

**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**

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## EESTI STANDARDI EESSÕNA

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Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
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English version

**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  
(IEC 62321-4:2013)**

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  
(CEI 62321-4:2013)

Verfahren zur Bestimmung von  
bestimmten Substanzen in Produkten der  
Elektrotechnik -  
Teil 4: Quecksilber in Polymeren, Metallen  
und Elektronik mit CV-AAS, CV-AFS, ICP-  
OES und ICP-MS  
(IEC 62321-4:2013)

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 111/299/FDIS, future edition 1 of IEC 62321-4, prepared by IEC/TC 111 "Environmental standardization for electrical and electronic products and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62321-4:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-10-25
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-11-15

EN 62321-4:2014 is a partial replacement of EN 62321:2009, forming a structural revision and replacing Clause 7 and Annex E.

Future parts in the EN 62321 series will gradually replace the corresponding clauses in EN 62321:2009. Until such time as all parts are published, however, EN 62321:2009 remains valid for those clauses not yet re-published as a separate part.

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The text of the International Standard IEC 62321-4:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 62321-5      NOTE      Harmonised as EN 62321-5.

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## 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]<sup>1</sup>. 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  $\mu\text{g}/\text{kg}$  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*

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<sup>1</sup> 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*<sup>2</sup>

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)

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<sup>2</sup> To be published.