NSF/ANSI STANDARD 49

Date Adopted & Effective	Issue Statements/ Annexes
March 2021	130, 141, 151, 153, 154, 155, 156, 157, 159, 160
March 2020	54, 82, 92, 120, 122, 127, 130, 133, 136, 138, 139, 140, 146, 147, 148, 149
January 2019	47, 59, 77, 105, 108, 109, 110, 111, 112, 115, 117, 118, 121, 125
March 2017	45, 56, 73, 76, 78, 79, 81, 86, 88, 90, 96, 99
February 2015	48, 49, 50, 51, 52, 53, 55, 60, 61, 72
July 2012	44, 46
November 29, 2010	23, 29
September 16, 2010	23, 24, 37/38, 41
June 2009	Annex G, 15, 28, 30, 34, 35, 36
April 2008	12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 25, 26, 31

NSF position statement dated May 17, 2011
(see CETA CAG-010-2011)

Presented by James T. Wagner
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ControlledEnvironmentConsulting

NSF/ANSI 49: MARCH 2021 CHANGES

Changes Effective March 2021

The following is based on the changes outlined in the Foreword of NSF/ANSI 49
The topics were discussed in committee as issue numbers which form the basis of discussion.

- **Issue 130, 141, 151, 153, 154, 155, 156, 157, 159, 160**
- Only completed issues are discussed.

ISSUE 130

This revision updated language throughout the standard regarding use of the previously added terms total work area and usable work area.

- **N-1.6.1 Purpose**
  - These tests determine whether aerosols will be contained within the cabinet, outside contaminants will not enter the cabinet usable work area, and aerosol contamination of other equipment in the cabinet will be minimized.
- **N-1.8.4 Acceptance**
  - The average downward airflow velocity through the cross section of the unobstructed usable work area (with removable acceptable option components removed) at the level 4 inches (100 mm) above the bottom of the sash of cabinets meeting the requirements of Section N-1.6 shall be the values specified by the manufacturer.
- **I-1.3.1.1 Question one: What needs to be protected?**
  - …The Class I BSC will protect the operator and the lab, however, because room air constantly washes over the usable work area, the product is exposed to airborne contaminants.

ISSUE 130 (CONTINUED)

I-1.7.1.5 Effective usable work area layouts will minimize reach to avoid neck and shoulder stress and fatigue. Rotating tables are available to minimize reach.

I-1.7.4 BSC techniques

- …and *(2)* airborne contamination generated in the usable work area is controlled by flow of airstreams in a top-to-bottom direction;

I-1.7.5 BSC start up procedure

- **…**This will minimize the shedding of skin flora into the usable work area and also protect hands and arms from viable microbial contamination.

I-1.11.2.3 downflow velocity profile:

- …Airflow velocities and the average of the airflow through the usable work area may be calculated as a whole (uniform) or may be separated into two or more adjoining areas (zoned) with averages calculated for each zone.

Note there are 92 instances of the use of "*total* work area". Too numerous to list here.

ISSUE 141

This revision updated multiple definitions in Section 3

- Some definitions moved from other sections into the definitions section 3.
- **3.8 cabinet classification**: Although this standard covers only Class II BSCs, Class I and Class III cabinets are currently defined and known to be commercially available.
  - ➢ This definition was modified.
- Other minor changes throughout the standard

ISSUE 151

This issue modified language in Section N-1.6 regarding the occurrence of positive control plates.

ISSUE 153

This revision updated language in Sections 3.19.1, 6.11, 6.15, and N-1.6.5.1 regarding use of the term *smoke*.

- The word "smoke" was removed from the standard because the visible medium used is not truly a smoke.
  - 3.19.1 Changed smoke particles to aerosol particles
  - 6.11, 6.15 Changed "Airflow smoke patterns" to "Airflow pattern test" and removed any reference to "smoke"
  - 6.1.6.5.1 Changed reference to "smoke" to "visible medium"

ISSUE 154

This revision modified language in Sections N-1.8, N-1.9, N-5.2, N-5.3, and N-5.12 regarding air velocity measurements and the field certification label.

