Universal Thermal Services
Allen R. Hildebrand (President)
E7064 Knopp Road
Manawa, Wisconsin 54949
Phone – Fax 920-596-2983
uts@ wolfnet.net

Service
Training
Calibration
Certification
Maintenance

Metco 9MC
Certificate of Calibration

Form Instructions: F-310-016 Rev. AE 31-Dec-13
Work Instructions: WI-016 Rev. A 22-Feb-10

Certificate Number: 2024-418

Customer:	Universal Thermal	**Console:**	Metco 9MC	**Powder Feeder**	N/A		
Address:	217 Center St	**Serial Number:**	9MC KM92570231-2	**Serial Number:**	N/A		
City:	Manawa	**Device ID Number:**	1455				
State:	WI	**Booth Number:**	N/A	**Powder Feeder**	N/A		
Zip:	54949	**Calibration As Received**		**Serial Number:**	N/A		
Name:	Allen Hildebrand	**With in 3%:**	No				
Phone Number:	920-596-2983	**Adjustments:**	Yes				

N.I.S.T. Instruments Used for This Calibration

Test Instrument:	Press. Transducer	**Test Instrument:**	Multi Meter	**Test Instrument:**	Amp Clamp Meter	**Test Instrument:**	Multi Meter		
Make:	Fluke	**Make:**	Fluke	**Make:**	Fluke	**Make:**	Fluke		
Model:	PV350	**Model:**	87V	**Model:**	i1010	Model:	233		
Serial Number:	PM-21	**Serial Number:**	MM-13	**Serial Number:**	AC-44	**Serial Number:**	MM-15		
Next Calibration Due:	12-Dec-24	**Next Calibration Due:**	24-May-24	**Next Calibration Due:**	24-May-24	**Next Calibration Due:**	7-Dec-24		

Test Inst: Low Flow	Mass Flow Meter	**Test Instrument: Medium**	Mass Flow Meter						
Make:	Alicat 75 scfh	**Make:**	Alicat 400 scfh						
Model:	PCU50SLPM	**Model:**	PCU250SLPM						
Serial Number:	282154	**Serial Number:**	282155						
Next Calibration Due:	7-Sep-24	**Next Calibration Due:**	7-Sep-24						

Manufacture Specifications

Flow Tube	Accuracy	Tube Pressure	Tube Scale	Scfh Per Metco	In The % of Deviation Column of Each Sheet After This Sheet Is The Manufacture Specifications, or Better, For The Individual Device
Argon flow meter	± 3%	75 psi	0-300 scfh	300	
Hydrogen flow meter	± 3%	50 psi	0-42 scfh	42	**0-3% Green is Acceptable**
Helium flow meter	± 3%	75 psi	0-225 scfh	225	**3.1-5% Orange is Alert**
Nitrogen flow in Argon Meter	± 3%	75 psi	0-300 scfh	300	**5.1% - > Red Is Fail**

System Performance w/Parameters as Provided by the Operator Initially

Gas	Pressure	Gas [Ball] Flow		Amps	Volts
Ar	80	100	**System**	500	37.5
H2	50	10	**Gun Type**		
N2	N/A	N/A	9MB		
He	N/A	N/A			

Notes:

Primary Flow Meter was Leaking, Found glass flow tube was chipped, Replaced Flow tube, float, and flow meter scale.
Replaced Hydrogen Flow Meter Scale.

Console Air Purge Safety Test:	**Pass**
Door Switch Safety Test:	**Pass**
Argon Supply Test:	**Pass**
Hydrogen Supply Test:	**Pass**
Nitrogen Supply Test:	**Pass**
Helium Supply Test:	**Pass**
E-Stop Console:	**Pass**
Leak Test:	**Pass**

Calibrated By:	Jeremy Bailey				
Calibrated Date:	15-Feb-24	**Calibration Due:**	15-Feb-25	**Signature:**	

All instruments have been calibrated against standards traceable to NIST. This Certification Sheet must not be altered in any way!

