

TECHNICAL REPORT

RAPPORT TECHNIQUE



**Audio/video, information and communication technology equipment –
Part 2: Explanatory information related to IEC 62368-1:2018**

**Équipements des technologies de l'audio/vidéo, de l'information
et de la communication –
Partie 2: Précisions relatives à l'IEC 62368-1:2018**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 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
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 corrigendum or an amendment might have been published.

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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries 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.

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.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

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 une fois par mois par email.

Service Clients - webstore.iec.ch/csc

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

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 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.

TECHNICAL REPORT

RAPPORT TECHNIQUE



**Audio/video, information and communication technology equipment –
Part 2: Explanatory information related to IEC 62368-1:2018**

**Équipements des technologies de l'audio/vidéo, de l'information
et de la communication –
Partie 2: Précisions relatives à l'IEC 62368-1:2018**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.160.01; 35.020

ISBN 978-2-8322-6716-5

**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.....	6
INTRODUCTION.....	9
0 Principles of this product safety standard.....	10
1 Scope.....	12
2 Normative references.....	13
3 Terms, definitions and abbreviations.....	13
4 General requirements.....	16
5 Electrically-caused injury.....	23
6 Electrically-caused fire.....	70
7 Injury caused by hazardous substances.....	105
8 Mechanically-caused injury.....	109
9 Thermal burn injury.....	117
10 Radiation.....	126
Annex A Examples of equipment within the scope of this standard.....	133
Annex B Normal operating condition tests, abnormal operating condition tests and single fault condition tests.....	133
Annex C UV Radiation.....	136
Annex D Test generators.....	136
Annex E Test conditions for equipment containing audio amplifiers.....	137
Annex F Equipment markings, instructions, and instructional safeguards.....	137
Annex G Components.....	138
Annex H Criteria for telephone ringing signals.....	146
Annex J Insulated winding wires for use without interleaved insulation.....	148
Annex K Safety interlocks.....	148
Annex L Disconnect devices.....	148
Annex M Equipment containing batteries and their protection circuits.....	149
Annex O Measurement of creepage distances and clearances.....	158
Annex P Safeguards against conductive objects.....	158
Annex Q Circuits intended for interconnection with building wiring.....	159
Annex R Limited short-circuit test.....	160
Annex S Tests for resistance to heat and fire.....	160
Annex T Mechanical strength tests.....	162
Annex U Mechanical strength of CRTs and protection against the effects of implosion.....	163
Annex V Determination of accessible parts.....	163
Annex X Alternative method for determining clearances for insulation in circuits connected to an AC mains not exceeding 420 V peak (300 V RMS).....	163
Annex Y Construction requirements for outdoor enclosures.....	164
Annex A (informative) Background information related to the use of SPDs.....	167
Annex B (informative) Background information related to measurement of discharges – Determining the R-C discharge time constant for X- and Y-capacitors.....	180
Annex C (informative) Background information related to resistance to candle flame ignition.....	192

Bibliography.....	193
Figure 1 – Risk reduction as given in ISO/IEC Guide 51.....	11
Figure 2 – HBSE Process Chart.....	12
Figure 3 – Protective bonding conductor as part of a safeguard.....	15
Figure 4 – Safeguards for protecting an ordinary person.....	19
Figure 5 – Safeguards for protecting an instructed person.....	19
Figure 6 – Safeguards for protecting a skilled person.....	20
Figure 7 – Flow chart showing the intent of the glass requirements.....	22
Figure 8 – Conventional time/current zones of effects of AC currents (15 Hz to 100 Hz) on persons for a current path corresponding to left hand to feet (see IEC/TS 60479-1:2005, Figure 20).....	25
Figure 9 – Conventional time/current zones of effects of DC currents on persons for a longitudinal upward current path (see IEC/TS 60479-1:2005, Figure 22).....	26
Figure 10 – Illustration that limits depend on both voltage and current.....	27
Figure 11 – Illustration of working voltage.....	39
Figure 12 – Illustration of transient voltages on paired conductor external circuits.....	41
Figure 13 – Illustration of transient voltages on coaxial-cable external circuits.....	42
Figure 14 – Basic and reinforced insulation in Table 14 of IEC 62368-1:2018; ratio reinforced to basic.....	43
Figure 15 – Reinforced clearances according to Rule 1, Rule 2, and Table 14.....	45
Figure 16 – Example illustrating accessible internal wiring.....	53
Figure 17 – Waveform on insulation without surge suppressors and no breakdown.....	56
Figure 18 – Waveforms on insulation during breakdown without surge suppressors.....	57
Figure 19 – Waveforms on insulation with surge suppressors in operation.....	57
Figure 20 – Waveform on short-circuited surge suppressor and insulation.....	57
Figure 21 – Example for an ES2 source.....	59
Figure 22 – Example for an ES3 source.....	59
Figure 23 – Overview of protective conductors.....	61
Figure 24 – Example of a typical touch current measuring network.....	64
Figure 25 – Touch current from a floating circuit.....	66
Figure 26 – Touch current from an earthed circuit.....	67
Figure 27 – Summation of touch currents in a PABX.....	67
Figure 28 – Possible safeguards against electrically-caused fire.....	75
Figure 29 – Fire clause flow chart.....	78
Figure 30 – Prevent ignition flow chart.....	83
Figure 31 – Control fire spread summary.....	85
Figure 32 – Control fire spread PS2.....	86
Figure 33 – Control fire spread PS3.....	87
Figure 34 – Fire cone application to a large component.....	96
Figure 35 – Flowchart demonstrating the hierarchy of hazard management.....	108
Figure 36 – Model for chemical injury.....	109
Figure 37 – Direction of forces to be applied.....	114
Figure 38 – Model for a burn injury.....	117