- N-1.8 added "The anemometer probe shall not be hand held for any downflow velocity measurements."
- N-1.9 added "The anemometer probe shall not be hand held"
- N-5.2 added "The anemometer probe shall not be hand held for any downflow velocity measurements."
- N-5.3 added "The anemometer probe shall not be hand held. Acceptable methods include a ring-stand and clamp, manufacturer supplied probe holder or when the BSC manufacturer has made provisions for accurately locating the anemometer sensing element by resting the probe on the exhaust collar and a second lip for stability.
- N-5.12 added "Technician NSF listing number, if applicable." to the Field certification label requirements.

ISSUE 155

This revision updated language in Section 5.25.6 regarding the warm up period.

- This sentence was changed as follows: When starting the cabinet blowers from a dead stop, the inflow alarm must activate a visual indication until the cabinet either enters into a visually indicated warm up period ~~not to exceed 2 minutes~~ or the appropriate inflow velocity is achieved to ensure proper alarm system function.

ISSUE 156

This revision affirms language in Section N-1.6 regarding the placement of biological test control plates.

- Added to N-1.6.5.1.4.b) "A visible aerosol or mist test may be performed to determine where the test organism will be best captured in the areas described above, allowing unnecessary control plates to be eliminated."

ISSUE 157

This revision further clarifies language in Section N-1.6 regarding biological tests.

ISSUE 159

This revision modifies language regarding electrical safety in Section 6.14.

Added "For the purposes of this requirement, an "authorized testing laboratory" shall be either a US Occupational Safety and Health Administration (OSHA) Nationally Recognized Testing Laboratory (NRTL) or an International Electrotechnical Commission for Electrical Equipment CB Testing Laboratory (CBTL)."

ISSUE 160

3.8.2

- This sentence was eliminated ~~"Class II BSCs provide the microbe-free work environment necessary for cell culture propagation and also may be used for the formulation of nonvolatile antineoplastic or chemotherapeutic drugs."~~

ISSUE 160 CONTINUED

This revision adds clarifying language to definitions in Sections 3.5.3 and 3.8.2.

- **3.8.3 Class III**: The Class III BSC was designed for work with highly infectious microbiological agents and other hazardous operations. It provides maximum protection for the environment and the worker. ~~It is a gas-tight (no leak greater than 1 × 10-7 mL/s with 1% test gas at 3 inches (750 Pa) pressure water gauge)21 enclosure with a viewing window that is secured with locks, or requires the use of tools to open, or both.~~ Access for passage of materials into the cabinet may be through any of the following: a dunk tank that is accessible through the cabinet floor, a double-door pass-through box that can be decontaminated between uses, integrated double door autoclaves, and portable docking stations with double sealing connecting mechanisms that can be decontaminated between uses. Reversing that process allows materials to be removed from the Class III BSC. Both supply and exhaust air are HEPA/ULPA filtered. Exhaust air must pass through two HEPA/ULPA filters in series, before discharge to the outdoors. Airflow is maintained by an exhaust system exterior to the cabinet, which keeps the cabinet under negative pressure according to manufacturer design pressure criteria~~. Sometimes because of laboratory conditions an optional exhaust fan may be required. This exhaust fan should generally be kept separate from the exhaust fans of the facility ventilation system. If a cabinet exhaust system is required it should be equipped with an appropriate alarm system which both notifies the cabinet user and shuts down the cabinet exhaust system in the event of a facility exhaust system failure.~~ This exhaust fan should generally be kept separate from the exhaust fans of the facility ventilation system and be equipped with an appropriate alarm system which both notifies the cabinet user and shuts down the cabinet exhaust system in the event of a facility exhaust system failure.

ISSUE 160 CONTINUED

3.8.3 Class III:

This paragraph was modified as noted:

- Rubber gloves / sleeves or equivalent glove material, are sealed to ports in the cabinet and allow direct manipulation of the materials isolated inside. The glove material shall be compatible for use with the materials being used in the cabinet. The exhaust system for the cabinet shall provide inflow to the cabinet arm port in the event of a rubber glove / sleeve breach. ~~The minimum breach velocity shall be measured with a hot wire in the middle of the arm port and shall be no less than 100 ft/min (0.51 m/s). It is not a requirement for the work area to be free of turbulence or cross contamination.~~

NSF/ANSI 49: MARCH 2020 CHANGES

Changes Effective March 2020

The following is based on the changes outlined in the Foreword of NSF/ANSI 49
The topics were discussed in committee as issue numbers which form the basis of discussion.

