



NSAI
Standards

Irish Standard
I.S. EN 61577-4:2014

Radiation protection instrumentation - Radon and radon decay product measuring instruments - Part 4: Equipment for the production of reference atmospheres containing radon isotopes and their decay products (STAR)

I.S. EN 61577-4:2014

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English Version

**Radiation protection instrumentation - Radon and radon decay
product measuring instruments - Part 4: Equipment for the
production of reference atmospheres containing radon isotopes
and their decay products (STAR)
(IEC 61577-4:2009 , modified)**

Instrumentation pour la radioprotection - Instruments de
mesure du radon et des descendants du radon - Partie 4:
Dispositif pour la réalisation d'atmosphères de référence
contenant des isotopes du radon et leurs descendants
(STAR)
(CEI 61577-4:2009 , modifiée)

Strahlenschutz-Messgeräte - Geräte für die Messung von
Radon und Radon-Folgeprodukten - Teil 4: Einrichtungen
für die Herstellung von Referenzatmosphären mit
Radonisotopen und ihren Folgeprodukten (STAR)
(IEC 61577-4:2009 , modifiziert)

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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

This document (EN 61577-4:2014) consists of the text of IEC 61577-4:2009 prepared by IEC/SC 45B "Radiation protection instrumentation" of IEC/TC 45 "Nuclear instrumentation", together with the common modifications prepared by CLC/TC 45B "Radiation protection instrumentation".

The following dates are fixed:

- latest date by which this document has to be implemented (dop) 2015-11-17
at national level by publication of an identical
national standard or by endorsement
- latest date by which the national standards conflicting (dow) 2017-11-17
with this document have to be withdrawn

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Endorsement notice

The text of the International Standard IEC 61577-4:2009 was approved by CENELEC as a European Standard with agreed common modifications.

COMMON MODIFICATIONS

2 Normative references

Replace the title indicated for IEC 61577 (all parts) with “*Radiation protection instrumentation – Radon and radon decay product measuring instruments*”.

3 Terms, definitions and units

3.2 Specific terms and definitions

3.2.11 unattached fraction of *PAEC*

Delete the note.

Add a new note below the entry:

NOTE Z1 The particle size concerned is below 10 nm.

3.2.12 attached fraction

Replace in the note 0,3 µm with 0,5 µm.

6 Requirements for the reference atmosphere provided by STAR

6.3 Influence quantities

6.3.1 General

Add to the paragraph “According to Clause 4, only those influence quantities relevant to the kind of STAR under test need to be considered.”

6.3.2 Temperature

In the second paragraph, **replace** “+18 °C to +22 °C” with “+18 °C to +24 °C”.

6.3.3 Relative humidity

In the second paragraph, **replace** “50 % RH” with “65 % RH” and “40 % RH to 60 % RH” with “40 % RH to 75 % RH”.

Table 1 – Reference and standard test conditions

Replace the line for temperature as follows:

Temperature	20 °C	18 °C to 24 °C
-------------	-------	----------------

Replace the line for relative humidity as follows:

Relative humidity	65 %	40 % to 75 %
-------------------	------	--------------

Replace the line for ambient gamma dose rate as follows:

Ambient γ dose rate	Negligible	$<0,25 \mu\text{Sv} \cdot \text{h}^{-1}$
----------------------------	------------	--

Replace the line for unattached fraction as follows:

Unattached fraction	Negligible	$<0,25$
---------------------	------------	---------

Replace the line for aerosol size (AMTD or AMAD) as follows:

Aerosol size (AMTD or AMAD)*	$0,2 \mu\text{m}$	$0,1 \mu\text{m}$ to $0,5 \mu\text{m}$
------------------------------	-------------------	--

Table A.1 – Atmosphere characteristic ranges (typical values)

Delete the line of the unattached fraction of RnDP_{222} .

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 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-111	1996	International Electrotechnical Vocabulary - Chapter 111: Physics and chemistry	-	-
IEC 60050-393	2003	International Electrotechnical Vocabulary - Part 393: Nuclear instrumentation - Physical phenomena and basic concepts	-	-
IEC 60050-394	2007	International Electrotechnical Vocabulary - Part 394: Nuclear instrumentation - Instruments, systems, equipment and detectors	-	-
IEC 61577	series	Radiation protection instrumentation - Radon and radon decay product measuring instruments	EN 61577	series
ISO/IEC 17025	-	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	-
ISO/IEC Guide 99	2007	International vocabulary of metrology - Basic and general concepts and associated terms (VIM)	-	-
ICRP 32	-	Annals of the ICRP, Publication N° 32, Limits for inhalation of Radon Daughters by Workers, Vol. 6, N°1, 1981, Pergamon Press	-	-
ICRP 38	-	Annals of the ICRP, Publication N° 38, Radionuclide transformations, Energy and Intensity of Emissions, Vol. 11 – 13, 1983, Pergamon Press	-	-
ICRP 65	-	Annals of the ICRP, Publication N° 65, ICRP Publication 65: Protection against Radon-222 at Home and at Work, Vol. 23/2, 1994, Pergamon Press	-	-

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IEC 61577-4

Edition 1.0 2009-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Radiation protection instrumentation – Radon and radon decay product
measuring instruments –**

