# APPENDIX I

# Sampling Equipment/Instrumentation Calibration Documentation

# Temperature Readout Calibration

## Isokinetic Sampling Consoles

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

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

### Temperature Readout Calibration [1]

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

### Temperature Readout Linearity Check

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

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

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

2 Difference is calculated as follows:

**Difference = Observed - Theoretical**

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

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

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

Console ID A161395

Thermometer ID 111858733

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

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

Notes:

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

# 5 Point Console Dry Gas Meter Calibration

Console ID: A161395

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

| Expiration Date |
|---|
| 27-Dec-2013 |

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

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

*CDS-04S 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 | mlb | Reviewed by | Initials | NMP | Leak Check | (+) | OK |
|---|---|---|---|---|---|---|---|---|
| | Date | 8/7/13 | | Date | 8/9/13 | | (-) | OK |

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

**Temperature Readout Calibration**

**Check the readout against a NIST Thermometer**

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

**Check the readout linearity (one channel only)**

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

# Pre/Post Test Console Calibration Check

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

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

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

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

# Pre/Post Test Console Calibration Check

| Console ID | | A161395 |
|---|---|---|
| Calibrated by | Initials | NMP |
| | Date | 11/11/13 |
| Reviewed by | Initials | MB |
| | Date | 11/12/13 |

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

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

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

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

Console ID A161395

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

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

**Temperature Readout Calibration**

**Check the readout against a NIST Thermometer**

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

**Check the readout linearity (one channel only)**

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

# 5 Point Console Dry Gas Meter Calibration

Console ID A161399

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

| Expiration Date |
|---|
| 25-Dec-2013 |

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

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

*CDS-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 | MB | Leak Check | (+) | OK |
|---|---|---|---|---|---|---|---|---|
| | Date | 6/26/13 | | Date | 6/28/13 | | (-) | OK |

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

Notes:

# Temperature Readout Calibration

## Isokinetic Sampling Consoles

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

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

### Temperature Readout Calibration [1]

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

### Temperature Readout Linearity Check

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

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

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

[2] Difference is calculated as follows:

**Difference = Observed - Theoretical**

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

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

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

Console ID A161399

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

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

Temperature Readout Calibration

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

Check the readout linearity (one channel only)

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

# Pre/Post Test Console Calibration Check

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

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

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

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

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

Console ID A161399

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

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

**Temperature Readout Calibration**

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

Check the readout linearity (one channel only)

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

# Pre/Post Test Console Calibration Check

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

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

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

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

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

Console ID A16401

Thermometer ID 111858733

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

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

Notes:

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

# 5 Point Console Dry Gas Meter Calibration

Console ID A161401

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

| Expiration Date |
|---|
| 29-Nov-2013 |

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

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

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

# Temperature Readout Calibration

## Isokinetic Sampling Consoles

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

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

### Temperature Readout Calibration [1]

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

### Temperature Readout Linearity Check

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

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

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

[2] Difference is calculated as follows:

**Difference = Observed - Theoretical**

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

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

# Pre/Post Test Console Calibration Check

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

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

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

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

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

Console ID A161401

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

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

**Temperature Readout Calibration**

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

**Check the readout linearity (one channel only)**

Voltage Supply ID 27470881 — Channel No 1

| Voltage (mv) | Theoretical (°F) | Observed (°F) | Difference (°F) |
|---|---|---|---|
| 0 | 32 | 32 | 0 |
| 1 | 77 | 77 | 0 |
| 3 | 165 | 165 | 0 |
| 7 | 341 | 341 | 0 |
| 15 | 692 | 694 | 2 |

# Pre/Post Test Console Calibration Check

| Console ID | | A161401 |
|---|---|---|
| Calibrated by | Initials | NMP |
| | Date | 11/11/13 |
| Reviewed by | Initials | MJB |
| | Date | 11/12/13 |