- **Issue 54, 82, 92, 120, 122, 127, 130, 133, 136, 138, 139, 140, 146, 147, 148, 149**
- Only completed issues are discussed.

ISSUE 54

This revision affirms new and updated language in Annex N-5 (formerly Annex F) concerning the use of the Secondary method for measuring airflow.

ISSUE 82

This revision affirms new language in Annex I-1 (formerly Annex E) regarding the term *percent recirculation*.

ISSUE 92

This revision affirms new and updated language in Section 3 and Annex N-5 (formerly Annex F) regarding canopy field testing.

ISSUE 120

This revision affirms new language in Section 3 regarding the addition of the newly proposed term *plenum*.

ISSUE 122

This revision affirms new and revised language in Annex N-5 (formerly Annex F) regarding the Certification Label.

ISSUE 127

This revision affirms revised language regarding the use of the term *NOTE*.

ISSUE 130

This revision affirms revised language regarding the definition of the term *work area*.

ISSUE 133

This revision affirms revised language in Section 5 regarding the data plate.

ISSUE 136

This revision affirms revised language in Annex N-1 (formerly Annex A) and Annex N-5 (formerly Annex F) regarding the sash seal smoke test.

ISSUE 138

This revision affirms revised language regarding the range of measurement for vibration frequency.

ISSUE 139

This revision affirms revised language in Annex I-1 (formerly Annex E).

ISSUE 140

This revision affirms revised language in Annex N-1 (formerly Annex A) regarding accuracy requirements for the manometer used for the pressure decay and motor blower performance tests.

ISSUE 146

This revision addresses inconsistencies of incubation times and temperatures during the various biological tests in Annex N-1.

ISSUE 147

This revision affirms revised language in Annex N-1 (formerly Annex A) regarding filter porosity for filtering impinger water.

ISSUE 148

This revision affirms revised language in Annex N-1 (formerly Annex A) regarding the confirmation requirements for the Cross Center test.

ISSUE 149

This revision affirms revised language in Section 2 regarding Normative References.

NSF/ANSI 49: MARCH 2020 CHANGES

Annexes

Annexes	
Previously known as:	**Now known as:**
Annex A	Normative Annex 1 (N-1)
Annex B	Normative Annex 2 (N-2)
Annex C	Normative Annex 3 (N-3)
Annex D	Normative Annex 4 (N-4)
Annex E	Informative Annex 1 (I-1)
Annex F	Normative Annex 5 (N-5)
Annex G	Informative Annex 2 (I-2)
Annex H	Informative Annex 3 (I-3)
Annex I	Informative Annex 4 (I-4)
Annex J	Informative Annex 5 (I-5)
Annex K	Informative Annex 6 (I-6)

NSF/ANSI 49: JANUARY 2019 CHANGES

The following is based on the changes outlined in the Foreword of NSF/ANSI 49

The topics were discussed in committee as issue numbers which form the basis of discussion.

- **Issue 47, 59, 77, 105, 108, 109, 110, 111, 112, 115, 117, 118, 121, and 125**
- Only completed issues are discussed.

ISSUE 47

Revised and added new language in Annex A regarding the cross contamination test procedure.

ISSUE 59

Revised and added new language for the airflow alarm requirement language for all cabinet types.

ISSUE 77

Added language to Annex A regarding confirmation tests when there is a test failure.

ISSUE 105

Added new language in Annex E regarding risk assessment of biosafety cabinets exhaust system pressurization in the event of an exhaust system failure.

ISSUE 108

Added new language in Annex F regarding exhaust airflow alarms

ISSUE 109

Revised and added new language referring to the term Certification throughout this standard.

ISSUE 110

Revised language in Section 1.3 regarding the identification of major software changes to biosafety cabinets.

ISSUE 111

Added new and revised language to Section 3 regarding the terms visible and viewable, and added provisions for the optional use of digital data plates to Section 5.

ISSUE 112

Revised and added new language in Annex G regarding the generation and dispersion of decontamination gas.

