

Fumehood Performance Test Report

6' Protector ECHO IPA Modified NIH Test

Prepared For

Labconco Corporation

Prepared By

AccuTec

Services, Inc.
www.atsiusa.com

Report Date: 02-12-2015

Project No.: 142327

Table of Contents

<u>Title</u>	<u>Section</u>
Report Summary	1
Airflow Velocity Data	2
Airflow Visualization	3
Trace Gas Data	4
Certificates of Calibration	5

1.0 Introduction

- 1.1 This report documents the work performed by AccuTec Services, Inc. for the Labconco Corporation, at the Labconco Manufacturing Plant located in Kansas City, MO.
- 1.2 The scope of the project is to test the as manufactured performance of the 6' Protector ECHO Labconco Laboratory Fume Hood. The Protector ECHO series fume hoods are ductless bench top fume hood equipped with chemical filters.
- 1.3 The fume hood was tested in accordance with a modified ASHRAE 110/ National Institute of Health (NIH) fume hood testing protocol; to establish an "As Manufactured" rating for the equipment.
 - 1.3.1 The ASHRAE 110/ National Institute of Health (NIH) protocols were modified by replacing the tracer gas SF6 with Isopropyl Alcohol (IPA).
 - 1.3.2 20 mL of IPA is exposed and evaporated in a 12.25" x 17.25" x 0.50" tray for each tracer gas test listed below, unless otherwise noted.
 - 1.3.2.1 Breathing zone left, center, right
 - 1.3.2.2 Walk-By
 - 1.3.2.3 Sash Movement Effect
 - 1.3.2.4 Perimeter Scan (30mL IPA)
 - 1.3.3 A mannequin, with a breathing zone 3" from the sash, is used to simulate lab personnel working in the hood.
 - 1.3.4 Velocity measurements are taken in the center of no greater than 1ft² areas in the opening plane of the fume hood.
 - 1.3.5 Large and small scale visible smoke pattern testing.

2.0 Summary

- 2.1 All test methods were performed in accordance with the guidelines established by the National Institute of Health Fume Hood Testing Protocol for Constant Volume Fume Hoods, and ANSI/ASHRAE 110-1995. The ASHRAE test was modified by replacing the standard tracer gas (SF6) with isopropyl alcohol in order to properly challenge the overall containment capability of the chemically filtered stand alone fume hood.
- 2.2 The Fume Hood airflow was balanced to within the design intake face velocity range and tested at 66 FPM.
- 2.3 Large and small scale smoke sources were used in the work area as well as around the front sash opening to confirm acceptable visible containment and airflow patterns.



- 2.2.1 Airflow velocity data is located in Section 2 of this report.
- 2.2.2 Airflow visualization data is located in section 3 of this report
- 2.2.3 Trace gas test data is located in section 4 of this report.
- 2.2.4 Certificates of calibration are located in section 5 of this report

3.0 Fume Hood Ratings

- 3.1 The 6' Protector ECHO ductless fume hood passed the acceptance criteria of no greater than AM-0.05 as listed in the specifications. The actual rating is shown in the table below.

IPA NIH Fume Hood Test	
Fume Hood SN	140997697B
Rating	AM-0.000



4.0 Abbreviations

- 4.1 The following abbreviations may have been used throughout this report and are represented here for reference.

SME	Sash Movement Effect	AM	As Manufactured
FPM	Feet per minute	Sec.	Seconds
Cal.	Calibration	L/m	Liters per minute
ppm.	Parts Per Million	No.	Number

5.0 Standards Utilized

- 5.1 The following calibrated field equipment was used in the execution of this work. Current certificates of calibration are provided in Section 5 of this report.

Device	Model	Serial No.
TSI Anemometer	966	P07460054
BIOS Flow Meter	Definer 220	119896
MiniRAE 2000	2000	110-014350

6.0 References

- 5.1 National Institute of Health "Fume Hood Testing Protocol for Constant Volume Fume Hoods" 1999.
- 5.2 ANSI/ASHRAE 110-1995 "Method of Testing Performance of Laboratory Fume Hoods"
- 5.3 Testing Protocol for ERLAB Ductless Fume Hood, Prepared by Exposure Control Technologies, Inc.

