

INTERNATIONAL STANDARD



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

(<https://standards.iteh.ai>)

Document Preview

IEC 62368-1:2018

<https://standards.iteh.ai/catalog/standards/iec/23853430-e91c-4580-8d49-34cbdc749abc/iec-62368-1-2018>

Withhold



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 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.

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

Tel.: +41 22 919 02 11
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 - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 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: sales@iec.ch.

IEC 62368-1:2018

<https://standards.iteh.ai/standards/iec/23853430-e91c-4580-8d49-34cbdc749abc/iec-62368-1-2018>



IEC 62368-1

Edition 3.0 2018-10
REDLINE VERSION

INTERNATIONAL STANDARD



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

Withhold
iTech Standards
(<https://standards.iteh.ai>)
Document Preview

IEC 62368-1:2018

<https://standards.iteh.ai/catalog/standards/iec/23853430-e91c-4580-8d49-34cbdc749abc/iec-62368-1-2018>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.160.01; 35.020

ISBN 978-2-8322-6111-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	20
INTRODUCTION.....	23
0 Principles of this product safety standard	23
0.1 Objective	23
0.2 Persons	23
0.2.1 General	23
0.2.2 Ordinary person	23
0.2.3 Instructed person	23
0.2.4 Skilled person	23
0.3 Model for pain and injury	24
0.4 Energy sources	24
0.5 Safeguards	25
0.5.1 General	25
0.5.2 Equipment safeguard	26
0.5.3 Installation safeguard.....	26
0.5.4 Personal safeguard.....	26
0.5.5 Behavioural safeguards.....	27
0.5.6 Safeguards during ordinary or instructed person service conditions.....	28
0.5.7 Equipment safeguards during skilled person service conditions.....	28
0.5.8 Examples of safeguard characteristics.....	28
0.6 Electrically-caused pain or injury (electric shock)	29
0.6.1 Models for electrically-caused pain or injury.....	29
0.6.2 Models for protection against electrically-caused pain or injury	30
0.7 Electrically-caused fire	31
0.7.1 Models for electrically-caused fire	31
0.7.2 Models for protection against electrically-caused fire	31
0.8 Injury caused by hazardous substances.....	32
0.9 Mechanically-caused injury.....	32
0.10 Thermally-caused injury (skin burn)	33
0.10.1 Models for thermally-caused injury	33
0.10.2 Models for protection against thermally-caused pain or injury.....	34
0.11 Radiation-caused injury.....	35
1 Scope.....	36
2 Normative references.....	38
3 Terms, definitions and abbreviated terms	45
3.1 Energy source abbreviations	45
3.2 Other abbreviations	46
3.3 Terms and definitions	47
3.3.1 Circuit terms	50
3.3.2 Enclosure terms	50
3.3.3 Equipment terms	51
3.3.4 Flammability terms	52
3.3.5 Electrical insulation	54
3.3.6 Miscellaneous	54
3.3.7 Operating and fault conditions	56
3.3.8 Persons	58

