

# Low-voltage power supplies, d.c. output —

## Part 7: Safety requirements

ICS 29.200

# National foreword

This British Standard is the UK implementation of EN 61204-7:2006 incorporating A11:2009. It is derived from IEC 61204-7:2006. It supersedes BS EN 61204-7:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/22, Power electronics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 December 2006

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## Amendments/corrigenda issued since publication

| Comments        | Date                                                                          |
|-----------------|-------------------------------------------------------------------------------|
| 31 October 2009 | Implementation of CENELEC amendment A11:2009. Subclause <b>1.7.1.Z1</b> added |
|                 |                                                                               |
|                 |                                                                               |
|                 |                                                                               |

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English version

**Low voltage power supplies, d.c. output**  
**Part 7: Safety requirements**  
(IEC 61204-7:2006)

Alimentations basse tension,  
sortie continue  
Partie 7: Exigences de sécurité  
(CEI 61204-7:2006)

Stromversorgungsgeräte  
für Niederspannung  
mit Gleichstromausgang  
Teil 7: Sicherheitsanforderungen  
(IEC 61204-7:2006)

This European Standard was approved by CENELEC on 2006-10-01. 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, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the 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

The text of document 22E/101/FDIS, future edition 1 of IEC 61204-7, prepared by SC 22E, Stabilized power supplies, of IEC TC 22, Power electronic systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61204-7 on 2006-10-01.

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) 2007-07-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2009-10-01

This standard does not follow the rules for structuring European Standards as given in Part 3 of the CEN/CENELEC Internal Regulations because of the varied requirements which can apply to power supplies. It assumes that all power supplies are required to meet either EN 60950:2000 (IEC 60950:1999, mod.) and/or EN 60950-1:2001 (IEC 60950-1:2001, mod.). In addition power supplies may also have to meet the requirements of other standards dependent on the application. To satisfy this need it was decided that all power supplies shall meet EN 60950:2000 and/or EN 60950-1:2001 as described in the main body of this standard. The differences between these requirements and those of other standards can then be optionally applied by applying any or all of the appropriate annexes. This was done to avoid confusion.

The annexes of this standard are clearly described in 1.1.1.

EN 61204 (IEC 61024) consists of the following parts, under the general title *Low voltage power supplies, DC output*:

Part 1: Reserved for future use.

Part 2: Performance characteristics<sup>1)</sup>

Part 3: Electromagnetic compatibility (EMC)

Part 4: Tests other than EMC<sup>1)</sup>

Part 5: Reserved for future use.

Part 6: Requirements for low-voltage power supplies of assessed performance

Part 7: Safety requirements

This standard should be read in conjunction with EN 60950:2000 and/or EN 60950-1:2001.

It makes reference to the standard EN 60950:2000 and/or EN 60950-1:2001 in the form of “clause number/RD”. In this context, “RD” means “Reference Document” i.e. EN 60950:2000 and/or EN 60950-1:2001. Unless otherwise specified, RD means that both documents apply. However, it is only necessary to apply one or other of these standards. Wherever the word equipment occurs in this reference document, this means POWER SUPPLY. The annexes of EN 60950:2000 and/or EN 60950-1:2001 are also referred to by means of “RD” where these are specific references, otherwise these annexes apply as detailed in the clauses of these standards referred to in this standard.

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<sup>1)</sup> Under consideration

In this standard, the following print types are used:

- Requirements proper and normative annexes: in roman type.
- *Compliance statements and test specifications: in italic type.*
- Notes and other informative matter: in smaller roman type.
- Normative conditions within tables: in smaller roman type.
- Terms that are defined in 1.2: SMALL CAPITALS.

Annexes ZA and ZB have been added by CENELEC.

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### Endorsement notice

The text of the International Standard IEC 61204-7:2006 was approved by CENELEC as a European Standard without any modification.

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### Foreword to amendment A11

This amendment was prepared by the Technical Committee CENELEC TC 22X, Power electronics.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A11 to EN 61204-7:2006 on 2009-06-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented  
at national level by publication of an identical  
national standard or by endorsement (dop) 2010-06-01
- latest date by which the national standards conflicting  
with the amendment have to be withdrawn (dow) 2012-06-01

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## LOW-VOLTAGE POWER SUPPLIES, DC OUTPUT –

### Part 7: Safety requirements

#### 0 Principles of Safety

The principles of 0/RD apply.

#### 1 General

##### 1.1 Scope

###### 1.1.1 Equipment covered by this standard

This part of IEC 61204 specifies the safety requirements for POWER SUPPLY units providing DC output(s) with or without auxiliary a.c. output(s) operating from a.c. or d.c. source voltages up to 600 V a.c. or 1 000 V d.c. (See exceptions in 1.1.3).

NOTE Ringing generators used in telecoms applications are covered by this standard.

This product standard covers both STAND-ALONE and COMPONENT POWER SUPPLY units as defined in this document. POWER SUPPLY units, which comply with the main body of this standard, satisfy the requirements of POWER SUPPLY units for use in or with IT equipment normally covered by IEC 60950:1999 and/or IEC 60950-1:2001. POWER SUPPLY units will also comply with the appropriate standard or application requirements given below if they also meet the additional requirements of the appropriate annex.

PS-A Measurement, control and laboratory equipment normally covered by IEC 61010-1:2001.

PS-B Medical equipment (under consideration) – *normally covered by IEC 60601-1:2005.*

NOTE This annex will be based on IEC 60601-1:2005 (Third Edition)

PS-C Reserved for future use.

PS-D Audio, Video and similar electronic apparatus – normally covered by IEC 60065:2001.

PS-E DC Power and distribution equipment.

This standard also covers DC-DC converters.

Where no standards exist, use of this standard for other applications is not precluded.

###### 1.1.2 Additional requirements

Requirements additional to those specified in this standard may be necessary for:

- POWER SUPPLIES intended for operation in special environments (for example, extremes of temperature; excessive dust, moisture or vibration; flammable gases; and corrosive or explosive atmospheres);

- POWER SUPPLIES intended to be used in vehicles, on board ships or aircraft, or in tropical countries;
- POWER SUPPLIES intended for use where ingress of water is possible; for guidance on such requirements and on relevant testing, see annex T/RD.

Attention is drawn to the fact that authorities in some countries impose additional requirements for health, environmental and similar reasons.

POWER SUPPLIES for use in or with power installations may have to meet additional requirements of IEC 62103:2003.

### **1.1.3 Exclusions**

This standard does not apply to

- motor-generator sets;
- uninterruptible POWER SUPPLIES (UPS) to IEC 62040-1-1:2004;
- POWER SUPPLIES covered by IEC 61558-1:2005 (i.e. POWER SUPPLY units incorporating safety isolating transformers providing SELV or PELV output(s) in accordance with IEC 60364-4-41:2001 and POWER SUPPLIES for use with household and other consumer products, except those covered by IEC 60065:2001 and IEC 60950:1999 and/or IEC 60950-1:2001;
- transformers covered by IEC 61558-1:2005;
- step-down converters covered by IEC 60146-1-1:1991;
- POWER SUPPLIES and converters for use with or in products covered by IEC 61347-2-2:2000.

### **1.2 Definitions**

NOTE The definitions in the RD document apply to this standard. The definitions given below also apply to this standard. The definitions given in a particular annex apply to that annex only.

The provisions of 1.2/RD apply with the addition of:

Definition in alphabetical order of nouns

|                                      |           |
|--------------------------------------|-----------|
| CURRENT, OUTPUT SHORT CIRCUIT        | 1.2.1.108 |
| CURRENT LIMIT, OUTPUT                | 1.2.1.107 |
| CURRENT, RATED OUTPUT                | 1.2.1.102 |
| CURRENT RANGE, RATED OUTPUT          | 1.2.1.103 |
| EQUIPMENT, DC POWER AND DISTRIBUTION | 1.2.100.3 |
| FREQUENCY, RATED OUTPUT              | 1.2.1.104 |
| FREQUENCY RANGE, RATED OUTPUT        | 1.2.1.105 |
| MAINS OUTPUT, AUXILIARY              | 1.2.8.100 |
| POWER, RATED OUTPUT                  | 1.2.1.106 |
| POWER SUPPLY                         | 1.2.100.1 |
| POWER SUPPLY, COMPONENT              | 1.2.100.2 |
| POWER SUPPLY, STAND-ALONE            | 1.2.100.4 |
| VOLTAGE, RATED OUTPUT                | 1.2.1.100 |
| VOLTAGE RANGE, RATED OUTPUT          | 1.2.1.101 |

The definition of SELV CIRCUIT used in this standard is that defined in IEC 60950:1999 and/or IEC 60950-1:2001 and not that defined in IEC 60364-4-41:2001.

## **1.2.100 Equipment**

### **1.2.100.1**

#### **POWER SUPPLY**

electrical or electronic device which transforms electrical power into single or multiple power outputs. It may also isolate, regulate and/or convert the power. This may consist of one or more individual POWER SUPPLIES with associated circuitry and hardware

### **1.2.100.2**

#### **COMPONENT POWER SUPPLY**

POWER SUPPLY which may not comply with some of the requirements of the standard such as ENCLOSURE requirements. This type of POWER SUPPLY is intended for incorporation within an end product, which in turn complies with all the requirements of the end product standard

### **1.2.100.3**

#### **POWER AND DISTRIBUTION EQUIPMENT**

equipment to supply DC power to communication equipment; and normally consisting of batteries, POWER SUPPLIES, control and monitoring circuits, and distribution panels all interconnected to provide isolated SECONDARY CIRCUIT power to IT equipment loads. Components within this system are normally installed in racks, cabinets, or other structures

### **1.2.100.4**

#### **STAND-ALONE POWER SUPPLY**

POWER SUPPLY that in itself is an end use product

### **1.2.1.100**

#### **RATED OUTPUT VOLTAGE**

output voltage as declared by the manufacturer

#### **1.2.1.101**

##### **RATED OUTPUT VOLTAGE RANGE**

output voltage range as declared by the manufacturer, expressed by its lower and upper RATED OUTPUT VOLTAGES

#### **1.2.1.102**

##### **RATED OUTPUT CURRENT**

output current as declared by the manufacturer

#### **1.2.1.103**

##### **RATED OUTPUT CURRENT RANGE**

the output current range as declared by the manufacturer, expressed by its lower and upper RATED OUTPUT CURRENTS

#### **1.2.1.104**

##### **RATED OUTPUT FREQUENCY**

output frequency as declared by the manufacturer

#### **1.2.1.105**

##### **RATED OUTPUT FREQUENCY RANGE**

output frequency range as declared by the manufacturer, expressed by its lower and upper rated output frequencies

**1.2.1.106**

**RATED OUTPUT POWER**

the continuous or average total output power as specified by the manufacturer

**1.2.1.107**

**OUTPUT CURRENT LIMIT**

maximum current obtainable from an output with the other outputs, if any, loaded to minimum or no load conditions

**1.2.1.108**

**OUTPUT SHORT CIRCUIT CURRENT**

current resulting from a direct short circuit across the output with the other outputs, if any, loaded to minimum or no load conditions

**1.2.8.100**

**AUXILIARY MAINS OUTPUT**

AC output which is either directly connected or via EMC filtering components, AC switches or fuses to the AC MAINS SUPPLY

**1.3 General requirements**

The provisions of 1.3/RD apply.

**1.4 General conditions for tests**

The provisions of 1.4/RD apply with the addition of:

**1.4.100 Output loading**

For tests involving the determination of WORKING VOLTAGES, SELV CIRCUITS and TNV CIRCUITS, it is important to conduct investigative testing between zero load and 10 % of full rated load, or in some cases between zero and full rated load depending on the POWER SUPPLY topology, to determine the worst case. If the manufacturer specifies a minimum load in the USER GUIDE, then this consideration may not be necessary.

NOTE Typical output averaging filter chokes go off-load or lose control between zero and 10 % of the full rated load and can cause outputs to no longer meet the requirements of SELV CIRCUITS or TNV CIRCUITS under certain conditions. This phenomenon can also cause problems with control loops.

**1.4.101** If the output voltage is controlled by any means accessible to the operator, the tests shall be conducted at the worst case voltage level(s) permitted by the control means.

**1.4.4.100** A COMPONENT POWER SUPPLY is normally tested on the bench unless instructed by the manufacturer to test in the end product or in an ENCLOSURE simulating end usage.

**1.4.5.100** For POWER SUPPLIES using DC input, if the voltage range is not specified, the tolerance shall be taken as +20 % and –15 %.

**1.4.5.101** In determining the most unfavourable input voltage, consideration shall be given to the test being conducted. POWER SUPPLIES that are rated for operation on both AC and DC inputs, shall be tested using both AC and DC supplies.

NOTE For some products and tests the worst case input voltage may be the minimum value for example, for heating test.

**1.4.6.100** For TOUCH CURRENTS and PROTECTIVE CONDUCTOR CURRENTS, the test shall be conducted at the upper limit of the RATED FREQUENCY RANGE. Where facilities are unavailable to provide the required higher frequency AC MAINS SUPPLY, it is permitted to measure the values at any available frequency within the specified RATED FREQUENCY RANGE, and scale these values using the formula:

$$I_{HF} = I_M \cdot F_H / F_M$$

where

$I_{HF}$  = current at the highest frequency within the specified range

$I_M$  = current measured at the available frequency within the specified range

$F_H$  = highest frequency within the specified range

$F_M$  = available frequency within the specified range

**1.4.10.100** For determining the input current, all outputs including auxiliary mains outputs and AC outputs (ringing generators) shall be loaded to their rated values.

**1.4.12.100** When conducting the heating test, consideration shall be given to the clearance around ventilation openings as specified by the manufacturer and to the various permitted orientations of the POWER SUPPLY in application, irrespective of whether integral fans are fitted.

If the rated ambient temperature is above 50 °C, the heating test (see 4.5.1/RD) shall be conducted at the rated ambient temperature.

**1.4.14.100** Consideration shall be given to the permitted orientations of the POWER SUPPLY and the effects of any forced airflow during abnormal testing. In all cases, the electric strength tests of 5.3.8.2/RD shall be carried out.

**1.4.14.101** When a manufacturer specifies a minimum load for an output, disconnection of the minimum load is considered a single fault.

## 1.5 Components

The provisions of 1.5/RD apply with the addition of:

### 1.5.100 Electrolytic capacitors

Electrolytic capacitors shall have adequate clearances for venting in accordance with the capacitor manufacturer's specifications.

