

Specification for

**Safety of information
technology equipment,
including electrical business
equipment**

The European Standard EN 60950 : 1992 has the status of a
British Standard

ICS 35.020; 35.260.10

Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom

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Summary of pages

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National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee and is the English language version of EN 60950 : 1992 *Safety of information technology equipment including electrical business equipment* including amendments A1, A2, A3 and A4, published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC Publication 950 : 1991 second edition as amended by Amendments 1 : 1992, 2 : 1993, 3 : 1995 and 4 : 1996, published by the International Electrotechnical Commission (IEC). It supersedes BS 7002 : 1989.

The foreword of EN 60950 makes reference to the 'date of withdrawal', dow, of the relevant national standard. In this case the relevant national standard is BS 7002 : 1989, which will cease to be applicable to information technology equipment within the scope of EN 60950 on 1995-03-01. Certification and marks will not be awarded after this date with respect to BS 7002 : 1989. However, such certification marks, already awarded, may continue to apply to production until 2000-03-01.

The foreword of the EN Amendment A1 makes reference to the 'date of withdrawal (dow) of conflicting national standards' as 1995-03-01. In this case the conflicting national standard is BS EN 60950 : 1992 but the 'dow' relates only to those parts of the British Standard subject to Amendment No. 1. Certificates and marks will not be awarded after this date with respect to the British Standard not incorporating Amendment No. 1. They will be awarded with respect only to the amended British Standard. However, such certificates and marks already awarded with respect to the British Standard not incorporating Amendment No. 1 may continue to apply for production until 2000-03-01.

The foreword of the EN Amendment A2 makes reference to the 'date of withdrawal (dow) of conflicting national standards' as 1995-03-01. In this case the conflicting national standard is BS EN 60950 : 1992 but the 'dow' relates only to those parts of the British Standard subject to Amendment No. 2. Certificates and marks will not be awarded after this date with respect to the British Standard not incorporating Amendment No. 2. They will be awarded with respect only to the amended British Standard. However, such certificates and marks already awarded with respect to the British Standard not incorporating Amendment No. 2 may continue to apply for production until 2000-03-01.

Annex D of EN 60950/A2 makes reference to the measuring instrument for earth leakage current testing as given in annex D of EN 60950 : 1992 (unamended). For information, the unamended annex D of EN 60950 : 1992 is reproduced in national annex ND.

The foreword of the EN Amendment A3 makes reference to the 'date of withdrawal (dow) of conflicting national standards' as 1997-01-01. In this case the conflicting national standard is BS EN 60950 : 1992 but the 'dow' relates only to those parts of the British Standard subject to Amendment No. 3. Certificates and marks will not be awarded after this date with respect to the British Standard not incorporating Amendment No. 3. They will be awarded with respect only to the amended British Standard, however, such certificates and marks already awarded with respect to the British Standard not incorporating Amendment No. 3 may continue to apply for production until 2002-01-01.

Analogous provisions apply in respect of Amendment No. 4, for which the dow is 1998-08-01 and the expiry date for current approvals is 2003-08-15 and in respect of Amendment No. 5, for which the dow is 1998-08-01 and the expiry date for current approvals is 2003-08-01.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by a single line in the margin. Parts of the original IEC text that have been modified by CENELEC have been quoted in national annex NA. Attention is drawn to new annex ZD which lists all common modifications currently in force.

In this standard, the following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type*;
- notes and other informative matter: in smaller roman type:
- conditions applicable to tables: in small roman type:
- terms that are defined in 1.2: SMALL CAPITALS.

|| References in the text to IEC page numbers should be ignored.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60950

August 1992

+ A1

January 1993

+ A2

August 1993

+ A3

October 1995

+ A4

March 1997

+ A11

October 1997

UDC 681.3 : 651.2 : 620.1 : 614.8

ICS 35.260.10; 35.020

Descriptors: Information technology equipment, business equipment, personal computer, safety

English version

Safety of information technology equipment, including electrical business equipment

(including amendments A1 : 1993, A2 : 1993, A3 : 1995, A4 : 1997 and A11 : 1997)

(IEC 950 : 1991 + amendment 1 : 1992 + amendment 2 : 1993 + amendment 3 : 1995 + amendment 4 : 1996, modified)

Sécurité des matériels de traitement de l'information, y compris les matériels de bureau électriques

(inclut les amendements A1 : 1993, A2 : 1993, A3 : 1995, A4 : 1997 et A11 : 1997)

(CEI 950 : 1991 + amendement 1 : 1992

+ amendement 2 : 1993 + amendement 3 : 1995,

+ amendement 4 : 1996 modifiée)

Sicherheit von Einrichtungen der Informationstechnik, einschließlich elektrischer Büromaschinen

(enthält Änderungen A1 : 1993, A2 : 1993, A3 : 1995 A4 : 1997 und A11 : 1997)

(IEC 950 : 1991 + Änderung 1 : 1992

+ Änderung 2 : 1993 + Änderung 3 : 1995,

+ Änderung 4 : 1996 modifiziert)

This European Standard was approved by CENELEC on 1992-06-16, amendment A1 was approved by CENELEC on 1992-12-09, amendment A2 was approved by CENELEC on 1993-07-06, amendment A3 was approved by CENELEC on 1994-12-06. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

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

CENELEC

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

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

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Ref. No. EN 60950 : 1992 + A1 : 1993 + A2 : 1993 + A3 : 1995 + A4 : 1997 + A11 : 1997 E

Foreword

Following a decision taken by the CENELEC Technical Board at their meeting in London on 23 September 1991, the International Publication IEC 950 : 1991 was submitted to the CENELEC Unique Acceptance Procedure (UAP) in October 1991 for acceptance as a European Standard.

The reference document, with common modifications as prepared by Reporting Secretariat SR 74, was approved by CENELEC as EN 60950 on 16 June 1992.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1993-03-01
- latest date of withdrawal of conflicting national standards (dow) 1995-03-01

For products which have complied with EN 60950 : 1988 and its amendments A1 : 1990 and A2 : 1991 before 1995-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-03-01.

Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given only for information. In this standard annexes ZA and ZB are normative and annex ZC is informative.

Foreword to amendment A1

At the request of the 71st Technical Board of CENELEC, amendment 1 : 1992 to the international standard IEC 950 : 1991 was submitted to the CENELEC Unique Acceptance Procedure (UAP) in May 1992 for acceptance as a European Standard.

The text of the international standard was approved by CENELEC as amendment A1 to EN 60950 on 9 December 1992.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1993-09-01
- latest date of withdrawal of conflicting national standards (dow) 1995-03-01

For products which have complied with EN 60950 : 1992 before 1995-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-03-01.

Endorsement notice

The text of amendment 1 : 1992 to the international standard IEC 950 : 1991 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A2

At the request of the 71st Technical Board of CENELEC, the manuscript of amendment 2 to the international standard IEC 950 : 1991 was submitted to the CENELEC Unique Acceptance Procedure (UAP) in November 1992 for acceptance as a European Standard.

The reference document, with common modifications as prepared by Reporting Secretariat SR 74, was approved by CENELEC as amendment A2 to EN 60950 on 6 July 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-03-01
- latest date of withdrawal of conflicting national standards (dow) 1995-03-01

For products which have complied with EN 60950 : 1992 and its amendment A1 : 1993 before 1995-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-03-01.

NOTE. The following amendments have been made to annexes ZB and ZC:

Annex ZB – Special national conditions:

A new special national condition for Norway has been allowed for subclauses 2.3.9, 2.9.1 and 5.4.9.

The special national condition for Denmark for subclause 5.4.1 has been deleted.

Annex ZC – A-deviations:

The UK deviation for subclauses 2.8.4 and 2.8.5 has been deleted.

