

BS EN 60065:2014+A11:2017

Incorporating corrigenda December 2015 and December 2016



BSI Standards Publication

Audio, video and similar electronic apparatus — Safety requirements (IEC 60065:2014, modified)

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National foreword

This British Standard is the UK implementation of EN 60065:2014+A11:2017. It is derived from IEC 60065:2014, incorporating corrigenda December 2015 and December 2016. It supersedes BS EN 60065:2014 which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags **Ⓒ** **Ⓒ**.

The UK participation in its preparation was entrusted to Technical Committee EPL/108, Safety of electronic equipment within the field of audio/video, information technology and communication technology.

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.

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Published by BSI Standards Limited 2016

ISBN 978 0 580 93634 0

ICS 97.020

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2015.

Amendments/corrigenda issued since publication

Date	Text affected
31 July 2017	Implementation of IEC corrigendum December 2015: Subclause 9.1.1.2 updated
31 July 2017	Implementation of IEC corrigendum December 2016: Subclause 12.7.1 updated
31 July 2017	Implementation of CENELEC amendment A11:2017: Italian A-deviation removed from Annex ZC

English Version

Audio, video and similar electronic apparatus - Safety
requirements
(IEC 60065:2014, modified)

Appareils audio, vidéo et appareils électroniques analogues
- Exigences de sécurité
(CEI 60065:2014, modifiée)

Audio-, Video- und ähnliche elektronische Geräte -
Sicherheitsanforderungen
(IEC 60065:2014, modifiziert)

This European Standard was approved by CENELEC on 2014-11-17. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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

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Foreword

This document (EN 60065:2014) consists of the text of IEC 60065:2014 prepared by IEC/TC 108 "Safety of electronic equipment within the field of audio/video, information technology and communication technology", together with the common modifications prepared by CLC/TC 108X "Safety of electronic equipment within the fields of Audio/Video, Information Technology and Communication Technology".

The following dates are fixed:

- latest date by which the document has to be implemented at national level (dop) 2015-11-17
by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-11-17

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

EN 60065:2014 supersedes EN 60065:2002.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60065:2014 are prefixed "Z".

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60065:2014 was approved by CENELEC as a European Standard with agreed common modifications.

Foreword to amendment A11

This document (EN 60065:2014/A11:2017) has been prepared by CLC/TC 108X "Safety of electronic equipment within the fields of Audio/Video, Information Technology and Communication Technology".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-12-14
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2019-12-14

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
-	-	Safety of toys - Part 1: Mechanical and physical properties	EN 71-1	-
-	-	Sound system equipment: Headphones and earphones associated with personal music players - Maximum sound pressure level measurement methodology - Part 1: General method for "one package equipment"	EN 50332-1	-
-	-	Sound system equipment: Headphones and earphones associated with personal music players - Maximum sound pressure level measurement methodology - Part 2: Matching of sets with headphones if either or both are offered separately, or are offered as one package equipment but with standardised connectors between the two allowing to combine components of different manufacturers or different design	EN 50332-2	-
IEC 60027	series	Letter symbols to be used in electrical technology	EN 60027	series
IEC 60038 (mod)	2009	IEC standard voltages	EN 60038	2011
IEC 60068-2-6	2007	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	2008
IEC 60068-2-31	2008	Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens	EN 60068-2-31	2008
IEC 60068-2-75	-	Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-78	-	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	-
IEC 60085	-	Electrical insulation - Thermal evaluation and designation	EN 60085	-
IEC 60086-4	-	Primary batteries - Part 4: Safety of lithium batteries	EN 60086-4	-
IEC 60107-1	1997	Methods of measurement on receivers for television broadcast transmissions - Part 1: General considerations - Measurements at radio and video frequencies	EN 60107-1	1997
IEC 60112 + corr. June + corr. October + A1	2003 2003 2003 2009	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112 - - + A1	2003 - - 2009
IEC 60127	series	Miniature fuses	EN 60127	series
IEC 60127-6	-	Miniature fuses - Part 6: Fuse-holders for miniature cartridge fuse-links	EN 60127-6	-
IEC 60167	1964	Methods of test for the determination of the insulation resistance of solid insulating materials	HD 568 S1 ¹⁾	1990
IEC 60216	series	Electrical insulating materials - Thermal endurance properties	EN 60216	series
IEC 60227 (mod)	series	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V	HD 21 ²⁾	series
IEC 60227-2 + corr. April	1997 1998	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 2: Test methods	-	-
IEC 60245	series	Rubber insulated cables - Rated voltages up to and including 450/750 V	-	-
IEC 60249-2	series	Base materials for printed circuits - Part 2: Specifications	-	-
IEC 60268-1	1985	Sound system equipment - Part 1: General	HD 483.1 S2 ³⁾	1989

1) HD 568 S1:1990 is partially superseded by EN 62631-1:2011, which is based on IEC 62631-1:2011.

2) The HD 21 series is related to, but not directly equivalent with the IEC 60227 series. Also EN 50363, EN 50395 and EN 50396 are to be taken into account.

3) HD 483.1 S2:1989 includes A1:1998 to IEC 60268-1:1985.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60317-43	-	Specifications for particular types of winding wires - Part 43: Aromatic polyimide tape wrapped round copper wire, class 240	EN 60317-43	-
IEC 60320	series	Appliance couplers for household and similar general purposes	EN 60320	series
IEC 60320-1	-	Appliance couplers for household and similar general purposes - Part 1: General requirements	EN 60320-1	-
IEC 60335-1	-	Household and similar electrical appliances - Safety - Part 1: General requirements	EN 60335-1	-
IEC 60384-1 + corr. November	2008 2008	Fixed capacitors for use in electronic equipment - Part 1: Generic specification	EN 60384-1 -	2009 -
IEC 60384-14	2005	Fixed capacitors for use in electronic equipment - Part 14: Sectional specification - Fixed capacitors for electromagnetic interference suppression and connection to the supply mains	EN 60384-14 4)	2005
IEC 60410	1973	Sampling plans and procedures for inspection - by attributes		-
IEC 60417-DB		Graphical symbols for use on equipment, <i>available from:</i> < http://www.graphical-symbols.info/equipment >	-	-
IEC 60454	series	Pressure-sensitive adhesive tapes for electrical purposes	EN 60454	series
IEC 60529 -	1989 -	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May	1991 1993
IEC 60664-1	2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	2007
IEC 60664-3	-	Insulation coordination for equipment within low-voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	-
IEC 60691	2002	Thermal-links - Requirements and application guide	EN 60691	2003
IEC 60695-11-5	2004	Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance	EN 60695-11-5	2005

4) EN 60384-14:2005 is superseded by EN 60384-14:2013, which is based on IEC 60384-14:2013.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60695-11-10	2013	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	2013
IEC 60730-1 (mod)	2010	Automatic electrical controls for household and similar use - Part 1: General requirements	EN 60730-1	2011
IEC 60747-5-5 + A1	2007 2013	Semiconductor devices - Discrete devices - Part 5-5: Optoelectronic devices - Photocouplers	EN 60747-5-5 -	2011 -
IEC 60825-1 + corr. August	2007 2008	Safety of laser products - Part 1: Equipment classification and requirements	EN 60825-1 ⁵⁾	2007
IEC 60851-3	2009	Winding wires - Test methods - Part 3: Mechanical properties	EN 60851-3	2009
IEC 60851-5	2008	Winding wires - Test methods - Part 5: Electrical properties	EN 60851-5	2008
IEC 60851-6	2012	Winding wires - Test methods - Part 6: Thermal properties	EN 60851-6	2012
IEC 60906	series	IEC system of plugs and socket-outlets for household and similar purposes	-	-
IEC 60950-1 (mod) + corr. August - + corr. August - + A1 (mod) + corr. August - + A2 (mod)	2005 2006 - 2013 - 2009 2012 - 2013	Information technology equipment - Safety - Part 1: General requirements	EN 60950-1 - + AC:2011 - + A11 + A1 - + A12 + A2	2006 - 2011 - 2009 2010 - 2011 2013
IEC 60990	-	Methods of measurement of touch current and protective conductor current	EN 60990	-
IEC 60998-2-2	-	Connecting devices for low-voltage circuits for household and similar purposes - Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units	EN 60998-2-2	-
IEC 60999-1	-	Connecting devices - Electrical copper conductors - Safety requirements for screw- type and screwless-type clamping units - Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm ² up to 35 mm ² (included)	EN 60999-1	-

5) EN 60825-1:2007 is superseded by EN 60825-1:2014, which is based on IEC 60825-1:2014.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60999-2	-	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units - Part 2: Particular requirements for clamping units for conductors above 35 mm ² up to 300 mm ² (included)	EN 60999-2	-
IEC 61032 + corr. January	1997 2003	Protection of persons and equipment by enclosures - Probes for verification	EN 61032 -	1998 -
IEC 61051-2 + A1	1991 2009	Varistors for use in electronic equipment - Part 2: Sectional specification for surge suppression varistors	-	-
IEC 61058-1 (mod) + corr. January	2000 2009	Switches for appliances - Part 1: General requirements	EN 61058-1 ⁶⁾ -	2002 -
IEC/TR 61149	-	Guide for safe handling and operation of mobile radio equipment	-	-
IEC 61260	-	Electroacoustics - Octave-band and fractional-octave-band filters	EN 61260	-
IEC 61293	-	Marking of electrical equipment with ratings related to electrical supply - Safety requirements	EN 61293	-
IEC 61558-1 - + corr. March + corr. March + corr. April + A1	2005 - 2008 2010 2011 2009	Safety of power transformers, power supplies, reactors and similar products - Part 1: General requirements and tests	EN 61558-1 + corr. August - - - + A1	2005 2006 - - - 2009
IEC 61558-2-16	-	Safety of transformers, reactors, power supply units and similar products for voltages up to 1 100 V - Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units	EN 61558-2-16	-
IEC 61965	-	Mechanical safety of cathode ray tubes	EN 61965	-
IEC 62133	-	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications	EN 62133	-
IEC 62151 + corr. March + corr. June	2000 2001 2001	Safety of equipment electrically connected to a telecommunication network	-	-

