

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Équipements des technologies de l'audio/vidéo, de l'information et de la
communication –
Partie 1: Exigences de sécurité**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 55 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Équipements des technologies de l'audio/vidéo, de l'information et de la
communication –
Partie 1: Exigences de sécurité**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

ICS 33.160.01, 35.020

ISBN 978-2-8322-1405-3

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	19
INTRODUCTION.....	22
0 Principles of this product safety standard	22
0.1 Objective	22
0.2 Persons	22
0.2.1 General	22
0.2.2 Ordinary person	22
0.2.3 Instructed person	22
0.2.4 Skilled person	22
0.3 Model for pain and injury	22
0.4 Energy sources	23
0.5 Safeguards	24
0.5.1 General	24
0.5.2 Equipment safeguard	25
0.5.3 Installation safeguard	25
0.5.4 Personal safeguard	25
0.5.5 Behavioural safeguards	26
0.5.6 Safeguards during ordinary or instructed person service conditions	27
0.5.7 Equipment safeguards during skilled person service conditions	27
0.5.8 Examples of safeguard characteristics	27
0.6 Electrically-caused pain or injury (electric shock)	28
0.6.1 Models for electrically-caused pain or injury	28
0.6.2 Models for protection against electrically-caused pain or injury	29
0.7 Electrically-caused fire	30
0.7.1 Models for electrically-caused fire	30
0.7.2 Models for protection against electrically-caused fire	31
0.8 Injury caused by hazardous substances	31
0.9 Mechanically-caused injury	32
0.10 Thermally-caused injury (skin burn)	32
0.10.1 Models for thermally-caused injury	32
0.10.2 Models for protection against thermally-caused pain or injury	33
0.11 Radiation-caused injury	34
1 Scope	36
2 Normative references	37
3 Terms, definitions and abbreviations	43
3.1 Energy source abbreviations	43
3.2 Other abbreviations	43
3.3 Terms and definitions	44
3.3.1 Circuit terms	46
3.3.2 Enclosure terms	46
3.3.3 Equipment terms	47
3.3.4 Flammability terms	47
3.3.5 Insulation	49
3.3.6 Miscellaneous	49

3.3.7	Operating and fault conditions	51
3.3.8	Persons	52
3.3.9	Potential ignition sources	52
3.3.10	Ratings	53
3.3.11	Safeguards	53
3.3.12	Spacings	55
3.3.13	Temperature controls	55
3.3.14	Voltages and currents	55
3.3.15	Classes of equipment with respect to protection from electric shock	56
3.3.16	Chemical terms	57
3.3.17	Batteries	57
4	General requirements	59
4.1	General	59
4.1.1	Application of requirements and acceptance of materials, components and subassemblies	59
4.1.2	Use of components	59
4.1.3	Equipment design and construction	59
4.1.4	Equipment installation	60
4.1.5	Constructions and components not specifically covered	60
4.1.6	Orientation during transport and use	60
4.1.7	Choice of criteria	60
4.1.8	Conductive liquids	60
4.1.9	Electrical measuring instruments	60
4.1.10	Temperature measurements	60
4.1.11	Steady state conditions	61
4.1.12	Hierarchy of safeguards	61
4.1.13	Examples mentioned in the standard	61
4.1.14	Tests on parts or samples separate from the end-product	61
4.1.15	Markings and instructions	61
4.2	Energy source classifications	61
4.2.1	Class 1 energy source	61
4.2.2	Class 2 energy source	62
4.2.3	Class 3 energy source	62
4.2.4	Energy source classification by declaration	62
4.3	Protection against energy sources	62
4.3.1	General	62
4.3.2	Safeguards for protection of an ordinary person	62
4.3.3	Safeguards for protection of an instructed person	64
4.3.4	Safeguards for protection of a skilled person	64
4.3.5	Safeguards in a restricted access area	65
4.4	Safeguards	66
4.4.1	Equivalent materials or components	66
4.4.2	Composition of a safeguard	66
4.4.3	Accessible parts of a safeguard	66
4.4.4	Safeguard robustness	66
4.5	Explosion	68
4.5.1	General	68
4.5.2	Requirements	68

4.6	Fixing of conductors.....	69
4.6.1	Requirements	69
4.6.2	Compliance criteria.....	69
4.7	Equipment for direct insertion into mains socket-outlets	69
4.7.1	General	69
4.7.2	Requirements	69
4.7.3	Compliance criteria.....	70
4.8	Products containing lithium coin / button cell batteries	70
4.8.1	General	70
4.8.2	Instructional safeguard	70
4.8.3	Construction	70
4.8.4	Tests	71
4.8.5	Compliance criteria.....	71
4.9	Likelihood of fire or shock due to entry of conductive objects	72
5	Electrically-caused injury.....	72
5.1	General.....	72
5.2	Classification and limits of electrical energy sources.....	73
5.2.1	Electrical energy source classifications.....	73
5.2.2	Electrical energy source ES1 and ES2 limits.....	73
5.3	Protection against electrical energy sources	79
5.3.1	General	79
5.3.2	Accessibility to electrical energy sources and safeguards	79
5.4	Insulation materials and requirements.....	81
5.4.1	General	81
5.4.2	Clearances	87
5.4.3	Creepage distances	97
5.4.4	Solid insulation	101
5.4.5	Antenna terminal insulation.....	110
5.4.6	Insulation of internal wire as a part of a supplementary safeguard	111
5.4.7	Tests for semiconductor components and for cemented joints	111
5.4.8	Humidity conditioning	111
5.4.9	Electric strength test.....	112
5.4.10	Safeguards against transient voltages from external circuits	115
5.4.11	Separation between external circuits and earth.....	117
5.5	Components as safeguards.....	118
5.5.1	General	118
5.5.2	Capacitors and RC units	118
5.5.3	Transformers	120
5.5.4	Optocouplers	120
5.5.5	Relays	120
5.5.6	Resistors	120
5.5.7	SPDs.....	120
5.5.8	Insulation between the mains and an external circuit consisting of a coaxial cable	121
5.6	Protective conductor	121
5.6.1	General	121
5.6.2	Requirements for protective conductors	121
5.6.3	Requirements for protective earthing conductors	122

5.6.4	Requirements for protective bonding conductors	123
5.6.5	Terminals for protective conductors	125
5.6.6	Resistance of the protective bonding system	126
5.6.7	Reliable earthing	128
5.7	Prospective touch voltage, touch current and protective conductor current.....	128
5.7.1	General	128
5.7.2	Measuring devices and networks	128
5.7.3	Equipment set-up, supply connections and earth connections.....	128
5.7.4	Earthed accessible conductive parts	129
5.7.5	Protective conductor current	129
5.7.6	Prospective touch voltage and touch current due to external circuits.....	130
5.7.7	Summation of touch currents from external circuits.....	131
6	Electrically-caused fire	133
6.1	General.....	133
6.2	Classification of power sources (PS) and potential ignition sources (PIS)	133
6.2.1	General.....	133
6.2.2	Power source circuit classifications	133
6.2.3	Classification of potential ignition sources	136
6.3	Safeguards against fire under normal operating conditions and abnormal operating conditions.....	137
6.3.1	Requirements	137
6.3.2	Compliance criteria.....	138
6.4	Safeguards against fire under single fault conditions.....	138
6.4.1	General	138
6.4.2	Reduction of the likelihood of ignition under single fault conditions in PS1 circuits.....	138
6.4.3	Reduction of the likelihood of ignition under single fault conditions in PS2 circuits and PS3 circuits	138
6.4.4	Control of fire spread in PS1 circuits.....	140
6.4.5	Control of fire spread in PS2 circuits.....	140
6.4.6	Control of fire spread in a PS3 circuit	141
6.4.7	Separation of combustible materials from a PIS.....	142
6.4.8	Fire enclosures and fire barriers	144
6.5	Internal and external wiring.....	149
6.5.1	Requirements	149
6.5.2	Compliance criteria.....	149
6.5.3	Requirements for interconnection to building wiring.....	149
6.5.4	Compliance criteria.....	150
6.6	Safeguards against fire due to the connection of additional equipment.....	150
7	Injury caused by hazardous substances	150
7.1	General.....	150
7.2	Reduction of exposure to hazardous substances.....	150
7.3	Ozone exposure.....	150
7.4	Use of personal safeguards (PPE)	150
7.5	Use of instructional safeguards and instructions	151
7.6	Batteries and their protection circuits	151
8	Mechanically-caused injury.....	151
8.1	General.....	151

8.2	Mechanical energy source classifications	151
8.2.1	General classification	151
8.2.2	MS1	153
8.2.3	MS2	153
8.2.4	MS3	153
8.3	Safeguards against mechanical energy sources	153
8.4	Safeguards against parts with sharp edges and corners	153
8.4.1	Requirements	153
8.4.2	Compliance criteria	154
8.5	Safeguards against moving parts	154
8.5.1	Requirements	154
8.5.2	Instructional safeguard requirements	154
8.5.3	Compliance criteria	155
8.5.4	Special categories of equipment comprising moving parts	155
8.5.5	High pressure lamps	157
8.6	Stability of equipment	158
8.6.1	Requirements	158
8.6.2	Static stability	159
8.6.3	Relocation stability test	160
8.6.4	Glass slide test	160
8.6.5	Horizontal force test and compliance criteria	161
8.7	Equipment mounted to a wall or ceiling	161
8.7.1	Requirements	161
8.7.2	Test methods	161
8.7.3	Compliance criteria	163
8.8	Handle strength	163
8.8.1	General	163
8.8.2	Test method and compliance criteria	163
8.9	Wheels or casters attachment requirements	163
8.9.1	General	163
8.9.2	Test method	164
8.10	Carts, stands, and similar carriers	164
8.10.1	General	164
8.10.2	Marking and instructions	164
8.10.3	Cart, stand or carrier loading test and compliance criteria	165
8.10.4	Cart, stand or carrier impact test	165
8.10.5	Mechanical stability	165
8.10.6	Thermoplastic temperature stability	166
8.11	Mounting means for rack mounted equipment	166
8.11.1	General	166
8.11.2	Requirements	166
8.11.3	Mechanical strength test	167
8.11.4	Mechanical strength test, 250 N, including end stops	167
8.11.5	Compliance criteria	167
8.12	Telescoping or rod antennas	167
9	Thermal burn injury	168
9.1	General	168
9.2	Thermal energy source classifications	168
9.2.1	General	168