Figure 39 – Model for safeguards against thermal burn injury	119
Figure 40 – Model for absence of a thermal hazard.....	120
Figure 41 – Model for presence of a thermal hazard with a physical safeguard in place	120
Figure 42 – Model for presence of a thermal hazard with behavioural safeguard in place.....	120
Figure 43 – Flowchart for evaluation of Image projectors (beamers)	128
Figure 44 – Graphical representation of $L_{Aeq,T}$	130
Figure 45 – Overview of operating modes	135
Figure 46 – Voltage-current characteristics (Typical data).....	140
Figure 47 – Example of IC current limiter circuit.....	144
Figure 48 – Current limit curves	147
Figure 49 – Example of a dummy battery circuit.....	157
Figure 50 – Example of a circuit with two power sources.....	160
Figure A.1 – Installation has poor earthing and bonding; equipment damaged (from ITU-T K.66).....	168
Figure A.2 – Installation has poor earthing and bonding; using main earth bar for protection against lightning strike (from ITU-T K.66)	168
Figure A.3 – Installation with poor earthing and bonding, using a varistor and a GDT for protection against a lightning strike.....	169
Figure A.4 – Installation with poor earthing and bonding; equipment damaged (TV set)	169
Figure A.5 – Safeguards	170
Figure A.6 – Discharge stages	174
Figure A.7 – Holdover	175
Figure A.8 – Discharge	176
Figure A.9 – Characteristics.....	177
Figure A.10 – Follow on current pictures	178
Figure B.1 – Typical EMC filter schematic.....	180
Figure B.2 – 100 MΩ oscilloscope probes	182
Figure B.3 – Combinations of EUT resistance and capacitance for 1-s time constant.....	184
Figure B.4 – 240 V mains followed by capacitor discharge.....	186
Figure B.5 – Time constant measurement schematic	187
Figure B.6 – Worst-case measured time constant values for 100 MΩ and 10 MΩ probes	191
Table 1 – General summary of required safeguards	20
Table 2 – Time/current zones for AC 15 Hz to 100 Hz for hand to feet pathway (see IEC/TS 60479-1:2005, Table 11).....	26
Table 3 – Time/current zones for DC for hand to feet pathway (see IEC/TS 60479- 1:2005, Table 13).....	27
Table 4 – Limit values of accessible capacitance (threshold of pain).....	30
Table 5 – Total body resistances R_T for a current path hand to hand, DC, for large surface areas of contact in dry condition	32
Table 6 – Insulation requirements for external circuits	42
Table 7 – Voltage drop across clearance and solid insulation in series	47
Table 8 – Examples of application of various safeguards	77

