



100X Automated Filter Tester

Customer:	FLOWTECH WA
Part Number:	100X-SM-SF-S-100-240-S-S-U
Unit Serial Number:	34962
Verification Date:	Wednesday, July 22, 2020
Unit Type	Manual
Aerosol:	Salt

Calibration Equipment Used

Description	Serial #	Calibration Date	Calibration Due Date
Digital Multi Meter	16460040	11/15/2019	11/15/2020
Manometer 0-100PSI	00AU91	8/6/2019	8/6/2020
Manometer 0-10PSI	00AU92	8/6/2019	8/6/2020
Pressure Calibrator	1052442	10/22/2019	10/22/2020
Hi Pot Device	26540	4/21/2020	4/21/2021
Humidity/Temperature Meter	180702753	8/29/2019	8/29/2020
Aerosol Electrometer	70824060	10/22/2018	10/22/2023
Digital Scale	6A7604582	8/28/2019	8/28/2020
SMPS			
DMA	3082001816002	4/10/2020	4/10/2022
CPC	3750181501	4/16/2020	4/16/2022

Boards Configuration

Part Number	Description	Serial #	Revision	Software Revision
0800195	Relay Ctrl Brd	KEI00348	A	1.1
0800197	Diff Press Sensor Brd	00202	F	1.2
0800198	Flow Ctrl Brd	KEI00261	A	1.2
0800199	Thermocouple Brd	33197	E	1.3
0800200	LSC Brd	KEI00111	J	1.04
0800201	Level Sensor Brd	KEI00130	C	N/A
0800205	I2C Hub Brd	KEI00314	C	N/A
0800206	Power Control Brd	SC-620-020	F	N/A
0800207	Pressure Sensor Brd	33951	C	1.1
0800207	Pressure Sensor Brd	33962	C	1.1
0800208	Misc I/O Brd	KEI00278	E	1.05
40-00800-003	Main Control Brd	5493009	A	2.01.00B

		Serial #	Calibration Date	Calibration Due
5300162	Mass Flow Controller	250202	7/22/2020	7/22/2021

HiPot Testing

AC Dielectric Test	Pass	
AC Test Result	10.05	mA
Ground Bond Test	Pass	
Ground Bond Resistance	66.8	mΩ

Voltages Checks

Line Voltage		0	0
	220	230.0	23.0
Power Board	TP1 to GND (TP3)	Nominal (VDC)	Tolerance (VDC)
	24.0	24.0	1.2
	24.06	24.00	0.24
	5.00	5.00	0.05
LSC Board	TP8 to GND (TP13)		
	15.35	15.00	0.75
	TP11 to GND (TP13)		
	-14.87	-15.00	0.75

Valve Manifold Setup

Valve Name	Description	Value	Nominal Value	Tolerance	Unit
SV2	Generator Nozzle Air	50.1	51	2	PSI
SV6	Generator Dilution Air	19.3	20	2	PSI
SV8	Vacuum Pump	70	70	10	PSI
SV5	Chuck Pressure	31.4	30	10	PSI
SV7	High Pressure Clamp	54.7	55	2	PSI
SV9	Stack Dilution Air	12.7	14	5	PSI
NV1	Purge Air	103	100	5	dB
FM1	Generator Dilution Air	36	35	5	LPM
NV4	Stack Dilution Air	55.6	55	5	LPM

Aerosol Conditioning

	Measured	Nominal	Tolerance	Units
Temperature	22	25.0	5.0	°C
Humidity	34.9	30.0	10.0	%RH

