



American National Standard Performance Criteria for Spectroscopy- Based Portal Monitors Used for Homeland Security

Accredited by the American National Standards Institute

Sponsored by the
National Committee on Radiation Instrumentation, N42

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Secretariat

Institute of Electrical and Electronics Engineers, Inc.

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Abstract: The performance requirements for radionuclide identifying portal monitors, also referred to as spectroscopic portal monitors, are described in this standard. The requirements stated are based on monitors used in support of efforts associated with the U.S. Department of Homeland Security.

Keywords: gamma spectroscopy, homeland security, instrument test, portal monitors, radiation detectors, radionuclide identification

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This introduction is not part of ANSI N42.38-2006, American National Standard Performance Criteria for Spectroscopy-Based Portal Monitors Used for Homeland Security.

This standard is the responsibility of the Accredited American Standards Committee on Radiation Instrumentation, N42. The standard was approved by the N42 letter ballot of July–August 2006.

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American National Standard Performance Criteria for Spectroscopy- Based Portal Monitors Used for Homeland Security

1. Overview

1.1 Scope

This standard specifies the operational and performance requirements for spectroscopy-based portal monitors used in U.S. Homeland Security applications. Spectroscopy-based portal monitors have the ability to detect radioactivity and identify radionuclides that may be present in or on persons, vehicles, or containers through the use of gamma spectroscopy techniques. Performance requirements for those portal monitors that do not provide information about the specific radionuclide present are addressed by ANSI N42.35.

Operational requirements established by this standard include radiation detection and radionuclide identification, and those requirements associated with the expected electrical, mechanical, and environmental conditions when a monitor is deployed.

The test methods described in this standard provide a means to ensure that a monitor meets the requirements stated. Successful completion of the tests described in this standard should not be construed as an ability to successfully detect and identify all radionuclides in all environments.

This standard does not address portal monitors that may have the ability to reduce the effects caused by the presence of naturally occurring radioactive material (NORM) without the ability to identify specific radionuclides (see ANSI N42.35).¹

1.2 Purpose

The purpose of this standard is to specify the performance criteria and test methods for spectroscopy-based portal monitors used for Homeland Security.

¹ The ANSI N42 publications included in this clause are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

1.3 General

1.3.1 Evaluation of monitors

Testing is conducted under a set of conditions to determine if a monitor meets the requirements of this standard. Special applications, which could include a monitor's operation under weather conditions not addressed by this standard, shall require additional testing. Detection needs not addressed by this standard shall also require additional testing.

Evaluations provide information to government agencies and other users on the capability of radionuclide-identifying portal monitors for reliably detecting and identifying radioactive material.

1.3.2 Meeting performance specifications

Obtaining operating performance that meets or exceeds the specifications stated in this standard depends upon properly installing the monitor, establishing appropriate operating parameters, providing security for the systems, maintaining calibration, implementing a suitable routine testing and maintenance program, auditing compliance with quality requirements, and providing proper training for operating personnel.

2. Normative references

This standard shall be used in conjunction with the following publications. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI N42.22, American National Standard—Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.²

ANSI N42.23, American National Standard Measurement and Associated Quality Assurance for Radioassay Laboratories.

ANSI N42.34, American National Standard Performance Criteria for Hand-Held Instruments for the Detection and Identification of Radionuclides.

ANSI N42.35, American National Standard for Evaluation and Performance of Radiation Detection Portal Monitors for Use in Homeland Security.

ANSI N42.42, American National Standard Data Format Standard for Radiation Detectors Used for Homeland Security.³

ANSI/TIA-232-F-1997, Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.

ANSI/TIA/EIA-485-A-98, Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems.

FCC Rules, Code of Federal Regulations, Title 47, Part 15, Radio Frequency Devices.⁴

² The ANSI N42 publications included in this clause are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

³ The ANSI N42.42 schema can be obtained from <http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/xml.html>.

⁴ CFR publications are available from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, USA (<http://www.access.gpo.gov/>).

IAEA Safety Guide No. RS-G-1.9, Categorization of Radioactive Sources.⁵

IEC 60050-393 {Ed.2.0}, International Electrotechnical Vocabulary—Part 393: Nuclear instrumentation: Physical phenomena and basic concepts.⁶

IEC 60050-394, {Ed.2.0}, International Electrotechnical Vocabulary—Chapter 394: Nuclear instrumentation: Instruments.

IEC 60068-1, Environmental Testing—Part 1: General and Guidance.

IEC 60068-2-18, Environmental Testing—Part 2-18: Tests—Test R and Guidance: Water.

IEC 60068-2-75, Environmental Testing—Part 2-75: Tests—Test Eh: Hammer Tests.

IEC 60529, Degrees of Protection Provided by Enclosures (IP Code), IP54.