The Norwegian deviation for subclause 5.4.9 has been transferred to annex ZB (Special national conditions) and the one for subclause 6.3 has been deleted.

Foreword to amendment A3

The manuscript of amendment 3 to international standard IEC 950 was submitted to the IEC/CENELEC parallel voting procedure in May 1994 for acceptance as a European Standard.

The reference document [74(Central Office)246] with common modifications prepared by CLC/TC74 was approved by CENELEC as amendment 3 to EN 60950 in December 1994.

In May 1994, EN 60950 : 1992/AB : 1994 was prepared in order to modify two existing common modifications and was submitted to the CENELEC formal voting procedure. This was approved by CENELEC as a further amendment to EN 60950 and has been included in amendment 3.

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) 1996-01-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-01-01

For products which comply with EN 60950 : 1992 and its amendments A1 : 1993 and A2 : 1993 before 1997-01-01, as shown by the manufacturer or by a certification body, this previous standard continues to apply for production until 2002-01-01.

Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given for information only. In this standard, annex ZA, which replaces annex ZA in EN 60950 : 1992/A2 : 1993, and annex ZB are normative, annex ZC is informative.

The following amendments have been made to Annexes ZA, ZB and ZC:

Annex ZA has been revised to align with the reference document.

Annex ZB — Special national conditions (Snc)

- 1.7.1 The Snc for the United Kingdom has been withdrawn.
- 2.3.6 The Snc for Denmark and Finland has been withdrawn.
- 2.5.2 The Snc for Denmark has been amended and one for Norway has been included.
- 3.2.1 The Snc for Denmark has been amended.
The Snc for Switzerland has been amended.
An Snc for the United Kingdom has been included.
- 3.3.5 The Snc for the UK has been amended.
- 4.3.18 An Snc for the United Kingdom has been included.
- 5.1 The Snc for Norway has been withdrawn.
- 6.2.1.4 b) The Sncs for Finland and Norway have been amended.
- 6.4.1 The Snc for Finland has been withdrawn.

Annex ZC — A-deviations

- 1.1.3 The deviation for Switzerland has been withdrawn.
- 1.7.2 The deviation for the United Kingdom has been withdrawn.
- 1.7.18 The deviation for Sweden has been withdrawn.
- 2.11 The deviations for Finland, Denmark and Norway have been withdrawn.

Foreword to amendment A4

The text of document 74/422/FDIS, future amendment 4 of IEC 950 : 1991, prepared by IEC TC 74, Safety and energy efficiency of IT equipment, was submitted to the IEC-CENELEC parallel vote.

In October 1996, a draft amendment was submitted to the formal vote in order to introduce a common modification in the text of amendment 4.

The combined text was approved by CENELEC as amendment A4 to EN 60950 : 1992 on 1996-12-09.

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) 1997-08-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1998-08-01

For products which have complied with EN 60950 : 1992 and its amendments A1 : 1993, A2 : 1993 and A3 : 1995 before 1998-08-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2003-08-01.

Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given for information only. In this standard, annexes ZA and ZB are normative, annexes ZC and ZD are informative.

Annexes ZA, ZB and ZC replace the annexes of EN 60950 : 1992/A3 : 1995.

Annex ZD has been added to provide an overview of all current common modifications to IEC 950 : 1991 and its amendments 1 to 4.

Foreword to amendment A11

During the CENELEC TC 74 meeting held in November 1996 the classification and labelling of lasers within equipment was discussed.

It was agreed that the current references to IEC 60825 in EN 60950 : 1992 were no longer appropriate and, therefore, an amendment to update EN 60950 was submitted to the formal vote and was approved by CENELEC as amendment A11 to EN 60950 : 1992 on 1997-07-01.

This amendment was prepared by the Technical Committee CENELEC TC 74, Safety and energy efficiency of information technology equipment.

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) 1998-02-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1998-08-01

For products which have complied with EN 60950 : 1992 and its amendments A1 : 1993 + A2 : 1993 + A3 : 1995 + A4 : 1997 before 1998-08-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2003-08-01.

The following amendments have been made to Annexes ZA, ZB and ZC:

Annex ZA has been revised to align with the reference document.

Annex ZB – Special national conditions (Snc)

- 1.6.4 An Snc for Norway has been included
- 2.3.5 The Snc for Norway (2.3.9) has been moved to 2.3.5
- 5.4.9 The Snc for Norway has been amended
- 6.1 The Snc for Switzerland has been withdrawn
- 6.2.1.2 An Snc for Norway has been included
An Snc for Sweden has been included
- 6.3.3 The Snc for Norway has been withdrawn
- 6.3.3.1 An Snc for Norway has been included
An Snc for Sweden has been included
- 6.3.3.2 An Snc for Norway has been included

Annex ZC – A-deviations – No change

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INTRODUCTION

PRINCIPLES OF SAFETY

General principles

It is essential that designers understand the underlying principles of safety requirements in order that they can engineer safe equipment.

The following is not an alternative to the detailed requirements of this standard, but is intended to provide designers with an appreciation of the principles on which these requirements are based.

Hazards

Application of this standard is intended to prevent injury or damage due to the following hazards:

- Electric shock
- Energy hazards
- Fire
- Mechanical and heat hazards
- Radiation hazards
- Chemical hazards.

Electric shock is due to current passing through the human body. Currents of the order of a milliampere can cause a reaction in persons in good health and may cause indirect danger due to involuntary reaction. Higher currents can have more damaging effects. Voltages up to about 40 V peak, or 60 V d.c., are not generally regarded as dangerous under dry conditions, but parts which have to be touched or handled should be at earth potential or properly insulated.

There are two types of persons who are normally concerned with information technology equipment, OPERATORS and SERVICE PERSONNEL.

"OPERATOR" is the term applied to all other than SERVICE PERSONNEL, and requirements for protection assume that the OPERATOR is oblivious to electrical hazards, but does not act intentionally in the sense of creating a hazard. Consequently, the requirements provide protection for cleaners and casual visitors as well as the assigned OPERATORS.

It is assumed that SERVICE PERSONNEL will be reasonably careful in dealing with obvious hazards, but the design should protect against mishap by use of warning labels, shields for HAZARDOUS VOLTAGE terminals, segregation of SAFETY EXTRA-LOW VOLTAGE CIRCUITS (SELV CIRCUITS) from HAZARDOUS VOLTAGES, etc. More important, SERVICE PERSONNEL should be protected against unexpected hazards.

It is normal to provide two levels of protection for OPERATORS to prevent electric shock caused by a fault. Thus a single fault and its resulting faults will not create a hazard. However, provision of additional protective measures, such as protective earthing or SUPPLEMENTARY INSULATION, is not considered a substitute for, or a relief from, properly designed BASIC INSULATION.

MOVABLE EQUIPMENT is considered to present a slightly increased risk of shock, due to possible extra strain on the supply cord leading to rupture of the earth conductor and a consequent leakage current hazard. With HAND-HELD EQUIPMENT, this risk is increased, wear on the cord is more likely, and further hazards could arise if the units were dropped.

Electric shock: causes and prevention

Causes:

Contact with parts normally at HAZARDOUS VOLTAGE.

Breakdown of insulation between parts normally at HAZARDOUS VOLTAGE and accessible conductive parts.

Breakdown of insulation between parts normally at HAZARDOUS VOLTAGE and SELV CIRCUITS, thereby putting accessible parts at HAZARDOUS VOLTAGE.

Breakdown of insulation guarding parts at HAZARDOUS VOLTAGE.

Leakage current from parts at HAZARDOUS VOLTAGE to BODY of CLASS II EQUIPMENT. Failure of protective earth connection of CLASS I EQUIPMENT carrying leakage current. (Leakage current includes current due to RFI filter components connected between PRIMARY CIRCUITS and frame.)