ISSUE 115

Added new language in Section 6.10 regarding inflow requirements for Type C1 Cabinets.

ISSUE 117

Updates the language throughout this Standard regarding the use of the term “and/or”.

ISSUE 118

Revised language in Section 5.25.3 and Annex F regarding the exhaust alarm in Type B biosafety cabinets.

ISSUE 121

Revised language in Section 5.26.2 regarding electrical wiring.

ISSUE 125

Revised language in Section 5.26.2 regarding the term “running power”.

NSF/ANSI 49: MARCH 2017 CHANGES

Changes Effective March 2017

Note: That in addition to this summary, CETA published an applications guide to provide a more detailed explanation including rationale for the changes.

The following is based on the changes outlined in the Foreword of NSF/ANSI 49

The topics were discussed in committee as issue numbers which form the basis of discussion.

- **Issue 45, 56, 73, 76, 78, 79, 81, 86, 88, 90, 96, and 99**
- Only completed issues are discussed.

ISSUE 45

Changes were made to Annex G covering the addition of Vaporized Hydrogen Peroxide as a decontamination agent in Biosafety Cabinetry, as well as clarifying the use of Chlorine Dioxide.

ISSUE 56

Language in section 6.14 was added regarding certification to IEC 61010-1 or a national standard based on it.

ISSUE 73

Updated/unified all cabinet definitions, Sections 5, 6, Annex A and F for the type C1.

ISSUE 76

Updated language was added referencing audible and visual alarms.

ISSUE 78

Metric conversions throughout the Standard were reviewed and updated.

ISSUE 79

Decontamination procedures in Annex G were updated.

ISSUE 81

Updated Annex E. Included all definitions from section 3, updated risk assessment, cabinet placement, cleaning procedures, usage procedures and added type C1.

ISSUE 86

Updates were made in Annex A to the incubation time and temperature prior to the micro check.

ISSUE 88

Section 5.32 was updated regarding cabinet height and width.

ISSUE 90

Redundancies about sliding sash alarms in subsections 5.19.4 and 5.25.1 were removed.

ISSUE 96

Language involving preparation of the spore suspension of Bacillus atrophaeus 9372 in Annex A was updated.

ISSUE 99

Update Soap bubble leak test procedure in Annex A to require manufacturers to provide metal seal plates and limits NSF test personnel time to seal leaks found.

NSF/ANSI STANDARD 49: FEBRUARY 2015 CHANGES

Changes effective February 2015

Note that in addition to this summary, CETA published an applications guide to provide a more detailed explanation including rationale for the changes.

- Issues 48, 49, 50, 51, 52, 53, 55, 60, 61, 72

ISSUE 48: MOTOR STABILITY TEST PROCEDURE

This revision adds a motor stability test procedure for motor speed control systems.

ISSUE 49: SEALANT USE LANGUAGE

This revision updates the sealant use language in Annex H, Section H.6.

- Updated recommended sealants for the BSCs.
  - SAE AMS-S-8802 or equivalent
  - Dow Corning RTV 732, 781,734, or RRTV 112 self leveling or equivalent

ISSUE 50: FANS

This revision affirms new language regarding the type of fans used in biosafety cabinets.

ISSUE 51: BIOSAFETY CABINET BLOWER STARTUP

This revision affirms new language regarding the type of biosafety cabinet blower startup.

ISSUE 52: DOP PORT LOCATION

This revision clarifies details surrounding the DOP port location in section 5.22

- Moved the challenge port from the top of the BSC on the outside to the inside under the work surface. The intent is to ensure that the challenge port is opened in negative pressure.

ISSUE 53: DEFINITIONS

This revision adds definitions to clarify biosafety cabinet shell penetrations and cable ports with consideration given to service technicians and cabinet users relating to safety.

ISSUE 55: INSTRUMENTATION LANGUAGE

This revision updates the instrumentation language.

ISSUE 60: AIRFLOW GRID LANGUAGE

This revision updates the airflow grid language in sections A.8.3.1 and A.8.3.2, and the related figure A15

- Clarifies minimum spacing and number of readings determination.
- Clarifies different zone dimensions for cabinets with sloped sash for different sash height

ISSUE 61: SASH POSITION

This revision updates the language in sections 5.19.4 and 5.25.1 to include a section requiring the use of a sash position "too low" alarm.

