



*NSF International Standard /  
American National Standard*

## NSF/ANSI 49 - 2011

**Biosafety Cabinetry: Design,  
Construction, Performance, and  
Field Certification**



*NSF International, an independent, not-for-profit, non-governmental organization, is dedicated to being the leading global provider of public health and safety-based risk management solutions while serving the interests of all stakeholders.*

*This Standard is subject to revision.  
Contact NSF to confirm this revision is current.*

Users of this Standard may request clarifications and interpretations, or propose revisions by contacting:

Chair, Joint Committee on Biosafety Cabinetry  
c/o NSF International  
789 North Dixboro Road, P.O. Box 130140  
Ann Arbor, Michigan 48113-0140 USA  
Phone: (734) 769-8010 Telex: 753215 NSF INTL  
FAX: (734) 769-0109  
E-mail: [info@nsf.org](mailto:info@nsf.org)  
Web: <http://www.nsf.org>

**NSF International Standard/  
American National Standard  
for Biosafety Cabinetry –  
Biosafety Cabinetry: Design,  
Construction, Performance, and  
Field Certification**

Standard Developer

**NSF International**

**NSF International**

**Designated as an ANSI Standard**

November 8, 2011

**American National Standards Institute**

Prepared by  
**The NSF Joint Committee on Biosafety Cabinetry**

Recommended for Adoption by  
**The NSF Council of Public Health Consultants**

Adopted by  
**The NSF Board of Trustees**  
**June 1976**

Revised May 1983  
Revised June 1987  
Revised May 1992  
Revised March 2002  
Addendum November 2002  
Revised February 2004  
Revised September 2004  
    Addendum October 2004  
    Addendum March 2005

Revised July 2007  
Revised October 2008  
Revised June 2009  
Revised September 2010  
Revised November 2010  
Revised November 2011

Published by

**NSF International**  
**PO Box 130140, Ann Arbor, Michigan 48113-0140, USA**

For ordering copies or for making inquiries with regard to this Standard, please reference the designation "NSF/ANSI 49 – 2011."

Copyright 2011 NSF International  
Previous edition © 2010, 2009, 2008, 2007, 2004, 2002, 1992, 1987, 1983, 1976

Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from NSF International.

Printed in the United States of America.

## Disclaimers<sup>1</sup>

NSF International (NSF), in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of NSF represent its professional judgment. NSF shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. NSF shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

NSF Standards provide basic criteria to promote sanitation and protection of the public health. Provisions for mechanical and electrical safety have not been included in this Standard because governmental agencies or other national standards-setting organizations provide safety requirements.

Participation in NSF's Standards development activities by regulatory agency representatives (federal, local, state) shall not constitute their agency's endorsement of NSF or any of its Standards.

Preference is given to the use of performance criteria measurable by examination or testing in NSF Standards development when such performance criteria may reasonably be used in lieu of design, materials, or construction criteria.

The illustrations, if provided, are intended to assist in understanding their adjacent standard requirements. However, the illustrations may not include **all** requirements for a specific product or unit, nor do they show the only method of fabricating such arrangements. Such partial drawings shall not be used to justify improper or incomplete design and construction.

Unless otherwise referenced, the annexes are not considered an integral part of NSF Standards. The annexes are provided as general guidelines to the manufacturer, regulatory agency, user, or certifying organization.

---

<sup>1</sup> The information contained in this Disclaimer is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Disclaimer may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

This page is intentionally left blank.