6) EN 61058-1:2002 includes A1:2001 to IEC 61058-1:2000 (mod).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62368-1	-	Audio/video, information and communication technology equipment - Part 1: Safety requirements	EN 62368-1	-
IEC 62471 (mod)	2006	Photobiological safety of lamps and lamp systems	EN 62471	2008
IEC Guide 104	-	The preparation of safety publications and the use of basic safety publications and group safety publications	-	-
IEC Guide 112	-	Guide on the safety of multimedia equipment	-	-
ISO 261	-	ISO general-purpose metric screw threads - General plan	-	-
ISO 262	-	ISO general-purpose metric screw threads - Selected sizes for screws, bolts and nuts	-	-
ISO 306	2004	Plastics - Thermoplastic materials - Determination of Vicat softening temperature (VST)	EN ISO 306 7)	2004
ISO 2859-1 + corr. March	1999 2001	Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection	-	-
ISO 7000 DB		Graphical symbols for use on equipment - Registered symbols, available from: < http://www.graphical-symbols.info/equipment >	-	-
ISO 9773	-	Plastics - Determination of burning behaviour of flexible vertical specimens in contact with a small-flame ignition source	-	-
ITU-T Recommendation K.44	-	Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents - Basic Recommendation	-	-

7) EN ISO 306:2004 is superseded by EN ISO 306:2013, which is based on ISO 306:2013.

Annex ZB (normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

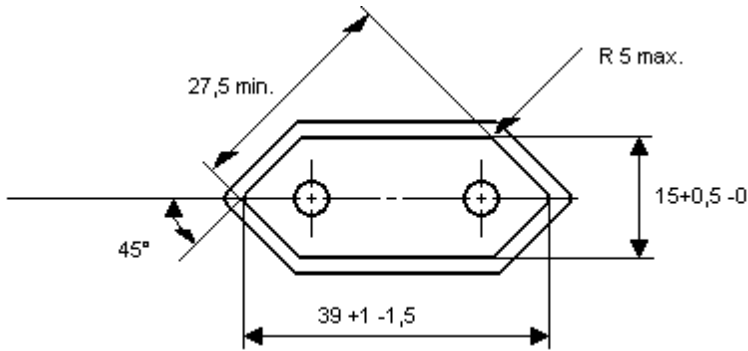
NOTE If it affects harmonization, it forms part of the European Standard.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Clause	Special national condition
2.6.1	Denmark The following is added: Certain types of Class I apparatus, see 15.1.1, may be provided with a plug not establishing earthing continuity when inserted in Danish socket-outlets <i>Justification:</i> Heavy Current Regulations, Section 6c
3.21	Denmark Add to the end of the subclause Due to many existing installations where the socket-outlets can be protected with fuses with higher rating than the rating of the socket-outlets the protection for pluggable equipment type A shall be an integral part of the equipment. <i>Justification:</i> In Denmark an existing 13 A socket outlet can be protected by a 20 A fuse.
5.4	Denmark, Finland, Norway and Sweden To the end of the subclause the following is added: CLASS I apparatus which is intended for connection to the building installation wiring via a plug or an appliance coupler, or both and in addition is intended for connection to other apparatus or a network shall, if safety relies on connection to protective earth or if surge suppressors are connected between the network TERMINALS and ACCESSIBLE parts, have a marking stating that the apparatus must be connected to an earthed MAINS socket-outlet. The marking text in the applicable countries shall be as follows: In Denmark: "Apparatets stikprop skal tilsluttes en stikkontakt med jord, som giver forbindelse til stikproppens jord." In Finland: "Laitte on liitettävä suojakoskettimilla varustettuun pistorasiaan" In Norway: "Apparatet må tilkoples jordet stikkontakt" In Sweden: "Apparaten skall anslutas till jordat uttag"

Clause	Special national condition
5.5.2	Norway and Sweden Add to the end of 5.5.2 (after the compliance statement) the following: The screen of the coaxial cable of the television distribution system is normally not earthed at the entrance of the building and there is normally no equipotential bonding system within the building. Therefore the protective earthing of the building installation need to be isolated from the screen of a coaxial cable based television distribution system. It is however accepted to provide the insulation external to the apparatus by an adapter or an interconnection cable with galvanic isolator, which may be provided by a retailer, for example. The user manual shall then have the following or similar information in Norwegian and Swedish language respectively, depending on in what country the apparatus is intended to be used in: “Apparatus connected to the protective earthing of the building installation through the MAINS connection or through other apparatus with a connection to protective earthing – and to a television distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a television distribution system has therefore to be provided through a device providing electrical isolation below a certain frequency range (galvanic isolator, see EN 60728-11)” NOTE In Norway, due to regulation for installations of CATV-installations, and in Sweden, a galvanic isolator shall provide electrical insulation below 5 MHz. The insulation shall withstand a dielectric strength of 1,5 kV r.m.s., 50 Hz or 60 Hz, for 1 min. Translation to Norwegian (the Swedish text will also be accepted in Norway): “Utstyr som er koplet til beskyttelsesjord via nettplugg og/eller via annet jordtilkoplet utstyr – og er tilkoplet et kabel-TV nett, kan forårsake brannfare. For å unngå dette skal det ved tilkopling av utstyret til kabel-TV nettet installeres en galvanisk isolator mellom utstyret og kabel-TV nettet.” Translation to Swedish: ”Utrustning som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet.”
13.3.1	Norway Add to the second paragraph the following: Due to the IT power distribution system used, the a.c. MAINS supply voltage is considered to be equal to the line-to-line voltage, and will remain 230 V in case of a single earth fault. <i>Justification:</i> Based on a use in Norway of an IT power distribution system where the neutral is not provided

Clause	Special national condition
15.1.1	Denmark To the first paragraph the following is added: In Denmark, supply cords of single phase appliances having a rated current not exceeding 13 A shall be provided with a plug according to DS 60884-2-D1. Appliances of Class I provided with socket-outlets with earth contact or which are intended to be used in locations where protection against indirect contact is required according to the wiring rules shall be provided with a plug which assure earth continuity with the socket-outlet in accordance with DS 60884-2-D1. If a single-phase equipment having a RATED CURRENT exceeding 13 A or if a poly-phase equipment is provided with a supply cord with a plug, this plug shall be in accordance with the standard sheets DK 6-1a in DS 60884-2-D1 or EN 60309-1. To the second paragraph the following is added: Socket outlets intended for providing power to Class II apparatus with a rated current of 2,5 A shall be in accordance with DS 60884-2-D1 standard sheet DKA 1-4a. Other current rating socket outlets shall be in compliance with DS 60884-2-D1 Standard Sheet DKA 1-3a or DKA 1-1c. To the third paragraph the following is added: Mains socket-outlets with earthing contact shall be in compliance with DS 60884-2-D1, Standard sheet DK 1-3a, DK 1-1c, DK 1-1d, DK 1-5a or DK 1-7a <i>Justification:</i> Heavy Current Regulations, Section 6c
15.1.1	Ireland Apparatus which is fitted with a flexible cable or cord shall be provided with a plug in accordance with Statutory Instrument 525: 1997, "13 A Plugs and Conversion Adapters for Domestic Use Regulations: 1997. <i>Justification:</i> SI 525: 1997
15.1.1	Norway Mains socket-outlets mounted on Class II apparatus shall comply with the specifications given in CEE Publ. 7 as far as applicable, with the following amendments: § 8 Dimensions a) 2,5 A 250 V two-pole socket-outlets for electronic apparatus shall comply with the enclosed Standard Sheet I.

