

## **APPENDIX I**

# **Sampling Equipment/Instrumentation Calibration Documentation**

# Temperature Readout Calibration

## Isokinetic Sampling Consoles

Readout ID Number	<u>A161395</u>	Calibrated by:	<u>EOF</u>
Reference Thermometer ID Number	<u>111858733</u>	Date	<u>6/28/13</u>
Voltage Generator ID Number	<u>A178550</u>	Reviewed by	<u>NMP</u>
		Date	<u>7/3/13</u>

### Temperature Readout Calibration<sup>1</sup>

Reference Thermometer (°F)	<u>32</u>
Temperature Readout (°F)	<u>33</u>
Was Readout adjusted?	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no

### Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F)			Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference <sup>2,3</sup>			Theoretical	Observed	Difference
1	0.0	32	<u>32</u>	<u>0</u>	4	-1.0	-10	<u>-11</u>	<u>-1</u>
	1.0	77	<u>76</u>	<u>-1</u>		0.0	32	<u>32</u>	<u>0</u>
	3.0	165	<u>165</u>	<u>0</u>		1.0	77	<u>76</u>	<u>-1</u>
	5.0	251	<u>253</u>	<u>2</u>		2.0	121	<u>120</u>	<u>-1</u>
	7.0	341	<u>341</u>	<u>0</u>		3.0	165	<u>164</u>	<u>-1</u>
	10.0	475	<u>474</u>	<u>-1</u>	5	-1.0	-10	<u>-11</u>	<u>-1</u>
	15.0	692	<u>694</u>	<u>2</u>		0.0	32	<u>32</u>	<u>0</u>
	20.0	905	<u>907</u>	<u>2</u>		1.0	77	<u>76</u>	<u>-1</u>
	30.0	1329	<u>1331</u>	<u>2</u>		2.0	121	<u>121</u>	<u>0</u>
	40.0	1772	<u>1774</u>	<u>2</u>		3.0	165	<u>165</u>	<u>0</u>
2	0.0	32	<u>32</u>	<u>0</u>	6	-1.0	-10	<u>-11</u>	<u>-1</u>
	3.0	165	<u>165</u>	<u>0</u>		0.0	32	<u>32</u>	<u>0</u>
	4.0	208	<u>209</u>	<u>1</u>		1.0	77	<u>76</u>	<u>-1</u>
	5.0	251	<u>253</u>	<u>2</u>		2.0	121	<u>121</u>	<u>0</u>
	7.0	341	<u>341</u>	<u>0</u>		3.0	165	<u>165</u>	<u>0</u>
3	0.0	32	<u>32</u>	<u>0</u>	7	-1.0	-10	<u>-11</u>	<u>-1</u>
	3.0	165	<u>165</u>	<u>0</u>		0.0	32	<u>32</u>	<u>0</u>
	4.0	208	<u>209</u>	<u>1</u>		1.0	77	<u>76</u>	<u>-1</u>
	5.0	251	<u>253</u>	<u>2</u>		2.0	121	<u>121</u>	<u>0</u>
	7.0	341	<u>342</u>	<u>1</u>		3.0	165	<u>165</u>	<u>0</u>

<sup>1</sup> Reference thermometer and readout must agree within 2°F.

<sup>2</sup> Difference is calculated as follows:

**Difference = Observed - Theoretical**

<sup>3</sup> Acceptable difference is ±5°F for temperatures below 1000°F and ±10°F for temperatures above 1000°F.

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

Console ID A161395

Thermometer ID 11858733

Calibrated by	Initials	MIB/EDF	Reviewed by	Initials	NMP	Leak Check	
	Date	06-28-13				Date	7/3/13
						(-)	OK

Critical Orifice	Identification Number	Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B	Run 4A	Run 4B	Run 5A	Run 5B
		K Factor	N-1	0.2647	N-2	0.3629	N-3	0.5193	N-4	0.6109	N-5
Subject DGM	DGM Initial Reading (ft <sup>3</sup> )	761.995	747.130	721.853	727.708	732.869	739.544	746.246	754.118	772.272	781.536
	DGM Final Reading (ft <sup>3</sup> )	767.130	772.272	727.408	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 <sub>2</sub> O)	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

# 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: Orifice K': Dry Gas Meter	N-1 0.2647		N-2 0.3629		N-3 0.5193		N-4 0.6109		N-5 0.7198	
	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #4a	Run #4b	Run #5a	Run #5b
Initial Reading, (ft <sup>3</sup> )	761.995	767.130	721.853	727.708	732.869	739.548	746.246	754.118	772.272	781.536
Final Reading, (ft <sup>3</sup> )	767.130	772.272	727.488	732.869	739.548	746.246	754.118	761.995	781.536	790.817
Difference, (ft <sup>3</sup> )	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 <sub>2</sub> O)	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 <sub>mstd</sub> )	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 <sub>crstd</sub> )	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	1.012	1.008	1.008	1.011	1.011	1.012	1.012	1.011	1.011
Delta H@ <sub>1</sub> ("H <sub>2</sub> O)	1.706	1.706	1.798	1.772	1.918	1.916	1.847	1.845	1.870	1.868
Average ΔH@ <sub>1</sub> ("H <sub>2</sub> O)	1.706	1.706	1.785	1.785	1.917	1.917	1.846	1.846	1.869	1.869

Current Average Y	1.011
All individual Y within 2% of mean?	TRUE
Average Delta H@	1.824
All individual ΔH@ within 0.20 "H <sub>2</sub> O of mean	TRUE

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

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

Console ID **A161395**

Calibrated by	Initials	Reviewed by	Initials	Leak Check	
	Date	Date	Date	(+)	(-)
	MLB		NMP		
	8/17/13		8/9/13		
				OK	OK

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
Critical Orifice	Identification Number	N-2		N-3		N-4	
	K Factor	0.3629		0.5193		0.6109	
Subject DGM	DGM Initial Reading (ft <sup>3</sup> )	941.837	947.865	953.895	960.503	967.796	975.623
	DGM Final Reading (ft <sup>3</sup> )	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 <sub>2</sub> O)	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

