Esco Micro Pte Ltd ~ Esco Laboratory Fume Hood Division ~ 21 Changi South Street 1 ~ Singapore 486 777
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Esco Laboratory Fume Hood
Test Report
Based on ASHRAE 110-1995
Model: EFH-4AX

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Here in Esco, our fundamental objective is to provide our customers with the equipment that meets and exceeds safety standards, while maintaining consistent quality

Our fume hoods are tested against ANSI/ ASHRAE110-1995 standards and compliance assured to afford users with assurance of the performance of Esco fume hoods. The ASHRAE 110-1995 standard is one of the latest and most comprehensive methods for testing operator safety level of fume hoods by determining qualitatively and repeatably how well fume hood contain the gases and vapours released in the work zone. First published in 1985, and extensively revised in 1995, the method employs a set of comprehensive tests to evaluate the hood performance:

Methodology

The hood is installed in Esco test room. Layout of test room is shown in figure 1.
Test procedures are based on ANSI/ ASHRAE 110 " Method of Testing Performance of Laboratory Fume Hoods."

- Exhaust Flow was adjusted to achieve a target average face velocity of approximately 0.5m/s.

- All air conditioning and ventilation units in test room is switched off, except a FFU[1] unit positioned 4m away, directly facing sash opening for constant air supply. Air volume is adjusted to supply approximately the same volume exhausted by fume hood.

Laboratory Layout

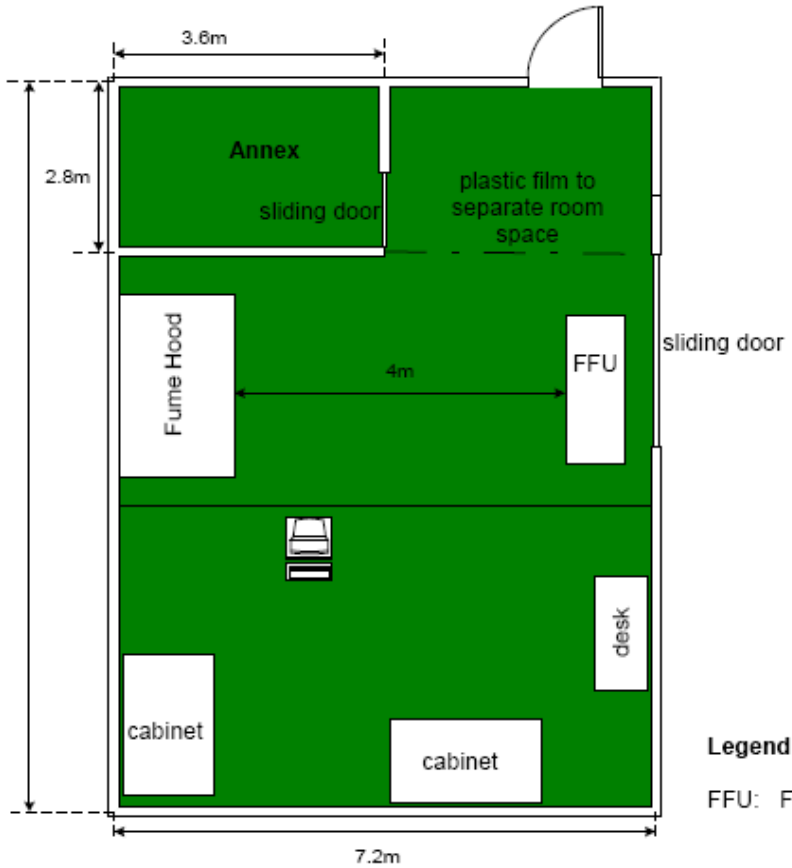

Figure 1 General Layout of Laboratory

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1. Flow Visualisation

Flow visualization qualitatively tests a hood's ability to contain vapors. This test consists of a small local challenge (use of a smoke tube), and a gross challenge (use of a smoke candle or smoke generator) to the hood. Smoke is released in the hood to visually determine if a hood or associated ductwork leaks.