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

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

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

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

**Temperature Readout Calibration**

**Check the readout against a NIST Thermometer**

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

**Check the readout linearity (one channel only)**

Voltage Supply ID 27470881 — Channel No 1

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

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

Console ID A183521

Thermometer ID 111858733

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

| | | Run 1A | Run 1B | Run 2A | Run 2B | Run 3A | Run 3B | Run 4A | Run 4B | Run 5A | Run 5B |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Critical Orifice | Identification Number | N-1 | | N-2 | | N-3 | | N-4 | | N-5 | |
| | K Factor | 0.2647 | | 0.3629 | | 0.5193 | | 0.6109 | | 0.7198 | |
| Subject DGM | DGM Initial Reading ($ft^3$) | 45.662 | 50.946 | 56.242 | 61.568 | ~~66.905~~ 67.091 | 74.017 | 80.943 | 89.096 | 97.268 | 106.844 |
| | DGM Final Reading ($ft^3$) | 50.946 | 56.242 | 61.568 | 66.905 | 74.017 | 80.943 | 89.096 | 97.268 | 106.844 | 116.438 |
| | Initial DGM Temperature (°F) | 75 | 75 | 76 | 77 | 77 | 77 | 77 | 78 | 78 | 78 |
| | Final DGM Temperature (°F) | 75 | 76 | 77 | 77 | 77 | 77 | 78 | 78 | 78 | 79 |
| Test Time (minutes) | | 15 | 15 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 10 |
| Orifice Manometer, ΔH ("$H_2O$) | | 0.34 | 0.34 | 0.65 | 0.65 | 1.4 | 1.4 | 1.9 | 1.9 | 2.7 | 2.7 |
| Barometric Pressure ("Hg) | | 29.15 | 29.15 | 29.15 | 29.15 | 29.15 | 29.15 | 29.15 | 29.15 | 29.15 | 29.15 |
| Ambient Temperature (°F) | | 76 | 76 | 77 | 77 | 76 | 76 | 76 | 76 | 76 | 76 |
| Pump Vacuum ("Hg) | | 23.5 | 23.5 | 22.5 | 22.5 | 20.5 | 20.5 | 19.5 | 19.5 | 18.0 | 18.0 |

Notes:

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

# 5 Point Console Dry Gas Meter Calibration

Console ID A183521

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

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

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

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

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

# Temperature Readout Calibration

## Isokinetic Sampling Consoles

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

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

### Temperature Readout Calibration [1]

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

### Temperature Readout Linearity Check

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

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

[2] Difference is calculated as follows:

**Difference = Observed - Theoretical**

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

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

# Pre/Post Test Console Calibration Check

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

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

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

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

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

Console ID A183521

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

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

**Temperature Readout Calibration**

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

**Check the readout linearity (one channel only)**

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

# Pre/Post Test Console Calibration Check

| Console ID | | A183521 |
|---|---|---|
| Calibrated by | Initials | NMP |
| | Date | 11/11/13 |
| Reviewed by | Initials | mb |
| | Date | 11/12/13 |

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

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

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

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

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

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

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

**Temperature Readout Calibration**

**Check the readout against a NIST Thermometer**

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

**Check the readout linearity (one channel only)**

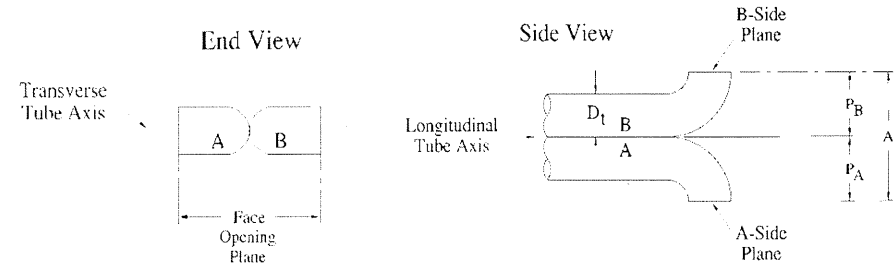
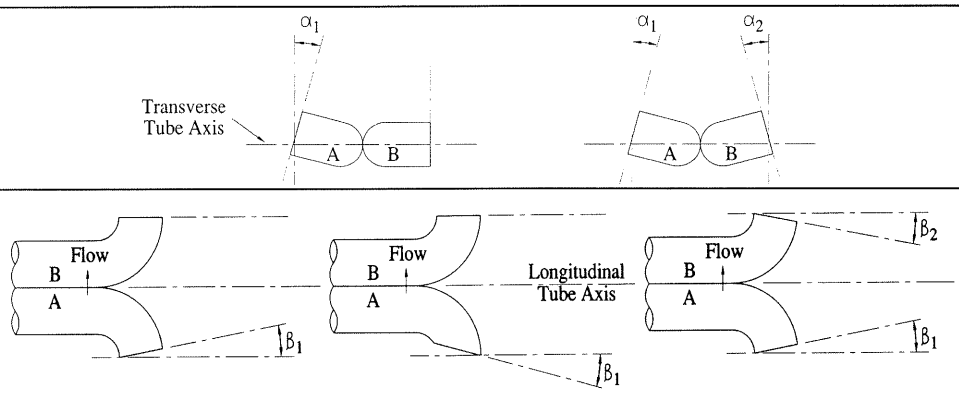
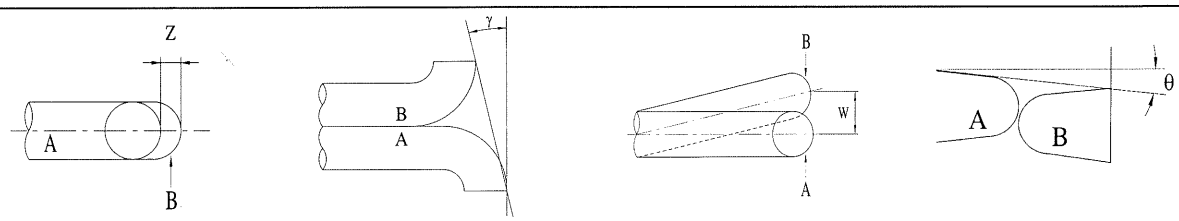
| Voltage Supply ID | 27470881 | Channel No | 1 |
|---|---|---|---|
| Voltage (mv) | Theoretical (°F) | Observed (°F) | Difference (°F) |
| 0 | 32 | 32 | 0 |
| 1 | 77 | 77 | 0 |
| 3 | 165 | 166 | 1 |
| 7 | 341 | 342 | 1 |
| 15 | 692 | 695 | 3 |