Check the readout against a NIST Thermometer		Check the readout linearity (one channel only)																									
NIST Thermometer ID	11858733	Voltage Supply ID	27470881																								
Thermometer Reading (°F)	32	Channel No	1																								
Readout Reading (°F)	32	Voltage (mv)	Theoretical (°F)																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; text-align: center;">0</td> <td style="width: 20%; text-align: center;">32</td> <td style="width: 20%; text-align: center;">Observed (°F)</td> <td style="width: 40%; text-align: center;">Difference (°F)</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">77</td> <td style="text-align: center;">32</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">165</td> <td style="text-align: center;">76</td> <td style="text-align: center;">-1</td> </tr> <tr> <td style="text-align: center;">7</td> <td style="text-align: center;">341</td> <td style="text-align: center;">165</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">15</td> <td style="text-align: center;">692</td> <td style="text-align: center;">341</td> <td style="text-align: center;">0</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">693</td> <td style="text-align: center;">1</td> </tr> </table>				0	32	Observed (°F)	Difference (°F)	1	77	32	0	3	165	76	-1	7	341	165	0	15	692	341	0			693	1
0	32	Observed (°F)	Difference (°F)																								
1	77	32	0																								
3	165	76	-1																								
7	341	165	0																								
15	692	341	0																								
		693	1																								
<div style="border: 1px solid black; width: 100%; height: 100%; position: relative;"> <span style="position: absolute; top: -20px; left: 50%; transform: translate(-50%, -50%); font-weight: bold;">Temperature Readout Calibration</span> </div>																											

# 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

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

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

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

### Pre/Post Test Console Calibration Check

Console ID	A161395		
Calibrated by	Initials	NMP	
	Date	11/11/13	
Reviewed by	Initials	<i>[Signature]</i>	
	Date	11/12/13	

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

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

Console ID **AL61395**

Calibrated by	<b>NMP</b>	Reviewed by	mib	Leak Check	(+)	(-)
	u/11/13		11/12/13		✓	✓

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
<b>Critical Orifice</b>	Identification Number	N2		N3		N4	
	K Factor	0.3629		0.5193		0.6109	
<b>Subject DGM</b>	DGM Initial Reading (ft <sup>3</sup> )	736.557	741.693	750.558	757.225	764.564	772.406
	DGM Final Reading (ft <sup>3</sup> )	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 <sub>2</sub> O)	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

		Check the readout against a NIST Thermometer			Check the readout linearity (one channel only)																											
<b>Temperature Readout Calibration</b>	NIST Thermometer ID	111850733			Voltage Supply ID 27470881 Channel No 1																											
	Thermometer Reading (°F)	32			Theoretical (°F)																											
	Readout Reading (°F)	32			Observed (°F)																											
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">32</td> <td style="width: 10%; text-align: center;">32</td> <td style="width: 10%; text-align: center;">Difference (°F)</td> <td style="width: 10%; text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">77</td> <td style="text-align: center;">76</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-1</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">165</td> <td style="text-align: center;">164</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-1</td> </tr> <tr> <td style="text-align: center;">7</td> <td style="text-align: center;">341</td> <td style="text-align: center;">341</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">15</td> <td style="text-align: center;">692</td> <td style="text-align: center;">695</td> <td style="text-align: center;">3</td> <td style="text-align: center;">3</td> </tr> </table>								0	32	32	Difference (°F)	0	1	77	76	-	-1	3	165	164	-	-1	7	341	341	0	0	15	692	695	3
0	32	32	Difference (°F)	0																												
1	77	76	-	-1																												
3	165	164	-	-1																												
7	341	341	0	0																												
15	692	695	3	3																												



## 5 Point Console Dry Gas Meter Calibration

Console ID A161399

Calibrated by	Initials
Reviewed by	EDF
	Date
	6/26/13
	Initials
	WMS
	Date
	6/28/13

Expiration Date 25-Dec-2013
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	N-1		N-2		N-3		N-4		N-5	
Orifice ID:	N-1		N-2		N-3		N-4		N-5	
Orifice K <sub>i</sub> :	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 <sup>3</sup> )	686.581	691.691	696.813	701.987	708.308	715.082	721.851	729.852	737.849	747.256
Final Reading, (ft <sup>3</sup> )	691.691	696.813	701.987	707.193	715.082	721.851	729.852	737.849	747.256	756.718
Difference, (ft <sup>3</sup> )	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 <sub>2</sub> O)	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 <sub>mstd</sub> )	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 <sub>crstd</sub> )	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 <sub>2</sub> O)	1.703	1.703	1.764	1.738	1.783	1.783	1.846	1.846	1.869	1.867
Average ΔH@, ("H <sub>2</sub> O)	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 ΔH@ within 0.20 "H <sub>2</sub> O of mean	TRUE

CDS-045 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	MIB	Leak Check	(+)	OK
	Date	6/26/13		Date	6/28/13		(-)	OK

Critical Orifice	Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B	Run 4A	Run 4B	Run 5A	Run 5B
	Identification Number	N-1								
K Factor	0.2647									
DGM Initial Reading (ft <sup>3</sup> )	686.581	691.691	696.813	701.987	707.193	715.082	721.851	729.852	737.849	747.254
DGM Final Reading (ft <sup>3</sup> )	691.691	696.813	701.987	707.193	715.082	721.851	729.852	737.849	747.254	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 <sub>2</sub> O)	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	29.14	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 Calibrated by: EDF  
 Reference Thermometer ID Number 111858733 Date 6/26/13  
 Voltage Generator ID Number A178550 Reviewed by MB  
 Date 062813

### Temperature Readout Calibration<sup>1</sup>

Reference Thermometer (°F)	32
Temperature Readout (°F)	32
Was Readout adjusted?	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no

### Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F)			Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference <sup>2,3</sup>			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	165	0
	10.0	475	475	0	5	-1.0	-10	-12	-2
	15.0	692	695	3		0.0	32	32	0
	20.0	905	907	2		1.0	77	76	-1
	30.0	1329	1332	3		2.0	121	120	-1
	40.0	1772	1777	5		3.0	165	165	0
2	0.0	32	32	0	6	-1.0	-10	-12	-2
	3.0	165	165	0		0.0	32	32	0
	4.0	208	210	2		1.0	77	76	-1
	5.0	251	254	3		2.0	121	121	0
	7.0	341	342	1		3.0	165	165	0
3	0.0	32	32 <sup>EDF</sup> <del>32</del> <sub>6/26</sub>	0	7	-1.0	-10	-12	-2
	3.0	165	165	0		0.0	32	32	0
	4.0	208	209	1		1.0	77	76	-1
	5.0	251	254	3		2.0	121	120	-1
	7.0	341	342	1		3.0	165	165	0

<sup>1</sup> Reference thermometer and readout must agree within 2°F.