Airflow Velocity Test Report

Project: Labconco
 Location: Labconco Test Lab
 Manufacturer: Labconco
 Unit ID: 182610002

Model: Protector ECHO
 Serial No.: 140997697B
 Type: Ductless Fume Hood

Position of Sash (Percent Open)			100%
Average Airflow Face Velocity (fpm)			66
Highest Airflow Face Velocity (fpm)			74
Lowest Airflow Face Velocity (fpm)			58

16" Actual Sash Height
62.25" Actual Sash Width
16" Design Sash Height
62.25" Design Sash Width
Vertical Sash Configuration
60 fpm Design Airflow Face Velocity

Narrative: Tested to NIH Protocol with simulated apparatus, consisting
of two 3.8 L round paint cans, one 300 mm by 300 mm card-
board box, and three 150 mm by 150 mm by 300 mm card-
board boxes. These items are positioned randomly
between 150 mm and 250 mm behind the sash and
supported off the work surface by 50 mm by 50 mm blocks.

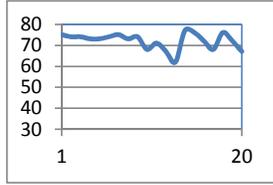
Acceptance Criteria: X Has Been Met Has Not Been Met

Notes: Tested to modified NIH protocol. Replaced the trace gas SF6 with Isopropyl Alcohol (IPA).
Design velocity 60 FPM.

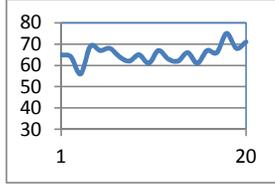
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Technician: CLF Test Date: 19-Jan-15

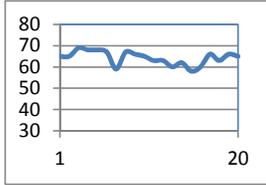
Airflow Velocity Test Report



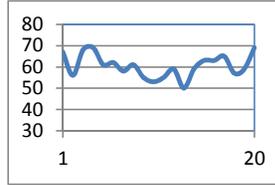
Max Velocity:	77 fpm
Min Velocity:	62 fpm
Avg Velocity:	72 fpm



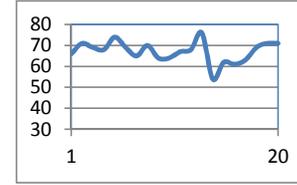
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Min Velocity:	56 fpm
Avg Velocity:	65 fpm



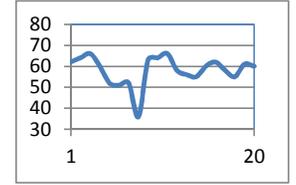
Max Velocity:	69 fpm
Min Velocity:	58 fpm
Avg Velocity:	64 fpm



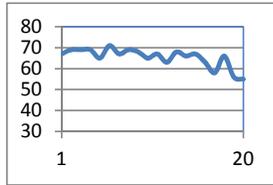
Max Velocity:	69 fpm
Min Velocity:	50 fpm
Avg Velocity:	60 fpm



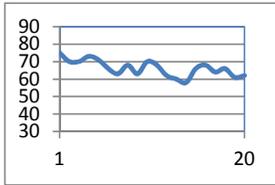
Max Velocity:	76 fpm
Min Velocity:	54 fpm
Avg Velocity:	67 fpm



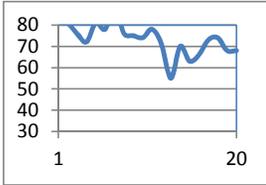
Max Velocity:	66 fpm
Min Velocity:	36 fpm
Avg Velocity:	58 fpm



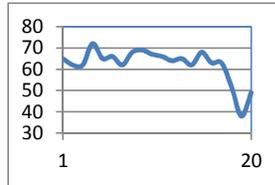
Max Velocity:	71 fpm
Min Velocity:	55 fpm
Avg Velocity:	65.4 fpm



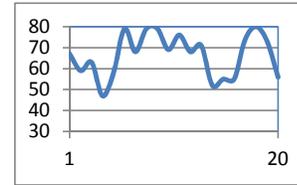
Max Velocity:	75 fpm
Min Velocity:	58 fpm
Avg Velocity:	66 fpm