3.3.9	Potential ignition sources	58
3.3.10	Ratings	58
3.3.11	Safeguards	59
3.3.12	Spacings.....	61
3.3.13	Temperature controls	61
3.3.14	Voltages and currents	61
3.3.15	Classes of equipment with respect to protection from electric shock.....	62
3.3.16	Chemical terms	63
3.3.17	Batteries	64
3.3.18	FIW terms	65
3.3.19	Sound exposure	65
4	General requirements	66
4.1	General.....	66
4.1.1	Application of requirements and acceptance of materials, components and subassemblies	66
4.1.2	Use of components	66
4.1.3	Equipment design and construction	67
4.1.4	Equipment installation.....	67
4.1.5	Constructions and components not specifically covered.....	67
4.1.6	Orientation during transport and use.....	67
4.1.7	Choice of criteria.....	68
4.1.8	Conductive liquids Liquids and liquid filled components (LFC).....	68
4.1.9	Electrical measuring instruments.....	68
4.1.10	Temperature measurements.....	68
4.1.11	Steady state conditions.....	69
4.1.12	Hierarchy of safeguards	69
4.1.13	Examples mentioned in this document.....	69
4.1.14	Tests on parts or samples separate from the end-product	69
4.1.15	Markings and instructions.....	69
4.2	Energy source classifications	69
4.2.1	Class 1 energy source.....	69
4.2.2	Class 2 energy source.....	70
4.2.3	Class 3 energy source.....	70
4.2.4	Energy source classification by declaration.....	70
4.3	Protection against energy sources	70
4.3.1	General	70
4.3.2	Safeguards for protection of an ordinary person.....	70
4.3.3	Safeguards for protection of an instructed person	72
4.3.4	Safeguards for protection of a skilled person	73
4.3.5	Safeguards in a restricted access area	74
4.4	Safeguards	74
4.4.1	Equivalent materials or components	74
4.4.2	Composition of a safeguard.....	74
	Accessible parts of a safeguard.....	
4.4.3	Safeguard robustness	74
4.4.4	Displacement of a safeguard by an insulating liquid	77
4.4.5	Safety interlocks	77
4.5	Explosion.....	77
4.5.1	General	77

4.5.2	Requirements	78
4.6	Fixing of conductors	78
4.6.1	Requirements	78
4.6.2	Compliance criteria	78
4.7	Equipment for direct insertion into mains socket-outlets	78
4.7.1	General	78
4.7.2	Requirements	78
4.7.3	Compliance criteria	79
4.8	Products Equipment containing lithium coin / button cell batteries	79
4.8.1	General	79
4.8.2	Instructional safeguard	79
4.8.3	Construction	80
4.8.4	Tests	80
4.8.5	Compliance criteria	81
4.9	Likelihood of fire or shock due to entry of conductive objects	81
4.10	Components requirements	82
4.10.1	Disconnect device	82
4.10.2	Switches and relays	82
5	Electrically-caused injury	82
5.1	General	82
5.2	Classification and limits of electrical energy sources	82
5.2.1	Electrical energy source classifications	82
5.2.2	Electrical energy source ES1 and ES2 limits	83
5.3	Protection against electrical energy sources	88
5.3.1	General	88
5.3.2	Accessibility to electrical energy sources and safeguards	88
5.4	Insulation materials and requirements	91
5.4.1	General	91
5.4.2	Clearances	96
5.4.3	Creepage distances	106
5.4.4	Solid insulation	110
5.4.5	Antenna terminal insulation	120
5.4.6	Insulation of internal wire as a part of a supplementary safeguard	121
5.4.7	Tests for semiconductor components and for cemented joints	121
5.4.8	Humidity conditioning	122
5.4.9	Electric strength test	122
5.4.10	Safeguards against transient voltages from external circuits	126
5.4.11	Separation between external circuits and earth	128
5.4.12	Insulating liquid	129
5.5	Components as safeguards	130
5.5.1	General	130
5.5.2	Capacitors and RC units	130
5.5.3	Transformers	131
5.5.4	Optocouplers	131
5.5.5	Relays	132
5.5.6	Resistors	132
5.5.7	SPDs	133
5.5.8	Insulation between the mains and an external circuit consisting of a coaxial cable	134