Clause	Special national condition
15.1.1 continued	Norway (continued) STANDARD SHEET I 2,5 A/250 V SOCKET-OUTLET FOR ELECTRONIC APPLIANCES OF CLASS II  Dimensions in mm Other dimensions according to CEE Publication 7 Standard Sheet I "Portable Single-Way Socket-Outlets". § 24 Mechanical strength a) 2,5 A, 250 V socket-outlets for Class II electronic apparatus are tested as specified in EN 60065:2014, 12.1.3. Also the protecting rim shall be tested. <i>Justification:</i> Act of 24 May 1929 relating to supervision of electrical installation (TEA 1929/FEL 1998).
15.1.1	United Kingdom Apparatus which is fitted with a flexible cable or cord and is designed to be connected to a mains socket conforming to BS 1363 by means of that flexible cable or cord and plug shall be fitted with a "standard plug" in accordance with Statutory Instrument 1768: 1994: The Plugs and Sockets etc. (Safety) Regulations 1994, unless exempted by those Regulations. NOTE "Standard plug" is defined in SI 1768:1994 and essentially means an approved plug conforming to BS 1363 or an approved conversion plug. <i>Justification:</i> SI 1768: 1994

Clause	Special national condition
Annex B	Finland, Norway and Sweden All sub clauses given below are sub clauses of IEC 62151 (ref. corrigenda 1 and 2 to IEC 62151). Subclause 4.1.1 (corrigendum 2): Add after the first paragraph: NOTE In Finland, Norway and Sweden, CLASS I equipment which is intended for connection to the building installation via a non-industrial plug or a non-industrial appliance coupler, or both and in addition is intended for connection to other equipment or a network shall, if safety relies on connection to protective earth or if surge suppressors are connected between the network terminals and ACCESSIBLE parts, has a marking stating that the equipment must be connected to an earthed mains socket-outlet. The marking text in the applicable countries shall be as follows: In Finland: “ Laite on liitettävä suojakoskettimilla varustettuun pistorasiaan ” In Norway: “Apparatet må tilkoples jordet stikkontakt” In Sweden: "Apparaten skall anslutas till jordat uttag" Subclause 4.1.4 (corrigendum 1) Add at the end of the subclause: NOTE In Norway, for requirements see 4.1.1, note and 5.3.1, note 1. Subclause 4.2.1.2 (corrigendum 1) Add at the end of the subclause: NOTE 3 In Norway, for requirements see 5.3.1, note 1. Subclause 4.2.1.3 (corrigendum 2) Add at the end of the subclause: NOTE In Norway, for requirements see 4.1.1, note and 5.3.1, note 1. Subclause 4.2.1.4 (corrigendum 1) Number the existing note as NOTE 1 and add at the end of the subclause the following NOTE 2: NOTE 2 In Norway, for requirements see 4.1.1, note and 5.3.1, note 1. Subclause 5.3.1 (corrigendum 1) Add after the first test specifications paragraph: NOTE 1 In Finland, Norway and Sweden, there are additional requirements for the insulation. Renumber the existing note as NOTE 2.

Clause	Special national condition
Annex B (continued)	For additional requirements for the insulation in Finland, Norway and Sweden in NOTE 1 the following text is added between the first and the second paragraph (this text is identical to the corresponding EN 60950-1:2001): NOTE 1 In Finland, Norway and Sweden, if this insulation is solid, including insulation forming part of a component, it shall at least consist of either - two layers of thin sheet material, each of which shall pass the electric strength test below, or - one layer having a distance through insulation of at least 0,4 mm, which shall pass the electric strength test below If this insulation forms part of a semiconductor component (e.g. an optocoupler), there is no distance through insulation requirement for the insulation consisting of an insulating compound completely filling the casing, so that CLEARANCES and CREEPAGE DISTANCES do not exist, if the component passes the electric strength test in the accordance with the compliance clause below and in addition: - passes the test and inspection criteria of 13.6 with an electric strength test of 10.3 using the test voltage of 1,5 kV multiplied by 1,6, and - is subject to routine testing for electric strength during manufacturing, using a test voltage of 1,5 kV (for performance of the test see N.2.1). It is permitted to bridge this insulation with a capacitor complying with EN 132400:1994, subclass Y2. A capacitor classified Y3 according to EN 132400:1994, may bridge this insulation under the following conditions: - the insulation requirements are satisfied by having a capacitor classified Y3 as defined by EN 132400, which in addition to the Y3 testing, is tested with an impulse test of 2,5 kV defined in IEC 62151:2000, 6.2.1; - the additional testing shall be performed on all the test specimens as described in EN 132400; - the impulse test of 2,5 kV is to be performed before the endurance test in EN 132400 in the sequence of tests as described in EN 132400. Subclause 5.3.2 (corrigendum 1) Add after the fourth dash: NOTE In Finland, Norway and Sweden, exclusions are applicable for equipment which is intended for connection to the building installation wiring using screw terminals or other reliable means, and for 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 EN 60309 or with a comparable national standard.
J.2	Norway After Table J.1 the following is added: Due to the IT power distribution system used, the a.c. MAINS supply voltage is considered to be equal to the line-to-line voltage, and will remain 230 V in case of a single earth fault. <i>Justification:</i> Based on a use in Norway of an IT power distribution system where the neutral is not provided

Annex ZC (informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC national member.

This European Standard falls under Directive 2006/95/EC.

NOTE (from CEN/CENELEC IR Part 2:2011, 2.17): Where standards fall under EU Directives, it is the view of the Commission of the European Communities (OJ No C 59; 1982-03-09) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted except under the safeguard procedure provided for in the relevant Directive.

A-deviations in an EFTA-country are valid instead of the relevant provisions of the European Standard in that country until they have been removed.

Clause	National deviation
6.1	Germany The following requirement applies: For the operation of any cathode ray tube intended for the display of visual images operating at an acceleration voltage exceeding 40 kV, authorization is required, or application of type approval (Bauartzulassung) and marking. <i>Justification:</i> German ministerial decree against ionizing radiation (Röntgenverordnung), in force since 2002-07-01, implementing the Council Directive 96/29/Euratom in Germany. NOTE Contact address: Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig, Tel.: Int+49-531-592-6320, Internet: http://www.ptb.de
14.1	Sweden The following requirements shall be fulfilled: Switches containing mercury such as thermostats, relays and level controllers are not allowed.

Annex ZD
(informative)

IEC and CENELEC code designations for flexible cords

Table ZD.1 – IEC and CENELEC code designations for flexible cords

Type of flexible cord	Code designations	
	IEC	CENELEC
PVC insulated cords		
Flat twin tinsel cord	60227 IEC 41	H03VH-Y
Light polyvinyl chloride sheathed flexible cord	60227 IEC 52	H03VV-F H03VVH2-F
Ordinary polyvinyl chloride sheathed flexible cord	60277 IEC 53	H05VV-F H05VVH2-F
Rubber insulated cords		
Braided cord	60245 IEC 51	H03RT-F
Ordinary tough rubber sheathed flexible cord	60245 IEC 53	H05RR-F
Ordinary polychloroprene sheathed flexible cord	60245 IEC 57	H05RN-F
Heavy polychloroprene sheathed flexible cord	60245 IEC 66	H07RN-F
Cords having high flexibility		
Rubber insulated and sheathed cord	60245 IEC 86	H03RR-H
Rubber insulated, crosslinked PVC sheathed cord	60245 IEC 87	H03RV4-H
Crosslinked PVC insulated and sheathed cord	60245 IEC 88	H03V4V4-H

Annex ZE (informative)

Significance of $L_{Aeq,T}$ in EN 50332-1 and additional information

$L_{Aeq,T}$ is derived from the general formula for equivalent sound pressure:

$$L_{eq} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2}{p_0^2} dt \right]$$

This is represented graphically in Figure ZE.1:

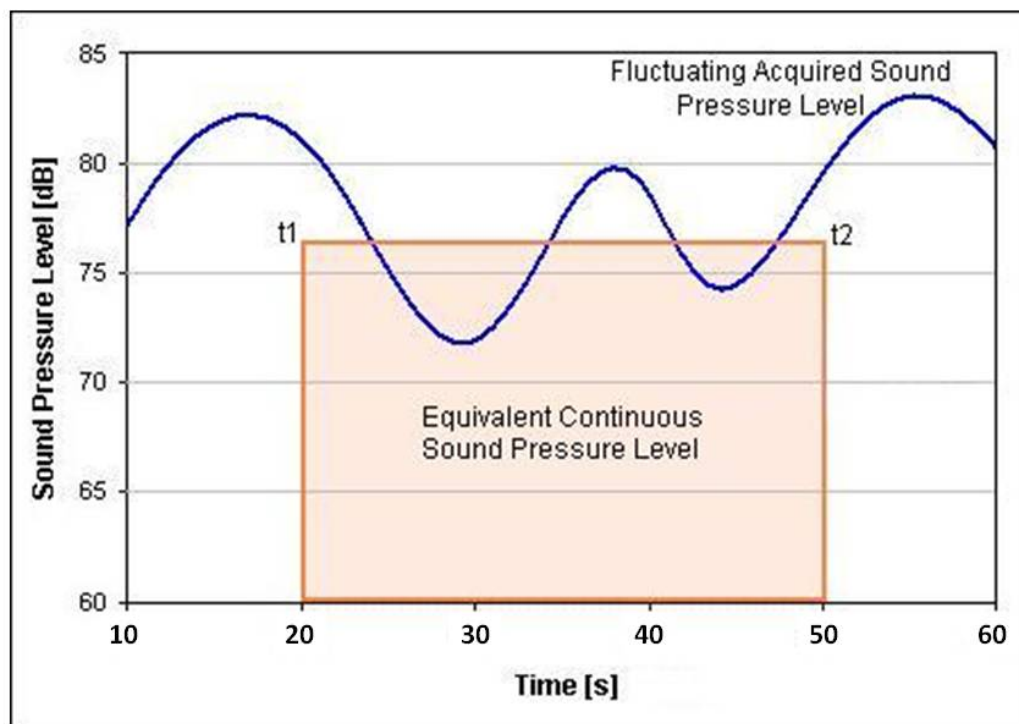


Figure ZE.1

In EN 50332-1, the measurement time interval ($t_2 - t_1$) is 30 s.

In practice, and for the purposes of listening to personal music player content, $L_{Aeq,T}$ has a time interval T ($t_2 - t_1$) in the order of minutes / hours and not seconds.

