BS EN 62321-4:2014+A1:2017

BSI Standards Publication

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)

bsi.

National foreword

This British Standard is the UK implementation of EN 62321-4:2014, including amendment A1:2017. It is identical to IEC 62321-4:2013, including amendment 1:2017. It supersedes BS EN 62321-4:2014, which is withdrawn.

The text of IEC amendment 1:2017 has been provided in its entirety at the beginning of this document. BSI's policy of providing consolidated content remains unchanged; however, in the interest of expediency, in this instance BSI have chosen to collate the relevant content at the beginning of this document.

The UK participation in its preparation was entrusted to Technical Committee GEL/111, Electrotechnical environment committee.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Amendments/corrigenda issued since publication

Date	Text affected
31 March 2018	Implementation of IEC amendment 1:2017 with CENELEC endorsement A1:2017

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62321-4

April 2014

ICS 13.020; 43.040.10

Supersedes EN 62321:2009 (partially)

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)

This European Standard was approved by CENELEC on 2013-11-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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CENELEC

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

Ref. No. EN 62321-4:2014 E

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.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62321-4:2014/A1

November 2017

ICS 13.020; 43.040.10

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/A1:2017)

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 (IEC 62321-4:2013/A1:2017)

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/A1:2017)

This amendment A1 modifies the European Standard EN 62321-4:2014; it was approved by CENELEC on 2017-08-17. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

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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

European foreword

The text of document 111/414/CDV, future IEC 62321-4:2013/A1, 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/A1:2017.

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)	2018-05-17
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-08-17

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Endorsement notice

The text of the International Standard IEC 62321-4:2013/A1:2017 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 62321-1	-	Determination of certain substances in electrotechnical products - Part 1: Introduction and overview	EN 62321-1	-
IEC 62321-2	-	Determination of certain substances in electrotechnical products - Part 2: Disassembly, disjunction and mechanical sample preparation	EN 62321-2	-
IEC 62321-3-1	-	Determination of certain substances in electrotechnical products - Part 3-1: Screening electrotechnical products for lead, mercury, cadmium, total chromium and total bromine using X-ray Fluorescence Spectrometry	EN 62321-3-1	-
IEC 62554	-	Sample preparation for measurement of mercury level in fluorescent lamps	EN 62554	-
ISO 3696	-	Water for analytical laboratory use - Specification and test methods	EN ISO 3696	-

IEC 62321-4

Edition 1.0 2017-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.020; 43.040.10

ISBN 978-2-8322-4410-4

FOREWORD

This amendment has been prepared by IEC technical committee 111: Environmental standardization for electrical and electronic products and systems.

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

CDV	Report on voting
111/414/CDV	111/431/RVC

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website 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.

1 Scope

Delete, in the second sentence of the second paragraph, the words "cold cathode".

5.1 General

Add, at the end of the subclause, the following new text:

Warning: Analytical experts need to investigate the matrix effect or possible interferences of the phosphor to choose the appropriate conditions.

6 Sampling and test portion

Replace the existing third paragraph with the following new text:

For the sample preparation of mercury in fluorescent lamps, follow the instructions given in IEC 62554.

8.1 General

Add, before the NOTE, the following new text:

"CV-AAS" is the preferred method due to its sensitivity and ease of use for fluorescent lamps.

9 Calculation

Replace the existing text and formula with the following new text and formulae:

The concentration measured in 8.3 is the concentration of mercury in the sample solution. The total amount of mercury in the sample is calculated from Formula (1):

$$m_{Hg} = (A_1 - A_2) \times V1_{Hg} \times D \quad (1)$$

where

m_{Hg} is the total (absolute) amount of mercury in the sample in mg;

$V1_{Hg}$ is the total volume of the original sample solution in l;

D is the diluting factor after diluting the original sample solution;

A_1 is the concentration of Hg in the sample solution in mg/l;

A_2 is the concentration of Hg in the reagent blank solution in mg/l;

The total concentration of mercury in the sample is calculated from Formula (2):

$$C_{Hg} = \frac{(A_3 - A_4)}{M} \times V2_{Hg} \times D \quad (2)$$

where

C_{Hg} is the total concentration of Hg in the sample in µg/g;

$V2_{Hg}$ is the total volume of the original sample solution in ml;

D is the diluting factor after diluting the original sample solution;

A_3 is the concentration of Hg in the sample solution in mg/l;

A_4 is the concentration of Hg in the reagent blank solution in mg/l;

M is the mass of the original/complete sample in g.

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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

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 62321-4 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*

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1 Figures in square brackets refer to the bibliography.