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Amperage and Voltage Meter

Customer: Universal Thermal

Certificate Number : 2024-418

Form Instructions: F-310-016 Rev. AE 31-Dec-13

Console:	Metco 9MC		**Serial Number:**	9MC KM92570231-2	**Booth :**	N/A	
Testing Instrument:	Amp Clamp Meter	i1010	**Serial Number:**	AC-44	**Testing Instrument:**	Multi Meter 87V	**Serial Number:** MM-13

Amp Meter

Device Under Test: Digital Amp Meter **Amps Full Scale [FS]** 1000 **Device ID Number:** N/A

Amps Set Point	Amp Meter Display Reading	As Found NIST Meter	As Found Amps Deviation	As Found Amps % Deviation	Tolerences Pass/Fail	As Left NIST Meter	As Left Amps Deviation	As Left Amps % Deviation		Tolerences Pass/Fail
300	300	308	8.0	**0.8**	Pass	308	8.0	**0.8**		Pass
400	400	408	8.0	**0.8**	Pass	408	8.0	**0.8**		Pass
500	500	508	8.0	**0.8**	Pass	508	8.0	**0.8**		Pass
600	600	610	10.0	**1.0**	Pass	610	10.0	**1.0**		Pass
700	700	710	10.0	**1.0**	Pass	710	10.0	**1.0**		Pass
800	800	810	10.0	**1.0**	Pass	810	10.0	**1.0**		Pass
900	900	909	9.0	**0.9**	Pass	909	9.0	**0.9**		Pass

Volt Meter

Device Under Test: Digital Volt Meter **Volts Full Scale [FS]** 100 **Device ID Number:**

Volt Meter Set Point	Volt Meter Display Reading	As Found NIST Meter	As Found Volts Deviation	As Found Volts % Deviation	Tolerences Pass/Fail	As Left NIST Meter	As Left Volts Deviation	As Left Volts % Deviation		Tolerences Pass/Fail
26.0	26.0	26.5	0.5	**0.5**	Pass	26.5	0.5	**0.5**		Pass
31.0	31.0	31.8	0.8	**0.8**	Pass	31.8	0.8	**0.8**		Pass
40.0	40.0	40.5	0.5	**0.5**	Pass	40.5	0.5	**0.5**		Pass
50.0	50.0	50.5	0.5	**0.5**	Pass	50.5	0.5	**0.5**		Pass

System Performance w/Parameters after Calibration

Gas	Pressure	Gas [Ball] Flow	Amps
Ar	80	100	500
H2	50	10	**Volts**
N2	N/A	N/A	37.5
He	N/A	N/A	

Calibrated By: Jeremy Bailey
Calibrated Date: 15-Feb-24 **Calibration Due:** 15-Feb-25 **Signature:**

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Customer Universal Thermal

Air Gauges

Certificate Number: 2024-418

Console:	Metco 9MC		**Serial Number:**	9MC KM92570231-2	**Booth :**	N/A			
Testing Instrument:	Press. Transducer	PV350	**Serial Number:**	PM-21	**Testing Instrument:**	Multi Meter	87V	**Serial Number:**	MM-13

Vibrator Air #1

Device Under Test: Vibrator #1 Gauge **Pressure Full Scale [FS]** 60 PSI **Device ID Number:** N/A

Pressure (PSI) Set Point	As Set Gauge Setting	As Found NIST Pressure	As Found PSI Deviation	As Found PSI % of Deviation	Tolerences Pass/Fail	As Left NIST Pressure	As Left PSI Deviation	As Left PSI % Deviation		Tolerences Pass/Fail
10	10	9.7	-0.3	**-0.5**	Pass	9.7	-0.3	**-0.5**		Pass
20	20	20.5	0.5	**0.8**	Pass	20.5	0.5	**0.8**		Pass
30	30	30.5	0.5	**0.8**	Pass	30.5	0.5	**0.8**		Pass
40	40	41.0	1.0	**1.7**	Pass	41.0	1.0	**1.7**		Pass
50	50	51.0	1.0	**1.7**	Pass	51.0	1.0	**1.7**		Pass
60	60	61.0	1.0	**1.7**	Pass	61.0	1.0	**1.7**		Pass

Vibrator Air #2

Device Under Test: Vibrator #2 Gauge **Pressure Full Scale [FS]** 60 PSI **Device ID Number:** N/A

