

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE
NORME DE LA CEI

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Convertisseurs à semiconducteurs

**Quatrième partie: Méthode de spécification des performances et procédures d'essais
des alimentations sans interruption**

Semiconductor convertors

**Part 4: Method of specifying the performance and test requirements
of uninterruptible power systems**



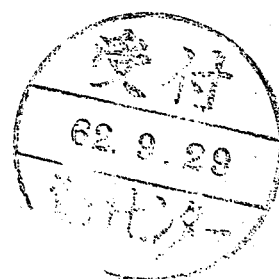
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Bureau Central de la Commission Electrotechnique Internationale

3, rue de Varembé

Genève, Suisse



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR CONVERTORS**Part 4: Method of specifying the performance and test requirements
of uninterruptible power systems**

FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 22B: Semiconductor Convertors, IEC Technical Committee No. 22: Power Electronics.

The text of this standard is based upon the following documents:

Six Months' Rule	Report on Voting
22B(CO)44	22B(CO)47

Further information can be found in the Report on Voting indicated in the table above.

3.6 *Inverter*

Electronic convertor for inversion.

3.7 *UPS switch*

Switch (quenched, line- or self-commutated, electronic or mechanical, depending on required continuity of load power) used to connect/isolate UPS or bypass to/from load.

3.8 *Transfer switch*

UPS switch consisting of one or more switches used to transfer power from one source to another.

3.9 *Electronic power switch*

Operative unit for electronic power switching comprising at least one electronic controllable valve device.

3.10 *Quenching*

The termination of current conduction in an arm without commutation.

3.11 *Commutation*

The transfer of current from one arm to another with both arms carrying current simultaneously.

3.12 *Line commutation*

External commutation whereby the commutating voltage is supplied from the line.

3.13 *Self-commutation*

Commutation whereby the commutating voltage is supplied by components within the convertor or the electronic switch.

3.14 *Prime power*

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

3.15 *Stand-by power*

Power intended to replace prime power in the event of prime power failure.

3.16 *A.C. input*

Power supplied to UPS and bypass, if any, which can be either prime power or standby power.

3.17 *Bypass*

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

3.18 *Bypass power*

Power (prime or stand-by power) supplied via the bypass.

3.19 *Power failure*

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

3.20 *UPS unit*

Complete UPS consisting of at least one of each of the following functional units: inverter, rectifier and battery or other energy storage means, which may operate with other UPS units to form a parallel or a redundant UPS.

3.21 Single UPS

UPS comprising only one UPS unit.

3.22 Parallel UPS

UPS comprising two or more UPS units operating in parallel.

3.23 Partial parallel UPS

UPS with parallel operating invertors with common battery and/or rectifier.

3.24 Partial redundant UPS

UPS with redundancy in invertors or invertors and/or other functional units.

3.25 Redundant UPS

UPS with redundancy in UPS units.

3.26 Redundancy

Addition of functional units or groups of functional units in a system to enhance the continuity of load power.

3.27 Stand-by redundant UPS

Redundant UPS in which one or more UPS units are held in reserve until the operating UPS unit fails.

3.28 Parallel redundant UPS

Redundant UPS with a number of paralleled load-sharing UPS units the remainder of which, upon failure of one or more UPS units, takes over the full load.

3.29 Rating

Set of rated values and operating conditions.

3.30 Rated value

Quantity value assigned, generally by a manufacturer, for a specified operating condition of a component, device or equipment.

3.31 Nominal value

Suitable approximate quantity value used to designate or identify a component, device or equipment.

3.32 Limiting value

Greatest or smallest admissible value of a specified input or output quantity.

3.33 Tolerance band

Range of values of a quantity within specified limits.

3.34 Output voltage

R.M.S. value (unless otherwise specified for a particular load) of the voltage between the output terminals.

3.35 Output current

R.M.S. value of the current (unless otherwise specified for a particular load) between the output terminals.