Prevention:

Prevent OPERATOR access to parts at HAZARDOUS VOLTAGE by fixed or locked covers, interlocks, etc. Discharge capacitors at HAZARDOUS VOLTAGE.

Either connect the accessible conductive parts to earth so that the voltage which can develop is limited to a safe value and the circuit overcurrent protection will disconnect the parts having low impedance faults; or use DOUBLE or REINFORCED INSULATION between parts normally at HAZARDOUS VOLTAGE and accessible conductive parts, so that breakdown is not likely to occur.

Segregate hazardous and SELV CIRCUITS. Separate by earthed metal screens, or DOUBLE or REINFORCED INSULATION. Earth SELV CIRCUITS if capable of carrying possible fault currents.

For parts at HAZARDOUS VOLTAGE insulation which is accessible to the OPERATOR should have adequate mechanical and electrical strength to eliminate this danger.

Limit leakage current to BODY to a safe value, or provide high integrity protective earth connection.

Energy hazards

Short-circuiting between adjacent poles of high current supplies or high capacitance circuits may cause arcing or ejection of molten metal resulting in burns. Even low voltage circuits may be dangerous in this respect. Protect by separation, by shielding or by using SAFETY INTERLOCKS.

Fire

Temperatures which could cause a fire risk may result from overloads, component failure, insulation breakdown, high resistance or loose connections. However, fires originating within the equipment should not spread beyond the immediate vicinity of the source of the fire or cause damage to the surroundings of the equipment.

These design objectives should be met by:

- taking all reasonable steps to avoid high temperature which might cause ignition,
- controlling the position of combustible materials in relation to possible ignition sources,
- limiting the quantity of combustible materials used,
- ensuring that, if combustible materials are used they have the lowest flammability practicable,
- using ENCLOSURES or barriers, if necessary, to limit the spread of fire within the equipment,
- using suitable materials for the outer ENCLOSURES of the equipment.

Mechanical and heat hazards

Requirements are included to prevent injury due to high temperatures of parts accessible to the OPERATOR; to ensure that the equipment is mechanically stable and structurally sound; to avoid the presence of sharp edges and points; and to provide adequate guarding or interlocking of dangerous moving parts.

Radiation hazards

If equipment emits some forms of radiation, requirements are necessary to keep OPERATOR and SERVICE PERSONNEL exposures to acceptable levels.

The types of radiation that can be encountered are sonic, radio frequency, infra-red, high intensity visible and coherent light, ultraviolet, ionizing, etc.

Chemical hazards

Hazardous chemicals cause injuries and damage through contact with them, their vapours and fumes. Controls including appropriate warning labels are required to limit such contact, as far as practicable, under normal and abnormal conditions.

Materials

Materials used in the construction of equipment should be selected and arranged such that they can be expected to perform in a reliable manner without a risk of energy hazard or electric shock developing, and such that they would not contribute significantly to the development of a serious fire hazard.

SAFETY OF INFORMATION TECHNOLOGY EQUIPMENT

**1 General****1.1 Scope****1.1.1 Equipment covered by this standard**

This standard is applicable to mains-powered or battery-powered information technology equipment, including electrical business equipment and associated equipment, with a RATED VOLTAGE not exceeding 600 V.

This standard is also applicable to such equipment designed and intended to be connected directly to a TELECOMMUNICATION NETWORK and forming part of a subscriber's installation, regardless of ownership and of responsibility for installation and maintenance, and regardless of the source of power.

This standard specifies requirements intended to ensure safety for the OPERATOR and layman who may come into contact with the equipment and, where specifically stated, for SERVICE PERSONNEL.

This standard is intended to ensure the safety of installed equipment, whether it consists of a system of interconnected units or independent units, subject to installing, operating and maintaining the equipment in the manner prescribed by the manufacturer.

Examples of equipment which is within the scope of this standard are:

accounting machines	monetary processing machines
book-keeping machines	including automated teller
calculators	(cash dispensing) machines
cash registers	motor-operated files
copying machines	PABXs
data circuit terminating	paper jogging machines
equipment (e.g. modems)	paper tape readers and punchers
data preparation equipment	paper trimmers (punchers,
data processing equipment	cutting machines, separators)
data terminal equipment	pencil sharpeners
dictation equipment	personal computers
document shredding machines	photoprinting equipment
duplicators	plotters
electrically operated drawing	point of sale terminals including
machines (plotters)	associated electronic scales
erasers	postage machines
facsimile equipment	staplers
key telephone systems	telephone answering machines
magnetic tape handlers	telephone sets
mail processing machines	teleprinters
micrographic office equipment	text processing equipment
modems	typewriters
	visual display units



This list is not intended to be comprehensive, and equipment that is not listed is not necessarily excluded from the scope.

1.1.2 Additional requirements



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

- equipment intended for operation while exposed, for example, to extremes of temperature; to excessive dust, moisture, or vibration; to flammable gases; to corrosive or explosive atmospheres;
- electromedical applications with physical connections to the patient;
- equipment intended to be used in vehicles, on board ships or aircraft, in tropical countries, or at elevations greater than 2 000 m;
- equipment subject to transient overvoltages exceeding Overvoltage Category II (also known as Installation Category II) according to IEC 664; additional protection might be necessary in the mains supply to the equipment;
- equipment intended for use where ingress of water is possible; for guidance on such requirements and on relevant testing, see annex T.



NOTE - Attention is drawn to the fact that authorities of some countries impose additional requirements.

1.1.3 Exclusions



This standard does not apply to:

- support equipment, such as air conditioning, fire detection or fire extinguishing systems; power supply systems, such as motor-generator sets, battery back-up systems and transformers, which are not an integral part of the equipment; building branch wiring;
- duplicating machines, including offset lithographic machines, which are intended primarily for sizes larger than A3 as specified in ISO 216;
- devices requiring no source of electrical power.



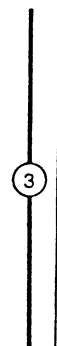
1.2 Definitions

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

Definitions in alphabetical order of nouns

Area, operator access	1.2.7.1
Area, service access	1.2.7.2
Body	1.2.7.5
Cables, interconnecting	1.2.11.7
Circuit, ELV	1.2.8.4
Circuit, limited current	1.2.8.6
Circuit, primary	1.2.8.1
Circuit, SELV	1.2.8.5
Circuit, secondary	1.2.8.2
Circuit, telecommunication network voltage (TNV)	1.2.8.8
Circuit, TNV-1	1.2.8.9
Circuit, TNV-2	1.2.8.10
Circuit, TNV-3	1.2.8.11
Classification, flammability, of materials	1.2.13.1
Clearance	1.2.10.2
Cord, detachable power supply	1.2.5.4
Cord, non-detachable power supply	1.2.5.5
Creepage distance	1.2.10.1
Current, rated	1.2.1.3
Cut-out, thermal	1.2.11.4
Cut-out, thermal, automatic reset	1.2.11.5
Cut-out, thermal, manual reset	1.2.11.6
Enclosure	1.2.6.1
Enclosure, electrical	1.2.6.4
Enclosure, fire	1.2.6.2
Enclosure, mechanical	1.2.6.3
Energy level, hazardous	1.2.8.7
Equipment, Class I	1.2.4.1
Equipment, Class II	1.2.4.2
Equipment, Class III	1.2.4.3
Equipment, direct plug-in	1.2.3.6
Equipment, fixed	1.2.3.4
Equipment, for building-in	1.2.3.5
Equipment, hand-held	1.2.3.2
Equipment, movable	1.2.3.1
Equipment, permanently connected	1.2.5.3
Equipment, pluggable, type A	1.2.5.1
Equipment, pluggable, type B	1.2.5.2
Equipment, stationary	1.2.3.3
Frequency, rated	1.2.1.4
Insulation, basic	1.2.9.2
Insulation, double	1.2.9.4
Insulation, operational	1.2.9.1
Insulation, reinforced	1.2.9.5
Insulation, supplementary	1.2.9.3
Interconnecting cables	1.2.11.7
Interlock, safety	1.2.7.6
Limit, explosion	1.2.13.10
Limiter, temperature	1.2.11.3
Load, normal	1.2.2.1
Location, restricted access	1.2.7.3
Material, 5V class	1.2.13.5
Material, HB class	1.2.13.8
Material, HBF class foamed	1.2.13.9
Material, HF-1 class foamed	1.2.13.6
Material, HF-2 class foamed	1.2.13.7
Material, V-0 class	1.2.13.2
Material, V-1 class	1.2.13.3
Material, V-2 class	1.2.13.4
Operation, continuous	1.2.2.3