6.5 (Limitation value) of EN 50332-1:2000 acknowledges this fact and states that the 100 dB limit equates to a long time average of 90 dB $L_{Aeq,T}$. By using the HD 483.1 “programme simulation noise” test signal, this also takes the spectral content into account.

The SCENHIR ⁵⁾ report states that 80 dB(A) is considered safe for an exposure time of 40 h/week. Most persons do not listen to 40 h/week to their personal music player. In addition, not all music tracks are at the same level of the simulated noise signal. Whilst modern music tends to be at around the same level, most of the available music is at a lower average level. Therefore, the working group ⁶⁾ considers a value of 85 dB(A) to be safe for an overwhelming majority of the users of personal music players.

5) SCENIHR opinion of 23 Sept 2008: Potential health risks of exposure to noise from personal music players and mobile phones including a music playing function.

6) CLC/TC 108X/WG 03.

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INTRODUCTION

Principles of safety

General

This introduction is intended to provide an appreciation of the principles on which the requirements of this standard are based. Such an understanding is essential in order that safe apparatus can be designed and manufactured.

The requirements of this standard are intended to provide protection to persons as well as to the surroundings of the apparatus.

Attention is drawn to the principle that the requirements, which are standardized, are the minimum considered necessary to establish a satisfactory level of safety.

Further development in techniques and technologies may entail the need for future modification of this standard.

NOTE The expression "protection to the surroundings of the apparatus" implies that this protection should also include protection of the natural environment in which the apparatus is intended to be used, taking into account the life cycle of the apparatus, i.e. manufacturing, use, maintenance, disposal and possible end-of-life recycling of parts of the apparatus.

Hazards

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

- electric shock;
- excessive temperatures;
- radiation;
- implosion;
- mechanical hazards;
- fire;
- chemical burns (for example, as a result of the ingestion of lithium chemistry button/coin cells).

Electric shock

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 secondary risks due to involuntary reaction. Higher currents can have more damaging effects. Voltages below certain limits are generally regarded as not dangerous under specified conditions. In order to provide protection against the possibility of higher voltages appearing on parts that may be touched or handled, such parts are either earthed or adequately insulated.

For parts which can be touched, two levels of protection are normally provided to prevent electric shock caused by a single fault. Thus a single fault and any consequential faults will not create a hazard. The provision of additional protective measures, such as SUPPLEMENTARY INSULATION or protective earthing, is not considered a substitute for, or a relief from, properly designed BASIC INSULATION.

Cause

Contacts with parts normally at hazardous voltage.

Prevention

Prevent access to parts at hazardous voltage by fixed or locked covers, interlocks, etc.

Discharge capacitors at hazardous voltages.

Breakdown of insulation between parts normally at hazardous voltage and accessible parts.

Either use double or reinforced insulation between parts normally at hazardous voltages and accessible parts so that breakdown is not likely to occur, or connect accessible conductive parts to protective earth so that the voltage which can develop is limited to a safe value. Provide adequate mechanical and electrical strength.

Breakdown of insulation between parts normally at hazardous voltage and circuits normally at non-hazardous voltages, thereby putting accessible parts and terminals at hazardous voltage.

Segregate hazardous and non-hazardous voltage circuits either by double or reinforced insulation so that breakdown is not likely to occur, or by a protective earthed screen, or connect the circuit normally at non-hazardous voltage to protective earth, so that the voltage which can develop is limited to a safe value.

Touch current from parts at hazardous voltage through the human body.

(Touch current can include current due to RFI filter components connected between mains supply circuits and accessible parts or terminals.)

Limit touch current to a safe value or provide a protective earthing connection to the accessible parts.

Excessive temperatures

Requirements are included to prevent injury due to excessive temperatures of accessible parts, to prevent damaging of insulation due to excessive internal temperatures, and to prevent mechanical instability due to excessive temperatures developed inside the apparatus.

Radiation

Requirements are included to prevent injury due to excessive energy levels of ionizing and laser radiation, for example by limiting the radiation to non-hazardous values.

Implosion

Requirements are included to prevent injury due to implosion of picture tubes.

Mechanical hazards

Requirements are included to ensure that the apparatus and its parts have adequate mechanical strength and stability, to avoid the presence of sharp edges and to provide guarding or interlocking of dangerous moving parts.

Fire

A fire can result from:

- heat;
- arcing;

caused by

- overloads;
- component failure;
- insulation breakdown;
- bad connections;
- conductor breakage.

Requirements are included that are intended to prevent fire originating within the apparatus from spreading beyond the immediate vicinity of the source of the fire or from causing damage to the surroundings of the apparatus.

The following preventive measures are recommended:

- the use of suitable components and subassemblies;
- the prevention of excessive temperature rise that might cause ignition under normal or fault conditions;
- the use of measures to eliminate POTENTIAL IGNITION SOURCES such as inadequate contacts, bad connections, interruptions;
- the limitation of the quantity of combustible material used;
- the control of the position of combustible materials in relation to POTENTIAL IGNITION SOURCES;
- the use of materials with high resistance to fire in the vicinity of POTENTIAL IGNITION SOURCES;
- the use of encapsulation or barriers to limit the spread of fire within the apparatus;
- the use of suitable fire retardant materials for the enclosure.

AUDIO, VIDEO AND SIMILAR ELECTRONIC APPARATUS – SAFETY REQUIREMENTS

1 General

1.1 Scope

1.1.1 This International Safety Standard applies to electronic apparatus designed to be fed from the MAINS, from a SUPPLY APPARATUS, from batteries or from REMOTE POWER FEEDING and intended for reception, generation, recording or reproduction of audio, video and associated signals. It also applies to apparatus designed to be used exclusively in combination with the above-mentioned apparatus.

This standard primarily concerns apparatus intended for household and similar general use but which may also be used in places of public assembly such as schools, theatres, places of worship and the workplace. PROFESSIONAL APPARATUS intended for use as described above is also covered unless falling specifically within the scope of other standards.

This standard concerns only safety aspects of the above apparatus; it does not concern other matters, such as style or performance.

This standard applies to the above-mentioned apparatus, if designed to be connected to the TELECOMMUNICATION NETWORK or similar network, for example by means of an integrated modem.

Some examples of apparatus within the scope of this standard are:

- receiving apparatus and amplifiers for sound and/or vision;
- independent LOAD TRANSDUCERS and SOURCE TRANSDUCERS;
- SUPPLY APPARATUS intended to supply other apparatus covered by the scope of this standard;
- ELECTRONIC MUSICAL INSTRUMENTS, and electronic accessories such as rhythm generators, tone generators, music tuners and the like for use with electronic or non-electronic musical instruments;
- audio and/or video educational apparatus;
- video projectors;

NOTE 1 Film projectors, slide projectors and overhead projectors are covered by IEC 60335-2-56.

- video cameras and video monitors;
- video games and flipper games;
- juke boxes;
- electronic gaming and scoring machines;

NOTE 2 Video games, flipper games and gaming machines and other amusement games for commercial use are covered by IEC 60335-2-82.

- teletext equipment;
- record and optical disc players;
- tape and optical disc recorders;
- antenna signal converters and amplifiers;
- antenna positioners;
- Citizen's Band apparatus;

- apparatus for IMAGERY;
- electronic light effect apparatus;
- apparatus for use in alarm systems;
- intercommunication apparatus, using low voltage MAINS as the transmission medium;
- cable head-end receivers;
- professional general use amplifiers, record or disc players, tape players, recorders, and public address systems;
- professional sound/video systems;
- electronic flash apparatus for photographic purposes (see Annex L); and
- multimedia apparatus.

The requirements of IEC 60950-1 may also be used to meet the requirements for safety of multimedia apparatus (see also IEC Guide 112).

1.1.2 This standard applies to apparatus with a RATED SUPPLY VOLTAGE not exceeding

- 250 V a.c. single phase or d.c. supply;
- 433 V a.c. in the case of apparatus for connection to a supply other than single-phase.

1.1.3 This standard applies to apparatus for use at altitudes not exceeding 2 000 m above sea level, primarily in dry locations and in regions with moderate or tropical climates.

For apparatus with protection against splashing water, additional requirements are given in Annex A.

For apparatus to be connected to TELECOMMUNICATION NETWORKS, additional requirements are given in Annex B.

For apparatus intended to be used in vehicles, ships or aircraft, or at altitudes exceeding 2 000 m above sea level, additional requirements may be necessary.

NOTE 1 See Table A.2 of IEC 60664-1:2007.

 Text deleted 

Requirements, additional to those specified in this standard, may be necessary for apparatus intended for special conditions of use.

1.1.4 For apparatus designed to be fed from the MAINS, this standard applies to apparatus intended to be connected to a MAINS supply with transient overvoltages not exceeding overvoltage category II according to IEC 60664-1.

For apparatus subject to transient overvoltages exceeding those for overvoltage category II, additional protection may be necessary in the MAINS supply of the apparatus.