Pressure (PSI) Set Point	As Set Gauge Setting	As Found NIST Pressure	As Found PSI Deviation	As Found PSI % of Deviation	Tolerences Pass/Fail	As Left NIST Pressure	As Left PSI Deviation	As Left PSI % Deviation		Tolerences Pass/Fail
10	10	10.3	0.3	**0.5**	Pass	10.3	0.3	**0.5**		Pass
20	20	20.3	0.3	**0.5**	Pass	20.3	0.3	**0.5**		Pass
30	30	30.3	0.3	**0.5**	Pass	30.3	0.3	**0.5**		Pass
40	40	40.7	0.7	**1.2**	Pass	40.7	0.7	**1.2**		Pass
50	50	51.0	1.0	**1.7**	Pass	51.0	1.0	**1.7**		Pass
60	60	61.2	1.2	**2.0**	Pass	61.2	1.2	**2.0**		Pass

Cooling Air

Device Under Test: Cooling Air Gauge **Pressure Full Scale [FS]** 160 PSI **Device ID Number:** N/A

Pressure (PSI) Set Point	As Set Gauge Setting	As Found NIST Pressure	As Found PSI Deviation	As Found PSI % of Deviation	Tolerences Pass/Fail	As Left NIST Pressure	As Left PSI Deviation	As Left PSI % Deviation		Tolerences Pass/Fail
20	20	20.7	0.7	**0.4**	Pass	20.7	0.7	**0.4**		Pass
40	40	41.2	1.2	**0.8**	Pass	41.2	1.2	**0.8**		Pass
60	60	61.0	1.0	**0.6**	Pass	61.0	1.0	**0.6**		Pass
80	80	81.3	1.3	**0.8**	Pass	81.3	1.3	**0.8**		Pass
						0.0				

Calibrated By: Jeremy Bailey
Calibrated Date: 15-Feb-24 **Calibration Due:** 15-Feb-25 **Signature:**

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Customer: Universal Thermal

Gas Gauges

Form Number: F-310-016 Rev. AE 31-Dec-13

Certificate Number : 2024-418

Console:	Metco 9MC		**Serial Number:**	9MC KM92570231-2	**Booth :**	N/A			
Testing Instrument:	Press. Transducer	PV350	**Serial Number:**	PM-21	**Testing Instrument:**	Multi Meter	87V	**Serial Number:**	MM-13

Primary Gas Pressure Gauge

Device Under Test: Arc Gas Gauge **Pressure Full Scale [FS]** 100 PSI **Device ID Number:** N/A

Pressure (PSI) Set Point	As Set Gauge Setting	As Found NIST Pressure	As Found PSI Deviation	As Found PSI % of Deviation	Tolerences Pass/Fail	As Left NIST Pressure	As Left PSI Deviation	As Left PSI % Deviation		Tolerences Pass/Fail
40	40	40.8	0.8	**0.8**	Pass	40.8	0.8	**0.8**		Pass
50	50	50.5	0.5	**0.5**	Pass	50.5	0.5	**0.5**		Pass
60	60	60.5	0.5	**0.5**	Pass	60.5	0.5	**0.5**		Pass
70	70	70.2	0.2	**0.2**	Pass	70.2	0.2	**0.2**		Pass
80	80	80.6	0.6	**0.6**	Pass	80.6	0.6	**0.6**		Pass
90	90	91.0	1.0	**1.0**	Pass	91.0	1.0	**1.0**		Pass
100	100	101.7	1.7	**1.7**	Pass	101.7	1.7	**1.7**		Pass

Secondary Gas Pressure Gauge

Device Under Test: Sec. Gas Gauge **Pressure Full Scale [FS]** 100 PSI **Device ID Number:** N/A

Pressure (PSI) Set Point	As Set Gauge Setting	As Found NIST Pressure	As Found PSI Deviation	As Found PSI % of Deviation	Tolerences Pass/Fail	As Left NIST Pressure	As Left PSI Deviation	As Left PSI % Deviation		Tolerences Pass/Fail
40	40	40.1	0.1	**0.1**	Pass	40.1	0.1	**0.1**		Pass
50	50	50.0	0.0	**0.0**	Pass	50.0	0.0	**0.0**		Pass
60	60	60.1	0.1	**0.1**	Pass	60.1	0.1	**0.1**		Pass
70	70	70.1	0.1	**0.1**	Pass	70.1	0.1	**0.1**		Pass
80	80	80.0	0.0	**0.0**	Pass	80.0	0.0	**0.0**		Pass
90	90	90.0	0.0	**0.0**	Pass	90.0	0.0	**0.0**		Pass
100	100	99.8	-0.2	**-0.2**	Pass	99.8	-0.2	**-0.2**		Pass

Calibrated By: Jeremy Bailey
Calibrated Date: 15-Feb-24 **Calibration Due:** 15-Feb-25 **Signature:**

