APPENDIX I

Sampling Equipment/Instrumentation Calibration Documentation

Temperature Readout Calibration

Isokinetic Sampling Consoles

Readout ID Number: A161395
Reference Thermometer ID Number: 111858733
Voltage Generator ID Number: A178550

Calibrated by: EDF
Date: 6/28/13
Reviewed by: NMP
Date: 7/3/13

Temperature Readout Calibration [1]

Reference Thermometer (°F)	32
Temperature Readout (°F)	33
Was Readout adjusted?	☑ yes ☐ no

Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference [2,3]
1	0.0	32	32	0
	1.0	77	76	-1
	3.0	165	165	0
	5.0	251	253	2
	7.0	341	341	0
	10.0	475	474	-1
	15.0	692	694	2
	20.0	905	907	2
	30.0	1329	1331	2
	40.0	1772	1774	2
2	0.0	32	32	0
	3.0	165	165	0
	4.0	208	209	1
	5.0	251	253	2
	7.0	341	341	0
3	0.0	32	32	0
	3.0	165	165	0
	4.0	208	209	1
	5.0	251	253	2
	7.0	341	342	1

Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference
4	-1.0	-10	-11	-1
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	120	-1
	3.0	165	164	-1
5	-1.0	-10	-11	-1
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	121	0
	3.0	165	165	0
6	-1.0	-10	-11	-1
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	121	0
	3.0	165	165	0
7	-1.0	-10	-11	-1
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	121	0
	3.0	165	165	0

[1] Reference thermometer and readout must agree within 2°F.

[2] Difference is calculated as follows:

Difference = Observed - Theoretical

[3] Acceptable difference is ±5°F for temperatures below 1000°F and ±10°F for temperatures above 1000°F.

CDS-02 Temperature Readout
Per EM SOP-001
Revision Date: January 2012
Reviewed: January 2013

Five-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161395

Thermometer ID 111858733

Calibrated by	Initials	MLb/EOF	Reviewed by	Initials	NMP	Leak Check	(+)	OK
	Date	06-28-13		Date	7/3/13		(-)	OK

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B	Run 4A	Run 4B	Run 5A	Run 5B
Critical Orifice	Identification Number	N-1		N-2		N-3		N-4		N-5	
	K Factor	0.2647		0.3629		0.5193		0.6109		0.7198	
Subject DGM	DGM Initial Reading (ft^3)	761.995	767.130	721.853	727.708	732.869	739.548	746.246	754.118	772.272	781.536
	DGM Final Reading (ft^3)	767.130	772.272	727.488	732.869	739.548	746.246	754.118	761.995	781.536	790.817
	Initial DGM Temperature (°F)	75	75	73.	73	73	73	74	75	75	76
	Final DGM Temperature (°F)	75	75	73	73	73	74	75	75	76	76
Test Time (minutes)		15	15	12	11	10	10	10	10	10	10
Orifice Manometer, ΔH ("H_2O)		0.35	0.35	0.69	0.68	1.5	1.5	2.0	2.0	2.8	2.8
Barometric Pressure ("Hg)		29.12	29.12	29.14	29.14	29.12	29.12	29.12	29.12	29.12	29.12
Ambient Temperature (°F)		75	75	75	75	75	75	75	75	76	76
Pump Vacuum ("Hg)		23.0	23.0	22.5	22.5	20.5	20.5	19.0	19.0	18.0	18.0

Notes:

CDS-04 DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

R5-2014-0104710000094

5 Point Console Dry Gas Meter Calibration

Console ID: A161395

Calibrated by	Initials	EDF
	Date	6/28/13
Reviewed by	Initials	NMP
	Date	7/3/13

Expiration Date
27-Dec-2013

Orifice ID:	N-1		N-2		N-3		N-4		N-5	
Orifice K':	0.2647		0.3629		0.5193		0.6109		0.7198	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #4a	Run #4b	Run #5a	Run #5b
Initial Reading, (ft^3)	761.995	767.130	721.853	727.708	732.869	739.548	746.246	754.118	772.272	781.536
Final Reading, (ft^3)	767.130	772.272	727.488	732.869	739.548	746.246	754.118	761.995	781.536	790.817
Difference, (ft^3)	5.135	5.142	5.635	5.161	6.679	6.698	7.872	7.877	9.264	9.281
Initial Meter Temp., (°F)	75	75	73	73	73	73	74	75	75	76
Final Meter Temp., (°F)	75	75	73	73	73	74	75	75	76	76
Average Meter Temp., (°F)	75.0	75.0	73.0	73.0	73.0	73.5	74.5	75.0	75.5	76.0
Test Time (min.)	15	15	12	11	10	10	10	10	10	10
Orifice Manometer Reading, ("H_2O)	0.35	0.35	0.69	0.68	1.50	1.50	2.00	2.00	2.80	2.80
Barometric Pressure, ("Hg)	29.12	29.12	29.14	29.14	29.12	29.12	29.12	29.12	29.12	29.12
Ambient Temperature, (°F)	75	75	75	75	75	75	75	75	76	76
Pump Vacuum, ("Hg)	23	23	22.5	22.5	20.5	20.5	19	19	18	18
Standard Volume of the Meter, (V_{mstd})	4.935	4.941	5.444	4.986	6.461	6.474	7.604	7.601	8.949	8.957
Standard Volume of Critical Orifice, (V_{crstd})	4.999	4.999	5.486	5.029	6.538	6.538	7.691	7.691	9.054	9.054
Flow Rate (cfm)	0.329	0.329	0.454	0.453	0.646	0.647	0.760	0.760	0.895	0.896
DGM Calibration Factor, (Y)	1.013	1.012	1.008	1.009	1.012	1.010	1.012	1.012	1.012	1.011
Average DGM Calibration Factor (Y)	1.012		1.008		1.011		1.012		1.011	
Delta H@, ("H_2O)	1.706	1.706	1.798	1.772	1.918	1.916	1.847	1.845	1.870	1.868
Average ΔH@, ("H_2O)	1.706		1.785		1.917		1.846		1.869	

Current Average Y	1.011
All Individual Y within 2% of mean?	TRUE
Average Delta $H_@$	1.824
All individual $\Delta H_@$ within 0.20 "H_2O of mean	TRUE

CDS-045 DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

R5-2014-0104710000094

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161395

Calibrated by	Initials	mlb	Reviewed by	Initials	NMP	Leak Check	(+)	OK
	Date	8/7/13		Date	8/9/13		(-)	OK

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N-2		N-3		N-4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	941.837	947.865	953.895	960.503	967.796	975.623
		DGM Final Reading (ft^3)	947.865	953.895	960.503	967.796	975.623	984.250
		Initial Temperature (°F)	68	68	69	70	72	73
		Final Temperature (°F)	68	69	70	72	73	73
	Test Time (minutes)		13	13	10	11	10	11
	Orifice Manometer, ΔH ("H_2O)		0.70	0.70	1.4	1.4	2.0	2.0
	Barometric Pressure ("Hg)		29.10	29.10	29.10	29.10	29.10	29.10
	Ambient Temperature (°F)		73.0	73.0	74.0	74.0	75.0	75.0
	Pump Vacuum ("Hg)		21.0	21.0	19.5	19.5	18.0	18.0

Temperature Readout Calibration

Check the readout against a NIST Thermometer

NIST Thermometer ID	111858733
Thermometer Reading (°F)	32
Readout Reading (°F)	32

Check the readout linearity (one channel only)

Voltage Supply ID	27470881	Channel No	1
Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	76	-1
3	165	165	0
7	341	341	0
15	692	693	1

R5-2014-0104710000094

Pre/Post Test Console Calibration Check

Console ID		A161395
Calibrated by	Initials	mlb
	Date	8/7/13
Reviewed by	Initials	NMP
	Date	8/9/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	941.837	947.865	953.895	960.503	967.796	975.623
Final Reading, (ft^3)	947.865	953.895	960.503	967.796	975.623	984.250
Difference, (ft^3)	6.028	6.030	6.608	7.293	7.827	8.627
Initial Meter Temp., (°F)	68	68	69	70	72	73
Final Meter Temp., (°F)	68	69	70	72	73	73
Average Meter Temp., (°F)	68.0	68.5	69.5	71.0	72.5	73.0
Test Time (min.)	13	13	10	11	10	11
Orifice Manometer Reading, ("H_2O)	0.70	0.70	1.40	1.40	2.00	2.00
Barometric Pressure, ("Hg)	29.10	29.10	29.10	29.10	29.10	29.10
Ambient Temperature, (°F)	73	73	74	74	75	75
Pump Vacuum, ("Hg)	21	21	19.5	19.5	18	18
Standard Volume of the Meter, (Vmstd)	5.871	5.867	6.429	7.075	7.583	8.351
Standard Volume of Critical Orifice, (Vcrstd)	5.946	5.946	6.539	7.193	7.686	8.454
DGM Calibration Factor, (Y)	1.013	1.014	1.017	1.017	1.014	1.012
Delta H@	1.84	1.84	1.80	1.79	1.86	1.85

Average Y =	1.014
Reference Yd =	1.011
Percent Difference =	0.3
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.829

CDS-0451 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Pre/Post Test Console Calibration Check

Console ID	A161395	
Calibrated by	Initials	NMP
	Date	11/11/13
Reviewed by	Initials	[illegible]
	Date	11/18/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	736.557	741.693	750.558	757.225	764.564	772.406
Final Reading, (ft^3)	741.693	750.558	757.225	764.564	772.406	780.258
Difference, (ft^3)	5.136	8.865	6.667	7.339	7.842	7.852
Initial Meter Temp., (°F)	70	70	71	72	72	73
Final Meter Temp., (°F)	70	71	72	72	73	73
Average Meter Temp., (°F)	70.0	70.5	71.5	72.0	72.5	73.0
Test Time (min.)	11	19	10	11	10	10
Orifice Manometer Reading, ("H_2O)	0.71	0.71	1.50	1.50	2.10	2.10
Barometric Pressure, ("Hg)	29.43	29.43	29.43	29.43	29.43	29.43
Ambient Temperature, (°F)	68	68	68	68	68	68
Pump Vacuum, ("Hg)	22	22	20	20	19	19
Standard Volume of the Meter, (Vmstd)	5.040	8.691	6.536	7.189	7.685	7.688
Standard Volume of Critical Orifice, (Vcrstd)	5.113	8.831	6.651	7.316	7.824	7.824
DGM Calibration Factor, (Y)	1.014	1.016	1.018	1.018	1.018	1.018
Delta H@	1.82	1.82	1.88	1.88	1.90	1.90

Average Y =	1.017
Reference Yd =	1.011
Percent Difference =	0.6
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.865

CDS-0452 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161395

Calibrated by	Initials	NMP	Reviewed by	Initials	MB	Leak Check	(+)	✓
	Date	11/11/13		Date	11/12/13		(-)	✓

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N2		N3		N4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	736.557	741.693	750.558	757.225	764.564	772.406
		DGM Final Reading (ft^3)	741.693	750.558	757.225	764.564	772.406	780.258
		Initial Temperature (°F)	70	70	71	72	72	73
		Final Temperature (°F)	70	71	72	72	73	73
	Test Time (minutes)		11	19	10	11	10	10
	Orifice Manometer, ΔH ("H_2O)		0.71	0.71	1.50	1.50	2.10	2.10
	Barometric Pressure ("Hg)		29.43	29.43	29.43	29.43	29.43	29.43
	Ambient Temperature (°F)		68	68	68	68	68	68
	Pump Vacuum ("Hg)		22	22	20	20	19	19

Temperature Readout Calibration

Check the readout against a NIST Thermometer	
NIST Thermometer ID	111858733
Thermometer Reading (°F)	32
Readout Reading (°F)	32

Check the readout linearity (one channel only)

Voltage Supply ID	27470881	Channel No	1
Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	76	-1
3	165	164	-1
7	341	341	0
15	692	695	3

R5-2014-0104710000094

R5-2014-0104710000094

5 Point Console Dry Gas Meter Calibration

Console ID: A161399

Calibrated by	Initials	EDF
	Date	6/26/13
Reviewed by	Initials	MTB
	Date	6/28/13.

