

**Radiation protection instrumentation - Installed  
radiation monitors for the detection of radioactive and  
special nuclear materials at national borders**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 62244:2011 sisaldab Euroopa standardi EN 62244:2011 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 29.07.2011 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

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Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 62244:2011 consists of the English text of the European standard EN 62244:2011.

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**Radiation protection instrumentation -  
Installed radiation monitors for the detection of radioactive and special  
nuclear materials at national borders  
(IEC 62244:2006, modified)**

Instrumentation pour la radioprotection -  
Moniteurs de rayonnement installés pour  
la détection des matériaux nucléaires  
radioactifs et spéciaux aux frontières  
nationales  
(CEI 62244:2006, modifiée)

Strahlenschutz-Messgeräte -  
Fest installierte Strahlungsmonitore für  
den Nachweis von radioaktiven Stoffen  
und spaltbarem Nuklearmaterial an  
Staatsgrenzen  
(IEC 62244:2006, modifiziert)

This European Standard was approved by CENELEC on 2011-06-27. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

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

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

## Foreword

The text of the International Standard IEC 62244:2006, prepared by SC 45B, "Radiation protection instrumentation", of IEC TC 45, "Nuclear instrumentation", together with the common modifications prepared by the Technical Committee CENELEC TC 45B, Radiation protection instrumentation, was submitted to the CENELEC formal vote and was approved by CENELEC as EN 62244 on 2011-06-27.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- |  |       |            |
|--|-------|------------|
| – latest date by which the EN has to be implemented<br>at national level by publication of an identical<br>national standard or by endorsement | (dop) | 2012-06-27 |
| – latest date by which the national standards conflicting<br>with the EN have to be withdrawn  | (dow) | 2014-06-27 |

Annex ZA has been added by CENELEC.

Subclauses which are additional to those in IEC 62244 are prefixed "Z".

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## Endorsement notice

The text of the International Standard IEC 62244:2006 was approved by CENELEC as a European Standard with agreed common modifications as given below.

### COMMON MODIFICATIONS

#### 3 Terms and definitions

##### 3.1 alarm assembly

Change text to “component that provides audio or visual signals, or both, when an alarm level is exceeded or a malfunction occurs”.

##### 3.2 detection assembly

Change text to “component of the installed radiation monitor system that contains the detector(s) and associated electronic devices”.

##### 3.3 detection zone

Insert “being monitored” between “person” and “may”.

##### 3.6 reference point of the detector zone

Delete “that” at start of definition.

#### Add a new definition

##### “3.Z1 special nuclear materials

plutonium except that with isotopic concentration exceeding 80 % in plutonium-238; uranium-233; uranium enriched in the isotope 235 or 233; uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore-residue; any material containing one or more of the foregoing.

(IAEA-TECDOC-1311)”

#### 4 General Characteristics

##### 4.1 Overview

Replace the last paragraph with “Figure 1 shows an example of the detection zone dimensions for a monitor that uses two detection assemblies. The following detection zone widths,  $W$ , are applicable to the above four types of monitors.

- pedestrian: Single detector assembly, 1,0 m.  
Two detector assemblies, 1,0 m;
- road vehicle: not exceeding 5,0 m;
- rail vehicles: not exceeding 6,0 m;
- conveyor: See 4.5.”.

##### 4.2 Pedestrian

Delete last sentence of paragraph 1.

2<sup>nd</sup> paragraph, delete 2<sup>nd</sup> sentence.

Replace last sentence with “For dynamic monitors, the range of passage speeds shall be specified by the manufacturer, this range shall include 1,2 m/s for pedestrian monitors.”

### 4.3 Road vehicles (includes road transported containers)

Replace last sentence with "For dynamic monitors, the range of passage speeds shall be specified by the manufacturer, this range shall include 8 km/h for road vehicle monitors."

### 4.4 Rail vehicles (includes rail transported containers)

Replace last sentence with "For dynamic monitors, the range of passage speeds shall be specified by the manufacturer, this range shall include 8 km/h for rail vehicle monitors."

### 4.5 Conveyor

Replace last sentence with "For dynamic monitors, the range of passage speeds shall be specified by the manufacturer, this range shall include 1 m/s for conveyor monitors."

### 4.6 Configuration

Replace 2<sup>nd</sup> paragraph with "A detection assembly may consist of a single detector or multiple detectors contained within a protective cabinet. A monitor may consist of a single detector assembly or multiple detector assemblies."

Start the last two paragraphs with "The monitor shall ...".

### 4.8 Speed control

Replace the section with "The performance of the monitor is dependent on the speed at which the object being monitored passes through the detection zone. Therefore the monitors, with the exception of the pedestrian and conveyor monitors, shall include a device for measuring the average speed of the object passing through the detection zone. An excessive speed alarm shall be provided that would indicate if the passage speed exceeds the upper speed of the range stated by the manufacturer. The speed alarm set point shall be adjustable up to a manufacturer-defined maximum speed."