Performance Validation

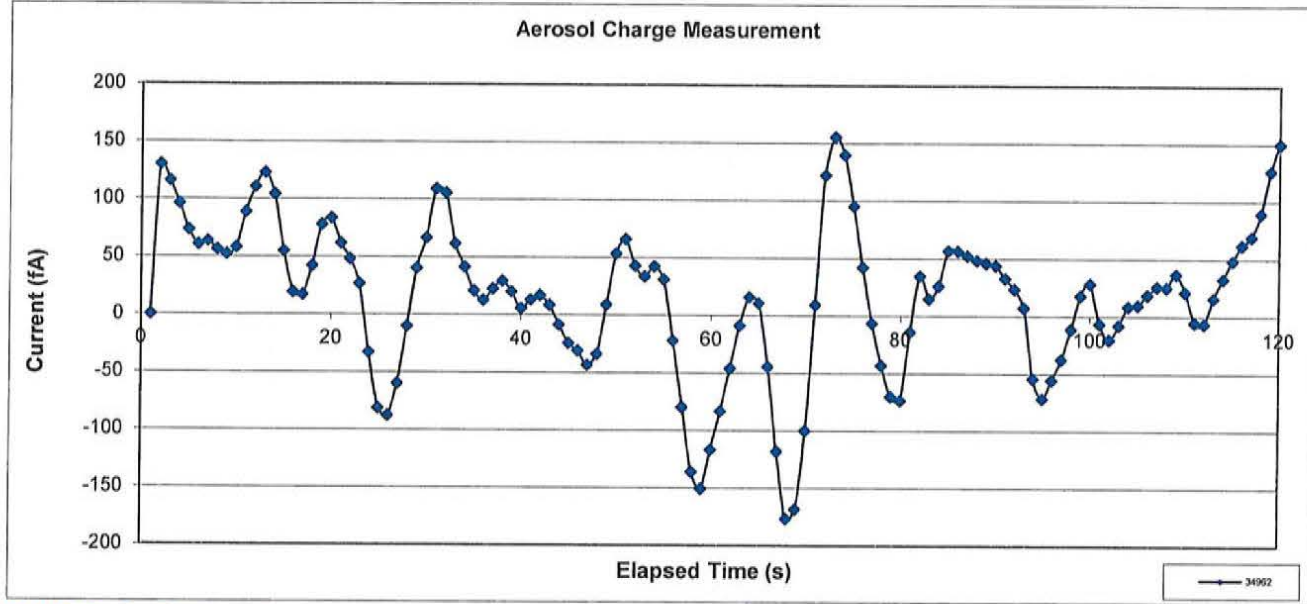
Settings

Load Time	8s
Sample Time	25
Flow Rate	85lpm

# of Filter sheets	Test	Lot Number	% Penetration	Resistance	Flow
2	Test #1	511264	1.7568	49.1	84.9
	Test #2	511264	1.7106	49.4	84.9
	Average		1.7337	49.3	84.9
3	Test #1	511264	0.3306	74	84.9
	Test #2	511264	0.3206	74.6	85
	Average		0.3256	74.3	85.0
4	Test #1	511264	0.07	100	84.9
	Test #2	511264	0.068	99.5	84.9
	Average		0.0690	99.75	84.9

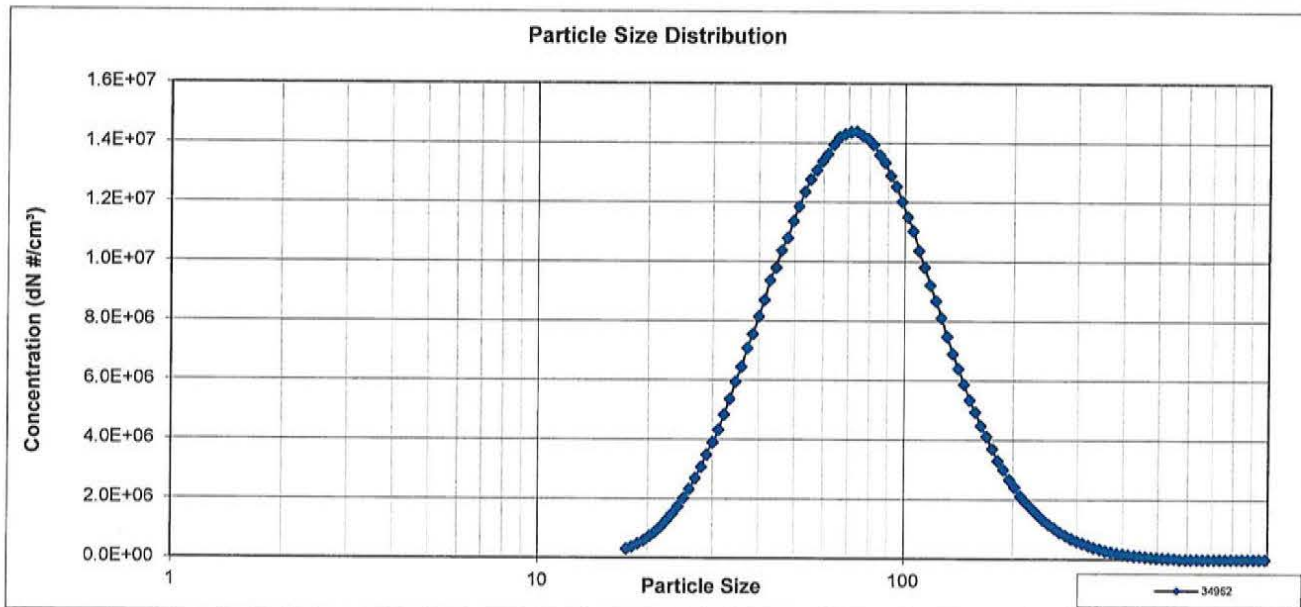
Ionizer Balance

	fA	#/cm ³
Mean	18.62	4089.05
Min	-176.67	395.963
Max	155.42	13266.2
Std. Dev. (RMS)	66.0879	3138.59