3.36 Output power

Active power (sum of the power of the fundamental frequency components of voltage and current and power of the harmonic components) from the output terminals.

3.37 Load power factor

Characteristic of an a.c. load in terms expressed by the ratio of active power to apparent power assuming an ideal sinusoidal voltage.

3.38 Short circuit output current

Current which flows from the UPS into a short circuit across its output terminals.

3.39 Output impedance

Impedance presented by the convertor to the load for specified frequencies.

3.40 Relative harmonic content

Ratio of the r.m.s. values of the harmonic content to the r.m.s. value of the total non-sinusoidal periodic function.

3.41 Periodic output voltage modulation

Periodic variation of output voltage amplitude at frequencies less than the fundamental output frequency.

Note. — For the purpose of this standard the term "variation" has the following meaning: The difference of the values of a quantity before and after a change of an influence quantity.

The term "deviation" has the following meaning: The difference between the actual values of a quantity and the ideal waveform or nominal value respectively.

3.42 R.M.S. voltage variation

Difference between the r.m.s. voltage and the corresponding previously undisturbed r.m.s. voltage.

3.43 Voltage time integral variation

Difference between the voltage time integral over one half-cycle and the corresponding value of the previously undisturbed waveform.

3.44 Peak voltage variation

Difference between the actual peak voltage and the corresponding value of the previously undisturbed waveform.

3.45 Frequency modulation

Variation of the output frequency.

3.46 UPS efficiency

Ratio of output power to input power under specified service conditions with no energy transfer to or from the energy storage means.

3.47 Stored energy time

Minimum time during which the UPS will ensure continuity of load power under specified service conditions starting with a fully charged energy storage means when a.c. input power fails.

3.48 Restored energy time

Maximum time required by the energy storage means of the UPS to be fully charged with the UPS operating under specified service conditions.

3.49 Transient

That part of the variation in a quantity during transition from one steady-state operating condition to another which ultimately disappears.

3.50 Subtransient (less than half a cycle) voltage waveform variation

Difference between the voltage waveform and the corresponding portion of the previous half cycle of the voltage.

3.51 Recovery time

Time interval between a step change in one of the control quantities or influence quantities and the instant when the stabilized output quantity returns to and stays within the steady-state tolerance band.

3.52 Transfer time

Time interval between the initiation of transfer and the instant when the output quantities have been transferred.

3.53 Interruption time

Time interval during which the output voltage is below the lower limit of the tolerance band.

3.54 Supply impedance

Impedance at the input lines to the UPS with the UPS disconnected.

4. Types of uninterruptible power systems (UPS)

Various types of UPS configurations are used to achieve different degrees of continuity of load power and/or to increase output power rating.

This clause explains some typical arrangements in use and the important characteristics of each of these.

4.1 Single UPS

The simplest arrangement is a single UPS.

4.1.1 Single UPS without bypass

A single UPS is capable of ensuring continuity of load power as long as it continues to operate within its specification. The load will not normally be disturbed by an a.c. input power failure (see Figure 1).

4.1.1.1 Single UPS with a common rectifier for inverter and battery

The inverter always supplies the power to the load and it takes its power from either the a.c. input via the rectifier or from the battery (see Figure 1). The rectifier has to be controlled so as to recharge and maintain the battery in a charged condition.

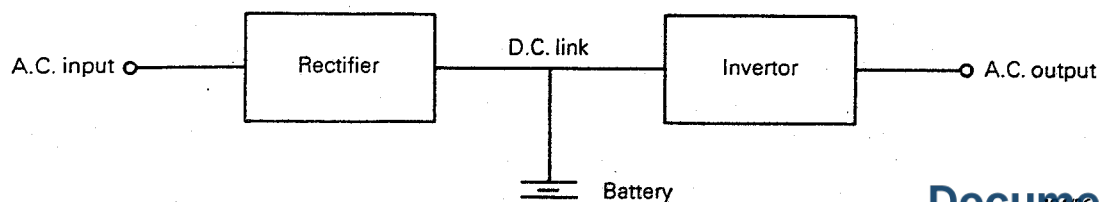


FIG. 1. — Single UPS with a common rectifier for inverter and battery.