Expiration Date
25-Dec-2013

Orifice ID:	N-1		N-2		N-3		N-4		N-5	
Orifice K':	0.2647		0.3629		0.5193		0.6109		0.7198	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #4a	Run #4b	Run #5a	Run #5b
Initial Reading, (ft^3)	686.581	691.691	696.813	701.987	708.308	715.082	721.851	729.852	737.849	747.256
Final Reading, (ft^3)	691.691	696.813	701.987	707.193	715.082	721.851	729.852	737.849	747.256	756.718
Difference, (ft^3)	5.110	5.122	5.174	5.206	6.774	6.769	8.001	7.997	9.407	9.462
Initial Meter Temp., (°F)	74	74	74	74	74	74	74	74	74	74
Final Meter Temp., (°F)	74	74	74	74	74	74	74	74	74	75
Average Meter Temp., (°F)	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.5
Test Time (min.)	15	15	11	11	10	10	10	10	10	10
Orifice Manometer Reading, ("H_2O)	0.35	0.35	0.68	0.67	1.40	1.40	2.00	2.00	2.80	2.80
Barometric Pressure, ("Hg)	29.17	29.17	29.16	29.16	29.16	29.16	29.11	29.11	29.11	29.11
Ambient Temperature, (°F)	74	74	74	74	75	75	74	74	74	74
Pump Vacuum, ("Hg)	21.5	21.5	20.5	20.5	18.5	18.5	17	17	15.5	15.5
Standard Volume of the Meter, (V_{mstd})	4.928	4.940	4.992	5.023	6.548	6.543	7.733	7.729	9.110	9.155
Standard Volume of Critical Orifice, (V_{crstd})	5.012	5.012	5.037	5.037	6.547	6.547	7.696	7.696	9.067	9.067
Flow Rate (cfm)	0.329	0.329	0.454	0.457	0.655	0.654	0.773	0.773	0.911	0.915
DGM Calibration Factor, (Y)	1.017	1.015	1.009	1.003	1.000	1.001	0.995	0.996	0.995	0.990
Average DGM Calibration Factor (Y)	1.016		1.006		1.000		0.995		0.993	
Delta H@, ("H_2O)	1.703	1.703	1.764	1.738	1.783	1.783	1.846	1.846	1.869	1.867
Average ΔH@, ("H_2O)	1.703		1.751		1.783		1.846		1.868	

Current Average Y	1.002
All Individual Y within 2% of mean?	TRUE
Average Delta $H_@$	1.790
All individual $\Delta H_@$ within 0.20 "H_2O of mean	TRUE

CDS-04S DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

Five-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161399

Thermometer ID 111858733

Calibrated by	Initials	EDF	Reviewed by	Initials	MB	Leak Check	(+)	OK
	Date	6/26/13		Date	6/28/13		(-)	OK

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B	Run 4A	Run 4B	Run 5A	Run 5B
Critical Orifice	Identification Number	N-1		N-2		N-3		N-4		N-5	
	K Factor	0.2647		0.3629		0.5193		0.6109		0.7198	
Subject DGM	DGM Initial Reading (ft^3)	686.581	691.691	696.813	701.987	~~707.193~~ 708.308	715.082	721.851	729.852	737.849	747.256
	DGM Final Reading (ft^3)	691.691	696.813	701.987	707.193	715.082	721.851	729.852	737.849	747.256	756.718
	Initial DGM Temperature (°F)	74	74	74	74	74	74	74	74	74	74
	Final DGM Temperature (°F)	74	74	74	74	74	74	74	74	74	75
Test Time (minutes)		15	15	11	11	10	10	10	10	10	10
Orifice Manometer, ΔH ("H_2O)		0.35	0.35	0.68	0.67	1.4	1.4	2.0	2.0	2.8	2.8
Barometric Pressure ("Hg)		29.17	29.17	29.16	29.16	29.16	29.16	29.11	29.11	29.11	29.11
Ambient Temperature (°F)		74	74	74	74	75	75	74	74	74	74
Pump Vacuum ("Hg)		21.5	21.5	20.5	20.5	18.5	18.5	17.0	17.0	15.5	15.5

Notes:

CDS-04 DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

Temperature Readout Calibration

Isokinetic Sampling Consoles

Readout ID Number: A161399
Reference Thermometer ID Number: 111858733
Voltage Generator ID Number: A178550

Calibrated by: EDF
Date: 6/26/13
Reviewed by: MHB
Date: 06/28/13

Temperature Readout Calibration [1]

Reference Thermometer (°F)	32
Temperature Readout (°F)	32
Was Readout adjusted?	☐yes ☑no

Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F) Theoretical	Observed	Difference [2,3]
1	0.0	32	32	0
	1.0	77	76	-1
	3.0	165	165	0
	5.0	251	253	2
	7.0	341	342	1
	10.0	475	475	0
	15.0	692	695	3
	20.0	905	907	2
	30.0	1329	1332	3
	40.0	1772	1777	5
2	0.0	32	32	0
	3.0	165	165	0
	4.0	208	210	2
	5.0	251	254	3
	7.0	341	342	1
3	0.0	32	32 ~~0~~ EDF 6/26	0
	3.0	165	165	0
	4.0	208	209	1
	5.0	251	254	3
	7.0	341	342	1

Channel	Voltage (mV)	Temperature (°F) Theoretical	Observed	Difference
4	-1.0	-10	-12	-2
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	120	-1
	3.0	165	165	0
5	-1.0	-10	-12	-2
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	120	-1
	3.0	165	165	0
6	-1.0	-10	-12	-2
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	121	0
	3.0	165	165	0
7	-1.0	-10	-12	-2
	0.0	32	32	0
	1.0	77	76	-1
	2.0	121	120	-1
	3.0	165	165	0

[1] Reference thermometer and readout must agree within 2°F.
[2] Difference is calculated as follows:

Difference = Observed - Theoretical

[3] Acceptable difference is ±5°F for temperatures below 1000°F and ±10°F for temperatures above 1000°F.

CDS-02 Temperature Readout
Per EM SOP-001
Revision Date: January 2012
Reviewed: January 2013

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161399

Calibrated by	Initials	mlb	Reviewed by	Initials	NMP	Leak Check	(+)	OK
	Date	8/7/13		Date	8/9/13		(-)	OK

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N-2		N-3		N-4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	756.853	762.782	768.700	775.278	781.898	789.754
		DGM Final Reading (ft^3)	762.782	768.700	775.278	781.898	789.754	797.689
		Initial Temperature (°F)	66	67	69	69	70	71
		Final Temperature (°F)	67	69	69	70	71	72
	Test Time (minutes)		13	13	10	10	10	10
	Orifice Manometer, ΔH ("H_2O)		0.68	0.68	1.4	1.4	1.9	1.9
	Barometric Pressure ("Hg)		29.10	29.10	29.10	29.10	29.10	29.10
	Ambient Temperature (°F)		70.0	70.0	71.0	71.0	72.0	72.0
	Pump Vacuum ("Hg)		~~20.5~~ 20.5	20.5	19.0	19.0	17.5	17.5

Temperature Readout Calibration

Check the readout against a NIST Thermometer	
NIST Thermometer ID	111858733
Thermometer Reading (°F)	32
Readout Reading (°F)	32

Check the readout linearity (one channel only)

Voltage Supply ID	27470881	Channel No	1
Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	77	0
3	165	165	0
7	341	343	2
15	692	693	1

R5-2014-0104710000094

Pre/Post Test Console Calibration Check

Console ID	A161399	
Calibrated by	Initials	mlb
	Date	8/7/13
Reviewed by	Initials	NMP
	Date	8/5/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	756.853	762.782	768.700	775.278	781.898	789.754
Final Reading, (ft^3)	762.782	768.700	775.278	781.898	789.754	797.689
Difference, (ft^3)	5.929	5.918	6.578	6.620	7.856	7.935
Initial Meter Temp., (°F)	66	67	69	69	70	71
Final Meter Temp., (°F)	67	69	69	70	71	72
Average Meter Temp., (°F)	66.5	68.0	69.0	69.5	70.5	71.5
Test Time (min.)	13	13	10	10	10	10
Orifice Manometer Reading, ("H_2O)	0.68	0.68	1.40	1.40	1.90	1.90
Barometric Pressure, ("Hg)	29.10	29.10	29.10	29.10	29.10	29.10
Ambient Temperature, (°F)	70	70	71	71	72	72
Pump Vacuum, ("Hg)	20.5	20.5	19	19	17.5	17.5
Standard Volume of the Meter, (Vmstd)	5.791	5.763	6.406	6.440	7.638	7.700
Standard Volume of Critical Orifice, (Vcrstd)	5.963	5.963	6.558	6.558	7.707	7.707
DGM Calibration Factor, (Y)	1.030	1.035	1.024	1.018	1.009	1.001
Delta H@	1.78	1.77	1.79	1.79	1.76	1.75

Average Y =	1.019
Reference Yd =	1.002
Percent Difference =	1.7
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.774

CDS-04S1 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161399

Calibrated by	Initials	NMP	Reviewed by	Initials	MLB	Leak Check	(+)	✓
	Date	11/7/13		Date	11/12/13		(-)	✓

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N2		N3		N4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	826.977	~~832.705~~ NMP 11/7/13	813.~~460~~ 421	820.191	~~839.884~~ NMP 11/7/13	852.377
		DGM Final Reading (ft^3)	832.705	833.694 839.884	820.191	826.977	842.756	872.471
		Initial Temperature (°F)	69	69	67	68	70 852377	71
		Final Temperature (°F)	69	70	68	68	71	71
		Test Time (minutes)	~~10~~ 12	13	10	10	12	25
		Orifice Manometer, ΔH ("H_2O) NMP 11/7/13	0.68	0.68	1.45	1.45	2.00	2.00
		Barometric Pressure ("Hg)	29.55	29.55	29.55	29.55	29.55	29.55
		Ambient Temperature (°F)	66	66	66	66	66	66
		Pump Vacuum ("Hg)	22	22	20	20	18	18

Temperature Readout Calibration

Check the readout against a NIST Thermometer	
NIST Thermometer ID	111858733
Thermometer Reading (°F)	32
Readout Reading (°F)	32

Check the readout linearity (one channel only)

Voltage Supply ID	27470881	Channel No	1
Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	77	0
3	165	165	0
7	341	342	1
15	692	695	3

R5-2014-0104710000094

Pre/Post Test Console Calibration Check

Console ID		A161399
Calibrated by	Initials	nmp
	Date	11.7.13
Reviewed by	Initials	MB
	Date	11/12/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	826.977	833.694	813.421	820.191	842.756	852.377
Final Reading, (ft^3)	832.705	839.884	820.191	826.977	852.377	872.471
Difference, (ft^3)	5.728	6.190	6.770	6.786	9.621	20.094
Initial Meter Temp., (°F)	69	69	67	68	70	71
Final Meter Temp., (°F)	69	70	68	68	71	71
Average Meter Temp., (°F)	69.0	69.5	67.5	68.0	70.5	71.0
Test Time (min.)	12	13	10	10	12	25
Orifice Manometer Reading, ("H_2O)	0.68	0.68	1.45	1.45	2.00	2.00
Barometric Pressure, ("Hg)	29.55	29.55	29.55	29.55	29.55	29.55
Ambient Temperature, (°F)	66	66	66	66	66	66
Pump Vacuum, ("Hg)	22	22	20	20	18	18
Standard Volume of the Meter, (Vmstd)	5.654	6.104	6.714	6.724	9.501	19.824
Standard Volume of Critical Orifice, (Vcrstd)	5.611	6.078	6.691	6.691	9.445	19.678
DGM Calibration Factor, (Y)	0.992	0.996	0.997	0.995	0.994	0.993
Delta H@	1.73	1.73	1.81	1.81	1.80	1.80

Average Y =	0.994
Reference Yd =	1.002
Percent Difference =	-0.8
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.782

CDS-0452 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Five-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A16401

Thermometer ID 111858733

Calibrated by	Initials	mlb	Reviewed by	Initials	EDF	Leak Check	(+)	OK
	Date	5-31-13		Date	6-3-13		(-)	OK

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B	Run 4A	Run 4B	Run 5A	Run 5B
Critical Orifice	Identification Number	N-1		N-2		N-3		N-4		N5	
	K Factor	0.2647		0.3629		0.5193		0.6109		0.7198	
Subject DGM	DGM Initial Reading (ft^3)	273.143	278.708	227.617	235.235	242.843	249.607	256.368	264.359	284.259	298.350
	DGM Final Reading (ft^3)	278.708	284.259	235.230	242.842	249.607	256.368	264.359	273.143	298.350	312.457
	Initial DGM Temperature (°F)	75	76	71	71	72	73	74	75	77	77
	Final DGM Temperature (°F)	76	76	71	72	73	74	75	75	77	77
Test Time (minutes)		16	16	16	16	10	10	10	11	15	15
Orifice Manometer, ΔH ("H_2O)		0.33	0.33	0.64	0.64	1.3	1.3	1.8	1.8	2.5	2.5
Barometric Pressure ("Hg)		29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10
Ambient Temperature (°F)		75	75	72	72	73	73	74	74	75	75
Pump Vacuum ("Hg)		21.5	21.5	20.5	20.5	18.5	18.5	17.5	17.5.	16.0	16.0