### 1.5.101 AC mains supply connected transformers

Transformers intended to be connected directly, or via EMC filtering components, AC switches or fuses, to the AC MAINS SUPPLY, and which meet the requirements of IEC 61558-1:2005, are considered acceptable. Acceptability of the combination is to be determined in the application.

**1.5.7.1.100** Where a Y1 capacitor is used to bridge DOUBLE or REINFORCED INSULATION and its insulating coating is used to provide REINFORCED INSULATION, the capacitor shall comply with the requirements for REINFORCED INSULATION between the TERMINALS and the body.

## 1.6 Power interface

The provisions of 1.6/RD apply.

**1.6.2.100** The outputs shall be loaded within the manufacturers specified ratings to provide the maximum input current.

## 1.7 Marking and instructions

The provisions of 1.7/RD apply with the addition of:

**1.7.1.100** DC outputs and AC auxiliary outputs of STAND ALONE POWER SUPPLIES shall be marked with polarity, voltage and current ratings. In addition AC auxiliary outputs shall be marked with the frequency if different from the input frequency. This information may be provided in the instructions if the output appears on a polarized connector.

**1.7.1.101** COMPONENT POWER SUPPLIES shall be provided with at least the following information for input and output as applicable, either on the POWER SUPPLY or in the installation instructions or data sheets or specifications

- RATED VOLTAGE(S) or RATED VOLTAGE RANGE(S)/RATED CURRENT(S) or RATED CURRENT RANGE(S)
- for DC only, symbol or notation “d.c.” for the nature of the voltage
- RATED FREQUENCY or RATED FREQUENCY RANGE(S)
- rated maximum ambient temperature if greater than 25 °C, or operating conditions, for example maximum base plate temperature
- OUTPUT CURRENT LIMIT(S)
- output short circuit current(s)
- rated maximum output power where it is less than the sum of the individual maximum RATED OUTPUT POWER
- symbol or notation “double insulated” for Class II POWER SUPPLY
- requirement for overcurrent protection if not provided as an integral part of the POWER SUPPLY
- TERMINAL or pin-out identification
- information about the airflow, if applicable

NOTE Optional output level information may be provided as given in Annex PS-F.

The following shall be marked on the POWER SUPPLY:

- manufacturer’s identification
- manufacturer’s model or type reference

NOTE The following table describes if a particular requirement can be in the form of markings and/or installation instructions.

**1.7.1.21** For all STAND ALONE POWER SUPPLIES, the operating instructions and/or the installation instructions shall state the type of equipment the POWER SUPPLIES are intended to be interconnected with.

For all COMPONENT POWER SUPPLIES these instructions shall state the type of equipment the POWER SUPPLIES are intended to be used with, in accordance with the annexes, if any, that have been applied in addition to the main body of the standard.

Examples of possible declarations are:

- Where the product has only been tested to the main body of this standard: “This power supply is intended only to be used in connection with information technology equipment.”
- Where the product has only been tested to the main body of this standard and Annex PS-A: “This power supply is intended only to be used in connection with information technology equipment and/or equipment for measurement, control and laboratory use.”
- Where the product has only been tested to the main body of this standard and Annex PS-D: “This power supply is intended only to be used in connection with information technology equipment and/or audio, video and/or similar electronic apparatus.”

- Where the product has only been tested to the main body of this standard and Annexes PS-A and PS-D: “This power supply is intended only to be used in connection with information technology equipment and/or equipment for measurement, control and laboratory use and/or audio, video and/or similar electronic apparatus.”

*Compliance is checked by inspection.*

**Table 1A.101 – Marking and installation instruction information**

| Information                                                                                                                                                                                              | POWER SUPPLY<br>Type |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------|
|                                                                                                                                                                                                          | STAND-ALONE          | COMPONENT           |
| Rated voltage                                                                                                                                                                                            | M <sup>a</sup>       | M or D <sup>b</sup> |
| For DC only                                                                                                                                                                                              | M                    | M or D              |
| Rated frequency                                                                                                                                                                                          | M                    | M or D              |
| Rated maximum ambient temperature                                                                                                                                                                        | M or D               | M or D              |
| Output current limit(s)                                                                                                                                                                                  | M or D               | M or D              |
| Rated maximum output                                                                                                                                                                                     | M                    | M or D              |
| Symbol for double insulation                                                                                                                                                                             | M                    | M                   |
| Requirement for over-current                                                                                                                                                                             | M or D               | M or D              |
| Terminal or pin-out                                                                                                                                                                                      | M or D <sup>c</sup>  | M or D              |
| DC polarity                                                                                                                                                                                              | M                    | M or D              |
| AC auxiliary out frequency                                                                                                                                                                               | M                    | M or D              |
| Manufacturer's identification                                                                                                                                                                            | M                    | M                   |
| Model or type reference                                                                                                                                                                                  | M                    | M                   |
| <sup>a</sup> M marked on product<br><sup>b</sup> D installation instructions or data sheets<br><sup>c</sup> If the output connector is polarized, information may be in the instructions or data sheets. |                      |                     |

**1.7.7.1.100** The symbol  IEC 60417-5019 (2002-10) shall be used only for the main protective earthing TERMINAL.

**1.7.7.2.100** The input TERMINALS of component POWER SUPPLIES shall be identified. For DC inputs, the polarity shall be identified.

## 2 Protection from hazards

The provisions of 2/RD apply with the following additions:

### 2.1 Protection from electric shock and energy hazards

The provisions of 2.1/RD apply, except in the case of component POWER SUPPLIES, and with the following addition:

**2.1.1.7.100** The input discharge test shall be carried out at maximum input voltage including the tolerance and at the most unfavourable loading condition, which is usually no load. If a resistor is provided to comply with the requirements of 2.1.1.7./RD, an overcurrent protective device, if provided, shall not be wired between the capacitor and resistor.

## 2.2 SELV circuits

The provisions of 2.2/RD apply with the following additions:

**2.2.2.100** An SELV CIRCUIT shall remain an SELV CIRCUIT over its rated output current range and shall take into account the interactive effects of any other outputs operating within their RATED OUTPUT CURRENT RANGES.

## 2.3 TNV circuits

The provisions of 2.3/RD apply to outputs designated as TNV CIRCUITS with the following note.

NOTE For 2.3.1./RD – The ringing signal may be generated within the POWER SUPPLY and the uncadenced (uninterrupted) signal may be on internal and/or external circuits. The separation of these circuits from other circuits is as follows:

**Table 1A.100 – Separation of ringing circuits from other circuits**

| Type of circuit                                          | Required separation               |
|----------------------------------------------------------|-----------------------------------|
| PRIMARY CIRCUIT                                          | 2.3.3./RD                         |
| TNV-2 CIRCUIT, TNV-3 CIRCUIT                             | Not required – test as Annex M/RD |
| SELV CIRCUIT, TNV-1 CIRCUIT, Accessible Conductive Parts | 2.3.2./RD                         |
| Other circuits                                           | 2.3.4./RD                         |

**2.3.1.100** A TNV CIRCUIT shall remain a TNV CIRCUIT over its RATED OUTPUT CURRENT RANGE and shall take into account the interactive effects of any other outputs operating within their RATED OUTPUT CURRENT RANGES.

## 2.4 Limited current circuits

The provisions of 2.4/RD apply with the following provision (this provision has been incorporated into IEC 60950-1:2001).

**2.4.100** Alternatively, it is permitted to use the measuring instruments of annex D/RD instead of the non-inductive resistor of  $2\,000\ \Omega \pm 10\%$  mentioned in 2.4/RD. When using the measuring instrument of Figure D.1/RD, the voltage  $U_2$  is measured and the current available from the limited current circuit is calculated by dividing the measured voltage  $U_2$  by 500. The calculated value shall not exceed 0,7 mA peak. When using the measuring instrument of Figure D.2/RD, the measured value of the current shall not exceed 0,7 mA peak.

NOTE If one side of the LIMITED CURRENT CIRCUIT has a conductive connection to earth then point B of the measuring circuit of Figure D.1/RD should be connected to that point.

## 2.5 Limited power sources

The provisions of 2.5/RD apply.

## 2.6 Provisions for earthing and bonding

The provisions of 2.6/RD apply.

NOTE For COMPONENT POWER SUPPLIES, when measuring the resistance of the protective bonding conductor, or measuring the voltage drop across the PROTECTIVE BONDING CONDUCTOR, the resistance should be less than  $0,1\ \Omega$  and the measured voltage drop should be less than 2,5 V.

## 2.7 Overcurrent and earth fault protection in primary circuits

The provisions of 2.7/RD apply.

## 2.8 Safety interlocks

The provisions of 2.8/RD apply.

## 2.9 Electrical insulation

The provisions of 2.9/RD apply.

## 2.10 Clearances, creepage distances and distances through insulation

The provisions of 2.10/RD apply.

## 3 Wiring, connections and supply

The provisions of 3/RD apply.

## 4 Physical requirements

The provisions of 4/RD apply with the following notes.

NOTE 1 For COMPONENT POWER SUPPLIES 4.2.2/RD always applies and 4.2.3/RD is to be conducted if applicable.

NOTE 2 For COMPONENT POWER SUPPLIES with thermoplastic ENCLOSURES which are OPERATOR accessible in the end product, 4.2.7/RD applies.

NOTE 3 Normally 4.2.8/RD, 4.2.9/RD, 4.3.7/RD, 4.3.10/RD, 4.3.11/RD, 4.3.12/RD and 4.3.13/RD do not apply to POWER SUPPLIES. However, COMPONENT POWER SUPPLIES may be used in the end-use equipment for which one or more of these sections may apply. These clauses may also apply to STAND-ALONE POWER SUPPLIES.

NOTE 4 An example of the test equipment for conducting the test of 4.3.6/RD may be found in IEC 60065:2001, Figure 11.

## 5 Electrical requirements and simulated abnormal conditions

### 5.1 Touch current and protective conductor current

The provisions of 5.1/RD apply with the following additions and notes.

NOTE 1 TOUCH CURRENTS caused by Y capacitors are higher in IT power distribution systems than in TN or TT systems by a factor of  $1 + \sqrt{3} = 2,73$ .

NOTE 2 With reference to 5.1.6/RD, the TOUCH CURRENT of a component POWER SUPPLY should be less than the values given in Table 5A/RD.

### 5.2 Electric strength

The provisions of 5.2/RD apply.

### 5.3 Abnormal operating and fault conditions

The provisions of 5.3/RD apply with the following additions:

**5.3.2.100** For the blocked airflow and locked rotor tests, the permitted orientations of the POWER SUPPLY in the application in question shall be taken into account.

### **5.3.1 Transformers**

The provisions of 5.3.3/RD apply with following additions and notes:

**5.3.3.100** The compliance criteria of 5.3.8.1/RD and 5.3.8.2/RD apply to 5.3.3/RD.

NOTE For integrated transformers in printed wiring boards the maximum temperature class of the printed wiring board material should be considered.

**5.3.5.100** Subclause 5.3.5/RD applies to PRIMARY CIRCUITS also (this provision has been incorporated into IEC 60950-1:2001)

### **5.3.2 Simulation of faults**

The provisions of 5.3.6/RD apply with the addition of the following note:

NOTE When conducting tests on a component POWER SUPPLY, the protective device which protects it, whether this be the building installation protective device, one within the end equipment or one within the POWER SUPPLY itself, should be in the circuit.

#### **5.3.8.1.100 During the tests**

Fuses are not permitted to shatter or rupture their casing. Neither must their end caps become loose during the abnormal tests. Where fuses rated for AC are used in DC circuits, then the test shall be repeated 10 times using the DC supply, and shall pass the electric strength test between their end caps, using a test voltage as specified in Table 5B/RD.

An electrolytic capacitor is permitted to vent if venting does not cause a safety hazard within the meaning of this standard.

Where thermal controls, thermistors and similar devices are relied upon for safety, they shall comply with the applicable IEC component standard or shall be tested in application in accordance with Annex K/RD. If they do not comply with the applicable IEC component standard or Annex K/RD, then they shall be short circuited for all abnormal operating conditions.

Traces of printed circuit boards are not permitted to act as fuses. If the trace opens then it is to be linked out across the break and the test repeated. This process shall be repeated until the test reaches an ultimate conclusion (without a trace opening).

NOTE One method to determine whether fire or molten metal propagate beyond the EUT, is to conduct abnormal tests with the EUT covered with cheesecloth or tissue paper.

## **6 Connection to telecommunication networks**

The provisions of 6.2/RD do not normally apply. The provisions of 6.1/RD and 6.3/RD apply only if the output of a POWER SUPPLY is intended to be connected directly to a TELECOMMUNICATION NETWORK. POWER SUPPLIES with outputs classed as TNV CIRCUITS must comply with 2.3/RD.

## **7 Connection to a cable distribution system**

This clause is applicable to IEC 60950-1:2001 only, and applies solely to POWER SUPPLIES which may have a connection to cable distribution systems.

## **ANNEXES**

All the Annexes of the reference document, Annexes/RD apply with the exception of Annexes H and L.

Annex Y may be applicable but only when IEC 60950-1:2001 is used.

## Annex PS-A (normative)

### Requirements for power supply units for use in electrical equipment for measurement, control and laboratory use

#### PS-A.0 General

POWER SUPPLY units used in test and measurement, control and laboratory equipment shall comply with the additional requirements of this annex.

NOTE The following are the additional requirements to comply with IEC 61010-1:2001. For the complete and actual text of the requirements, see IEC 61010-1:2001. Some of the following requirements may not be applicable to COMPONENT POWER SUPPLIES. However, consideration should be given to surfaces that may serve as part of the enclosure in the end application. Alternatively, if a POWER SUPPLY unit is required to comply with IEC 61010-1:2001 only, then the requirements of IEC 61010-1:2001 alone may be used. However the POWER SUPPLY unit in that case may not comply with IEC 61204-7.

NOTE STAND-ALONE POWER SUPPLIES having either HAZARDOUS VOLTAGE or HAZARDOUS ENERGY LEVEL output TERMINALS must comply with the requirements of Annex PS-A.

NOTE The following comparison table relates the clause for compliance with IEC 61010-1:2001 with the appropriate clause either in the Main Body of IEC 61204-7 or to that in the Annex PS-A. In turn the main body of IEC 61204-7 references the IEC 60950:1999 and/or IEC 60950-1:2001. Where the main body of this standard references back to the reference documents, that is "/RD", these references are given in parentheses in the following table and in the text to help the reader.