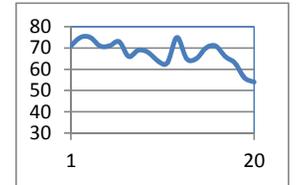
Max Velocity:	89 fpm
Min Velocity:	55 fpm
Avg Velocity:	74 fpm



Max Velocity:	72 fpm
Min Velocity:	38 fpm
Avg Velocity:	62.4 fpm



Max Velocity:	80 fpm
Min Velocity:	47 fpm
Avg Velocity:	66 fpm



Max Velocity:	75 fpm
Min Velocity:	54 fpm
Avg Velocity:	68 fpm

Total:

Avg Velocity:	66 fpm
Max Velocity:	74 fpm
Min Velocity:	58 fpm

Airflow Visualization Test Report (Local)

Project: Labconco
 Location: Labconco Test Lab
 Manufacturer: Labconco
 Unit ID: 182610002

Model: Protector ECHO
 Serial No.: 140997697B
 Type: Ductless Fume Hood

Challenge: Local Large Volume

16" Sash Height
62.25" Sash Width
Vertical Sash Configuration
Smoke Pen Challenge Medium

Narrative: Tested to NIH Protocol with simulated apparatus, consisting of two 3.8 L round paint cans, one 300 mm by 300 mm cardboard box, and three 150 mm by 150 mm by 300 mm cardboard boxes. These items are positioned randomly between 150 mm and 250 mm behind the sash and supported off the work surface by 50 mm by 50 mm blocks.

Airfoil Test: Pass Fail

Sash Perimeter Test: Pass Fail

Sash Bottom Test: Pass Fail

Work Surface Test: Pass Fail

Hood Cavity Test: Pass Fail

Sash Closed Perimeter/Interior Test: Pass Fail

Acceptance Criteria: Has Been Met Has Not Been Met

Notes: Tested to modified NIH protocol. Replaced the trace gas SF6 with Isopropyl Alcohol (IPA).
Design velocity 60 FPM.

Technician: CLF

Test Date: 19-Jan-15

Airflow Visualization Test Report (Large Volume)

Project: Labconco
 Location: Labconco Test Lab
 Manufacturer: Labconco
 Unit ID: 182610002

Model: Protector ECHO
 Serial No.: 140997697B
 Type: Ductless Fume Hood

Challenge: Local Large Volume

16" Sash Height
62.25" Sash Width
Vertical Sash Configuration
Glycol Fogger Challenge Medium

Narrative: Tested to NIH Protocol with simulated apparatus, consisting of two 3.8 L round paint cans, one 300 mm by 300 mm cardboard box, and three 150 mm by 150 mm by 300 mm cardboard boxes. These items are positioned randomly between 150 mm and 250 mm behind the sash and supported off the work surface by 50 mm by 50 mm blocks.

Airfoil Test: Pass Fail
 Sash Perimeter Test: Pass Fail
 Sash Bottom Test: Pass Fail
 Work Surface Test: Pass Fail
 Hood Cavity Test: Pass Fail
 Sash Closed Perimeter/Interior Test: Pass Fail

Acceptance Criteria: Has Been Met Has Not Been Met

Notes: Tested to modified NIH protocol. Replaced the trace gas SF6 with Isopropyl Alcohol (IPA).
Design velocity 60 FPM.

Technician: CLF Test Date: 19-Jan-15

Tracer Gas Containment Test Report

Project:	<u>Labconco</u>	Model:	<u>Protector ECHO</u>
Location:	<u>Labconco Test Lab</u>	Serial No.:	<u>140997697B</u>
Manufacturer:	<u>Labconco</u>	Type:	<u>Ductless Fume Hood</u>
Unit ID:	<u>182610002</u>		

	Left	Center	Right	Rapid Walk-by
Average Concentration:	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>
Peak Concentration:	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>	<u>0</u>