Notes:

CDS-04 DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

5 Point Console Dry Gas Meter Calibration

Console ID A161401

Calibrated by	Initials	mlb
	Date	5/31/13
Reviewed by	Initials	EOF
	Date	6/3/13

Expiration Date
29-Nov-2013

Orifice ID:	N-1		N-2		N-3		N-4		N-5	
Orifice K':	0.2647		0.3629		0.5193		0.6109		0.7198	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #4a	Run #4b	Run #5a	Run #5b
Initial Reading, (ft^3)	273.143	278.708	227.617	235.235	242.843	249.607	256.368	264.359	284.259	298.350
Final Reading, (ft^3)	278.708	284.259	235.230	242.842	249.607	256.368	264.359	273.143	298.350	312.457
Difference, (ft^3)	5.565	5.551	7.613	7.607	6.764	6.761	7.991	8.784	14.091	14.107
Initial Meter Temp., (°F)	75	76	71	71	72	73	74	75	77	77
Final Meter Temp., (°F)	76	76	71	72	73	74	75	75	77	77
Average Meter Temp., (°F)	75.5	76.0	71.0	71.5	72.5	73.5	74.5	75.0	77.0	77.0
Test Time (min.)	16	16	16	16	10	10	10	11	15	15
Orifice Manometer Reading, ("H_2O)	0.33	0.33	0.64	0.64	1.30	1.30	1.80	1.80	2.50	2.50
Barometric Pressure, ("Hg)	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10
Ambient Temperature, (°F)	75	75	72	72	73	73	74	74	75	75
Pump Vacuum, ("Hg)	21.5	21.5	20.5	20.5	18.5	18.5	17.5	17.5	16	16
Standard Volume of the Meter, (V_{mstd})	5.339	5.321	7.371	7.359	6.542	6.527	7.709	8.466	13.555	13.570
Standard Volume of Critical Orifice, (V_{crstd})	5.328	5.328	7.326	7.326	6.546	6.546	7.693	8.462	13.584	13.584
Flow Rate (cfm)	0.334	0.333	0.461	0.460	0.654	0.653	0.771	0.770	0.904	0.905
DGM Calibration Factor, (Y)	0.998	1.001	0.994	0.995	1.001	1.003	0.998	1.000	1.002	1.001
Average DGM Calibration Factor (Y)	1.000		0.995		1.002		0.999		1.002	
Delta H@, ("H_2O)	1.608	1.606	1.666	1.665	1.657	1.654	1.659	1.657	1.661	1.661
Average ΔH@, ("H_2O)	1.607		1.665		1.655		1.658		1.661	

Current Average Y	0.999
All Individual Y within 2% of mean?	TRUE
Average Delta $H_@$	1.649
All individual $\Delta H_@$ within 0.20 "H_2O of mean	TRUE

CDS-04S DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

Temperature Readout Calibration

Isokinetic Sampling Consoles

Readout ID Number: A161401
Reference Thermometer ID Number: 111858733
Voltage Generator ID Number: A178550

Calibrated by: MLB
Date: 5-31-2013
Reviewed by: EOF
Date: 6-3-2013

Temperature Readout Calibration[1]

Reference Thermometer (°F)	32
Temperature Readout (°F)	32
Was Readout adjusted?	☐yes ☑no

Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F)			Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference[2,3]			Theoretical	Observed	Difference
1	0.0	32	32	0	4	-1.0	-10	-10	0
	1.0	77	76	-1		0.0	32	32	0
	3.0	165	165	0		1.0	77	76	-1
	5.0	251	252	1		2.0	121	120	-1
	7.0	341	341	0		3.0	165	164	-1
	10.0	475	473	-2	5	-1.0	-10	-10	0
	15.0	692	694	2		0.0	32	32	0
	20.0	905	905	0		1.0	77	77	0
	30.0	1329	1329	0		2.0	121	121	0
	40.0	1772	1772	0		3.0	165	165	0
2	0.0	32	32	0	6	-1.0	-10	-10	0
	3.0	165	165	0		0.0	32	32	0
	4.0	208	209	1		1.0	77	77	0
	5.0	251	253	2		2.0	121	121	0
	7.0	341	341	0		3.0	165	165	0
3	0.0	32	32	0	7	-1.0	-10	-10	0
	3.0	165	165	0		0.0	32	32	0
	4.0	208	209	1		1.0	77	76	-1
	5.0	251	253	2		2.0	121	121	0
	7.0	341	342	1		3.0	165	164	-1

[1] Reference thermometer and readout must agree within 2°F.

[2] Difference is calculated as follows:

Difference = Observed - Theoretical

[3] Acceptable difference is ±5°F for temperatures below 1000°F and ±10°F for temperatures above 1000°F.

CDS-02 Temperature Readout
Per EM SOP-001
Revision Date: January 2012
Reviewed: January 2013

Pre/Post Test Console Calibration Check

Console ID		A161401
Calibrated by	Initials	mlb
	Date	8/6/13
Reviewed by	Initials	NMP
	Date	8/7/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	435.015	441.162	447.312	454.084	461.528	469.511
Final Reading, (ft^3)	441.162	447.319	454.084	461.528	469.511	477.499
Difference, (ft^3)	6.147	6.157	6.772	7.444	7.983	7.988
Initial Meter Temp., (°F)	68	69	71	72	73	74
Final Meter Temp., (°F)	69	71	72	72	74	75
Average Meter Temp., (°F)	68.5	70.0	71.5	72.0	73.5	74.5
Test Time (min.)	13	13	10	11	10	10
Orifice Manometer Reading, ("H_2O)	0.66	0.66	1.30	1.30	1.80	1.80
Barometric Pressure, ("Hg)	29.14	29.14	29.14	29.14	29.14	29.14
Ambient Temperature, (°F)	71	71	72	72	73	73
Pump Vacuum, ("Hg)	21	21	19	19	17.5	17.5
Standard Volume of the Meter, (Vmstd)	5.989	5.981	6.571	7.216	7.727	7.717
Standard Volume of Critical Orifice, (Vcrstd)	5.966	5.966	6.561	7.217	7.711	7.711
DGM Calibration Factor, (Y)	0.996	0.997	0.998	1.000	0.998	0.999
Delta H@	1.72	1.72	1.65	1.65	1.66	1.65

Average Y =	0.998
Reference Yd =	0.999
Percent Difference =	-0.1
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.676

CDS-0451 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161401

Calibrated by	Initials	MLB	Reviewed by	Initials	NMP	Leak Check	(+)	OK
	Date	8/6/13		Date	8/7/13		(-)	OK

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N-2		N-3		N-4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	435.015	441.162	447.312	454.084	461.528	469.511
		DGM Final Reading (ft^3)	441.162	447.319	454.084	461.528	469.511	477.499
		Initial Temperature (°F)	68	69	71	72	73	74
		Final Temperature (°F)	69	71	72	72	74	75
	Test Time (minutes)		13	13	10	11	10	10
	Orifice Manometer, ΔH ("H_2O)		0.66	0.66	1.3	1.3	1.8	1.8
	Barometric Pressure ("Hg)		29.14	29.14	29.14	29.14	29.14	29.14
	Ambient Temperature (°F)		71.0	71.0	72.0	72.0	73.0	73.0
	Pump Vacuum ("Hg)		21.0	21.0	19.0	19.0	17.5	17.5

Temperature Readout Calibration

Check the readout against a NIST Thermometer	
NIST Thermometer ID	111858733
Thermometer Reading (°F)	32
Readout Reading (°F)	32

Check the readout linearity (one channel only)

Voltage Supply ID	27470881	Channel No	1
Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	77	0
3	165	165	0
7	341	341	0
15	692	694	2

R5-2014-0104710000094

Pre/Post Test Console Calibration Check

Console ID		A161401
Calibrated by	Initials	NMP
	Date	11/11/13
Reviewed by	Initials	MWB
	Date	11/12/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	846.065	851.329	808.429	815.238	829.214	837.230
Final Reading, (ft^3)	851.329	856.599	815.238	828.880	837.230	846.065
Difference, (ft^3)	5.264	5.270	6.809	13.642	8.016	8.835
Initial Meter Temp., (°F)	73	73	71	71	72	73
Final Meter Temp., (°F)	73	74	71	72	73	73
Average Meter Temp., (°F)	73.0	73.5	71.0	71.5	72.5	73.0
Test Time (min.)	11	11	10	20	10	11
Orifice Manometer Reading, ("H_2O)	0.65	0.65	1.40	1.40	1.90	1.90
Barometric Pressure, ("Hg)	29.43	29.43	29.43	29.43	29.43	29.43
Ambient Temperature, (°F)	68	68	68	68	68	68
Pump Vacuum, ("Hg)	20	20	19	19	17	17
Standard Volume of the Meter, (Vmstd)	5.135	5.137	6.680	13.371	7.852	8.646
Standard Volume of Critical Orifice, (Vcrstd)	5.113	5.113	6.651	13.302	7.824	8.607
DGM Calibration Factor, (Y)	0.996	0.995	0.996	0.995	0.996	0.995
Delta H@	1.65	1.65	1.75	1.75	1.72	1.72

Average Y =	0.996
Reference Yd =	0.996
Percent Difference =	0.0
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.708

CDS-04S1 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A161401

Calibrated by	Initials	NMP	Reviewed by	Initials	MB	Leak Check	(+)	✓
	Date	11/11/13		Date	11/12/13		(-)	✓

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N2		N3		N4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	846.065	851.329	808.429	815.238	829.214 ~~828.880~~	837.230
		DGM Final Reading (ft^3)	851.329	856.599	815.238	828.880	837.230	846.065
		Initial Temperature (°F)	73	73	71	71	72	73
		Final Temperature (°F)	73	74	71	72	73	73
	Test Time (minutes)		11	11	10	20	10	11
	Orifice Manometer, ΔH ("H_2O)		0.65	0.65	1.40	1.40	1.90	1.90
	Barometric Pressure ("Hg)		29.43	29.43	29.43	29.43	29.43	29.43
	Ambient Temperature (°F)		68	68	68	68	68	68
	Pump Vacuum ("Hg)		20	20	19	19	17	17

Temperature Readout Calibration

Check the readout against a NIST Thermometer

NIST Thermometer ID	111858733
Thermometer Reading (°F)	32
Readout Reading (°F)	32

Check the readout linearity (one channel only)

Voltage Supply ID 27470881 — Channel No 1

Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	76	-1
3	165	164	-1
7	341	340	-1
15	692	692	0

R5-2014-0104710000094

Five-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A183521

Thermometer ID 111858733

Calibrated by	Initials	EDF	Reviewed by	Initials	DL	Leak Check	(+)	OK
	Date	6/25/13		Date	6-25-13		(-)	OK

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B	Run 4A	Run 4B	Run 5A	Run 5B
Critical Orifice	Identification Number	N-1		N-2		N-3		N-4		N-5	
	K Factor	0.2647		0.3629		0.5193		0.6109		0.7198	
Subject DGM	DGM Initial Reading (ft^3)	45.662	50.946	56.242	61.568	~~66.905~~ 67.891	74.017	80.943	89.096	97.268	106.844
	DGM Final Reading (ft^3)	50.946	56.242	61.568	66.905	74.017	80.943	89.096	97.268	106.844	116.438
	Initial DGM Temperature (°F)	75	75	76	77	77	77	77	78	78	78
	Final DGM Temperature (°F)	75	76	77	77	77	77	78	78	78	79
Test Time (minutes)		15	15	11	11	10	10	10	10	10	10
Orifice Manometer, ΔH ("H_2O)		0.34	0.34	0.65	0.65	1.4	1.4	1.9	1.9	2.7	2.7
Barometric Pressure ("Hg)		29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15
Ambient Temperature (°F)		76	76	77	77	76	76	76	76	76	76
Pump Vacuum ("Hg)		23.5	23.5	22.5	22.5	20.5	20.5	19.5	19.5	18.0	18.0

Notes:

