Test Report

ASHRAE 110-2016
METHODS OF TESTING PERFORMANCE OF LABORATORY FUME HOODS
AS INSTALLED (AI) MODIFIED

Performed For
ABC University

SUMMERY OF RESULTS: PASS

Signed and on behalf by

Chip Albright
President

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Contents

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SUMMARY OF RESULTS

Hood Identification Number	22 A69 P49
Hood Manufacturer	HEMCO
Model Number	Uniflow SL
Hood Width	60”
Hood Style	Bench
Sash Type	Vertical Rising
Hood Type	VAV
Sash Opening (Height/Width)	18 in/48 in (457 mm*1220 mm)
Design Face Velocity	100 fpm (0.5m/s)
Static Pressure	57 Pa
Volume	635 cfm

Testing was performed in accordance with guidelines provided in the ANSI/ASHRAE 110-2016:"Method of Testing Performance of Laboratory Fume Hoods". The testing protocol has been modified to replace the SF6 Tracer Gas used for containment testing with the Tri-Color Visualizer. The criteria for performance were adopted from recommendations by, SEFA and ANSI/AIHA/ASSE Z9.5-2022 – Laboratory Ventilation along with relevant industry standards on laboratory ventilation. The hood was tested AS Installed **(AI).**

Results of tests revealed that the fume hood meets acceptance criteria as described herein, with successful containment during smoke visualization tests, face velocity profile and Tri-Color Containment Tests.

Refer to the “Test Results” section for details of tests. The safety certification label for this hood can be viewed by scanning the QR code on the hood, or going to fumehoodreportsonline.com and entering the HIN number.

Testing and evaluation were performed by:

Signature:

Tester:

Date:

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Photo 1

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HOOD PERFORMANCE METHODOLOGY

Testing was performed in accordance with guidelines provided in the ANSI/ASHRAE 110-2016 "Method of Testing Performance of Laboratory Fume Hoods".

The ASHRAE 110 -2016 Testing Protocol permits modification for different styles and sizes of fume hoods, and other conditions and user requirements. Given that Sulfur Hexafluoride SF_6 is a strong greenhouse gas and banned in many locations, we have replaced its use with Tri-Color Containment Testing. The use of SF_6 is reserved for troubleshooting.

The ANSI/ASHRAE 110-2016 fume hood performance AM tests included:

- Face Velocity Test
- Visualization of Airflow Patterns
- Tri-Color Containment Challenges
  - Full Open Sash Position
  - Design Height (Operating) Sash Position
  - Standing in front of the hood
  - Rapid Sash movement
  - Combo Sash, Various Positions if applicable
  - Walk By
  - Rapid Hand Movement
  - Material Existing Hood
  - Lab Door Test
  - Other Hoods opening and closing

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INSTRUMENTATION AND EQUIPMENT

Velocity Transducers	Four (4) TSI Model 8455-03 Air Flow Transducers, Serial Number: xxxxxxx, xxxxxx, xxxxxxx, xxxxxxxxx, Range of detection 25 to 200 fpm. (Calibration Date)
Handhold Anemometer	???????TSI, Model 9545-A, Serial Number: xxxxxxxx, Range of detection 0 to 6,000 ft/min (0 to 30 m/s). (Calibration Date)
Smoke Maker	Fume Hood Certified Zero-Velocity Hazer
Tri-Color Visualizer	Fume Hood Certified, Tri-Color Visualizer consisting of a fume simulator and an array of lasers of various colors used to create a light curtain.

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TEST CONDITIONS

Room Ventilation: At full normal operation according to the AI criteria.

Room Description: The test was conducted at zzzzzzzzzzzzz. The test laboratory is 6 m long x 6m wide x 3.65m high. See Layout of test room for complete mechanical details. The room has two doors, one 3' standard passage door and one 10' overhead door centered behind the hood. The doors remain closed during the test.

Cross Drafts: Crosscurrents in the area 5' in front of the hood are far below 30 fpm.

Room pressurization: Measured and maintained at 0.02 in. of water (5 Pa) below the static pressure outside the test room.