1.2 Normative references

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

 EN 71-1, *Safety of toys – Part 1: Mechanical and physical properties*

EN 50332-1, *Sound system equipment: Headphones and earphones associated with personal music players – Maximum sound pressure level measurement methodology – Part 1: General method for "one package equipment"* 

- ☐ EN 50332-2, *Sound system equipment: Headphones and earphones associated with personal music players – Maximum sound pressure level measurement methodology – Part 2: Matching of sets with headphones if either or both are offered separately, or are offered as one package equipment but with standardised connectors between the two allowing to combine components of different manufacturers or different design* ☐

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

IEC 60038:2009, *IEC standard voltages*

IEC 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-31:2008, *Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60086-4, *Primary batteries – Part 4: Safety of lithium batteries*

IEC 60107-1:1997, *Methods of measurement on receivers for television broadcast transmissions – Part 1: General considerations – Measurements at radio and video frequencies*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*
Amendment 1:2009

IEC 60127 (all parts), *Miniature fuses*

IEC 60127-6, *Miniature fuses. Part 6: Fuse-holders for miniature cartridge fuse-links*

IEC 60167:1964, *Methods of test for the determination of the insulation resistance of solid insulating materials*

IEC 60216 (all parts), *Electrical insulating materials – Thermal endurance properties*

IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60227-2:1997, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60245 (all parts), *Rubber insulated cables – Rated voltages up to and including 450/750 V*

IEC 60249-2 (all parts), *Base materials for printed circuits – Part 2: Specifications*

IEC 60268-1:1985, *Sound system equipment – Part 1: General*

IEC 60317-43, *Specifications for particular types of winding wires – Part 43: Aromatic polyimide type wrapped round copper wire, class 240*

IEC 60320 (all parts), *Appliance couplers for household and similar general purposes*

IEC 60320-1, *Appliance couplers for household and similar general purposes – Part 1: General requirements*

IEC 60335-1, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60384-1:2008, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60384-14:2005, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60417, *Graphical symbols for use on equipment*, available from: <<http://www.graphical-symbols.info/equipment>>

IEC 60454 (all parts), *Pressure-sensitive adhesive tapes for electrical purposes*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60691:2002, *Thermal links – Requirements and application guide*

IEC 60695-11-5:2004, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60695-11-10:2013, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60730-1:2010, *Automatic electrical controls for household and similar use – Part 1: General requirements*

IEC 60747-5-5:2007, *Semiconductor devices – Discrete devices – Part 5-5: Optoelectronic devices – Photocouplers*
Amendment 1:2013

IEC 60825-1:2007, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60851-3:2009, *Winding wires – Test methods – Part 3: Mechanical properties*

IEC 60851-5:2008, *Winding wires – Test methods – Part 5: Electrical properties*

IEC 60851-6:2012, *Winding wires – Test methods – Part 6: Thermal properties*

IEC 60906 (all parts), *IEC system of plugs and socket-outlets for household and similar purposes*

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*
Amendment 1:2009
Amendment 2:2013¹

IEC 60990, *Methods of measurement of touch current and protective conductor current*

¹ A consolidated edition (2.2) exists, that includes IEC 60950-1:2005 and its Amendments 1:2009 and 2:2013.

IEC 60998-2-2, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*

IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

IEC 60999-2, *Connecting devices – Electrical copper conductors. Safety requirements for screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping units for conductors above 35 mm² up to 300 mm² (included)*

IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61051-2:1991, *Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors*
Amendment 1:2009

IEC 61058-1:2000, *Switches for appliances – Part 1: General requirements*

IEC/TS 61149, *Guide for safe handling and operation of mobile radio equipment*

IEC 61260, *Electroacoustics – Octave-band and fractional-octave-band filters*

IEC 61293, *Marking of electrical equipment with ratings related to electrical supply – Safety requirements*

IEC 61558-1:2005, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*
Amendment 1:2009²

IEC 61558-2-16, *Safety of power transformers, power supply units and similar products for voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*

IEC 61965, *Mechanical safety of cathode ray tubes*

IEC 62133, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

IEC 62151:2000, *Safety of equipment electrically connected to a telecommunication network*

IEC 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 62471:2006, *Photobiological safety of lamps and lamp systems*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

IEC Guide 112, *Guide on the safety of multimedia equipment*

² A consolidated edition (2.1) exists, that includes IEC 61558-1:2005 and its Amendment 1:2009.

ISO 261, *ISO general purpose metric screw threads – General plan*

ISO 262, *ISO general-purpose metric screw threads – Selected sizes for screws, bolts and nuts*

ISO 306:2004, *Plastics – Thermoplastic materials – Determination of Vicat softening temperature (VST)*

ISO 2859-1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality level (AQL) for lot-by-lot inspection*

ISO 7000, *Graphical symbols for use on equipment – Index and synopsis*, available from:
<<http://www.graphical-symbols.info/equipment>>

ISO 9773, *Plastics – Determination of burning behaviour of thin flexible vertical specimens in contact with a small-flame ignition source*

ITU-T Recommendation K.44, *Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic recommendation*

2 Terms and definitions

2.1 Definitions in alphabetical order

For the purposes of this document, the following terms and definitions apply.

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AVAILABLE POWER.....	2.3.7
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USER	2.8.7
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WORKING VOLTAGE	2.3.2

2.2 Types of apparatus

2.2.1

AUDIO AMPLIFIER

either an independent audio signal amplifying apparatus or the audio signal amplifying part of an apparatus to which this standard applies

2.2.2

ELECTRONIC MUSICAL INSTRUMENT

electronic apparatus such as an electronic organ, electronic piano or music synthesiser that produces music under the control of the USER

2.2.3

SUPPLY APPARATUS

apparatus which takes power from the MAINS and from which one or more other apparatus are fed

2.2.4

SUPPLY APPARATUS FOR GENERAL USE

SUPPLY APPARATUS which can be used without special measures not only for the supply of apparatus within the scope of this standard, but also for the supply of other appliances or devices, for example pocket-calculators

2.2.5

SPECIAL SUPPLY APPARATUS

SUPPLY APPARATUS which is designed to be used only for the supply of specified apparatus within the scope of this standard

2.2.6

LASER SYSTEM

LASER in combination with an appropriate laser energy source with or without additional incorporated components

Note 1 to entry: See 3.48 of IEC 60825-1:2007.

2.2.7

LASER

device which can be made to produce or amplify electromagnetic radiation in the wavelength range from 180 nm to 1 mm primarily by the process of controlled stimulated emission

Note 1 to entry: See 3.41 of IEC 60825-1:2007.

Note 2 to entry: Devices to which this definition does not apply are light emitting diodes (LEDs) used for displays, infrared remote controls, infrared audio/visual signal transmission and optocouplers.

2.2.8

IMAGERY

processing, editing, manipulation and/or storing of video signals

2.2.9

REMOTE CONTROL

controlling of an apparatus from a distance, for example mechanically, electrically, acoustically or by means of radiation

2.2.10

PORTABLE APPARATUS

apparatus specifically designed to be carried easily, the mass of which does not exceed 18 kg

2.2.11

TRANSPORTABLE APPARATUS

apparatus, the mass of which exceeds 18 kg, specifically designed to be moved frequently from place to place

Note 1 to entry: Examples of TRANSPORTABLE APPARATUS are musical instruments and their associated amplifiers.

2.2.12

PROFESSIONAL APPARATUS

apparatus for use in trades, professions or industries and which is not intended for sale to the general public

Note 1 to entry: The designation should be specified by the manufacturer.

2.3 Ratings and electrical values

2.3.1

RATED SUPPLY VOLTAGE

supply voltage or voltage range (for three-phase supply, the line-to-line voltage) for which the manufacturer has designed the apparatus

2.3.2

WORKING VOLTAGE

highest voltage, non-repetitive transients being disregarded, to which the insulation under consideration is or can be subjected when the apparatus is operating at its RATED SUPPLY VOLTAGE under normal operating conditions

2.3.3

RIPPLE FREE

d.c. voltage with a r.m.s. value of a ripple content of not more than 10 % of the d.c. component; the maximum peak voltage does not exceed 140 V for a nominal 120 V RIPPLE FREE d.c. system, and does not exceed 70 V for a nominal 60 V RIPPLE FREE d.c. system

2.3.4

NON-CLIPPED OUTPUT POWER

sine-wave power dissipated in the RATED LOAD IMPEDANCE, measured at 1 000 Hz at the onset of clipping on either one, or both peaks

Note 1 to entry: In cases where an amplifier is not intended for operation at 1 000 Hz, a test frequency at the peak response shall be used.

2.3.5

RATED LOAD IMPEDANCE

resistance, specified by the manufacturer, by which an output circuit should be terminated

2.3.6

RATED CURRENT CONSUMPTION

current consumption of an apparatus operating at its RATED SUPPLY VOLTAGE under normal operating conditions

2.3.7

AVAILABLE POWER

maximum power which can be drawn from the supplying circuit through a resistive load whose value is chosen to maximise the power for more than 2 min when the circuit supplied is disconnected

Note 1 to entry: See Figure 1.

2.3.8

REQUIRED WITHSTAND VOLTAGE

peak voltage that the insulation under consideration is required to withstand

2.3.9

TELECOMMUNICATION NETWORK TRANSIENT VOLTAGE

highest peak voltage expected at the TELECOMMUNICATION NETWORK connection point of the apparatus, arising from external transients on the network

2.3.10

RATED POWER CONSUMPTION

power in watts consumed in an apparatus operating at its RATED SUPPLY VOLTAGE under normal operating conditions

2.4 Supply and external connections

2.4.1

MAINS

power source with a nominal voltage of more than 35 V (peak) a.c. or d.c. which is not used solely to supply apparatus specified in 1.1.1

2.4.2

PERMANENTLY CONNECTED APPARATUS

apparatus which is intended for connection to the MAINS by a connection which cannot be loosened BY HAND

2.4.3

DIRECTLY CONNECTED TO THE MAINS

electrical connection with the MAINS in such a way that a connection to either pole of the MAINS causes in that connection a permanent current equal to or greater than 9 A, protective devices in the apparatus being not short-circuited

Note 1 to entry: A current of 9 A is chosen as the minimum breaking current of a 6 A fuse.

