

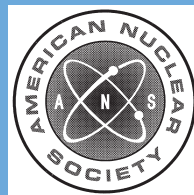
# American Nuclear Society

**WITHDRAWN**

use of borosilicate-glass Raschig  
rings as a neutron absorber in  
solutions of fissile material

an American National Standard

No longer being maintained as an  
American National Standard. This  
standard may contain outdated material  
or may have been superseded by  
another standard. Please contact the  
ANS Standards Administrator for details.



published by the  
American Nuclear Society  
555 North Kensington Avenue  
La Grange Park, Illinois 60526 USA

**ANSI/ANS-8.5-1979**  
**Revision of**  
**N16.4-1971**

**American National Standard**  
**Use of Borosilicate-Glass Raschig**  
**Rings as a Neutron Absorber**  
**in Solutions of Fissile Material**

**Secretariat**  
**American Nuclear Society**

Prepared by the  
**American Nuclear Society**  
**Standards Committee**  
**Work Group ANS-8.5**

Published by the  
**American Nuclear Society®**  
**555 North Kensington Avenue**  
**La Grange Park, Illinois 60525 USA**

Approved October 9, 1979  
by the  
**American National Standards Institute, Inc.**

## **American National Standard**

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

**CAUTION NOTICE:** This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of this standard may receive current information, including interpretation, on all standards published by the American Nuclear Society by calling or writing to the Society.

Published by

**American Nuclear Society**  
**555 North Kensington Avenue, La Grange Park, Illinois 60525 USA**

Price: \$16.00

Copyright © 1980 by American Nuclear Society.

Any part of this Standard may be quoted. Credit lines should read "Extracted from American National Standard ANSI/ANS-8.5-1979 with permission of the publisher, the American Nuclear Society." Reproduction prohibited under copyright convention unless written permission is granted by the American Nuclear Society.

Printed in the United States of America

## Foreword

(This Foreword is not a part of American National Standard Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material, ANSI/ANS-8.5-1979.)

This standard, which provides guidance for the use of borosilicate-glass raschig rings as a neutron absorber for criticality control in plants processing fissile materials, was first approved as N16.4-1971 and this revision results from the prescribed five-year review. It recommends maximum concentrations of homogeneous solutions of uranium and plutonium in vessels of unlimited size when packed with rings. Although the general use of neutron absorbers, including raschig rings, for this purpose dates back to 1958, some applications were recorded as early as the mid-1940s.

In this standard the concentration of solutions is expressed as the mass of plutonium or of uranium per unit volume. Limitations on the relative abundance of the various isotopes of plutonium are imposed in the specifications applicable to plutonium solutions. The limits on total uranium concentration, which are based on 100%  $^{235}\text{U}$ , apply to uranium of any  $^{235}\text{U}$  content. At enrichments of  $\leq 5.0$  wt%  $^{235}\text{U}$ , the limits are expressed as mass of  $^{235}\text{U}$  per unit volume. The  $^{233}\text{U}$  content of solutions in which  $^{235}\text{U}$  is the principal uranium isotope is limited.

Added in this revision is a requirement to determine the loss in glass volume (6.3.3) which may occur in acid media due to leaching and in caustic media due to dissolution. In addition an alternate nondestructive test (6.4.2) that provides a conservative estimate of the loss of boron from the rings is included. Further, this revision provides guidance for use of rings as a secondary criticality control, for their application to caustic solutions under limited conditions, and for rings in aqueous solutions of uranium containing  $\leq 5.0$  wt%  $^{235}\text{U}$ .

The experimental data forming the bases for the specifications and a review of experience with raschig rings were reported by Nichols et al.<sup>1</sup> at the time of initial preparation of this standard. Additional data that provide bases for this revision have also been published.<sup>2,3</sup>

This document was approved as an American National Standard in 1971. The present revision, which extends the provision of the original standard, was coordinated by N. Ketzlach of the U.S. Nuclear Regulatory Commission assisted by B. Ernst of Babcock and Wilcox Company, J.D. McCarthy of Rockwell International, Rocky Flats Plant, and P. B. Adams and A. B. Doyle of Corning Glass Company.

