IEC 62321-1

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INTERNATIONAL STANDARD

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HORIZONTAL STANDARD

NORME HORIZONTALE

Determination of certain substances in electrotechnical products – Part 1: Introduction and overview

Détermination de certaines substances dans les produits électrotechniques – Partie 1: Introduction et présentation

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DETERMINATION OF CERTAIN SUBSTANCES IN ELECTROTECHNICAL PRODUCTS –

Part 1: Introduction and overview

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.
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International Standard IEC 62321-1 has been prepared by IEC technical committee 111: Environmental standardization for electrical and electronic products and systems.

It has the status of a horizontal standard in accordance with IEC Guide 108.

The first edition of IEC 62321:2008 was a 'stand-alone' standard that included an introduction, an overview of test methods, a mechanical sample preparation as well as various test method clauses.

This first edition of IEC 62321-1 is a partial replacement of IEC 62321, forming a structural revision and replacing Clauses 1 to 4.

Future parts in the IEC 62321 series will gradually replace the corresponding clauses from IEC 62321:2008. Until such time as all parts are published, however, IEC 62321:2008 remains valid for those clauses not yet re-published as a separate part.

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

FDIS	Report on voting
111/295/FDIS	111/306/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 62321 series can be found on the IEC website under the general title: *Determination of certain substances in electrotechnical products.*

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

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

The use of certain substances (e.g. lead (Pb), cadmium (Cd) and polybrominated diphenyl ethers (PBDEs)) in electrotechnical products, is a source of concern in current and proposed regional legislation.

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 of concern in electrotechnical products on a consistent global basis.

The first edition of IEC 62321:2008 was a single 'stand-alone' standard that included an introduction, an overview of test methods, a mechanical sample preparation as well as various test method clauses.

The structure of the new multi-part IEC 62321 series comprises:

– Determination of certain substances in electrotechnical products – Part 1: Introduction and overview.

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

The remaining parts specify screening and verification test methods for the determination of certain substances, each part representing a given substance.

WARNING – Persons using this International Standard should be familiar with normal laboratory practice. This standard 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 1: Introduction and overview

1 Scope

This part of IEC 62321 refers to the sample as the object to be processed and measured. The nature of the sample and the manner in which it is acquired is defined by the entity carrying out the tests and not by this standard.

It is noted that the selection of the sample may affect the interpretation of the test results.

While this standard provides guidance on the disassembly procedure employed for obtaining a sample, it does not determine or specify:

- the level of the disassembly procedure required for obtaining a sample;
- the definition of a “unit” or “homogenous material” as the sample;
- conformity assessment procedures.

NOTE Further guidance on assessment procedures may be found in IEC/TR 62476 [2].

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.

ISO 78-2:1999, *Chemistry – Layouts for standards – Part 2: Methods of chemical analysis*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
analyte
substance to be measured

3.1.2
electronics
material used in electrical or electronic equipment that is not metal or plastic (e.g. ceramic) or not uniform in composition throughout and cannot be practically disassembled to individual discrete materials

EXAMPLE Resistors, capacitors, diodes, integrated circuits, hybrids, application-specific integrated circuits, wound components, relays and their materials.

3.1.3
field replaceable unit
part, component or subassembly that is easily removed (mechanically disjointed) using ordinary tools

Note 1 to entry: "Easily removed" means using ordinary tools to perform such functions as screwing or disconnecting, and only without irreversibly destroying the unit.

[SOURCE: IEC Guide 114:2005, definition 3.7] [3]

3.1.4
matrix
substance or mixture and its form or state in which analyte is embedded or to which analyte is attached

3.1.5
performance-based measurement system
set of processes wherein the data needs, mandates or limitations of a program or project are specified, serving as criteria for selecting appropriate methods to meet those needs in a cost-effective manner

Note 1 to entry: The criteria may be published in regulations, technical guidance documents, permits, work plans or enforcement orders.