Operation, intermittent	1.2.2.5
Operation, short-time	1.2.2.4
Operator	1.2.14.5
Part, decorative	1.2.6.5
Personnel, service	1.2.14.4
Range, rated frequency	1.2.1.5
Range, rated voltage	1.2.1.2
Surface, bounding	1.2.10.3
System, IT power	1.2.12.3
System, TN power	1.2.12.1
System, TT power	1.2.12.2
Telecommunication network	1.2.14.7
Telecommunication signal	1.2.14.8
Test, routine	1.2.14.2
Test, type	1.2.14.1
Thermostat	1.2.11.2
Time, rated operating	1.2.2.2
Tool	1.2.7.4
User	1.2.14.6
Voltage, d.c.	1.2.14.3
Voltage, hazardous	1.2.8.3
Voltage, rated	1.2.1.1
Voltage, working	1.2.9.6



1.2.1 *Equipment electrical ratings*

1.2.1.1 **RATED VOLTAGE:** The primary power voltage (for three-phase supply, the phase-to-phase voltage) as declared by the manufacturer.

1.2.1.2 **RATED VOLTAGE RANGE:** The primary power voltage range as declared by the manufacturer, expressed by its lower and upper RATED VOLTAGES.

1.2.1.3 **RATED CURRENT:** The input current of the equipment as declared by the manufacturer.

1.2.1.4 **RATED FREQUENCY:** The primary power frequency as declared by the manufacturer.

1.2.1.5 **RATED FREQUENCY RANGE:** The primary power frequency range as declared by the manufacturer, expressed by its lower and upper RATED FREQUENCIES.

1.2.2 *Operating conditions*

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

NORMAL LOAD conditions for some types of electrical business equipment are given in annex L.

1.2.2.2 **RATED OPERATING TIME:** The operating time assigned to the equipment by the manufacturer.

1.2.2.3 **CONTINUOUS OPERATION:** Operation under NORMAL LOAD for an unlimited period.



1.2.2.4 SHORT-TIME OPERATION: Operation under NORMAL LOAD for a specified period, starting from cold, the intervals after each period of operation being sufficient to allow the equipment to cool down to room temperature.

1.2.2.5 INTERMITTENT OPERATION: Operation in series of specified identical cycles each composed of a period of operation under NORMAL LOAD, followed by a rest period with the equipment switched off or running idle.

1.2.3 *Equipment mobility*

1.2.3.1 MOVABLE EQUIPMENT: Equipment which is either:

- 18 kg or less in mass and not fixed, or
- equipment with wheels, castors or other means to facilitate movement by the OPERATOR as required to perform its intended use.

1.2.3.2 HAND-HELD EQUIPMENT: MOVABLE EQUIPMENT, or a part of equipment, that is intended to be held in the hand during normal use.

1.2.3.3 STATIONARY EQUIPMENT: Equipment that is not MOVABLE EQUIPMENT.

1.2.3.4 FIXED EQUIPMENT: STATIONARY EQUIPMENT which is fastened or otherwise secured at a specific location.

1.2.3.5 EQUIPMENT FOR BUILDING-IN: Equipment intended to be installed in a prepared recess, such as in a wall, or similar situation.

NOTE - In general, EQUIPMENT FOR BUILDING-IN does not have an ENCLOSURE on all sides, as some of the sides will be protected after installation.

1.2.3.6 DIRECT PLUG-IN EQUIPMENT: Equipment that is intended to be used without a power supply cord; the mains plug forms an integral part of the equipment ENCLOSURE so that the weight of the equipment is taken by the socket-outlet.

1.2.4 *Classes of equipment — Protection against electric shock*

1.2.4.1 CLASS I EQUIPMENT: Equipment where protection against electric shock is achieved by:

- a) using BASIC INSULATION, and also
- b) providing a means of connecting to the protective earthing conductor in the building wiring those conductive parts that are otherwise capable of assuming HAZARDOUS VOLTAGES if the BASIC INSULATION fails.

NOTES

1 CLASS I EQUIPMENT may have parts with DOUBLE INSULATION or REINFORCED INSULATION, or parts operating in SELV CIRCUITS.

2 For equipment intended for use with a power supply cord, this provision includes a protective earthing conductor as part of the cord.

1.2.4.2 CLASS II EQUIPMENT: Equipment in which protection against electric shock does not rely on BASIC INSULATION only, but in which additional safety precautions, such as DOUBLE INSULATION or REINFORCED INSULATION, are provided, there being no reliance on either protective earthing or installation conditions.

NOTE 1 - This definition for CLASS II EQUIPMENT differs from the term CLASS II EQUIPMENT as used in IEC 536.

NOTE 2 - CLASS II EQUIPMENT may be of one of the following types:

- equipment having a durable and substantially continuous ELECTRICAL ENCLOSURE of insulating material which envelops all conductive parts, with the exception of small parts, such as nameplates, screws and rivets, which are isolated from parts at HAZARDOUS VOLTAGE by insulation at least equivalent to REINFORCED INSULATION; such equipment is called insulation-encased CLASS II EQUIPMENT;
- equipment having a substantially continuous metallic ELECTRICAL ENCLOSURE, in which DOUBLE or REINFORCED INSULATION is used throughout; such equipment is called metal-encased CLASS II EQUIPMENT;
- equipment which is a combination of the above two types.

1.2.4.3 CLASS III EQUIPMENT: Equipment in which protection against electric shock relies upon supply from SELV CIRCUITS and in which HAZARDOUS VOLTAGES are not generated.

1.2.5 Connection to the supply

1.2.5.1 PLUGGABLE EQUIPMENT TYPE A: Equipment which is intended for connection to the building installation wiring via a non-industrial plug and socket-outlet or a non-industrial appliance coupler, or both.

1.2.5.2 PLUGGABLE EQUIPMENT TYPE B: Equipment which is intended for connection to the building installation wiring via an industrial plug and socket-outlet or an appliance coupler, or both, complying with IEC 309, or with a comparable national standard.

1.2.5.3 PERMANENTLY CONNECTED EQUIPMENT: Equipment which is intended for connection to the building installation wiring by screw terminals.

1.2.5.4 DETACHABLE POWER SUPPLY CORD: A flexible cord, for supply purposes, intended to be connected to the equipment by means of a suitable appliance coupler.

1.2.5.5 NON-DETACHABLE POWER SUPPLY CORD: A flexible cord, for supply purposes, fixed to or assembled with the equipment.

Such a cord may be:

Ordinary: A flexible cord which can be easily replaced without special preparation of the cord or special TOOLS, or

Special: A flexible cord which is specially prepared, or requires the use of specially designed TOOLS for replacement, or is such that it cannot be replaced without damage to the equipment.