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

**Pitot ID:** 5-03

**Caliper ID:** 700802

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

| | | |
|---|---|---|
| **General Pitot Tube Alignment** |  | A = 0.938"<br>$D_t$ = 0.374"<br>0.188"≤ $D_t$ ≤ 0.375"?<br>Y (y/n)<br>1.05 ≤ $A/2D_t$ ≤ 1.50?<br>Y (y/n) |
| **Misalignment** |  | $\alpha_1$ = 0.7 °<br>$\alpha_2$ = 0.6 °<br>$\alpha_1$≤10°? Y (y/n)<br>$\alpha_2$≤10°? Y (y/n) |
| |  | $\beta_1$ = 0.8<br>$\beta_2$ = 0.3<br>$\beta_1$≤5°? Y (y/n)<br>$\beta_2$≤5°? Y (y/n) |
| |  | γ = 3.3 °<br>θ = 0.1 °<br>Z = A tan(γ) = 0.054<br>W = A tan(θ) = 0.002<br>Z ≤ 0.125"? Y (y/n)<br>W ≤ 0.031"? Y (y/n) |
| **Acceptability for Use** (Circle Selection) | If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84 | If all answers except the first ($D_t$) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel. / Any other situation, the pitot tube must be removed from service. |

**Probe ID:** 5-03

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

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

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

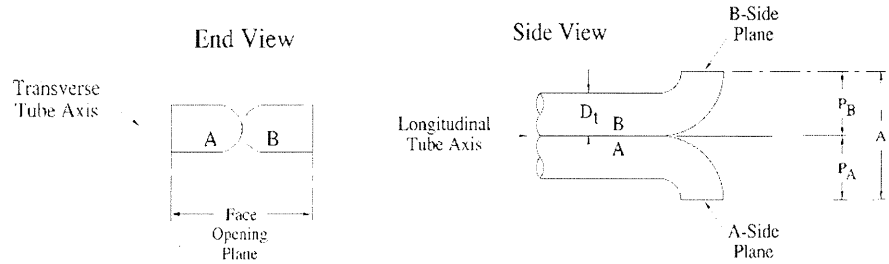
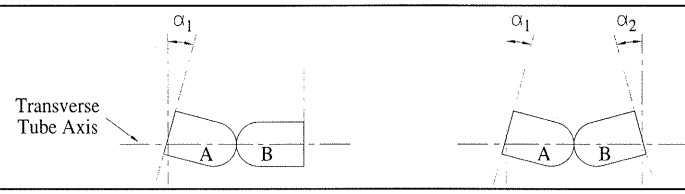
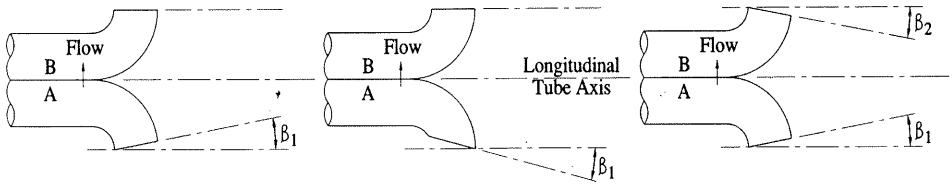
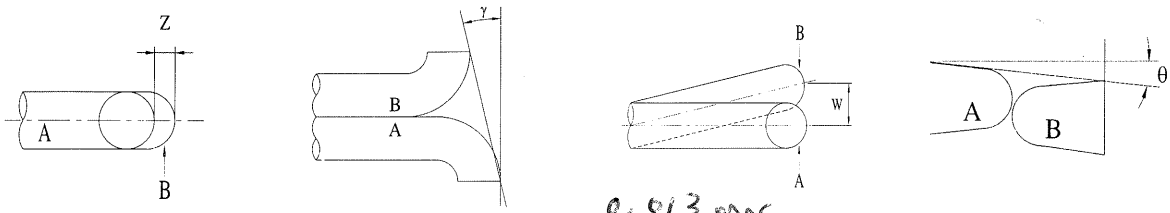
[2] $T_{abs;}$ (°R) = $T_F$ (°F) + 460