<sup>2</sup> Difference is calculated as follows:

**Difference = Observed - Theoretical**

<sup>3</sup> 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	Reviewed by	Initials	Leak Check	(+)	(-)
	Date	Date	Date	Check	OK	OK
	<b>mlb</b>		<b>NMP</b>			
	<b>8/7/13</b>		<b>8/9/13</b>			

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
Critical Orifice	Identification Number	<b>N-2</b>					
	K Factor	<b>0.36229</b>					
Subject DGM	DGM Initial Reading (ft <sup>3</sup> )	<b>756.853</b>	<b>762.182</b>	<b>768.700</b>	<b>775.278</b>	<b>781.898</b>	<b>789.754</b>
	DGM Final Reading (ft <sup>3</sup> )	<b>762.182</b>	<b>768.700</b>	<b>775.278</b>	<b>781.898</b>	<b>789.754</b>	<b>797.689</b>
	Initial Temperature (°F)	<b>66</b>	<b>67</b>	<b>69</b>	<b>69</b>	<b>70</b>	<b>71</b>
	Final Temperature (°F)	<b>67</b>	<b>69</b>	<b>69</b>	<b>70</b>	<b>71</b>	<b>72</b>
Test Time (minutes)		<b>13</b>	<b>13</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>
Orifice Manometer, ΔH ("H <sub>2</sub> O)		<b>0.68</b>	<b>0.68</b>	<b>1.4</b>	<b>1.4</b>	<b>1.9</b>	<b>1.9</b>
Barometric Pressure ("Hg)		<b>29.10</b>	<b>29.10</b>	<b>29.10</b>	<b>29.10</b>	<b>29.10</b>	<b>29.10</b>
Ambient Temperature (°F)		<b>70.0</b>	<b>70.0</b>	<b>71.0</b>	<b>71.0</b>	<b>72.0</b>	<b>72.0</b>
Pump Vacuum ("Hg)		<del>20.5</del> <b>20.5</b>	<b>20.5</b>	<b>19.0</b>	<b>19.0</b>	<b>17.5</b>	<b>17.5</b>

		Check the readout against a NIST Thermometer			Check the readout linearity (one channel only)		
NIST Thermometer ID		<b>11858133</b>			Voltage Supply ID <b>27470881</b>		
Thermometer Reading (°F)		<b>32</b>			Channel No <b>1</b>		
Readout Reading (°F)		<b>32</b>			Voltage (mv)		
Temperature Readout Calibration		X			Theoretical (°F)		
					Observed (°F)		
					Difference (°F)		
					0		
					32		
		1			32		
		3			77		
		7			165		
		15			341		
					693		
					693		

### 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	

	N-2 0.3629		N-3 0.5193		N-4 0.6109	
	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Dry Gas Meter						
Initial Reading, (ft <sup>3</sup> )	756.853	762.782	768.700	775.278	781.898	789.754
Final Reading, (ft <sup>3</sup> )	762.782	768.700	775.278	781.898	789.754	797.689
Difference, (ft <sup>3</sup> )	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 <sub>2</sub> O)	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-0451 DGM 3 point cal check against orifice  
Per EM SOP-003  
Revision Date: March 2013

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

Console ID A161314

Calibrated by	Initials	Reviewed by	Initials	Leak Check
	Date		Date	(+) / (-)
	NMP		MJB	✓
	4/7/13		11/12/13	✓

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
Critical Orifice	Identification Number	N2					
	K Factor	0.3629					
Subject DGM	DGM Initial Reading (ft <sup>3</sup> )	826.977	832.705	813.466	820.191	839.884	852.377
	DGM Final Reading (ft <sup>3</sup> )	832.705	839.884	820.191	826.977	842.756	872.471
	Initial Temperature (°F)	69	69	67	68	70	71
	Final Temperature (°F)	69	70	68	68	71	71
Test Time (minutes)		10-12					
Orifice Manometer, ΔH ("H <sub>2</sub> O)		0.68					
Barometric Pressure ("Hg)		29.55					
Ambient Temperature (°F)		66					
Pump Vacuum ("Hg)		22					
		NMP 4/7/13		NMP 4/7/13		NMP 4/7/13	
		0.68		0.5193		0.6169	
		1.45		1.45		2.00	
		29.55		29.55		29.55	
		66		66		66	
		22		20		18	

Check the readout against a NIST Thermometer		Check the readout linearity (one channel only)	
NIST Thermometer ID		27470881	
Thermometer Reading (°F)		32	
Readout Reading (°F)		32	
<div style="font-size: 4em; opacity: 0.5;">X</div>		Voltage Supply ID	
		Voltage (mv)	
		Theoretical (°F)	
		Observed (°F)	
		Difference (°F)	
		Channel No	
		1	
		32	
		77	
		165	
		342	
		695	
		0	
		0	
		0	
		1	
		3	

### 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

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

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 SCP-003*  
*Revision Date: March 2013*

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

Console ID A164401  
Thermometer ID III 8588733

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

Critical Orifice	Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B	Run 4A	Run 4B	Run 5A	Run 5B
	Identification Number	N-1		N-2		N-3		N-4		N-5
K Factor	0.2647		0.3629		0.5193		0.6109		0.7198	
DGM Initial Reading (ft <sup>3</sup> )	213.143	278.708	227.617	235.235	242.843	249.607	256.368	264.359	284.259	298.350
DGM Final Reading (ft <sup>3</sup> )	270.708	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		10		10		15	
Orifice Manometer, ΔH ("H <sub>2</sub> O)	0.33		0.64		1.3		1.3		2.5	
Barometric Pressure ("Hg)	29.10		29.10		29.10		29.10		29.10	
Ambient Temperature (°F)	75		72		73		73		75	
Pump Vacuum ("Hg)	21.5		20.5		18.5		18.5		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	EDF
Date	6/3/13	