SMPS Data Summary

	Number Particle Size	Diameter Particle Size	Surface Particle Size	Volume Particle Size	Mass Particle Size
median (nm)	72.1	97.1	134.1	189.0	189.0
mean (nm)	84.5	115.3	158.8	214.0	214.0
geo. mean (nm)	72.9	98.4	135.4	185.6	185.6
mode (nm)	73.7	94.7	126.3	187.7	187.7
geo. st. dev.	1.71	1.75	1.76	1.73	1.73
total conc.	8.40e+06(#/cm ³)	709.7(mm/cm ³)	2.57e+11(nm ² /cm ³)	6.80e+12(nm ³ /cm ³)	1.47e+04(μ g/m ³)



System Variables

Salt Variables List

7/22/2020
12:49:27 PM

ATI - 34962
Reagent: Salt
Operating Hours: 3

Software Revision

Console	PCM. 2. 00. 38B
DP Sensor	DPB. 1. 2
Flow Control f/c	FCI. 1. 2
LSC Interface	LSC. 1. 04
Misc I/O	MIO. 1. 05
Pressure Sensor 1	APB. 1. 1
Pressure Sensor 2	APB. 1. 1
Temp Monitor	TMB. 1. 3
Valve Control	VCB. 1. 1

Pressure Settings

Air Dryer Pressure:	73.6 PSI
Main Air Pressure:	95.6 PSI
Vacuum Pump Pressure:	71.6 PSI
Stack Dilution:	15.0 PSI
Generator Nozzle:	51.2 PSI
Dilution Air:	1.0 PSI
Dilution Flow:	61 lpm

Chuck Differential:	0 mmH2O
Cylinder Clamp:	57.3 PSI
Cylinder Up/Down:	33.5 PSI
Generator Dilution:	18.7 PSI

Flow Settings

Maximum Flow:	120
Measurement Mode:	SLPM

Alarms Settings

Penetration High Limit:	0.0200	Enabled
Penetration Low Limit:	0.0005	Disabled
Resistance High Limit:	25.0	Enabled
Resistance Low Limit:	15.0	Disabled
Flow Tolerance:	2.0	Disabled

Test Setup

Test Flow:	85.0
Load Time:	8.0
Extended Load Time:	8.0
Sample Time:	2.0
Open Time:	1.0
Cycles till Calibration:	1000

Generator and LSC

Gravimetric Test:	16.7
LSC Offset:	0
LSC Sensitivity:	83
LSC Zero(volts):	0.0150

42CFR Part 84 Aerosol Requirements

	Unit	NIOSH
Count Median Diameter	34962	42CFR Part 84
Standard Geometric Deviation	72.1	75nm ± 20nm
Aerosol Temperature	1.71	≤1.86
Relative Humidity	22	25±5 °C
	34.9	30% ± 10%

Approvals

ATI Production	
s22	s22
s22	s22
Print Name	Print Name



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**CALIBRATION AND TEST REPORT
 DIFFERENTIAL PRESSURE SENSOR BOARD 0800197**

Report Number	0800197-072220-00202
Procedure	IAT-190-WI
Part Number	0800197
Revision	F
PCBA Serial Number	00202
Firmware Revision	1.2

CALIBRATION EQUIPMENT USED	SERIAL NUMBER	CALIBRATION DATE	CALIBRATION DUE DATE
Digital Multi Meter	16460040	11/15/2019	11/15/2020
Pressure Calibrator	00AU92	8/6/2019	8/6/2020
Digital Manometer	1052442	10/22/2019	10/22/2020

ITEM	AS FOUND ^{*1}	AS LEFT	TOLERANCE
ELECTRICAL CHECK			
TP8 to GND (TP7)	C	2.498	2.500 V ± 0.125 V
Upper Calibration Point	C	100.1	100.0 mmH2O ± 0.5 mmH2O
Verification Point	C	35.2	35.0 mmH2O ± 0.5 mmH2O
Verification Point	C	3.0	3.0 mmH2O ± 0.5 mmH2O
CHANNEL 1			
Upper Calibration Point	C	3.5	3.5 PSI ± 0.1 PSI
Verification Point	C	1.5	1.5 PSI ± 0.1 PSI