Background Levels: The background level is below 10% of control level.

Lab Temperature: The temperature of the test is controlled in 22℃±2.7℃.

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RECOMMENDED PERFORMANCE CRITERIA

The following criteria are assembled from industry consensus standards and are provided as an aid in the evaluation of performance data. The criteria are based on ASHRAE, SEFA, ANSI Z9.5, and other related laboratory ventilation standards and specifications. The criteria apply to the following tests:

Face Velocity Test

Hood exhaust flow was set to achieve the design average face velocity for testing. Form an imaginary grid pattern by equally dividing he design hood opening into vertical and horizontal dimensions. The grid spaces shall be less than 1 ft^2 (0.09 m^2), and the larger side of the grid rectangle shall not exceed 13 in. (330 mm). Velocity readings was recorded with a calibrated anemometer fixed at the center of each grid rectangle. Air velocities were recorded at one-second intervals for 20 seconds at each grid location. The mean of the grid velocities was averaged for the opening to determine the overall average face velocity.

Smoke Visualization Test

This test is a visualization of a hood's ability to contain vapors. It consists of both a small local challenge and a large-volume challenge to the hood. The intent of this test is to access the performance of the hood as it is typically used. Because the investigator is often at the face of the hood while performing the tests, care shall be exercised to ensure that the body of the investigator does not influence the smoke visualization. Under ideal conditions, the smoke will flow smoothly, drawn from the point of release toward the slots in the rear baffle. Results are reported as a qualitative judgment of airflow distribution according to the following rating guide:

Rating	Description
Fail	• Smoke was visually observed escaping from the hood
Low Pass (Poor)	• Reverse flow of smoke is evident near opening • Lazy flow into hood along openings • Slow capture and clearance • Observed potential for escape
Pass (Fail)	• Some Reverse flow in hood not necessarily at opening • Limited turbulent vortex flow inside hood • Smoke is captured and clears readily • No visible escape
High Pass (Good)	• Good capture and quick clearance • Limited vortex flow inside hood • No reverse flow regions • No visible escape

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Tri-Color Containment Tests

In lieu of us the SF_6 tracer gas containment tests which utilize Sulfur Hexafluoride which is a strong greenhouse gas and it use is restricted in many places, we have substituted a more environmentally friendly and sustainable containment test utilizing haze and lasers to show loss of containment. While the standard Tracer Gas tests are largely static, Tri-Color adds realistic dynamic challenges to verify containment under normal lab usage. When loss of containment passes through the green laser light curtain, it is illuminated indicating loss of containment. Given it is almost impossible for a fume hood to contain 100% in real world conditions, the Tri-Color Visualizer allow you to see the impact on containment of various actions in and around the hood. These challenges are video recorded and stored on a secure cloud server for future reference. .

The challenges include: Full Open Sash Position, Design Height (Operating) Sash Position, Standing in front of the hood, Rapid Sash movement, Combo Sash, Various Positions if applicable, Walk By, Rapid Hand Movement, Material Existing Hood, Lab Door Test, and Other Hoods opening and closing

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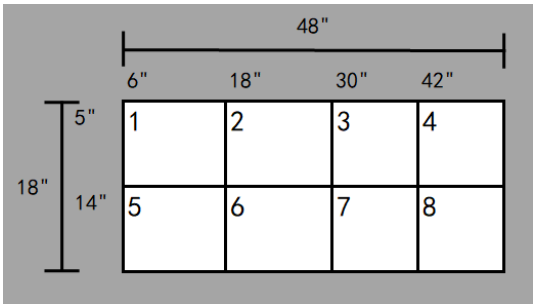
TEST RESULTS

Face Velocity Measurements



Position No.	Reading of Velocity					
	#1	#2	#3	#4	Avg. (fpm)	Avg. (m/s)
1	94	95	99	99	97	0.48
2	91	95	92	92	93	0.46
3	94	93	93	93	93	0.47
4	99	95	93	93	95	0.48
5	83	81	90	90	86	0.43
6	85	84	84	84	84	0.42
7	79	82	80	80	80	0.40
8	93	90	88	88	90	0.45
	Average Face Velocity:				90	0.45
	Highest Reading:				99	0.50
	Lowest Reading:				79	0.40

Rating of Face Velocity: PASS

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Airflow Visualization Tests

Local Visualization Challenge

Smoke was applied to the following locations with the listed results.

