

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Determination of certain substances in electrotechnical products –
Part 4: Mercury in polymers, metals and electronics
by CV-AAS, CV-AFS, ICP-OES and ICP-MS**

**Détermination de certaines substances dans les produits électrotechniques –
Partie 4: Mercure dans les polymères, métaux et produits électroniques par
CV-AAS, CV-AFS, ICP-OES et ICP-MS**



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

ICS 13.020; 43.040.10

ISBN 978-2-83220-841-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DETERMINATION OF CERTAIN SUBSTANCES
IN ELECTROTECHNICAL PRODUCTS –****Part 4: Mercury in polymers, metals and electronics
by CV-AAS, CV-AFS, ICP-OES and ICP-MS**

FOREWORD

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International Standard IEC 62321-4 has been prepared by IEC technical committee 111: Environmental standardization for electrical and electronic products and systems.

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 62321-4 is a partial replacement of IEC 62321, forming a structural revision and replacing Clause 7 and Annex E.

Future parts in the IEC 62321 series will gradually replace the corresponding clauses in 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
111/299/FDIS	111/309/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- withdrawn,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.

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 (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.

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 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS

1 Scope

This part of IEC 62321 describes test methods for mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS.

This standard specifies the determination of the levels of mercury (Hg) contained in electrotechnical products. These materials are polymers, metals and electronics (e.g. printed wiring boards, cold cathode fluorescent lamps, mercury switches). Batteries containing Hg should be handled as described in [1]¹. The interlaboratory study has only evaluated these test methods for plastics, other matrices were not covered.

This standard refers to the sample as the object to be processed and measured. What the sample is or how to get to the sample is defined by the entity carrying out the tests. Further guidance on obtaining representative samples from finished electronic products to be tested for levels of regulated substances may be found in IEC 62321-2. It is noted that the selection and/or determination of the sample may affect the interpretation of the test results.

This standard describes the use of four methods, namely CV-AAS (cold vapour atomic absorption spectrometry), CV-AFS (cold vapour atomic fluorescence spectrometry) ICP-OES (inductively coupled plasma optical emission spectrometry), and ICP-MS (inductively coupled plasma mass spectrometry) as well as several procedures for preparing the sample solution from which the most appropriate method of analysis can be selected by experts.

Analysis by CV-AAS, CV-AFS, ICP-OES and ICP-MS allows the determination of the target element, mercury, with high precision (uncertainty in the low per cent range) and/or high sensitivity (down to the µg/kg level). The test procedures described in this standard are intended to provide the highest level of accuracy and precision for concentrations of mercury in the range from 4 mg/kg to 1 000 mg/kg. The procedures are not limited for higher concentrations.

For direct analysis, using thermal decomposition-gold amalgamation in conjunction with CV-AAS (TD(G)-AAS) can be also applied for mercury analysis without sample digestion, although the detection limits are higher than other methods due to the reduced sample size.

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.

IEC 62321-1, *Determination of levels of certain substances in electrotechnical products – Part 1: Introduction and overview*

¹ Figures in square brackets refer to the bibliography.

IEC 62321-2, *Determination of levels of certain substances in electrotechnical products – Part 2: Disassembly, disjointment and mechanical sample preparation*²

IEC 62321-3-1, *Determination of certain substances in electrotechnical products – Part 3-1: Screening – Lead, mercury, cadmium, total chromium and total bromine by X-ray fluorescence spectrometry*

IEC 62554, *Sample preparation for measurement of mercury level in fluorescent lamps*

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62321-1 as well as the following, apply.

3.1.1

accuracy

closeness of agreement between a test result and an accepted reference value

3.1.2

blank calibration solution

calibration solution without analyte

3.1.3

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)

3.1.4

calibration solution

solution used to calibrate the instrument prepared either from (a) stock solution(s) or from a (certified) reference material

3.1.5

certified reference material

reference material, accompanied by documentation issued by an authoritative body and providing one or more specified property values with associated uncertainties and traceabilities using valid procedures

3.1.6

laboratory control sample

known matrix spiked with compound(s) representative of the target analytes, used to document laboratory performance

[SOURCE: US EPA SW-846] [2]

3.1.7

reagent blank solution

prepared by adding to the solvent the same amounts of reagents as those added to the test sample solution (same final volume)

² To be published.