CDS-04 DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

5 Point Console Dry Gas Meter Calibration

Console ID A183521

Calibrated by	Initials	EDF
	Date	6/25/13
Reviewed by	Initials	pl
	Date	6-25-13

Expiration Date
24-Dec-2013

Orifice ID:	N-1		N-2		N-3		N-4		N-5	
Orifice K':	0.2647		0.3629		0.5193		0.6109		0.7198	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #4a	Run #4b	Run #5a	Run #5b
Initial Reading, (ft^3)	45.662	50.946	56.242	61.568	67.091	74.017	80.943	89.096	97.268	106.844
Final Reading, (ft^3)	50.946	56.242	61.568	66.905	74.017	80.943	89.096	97.268	106.844	116.438
Difference, (ft^3)	5.284	5.296	5.326	5.337	6.926	6.926	8.153	8.172	9.576	9.594
Initial Meter Temp., (°F)	75	75	76	77	77	77	77	78	78	78
Final Meter Temp., (°F)	75	76	77	77	77	77	78	78	78	79
Average Meter Temp., (°F)	75.0	75.5	76.5	77.0	77.0	77.0	77.5	78.0	78.0	78.5
Test Time (min.)	15	15	11	11	10	10	10	10	10	10
Orifice Manometer Reading, ("H_2O)	0.34	0.34	0.65	0.65	1.40	1.40	1.90	1.90	2.70	2.70
Barometric Pressure, ("Hg)	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15
Ambient Temperature, (°F)	76	76	77	77	76	76	76	76	76	76
Pump Vacuum, ("Hg)	23.5	23.5	22.5	22.5	20.5	20.5	19.5	19.5	18	18
Standard Volume of the Meter, (V_{mstd})	5.083	5.090	5.113	5.119	6.655	6.655	7.837	7.848	9.215	9.224
Standard Volume of Critical Orifice, (V_{crstd})	4.999	4.999	5.021	5.021	6.538	6.538	7.692	7.692	9.063	9.063
Flow Rate (cfm)	0.339	0.339	0.465	0.465	0.666	0.666	0.784	0.785	0.921	0.922
DGM Calibration Factor, (Y)	0.984	0.982	0.982	0.981	0.982	0.982	0.981	0.980	0.984	0.983
Average DGM Calibration Factor (Y)	0.983		0.982		0.982		0.981		0.983	
Delta H@, ("H_2O)	1.658	1.657	1.688	1.686	1.777	1.777	1.745	1.744	1.792	1.790
Average ΔH@, ("H_2O)	1.658		1.687		1.777		1.745		1.791	

Current Average Y	0.982
All Individual Y within 2% of mean?	TRUE
Average Delta $H_@$	1.732
All individual $\Delta H_@$ within 0.20 "H_2O of mean	TRUE

CDS-045 DGM 5 point against orifice
Per EM SOP-002
Revision Date: March 2013

Temperature Readout Calibration

Isokinetic Sampling Consoles

Readout ID Number: A183521
Reference Thermometer ID Number: 111858733
Voltage Generator ID Number: A178550

Calibrated by: EDF
Date: 6/25/13
Reviewed by: DC
Date: 6/25/13

Temperature Readout Calibration[1]

Reference Thermometer (°F)	32
Temperature Readout (°F)	34
Was Readout adjusted?	☑ yes ☐ no

Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F)			Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference[2,3]			Theoretical	Observed	Difference
1	0.0	32	32	0	4	-1.0	-10	-12	-2
	1.0	77	76	-1		0.0	32	32	0
	3.0	165	165	0		1.0	77	76	-1
	5.0	251	253	2		2.0	121	120	-1
	7.0	341	342	1		3.0	165	164	-1
	10.0	475	474	-1	5	-1.0	-10	-12	-2
	15.0	692	694	2		0.0	32	32	0
	20.0	905	906	1		1.0	77	76	-1
	30.0	1329	1329	0		2.0	121	120	-1
	40.0	1772	1772	0		3.0	165	164	-1
2	0.0	32	32	0	6	-1.0	-10	-11	-1
	3.0	165	164	-1		0.0	32	32	0
	4.0	208	208	0		1.0	77	76	-1
	5.0	251	253	2		2.0	121	120	-1
	7.0	341	341	0		3.0	165	164	-1
3	0.0	32	32	0	7	-1.0	-10	-12	-2
	3.0	165	164	-1		0.0	32	32	0
	4.0	208	209	1		1.0	77	76	-1
	5.0	251	253	2		2.0	121	120	-1
	7.0	341	341	0		3.0	165	164	-1

[1] Reference thermometer and readout must agree within 2°F.
[2] Difference is calculated as follows:

Difference = Observed - Theoretical

[3] Acceptable difference is ±5°F for temperatures below 1000°F and ±10°F for temperatures above 1000°F.

CDS-02 Temperature Readout
Per EM SOP-001
Revision Date: January 2012
Reviewed: January 2013

Pre/Post Test Console Calibration Check

Console ID		A183521
Calibrated by	Initials	mlb
	Date	8/6/13
Reviewed by	Initials	NMP
	Date	8/7/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	156.124	162.384	168.645	175.528	182.429	190.564
Final Reading, (ft^3)	162.384	168.645	175.528	182.429	190.564	198.704
Difference, (ft^3)	6.260	6.261	6.883	6.901	8.135	8.140
Initial Meter Temp., (°F)	68	69	71	72	73	74
Final Meter Temp., (°F)	69	71	72	73	74	75
Average Meter Temp., (°F)	68.5	70.0	71.5	72.5	73.5	74.5
Test Time (min.)	13	13	10	10	10	10
Orifice Manometer Reading, ("H_2O)	0.67	0.67	1.30	1.30	1.80	1.80
Barometric Pressure, ("Hg)	29.14	29.14	29.14	29.14	29.14	29.14
Ambient Temperature, (°F)	74	74	75	75	75	75
Pump Vacuum, ("Hg)	21	21	19.5	19.5	18.5	18.5
Standard Volume of the Meter, (Vmstd)	6.099	6.083	6.679	6.683	7.874	7.864
Standard Volume of Critical Orifice, (Vcrstd)	5.949	5.949	6.542	6.542	7.696	7.696
DGM Calibration Factor, (Y)	0.975	0.978	0.980	0.979	0.977	0.979
Delta H@	1.76	1.75	1.66	1.66	1.66	1.66

Average Y =	0.978
Reference Yd =	0.982
Percent Difference =	-0.4
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.693

CDS-0451 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID A183521

Calibrated by	Initials	mlb	Reviewed by	Initials	NMP	Leak Check	(+)	OK
	Date	8/6/13		Date	8/7/13		(-)	OK.

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N-2		N-3		N-4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	156.124	162.384	168.645	175.528	182.429	190.564
		DGM Final Reading (ft^3)	162.384	168.645	175.528	182.429	190.564	198.704
		Initial Temperature (°F)	68	69	71	72	73	74
		Final Temperature (°F)	69	71	72	73	74	75
	Test Time (minutes)		13	13	10	10	10	10
	Orifice Manometer, ΔH ("H_2O)		0.67	0.67	1.3	1.3	1.8	1.8
	Barometric Pressure ("Hg)		29.14	29.14	29.14	29.14	29.14	29.14
	Ambient Temperature (°F)		74	74	75.0	75.0	75.0	75.0
	Pump Vacuum ("Hg)		21.0	21.0	19.5	19.5	18.5	18.5

Temperature Readout Calibration	Check the readout against a NIST Thermometer	
	NIST Thermometer ID	111858733
	Thermometer Reading (°F)	32
	Readout Reading (°F)	32

Check the readout linearity (one channel only)			
Voltage Supply ID	27470881	Channel No	1
Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	77	0
3	165	165	0
7	341	341	0
15	692	693	1

CDS-05 DGM Calibration, 3 point vs orifices
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Pre/Post Test Console Calibration Check

Console ID	A183521	
Calibrated by	Initials	NMP
	Date	11/11/13
Reviewed by	Initials	mS
	Date	11/12/13

Orifice ID:	N-2		N-3		N-4	
Orifice K':	0.3629		0.5193		0.6109	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	224.937	234.501	203.573	213.916	242.344	252.915
Final Reading, (ft^3)	234.501	242.344	213.916	224.937	252.915	261.047
Difference, (ft^3)	9.564	7.843	10.343	11.021	10.571	8.132
Initial Meter Temp., (°F)	68	69	67	68	70	70
Final Meter Temp., (°F)	69	70	67	68	70	71
Average Meter Temp., (°F)	68.5	69.5	67.0	68.0	70.0	70.5
Test Time (min.)	20	16	15	16	13	10
Orifice Manometer Reading, ("H_2O)	0.68	0.68	1.40	1.40	2.00	2.00
Barometric Pressure, ("Hg)	29.74	29.74	29.74	29.47	29.74	29.74
Ambient Temperature, (°F)	66	66	66	66	66	66
Pump Vacuum, ("Hg)	20	20	19	19	17	17
Standard Volume of the Meter, (Vmstd)	9.510	7.784	10.332	10.889	10.515	8.082
Standard Volume of Critical Orifice, (Vcrstd)	9.412	7.529	10.101	10.676	10.298	7.922
DGM Calibration Factor, (Y)	0.990	0.967	0.978	0.980	0.979	0.980
Delta H@	1.72	1.72	1.74	1.75	1.79	1.79

Average Y =	0.979
Reference Yd =	0.982
Percent Difference =	-0.3
Is Measured Y within 5% of Reference Yd?	TRUE
Average Delta H@ =	1.753

CDS-04S2 DGM 3 point cal check against orifice
Per EM SOP-003
Revision Date: March 2013

R5-2014-0104710000094

Three-Point Dry Gas Meter Calibration
(Against Critical Orifice)

Console ID ~~A167~~ A183521 NMP 11/12/13

Calibrated by	Initials	NMP	Reviewed by	Initials	MB	Leak Check	(+)	✓
	Date	11/12/13		Date	11/12/13		(-)	✓

			Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
DGM Calibration	Critical Orifice	Identification Number	N2		N3		N4	
		K Factor	0.3629		0.5193		0.6109	
	Subject DGM	DGM Initial Reading (ft^3)	224.937	234.501	203.573	213.916	242.344	252.915
		DGM Final Reading (ft^3)	234.501	242.344	213.916	224.937	252.915	261.047
		Initial Temperature (°F)	68	69	67	68	70	70
		Final Temperature (°F)	69	70	67	68	70	71
	Test Time (minutes)		20	16	15	16	13	10
	Orifice Manometer, ΔH ("H_2O)		0.68	0.68	1.4	1.4	2.0	2.0
	Barometric Pressure ("Hg)		29.74	29.74	29.74	29.47	29.74	29.74
	Ambient Temperature (°F)		66	66	66	66	66	66
	Pump Vacuum ("Hg)		20	20	19	19	17	17

Temperature Readout Calibration	Check the readout against a NIST Thermometer	
	NIST Thermometer ID	111858733
	Thermometer Reading (°F)	32
	Readout Reading (°F)	32

Check the readout linearity (one channel only)			
Voltage Supply ID	27470881	Channel No	1
Voltage (mv)	Theoretical (°F)	Observed (°F)	Difference (°F)
0	32	32	0
1	77	77	0
3	165	166	1
7	341	342	1
15	692	695	3

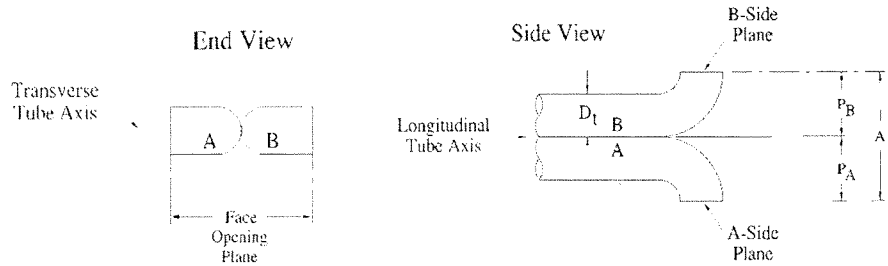
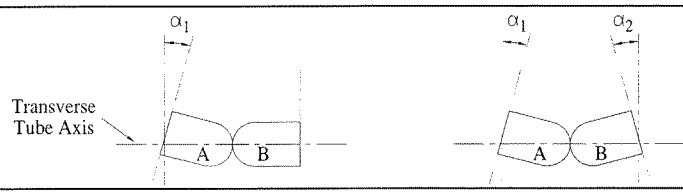
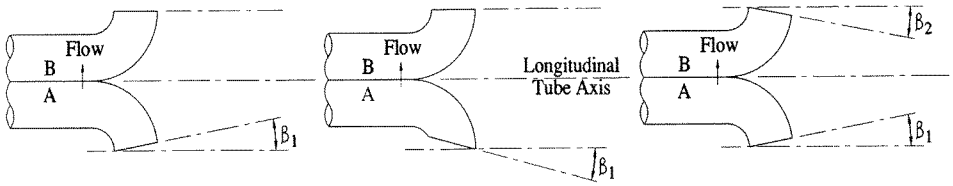
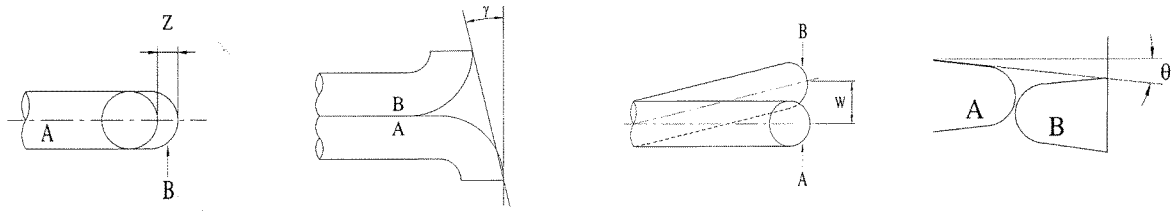
R5-2014-0104710000094

S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: 5-03

Caliper ID: 700802

Calibrated by	Initials	MAS	Reviewed by	Initials	CM
	Date	8-27-13		Date	9/6/13

General Pitot Tube Alignment		A = 0.938" D_t = 0.374" 0.188"≤ D_t ≤ 0.375"? Y (y/n) $1.05 \le A/2D_t \le 1.50$? Y (y/n)
Misalignment		α_1 = 0.7 ° α_2 = 0.6 ° α_1≤10°? Y (y/n) α_2≤10°? Y (y/n)
		β_1 = 0.8 β_2 = 0.3 β_1≤5°? Y (y/n) β_2≤5°? Y (y/n)
		γ = 3.3 ° θ = 0.1 ° Z = A tan(γ) = 0.054 W = A tan(θ) = 0.002 Z ≤ 0.125"? Y (y/n) W ≤ 0.031"? Y (y/n)
Acceptability for Use (Circle Selection)	If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84	If all answers except the first (D_t) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel. / Any other situation, the pitot tube must be removed from service.

