NSF/ANSI 49-2007
Class II (laminar flow) biosafety cabinetry

3.4.2.1 Class II Type A1 cabinets (formerly designated Type A): cabinets that

- maintain minimum average inflow velocity of 75 ft/min (0.38 m/s) through the work access opening;
- have HEPA filtered downflow air that is a portion of the mixed downflow and inflow air from a common plenum (i.e., a plenum from which a portion of the air is exhausted from the cabinet and the remainder supplied to the work area);
- may exhaust HEPA filtered air back into the laboratory or to the environment through an exhaust canopy; and
- have all biologically contaminated ducts and plenums under negative pressure or surrounded by negative pressure ducts and plenums.

Type A1 cabinets are not suitable for work with volatile toxic chemicals and volatile radionuclides.

3.4.2.2 Class II, Type A2 cabinets (formerly designated Type B3): cabinets that

- maintain a minimum average inflow velocity of 100 ft/min (0.51 m/s) through the work access opening;
- have HEPA filtered downflow air that is a portion of the mixed downflow and inflow air from a common exhaust plenum;
- may exhaust HEPA filtered air back into the laboratory or to the environment through an exhaust canopy; and
- have all biologically contaminated ducts and plenums under negative pressure or surrounded by negative pressure ducts and plenums.

Type A2 cabinets used for work with minute quantities of volatile toxic chemicals and tracer amounts of radionuclides required as an adjunct to microbiological studies must be exhausted through properly functioning exhaust canopies.

6.2 Pressure decay / soap bubble / tracer gas leak

All biologically contaminated air plenums under positive pressure to the room during normal cabinet operation shall be tracer gas leak tight. The periphery and penetrations of all other plenums shall be leak tight when tested by the pressure decay or soap bubble test (see annex A, section A.1).

6.2.1 The cabinet shall hold 2 in w. g. (500 Pa) within ± 10% for 30 min or all welds, gaskets, penetrations, or seals on exterior surfaces of air plenums shall be free of soap bubbles when at 2 in w. g. (500 Pa) ± 10% pressure above atmospheric.

6.2.2 Helium leakage shall not exceed $1 \times 10^{-5}$ cc/s when pressurized to 2 in w. g. (500 Pa) with at least 15% cabinet concentration of helium.

6.2.3 Sulfur hexafluoride (SF$_6$) leakage shall not exceed $5 \times 10^{-7}$ cc/s when pressurized to 2 in w. g. (500 Pa) with SF$_6$. 
A.1.2 Helium leak test

A.1.2.1 Purpose

This test on all biologically contaminated air plenums under positive pressure to the room determines whether exterior joints made by welding, gasketing, or sealing with sealants are free of leaks that might release potentially hazardous materials into the atmosphere.

A.1.2.2 Apparatus

The helium leak detector shall be calibrated in accordance with the manufacturer's instructions using a calibrated leak standard.

A.1.2.3 Method

a) The room where testing will be performed shall be free of test gases, and air movements shall be kept to a minimum. Where leaks are detected, they shall be below the acceptable leak rate for the test or, alternatively, corrected for by the leak detector instrument. No smoking should take place in the test area.

b) Prepare the cabinet as a sealed system (see annex A, section A.1.1).

c) Pressurize the cabinet with air to 2 in w. g. (500 Pa). If the cabinet holds this pressure without more than ±10% loss for 30 min, release pressure. If the cabinet does not hold this pressure, examine for gross leaks with liquid leak detector (see annex A, section A.1.1), repair, and retest.

d) Helium leak: Flow pure helium through the cabinet until the well-mixed helium concentration at the exhaust point reads 15% helium, and then pressurize the cabinet to 2 in w. g. (500 Pa). Alternatively, use an inflated bladder inside the cabinet to displace 15% of the internal gas volume and inject helium into the cabinet volume while venting the bladder outside the cabinet volume. Then pressurize to 2 in w. g. (500 Pa).