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Customer: Universal Thermal

Argon Flow

Tube Scale 0-300 @ 75 psi Ar @ 70°F

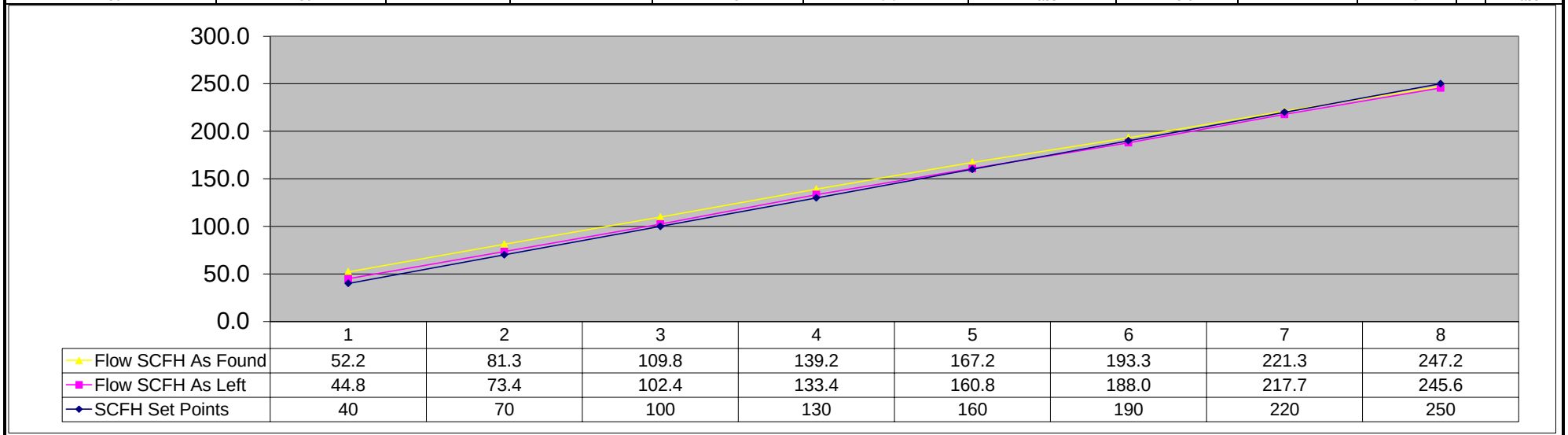
Form Number: F-310-016 Rev. AE 31-Dec-13

Certificate Number: 2024-418

Console:	Metco 9MC	**Serial Number:**	None				
Device ID Number:		**Booth:**	None				
Device Under Test:	Primary Flow Meter	**Type of Gas:**	Argon	**Scale Rate:**	Flow is in SCFH	**Full Flow SCFH [FS]:**	300

Testing Instrument:	Mass Flow Meter	Alicat 400 scfh	**Serial Number:**	282155

Flow Tube SCFH Set Point	Flow Tube SCFH Converted		As Found NIST SCFH	As Found Actual SCFH Deviation	As Found SCFH % Deviation	Tolerences Pass/Fail	Adjusted As Left NIST SCFH	As Left SCFH Deviation	As Left SCFH % Deviation		Tolerences Pass/Fail
40	40		52.2	12.2	4.1	Pass	44.8	4.8	1.6		Pass
70	70		81.3	11.3	3.8	Pass	73.4	3.4	1.1		Pass
100	100		109.8	9.8	3.3	Pass	102.4	2.4	0.8		Pass
130	130		139.2	9.2	3.1	Pass	133.4	3.4	1.1		Pass
160	160		167.2	7.2	2.4	Pass	160.8	0.8	0.3		Pass
190	190		193.3	3.3	1.1	Pass	188.0	-2.0	-0.7		Pass
220	220		221.3	1.3	0.4	Pass	217.7	-2.3	-0.8		Pass
250	250		247.2	-2.8	-0.9	Pass	245.6	-4.4	-1.5		Pass



	1	2	3	4	5	6	7	8
Flow SCFH As Found	52.2	81.3	109.8	139.2	167.2	193.3	221.3	247.2
Flow SCFH As Left	44.8	73.4	102.4	133.4	160.8	188.0	217.7	245.6
SCFH Set Points	40	70	100	130	160	190	220	250