*1 (A) In Tolerance When Received (B) Out of Tolerance When Received (C) New Instrument, N/A

Condition of Unit as Found

In Tolerance Out of Tolerance Inoperable N/A

The instrument listed on this certification has been calibrated against standards traceable to the National Institute of Standards and Technology (NIST) or other recognized national metrology institutes, derived from ratio type measurements, or compared to nationally recognized consensus standards. A test uncertainty ratio of 4:1 was maintained unless otherwise stated. Any number of factors may cause the calibration item to drift out of calibration before the calibration interval has expired. The quality management system of Air Techniques International (ATI) is registered to ISO 9001:2015. The calibration of the above instrument manufactured by ATI was calibrated in compliance with applicable ATI procedures. All results contained within this certification relate only to item calibrated. This certificate shall not be reproduced except in full and with the consent of Air Techniques International.

Temperature: RH:

Test Technician	Calibration Date	Calibration Due
	22-Jul-2020	22-Jul-2021



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**CALIBRATION AND TEST REPORT
 PRESSURE SENSOR BOARD 0800207**

Report Number	0800207-072220-33951
Calibration Procedure / Rev #	IAT-192-WI / Rev A
Part Number	0800207
Revision	C
PCBA Serial Number	33951
Firmware Revision	1.1

CALIBRATION EQUIPMENT USED	SERIAL NUMBER	CALIBRATION DATE	CALIBRATION DUE DATE
Digital Multi Meter	16460040	15-Nov-2019	15-Nov-2020
Digital Pressure Gauge	00AU91	6-Aug-2019	6-Aug-2020

ITEM	AS FOUND ^{*1}	AS LEFT	ACTUAL	TOLERANCE
ELECTRICAL CHECK				
TP8 to GND (TP7)	C	4.092	4.096 V	± 0.205 V
TP17 to GND (TP7)	C	4.091	4.096 V	± 0.205 V
CHANNEL 0				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI
CHANNEL 1				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI
CHANNEL 2				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI
CHANNEL 3				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI

*1 (A) In Tolerance When Received (B) Out of Tolerance When Received (C) New Instrument, N/A

Condition of Unit as Found

In Tolerance Out of Tolerance Inoperable N/A

The instrument listed on this certification has been calibrated against standards traceable to the National Institute of Standards and Technology (NIST) or other recognized national metrology institutes, derived from ratio type measurements, or compared to nationally recognized consensus standards. A test uncertainty ratio of 4:1 was maintained unless otherwise stated. Any number of factors may cause the calibration item to drift out of calibration before the calibration interval has expired. The quality management system of Air Techniques International (ATI) is registered to ISO 9001:2015. The calibration of the above instrument manufactured by ATI was calibrated in compliance with applicable ATI procedures. All results contained within this certification relate only to item calibrated. This certificate shall not be reproduced except in full and with the consent of Air Techniques International.

Temperature: RH:

Test Technician	Calibration Date	Calibration Due
s22	22-Jul-2020	22-Jul-2021



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**CALIBRATION AND TEST REPORT
 PRESSURE SENSOR BOARD 0800207**

Report Number	0800207-072220-33962
Calibration Procedure / Rev #	IAT-192-WI / Rev A
Part Number	0800207
Revision	C
PCBA Serial Number	33962
Firmware Revision	I.1

CALIBRATION EQUIPMENT USED	SERIAL NUMBER	CALIBRATION DATE	CALIBRATION DUE DATE
Digital Multi Meter	16460040	15-Nov-2019	15-Nov-2020
Digital Pressure Gauge	00AU9I	6-Aug-2019	6-Aug-2020

ITEM	AS FOUND ^{*1}	AS LEFT	ACTUAL	TOLERANCE
ELECTRICAL CHECK				
TP8 to GND (TP7)	C	4.090	4.096 V	± 0.205 V
TP17 to GND (TP7)	C	4.089	4.096 V	± 0.205 V
CHANNEL 0				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI
CHANNEL 1				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI
CHANNEL 2				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI
CHANNEL 3				
Upper Calibration Point	C	90	90 PSI	± 1 PSI
Verification Point	C	50	50 PSI	± 1 PSI

*1 (A) In Tolerance When Received (B) Out of Tolerance When Received (C) New Instrument, N/A