2.4.4

CONDUCTIVELY CONNECTED TO THE MAINS

electrical connection with the MAINS in such a way that a connection through a resistance of $2\,000\ \Omega$ to either pole of the MAINS causes in that resistance a permanent current greater than 0,7 mA (peak), the apparatus not being connected to earth

2.4.5

TERMINAL

part of an apparatus by which connection is made to external conductors or other apparatus

Note 1 to entry: A TERMINAL may contain several contacts.

2.4.6

PROTECTIVE EARTHING TERMINAL

TERMINAL to which parts are connected which are required to be connected to earth for safety reasons

2.4.7

TELECOMMUNICATION NETWORK

metallically-terminated transmission medium intended for communication between apparatus 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;
- television distribution systems using cable

Note 1 to entry: The term TELECOMMUNICATION NETWORK is defined in terms of its functionality, not its electrical characteristics. A TELECOMMUNICATION NETWORK is not itself defined as being a TNV CIRCUIT. Only the circuits in apparatus are so classified.

Note 2 to entry: 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.

Note 3 to entry: 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.

2.4.8

REMOTE POWER FEEDING

supply of power to apparatus via a cable network, for example a TELECOMMUNICATION NETWORK or a cable distribution network for antenna signals

2.4.9

TNV CIRCUIT

circuit which is in the apparatus and to which the ACCESSIBLE area of contact is limited (except for a TNV-0 CIRCUIT) and that is so designed and protected that, under normal operating and fault conditions, the voltages do not exceed specified limiting values

Note 1 to entry: A TNV CIRCUIT is considered to be a circuit which is not CONDUCTIVELY CONNECTED TO THE MAINS.

Note 2 to entry: The specified limiting values of voltages under normal operating and fault conditions are given in Annex B. For requirements regarding accessibility of TNV CIRCUITS, see 4.2.1 of IEC 62151:2001.

Note 3 to entry: TNV CIRCUITS are classified as TNV-0, TNV-1, TNV-2 and TNV-3 circuits as defined in 2.4.10, 2.4.11, 2.4.12, and 2.4.13 respectively.

Note 4 to entry: The voltage relationships between TNV CIRCUITS are shown in the Table 1.

Table 1 – Voltage ranges of TNV-CIRCUITS

Overvoltages from TELECOMMUNICATION NETWORKS possible?	Voltage ranges	
	Within TNV-0 CIRCUIT limits	Exceeding TNV-0 CIRCUIT limits but within TNV CIRCUIT limits
Yes	TNV-1 CIRCUIT	TNV-3 CIRCUIT
No	TNV-0 CIRCUIT	TNV-2 CIRCUIT

2.4.10

TNV-0 CIRCUIT

TNV CIRCUIT:

- whose voltages do not exceed a safe value under normal operating conditions and under fault conditions; and
- which is not subject to overvoltages from TELECOMMUNICATION NETWORKS

Note 1 to entry: The limiting values of voltages under normal operating and fault conditions are specified in 9.1.1.2 and 11.1 respectively.

2.4.11

TNV-1 CIRCUIT

TNV CIRCUIT:

- whose voltages do not exceed the limits for a TNV-0 CIRCUIT under normal operating conditions; and
- on which overvoltages from TELECOMMUNICATION NETWORKS are possible

2.4.12

TNV-2 CIRCUIT

TNV CIRCUIT:

- whose voltages exceed the limits for a TNV-0 CIRCUIT under normal operating conditions; and
- which is not subject to overvoltages from TELECOMMUNICATION NETWORKS

2.4.13

TNV-3 CIRCUIT

TNV CIRCUIT:

- whose voltages exceed the limits for a TNV-0 CIRCUIT under normal operating conditions; and
- on which overvoltages from TELECOMMUNICATION NETWORKS are possible

2.5 Signals, sources, loads

2.5.1

PINK NOISE

NOISE SIGNAL whose energy per unit bandwidth ($\frac{\Delta W}{\Delta f}$) is inversely proportional to frequency

2.5.2

NOISE SIGNAL

stationary random signal having normal probability distribution of instantaneous values

Note 1 to entry: Unless otherwise stated, the mean value is zero.

2.5.3

SOURCE TRANSDUCER

apparatus intended to convert the energy of a non-electrical signal to electrical energy

Note 1 to entry: Examples are microphone, image sensor, magnetic reproducing head, LASER pick-up.

2.5.4

LOAD TRANSDUCER

apparatus intended to convert the energy of an electrical signal into another form of energy

Note 1 to entry: Examples may include a loudspeaker, picture tube, liquid crystal display, magnetic recording head.

2.6 Protection against electric shock, insulations

2.6.1

CLASS I

design in which protection against electric shock does not rely on BASIC INSULATION only, but which includes an additional safety precaution in such a way that means are provided for the connection of ACCESSIBLE conductive parts to the protective (earthing) conductor in the fixed wiring of the installation, in such a way that ACCESSIBLE conductive parts cannot become HAZARDOUS LIVE in the event of a failure of the BASIC INSULATION

Note 1 to entry: Such a design may have parts of CLASS II.

2.6.2

CLASS II

design 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 provision for protective earthing or reliance upon installation conditions

2.6.3

BASIC INSULATION

insulation applied to HAZARDOUS LIVE parts to provide basic protection against electric shock

Note 1 to entry: BASIC INSULATION may also serve as functional insulation.

2.6.4

DOUBLE INSULATION

insulation comprising both BASIC INSULATION and SUPPLEMENTARY INSULATION

2.6.5

SUPPLEMENTARY INSULATION

independent insulation applied in addition to BASIC INSULATION in order to reduce the risk of electric shock in the event of a failure of the BASIC INSULATION

2.6.6

REINFORCED INSULATION

single insulation applied to HAZARDOUS LIVE parts which provides a degree of protection against electric shock equivalent to DOUBLE INSULATION

Note 1 to entry: REINFORCED INSULATION may comprise several layers which cannot be tested singly as BASIC INSULATION or SUPPLEMENTARY INSULATION.

2.6.7

PROTECTIVE SEPARATION

separation between circuits by means of basic and supplementary protection (BASIC INSULATION plus SUPPLEMENTARY INSULATION or plus PROTECTIVE SCREENING) or by an equivalent protective provision, for example REINFORCED INSULATION

2.6.8

PROTECTIVE SCREENING

separation from HAZARDOUS LIVE parts by means of an interposed conductive screen, connected to the PROTECTIVE EARTHING TERMINAL

2.6.9

TOUCH CURRENT

electric current through a human body when it touches one or more ACCESSIBLE parts

2.6.10

HAZARDOUS LIVE

electrical condition of an object from which a hazardous TOUCH CURRENT (electric shock) could be drawn

Note 1 to entry: See 9.1.1.

2.6.11

CLEARANCE

shortest distance in air between two conductive parts

2.6.12

CREEPAGE DISTANCE

shortest distance along the surface of an insulating material between two conductive parts

2.7 Components

2.7.1

ISOLATING TRANSFORMER

transformer with PROTECTIVE SEPARATION between the input and output windings

2.7.2

SEPARATING TRANSFORMER

transformer, the input windings of which are separated from the output windings by at least BASIC INSULATION

Note 1 to entry: Such transformers may have parts meeting the requirements of ISOLATING TRANSFORMERS.

2.7.3

THERMAL RELEASE

device which prevents the maintenance of excessively high temperatures in certain parts of the apparatus by disconnecting these parts from their supply

Note 1 to entry: PTC THERMISTORS (see 2.7.8) are not THERMAL RELEASES in the sense of this definition.

2.7.4

THERMAL CUT-OUT

THERMAL RELEASE with reset which has no provision for temperature setting by the USER

Note 1 to entry: A THERMAL CUT-OUT may be of the automatic or of the manual reset type.

2.7.5

THERMAL LINK

THERMAL RELEASE without reset, which operates only once and then requires partial or complete replacement

2.7.6

TRIP-FREE

automatic action, with a reset actuating member, so designed that the automatic action is independent of manipulation or position of the reset mechanism

2.7.7

MICRO-DISCONNECTION

adequate contact separation so as to ensure functional security

Note 1 to entry: There is a requirement for the dielectric strength of the contact gap but no dimensional requirement.

2.7.8

PTC THERMISTOR

thermally sensitive semiconductor resistor, which shows a step-like increase in its resistance when the increasing temperature reaches a specific value

Note 1 to entry: The change of temperature is obtained either by the flow of current through the thermosensitive element, or by a change in the ambient temperature, or by a combination of both.

2.7.9

SAFETY INTERLOCK

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

2.7.10

MANUALLY OPERATED MECHANICAL SWITCH

device operated BY HAND, not incorporating semiconductors, and situated anywhere in the circuit of the apparatus, which can interrupt the intended function, such as sound and/or vision, by moving contacts

Note 1 to entry: Examples of MANUALLY OPERATED MECHANICAL SWITCHES are single-pole or all-pole MAINS SWITCHES, functional switches and switching systems which, for example, can be a combination of relays and switches controlling the relays.