3.1.6
precision
closeness of agreement between independent test results obtained under stipulated conditions

3.1.7
reference material
material, sufficiently homogeneous and stable with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties

3.1.8
repeatability
precision under repeatability conditions

[SOURCE: ISO 5725-1:1994, definition 3.13] [4]

3.1.9
reproducibility
precision under reproducibility conditions

[SOURCE: ISO 5725-1:1994, definition 3.17]

3.1.10
screening
analytical procedure to determine the presence or absence of substances in the representative part or section of a product, relative to the value or values chosen as the criterion for presence, absence or further testing

Note 1 to entry: If the screening method produces values that are not conclusive, then additional analysis or other follow-up actions may be necessary to make a final presence/absence decision.

3.2 Abbreviations

AAS	Atomic Absorption Spectrometry
C-IC	Combustion – Ion chromatography
CV-AAS	Cold Vapour Atomic Absorption Spectrometry
CV-AFS	Cold Vapour Atomic Fluorescence Spectroscopy
EPA	Environmental Protection Agency
FRU	Field replaceable unit
GC-MS	Gas chromatography – mass spectrometry
GLP	Good laboratory practice
HPLC-UV	High-performance liquid chromatography – ultraviolet
IC	Ion Chromatography
IAMS	Ion attached mass spectrometry
ICP-MS	Inductively coupled plasma mass spectrometry
ICP-OES	Inductively coupled plasma optical emission spectrometry
IS	Internal standard
IUPAC	International Union of Pure and Applied Chemistry
LOD	Limit of detection
LOQ	Limit of quantification
MDL	Method detection limit
PBB	Polybrominated biphenyl
PBDE	Polybrominated diphenyl ether
PBMS	Performance-based measurement system
PWB	Printed wiring board
QC	Quality control
UV-VIS	Ultraviolet–visible Spectroscopy
XRF	X-ray fluorescence

4 Test methods – Overview

4.1 Field of application

The contents of the test methods to determine the levels of certain substances are grouped in two important steps:

a) analytical test methods;

b) laboratory implementation.

Analytical test methods were developed and validated to ensure their suitability to the task. The structure of each of the test methods are generally aligned in accordance with ISO 78-2 where applicable, i.e.:

– Foreword
– Introduction
– Title
– Warnings
– Scope
– Normative references
– Definitions

– Principle
– Reactions
– Reagents and materials
– Apparatus
– Sampling
– Procedure
– Calculation
– Precision
– Quality assurance and control protocols
– Special cases
– Test report
– Annexes
– Bibliography

Laboratory implementation is not covered in this standard, as laboratories are able to implement test methods described using test methods and standards addressed in other sources. The implementation step includes suitable quality assurance measures and a validation protocol that documents the performance of the analytical method using the instruments in the laboratory. Quality assurance systems such as good laboratory practice (GLP) and/or accreditation to similar international or national systems (e.g. ISO 17025) are strongly encouraged.

4.2 Sample

This standard refers to the sample as the object to be processed and measured according to the test methods to determine the levels of certain substances. A sample can either be a polymer, a metal or electronics.

The entity carrying out the test methods shall define the sample and how to produce it with respect to applicable normative documents.