- Now must alarm for more than 1" above and below

ISSUE 72: FIGURES

This revision updates multiple figures throughout the Standard to improve clarity.

NSF/ANSI STANDARD 49: JULY 2012 CHANGES

Changes effective July 2012

- Issues 44, 46

ISSUE 44: CABINETS LESS THAN 3 FEET

Updates the language in the Standard to include a test method for biosafety cabinets with an interior sidewall dimension of three feet or less.

ISSUE 46: DIRECT INFLOW MEASUREMENT (DIM) & EXHAUST CLEARANCE

Updates the Standard to include a reference to non-back pressure compensated readings used in a Direct Inflow Measurement (DIM) in Annex A, Annex B, and Annex F

Updates the language in Annex A, Annex E and Annex F for the 12 in (30 CM) clearance requirement used for measuring an exhaust HEPA filter

NSF/ANSI 49: NOVEMBER 2010 CHANGES

Changes effective November 29, 2010

The following summary of changes is based on the changes outlined in the Foreword
The issues were discussed in committee as issue numbers which form the basis of discussion.

- **Issue 23, 29**
- Only completed issues are discussed.
- Note that these two simple changes are addendum to the other 2010 changes

ISSUE 23: B2 DEFINITION

Errors in the September 2010 version were corrected. B2 Cabinet description is now correct.

ISSUE 29: UNIFORM AND ZONED DOWNFLOW

A.8.3.1 Uniform downflow cabinets

- No change to this section

A.8.3.2 Non-uniform downflow (zoned) cabinets

- The grid must have equidistant spacing
- Each zone must have at least 7 points within it
- The distance between test points shall not be less than 4" nor more than 8" inches apart
- The area defined by the perimeter of the test points must equal at least 30% of the total area of the plane in which the readings are taken.
- Each zone shall be taken at least 6 in away from the walls and sash enclosing the work area.

NSF/ANSI 49: SEPTEMBER 2010 CHANGES

Changes effective September 2010

The following summary of changes is based on the changes outlined in the Foreword
The issues were discussed in committee as issue numbers which form the basis of discussion.

- **Issue 23, 24, 37/38, 41**
- Only completed issues are discussed.

One additional item was added and not listed as with an issue number.

- **Annex K**

ISSUE 23: HARD DUCTING CABINETS

5.2 "The canopy connection type of BSC exhaust connection is required for externally vented Class II, Type A1 or A2 BSCs."

- Minor changes to wording from previous version of standard.

F.7.3.3 "Direct connected A1 or A2 BSCs shall not be considered in compliance with the Standard."

- New language intended to end "grace period" for conversion of old installation direct connections for type A1 and A2 cabinets.
  - ➢ Strong recommendation since 2002 now becomes a requirement. All externally vented A cabinets now must be connected with a canopy exhaust connection or they cannot be certified to be in compliance with the standard.

ISSUE 23: HARD DUCTING CABINETS

F.7.3.3 "Using a visible medium source positioned to demonstrate containment of BSC exhaust by the canopy, reduce the external exhaust until the alarm signals audibly. The alarm shall sound before visible canopy containment is lost."

- New language for testing canopy connections.
- It should be noted that new language for this is anticipated that will be consistent with other alarm requirements (within 15 seconds).

ISSUE 23: ULPA FILTERS

HEPA references now are HEPA/ULPA

ISSUE 24: ALARMS

5.23.4 “Any Type A1 or A2 cabinet when canopy connected shall have audible and visual alarm indication notifying the user of a potential loss in canopy containment”

ISSUE 37/38: ILLUSTRATIONS

New illustrations throughout the document

ISSUE 41: IEC 61010

"The standard was revised to be more inclusive of markets outside North America by modifying section 6 – Performance of the standard."

- **6.14 Electrical safety**

"The cabinet shall be tested by a National Recognized testing Laboratory (NRTL) for compliance to the requirements of the current edition of any national standard that is based on IEC 61010-1. Compliance is demonstrated by cabinet listing, i.e. UL, CSA, or IECEE CB Scheme certificate."

