

# PUBLICLY AVAILABLE SPECIFICATION

## PRE-STANDARD

---

**Electrotechnical products – Determination of restricted substances – Sampling  
procedure – Guidelines**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 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  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://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.

- Catalogue of IEC publications: [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

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 It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

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

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: [www.iec.ch/webstore/custserv](http://www.iec.ch/webstore/custserv)

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00



IEC/PAS 62596

Edition 1.0 2009-01

# PUBLICLY AVAILABLE SPECIFICATION

## PRE-STANDARD

---

**Electrotechnical products – Determination of restricted substances – Sampling procedure – Guidelines**

IEC/PAS 62596 Ed. 1.0 - Preview only Copy via ILLNAS e-Shop

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE **XA**

---

ICS13.020, 43.040.10

ISBN 2-8318-1019-4

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms, definitions and abbreviations .....	6
3.1 Terms and definitions .....	6
3.2 Abbreviations .....	8
4 Introduction to sampling .....	9
4.1 Introductory remark .....	9
4.2 Requirements and concerns for restricted substances .....	9
4.3 Complexity of electrotechnical products and related challenges .....	10
4.4 Strategies for sampling.....	11
5 Sampling.....	13
5.1 Introductory remark .....	13
5.2 Partial disassembly .....	13
5.2.1 Example 1: Cell phone type A – Disassembly without tools.....	14
5.2.2 Example 2: Cell phone type B – Partial disassembly.....	15
5.3 Complete disassembly.....	16
5.4 Partial disjointment.....	18
5.4.1 Introductory remark .....	18
5.5 Complete disjointment.....	20
5.5.1 Introductory remark .....	20
5.5.2 Typical examples of disjointment at the component level .....	20
5.5.3 Examples of disjointment at the base materials level – Disjointment of integrated circuit (IC) chips.....	22
5.6 Considerations of sampling and disjointment.....	25
5.6.1 Introductory remark .....	25
5.6.2 Sample size required.....	25
5.6.3 Sample size v. detection limit .....	26
5.6.4 Composite testing of disjointable samples .....	27
5.6.5 Non-uniform “homogeneous materials” .....	28
5.6.6 Determination of sampling position of homogeneous materials .....	29
6 Conclusions and recommendations .....	29
Annex A (informative) Examples of procedures for sampling and disjointment .....	30
Annex B (informative) Probability of presence of restricted substances.....	40
Annex C (informative) Composite testing and sampling.....	42
Annex D (informative) Tools used in sampling .....	44
Annex E (informative) Use of XRF screening techniques in sampling.....	45
Bibliography.....	54
Figure 1 – Generic iterative procedure for sampling.....	11
Figure 2 – Cell phone with battery charger and camera lens cap.....	14
Figure 3 – Cell Phone with battery and back cover removed .....	15
Figure 4 – Partial disassembly of a cell phone (type B) into its major components .....	16