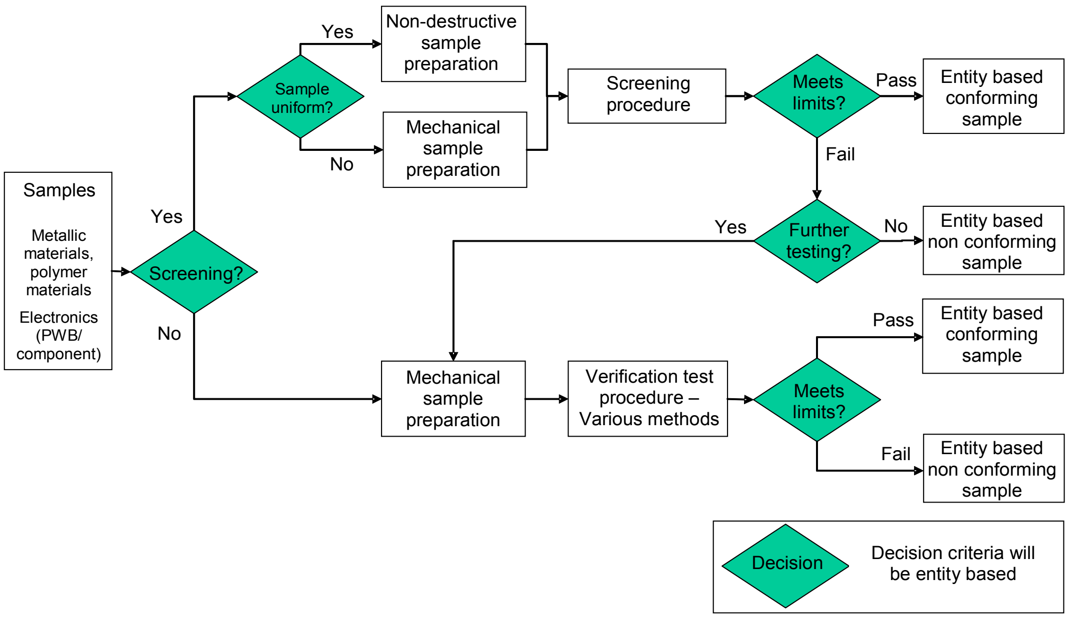
NOTE The entity can either be the organization commissioning the work or the organization carrying out the work. In practice, the requestor and the analyst will agree on the sample to be taken.

The entity may decide to prepare a sample from homogenous material. For this kind of sample, the test methods applicable to metals or polymers are especially suitable.

The entity may also decide to prepare a sample from an electronic component, an electronic assembly or a FRU. For this kind of sample, the test methods applicable to electronics are especially suitable.

4.3 Test methods – Flow chart

Figure 1 gives a flow chart of the test methods to determine the levels of certain substances in electrotechnical products.


Samples
Metallic materials, polymer materials
Electronics (PWB/ component)
Screening?
Yes
No
Sample uniform?
Yes
No
Non-destructive sample preparation
Mechanical sample preparation
Screening procedure
Meets limits?
Pass
Fail
Entity based conforming sample
Further testing?
Yes
No
Entity based non conforming sample
Mechanical sample preparation
Verification test procedure – Various methods
Meets limits?
Pass
Entity based conforming sample
Fail
Entity based non conforming sample
Decision
Decision criteria will be entity based

IEC 2244/08

Figure 1 – Flow chart of the test methods

After obtaining the sample, a decision is taken as to whether the screening procedure or the verification procedure using a variety of test methods will be used.

The use of the term “screening” for the evaluation of certain substances (e.g. lead, cadmium, hexavalent chromium, etc.) in electrical and electronic equipment is widely used in reference to analytical testing methods. Screening methods provide the analyst a convenient approach to evaluate for the presence or quantity of certain substance(s) in samples. Screening may employ qualitative or semi-quantitative methods. In some cases, a quantitative method may be used for screening purposes if the actual targeted substance(s) are difficult to analyse directly (e.g. hexavalent Cr).

Depending on the screening results however, additional analysis methods may need to be employed to definitively verify the presence or quantity of certain substances. These definitive analysis methods are referred to as verification methods.

While X-ray fluorescence spectrometry (XRF) is the tool most commonly associated with the screening approach, it is not limited to this analytical measurement technique. Users of this family of standards will understand that multiple measurement techniques can be employed for the purpose of “screening”.

Screening for hexavalent chromium (Cr VI) for example, can be accomplished by a total chromium measurement using a non-destructive XRF analysis method. Similarly, total chromium analysis could be performed by a destructive analysis using an inductively coupled plasma measurement method. Either measurement can be effectively employed to evaluate for the presence or quantity of hexavalent chromium since the concentration of the hexavalent species can be no greater than the total chromium concentration value.

Likewise, a total bromine measurement using a non-destructive XRF analysis method or C-IC method can be used in the same fashion. Either measurement can be effectively employed to evaluate for the presence or quantity (PBBs) or (PBDEs) in a sample when relating the total bromine content to the composition of these compounds.

In both examples however, the detection of elevated total element levels requires additional verification method analysis (e.g. UV-VIS or GC-MS techniques) to confirm the potential presence or quantity of hexavalent chromium (Cr +IV) or PBB/PBDE compound species.