

INTERNATIONAL STANDARD

NORME INTERNATIONALE



HORIZONTAL PUBLICATION
PUBLICATION HORIZONTALE

**Determination of certain substances in electrotechnical products –
Part 2: Disassembly, disjointment and mechanical sample preparation**

**Détermination de certaines substances dans les produits électrotechniques –
Partie 2: Démontage, défabrication et préparation mécanique de l'échantillon**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2021 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 It also gives information on projects, replaced and withdrawn publications.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.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

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 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

IEC online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

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.



IEC 62321-2

Edition 2.0 2021-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE



HORIZONTAL PUBLICATION
PUBLICATION HORIZONTALE

**Determination of certain substances in electrotechnical products –
Part 2: Disassembly, disjointment and mechanical sample preparation**

**Détermination de certaines substances dans les produits électrotechniques –
Partie 2: Démontage, défabrication et préparation mécanique de l'échantillon**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.020.01; 43.040.10

ISBN 978-2-8322-9926-5

**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.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms, definitions and abbreviated terms	9
3.1 Terms and definitions.....	9
3.2 Abbreviated terms.....	9
4 Introduction to sampling	10
4.1 Introductory remarks.....	10
4.2 Requirements for certain substances	10
4.3 Complexity of electrotechnical products and related challenges	11
4.4 Sampling procedure	12
4.5 Scope of the analysis.....	13
4.6 Purpose of the analysis.....	14
4.7 Testing strategy	14
5 Sampling plan.....	15
5.1 Introductory remarks.....	15
5.2 Sampling of a complete product.....	15
5.3 Partial disassembly.....	16
5.4 Complete disassembly	16
5.5 Partial disjointment	16
5.6 Complete disjointment	16
5.7 Test sample considerations.....	17
5.7.1 Introductory remarks.....	17
5.7.2 Required sample size	17
5.7.3 Sample size versus detection limit	18
5.7.4 Composite sample considerations.....	19
5.7.5 Non-uniform "homogeneous materials"	19
5.7.6 Determination of sampling of homogeneous materials from different positions.....	21
6 Conclusions and recommendations for sampling	21
7 Mechanical sample preparation	21
7.1 Overview.....	21
7.1.1 Field of application	21
7.1.2 Quality assurance.....	22
7.2 Apparatus, equipment and materials	22
7.3 Procedure.....	23
7.3.1 General	23
7.3.2 Manual cutting	23
7.3.3 Coarse grinding or milling.....	23
7.3.4 Homogenizing.....	23
7.3.5 Fine grinding or milling	23
7.3.6 Very fine grinding of polymers and organic materials	24
Annex A (informative) Examples of procedures for sampling and disjointment	25
Annex B (informative) Probability of the presence of certain substances.....	33
Annex C (informative) Composite testing and sampling.....	37

C.1	Introductory remarks	37
C.2	Calculated maximum concentration for a composite sample based on detection limit	37
C.3	Required detection limit for a composite sample based on the maximum allowable concentration	38
Annex D (informative)	Tools used in sampling.....	40
Annex E (informative)	Examples of mobile phone disassembly and disjointment	41
E.1	General.....	41
E.2	Partial disassembly without tools – Mobile phone type A.....	41
E.3	Partial disassembly with simple tools – Mobile phone type B.....	43
E.4	Complete disassembly – Mobile phone type B	44
E.5	Partial disjointment – Mobile phone type B.....	45
E.6	Complete disjointment – Examples of disjointment of small electronic parts	46
E.7	Complete disjointment of integrated circuit lead frame package	48
E.8	Complete disjointment of ball grid array (BGA) package.....	48
E.8.1	General	48
E.8.2	Solder ball removal from BGA package – Hand removal procedure.....	49
E.8.3	Solder ball removal from BGA package – Solder ball shear procedure.....	50
Bibliography.....		51
Figure 1 – Generic iterative procedure for sampling		12
Figure 2 – Cross-section of a 900 µm wide lead oxide-based resistor (SMD)		20
Figure A.1 – Methodology for sampling and disjointment.....		26
Figure A.2 – Sampling of DVD player.....		27
Figure A.3 – Sampling of LCD TV		28
Figure A.4 – Sampling of PDA		29
Figure A.5 – Sampling of desk fan		30
Figure A.6 – Sampling of parts – Thick film resistor		31
Figure A.7 – Sampling of parts – SMD potentiometer		32
Figure D.1 – Hot gas gun for removing electronic parts.....		40
Figure D.2 – Vacuum pin to remove target electronic devices		40
Figure E.1 – Mobile phone type A with battery charger and camera lens cap		41
Figure E.2 – Mobile phone type A with battery and back cover removed		42
Figure E.3 – Partial disassembly of a mobile phone (type B) into its major parts		43
Figure E.4 – Complete disassembly of key pad.....		44
Figure E.5 – Complete disassembly of bottom housing		44
Figure E.6 – Complete disassembly of other housing or frame		45
Figure E.7 – Parts of the TFT display of the mobile phone (type B) after partial disjointment		45
Figure E.8 – Parts of the main PCB of the mobile phone (type B) after partial disjointment		46
Figure E.9 – Disjointment of lead frame		48
Figure E.10 – BGA package prior to disjointment.....		49
Figure E.11 – BGA package disjointed by hand removal procedure.....		49
Figure E.12 – Solder ball material collected from BGA using hand removal procedure		50
Figure E.13 – BGA solder ball removal using ball shear procedure		50