9.2.2	TS1	168
9.2.3	TS2	168
9.2.4	TS3	168
9.2.5	Test method and compliance criteria	168
9.2.6	Touch temperature levels	169
9.3	Safeguards against thermal energy sources	170
9.4	Requirements for safeguards	170
9.4.1	Equipment safeguard	170
9.4.2	Instructional safeguard	170
10	Radiation	170
10.1	General	170
10.2	Radiation energy source classifications	170
10.2.1	General classification	170
10.2.2	RS1	172
10.2.3	RS2	172
10.2.4	RS3	172
10.3	Safeguards against laser radiation	172
10.3.1	Requirements	172
10.3.2	Compliance criteria	172
10.4	Safeguards against visible, infra-red, and ultra-violet radiation	173
10.4.1	General	173
10.4.2	Instructional safeguard	173
10.4.3	Compliance criteria	174
10.5	Safeguards against x-radiation	174
10.5.1	Requirements	174
10.5.2	Compliance criteria	174
10.5.3	Test method	174
10.6	Safeguards against acoustic energy sources	175
10.6.1	General	175
10.6.2	Classification	176
10.6.3	Measurement methods	176
10.6.4	Protection of persons	177
10.6.5	Requirements for listening devices (headphones, earphones, etc.)	177
Annex A (informative)	Examples of equipment within the scope of this standard	179
Annex B (normative)	Normal operating condition tests, abnormal operating condition tests and single fault condition tests	180
B.1	General	180
B.1.1	Introduction	180
B.1.2	Test applicability	180
B.1.3	Type of test	180
B.1.4	Test samples	180
B.1.5	Compliance by inspection of relevant data	180
B.1.6	Temperature measurement conditions	180
B.2	Normal operating conditions	181
B.2.1	General	181
B.2.2	Supply frequency	181
B.2.3	Supply voltage	181
B.2.4	Normal operating voltages	182

B.2.5	Input test	182
B.2.6	Operating temperature measurement conditions	183
B.2.7	Battery charging and discharging under normal operating conditions	183
B.3	Simulated abnormal operating conditions	184
B.3.1	General	184
B.3.2	Covering of ventilation openings	184
B.3.3	DC mains polarity test	185
B.3.4	Setting of voltage selector	185
B.3.5	Maximum load at output terminals	185
B.3.6	Reverse battery polarity	185
B.3.7	Audio amplifier abnormal operating conditions	185
B.3.8	Compliance criteria during and after abnormal operating conditions	185
B.4	Simulated single fault conditions	185
B.4.1	General	185
B.4.2	Temperature controlling device	186
B.4.3	Motor tests	186
B.4.4	Functional insulation	186
B.4.5	Short-circuit and interruption of electrodes in tubes and semiconductors	187
B.4.6	Short-circuit or disconnection of passive components	187
B.4.7	Continuous operation of components	187
B.4.8	Compliance criteria during and after single fault conditions	188
B.4.9	Battery charging and discharging under single fault conditions	188
Annex C (normative)	UV radiation	189
C.1	Protection of materials in equipment from UV radiation	189
C.1.1	General	189
C.1.2	Requirements	189
C.1.3	Test method and compliance criteria	189
C.2	UV light conditioning test	190
C.2.1	Test apparatus	190
C.2.2	Mounting of test samples	190
C.2.3	Carbon-arc light-exposure test	190
C.2.4	Xenon-arc light-exposure test	190
Annex D (normative)	Test generators	191
D.1	Impulse test generators	191
D.2	Antenna interface test generator	192
D.3	Electronic pulse generator	192
Annex E (normative)	Test conditions for equipment containing audio amplifiers	193
E.1	Audio amplifier normal operating conditions	193
E.2	Audio amplifier abnormal operating conditions	194
Annex F (normative)	Equipment markings, instructions, and instructional safeguards	195
F.1	General	195
F.2	Letter symbols and graphical symbols	195
F.2.1	Letter symbols	195
F.2.2	Graphical symbols	195
F.2.3	Compliance criteria	195
F.3	Equipment markings	195

F.3.1	Equipment marking locations	195
F.3.2	Equipment identification markings	196
F.3.3	Equipment rating markings	196
F.3.4	Voltage setting device	198
F.3.5	Markings on terminals and operating devices	198
F.3.6	Equipment markings related to equipment classification	199
F.3.7	Equipment IP rating marking	200
F.3.8	External power supply output marking	200
F.3.9	Durability, legibility and permanence of markings	201
F.3.10	Test for the permanence of markings	201
F.4	Instructions	201
F.5	Instructional safeguards	202
Annex G (normative)	Components	205
G.1	Switches	205
G.1.1	General	205
G.1.2	Requirements	205
G.1.3	Test method and compliance criteria	206
G.2	Relays	206
G.2.1	Requirements	206
G.2.2	Overload test	207
G.2.3	Relay controlling connectors supplying power to other equipment	207
G.2.4	Test method and compliance criteria	207
G.3	Protective devices	207
G.3.1	Thermal cut-offs	207
G.3.2	Thermal links	208
G.3.3	PTC thermistors	209
G.3.4	Overcurrent protective devices	210
G.3.5	Safeguard components not mentioned in G.3.1 to G.3.4	210
G.4	Connectors	210
G.4.1	Clearance and creepage distance requirements	210
G.4.2	Mains connectors	210
G.4.3	Connectors other than mains connectors	211
G.5	Wound components	211
G.5.1	Wire insulation in wound components	211
G.5.2	Endurance test	211
G.5.3	Transformers	213
G.5.4	Motors	216
G.6	Wire insulation	220
G.6.1	General	220
G.6.2	Solvent-based enamel winding insulation	221
G.7	Mains supply cords	221
G.7.1	General	221
G.7.2	Cross sectional area	222
G.7.3	Cord anchorages and strain relief for non-detachable power supply cords	224
G.7.4	Cord entry	225
G.7.5	Non-detachable cord bend protection	225
G.7.6	Supply wiring space	226

G.8	Varistors	227
G.8.1	General	227
G.8.2	Safeguards against electric shock	227
G.8.3	Safeguards against fire	228
G.9	Integrated circuit (IC) current limiters	230
G.9.1	Requirements	230
G.9.2	Test program 1	230
G.9.3	Test program 2	231
G.9.4	Test program 3	231
G.9.5	Compliance criteria	232
G.10	Resistors	232
G.10.1	General	232
G.10.2	Resistor test	232
G.10.3	Resistors serving as safeguards between the mains and an external circuit consisting of a coaxial cable	232
G.11	Capacitors and RC units	233
G.11.1	General	233
G.11.2	Conditioning of capacitors and RC units	233
G.11.3	Rules for selecting capacitors	233
G.11.4	Examples of the application of capacitors	234
G.12	Optocouplers	237
G.13	Printed boards	237
G.13.1	General	237
G.13.2	Uncoated printed boards	237
G.13.3	Coated printed boards	237
G.13.4	Insulation between conductors on the same inner surface	239
G.13.5	Insulation between conductors on different surfaces	240
G.13.6	Tests on coated printed boards	240
G.14	Coatings on component terminals	242
G.14.1	Requirements	242
G.14.2	Test method and compliance criteria	242
G.15	Pressurized liquid filled components	243
G.15.1	General	243
G.15.2	Requirements	243
G.15.3	Test methods and compliance criteria	243
G.15.4	Compliance criteria	244
G.16	IC including capacitor discharge function (ICX)	244
G.16.1	Requirements	244
G.16.2	Tests	245
G.16.3	Compliance criteria	245
Annex H (normative)	Criteria for telephone ringing signals	246
H.1	General	246
H.2	Method A	246
H.3	Method B	249
H.3.1	Ringing signal	249
H.3.2	Tripping device and monitoring voltage	249
Annex I (informative)	Overvoltage categories (see IEC 60364-4-44)	251
Annex J (normative)	Insulated winding wires for use without interleaved insulation	252
J.1	General	252

J.2	Type tests	252
J.2.1	General	252
J.2.2	Electric strength	252
J.2.3	Flexibility and adherence	253
J.2.4	Heat shock	253
J.2.5	Retention of electric strength after bending	254
J.3	Testing during manufacturing	254
J.3.1	General	254
J.3.2	Routine test	254
J.3.3	Sampling test	254
Annex K (normative)	Safety interlocks	255
K.1	General	255
K.1.1	General requirements	255
K.1.2	Test method and compliance criteria	255
K.2	Components of the safety interlock safeguard mechanism	256
K.3	Inadvertent change of operating mode	256
K.4	Interlock safeguard override	256
K.5	Fail-safe	256
K.5.1	Requirement	256
K.5.2	Test method and compliance criteria	256
K.6	Mechanically operated safety interlocks	257
K.6.1	Endurance requirement	257
K.6.2	Test method and compliance criteria	257
K.7	Interlock circuit isolation	257
K.7.1	Separation distances for contact gaps and interlock circuit elements	257
K.7.2	Overload test	257
K.7.3	Endurance test	258
K.7.4	Electric strength test	258
Annex L (normative)	Disconnect devices	259
L.1	General requirements	259
L.2	Permanently connected equipment	259
L.3	Parts that remain energized	259
L.4	Single-phase equipment	259
L.5	Three-phase equipment	260
L.6	Switches as disconnect devices	260
L.7	Plugs as disconnect devices	260
L.8	Multiple power sources	260
L.9	Compliance criteria	261
Annex M (normative)	Equipment containing batteries and their protection circuits	262
M.1	General requirements	262
M.2	Safety of batteries and their cells	262
M.2.1	Requirements	262
M.2.2	Compliance criteria	262
M.3	Protection circuits for batteries provided within the equipment	263
M.3.1	Requirements	263
M.3.2	Test method	263
M.3.3	Compliance criteria	264