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

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

**Caliper ID:** 700802

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

| | | |
|---|---|---|
| **General Pitot Tube Alignment** |   | A = 0.949"<br>$D_t$ = 0.375"<br>0.188" ≤ $D_t$ ≤ 0.375"? Y (y/n)<br>1.05 ≤ $A/2D_t$ ≤ 1.50? Y (y/n) |
| **Misalignment** |   | $\alpha_1$ = 0.3 °<br>$\alpha_2$ = 0.7 °<br>$\alpha_1$≤10°? Y (y/n)<br>$\alpha_2$≤10°? Y (y/n) |
| |   | $\beta_1$ = 0.4<br>$\beta_2$ = 0.7<br>$\beta_1$≤5°? Y (y/n)<br>$\beta_2$≤5°? Y (y/n) |
| |   | γ = 0.8 °<br>θ = 1.2 °<br>Z = A tan(γ) = ~~0.016~~ 0.013 MAS<br>W = A tan(θ) = ~~0.016~~ 0.020 MAS<br>Z ≤ 0.125"? Y (y/n)<br>W ≤ 0.031"? Y (y/n) |
| **Acceptability for Use (Circle Selection)** | If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84 | If all answers except the first ($D_t$) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel. / Any other situation, the pitot tube must be removed from service. |

**Probe ID:** 5-07

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

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

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

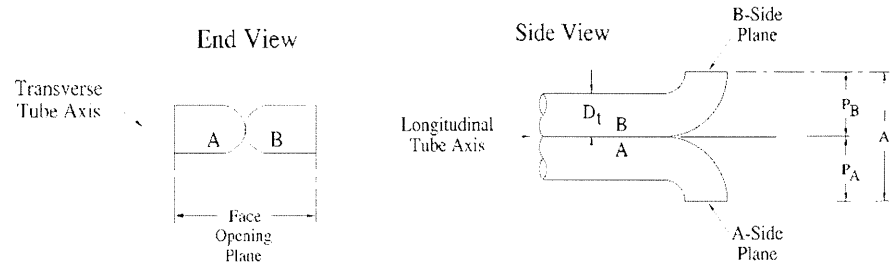
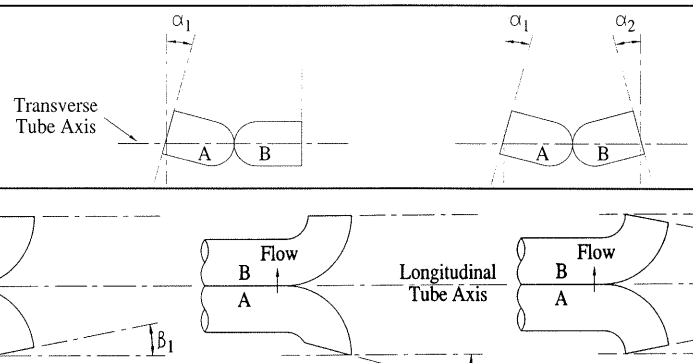
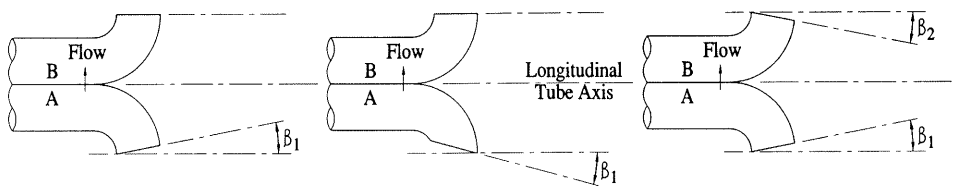
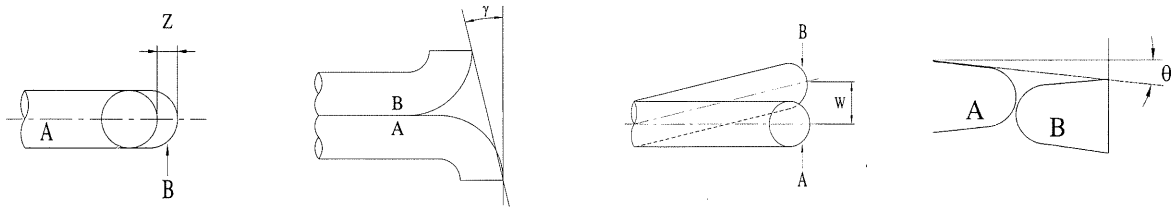
[2] $T_{abs}$ (°R) = $T_F$ (°F) + 460