NOTE Note that the clause, table and figure reference numbers in PS-A are the same as IEC 61010-1:2001 with PS-A in front of them to make cross-reference easy.

**Table PS-A 100 – Comparison of IEC 61010-1:2001 and IEC 61204-7**

| Clause in IEC 61010-1 (2001) | Topic                             | Clause in IEC 61204-7 |            | Comments                                                                                                                                                                                    |
|------------------------------|-----------------------------------|-----------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                                   | Main body             | Annex PS-A |                                                                                                                                                                                             |
| 1.1                          | Scope                             | 1.1                   |            |                                                                                                                                                                                             |
| 1.1.1                        | Equipment included in scope       |                       | PS A.1.1.1 | Replace "This part of IEC 61010-1:2001" with "annex". Add text "power supplies used with" after "safety requirements for".                                                                  |
| 1.1.2                        | Equipment excluded from scope     |                       |            | Not applicable for power supplies                                                                                                                                                           |
| 1.1.3                        | Computing equipment               |                       | PS A.1.1.3 | Replace "standard" (2 places) with "annex" and add "power supplies for" before the word "computers"                                                                                         |
| 1.2                          | Object                            | 0 (0/RD)              |            |                                                                                                                                                                                             |
| 1.3                          | Verification                      |                       | PS A.1.3   | Replace "standard" with "annex" (2 places)                                                                                                                                                  |
| 1.4                          | Environmental conditions          |                       | PS A.1.4   | Similar to IEC 61204-7                                                                                                                                                                      |
| 1.4.1                        | Normal environmental conditions   |                       | PS A.1.4.1 | Replace "standard" with "annex"                                                                                                                                                             |
| 1.4.2                        | Extended environmental conditions |                       | PS-A.1.4.2 | Replace "standard" with "annex". Not in IEC 61204-7 – important factors: over-voltage categories III and IV; higher relative humidity and mains supply fluctuations in excess of $\pm 10$ % |

| Clause in IEC 61010-1 (2001) | Topic                           | Clause in IEC 61204-7           |             | Comments                          |
|------------------------------|---------------------------------|---------------------------------|-------------|-----------------------------------|
|                              |                                 | Main body                       | Annex PS-A  |                                   |
| 2                            | Normative references            |                                 | PS-A.2      |                                   |
| 3                            | Terms and definitions           | 1.2 (1.2/RD)                    | Plus PS-A.3 |                                   |
| 3.1.1                        | Fixed equipment                 |                                 | PS-A.3.1.1  |                                   |
| 3.1.2                        | Permanently connected equipment | 1.2 (1.2.5.3/RD)                |             |                                   |
| 3.1.3                        | Portable equipment              | 1.2 (1.2.3.3/RD)                |             |                                   |
| 3.1.4                        | Hand-held equipment             | 1.2 (1.2.3.2/RD)                |             |                                   |
| 3.1.5                        | Tool                            | 1.2 (1.2.7.4/RD)                |             |                                   |
| 3.2.1                        | Terminal                        |                                 | PS-A.3.2.1  |                                   |
| 3.2.2                        | Functional earth terminal       |                                 | PS-A.3.2.2* | *Without the note                 |
| 3.2.3                        | Protective conductor terminal   |                                 | PS-A.3.2.3  |                                   |
| 3.2.4                        | Enclosure                       | 1.2 (1.2.6.1/RD)                |             |                                   |
| 3.2.5                        | Barrier                         |                                 | PS-A.3.2.5  |                                   |
| 3.3.1                        | Rated (value)                   |                                 | PS-A.3.3.1  |                                   |
| 3.3.2                        | Rating                          |                                 | PS-A.3.3.2  |                                   |
| 3.4.1                        | Type test                       | 1.2 (1.2.13.1/RD)               |             |                                   |
| 3.4.2                        | Routine test                    | 1.2 (1.2.13.3/RD)               |             |                                   |
| 3.5.1                        | Accessible                      | 1.2 (1.2.7.1/RD)                |             |                                   |
| 3.5.2                        | Hazard                          | 0 (0/RD)                        |             | Covered in "Principles of Safety" |
| 3.5.3                        | Hazardous live                  |                                 | PS-A.3.5.3  |                                   |
| 3.5.4                        | High integrity                  |                                 |             | Not applicable for power supplies |
| 3.5.5                        | Mains                           | 1.2 (1.2.8.1/RD, 1.2.8.2/RD*)   |             | *This applies to IEC 60950-1 only |
| 3.5.6                        | Mains circuit                   | 1.2 (1.2.8.2/RD*, 1.2.8.3/RD**) |             | *IEC 60950<br>**IEC 60950-1       |
| 3.5.7                        | Protective impedance            |                                 |             | Not applicable for power supplies |
| 3.5.8                        | Protective bonding              | 1.2 (1.2.13.11/RD)              |             |                                   |
| 3.5.9                        | Normal use                      | 1.2 (1.2.2.1/RD)                |             |                                   |
| 3.5.10                       | Normal condition                |                                 | PS-A.3.5.10 |                                   |
| 3.5.11                       | Single fault condition          |                                 | PS-A.3.5.11 |                                   |
| 3.5.12                       | Operator                        |                                 | PS-A.3.5.12 |                                   |
| 3.5.13                       | Responsible body                |                                 | PS-A.3.5.13 |                                   |
| 3.5.14                       | Wet location                    |                                 | PS-A.3.5.14 |                                   |

| Clause in IEC 61010-1 (2001) | Topic                      | Clause in IEC 61204-7                            |              | Comments                                      |
|------------------------------|----------------------------|--------------------------------------------------|--------------|-----------------------------------------------|
|                              |                            | Main body                                        | Annex PS-A   |                                               |
| 3.6.1                        | Basic insulation           | 1.2 (1.2.9.2/RD)                                 |              |                                               |
| 3.6.2                        | Supplementary insulation   | 1.2 (1.2.9.3/RD)                                 |              |                                               |
| 3.6.3                        | Double insulation          | 1.2 (1.2.9.4/RD)                                 |              |                                               |
| 3.6.4                        | Reinforced insulation      | 1.2 (1.2.9.5/RD)                                 |              |                                               |
| 3.6.5                        | Pollution                  |                                                  | PS-A.3.6.5   |                                               |
| 3.6.6                        | Pollution degree           |                                                  | PS-A.3.6.6   |                                               |
| 3.6.6.1                      | Pollution degree 1         |                                                  | PS-A.3.6.6.1 |                                               |
| 3.6.6.2                      | Pollution degree 2         |                                                  | PS-A.3.6.6.2 |                                               |
| 3.6.6.3                      | Pollution degree 3         |                                                  | PS-A.3.6.6.3 |                                               |
| 3.6.7                        | Clearance                  | 1.2 (1.2.10.1/RD)                                |              |                                               |
| 3.6.8                        | Creepage distance          | 1.2 (1.2.10.2/RD)                                |              |                                               |
| 4                            | Tests                      | 1.4 (1.4/RD)                                     |              |                                               |
| 4.1                          | General                    | 1.4 (1.4.1/RD<br>1.4.2/RD)                       |              |                                               |
| 4.2                          | Sequence of tests          | 1.4 (1.4.3/RD)                                   |              |                                               |
| 4.3.1                        | Environmental conditions   |                                                  | PS-A.4.3.1   |                                               |
| 4.3.2                        | State of equipment         | 1.4 (1.4.4/RD)                                   |              |                                               |
| 4.3.2.1                      | Position of equipment      | 1.4 (1.4.4/RD)                                   |              |                                               |
| 4.3.2.2                      | Accessories                |                                                  |              | Not applicable for power supplies             |
| 4.3.2.3                      | Covers and removable parts | 1.4 (1.4.4/RD)                                   |              |                                               |
| 4.3.2.4                      | Mains supply               | 1.4.5.101 (1.4.5/RD)                             |              |                                               |
| 4.3.2.5                      | Input and output voltages  | 1.4.10.100                                       |              |                                               |
| 4.3.2.6                      | Earth terminals            | 1.4 (1.4.9/RD)                                   |              |                                               |
| 4.3.2.7                      | Controls                   | 1.4 (1.4.4/RD)                                   |              |                                               |
| 4.3.2.8                      | Connections                |                                                  | PS-A.4.3.2.8 | Applicable to stand-alone power supplies only |
| 4.3.2.9                      | Load on motors             | 1.4 (1.4.4/RD)                                   |              |                                               |
| 4.3.2.10                     | Output                     | 1.4.100<br>1.4.101                               |              |                                               |
| 4.3.2.11                     | Duty cycle                 | 1.4 (1.4.4/RD)<br>1.7 (1.7.3/RD)<br>4 (4.5.1/RD) |              |                                               |
| 4.3.2.12                     | Loading and filling        |                                                  |              | Not applicable for power supplies             |
| 4.3.2.13                     | Heating equipment          |                                                  |              | Not applicable for power supplies             |

| Clause in IEC 61010-1 (2001) | Topic                                                       | Clause in IEC 61204-7                   |              | Comments                                                             |
|------------------------------|-------------------------------------------------------------|-----------------------------------------|--------------|----------------------------------------------------------------------|
|                              |                                                             | Main body                               | Annex PS-A   |                                                                      |
| 4.4                          | Testing in single fault condition                           | 1.4 (1.4.14/RD)                         |              |                                                                      |
| 4.4.1                        | General                                                     | 1.4 (1.4.14/RD)                         |              |                                                                      |
| 4.4.2                        | Application of fault conditions                             | 1.4 (1.4.14/RD)                         |              |                                                                      |
| 4.4.2.1                      | Protective impedance                                        |                                         |              | Not applicable for power supplies                                    |
| 4.4.2.2                      | Protective conductor                                        |                                         | PS-A.4.4.2.2 |                                                                      |
| 4.4.2.3                      | Equipment or parts for short term or intermittent operation | 5.3 (5.3.5/RD, 5.3.7/RD, 5.3.8/RD)      |              |                                                                      |
| 4.4.2.4                      | Motors                                                      | 5.3 plus Annexes (5.3.2/RD, Annex B/RD) |              |                                                                      |
| 4.4.2.5                      | Capacitors (motors)                                         | Annexes (Annex B8/RD)                   |              |                                                                      |
| 4.4.2.6                      | Mains transformers                                          | 5.3 and Annexes (5.3.3/RD, Annex C/RD)  |              |                                                                      |
| 4.4.2.6.1                    | Short circuit                                               | 5.3 (5.3.3/RD)                          |              |                                                                      |
| 4.4.2.6.2                    | Overload                                                    | Annexes (Annex C1/RD)                   |              |                                                                      |
| 4.4.2.7                      | Outputs                                                     | 5.3 (5.3/RD)                            |              |                                                                      |
| 4.4.2.8                      | Equipment for more than one supply                          |                                         | PS-A.4.4.2.8 |                                                                      |
| 4.4.2.9                      | Cooling                                                     | 5.3 (5.3.1/RD)                          |              |                                                                      |
| 4.4.2.10                     | Heating devices                                             |                                         |              | Not applicable for power supplies                                    |
| 4.4.2.11                     | Insulation between circuits and parts                       | 5.3 (5.3.4/RD)                          |              |                                                                      |
| 4.4.2.12                     | Interlocks                                                  | 2.8 (2.8/RD)                            |              | IEC 61204-7 does not use the term "high integrity" components        |
| 4.4.3                        | Duration of tests                                           |                                         | PS-A.4.4.3   |                                                                      |
| 4.4.3.1                      |                                                             | 5.3 (5.3.7/RD)                          | PS-A.4.4.3.1 | Wording in IEC 61010-1:2001 is more specific.<br>Thermal equilibrium |
| 4.4.3.2                      |                                                             |                                         | PS-A.4.4.3.2 | Thermal cutouts and similar                                          |
| 4.4.3.3                      |                                                             |                                         | PS-A.4.4.3.3 | Fuse characteristics                                                 |

| Clause in IEC 61010-1 (2001) | Topic                                                             | Clause in IEC 61204-7                              |                                    | Comments                                                           |
|------------------------------|-------------------------------------------------------------------|----------------------------------------------------|------------------------------------|--------------------------------------------------------------------|
|                              |                                                                   | Main body                                          | Annex PS-A                         |                                                                    |
| 4.4.4                        | Conformity after application of fault conditions                  |                                                    | PS-A.4.4.4                         |                                                                    |
| 4.4.4.1                      |                                                                   |                                                    | PS-A.4.4.4.1                       | Conformity-shock                                                   |
| 4.4.4.2                      |                                                                   |                                                    | PS-A.4.4.4.2                       | Conformity-temperature                                             |
| 4.4.4.3                      |                                                                   |                                                    | PS-A.4.4.4.3                       | Conformity-fire                                                    |
| 4.4.4.4                      |                                                                   |                                                    | PS-A.4.4.4.4                       | Conformity-other hazards                                           |
| 5                            | Marking and documentation                                         | 1.7 (1.7/RD)                                       |                                    |                                                                    |
| 5.1                          | Marking                                                           | 1.7 (1.7/RD)                                       |                                    |                                                                    |
| 5.1.1                        | General                                                           | 1.7 (1.7.1/RD)                                     | Plus third paragraph of PS-A.5.1.1 |                                                                    |
| 5.1.2                        | Identification                                                    | 1.7 (1.7.1/RD)                                     |                                    |                                                                    |
| 5.1.3                        | Mains supply                                                      | 1.7 (1.7.1/RD)                                     | Plus PS-A.5.1.3 Table PS-A1        | Table 1 of IEC 61010-1:2001 provides more symbols than IEC 61204-7 |
| 5.1.4                        | Fuses                                                             | 1.7 (1.7.6/RD)                                     |                                    |                                                                    |
| 5.1.5                        | Terminals, connections and operating devices                      |                                                    | PS-A.5.1.5                         | Applicable for stand-alone power supplies only                     |
| 5.1.5.1                      | Terminals                                                         |                                                    | PS-A.5.1.5.1                       |                                                                    |
| 5.1.6                        | Switches and circuit breakers                                     | 1.5 and 3 (1.5.1/RD, 3.4.2/RD, 3.4.5/RD, 3.4.8/RD) |                                    |                                                                    |
| 5.1.7                        | Equipment protected by double insulation or reinforced insulation | 1.7 (1.7.1/RD)                                     |                                    |                                                                    |
| 5.1.8                        | Field wiring terminal boxes                                       |                                                    | PS-A.5.1.8                         |                                                                    |
| 5.2                          | Warning markings                                                  |                                                    | PS-A.5.2                           |                                                                    |
| 5.3                          | Durability of markings                                            |                                                    | PS-A.5.3                           | Different solvent than IEC 61204-7, 1.7 (1.7.13/RD)                |
| 5.4                          | Documentation                                                     |                                                    | PS-A.5.4                           |                                                                    |
| 5.4.1                        | General                                                           |                                                    | PS-A.5.4.1                         | More detailed than IEC 61204-7, 1.7 (1.7.2/RD)                     |
| 5.4.2                        | Equipment ratings                                                 |                                                    | PS-A.5.4.2                         | More detailed than IEC 61204-7, 1.7 (1.7.2/RD)                     |
| 5.4.3                        | Equipment installation                                            |                                                    | PS-A.5.4.3                         | More detailed than IEC 61204-7, 1.7 (1.7.2/RD)                     |
| 5.4.4                        | Equipment operation                                               |                                                    | PS-A.5.4.4                         | More detailed than IEC 61204-7, 1.7 (1.7.2/RD)                     |
| 5.4.5                        | Equipment maintenance                                             |                                                    | PS-A.5.4.5                         | More detailed than IEC 61204-7, 1.7 (1.7.2/RD)                     |