**Part 4: Equipment for the production of reference atmospheres containing radon
isotopes and their decay products (STAR)**

**Instrumentation pour la radioprotection – Instruments de mesure du radon et
des descendants du radon –**

**Partie 4: Dispositif pour la réalisation d’atmosphères de référence contenant des
isotopes du radon et leurs descendants (STAR)**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIATION PROTECTION INSTRUMENTATION – RADON AND RADON DECAY PRODUCT MEASURING INSTRUMENTS –

Part 4: Equipment for the production of reference atmospheres containing radon isotopes and their decay products (STAR)

FOREWORD

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International Standard IEC 61577-4 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

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

FDIS	Report on voting
45B/598/FDIS	45B/606/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 of the IEC 61577 series, under the general title *Radiation protection instrumentation – Radon and radon decay product measuring instruments*, can be found on the IEC website.

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

INTRODUCTION

Radon is a radioactive gas produced by the decay of ^{226}Ra , ^{223}Ra and ^{224}Ra , respectively decay products of ^{238}U , ^{235}U and ^{232}Th which are present in the earth's crust. By decay, radon isotopes (i.e. ^{222}Rn , ^{219}Rn , ^{220}Rn) produce three decay chains, each ending in a stable lead isotope.

NOTE In normal conditions, due to the very short half-life of ^{219}Rn , its activity and the activity of its RnDP¹ are considered negligible compared to the activity of the two other series. Its health effects are therefore not important. Thus in this standard ^{219}Rn and its decay products are not considered.

Radon isotopes and their corresponding short-lived Radon Decay Products (RnDP) (i.e. ^{218}Po , ^{214}Pb , ^{214}Bi , ^{214}Po for ^{222}Rn , and ^{216}Po , ^{212}Pb , ^{212}Bi , ^{212}Po , ^{208}Tl for ^{220}Rn) are of considerable importance, as they constitute the major part of the radiological exposure to natural radioactivity for the general public and workers. In some workplaces, for instance in underground mines, spas and waterworks, the workers are exposed to very significant levels of RnDP. These radionuclides are present in variable quantities in the air, in a gaseous form for the radon isotopes, and as very fine particles for the decay products. It is worthwhile for health physicists to be able to measure with a great accuracy the level of this kind of natural radioactivity in the atmosphere. Because the very particular behaviour of these radioactive elements in the atmosphere and in the corresponding measuring instruments, it is necessary to formalize the way such instruments could be tested.

Remark:

In order to facilitate its use, the IEC 61577 series is divided into the following different parts:

IEC 61577-1: This emphasizes the terminology and units of the specific field of radon and radon decay products (RnDP) measurement techniques and presents briefly the concept of System for Test Atmospheres with Radon (STAR) used for test and calibration of radon and RnDP measuring devices.

IEC 61577-2: This part is dedicated to the tests of ^{222}Rn and ^{220}Rn measuring instruments.

IEC 61577-3: This part is dedicated to the tests of RnDP_{222} and RnDP_{220} measuring instruments.

IEC 61577-4: Details how a STAR is constructed and how it can be used for testing.

¹ RnDP is the acronym of Radon Decay Products and it is equivalent to Radon Progeny (see [1] in the Bibliography).

RADIATION PROTECTION INSTRUMENTATION – RADON AND RADON DECAY PRODUCT MEASURING INSTRUMENTS –

Part 4: Equipment for the production of reference atmospheres containing radon isotopes and their decay products (STAR)

1 Scope and object

The IEC 61577 series covers the general features concerning test and calibration of radon and radon decay products measuring instruments. It is also intended to help define type tests, which have to be conducted in order to qualify these instruments. These type tests are described in IEC 61577-2 and IEC 61577-3. This standard addresses only the instruments and associated methods for measuring isotopes 220 and 222 of radon and their subsequent short-lived decay products in gases.

IEC 61577-4 concerns the System for Test Atmospheres with Radon (STAR) needed for testing, in a reference atmosphere, the instruments measuring radon and RnDP. The clauses that follow do neither claim to solve all the problems involved in the production of equipment for setting up reference atmospheres for radon and its decay products, nor to describe all the methods for doing so. They do however set out to be a guide enabling those faced with such problems to choose the best methods for adoption in full knowledge of the facts.

2 Normative references

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.

IEC 60050-111:1996, *International Electrotechnical Vocabulary (IEV) – Chapter 111: Physics and chemistry*

IEC 60050-393:2003, *International Electrotechnical Vocabulary (IEV) – Part 393: Nuclear instrumentation – Physical phenomena and basic concepts*

IEC 60050-394:2007, *International Electrotechnical Vocabulary (IEV) – Part 394: Nuclear instrumentation – Instruments, systems, equipment and detectors*

IEC 61577 (all parts), *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures*

ISO/IEC Guide 99:2007, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ICRP 32: *Annals of the ICRP, Publication N° 32, Limits for inhalation of Radon Daughters by Workers, Vol. 6, N°1, 1981, Pergamon Press*

ICRP 38: *Annals of the ICRP, Publication N° 38, Radionuclides transformations, Energy and Intensity of Emissions, Vol. 11 - 13, 1983, Pergamon Press*

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