## Contents

1	General .....	1
1.1	Scope .....	1
1.2	Minimum requirements .....	1
1.3	Variations in design and construction .....	1
2	Normative references .....	1
3	Definitions .....	3
4	Materials .....	9
4.1	General .....	9
4.2	Interior work surfaces .....	10
4.3	Exposed interior surfaces .....	10
4.4	Other interior and exterior surfaces .....	10
4.5	Materials and finishes .....	10
5	Design and construction .....	11
5.1	General .....	11
5.2	Cleanability .....	11
5.3	Decontamination .....	12
5.4	Canopy connect exhaust .....	12
5.5	Direct connect exhaust .....	12
5.6	Duct and plenum design .....	12
5.7	Internal corners and angles .....	12
5.8	External corners and angles .....	13
5.9	Joints and seams .....	13
5.10	Fastening methods .....	13
5.11	Welds .....	13
5.12	Solder .....	13
5.13	Removable panels .....	14
5.14	Stability .....	14
5.15	Provision for mounting .....	14
5.16	Legs and feet .....	14
5.17	Reinforcing and framing .....	14
5.18	Fixed panels .....	14
5.19	Doors and covers .....	14
5.20	Louvers and openings .....	15
5.21	Tracks and guides .....	15
5.22	Filters .....	15
5.23	Gaskets and sealants .....	16
5.24	Stopcocks and service outlets .....	16
5.25	Alarms .....	16
5.26	Electrical components .....	17
5.27	Lighting .....	17
5.28	Gauges .....	18
5.29	Drain spillage trough .....	18
5.30	Diffuser placement .....	18
5.31	Work area components placement .....	18
5.32	Height and width .....	18
5.33	Data plate(s) .....	18
6	Performance .....	27
6.1	General .....	27
6.2	Pressure decay / soap bubble / tracer gas leak .....	27
6.3	HEPA/ULPA filter leak .....	27
6.4	Noise level .....	27
6.5	Lighting intensity .....	27
6.6	Vibration .....	27
6.7	Personnel, product, and cross-contamination protection .....	27
6.8	Stability .....	28
6.9	Downflow and inflow velocities .....	28

6.10 Inflow velocity .....	29
6.11 Airflow smoke patterns .....	29
6.12 Drain spillage trough leakage .....	30
6.13 Motor/blower performance.....	30
6.14 Electrical safety.....	30
6.15 Performance data .....	30
6.16 Record maintenance .....	30
Annex A .....	A1
A.1 Pressure decay / soap bubble .....	A1
A.2 HEPA/ULPA filter leak test.....	A2
A.3 Noise level test.....	A4
A.4 Lighting intensity test.....	A5
A.5 Vibration test .....	A5
A.6 Personnel, product, and cross-contamination protection (biological) tests .....	A6
A.7 Stability tests .....	A11
A.8 Downflow velocity.....	A13
A.9 Inflow velocity (face velocity) test.....	A15
A.10 Airflow smoke patterns test .....	A18
A.11 Drain spillage trough leakage test .....	A19
A.12 Motor/blower performance.....	A20
Annex B .....	B1
B.1 Method to verify fitness for use of potential direct inflow measurement devices.....	B1
Annex C .....	C1
C.1 Selection .....	C1
C.2 Calibration .....	C1
Annex D .....	D1
D.1 Chemical resistance.....	D1
D.2 Abrasion resistance.....	D1
Annex E .....	E1
E.1 Biosafety consultation prior to BSC purchase .....	E1
E.2 Risk assessment procedure.....	E1
E.3 Biosafety cabinet selection .....	E3
E.4 Prior to the purchase.....	E9
E.5 Inspection.....	E11
E.6 Moving a permanently installed biosafety cabinet .....	E11
E.7 Lifespan of BSCs .....	E11
E.8 Decommissioning process .....	E12
Annex F .....	F1
F.1 Field certification preconditions and intervals .....	F1
F.2 Downflow velocity.....	F2
F.3 Inflow velocity (face velocity) test.....	F4
F.4 Airflow smoke patterns test.....	F8
F.5 HEPA/ULPA filter leak test.....	F9
F.6 Pressure decay / soap bubble .....	F11
F.7 Site installation assessment tests .....	F13
F.8 Electrical leakage and ground circuit resistance and polarity tests .....	F14
F.9 Lighting intensity test.....	F14
F.10 Vibration test.....	F15
F.11 Noise level tests.....	F15
F.12 Record of field certification .....	F16
Annex G .....	G1
G.1 Recommended microbiological decontamination procedure .....	G1
G.2 Recommended HEPA/ULPA filter disposal procedures.....	G8



Annex H	H1
H.1 Sheet metal and finishes	H1
H.2 Glass	H1
H.3 HEPA/ULPA filter gasket materials	H1
H.4 HEPA/ULPA filter case – Type IC	H2
H.5 Specifications	H2
H.6 Sealants	H2
H.7 Fans	H2
H.8 Components and wiring	H2
Annex I	I1
I.1 Miscellaneous publications	I1
I.2 Federal specifications	I2
I.3 Federal standards	I3
I.4 Military specifications	I3
Annex J	J1
J.1 Helium leak test	J1
J.2 Sulfur hexafluoride (SF <sub>6</sub> ) leak test	J2
Annex K	K1
K.1 Introduction	K1
K.2 Protocol	K1

This page is intentionally left blank.

