IEC 60412

Edition 3.0 2014-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Nuclear instrumentation – Nomenclature (identification) of scintillators and scintillation detectors and standard dimensions of scintillators

Instrumentation nucléaire – Nomenclature (identification) des scintillateurs et des détecteurs à scintillation et dimensions normalisées des scintillateurs

IEC 60412:2014-09(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org
Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
Plus de 55 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 60412

Edition 3.0 2014-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Nuclear instrumentation – Nomenclature (identification) of scintillators and scintillation detectors and standard dimensions of scintillators

Instrumentation nucléaire – Nomenclature (identification) des scintillateurs et des détecteurs à scintillation et dimensions normalisées des scintillateurs

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX M

ICS 27.120

ISBN 978-2-8322-1859-4

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

NUCLEAR INSTRUMENTATION – NOMENCLATURE (IDENTIFICATION) OF SCINTILLATORS AND SCINTILLATION DETECTORS AND STANDARD DIMENSIONS OF SCINTILLATORS

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.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60412 has been prepared by IEC technical committee 45: Nuclear instrumentation.

This third edition cancels and replaces the second edition published in 2007. It constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

- Nomenclature of scintillation detectors was expanded by phoswich detector and single-line multi-channel detector.
- Some missing positions in the nomenclature of the previous edition were filled out.

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

FDIS	Report on voting
45/777/FDIS	45/780/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.

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

Recently each manufacturer of scintillation detectors has been offering its own nomenclature presenting in it, in the first place, their trademarks and introducing their own abbreviations (identification). The nomenclature of scintillators and scintillation detectors is quite complicated and usually includes type of detector, scintillator's material, geometry and dimensions of scintillator, materials of housing and window, type and dimensions of photomultiplier tube or photodiode, presence of additional electronic devices and some other characteristics. Different manufacturers offer different content and different order of characteristic designations in the identifiers of their products. This makes perception by a customer of the meaning of symbols in these identifiers difficult. The situation can be improved through introducing a uniform system of nomenclature (identification) of scintillators and scintillation detectors. For this purpose it is advisable to use designations of separate parameters in a strict order, guided by a principle: from the main parameters to secondary ones. This approach will introduce uniformity into the system of nomenclature (identification) of scintillators and scintillation detectors, as well as facilitate the perception of this system and correct selection of products by the customer.

NUCLEAR INSTRUMENTATION – NOMENCLATURE (IDENTIFICATION) OF SCINTILLATORS AND SCINTILLATION DETECTORS AND STANDARD DIMENSIONS OF SCINTILLATORS

1 Scope

This International Standard gives guidelines for scintillation detectors and scintillators nomenclature (identification) and standard dimensions of scintillators.

This International Standard is applicable to all types of solid organic and inorganic scintillators used in detectors for scintillation counting and spectrometry.

The object of this standard is to define a standardized nomenclature for scintillation detectors in which most of the properties can be found.

The object of this standard is to standardize the dimensions of bare scintillators in order to facilitate interchangeability of non-encapsulated scintillators and to facilitate intercomparisons of measurements with encapsulated scintillators.

Liquid scintillators are not addressed by this standard.

NOTE The identification labels laid down in Clause 2 of the present standard include certain dimensions which may be expressed in millimetres or inches. The SI system recommends the use of millimetres rather than inches.

2 Nomenclature of scintillation detectors and scintillators

2.1 General

The identification of a scintillation detector is specified by a predefined sequence of specification items described below. Each specification item refers to a specific property of the detector material and/or construction.

The general structure of an identification label includes symbols, described in 2.2 to 2.13, and given in the same order in which these subclauses are provided.

2.2 Configuration

This definition is producer-specific, for example:

C – crystal without photomultiplier (see example 1 at the end of this clause);

HC – housed crystal (see example 2);

HCW – housed crystal with a well;

HCH – housed crystal with a hole;

IMP – housed crystal with integrally mounted photomultiplier (see examples 3 to 5);

PhX – phoswich, where X is the number of scintillators (see example 6);

X CH Y – single-line X-channels detector (see example 7), where X is the number of channels in line; Y is pitch.

2.3 Geometry of the scintillator

V – cubic;

R – rectangular;

S – spherical;

H – hexagonal;

C – cylindrical.

2.4 Dimensions of the scintillator cross-section in mm

Specification in inches shall be marked as such, e.g. 2’’.

In the case of rectangular scintillator dimensions, the two measures are separated by the letter "x" (see example 2 below). The most frequently found (standard) dimensions of scintillator diameters are listed in Table A.1.

2.5 Height of the scintillator in mm

Specification in inches shall be marked as such, e.g. 4".