Expiration Date	29-Nov-2013
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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 <sup>3</sup> )	273.143	278.708	227.617	235.235	242.843	249.607	256.368	264.359	284.259	298.350
Final Reading, (ft <sup>3</sup> )	278.708	284.259	235.230	242.842	249.607	256.368	264.359	273.143	298.350	312.457
Difference, (ft <sup>3</sup> )	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 <sub>2</sub> O)	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 <sub>mstd</sub> )	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 <sub>critd</sub> )	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 <sub>2</sub> O)	1.608	1.606	1.666	1.665	1.657	1.654	1.659	1.657	1.661	1.661
Average ΔH@, ("H <sub>2</sub> O)	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 ΔH@ within 0.20 "H <sub>2</sub> O of mean	TRUE

CD5-045 DGM 5 point against orifice  
Per EM SOP-002  
Revision Date: March 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

	N-2		N-3		N-4	
	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Orifice ID:	0.3629		0.5193		0.6109	
Orifice K':						
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft <sup>3</sup> )	435.015	441.162	447.312	454.084	461.528	469.511
Final Reading, (ft <sup>3</sup> )	441.162	447.319	454.084	461.528	469.511	477.499
Difference, (ft <sup>3</sup> )	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 <sub>2</sub> O)	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

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

Console ID **A161401**

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

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
Critical Orifice	Identification Number	N-2					
	K Factor	0.3629					
Subject DGM	DGM Initial Reading (ft <sup>3</sup> )	435.015	441.162	447.312	454.084	461.528	469.511
	DGM Final Reading (ft <sup>3</sup> )	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 <sub>2</sub> O)	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

		Check the readout linearity (one channel only)		
		Voltage Supply ID	Channel No	Difference (°F)
Check the readout against a NIST Thermometer		27470881	1	
NIST Thermometer ID	11858733			
Thermometer Reading (°F)	32	Theoretical (°F)		Difference (°F)
Readout Reading (°F)	32	0	32	0
<div style="border: 1px solid black; width: 100%; height: 100%; position: relative;"> <span style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); font-size: 4em; opacity: 0.5;">X</span> </div>				
		1	77	0
		3	165	0
		7	341	0
		15	692	2

## Pre/Post Test Console Calibration Check

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

	N-2		N-3		N-4	
Orifice ID:						
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 <sup>3</sup> )	846.065	851.329	808.429	815.238	829.214	837.230
Final Reading, (ft <sup>3</sup> )	851.329	856.599	815.238	828.880	837.230	846.065
Difference, (ft <sup>3</sup> )	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 <sub>2</sub> O)	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-0451 DGM 3 point cal check against orifice  
Per EM SOP-003  
Revision Date: March 2013

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

Console ID A161401

Calibrated by	Initials	Reviewed by	Initials	Leak Check	
	Date	Date		(+)	(-)
	<u>NMP</u>		<u>MB</u>		<input checked="" type="checkbox"/>
	<u>11/11/13</u>		<u>11/12/13</u>		<input checked="" type="checkbox"/>

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

Check the readout against a NIST Thermometer		Check the readout linearity (one channel only)	
NIST Thermometer ID	<u>111 858733</u>	Voltage Supply ID	<u>27470681</u>
Thermometer Reading (°F)	<u>32</u>	Voltage (mv)	
Readout Reading (°F)	<u>32</u>	0	<u>32</u>
Temperature Readout Calibration		1	<u>76</u>
		3	<u>164</u>
		7	<u>340</u>
		15	<u>692</u>
		Theoretical (°F)	Observed (°F)
		32	<u>32</u>
		77	<u>76</u>
		165	<u>164</u>
		341	<u>340</u>
		692	<u>692</u>
		Difference (°F)	<u>0</u>
			<u>-1</u>
			<u>-1</u>
			<u>-1</u>
			<u>0</u>

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

Console ID A183521  
Thermometer ID 111858733

Calibrated by	Initials	<u>EOE</u>	Reviewed by	Initials	<u>OK</u>	Leak Check	(+)	<u>OK</u>
	Date	<u>6/25/13</u>		Date	<u>6-25-13</u>		(-)	<u>OK</u>

Critical Orifice	Run 1A		Run 1B		Run 2A		Run 2B		Run 3A		Run 3B		Run 4A		Run 4B		Run 5A		Run 5B																					
	Identification Number	K Factor	DGM Initial Reading (ft <sup>3</sup> )	DGM Final Reading (ft <sup>3</sup> )	Initial DGM Temperature (°F)	Final DGM Temperature (°F)	DGM Initial Reading (ft <sup>3</sup> )	DGM Final Reading (ft <sup>3</sup> )	Initial DGM Temperature (°F)	Final DGM Temperature (°F)	DGM Initial Reading (ft <sup>3</sup> )	DGM Final Reading (ft <sup>3</sup> )	Initial DGM Temperature (°F)	Final DGM Temperature (°F)	DGM Initial Reading (ft <sup>3</sup> )	DGM Final Reading (ft <sup>3</sup> )	Initial DGM Temperature (°F)	Final DGM Temperature (°F)	DGM Initial Reading (ft <sup>3</sup> )	DGM Final Reading (ft <sup>3</sup> )	Initial DGM Temperature (°F)	Final DGM Temperature (°F)																		
Subject DGM	N-1	0.2647	45.662	50.946	75	75	50.946	56.242	75	76	61.568	66.905	77	77	74.017	80.943	77	77	80.943	89.096	77	78	97.268	106.844	78	78	97.268	106.844	78	79	106.844	116.438	78	78	97.268	106.844				
	N-2	0.3629	50.946	56.242	75	76	61.568	66.905	76	77	74.017	80.943	77	77	80.943	89.096	77	78	89.096	97.268	77	78	97.268	106.844	78	78	97.268	106.844	78	79	106.844	116.438	78	78	97.268	106.844				
	N-3	0.5193	56.242	61.568	76	77	66.905	74.017	77	77	80.943	89.096	77	77	89.096	97.268	77	78	97.268	106.844	77	78	106.844	116.438	78	78	106.844	116.438	78	79	116.438	126.032	78	79	126.032	135.626	79	79	126.032	135.626
	N-4	0.6109	61.568	66.905	77	77	74.017	80.943	77	77	89.096	97.268	77	78	97.268	106.844	77	78	106.844	116.438	77	78	116.438	126.032	78	78	116.438	126.032	78	79	126.032	135.626	78	79	135.626	145.220	79	79	135.626	145.220
	N-5	0.7198	66.905	74.017	77	77	80.943	89.096	77	78	97.268	106.844	77	78	106.844	116.438	77	78	116.438	126.032	77	78	126.032	135.626	78	78	126.032	135.626	78	79	135.626	145.220	78	79	145.220	154.814	79	79	145.220	154.814
Test Time (minutes)	15	15	11	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10		
Orifice Manometer, ΔH ("H <sub>2</sub> O)	0.34	0.34	0.65	0.65	1.4	1.4	1.4	1.4	1.4	1.9	1.9	1.9	1.9	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	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	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	29.15	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	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Pump Vacuum ("Hg)	23.5	23.5	22.5	22.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5