In case of a.c. input power failure, the battery will supply the power at a decreasing d.c. voltage until it is too low for satisfactory output of the inverter. The type and capacity of the battery will determine the length of time the system can operate without an a.c. input supply.

The frequency, number of phases and voltage levels of the input and output may be different.

The output can be designed to meet much more stringent specifications than those normally obtainable from the input power source, i.e. closer voltage and frequency tolerances and reduced transient variations as well as protection against input power failure.

4.1.1.2 Single UPS with separate battery charger

The requirements of the rectifier to supply the inverter input power and charge the battery may conflict with each other so that the UPS may be designed with a separate battery charger.

From a user's point of view, the above comments on single UPS apply to this system also.

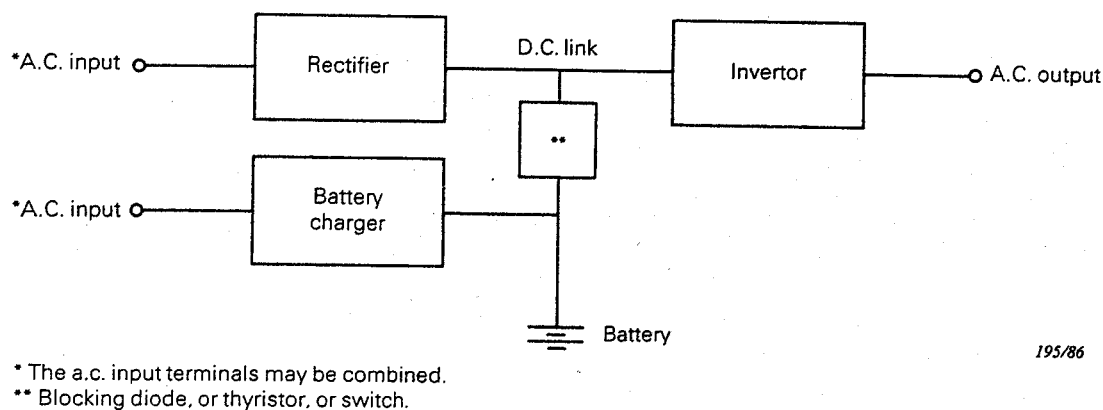


FIG. 2. — Single UPS with separate battery charger.

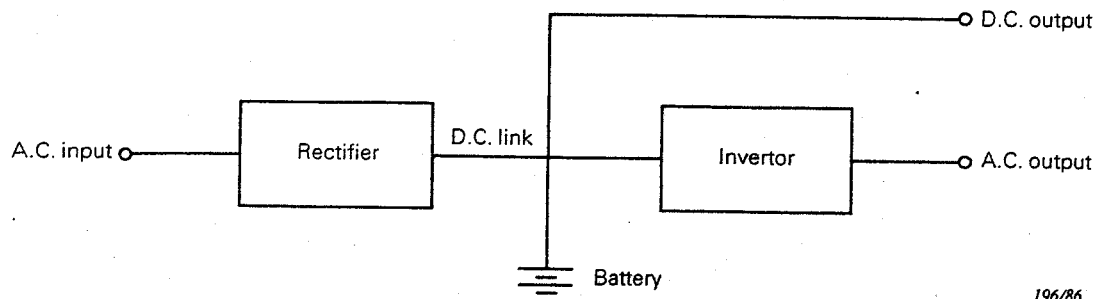


FIG. 3. — Single UPS with d.c. and a.c. output.

4.1.1.3 Single UPS with d.c. and a.c. outputs

Some applications require a source of uninterruptible d.c. power as well as a.c. power. Combined systems are possible. An example is given in Figure 3.