Calibrated By:	Jeremy Bailey			
Calibrated Date:	15-Feb-24	**Calibration Due:**	15-Feb-25	**Signature:**

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Customer: Universal Thermal

Hydrogen Flow

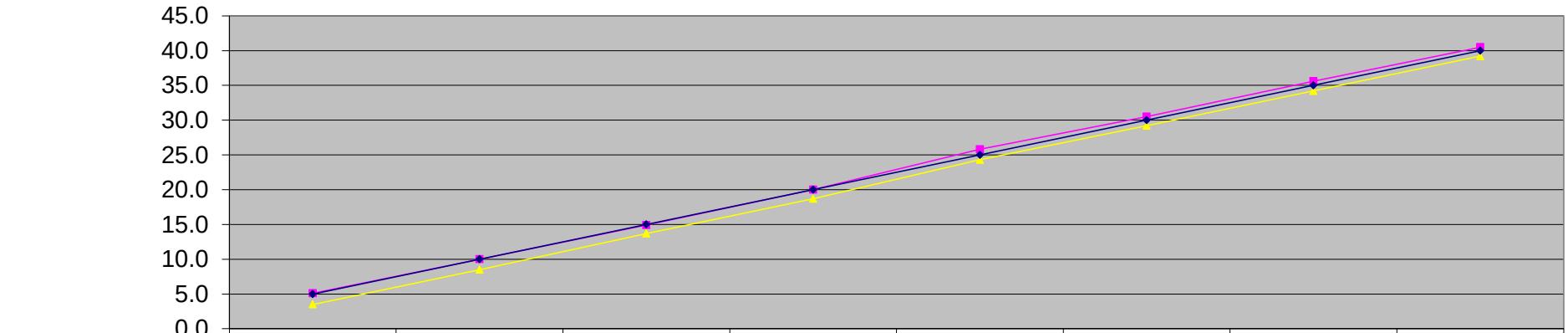
Tube Scale 0-42 @ 50 psi H2 @ 70 ° F

Certificate Number: 2024-418

Console:	Metco 9MC	**Serial Number:**	9MC KM92570231-2				
Device ID Number:	N/A	**Booth :**	N/A				
Device Under Test:	Secondary Gas Flow Tube	**Type of Gas:**	Hydrogen	**Scale Rate:**	Flow is in SCFH	**Full Flow SCFH [FS]:**	42

Testing Instrument:	Mass Flow Meter	Alicat 75 scfh	**Serial Number:**	282154

Flow Tube SCFH Set Point	Flow Tube SCFH Converted		As Found NIST SCFH	As Found Actual SCFH Deviation	As Found SCFH % Deviation	Tolerences Pass/Fail	Adjusted As Left NIST SCFH	As Left SCFH Deviation	As Left SCFH % Deviation		Tolerences Pass/Fail
5	5		3.5	-1.5	**-3.6**	Pass	5.1	0.1	**0.2**		Pass
10	10		8.5	-1.5	**-3.6**	Pass	10.0	0.0	**0.0**		Pass
15	15		13.7	-1.3	**-3.1**	Pass	14.9	-0.1	**-0.2**		Pass
20	20		18.7	-1.3	**-3.1**	Pass	20.0	0.0	**0.0**		Pass
25	25		24.3	-0.7	**-1.7**	Pass	25.8	0.8	**1.9**		Pass
30	30		29.2	-0.8	**-1.9**	Pass	30.5	0.5	**1.2**		Pass
35	35		34.2	-0.8	**-1.9**	Pass	35.6	0.6	**1.4**		Pass
40	40		39.2	-0.8	**-1.9**	Pass	40.5	0.5	**1.2**		Pass



	1	2	3	4	5	6	7	8
Flow SCFH As Found	3.5	8.5	13.7	18.7	24.3	29.2	34.2	39.2
Flow SCFH As Left	5.1	10.0	14.9	20.0	25.8	30.5	35.6	40.5
SCFH Set Points	5	10	15	20	25	30	35	40

Calibrated By:	Jeremy Bailey			
Calibrated Date:	15-Feb-24	**Calibration Due:**	15-Feb-25	**Signature:**