Probe ID: 5-03

Calibrated by	Initials	MAS	Reviewed by	Initials	CM
	Date	8-27-13		Date	9/6/13

Stack Thermocouple Calibration [1]	Reference Thermometer ID No. [2]	Thermocouple Readout ID No.	Compare thermocouple to reference thermometer	Calculate applicability range for thermocouple	
	130090343 T_F 355°F $T_{abs,RT}$ 815 °R	A161402 T_F 353°F $T_{abs,TC}$ 813 °R	$\frac{T_{abs,TC}}{T_{abs,RT}}$ = 0.998 Is this between 0.985 and 1.015? ____(y/n)	$Min_{abs} = 0.9 \times T_{abs,TC}$ 732 °R	$Min_F = Min_{abs} - 460$ 272°F
				$Max_{abs} = 1.1 \times T_{abs,TC}$ 894 °R	$Max_F = Max_{abs} - 460$ 434°F

[1] Per SOP 032, this calibration is generally performed at 160°F.

[2] T_{abs} (°R) = T_F (°F) + 460

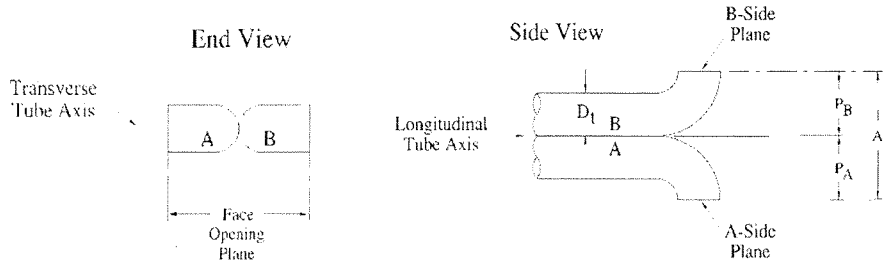
S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: ~~8-07~~ 5-07 MAS 8-27-13

Caliper ID: 700802

Calibrated by	Initials	MAS	Reviewed by	Initials	EM
	Date	8-27-13		Date	9/6/13

General Pitot Tube Alignment



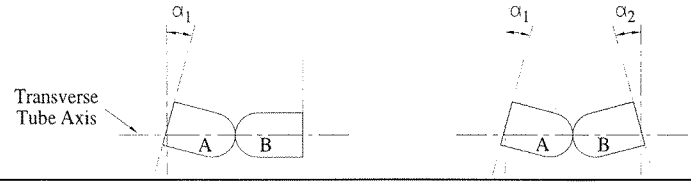
A = 0.949"

D_t = 0.375"

0.188" ≤ D_t ≤ 0.375"? Y (y/n)

$1.05 \le A/2D_t \le 1.50$? Y (y/n)

Misalignment

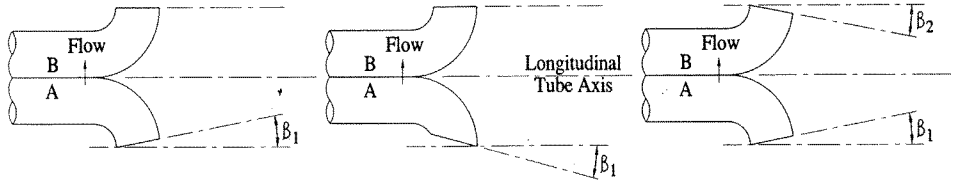


α_1 = 0.3 °

α_2 = 0.7 °

$\alpha_1 \le 10°$? Y (y/n)

$\alpha_2 \le 10°$? Y (y/n)

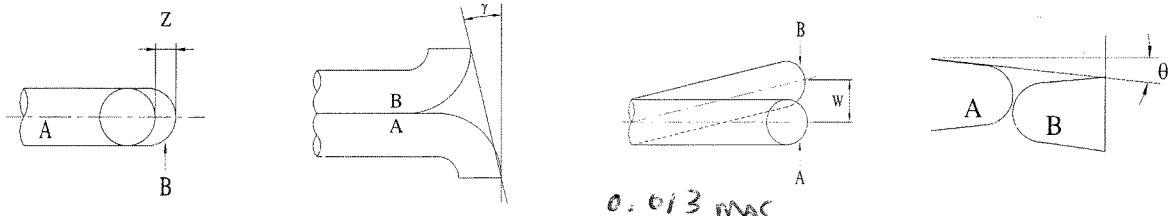


β_1 = 0.4

β_2 = 0.7

$\beta_1 \le 5°$? Y (y/n)

$\beta_2 \le 5°$? Y (y/n)



γ = 0.8 °

θ = 1.2 °

Z = A tan(γ) = ~~0.016~~ 0.013 MAS

W = A tan(θ) = ~~0.016~~ 0.020 MAS

Z ≤ 0.125"? Y (y/n)

W ≤ 0.031"? Y (y/n)

Acceptability for Use (Circle Selection)	If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84	If all answers except the first (D_t) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel.	Any other situation, the pitot tube must be removed from service.

Probe ID: 5-07

Calibrated by	Initials	MAS	Reviewed by	Initials	EM
	Date	8-27-13		Date	9/6/13

Stack Thermocouple Calibration [1]	Reference Thermometer ID No. [2]	Thermocouple Readout ID No.	Compare thermocouple to reference thermometer	Calculate applicability range for thermocouple	
	130090343	A161402	$\frac{T_{abs,TC}}{T_{abs,RT}}$ = 0.998	$Min_{abs} = 0.9 \times T_{abs,TC}$ 730 °R	$Min_F = Min_{abs} - 460$ 270 °F
	T_F 353 °F	T_F 351 °F	Is this between 0.985 and 1.015? Y (y/n)	$Max_{abs} = 1.1 \times T_{abs,TC}$ 892 °R	$Max_F = Max_{abs} - 460$ 432 °F
	$T_{abs,RT}$ 813 °R	$T_{abs,TC}$ 811 °R			

[1] Per SOP 032, this calibration is generally performed at 160°F.

[2] T_{abs} (°R) = T_F (°F) + 460

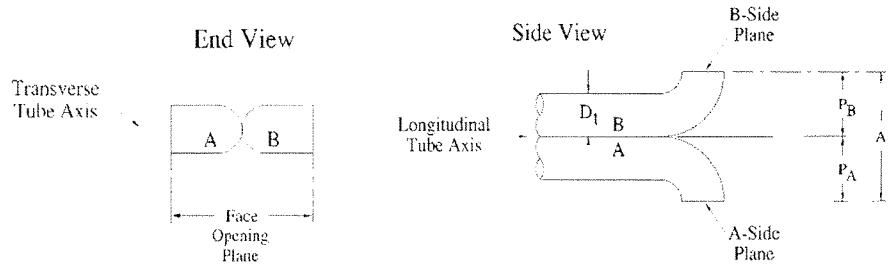
S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: S-19

Caliper ID: 700802

Calibrated by	Initials	DL	Reviewed by	Initials	EY
	Date	8-26-13		Date	9/6/13

General Pitot Tube Alignment



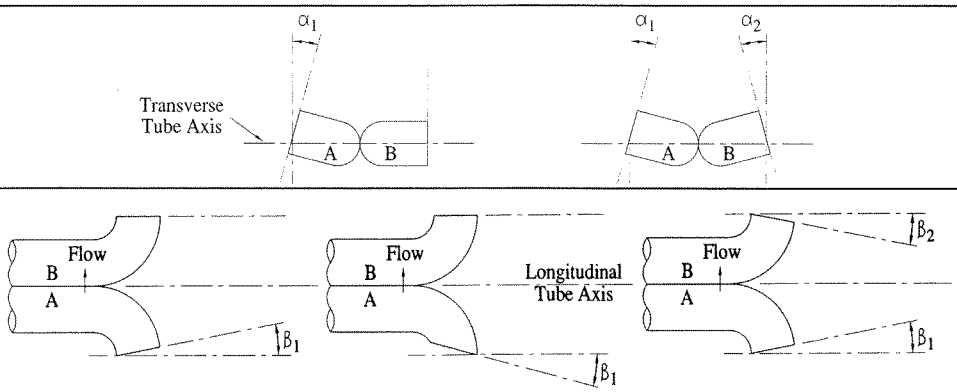
A = 0.946"

D_t = 0.374"

0.188" ≤ D_t ≤ 0.375"? Y (y/n)

$1.05 \le A/2D_t \le 1.50$? Y (y/n)

Misalignment



α_1 = 0.8 °

α_2 = 1.2 °

$\alpha_1 \le 10°$? Y (y/n)

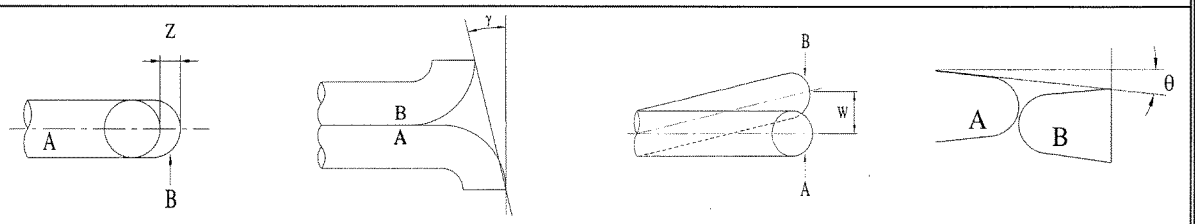
$\alpha_2 \le 10°$? Y (y/n)

β_1 = 0.4

β_2 = 0.9

$\beta_1 \le 5°$? Y (y/n)

$\beta_2 \le 5°$? Y (y/n)



γ = 0.8 °

θ = 0.1 °

Z = A tan(γ) = 0.013

W = A tan(θ) = 0.002

Z ≤ 0.125"? Y (y/n)

W ≤ 0.031"? Y (y/n)

Acceptability for Use (Circle Selection)

If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84	If all answers except the first (D_t) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel.	Any other situation, the pitot tube must be removed from service.

Probe ID: S-19

Calibrated by	Initials	DL	Reviewed by	Initials	EY
	Date	8-26-13		Date	9/6/13

Stack Thermocouple Calibration [1]

Reference Thermometer ID No. [2]	Thermocouple Readout ID No.	Compare thermocouple to reference thermometer	Calculate applicability range for thermocouple	
130090343	A161402	$\frac{T_{abs,TC}}{T_{abs,RT}}$ = 0.998	$Min_{abs} = 0.9 \times T_{abs,TC}$ 730 °R	$Min_F = Min_{abs} - 460$ 270 °F
T_F 353 °F	T_F 351 °F	Is this between 0.985 and 1.015? Y (y/n)	$Max_{abs} = 1.1 \times T_{abs,TC}$ 892 °R	$Max_F = Max_{abs} - 460$ 432 °F
$T_{abs,RT}$ 813 °R	$T_{abs,TC}$ 811 °R			

[1] Per SOP 032, this calibration is generally performed at 160°F.