The term "specially prepared" includes provision of an integral cord guard, the use of cable lugs, formation of eyelets etc., but not the re-shaping of the conductor before introduction into a terminal or the twisting of a stranded conductor to consolidate the end.

1.2.6 Enclosures

1.2.6.1 ENCLOSURE: A part of the equipment providing one or more of the functions described in 1.2.6.2, 1.2.6.3 or 1.2.6.4.

1.2.6.2 FIRE ENCLOSURE: A part of the equipment intended to minimize the spread of fire or flames from within.

1.2.6.3 MECHANICAL ENCLOSURE: A part of the equipment intended to prevent injury due to mechanical and other physical hazards.

1.2.6.4 ELECTRICAL ENCLOSURE: A part of the equipment intended to prevent contact with parts at HAZARDOUS VOLTAGE or HAZARDOUS ENERGY LEVELS.

1.2.6.5 DECORATIVE PART: A part of the equipment, outside the ENCLOSURE, which has no safety function.

1.2.7 Accessibility

1.2.7.1 OPERATOR ACCESS AREA: An area to which, under normal operating conditions, one of the following applies:

- access can be gained without the use of a TOOL, or
- the means of access is deliberately provided to the OPERATOR, or
- the OPERATOR is instructed to enter regardless of whether or not a TOOL is needed to gain access.

The terms "access" and "accessible," unless qualified, relate to OPERATOR ACCESS AREA as defined above.

1.2.7.2 SERVICE ACCESS AREA: An area, other than an OPERATOR ACCESS AREA, where it is necessary for SERVICE PERSONNEL to have access even with the equipment switched on.

1.2.7.3 RESTRICTED ACCESS LOCATION: A location for equipment where both of the following dashed paragraphs apply:

- access can only be gained by SERVICE PERSONNEL or by USERS who have been instructed about the reasons for the restrictions applied to the location and about any precautions that must be taken; and
- access is through the use of a TOOL or lock and key, or other means of security, and is controlled by the authority responsible for the location.

NOTE - The requirements for equipment intended for installation in RESTRICTED ACCESS LOCATIONS are the same as for OPERATOR ACCESS AREAS, except for relaxations given in 2.1.4.2 and 5.1 and an additional requirement in 1.7.19.

1.2.7.4 TOOL: A screwdriver or any other object which may be used to operate a screw, latch or similar fixing means.

1.2.7.5 BODY: All accessible conductive parts, shafts of handles, knobs, grips and the like, and metal foil in contact with all accessible surfaces of insulating material.

1.2.7.6 SAFETY INTERLOCK: A means either of preventing access to a hazardous area until the hazard is removed, or of automatically removing the hazardous condition when access is gained.

1.2.8 Circuits and circuit characteristics

1.2.8.1 PRIMARY CIRCUIT: An internal circuit which is directly connected to the external supply mains or other equivalent source (such as a motor-generator set) which supplies the electric power. It includes the primary windings of transformers, motors, other loading devices and the means of connection to the supply mains.

1.2.8.2 SECONDARY CIRCUIT: A circuit which has no direct connection to primary power and derives its power from a transformer, converter or equivalent isolation device, or from a battery.

1.2.8.3 HAZARDOUS VOLTAGE: A voltage exceeding 42.4 V peak, or 60 V d.c., existing in a circuit which does not meet the requirements for either a LIMITED CURRENT CIRCUIT or a TNV CIRCUIT.

1.2.8.4 ELV CIRCUIT: A SECONDARY CIRCUIT with voltages between any two conductors of the ELV CIRCUIT, and between any one such conductor and earth, not exceeding 42.4 V peak, or 60 V d.c., under normal operating conditions, which is separated from HAZARDOUS VOLTAGE by at least BASIC INSULATION, and which neither meets all of the requirements for an SELV CIRCUIT nor meets all of the requirements for a LIMITED CURRENT CIRCUIT.

1.2.8.5 SELV CIRCUIT: A SECONDARY CIRCUIT which is so designed and protected that, under normal and single fault conditions, its voltages do not exceed a safe value.

NOTES

- 1 The limiting values of voltage under normal operating and single fault conditions are specified in 2.3. See also annex V and table V.1.
- 2 This definition of an SELV CIRCUIT differs from the term SELV as used in IEC 364.

1.2.8.6 LIMITED CURRENT CIRCUIT: A circuit which is so designed and protected that, under both normal conditions and a likely fault condition, the current which can be drawn is not hazardous.

NOTE - The limiting values are specified in 2.4.

1.2.8.7 HAZARDOUS ENERGY LEVEL: A stored energy level of 20 J or more, or an available continuous power level of 240 VA or more, at a potential of 2 V or more.

1.2.8.8 TELECOMMUNICATION NETWORK VOLTAGE (TNV) CIRCUIT: A circuit in the equipment to which the accessible area of contact is limited and that is so designed and protected that, under normal operating and single fault conditions, the voltages do not exceed specified limiting values.

A TNV CIRCUIT is considered to be a SECONDARY CIRCUIT in the meaning of this standard.

NOTE - The specified limiting values of voltages under normal operating and single fault conditions are in 6.2.1.1. See also annex V. Requirements regarding accessibility for TNV CIRCUITS are in 6.2.2.

TNV CIRCUITS are classified as TNV-1, TNV-2 and TNV-3 CIRCUITS as defined in 1.2.8.9, 1.2.8.10, 1.2.8.11 and as shown in table V.1.

1.2.8.9 TNV-1 CIRCUIT: A TNV CIRCUIT:

- whose normal operating voltages do not exceed the limits for an SELV CIRCUIT under normal operating conditions,
- on which overvoltages from TELECOMMUNICATION NETWORKS are possible.

4

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1.2.8.10 TNV-2 CIRCUIT: A TNV CIRCUIT:

- whose normal operating voltages exceed the limits for an SELV CIRCUIT under normal operating conditions,
- which is not subject to overvoltages from TELECOMMUNICATION NETWORKS.

1.2.8.11 TNV-3 CIRCUIT: A TNV CIRCUIT:

- whose normal operating voltages exceed the limits for an SELV CIRCUIT under normal operating conditions,
- on which overvoltages from TELECOMMUNICATION NETWORKS are possible.

1.2.9 *Insulation*

1.2.9.1 OPERATIONAL INSULATION: Insulation needed for the correct operation of the equipment.

NOTE - OPERATIONAL INSULATION by definition does not protect against electric shock. It may, however, serve to minimize exposure to ignition and fire.

1.2.9.2 BASIC INSULATION: Insulation to provide basic protection against electric shock.

1.2.9.3 SUPPLEMENTARY INSULATION: Independent insulation applied in addition to BASIC INSULATION in order to ensure protection against electric shock in the event of a failure of the BASIC INSULATION.

1.2.9.4 **DOUBLE INSULATION:** Insulation comprising both BASIC INSULATION and SUPPLEMENTARY INSULATION.

1.2.9.5 **REINFORCED INSULATION:** A single insulation system which provides a degree of protection against electric shock equivalent to DOUBLE INSULATION under the conditions specified in this standard.

NOTE - The term "insulation system" does not imply that the insulation has to be in one homogeneous piece. It may comprise several layers which cannot be tested as SUPPLEMENTARY or BASIC INSULATION.

1.2.9.6 **WORKING VOLTAGE:** The highest voltage to which the insulation under consideration is, or can be, subjected when the equipment is operating at its RATED VOLTAGE under conditions of normal use.

NOTE - See 2.2.7.

1.2.9.7 Deleted – reserved for future use.

1.2.10 *Creepage distances and clearances*

1.2.10.1 **CREEPAGE DISTANCE:** The shortest path between two conductive parts, or between a conductive part and the BOUNDING SURFACE of the equipment, measured along the surface of the insulation.