5.5.9	Safeguards for socket-outlets in outdoor equipment.....	134
5.6	Protective conductor	134
5.6.1	General	134
5.6.2	Requirements for protective conductors.....	134
5.6.3	Requirements for protective earthing conductors	135
5.6.4	Requirements for protective bonding conductors.....	136
5.6.5	Terminals for protective conductors	138
5.6.6	Resistance of the protective bonding system	139
5.6.7	Reliable connection of a protective earthing conductor.....	141
5.6.8	Functional earthing	141
5.7	Prospective touch voltage, touch current and protective conductor current	142
5.7.1	General	142
5.7.2	Measuring devices and networks.....	142
5.7.3	Equipment set-up, supply connections and earth connections	142
5.7.4	Unearthed accessible parts	142
5.7.5	Earthed accessible conductive parts.....	143
	Protective conductor current.....	
5.7.6	Requirements when touch current exceeds ES2 limits.....	143
5.7.7	Prospective touch voltage and touch current due to associated with external circuits.....	144
5.7.8	Summation of touch currents from external circuits.....	146
5.8	Backfeed safeguard in battery backed up supplies.....	147
6	Electrically-caused fire.....	148
6.1	General.....	148
6.2	Classification of power sources (PS) and potential ignition sources (PIS)	148
6.2.1	General	148
6.2.2	Power source circuit classifications	148
6.2.3	Classification of potential ignition sources	151
6.3	Safeguards against fire under normal operating conditions and abnormal operating conditions.....	152
6.3.1	Requirements	152
6.3.2	Compliance criteria	153
6.4	Safeguards against fire under single fault conditions.....	153
6.4.1	General.....	153
6.4.2	Reduction of the likelihood of ignition under single fault conditions in PS1 circuits	154
6.4.3	Reduction of the likelihood of ignition under single fault conditions in PS2 circuits and PS3 circuits.....	154
6.4.4	Control of fire spread in PS1 circuits.....	156
6.4.5	Control of fire spread in PS2 circuits.....	156
6.4.6	Control of fire spread in a PS3 circuit	157
6.4.7	Separation of combustible materials from a PIS	158
6.4.8	Fire enclosures and fire barriers	161
6.4.9	Flammability of an insulating liquid	168
6.5	Internal and external wiring	168
6.5.1	General requirements.....	168
	Compliance criteria.....	
6.5.2	Requirements for interconnection to building wiring.	169
	Compliance criteria.....	
6.5.3	Internal wiring for socket-outlets.....	169

6.6	Safeguards against fire due to the connection of additional equipment	170
7	Injury caused by hazardous substances	170
7.1	General.....	170
7.2	Reduction of exposure to hazardous substances.....	170
7.3	Ozone exposure.....	170
7.4	Use of personal safeguards or personal protective equipment (PPE)	171
7.5	Use of instructional safeguards and instructions.....	171
7.6	Batteries and their protection circuits	171
8	Mechanically-caused injury	171
8.1	General.....	171
8.2	Mechanical energy source classifications.....	171
8.2.1	General classification.....	171
8.2.2	MS1.....	173
8.2.3	MS2.....	174
8.2.4	MS3.....	174
8.3	Safeguards against mechanical energy sources.....	174
8.4	Safeguards against parts with sharp edges and corners.....	174
8.4.1	Requirements	174
8.4.2	Compliance criteria	174
8.5	Safeguards against moving parts.....	175
8.5.1	Requirements	175
8.5.2	Instructional safeguard requirements.....	176
8.5.3	Compliance criteria	176
8.5.4	Special categories of equipment comprising containing moving parts	176
8.5.5	High pressure lamps.....	182
8.6	Stability of equipment.....	182
8.6.1	Requirements	182
8.6.2	Static stability	184
8.6.3	Relocation stability test	185
8.6.4	Glass slide test.....	186
8.6.5	Horizontal force test and compliance criteria.....	186
8.7	Equipment mounted to a wall, ceiling or other structure.....	186
8.7.1	Requirements	186
8.7.2	Test methods and compliance criteria	187
8.7.3	Compliance criteria	188
8.8	Handle strength.....	188
8.8.1	General	188
8.8.2	Test method.....	189
8.9	Wheels or casters attachment requirements.....	189
8.9.1	General	189
8.9.2	Test method.....	189
8.10	Carts, stands, and similar carriers	190
8.10.1	General	190
8.10.2	Marking and instructions	190
8.10.3	Cart, stand or carrier loading test and compliance criteria	191
8.10.4	Cart, stand or carrier impact test	191
8.10.5	Mechanical stability.....	191
8.10.6	Thermoplastic temperature stability	192