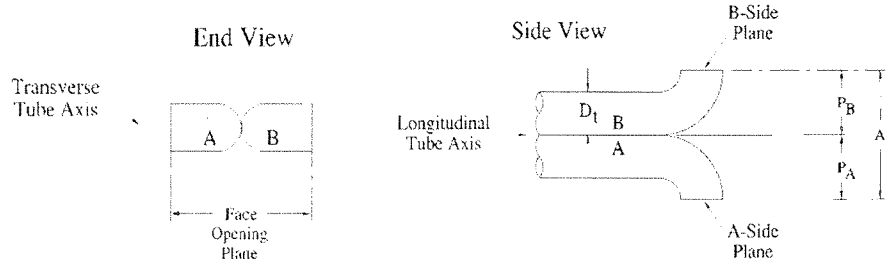
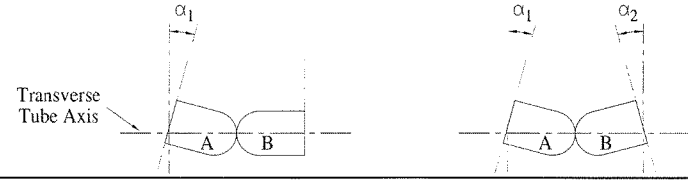
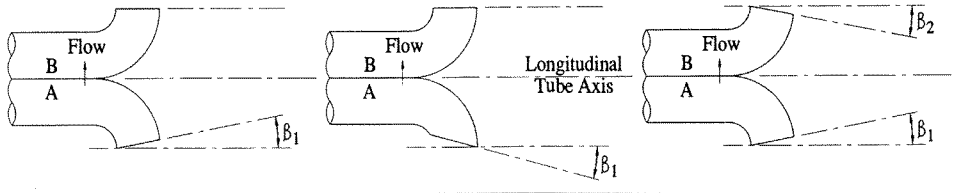
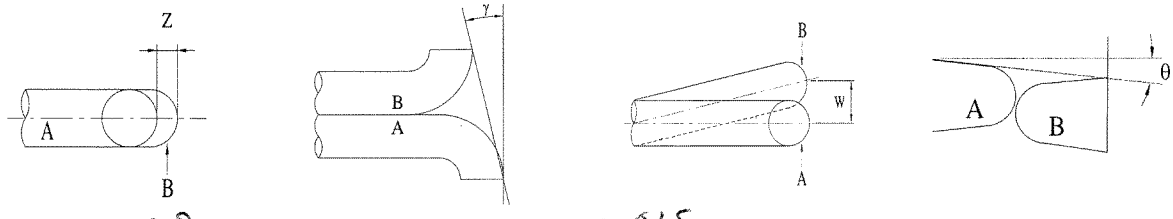
[2] $T_{abs;}$ (°R) = T_F (°F) + 460

S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: P-302

Caliper ID: 700802

Calibrated by	Initials	DC	Reviewed by	Initials	EM
	Date	8-26-13		Date	9/4/13

General Pitot Tube Alignment		A = 0.952" D_t = 0.372" 0.188"≤ D_t ≤ 0.375"? Y (y/n) 1.05 ≤ $A/2D_t$ ≤ 1.50? Y (y/n)
Misalignment		α_1 = 0.4 ° α_2 = 0.7 ° α_1≤10°? Y (y/n) α_2≤10°? Y (y/n)
		β_1 = 0.5 β_2 = 0.2 β_1≤5°? Y (y/n) β_2≤5°? Y (y/n)
		γ = 0.9 ° θ = 1.2 ° Z = A tan(γ) = 0.015 W = A tan(θ) = 0.020 Z ≤ 0.125"? Y (y/n) W ≤ 0.031"? Y (y/n)
Acceptability for Use (Circle Selection)	If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84	If all answers except the first (D_t) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel.	Any other situation, the pitot tube must be removed from service.

Probe ID: P-302

Calibrated by	Initials	DC	Reviewed by	Initials	EM
	Date	8-26-13		Date	9/4/13

Stack Thermocouple Calibration [1]	Reference Thermometer ID No. [2]	Thermocouple Readout ID No.	Compare thermocouple to reference thermometer	Calculate applicability range for thermocouple	
	130090343 T_F 352 °F $T_{abs,RT}$ 812 °R	A161402 T_F 349 °F $T_{abs,TC}$ 809 °R	$\frac{T_{abs,TC}}{T_{abs,RT}}$ = 0.996 Is this between 0.985 and 1.015? Y (y/n)	$Min_{abs} = 0.9 \times T_{abs,TC}$ 728 °R	$Min_F = Min_{abs} - 460$ 268 °F
				$Max_{abs} = 1.1 \times T_{abs,TC}$ 890 °R	$Max_F = Max_{abs} - 460$ 430 °F

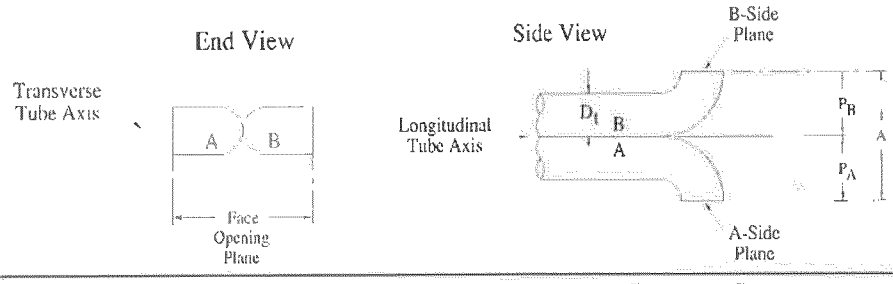
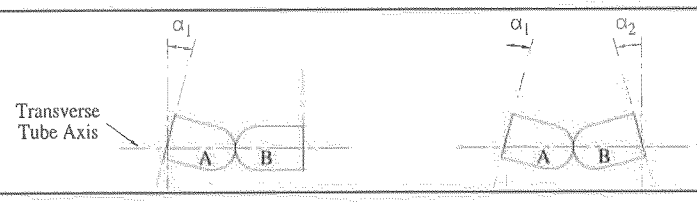
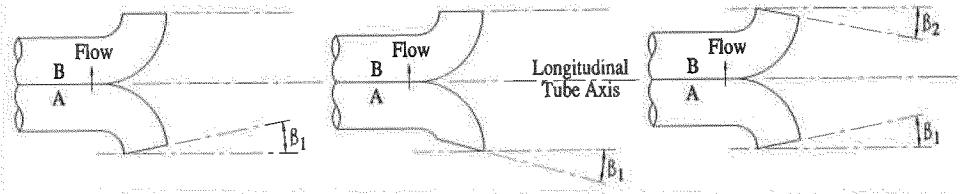
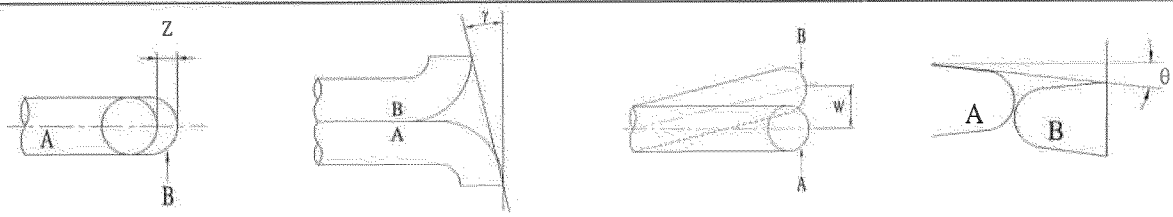
[1] Per SOP 032, this calibration is generally performed at 160°F.

[2] $T_{abs;}$ (°R) = T_F (°F) + 460

S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: P-529
Caliper ID: 701615

Calibrated by	Initials	NMP	Reviewed by	Initials	DC
	Date	10/1/13		Date	10-4-13

General Pitot Tube Alignment		A = 0.919 " D_t = 0.373 " 0.188" ≤ D_t ≤ 0.375"? Y (y/n) 1.05 ≤ A/2D_t ≤ 1.50? Y (y/n)
Misalignment		α_1 = 0.4 ° α_2 = 0.8 ° α_1≤10°? Y (y/n) α_2≤10°? Y (y/n)
		β_1 = 0 β_2 = 0.8 β_1≤5°? Y (y/n) β_2≤5°? Y (y/n)
		γ = 0.7 ° θ = 1.6 ° Z = A tan(γ) = 0.011 W = A tan(θ) = 0.026 Z ≤ 0.125"? Y (y/n) W ≤ 0.031"? Y (y/n)
Acceptability for Use (Circle Selection)	If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84	If all answers except the first (D_t) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel.	Any other situation, the pitot tube must be removed from service.

Probe ID: P-529

Calibrated by	Initials	NMP	Reviewed by	Initials	DC
	Date	10/4/13		Date	10-4-13

Stack Thermocouple Calibration [1]	Reference Thermometer ID No. [2]	Thermocouple Readout ID No.	Compare thermocouple to reference thermometer	Calculate applicability range for thermocouple	
	~~111858733~~ ~~1300903~~43 T_F 388 °F $T_{abs,RT}$ 848 °R	A161402 T_F 395 °F $T_{abs,TC}$ 845 °R	$\frac{T_{abs,TC}}{T_{abs,RT}}$ = 0.996 Is this between 0.985 and 1.015? Y (y/n)	$Min_{abs} = 0.9 \times T_{abs,TC}$ 761 °R	$Min_F = Min_{abs} - 460$ 301 °F
				$Max_{abs} = 1.1 \times T_{abs,TC}$ 930 °R	$Max_F = Max_{abs} - 460$ 470 °F

[1] Per SOP 032, this calibration is generally performed at 160°F.
[2] $T_{abs;}$ (°R) = T_F (°F) + 460

Calibration Data Sheet – Calipers

Caliper ID Number 700903

Calibrated by	Initials	mb
	Date	2-6-2012
Reviewed by	Initials	DRB
	Date	02/06/12

Calibration Expires (2 years after calibration)	2-6-2014

	Ring Gauge		Caliper	
	ID No.	Diameter (in)	Measurement (in)	Error
1	030042	0.34999	0.348	-0.57
2	030042	0.34999	0.348	-0.57
3	030042	0.34999	0.349	-0.28

	Ring Gauge		Caliper	
	ID No.	Diameter (in)	Measurement (in)	Error
1	020035	0.23984	0.239	-0.35
2	020035	0.23984	0.238	-0.77
3	020035	0.23984	0.239	-0.35

$$\text{Error} = \frac{\text{Measured} - \text{Standard}}{\text{Standard}} \times 100\%$$

Error for each of the three determinations must be within ±2%

CDS-18 Calipers
Per EM SOP-022
Revision Date: February 2012

Portable Barometer Calibration

Portable Barometer Identification BP-2

Reference Barometer Identification NIST 7485

Calibrated by	Initials	MLb
	Date	8/28/13
Reviewed by	Initials	EDF
	Date	9/17/13

Laboratory barometer reading (reference) (in Hg)	29.28
Portable barometer reading after correction (in Hg)	29.28
Difference between reference and portable after correction (in Hg)	Ø
Is the difference ≤±0.1 in Hg (yes/no)	Yes

Notes:

CDS-20 Portable Barometer
Per EM SOP-008
Revision Date: January 2008
Reviewed: January 2013

Bastrop Scale Company, Inc.
P.O. Drawer 2100
Bastrop, TX 78602

Bastrop Scale Co. Inc.
In Balance Since 1971

(877) 321-3443
Fax (512) 321-1114
email: info@bastropscale.com
wwwbastropscale.com

CERTIFICATION OF CALIBRATION

CUSTOMER # : 132950 SCALE # : 100008310

CUSTOMER NAME : URS CORPORATION

SERVICE ADDRESS : 9400 AMBERGLEN BLVD.