Static Mode Performance Rating: AM- 0.000

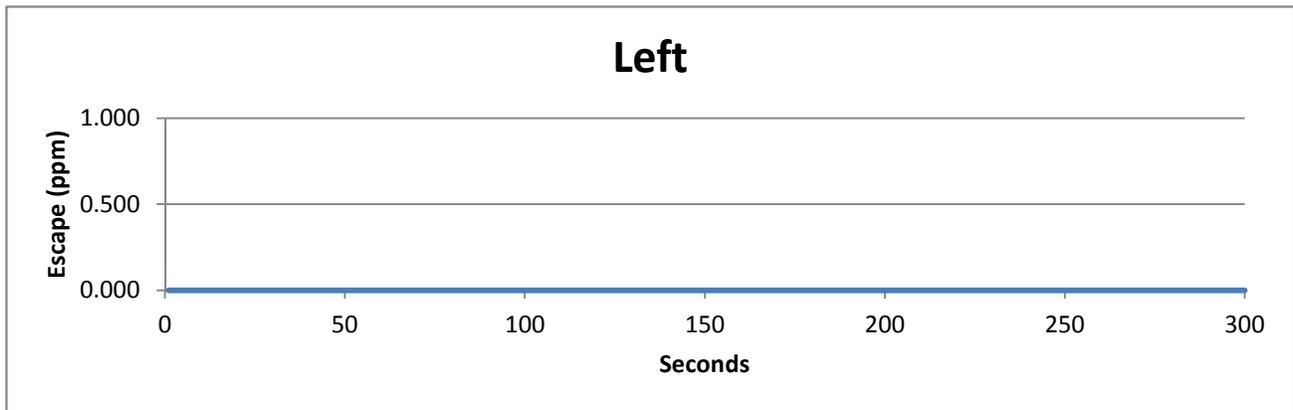
<u>16"</u>	Sash Height	Narrative: <u>Tested to NIH Protocol with simulated apparatus, consisting of two 3.8 L round paint cans, one 300 mm by 300 mm cardboard box, and three 150 mm by 150 mm by 300 mm cardboard boxes. These items are positioned randomly between 150 mm and 250 mm behind the sash and supported off the work surface by 50 mm by 50 mm blocks.</u>
<u>62.25"</u>	Sash Width	
<u>Vertical</u>	Sash Configuration	
<u>20 mL IPA</u>	Tracer Gas Release Rate	

Acceptance Criteria: X Has Been Met Has Not Been Met

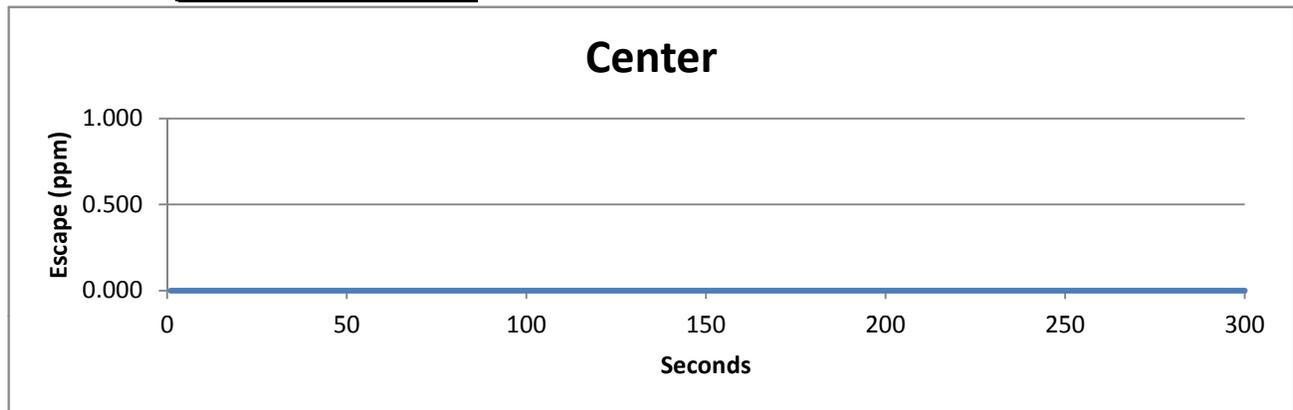
Notes: Tested to modified NIH protocol. Replaced the trace gas SF6 with Isopropyl Alcohol (IPA).
Design velocity 60 FPM.