| Clause in IEC 61010-1 (2001) | Topic                                                          | Clause in IEC 61204-7            |                                                  | Comments                                                                                                                                                                                                                                                                                                                   |
|------------------------------|----------------------------------------------------------------|----------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                                                                | Main body                        | Annex PS-A                                       |                                                                                                                                                                                                                                                                                                                            |
| 6                            | Protection against electric shock                              |                                  |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.1                          | General                                                        |                                  |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.1.1                        | Requirements                                                   | 2 (2/RD)                         |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.1.2                        | Exceptions<br>a) lamp sockets<br>b) batteries<br>c) terminals* | 2 (2.1.1.1/RD)                   | PS-A.6.1.2<br><br>PS-A.6.1.2 b)<br>PS-A.6.1.2 c) | 6.1.2 of IEC 61010-1:2001 complete without section a).<br><br>* Terminals of this type are applicable to stand-alone power supplies only                                                                                                                                                                                   |
| 6.2                          | Determination of accessible parts                              | 2 (2.1.1.1/RD)                   |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.2.1                        | Examinations                                                   | 2 (2.1.1.1/RD)                   |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.2.2                        | Openings above parts that are hazardous live                   |                                  | PS-A.6.2.2                                       | Has additional tests compared to IEC 61204-7                                                                                                                                                                                                                                                                               |
| 6.2.3                        | Openings for preset controls                                   |                                  | PS-A.6.2.3                                       |                                                                                                                                                                                                                                                                                                                            |
| 6.3                          | Permissible limits for accessible parts                        | 2 (2.1.1.1/RD, 2.1.1.5/RD)       | Port ion of PS-A.6.3                             | No energy hazard shall exist between an accessible part and earth or two accessible parts on the power supply within a distance of 1,8 m                                                                                                                                                                                   |
| 6.3.1                        | Values in normal condition                                     |                                  |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.3.1 a)                     | Voltage                                                        |                                  | PS-A.6.3.1 a)                                    | IEC 61010-1:2001 covers wet locations that are not covered by IEC 61204-7. For wet locations use IEC 61010-1:2001, 6.3.1 a)                                                                                                                                                                                                |
| 6.3.1 b)                     | Current                                                        |                                  | PS-A.6.3.1 (b)                                   |                                                                                                                                                                                                                                                                                                                            |
| 6.3.1 c)                     | Capacitance                                                    | 2.4 (2.4.2/RD)                   |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.3.2                        | Values in single fault condition                               |                                  |                                                  |                                                                                                                                                                                                                                                                                                                            |
| 6.3.2 a)                     | Single fault – voltage                                         | 2.2 and 2.3 (2.2.3/RD, 2.3.2/RD) | PS-A.6.3.2 a) *                                  | * Wet condition only                                                                                                                                                                                                                                                                                                       |
| 6.3.2 b)                     | Single fault – current                                         | 2.4 and 5.1 (2.4.2/RD, 5.1/RD)   | PS-A.6.3.2 b) 1)*                                | 5.1.7 of IEC 61010-1:2001 is not applicable. The 5 % earthing (leakage) conductor current is not permitted for permanently connected power supplies in IEC 61010-1:2001.<br><br>*Add the 3,5 mA limit for permanently connected equipment and the measuring circuit for wet locations from 6.3.2 b) 1) of IEC 61010-1:2001 |

| Clause in IEC 61010-1 (2001) | Topic                                                       | Clause in IEC 61204-7                                  |                 | Comments                                                                                                                                                                                |
|------------------------------|-------------------------------------------------------------|--------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                                                             | Main body                                              | Annex PS-A      |                                                                                                                                                                                         |
| 6.3.2 c)                     | Capacitance (single fault)                                  | 2.4 (2.4.2/RD)                                         |                 | IEC 61010-1:2001 is less restrictive                                                                                                                                                    |
| 6.4                          | Protection in normal condition                              | 1.3 and 2.2 (1.3.2/RD, 2.2.2/RD)                       | PS-A.6.4*       | * The paragraph in the text of 6.4 of IEC 61010-1:2001 starting with "Conformity is checked. . ."                                                                                       |
| 6.5                          | Protection in single fault condition                        | 0 and 2.2 (0.2.1/RD, 2.2.3/RD)                         |                 |                                                                                                                                                                                         |
| 6.5.1                        | Protective bonding                                          | 2.6 (2.6.1/RD)                                         |                 |                                                                                                                                                                                         |
| 6.5.1.1                      | Integrity of protective bonding                             | 2.6 and 3 (2.6.1/RD, 2.6.5.4/RD, 2.6.5.5/RD, 3.1.9/RD) | PS-A.6.5.1.1*   | * Parts (a), (d), (e), (f), and (h) in the text of 6.5.1.1 of IEC 61010-1:2001                                                                                                          |
| 6.5.1.2                      | Protective conductor terminal                               | 2.6 and 3 (2.6.4/RD, 3.3/RD)                           | PS-A.6.5.1.2*   | * Table 2 of 6.5.1.2 of IEC 61010-1:2001 specifying tightening torques                                                                                                                  |
| 6.5.1.3                      | Impedance of protective bonding of plug connected equipment | 2.6 (2.6.3.3/RD*, 2.6.3.4/RD**)                        | PS-A.6.5.1.3*** | * IEC 60950<br>** IEC 60950-1<br>*** Test current is the larger of 25 A d.c. or a.c. r.m.s. or 2 times the current rating of the power supply                                           |
| 6.5.1.4                      | Bonding impedance of permanently connected equipment        | 2.6 (2.6.3.3/RD*, 2.6.3.4/RD**)                        |                 | * IEC 60950<br>** IEC 60950-1<br>IEC 61204-7 is more restrictive                                                                                                                        |
| 6.5.1.5                      | Indirect bonding for test and measurement equipment         |                                                        |                 | Not applicable for power supplies                                                                                                                                                       |
| 6.5.2                        | Double insulation and reinforced insulation                 | 2.9 (2.9.5/RD)                                         | PS-A.6.5.2*     | * Refer to 6.7 and 6.8 of IEC 61010-1:2001                                                                                                                                              |
| 6.5.3                        | Protective impedance                                        | 1.5 (1.5.7/RD)                                         |                 |                                                                                                                                                                                         |
| 6.5.4                        | Automatic disconnection of the supply                       |                                                        | PS-A.6.5.4      |                                                                                                                                                                                         |
| 6.6                          | Connections to external circuits                            |                                                        |                 |                                                                                                                                                                                         |
| 6.6.1                        | General                                                     | 3 (3.5/RD)                                             |                 | Rated conditions at terminals must align with power supply rating                                                                                                                       |
| 6.6.2                        | Terminals for external circuits                             |                                                        | PS-A.6.6.2      | For stand-alone power supplies 6.6.2 of IEC 61010-1:2001 is required but conflicts with IEC 60950:1999 and IEC 60950-1:2001. So in this case 6.6.2 of IEC 61010-1:2001 takes precedence |

| Clause in IEC 61010-1 (2001) | Topic                                                                                    | Clause in IEC 61204-7       |              | Comments                                                                                                                                                                                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------|-----------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                                                                                          | Main body                   | Annex PS-A   |                                                                                                                                                                                                                                                                                     |
| 6.6.3                        | Circuits with terminals which are hazardous live                                         | 3 (3.1.9/RD, 3.3.6/RD)      | PS-A.6.6.3   | For stand-alone power supplies 6.6.3 of IEC 61010-1:2001 is required but conflicts with IEC 60950:1999 and IEC 60950-1:2001. So in this case 6.6.3 of IEC 61010-1:2001 takes precedence                                                                                             |
| 6.6.4                        | Accessible terminals for stranded conductors                                             | 3 (3.3.8/RD)                |              |                                                                                                                                                                                                                                                                                     |
| 6.7                          | Clearances and creepage distances                                                        |                             | PS-A.6.7     | Different procedure than used in IEC 61204-7                                                                                                                                                                                                                                        |
| 6.7.1                        | General requirements                                                                     |                             |              |                                                                                                                                                                                                                                                                                     |
| 6.7.1.1                      | Clearances                                                                               | 2.10 (2.10.3/RD)            |              |                                                                                                                                                                                                                                                                                     |
| 6.7.1.2                      | Creepage distances                                                                       | 2.10 (2.10.4/RD)            |              |                                                                                                                                                                                                                                                                                     |
| 6.7.2                        | Mains circuits                                                                           | 2.10 (2.10.3/RD, 2.10.4/RD) |              |                                                                                                                                                                                                                                                                                     |
| 6.7.3                        | Circuits other than mains circuits                                                       |                             |              |                                                                                                                                                                                                                                                                                     |
| 6.7.3.1                      | Clearance values – General                                                               |                             | PS-A.6.7.3.1 |                                                                                                                                                                                                                                                                                     |
| 6.7.3.2                      | Clearance values where Table 5 does not apply and for circuits in measurement category I |                             | PS-A.6.7.3.2 |                                                                                                                                                                                                                                                                                     |
| 6.7.3.3                      | Creepage distance values                                                                 |                             | PS-A.6.7.3.3 |                                                                                                                                                                                                                                                                                     |
| 6.7.4<br>6.7.4.1<br>6.7.4.2  | Measuring circuits                                                                       |                             |              | Not applicable for power supplies                                                                                                                                                                                                                                                   |
| 6.8                          | Procedure for dielectric strength tests                                                  | 5.2 (5.2/RD)                | PS-A.6.8     | Different procedure than used in IEC 61204-7<br><br>The test in IEC 61010-1:2001 is not needed except for reduced clearance based upon homogenous construction that is not addressed in the main body of IEC 61204-7. If reduced clearances are used refer to IEC 61010-1:2001, 6.8 |
| 6.8.1                        | Reference test earth                                                                     |                             | PS-A.6.8.1   |                                                                                                                                                                                                                                                                                     |
| 6.8.2                        | Humidity preconditioning                                                                 |                             | PS-A.6.8.2   |                                                                                                                                                                                                                                                                                     |
| 6.8.3                        | Conduct of tests                                                                         |                             | PS-A.6.8.3   |                                                                                                                                                                                                                                                                                     |

| Clause in IEC 61010-1 (2001) | Topic                                                                                    | Clause in IEC 61204-7                                                         |                               | Comments                                                                                                                                  |
|------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                                                                                          | Main body                                                                     | Annex PS-A                    |                                                                                                                                           |
| 6.8.4                        | Voltage tests                                                                            |                                                                               | PS-A.6.8.4                    |                                                                                                                                           |
| 6.8.4.1                      | Altitude correction of test voltages for checking clearances in homogeneous construction |                                                                               |                               | Not acceptable for power supplies                                                                                                         |
| 6.9                          | Constructional requirements for protection against electric shock                        |                                                                               |                               |                                                                                                                                           |
| 6.9.1                        | General                                                                                  | 1.3, 2.9, 2.10 and 3<br>(1.3.2/RD, 2.9.1/RD, 2.10.5.2/RD, 3.1.3/RD, 3.1.9/RD) | PS-A.6.9.1 b)                 |                                                                                                                                           |
| 6.9.2                        | Enclosures of equipment with double insulation or reinforced insulation                  | 1.2, 2.2 and 2.9<br>(1.2.4.2/RD, 2.2.3/RD, 2.9.5/RD)                          |                               | Essentially covered by IEC 61204-7                                                                                                        |
| 6.9.3                        | Over-range indication                                                                    |                                                                               | PS-A.6.9.3                    | May be applicable to stand-alone power supplies                                                                                           |
| 6.10                         | Connection to mains supply source and connections between parts of equipment             |                                                                               |                               |                                                                                                                                           |
| 6.10.1                       | Mains supply cords                                                                       | 3 (3.2.5/RD)                                                                  | PS-A.6.10.1 Parts b) and c)   |                                                                                                                                           |
| 6.10.2                       | Fitting of non-detachable mains supply cords                                             | 3 (3.2.6/RD)                                                                  | PS-A.6.10.2* and Table PS-A11 | * After the 25 times pull test, the cord anchorage is subjected for 1 min to a torque of the value shown in Table 11 of IEC 61010-1: 2001 |
| 6.10.3                       | Plugs and connectors                                                                     | 1.5, 1.7, 3 and 4 (1.5.1/RD, 1.7.5/RD, 3.2.4/RD, 4.3.5/RD)                    |                               |                                                                                                                                           |
| 6.11                         | Disconnection from supply source                                                         |                                                                               |                               |                                                                                                                                           |
| 6.11.1                       | General                                                                                  | 3 (3.4.1/RD)                                                                  |                               |                                                                                                                                           |
| 6.11.1.1                     | Exceptions                                                                               | 3 (3.4.1/RD)                                                                  |                               |                                                                                                                                           |
| 6.11.2                       | Requirements according to type of equipment                                              |                                                                               |                               |                                                                                                                                           |
| 6.11.2.1                     | Permanently connected equipment and multi-phase equipment                                | 3 (3.4.3/RD)                                                                  |                               |                                                                                                                                           |
| 6.11.2.2                     | Single phase cord-connected equipment                                                    | 3 (3.4.2/RD, 3.4.6/RD)                                                        |                               |                                                                                                                                           |
| 6.11.2.3                     | Hazards arising from function                                                            |                                                                               |                               | Not applicable for power supplies                                                                                                         |

