Testing
On-Site Field Tests

NSF49 requirement:
- Downflow velocity
- Inflow velocity
- Airflow smoke patterns
- HEPA/ULPA filter leak
- Site installation assessment tests

NSF49 recommendations:
- Light intensity
- Noise level
- Vibration
- UV (This is only from 1992 standards)
Site installation assessment test:

- Airflow Alarm
- Sash alarm
- Blower interlock (B2 only)
- Airflow smoke pattern on exhaust duct connection
BSC Airflow Pattern
Inflow (NSF 6.10, EN Annex G & H) (Routine)

- 1st method: DIM (accurate but expensive)
- 2nd method: Restricted Opening - hot wire
- 3rd method: Exhaust Measurement – hot wire/vane

- Inflow is within +/- 0.025 m/s from setpoint
- Inflow for Class 2 (EN / JACA) $\geq 0.40$ m/s
- Inflow for Class 2 Type A2 (NSF) $\geq 0.51$ m/s
- Inflow for Class 2 Type B2 (NSF) $\geq 0.51$ m/s
DIM
Esco: Shortridge Flow Hood, ADM-870C meter
Accuracy: $\pm 3\%$ reading $\pm 0.002 \text{ m}^3/\text{s}$
Website: www.shortridge.com
DIM:
• Seal open areas not covered by capture hood
• Take 5 readings and average
• Velocity = Volumetric flow rate / Aperture area
• Example
• Inflow Velocity = Volume / Area
• Ave. Inflow Volume = (Flow Hood Reading) l/s = --------------- m³/s
• Area for 4 ft cabinet = 1.27 X 0.229 m²
• Ave. Volume = 154 l/s = 0.154 m³/s
• Inflow Velocity = 0.154/(1.27X0.229) = 0.53 m/s
• Acceptance : 0.53 m/s +/- 0.025 m/s
Thermal anemometer - accuracy: ± 0.015 m/s or 3% indicated velocity (whichever is higher)

Fixture and clamp for thermal anemometer

Use restricted opening method

Lower sash window to 76 mm

Use fixture stand and clamp

Take reading on the center of aperture height

Take reading starting > 10 cm from side wall

Take reading every < 15 cm apart

Average the velocity readings

Apply height correction factor:
Inflow: Secondary Method

Remove Arm’s Rest
Inflow: Secondary Method

- **Gage block**
- **Masking tape covering the gap between tray and cabinet with marks to indicate probe position**
- **Recommended Thermo-anemometer: TSI Velocicalc Plus 8384**

**Measurements:**
- 76 mm
- 38 mm
- 127 mm
- 1270 mm

**Annotations:**
- Sash window lower edge
- Probe's white tip is 38 mm (1.5 inches) from sash window lower edge
- Probe holder with magnet attached to bottom of cabinet and touching front nosing of cabinet
Points to note:

If the sash glass is too front, clamp the thickest part of the probe with the holder so as to bring the probe outwards to be inline with the glass.

If the sash glass is too back, clamp the thinnest part of the probe with the holder so as to bring the probe inwards to be inline with the glass.
Inflow: Secondary Method

Conversion/Correction Factor – Specific to Models
(As found on the test report.

\[ \nu = \frac{76}{173} \]

<table>
<thead>
<tr>
<th>Cabinet</th>
<th>LA2-3xx</th>
<th>LA2-4xx</th>
<th>LA2-5xx</th>
<th>LA2-6xx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion factor</td>
<td>0.365</td>
<td>0.308</td>
<td>0.313</td>
<td>0.342</td>
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</tbody>
</table>
Downflow velocity  
(NSF 5.9, EN Annexes G,H)  
(Routine)

- Downflow velocity within +/- 0.025 m/s of manufacturer’s setpoint

- EN only: Downflow is ≥ 0.25 m/s

- Individual variation ≤ 20 % from average or
  NSF only: 0.08 m/s whichever is greater

- NSF only: For Non-uniform downflow: specify gradient, variation ≤ 20 %
Method & Location:

NSF49:2002

- Left to right grid: <15 cm from walls and apart
- Front to back grid: <15 cm from walls and apart
- 10 cm above the sash window lower edge
10cm Sash
15cm Walls
≤15cm Apart
HEPA filter leak (NSF 6.3, EN Annex D) (Routine)
Scan HEPA filter: media & gasket with DOP/PAO