Table 1 – Minimum number of lead frame samples required for analytical testing	17
Table 2 – Levels of a certain substance (e.g. Pb) in a composite sample	19
Table B.1 – Probability of the presence of certain substances in materials and parts used in electrotechnical products	33
Table B.2 – Probability of the presence of additional certain substances in polymeric materials.....	36
Table C.1 – Calculated maximum concentration for a composite sample based on detection limit	38
Table C.2 – Required detection limit for a composite sample based on the maximum allowable concentration	39
Table E.1 – Possible certain substances or screening substances from a mobile phone (type A).....	42
Table E.2 – Possible certain substances in major parts of the mobile phone (type B).....	43
Table E.3 – Examples of disjointment for typical small electronic parts	47

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DETERMINATION OF CERTAIN SUBSTANCES
IN ELECTROTECHNICAL PRODUCTS –****Part 2: Disassembly, disjointment and mechanical sample preparation**

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.

IEC 62321-2 has been prepared by IEC technical committee 111: Environmental standardization for electrical and electronic products and systems. It is an International Standard.

This second edition cancels and replaces the first edition published in 2013. This edition constitutes a technical revision.

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

- a) Reference to the IEC 62321 series instead of to a list of individual parts of the IEC 62321 series.
- b) Update of the flow chart in Figure 1. Restructure of Clause 4 and update of examples in Annex A.

- c) Adjustment of the risk levels of certain parts and materials to reflect the recent technology development and material change. Update of Table B.1 to include the risk levels of phthalates. Creation of Table B.2 for other substances (e.g. HBCDD, PAH) in polymeric materials.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
111/619/FDIS	111/628/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62321 series, published under the general title *Determination of certain substances in electrotechnical products*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

IMPORTANT – The "colour inside" logo on the cover page of this document 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

The widespread use of electrotechnical products has drawn increased attention to their impact on the environment. In many countries this has resulted in the adaptation of regulations affecting wastes, substances and energy use of electrotechnical products.

The use of certain substances in electrotechnical products is a source of either concern or importance in current and proposed regional legislations.

The purpose of the IEC 62321 series is therefore to provide test methods that will allow the electrotechnical industry to determine the levels of certain substances in electrotechnical products on a consistent global basis. This document, as an important part of the IEC 62321 series, covers strategies of sampling along with the mechanical preparation.

WARNING – Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

DETERMINATION OF CERTAIN SUBSTANCES IN ELECTROTECHNICAL PRODUCTS –

Part 2: Disassembly, disjointment and mechanical sample preparation

1 Scope

This part of IEC 62321 provides strategies of sampling along with the mechanical preparation of samples from electrotechnical products. These samples can be used for analytical testing to determine the levels of certain substances as described in the test methods in other parts of the IEC 62321 series. Restrictions for substances will vary between geographic regions and can be updated on a regular basis. This document describes a generic process for obtaining and preparing samples prior to the determination of any substance of concern.

This document does not provide:

- full guidance on each and every product that could be classified as electrotechnical product. Since there is a huge variety of electrotechnical parts, with various structures and compositions, along with the continuous innovations in the industry, it is unrealistic to attempt to provide procedures for the disjointment of every type of part;
- guidance regarding other routes to gather additional information on certain substances in a product, although the information collected has relevance to the sampling strategies in this document;
- safe disassembly and mechanical disjointment instructions related to electrotechnical products (e.g. mercury-containing switches) and the recycling industry (e.g. how to handle CRTs or the safe removal of batteries). See IEC 62554 [1]¹ for the disjointment and mechanical sample preparation of mercury-containing fluorescent lamps;
- sampling procedures for packaging and packaging materials;
- analytical procedures to measure the levels of certain substances. This is covered by other standards (e.g. other parts of the IEC 62321 series), which are referred to as "test standards" in this document;
- guidelines for assessment of compliance.

This document has the status of a horizontal standard in accordance with IEC Guide 108 [2].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62321 (all parts), *Determination of certain substances in electrotechnical products*

¹ Numbers in square brackets refer to the bibliography.