Notes:

## 5 Point Console Dry Gas Meter Calibration

Console ID A183521

Calibrated by	Initials
Reviewed by	Date
	Initials
	Date

Expiration Date 24-Dec-2013
--------------------------------

	N-1		N-2		N-3		N-4		N-5	
	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #4a	Run #4b	Run #5a	Run #5b
Dry Gas Meter										
Initial Reading, (ft <sup>3</sup> )	45.662	50.946	56.242	61.568	67.091	74.017	80.943	89.096	97.268	106.844
Final Reading, (ft <sup>3</sup> )	50.946	56.242	61.568	66.905	74.017	80.943	89.096	97.268	106.844	116.438
Difference, (ft <sup>3</sup> )	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 <sub>2</sub> O)	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 <sub>mstd</sub> )	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 <sub>crstd</sub> )	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 <sub>2</sub> O)	1.658	1.657	1.688	1.686	1.777	1.777	1.745	1.744	1.792	1.790
Average ΔH@, ("H <sub>2</sub> O)	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 ΔH@ within 0.20 "H <sub>2</sub> O 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	Calibrated by:	E OF
Reference Thermometer ID Number	111858733	Date	6/25/13
Voltage Generator ID Number	A178550	Reviewed by	PC
		Date	6/25/13

### Temperature Readout Calibration <sup>1</sup>

Reference Thermometer (°F)	32
Temperature Readout (°F)	34
Was Readout adjusted?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

### Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F)			Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference <sup>2,3</sup>			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

<sup>1</sup> Reference thermometer and readout must agree within 2°F.

<sup>2</sup> Difference is calculated as follows:  
**Difference = Observed - Theoretical**

<sup>3</sup> Acceptable difference is ±5°F for temperatures below 1000°F and ±10°F for temperatures above 1000°F.

### 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

	N-2		N-3			N-4		
	0.3629		0.5193			0.6109		
Orifice ID:								
Orifice K':								
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #3c	Run #3d
Initial Reading, (ft <sup>3</sup> )	156.124	162.384	168.645	175.528	182.429	190.564	198.704	206.845
Final Reading, (ft <sup>3</sup> )	162.384	168.645	175.528	182.429	190.564	198.704	206.845	214.986
Difference, (ft <sup>3</sup> )	6.260	6.261	6.883	6.901	8.135	8.140	8.140	8.140
Initial Meter Temp., (°F)	68	69	71	72	73	74	74	74
Final Meter Temp., (°F)	69	71	72	73	74	75	75	75
Average Meter Temp., (°F)	68.5	70.0	71.5	72.5	73.5	74.5	74.5	74.5
Test Time (min.)	13	13	10	10	10	10	10	10
Orifice Manometer Reading, ("H <sub>2</sub> O)	0.67	0.67	1.30	1.30	1.80	1.80	1.80	1.80
Barometric Pressure, ("Hg)	29.14	29.14	29.14	29.14	29.14	29.14	29.14	29.14
Ambient Temperature, (°F)	74	74	75	75	75	75	75	75
Pump Vacuum, ("Hg)	21	21	19.5	19.5	18.5	18.5	18.5	18.5
Standard Volume of the Meter, (V <sub>mstd</sub> )	6.099	6.083	6.679	6.683	7.874	7.864	7.864	7.864
Standard Volume of Critical Orifice, (V <sub>crstd</sub> )	5.949	5.949	6.542	6.542	7.696	7.696	7.696	7.696
DGM Calibration Factor, (Y)	0.975	0.978	0.980	0.979	0.977	0.979	0.979	0.979
Delta H@	1.76	1.75	1.66	1.66	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

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

Console ID **A183521**

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

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
Critical Orifice	Identification Number	N-2		N-3		N-4	
	K Factor	0.3629		0.5193		0.6109	
Subject DGM	DGM Initial Reading (ft <sup>3</sup> )	156.124	162.384	168.645	175.528	182.429	190.564
	DGM Final Reading (ft <sup>3</sup> )	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 <sub>2</sub> O)	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

Check the readout against a NIST Thermometer		Check the readout linearity (one channel only)																															
NIST Thermometer ID	111858733	Voltage Supply ID	27470881																														
Thermometer Reading (°F)	32	Voltage (mv)	32																														
Readout Reading (°F)	32	Theoretical (°F)	77																														
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td>0</td> <td>32</td> <td>32</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>77</td> <td>77</td> <td>0</td> <td>0</td> </tr> <tr> <td>3</td> <td>165</td> <td>165</td> <td>0</td> <td>0</td> </tr> <tr> <td>7</td> <td>341</td> <td>341</td> <td>0</td> <td>0</td> </tr> <tr> <td>15</td> <td>693</td> <td>693</td> <td>1</td> <td>1</td> </tr> </table>									0	32	32	0	0	1	77	77	0	0	3	165	165	0	0	7	341	341	0	0	15	693	693	1	1
0	32	32	0	0																													
1	77	77	0	0																													
3	165	165	0	0																													
7	341	341	0	0																													
15	693	693	1	1																													
Temperature Readout Calibration	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> </table>																																
	Channel No	Observed (°F)	Difference (°F)																														

## Pre/Post Test Console Calibration Check

Console ID	A183521	
Calibrated by	Initials	NMP
	Date	11/11/13
Reviewed by	Initials	<i>[Signature]</i>
	Date	11/12/13

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

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

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

Console ID ~~111213~~ **A183521**

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

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
Critical Orifice	Identification Number	N2					
	K Factor	0.3629					
Subject DGM	DGM Initial Reading (ft <sup>3</sup> )	224.937	234.501	203.573	213.916	242.344	252.915
	DGM Final Reading (ft <sup>3</sup> )	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 <sub>2</sub> O)	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