ANNEX G: AMMONIUM CARBONATE
(NOT A NUMBERED ISSUE)

G.1.3.1 "The *ammonium carbonate* should be weighed out so that it is 10% greater than the weight of paraformaldehyde used for the decontamination to ensure completion of the reaction."

- Changed from *Ammonium **bi**carbonate* to reflect Dr. Luftman's work published in "Applied Biosafety 10(2)-2005."
  - Bicarbonate should be 1.6:1 according to this article.

ANNEX K

A "Protocol for the Validation of Alternative Biosafety Cabinet Decontaminating Methods and Agents" was added in the form a new annex (Annex K).

- This is an informative annex

NSF/ANSI 49: JUNE 2009 CHANGES

Changes effective June 2009

The following summary of changes is based on the changes outlined in the Foreword
The issues were discussed in committee as issue numbers which form the basis of discussion.

- **Annex G, Issue 15, 28, 30, 34, 35, 36**
- Only completed issues are discussed.

ANNEX G

New section in 2008 largely unchanged.

ISSUE 15: AEROSOL INTRODUCTION POINT

A2.3.1a) "The manufacturer shall determine the aerosol introduction point that provides the most uniform distribution"

- Same as 2008

New language for 2009

- The **location of the aerosol introduction point** shall be clearly described or indicated in a manner readily available to the certifier.
  - On the cabinet data plate (or)
  - With the electrical schematic if the schematic is affixed to the cabinet

ISSUE 28: ILLUSTRATIONS

Illustrations throughout the document were updated to take advantage of modern technology.

- Thanks to Jim Hunter, Labconco Corporation

ISSUE 30: BIOLOGICAL VS. BIOSAFETY

The term “biosafety” is now used throughout the standard. The title was changed previously but there were some cases where old terminology remained in the 2008 version.

ISSUE 34: ACCEPTANCE STATEMENTS

Correct the acceptance statements in Annex F for consistency with Annex A.

- F2.4 Format change. Use of word "shall"
- F3.4 Use of word "shall"
- F4.4 No change
- F5.4 No change
- F6.1.5 Use of word "shall"
- F7 N/A
- F8 N/A
- F9.4 Use of word "shall"
- F10.4 Use of word "shall"
- F11.4 Use of word "shall"

ISSUE 35: MULTIPLE ISSUES

3.26 Added a definition for w.g. (water gauge)

- "Another common name for inch of water column. The word "gauge" after a pressure reading indicates that the pressure stated is actually the difference between the absolute or total pressure and the air pressure at the time of the reading".

UL References were updated throughout.

F.1 First reference to NSF/ANSI 49-2002 changed to NSF/ANSI 49 to clarify.

- With exception of downflow velocity test, **all** cabinets will be field tested to **current** version of Annex F regardless of manufacture date.

ISSUE 36: PLENUM DESIGN

5.4 All biologically contaminated ducts and plenums in Type A1, A2, B1, and B2 cabinets shall be maintained under negative pressure or enclosed within a negative pressure zone.

- Match the definition for a type A1 cabinet as in the 2008 version of NSF/ANSI 49. Removed contradictory language.
  - A1 cabinets can no longer have positive pressure contaminated plenum.

NSF/ANSI STANDARD 49: APRIL 2008 CHANGES

Changes effective April 2008

- **Issue 12, 13, 14, 16, 17, 18, 19, 20, 22, 25, 26, 31**

ISSUE 12: HEPA FILTERS

3.14* High efficiency air filters (for use in class II biosafety cabinets)

- Added **(for use in class II biosafety cabinets)** to the title to make it clear that the language in the standard only addresses filters as they pertain to BSCs.

***Note that this is NOT section 3.13 as stated in the foreword.

ISSUE 13, 21: CABINET DESCRIPTIONS - TYPE A

Change for Class II Type A1

- All biologically contaminated plenums under negative pressure or surrounded by negative pressure ducts and plenums.
  - Positive pressure exterior plenums are no longer allowed on any Class II BSC.

F.1.1 Tests directly related to containment – cabinet integrity test

- Old A1 cabinets only
- New positive pressure plenum cabinets only

ISSUE 14: CONCURRENT BALANCE VALUE

Added definition for CBV (3.10)

- For all direct-connected BSCs
- Compares the primary (DIM) value to a duct traverse.
  - Traverse per ASHRAE std. 111-2008
- Requirements for listing now specified
  - Exhaust volume @ filter load value (pressure)
  - Allowance for filter loading added to measured value
    - B1 0.3" w.c.
    - B2 0.7" w.c.