The most frequently found (standard) dimensions of scintillator heights are listed in Table A.2.

2.6 Scintillator material

Doping elements are written in parentheses.

N – NaI(Tl);

CT – CsI(Tl);

CN – CsI(Na);

LiI – LiI(Eu);

CaF – CaF_2(Eu);

BGO – $Bi_4Ge_3O_{12}$;

CWO – $CdWO_4$;

PWO – $PbWO_4$;

LC – $LaCl_3$(Ce);

LB – $LaBr_3$(Ce);

P – Plastic;

LSO – Lu_2SiO_5;

LYSO – $Lu_{1,8}Y_{0,8}SiO_5$;

GSO – Gd_2SiO_5;

ZS – ZnSe;

ZST – ZnSe(Te);

ZWO – $ZnWO_4$;

YC – YAG(Ce);

BF – BaF_2;

CI – CsI;

CaWO – $CaWO_4$;

CLYC – Cs_2LiYCl_6(Ce);

SI – SrI_2(Eu);

PMMA – polymethylmetacrylate;

PS – polystyrene;

PVT – polyvinyltoluene.

Other materials are available.

For phoswich detectors all materials are separated by a slash (/). For each type of scintillator material, geometry, diameter and height of scintillator should be given according to 2.3 to 2.6.

2.7 Type of entrance window

A – aluminium window;

B – beryllium window;

K – carbon epoxy window;

M – polyethyleneterphthalate window;

S – steel window;

SS – stainless steel window.

2.8 Type of output window

SL – silica glass;

O – optical glass;

B – borosilicate glass;

Pl – plastic;

W – without window.

2.9 Type of housing

S – steel housing (chrome plated);

C – copper housing;

St – standard aluminium housing;

SS – stainless steel housing.

2.10 Diameter of the photomultiplier tube (PMT) in mm

Specification in inches shall be marked as such, e.g. 7".

In the case when a detector has several PMTs, the diameters are separated by a slash (/).

2.11 Extra features of PMT or type of photodiode

M – external solid μ-metal shield;

E1 – built-in Voltage Divider (VD);

E2 – built-in voltage divider and preamplifier;

HV – built-in high voltage generator;

P – pure NaI used as light-guide;

Q – quartz glass used as light-guide;

PS – position sensitive anode;

PIN – type of photodiode - p-in;

PN – type of photodiode - p-n;

SPM – silicon photomultiplier;

APD – avalanche photodiode;

SDD – silicon drift diode;

MCP – micro-channel plate.

In the case when PMT has several extra features they are separated by commas.

2.12 Extra features of scintillation detector

Am – Am-241 or Am-243 alpha source built-in;

PMT L – LED or laser built-in;

X – customized configuration;

LB – low background materials.

R – ruggedized construction;

Pxx.x-yy – axial well in crystal with xx,x mm diameter and yy mm depth;

Lxx.x-yy – lateral well in crystal with xx,x mm diameter and yy mm depth.

2.13 Type of scintillation detector application

X – X radiation;

G – γ radiation;

B – β-radiation;

A – α-radiation;

TN – thermal neutron;

FN – fast neutron.

In the case when a scintillation detector has several extra features, these are separated by commas.

Examples of scintillation detector identification:

Example 1

C R 100 × 200 200 BGO

$Bi_4Ge_3O_{12}$ scintillator, rectangular form with size: 100 mm × 200 mm × 200 mm.

Example 2

HC R 30 × 50 100 CN A O St

Housed scintillator CsI(Na) with rectangular form with size 30 mm × 50 mm × 100 mm in standard aluminium housing, aluminium entrance window and optical output window.

Example 3

IMP C 12,5 6,5 LiI A O St 12,7 E1

Cylindrical LiI(Eu) crystal of 12,5 mm diameter and 6,5 mm height with aluminium entrance window, optical output window, standard aluminium housing and PMT mounted as a whole of 12,7 mm diameter with built-in voltage divider used.

Example 4

IMP C 2" 1" BGO A O St 3" E1

Cylindrical BGO crystal of 2" diameter and 1" height with Al entrance window and standard Al housing. Type of output window is optical glass. One long PMT of 3” diameter with built-in voltage divider.

Example 5

IMP R 100 × 100 400 N SS SL SS 3"/3" E2 LB

Rectangular NaI(Tl) crystal of 100 mm by 100 mm area and 400 mm height with stainless steel entrance window and stainless steel housing. Type of output window is silica glass. Two PMTs of 3 inches diameter, with built-in voltage dividers and preamplifiers and low background materials used.

Example 6

Ph2 C 190 3,5 N/ C 190 40 CT B OP St 5”