M.4	Additional safeguards for equipment containing a secondary lithium battery	264
M.4.1	General	264
M.4.2	Charging safeguards	264
M.4.3	Fire enclosure.....	265
M.4.4	Drop test of equipment containing a secondary lithium battery.....	266
M.5	Risk of burn due to short-circuit during carrying	267
M.5.1	Requirements	267
M.5.2	Test method and compliance criteria	267
M.6	Prevention of short-circuits and protection from other effects of electric current	267
M.6.1	Short-circuits	267
M.6.2	Leakage currents	268
M.7	Risk of explosion from lead acid and NiCd batteries.....	268
M.7.1	Ventilation preventing an explosive gas concentration	268
M.7.2	Test method and compliance criteria	268
M.8	Protection against internal ignition from external spark sources of batteries with aqueous electrolyte	270
M.8.1	General	270
M.8.2	Test method	270
M.9	Preventing electrolyte spillage	273
M.9.1	Protection from electrolyte spillage	273
M.9.2	Tray for preventing electrolyte spillage	273
M.10	Instructions to prevent reasonably foreseeable misuse	273
Annex N (normative)	Electrochemical potentials (V).....	274
Annex O (normative)	Measurement of creepage distances and clearances	275
Annex P (normative)	Safeguards against conductive objects	283
P.1	General.....	283
P.2	Safeguards against entry or consequences of entry of a foreign object	283
P.2.1	General	283
P.2.2	Safeguards against entry of a foreign object	283
P.2.3	Safeguards against the consequences of entry of a foreign object	284
P.3	Safeguards against spillage of internal liquids.....	286
P.3.1	General	286
P.3.2	Determination of spillage consequences	286
P.3.3	Spillage safeguards	286
P.3.4	Compliance criteria.....	287
P.4	Metallized coatings and adhesives securing parts	287
P.4.1	General	287
P.4.2	Tests	287
Annex Q (normative)	Circuits intended for interconnection with building wiring	290
Q.1	Limited power source	290
Q.1.1	Requirements	290
Q.1.2	Test method and compliance criteria	290
Q.2	Test for external circuits – paired conductor cable	291
Annex R (normative)	Limited short-circuit test.....	292
R.1	General.....	292
R.2	Test setup.....	292

R.3	Test method	292
R.4	Compliance criteria	293
Annex S (normative)	Tests for resistance to heat and fire	294
S.1	Flammability test for fire enclosure and fire barrier materials of equipment where the steady-state power does not exceed 4 000 W	294
S.2	Flammability test for fire enclosure and fire barrier integrity	295
S.3	Flammability tests for the bottom of a fire enclosure	296
S.3.1	Mounting of samples	296
S.3.2	Test method and compliance criteria	296
S.4	Flammability classification of materials	296
S.5	Flammability test for fire enclosure materials of equipment with a steady-state power exceeding 4 000 W	297
Annex T (normative)	Mechanical strength tests	299
T.1	General	299
T.2	Steady force test, 10 N	299
T.3	Steady force test, 30 N	299
T.4	Steady force test, 100 N	299
T.5	Steady force test, 250 N	299
T.6	Enclosure impact test	299
T.7	Drop test	300
T.8	Stress relief test	300
T.9	Impact test	301
T.10	Glass fragmentation test	301
T.11	Test for telescoping or rod antennas	302
Annex U (normative)	Mechanical strength of CRTs and protection against the effects of implosion	303
U.1	General	303
U.2	Test method and compliance criteria for non-intrinsically protected CRTs	304
U.3	Protective screen	304
Annex V (normative)	Determination of accessible parts	305
V.1	Accessible parts of equipment	305
V.1.1	General	305
V.1.2	Test method 1 – Surfaces and openings tested with jointed test probes	305
V.1.3	Test method 2 – Openings tested with straight unjointed test probes	305
V.1.4	Test method 3 – Plugs, jacks, connectors	308
V.1.5	Test method 4 – Slot openings	309
V.1.6	Test method 5 – Terminals intended to be used by an ordinary person	309
V.2	Accessible part criterion	310
Annex W (informative)	Comparison of terms introduced in this standard	311
W.1	General	311
W.2	Comparison of terms	311
Bibliography	324
Figure 1	Three block model for pain and injury	23
Figure 2	Three block model for safety	24
Figure 3	Schematic and model for electrically-caused pain or injury	29

Figure 4 – Model for protection against electrically-caused pain or injury	29
Figure 5 – Model for electrically-caused fire	30
Figure 6 – Models for protection against fire	31
Figure 7 – Schematic and model for thermally-caused injury	33
Figure 8 – Model for protection against thermally-caused injury	34
Figure 9 – Model for protection of an ordinary person against a class 1 energy source	62
Figure 10 – Model for protection of an ordinary person against a class 2 energy source	63
Figure 11 – Model for protection of an ordinary person against a class 2 energy source during ordinary person servicing conditions	63
Figure 12 – Model for protection of an ordinary person against a class 3 energy source	63
Figure 13 – Model for protection of an instructed person against a class 1 energy source	64
Figure 14 – Model for protection of an instructed person against a class 2 energy source	64
Figure 15 – Model for protection of an instructed person against a class 3 energy source	64
Figure 16 – Model for protection of a skilled person against a class 1 energy source	65
Figure 17 – Model for protection of a skilled person against a class 2 energy source	65
Figure 18 – Model for protection of a skilled person against a class 3 energy source	65
Figure 19 – Model for protection of a skilled person against class 3 energy sources during equipment servicing conditions	65
Figure 20 – Test hook	72
Figure 21 – Illustration showing ES limits for voltage and current	74
Figure 22 – Maximum values for combined a.c. current and d.c. current	76
Figure 23 – Maximum values for combined a.c. voltage and d.c. voltage	76
Figure 24 – Contact requirements to bare internal conductive parts	80
Figure 25 – Mandrel	105
Figure 26 – Initial position of mandrel	106
Figure 27 – Final position of mandrel	106
Figure 28 – Position of metal foil on insulating material	106
Figure 29 – Example of electric strength test instrument for solid insulation	114
Figure 30 – Application points of test voltage	115
Figure 31 – Test for separation between an external circuit and earth	118
Figure 32 – Test circuit for touch current of single-phase equipment	131
Figure 33 – Test circuit for touch current of three-phase equipment	131
Figure 34 – Power measurement for worst-case fault	134
Figure 35 – Power measurement for worst-case power source fault	135
Figure 36 – Illustration of power source classification	136
Figure 37 – Minimum separation requirements from an arcing PIS	142
Figure 38 – Extended separation requirements from a PIS	142
Figure 39 – Rotated separation requirements due to forced air flow	143
Figure 40 – Deflected separation requirements from a PIS when a fire barrier is used	144
Figure 41 – Top openings	146
Figure 42 – Bottom openings	147
Figure 43 – Limits for moving fan blades made of non-plastic materials	152

Figure 44 – Limits for moving fan blades made of plastic materials	152
Figure D.1 – 1,2/50 μ s and 10/700 μ s voltage impulse generator	191
Figure D.2 – Antenna interface test generator circuit	192
Figure D.3 – Example of an electronic pulse generator	192
Figure E.1 – Band-pass filter for wide-band noise measurement	194
Figure F.1 – Example of an instructional safeguard	203
Figure G.1 – Determination of arithmetic average temperature	215
Figure G.2 – Thermal ageing time	241
Figure G.3 – Abrasion resistance test for coating layers	242
Figure H.1 – Definition of ringing period and cadence cycle	247
Figure H.2 – I_{TS1} limit curve for cadenced ringing signal	248
Figure H.3 – Peak and peak-to-peak currents	248
Figure H.4 – Ringing voltage trip criteria	250
Figure M.1 – Distance d as a function of the rated capacity for various charge currents I (mA/Ah)	272
Figure O.1 – Narrow groove	275
Figure O.2 – Wide groove	275
Figure O.3 – V-shaped groove	276
Figure O.4 – Intervening unconnected conductive part	276
Figure O.5 – Rib	276
Figure O.6 – Uncemented joint with narrow groove	276
Figure O.7 – Uncemented joint with wide groove	277
Figure O.8 – Uncemented joint with narrow and wide grooves	277
Figure O.9 – Narrow recess	278
Figure O.10 – Wide recess	278
Figure O.11 – Coating around terminals	278
Figure O.12 – Coating over printed wiring	279
Figure O.13 – Example of measurements in an enclosure of insulating material	279
Figure O.14 – Cemented joints in multi-layer printed boards	280
Figure O.15 – Device filled with insulating compound	280
Figure O.16 – Partitioned bobbin	280
Figure O.17 – Materials with different CTI values	281
Figure O.18 – Materials with different CTI values having an air gap of less than X mm	281
Figure O.19 – Materials with different CTI values having an air groove of less than X mm	282
Figure O.20 – Materials with different CTI values having an air groove not smaller than X mm	282
Figure P.1 – Examples of cross-sections of designs of top openings which prevent vertical entry	284
Figure P.2 – Examples of cross-sections of designs of side opening louvres which prevent vertical entry	284
Figure P.3 – Internal volume locus for foreign object entry	285
Figure T.1 – Impact test using sphere	300
Figure V.1 – Jointed test probe for equipment likely to be accessible to children	306
Figure V.2 – Jointed test probe for equipment not likely to be accessible to children	307