SERVICE CITY ST ZIP : AUSTIN TX. 78729

MAKE : SARTORIUS CAPACITY : 4100G

MODEL : TE4101 GRADUATION SIZE : .1 G

S.N. : 21450056 TOLERANCE :

LOCATION / DEPT. : MOBILE

BEFORE SERVICE:

Corner or Section Error: 0 @ 1000g

AFTER SERVICE:

Corner or Section Error: 0 @ 1000g

Test Weights Applied	Scale Reading as Found	Scale Reading as Left
10 G	10.0g	10.0g
100 G	100.0g	100.0g
1000 G	1000.0g	1000.0g
2000 G	2000.0g	2000.0g
4000 G	4000.0g	4000.0g

The weights used for this test are traceable to the National Institute of Standards & Technology (NIST). Testing equipment is certified each year with standards traceable to NIST. Credentials may be obtained by visiting http://www.bastropscale.com/credentials.html

Technician Eugen Tugi **License #** 75161 **Date** 6/27/13

Certificate #s of weights used: 193701, 193696

Bastrop Scale Co., Inc.
TDA Service & Inspection License #245519
BSCI FORM: ISO-R

Balance Calibration

Balance ID TE 4101A

Calibrated by	Initials	MIB	Reviewed by	Initials	DL
	Date	6-27-13		Date	7-3-13

Initial Calibration	External Contractor	Date
	BASTROP SCALE CO. INC.	06-27-13

Per EM SOP-010, this balance calibration is good for one year.
Expiration Date:
06-27-2014

	Calibration Weight		Balance Reading (g)	Acceptable Range (g)
	ID #	Mass (g)		
Linearity Check	83056	50	50.0	49.9 – 50.1
	83055	100	100.0	99.9 - 100.1
	83054	200	200.0	199.8 - 200.2
	83053	500	500.0	499.5 - 500.5
	83052	1000	999.9	999 - 1001

Did not use mlb 6/27/13

	Calibration Weight[1] (g)	Balance Reading (g)
Calibration of Student Weights	20A	20.0
	20B	20.0
	50	50.0
	100	100.0
Student Weight Set ID 700224	200A	200.0
	200B	200.0
	500	499.8
	1000	999.8
		Did not use 6/27/13 MIB

1 Use only calibration weights greater than 20 g.

CDS-08A: Balance Calibration
Per EM SOP-010
Revision Date: July 2012

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

11426 FAIRMONT PKWY, LA PORTE, TX 77571 Phone: 800-248-1427 Fax: 281-474-8419

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: URS
Document # : 41429550-001

Customer

URS CORPORATION

9400 AMBERGLEN BLVD
AUSTIN TX 78729
US

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: AAL4460 **Certification Date:** 26Apr2011 **Exp. Date:** 25Apr2014
Cylinder Pressure*:** 2000 PSIG **Batch No:** LAP0039832

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
PROPANE	21.1 PPM	+/- 1%	Direct NIST and VSL
AIR	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2012	ALM038957	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
HP-Y/HP 6890/US00000974	06Apr2011	GAS CHROMATOGRAPHY

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

PROPANE

Date: 26Apr2011 Response Unit: PPM
Z1 = 0.00000 R1 = 35964.00 T1 = 7665.000
R2 = 35947.00 Z2 = 0.00000 T2 = 7674.000
Z3 = 0.00000 T3 = 7670.000 R3 = 35932.00
Avg. Concentration: 21.10 PPM

Second Triad Analysis

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999832
Constants: A = 0.016711152
B = 0.00269222 C =
D = E =

Special Notes:

APPROVED

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11426 FAIRMONT PKWY, LA PORTE, TX 77571 Phone: 800-248-1427 Fax: 281-474-8419

RATA CLASS

Dual-Analyzed Calibration Standard

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A32010
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: URS
Project No.: 04-83367-001

Customer
URS
ITEM# URS005

ANALYTICAL INFORMATION Gas Type : NONE

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: AL899
Cylinder Pressure*:** 2000 PSIG

Certification Date: 21Apr2010

Exp. Date: 22Apr2018
Batch No: LAP0015199

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
PROPANE	12.9 PPM	+/- 1%	Direct NIST and VSL
AIR	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2012	ALM013540	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
HP-Y/HP 6890/US00000974	21Apr2010	GAS CHROMATOGRAPHY

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis
PROPANE
Date: 21Apr2010 Response Unit: PPM
Z1=0.00000 R1=33743.00 T1=4402.000
R2=33685.00 Z2=0.00000 T2=4407.000
Z3=0.00000 T3=4423.000 R3=33693.00
Avg. Concentration: 12.90 PPM

Second Triad Analysis

Calibration Curve
Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.999999196 1668
Constants: A=-0.02589997
B=0.002606169 C=
D= E=

Special Notes:
The expiration date has been extended without re-assay per EPA 600/R23-23/542.
CERTS AND TAGS URS ITEM# URS005

QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

11426 FAIRMONT PKWY, LA PORTE, TX 77571 Phone: 800-248-1427 Fax: 281-474-8419

RATA CLASS

Dual-Analyzed Calibration Standard

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A32011

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: URS
Document # : 43711369-001

Customer
URS CORPORATION

9400 AMBERGLEN BLVD
AUSTIN TX 78729
US

ANALYTICAL INFORMATION Gas Type : NONE

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC111534 **Certification Date:** 31Oct2011 **Exp. Date:** 30Oct2014
Cylinder Pressure*:** 2000 PSIG **Batch No:** LAP0051851

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
PROPANE	21.3	PPM	+/- 1%	Direct NIST and VSL
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2012	ALM013540	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
HP-Y/HP 6890/US00000974	06Oct2011	GAS CHROMATOGRAPHY

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

PROPANE
Date: 31Oct2011 Response Unit: PPM
Z1 = 0.00000 R1 = 40950.00 T1 = 8848.000
R2 = 41012.00 Z2 = 0.00000 T2 = 8829.000
Z3 = 0.00000 T3 = 8812.000 R3 = 41032.00
Avg. Concentration: 21.29 PPM

Second Triad Analysis

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999304
Constants: A = 0.007844213
B = 0.00239885 C =
D = E =

Special Notes: URS-004

APPROVED BY: ROGER NGUYEN

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RATA CLASS

Dual-Analyzed Calibration Standard

CERTIFICATE OF ACCURACY: Interference Free™ Multi-Component EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A32011
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: STOCK
Document # : 44094399-001

Customer
URS CORPORATION

9400 AMBERGLEN BLVD
AUSTIN TX 78729
US

ANALYTICAL INFORMATION Gas Type : CO2,O2,BALN

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC189665
Cylinder Pressure*:** 1850 PSIG

Certification Date: 14Dec2011

Exp. Date: 15Dec2019
Batch No: LAP0054691

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
CARBON DIOXIDE	19.2 %	+/- 1%	Direct NIST and VSL
OXYGEN	22.5 %	+/- 1%	Direct NIST and VSL
NITROGEN	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1800	01Mar2013	K026135	17.87 %	CARBON DIOXIDE
NTRM 2659	02Oct2012	1D003416	20.85 %	OXYGEN

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
FTIR//MG-09-149	02Dec2011	FTIR
SERVOMEX/MODEL 244A/701/716	01Dec2011	PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis	Second Triad Analysis	Calibration Curve
CARBON DIOXIDE		
Date: 13Dec2011 Response Unit: %		Concentration=A+Bx+Cx2+Dx3+Ex4
Z1=-0.00143 R1=17.78329 T1=19.14079		r=9.99997E-1
R2=17.78502 Z2=-0.00071 T2=19.14128		Constants: A=0.00000E+0
Z3=0.00239 T3=19.14149 R3=17.79819		B=9.05981E-1 C=1.21380E-2
Avg. Concentration: 19.23 %		D=0.00000E+0 E=0.00000E+0
OXYGEN		
Date: 14Dec2011 Response Unit: VOLTS		Concentration=A+Bx+Cx2+Dx3+Ex4
Z1=0.00000 R1=0.84000 T1=0.90550		r=0.9999996
R2=0.84000 Z2=0.00000 T2=0.90550		Constants: A=-0.00147786
Z3=0.00000 T3=0.90550 R3=0.84000		B=24.85715966 C=
Avg. Concentration: 22.47 %		D= E=

Special Notes:
The expiration date has been extended without re-assay per EPA 600/R23-23/542.
URS020 CGA 590 ; DEW PT. 40 DEG. F.

QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

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8832 DICE ROAD, SANTA FE SPRINGS, CA 90670-2516 Phone: 800-323-2212 Fax: 562-464-5262

RATA CLASS

Dual-Analyzed Calibration Standard

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A52010
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
8832 DICE ROAD
SANTA FE SPRINGS, CA 90670-2516

P.O. No.: CORIS DOC# 36930344
Project No.: 02-70228-001

Customer
URS CORPORATION

ANALYTICAL INFORMATION Gas Type : NONE

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC250309
Cylinder Pressure*:** 2000 PSIG

Certification Date: 16Apr2010

Exp. Date: 17Apr2018
Batch No: SBO0018223

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
PROPANE	7.58 PPM	+/- 1%	Direct NIST and VSL
AIR	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1666	02Oct2012	AAL16735	9.470 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
HP/G1540A/US00003390/METH	16Apr2010	FID &TCD

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis
PROPANE
Date: 16Apr2010 Response Unit: AREA
Z1=0.00000 R1=216.5510 T1=173.5190
R2=216.8600 Z2=0.00000 T2=173.7060
Z3=0.00000 T3=173.2980 R3=216.5200
Avg. Concentration: 7.583 PPM

Second Triad Analysis

Calibration Curve
Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.999998 1666
Constants: A=-0.0052589
B=0.042959204 C=
D= E=

Special Notes:
The expiration date has been extended without re-assay per EPA 600/R23-23/542.
URS ITEM # URS006

QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A22012

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 59661-70-65000
Document # : 45935248-042

Customer
CLEAN AIR INSTRUMENT RENTAL

JACK BIONDA
110 TECHNOLOGY DRIVE
RID PARK, FINLAY TOWNSHIP
CORAOPOLIS PA 15108
US

ANALYTICAL INFORMATION Gas Type : OC2

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC43355 **Certification Date:** 16May2012 **Exp. Date:** 16May2015
Cylinder Pressure*:** 2000 PSIG **Batch No:** TR00057923

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
OXYGEN	10.1	%	+/- 1%	Direct NIST and VSL
CARBON DIOXIDE	10.0	%	+/- 1%	Direct NIST and VSL
NITROGEN		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2350 23	04Jan2018	K024582	23.20 %	OXYGEN
NTRM 2300	17Aug2016	K026052	23.04 %	CARBON DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
CAI/110P/V03018	07May2012	PARAMAGNETIC
PIR/2000/609015	07May2012	NDIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis	Second Triad Analysis	Calibration Curve
OXYGEN		
Date: 14May2012 Response Unit: %		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Z1 = 0.00000 R1 = 23.20000 T1 = 10.09000		r = 0.999997
R2 = 23.20000 Z2 = 0.00000 T2 = 10.08000		Constants: A = -0.04233969
Z3 = 0.00000 T3 = 10.08000 R3 = 23.20000		B = 1.001808266 C = 0
Avg. Concentration: 10.06 %		D = 0 E = 0
CARBON DIOXIDE		
Date: 17May2012 Response Unit: MV		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Z1 = 0.00000 R1 = 99.10000 T1 = 60.30000		r = 0.999987
R2 = 99.10000 Z2 = 0.00000 T2 = 60.30000		Constants: A = -0.00518415
Z3 = 0.00000 T3 = 60.30000 R3 = 99.10000		B = 0.136464952 C = -0.0002272
Avg. Concentration: 10.01 %		D = 1.23741E-05 E = 0

APPROVED BY: _____
JEFF CROTEAU

I-43

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 58320-71-65000
Project No.: 05-90126-010

Customer
CLEAN AIR ENGINEERING
DON ALLEN
500 W. WOOD STREET
PALATINE IL 60067

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM025456 **Certification Date:** 09Aug2010 **Exp. Date:** 08Aug2013
Cylinder Pressure*:** 1900 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
PROPANE	24.7	PPM	+/- 1%	Direct NIST and VSL
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2012	ALM029313	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	21Jul2010	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

PROPANE
Date: 09Aug2010 Response Unit:AREA
Z1=0.00000 R1=2622160. T1=657219.0
R2=2622754. Z2=0.00000 T2=655938.0
Z3=0.00000 T3=655843.0 R3=2634150.
Avg. Concentration: 24.70 PPM

Second Triad Analysis

Calibration Curve

Concentration=A+Bx+Cx2+Dx3+Ex4
r=1.000000
Constants: A=-0.03187273
B=3.73069E-05 C=0
D=0 E=0

APPROVED BY: ROBERT LESNIAK

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A22012

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 59748-71-65000
Document # : 46609118-016

Customer
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

ANALYTICAL INFORMATION Gas Type : NONE

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM028646 **Certification Date:** 27Jun2012 **Exp. Date:** 27Jun2015
Cylinder Pressure*:** 1950 PSIG **Batch No:** TR00060969

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
PROPANE	14.8	PPM	+/- 1%	Direct NIST and VSL
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2013	ALM002439	99.50 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	14Jun2012	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

PROPANE
Date: 27Jun2012 Response Unit: AREA
Z1=0.00000 R1=2645098. T1=391838.0
R2=2640869. Z2=0.00000 T2=391350.0
Z3=0.00000 T3=391152.0 R3=2623861.
Avg. Concentration: 14.83 PPM

Second Triad Analysis

Calibration Curve

Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.9999
Constants: A=0.044239133
B=3.65176E-05 C=0
D=0 E=0

Special Notes: DELIVERY DOC# IS 46607392

APPROVED BY: HILARY THATCHER

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A22012
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 59748-71-65000
Document # : 46609118-015