## 5 General test procedures

### 5.6 Alarm probability for gamma and neutron radiation

Change in line two "detection probability" to "alarm probability"

### 5.7 Reference radiation

#### 5.7.1 Gamma

First NOTE: Change "NOTE" to "NOTE 1".

First line of new NOTE 1: Change "0,1 µSv/h" to "0,1 µGy/h".

Line 3 of third paragraph: After "if not encapsulated" insert "in 0,25 mm stainless steel".

Last NOTE: Change "NOTE" to "NOTE 2".

#### 5.7.2 Neutron

Replace whole section with "<sup>252</sup>Cf shall be used for neutron tests. The source should have an activity that would produce an unscattered neutron fluence rate of 0,04 cm<sup>-2</sup> s<sup>-1</sup> at the closest point of the detector. This fluence rate is approximately equivalent to a neutron emission rate of 20 000 s<sup>-1</sup> at 2 m source to detection surface distance."

### 5.7.3 SNM

Replace heading with “**Special nuclear material (SNM)**”

Replace whole section with “Standardized SNM test sources given in Annex A may be used by agreement between manufacturer and user. Test should be performed using the acceptance requirements given in 6.3 or 6.4 (i.e. 49 successes out of 50 trials).”.

## 6 Radiation characteristics

Change title to “Radiation characteristics (applicable to all types of monitors)”.

### 6.1 False alarm test

#### 6.1.1 Requirements

Replace whole section with “No more than one alarm shall occur over a period of 100 h with the monitor operating in a stable background with a level below the set alarm level.”.

#### 6.1.2 Method of tests

Replace first sentence with “With the monitor operating normally in a stable background initiate a monitoring cycle as per the manufacturer’s specification at 5 min intervals for a period of 100 h.”.

### 6.2 Background effects

#### 6.2.1 Requirement

Insert new sentence between first and second paragraph. “The instrument shall alarm when exposed at 1,5 times the manufacturer’s stated instrument’s maximum background level.”.

#### 6.2.2 Method of tests

Number first paragraph a).

Replace 2<sup>nd</sup> paragraph with the following two paragraphs:

“b) Place the monitor for 100 s in a background level equal to the manufacturer’s stated maximum background plus 50 %. During this 100 s the monitor shall indicate “non operational”.

c) Place the monitor in a background level equal to the manufacturer’s stated maximum background. Then perform a gamma detection test as stated in step 6.3.2 for <sup>137</sup>Cs only. The monitor shall meet the requirements given in 6.3.1.”.

### 6.3 Gamma radiation detection

#### 6.3.2 Method of test

Replace first sentence with “For a dynamic monitor, the source shall be moved through the detection zone at the passage velocity stated for that particular monitor type, 1,2 m/s for pedestrian monitors, 8 km/h for road and rail vehicle monitors and 1 m/s for conveyor monitors.”.

## **6.4 Neutron radiation detection**

### **6.4.2 Method of test**

Change NOTE to "This fluence rate is approximately equivalent to a neutron emission rate of  $20\,000\text{ s}^{-1}$  at 2 m source to detection surface distance."

Add at the end of second paragraph ", 1,2 m/s for pedestrian monitors, 8 km/h for road and rail vehicle monitors and 1 m/s for conveyor monitors."

## **6.5 Overload characteristics**

### **6.5.2 Method of test**

Remove in line 2 "ambient".

Add at the end of this section "This shall be demonstrated using a  $^{137}\text{Cs}$  source with the test method described in 6.3 but with a reduced number of trials."

## **7 Electrical characteristics**

### **7.1 Mains operation**

#### **7.1.2 Method of test**

Replace in the first line "defined in 6.3" with "defined in 5.7".

## **8 Electromagnetic compatibility**

### **8.1 External magnetic fields**

#### **8.1.1 Requirements**

Insert at the end of the paragraph "When exposed to external magnetic fields the count rate shall not vary by more than  $\pm 15\%$  from the rate under standard test conditions."

#### **8.1.2 Method of test**

Add at the end of the last sentence "due to the magnetic field."

### **8.2 Radiated electromagnetic fields**

#### **8.2.2 Method of test**

Add at the end of the penultimate sentence "with maximum of  $\pm 15\%$  of count rate change"

Change in the last line "setting" to "status".

### **8.3 Conducted disturbances by bursts and radio frequencies**

#### **8.3.2 Method of test**

Change in test c) "decades" to "order of magnitude".

Add in the last sentence at the end "due to the conducted disturbances".



## **9 Mechanical characteristics**

### **9.3 Vibration test**

#### **9.3.2 Method of test**

Add at the end of section a) "(IEC 60068-2-6)".

### **9.4 Microphonics/impact**

#### **9.4.1 Requirements**

Insert between "unaffected" and "by" "(remain within  $\pm 15$  % of the pre-test values)".

#### **9.4.2 Method of test**

Delete second paragraph.

## **10 Environmental characteristics**

### **10.1 Ambient temperature**

#### **10.1.2 Method of test**

Add at the end of second paragraph "and in 10.1.1".

### **10.2 Relative humidity**

#### **10.2.2 Method of test**

Add in line 5 between "Table 3" and "is" "and in 10.2.1".