| Clause in IEC 61010-1 (2001) | Topic                                                                 | Clause in IEC 61204-7                              |                | Comments                                                                                                             |
|------------------------------|-----------------------------------------------------------------------|----------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------|
|                              |                                                                       | Main body                                          | Annex PS-A     |                                                                                                                      |
| 6.11.3                       | Disconnecting devices                                                 | 3 (3.4.2/RD)                                       |                |                                                                                                                      |
| 6.11.3.1                     | Switches and circuit breakers                                         | 1.5 and 3 (1.5.1/RD, 3.4.2/RD, 3.4.5/RD, 3.4.8/RD) |                |                                                                                                                      |
| 6.11.3.2                     | Appliance couplers and plugs                                          | 1.5 and 3 (1.5.1/RD, 3.2.4/RD)                     | PS-A.6.11.3.2* | * Maximum cord length for portable equipment is 3 m                                                                  |
| 7                            | Protection against mechanical hazards                                 | 4 (4.4/RD)                                         |                |                                                                                                                      |
| 7.1                          | General                                                               | 4 (4.4.1/RD)                                       | PS-A.7.1*      | * Single fault condition shall be taken into account                                                                 |
| 7.2                          | Moving parts                                                          | 4 (4.4.2/RD)                                       |                |                                                                                                                      |
| 7.3                          | Stability                                                             | 4 (4.1/RD)                                         |                |                                                                                                                      |
| 7.4                          | Provisions for lifting and carrying                                   |                                                    | PS-A.7.4       |                                                                                                                      |
| 7.5                          | Wall mounting                                                         | 4 (4.2.10/RD)                                      | PS-A.7.5*      | * Third and fourth paragraphs apply                                                                                  |
| 7.6                          | Expelled parts                                                        |                                                    |                | Not applicable for power supplies                                                                                    |
| 8                            | Mechanical resistance to shock and impact                             |                                                    | PS-A.8         |                                                                                                                      |
| 8.1                          | Enclosure rigidity test                                               |                                                    |                |                                                                                                                      |
| 8.1.1                        | Static test                                                           |                                                    | PS-A.8.1.1     |                                                                                                                      |
| 8.1.2                        | Dynamic test                                                          | 4 (4.2.5/RD)                                       |                |                                                                                                                      |
| 8.2                          | Drop test                                                             |                                                    |                |                                                                                                                      |
| 8.2.1                        | Equipment other than hand-held equipment and direct plug-in equipment |                                                    | PS-A.8.2.1     | 8.2.1 of IEC 61010-1:2001 covers power supplies up to 20 kg and also up to 100 kg                                    |
| 8.2.1.1                      | Corner drop test                                                      |                                                    | PS-A.8.2.1.1   |                                                                                                                      |
| 8.2.1.2                      | Face drop test                                                        |                                                    | PS-A.8.2.1.2   |                                                                                                                      |
| 8.2.2                        | Hand-held equipment and direct plug-in equipment                      | 4 (4.2.6/RD)                                       | PS-A.8.2.2*    | * If the minimum rated ambient temperature is below 2 °C, the test is conducted at the specified ambient temperature |
| 9                            | Protection against the spread of fire                                 | 4 (4.7/RD)                                         |                |                                                                                                                      |
| 9.1                          | Eliminating or reducing the sources of ignition within the equipment  | 4 (4.7.1/RD, 4.7.2.1/RD)                           |                |                                                                                                                      |
| 9.2                          | Containment of fire within the equipment, should it occur             | 4 (4.7.1/RD, 4.7.2/RD)                             | PS-A.9.2 b)*   | * 9.4 of IEC 61010-1:2001 is not applicable                                                                          |

| Clause in IEC 61010-1 (2001) | Topic                                                            | Clause in IEC 61204-7                                       |                                               | Comments                                                                                                                                                         |
|------------------------------|------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                                                                  | Main body                                                   | Annex PS-A                                    |                                                                                                                                                                  |
| 9.2.1                        | Constructional requirements                                      | 4 (4.6.2/RD, 4.7.3/RD)                                      | PS-A.9.2.1a)<br>PS-A.9.2.1<br>b) Figure PS-A6 |                                                                                                                                                                  |
| 9.3                          | Limited-energy circuit                                           | 2.5 (2.5/RD)                                                |                                               | Essentially the same as IEC 61204-7                                                                                                                              |
| 9.4                          | Requirements for equipment containing or using flammable liquids |                                                             |                                               | Not applicable for power supplies                                                                                                                                |
| 9.5                          | Overcurrent protection                                           | 2.7 (2.7/RD)                                                |                                               |                                                                                                                                                                  |
| 9.5.1                        | Permanently connected equipment                                  | 2.7 (2.7.1/RD)                                              |                                               |                                                                                                                                                                  |
| 9.5.2                        | Other equipment                                                  |                                                             | PS-A.9.5.2                                    |                                                                                                                                                                  |
| 10                           | Equipment temperature limits and resistance to heat              |                                                             |                                               |                                                                                                                                                                  |
| 10.1                         | Surface temperature limits for protection against burns          |                                                             | PS-A.10.1<br>Table PS-A15                     |                                                                                                                                                                  |
| 10.2                         | Temperatures of windings                                         | 4, 5.3 and Annexes)<br>(4.5.1/RD, 5.3.8.1/RD, Annex C.1/RD) | PS-A.10.2*                                    | * Minimum ambient temperature is 40 °C<br><br>A max. temperature of 300 °C is permitted in IEC 61204-7 under single fault conditions but not in IEC 61010-1:2001 |
| 10.3                         | Other temperature measurements                                   | 4 and 5.3<br>(4.5/RD, 5.3/RD)                               | PS-A.10.3*                                    | * Parts a), c), d) and e) of the text of 10.3. Part b) of IEC 61010-1:2001 is not applicable to power supplies                                                   |
| 10.4                         | Conduct of temperature tests                                     | 1.4<br>(1.4.12/RD, 1.4.13/RD)                               |                                               | Ambient temperature is 40 °C minimum                                                                                                                             |
| 10.4.1                       | Temperature measurement of heating equipment                     |                                                             |                                               | Not applicable for power supplies                                                                                                                                |
| 10.4.2                       | Equipment intended for installation in a cabinet or a wall       |                                                             | PS-A.10.4.2                                   |                                                                                                                                                                  |
| 10.5                         | Resistance to heat                                               |                                                             | PS-A.10.5                                     |                                                                                                                                                                  |
| 10.5.1                       | Integrity of clearances and creepage distances                   |                                                             | PS-A.10.5.1                                   | Distances measured when the power supply is still hot after applying the appropriate ambient temperature                                                         |
| 10.5.2                       | Non-metallic enclosures                                          | 4 (4.2.7/RD)                                                | PS-A.10.5.2*                                  | *Tests of PS-A.8.1.1 and PS-A.8.2.1 are repeated after the test of 4 of IEC 61204-7 (4.2.7/RD)                                                                   |
| 10.5.3                       | Insulating material                                              | 4 (4.5.2/RD)                                                |                                               |                                                                                                                                                                  |

| Clause in IEC 61010-1 (2001)                 | Topic                                                                                            | Clause in IEC 61204-7         |             | Comments                             |
|----------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------|-------------|--------------------------------------|
|                                              |                                                                                                  | Main body                     | Annex PS-A  |                                      |
| 11<br>11.1<br>11.2<br>11.3<br>11.4           | Protection against hazards from fluids                                                           |                               |             | Not applicable for power supplies    |
| 11.5                                         | Battery electrolyte                                                                              |                               | PS-A.11.5   |                                      |
| 11.6                                         | Specially protected equipment                                                                    | Annexes (Annex T/RD)          | PS-A.11.6   |                                      |
| 11.7<br>11.7.1<br>11.7.2<br>11.7.3<br>11.7.4 | Fluid pressure and leakage                                                                       |                               |             | Not applicable for power supplies    |
| 12<br>12.1<br>12.2<br>12.2.1<br>12.2.2       | Protection against radiation, including laser sources, and against sonic and ultrasonic pressure |                               |             | Not applicable for power supplies    |
| 12.3                                         | Ultraviolet (UV) radiation                                                                       |                               |             | Not applicable for power supplies    |
| 12.4                                         | Microwave radiation                                                                              |                               |             | Not applicable for power supplies    |
| 12.5<br>12.5.1<br>12.5.2                     | Sonic and ultrasonic pressure                                                                    |                               |             | Not applicable for power supplies    |
| 12.6                                         | Laser sources                                                                                    | 4 (4.3.13/RD*, 4.3.13.5/RD**) |             | *IEC 60950<br>**IEC 60950-1          |
| 13<br>13.1<br>13.2<br>13.2.1                 | Protection against liberated gases, explosion and implosion                                      |                               |             | Not applicable for power supplies    |
| 13.2.2                                       | Batteries and battery charging                                                                   |                               | PS-A.13.2.2 |                                      |
| 13.2.3                                       | Implosion of cathode ray tubes                                                                   |                               |             | Not applicable for power supplies    |
| 13.2.4                                       | Equipment rated for high pressures                                                               |                               |             | Not applicable for power supplies    |
| 14                                           | Components                                                                                       |                               |             |                                      |
| 14.1                                         | General                                                                                          | 1.5 (1.5.1/RD, 1.5.2/RD)      |             |                                      |
| 14.2                                         | Motors                                                                                           |                               |             |                                      |
| 14.2.1                                       | Motor temperatures                                                                               | Annexes (Annex B3/RD)         |             | Minimum ambient temperature is 40 °C |

| Clause in IEC 61010-1 (2001) | Topic                                                                 | Clause in IEC 61204-7                  |                  | Comments                                                                                                                                                                                                                                                                          |
|------------------------------|-----------------------------------------------------------------------|----------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                                                                       | Main body                              | Annex PS-A       |                                                                                                                                                                                                                                                                                   |
| 14.2.2                       | Series excitation motors                                              |                                        |                  | Not applicable for power supplies                                                                                                                                                                                                                                                 |
| 14.3                         | Overtemperature protection devices                                    | Annexes (Annex K/RD)                   |                  |                                                                                                                                                                                                                                                                                   |
| 14.4                         | Fuse holders                                                          | 2.1.1.1 b)/RD)                         |                  |                                                                                                                                                                                                                                                                                   |
| 14.5                         | Mains voltage selecting devices                                       |                                        | PS-A.14.5        |                                                                                                                                                                                                                                                                                   |
| 14.6                         | High integrity components                                             |                                        |                  | Not used in IEC 61204-7. Not applicable to power supplies                                                                                                                                                                                                                         |
| 14.7                         | Mains transformers tested outside equipment                           | 5.3 and Annexes (5.3.3/RD, Annex C/RD) |                  |                                                                                                                                                                                                                                                                                   |
| 14.8                         | Printed circuit boards                                                |                                        | PS-A.14.8        | All PWBs must be rated FV-1(V-1.)                                                                                                                                                                                                                                                 |
| 14.9                         | Circuits or components used as transient overvoltage limiting devices |                                        |                  | Not permitted by IEC 61204-7 in the primary circuit                                                                                                                                                                                                                               |
| 15                           | Protection by interlocks                                              | 2.8 (2.8/RD)                           |                  |                                                                                                                                                                                                                                                                                   |
| 15.1                         | General                                                               | 2.8 (2.8.1/RD, 2.8.2/RD)               |                  |                                                                                                                                                                                                                                                                                   |
| 15.2                         | Prevention of reactivating                                            | 2.8 (2.8.3/RD)                         |                  |                                                                                                                                                                                                                                                                                   |
| 15.3                         | Reliability                                                           | 2.8 (2.8.4/RD, 2.8.7.2/RD, 2.8.7.3/RD) |                  |                                                                                                                                                                                                                                                                                   |
| 16<br>16.1<br>16.2           | Test and measurement equipment                                        |                                        |                  | Not applicable for power supplies                                                                                                                                                                                                                                                 |
| Annex A                      | Measuring circuits for accessible current                             | Annexes (Annex D/RD)                   | Appendix PS-A.A4 |                                                                                                                                                                                                                                                                                   |
| Annex B                      | Standard test finger                                                  | 2.1 (Fig. 2A/RD)                       |                  | Rigid finger is referenced in 2.1.1.1d)/RD                                                                                                                                                                                                                                        |
| Annex C                      | Measurement of clearances and creepage distances                      | Annexes (Annex F/RD)                   |                  |                                                                                                                                                                                                                                                                                   |
| Annex D                      | Parts between which insulation requirements are specified             | 2.2 (2.2.3/RD)                         |                  | IEC 61204-7 is more stringent                                                                                                                                                                                                                                                     |
| Annex E                      | Reduction of pollution degrees                                        | 2.10 (2.10.7/RD)                       | Appendix PS-A.E* | * Covered by IEC 61204-7, 2.10, except that for IEC 61010-1:2001, coated PWBs are not acceptable for reducing pollution degree 3 to 1. Also coated PWBs tested to IEC 61204-7, 2.10, are not permitted to use the separation distances of Table 2N/RD for use in IEC 61010-1:2001 |

| Clause in IEC 61010-1 (2001)                                                                                                                                                             | Topic                                          | Clause in IEC 61204-7 |                                                                                | Comments                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|                                                                                                                                                                                          |                                                | Main body             | Annex PS-A                                                                     |                                                                                           |
| Annex F                                                                                                                                                                                  | Routine tests                                  |                       | Appendix PS-A.F<br>Appendix PS-A.F1<br>Appendix PS-A.F2*<br>Appendix PS-A.F3** | * Time is 2 s compared to 1 s for IEC 61204-7.<br><br>** Not applicable to power supplies |
| Annex G                                                                                                                                                                                  | Leakage and rupture from fluids under pressure |                       |                                                                                | Not applicable to power supplies                                                          |
| NOTE 1 Those clauses in the column for Annex PS-A will generally be added in their entirety with appropriate editing to Annex PS-A. If a portion of the clause is indicated, see Note 2. |                                                |                       |                                                                                |                                                                                           |
| NOTE 2 In the "comments" column, material marked with asterisk(s) is a brief summary of parts of clauses that are to be added to Annex PS-A.                                             |                                                |                       |                                                                                |                                                                                           |

## PS-A.1 Scope and Object

### PS-A.1.1 Scope

#### PS-A.1.1.1 Power supplies included in scope

This annex specifies general safety requirements for POWER SUPPLIES intended for professional, industrial process, and educational use, as part of the equipments defined in a) to d) below and when used under the environmental conditions of PS-A.1.4.