Locations	Results
Under the airfoil	Good capture and quick clearance No visible escape.
Left wall to the hood face and 6 in. (150 mm) behind the face of the hood and along the top of the face opening.	No reverse flow in the hood. No dead air spaces visible. No visible escape.
Right wall to the hood face and 6 in. (150 mm) behind the face of the hood and along the top of the face opening.	No reverse flow in the hood. No dead air spaces visible. No visible escape.
The work surface of the hood in a line parallel to the hood face and 6 in. (150 mm) behind the face of the hood and along the top of the face opening.	No reverse flow in the hood. No dead air spaces visible. No visible escape.
Along the work surface in the middle line	No reverse flow in the hood. No dead air spaces visible. No visible escape.
Above the bottom of the sash and inside the hood around the sash handle	No dead air spaces visible. No visible escape.
Release smoke outside the hood around the sash opening including over the sash handle	Good capture and quick clearance Limited turbulent vortex flow above the airfoil. No visible escape.
In the cavity above the hood opening	Smoke is captured and clears readily No visible escape.

Rating of Flow Visualization: Pass

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Large Volume Visualization Challenge

Smoke was applied to the following locations with the listed results.

Locations	Results
Under the airfoil	Good capture and quick clearance No visible escape.
Left wall to the hood face and 6 in. (150 mm) behind the face of the hood and along the top of the face opening.	No reverse flow in the hood. No dead air spaces visible. No visible escape.
Right wall to the hood face and 6 in. (150 mm) behind the face of the hood and along the top of the face opening.	No reverse flow in the hood. No dead air spaces visible. No visible escape.
Release smoke at right wall to the hood face and 6 in. (150 mm) behind the face of the hood and along the top of the face opening.	No reverse flow in the hood. No dead air spaces visible. No visible escape.
Along the work surface in the middle line	No reverse flow in the hood. No dead air spaces visible. No visible escape.
Release smoke inside the hood above the bottom of the sash.	Smoke is captured and clears readily No visible escape.
Release smoke in the cavity above the hood opening.	Some reverse flow inside the hood. No visible escape.

Rating of Flow Visualization: Pass

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Tri-Color Containment Tests

Full Open

Full Open is for setup only, but we want to see what the hood is doing in the worst sash position.

Rating of Challenge: Pass

Design Opening

The design opening is the working height that the system was designed for. It is often around 18" many hoods have a sash stop at the design position. Some hoods have matching arrows at the design position. This should be the position the sash is opening to when working.

Rating of Challenge: Pass

Standing in front of the hood

A person in front of the hood creates turbulence that can draw chemicals out of the hood

Rating of Challenge: Pass

Rapid Sash movement

Opening and closing the sash can cause loss of containment especially at the edges of the sash.

Rating of Challenge: Pass

Combo Sash

Combo sashes over unique challenges since they create vertical vortex. Combo sashes are prone to loss of containment along the vertical edges of the sash glass.

Rating of Challenge: N/A

Walk By

Pedestrian traffic in front of the hood can draw chemicals out of the hood.

Rating of Challenge: Pass

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Rapid Hand Movement

Turbulence caused by rapid movement in the fume chamber can cause loss of containment.

Rating of Challenge: Pass

Material Existing Hood

Removing items from the hood can cause chemicals to follow the item out of the hood.

Rating of Challenge: Pass

Lab Door Test

Containment is greatly impacted by the air balance of the room. Opening and closing the door causes the room balance to change.

Rating of Challenge: Pass

Other Hoods opening and closing

When there are other hoods in the room and their sashes are opened and closed, it causes the room balance to shift. In a VAV system there is a lag time. During this time there can be loss of containment.

