipment and position of movable parts
- operating mode
- adjustments of thermostats, regulating devices or similar controls in operator access area, which are:
  - a) adjustable without the use of a tool, or
  - b) adjustable using a means, such as a key or a tool, deliberately provided for the operator.

- 1.4.2 In determining the most unfavorable supply voltage for a test, the following variables shall be taken into account:
- multiple rated voltages
  - extremes of rated voltage ranges
  - tolerance on rated voltage as specified by the manufacturer  
If tolerance is not specified, it shall be taken as + 6% and - 10% (see 1.6.5/RD)

1.4.3 In determination of input current, and where other test results could be affected, the following variables shall be considered and adjusted to give the most unfavorable results:

- loads due to recharging of batteries;
- loads due to optional features, offered or provided for by the manufacturer for inclusion in or with the equipment under test;
- loads due to other units of equipment intended by the manufacturer to draw power from the equipment under test;
- loads which could be connected to any standard supply outlets in operator access areas on the equipment, up to the value indicated in the marking required by 1.7.3 or 1.7.4.

Note: Artificial loads may be used to simulate such loads during testing.

## 1.5 COMPONENTS

The provisions of 1.5.1/RD, 1.5.2/RD, 1.5.3/RD, 1.5.4/RD apply

## 1.6 POWER INTERFACE

The provisions of 1.6.4/RD and 1.6.5/RD apply together with the following:

1.6.1 The neutral conductors, if any, shall be insulated from earth and the body throughout the equipment, as if they were a phase conductor. Components connected between neutral and earth shall be rated for a proper working voltage depending on the configuration. In the case of the output neutral conductor being isolated from the input neutral conductor, the service personnel responsible for the installation shall connect this output neutral conductor to earth, if permitted by local wiring rules and if so detailed in the installation instructions.

*Compliance is checked by inspection.*

## 1.7 MARKING AND INSTRUCTIONS

### 1.7.1 POWER RATING

Equipment shall be provided with adequate markings in order to specify:

- input supply requirements;
- output supply ratings.

For equipment intended to be installed by anyone other than service personnel, the marking shall be readily visible either in an operator access area or shall be located on an outside surface of the equipment. If located on an outside surface of fixed equipment, the marking shall be discernible after the equipment has been installed as in normal use.

Markings that are not visible from the outside of the equipment are considered to be in compliance if they are directly visible when opening a door or cover. If the area behind a door or cover is not an operator access area, a readily visible marker should be attached to the equipment to clearly indicate the location of the marking; it is allowed to use a temporary marker.

The markings of input and output shall include the followings :

- rated voltage(s) or rated voltage range(s), in V.

The voltage range shall have a hyphen (-) between the minimum and maximum rated voltages. When multiple rated voltages or voltage ranges are given, they shall be separated by a solidus (/).

Note: Some examples of rated voltage markings are:

Rated voltage range: 220 - 240 V. This means that the equipment is designed to be connected to any supply having a nominal voltage between 220 and 240 V.

Multiple rated voltage: 120/220/240 V. This means that the equipment is designed to be connected to a supply having a nominal voltage of 120, 220 or 240 V, usually after internal adjustment.

- symbol for nature of supply, for d.c. only;
  - rated frequency or rated frequency range, in Hz, unless the equipment is designed for d.c. only;
  - rated current, in A.
- For equipment with multiple rated voltages, the corresponding rated currents shall be marked such that the different current ratings are separated by a solidus (/) and the relation between rated voltage and associated rated current appears distinctly.
- Equipment with a rated voltage range shall be marked with either the maximum rated current, or with the current range.

Note: If a unit is not provided with a means for direct connection to the supply mains, it need not be marked with its rated current.

- number of phases (1  $\phi$  - 3  $\phi$ ) with or without neutral;
- output rated active power, in W or kW (1);
- output rated apparent power, in VA or kVA (1);
- maximum ambient operating temperature range (optional);
- stored energy time, in min. or h. (only for built - in batteries at rated output active power and at ambient temperature optional);
- manufacturer's name, trade mark or identification mark;
- manufacturer's model or type reference;
- symbol for Class II construction, for Class II equipment only;

Note 1: Compliance according to Annex M.

Note 2: Additional markings are allowed, provided they do not give rise to misunderstanding.

Where symbols are used, they shall conform with ISO Standard 7000 and IEC Publication 417, where appropriate symbols exist.

For units designed with additional separate automatic by-pass/maintenance by-pass, additional input a.c. supply or external batteries, it shall be allowed for the relevant supply ratings to be specified in the accompanying installation instructions.

Where this is done, the following instruction shall appear on or near the point of connection:

**SEE INSTALLATION INSTRUCTIONS BEFORE CONNECTING TO THE SUPPLY**

## 1.7.2

### **SAFETY INSTRUCTIONS**

If it is necessary to take special precautions to avoid the introduction of hazards when operating, installing, maintaining transporting or storing UPS, the manufacturer shall make available the necessary instructions.

Note 1: Special precautions may be necessary, for example for battery connection of the equipment to the supply and the interconnection of separate units, if any.

Note 2: Where appropriate, installation instructions should include reference to national wiring rules.

Note 3: Maintenance information is normally made available only to service personnel.

The operating instructions and, for pluggable equipment intended for user installation, also the installation instructions, shall be made available to the user.

The manufacturer shall provide the user with guidance on the level of competence necessary for installation, e.g.:

- operator installable: any pluggable A or B equipment with battery already installed by the supplier.
- service personnel installable: any fixed equipment or equipment with batteries not installed when delivered to the user.

The manufacturer shall provide the user with guidance on the level of competence necessary to operate the equipment as:

- operated by any individual with no previous experience;
- operated by individuals with previous training.

When the disconnect device is not incorporated in the equipment (see 2.6.3/RD) or when the plug on the power supply cord is intended to serve as the disconnect device, the installation instructions shall state that:

- for permanently connected equipment, a readily accessible disconnect device shall be incorporated in the fixed wiring;
- for pluggable equipment the socket-outlet shall be installed near the equipment and shall be easily accessible.