Figure V.3 – Blunt probe	308
Figure V.4 – Wedge probe	309
Figure V.5 – Terminal probe	310
Table 1 – Response to energy class	23
Table 2 – Examples of body response or property damage related to energy sources	24
Table 3 – Examples of safeguard characteristics	28
Table 4 – Electrical energy source limits for steady-state ES1 and ES2	75
Table 5 – Electrical energy source limits for a charged capacitor	77
Table 6 – Voltage limits for single pulses	78
Table 7 – Current limits for single pulses	78
Table 8 – Electrical energy source limits for repetitive pulses	79
Table 9 – Minimum air gap distance	80
Table 10 – Temperature limits for materials, components and systems	83
Table 11 – Minimum clearances for voltages with frequencies up to 30 kHz	89
Table 12 – Minimum clearances for voltages with frequencies above 30 kHz	90
Table 13 – Mains transient voltages	91
Table 14 – External circuit transient voltages	93
Table 15 – Minimum clearances using required withstand voltage	95
Table 16 – Electric strength test voltages	96
Table 17 – Multiplication factors for clearances and test voltages	96
Table 18 – Minimum creepage distances for basic insulation and supplementary insulation in mm	100
Table 19 – Minimum values of creepage distances (in mm) for frequencies higher than 30 kHz and up to 400 kHz	101
Table 20 – Tests for insulation in non-separable layers	104
Table 21 – Electric field strength E_P for some commonly used materials	108
Table 22 – Reduction factors for the value of breakdown electric field strength E_P at higher frequencies	109
Table 23 – Reduction factors for the value of breakdown electric field strength E_P at higher frequencies for thin materials	109
Table 24 – Values for insulation resistance	110
Table 25 – Distance through insulation of internal wiring	111
Table 26 – Test voltages for electric strength tests based on transient voltages	113
Table 27 – Test voltages for electric strength tests based on peak working voltages	113
Table 28 – Test voltages for electric strength tests based on temporary overvoltages	114
Table 29 – Test values for electric strength tests	116
Table 30 – Protective earthing conductor sizes for reinforced safeguards for permanently connected equipment	123
Table 31 – Minimum protective bonding conductor size of copper conductors	124
Table 32 – Sizes of terminals for protective conductors	126
Table 33 – Test duration, mains connected equipment	127
Table 34 – Size and spacing of holes in metal bottoms of fire enclosures	148
Table 35 – Classification for various categories of mechanical energy sources	151
Table 36 – Overview of requirements and tests	158

Table 37 – Torque to be applied to screws.....	162
Table 38 – Touch temperature limits for accessible parts.....	169
Table 39 – Radiation energy source classifications.....	171
Table C.1 – Minimum property retention limits after UV exposure.....	189
Table D.1 – Component values for Figure D.1 and Figure D.2.....	192
Table E.1 – Audio signal electrical energy source classes and safeguards.....	194
Table F.1 – Instructional safeguard element description and examples.....	203
Table F.2 – Examples of markings, instructions, and instructional safeguards.....	204
Table G.1 – Peak surge current.....	206
Table G.2 – Test temperature and testing time (days) per cycle.....	212
Table G.3 – Temperature limits for transformer windings and for motor windings (except for the motor running overload test).....	215
Table G.4 – Temperature limits for running overload tests.....	217
Table G.5 – Sizes of conductors.....	223
Table G.6 – Strain relief test force.....	224
Table G.7 – Varistor overload and temporary overvoltage test.....	228
Table G.8 – Capacitor ratings according to IEC 60384-14.....	234
Table G.9 – Examples of the application of Y capacitors based on the test voltages of Table 26.....	235
Table G.10 – Examples of the application of Y capacitors based on the test voltages of Table 27.....	236
Table G.11 – Examples of the application of Y capacitors based on the test voltages of Table 28.....	236
Table G.12 – Examples of the application of X capacitors, line to line or line to neutral.....	237
Table G.13 – Minimum separation distances for coated printed boards.....	239
Table G.14 – Insulation in printed boards.....	240
Table I.1 – Overvoltage categories.....	251
Table J.1 – Mandrel diameter.....	253
Table J.2 – Oven temperature.....	254
Table M.1 – Values of f_g and f_s	269
Table O.1 – Value of X	275
Table Q.1 – Limits for inherently limited power sources.....	290
Table Q.2 – Limits for power sources not inherently limited (overcurrent protective device required).....	291
Table S.1 – Foamed materials.....	297
Table S.2 – Rigid materials.....	297
Table S.3 – Very thin materials.....	297
Table T.1 – Impact force.....	301
Table T.2 – Torque values for end-piece test.....	302
Table W.1 – Comparison of terms and definitions in IEC 60664-1:2007 and IEC 62368-1.....	311
Table W.2 – Comparison of terms and definitions in IEC 61140:2001 and IEC 62368-1.....	313
Table W.3 – Comparison of terms and definitions in IEC 60950-1:2005 and IEC 62368-1.....	316
Table W.4 – Comparison of terms and definitions in IEC 60728-11 and IEC 62368-1.....	319

Table W.5 – Comparison of terms and definitions in IEC 62151 and IEC 62368-1	320
Table W.6 – Comparison of terms and definitions in IEC 60065 and IEC 62368-1	321

This document is a preview generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**AUDIO/VIDEO, INFORMATION AND COMMUNICATION
TECHNOLOGY EQUIPMENT –****Part 1: Safety requirements**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62368-1 has been prepared by TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology.

This second edition cancels and replaces the first edition published in 2010. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- addition of requirements for LEDs;
- new requirements for wall and ceiling mounting means;
- addition of acoustic shock requirements for personal music players;
- revision of the battery requirements, including new requirements for coin / button cell batteries;
- revision of the burn requirements.

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

FDIS	Report on voting
108/521/FDIS	108/531/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62368 series, published under the general title *Audio/video, information and communication technology equipment*, can be found on the IEC website.

The “in some countries” notes regarding differing national practices are contained in the following subclauses:

0.2.1, 1, 4.1.15, 4.7.3, 5.2.2.2, 5.4.2.3.2.4, 5.4.2.5, 5.4.5.1, 5.5.2.1, 5.5.6, 5.6.4.2, 5.7.5, 5.7.6.1, 10.5.8, 10.6.2.1, F.3.3.6, Table 13, Table 14 and Table 39.

In this standard, the following print types or formats are used:

- requirements proper and normative annexes: in roman type;
- compliance statements and test specifications: *in italic type*;
- notes/explanatory matter: in smaller roman type;
- normative conditions within tables: in smaller roman type;
- terms that are defined in 3.3: **bold**.

In figures and tables, if colour is available:

- green colour denotes a class 1 energy source;
- yellow colour denotes a class 2 energy source;
- red colour denotes a class 3 energy source.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

NOTE 1 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests. It is the recommendation of the committee that the content of this publication be adopted for mandatory implementation nationally not earlier than five years from the date of publication of this standard.

NOTE 2 IEC 62368-1 is based on the principles of hazard based safety engineering, which is a different way of developing and specifying safety considerations than that of the current practice. While this standard is different from traditional IEC safety standards in its approach and while it is believed that IEC 62368-1 provides a number of advantages, its introduction and evolution is not intended to result in significant changes to the existing safety philosophy that led to the development of the safety requirements contained in IEC 60065 and IEC 60950-1. The predominant reason behind the creation of IEC 62368-1 is to simplify the problems created by the merging of the technologies of ITE and CE. The techniques used are novel so that a learning process is required and experience is needed in its application. Consequently, the committee recommends that this edition of the standard be considered as an alternative to IEC 60065 or IEC 60950-1 at least over the recommended transition period.

NOTE 3 Explanatory information related to IEC 62368-1 is contained in IEC/TR 62368-2. It provides rationale together with explanatory information related to this standard.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

0 Principles of this product safety standard

0.1 Objective

This part of IEC 62368 is a product safety standard that classifies energy sources, prescribes **safeguards** against those energy sources, and provides guidance on the application of, and requirements for, those **safeguards**.

The prescribed **safeguards** are intended to reduce the likelihood of pain, injury and, in the case of fire, property damage.

The objective of the INTRODUCTION is to help designers to understand the underlying principles of safety in order to design safe equipment. These principles are informative and not an alternative to the detailed requirements of this standard.

0.2 Persons

0.2.1 General

This standard describes **safeguards** for the protection of three kinds of persons: the **ordinary person**, the **instructed person**, and the **skilled person**. This standard assumes that a person will not intentionally create conditions or situations that could cause pain or injury.

NOTE In Australia, the work conducted by an **instructed person** or **skilled person** may require formal licensing from regulatory authorities.

0.2.2 Ordinary person

Ordinary person is the term applied to all persons other than **instructed persons** and **skilled persons**. **Ordinary persons** include not only users of the equipment, but also all persons who may have access to the equipment or who may be in the vicinity of the equipment. Under **normal operating conditions** or **abnormal operating conditions**, **ordinary persons** should not be exposed to parts comprising energy sources capable of causing pain or injury. Under a **single fault condition**, **ordinary persons** should not be exposed to parts comprising energy sources capable of causing injury.