The development of the standard and its maintenance were performed under Subcommittee 8 of the Standards Committee of the American Nuclear Society. At the time of the approval of the revision, Subcommittee 8, Fissionable Materials Outside Reactors, had the following membership:

J. D. McLendon, Chairman, <i>Union Carbide Corporation, Nuclear Division</i>	D. M. Dawson, <i>General Electric Company</i>
E. B. Johnson, Secretary, <i>Oak Ridge National Laboratory</i>	Norman Ketzlach, <i>U. S. Nuclear Regulatory Commission</i>
F. M. Alcorn, <i>Babcock and Wilcox Company</i>	W. G. Morrison, <i>Allied Chemical Corporation</i>
H. K. Clark, <i>Savannah River Laboratory</i>	David R. Smith, <i>Los Alamos Scientific Laboratory</i>
E. D. Clayton, <i>Battelle-Pacific Northwest Laboratories</i>	J. T. Thomas, <i>Oak Ridge National Laboratory</i>
	G. E. Whitesides, <i>Oak Ridge National Laboratory</i>
	Frank E. Woltz, <i>Goodyear Atomic Corporation</i>

<sup>1</sup>J. P. Nichols, C. L. Schuske, and D. W. Magnuson, "Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material," Y-CDC-8, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (1971).

<sup>2</sup>P. B. Adams, Chapter 14 in *Ultrapurity*, M. Zief and R. Speights Editors, Marcel Dekker, Inc., New York (1972).

<sup>3</sup>N. Ketzlach, *Nucl. Tech.*, 42, 65 (1979).

The American National Standards Committee N16, Nuclear Criticality Safety, which reviewed and approved this Standard in 1979, had the following membership:

Dixon Callihan, Chairman  
E. B. Johnson, Secretary

*Organization*

*Representative*

Allied-General Nuclear Services .....	William R. Waltz
American Institute of Chemical Engineers .....	Alex F. Perge
American Nuclear Society .....	Dixon Callihan
American Society for Testing and Materials .....	Ricardo Artigas J. H. Bystrom (Alternate)
Atomic Industrial Forum, Inc. ....	D. F. Cronin
Exxon Nuclear Company.....	Warren S. Nechodom
Health Physics Society .....	Fred W. Sanders F. F. Haywood (Alternate)
Institute of Nuclear Materials Management .....	Leo E. Hansen
U. S. Department of Energy .....	Lorin Brinkerhoff
U. S. Nuclear Regulatory Commission.....	Robert L. Stevenson
<i>Individual Members</i> .....	C. Leslie Brown E. B. Johnson H. C. Paxton

<b>Contents</b>	<b>Section</b>	<b>Page</b>
1.	Scope .....	1
2.	Definitions .....	1
	2.1 Limitations .....	1
	2.2 Shall, Should, and May .....	1
	2.3 Glossary of Terms .....	1
3.	General Specifications and Criteria .....	1
	3.1 Chemical Environment .....	1
	3.2 Physical Environment .....	2
4.	Specifications for Rings .....	2
	4.1 Composition .....	2
	4.2 Chemical Acceptance Test .....	2
	4.3 Ring Dimensions .....	2
	4.4 Surface Finish .....	3
	4.5 Mechanical Shock-Resistance Test .....	3
5.	Specifications For Packed Vessels.....	3
	5.1 Unpacked Piping in Vessels .....	3
	5.2 Determination of Level of the Rings .....	4
	5.3 Allowable Volume of Solution in a Vessel Packed with Rings.....	4
	5.4 Vessel Leakage.....	4
	5.5 Determination of Glass Volume Fraction .....	4
	5.6 Installation of Rings .....	4
6.	Maintenance Inspection .....	4
	6.1 Settling.....	4
	6.2 Solids Accumulation.....	4
	6.3 Physical Properties .....	5
	6.4 Boron Content of Rings .....	6
	6.5 Inspection Intervals .....	6
7.	Maximum Specified Concentrations of Fissile Solutions.....	6
8.	References.....	6
	Appendix .....	8
	Fig. 1 Tumbler Drum .....	3