Customer
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

ANALYTICAL INFORMATION Gas Type : NONE

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM057529
Cylinder Pressure***: 1950 PSIG
Certification Date: 27Jun2012
Exp. Date: 27Jun2015
Batch No: TRO0060970

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
PROPANE	8.43	PPM	+/- 1%	Direct NIST and VSL
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2013	ALM002439	99.50 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	14Jun2012	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis	Second Triad Analysis	Calibration Curve
PROPANE		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Date: 27Jun2012 Response Unit: AREA		r = 0.9999
Z1 = 0.00000 R1 = 2645098. T1 = 222869.0		Constants: A = 0.044239133
R2 = 2640869. Z2 = 0.00000 T2 = 221994.0		B = 3.65176E-05 C = 0
Z3 = 0.00000 T3 = 221877.0 R3 = 2623861.		D = 0 E = 0
Avg. Concentration: 8.429 PPM		

Special Notes: DELIVERY DOC# IS 46607392

APPROVED BY: JEFF CROTEAU

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11426 FAIRMONT PKWY, LA PORTE, TX 77571 Phone: 800-248-1427 Fax: 281-474-8419

RATA CLASS

Dual-Analyzed Calibration Standard

CERTIFICATE OF ACCURACY: Interference Free™ Multi-Component EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A32011
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: STOCK
Document # : 44094399-001

Customer
URS CORPORATION

9400 AMBERGLEN BLVD
AUSTIN TX 78729
US

ANALYTICAL INFORMATION Gas Type : CO2,O2,BALN

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC189665
Cylinder Pressure*:** 1850 PSIG

Certification Date: 14Dec2011

Exp. Date: 15Dec2019
Batch No: LAP0054691

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
CARBON DIOXIDE	19.2 %	+/- 1%	Direct NIST and VSL
OXYGEN	22.5 %	+/- 1%	Direct NIST and VSL
NITROGEN	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1800	01Mar2013	K026135	17.87 %	CARBON DIOXIDE
NTRM 2659	02Oct2012	1D003416	20.85 %	OXYGEN

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
FTIR//MG-09-149	02Dec2011	FTIR
SERVOMEX/MODEL 244A/701/716	01Dec2011	PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis
CARBON DIOXIDE
Date: 13Dec2011 Response Unit: %
Z1=-0.00143 R1=17.78329 T1=19.14079
R2=17.78502 Z2=-0.00071 T2=19.14128
Z3=0.00239 T3=19.14149 R3=17.79819
Avg. Concentration: 19.23 %

OXYGEN
Date: 14Dec2011 Response Unit: VOLTS
Z1=0.00000 R1=0.84000 T1=0.90550
R2=0.84000 Z2=0.00000 T2=0.90550
Z3=0.00000 T3=0.90550 R3=0.84000
Avg. Concentration: 22.47 %

Second Triad Analysis

Calibration Curve

Concentration=A+Bx+Cx2+Dx3+Ex4
r=9.99997E-1
Constants: A=0.00000E+0
B=9.05981E-1 C=1.21380E-2
D=0.00000E+0 E=0.00000E+0

Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.9999996
Constants: A=-0.00147786
B=24.85715966 C=
D= E=

Special Notes:
The expiration date has been extended without re-assay per EPA 600/R23-23/542.
URS020 CGA 590 ; DEW PT. 40 DEG. F.

QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A22012

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 59661-70-65000
Document # : 45935248-042

Customer
CLEAN AIR INSTRUMENT RENTAL

JACK BIONDA
110 TECHNOLOGY DRIVE
RID PARK, FINLAY TOWNSHIP
CORAOPOLIS PA 15108
US

ANALYTICAL INFORMATION Gas Type : OC2

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC43355 **Certification Date:** 16May2012 **Exp. Date:** 16May2015
Cylinder Pressure*:** 2000 PSIG **Batch No:** TR00057923

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
OXYGEN	10.1	%	+/- 1%	Direct NIST and VSL
CARBON DIOXIDE	10.0	%	+/- 1%	Direct NIST and VSL
NITROGEN		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2350 23	04Jan2018	K024582	23.20 %	OXYGEN
NTRM 2300	17Aug2016	K026052	23.04 %	CARBON DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
CAI/110P/V03018	07May2012	PARAMAGNETIC
PIR/2000/609015	07May2012	NDIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis	Second Triad Analysis	Calibration Curve
OXYGEN		
Date: 14May2012 Response Unit: %		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Z1 = 0.00000 R1 = 23.20000 T1 = 10.09000		r = 0.999997
R2 = 23.20000 Z2 = 0.00000 T2 = 10.08000		Constants: A = -0.04233969
Z3 = 0.00000 T3 = 10.08000 R3 = 23.20000		B = 1.001808266 C = 0
Avg. Concentration: 10.06 %		D = 0 E = 0
CARBON DIOXIDE		
Date: 17May2012 Response Unit: MV		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Z1 = 0.00000 R1 = 99.10000 T1 = 60.30000		r = 0.999987
R2 = 99.10000 Z2 = 0.00000 T2 = 60.30000		Constants: A = -0.00518415
Z3 = 0.00000 T3 = 60.30000 R3 = 99.10000		B = 0.136464952 C = -0.0002272
Avg. Concentration: 10.01 %		D = 1.23741E-05 E = 0

APPROVED BY: _____
JEFF CROTEAU

I-48

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 58320-71-65000
Project No.: 05-90126-010

Customer
CLEAN AIR ENGINEERING
DON ALLEN
500 W. WOOD STREET
PALATINE IL 60067

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM025456 **Certification Date:** 09Aug2010 **Exp. Date:** 08Aug2013
Cylinder Pressure*:** 1900 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
PROPANE	24.7	PPM	+/- 1%	Direct NIST and VSL
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2012	ALM029313	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	21Jul2010	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

PROPANE
Date: 09Aug2010 Response Unit:AREA
Z1=0.00000 R1=2622160. T1=657219.0
R2=2622754. Z2=0.00000 T2=655938.0
Z3=0.00000 T3=655843.0 R3=2634150.
Avg. Concentration: 24.70 PPM

Second Triad Analysis

Calibration Curve

Concentration=A+Bx+Cx2+Dx3+Ex4
r=1.000000
Constants: A=-0.03187273
B=3.73069E-05 C=0
D=0 E=0

APPROVED BY: ROBERT LESNIAK

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A22012

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 59748-71-65000
Document # : 46609118-016

Customer
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

ANALYTICAL INFORMATION Gas Type : NONE

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM028646 **Certification Date:** 27Jun2012 **Exp. Date:** 27Jun2015
Cylinder Pressure*:** 1950 PSIG **Batch No:** TR00060969

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
PROPANE	14.8	PPM	+/- 1%	Direct NIST and VSL
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2013	ALM002439	99.50 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	14Jun2012	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

PROPANE
Date: 27Jun2012 Response Unit: AREA
Z1=0.00000 R1=2645098. T1=391838.0
R2=2640869. Z2=0.00000 T2=391350.0
Z3=0.00000 T3=391152.0 R3=2623861.
Avg. Concentration: 14.83 PPM

Second Triad Analysis

Calibration Curve

Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.9999
Constants: A=0.044239133
B=3.65176E-05 C=0
D=0 E=0

Special Notes: DELIVERY DOC# IS 46607392

APPROVED BY: HILARY THATCHER

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A22012

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 59748-71-65000
Document # : 46609118-015

Customer
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

ANALYTICAL INFORMATION Gas Type : NONE

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM057529
Cylinder Pressure***: 1950 PSIG
Certification Date: 27Jun2012
Exp. Date: 27Jun2015
Batch No: TRO0060970

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
PROPANE	8.43	PPM	+/- 1%	Direct NIST and VSL
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2013	ALM002439	99.50 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	14Jun2012	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis	Second Triad Analysis	Calibration Curve
PROPANE		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Date: 27Jun2012 Response Unit: AREA		r = 0.9999
Z1 = 0.00000 R1 = 2645098. T1 = 222869.0		Constants: A = 0.044239133
R2 = 2640869. Z2 = 0.00000 T2 = 221994.0		B = 3.65176E-05 C = 0
Z3 = 0.00000 T3 = 221877.0 R3 = 2623861.		D = 0 E = 0
Avg. Concentration: 8.429 PPM		

Special Notes: DELIVERY DOC# IS 46607392

APPROVED BY: JEFF CROTEAU

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11426 FAIRMONT PKWY, LA PORTE, TX 77571 Phone: 800-248-1427 Fax: 281-474-8419

RATA CLASS

Dual-Analyzed Calibration Standard

CERTIFICATE OF ACCURACY: Interference Free™Multi-Component EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A32011
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: STOCK
Document # : 44094399-001

Customer
URS CORPORATION

9400 AMBERGLEN BLVD
AUSTIN TX 78729
US

ANALYTICAL INFORMATION Gas Type : CO2,O2,BALN

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC189665
Cylinder Pressure*:** 1850 PSIG

Certification Date: 14Dec2011

Exp. Date: 15Dec2019
Batch No: LAP0054691

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
CARBON DIOXIDE	19.2 %	+/- 1%	Direct NIST and VSL
OXYGEN	22.5 %	+/- 1%	Direct NIST and VSL
NITROGEN	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1800	01Mar2013	K026135	17.87 %	CARBON DIOXIDE
NTRM 2659	02Oct2012	1D003416	20.85 %	OXYGEN

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
FTIR//MG-09-149	02Dec2011	FTIR
SERVOMEX/MODEL 244A/701/716	01Dec2011	PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis
CARBON DIOXIDE
Date: 13Dec2011 Response Unit: %
Z1=-0.00143 R1=17.78329 T1=19.14079
R2=17.78502 Z2=-0.00071 T2=19.14128
Z3=0.00239 T3=19.14149 R3=17.79819
Avg. Concentration: 19.23 %

OXYGEN
Date: 14Dec2011 Response Unit: VOLTS
Z1=0.00000 R1=0.84000 T1=0.90550
R2=0.84000 Z2=0.00000 T2=0.90550
Z3=0.00000 T3=0.90550 R3=0.84000
Avg. Concentration: 22.47 %

Second Triad Analysis

Calibration Curve

Concentration=A+Bx+Cx2+Dx3+Ex4
r=9.99997E-1
Constants: A=0.00000E+0
B=9.05981E-1 C=1.21380E-2
D=0.00000E+0 E=0.00000E+0

Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.9999996
Constants: A=-0.00147786
B=24.85715966 C=
D= E=

Special Notes:
The expiration date has been extended without re-assay per EPA 600/R23-23/542.
URS020 CGA 590 ; DEW PT. 40 DEG. F.

QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory - PGVP Vendor ID: A22012

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 59661-70-65000
Document # : 45935248-042

Customer
CLEAN AIR INSTRUMENT RENTAL

JACK BIONDA
110 TECHNOLOGY DRIVE
RID PARK, FINLAY TOWNSHIP
CORAOPOLIS PA 15108
US

ANALYTICAL INFORMATION Gas Type : OC2

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: CC43355 **Certification Date:** 16May2012 **Exp. Date:** 16May2015
Cylinder Pressure*:** 2000 PSIG **Batch No:** TR00057923

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
OXYGEN	10.1	%	+/- 1%	Direct NIST and VSL
CARBON DIOXIDE	10.0	%	+/- 1%	Direct NIST and VSL
NITROGEN		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2350 23	04Jan2018	K024582	23.20 %	OXYGEN
NTRM 2300	17Aug2016	K026052	23.04 %	CARBON DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
CAI/110P/V03018	07May2012	PARAMAGNETIC
PIR/2000/609015	07May2012	NDIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis	Second Triad Analysis	Calibration Curve
OXYGEN		
Date: 14May2012 Response Unit: %		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Z1 = 0.00000 R1 = 23.20000 T1 = 10.09000		r = 0.999997
R2 = 23.20000 Z2 = 0.00000 T2 = 10.08000		Constants: A = -0.04233969
Z3 = 0.00000 T3 = 10.08000 R3 = 23.20000		B = 1.001808266 C = 0
Avg. Concentration: 10.06 %		D = 0 E = 0
CARBON DIOXIDE		
Date: 17May2012 Response Unit: MV		Concentration = A + Bx + Cx2 + Dx3 + Ex4
Z1 = 0.00000 R1 = 99.10000 T1 = 60.30000		r = 0.999987
R2 = 99.10000 Z2 = 0.00000 T2 = 60.30000		Constants: A = -0.00518415
Z3 = 0.00000 T3 = 60.30000 R3 = 99.10000		B = 0.136464952 C = -0.0002272
Avg. Concentration: 10.01 %		D = 1.23741E-05 E = 0

APPROVED BY: _____
JEFF CROTEAU