0.2.3 Instructed person

Instructed person is a term applied to persons who have been instructed and trained by a **skilled person**, or who are supervised by a **skilled person**, to identify energy sources that may cause pain (see Table 1) and to take precautions to avoid unintentional contact with or exposure to those energy sources. Under **normal operating conditions**, **abnormal operating conditions** or **single fault conditions**, **instructed persons** should not be exposed to parts comprising energy sources capable of causing injury.

0.2.4 Skilled person

Skilled person is a term applied to persons who have training or experience in the equipment technology, particularly in knowing the various energies and energy magnitudes used in the equipment. **Skilled persons** are expected to use their training and experience to recognize energy sources capable of causing pain or injury and to take action for protection from injury from those energies. **Skilled persons** should also be protected against unintentional contact or exposure to energy sources capable of causing injury.

0.3 Model for pain and injury

An energy source that causes pain or injury does so through the transfer of some form of energy to or from a body part.

This concept is represented by a three-block model (see Figure 1).

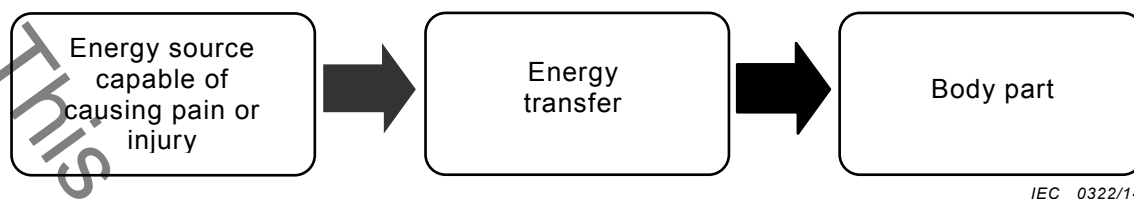


Figure 1 – Three block model for pain and injury

This safety standard specifies three classes of energy sources defined by magnitudes and durations of source parameters relative to either the body or to **combustible material** responses to those energy sources. Each energy class (see 4.2) is a function of the body part or the **combustible material** susceptibility to that energy magnitude (see Table 1).

Table 1 – Response to energy class

Energy source	Effect on the body	Effect on combustible materials
Class 1	Not painful, but may be detectable	Ignition not likely
Class 2	Painful, but not an injury	Ignition possible, but limited growth and spread of fire
Class 3	Injury	Ignition likely, rapid growth and spread of fire

The energy threshold for pain or injury is not constant throughout the population. For example, for some energy sources, the threshold is a function of body mass; the lower the mass, the lower the threshold, and vice-versa. Other body variables include age, state of health, state of emotions, effect of drugs, skin characteristics, etc. Furthermore, even where outward appearances otherwise appear equal, individuals differ in their thresholds of susceptibility to the same energy source.

The effect of duration of energy transfer is a function of the specific energy form. For example, pain or injury from thermal energy can be very short (1 s) for high skin temperature, or very long (several hours) for low skin temperature.

Furthermore, the pain or injury may occur some considerable time after the transfer of energy to a body part. For example, pain or injury from some chemical or physiological reaction may not be manifested for days, weeks, months, or years.

0.4 Energy sources

Energy sources are addressed by this standard, together with the pain or injury that results from a transfer of that energy to the body, and the likelihood of property damage that results from fire escaping the equipment.

An electrical product is connected to an electrical energy source (for example, the **mains**), an external power supply, or a **battery**. An electrical product uses the electrical energy to perform its intended functions.

In the process of using electrical energy, the product transforms the electrical energy into other forms of energy (for example, thermal energy, kinetic energy, optical energy, audio energy, electromagnetic energy, etc.). Some energy transformations may be a deliberate part of the product function (for example, moving parts of a printer, images on a visual display unit, sound from a speaker, etc.). Some energy transformations may be a by-product of the product function (for example, heat dissipated by functional circuits, x-radiation from a cathode-ray tube, etc.).

Some products may use energy sources that are non-electrical energy sources such as **batteries**, moving parts, or chemicals, etc. The energy in these other sources may be transferred to or from a body part, or may be transformed into other energy forms (for example, a **battery** transforms chemical energy into electrical energy, or a moving body part transfers its kinetic energy to a sharp edge).

Examples of the types of energy forms and the associated injuries and property damage addressed in this standard are in Table 2.

Table 2 – Examples of body response or property damage related to energy sources

Forms of energy	Examples of body response or property damage	Clause
Electrical energy (for example, energized conductive parts)	Pain, fibrillation, cardiac arrest, respiratory arrest, skin burn, or internal organ burn	5
Thermal energy (for example, electrical ignition and spread of fire)	Electrically-caused fire leading to burn-related pain or injury, or property damage	6
Chemical reaction (for example, electrolyte, poison)	Skin damage, organ damage, or poisoning	7
Kinetic energy (for example, moving parts of equipment, or a moving body part against an equipment part)	Laceration, puncture, abrasion, contusion, crush, amputation, or loss of a limb, eye, ear, etc.	8
Thermal energy (for example, hot accessible parts)	Skin burn	9
Radiated energy (for example, electromagnetic energy, optical energy, acoustic energy)	Loss of sight, skin burn, or loss of hearing	10

0.5 Safeguards

0.5.1 General

Many products necessarily use energy capable of causing pain or injury. Product design cannot eliminate such energy use. Consequently, such products should use a scheme that reduces the likelihood of such energy being transferred to a body part. The scheme that reduces the likelihood of energy transfer to a body part is a **safeguard** (see Figure 2).



Figure 2 – Three block model for safety

A **safeguard** is a device or scheme or system that

- is interposed between an energy source capable of causing pain or injury and a body part, and
- reduces the likelihood of transfer of energy capable of causing pain or injury to a body part.

NOTE **Safeguard** mechanisms against transfer of energy capable of causing pain or injury include:

- attenuating the energy (reduces the value of the energy); or
- impeding the energy (slows the rate of energy transfer); or
- diverting the energy (changes the energy direction); or
- disconnecting, interrupting, or disabling the energy source; or
- enveloping the energy source (reduces the likelihood of the energy from escaping); or
- interposing a barrier between a body part and the energy source.

A **safeguard** can be applied to the equipment, to the local installation, to a person or can be a learned or directed behaviour (for example, resulting from an **instructional safeguard**) intended to reduce the likelihood of transfer of energy capable of causing pain or injury. A **safeguard** may be a single element or may be a set of elements.

Generally, the order of preference for providing **safeguards** is:

- **equipment safeguards** are always useful, since they do not require any knowledge or actions by persons coming into contact with the equipment;
- **installation safeguards** are useful when a safety characteristic can only be provided after installation (for example, the equipment has to be bolted to the floor to provide stability);
- behavioural **safeguards** are useful when the equipment requires an energy source to be **accessible**.

In practice, **safeguard** selection accounts for the nature of the energy source, the intended user, the functional requirements of the equipment, and similar considerations.

0.5.2 Equipment safeguard

An **equipment safeguard** may be a **basic safeguard**, a **supplementary safeguard**, a **double safeguard**, or a **reinforced safeguard**.

0.5.3 Installation safeguard

Installation safeguards are not controlled by the equipment manufacturer, although in some cases, **installation safeguards** may be specified in the equipment installation instructions.

Generally, with respect to equipment, an **installation safeguard** is a **supplementary safeguard**.

NOTE For example, the protective earthing **supplementary safeguard** is located partly in the equipment and partly in the installation. The protective earthing **supplementary safeguard** is not effective until the equipment is connected to the installation.

Requirements for **installation safeguards** are not addressed in this standard. However, this standard does assume some **installation safeguards**, such as protective earthing, are in place and are effective.

0.5.4 Personal safeguard

A **personal safeguard** may be a **basic safeguard**, a **supplementary safeguard**, or a **reinforced safeguard**.

Requirements for **personal safeguards** are not addressed in this standard. However, this standard does assume that **personal safeguards** are available for use as specified by the manufacturer.

0.5.5 Behavioural safeguards

0.5.5.1 Introduction to behavioural safeguards

In the absence of an equipment, installation, or **personal safeguard**, a person may use a specific behaviour as a **safeguard** to avoid energy transfer and consequent injury. A behavioural **safeguard** is a voluntary or instructed behaviour intended to reduce the likelihood of transfer of energy to a body part.

Three kinds of behavioural **safeguards** are specified in this standard. Each kind of behavioural **safeguard** is associated with a specific kind of person. An **instructional safeguard** is usually addressed to an **ordinary person**, but may also be addressed to an **instructed person** or a **skilled person**. A **precautionary safeguard** is used by an **instructed person**. A **skill safeguard** is used by a **skilled person**.

0.5.5.2 Instructional safeguard

An **instructional safeguard** is a means of providing information, describing the existence and location of an energy source capable of causing pain or injury, and is intended to invoke a specific behaviour on the part of a person to reduce the likelihood of transfer of energy to a body part (see Annex F).

An **instructional safeguard** may be a visual indicator (symbols or words or both) or an audible message, as applicable to the expected use of the product.

When accessing locations where the equipment needs to be energized to perform a service activity, an **instructional safeguard** may be considered acceptable protection to bypass an **equipment safeguard** such that the person is made aware of how to avoid contact with a class 2 or class 3 energy source.

If **equipment safeguards** would interfere with or prohibit the equipment function, an **instructional safeguard** may replace an **equipment safeguard**.

If exposure to an energy source capable of causing pain or injury is essential to the correct functioning of equipment, an **instructional safeguard** may be used to ensure protection of persons instead of another **safeguard**. Consideration should be given as to whether the **instructional safeguard** should require the use of a **personal safeguard**.

Provision of an **instructional safeguard** does not result in an **ordinary person** becoming an **instructed person** (see 0.5.5.3).