Rating of Challenge: Pass

Each of these challenges have been video recorded and are available for viewing,

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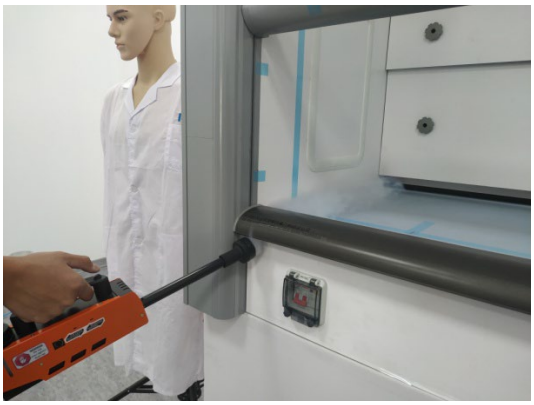
Appendix A Photos of Test Process

Test Room Setup

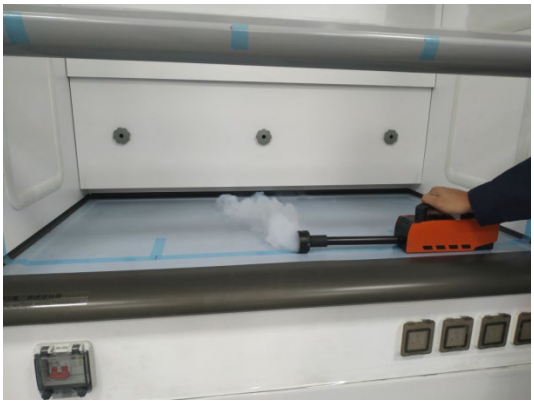


Local Flow Visualization View 1

Local Flow Visualization View 2

Local Flow Visualization View 3

Local Flow Visualization View 4



Local Flow Visualization View 5

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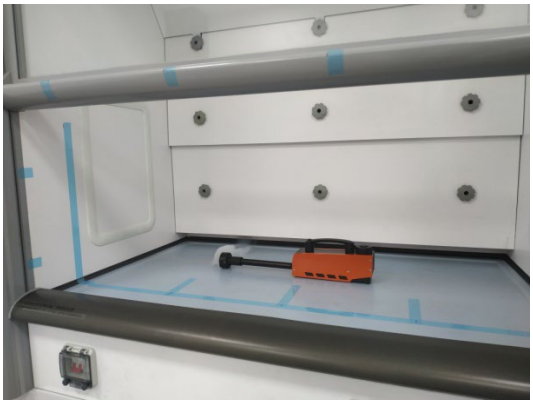
Local Flow Visualization View 6

Local Flow Visualization View 7



Local Flow Visualization View 8

Local Flow Visualization View 9

Local Flow Visualization View 10

Local Flow Visualization View 11

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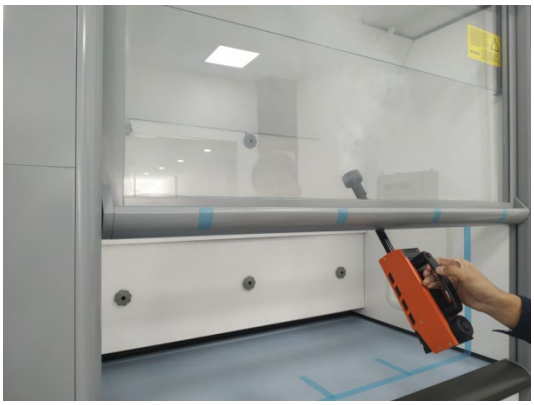

Large-volume Flow Visualization View 12

Large-volume Flow Visualization View 1

Large-volume Flow Visualization View 2

Large-volume Flow Visualization View 3

Large-volume Flow Visualization View 4

Large-volume Flow Visualization View 5

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Large-volume Flow Visualization View 6