Standards Utilized:	<u>MiniRAE 2000</u>	Cal. Due Date:	<u>15-Jan-16</u>
Technician:	<u>CLF</u>	Test Date:	<u>19-Jan-15</u>

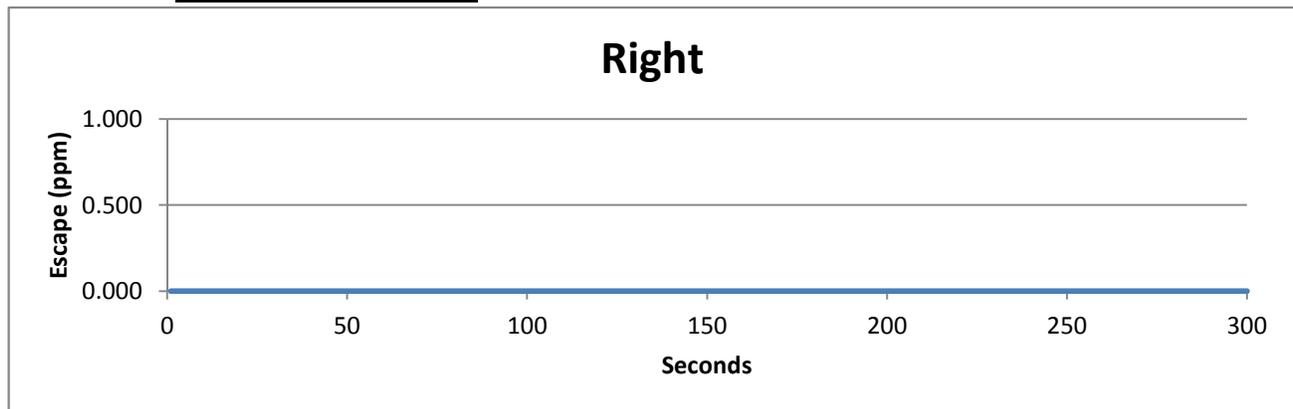
Tracer Gas Containment Test Report



Average:	0.000 ppm
Peak:	0.000 ppm

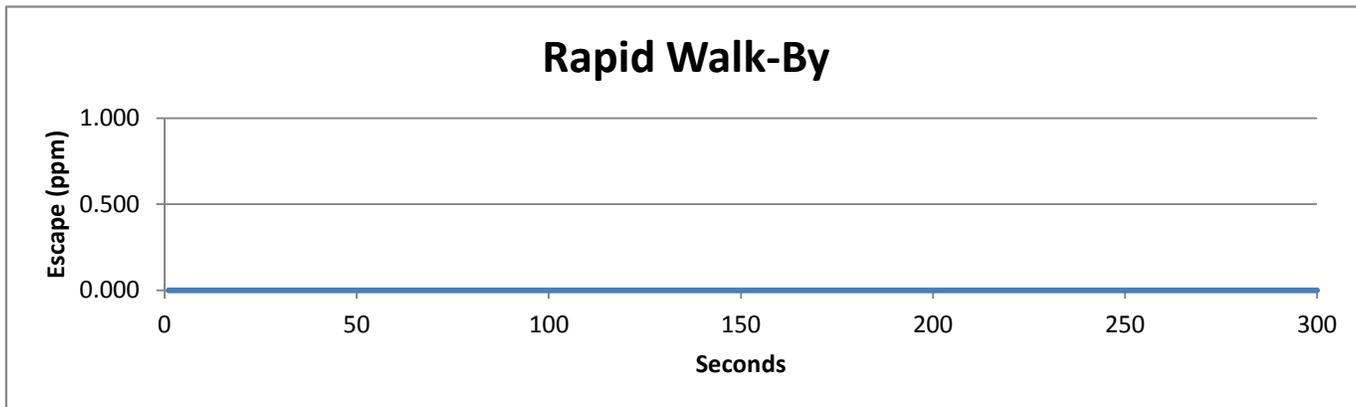


Average:	0.000 ppm
Peak:	0.000 ppm



Average:	0.000 ppm
Peak:	0.000 ppm

Tracer Gas Containment Test Report
Walk-By



Average:	0.000	ppm
Peak:	0.000	ppm

Narrative: Following right, center, and left tracer gas testing, a 5 minute rapid walk by test is conducted. Rapid walk by test has the manikin and ejector in the center position. Tracer gas levels are recorded while three rapid walk-by tests are conducted, at 300mm behind the manikin, spaced 30 seconds apart.

Notes: Tested to modified NIH protocol. Replaced the trace gas SF6 with Isopropyl Alcohol (IPA).