ISSUE 16: STANDARD TITLE

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

- Remove reference to Class II to include all types of cabinets

ISSUE 17, 20: INTERLOCKS FOR TYPE B CABINETS

Section F.7.3.2

- **Changed requirement for interlock verification to Type B cabinets from Type B2 cabinets.**
  - Significant impact for B1 cabinet testing!

ISSUE 18: DOWNFLOW VELOCITY MEASUREMENT

F.1 clarification language

- Downflow velocity readings shall be taken 4" above the bottom edge of the window only when so stated on the manufacturers data plate or when the manufacturers data plate label indicates the cabinet was listed to NSF 49-2002 or later.

ISSUE 19: SOUND LEVEL MEASUREMENTS - ANNEX F

F.11.4 Acceptance (sound level)

- Cabinet passes when overall noise level does not exceed 70 dbA when ambient is not greater than 60 dbA.
  - When ambient exceeds 60 dbA, correction curves are used.

Difference between total and background sound readings in dbA	Number to subtract from total to yield corrected noise level
0-2	Reduce background levels
3	3
4-5	2
6-10	1
>10	0

ISSUE 26: REPORTED VALUES

Certification Report - F.12.2

- A certification report that will carry the language **"certified in accordance with the NSF annex F"** or any similar language shall, at a minimum, include the following:
  - BSC Model Number
  - BSC Serial Number
  - BSC Location
  - **BSC Venting Information**
    - Ducted or not ducted
      - Type of connection (canopy, direct, or none)
  - Type of BSC
  - Test equipment used for each test
    - Manufacturer, model, serial number, calibration date
  - **Specific test data as detailed in annex F**
  - **Acceptance criteria for each test**
  - **Printed** name of certification technician
  - Retest date

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Downflow Velocity for Uniform Downflow Cabinets – F.2.3.1**
      - Individual velocity readings in the applicable grid
      - Overall average of velocity readings
      - Minimum velocity reading
      - Maximum velocity reading
      - Acceptance criteria for average airflow velocity
      - Acceptance criteria for airflow velocity uniformity
      - Name of test (Uniform Downflow Velocity Test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Downflow velocity for Non-Uniform Downflow Cabinets** *for each zone* **– F.2.3.2**
      - Individual velocity readings in the applicable grid
      - Overall average of velocity readings
      - Minimum velocity reading
      - Maximum velocity reading
      - Acceptance criteria for average airflow velocity
      - Acceptance criteria for airflow velocity uniformity
      - Name of test (Uniform Downflow Velocity Test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Intake Velocity using the Direct Measurement Method – F.3.3.2**
      - Individual volume readings
      - Overall average of the volume
      - Calculated inflow volume
      - Work access opening area
      - View screen opening height
      - Correction factor used (if applicable)
      - Acceptance criteria for average inflow volume
      - Acceptance criteria for calculated inflow velocity
      - Inflow velocity test method
      - Name of test (Inflow velocity test)

ISSUE 26: REPORTED VALUES

Reported Values

Annex F: Requirements for "Reported Values" are now delineated for each test in Annex F.

- **Intake Velocity using a thermal anemometer to measure exhaust velocity to determine inflow velocity – F.3.3.3.1**
  - Individual exhaust velocity readings
  - Overall average of the exhaust velocity readings
  - Calculated exhaust volume
  - Calculated inflow volume
  - Exhaust opening dimensions
  - Exhaust opening effective area
  - Work access opening area and dimensions
  - View screen opening height
  - Correction factor used (if applicable)
  - Acceptance criteria for calculated inflow velocity
  - Acceptance criteria for calculated inflow velocity
  - Inflow velocity test method
  - Name of test (Inflow velocity test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Intake Velocity using a thermal anemometer to measure velocity through a constricted access opening to determine average inflow velocity – F.3.3.3.2**
      - Individual constricted velocity readings
      - Overall average of the inflow velocity readings
      - Calculated inflow volume
      - Work access opening dimensions and area
      - Correction factor used (if applicable)
      - Acceptance criteria for average inflow velocity
      - Inflow velocity test method
      - Name of test (Inflow velocity test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Intake Velocity using a thermal anemometer to measure velocity through the access opening to determine average inflow velocity (B1) – F.3.3.3.3**
      - Individual velocity readings
      - Overall average of the inflow velocity readings
      - Calculated inflow volume
      - Work access opening dimensions and area
      - Correction factor used (if applicable)
      - Acceptance criteria for average inflow velocity
      - Inflow velocity test method
      - Name of test (Inflow velocity test)