##### a) Electrical test and measurement equipment

This is equipment which by electrical means tests, measures, indicates or records one or more electrical or non-electrical quantities, also non-measuring equipment such as signal generators, measurement standards, POWER SUPPLIES, transducers, transmitters, etc.

NOTE All indicating and recording electrical measuring instruments fall within the scope of IEC 61010-1:2001 unless they are panel meters designed only for building-in to other equipment. Build-in panel meters are considered to be components, and only need to meet the relevant requirements of IEC 61010-1:2001, or other standards, as part of the equipment into which they are built.

##### b) Electrical control equipment

This is equipment which controls one or more output quantities to specific values, with each value determined by manual setting, by local or remote programming, or by one or more input variables.

##### c) Electrical laboratory equipment

This is equipment which measures, indicates, monitors or analyses substances, or is used to prepare materials, and includes in vitro diagnostic (IVD) equipment

This equipment may also be used in areas other than laboratories, for example self-test IVD equipment may be used in the home.

##### d) Accessories intended for use with the above (for example, sample handling equipment).

**PS-A.1.1.3 Computing equipment**

This annex applies to POWER SUPPLIES where these are used with computers, processors, etc. which form part of equipment within the scope of IEC 61010-1:2001 or are designed for use exclusively with such equipment.

NOTE Computing devices and similar equipment within the scope of IEC 60950:1999 or IEC 60950-1:2001 and conforming to its requirements are considered to be suitable for use with equipment within the scope of IEC 61010-1:2001. However, some of the requirements of IEC 60950:1999 or IEC 60950-1:2001 for resistance to moisture and liquids are less stringent than those in IEC 61010-1:2001. If hazards from moisture or liquids could affect equipment that conforms to IEC 60950:1999 or IEC 60950-1:2001 and is used with equipment which conforms to IEC 61010-1:2001, the instructions for use should specify any additional precautions required.

**PS-A.1.3 Verification**

This annex also specifies methods of verifying, through inspection and type testing, that the POWER SUPPLY meets the requirements of IEC 61010-1:2001.

NOTE Requirements for ROUTINE TESTS are given in Appendix PS-A.F.

**PS-A.1.4 Environmental conditions****PS-A.1.4.1 Normal environmental conditions**

This annex applies to POWER SUPPLIES designed to be safe at least under the following conditions:

- a) indoor use;
- b) altitude up to 2 000 m;
- c) ambient temperature 5 °C to 40 °C;
- d) maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
- e) mains supply voltage fluctuations up to  $\pm 10$  % of the nominal voltage;
- f) transient overvoltages typically present on the mains supply;

NOTE The normal level of transient overvoltages is the impulse withstand (overvoltage) category II of IEC 60664-1:2002.

- g) applicable rated POLLUTION DEGREE.

**PS-A.1.4.2 Extended environmental conditions**

This annex applies to POWER SUPPLIES designed to be safe not only in the environmental conditions specified in PS-A.1.4.1, but also in any of the following conditions for which the POWER SUPPLY is rated by the manufacturer:

- a) outdoor use;
- b) altitude above 2 000 m;
- c) ambient temperatures below 5 °C or above 40 °C;
- d) relative humidity above the levels specified in PS-A.1.4.1;
- e) mains supply voltage fluctuations exceeding  $\pm 10$  % of the nominal voltage.

## PS-A.2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Annex PS-P applies with the addition of the following:

IEC 60027(all parts), *Letter symbols to be used in electrical technology*

IEC 60270:2000, *High-voltage test techniques – Partial discharge measurements*

IEC 60309 (all parts), *Plugs, socket-outlets and couplers for industrial purposes*

IEC 60445:1999, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals and of terminations of certain designated conductors, including general rules for an alphanumeric system*

IEC 60447:2004, *Basic and safety principles for man-machine interface, marking and identification – Actuating principles*

IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:2002, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60707:1999, *Flammability of solid non metallic materials when exposed to flame sources – List of test methods<sup>2</sup>*

IEC 61010-1:2001, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

## PS-A.3 Terms and definitions

Unless otherwise specified, values of "voltage" and "current" are the r.m.s. values of an alternating, direct or composite voltage or current.

Definition in alphabetical order of nouns

|                         |               |
|-------------------------|---------------|
| BARRIER                 | PS-A.3.2.5    |
| BODY, RESPONSIBLE       | PS-A.3.5.13   |
| CONDITION, NORMAL       | PS-A.3.5.10   |
| CONDITION, SINGLE FAULT | PS-A.3.5.11   |
| HAZARDOUS LIVE          | PS-A.3.5.3    |
| LOCATION, WET           | PS-A.3.5.14   |
| OPERATOR                | PS-A.3.5.12   |
| POLLUTION               | PS-A.3.6.5    |
| POLLUTION DEGREE        | PS-A. 3.6.6   |
| POLLUTION DEGREE 1      | PS-A. 3.6.6.1 |
| POLLUTION DEGREE 2      | PS-A. 3.6.6.2 |
| POLLUTION DEGREE 3      | PS-A. 3.6.6.3 |

<sup>2</sup> This publication has been replaced by IEC publications 60695-11-10 and 60695-11-20 (2003)

|                                |            |
|--------------------------------|------------|
| POWER SUPPLIES, FIXED          | PS-A.3.1.1 |
| RATED (VALUE)                  | PS-A.3.3.1 |
| RATING                         | PS-A.3.3.2 |
| TERMINAL                       | PS-A.3.2.1 |
| TERMINAL, FUNCTIONAL EARTH     | PS-A.3.2.2 |
| TERMINAL, PROTECTIVE CONDUCTOR | PS-A.3.2.3 |

**PS-A.3.1.1****FIXED POWER SUPPLIES**

POWER SUPPLIES fastened to a support, or otherwise secured in a specific location

[IEV 826-16-07 modified]

**PS-A.3.2.1****TERMINAL**

component provided for the connection of a POWER SUPPLY to external conductors

[IEV 151-12-12 modified]

NOTE TERMINALS can contain one or several contacts and the term therefore includes sockets, connectors, etc.

**PS-A.3.2.2****FUNCTIONAL EARTH TERMINAL**

TERMINAL by which electrical connection is made directly to a point of measuring or control circuit or to a screening part and which is intended to be earthed for any functional purpose other than safety

**PS-A.3.2.3****PROTECTIVE CONDUCTOR TERMINAL**

TERMINAL which is bonded to conductive parts of a POWER SUPPLY for safety purposes and is intended to be connected to an external protective earthing system

**PS-A.3.2.5****BARRIER**

part providing protection against direct contact from any usual direction of access

NOTE Enclosures and barriers may provide protection against the spread of fire (see PS-A.9.2.1 b)).

**PS-A.3.3.1****RATED (value)**

quantity value assigned, generally by a manufacturer, for a specified operating condition of a component POWER SUPPLY or STAND-ALONE POWER SUPPLY

[IEV 151-16-08 modified]

**PS-A.3.3.2****RATING**

set of RATED values and operating conditions

[IEV 151-16-11]

**PS-A.3.5.3****HAZARDOUS LIVE**

capable of rendering an electric shock or electric burn in NORMAL CONDITION or SINGLE FAULT CONDITION

NOTE See PS-A.6.3.1 a) and b) for values applicable to NORMAL CONDITION and PS-A.6.3.2 a) and b) for the higher values deemed to be appropriate in SINGLE FAULT CONDITION.

**PS-A.3.5.10****NORMAL CONDITION**

condition in which all means for protection against HAZARDS are intact

**PS-A.3.5.11****SINGLE FAULT CONDITION**

condition in which one means for protection against HAZARD is defective or one fault is present which could cause a HAZARD

NOTE If a SINGLE FAULT CONDITION results unavoidably in another SINGLE FAULT CONDITION, the two failures are considered as one SINGLE FAULT CONDITION.

**PS-A.3.5.12****OPERATOR**

person operating the POWER SUPPLY for its intended purpose

NOTE The OPERATOR should have received training appropriate for this purpose.

**PS-A.3.5.13****RESPONSIBLE BODY**

individual or group responsible for the use and maintenance of the POWER SUPPLY and for ensuring that OPERATORS are adequately trained

**PS-A.3.5.14****WET LOCATION**

location where water or another conductive liquid may be present and is likely to cause reduced human body impedance due to wetting of the contact between the human body and the equipment, or wetting of the contact between the human body and the environment

**PS-A.3.6.5****POLLUTION**

addition of foreign matter, solid, liquid or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity

**PS-A.3.6.6****POLLUTION DEGREE**

for the purpose of evaluating spacings, the following degrees of POLLUTION in the micro-environment are defined

**PS-A.3.6.6.1****POLLUTION DEGREE 1**

no POLLUTION or only dry, non-conductive POLLUTION occurs. The POLLUTION has no influence

**PS-A.3.6.6.2****POLLUTION DEGREE 2**

normally only non-conductive POLLUTION occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected

**PS-A.3.6.6.3****POLLUTION DEGREE 3**

conductive POLLUTION occurs, or dry, non-conductive POLLUTION occurs which becomes conductive due to condensation which is expected

NOTE In such conditions, POWER SUPPLIES are normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

**PS-A.4.3.1 Environmental conditions**

Unless otherwise specified in this standard, the following environmental conditions shall exist in the test location:

- a) a temperature of 15 °C to 35 °C;
- b) a relative humidity of not more than 75 %, but not exceeding the limits of PS-A.1.4.1 d);
- c) an air pressure of 75 kPa to 106 kPa;
- d) no hoar-frost, dew, percolating water, rain, solar radiation, etc.

**PS-A.4.3.2.8 Connections**

POWER SUPPLY shall be connected for its intended purpose, or not connected

**PS-A.4.4.2.2 Protective conductor**

the protective conductor shall be interrupted, except for permanently connected POWER SUPPLIES or POWER SUPPLIES utilizing a connector in accordance with series IEC 60309.

**PS-A.4.4.2.8 Power supplies for more than one supply**

POWER SUPPLIES which are designed to be operated from more than one type of supply shall be simultaneously connected to these supplies, unless this is prevented by the construction

**PS-A.4.4.3 Duration of tests**

**PS-A.4.4.3.1** *The POWER SUPPLY shall be operated until further change as a result of the applied fault is unlikely. Each test is normally limited to 1 h since a secondary fault arising from a SINGLE FAULT condition will usually manifest itself within that time. If there is an indication that a risk of electric shock, spread of fire or injury to persons may eventually occur, the test shall be continued until one of these HAZARDS does occur or for a maximum period of 4 h, unless a HAZARD occurs before then.*

**PS-A.4.4.3.2** *Where a device which interrupts or limits the current during operation is included to limit the temperature of parts which can easily be touched, the maximum temperature attained by the POWER SUPPLY shall be measured, whether the device operates or not.*

**PS-A.4.4.3.3** *If a fault is terminated by the opening of a fuse and if the fuse does not operate within approximately 1 s, the current through the fuse under the relevant fault condition shall be measured. Evaluation with the pre-arcing time/current characteristics shall be made to find out whether the minimum operating current of the fuse is reached or exceeded and what is the maximum time before the fuse operates. The current through the fuse may vary as a function of time.*

*If the minimum operating current of the fuse is not reached in the test, the POWER SUPPLY shall be operated for a period corresponding to the maximum fusing time or continuously for the duration specified in PS-A.4.4.3.1.*

#### **PS-A.4.4.4 Conformity after application of fault conditions**

**PS-A.4.4.4.1** *Conformity with requirements for protection against electric shock is checked after the application of single faults as follows:*

- a) by making the measurements of PS-A.6.3.2 a) and b) to check that no accessible conductive parts have become HAZARDOUS LIVE;*
- b) by performing a voltage test on DOUBLE INSULATION or REINFORCED INSULATION to check that there is still one level of protection by insulation. The voltage test is made as specified in PS-A.6.8 (without conformity preconditioning) with the test voltage for BASIC INSULATION.*
- c) by measuring the temperature of transformer windings if the protection against electrical HAZARDS is achieved by DOUBLE INSULATION or REINFORCED INSULATION within the transformer. The temperatures of 5.3 of the main body of this standard (5.3.8.1/RD) shall not be exceeded.*

**PS-A.4.4.4.2** *Conformity with requirements for temperature protection is checked by determining the temperature of the outer surface of the ENCLOSURE and of parts which can easily be touched.*

*Except for heated surfaces of heating equipment, the temperature of these parts shall not exceed 105 °C at an ambient temperature of 40 °C or the maximum RATED ambient temperature if higher.*

*This temperature is determined by measuring the temperature rise of the surface or part and adding it to 40 °C or the maximum RATED ambient temperature if higher.*

**PS-A.4.4.4.3** *Conformity with requirements for protection against the spread of fire is checked by placing the POWER SUPPLY on white tissue-paper covering a softwood surface and covering the POWER SUPPLY with cheesecloth. No molten metal, burning insulation, flaming particles, etc. shall fall on the surface on which the POWER SUPPLY stands and there shall be no charring, glowing, or flaming of the tissue paper or cheesecloth. Melting of insulation material shall be ignored if no HAZARD could arise.*

**PS-A.4.4.4.4** *Conformity with requirements for protection against other HAZARDS is checked as specified in PS-A.7.1, PS-A.8, PS-A.11.5, PS-A.11.6, PS-A.13.2.2 and PS-A.14.5.*

#### **PS-A.5.1.1 General**

Letter symbols for quantities and units shall be in accordance with IEC series 60027. Graphic symbols shall be in accordance with Table PS-A1 if applicable. There are no colour requirements for symbols. Graphic symbols shall be explained in the documentation.

NOTE Markings should not be on the bottom of the POWER SUPPLY, except where space is limited.

*Conformity is checked by inspection.*

#### **PS-A.5.1.3 Mains supply**

The POWER SUPPLY shall be marked with the following information:

## a) nature of supply:

1) RATED mains frequency or range of frequencies;

2) d.c.: symbol 1 of Table PS-A1;

NOTE 1 For information purposes it may be useful to mark:

– POWER SUPPLIES intended for a.c. with symbol 2 of Table PS-A1;

– POWER SUPPLIES suitable for both AC and DC with symbol 3 of Table PS-A1;

– POWER SUPPLIES for three-phase supply with symbol 4 of Table PS-A1.