2.7.11

MAINS SWITCH

MANUALLY OPERATED MECHANICAL SWITCH which interrupts either one pole or all poles of the MAINS, except the protective earthing conductor

2.7.12

PRINTED BOARD

base material cut to size, containing all needed holes and bearing at least one CONDUCTIVE PATTERN

2.7.13

CONDUCTIVE PATTERN

configuration formed by electrically conductive material of a PRINTED BOARD

2.7.14

SPECIAL BATTERY

rechargeable battery or group of rechargeable batteries, identified by battery manufacturer's name and catalogue number, provided with the apparatus or recommended by the manufacturer

2.7.15

COIN CELL BATTERY

BUTTON CELL BATTERY

small, single cell battery having a diameter greater than its height

2.8 Miscellaneous

2.8.1

TYPE TEST

test of one or more specimens made on a certain design to show that the design meets all requirements of this standard

2.8.2

ROUTINE TEST

test to which each specimen is subjected during or after manufacture to ascertain whether it complies with certain criteria

2.8.3

ACCESSIBLE

possibility of touching by the test finger according to IEC 61032:1997, test probe B

Note 1 to entry: Any ACCESSIBLE area of a non-conductive part is considered as being covered with a conductive layer (see Figure 3 as an example).

2.8.4

BY HAND

operation that does not require the use of any object such as a tool, coin, etc.

2.8.5

SKILLED PERSON

person with relevant education and experience to enable him or her to avoid dangers and to prevent risks which electricity may create

2.8.6

INSTRUCTED PERSON

person adequately advised or supervised by a SKILLED PERSON to enable him or her to avoid dangers and to prevent risks which electricity may create

2.8.7

USER

any person, other than a SKILLED PERSON or an INSTRUCTED PERSON, who may come into contact with the apparatus

2.8.8

STAND-BY

operating condition where the main functions, such as sound and/or vision, are switched-off and where the apparatus is only partly in operation

Note 1 to entry: In this condition, permanent functions, such as a clock, are maintained and it allows the apparatus to be brought into full operation, for example by REMOTE CONTROL or automatically.

2.8.9

WOOD-BASED MATERIAL

material in which the main ingredient is machined natural wood, coupled with a binder

Note 1 to entry: Examples of WOOD-BASED MATERIAL are materials incorporating ground or chipped wood, such as hard fibre board or chip board.

2.8.10

FIRE ENCLOSURE

part of the apparatus intended to minimize the spread of fire or flames from within

2.8.11

POTENTIAL IGNITION SOURCE

possible fault which can start a fire if the open-circuit voltage measured across an interruption or faulty contact exceeds a value of 50 V (peak) a.c. or d.c. and the product of the peak value of this voltage and the measured r.m.s. current under normal operating conditions exceeds 15 VA

Note 1 to entry: Such a faulty contact or interruption in an electrical connection includes those which may occur in CONDUCTIVE PATTERNS ON PRINTED BOARDS.

Note 2 to entry: An electronic protection circuit may be used to prevent such a fault from becoming a POTENTIAL IGNITION SOURCE.

2.8.12

PASSIVE FLAMMABILITY

flammability caused by external heating of the component

Note 1 to entry: It can be caused for example, by flames.

3 General requirements

3.1 General

The apparatus shall be so designed and constructed as to present no danger when used for its intended purpose, either in normal operating conditions or under fault conditions, particularly providing protection against

- hazardous currents passing through the human body (electric shock);
- excessive temperatures;
- hazardous radiations;
- effects of implosion and explosion;
- mechanical instability;
- injury by mechanical parts; and
- start and spread of fire.

In general, compliance is checked under normal operating conditions and under fault conditions, as specified in 4.2 and 4.3, by carrying out all the relevant tests specified.

3.2 Designation of classes

Apparatus designed to be fed from the MAINS shall be constructed according to the requirements of CLASS I, or CLASS II apparatus.

3.3 Constructions and components not specifically covered

Where the equipment involves technologies, components and materials or methods of construction not specifically covered in this standard, the equipment shall provide safety measures not less than that generally afforded by this standard and the principles of safety contained herein.

3.4 Components and subassemblies that comply with IEC 62368-1

Components and subassemblies that comply with IEC 62368-1 are acceptable as part of an apparatus covered by this standard without further evaluation other than to give consideration to the appropriate use of the component or subassembly in the end-product.

[C] 3.21 Protective devices

To protect against excessive current, short-circuits and earth faults in MAINS, protective devices shall be included either as integral parts of the equipment or as parts of the building installation, subject to the following, a), b) and c):

- a) except as detailed in b) and c), protective devices necessary to comply with the requirements of Clause 11 shall be included as parts of the equipment;
- b) for components in series or parallel with the mains input to the equipment such as the supply cord, appliance coupler, r.f.i. filter and switch, short-circuit and earth fault protection may be provided by protective devices in the building installation;
- c) it is permitted for equipment supplied via an industrial mains plug or for PERMANENTLY CONNECTED APPARATUS, to rely on dedicated over current and short-circuit protection in the building installation, provided that the means of protection, e.g. fuses or circuit breakers, is fully specified in the installation instructions. **[C]**

- Ⓒ If reliance is placed on protection in the building installation, the installation instructions shall so state, except that for apparatus not supplied via an industrial mains plug or for PERMANENTLY CONNECTED APPARATUS the building installation shall be regarded as providing protection in accordance with the rating of the wall socket outlet. Ⓒ

4 General test conditions

4.1 Conduct of tests

4.1.1 Tests according to this standard are TYPE TESTS.

- Ⓒ NOTE For ROUTINE TEST, reference is made to EN 50514:2008. Ⓒ

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

As an alternative to carrying out tests on the complete apparatus, tests may be carried out separately on circuits, components or subassemblies outside the apparatus, provided that inspection of the apparatus and circuit arrangements ensures that such testing will indicate that the assembled apparatus would conform to the requirements of this standard.

If any such test indicates a likelihood of non-compliance in the complete apparatus, the test shall be repeated in the apparatus.

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

The tests should be carried out in the following order:

- *component or material pre-selection;*
- *component or subassembly bench tests;*
- *tests where the apparatus is not energized;*
- *live tests*
 - *under normal operating conditions,*
 - *under abnormal operating conditions,*
 - *involving likely destruction.*

NOTE In view of the amount of resources involved in testing and in order to minimize waste, all parties concerned can jointly consider the test programme, the test samples and the test sequence.

4.1.3 *Unless otherwise specified, the tests are carried out under normal operating conditions at:*

- *an ambient temperature between 15 °C and 35 °C, and*
- *a relative humidity of 75 % maximum.*

4.1.4 *Any position of intended use of the apparatus, normal ventilation not being impeded.*

The temperature measurements shall be carried out with the apparatus positioned in accordance with the instructions for use provided by the manufacturer, or, in the absence of instructions, the apparatus shall be positioned 5 cm behind the front edge of an open-fronted wooden test box with 1 cm free space along the sides and top and 5 cm depth behind the apparatus.

Tests on apparatus, intended to be part of an assembly not provided by the apparatus manufacturer, shall be carried out according to the instructions for use provided by the apparatus manufacturer, specifically those dealing with proper ventilation.

The apparatus shall also comply with Table 3 when tested on an open bench.

4.1.5 *The characteristics of the supply source, except those specified in 4.2.2, used during the tests shall not appreciably influence the test results.*

Examples of such characteristics are source impedance and waveform.

4.1.6 *Where relevant, a standard signal consisting of PINK NOISE, band-limited by a filter whose response conforms to that given in Figure C.1 in Annex C.*

NOTE If appropriate, the standard signal can be used to modulate a carrier wave.

The output measuring equipment shall indicate true r.m.s. values for crest factors up to at least 3, and the frequency response shall conform to that shown in Annex C.

4.1.7 *The a.c. values given in this standard are r.m.s. values, unless specified otherwise.*

The d.c. values given in this standard are RIPPLE FREE values.

4.2 Normal operating conditions

4.2.1 *Normal operating conditions are the most unfavourable combination of the following conditions.*

4.2.2 *The apparatus, except battery-operated apparatus, is connected to a supply voltage of 0,9 times or 1,1 times of any RATED SUPPLY VOLTAGE for which the apparatus is designed.*

For battery-operated apparatus a fully charged rechargeable battery or dry batteries in a fresh condition are used.

RATED CURRENT CONSUMPTION and RATED POWER CONSUMPTION are measured at the RATED SUPPLY VOLTAGE. For RATED CURRENT CONSUMPTION or RATED POWER CONSUMPTION measurements of television sets, the following settings shall apply:

- *the 'three vertical bar signal' shall be used as defined in 3.2.1.3 of IEC 60107-1:1997; and*
- *USER ACCESSIBLE picture controls shall be adjusted so as to obtain the maximum power consumption; and*
- *sound settings shall be as defined in 4.2.5 a) of this standard.*

In case of doubt, tests may also be performed at the value of any RATED SUPPLY VOLTAGE.

For apparatus having a RATED SUPPLY VOLTAGE range not requiring the adjustment of a voltage setting device, the apparatus is connected to a supply voltage of 0,9 times the lower limit or 1,1 times the upper limit of any RATED SUPPLY VOLTAGE range; moreover, the apparatus is connected to any nominal supply voltage within the RATED SUPPLY VOLTAGE range marked on the apparatus.

Any rated supply frequency marked on the apparatus is used.

Any type of supply for which the apparatus is designed to be used.

For d.c. supply any polarity is used, unless this is prevented by the construction of the apparatus.