**NSF 49:**
- Leak $\leq 0.01$ % (HEPA is 99.99 % efficient)
- For filters that can’t be surface scanned: $\leq 0.005$ %

**EN 12469:**
- Leak $\leq 0.01$ %
Aerosol Photometer

Esco: Air Techniques International (ATI) TDA- G/2H
Accuracy: ± 1% of reading
Resolution: 0.0001%
Website: www.atitstest.com
Artificial Aerosol Generator that requires no Compressor:
• ATI TDA-6D → just plug to electrical power source
Method & Location:
Scan < 2.5 cm media & gasket at speed < 5 cm/s

Theoretical upstream concentration:

\[ \frac{1500 \text{ Noz}}{\text{Total Ai}} \]

Acceptance:
Surface scan < 0.01 %
can not be scanned < 0.005 %
Filter Testing: The Set-up

- Aerosol generator
- Cabinet Up-stream port
- Instrument Up-stream port
- Inst. Down-stream port
- Aerosol photometer
- Nozzle probe
Filter Testing: Remove the Diffuser
Filter Testing: Scan Perimeter & Media

Perimeter

Nozzle

HEPA Filter
Testing Downflow Filter

Spray PAO aerosol here

Acceptance criteria:
PAO Penetration < 0.01%

Surface scan downflow filter here
Testing Exhaust Filter

Spray PAO aerosol on the work zone

Do total penetration scan on the duct

Acceptance criteria:
PAO Penetration < 0.005%

If you can not scan at 7-10 d away, vary the depth and location of the scanning probe.
Downflow:
Centerline, left to right, 10 cm above sash lower edge

View screen retention:
2.5 cm behind sash, 15 cm above lower edge, L to R

Work opening edge retention:
Aperture perimeter, 3.8 cm outside opening

Sash window wiper seal test:
5 cm along side and top sash perimeter
Smoke Pattern
Smoke Pattern

Esco Sonic Smoke Generator
Light intensity meter
Esco: Extech Instruments 407026
Accuracy: ± 4% of reading ± 2 digits
Website: www.extech.com
Light Intensity: Measurement

Location:
• Centerline, left to right
• 15 cm from walls
• 30 cm apart
( NSF49 15 cm from each side walls, not more than 30 cm between test points)

Acceptance:
• Average > 650 lux (for NSF49)
  Individual reading not less than 480 lux, where background light is (110 +/- 50 lux)
• Average > 750 lux (for EN)
Noise Level Test: Equipment

- Noise level meter
  Esco: Quest Technologies 1100 & QC-20 Calibrator
  Accuracy: ± 0.5 dBA (noise meter)
  ± 0.3 dBA (calibrator)
  Website: [www.quest-technologies.com](http://www.quest-technologies.com)
Noise Level Test: Measurement

Location:
NSF - 30 cm horizontal from front of the cabinet
  - 38 cm vertical from work surface level
EN - 1 m from the centre of the front aperture of the cabinet

Acceptance:
NSF - 67 dBA with ambient max: 55 dBA
  (Field test is higher in acceptance)
EN - 65 dBA with ambient max: 55 dBA

Noise Correction:
When difference between ambient and cabinet running is less than 10dBA.
Noisy Ambient Background

Noise Correction Factor

dB Subtracted from Measurement

dB Difference Between Measurement and Background
A vibration analyzer with a minimum reliable reading of $1.0 \times 10^{-4}$ in (2.5 um) rms amplitude or the ability to detect differences of this magnitude, set up in accordance with manufacturer's instructions.
Location:
NSF /EN - Center of the worksurface

Acceptance:
NSF - net displacement should not exceed 0.005mm RMS amplitude in the centre of the work surface between 10 Hz and 10 kHz (Field test acceptance is 0.05mm)

EN - net displacement should not exceed 0.005mm RMS amplitude in the centre of the work surface between 20 Hz and 20kHz
UV Intensity: Measurement

Location:
• Centerline, left to right
• 15 cm from walls
• 30 cm apart

Acceptance:
• Average > 40 µW/cm²
Thank you