8.11	Mounting means for rack-mounted equipment slide-rail mounted equipment (SRME).....	192
8.11.1	General	192
8.11.2	Requirements	192
8.11.3	Mechanical strength test	193
8.11.4	Compliance criteria	194
8.12	Telescoping or rod antennas	194
9	Thermal burn injury.....	194
9.1	General.....	194
9.2	Thermal energy source classifications	194
	General	
9.2.1	TS1	195
9.2.2	TS2	195
9.2.3	TS3	195
9.3	Touch temperature limits	195
9.3.1	Requirements	195
9.3.2	Test method and compliance criteria	195
	Touch temperature levels	
9.4	Safeguards against thermal energy sources.....	197
9.5	Requirements for safeguards.....	198
9.5.1	Equipment safeguard	198
9.5.2	Instructional safeguard.....	198
9.6	Requirements for wireless power transmitters.....	199
9.6.1	General	199
9.6.2	Specification of the foreign objects	199
9.6.3	Test method and compliance criteria	201
10	Radiation.....	202
10.1	General.....	202
10.2	Radiation energy source classifications	202
10.2.1	General classification	202
10.2.2	RS1	205
10.2.3	RS2	206
10.2.4	RS3	206
10.3	Safeguards against laser radiation.....	206
	Requirements	
	Compliance criteria	
10.4	Safeguards against visible, infra-red, and ultra-violet radiation optical radiation from lamps and lamp systems (including LED types).....	207
10.4.1	General requirements.....	207
10.4.2	Requirements for enclosures	209
10.4.3	Instructional safeguard.....	209
10.4.4	Compliance criteria	211
10.5	Safeguards against X-radiation.....	211
10.5.1	Requirements	211
10.5.2	Compliance criteria	211
10.5.3	Test method.....	212
10.6	Safeguards against acoustic energy sources	212
10.6.1	General	212
10.6.2	Classification	213

10.6.3	Requirements for dose-based systems	215
10.6.4	Measurement methods	215
10.6.5	Protection of persons	215
10.6.6	Requirements for listening devices (headphones, earphones, etc.).....	216
Annex A (informative) Examples of equipment within the scope of this document		218
Annex B (normative) Normal operating condition tests, abnormal operating condition tests and single fault condition tests.....		219
B.1	General.....	219
B.1.1	Introduction Test applicability	219
B.1.2	Type of test.....	219
B.1.3	Test samples	219
B.1.4	Compliance by inspection of relevant data.....	219
B.1.5	Temperature measurement conditions	219
B.2	Normal operating conditions	220
B.2.1	General	220
B.2.2	Supply frequency	220
B.2.3	Supply voltage	220
B.2.4	Normal operating voltages.....	221
B.2.5	Input test	221
B.2.6	Operating temperature measurement conditions	222
B.2.7	Battery charging and discharging under normal operating conditions.....	222
B.3	Simulated abnormal operating conditions.....	222
B.3.1	General	222
B.3.2	Covering of ventilation openings.....	223
B.3.3	DC mains polarity test.....	224
B.3.4	Setting of voltage selector.....	224
B.3.5	Maximum load at output terminals	224
B.3.6	Reverse battery polarity	224
B.3.7	Audio amplifier abnormal operating conditions	224
B.3.8	Compliance criteria during and after abnormal operating conditions	224
B.4	Simulated single fault conditions.....	224
B.4.1	General	224
B.4.2	Temperature controlling device.....	225
B.4.3	Motor tests.....	225
B.4.4	Functional insulation	225
B.4.5	Short-circuit and interruption of electrodes in tubes and semiconductors	226
B.4.6	Short-circuit or disconnection of passive components	226
B.4.7	Continuous operation of components	226
B.4.8	Compliance criteria during and after single fault conditions	227
B.4.9	Battery charging and discharging under single fault conditions.....	227
Annex C (normative) UV radiation		228
C.1	Protection of materials in equipment from UV radiation	228
C.1.1	General	228
C.1.2	Requirements	228
C.1.3	Test method and compliance criteria	228
C.2	UV light conditioning test.....	229
C.2.1	Test apparatus.....	229
C.2.2	Mounting of test samples.....	229
C.2.3	Carbon-arc light-exposure test	229