4.2.3 *Any position of controls which are ACCESSIBLE to the USER for adjustment BY HAND, including REMOTE CONTROLS, excluding voltage setting devices complying with 14.9 and volume controls and tone controls.*

Any cable connected REMOTE CONTROL device, detachable by a connector or a similar device, is connected or not.

A cover, enclosing a LASER SYSTEM, which can be opened BY HAND, is opened fully, opened partly or closed.

4.2.4 *In the case of single-phase supply, any earth TERMINAL and any PROTECTIVE EARTHING TERMINAL may be connected to either pole of the isolated supply source used during the test.*

In the case of a supply other than single phase, any earth TERMINAL and any PROTECTIVE EARTHING TERMINAL may be connected to the neutral or to any phase of the isolated supply source used during the test.

4.2.5 *In addition, for an AUDIO AMPLIFIER:*

- a) *The apparatus is operated in such a way as to deliver one-eighth of the NON-CLIPPED OUTPUT POWER to the RATED LOAD IMPEDANCE using the standard signal described in 4.1.6 with the tone controls set to their mid position.*

Where the NON-CLIPPED OUTPUT POWER cannot be obtained using the standard signal, one-eighth of the maximum attainable output power is taken.

As an alternative, where the amplifier function is not adversely affected, a sine wave of 1 kHz or where applicable, another frequency corresponding to the geometric mean of the upper and lower –3 dB response points of the relevant part of the apparatus may be used to supply each channel.

If the result of a measurement performed with a sine wave does not comply with this standard, the measurement with PINK NOISE is decisive.

When determining whether a part or output TERMINAL contact is HAZARDOUS LIVE according to 9.1.1.2 and 11.1, the apparatus shall be operated with a sinusoidal input test signal of 1 kHz or where applicable, another frequency corresponding to the geometric mean of the upper and lower –3 dB response points of the relevant amplifier part of the apparatus, sufficient in amplitude for the apparatus to deliver the NON-CLIPPED OUTPUT POWER into its RATED LOAD IMPEDANCE. Open-circuit output voltage is determined after the load is removed.

- b) *The most unfavourable RATED LOAD IMPEDANCE of any output circuit is connected.*
- c) *Organs or similar instruments which have a tone-generator unit are operated with any combination of two bass pedal keys, if any, and ten manual keys depressed, and all stops and tabs which can increase the output power are activated.*

For AUDIO AMPLIFIERS used in an ELECTRONIC MUSICAL INSTRUMENT which does not generate a continuous tone, the standard signal described in 4.1.6 is applied to the signal input TERMINAL or to the appropriate input stage of the AUDIO AMPLIFIER.

- d) *Where the intended amplifier function depends on phase difference between two channels, there shall be a phase difference of 90° between the signals applied to the two channels.*
- e) *For equipment containing multi-channel amplifiers, where each channel can be operated independently, each channel shall be operated using the RATED LOAD IMPEDANCE at the output power level that corresponds to 1/8 of the NON-CLIPPED OUTPUT POWER. Where some channels cannot be operated independently, those channels shall be operated using the RATED LOAD IMPEDANCE at the output power level that corresponds, by design, to 1/8 of the NON-CLIPPED OUTPUT POWER of the adjustable amplifier channel(s).*

4.2.6 *For apparatus incorporating motors, load conditions for the motor are chosen which may occur during intended use, including stalling BY HAND if this is possible.*

4.2.7 *An apparatus supplying power to other apparatus is loaded to give its rated power or is not loaded.*

4.2.8 *A SUPPLY APPARATUS to be used inside apparatus for which it is intended exclusively, is tested within such apparatus after installation according to the manufacturer's instruction for use.*

4.2.9 In addition, for Citizen's Band apparatus, the *RATED LOAD IMPEDANCE* is connected or not to the antenna *TERMINAL* or, if applicable, to a telescopic antenna extended to any length. The transmitting test conditions are specified in IEC/TS 61149.

4.2.10 Antenna positioners shall comply with all of the following requirements:

4.2.10.1 For antenna positioners in combination with their control and *SUPPLY APPARATUS*:

- four consecutive movements from one endstop to the opposite endstop;
- followed by a 15 min resting period.

The movements and the resting periods are repeated as many times as necessary for the relevant tests. For temperature measurements the movements and the resting periods are repeated until a steady state of temperature has been reached but not longer than 4 h.

After the last movement period, the 15 min resting period does not apply to the temperature measurements.

4.2.10.2 In addition, for satellite antenna positioners consisting of a power supply and control unit without a motor drive system, the power supply unit shall be loaded in accordance with the marked output rating and operated with a duty cycle of 5 min on, and 15 min off.

4.2.11 Apparatus designed to be supplied exclusively by a *SPECIAL SUPPLY APPARATUS* specified by the manufacturer of the apparatus, shall be tested together with this *SPECIAL SUPPLY APPARATUS*.

The supply voltage for the *SPECIAL SUPPLY APPARATUS* is determined in accordance with 4.2.2.

Where a voltage setting device for the output voltage of the *SPECIAL SUPPLY APPARATUS* is provided, it shall be adjusted to the *RATED SUPPLY VOLTAGE* of the apparatus under test.

4.2.12 Apparatus which can be supplied by *SUPPLY APPARATUS FOR GENERAL USE* shall be supplied by a test power supply with a sufficient current capacity according to Table 2 corresponding to the *RATED SUPPLY VOLTAGE* of the apparatus under test. The values of no-load voltage given in Table 2 are subject to the under- and over-voltage provisions specified in 4.2.2.

Table 2 – Test power supply

RATED SUPPLY VOLTAGE V d.c.	Nominal no-load voltage V d.c.	Internal resistance Ω
1,5	2,25	0,75
3,0	4,50	1,50
4,5	6,75	2,25
6,0	9,00	3,00
7,5	11,25	3,75
9,0	13,50	4,50
12,0	18,00	6,00

The test power supply voltage and current parameters are not limited to those provided in this table. The parameters in the table are representative for supply apparatus having output voltage(s) < 12 V d.c. and rated output current < 1 A.

4.2.13 Apparatus intended to be used with optional detachable legs or stands supplied by the manufacturer of the apparatus are tested with or without legs or stands fitted.

4.3 Fault conditions

4.3.1 For operation under fault conditions, in addition to the normal operating conditions mentioned in 4.2, each of the following conditions is applied one at a time and, associated with it, those other fault conditions which are a logical consequence.

NOTE 1 The logical consequences of a fault condition are those which occur when a fault is applied.

Circuits, or parts of a circuit supplied with an open circuit voltage not exceeding 35 V (peak) a.c. or d.c. and not generating voltages above that value, are not considered to present a fire hazard if the current which may be drawn from the supplying circuit for more than 2 min at any load, including short-circuit, is limited to not more than 0,2 A. Such supplied circuits are not subject to fault conditions testing.

An example of a test circuit to measure the voltage and the current is given in Figure 1.

NOTE 2 Examination of the apparatus and all its circuit diagrams, excluding the internal circuit diagrams of integrated circuits, generally shows the fault conditions that are likely to create a hazard and that are to be applied. These are applied in sequence, in the order that is most convenient.

The examination of the apparatus and circuit diagrams indicate the operating conditions under which simulated faults are applied in order to produce the most unfavourable effects. In most cases, the effects of a simulated fault are most unfavourable if the simulated fault is applied while the apparatus is in full operation.

However, for some parts, the most unfavourable effects can occur if the simulated fault is applied before switching on the apparatus. It is also possible that the most unfavourable effects could occur when a simulated fault is applied when the apparatus is in a STAND-BY condition.

NOTE 3 When carrying out the examination in NOTE 2, the operating characteristics of integrated circuits are taken into consideration.

NOTE 4 The fault tests are only to be made in the wooden test box mentioned in 4.1.4, if no installation instructions are provided and there is a possibility that the test box will influence the results.

When a specified fault condition test is carried out, it can cause consequential faults which either interrupt or short-circuit a component. In case of doubt, the fault condition test shall be repeated up to two more times with replacement components in order to check that the same result is always obtained. Should this not be the case, the most unfavourable consequential fault, whether interruption or short circuit, shall be applied together with the specified fault condition.

4.3.2 *Short-circuit across CLEARANCES and CREEPAGE DISTANCES, if they are less than the values specified in Clause 13 for BASIC and SUPPLEMENTARY INSULATION, with the exception of insulation between parts of different polarity DIRECTLY CONNECTED TO THE MAINS.*

NOTE For CLEARANCES between parts of different polarity DIRECTLY CONNECTED TO THE MAINS, reference is made to 13.1.

4.3.3 *Short-circuit across parts of insulating material, the short-circuiting of which might cause an infringement of the requirements regarding protection against electric shock hazard or overheating, with the exception of insulating parts which comply with the requirements of 10.4.*

NOTE This does not imply a need to short-circuit the insulation between turns of coils.

4.3.4 *Short-circuit, or if applicable, interruption of:*

- *heaters of electronic tubes;*
- *insulation between heaters and cathodes of electronic tubes;*
- *spacings in electronic tubes, excluding picture tubes; and*
- *semiconductor devices, one lead at a time interrupted or any two leads connected together one pair at a time (but see 4.3.5 d)).*

NOTE If electronic tubes are so constructed that a short circuit between certain electrodes is highly improbable or even impossible, the electrodes concerned need not be short-circuited.