Acceptance criteria: the rating guideline is as follows

Grading	Observations
Fail	Smoke observed escaping from the hood.
Poor	Reverse flow of smoke near opening. Lazy flow into opening along boundary. Observed potential for escape.
Fair	Some reverse flow, not necessarily at the opening. No visible escape.
Good	No reverse flows. Active flow streams into hood around boundary

Local Smoke Visualization

- A stream of smoke is discharged from the stick
  a) along the left and right walls,
  b) along the joints between the walls and the work surface
  c) behind the airfoil
  d) the work surface of the hood in a line parallel to the hood face
  e) 6 in. (150 mm) behind the face of the hood
  f) along the top of the face opening
  g) in an 8-in. (200-mm) diameter circle on the back of the hood

- The smoke shall be carried to the back of the hood and exhausted smoothly and not be entrained in the vortex at the top of the hood.

Results: *Fair*

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a) along the left and right walls: No reverse or lazy flow observed, smoke is smoothly exhausted to the back baffle

b) along the joints between the walls and the work surface: No reverse or lazy flow observed, smoke is smoothly exhausted to at the back baffle

c) behind the airfoil : Slight reverse and lazy flow, but no escape. Smoke is eventually exhausted to the back baffle.

d) the work surface of the hood in a line parallel to the hood face: No reverse or lazy flow observed, smoke is smoothly exhausted to at the back baffle

e) 6 in. (150 mm) behind the face of the hood: No reverse or lazy flow observed, smoke is smoothly exhausted to at the back baffle

f) along the top of the face opening: No reverse or lazy flow observed, smoke is smoothly exhausted to at the back baffle

g) in an 8-in. (200-mm) diameter circle on the back of the hood: No reverse or lazy flow observed, smoke is smoothly exhausted to at the back baffle

Gross Smoke Visualization

- Place the smoke candle inside the cage, to release a large volume in the center of the work surface width and 6 in. (150-mm) behind the sash. Light up the candle and observe the direction of smoke flow.
- Observe carefully the flow pattern and watch out for reverse flow of smoke and escape from the fume hood. Grade the fume hood performance based on the table above.

Results: *Good*
The smoke distribution is good, free of vortex and reverse flow. Active flow streams into hood.

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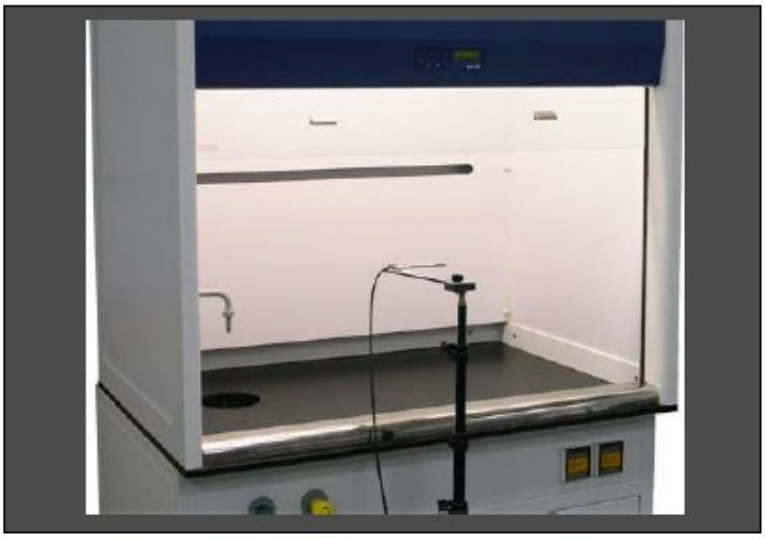
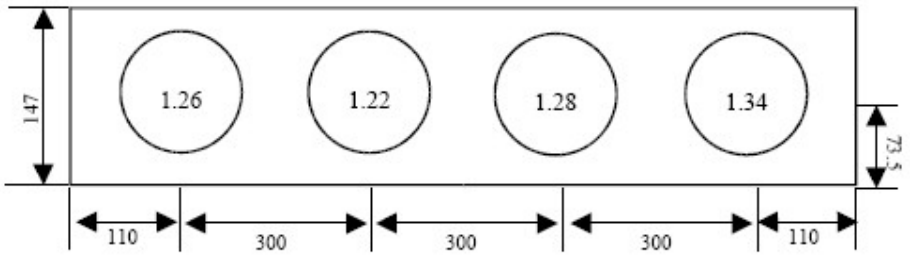
2. Face Velocity Measurement

Face velocity measurements determine the average velocity of air moving perpendicular to the hood face. This test examines the uniformity of face velocity across the face of the fume hood opening at different sash positions. The averaged reading provides insights to the qualitative performance.
Measurement is expressed in m/s. The open face of fume hood is divided into equal square grids with the size of no greater than 300x300mm and the velocity measurement is taken as one reading per 0.2 sec and averaged over 300 sample readings.