Sash Movement Effect Report

Project: Labconco
 Location: Labconco Test Lab
 Manufacturer: Labconco
 Unit ID: 182610002

Model: Protector ECHO
 Serial No.: 140997697B
 Type: Ductless Fume Hood

Tracer Gas Concentration (ppm)				
Time Span	Data Set No.	Cycle 1 Open	Cycle 2 Open	Cycle 3 Open
0-45 Secs	1	0.000	0.000	0.000
1-46 Secs	2	0.000	0.000	0.000
2-47 Secs	3	0.000	0.000	0.000
3-48 Secs	4	0.000	0.000	0.000
4-49 Secs	5	0.000	0.000	0.000
5-50 Secs	6	0.000	0.000	0.000
6-51 Secs	7	0.000	0.000	0.000
7-52 Secs	8	0.000	0.000	0.000
8-53 Secs	9	0.000	0.000	0.000
9-54 Secs	10	0.000	0.000	0.000
10-55 Secs	11	0.000	0.000	0.000
11-56 Secs	12	0.000	0.000	0.000
12-57 Secs	13	0.000	0.000	0.000
13-58 Secs	14	0.000	0.000	0.000
14-59 Secs	15	0.000	0.000	0.000
15-60 Secs	16	0.000	0.000	0.000
Total		0.000	0.000	0.000
Average		0.000	0.000	0.000
SME-AM		0.000		

16" Sash Height
62.25" Sash Width
Vertical Sash Configuration
20 mL IPA Tracer Gas Release Rate

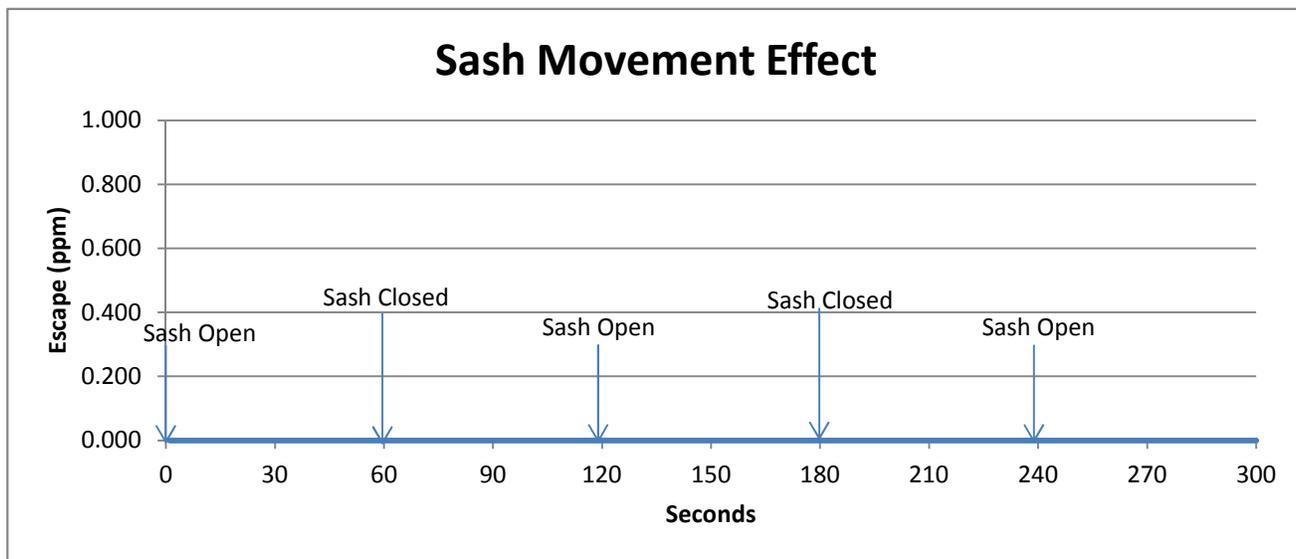
Notes: Tested to modified NIH protocol.
Replace the trace gas SF6 with IPA
(Isopropyl Alcohol). Design velocity 60 FPM.

