IEC 62321

Edition 1.0 2008-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Withdrawn

Electrotechnical products – Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)

Produits électrotechniques – Détermination des niveaux de six substances réglementées (plomb, mercure, cadmium, chrome hexavalent, diphényles polybromés, diphényléthers polybromés)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROTECHNICAL PRODUCTS – DETERMINATION OF LEVELS OF SIX REGULATED SUBSTANCES (LEAD, MERCURY, CADMIUM, HEXAVALENT CHROMIUM, POLYBROMINATED BIPHENYLS, POLYBROMINATED DIPHENYL ETHERS)

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

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

FDIS	Report on voting
111/116/FDIS	111/125/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.

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INTRODUCTION

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

The use of certain substances such as lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr(VI)) contained in inorganic and organic compounds, and two types of brominated flame retardants, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) in electrotechnical products, is regulated in current and proposed regional legislation.

The purpose of IEC 62321 is therefore to provide test methods that will allow the electrotechnical industry to determine the levels of regulated substances Pb, Hg, Cd, Cr(VI) and their compounds, as well as PBB and PBDE in electrotechnical products on a consistent global basis.

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ELECTROTECHNICAL PRODUCTS – DETERMINATION OF LEVELS OF SIX REGULATED SUBSTANCES (LEAD, MERCURY, CADMIUM, HEXAVALENT CHROMIUM, POLYBROMINATED BIPHENYLS, POLYBROMINATED DIPHENYL ETHERS)

1 Scope

IEC 62321, which is an International Standard, specifies the determination of the levels of lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr(VI)) contained in inorganic and organic compounds, and two types of brominated flame retardants, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) contained in electrotechnical products.

This standard 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.

NOTE 1 Further guidance on obtaining representative samples from finished electronic products to be tested for levels of regulated substances may be found in the future IEC Publicly Available Specification (PAS) for sampling disjointment[1].

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

This standard does not determine:

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

NOTE 2 Further guidance on assessment procedures may be found in the future IEC Technical Specification IEC/TS 62476[1][2].

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO/IEC Guide 98:1995, *ISO Guide to the expression of uncertainty in measurement (GUM)*

ISO 3696, *Water for analytical laboratory use – Specification and test methods*

ISO 5961, *Water quality – Determination of cadmium by atomic absorption spectrometry*

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

1 Under consideration, no number yet assigned.

2 Figures in square brackets refer to the bibliography.

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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
calibrant
calibration standard
substance in solid or liquid form with known and stable concentration(s) of the analyte(s) of interest used to establish instrument response (calibration curve) with respect to analyte(s) concentration(s)

3.1.3
calibration blank
substance identical in form and matrix composition to the calibrant(s) but containing no analyte(s)

3.1.4
certified reference material
CRM
reference material, accompanied by a certificate, one or more of whose properties are certified by a procedure which establishes traceability to an accurate realization of the unit in which the property values are expressed, and for which each certified value is accompanied by an uncertainty at a stated level of confidence

[ISO Guide 30][2]

3.1.5
digestate
solution obtained after completion of sample digestion process

3.1.6
electronic assembly
group of components, at least one of which is an electronic device, but in which individual parts may be replaced without damage to the assembly

EXAMPLE Group of components mounted on a printed wiring board.

[IEC 60730-1:1999, definition H.2.5.9][3]

3.1.7
electronic components
electrical or electronic devices that are not subject to disassembly without destruction or impairment of design use. They are sometimes called electronic parts, or piece parts

EXAMPLES Resistors, capacitors, diodes, integrated circuits, hybrids, application-specific integrated circuits, wound components and relays.