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Customer: Universal Thermal

Helium Flow

Tube Scale 0-225 @ 75 psi He @ 70ºF

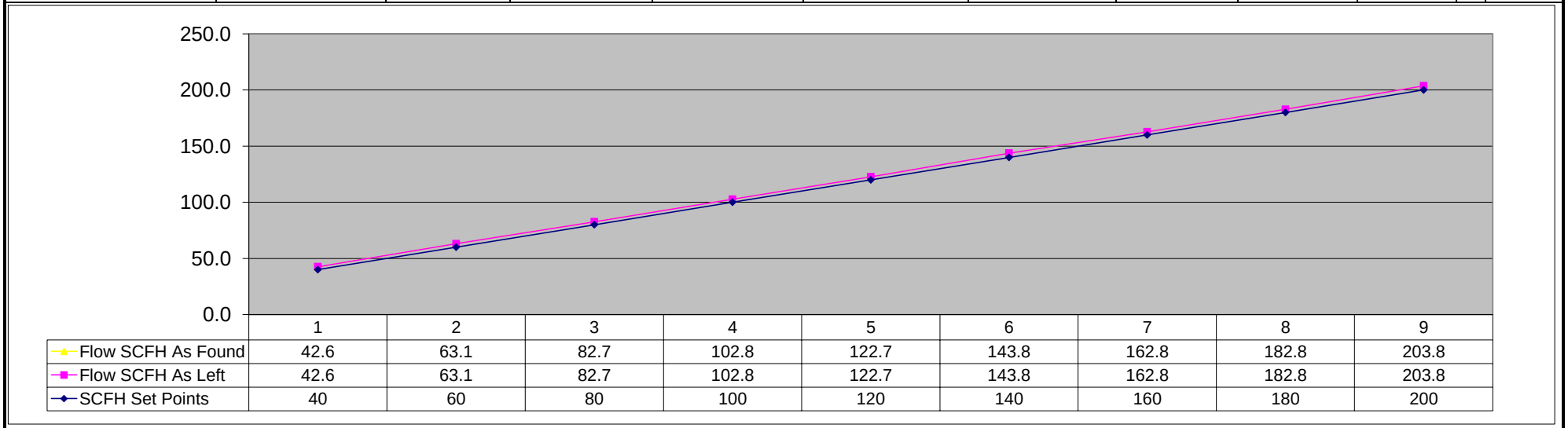
Form Number: F-310-016 Rev. AE 31-Dec-13

Certificate Number: 2024-418

Console:	Metco 9MC	**Serial Number:**	9MC KM92570231-2				
Device ID Number:	N/A	**Booth:**	N/A				
Device Under Test:	Secondary Gas Flow Tube	**Type of Gas:**	Helium	**Scale Rate:**	Flow is in SCFH	**Full Flow SCFH [FS]:**	225

Testing Instrument:	Mass Flow Meter	Alicat 400 scfh	**Serial Number:**	282155

Flow Tube SCFH Set Point	Flow Tube SCFH Converted		As Found NIST SCFH	As Found Actual SCFH Deviation	As Found SCFH % Deviation	Tolerences Pass/Fail	As Left NIST SCFH	As Left SCFH Deviation	As Left SCFH % Deviation		Tolerences Pass/Fail
40	40		42.6	2.6	**1.2**	Pass	42.6	2.6	**1.2**		Pass
60	60		63.1	3.1	**1.4**	Pass	63.1	3.1	**1.4**		Pass
80	80		82.7	2.7	**1.2**	Pass	82.7	2.7	**1.2**		Pass
100	100		102.8	2.8	**1.2**	Pass	102.8	2.8	**1.2**		Pass
120	120		122.7	2.7	**1.2**	Pass	122.7	2.7	**1.2**		Pass
140	140		143.8	3.8	**1.7**	Pass	143.8	3.8	**1.7**		Pass
160	160		162.8	2.8	**1.2**	Pass	162.8	2.8	**1.2**		Pass
180	180		182.8	2.8	**1.2**	Pass	182.8	2.8	**1.2**		Pass
200	200		203.8	3.8	**1.7**	Pass	203.8	3.8	**1.7**		Pass



	1	2	3	4	5	6	7	8	9
Flow SCFH As Found	42.6	63.1	82.7	102.8	122.7	143.8	162.8	182.8	203.8
Flow SCFH As Left	42.6	63.1	82.7	102.8	122.7	143.8	162.8	182.8	203.8
SCFH Set Points	40	60	80	100	120	140	160	180	200

Calibrated By:	Jeremy Bailey			
Calibrated Date:	15-Feb-24	**Calibration Due:**	15-Feb-25	**Signature:**

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