
Radiation protection equipment for the measuring and monitoring of airborne tritium

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RADIATION PROTECTION EQUIPMENT FOR THE MEASURING AND MONITORING OF AIRBORNE TRITIUM

Equipements mesureurs et moniteurs
de tritium atmosphérique utilisés
pour la radioprotection

Strahlenschutzrichtungen zur
Messung und Überwachung von Tritium
in Luft

BODY OF HD

The Harmonization Document consists of:

- IEC 710 (1981) edition 1; IEC/SC 45B, not appended

This Harmonization Document was approved by CENELEC on 7 September 1983

The English and French versions of this HD are provided by the text of the IEC publication and the German version is the official translation of the IEC text.

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

to announce the existence of this Harmonization Document at national level

by or before 1984-01-01

to publish their new harmonized national standard

by or before 1985-01-01

to withdraw all conflicting national standards

by or before 1985-01-01.

Harmonized national standards are listed on the HD information sheet, which is available from the CENELEC National Committees or from the CENELEC General Secretariat.

The CENELEC National Committees are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

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INTERNATIONALE
INTERNATIONAL
STANDARD**

**CEI
IEC
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIATION PROTECTION EQUIPMENT FOR THE MEASURING AND MONITORING OF AIRBORNE TRITIUM

FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by IEC Sub-Committee 45B: Radiation Protection Instrumentation, of IEC Technical Committee No. 45: Nuclear Instrumentation.

Drafts were discussed at the meetings held in Milan and in San Diego in 1975 and in Baden-Baden in 1977. As a result of this latter meeting, a draft, Document 45B(Central Office)26, was submitted to the National Committees for approval under the Six Months' Rule in June 1978.

Amendments, Document 45B(Central Office)32, were submitted to the National Committees for approval under the Two Months' Procedure in July 1980.

The National Committees of the following countries voted explicitly in favour of publication:

Australia	France	Sweden
Austria	Israel	Switzerland
Belgium	Italy	Turkey
Canada	Japan	Union of Soviet
China	Netherlands	Socialist Republics
Czechoslovakia	Poland	United Kingdom
Egypt	South Africa (Republic of)	United States of America
Finland	Spain	

Other IEC publications quoted in this standard:

- Publications Nos. 38: IEC Standard Voltages (third edition). Amendment No. 1 (1977).
- 50(151): International Electrotechnical Vocabulary (I.E.V.):
Chapter 151: Electrical and Magnetic Devices.
- 50(301): Chapter 301: General Terms on Measurements in Electricity (in preparation).
- 50(391): Chapter 391: Detection and Measurement of Ionizing Radiation by Electric Means.
- 50(392): Chapter 392: Nuclear Instrumentation. Supplement to Chapter 391.
- 68-2-27: Basic Environmental Testing Procedures, Part 2: Tests — Test Ea: Shock.
- 86: Primary Batteries.
- 181: Index of Electrical Measuring Apparatus Used in Connection with Ionizing Radiation.
- 181A: First Supplement to Publication 181.
- 293: Supply Voltages for Transistorized Nuclear Instruments.

RADIATION PROTECTION EQUIPMENT FOR THE MEASURING AND MONITORING OF AIRBORNE TRITIUM

CHAPTER I: GENERAL

1. Scope

The present standard is applicable to equipment for measuring and monitoring airborne tritium. Such equipment includes:

- meters for airborne tritium;
- monitors for airborne tritium.

The radiation measuring assemblies here indicated as “meters” and “monitors” are defined in Amendment No. 1 to IEC Publication 181: Index of Electrical Measuring Apparatus Used in Connection with Ionizing Radiation, as follows:*

1.1 *Radiation meter (radiation measuring assembly)*

An assembly designed to measure quantities concerned with ionizing radiation (activity, exposure rate, etc.) and including one or more radiation detectors and associated sub-assemblies or basic function units.

1.2 *(Radiation) monitor*

A radiation meter also provided with means for giving a warning, usually visual or audible, that the quantity connected with ionizing radiation exceeds some predetermined value or that the measured value is not within some predetermined limits.

2. Object

To lay down mandatory requirements and give examples of acceptable methods for the equipment for measuring or monitoring airborne tritium, and which shall achieve two principal objectives:

- 2.1 Determination of the average value of airborne tritium concentration in a working area and measurement of its variation as a function of time.
- 2.2 Actuation of a warning signal when either a predetermined high concentration or a predetermined time integrated concentration of airborne tritium at a given location is exceeded (for monitors).