0.5.5.3 Precautionary safeguard (used by an instructed person)

A **precautionary safeguard** is the training and experience or supervision of an **instructed person** by a **skilled person** to use precautions to protect the **instructed person** against class 2 energy sources. **Precautionary safeguards** are not specifically prescribed in this standard but are assumed to be effective when the term **instructed person** is used.

During equipment servicing, an **instructed person** may need to remove or defeat an **equipment safeguard**. In this case, an **instructed person** is expected to then apply precaution as a **safeguard** to avoid injury.

0.5.5.4 Skill safeguard (used by a skilled person)

A **skill safeguard** is the education, training, knowledge and experience of the **skilled person** that is used to protect the **skilled person** against class 2 or class 3 energy sources. **Skill safeguards** are not specifically prescribed in this standard but are assumed to be effective when the term **skilled person** is used.

During equipment servicing, a **skilled person** may need to remove or defeat an **equipment safeguard**. In this case, a **skilled person** is expected to then apply skill as a **safeguard** to avoid injury.

0.5.6 Safeguards during ordinary or instructed person service conditions

During **ordinary person** or **instructed person** service conditions, **safeguards** for such persons may be necessary. Such **safeguards** can be **equipment safeguards**, **personal safeguards**, or **instructional safeguards**.

0.5.7 Equipment safeguards during skilled person service conditions

During **skilled person** service conditions, **equipment safeguards** should be provided to protect against the effects of a body's involuntary reaction (for example, startle) that might cause unintentional contact with a class 3 energy source located outside the view of the **skilled person**.

NOTE This **safeguard** typically applies in large equipment, where the **skilled person** needs to partially or wholly enter between two or more class 3 energy source locations while servicing.

0.5.8 Examples of safeguard characteristics

Table 3 lists some examples of **safeguard** characteristics.

Table 3 – Examples of safeguard characteristics

Safeguard	Basic safeguard	Supplementary safeguard	Reinforced safeguard
Equipment safeguard: a physical part of an equipment	Effective under normal operating conditions	Effective in the event of failure of the basic safeguard	Effective under normal operating conditions and in the event of a single fault condition elsewhere in the equipment
	Example: basic insulation	Example: supplementary insulation	Example: reinforced insulation
	Example: normal temperatures below ignition temperatures	Example: fire enclosure	Not applicable
Installation safeguard: a physical part of a man-made installation	Effective under normal operating conditions	Effective in the event of failure of an equipment basic safeguard	Effective under normal operating conditions and in the event of a single fault condition elsewhere in the equipment
	Example: wire size	Example: overcurrent protective device	Example: socket outlet
Personal safeguard: a physical device worn on the body	In the absence of any equipment safeguard , effective under normal operating conditions	Effective in the event of failure of an equipment basic safeguard	In the absence of any equipment safeguard , effective under normal operating conditions and in the event of a single fault condition elsewhere in the equipment
	Example: gloves	Example: insulating floor mat	Example: electrically-insulated glove for handling live conductors
Instructional safeguard: a voluntary or instructed behaviour intended to reduce the likelihood of transfer of energy to a body part	In the absence of any equipment safeguard , effective under normal operating conditions	Effective in the event of failure of an equipment basic safeguard	Only effective on an exceptional basis, when providing all appropriate safeguards would prevent the intended functioning of the equipment
	Example: instructional safeguard to disconnect telecommunication cable before opening the cover	Example: after opening a door, an instructional safeguard against hot parts	Example: instructional safeguard of hot parts in an office photocopier, or a continuous roll paper cutter on a commercial printer

0.6 Electrically-caused pain or injury (electric shock)

0.6.1 Models for electrically-caused pain or injury

Electrically-caused pain or injury may occur when electrical energy capable of causing pain or injury is transferred to a body part (see Figure 3).

Electrical energy transfer occurs when there are two or more electrical contacts to the body:

- the first electrical contact is between a body part and a conductive part of the equipment;
- the second electrical contact is between another body part; and
 - earth, or
 - another conductive part of the equipment.

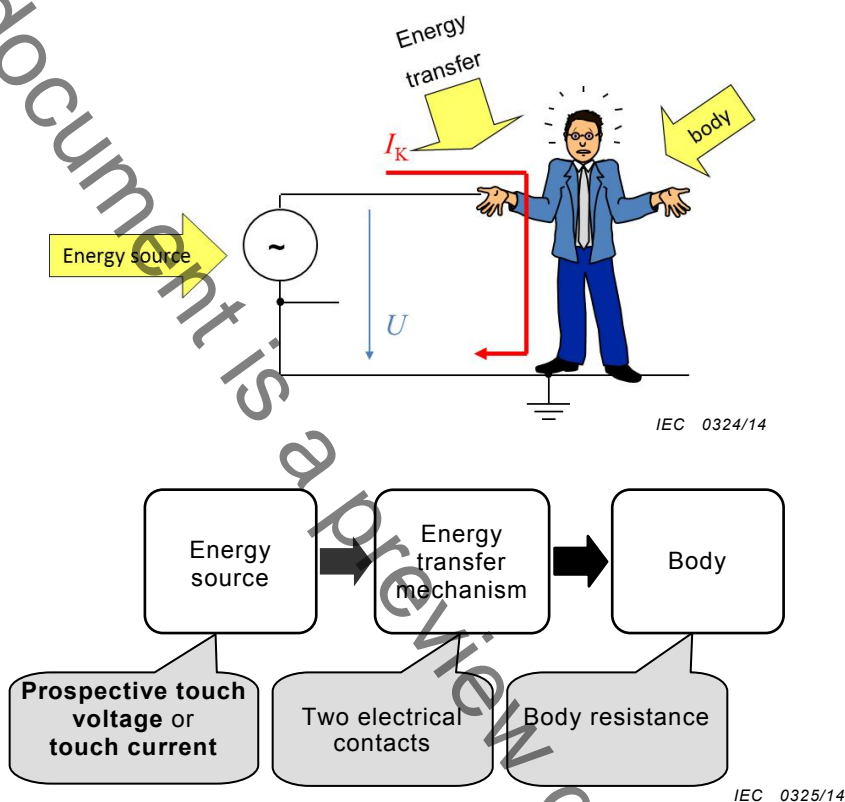


Figure 3 – Schematic and model for electrically-caused pain or injury

Depending on the magnitude, duration, wave shape, and frequency of the current, the effect to the human body varies from undetectable to detectable to painful to injurious.

0.6.2 Models for protection against electrically-caused pain or injury

Protection against electrically-caused pain or injury requires that one or more **safeguards** be interposed between an electrical energy source capable of causing pain or injury and a body part (see Figure 4).

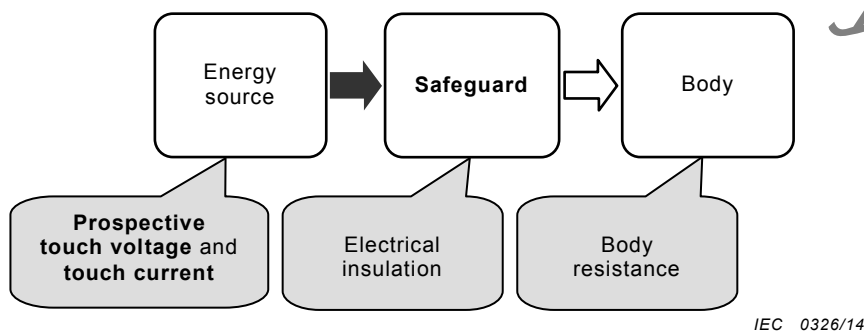


Figure 4 – Model for protection against electrically-caused pain or injury

Protection against electrically-caused pain is provided under **normal operating conditions** and **abnormal operating conditions**. Such protection requires that, under **normal operating conditions** and **abnormal operating conditions**, a **basic safeguard** be interposed between an electrical energy source capable of causing pain and an **ordinary person**.

The most common **basic safeguard** against an electrical energy source capable of causing pain is electrical insulation (also known as **basic insulation**) interposed between the energy source and a body part.

Protection against electrically-caused injury is provided under **normal operating conditions**, **abnormal operating conditions**, and **single fault conditions**. Such protection requires that, under **normal operating conditions** and **abnormal operating conditions**, both a **basic safeguard** and a **supplementary safeguard** be interposed between an electrical energy source capable of causing injury and an **ordinary person** (see 4.3.2.4), or an **instructed person** (see 4.3.3.3). In the event of a failure of either **safeguard**, the other **safeguard** becomes effective. The **supplementary safeguard** against an electrical energy source capable of causing injury is placed between the **basic safeguard** and a body part. A **supplementary safeguard** may be additional electrical insulation (**supplementary insulation**) or a protectively earthed conductive barrier or other construction that performs the same function.

The most common **safeguard** against an electrical energy source capable of causing injury is electrical insulation (also known as **double insulation** or **reinforced insulation**) placed between the energy source and a body part.

Likewise, a **reinforced safeguard** may be placed between an electrical energy source capable of causing injury and a body part.

0.7 Electrically-caused fire

0.7.1 Models for electrically-caused fire

Electrically-caused fire is due to conversion of electrical energy to thermal energy (see Figure 5), where the thermal energy heats a fuel material followed by ignition and combustion.

