BS IEC 61577-2:2014

BSI Standards Publication

# Radiation protection instrumentation — Radon and radon decay product measuring instruments

Part 2: Specific requirements for $^{222}Rn$ and $^{220}Rn$ measuring instruments

## National foreword

This British Standard is the UK implementation of IEC 61577-2:2014. It supersedes BS IEC 61577-2:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NCE/2, Radiation protection and measurement.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.


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# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

## Radiation protection instrumentation – Radon and radon decay product measuring instruments – Part 2: Specific requirements for $^{222}$Rn and $^{220}$Rn measuring instruments

## Instrumentation pour la radioprotection – Instruments de mesure du radon et des descendants du radon – Partie 2: Exigences spécifiques pour les instruments de mesure du $^{222}$Rn et du $^{220}$Rn

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

## Part 2: Specific requirements for $^{222}Rn$ and $^{220}Rn$ measuring instruments

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International Standard IEC 61577-2 has been prepared by sub-committee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

This second edition cancels and replaces the first edition issued in 2000. This edition constitutes a technical revision.

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

a) Addition of new requirements and tests concerning radiation detection performance.
b) Addition of new requirements and tests concerning environmental performance.

c) Harmonization of the requirements and tests concerning electrical and mechanical performance with other standards in the area of radon and radon decay product instrumentation.

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

| FDIS | Report on voting |
|---|---|
| 45B/793/FDIS | 45B/798/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 IEC 61577 series, under the general title *Radiation protection instrumentation – Radon and radon decay product measuring instruments*, can be found on the IEC website.

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

Radon is a radioactive trace 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. The radon isotope $^{220}$Rn is generally known as thoron[1].

NOTE In normal conditions, due to the very short half-life of $^{219}$Rn, its activity and the activity of its RnDP[2] are considered negligible compared to the activity of the other two series. Its health effects are therefore not important. Thus in this standard $^{219}$Rn and its decay products are not considered.

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

**IEC 61577-1:** This part emphasizes the terminology and units used in the specific field of radon and radon decay products (RnDP) measurement techniques and describes 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:** This part is dedicated to the construction of a STAR and its use for testing.

**IEC/TR 61577-5 (informative):** This is a technical report (to be developed) concerning special features of radon and/or RnDP measurement.

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1 The term *thoron* is not used in this standard. Instead, the term *radon* is used to denote the radionuclides $^{220}$Rn and $^{222}$Rn. In the case that one of these radionuclides is to be explicitly specified, the atomic mass number and the chemical symbol are given.

2 RnDP is the acronym for Radon Decay Products, which are sometimes called radon progeny. The term *Radon Decay Products* or its abbreviation (RnDP) denotes the whole set of short-lived decay products that becomes the focus of this standard. A particular isotope is indicated by its chemical symbol preceded by its mass number. The subscripts $_{222}$, $_{220}$ added to the symbol RnDP refer to the whole set of short-lived decay products of the corresponding radon isotope ($RnDP_{222}$: $^{218}$Po, $^{214}$Pb, $^{214}$Bi, $^{214}$Po, and $RnDP_{220}$: $^{216}$Po, $^{212}$Pb, $^{212}$Bi, $^{212}$Po, $^{208}$Tl).

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

## Part 2: Specific requirements for $^{222}$Rn and $^{220}$Rn measuring instruments

## 1 Scope

This part of IEC 61577 describes the specific requirements for instruments measuring the activity concentration of airborne $^{222}$Rn and $^{220}$Rn outdoors, in dwellings, and in workplaces including underground mines.

This standard applies practically to all types of electronic measuring instruments that are based on either spot or continuous measurements. The activity concentration can be measured by pumping or by diffusing the air containing $^{222}$Rn and/or $^{220}$Rn into the sensitive volume of the detection unit or at a particular moment by taking an air sample (grab sampling).

The different types of instrumentation used for measurements are stated in IEC 61577-1.

The standard does not apply to instruments using charcoal adsorption, electrets or solid state nuclear track detectors.

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

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61187, *Electrical and electronic measuring equipment – Documentation*

IEC 61577-1, *Radiation protection instrumentation – Radon and radon decay product measuring instruments – Part 1: General principles*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 11665-1, *Measurement of radioactivity in the environment – Air: radon-222 – Part 1: Origins of radon and its short-lived decay products and associated measurement methods*