



American National Standard
ANSI/HPS N43.9-2015 (R2025)

**For Gamma Radiography— Specifications for the
Design, Testing, and Performance Requirements for
Industrial Gamma Radiography System Equipment Using
Radiation Emitted by a Sealed Radioactive Source**

Approved 7 April 2025
American National Standards Institute, Inc.



Published by

Health Physics Society
950 Herndon Parkway, Suite 450
Herndon, VA 22170

Copyright © 2025 by the Health Physics Society.
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission of the publisher.

Printed in the United States of America

ANSI/HPS N43.9-2015 (R2025)

The N43-3.5 subcommittee members were:

R. D. "Donny" Dicharry, Chair	Source Production & Equipment Co., Inc.
Roy A. Parker, Ph.D.	Radiation Physicist
Ujagar S. Bhachu, P. Eng., C. Eng., F I Mech E., ASME	U. S. Nuclear Regulatory Commission
Wayne Gibson	Canadian Nuclear Safety Commission
Michael H. Henry	Conference of Radiation Control Program Directors, Inc.
Hank Kaczowka	QSA Global, Inc.
Dan Kalas	QSA Global, Inc.
Mike Tremblay	QSA Global, Inc.
Bill Huddleston	Industrial Nuclear, Inc.
Misha Gourevitch	MDS Nordion
Mike Krzaniak	MDS Nordion
George Johnson	American Society for Nondestructive Testing, Inc.
Garry Balestracci	Nondestructive Testing Management Association, Inc.

Additional input was provided by:

Jim Myers	U. S. Nuclear Regulatory Commission
Michelle Burgess	U. S. Nuclear Regulatory Commission
Dave Cochrane	Canadian Nuclear Safety Commission
Rajesh Garg	Canadian Nuclear Safety Commission
Kelley Richardt	Source Production & Equipment Co., Inc.
Kate Roughan	QSA Global, Inc.
Curt Auzenne	QSA Global, Inc.

This standard was consensus balloted and approved on 13 March 2015 by the American National Standards Institute Accredited Committee N43, Equipment for Non-Medical Radiation Applications. At the time of balloting, the N43 Committee had the following membership:

Chair	William Morris
Vice Chair	Gregory Komp
ABB Industrial Systems, Inc.	John R. Dukes
American Iron and Steel Institute	Anthony La Mastra
American Society for Testing and Materials	Marvin Turkanis
Canadian Nuclear Safety Commission	Rajesh Garg
Health Physics Society (HPS)	Wayne Glines
	Gregory Komp (alternate)
National Council on Radiation Protection and Measurements (NCRP)	Susan Langhorst
National Institute of Standard and Technology (NIST)	James Clark
	David Brown (alternate)
Underwriter Laboratories, Inc.	David Dini

U.S. Department of the Air Force,
Office of the Surgeon General

U.S. Department of the Army,
Office of the Surgeon General

U.S. Department of the Army

U.S. Department of Energy

U.S. Department of Health and Human
Services, Public Health Service

U.S. Department of Homeland Security

U.S. Department of the Navy

U.S. Nuclear Regulatory Commission

Individual member

Individual member

Individual member

Ramachandra Bhat

Craig Jones
Scott Goodison (alternate)

Gregory Komp

Judith Foulke
Steve Zobel (alternate)

Daniel Kassiday

Siraj Khan

Jerry Sanders

Tomas Herrera
Lymari Sepulveda (alternate)

Susan Engelhardt

David Lee

L. Scott Walker

Contents

Foreword	v
1.0 Scope	1
2.0 Normative References	1
3.0 Definitions and Abbreviations	1
3.1 Definitions.....	1
3.2 Abbreviations	4
4.0 Device Class and Category	4
4.1 Class of Exposure Device	4
4.2 Category of Exposure Device	4
5.0 Design and Performance	5
5.1 General Design Requirements	5
5.2 Shielding Efficiency.....	5
5.3 Safety Devices.....	5
5.4 Handling Facilities.....	7
5.5 Source Assembly	7
5.6 Control Assembly	7
5.7 Source Guide Tube.....	7
5.8 Test Requirements for Normal Conditions of Use	7
5.9 Resistance to Accident Conditions	8
6.0 Tests	8
6.1 Application of the Tests	9
6.2 Normal Conditions Tests	9
6.3 Accident Conditions Test	13
7.0 Marking	13
8.0 Identification of the Sealed Source in the Device	13
9.0 Accompanying Documents	13
9.1 Description.....	13
9.2 Technical Characteristics.....	14
9.3 Instructions for Use.....	14
9.4 Inspection and Maintenance.....	14
10.0 Qualification Requirements	15
10.1 Quality Assurance Program.....	15
10.2 Documentation	15

Appendixes

Appendix A	Source Path Wipe Test Procedure For Category II Exposure Device With Depleted Uranium Shield	16
Appendix B	Radiation Measurement Distance Correction Factors.....	17