## b) the RATED value(s) of the supply voltage(s) or the RATED range of the supply voltages;

NOTE 2 Rated voltage fluctuations may also be marked.

c) the maximum RATED power in watts (active power) or volt-amperes (apparent power), or the maximum RATED input current, with all accessories or plug-in modules connected. If the POWER SUPPLY can be used on more than one voltage range, separate values shall be marked for each voltage range unless the maximum and minimum values do not differ by more than 20 % of the mean value;

d) POWER SUPPLIES which the operator can set for different RATED supply voltages shall be provided with means for the indication of the voltage for which the POWER SUPPLY is set. For portable POWER SUPPLIES the indication shall be visible from the exterior. If the POWER SUPPLY is so constructed that the supply voltage setting can be altered without the use of a TOOL, the action of changing the setting shall also change the indication;

e) accessory mains socket-outlets accepting standard mains plugs shall be marked with the voltage if it is different from the mains supply voltage. If the outlet is for use only with specific equipment, it shall be marked to identify the equipment for which it is intended. If not, the maximum RATED CURRENT or power shall be marked, or symbol 14 of Table PS-A1 placed beside the outlet with the full details included in the documentation.

*Conformity is checked by inspection and by measurement of power or input current to check the marking of PS-A.5.1.3 c)). The measurement is made after the current has reached a stationary stage (usually after 1 min) so as to exclude any initial inrush current. The POWER SUPPLY shall be in the condition of maximum power consumption. Transients are ignored. The measured value shall not exceed the marked value by more than 10 %.*

Table PS-A1 – Symbols

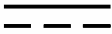
| Number | Symbol                                                                              | Publication          | Description                         |
|--------|-------------------------------------------------------------------------------------|----------------------|-------------------------------------|
| 1      |  | IEC 60417, No. 5031  | Direct current                      |
| 2      |  | IEC 60417, No. 5032  | Alternating current                 |
| 3      |  | IEC 60417, No. 5033  | Both direct and alternating current |
| 4      |  | IEC 60417, No 5032-1 | Three-phase alternating current     |
| 5      |  | IEC 60417, No. 5017  | Earth (ground) terminal             |
| 6      |  | IEC 60417, No. 5019  | Protective conductor terminal       |

Table PS-A1 (continued)

|                                                                                                                                          |                                                                                     |                     |                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------|
| 7                                                                                                                                        |    | IEC 60417, No. 5020 | Frame or chassis terminal                                                         |
| 8                                                                                                                                        |    | IEC 60417, No. 5021 | Equipotentiality                                                                  |
| 9                                                                                                                                        |    | IEC 60417, No. 5007 | On (Supply)                                                                       |
| 10                                                                                                                                       |    | IEC 60417, No. 5008 | Off (Supply)                                                                      |
| 11                                                                                                                                       |    | IEC 60417, No. 5172 | Power supplies protected throughout by double insulation or reinforced insulation |
| 12                                                                                                                                       |   |                     | Caution, risk of electric shock<br>Or use IEC 60417, No 5036                      |
| 13                                                                                                                                       |  | IEC 60417, No. 5041 | Caution, hot surface                                                              |
| 14                                                                                                                                       |  | ISO 7000-0434B      | Caution, risk of danger (see note)                                                |
| 15                                                                                                                                       |  | IEC 60417, No. 5268 | In position of a bistable push control                                            |
| 16                                                                                                                                       |  | IEC 60417, No. 5269 | Out position of a bistable push control                                           |
| NOTE See PS-A.5.4.1 which requires manufacturers to state that documentation must be consulted in all cases where this symbol is marked. |                                                                                     |                     |                                                                                   |

#### PS-A.5.1.5 Terminals, connections and operating devices

If necessary for safety, an indication shall be given of the purpose of TERMINALS, connectors, controls, and indicators, including any connections for fluids such as gas, water and drainage. Where there is insufficient space, symbol 14 of Table PS-A1 may be used.

NOTE 1 For additional information, see IEC 60445:1999 and IEC 60447:2004.

NOTE 2 Individual pins of multi-pin connectors need not be marked.

##### PS-A.5.1.5.1 Terminals

TERMINALS for connection to the mains supply shall be identifiable.

The following TERMINALS shall be marked as follows:

- a) functional earth TERMINALS with symbol 5 of Table PS-A1;
- b) PROTECTIVE CONDUCTOR TERMINALS with symbol 6 of Table PS-A1, except when the PROTECTIVE CONDUCTOR TERMINAL is part of an approved mains appliance inlet. The symbol shall be placed close to or on the TERMINAL;
- c) TERMINALS of measuring and control circuits which are permitted by PS-A.6.6.3 to be connected to accessible conductive parts with symbol 7 of Table PS-A1 if this connection is not self-evident;

NOTE This symbol may also be considered as a warning symbol in that it indicates that a HAZARDOUS LIVE voltage must not be connected to the TERMINAL. The symbol should also be used if it is likely that the OPERATOR could make such a connection inadvertently.

- d) TERMINALS supplied from the interior of the equipment and which are HAZARDOUS LIVE, with the voltage, current, charge or energy value or range, or with symbol 14 of Table PS-A1. This requirement does not apply to mains supply outlets where a standard mains socket outlet is used;
- e) accessible FUNCTIONAL EARTH TERMINALS connected to accessible conductive parts, with an indication that this is the case, unless it is self-evident. Symbol 8 of Table PS-A1 is acceptable for this marking.

*Conformity is checked by inspection.*

#### **PS-A.5.1.8 Field-wiring terminal boxes**

If the temperature of the TERMINALS or the ENCLOSURE of a field-wiring TERMINAL box or compartment exceeds 60 °C in NORMAL CONDITION at an ambient temperature of 40 °C, or the maximum RATED ambient temperature if higher, there shall be a marking of the minimum temperature RATING of the cable to be connected to the TERMINALS. The marking shall be visible before and during connection, or be beside the TERMINALS.

*Conformity, in case of doubt, is checked by measurement as specified in PS-A.10.3 a) and, if applicable, by inspection of markings.*

#### **PS-A.5.2 Warning markings**

Warning markings shall be visible when the STAND-ALONE POWER SUPPLY (does not apply to COMPONENT POWER SUPPLIES) is ready for normal use. If a warning applies to a particular part of the STAND-ALONE POWER SUPPLY, the marking shall be placed on or near to this part.

The size of warning markings shall be as follows.

- a) Symbols shall be at least 2,75 mm high. Text shall be at least 1,5 mm high and contrasting in colour with the background.
- b) Symbols or text moulded, stamped or engraved in a material shall be at least 2,0 mm high. If not contrasting in colour, they shall have a depth or raised height of at least 0,5 mm.

If it is necessary for the RESPONSIBLE BODY or OPERATOR to refer to the instruction manual to preserve the protection afforded by the POWER SUPPLY, the POWER SUPPLY shall be marked with symbol 14 of Table PS-A1. Symbol 14 is not required to be used with symbols which are explained in the manual.

If the instructions for use state that an OPERATOR is permitted to gain access, using a tool, to a part which in normal use may be HAZARDOUS LIVE, there shall be a warning marking which states that the POWER SUPPLY must be isolated or disconnected from the HAZARDOUS LIVE voltage before access.

Warning markings are specified in PS-A.5.1.3, PS-A.5.1.5, PS-A.5.1.5.1 c), PS-A.6.1.2 b), PS-A.6.6.2, PS-A.10.1 and PS-A.13.2.2.

*Conformity is checked by inspection.*

### **PS-A.5.3 Durability of markings**

Markings in accordance with, PS-A.5.1.3, Table PS-A1, PS-A.5.1.5, PS-A.5.1.5.1, PS-A.5.1.8 and PS-A.5.2 shall remain clear and legible under conditions of normal use and resist the effects of cleaning agents specified by the manufacturer.

*Conformity is checked by inspection and by performing the following test for durability of markings on the outside of the POWER SUPPLY. The markings are rubbed by hand, without undue pressure, for 30 s with a cloth soaked with the specified cleaning agent (or, if not specified, with isopropyl alcohol).*

*The markings shall be clearly legible after the above treatment, and adhesive labels shall not have worked loose or become curled at the edges.*

### **PS-A.5.4 Documentation**

#### **PS-A.5.4.1 General**

POWER SUPPLIES shall be accompanied by documentation for safety purposes as follows:

- a) intended use of the POWER SUPPLY;
- b) technical specification;
- c) instructions for use;
- d) name and address of manufacturer or supplier from whom technical assistance may be obtained;
- e) the information specified in PS-A.5.4.2 to PS-A.5.4.5 as applicable to POWER SUPPLIES;
- f) not applicable to POWER SUPPLIES;
- g) not applicable to POWER SUPPLIES.

If applicable, warning statements and a clear explanation of warning symbols marked on the POWER SUPPLY shall be provided in the documentation or shall be durably and legibly marked on the power supply. In particular, there shall be a statement that documentation needs to be consulted in all cases where symbol 14 of Table PS-A1 is used, in order to find out the nature of the potential hazard and any actions which have to be taken.

*Conformity is checked by inspection.*

#### **PS-A.5.4.2 Power supply ratings**

Documentation shall include the following:

- a) the supply voltage or voltage range, frequency or frequency range, and power or current RATING;
- b) a description of all input and output connections;
- c) the rating of the insulation of external circuits, appropriate for SINGLE FAULT CONDITIONS, if such circuits are nowhere accessible (see PS-A.6.6.2);

- d) a statement of the range of environmental conditions for which the equipment is designed (see PS-A.1.4);
- e) a statement of the degree of protection, if the equipment is RATED according to IEC 60529:2001.

*Conformity is checked by inspection.*

#### **PS-A.5.4.3 Power supply installation**

The documentation shall include installation and specific commissioning instructions (examples are listed below) and if necessary for safety, warnings against HAZARDS which could arise during installation or commissioning of the POWER SUPPLY:

- a) assembly, location and mounting requirements;
- b) instructions for protective earthing;
- c) connections to the supply;
- d) for permanently connected POWER SUPPLIES:
  - 1) supply wiring requirements;
  - 2) requirements for any external switch or circuit-breaker (see 3 of the Main Body of this standard (3.4.3/RD)) and external overcurrent protection devices (see 2.7 of this standard (2.7.1/RD)) and a recommendation that the switch or circuit-breaker be near the POWER SUPPLY;
- e) ventilation requirements;
- f) requirements for special services, for example air, cooling liquid;
- g) not applicable to POWER SUPPLIES;
- h) not applicable to POWER SUPPLIES;
- i) not applicable to POWER SUPPLIES.

*Conformity is checked by inspection.*

#### **PS-A.5.4.4 Power supply operation**

Instructions for use shall include, if applicable:

- a) identification of operating controls and their use in all operating modes;
- b) an instruction not to position the POWER SUPPLY so that it is difficult to operate the disconnecting device;
- c) instructions for interconnection to other equipment, including indication of detachable parts and any special materials;
- d) specification of limits for intermittent operation;
- e) an explanation of symbols related to safety which are used on the POWER SUPPLY;
- f) not applicable;
- g) not applicable;
- h) not applicable;
- i) not applicable.

There shall be a statement in the instructions that, if the POWER SUPPLY is used in a manner not specified by the manufacturer, the protection provided by the POWER SUPPLY may be impaired.

*Conformity is checked by inspection.*

#### PS-A.5.4.5 Power supply maintenance

Instructions for the RESPONSIBLE BODY concerning preventive maintenance and inspection necessary for safety shall be given in sufficient detail.

NOTE Instructions should advise the RESPONSIBLE BODY of any tests necessary to check that POWER SUPPLY is still in a safe condition. They should also warn against the repetition of any tests of this standard which could damage the POWER SUPPLY and reduce protection against HAZARDS.

For POWER SUPPLIES using replaceable BATTERIES, the specific battery type shall be stated.

The manufacturer shall specify any parts which are required to be examined or supplied only by the manufacturer or his agent.

The RATING and characteristics of replaceable fuses shall be stated.

*Conformity is checked by inspection.*

#### PS-A.6.1.2 Exceptions (from protection against electric shock)

If it is not feasible for operating reasons to prevent the following parts being both accessible and HAZARDOUS LIVE, they are permitted to be accessible to the OPERATOR during normal use while they are HAZARDOUS LIVE:

- a) parts of lamps and lamp sockets after lamp removal;
- b) parts intended to be replaced by the OPERATOR (for example BATTERIES) and which may be HAZARDOUS LIVE during the replacement or other OPERATOR action, but only if they are accessible only by means of a TOOL and have a warning marking (see PS-A.5.2);
- c) locking and screw-held type measuring TERMINALS, including TERMINALS which do not require the use of a TOOL.

If any of the parts in a) and b) receive a charge from an internal capacitor, they shall not be HAZARDOUS LIVE 10 s after interruption of the supply.

*If a charge is received from an internal capacitor, conformity is checked by the measurements of PS-A.6.3 to establish that the levels of 2.4 of this standard (2.4.2/RD) are not exceeded.*

#### PS-A.6.2.2 Openings above parts that are hazardous live

A metal test pin 100 mm long and 4 mm in diameter is inserted in any openings above parts which are HAZARDOUS LIVE. The test pin is suspended freely and allowed to penetrate up to 100 mm. The additional safety measures of PS-A.6.5.1.1, PS-A.6.5.1.2, PS-A.6.5.1.3, PS-A.6.5.2 and PS-A.6.5.4 for protection in SINGLE FAULT CONDITION are not required solely because a part is accessible by this test only. This test is not applied to TERMINALS.

#### PS-A.6.2.3 Openings for pre-set controls

A metal test pin 3 mm in diameter is inserted through holes intended to give access to pre-set controls which require the use of a screwdriver or other TOOL. The test pin is applied in every possible direction through the hole. Penetration shall not exceed three times the distance from the enclosure surface to the control shaft or 100 mm, whichever is smaller.

**PS-A.6.3 Permissible limits for accessible parts**

The voltage, current, charge or energy between an accessible part and reference test earth, or between any two accessible parts on the same piece of equipment within a distance of 1,8 m (over a surface or through air), shall not exceed the values of PS-A.6.3.1 in NORMAL CONDITION nor of PS-A.6.3.2 in SINGLE FAULT CONDITION.

**PS-A.6.3.1 Values in normal condition**

The following values apply to accessible circuits in wet locations only. The values for dry locations are covered by 2.2 of this standard (2.2.2/RD).

Values above the following levels in NORMAL CONDITION are deemed to be HAZARDOUS LIVE. The limits of PS-A.6.3.1 b) and c) apply only if the voltage exceeds the values of PS-A.6.3.1 a).