IEC 60721-4-4, Classification of Environmental Conditions—Part 4-4: Guidance for the Correlation and Transformation of Environmental Condition Classes of IEC 60721-3 to the Environmental Tests of IEC 60068—Stationary Use at Non-Weatherprotected Locations.

IEC 61000-4-1,, Electromagnetic Compatibility (EMC)—Part 4-1: Testing and Measurement Techniques—Overview of IEC 61000-4 Series..

IEC 61000-4-2, Electromagnetic Compatibility (EMC)—Part 4-2: Testing and Measurement Techniques—Electrostatic Discharge Immunity Test.

IEC 61000-4-3, Electromagnetic Compatibility (EMC)—Part 4-3: Testing and Measurement Techniques—Radiated, Radio-Frequency, Electromagnetic Field Immunity Test.

IEC 61000-4-4, Electromagnetic Compatibility (EMC)—Part 4-4: Testing and Measurement Techniques—Electrical Fast Transient/Burst Immunity Test.

IEC 61000-4-5, Electromagnetic Compatibility (EMC)—Part 4-5: Testing and Measurement Techniques—Surge Immunity Test.

IEC 61000-4-6, Electromagnetic Compatibility (EMC)—Part 4-6: Testing and Measurement Techniques—Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields.

IEC 61000-4-12, Electromagnetic Compatibility (EMC)—Part 4-12: Testing and Measurement Techniques—Oscillatory Waves Immunity Test.

IEC 61000-4-14, Electromagnetic Compatibility (EMC)—Part 4-14: Testing and Measurement Techniques—Voltage Fluctuation Immunity Test.

IEC 61000-4-28, Electromagnetic Compatibility (EMC)—Part 4-28: Testing and Measurement Techniques—Variation of Power Frequency Immunity Test.

IEC 61455, Nuclear Instrumentation—MCA Histogram Data Interchange Format for Nuclear Spectroscopy.

⁵ IAEA publications are available from the International Atomic Energy Agency, P.O. Box 100, Wagner Strasse 5, A-1400 Vienna, Austria (<http://www.iaea.org>).

⁶ IEC publications are available from the Sales Department of the International Electrotechnical Commission, Case Postale 131, 3 rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iec.ch/>). IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA (<http://www.ansi.org>).

ISO/IEC 4037-3, X and Gamma Reference Radiation for Calibrating Dosimeters and Doserate Meters and for Determining the Response as a Function of Photon Energy—Part 3: Calibration of Area and Personal Dosimeters and the Measurement of Their Response as a Function of Energy and Angle of Incidence.⁷

Manual for Railway Engineering, American Railway Engineering and Maintenance-of-Way Association, Mira Digital Publishing, Inc., 2003, Figure 28-1-3, page 28-1-5.⁸

NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).⁹

3. Definitions

The following definitions apply to this standard, as well as to ANSI N42.32 [B11],¹⁰ ANSI N42.33 [B12], ANSI N42.34 [B13], and ANSI N42.35, which have all been developed at the request of the U.S. Department of Homeland Security (DHS) for instruments to be used by DHS and emergency responders.

3.1 General definitions

3.1.1 A-weighted sound level: The frequency weighting of an acoustic spectrum according to a standardized frequency response-curve based on the frequency response of the human ear.

3.1.2 acceptance test: Evaluation or measurement of performance characteristics to verify that certain stated specifications and contractual requirements are met.

3.1.3 accepted ambient photon background: The background exposure rate as measured using a high-pressure ionization chamber, an energy compensated Geiger-Mueller (GM) tube, an energy compensated proportional counter, a tissue equivalent plastic scintillator, a scintillator with spectral compensation, or any other exposure rate instrument having a nearly constant energy response ($\pm 30\%$ in the energy range from 60 keV to 1.5 MeV).

3.1.4 accredited testing laboratory: Testing laboratory that has been accredited by an authoritative body with respect to its qualifications to perform verification tests on the type of instruments covered by this standard.

3.1.5 accuracy: The degree of agreement between the observed value with the conventionally true value of the quantity being measured.

3.1.6 adjust: To alter the reading of an instrument by means of a built-in variable (hardware or software) control.

3.1.7 alarm: An audible, visual, or other signal activated when the instrument reading or response exceeds a preset value or falls outside of a preset range.

3.1.8 calibrate: To adjust and/or determine the response or reading of a device relative to a series of conventionally true values.

⁷ ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH-1211, Genève 20, Switzerland/ Suisse (<http://www.iso.ch/>). ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

⁸ AREMA publications are available from AREMA, 10003 Derekwood Lane, Suite 210, Lanham, MD 20706-4362, USA (<http://www.arena.org>).

⁹ NEMA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://global.ihs.com/>).

¹⁰ The numbers in brackets correspond to those of the bibliography in Annex A.