C.2.4	Xenon-arc light-exposure test.....	229
Annex D (normative)	Test generators	230
D.1	Impulse test generators	230
D.2	Antenna interface test generator.....	230
D.3	Electronic pulse generator.....	231
Annex E (normative)	Test conditions for equipment containing audio amplifiers.....	232
E.1	Electrical energy source classification for audio signals	232
E.2	Audio amplifier normal operating conditions	232
E.3	Audio amplifier abnormal operating conditions	234
Annex F (normative)	Equipment markings, instructions, and instructional safeguards	235
F.1	General.....	235
F.2	Letter symbols and graphical symbols	235
F.2.1	Letter symbols	235
F.2.2	Graphical symbols	235
F.2.3	Compliance criteria	235
F.3	Equipment markings.....	235
F.3.1	Equipment marking locations.....	235
F.3.2	Equipment identification markings	236
F.3.3	Equipment rating markings	236
F.3.4	Voltage setting device	238
F.3.5	Markings on terminals and operating devices.....	239
F.3.6	Equipment markings related to equipment classification	240
F.3.7	Equipment IP rating marking	241
F.3.8	External power supply output marking	241
F.3.9	Durability, legibility and permanence of markings.....	241
F.3.10	Test for the permanence of markings.....	242
F.5	Instructional safeguards.....	243
Annex G (normative)	Components.....	246
G.1	Switches.....	246
G.1.1	General	246
G.1.2	Requirements	246
G.1.3	Test method and compliance criteria	247
G.2	Relays.....	247
G.2.1	Requirements	247
G.2.2	Overload test.....	248
G.2.3	Relay controlling connectors supplying power to other equipment	248
G.2.4	Test method and compliance criteria	248
G.3	Protective devices.....	248
G.3.1	Thermal cut-offs.....	248
G.3.2	Thermal links	249
G.3.3	PTC thermistors	250
G.3.4	Overcurrent protective devices	251
G.3.5	Safeguard components not mentioned in G.3.1 to G.3.4.....	251
G.4	Connectors	251
G.4.1	Clearance and creepage distance requirements.....	251
G.4.2	Mains connectors.....	251
G.4.3	Connectors other than mains connectors	252
G.5	Wound components.....	252

G.5.1	Wire insulation in wound components	252
G.5.2	Endurance test.....	252
G.5.3	Transformers	254
G.5.4	Motors	262
G.6	Wire insulation	266
G.6.1	General	266
G.6.2	Solvent-based enamel winding insulation Enamelled winding wire insulation	267
G.7	Mains supply cords	268
G.7.1	General	268
G.7.2	Cross sectional area	268
G.7.3	Cord anchorages and strain relief for non-detachable power supply cords	270
G.7.4	Cord entry.....	271
G.7.5	Non-detachable cord bend protection	271
G.7.6	Supply wiring space	272
G.8	Varistors	274
G.8.1	General	274
G.8.2	Safeguards against electric shock	275
G.8.2	Safeguards against fire	275
G.9	Integrated circuit (IC) current limiters	277
G.9.1	Requirements	277
G.9.2	Test program	279
	Test program 1	280
	Test program 2	280
	Test program 3	280
G.9.3	Compliance Criteria	280
G.10	Resistors	280
G.10.1	General	280
G.10.2	Conditioning	280
G.10.3	Resistor test	281
	Resistors serving as safeguards between the mains and an external circuit consisting of a coaxial cable	281
G.10.4	Voltage surge test.....	281
G.10.5	Impulse test	281
G.10.6	Overload test	281
G.11	Capacitors and RC units.....	282
G.11.1	General	282
G.11.2	Conditioning of capacitors and RC units	282
G.11.3	Rules for selecting capacitors.....	282
	Examples of the application of capacitors	282
G.12	Optocouplers	286
G.13	Printed boards	286
G.13.1	General	286
G.13.2	Uncoated printed boards	286
G.13.3	Coated printed boards.....	286
G.13.4	Insulation between conductors on the same inner surface	288
G.13.5	Insulation between conductors on different surfaces	289
G.13.6	Tests on coated printed boards	289
G.14	Coatings on component terminals.....	291