Large-volume Flow Visualization View 7

Large-volume Flow Visualization View 8

Face Velocity Test View

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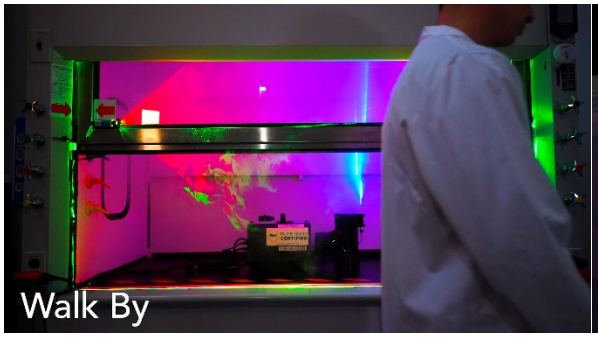

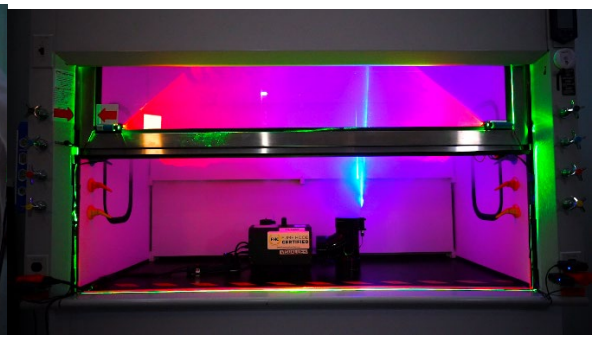

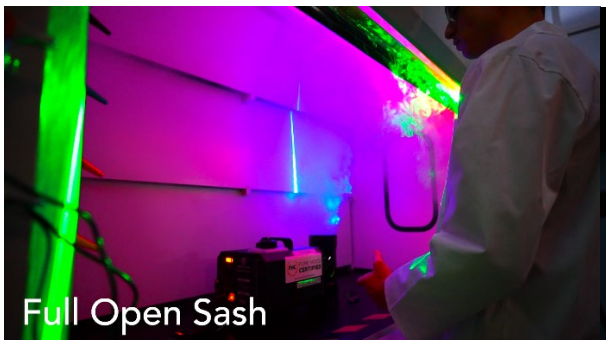

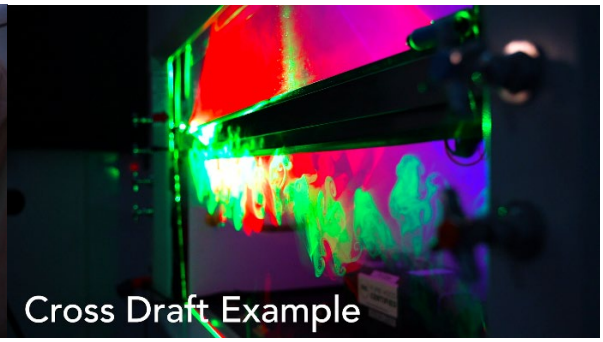

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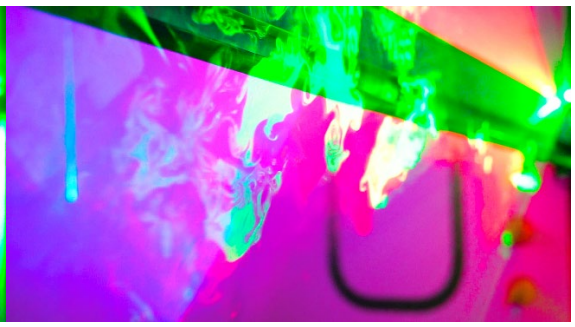

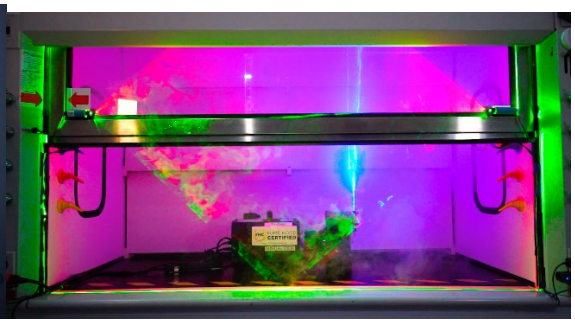


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Appendix B Calibration and Certification Certificate

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