Table 9 – Basic safeguards against fire under normal operating conditions and abnormal operating conditions	79
Table 10 – Supplementary safeguards against fire under single fault conditions	80
Table 11 – Method 1: Reduce the likelihood of ignition	82
Table 12 – Method 2: Control fire spread	91
Table 13 – Fire barrier and fire enclosure flammability requirements.....	98
Table 14 – Summary – Fire enclosure and fire barrier material requirements	102
Table 15 – Control of chemical hazards	107
Table 16 – Overview of requirements for dose-based systems	132
Table 17 – Safety of batteries and their cells – requirements (expanded information on documents and scope).....	151
Table B.1 – 100- MΩ oscilloscope probes	182
Table B.2 – Capacitor discharge	183
Table B.3 – Maximum $T_{measured}$ values for combinations of R_{EUT} and C_{EUT} for T_{EUT} of 1 s	190

INTERNATIONAL ELECTROTECHNICAL COMMISSION

AUDIO/VIDEO, INFORMATION AND COMMUNICATION TECHNOLOGY EQUIPMENT –

Part 2: Explanatory information related to IEC 62368-1:2018

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.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example, "state of the art".

IEC 62368-2, which is a Technical Report, has been prepared by IEC technical committee TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology.

This third edition updates the second edition of IEC 62368-2 published in 2014 to take into account changes made to IEC 62368-1:2014 as identified in the Foreword of IEC 62368-1:2018.

This Technical Report is informative only. In case of a conflict between IEC 62368-1 and IEC TR 62368-2, the requirements in IEC 62368-1 prevail over this Technical Report.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
108/708/DTR	108/711/RVDTR

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

In this document, the following print types are used:

- notes/explanatory matter: in smaller roman type;
- tables and figures that are included in the rationale have linked fields (shaded in grey if “field shading” is active);
- terms that are defined in IEC 62368-1: in **bold type**.

In this document, where the term (HBSDT) is used, it stands for Hazard Based Standard Development Team, which is the Working Group of IEC TC 108 responsible for the development and maintenance of IEC 62368-1.

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

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

In this document, only those subclauses from IEC 62368-1 considered to need further background reference information or explanation to benefit the reader in applying the relevant requirements are included. Therefore, not all numbered subclauses are cited. Unless otherwise noted, all references are to clauses, subclauses, annexes, figures or tables located in IEC 62368-1:2018.

The entries in the document may have one or two of the following subheadings in addition to the Rationale statement:

Source – where the source is known and is a document that is accessible to the general public, a reference is provided.

Purpose – where there is a need and when it may prove helpful to the understanding of the Rationale, we have added a Purpose statement.

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

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

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 document is different from traditional IEC safety documents in its approach and while it is believed that IEC 62368-1 provides a number of advantages, its introduction and evolution are 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 a learning process is required and experience is needed in its application. Consequently, the committee recommends that this edition of the document be considered as an alternative to IEC 60065 or IEC 60950-1 at least over the recommended transition period.

AUDIO/VIDEO, INFORMATION AND COMMUNICATION TECHNOLOGY EQUIPMENT –

Part 2: Explanatory information related to IEC 62368-1:2018

0 Principles of this product safety standard

Clause 0 is informational and provides a rationale for the normative clauses of the document.

0.5.1 General

ISO/IEC Guide 51:2014, 6.3.5 states:

“When reducing risks the order of priority shall be as follows:

- a) inherently safe design;*
- b) guards and protective devices;*
- c) information for end users.*

Inherently safe design measures are the first and most important step in the risk reduction process. This is because protective measures inherent to the characteristics of the product or system are likely to remain effective, whereas experience has shown that even well-designed guards and protective devices can fail or be violated and information for use might not be followed.

Guards and protective devices shall be used whenever an inherently safe design measure does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (for example, emergency stop equipment) might have to be implemented.

The end user has a role to play in the risk reduction procedure by complying with the information provided by the designer/supplier. However, information for use shall not be a substitute for the correct application of inherently safe design measures, guards or complementary protective measures.”

In general, this principle is used in IEC 62368-1. The table below shows a comparison between the hierarchy required in ISO/IEC Guide 51 and the hierarchy used in IEC 62368-1:2018:

ISO/IEC Guide 51	IEC 62368-1
a) inherently safe design	1. inherently safe design by limiting all energy hazards to class 1
b) guards and protective devices	2. equipment safeguards
	3. installation safeguards
	4. personal safeguards
c) information for end users	5. behavioral safeguards
	6. instructional safeguards

Risk assessment has been considered as part of the development of IEC 62368-1 as indicated in the following from ISO/IEC Guide 51 (Figure 1) in this document. See also the Hazard Based Safety Engineering (HBSE) Process Flow (Figure 2) in this document that also provides additional details for the above comparison.