Figure 5 – Complete disassembly of the key pad .....	17
Figure 6 – Complete disassembly of the bottom housing.....	17
Figure 7 – Complete disassembly of the other housing/frame .....	18
Figure 8 – Components of the TFT display of the cell phone after partial disjointment.....	19
Figure 9 – Components of the main PWB of the cell phone after partial disjointment .....	19
Figure 10 – Disjointment of lead frame component.....	22
Figure 11 – BGA package prior to disjointment .....	23
Figure 12 – BGA package disjointed by the hand removal procedure .....	23
Figure 13 – Solder ball material collected from BGA using a hand removal procedure .....	24
Figure 14 – BGA solder ball removal using the ball shear procedure.....	24
Figure 15 – Cross-section of a 900 µm wide lead oxide-based resistor (SMD) .....	28
Figure A.1 – Example of methodology for sampling and disjointment .....	31
Figure A.2 – Methodology for sampling and disjointment.....	32
Figure A.3 – Sampling of DVD player .....	33
Figure A.4 – Sampling of CRT .....	34
Figure A.5 – Sampling of LCD TV .....	35
Figure A.6 – Sampling of PDA/phone .....	36
Figure A.7 – Sampling of desk fan .....	37
Figure A.8 – Components – Example 1 – thick film resistor .....	38
Figure D.1 – Hot gas gun for removing the electronic components .....	44
Figure D.2 – Vacuum pin to remove the target electronic devices .....	44
Figure E.1 – AC power cord, X-ray spectra of sampled sections .....	47
Figure E.2 – RS232 cable and its X-ray spectra .....	48
Figure E.3 – Cell phone charger shown partially disassembled. ....	48
Figure E.4 – PWB and cable of cell phone charger .....	49
Figure E.5 – Spots from 1,27 mm and 0,3 mm collimators.....	50
Figure E.6 – Examples of substance mapping on PWBs .....	52
Figure E.7 – SEM-EDX image of Pb free solder with small intrusions of Pb (size = 30 µm).....	53
Table 1 – Possible restricted or screening substances from a cell phone .....	15
Table 2 – Possible restricted substances in major components of the cell phone .....	16
Table 3 – Examples of disjointment for typical small electronic components .....	21
Table 4 – Minimum number of lead frame samples required for analytical testing .....	26
Table 5 – Levels of a restricted substance in a composite sample .....	27
Table B.1 – Probability of presence of restricted substances in materials and components used in electrotechnical products .....	40
Table C.1 – Calculated maximum concentration for a composite sample based on detection limit .....	43
Table C.2 – Required detection limit for a composite sample based on the maximum allowable concentration .....	43
Table E.1 – Selection of samples for analysis of AC power cord .....	46
Table E.2 – Selection of samples (testing locations) for analysis after visual inspection – Cell phone charger.....	49
Table E.3 – Results of XRF analysis at spots 1 and 2 as shown in Figure E.6.....	52

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTROTECHNICAL PRODUCTS –  
DETERMINATION OF RESTRICTED SUBSTANCES –  
SAMPLING PROCEDURE – GUIDELINES**

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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.

A Publicly Available Specification (PAS) is a technical specification not fulfilling the requirements for a standard, but made available to the public.

IEC-PAS 62596 has been processed by IEC technical committee 111: Environmental standardization for electrotechnical products and systems.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
111/112/PAS	111/126/RVD

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

## INTRODUCTION

In the electrotechnical industry, much emphasis has been placed on minimizing the environmental burden of its products. Waste handling, recycling, chemicals and energy consumption are covered by regulations. Specifically, the use of materials containing lead (Pb), mercury (Hg), cadmium (Cd) and hexavalent chromium (Cr VI), as well as two types of brominated flame retardants (polybrominated biphenyls, PBBs, and polybrominated diphenyl ethers, PBDEs) in electrotechnical equipment is restricted in current and proposed regional legislation.

To demonstrate compliance with these requirements, it may be necessary to analyse electrotechnical products for a variety of reasons:

- to supplement supply chain material declarations (companies may choose to test products directly to determine compliance);
- companies may require their suppliers to perform analysis to support material declarations;
- companies may perform "spot checks" of their suppliers to assess compliance
- enforcement authorities may perform testing as part of their market surveillance activities.

IEC 62321 already provides test methods for the determination of six regulated substances in electrotechnical products. However, the preparatory steps before the analysis are critically important in obtaining accurate, reproducible results. Prior to this PAS, there was virtually no guidance or consensus as to how electrotechnical products should be sampled.

The purpose of this PAS is primarily to complement IEC 62321 by providing agreed guidelines on how electrotechnical products, assemblies and components should be sampled to determine the levels of restricted substances present.

Please note sampling and analytical testing is not the only way to obtain relevant information on the levels of substances in an electrotechnical product or component. Experience and knowledge of the materials used could remove the need for sampling and testing; for example, flame retardants are never used in metals. Furthermore, analytical test reports and material declarations received can be used to demonstrate that the levels of restricted substances are below the required limits.