Acceptance Criteria: X Has Been Met Has Not Been Met

Standards Utilized: MiniRAE 2000 Cal. Due Date: 15-Jan-16

Technician: CLF Test Date: 19-Jan-15

Tracer Gas Containment Report Sash Movement Effect

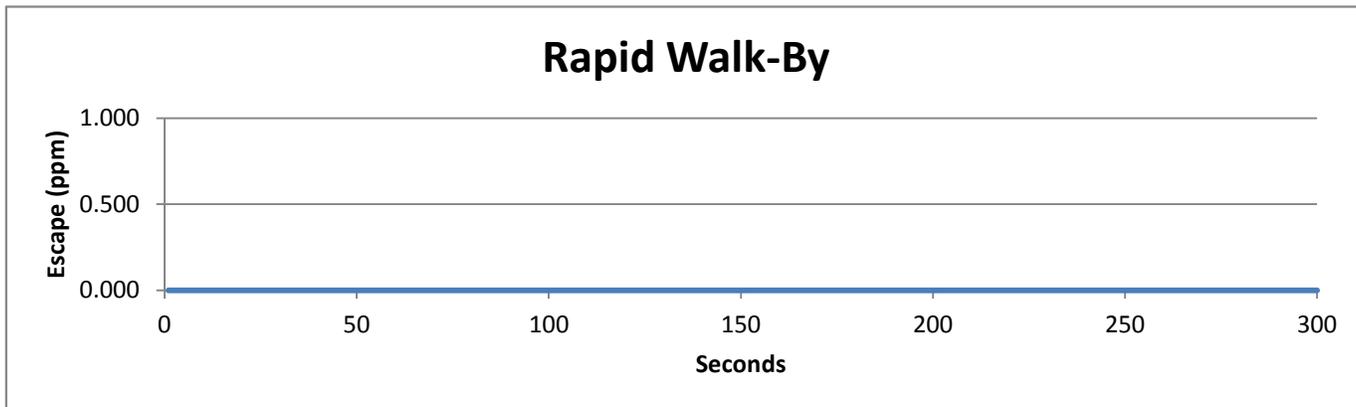


Narrative:

Notes: Tested to modified NIH protocol. Replaced the trace gas SF6 with Isopropyl Alcohol (IPA).
Design velocity 60 FPM.

Tracer Gas Containment Test Report

Walk-By



Average:	0.000	ppm
Peak:	0.000	ppm

Narrative: Following right, center, and left tracer gas testing, a 5 minute rapid walk by test is conducted. Rapid walk by test has the manikin and ejector in the center position. Tracer gas levels are recorded while three rapid walk-by tests are conducted, at 300mm behind the manikin, spaced 30 seconds apart.

Notes: Tested to modified NIH protocol. Replaced the trace gas SF6 with Isopropyl Alcohol (IPA).



Calibration Certificate

Certificate No.	5052989	Sold to:	AccuTec Services Inc. - Lee's Summit
Product	Definer 220 Medium Flow		320 NW Capital Drive
Serial No.	119896		Lee's Summit, MO 64086
Cal. Date	12-Jan-2015		USA

All calibrations are performed at Mesa Laboratories, Inc., 10 Park Place, Butler, NJ, 07405, an ISO 17025:2005 accredited laboratory through NVLAP of NIST. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

As Received Calibration Data

Technician Lilianna Malinowska
 Lab. Pressure 759 mmHg
 Lab. Temperature 22.5 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received
103.19 sccm	100.765 sccm	2.41 % %	1.00%	Out of Tolerance
1023.4 sccm	1000.5 sccm	2.29 % %	1.00%	Out of Tolerance
5119.6 sccm	5001.35 sccm	2.36 % %	1.00%	Out of Tolerance
17.4 °C	22.5 °C	-5.1 °C	±0.8°C	Out of Tolerance
758 mmHg	759 mmHg	-1.0 mmHg	±3.5mmHg	In Tolerance

Mesa Laboratoires Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	117991	22-Apr-2014	22-Apr-2015
Precision Thermometer	305460	9-Sep-2014	9-Sep-2015
Precision Barometer	2981392	24-Jun-2014	24-Jun-2015

Mesa Laboratories Inc. 10 Park Place Butler, NJ 07405 USA
 (973) 492-8400 FAX (973) 492-8270 www.mesalabs.com Symbol "MLAB" on the NASDAQ