Tables

Table 1	Output activity	3
Table 2	Maximum dose rates.....	6
Table 3	Normal conditions tests.....	8
Table 4	Accident conditions test	9
Table B.1	Correction factors for packages and detector sizes	17

Figures

Figure 1	Industrial gamma radiography system	3
Figure 2	Horizontal shock test.....	10
Figure 3	Kinking test.....	11
Figure 4	Crush test.....	11

Foreword (This foreword is not part of American National Standard ANSI/HPS N43.9-2015)

In 1991 the Nuclear Regulatory Commission (NRC) incorporated by reference N432-1980 into regulation. This was the first time that an industry standard was incorporated into industrial radiography regulation. Compliance with the standard by industry, and enforcement of the standard by regulators, was subsequently discovered to be difficult due to inadvertently unachievable specifications and the subjective nature of some of the provisions.

In 1991 a revision of N432-1980 was completed and the nomenclature of the standard was changed to N43.9-1991. This edition was not incorporated into NRC regulation.

In September, 2002, the N43-3.5 subcommittee reconvened to revise N43.9-1991. During the initial meeting the NRC stated that they may reference the entire revised standard or certain portions of it in NRC regulation. This served to guide the work of the subcommittee and goals were established for the revision. The primary objectives of this revision are to: (1) specify quality assurance program requirements for entities that engage in the design, manufacture, testing or repair of industrial gamma radiography system equipment and source changers, (2) revise qualification requirements for associated equipment, and (3) use clear, objective terms that will facilitate compliance. The title was revised to emphasize that the standard is primarily a performance standard.

The ISO 3999 was used as a reference document during the revision; initially ISO-3999-1-2000 and then ISO-3999-2004 later in the process. The subcommittee sought to harmonize with ISO-3999 as much as practical.

This edition cancels and replaces ANSI N43.9-1991.

There was parity among stakeholders in the revision process with manufacturers, users and government regulators involved and consensus agreement among the subcommittee members for approval of the revision was achieved. After the draft revision was submitted to N43 for approval numerous comments, primarily editorial, were returned to the subcommittee. The comments were addressed without the need for substantive revisions. The draft was resubmitted to N43 for approval and additional comments, including a negative vote, were returned. All comments were addressed and the negative vote was reversed.

For Gamma Radiography— Specifications for the Design, Testing, and Performance Requirements for Industrial Gamma Radiography System Equipment Using Radiation Emitted by a Sealed Radioactive Source

1.0 Scope

This standard specifies the design, testing, and performance requirements for industrial gamma radiography system equipment and source changers using radiation emitted by a sealed radioactive source.

The standard includes the qualification requirements for those who engage in the design, fabrication, assembly, testing, repair, or modification of industrial gamma radiography system equipment or source changers.

The operational use of such equipment is not covered by this standard.¹

Those provisions containing the word “shall” identify requirements that are necessary to meet the standards of protection in this document. Those using the word “should” indicate advisory recommendations that are to be applied when practical.

2.0 Normative References

The following standards contain provisions that are referenced in this standard. At the time of publication the editions indicated were valid, yet all standards are subject to revision. Users of this standard should evaluate the applicability of revisions to those standards.

- Health Physics Society. American national standard: Radiation symbol. McLean, VA; ANSI N2.1-2011; 2011.
- Health Physics Society. American national standard: Sealed radioactive

sources—classification. McLean, VA; ANSI/HPS N43.6-2007 (R2013); 2013.

3.0 Definitions and Abbreviations

The definitions, terms, and abbreviations contained in this standard, or in other American national standards referred to in this document, are not intended to embrace all legitimate meanings of the terms. They are applicable only to the subject treated in this standard. Commonly used industry terms are in brackets.

3.1 Definitions

Associated equipment: Equipment that is used in conjunction with an exposure device that drives, guides, or comes into contact with the source assembly. This includes, but is not necessarily limited to, control assemblies, source guide tubes, and collimators when used as source stops.

Automatic securing mechanism (ASM): A feature of an exposure device that automatically secures the source assembly when it is cranked back into the fully shielded position within the device. The ASM may only be released by means of a deliberate operation on the exposure device or control assembly.

Capacity: The maximum output activity in becquerels (curies) specified for a given radionuclide that may be contained in an exposure device or source changer.

Category: Type of exposure device based upon its intended use and the location of the sealed source when it is in the exposed position.

Class: Type of exposure device based upon its mobility.

Collimator (beam limiter): A shielding component used to limit the size, shape, or direction of the primary radiation beam.

Control adaptor: A component of the control assembly that attaches the control assembly to the exposure device.

Control assembly (remote control): An assembly that enables the sealed source(s) to be moved to the exposed position by

¹ If exposure devices are to be used as radioactive material transport packages, they shall also comply with current applicable transport regulations.