		Check the readout against a NIST Thermometer			Check the readout linearity (one channel only)		
Temperature Readout Calibration	NIST Thermometer ID	11858733			Voltage Supply ID 27470881		
	Thermometer Reading (°F)	32			Channel No 1		
	Readout Reading (°F)	32			Observed (°F)		
			32			Difference (°F)	
		32			32		
		32			77		
		32			166		
		32			342		
		32			695		

# S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: 5-03  
 Caliper ID: 700802

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

General Pitot Tube Alignment		$A = \underline{0.938}''$ $D_t = \underline{0.314}''$ $0.188'' \leq D_t \leq 0.375''?$ <u>Y</u> (y/n) $1.05 \leq \frac{A}{2D_t} \leq 1.50?$ <u>Y</u> (y/n)	
		$\alpha_1 = \underline{0.7}^\circ$ $\alpha_2 = \underline{0.6}^\circ$ $\alpha_1 \leq 10^\circ?$ <u>Y</u> (y/n) $\alpha_2 \leq 10^\circ?$ <u>Y</u> (y/n)	
		$\beta_1 = \underline{0.8}$ $\beta_2 = \underline{0.3}$ $\beta_1 \leq 5^\circ?$ <u>Y</u> (y/n) $\beta_2 \leq 5^\circ?$ <u>Y</u> (y/n)	
Misalignment		$\gamma = \underline{3.3}^\circ$ $\theta = \underline{0.1}^\circ$ $Z = A \tan(\gamma) = \underline{0.054}$ $W = A \tan(\theta) = \underline{0.002}$ $Z \leq 0.125''?$ <u>Y</u> (y/n) $W \leq 0.031''?$ <u>Y</u> (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	<u>MAS</u>	Reviewed by	Initials	<u>EM</u>
	Date	<u>8-27-13</u>		Date	<u>9/6/13</u>

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

<sup>1</sup> Per SOP 032, this calibration is generally performed at 160°F.  
<sup>2</sup>  $T_{abs} (^\circ R) = T_f (^\circ F) + 460$

# S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: 5-07 MAS  
~~8-07~~ 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			$A = 0.949''$ $D_t = 0.375''$ $0.188'' \leq D_t \leq 0.375''?$ <input checked="" type="checkbox"/> (y/n) $1.05 \leq \frac{A}{2D_t} \leq 1.50?$ <input checked="" type="checkbox"/> (y/n)
			$\alpha_1 = 0.13^\circ$ $\alpha_2 = 0.7^\circ$ $\alpha_1 \leq 10^\circ?$ <input checked="" type="checkbox"/> (y/n) $\alpha_2 \leq 10^\circ?$ <input checked="" type="checkbox"/> (y/n) $\beta_1 = 0.4$ $\beta_2 = 0.7$ $\beta_1 \leq 5^\circ?$ <input checked="" type="checkbox"/> (y/n) $\beta_2 \leq 5^\circ?$ <input checked="" type="checkbox"/> (y/n)
		$\gamma = 0.8^\circ$ $\theta = 1.2^\circ$ $Z = A \tan(\gamma) = \frac{0.013 \text{ MAS}}{0.016}$ $W = A \tan(\theta) = \frac{0.016}{0.020}$	$Z \leq 0.125''?$ <input checked="" type="checkbox"/> (y/n) $W \leq 0.031''?$ <input checked="" type="checkbox"/> (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 <sup>1</sup>	Reference Thermometer ID No. <sup>2</sup>	130090343	Thermocouple Readout ID No.	A161402	Compare thermocouple to reference thermometer	Calculate applicability range for thermocouple	
	$T_F$	353°F	$T_F$	351°F	$\frac{T_{abs,TC}}{T_{abs,RT}} = 0.998$	$Min_{abs} = 0.9 \times T_{abs,TC}$	$Min_F = Min_{abs} - 460$
	$T_{abs,RT}$	813°R	$T_{abs,TC}$	811°R	Is this between 0.985 and 1.015? <input checked="" type="checkbox"/> (y/n)	730°R	270°F
						$Max_{abs} = 1.1 \times T_{abs,TC}$	$Max_F = Max_{abs} - 460$
						892°R	432°F

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

# S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: S-19  
 Caliper ID: 700802

Calibrated by	Initials	<u>OC</u>	Reviewed by	Initials	<u>EM</u>
	Date	<u>8-26-13</u>		Date	<u>9/4/13</u>

General Pitot Tube Alignment		$A = 0.946''$ $D_t = 0.374''$ $0.188'' \leq D_t \leq 0.375''$ <u>Y</u> (y/n) $1.05 \leq \frac{A}{2D_t} \leq 1.50$ <u>Y</u> (y/n)	
		$\alpha_1 = 0.8^\circ$ $\alpha_2 = 1.2^\circ$ $\alpha_1 \leq 10^\circ$ <u>Y</u> (y/n) $\alpha_2 \leq 10^\circ$ <u>Y</u> (y/n)	
		$\beta_1 = 0.4$ $\beta_2 = 0.9$ $\beta_1 \leq 5^\circ$ <u>Y</u> (y/n) $\beta_2 \leq 5^\circ$ <u>Y</u> (y/n)	
Misalignment		$\gamma = 0.8^\circ$ $\theta = 0.1^\circ$ $Z = A \tan(\gamma) = 0.013$ $W = A \tan(\theta) = 0.002$ $Z \leq 0.125''$ <u>Y</u> (y/n) $W \leq 0.031''$ <u>Y</u> (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 <sub>t</sub> ) 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	<u>OC</u>	Reviewed by	Initials	<u>EM</u>
	Date	<u>8-26-13</u>		Date	<u>9/4/13</u>

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

<sup>1</sup> Per SOP 032, this calibration is generally performed at 160°F.

<sup>2</sup>  $T_{abs} (°R) = T_F (°F) + 460$



# S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: P-302  
 Caliper ID: 700802

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

General Pitot Tube Alignment			$A = \underline{0.952}''$ $D_t = \underline{0.372}''$ $0.188 \leq D_t \leq 0.375''?$ <u>Y</u> (y/n) $1.05 \leq A/2D_t \leq 1.50?$ <u>Y</u> (y/n)
			$\alpha_1 = \underline{0.4}^\circ$ $\alpha_2 = \underline{0.7}^\circ$ $\alpha_1 \leq 10^\circ?$ <u>Y</u> (y/n) $\alpha_2 \leq 10^\circ?$ <u>Y</u> (y/n)
			$\beta_1 = \underline{0.5}$ $\beta_2 = \underline{0.2}$ $\beta_1 \leq 5^\circ?$ <u>Y</u> (y/n) $\beta_2 \leq 5^\circ?$ <u>Y</u> (y/n)
Misalignment		$\gamma = \underline{0.9}^\circ$ $\theta = \underline{1.2}^\circ$	$Z = A \tan(\gamma) = \underline{0.015}$ $W = A \tan(\theta) = \underline{0.020}$ $Z \leq 0.125''?$ <u>Y</u> (y/n) $W \leq 0.031''?$ <u>Y</u> (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.

