

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

## EESTI STANDARDI EESSÕNA

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**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 62321-3-1:2013)**

Détermination de certaines substances  
dans les produits électrotechniques -  
Partie 3-1: Méthodes d'essai -  
Plomb, du mercure, du cadmium, du  
chrome total et du brome total par la  
spectrométrie par fluorescence X  
(CEI 62321-3-1:2013)

Verfahren zur Bestimmung von  
bestimmten Substanzen in Produkten der  
Elektrotechnik -  
Teil 3-1: Screening -  
Blei, Quecksilber, Cadmium,  
Gesamtchrom und Gesamtbrom durch  
Röntgenfluoreszenz-Spektrometrie  
(IEC 62321-3-1:2013)

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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 111/298/FDIS, future edition 1 of IEC 62321-3-1, 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 62321-3-1:2014.

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- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-11-15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 62321-3-1:2014 is a partial replacement of EN 62321:2009, forming a structural revision and generally replacing Clauses 6 and Annex D.

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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## 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	-
ISO/IEC Guide 98-1	-	Uncertainty of measurement - Part 1: Introduction to the expression of uncertainty in measurement	-	-

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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.**

### Part 3-1: Screening – Lead, mercury, cadmium, total chromium and total bromine by X-ray fluorescence spectrometry

Part 3-1 of IEC 62321 describes the screening analysis of five substances, specifically lead (Pb), mercury (Hg), cadmium (Cd), total chromium (Cr) and total bromine (Br) in uniform materials found in electrotechnical products, using the analytical technique of X-ray fluorescence (XRF) spectrometry.

The performance of this test method has been tested for the following substances in various media and within the concentration ranges as specified in Tables 1 to 5.

**Table 1 – Tested concentration ranges for lead in materials**

Substance/ element	Lead									
Parameter	Unit of measure	Medium/material tested								
		ABS <sup>a</sup>	PE <sup>b</sup>	Low- alloy steel	Al, Al-Si alloy	Lead- free solder	Ground PWB <sup>c</sup>	Crystal glass	PVC <sup>d</sup>	Poly- olefine
Concentration or concentration range tested	mg/kg	15,7 to 954	14 to 108	30 <sup>e</sup>	190 to 930	174	22 000 to 23 000	240 000	390 to 665	380 to 640

<sup>a</sup> Acrylonitrile butadiene styrene.

<sup>b</sup> Polyethylene.

<sup>c</sup> Printed wiring board.

<sup>d</sup> Polyvinyl chloride.

<sup>e</sup> This lead concentration was not detectable by instruments participating in tests.

**Table 2 – Tested concentration ranges for mercury in materials**

Substance/element	Mercury		
Parameter	Unit of measure	Medium/material tested	
		ABS <sup>a</sup>	PE <sup>b</sup>
Concentration or concentration range tested	mg/kg	100 to 942	4 to 25
<sup>a</sup> Acrylonitrile butadiene styrene.			
<sup>b</sup> Polyethylene.			

**Table 3 – Tested concentration ranges for cadmium in materials**

Substance/element	Cadmium			
Parameter	Unit of measure	Medium/material tested		
		Lead-free solder	ABS <sup>a</sup>	PE <sup>b</sup>
Concentration or concentration range tested	mg/kg	3 <sup>c</sup>	10 to 183	19,6 to 141
<sup>a</sup> Acrylonitrile butadiene styrene.				
<sup>b</sup> Polyethylene.				
<sup>c</sup> This cadmium concentration was not detectable by instruments participating in tests.				

**Table 4 – Tested concentration ranges for total chromium in materials**

Substance/element	Chromium					
Parameter	Unit of measure	Medium/material tested				
		ABS <sup>a</sup>	PE <sup>b</sup>	Low-alloy steel	Al, Al-Si alloy	Glass
Concentration or concentration range tested	mg/kg	16 to 944	16 to 115	240	130 to 1 100	94
<sup>a</sup> Acrylonitrile butadiene styrene.						
<sup>b</sup> Polyethylene.						

**Table 5 – Tested concentration ranges for total bromine in materials**

Substance/element	Bromine			
Parameter	Unit of measure	Medium/material tested		
		HIPS <sup>c</sup> , ABS <sup>a</sup>	PC/ABS <sup>d</sup>	PE <sup>b</sup>
Concentration or concentration range tested	mg/kg	25 to 118 400	800 to 2 400	96 to 808
<sup>a</sup> Acrylonitrile butadiene styrene.				
<sup>b</sup> Polyethylene.				
<sup>c</sup> High impact polystyrene.				
<sup>d</sup> Polycarbonate and ABS blend.				

These substances in similar media outside of the specified concentration ranges may be analysed according to this test method; however, the performance has not been established for this standard.

## 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 certain substances in electrotechnical products – Part 1: Introduction and overview*<sup>1</sup>

IEC 62321-2, *Determination of certain substances in electrotechnical products – Part 2: Disassembly, disjointment and mechanical sample preparation*<sup>1</sup>

IEC/ISO Guide 98-1, *Uncertainty of measurement – Part 1: Introduction to the expression of uncertainty in measurement*

## 3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in IEC 62321-1 and IEC 62321-2 apply.

## 4 Principle

### 4.1 Overview

The concept of 'screening' has been developed to reduce the amount of testing. Executed as a predecessor to any other test analysis, the main objective of screening is to quickly determine whether the screened part or section of a product:

- contains a certain substance at a concentration significantly higher than its value or values chosen as criterion, and therefore may be deemed unacceptable;
- contains a certain substance at a concentration significantly lower than its value or values chosen as criterion, and therefore may be deemed acceptable;
- contains a certain substance at a concentration so close to the value or values chosen as criterion that when all possible errors of measurement and safety factors are considered, no conclusive decision can be made about the acceptable absence or presence of a certain substance and, therefore, a follow-up action may be required, including further analysis using verification testing procedures.

This test method is designed specifically to screen for lead, mercury, cadmium, chromium and bromine (Pb, Hg, Cd, Cr, Br) in uniform materials, which occur in most electrotechnical products. Under typical circumstances, XRF spectrometry provides information on the total quantity of each element present in the sample, but does not identify compounds or valence states of the elements. Therefore, special attention shall be paid when screening for chromium and bromine, where the result will reflect only the total chromium and total bromine present. The presence of Cr(VI) or the brominated flame retardants PBB or PBDE shall be confirmed by a verification test procedure. When applying this method to electronics “as received”, which, by the nature of their design, are not uniform, care shall be taken in interpreting the results. Similarly, the analysis of Cr in conversion coatings may be difficult due to the presence of Cr in substrate material and/or because of insufficient sensitivity for Cr in typically very thin (several hundred nm) conversion coating layers.

Screening analysis can be carried out by one of two means:

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<sup>1</sup> To be published.