

N42.30

American National Standard for Performance Specification for Tritium Monitors

Accredited by the American National Standards Institute

Sponsored by the
National Committee on Radiation Instrumentation, N42



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Secretariat

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Approved 25 September 2002

American National Standards Institute

Abstract: The performance requirements for tritium monitors used for monitoring airborne tritium radioactivity are provided in this standard. It also provides test methods for establishing a monitor's performance characteristics.

Keywords: airborne tritium, monitors, radioactivity, tritium

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Introduction

(This introduction is not part of ANSI N42.30-2002, American National Standard for Performance Specification for Tritium Monitors.)

This standard is the responsibility of the Accredited American Standards Committee on Radiation Instrumentation, N42. Committee N42 delegated the development of this standard to Subcommittee N42.RPI. Drafts were reviewed by Committee N42, Subcommittee N42.RPI, and other interested parties; and the comments were utilized in producing the standard as finally approved. This standard was approved on N42 letter ballot of 25 September 2002.

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American National Standard for Performance Specification for Tritium Monitors

1. Scope

This standard provides the performance requirements for tritium monitors used for monitoring airborne tritium radioactivity.

This standard also provides a set of test methods that can be used to establish a monitor's performance characteristics.

Tritium monitors addressed by this standard are used for

- The determination of the average airborne tritium concentration in a work area and measurement of its variation as a function of time
- The activation of a warning signal when either a predetermined high concentration and/or exposure of airborne tritium at a given location is exceeded

This standard specifies general, radiation, chemical, electrical, mechanical, physical, and environmental performance requirements and test procedures. For equipment accepted for use prior to the issuance of this standard, meeting the stated requirements is at the discretion of the user.

2. Definitions

2.1 acceptance tests: A contractual test to prove to the purchaser that an instrument meets conditions of its specification.

2.2 coefficient of variation (V): The standard deviation expressed as a percentage of the mean by

$$V(\%) = \frac{\sigma}{\bar{x}} \times 100$$

2.3 conventionally true activity: The commonly accepted best estimate of the value of a quantity. This and its associated uncertainty will normally be determined by a national or transfer standard, or by a reference instrument calibrated against a national or transfer standard, or by measurement quality assurance with a national laboratory or qualified secondary laboratory.

2.4 effective range of measurement: The range of measurement within which the accuracy requirements of this standard are met.

2.5 least significant digit (LSD): The least significant digit displayed on the lowest range or decade of a digital display.

2.6 minimum detectable activity (MDA): A term used to indicate the ability of a particular monitor to discern between the radioactivity associated with the radionuclide content of a sample of interest and background radiation with a particular degree of statistical confidence (taken from NCRP 87-1987 [B11]¹). For this standard, MDA is the point where there is a 95% probability that the observed response is not produced by background alone.

2.7 qualification tests: Tests performed to verify that the requirements of a specification are fulfilled. These tests are subdivided into type tests and routine tests.

2.8 reference reading: The monitor's response while operating under normal laboratory conditions.

2.9 reproducibility: The degree of agreement between repeated measurements of the same property.

2.10 response time: The time taken to indicate an instantaneous change from 10% to 90% of the conventionally true activity at the rated nominal flow rate.

2.11 routine tests: Tests that each individual instrument is subjected to, during or after manufacture, to ascertain whether it complies with certain criteria.

2.12 tritium: The hydrogen isotope with one proton and two neutrons in the nucleus (³H or T).

2.13 tritium-in-air: Tritium of any chemical form in a gas form. For example: HTO-, T2O-, DTO-, HT- DT-, and T2-in-air are all considered to be tritium-in-air.

2.14 type tests: Evaluation or measurement of all identified performance characteristics of a representative sample of production model instruments. (ANSI N42.17C-1989 [B3])

3. General test information

Test procedures addressed by this standard, except where otherwise specified, are considered type tests. Any, or all, may be considered as acceptance tests by agreement between manufacturer and the user. The stated requirements are minimum requirements and may be extended for any particular monitor or function depending on the requirements of the user. Standard test conditions are defined in Table 1.

Table 1—Reference conditions and standard test conditions

Influence quantity	Reference conditions	Standard test conditions
Reference radioactive source	Air labeled with tritium in form appropriate to instrument under test	Air labeled with tritium in form appropriate to instrument under test
Warm-up time	Specified by the manufacturer	Specified by the manufacturer
Ambient temperature	20 °C	18 °C to 22 °C

¹The numbers in brackets correspond to the numbers in the bibliography in Annex B.

Table 1—Reference conditions and standard test conditions (continued)

Influence quantity	Reference conditions	Standard test conditions
Relative humidity	65%	50% to 75%
Atmospheric pressure	101.3 kPa	96 kPa to 106 kPa
Power supply voltage	Nominal supply voltage U_N	$U_N \pm 1\%$
Ambient gamma radiation	Absorbed dose rate air less than 20 $\mu\text{rad/h}$ at the detector position	Absorbed dose rate air less than 25 $\mu\text{rad/h}$ at the detector position
Magnetic induction of external origin	Negligible	Less than twice the value of the induction of the earth's magnetic field
Electromagnetic field of external origin	Negligible	Less than the smallest value which causes interference
Sampling flow rate	Adjustment to the nominal flow	Adjusted to nominal flow $\pm 5\%$
Contamination by radioactive materials	Negligible	Effect on detector less than or equal to that produced by the background noise of the ambient gamma radiation

Tests are classified according to whether they are performed under standard test conditions or under other conditions.

3.1 Tests performed under standard test conditions

Tests performed under standard test conditions are listed in Table 2 that indicates, for each characteristic, the specific requirement and the clause where the corresponding test method is described.

Table 2—Tests performed under standard test conditions

Characteristic under test	Requirement	Method of test clause
Power supply	Stated in 4.12	5.1
Alarms	Visual locally. Fail-safe contacts for digital outputs to remote alarms. Shall activate a local light that flashes until acknowledged and remains activated in a steady-on state until the alarm condition is corrected. The audible alarm has a local-acknowledge (silence) switch and is at least 10 dB to 15 dB above background noise level (not exceeding 85 dB at ≤ 3 m) at a frequency of 500 Hz to 3000 Hz. It shall not be a bell and shall not exceed 85 dB at ≤ 3 m.	5.2
Warm-up time	Shall be stated by the manufacturer.	5.3