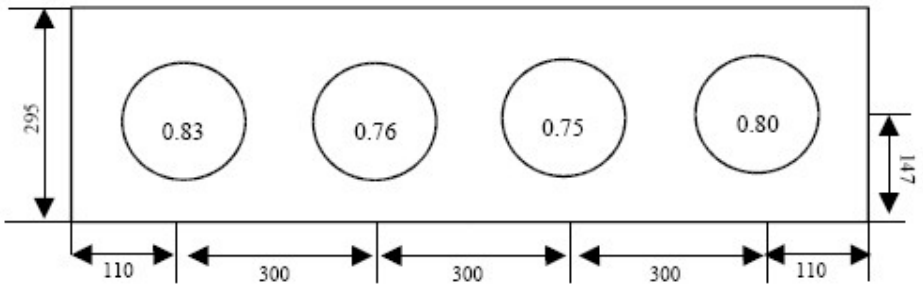
Results:

25% Sash Open



V_q = 1.28m/s

50% Sash Open



V_q =0.79m/s

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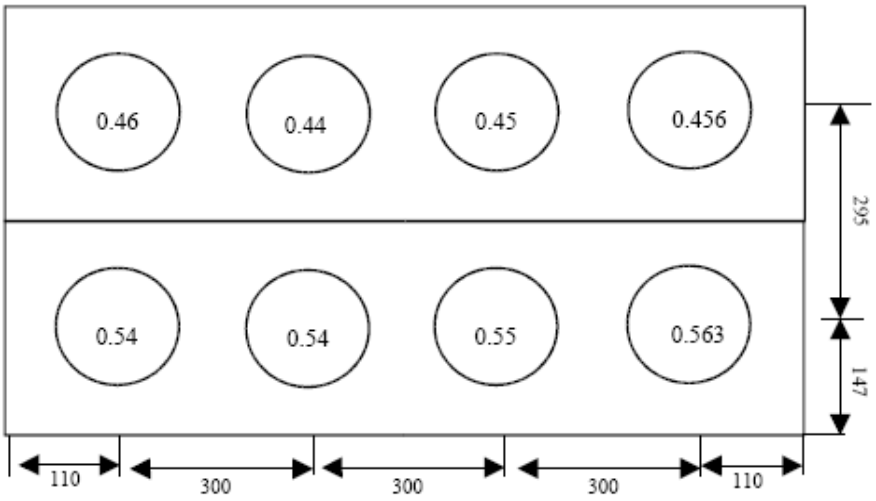
100% Sash Open



V_q = 0.5m/s

Cross Draft Velocity Measurement

Velocity measured through cross draft velocity transducer and averaged over 300 readings,

Results:
V_{cd}: 0.13m/s

Tracer Gas Test

This test uses a mannequin to simulate an actual personnel operating at the fume hood and working with gas released at 4Lters/ min. The test provides a quantitative measurement of gas leakage into a person's breathing zone and the environment.

a) Static Tracer Gas Test

Detector probe held at a person's normal breathing zone is used for monitoring gas leakage at fixed locations in front of the fume hood with the sash raised at different heights.

- Scan the background and make sure that it is at 0.00 ppm SF_6 level. Otherwise purge the room or take remedial steps to omit the SF_6 concentration.

- Using continuous data acquisition, record the detector readings for 5 minutes (10 readings per sec) Average of the reading is refereed as positional control level

- The ejector and mannequin shall be relocated to left and then right test position (150mm from hood's side wall) and the measurements shall be repeated for each test position. The control-level rating of the hood shall be the maximum of the positional control levels for the three test positions.