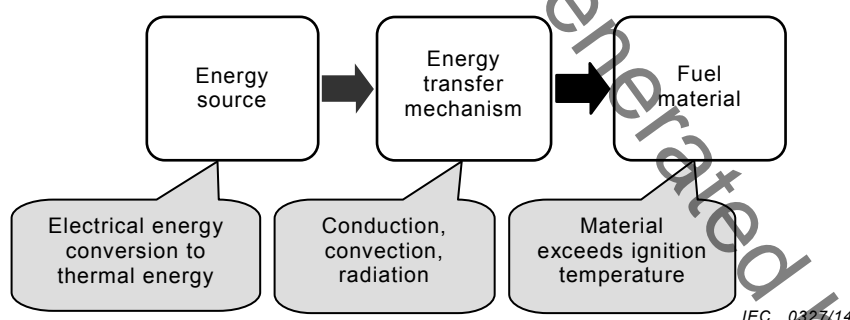


Figure 5 – Model for electrically-caused fire

Electrical energy is converted to thermal energy either in a resistance or in an arc and is transferred to a fuel material by conduction, convection, or radiation. As the fuel material heats, it chemically decomposes into gases, liquids and solids. When the gas is at its ignition temperature, the gas can be ignited by an ignition source. When the gas is at its spontaneous ignition temperature, the gas ignites by itself. Both result in fire.

0.7.2 Models for protection against electrically-caused fire

The **basic safeguard** against electrically-caused fire (see Figure 6) is that the temperature of a material, under **normal operating conditions** and **abnormal operating conditions**, does not cause the material to ignite.

The **supplementary safeguard** against electrically-caused fire reduces the likelihood of ignition or, in the case of ignition, reduces the likelihood of spread of fire.

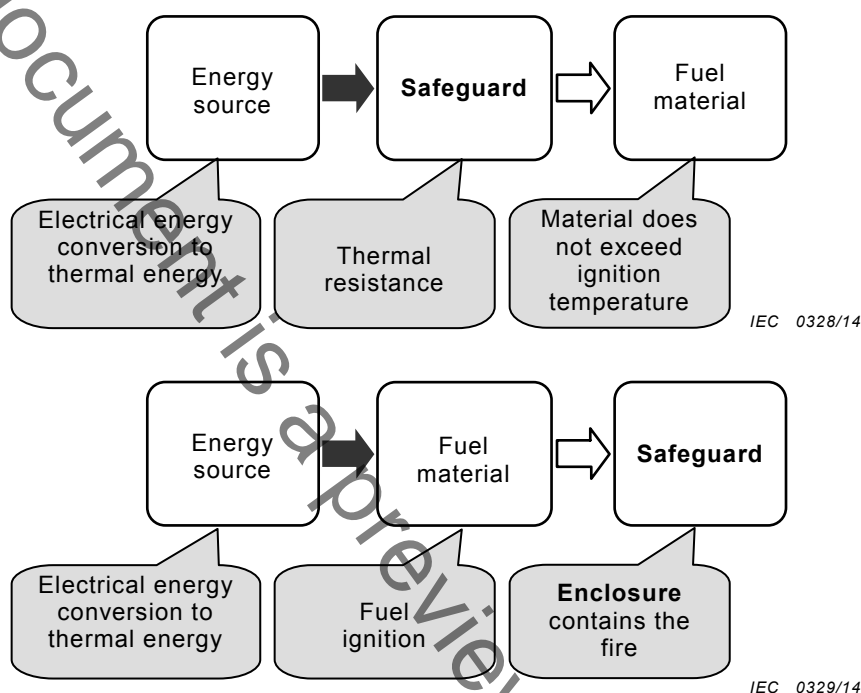


Figure 6 – Models for protection against fire

0.8 Injury caused by hazardous substances

Injury caused by **hazardous substances** is due to a chemical reaction with a body part. The extent of injury by a given substance depends on both the magnitude and duration of exposure and on the body part susceptibility to that substance.

The **basic safeguard** against injury caused by **hazardous substances** is containment of the material.

Supplementary safeguards against injury caused by **hazardous substances** may include:

- a second container or a spill-resistant container;
- containment trays;
- tamper-proof screws to prevent unauthorized access;
- **instructional safeguards**.

National and regional regulations govern the use of and exposure to **hazardous substances** used in equipment. These regulations do not enable a practical classification of **hazardous substances** in the manner in which other energy sources are classified in this standard. Therefore, energy source classifications are not applied in Clause 7.

0.9 Mechanically-caused injury

Mechanically-caused injury is due to kinetic energy transfer to a body part when a collision occurs between a body part and an equipment part. The kinetic energy is a function of the relative motion between a body part and **accessible** parts of the equipment, including parts ejected from the equipment that collide with a body part.

Examples of kinetic energy sources are:

- body motion relative to sharp edges and corners;
- part motion due to rotating or other moving parts, including pinch points;
- part motion due to loosening, exploding, or imploding parts;
- equipment motion due to instability;
- equipment motion due to wall, ceiling, or rack mounting means failure;
- equipment motion due to handle failure;
- part motion due to an exploding **battery**;
- equipment motion due to cart or stand instability or failure.

The **basic safeguard** against mechanically-caused injury is a function of the specific energy source. **Basic safeguards** may include:

- rounded edges and corners;
- an **enclosure** to prevent a moving part from being **accessible**;
- an **enclosure** to prevent expelling a moving part;
- a **safety interlock** to control access to an otherwise moving part;
- means to stop the motion of a moving part;
- means to stabilize the equipment;
- robust handles;
- robust mounting means;
- means to contain parts expelled during **explosion** or implosion.

The **supplementary safeguard** against mechanically-caused injury is a function of the specific energy source. **Supplementary safeguards** may include:

- **instructional safeguards**;
- instructions and training;
- additional **enclosures** or barriers;
- **safety interlocks**.

The **reinforced safeguard** against mechanically-caused injury is a function of the specific energy source. **Reinforced safeguards** may include:

- extra thick glass on the front of a CRT;
- rack slide-rails and means of support;
- **safety interlock**.

0.10 Thermally-caused injury (skin burn)

0.10.1 Models for thermally-caused injury

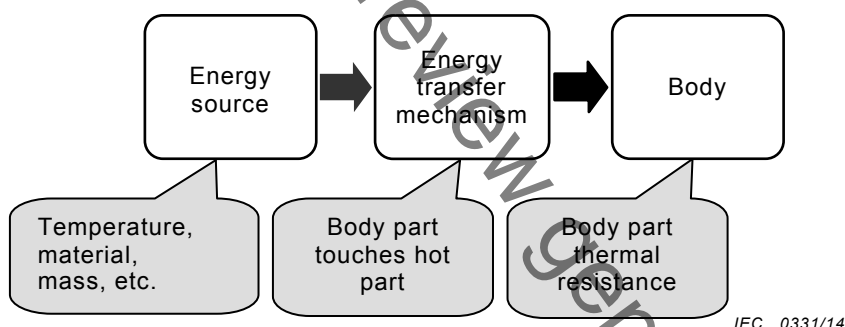
Thermally-caused injury may occur when thermal energy capable of causing injury is transferred to a body part (see Figure 7).

Thermal energy transfer occurs when a body touches a hot equipment part. The extent of injury depends on the temperature difference, the thermal mass of the object, rate of thermal energy transfer to the skin, and duration of contact.

The requirements in this standard only address **safeguards** against thermal energy transfer by conduction. This standard does not address **safeguards** against thermal energy transfer by convection or radiation.



IEC 0330/14



IEC 0331/14

Figure 7 – Schematic and model for thermally-caused injury

Depending on the temperature, contact duration, material properties, and mass of the material, the perception of the human body varies from warmth to heat that may result in pain or injury (burn).

0.10.2 Models for protection against thermally-caused pain or injury

Protection against thermally-caused pain or injury requires that one or more **safeguards** be interposed between a thermal energy source capable of causing pain or injury and an **ordinary person** (see Figure 8).

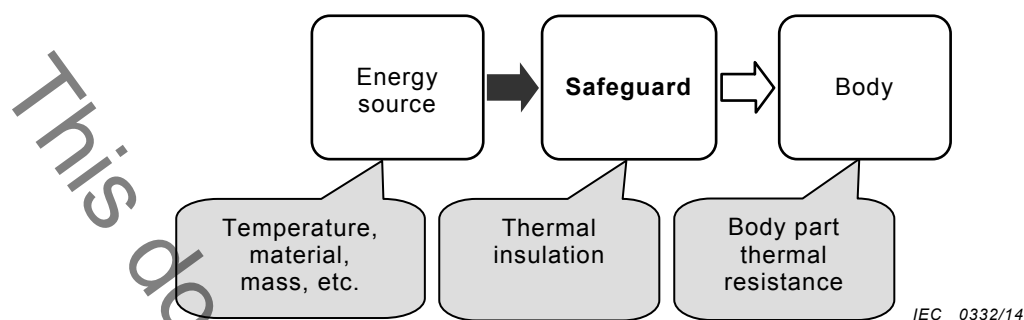


Figure 8 – Model for protection against thermally-caused injury

Protection against thermally-caused pain is required under **normal operating conditions** and **abnormal operating conditions**. Such protection requires that a **basic safeguard** be interposed between a thermal energy source capable of causing pain and an **ordinary person**.

Protection against thermally-caused injury is required under **normal operating conditions**, **abnormal operating conditions** and **single fault conditions**. Such protection requires that a **basic safeguard** and a **supplementary safeguard** be interposed between a thermal energy source capable of causing injury and an **ordinary person**.

The **basic safeguard** against a thermal energy source capable of causing pain or injury is thermal insulation placed between the energy source and a body part. In some cases, a **basic safeguard** against a thermal energy source capable of causing pain or injury may be an **instructional safeguard** identifying the hot parts and how to reduce the likelihood of injury. In some cases, a **basic safeguard** reduces the likelihood of a non-injurious thermal energy source from becoming a thermal energy source capable of causing pain or injury.

Examples of such **basic safeguards** are:

- control of electrical energy being converted to thermal energy (for example, a **thermostat**); and
- heat sinking, etc.

The **supplementary safeguard** against a thermal energy source capable of causing injury is thermal insulation placed between the energy source and a body part. In some cases, a **supplementary safeguard** against a thermal energy source capable of causing pain or injury may be an **instructional safeguard** identifying the hot parts and how to reduce the likelihood of injury.