Condition of Unit as Found

In Tolerance
 Out of Tolerance
 Inoperable
 N/A

The instrument listed on this certification has been calibrated against standards traceable to the National Institute of Standards and Technology (NIST) or other recognized national metrology institutes, derived from ratio type measurements, or compared to nationally recognized consensus standards. A test uncertainty ratio of 4:1 was maintained unless otherwise stated. Any number of factors may cause the calibration item to drift out of calibration before the calibration interval has expired. The quality management system of Air Techniques International (ATI) is registered to ISO 9001:2015. The calibration of the above instrument manufactured by ATI was calibrated in compliance with applicable ATI procedures. All results contained within this certification relate only to item calibrated. This certificate shall not be reproduced except in full and with the consent of Air Techniques International.

Temperature: RH:

Test Technician	Calibration Date	Calibration Due
s22	22-Jul-2020	22-Jul-2021



7641 N. Business Park Dr., Tucson, AZ 85743 U.S.A., 1.888.290.6060

Certificate of Calibration

Serial No. 250202 - 22-Jun-2020

Device Under Test

Customer:	Hamilton Associates, Inc.	Calibration Procedure/Rev. #:	DOC-AUTOCAL-GASFLOW/Rev. 94
Sales Order Number:	SO359448	Calibrated By:	s22
Serial Number:	250202	Calibration Date:	22-Jun-2020
Model Number:	MCR-250SLPM-D	Certification Number:	274637
Customer Part Number:	5300162	Full Scale Pressure:	160.00 PSIA
Software Version:	8v24.0-R23	Pressure Accuracy:	+/-0.5% of Full Scale
P/D/I Values:	139 / 7424 / 0	Temperature Accuracy:	+/-1.5°C
Adder Codes:	5M, 5IN, GAS: Air, RANGE (120 SLPM), P1: 2 PSIG, P2: VAC, STP: 21.1°C & 760 torr, HC, DS	Standard Temp. & Pressure:	21.10°C, 14.69595 PSIA
		Normal Temp. & Pressure:	0.00°C, 14.69595 PSIA
		Calibration due 1 yr. after receipt:	7/22/20
Process Gas:	Selectable		
Calibration Gas:	Air		
Range:	120.00 SLPM		
Gas Temperature:	27.91°C		
Ambient Humidity:	32.16%		

Equipment Used

Pressure:	TOOL-PRESSURE21-145PSIG	Voltage:	TOOL-CMTR34	Flow:	TOOL-MOLBOX2
Tool Due Date:	11-Dec-2020	Tool Due Date:	11-Sep-2020	Tool Due Date:	03-Dec-2021
Manufacturer/Model:	Alicat / P-100PSIG-D	Manufacturer/Model:	Flyke / 87V	Manufacturer/Model:	DH Instruments / Molbox 1 A700K-A
Device Uncertainty:	0.1% of Reading of full scale	Device Uncertainty:	+/- (0.1% + 1 digit)	Device Uncertainty:	NA \ Determined by Molbloc
Flow:	TOOL-MOLBLOC6	Temperature:	TOOL-TEMP15		
Tool Due Date:	05-Dec-2020	Tool Due Date:	13-Nov-2020		
Manufacturer/Model:	DH Instruments / 2E3-S	Manufacturer/Model:	ASL / F200-A-2+Probe		
Device Uncertainty:	+/- 0.2% of reading	Device Uncertainty:	+/- 0.02°C		

All test equipment used for calibration is NIST traceable.

Calibration

Uncertainty: +/- (0.4% of Reading + 0.2% of Full Scale)
Units of measure: SLPM

Calibration Pressure: Inlet: 2 PSIG
Outlet: VAC

Output 1 Configuration
mini-DIN Pin #6

Output 2 Configuration
mini-DIN Pin #2

D.U.T.	Actual	In Tolerance	Output 1	Output 2
0.00	0.00	Yes	0.000 Vdc	5.12 Vdc
30.00	30.03	Yes	1.250 Vdc	5.12 Vdc
60.05	60.10	Yes	2.502 Vdc	5.12 Vdc
90.00	90.05	Yes	3.750 Vdc	5.12 Vdc
119.99	120.01	Yes	5.00 Vdc	5.12 Vdc

Notes: 0-5V set-point.

Calibrated By:
QC Signature:

s22
s22

6/22/2020 3:27:00 PM

nc. is an ISO 9001 certified company.

CS1 Rev 17 Last Modified 15-May-2017

