SLOVENSKI STANDARD
SIST EN IEC 62372:2023

01-februar-2023

Jedrska merilna oprema - Scintilatorji v ohišju - Metode preskušanja svetlobnega toka in intrinzične ločljivosti (IEC 62372:2021)

Nuclear instrumentation - Housed scintillators - Test methods of light output and intrinsic resolution (IEC 62372:2021)

Strahlungsmessgeräte - Ummantelte Szintillatoren - Prüfverfahren für Lichtabgabe und intrinsische Auflösung (IEC 62372:2021)

Instrumentation nucléaire - Scintillateurs montés - Méthodes de mesure de la lumière sortante et de résolution intrinsèque (IEC 62372:2021)

Ta slovenski standard je istoveten z: **EN IEC 62372:2022**

ICS:

27.120.01 Jedrska energija na splošno Nuclear energy in general

SIST EN IEC 62372:2023 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 62372

December 2022

ICS 27.120.01

English Version

Nuclear instrumentation - Housed scintillators - Test methods of light output and intrinsic resolution (IEC 62372:2021)

Instrumentation nucléaire - Scintillateurs montés - Méthodes de mesure de la lumière sortante et de résolution intrinsèque (IEC 62372:2021)

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European foreword

This document (EN IEC 62372:2022) consists of the text of IEC 62372:2021 prepared by IEC/SC 45B “Radiation protection instrumentation” of IEC/TC 45 "Nuclear instrumentation".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-06-16
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2025-12-16

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IEC 62372

Edition 2.0 2021-02

INTERNATIONAL STANDARD

Nuclear instrumentation – Housed scintillators – Test methods of light output and intrinsic resolution

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.120.01

ISBN 978-2-8322-9322-5

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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NUCLEAR INSTRUMENTATION – HOUSED SCINTILLATORS – TEST METHODS OF LIGHT OUTPUT AND INTRINSIC RESOLUTION

FOREWORD

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International Standard IEC 62372 has been prepared by IEC technical committee 45: Nuclear instrumentation.

This second edition cancels and replaces the first edition published in 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- Title has been modified.
- To review the existing requirements and to update the terminology, definitions and normative references.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
45/913/FDIS	45/915/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

NUCLEAR INSTRUMENTATION – HOUSED SCINTILLATORS – TEST METHODS OF LIGHT OUTPUT AND INTRINSIC RESOLUTION

1 Scope

This document is applicable to housed scintillators for registration and spectrometry of alpha-, beta-, gamma-, X-ray and neutron radiation.

The main parameters, such as a light output and intrinsic resolution are established. This document specifies the requirements for the testing equipment and test methods of the basic parameters of housed scintillators, such as:

- the direct method is applicable to measure the light output of housed scintillators based on scintillation material. The housed scintillators certified by this method can be used as working standard of housed scintillators (hereinafter: working standard) when performing measurements by a relative method of comparison.
- the relative method of comparison with the working standard is applicable to housed scintillators based on the same scintillation material as the working standard.

This document does not apply to gas or liquid scintillators and scintillators for counting and current modes.

The numerical values of the parameters are set to the specific type of scintillators in the specifications.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
scintillator
luminescent material, usually liquid or solid, showing radioluminescence with a short afterglow

[SOURCE: IEC 60050-845:1987, 845-04-37]

3.1.2
housed scintillator
scintillator, housed in a container with a reflector and optical window

3.1.3
scintillation detector
radiation detector consisting of a scintillator that is usually optically coupled to a photosensitive device, directly or through light guides

Note 1 to entry: The scintillator consists of a scintillating material in which the ionizing particle produces a burst of luminescence radiation along its path. A common scintillator is NaI(Tl).

[SOURCE: IEC 60050-395:2014, 395-03-01]

3.1.4
assembly
light protective chamber containing a housed scintillator, photomultiplier (PMT), PMT voltage divider

Note 1 to entry: Assembly is used for testing of the housed scintillator.

3.1.5
light yield
η
ratio of scintillation photons summed energy (E_p) to energy (E) lost by ionizing particles in the scintillator

$$\eta = \frac{E_p}{E}$$

Note 1 to entry: Value of η depends on type and energy of ionizing particle.

3.1.6
light output
C

ratio of total energy (L_{ph}) of scintillation photons, which pass through the output window of the housed scintillator of ionizing radiation, to energy (E), lost by ionizing particles in the scintillator

$$C = \frac{L_{ph}}{E}$$

3.1.7
intrinsic resolution of housed scintillator of ionizing radiation
R_d
component, given by housed scintillator of ionizing radiation to energy resolution of the scintillation detector

Note 1 to entry: The intrinsic resolution R_d is defined from the relation:

$$R_d = \sqrt{R_a^2 - R_{pm}^2},$$

where

R_a is the energy resolution of the scintillation detector;

R_{pm} is PMT intrinsic resolution.

3.1.8
total absorption peak
portion of the spectral response curve corresponding to the total absorption of photon energy in a radiation detector

Note 1 to entry: This peak represents the total absorption of photon energy from all interactive processes, namely, a) photoelectric absorption, b) Compton effect, and c) pair production.

[SOURCE: IEC 60050-395:2014, 395-03-94]

3.1.9
photomultiplier tube spectrometric constant
A
parameter, characterizing properties of the photomultiplier tube

Note 1 to entry: Defined by the following formula:

$$A = (R_a^2 - R_d^2) \times C_{ph}$$

where C_{ph} is light output, photons/MeV.

3.1.10
working standard
working standard of housed scintillator that is used to check the measuring system and to measure the light output by a method of comparison

3.1.11
full width at half maximum
FWHM
in a distribution curve comprising a single peak, the distance between the abscissa of two points on the curve whose ordinates are half of the maximum ordinate of the peak

Note 1 to entry: If the curve considered comprises several peaks, a full width at half maximum exists for each peak.

3.1.12
expanded uncertainty
expanded uncertainty quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand

Note 1 to entry: The fraction may be viewed as the coverage probability or level of confidence of the interval.

Note 2 to entry: To associate a specific level of confidence with the interval defined by the expanded uncertainty requires explicit or implicit assumptions regarding the probability distribution characterized by the measurement result and its combined standard uncertainty. The level of confidence that may be attributed to this interval can be known only to the extent to which such assumptions may be justified.

[SOURCE: JCGM 100:2008, 2.35]

3.1.13
relative expanded uncertainty
ratio of the expanded uncertainty of a measurement to average value of quantity. It expresses the relative size of the uncertainty of a measurement (its precision)

3.2 Symbols and abbreviated terms

A the photomultiplier tube spectrometric constant;

a the assembly conversion factor with the housed scintillator;

a_i the value of conversion response, measured at energy value of E_i;

a_{max} the maximal value of a;

a_{min} the minimal value of a;

Δa the value of nonlinearity;

C the light output, in relative units;