e) Turn on the cabinet blower for 30 s to circulate gas.

f) Adjust the helium leak detector to a sensitivity setting of 1 x 10⁻⁵ cc/s, in accordance with the manufacturer's instructions.

g) Move the detector probe over seams, joints, utility penetrations, panel gaskets, and other areas of possible leakage. Hold the detector probe at the surface of cabinet, being careful not to jar the instrument. Move the detector probe over the surface at a rate of approximately 1.0 in/s (2.5 cm/s), keeping the probe 0.25 to 0.50 in (6.3 to 13 mm) away from the surface (see annex A, figure A1b).

A.1.2.4 Acceptance (helium leak test)

Measured leakage from any point in the cabinet shall not exceed a leak rate of 1 x 10⁻⁵ cc/s when pressurized to 2 in w. g. (500 Pa) with at least 15% concentration of helium.

A.2 Sulfur hexafluoride (SF₆) leak test

A.2.1 Purpose

This test on all biologically contaminated air plenums under positive pressure to the room determines whether exterior joints made by welding, gasketing, or sealing with sealants are free of leaks that might release potentially hazardous materials into the atmosphere.

A.2.2 Apparatus
an industrial-type SF₆ leak detector (Ion Track Inc. [ITI] Leakmeter, or equivalent capable of detecting a halide leak of 1 x 10⁻⁶ cc/s); and

the SF₆ leak detector (shall be calibrated in accordance with the manufacturer’s instructions using a calibrated leak standard).

A.2.3 Method

a) The room where testing will be performed shall be free of test gases, and air movements shall be kept to a minimum. Where levels are detected, they shall be below the acceptable leak rate for the test or, alternatively, corrected for by the leak detector instrument. No smoking should take place in the test area.

b) Prepare the cabinet as a sealed system (see annex A, section A.1.1).

c) Pressurize the cabinet with air to 2 in w. g. (500 Pa). If the cabinet holds this pressure without more than ± 10% loss for 30 min, release pressure. If the cabinet does not hold this pressure, examine for gross leaks with liquid leak detector (see annex A, section A.1.1), repair, and retest.

d) Pressurize the air-filled cabinet at atmospheric pressure to 2 in w. g. (500 Pa) with SF₆ gas.

e) Turn on the cabinet blower for 30 s to circulate gas.

f) Adjust the SF₆ leak detector to a sensitivity setting of 5 x 10⁻⁷ cc/s, in accordance with the manufacturer’s instructions.

g) Move the detector probe over seams, joints, utility penetrations, panel gaskets, and other areas of possible leakage. Hold the detector probe at the surface of cabinet, being careful not to jar the instrument. Move the detector probe over the surface at a rate of approximately 1 in/s (2.5 cm/s), keeping the probe 0.25 to 0.50 in (6.3 to 13 mm) away from the surface (annex A, figure A1b).

A.2.4 Acceptance (SF₆ leak test)

Measured leakage from any point in the cabinet shall not exceed a leak rate of 5 x 10⁻⁷ cc/s to compensate for the dilution of halide gas.

F.1.1 Tests directly related to containment (i. e., personnel and environmental protection) and product protection.

The following physical tests shall be conducted on-site for a certification to be considered for the statement “Field Certified in accordance with NSF/ANSI 49”:

- downflow velocity profile test;
- inflow velocity test;
- airflow smoke patterns test;
- HEPA filter leak test;
- cabinet integrity test (A1 cabinets: positive pressure plenum cabinets only); and
- site installation assessment tests.

Either a Pressure Decay or Soap Bubble Leak Test is mandatory for all Class II Type A1 cabinets (cabinets with exposed contaminated plenum). The tests shall be performed at the time of installation, when panels are removed, and after relocation.

The site installation assessment tests shall include:
- alarm functions as required by this Standard;
- blower interlock; and
- exhaust system performance (proper exhaust duct negative pressure and canopy performance).