1.2.10.2 **CLEARANCE:** The shortest distance between two conductive parts, or between a conductive part and the BOUNDING SURFACE of the equipment, measured through air.

1.2.10.3 **BOUNDING SURFACE:** The outer surface of the ELECTRICAL ENCLOSURE, considered as though metal foil were pressed into contact with accessible surfaces of insulating material.

1.2.11 *Components*

1.2.11.1 Deleted – reserved for future use.

1.2.11.2 **THERMOSTAT:** A cycling temperature-sensing control, which is intended to keep a temperature between two particular values under normal operating conditions and which may have provision for setting by the OPERATOR.

1.2.11.3 **TEMPERATURE LIMITER:** A temperature-sensing control which is intended to keep a temperature below or above one particular value during normal operating conditions and which may have provision for setting by the OPERATOR.

NOTE - A TEMPERATURE LIMITER may be of the automatic reset or of the manual reset type. It does not make the reverse operation during the normal duty cycle of the equipment.

1.2.11.4 **THERMAL CUT-OUT:** A temperature-sensing control intended to operate under abnormal operating conditions and which has no provision for the OPERATOR to change the temperature setting.

NOTE - A THERMAL CUT-OUT may be of the automatic reset or of the manual reset type.

1.2.11.5 THERMAL CUT-OUT, AUTOMATIC RESET: A THERMAL CUT-OUT which automatically restores the current after the relevant part of the equipment has cooled down sufficiently.

1.2.11.6 THERMAL CUT-OUT, MANUAL RESET: A THERMAL CUT-OUT which requires resetting by hand, or replacement of a part, in order to restore the current.

1.2.11.7 INTERCONNECTING CABLE: A cable that is external to the equipment and that is used to electrically connect an accessory to a unit of Information Technology Equipment, to interconnect units in a system or to connect a unit to a TELECOMMUNICATION NETWORK; such cable may carry any type of circuit from one unit to another.



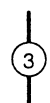
1.2.12 Power distribution

1.2.12.1 TN POWER SYSTEM: A power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to that point by protective earth conductors. Three types of TN POWER SYSTEMS are recognized according to the arrangement of neutral and protective earth conductors, as follows:



- TN-S system: having separate neutral and protective earth conductors throughout the system;
- TN-C-S system: in which neutral and protective functions are combined in a single conductor in a part of the system;
- TN-C system: in which neutral and protective functions are combined in a single conductor throughout the system.

Some TN POWER SYSTEMS are supplied from a secondary winding of a transformer that has an earthed centre tap (neutral). Where the two phase conductors and the neutral conductor are available, these systems are commonly known as a "single-phase, 3-wire power system".



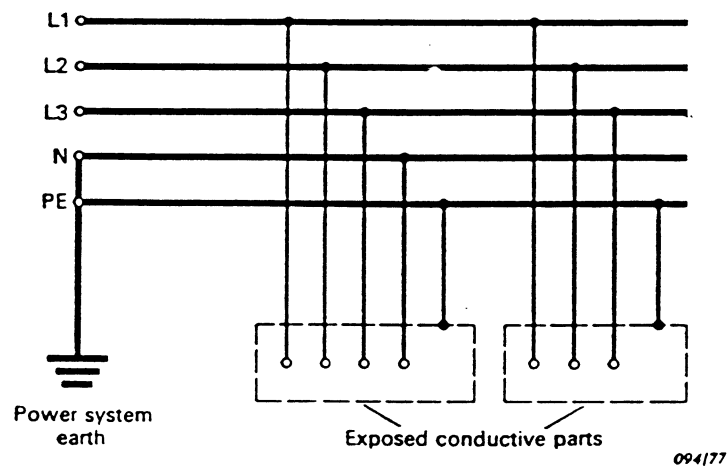


Figure 1 - Example of TN-S power system

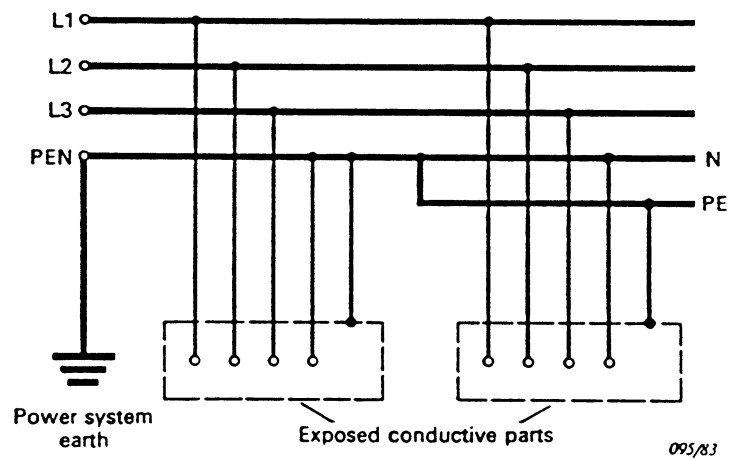


Figure 2 - Example of TN-C-S power system

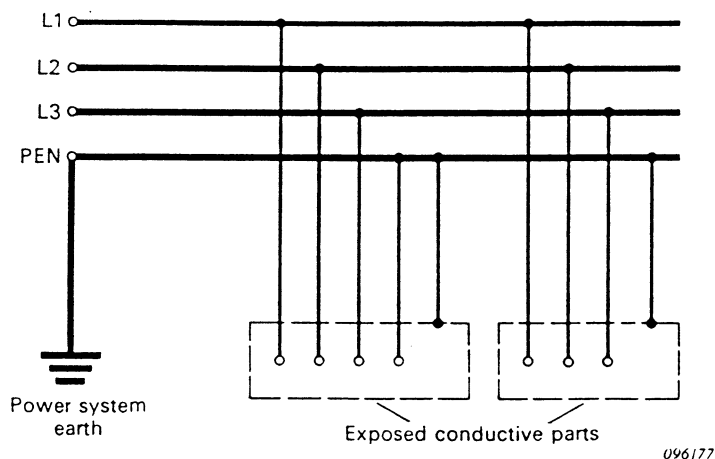


Figure 3 - Example of TN-C power system

1.2.12.2 TT POWER SYSTEM: A power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system.

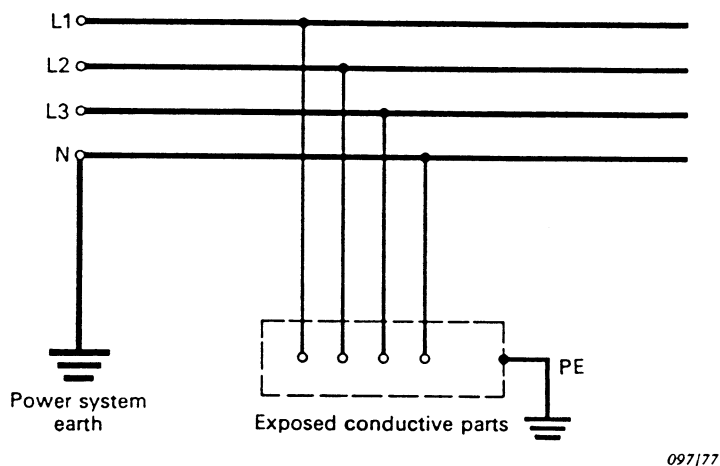


Figure 4 - Example of TT power system

1.2.12.3 IT POWER SYSTEM: A power distribution system having no direct connection to earth, the exposed conductive parts of the electrical installation being earthed.