0.11 Radiation-caused injury

Radiation-caused injury within the scope of this standard is generally attributed to one of the following energy transfer mechanisms:

- heating of a body organ caused by exposure to non-ionising radiation, such as the highly localised energy of a laser impinging on the retina, or heating a larger volume such as the energy from a high frequency wireless, electromagnetic fields, or high frequency transmitter; or
- auditory injury caused by over stimulation of the ear by excessive peaks or sustained loud sound, leading to physical or nerve damage.

Radiated energy is transferred by impingement of wave emission upon a body part.

The **basic safeguard** against radiation-caused injury is containment of the energy within an **enclosure** that is opaque to the radiated energy.

There are several **supplementary safeguards** against radiation-caused injury. The **supplementary safeguards** may include **safety interlocks** to disconnect power to the generator, tamper-proof screws to prevent unauthorized access, etc.

The **basic safeguard** against auditory injury is to limit the acoustic output of personal music players and their associated headphones and earphones.

Examples of **supplementary safeguards** against auditory pain and injury are the provision of warnings and information advising the user how to use the equipment correctly.

This document is a preview generated by EVS

AUDIO/VIDEO, INFORMATION AND COMMUNICATION TECHNOLOGY EQUIPMENT –

Part 1: Safety requirements

1 Scope

This part of IEC 62368 is applicable to the safety of electrical and electronic equipment within the field of audio, video, information and communication technology, and business and office machines with a **rated voltage** not exceeding 600 V. This standard does not include requirements for performance or functional characteristics of equipment.

NOTE 1 Examples of equipment within the scope of this standard are given in Annex A.

NOTE 2 A **rated voltage** of 600 V is considered to include equipment rated 400/690 V.

This part of IEC 62368 is also applicable to:

- components and subassemblies intended for incorporation in this equipment. Such components and subassemblies need not comply with every requirement of the standard, provided that the complete equipment, incorporating such components and subassemblies, does comply;
- external power supply units intended to supply other equipment within the scope of this part of IEC 62368;
- accessories intended to be used with equipment within the scope of this part of IEC 62368.

This part of IEC 62368 does not apply to power supply systems which are not an integral part of the equipment, such as motor-generator sets, **battery** backup systems and distribution transformers.

This part of IEC 62328 specifies **safeguards** for **ordinary persons**, **instructed persons**, and **skilled persons**. Additional requirements may apply for equipment that is clearly designed or intended for use by children or specifically attractive to children.

NOTE 3 In Australia, the work conducted by an **instructed person** or a **skilled person** may require formal licensing from regulatory authorities.

This standard assumes an altitude of 2 000 m unless specified otherwise by the manufacturer.

This part of IEC 62368 does not apply to equipment to be used in wet areas. Additional requirements may apply.

Additional requirements for equipment intended for outdoor installation are given in IEC 60950-22.

This part of IEC 62368 does not address:

- manufacturing processes except safety testing;
- injurious effects of gases released by thermal decomposition or combustion;
- disposal processes;
- effects of transport (other than as specified in this standard);
- effects of storage of materials, components, or the equipment itself;

- the likelihood of injury from particulate radiation such as alpha particles and beta particles;
- the likelihood of thermal injury due to radiated or convected thermal energy;
- the likelihood of injury due to flammable liquids;
- the use of the equipment in oxygen-enriched or **explosive** atmospheres;
- exposure to chemicals other than as specified in Clause 7;
- electrostatic discharge events;
- environmental aspects;
- requirements for functional safety.

NOTE 4 For specific functional and software safety requirements of electronic safety-related systems (for example, protective electronic circuits), see IEC 61508-1.

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.

IEC 60027-1, *Letter symbols to be used in electrical technology – Part 1: General*

IEC 60065, *Audio, video and similar electronic apparatus – Safety requirements*

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

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

IEC/TR 60083, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

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

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

IEC 60086-5, *Primary batteries – Part 5: Safety of batteries with aqueous electrolyte*

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*

IEC 60127 (all parts), *Miniature fuses*

IEC 60227-1, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60227-2:2003, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60245-1, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*

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

IEC 60317 (all parts), *Specifications for particular types of winding wires*

IEC 60317-43, *Specifications for particular types of winding wires – Part 43: Aromatic polyimide tape 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 60320-2-2, *Appliance couplers for household and similar general purposes – Part 2-2: Interconnection couplers for household and similar equipment*

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

IEC 60332-1-3, *Tests on electric and optical fibre cables under fire conditions – Part 1-3: Test for vertical flame propagation for a single insulated wire or cable – Procedure for determination of flaming droplets/particles*

IEC 60332-2-2, *Tests on electric and optical fibre cables under fire conditions – Part 2-2: Test for vertical flame propagation for a single small insulated wire or cable – Procedure for diffusion flame*

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

IEC 60529, *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 60695-10-2, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test*

IEC 60695-10-3, *Fire hazard testing – Part 10-3: Abnormal heat – Mould stress relief distortion test*

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

IEC 60695-11-20:1999, *Fire hazard testing – Part 11-20: Test flames – 500 W flame test methods*

IEC/TS 60695-11-21, *Fire hazard testing – Part 11-21: Test flames – 500 W vertical flame test method for tubular polymeric materials*

IEC 60728-11:2005, *Cable networks for television signals, sound signals and interactive services – Part 11: Safety*

IEC 60730 (all parts), *Automatic electrical controls for household and similar use*

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

IEC 60738-1:2009, *Thermistors – Directly heated positive temperature coefficient – Part 1: Generic specification*

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

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

IEC 60825-2:2004, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

IEC 60825-12, *Safety of laser products – Part 12: Safety of free space optical communication systems used for transmission of information*

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 60851-6:1996, *Winding wires – Test methods – Part 6: Thermal properties*

IEC 60896-11, *Stationary lead-acid batteries – Part 11: Vented types – General requirements and methods of tests*

IEC 60896-21:2004, *Stationary lead-acid batteries – Part 21: Valve regulated types – Methods of test*

IEC 60896-22, *Stationary lead-acid batteries – Part 22: Valve regulated types – Requirements*

IEC 60906-1, *IEC system of plugs and socket-outlets for household and similar purposes – Part 1: Plugs and socket-outlets 16 A 250 V a.c.*

IEC 60906-2, *IEC system of plugs and socket-outlets for household and similar purposes – Part 2: Plugs and socket-outlets 15 A 125 V a.c.*

IEC 60947-1, *Low-voltage switchgear and controlgear – Part 1: General rules*

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

IEC 60950-22:2005, *Information technology equipment – Safety – Part 22: Equipment to be installed outdoors*

IEC 60950-23, *Information technology equipment – Safety – Part 23: Large data storage equipment*

IEC 60990:1999, *Methods of measurement of touch current and protective conductor current*

IEC 60998-1, *Connecting devices for low-voltage circuits for household and similar purposes – Part 1: General requirements*

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 61051-1, *Varistors for use in electronic equipment – Part 1: Generic specification*

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

Amendment 1:2009

IEC 61056-1, *General purpose lead-acid batteries (valve-regulated types) – Part 1: General requirements, functional characteristics – Methods of test*

IEC 61056-2, *General purpose lead-acid batteries (valve-regulated types) – Part 2: Dimensions, terminals and marking*

IEC 61058-1:2008, *Switches for appliances – Part 1: General requirements*

IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*

IEC/TS 61201:2007, *Use of conventional touch voltage limits – Application guide*

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

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

IEC 61427, *Secondary cells and batteries for photovoltaic energy systems (PVES) – General requirements and methods of test*

IEC/TS 61430, *Secondary cells and batteries – Test methods for checking the performance of devices designed for reducing explosion hazards – Lead-acid starter batteries*

IEC 61434, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Guide to designation of current in alkaline secondary cell and battery standards*

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

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*¹

IEC 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*

IEC 61810-1:2008, *Electromechanical elementary relays – Part 1: General requirements*

IEC 61959, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Mechanical tests for sealed portable secondary cells and batteries*

IEC 61965:2003, *Mechanical safety of cathode ray tubes*

IEC 61984, *Connectors – Safety requirements and tests*

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 62281, *Safety of primary and secondary lithium cells and batteries during transport*

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

IEC/TR 62471-2, *Photobiological safety of lamps and lamp systems – Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety*

IEC 62485-2, *Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries*²

ISO 178, *Plastics – Determination of flexural properties*

ISO 179-1, *Plastics – Determination of Charpy impact properties – Part 1: Non-instrumented impact test*

ISO 180, *Plastics – Determination of Izod impact strength*

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

ISO 527 (all parts), *Plastics – Determination of tensile properties*

ISO 871, *Plastics – Determination of ignition temperature using a hot-air furnace*

ISO 3864 (all parts), *Graphical symbols – Safety colours and safety signs*

ISO 3864-2, *Graphical symbols – Safety colours and safety signs – Part 2: Design principles for product safety labels*

ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance*

¹ To be published.

² To be published.

ISO 4892-2:2006, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ISO 4892-4, *Plastics – Methods of exposure to laboratory light sources – Part 4: Open-flame carbon-arc lamps*

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

ISO 7010, *Graphical symbols – Safety colours and safety signs – Safety signs used in workplaces and public areas*

ISO 8256, *Plastics – Determination of tensile-impact strength*

ISO 9772, *Cellular plastics – Determination of horizontal burning characteristics of small specimens subjected to a small flame*

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

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

EN 50332-2, *Sound system equipment: Headphones and earphones associated with portable audio equipment – Maximum sound pressure level measurement methodology and limit considerations – Part 2: Matching of sets with headphones if either or both are offered separately*