- a) For POWER SUPPLIES rated for use in wet locations, the voltage levels are 16 V r.m.s. and 22,6 V peak or 35 V d.c.
- b) The current levels are:
  - 1) 0,5 mA r.m.s. for sinusoidal waveforms, 0,7 mA peak for non-sinusoidal waveform or mixed frequencies, or 2 mA d.c., when measured with the measuring circuit of Figure D.1 of IEC 60950:1999 and/or IEC 60950-1:2001. Alternatively the measuring circuit of Figure D.2 of IEC 60950:1999 and/or IEC 60950-1:2001 can be used if the frequency does not exceed 100 Hz. The measuring circuit of Figure PS-A.A.4 is used for POWER SUPPLIES RATED for use in wet locations.
  - 2) 70 mA r.m.s. when measured with the measuring circuit of Figure D.1 of IEC 60950:1999 and/or IEC 60950-1:2001. This relates to possible burns at higher frequencies.
- c) Limits of 2.4 of this standard (2.4.2/RD) apply.

**PS-A.6.3.2 Values in single fault condition**

The following values apply to accessible circuits in wet locations only. The values for dry locations are covered by 2.2 of this standard (2.2.3/RD).

Values above the following levels in SINGLE FAULT CONDITION are deemed to be HAZARDOUS LIVE. The limits of PS-A.6.3.2 b) and c) apply only if the voltage exceeds the values of PS-A.6.3.2 a).

- a) For POWER SUPPLIES RATED for use in wet locations, the voltage levels are 33 V r.m.s. and 46,7 V peak or 70 V d.c. For temporary voltages, the levels are those of Figure PS-A1, measured across a 50 k $\Omega$  resistor (use curves A and C only in Figure PS-A1).
- b) The current levels are:
  - 1) 3,5 mA r.m.s. for sinusoidal waveforms, 5 mA peak for non-sinusoidal waveforms or mixed frequencies, or 15 mA d.c., when measured with the measuring circuit of Figure D.1 of IEC 60950:1999 and/or IEC 60950-1:2001. Alternatively, the measuring circuit of Figure D.2 of IEC 60950:1999 and/or IEC 60950-1:2001 can be used if the frequency does not exceed 100 Hz. The measuring circuit of Figure PS-A.A.4 is used for POWER SUPPLIES rated for use in wet locations;
- c) Limits of 2.4 of this standard (2.4.2/RD) apply.

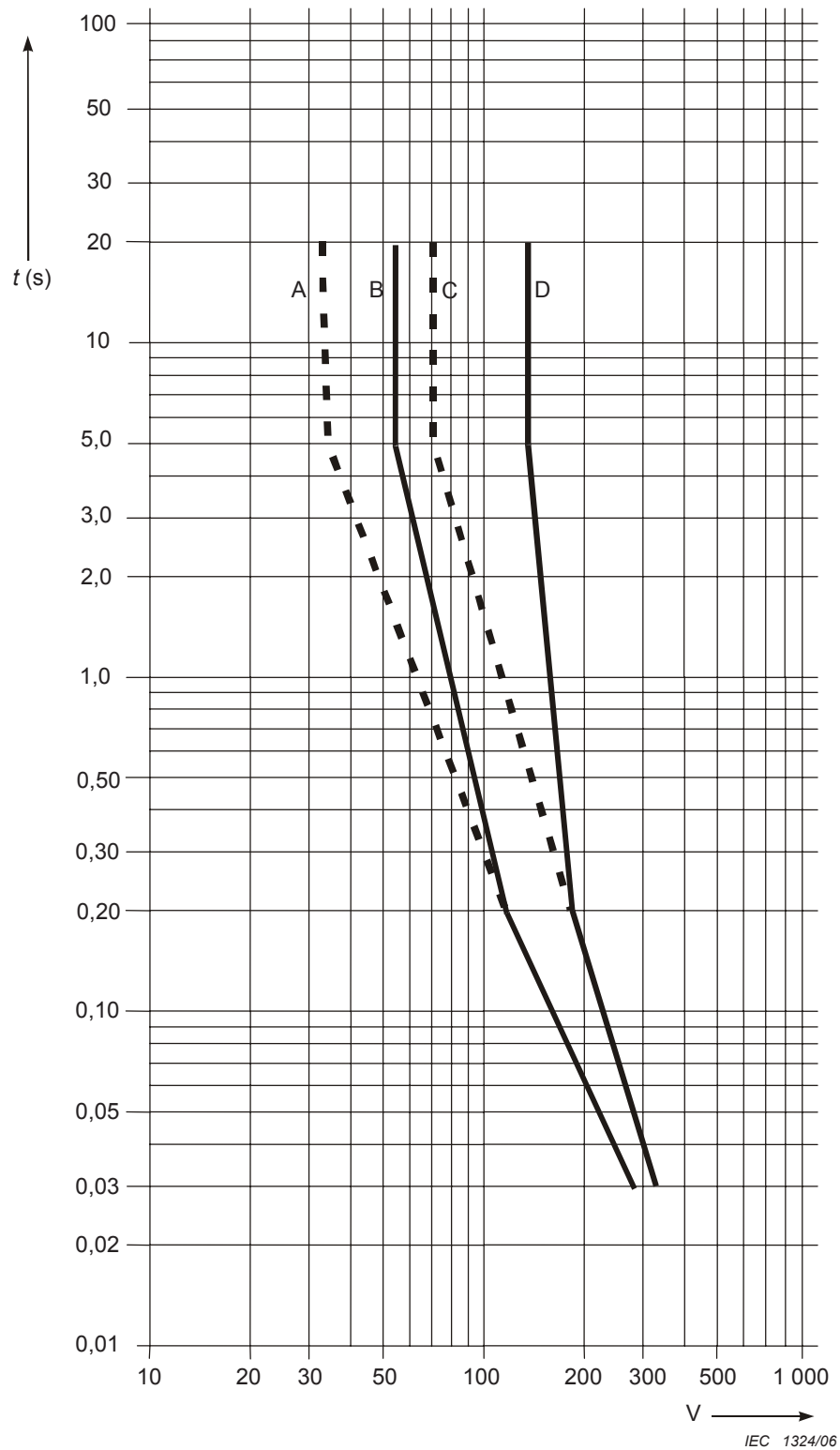


Figure PS-A1 – Maximum duration of short-term temporary accessible voltages in single fault condition (see PS-A.6.3.2 a))

**PS-A.6.4 Protection in normal condition**

Requirements of 2.1 of this standard (2.1.1/RD) apply.

*Conformity is checked by:*

- 1) *the determination of 2.1 (2.1.1/RD), PS-A.6.2.2 and PS-A.6.2.3, and the measurements of PS-A.6.3.1 a) and b), to establish that accessible conductive parts are not HAZARDOUS LIVE;*
- 2) *inspection or measurement of CLEARANCES and CREEPAGE DISTANCES as specified in PS-A.6.7;*
- 3) *the tests of PS-A.6.8 for dielectric strength of BASIC INSULATION;*
- 4) *the tests of 4 of this standard (4.2.5/RD) and PS-A.8 for rigidity of ENCLOSURES and BARRIERS.*

**PS-A.6.5.1.1 Integrity of protective bonding**

The integrity of protective bonding shall be assured by the following means.

- a) Protective bonding shall consist of directly connected structural parts or discrete conductors, or both. It shall withstand all thermal and dynamic stresses to which it could be subjected before one of the over-current protective means specified in 2.7 of this standard (2.7/RD) disconnects the equipment from the supply.
- d) Movable conductive connections, for example, hinges, slides, etc., shall not be the sole protective bonding path unless they are specifically designed for electrical inter-connection and meet the requirements of PS-A.6.5.1.3.
- e) The exterior metal braid of cables, even if connected to the PROTECTIVE CONDUCTOR TERMINAL, shall not be regarded as protective bonding.
- f) If power from the mains supply is passed through POWER SUPPLY for use by other equipment, means shall also be provided for passing the protective conductor through the POWER SUPPLY to protect the other equipment. The impedance to the protective conductor path through the equipment shall not exceed that specified in PS-A.6.5.1.3.
- h) POWER SUPPLIES using protective bonding shall be provided with a TERMINAL meeting the requirements of PS-A.6.5.1.2 and suitable for connection to a protective conductor.

*Conformity is checked by inspection.*

**PS-A.6.5.1.2 Protective conductor terminal**

If the PROTECTIVE CONDUCTOR TERMINAL is a binding screw it shall be of a suitable size for the bond wire, but no smaller than M4 (No. 6), with at least three turns of the screw engaged. The contact pressure required for a bonding connection shall not be capable of being reduced by deformation of materials forming part of the connection.

*Conformity is checked by inspection and by the following test. The assembly of a screw in a metal part or nut, together with the least favourable grounding conductor to be secured, and any associated conductor securing means shall withstand, without mechanical failure, three operations of assembly and disassembly when using the tightening torques specified in Table PS-A2.*

**Table PS-A2 – Tightening torque for screw assemblies**

|                         |     |     |     |     |      |
|-------------------------|-----|-----|-----|-----|------|
| Size of screw (mm)      | 4,0 | 5,0 | 6,0 | 8,0 | 10,0 |
| Tightening torque (N·m) | 1,2 | 2,0 | 3,0 | 6,0 | 10,0 |

**PS-A.6.5.1.3 Impedance of protective bonding**

*For POWER SUPPLIES RATED 16 A or less, conformity is checked by applying a test current for 1 min and then calculating impedance. The test current is the greater of:*

- a) 25 A d.c. or a.c. r.m.s. at RATED mains frequency;*
- b) a current equal to twice the RATED CURRENT of the equipment.*

*If the POWER SUPPLY contains overcurrent protection devices for all poles of the mains supply, and if the wiring on the supply side of the overcurrent protection devices cannot become connected to accessible conductive parts in the case of a single fault, the test current need not be more than twice the rated current of the internal overcurrent protection devices.*

*For POWER SUPPLIES RATED above 16 A, 2.6.3.3 of IEC 60950:1999 or 2.6.3.4 of IEC 60950-1:2001 applies.*

**PS-A.6.5.2 Double insulation and reinforced insulation**

CLEARANCES and CREEPAGE DISTANCES forming part of DOUBLE INSULATION or REINFORCED INSULATION shall meet the applicable requirements of PS-A.6.7 (see 2.2 and 2.9 of this standard (2.2.3/RD and 2.9.5/RD). ENCLOSURES shall meet the requirements of 1.2, 2.2 and 2.9 of this standard (1.2.4.2/RD, 2.2.3/RD and 2.9.5/RD)..

Solid insulation forming part of REINFORCED INSULATION shall pass the voltage test of PS-A.6.8 with the values for REINFORCED INSULATION.

*Conformity is checked as specified in PS-A.6.7 (see 2.2 and 2.9 of this standard (2.2.3/RD and 2.9.5/RD), PS-A.6.8 and 1.2, 2.2 and 2.9 of this standard (1.2.4.2/RD, 2.2.3/RD and 2.9.5/RD). The parts of double insulation are tested separately if this is possible; the tests for reinforced insulation are otherwise used. CLEARANCES and CREEPAGE DISTANCES necessary for safety can be checked by measurement.*

**PS-A.6.5.4 Automatic disconnection of the supply**

If automatic disconnection of the supply is used for protection in SINGLE FAULT CONDITION, the automatic disconnection device shall meet all the following requirements.

- a) It shall be supplied with the POWER SUPPLY or the installation instructions shall specify the device to be fitted as part of the installation.
- b) It shall be RATED to disconnect the load within the time specified in 2.4 of this standard (2.4.2/RD) for dry locations and Figure PS-A1 for wet locations.
- c) It shall be RATED for the maximum RATED load conditions of the POWER SUPPLY.

*Conformity is checked by inspection of the device specification and, if applicable, installation instructions. In case of doubt the device is tested to check that it disconnects the supply within the required time.*

#### **PS-A.6.6.2 Terminals for external circuits**

This applies to STAND-ALONE POWER SUPPLIES only.

TERMINALS which receive a charge from an internal capacitor shall not be HAZARDOUS LIVE 10 s after interruption of the supply.

TERMINALS which are energized from the interior, with HAZARDOUS LIVE VOLTAGE exceeding 1 kV r.m.s. or 1,5 kV d.c., or with floating voltage exceeding 1 kV r.m.s. or 1,5 kV d.c., shall not be accessible. POWER SUPPLIES with such TERMINALS shall be designed so that an accessible HAZARDOUS LIVE VOLTAGE is not present when connectors are not mated, or shall be marked with symbol 12 of Table PS-A1 (see PS-A.5.2) to warn the OPERATOR of the possible presence of an accessible HAZARDOUS LIVE voltage.

Unmated measuring TERMINALS which are HAZARDOUS LIVE when the maximum RATED VOLTAGE is applied to the TERMINAL shall not be accessible.

NOTE For locking and screw-held TERMINALS, see PS-A.6.1.2 c).

*Conformity is checked by inspection, and by the determination of accessible parts as specified in PS-A.6.2.2 and PS-A.6.2.3.*

#### **PS-A.6.6.3 Circuits with terminals which are hazardous live**

This applies to STAND-ALONE POWER SUPPLIES only.

These circuits shall not be connected to accessible conductive parts, except for circuits which are not mains circuits, and which are designed to be operated with one TERMINAL contact at earth potential. In such cases, the accessible conductive parts shall not be HAZARDOUS LIVE.

If such a circuit is also designed to be operated with one accessible TERMINAL contact (signal low) floating at a voltage which is not HAZARDOUS LIVE, this TERMINAL contact is permitted to be connected to a common FUNCTIONAL EARTH TERMINAL or system (for example a coaxial screening system). This common FUNCTIONAL EARTH TERMINAL or system is also permitted to be connected to other accessible conductive parts.

*Conformity is checked by inspection.*

#### **PS-A.6.7 Clearances and creepage distances**

CLEARANCES and CREEPAGE DISTANCES are specified in 2.10 of this standard (2.10.3/RD, 2.10.4/RD), PS-A.6.7.3.1, PS-A.6.7.3.2 and PS-A.6.7.3.3 so as to withstand the voltages that appear on the system for which the POWER SUPPLY is intended. They also take account of RATED environmental conditions and of any protective devices fitted within the POWER SUPPLY or required by the manufacturer's instructions.

There are no CLEARANCE or CREEPAGE DISTANCE requirements for the interior of void-free moulded parts, including the inner layers of multi-layer printed circuit boards.