Probe ID: P-302

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

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

<sup>1</sup> Per SOP 032, this calibration is generally performed at 160°F.  
<sup>2</sup>  $T_{abs} (^\circ R) = T_F (^\circ F) + 460$

# S-Type Pitot Tube Inspection and Probe Thermocouple Calibration Check

Pitot ID: P-529  
 Caliper ID: 701615

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

General Pitot Tube Alignment			$A = \underline{0.919}''$ $D_1 = \underline{0.373}''$ $0.188'' \leq D_1 \leq 0.375''?$ <u>Y</u> (y/n) $1.05 \leq A/2D_1 \leq 1.50?$ <u>Y</u> (y/n)	
		$\alpha_1 = \underline{0.4}^\circ$ $\alpha_2 = \underline{0.8}^\circ$ $\alpha_1 \leq 10^\circ?$ <u>Y</u> (y/n) $\alpha_2 \leq 10^\circ?$ <u>Y</u> (y/n)		$\beta_1 = \underline{0}$ $\beta_2 = \underline{0.8}$ $\beta_1 \leq 5^\circ?$ <u>Y</u> (y/n) $\beta_2 \leq 5^\circ?$ <u>Y</u> (y/n)
		$\gamma = \underline{0.7}^\circ$ $\theta = \underline{1.6}^\circ$ $Z = A \tan(\gamma) = \underline{0.011}$ $W = A \tan(\theta) = \underline{0.026}$	$Z \leq 0.125''?$ <u>Y</u> (y/n) $W \leq 0.031''?$ <u>Y</u> (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 ( $D_1$ ) 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	<u>NMP</u>	Reviewed by	Initials	<u>DC</u>
	Date	<u>10/4/13</u>		Date	<u>10-4-13</u>

Stack Thermocouple Calibration <sup>1</sup>	Reference Thermometer ID No. <sup>2</sup>	Thermocouple Readout ID No.	Compare thermocouple to reference thermometer	Calculate applicability range for thermocouple	
	<u>11858733</u> <u>130090343</u> $T_F = \underline{388}^\circ F$ $T_{abs, RT} = \underline{848}^\circ R$	<u>A161402</u> $T_F = \underline{385}^\circ F$ $T_{abs, TC} = \underline{845}^\circ R$		$\frac{T_{abs, TC}}{T_{abs, RT}} = \underline{0.996}$ Is this between 0.985 and 1.015? <u>Y</u> (y/n)	$Min_{abs} = 0.9 \times T_{abs, TC}$ <u>761</u> °R
				$Max_{abs} = 1.1 \times T_{abs, TC}$ <u>930</u> °R	$Max_F = Max_{abs} - 460$ <u>470</u> °F

<sup>1</sup> Per SOP 032, this calibration is generally performed at 160°F.  
<sup>2</sup>  $T_{abs}; (^\circ R) = T_F (^\circ F) + 460$

# Calibration Data Sheet – Calipers

Caliper ID Number 700903

Calibrated by	Initials	mlb
	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%

## 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)	∅
Is the difference $\leq \pm 0.1$ 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



(877) 321-3443  
Fax (512) 321-1114  
email: info@bastrop-scale.com  
www.bastrop-scale.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:**

**AFTER SERVICE:**

Corner or Section Error: 0 @ 1000g

Corner or Section Error: 0 @ 1000g

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

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.bastrop-scale.com/credentials.html>

Technician Eugen Trigi License # 95161 Date 6/27/13

Certificate #s of weights used: 1931701, 1931696

# Balance Calibration

Balance ID TE 4101A

Calibrated by	Initials	<u>MIB</u>	Reviewed by	Initials	<u>AL</u>
	Date	<u>6-27-13</u>		Date	<u>7-3-13</u>

Initial Calibration	External Contractor	Date
	<u>BASTROP SCALE CO. INC.</u>	<u>06-27-13</u>

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	<u>83056</u>	50	<u>50.0</u>	49.9 - 50.1
	<u>83055</u>	100	<u>100.0</u>	99.9 - 100.1
	<u>83054</u>	200	<u>200.0</u>	199.8 - 200.2
	<u>83053</u>	500	<u>500.0</u>	499.5 - 500.5
	<u>83052</u>	1000	<u>999.9</u>	999 - 1001

Did not use mib 612711

	Calibration Weight <sup>1</sup> (g)	Balance Reading (g)
Calibration of Student Weights  Student Weight Set ID <u>700224</u>	<u>20A</u>	<u>20.0</u>
	<u>20B</u>	<u>20.0</u>
	<u>50</u>	<u>50.0</u>
	<u>100</u>	<u>100.0</u>
	<u>200A</u>	<u>200.0</u>
	<u>200B</u>	<u>200.0</u>
	<u>500</u>	<u>499.8</u>
	<u>1000</u>	<u>999.8</u>

<sup>1</sup> Use only calibration weights greater than 20 g.