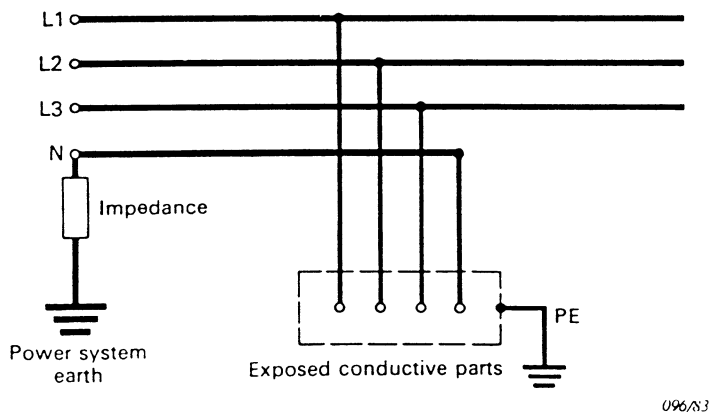


Figure 5 - Example of IT power system

1.2.13 *Flammability*

1.2.13.1 FLAMMABILITY CLASSIFICATION OF MATERIALS: The recognition of the ignition and burning resistance characteristics of materials other than metal or ceramic. Materials are classified as in 1.2.13.2 to 1.2.13.9 when tested in accordance with annex A.

NOTES

1 When applying the requirements in this standard, HF-1 CLASS FOAMED MATERIALS are regarded as better than those of CLASS HF-2, and HF-2 better than HBF.

2 Similarly, other MATERIALS, including rigid (engineering structural) foam of CLASSES 5V or V-0 are regarded as better than those of CLASS V-1, V-1 better than V-2, and V-2 better than HB.

1.2.13.2 V-0 CLASS MATERIAL: A material that, when tested in accordance with clause A.6, may flame or glow but will extinguish in an average period of time not exceeding 5 s; glowing particles or flaming drops released do not ignite surgical cotton.

1.2.13.3 V-1 CLASS MATERIAL: A material that, when tested in accordance with clause A.6, may flame or glow but will extinguish in an average period of time not exceeding 25 s; glowing particles or flaming drops released do not ignite surgical cotton.

1.2.13.4 V-2 CLASS MATERIAL: A material that, when tested in accordance with clause A.6, may flame or glow but will extinguish within an average period of time not exceeding 25 s; glowing particles or flaming drops released may ignite surgical cotton.

1.2.13.5 5V CLASS MATERIAL: A material that, when tested in accordance with clause A.9, may flame or glow but will extinguish within a prescribed period of time; glowing particles or flaming drops released do not ignite surgical cotton.

NOTE - Clause A.9 may be withdrawn as soon as IEC 707 is amended to include flammability Class 5V or its possible substitute.

1.2.13.6 HF-1 CLASS FOAMED MATERIAL: A foamed material that, when tested in accordance with clause A.7, may flame or glow but will extinguish within a prescribed period of time; flaming or glowing particles, or flaming drops released do not ignite surgical cotton.

1.2.13.7 HF-2 CLASS FOAMED MATERIAL: A foamed material that, when tested in accordance with clause A.7, may flame or glow but will extinguish within a prescribed period of time; flaming or glowing particles, or flaming drops released may ignite surgical cotton.

1.2.13.8 HB CLASS MATERIAL: Material that, when tested in accordance with clause A.8, does not exceed a specified maximum burning rate.

1.2.13.9 HBF CLASS FOAMED MATERIAL: A foamed material that, when tested in accordance with clause A.7, does not exceed a specified maximum burning rate.

1.2.13.10 EXPLOSION LIMIT: The lowest concentration of a combustible material in a mixture containing any of the following: gases, vapours, mists or dusts, in which a flame is able to propagate after removal of the ignition source.

1.2.14 *Miscellaneous*

1.2.14.1 TYPE TEST: Testing of a representative sample of the equipment with the objective of determining if the equipment, as designed and manufactured, can meet the requirements of this standard.

1.2.14.2 ROUTINE TEST: A test made on each individual device during or after manufacture to check if it complies with the requirements of the standard concerned or the criteria specified [IEV 151-04-16].

1.2.14.3 D.C. VOLTAGE: The average value of a voltage (as measured by a moving coil meter) having a peak-to-peak ripple not exceeding 10% of the average value.

NOTE — Where peak-to-peak ripple exceeds 10% of the average value, the requirements related to peak voltage are applicable.

1.2.14.4 SERVICE PERSONNEL: Persons having appropriate technical training and experience necessary to be aware of hazards to which they are exposed in performing a task and of measures to minimise the danger to themselves or other persons.

1.2.14.5 OPERATOR: Any person, other than SERVICE PERSONNEL.

The term OPERATOR in this standard is the same as the term USER and the two can be interchanged.

1.2.14.6 USER: See OPERATOR (1.2.14.5)

1.2.14.7 TELECOMMUNICATION NETWORK: A metallically terminated transmission medium intended for communication between equipments that may be located in separate buildings, excluding:

- the mains systems for supply, transmission and distribution of electrical power, if used as a telecommunication transmission medium; and
- TV distribution systems using cable; and
- SELV CIRCUITS connecting units of data processing equipment.

NOTES

1 The term TELECOMMUNICATION NETWORK is defined in terms of its functionality, not its electrical characteristics. A TELECOMMUNICATION NETWORK is not itself defined as being either an SELV CIRCUIT or a TNV CIRCUIT. Only the circuits in the equipment are so classified.

2 A TELECOMMUNICATION NETWORK may be

- publicly or privately owned;
- subject to transient overvoltages due to atmospheric discharges and faults in power distribution systems;
- subject to permanent longitudinal (common mode) voltages induced from nearby power lines or electric traction lines.

3 Examples of TELECOMMUNICATION NETWORKS are

- a public switched telephone network;
- a public data network;
- an ISDN network;
- a private network with electrical interface characteristics similar to the above.

1.2.14.8 Deleted - reserved for future use

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1.3 General requirements



1.3.1 Equipment design and construction

Equipment shall be so designed and constructed that, under all conditions of normal use and under a likely fault condition, it protects against risk of personal injury from electric shock and other hazards, and against serious fire originating in the equipment, within the meaning of this standard.

Where the equipment involves technologies and materials or methods of construction not specifically covered, the equipment shall provide a level of safety not less than that generally afforded by this standard and the Principles of Safety contained herein.



Unless otherwise specified, compliance is checked by inspection and by carrying out all the relevant tests.



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

1.3.2 User information



Sufficient information shall be provided to the user concerning any condition necessary to ensure that, when used as prescribed by the manufacturer, the equipment will not present a hazard within the meaning of this standard (see 1.7.2).

Compliance is checked by inspection.



1.3.3 Classification of equipment

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

CLASS I, or
CLASS II, or
CLASS III.

NOTE - Equipment containing ELV CIRCUITS or parts at HAZARDOUS VOLTAGE is Class I or Class II. There are no requirements in this standard for protection against electric shock for CLASS III EQUIPMENT.

1.4 General conditions for tests

1.4.1 The requirements and tests detailed in this standard shall be applied only if safety is involved. If it is evident from the design and construction of the equipment that a particular test is not applicable, the test shall not be made.

In order to establish whether or not safety is involved, the circuits and construction shall be carefully investigated to take into account the consequences of possible failures.



1.4.2 Except where otherwise stated, the tests specified in this standard are TYPE TESTS.

1.4.3 The sample or samples under test shall be representative of the equipment the USER would receive, or shall be the actual equipment ready for shipment to the USER.



As an alternative to carrying out tests on the complete equipment, tests may be carried out separately on circuits, components or sub-assemblies outside the equipment, provided that inspection of the equipment and circuit arrangements ensures that such testing will indicate that the assembled equipment would conform to the requirements of the standard. If any such test indicates a likelihood of non-conformance in the complete equipment, the test shall be repeated in the equipment.