ISSUE 26: REPORTED VALUES

Reported Values

Annex F: Requirements for "Reported Values" are now delineated for each test in Annex F.

- **Intake Velocity using an anemometer and pitot tube – F.3.3.3.4**
  - Individual duct velocity readings
  - Overall average of the duct velocity readings
  - Calculated exhaust volume
  - Duct size shape and area
  - Calculated inflow volume
  - Work access opening dimensions and area
  - Dimensions and area of the supply velocity measurement locations used to determine supply volume
  - Individual supply velocity readings (not to be confused with downflow velocities)
  - Calculated supply velocity and volume
  - Calculated inflow velocity and method used for calculations
  - Correction factor used (if applicable)
  - Acceptance criteria for calculated inflow velocity
  - Inflow velocity test method
  - Name of test (Inflow velocity test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Airflow Smoke Pattern Test – F.4.3**
      - Name of each test
      - Pass or fail for each test

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - ➢ Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **HEPA Filter Leak Test – F.5.3.1**
      - Upstream Aerosol Challenge Concentration
      - Method used to report concentration (measured or calculated)
      - Maximum leak penetration in percent
      - Method used (scanned or Probe tested)
      - Name of test (HEPA filter leak test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Pressure decay / soap bubble test – F.6.1.3**
      - Pressure range maintained during test
      - Pass or fail
      - Name of test (Pressure Decay Test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Site installation assessment tests – F.7**
      - Reported values are not specified in standard

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Lighting Intensity Test – F.9.3**
      - Individual background readings
      - Individual lighting intensity readings
      - Average background intensity
      - Average lighting intensity
      - Acceptance criteria
      - Pass or fail
      - Name of test (Lighting intensity test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Vibration Test – F.10.3**
      - Unit "On" vibration reading
      - Background vibration reading
      - Net vibration
      - Pass or fail
      - Name of test (Vibration Test)

ISSUE 26: REPORTED VALUES

Reported Values

- Annex F
  - Requirements for "Reported Values" are now delineated for each test in Annex F.
    - **Noise Level Tests – F.11.3**
      - Unit "On" sound level reading
      - Background sound level reading
      - Net sound level
      - Pass or fail
      - Name of test (Noise level test)

ISSUE 22, 25: ANNEX G

Informative annex expanded from formaldehyde decontamination to include:

- G.1 Biosafety Consultation prior to BSC purchase
- G.2 Risk Assessment procedures
- G.3 Cabinet selection
- G.4 Prior to the Purchase
- G.5 Inspection (of new cabinets)
- G.6 Moving a BSC
- G.7 Decontamination procedures
    - Expanded to include Chlorine Dioxide procedures
- G.8 HEPA Filter Disposal Procedures
- G.9 Lifespan of BSCs
- G.10 Decommissioning process

ISSUE 31: HELIUM AND SULFUR HEXAFLUORIDE TESTS

Annex J created as informational annex because there are no longer any exterior positive pressure contaminated plenum designs. Material removed from Annex A.

- J.1 Helium Leak Test
  - Previously section A.1
- J.2 Sulfur Hexafluoride (SF6) Leak Test
  - Previously section A.2

SUMMARY

Both minor and major changes were made to NSF/ANSI 49-2008. The most substantive changes were elimination of Type A cabinets with exterior positive pressure contaminated plenums, listing requirements for the Concurrent Balance Value, inclusion of chlorine dioxide decontamination procedures, and requirements for minimum reported values for field certification. Minor changes were made in 2009. The most substantive change made in 2010 is strengthening of language relating to external venting of class II Type A cabinets and specific new guidance for testing canopy connections.