G.14.1	Requirements	291
G.14.2	Test method and compliance criteria	291
G.15	Pressurized liquid filled components	292
	General	292
G.15.1	Requirements	292
G.15.2	Test methods and compliance criteria	292
G.15.3	Compliance criteria	293
G.16	IC that includes a capacitor discharge function (ICX)	293
G.16.1	Requirements	293
G.16.2	Tests	294
G.16.3	Compliance criteria	294
Annex H (normative)	Criteria for telephone ringing signals	295
H.1	General	295
H.2	Method A	295
H.3	Method B	298
H.3.1	Ringing signal	298
H.3.2	Tripping device and monitoring voltage	298
Annex I (informative)	Overvoltage categories (see IEC 60364-4-44)	300
Annex J (normative)	Insulated winding wires for use without interleaved insulation	301
J.1	General	301
J.2	Type tests	301
J.2.1	General	301
J.2.2	Electric strength	301
J.2.3	Flexibility and adherence	302
J.2.4	Heat shock	302
J.2.5	Retention of electric strength after bending	303
J.3	Testing during manufacturing	303
J.3.1	General	303
J.3.2	Routine Spark test	303
J.3.3	Sampling test	304
Annex K (normative)	Safety interlocks	305
K.1	General	305
K.1.1	General requirements	305
K.1.2	Test method and compliance criteria	305
K.2	Components of the safety interlock safeguard mechanism	305
K.3	Inadvertent change of operating mode	306
K.4	Interlock safeguard override	306
K.5	Fail-safe	306
K.5.1	Requirement	306
K.5.2	Test method and compliance criteria	306
K.6	Mechanically operated safety interlocks	307
K.6.1	Endurance requirement	307
K.6.2	Test method and compliance criteria	307
K.7	Interlock circuit isolation	307
K.7.1	Separation distances for contact gaps and interlock circuit elements	307
K.7.2	Overload test	308
K.7.3	Endurance test	308
K.7.4	Electric strength test	308

Annex L (normative) Disconnect devices	309
L.1 General requirements	309
L.2 Permanently connected equipment	309
L.3 Parts that remain energized	309
L.4 Single-phase equipment	309
L.5 Three-phase equipment	310
L.6 Switches as disconnect devices	310
L.7 Plugs as disconnect devices	310
L.8 Multiple power sources	310
L.9 Compliance criteria	311
Annex M (normative) Equipment containing batteries and their protection circuits	312
M.1 General requirements	312
M.2 Safety of batteries and their cells	312
M.2.1 Requirements	312
M.2.2 Compliance criteria	312
M.3 Protection circuits for batteries provided within the equipment	313
M.3.1 Requirements	313
M.3.2 Test method	313
M.3.3 Compliance criteria	314
M.4 Additional safeguards for equipment containing a portable secondary lithium battery	314
M.4.1 General	314
M.4.2 Charging safeguards	314
M.4.3 Fire enclosure	316
M.4.4 Drop test of equipment containing a secondary lithium battery	316
M.5 Risk of burn due to short-circuit during carrying	317
M.5.1 Requirements	317
M.5.2 Test method and compliance criteria	317
M.6 Prevention of short circuits and protection from other effects of electric current Safeguards against short-circuits	317
Short circuits	
M.6.1 requirements	317
M.6.2 Compliance criteria	318
Leakage currents	
M.7 Risk of explosion from lead acid and NiCd batteries	318
M.7.1 Ventilation preventing an explosive gas concentration	318
M.7.2 Test method and compliance criteria	319
M.7.3 Ventilation tests	323
M.7.4 Marking requirement	324
M.8 Protection against internal ignition from external spark sources of batteries with aqueous electrolyte	324
M.8.1 General	324
M.8.2 Test method	324
M.9 Preventing electrolyte spillage	327
M.9.1 Protection from electrolyte spillage	327
M.9.2 Tray for preventing electrolyte spillage	327
M.10 Instructions to prevent reasonably foreseeable misuse	327
Annex N (normative) Electrochemical potentials (V)	329
Annex O (normative) Measurement of creepage distances and clearances	330