* IEC Publication 50(391): International Electrotechnical Vocabulary (I.E.V.), Chapter 391: Detection and Measurement of Ionizing Radiation by Electric Means, Terms 391-13-01 and 391-13-04. Equipment is defined in IEC Publication 181, Term 105-010.

The activities of measured samples may be indicated directly during sampling or, in order to improve the precision and sensitivity of essays, after complementary laboratory analysis.

The object of this standard is to specify, for the equipment and the assemblies described above, general characteristics, general test procedures, radiation characteristics, electrical, mechanical, safety and environmental characteristics and also the identification certificate.

Supplementary requirements may be necessary for assemblies carried on land vehicles, aircraft, ships, etc.

3. Terminology

3.1 General terminology

The general terminology concerning detection and measurement of ionizing radiation and nuclear instrumentation is given in IEC Publications: 50(391), 50(392), 181 and 181A.

For the purpose of this publication, the following definitions shall apply in addition to I.E.V. general definitions:

3.2 Tritium

The use of the word “tritium” in this standard shall, unless specifically stated to the contrary, imply all forms of tritium, gaseous or vapour, including tritium gas, hydrocarbons and tritiated water vapours.

3.3 Coefficient of variation V

The ratio of the standard deviation σ to the arithmetic mean \bar{x} of a set of n measurements x_i ; given by the following formula:

$$V = \frac{\sigma}{\bar{x}} = \frac{1}{\bar{x}} \sqrt{\frac{1}{n-1} \sum_i^n (x_i - \bar{x})^2}$$

3.4 Conventionally true activity

The best appropriate value of the true activity of the reference source or a special source (see Clause 29).

3.5 Minimum detectable activity

That activity giving an indication which corresponds to twice the standard deviation of the background.

3.6 Error of indication

The difference between the indicated activity and the conventionally true activity at the point of measurement.

3.7 Relative error of indication

The quotient, expressed as a percentage, of the error of indication divided by the conventionally true activity.

3.8 *Relative intrinsic error*

The relative error of indication of an assembly referring to a specified activity under specified reference conditions.

3.9 *Effective range of measurement **

The range of measurement within which the requirements of this standard are met.

3.10 *Response time*

The time taken to indicate 63% of an instantaneous change in the level of the quantity being measured.

4. **Qualification tests**

Qualification tests are performed in order to verify that the requirements of a specification are fulfilled.

Qualification tests are subdivided into type tests and routine tests.

4.1 *Type tests*

A test of one or more pieces of equipment made to a certain design to show that the design meets certain specifications (I.E.V. 151-04-15).

4.2 *Routine tests*

A test to which each individual equipment is subjected, during or after manufacture, to ascertain whether it complies with certain criteria (I.E.V. 151-04-16).

5. **Acceptance tests**

A contractual test to prove to the purchaser that the equipment meet certain conditions of its specification (I.E.V. 151-04-20).

6. **Units**

In this standard, the units of the International System of Units (SI)**, including multiples and submultiples, are used.

For the radiation quantities and dosimetric terms the values expressed in the old units (curie, rad, rem) are also indicated in brackets.

The following non SI units could also be used:

for time: years, days, hours (h), minutes (min);

for energy: electron-volt (eV); $1 \text{ eV} = 1.602 \cdot 10^{-19} \text{ J}$.

Definitions of the radiation quantities and dosimetric terms will be given in the future IEC Publication 50(...).

* To be brought into line with the standard general definitions to be laid down in Chapter 301 of the I.E.V. (in preparation).

** Bureau international des poids et mesures: *Le système international d'unités (SI)*, third edition (1977).

7. Classification of equipment

Equipment and its assemblies are classified:

- 7.1 According to their function as:
- airborne tritium meters;
 - airborne tritium monitors.
- 7.2 According to their use as:
- installed assemblies, whether or not connected to the central radiation display panel;
 - transportable assemblies;
 - portable assemblies.
- 7.3 According to their measurement technique as:
- gross tritium meters or monitors;
 - selective tritium meters or monitors for one chemical form of airborne tritium, e.g. tritiated water vapour.
- 7.4 According to their electrical supply:
- mains;
 - battery.
- 7.5 According to the minimum detectable volume activity under standard test conditions:
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- Class I: [minimum detectable volume activity](https://standards.iteh.ai/catalog/standards/sist/2b271a9b-cc69-4c08-94f0-cb7c6cc9d2b/sist-hd-442-s1-2003) 20 kBq/m^3 ($0.54 \text{ }\mu\text{Ci m}^{-3}$);
 - Class II: minimum detectable volume activity 200 kBq/m^3 ($5.4 \text{ }\mu\text{Ci m}^{-3}$).
-