### **10.3 Sealing**

#### **10.3.2 Method of test**

Change in line 2 "10 l/m" to "10 l/m<sup>2</sup>".

## **11 Documentation**

### **11.2 Certificate**

Add at the end another bullet "– maximum operational background, see 6.2.1.".

### **Table 1 – Reference conditions and standard test conditions**

Add a new row below "Reference Gamma radiation source": "Reference Neutron radiation source" and add in both new columns 2 and 3 "<sup>252</sup>Cf".

### **Table 3 – Tests performed with variations of influence quantities**

Add in row 3 (External magnetic fields) in column 3 at the end "by more than  $\pm 15$  % of the rate under standard test conditions".

Insert in row 8 (Mechanical characteristics) in column 2, "Shock" before first paragraph and "Vibration" before second paragraph.

Replace in the last row the content of column 2 with "Rain of 10 l/m<sup>2</sup>".

**Annex ZA**  
(normative)  
**Normative references to international publications  
with their corresponding European publications**

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.

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 60038	-	IEC standard voltages	EN 60038 <sup>1</sup>	-
IEC 60050-393	-	International Electrotechnology Vocabulary - Part 393: Nuclear instrumentation - Physical phenomena and basic concepts	-	-
IEC 60050-394	1995	International Electrotechnical Vocabulary -	-	-
+ A1	1996	Chapter 394: Nuclear instrumentation:	-	-
+ A2	2000	Instruments	-	-
IEC 60068-2-18	-	Environmental testing - Part 2-18: Tests - Tests R and guidance: Water	EN 60068-2-18	-
IEC 60068-2-27	-	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60068-2-75	-	Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	-
IEC 60359	-	Electrical and electronic measurement equipment - Expression of performance	EN 60359	-
IEC 61000-4-2	-	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	-
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	-
IEC 61000-4-4	-	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4	-
IEC 61000-4-5	-	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	-
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	-
IEC 61000-4-12	-	Electromagnetic compatibility (EMC) - Part 4-12: Testing and measurement techniques - Ring wave immunity test	EN 61000-4-12	-
IEC 61187	-	Electrical and electronic measuring equipment - Documentation	EN 61187	-

<sup>1</sup> At draft stage.

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# **RADIATION PROTECTION INSTRUMENTATION – INSTALLED RADIATION MONITORS FOR THE DETECTION OF RADIOACTIVE AND SPECIAL NUCLEAR MATERIALS AT NATIONAL BORDERS**

## **1 Scope and object**

The scope of this International Standard is to define the performance of installed monitors used for the detection of gamma and neutron radiation emitters contained in objects/containers or vehicles, general characteristics, mechanical characteristics, environmental requirements, test procedures and documentation.

This standard is applicable to installed monitors designed to detect special nuclear and other radioactive materials by their emitted gamma and/or neutron radiation. They are used to monitor vehicles, cargo containers, people, or packages and are typically located at national and international borders, but may be used at any location where there is a need for this type of monitoring. This standard does not apply to hand-held monitors.

Information regarding the detection of special nuclear material (SNM) is contained in Annex A.

This standard provides the purchaser with information that may be used to determine the performance of the monitor in detecting the presence of radioactive sources. This standard does not provide the data needed to determine the performance of the monitor in measuring the quantity of the radioactive material.

In this standard, the term radioactive material includes both special nuclear and radioactive material unless otherwise specifically noted. The radioactive material may be transported by vehicle, carried by person, or concealed in a cargo container or in a package moved by conveyor belt, such as international mail parcels.

Conformance with the requirements of this standard does not guarantee that a radioactive source will always be discovered.

The selection of the location and the configuration of the monitoring system on each site needs to be optimised to achieve the best performance, however, this is outside the scope of this standard.

## **2 Normative references**

The following referenced documents are relevant to 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.

IEC 60038, *IEC standard voltages*

IEC 60050-393, *International Electrotechnical Vocabulary (IEV) – Part 393: Nuclear instrumentation – Physical phenomena and basic concepts*

IEC 60050-394:1995, *International Electrotechnical Vocabulary (IEV) – Chapter 394: Nuclear instrumentation: Instruments*  
Amendment 1 (1996)  
Amendment 2 (2000)

IEC 60068-2-18, *Environmental testing – Part 2-18: Tests – Test R and guidance: Water*

IEC 60068-2-27, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60359, *Electrical and electronic measurement equipment – Expression of performance*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test.*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances induced by radio-frequency fields*

IEC 61000-4-12, *Electromagnetic compatibility (EMC) – Part 4-12: Oscillatory waves immunity test*

IEC 61187, *Electrical and electronic equipment – Documentation*

### **3 Terms and definitions**

For the purposes of this document, the following terms and definitions, as well as those given in IEC 60050-393, IEC 60050-394 and IEC 60359, apply.

#### **3.1**

##### **alarm assembly**

component that provides audio or visual signals or both to call attention

#### **3.2**

##### **detection assembly**

that component of the installed radiation monitor system that contains the detectors and associated electronic devices