[IEC/TS 62239:2003][4]

3.1.8
electronics
electronic assembly and/or electronic component and/or field-replaceable unit

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3.1.9
field replaceable unit
FRU
part, component or subassembly that is easily removed (mechanically disjointed) using ordinary tools

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

[IEC Guide 114:2005, definition 3.7][5]

3.1.10
matrix
material or substance and its form or state in which analyte is embedded or to which analyte is attached

3.1.11
performance-based measurement system
PBMS
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 The criteria may be published in regulations, technical guidance documents, permits, work plans or enforcement orders.

3.1.12
reference material
material or substance, one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials

[ISO Guide 30, modified]

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3.2 Abbreviations

AAS	Atomic absorption spectrometry
ABS	Acrylonitrile butadiene styrene
AFS	Atomic fluorescence spectrometry
ASTM	American Society for Testing and Materials
BCR	Community Bureau of Reference (BCR : *Bureau Communautaire de Référence*)
BL	Below limit
BSA	N,O-bis(trimethylsilyl) acetamide
BSTFA	N,O-bis(trimethylsilyl)-trifluoroacetamide
CCC	Continuing calibration check standard
CCFL	Cold cathode fluorescent lamp
CFR	Code of Federal Regulations
CRM	Certified reference material
CV-AAS	Cold vapour atomic absorption spectrometry
CV-AFS	Cold vapour atomic fluorescence spectrometry
DBOFB	4,4'-dibromooctafluorobiphenyl
DIN	Deutsches Institut für Normung
DMDCS	Dimethyldichlorosilane in dichloromethane
EC	European Community

EDXRF	Energy dispersive X-ray fluorescence
EI	Electron ionization
EN	European norm
EPA	Environmental Protection Agency
EVAC	Ethylene vinyl acetate
FEP	Perfluoro(ethylene-propylene)
FP	Fundamental parameters
FRU	Field replaceable unit
GC	Gas chromatography
GC-MS	Gas chromatography – mass spectrometry
GLP	Good laboratory practice
HPLC-UV	High-performance liquid chromatography – ultraviolet
ICP-MS	Inductively coupled plasma mass spectrometry
ICP-OES	Inductively coupled plasma optical emission spectrometry
IS	Internal standard
IIS	International interlaboratory study
IUPAC	International Union of Pure and Applied Chemistry
JIS	Japanese Industrial Standard
LN	Liquid nitrogen
LOD	Limit of detection
LOQ	Limit of quantification
MDL	Method detection limit
NIST	National Institute of Standards and Technology
NMIJ	National Metrology Institute of Japan
OctaBB	Octabromobiphenyl
OctaBDE	Octabromodiphenyl ether
OL	Over limit
PAS	Publicly Available Specification
PBB	Polybrominated biphenyl
PBDE	Polybrominated diphenyl ether
PBMS	Performance-based measurement system
PC	Polycarbonate
PE	Polyethylene
PE-HD	High-density polyethylene
PFA	Perfluoro alkoxyl alkane resin
PS-HI	High-impact polystyrene
PTFE	Polytetrafluoroethylene
PTV	Programmable temperature vaporization
PVC	Polyvinyl chloride
PWB	Printed wiring board
QA	Quality assurance
QC	Quality control
RH	Relative humidity

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RSD	Relative standard deviation
SIM	Single (or “selected”) ion monitoring
SOP	Standard Operating Procedure
SRM	Standard reference material
TFM	Tetrafluoroethylene modified
US	United States
WC	Tungsten carbide
WDXRF	Wavelength dispersive X-ray fluorescence
XRF	X-ray fluorescence

4 Test methods – Overview

4.1 Field of application

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

- Analytical test methods
- Laboratory implementation

Analytical test methods were developed and validated to ensure their suitability to the task. They are divided into five main parts:

- Overview
- Apparatus/equipment and materials
- Reagents
- Sample preparation
- Test method, which includes:
  - calibration;
  - instrument performance;
  - sample analysis;
  - calculation of analytical results;
  - test report;
  - quality control.

Descriptions of individual test methods follow this outline.

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 the regulated substances. A sample can either be a polymer, a metal or electronics.

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