## Foreword<sup>2</sup>

The purpose of this Standard is to establish minimum requirements for materials, design, construction, and performance of Biosafety Cabinetry that are designed to protect personnel, product, and the environment. This Standard details requirements for performance testing as well as field certification testing.

This edition of the Standard (NSF/ANSI 49-2011) includes the following revisions:

### **Issue 27 – Class I and III**

Updates to the Class I and III definitions in Section 3.

### **Issue 39 - Sound level and Adhesives**

Updates to reflect OSHA guidelines for noise level readings in Section F.11.2 and also updates Section H.6.3 to reflect the IEST-RP-CC001 Section 8.3.2 recommendations for adhesives used in filter repair.

### **Issue 42 - Pressure decay test/Soap bubble leak test**

Updates to the language in Annex F, section F.1.1.

### **Issue 43 - Canopy Requirements and Performance**

Updates the language in 5.4 Canopy connect exhaust and in 5.25.4 Type A1 or A2 exhaust alarm to allow canopy testing for class II, type A1 & A2 cabinets. This same language is already part of Annex F (F.7.3.3).

### **General editorial corrections in various sections**

This Standard was developed by the NSF Joint Committee on Biosafety Cabinetry using the consensus process described by the American National Standards Institute.

Suggestions for improvement of this Standard are welcome. Comments should be sent to Chair, Joint Committee on Biosafety Cabinetry, c/o NSF International, Standards Department, PO Box 130140, Ann Arbor, Michigan 48113-0140, USA.

---

<sup>2</sup> The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

This page is intentionally left blank.

# NSF/ANSI International Standard for Biosafety Cabinetry —

## Biosafety Cabinetry: Design, Construction, Performance, and Field Certification

### 1 General

#### 1.1 Scope

This Standard applies to Class II (laminar flow) biosafety cabinetry designed to minimize hazards inherent in work with agents assigned to biosafety levels 1, 2, 3, or 4. It also defines the tests that shall be passed by such cabinetry to meet this Standard. This Standard includes basic requirements for the design, construction, and performance of biosafety cabinets that are intended to provide personnel, product, and environmental protection; reliable operation; durability and structural stability; cleanability; limitations on noise level; illumination; vibration; and motor/blower performance.

#### 1.2 Minimum requirements

Cabinets qualifying under this Standard shall have passed all of the designated tests. Units with component parts covered under existing NSF standards or criteria shall conform to those applicable requirements.

#### 1.3 Variations in design and construction

Cabinetry varying in design, construction, or installation of accessory equipment may qualify under this Standard, if appropriate tests and investigations indicate that the equipment is durable and reliable, can be cleaned and decontaminated, and performs in conformance to this Standard. Such equipment shall meet the requirements for materials and finishes in this Standard.

Major modifications require appropriate tests for conformance. Major modifications include, but are not limited to, changes in the following: location or capacity or quantity or all three of blower/motor(s); size or design or both of air plenums; position of High Efficiency Particulate Air/Ultra Low Penetrating Air (HEPA/ULPA) filters; position or redesign of work surface; work area intake and exhaust air grilles; window placement or design; access opening size; location and size of exhaust port; and built-in accessory equipment (centrifuges, ultraviolet lighting, supports for intravenous drug container, arm rests, etc.). Relocation of utility service equipment (electrical outlets, petcocks, etc.) is not considered a major modification if other provisions of this Standard are not compromised.

### 2 Normative references

The following documents contain requirements that, by reference in this text, constitute requirements of this Standard. At the time of publication, the indicated editions were valid. All documents are subject to revision, and parties are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below.

ACGIH, *Industrial Ventilation: A Manual of Recommended Practice*<sup>3</sup>

<sup>3</sup> American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Dr., Cincinnati, OH 45240 <www.acgih.org>.