MesaLabs



NVLAP Lab Code 200661-0

As Shipped Calibration Data

Certificate No. 5052989

Technician Lilianna Malinowska

Lab. Pressure 759 mmHg

Lab. Temperature 22.6 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped
102.19 sccm	101.755 sccm	0.43 %%	1.00%	In Tolerance
1004.5 sccm	1000.7 sccm	0.38 %%	1.00%	In Tolerance
5028.4 sccm	5001.45 sccm	0.54 %%	1.00%	In Tolerance
22.6 °C	22.6 °C	-	±0.8°C	In Tolerance
759 mmHg	759 mmHg	-	±3.5mmHg	In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	100439	8-May-2014	8-May-2015
Precision Thermometer	305460	9-Sep-2014	9-Sep-2015
Precision Barometer	2981392	24-Jun-2014	24-Jun-2015

Calibration Notes

The expanded uncertainty of flow, temperature, and pressure measurements all have a coverage factor of $k = 2$ for a confidence interval of approximately 95%.

Flow testing is in accordance with our test number PR18-13 with an expanded uncertainty of 0.18% using high-purity nitrogen or filtered laboratory air. Flow readings in sccm are performed at STP of 21.1°C and 760 mmHg.

Pressure testing is in accordance with our test number PR18-11 with an expanded uncertainty of 0.16 mmHg.

Temperature testing is in accordance with our test number PR18-12 with an expanded uncertainty of 0.04 °C.

Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

Technician Notes:

David W. Wilson, Chief Metrologist

Unit 08048



CERTIFICATE OF CALIBRATION AND TESTING

TSL Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
 Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 <http://www.tsl.com>

ENVIRONMENT CONDITION			MODEL	9555-P
TEMPERATURE	73.2 (22.9)	°F (°C)	SERIAL NUMBER	9555P0746017
RELATIVE HUMIDITY	24	%RH		
BAROMETRIC PRESSURE	28.71 (972.2)	inHg (hPa)		

<input checked="" type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

- CALIBRATION VERIFICATION RESULTS -

THERMO COUPLE			SYSTEM PRESSURE01-02			Unit: °F (°C)	
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	73.1 (22.8)	73.1 (22.8)	71.1~75.1 (21.7~23.9)				

DIFFERENTIAL PRESSURE			SYSTEM PRESSURE01-02			Unit: inH ₂ O (Pa)	
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	-3.715 (-925.0)	-3.734 (-929.8)	-3.756~-3.674 (-935.2~-914.8)	3	8.005 (1993.2)	8.011 (1994.7)	7.921~8.089 (1972.3~2014.2)
2	1.910 (475.6)	1.902 (473.6)	1.887~1.933 (469.9~481.3)	4	13.991 (3483.8)	14.010 (3488.5)	13.847~14.135 (3447.9~3519.6)

BAROMETRIC PRESSURE			SYSTEM PRESSURE01-02			Unit: inHg (hPa)	
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	19.65 (665.4)	19.65 (665.4)	19.26~20.04 (652.2~678.6)	3	34.37 (1163.9)	34.38 (1164.2)	33.68~35.06 (1140.5~1187.3)
2	28.79 (974.9)	28.79 (974.9)	28.21~29.37 (955.3~994.6)				

TSL does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSL's calibration system is registered to ISO-9001:2008.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E004626	10-30-14	10-30-15	Pressure	E005254	10-20-14	10-20-15
Pressure	E003982	09-10-14	03-10-15	DC Voltage	E003493	01-06-15	01-06-16

[Signature]

January 26, 2015

CALIBRATED

DATE

Certificate of Calibration

The following instrument

Model PGM-7600, MiniRAE 2000

Serial No. 110-014350

has been calibrated using gases that are traceable to N.I.S.T. standards.

After calibration, the instrument was re-checked with the calibration gases and given the results shown on the table.

Sensor	Test Gas Concentration	Gas Lot #	Reading
PID	Isobutylene 100 ppm ($\pm 2\%$)	95335	100
PID	Isobutylene 2000 ppm ($\pm 2\%$)	1406321	Pass
PID	Isobutylene 5000 ppm ($\pm 2\%$)	1612599	Pass

Calibration date: 1-15-2015

Calibrated by: Louis Le

RAE Systems, Inc.