Air Liquide America  
Specialty Gases LLC



# 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**

**Second Triad Analysis**

**Calibration Curve**

**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		

Concentration = A + Bx + Cx <sup>2</sup> + Dx <sup>3</sup> + Ex <sup>4</sup>	
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

#### 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

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

#### 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 America  
Specialty Gases LLC



# 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 - PGVP Vendor ID: A32011**

P.O. No.: URS

AIR LIQUIDE AMERICA SPECIALTY GASES LLC Document #: 43711369-001  
11426 FAIRMONT PKWY  
LA PORTE, TX 77571

**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  
**Cylinder Pressure\*\*\*:** 2000 PSIG

**Certification Date:** 31Oct2011

**Exp. Date:** 30Oct2014  
**Batch No:** LAP0051851

#### COMPONENT

#### CERTIFIED CONCENTRATION (Moles)

#### ACCURACY\*\*

#### TRACEABILITY

PROPANE  
AIR

21.3 PPM  
BALANCE

+/- 1%

Direct NIST and VSL

\*\*\* 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

##### Second Triad Analysis

##### Calibration Curve

#### 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

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
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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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

First Triad Analysis	(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)	Second Triad Analysis	Calibration Curve
<b>CARBON DIOXIDE</b> 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 %			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
<b>OXYGEN</b> 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 %			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)



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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

#### 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

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

#### Second Triad Analysis

#### Calibration Curve

Concentration=A+Bx+Cx<sup>2</sup>+Dx<sup>3</sup>+Ex<sup>4</sup>  
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 America  
Specialty Gases LLC



# 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: **TRO0057923**

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: %  
Z1=0.00000 R1=23.20000 T1=10.09000  
R2=23.20000 Z2=0.00000 T2=10.08000  
Z3=0.00000 T3=10.08000 R3=23.20000  
Avg. Concentration: 10.06 %

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
r = 0.999997  
Constants: A = -0.04233969  
B = 1.001808266 C = 0  
D = 0 E = 0

**CARBON DIOXIDE**

Date: 17May2012 Response Unit: MV  
Z1=0.00000 R1=99.10000 T1=60.30000  
R2=99.10000 Z2=0.00000 T2=60.30000  
Z3=0.00000 T3=60.30000 R3=99.10000  
Avg. Concentration: 10.01 %

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
r = 0.999987  
Constants: A = -0.00518415  
B = 0.136464952 C = -0.0002272  
D = 1.23741E-05 E = 0

APPROVED BY: \_\_\_\_\_

JEFF CROTEAU



Air Liquide America  
Specialty Gases LLC



# 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

#### Second Triad Analysis

#### Calibration Curve

#### 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

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
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: **TRO0060969**

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

#### Second Triad Analysis

#### Calibration Curve

#### 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

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
 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 HATCHER



**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: TRO060970

COMPONENT  
PROPANE  
AIR

CERTIFIED CONCENTRATION (Moles)  
8.43 PPM  
BALANCE

ACCURACY\*\*  
+/- 1%

TRACEABILITY  
Direct NIST and VSL

\*\*\* 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

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

### INSTRUMENTATION

<u>INSTRUMENT/MODEL/SERIAL#</u>	<u>DATE LAST CALIBRATED</u>	<u>ANALYTICAL PRINCIPLE</u>
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

Date:	Response Unit: AREA		
27Jun2012	R1 = 2645098.	T1 = 222869.0	
Z1 = 0.00000	Z2 = 0.00000	T2 = 221994.0	
R2 = 2640869.	T3 = 221877.0	R3 = 2623861.	
Z3 = 0.00000			
Avg. Concentration:	8.429	PPM	

Concentration = A + Bx + Cx <sup>2</sup> + Dx <sup>3</sup> + Ex <sup>4</sup>	
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:

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 America  
Specialty Gases LLC



# 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: TRO0057923

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: %  
Z1=0.00000 R1=23.20000 T1=10.09000  
R2=23.20000 Z2=0.00000 T2=10.08000  
Z3=0.00000 T3=10.08000 R3=23.20000  
Avg. Concentration: 10.06 %

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
r = 0.999997  
Constants: A = -0.04233969  
B = 1.001808266 C = 0  
D = 0 E = 0

#### CARBON DIOXIDE

Date: 17May2012 Response Unit: MV  
Z1=0.00000 R1=99.10000 T1=60.30000  
R2=99.10000 Z2=0.00000 T2=60.30000  
Z3=0.00000 T3=60.30000 R3=99.10000  
Avg. Concentration: 10.01 %

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
r = 0.999987  
Constants: A = -0.00518415  
B = 0.136464952 C = -0.0002272  
D = 1.23741E-05 E = 0

APPROVED BY:

JEFF CROTEAU



Air Liquide America  
Specialty Gases LLC



# 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 + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
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: **TRO0060969**

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

#### Second Triad Analysis

#### Calibration Curve

#### 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

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
 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 HATCHER



**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: **TRO060970**

COMPONENT  
PROPANE  
AIR

CERTIFIED CONCENTRATION (Moles)  
**8.43 PPM**  
BALANCE

ACCURACY\*\*  
+/- 1%

TRACEABILITY  
Direct NIST and VSL

\*\*\* 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

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

### INSTRUMENTATION

<u>INSTRUMENT/MODEL/SERIAL#</u>	<u>DATE LAST CALIBRATED</u>	<u>ANALYTICAL PRINCIPLE</u>
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

Date:	Response Unit:
27Jun2012	AREA
Z1 = 0.00000	R1 = 2645098. T1 = 222869.0
R2 = 2640869.	Z2 = 0.00000 T2 = 221994.0
Z3 = 0.00000	T3 = 221877.0 R3 = 2623861.
Avg. Concentration:	8.429 PPM

Concentration = A + Bx + Cx <sup>2</sup> + Dx <sup>3</sup> + Ex <sup>4</sup>	
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:

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 America  
Specialty Gases LLC



# 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**  
Cylinder Pressure\*\*\*: 2000 PSIG

Certification Date: 16May2012

Exp. Date: 16May2015  
Batch No: TRO0057923

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: %  
 Z1=0.00000 R1=23.20000 T1=10.09000  
 R2=23.20000 Z2=0.00000 T2=10.08000  
 Z3=0.00000 T3=10.08000 R3=23.20000  
 Avg. Concentration: 10.06 %

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
 r = 0.999997  
 Constants: A = -0.04233969  
 B = 1.001808266 C = 0  
 D = 0 E = 0

#### CARBON DIOXIDE

Date: 17May2012 Response Unit: MV  
 Z1=0.00000 R1=99.10000 T1=60.30000  
 R2=99.10000 Z2=0.00000 T2=60.30000  
 Z3=0.00000 T3=60.30000 R3=99.10000  
 Avg. Concentration: 10.01 %

Concentration = A + Bx + Cx<sup>2</sup> + Dx<sup>3</sup> + Ex<sup>4</sup>  
 r = 0.999987  
 Constants: A = -0.00518415  
 B = 0.136464952 C = -0.0002272  
 D = 1.23741E-05 E = 0

APPROVED BY:

JEFF CROTEAU