Acceptance: All hoods shall pass a three-position static tracer gas test in the laboratory environment, as installed, with a spillage not to exceed 0.05 ppm in any sash opening and any ejector & detector position

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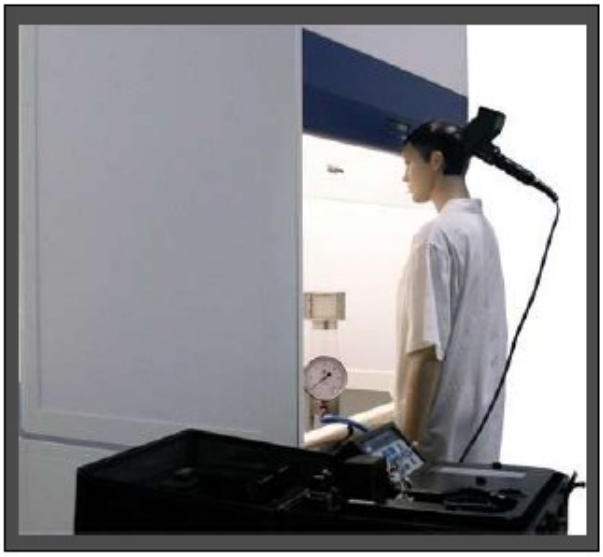

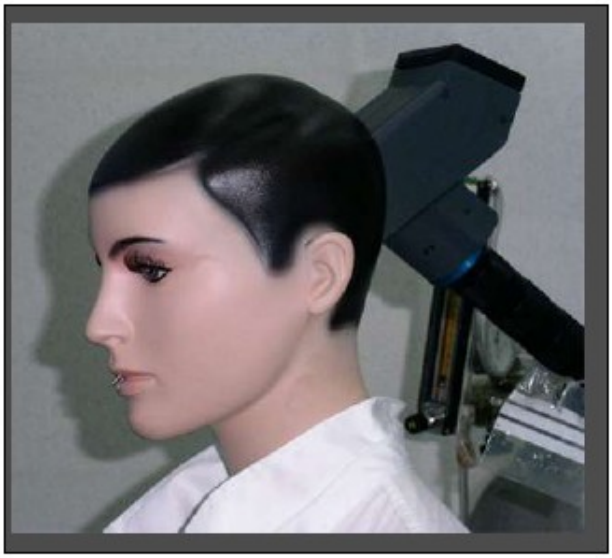

Results: *Pass*

Sash Pos	***L***		***C***		***R***	
100%	0.00	0.01	0.00	0.01	0.00	0.01
50%	0.00	0.01	0.00	0.01	0.00	0.01
25%	0.00	0.01	0.00	0.01	0.00	0.02

Key: Shaded column is peak value for each position.
Units in ppm

b) Surface Scan Test

Detects for any leaks at the periphery and external joints of the face of fume hood

- Remove the mannequin from the face of the hood.
- Use the leak detector to scan the periphery of the fume hood face with the ejector set to deliver 4 liters/minute with the sash at 25% opening.
- While standing away from the face of the hood, the probe is held 1 in. (25 mm) away from the edge of the hood opening and moved slowly around each opening at a rate of 3 in. (75 mm) per second.
- The maximum concentration and location observed during the traverse shall be recorded.

Acceptance: Leakage rate shall not exceed 0.05ppm

Results: *Pass*

Maximum SF_6 detected : 0.03ppm

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c) Sash Movement Effect

Determines if sash movement raises the level of gas leaks to an unacceptable level.

- Test shall begin with the mannequin in the center position with the ejector set to deliver 4 liters/minute with the sash at 25% opening.
- After two minutes, a background level with the sash 25% opened shall be determined. If tracer gas is detected with the sash closed, the test shall be terminated until the source of leakage is determined and eliminated.
- The sash shall be fully opened in a smooth motion at a velocity between 1.0 ft/s (0.3 m/s) and 1.5 ft/s (0.5 m/s) while tracer gas is released and the tracer gas concentration is recorded. The peak levels are noted. Use a stopwatch to note down the time of sash movement from 25% opened to 100% opened.
- After the system has stabilized, (face velocity reaches the design face velocity within 10% and a minimum of two minutes has passed after opening the sash) it is closed at a rate between 1.0 ft/s (0.3 m/s) and 1.5 ft/s (0.5 m/s) while continuing to record the tracer gas concentration. The cycle shall be repeated three times.

Acceptance: Maximum allowable leakage in "As Installed" is 1.00 ppm

Results: *Pass*

Maximum SF_6 detected: 0.13ppm

1. FFU is used to supply clean, laminar and controlled volume of airflow into a controlled environment.