If a test specified in this standard could be destructive, it is permitted to use a model to represent the condition to be evaluated.

NOTES

1 The tests should be carried out in the following order:

- component or material pre-selection;
- component or sub-assembly bench tests;
- tests where the equipment is not energized;
- live tests:
 - under normal operating conditions;
 - under abnormal operating conditions;
 - involving likely destruction.

2 In view of the amount of resource involved in testing and in order to minimize waste, it is recommended that all parties concerned jointly consider the test programme, the test samples and the test sequence.

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

- supply voltage,
- supply frequency,
- physical location of equipment and position of movable parts,
- operating mode,
- adjustment of THERMOSTATS, regulating devices or similar controls in OPERATOR ACCESS AREAS, which are:
 - adjustable without the use of a TOOL, or
 - adjustable using a means, such as a key or a TOOL, deliberately provided for the OPERATOR.

1.4.5 In determining the most unfavourable supply voltage for a test, the following variables shall be taken into account:

- multiple RATED VOLTAGES,
- extremes of RATED VOLTAGE RANGES,
- tolerance on RATED VOLTAGE as declared by the manufacturer.

If no tolerance is declared by the manufacturer, it shall be taken as +6% and –10%. If the rated voltage is 230 V single phase or 400 V three phase, the tolerance shall not be less than +10% and –10% (see 1.6.5).

When testing equipment designed for d.c. only, the possible influence of polarity shall be taken into account.

1.4.6 In determining the most unfavourable supply frequency for a test, different RATED FREQUENCY within the RATED FREQUENCY RANGE shall be taken into account (e.g. 50 Hz and 60 Hz) but consideration of the tolerance on a RATED FREQUENCY (e.g. 50 Hz $\pm$ 0,5 Hz) is not normally necessary.

1.4.7 Where a maximum temperature ($T_{\max}$) or a maximum temperature rise ($\Delta T_{\max}$) is specified for compliance with tests, it is based on the assumption that the room ambient air temperature will be 25 °C when the equipment is operating. However, the manufacturer may specify a higher ambient air temperature.

It is not necessary to maintain the ambient temperature (T_{amb}) at a specific value during tests, but it shall be monitored and recorded.

Temperatures measured on the equipment shall conform with one of the following conditions, all temperatures being in °C:

if $T_{\max}$ is specified: $(T - T_{\text{amb}}) \leq (T_{\max} - T_{\text{mra}})$

if $\Delta T_{\max}$ is specified: $(T - T_{\text{amb}}) \leq (\Delta T_{\max} + 25 - T_{\text{mra}})$

where:

T = the temperature of the given part measured under the prescribed test conditions, and

T_{mra} = the maximum room ambient temperature permitted by the manufacturer's specification or 25 °C, whichever is greater.

During the test, the room ambient temperature should not exceed T_{mra} unless agreed by all parties involved.

The classification of insulating materials (classes A, E, B, F and H) is in accordance with IEC 85.

1.4.8 Unless a particular method is specified, the temperatures of windings shall be determined either by the thermocouple method or by the resistance method (annex E). The temperatures of parts other than windings shall be determined by the thermocouple method. Any other suitable method of temperature measurement which does not noticeably influence the thermal balance and which achieves an accuracy sufficient to show compliance is also permitted. The choice of and position of temperature sensors shall be made so that they have minimum effect on the temperature of the part under test.

1.4.9 In determining of the input current, and where other test results could be affected, the following variables shall be considered and adjusted to give the most unfavourable results:

- loads due to optional features, offered or provided by the manufacturer for inclusion in or with the equipment under test;
- loads due to other units of equipment intended by the manufacturer to draw power from the equipment under test;
- loads which could be connected to any standard supply outlets in OPERATOR ACCESS AREAS on the equipment, up to the value indicated in the marking required by 1.7.5.

It is permitted to use artificial loads to simulate such loads during testing.

1.4.10 *Conductive liquids*

For the electrical requirements of this standard, conductive liquids shall be treated as conductive parts.

1.4.11 *Electrical measuring instruments*

Electrical measuring instruments shall have adequate bandwidth to provide accurate readings, taking into account all components (d.c., mains supply frequency, high frequency and harmonic content) of the parameter being measured. If the r.m.s. value is being measured, care shall be taken that measuring instruments give true r.m.s. readings of non-sinusoidal waveforms as well as sinusoidal waveforms.

1.4.12 *Simulated faults and abnormal conditions*

Where it is required to apply simulated faults or abnormal operating conditions, these shall be applied in turn and one at a time. Faults which are the direct consequence of the deliberate fault or abnormal operating condition are considered to be part of that deliberate fault or abnormal operating condition.

The equipment, circuit diagrams and component specifications are examined to determine those fault conditions that might reasonably be expected to occur. Examples include:

- short circuits and open circuits of semiconductor devices and capacitors;
- faults causing continuous dissipation in resistors designed for intermittent dissipation;
- internal faults in integrated circuits causing excessive dissipation;
- failure of BASIC INSULATION between current-carrying parts of the PRIMARY CIRCUIT and
 - accessible conductive parts,
 - earthed conductive screens,
 - parts of SELV CIRCUITS,
 - parts of LIMITED CURRENT CIRCUITS.

1.4.13 *Measurement of voltage to earth*

Where the standard specifies a voltage between a conductive part and earth, all of the following earthed parts are considered:

- the protective earthing terminal (if any); and
- any other conductive part required to be connected to protective earth (for example, see 2.5.2); and
- any conductive part that is earthed within the equipment for functional reasons.

Parts that will be earthed in the application by connection to other equipment, but are unearthed (floating) in the equipment as tested, shall be connected to earth at the point by which the highest voltage is obtained. Voltage drop in the protective earthing conductor of the power supply cord, or in an earthed conductor in other external wiring, is not included in the measurements.

1.4.14 *Equivalent materials*

Where the standard specifies BASIC or SUPPLEMENTARY INSULATION, the use of a better grade of insulation is permitted. Similarly, where the standard requires material of a particular FLAMMABILITY CLASS, the use of a better material is permitted.

1.5 *Components*

1.5.1 *General*

Where safety is involved, components shall comply either with the requirements of this standard or with the safety aspects of the relevant IEC component standards.

NOTE 1 - An IEC component standard is considered relevant only if the component in question clearly falls within its scope.

A component which is to be connected to an SELV CIRCUIT and also to an ELV CIRCUIT or to a part at HAZARDOUS VOLTAGE shall comply with the requirements of 2.3.

NOTE 2 - An example of such a component is a relay with different supplies connected to different elements (coils and contacts).

1.5.2 *Evaluation and testing of components*

Evaluation and testing of components shall be carried out as follows:

- *A component that has been demonstrated to comply with a standard harmonized with the relevant IEC component standard shall be checked for correct application and use in accordance with its rating. It shall be subjected to the applicable tests of this standard as part of the equipment with the exception of those tests which are part of the relevant IEC component standard;*
- *a component that has not been demonstrated to comply with a relevant standard as above shall be checked for correct application and use in accordance with its specified rating. It shall be subjected to the applicable tests of this standard, as part of the equipment, and to the applicable tests of the component standard, under the conditions occurring in the equipment;*

NOTE - The applicable test for compliance with a component standard is, in general, carried out separately. The number of test samples is, in general, the same as that required in the component standard.

- *where no relevant IEC component standard exists, or where components are used in circuits not in accordance with their specified ratings, the components shall be tested under the conditions occurring in the equipment. The number of samples required for test is, in general, the same as required by an equivalent standard;*
- *thermal controls shall be tested in accordance with annex K.*