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

**Pitot ID:** S-19

**Caliper ID:** 700802

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

| | | |
|---|---|---|
| **General Pitot Tube Alignment** |  | A = 0.946"<br>$D_t$ = 0.374"<br>0.188"≤ $D_t$ ≤ 0.375"? Y (y/n)<br>1.05 ≤ $A/2D_t$ ≤ 1.50? Y (y/n) |
| **Misalignment** |  | $\alpha_1$ = 0.8 °<br>$\alpha_2$ = 1.2 °<br>$\alpha_1$≤10°? Y (y/n)<br>$\alpha_2$≤10°? Y (y/n) |
| |  | $\beta_1$ = 0.4<br>$\beta_2$ = 0.9<br>$\beta_1$≤5°? Y (y/n)<br>$\beta_2$≤5°? Y (y/n) |
| |  | γ = 0.8 °<br>θ = 0.1 °<br>Z = A tan(γ) = 0.013<br>W = A tan(θ) = 0.002<br>Z ≤ 0.125"? Y (y/n)<br>W ≤ 0.031"? Y (y/n) |
| **Acceptability for Use** (Circle Selection) | If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84 | If all answers except the first ($D_t$) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel. / Any other situation, the pitot tube must be removed from service. |

**Probe ID:** S-19

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

| Stack Thermocouple Calibration [1] | Reference Thermometer ID No. [2] | Thermocouple Readout ID No. | Compare thermocouple to reference thermometer | Calculate applicability range for thermocouple | |
|---|---|---|---|---|---|
| | 130090343<br>$T_F$ 358 °F<br>$T_{abs,RT}$ 818 °R | A161402<br>$T_F$ 351 °F<br>$T_{abs,TC}$ 811 °R | $\frac{T_{abs,TC}}{T_{abs,RT}}$ = 0.998<br>Is this between 0.985 and 1.015? Y (y/n) | $Min_{abs} = 0.9 \times T_{abs,TC}$<br>730 °R | $Min_F = Min_{abs} - 460$<br>270 °F |
| | | | | $Max_{abs} = 1.1 \times T_{abs,TC}$<br>892 °R | $Max_F = Max_{abs} - 460$<br>432 °F |

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

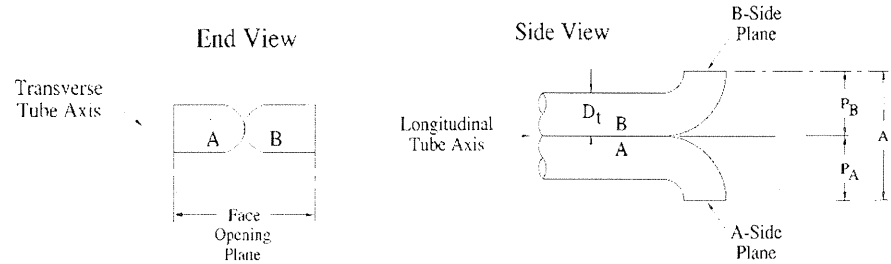
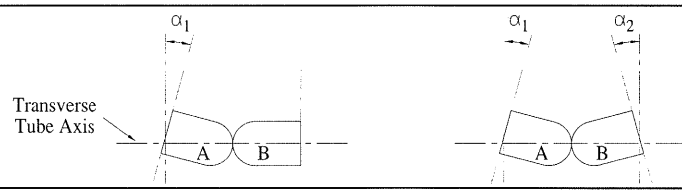
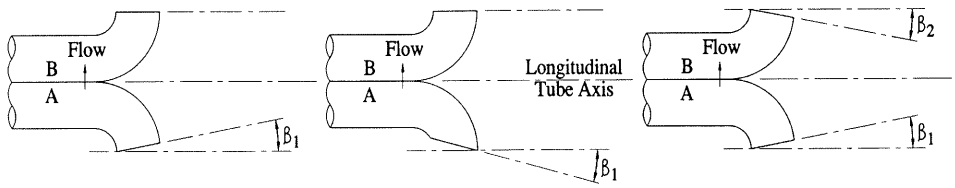
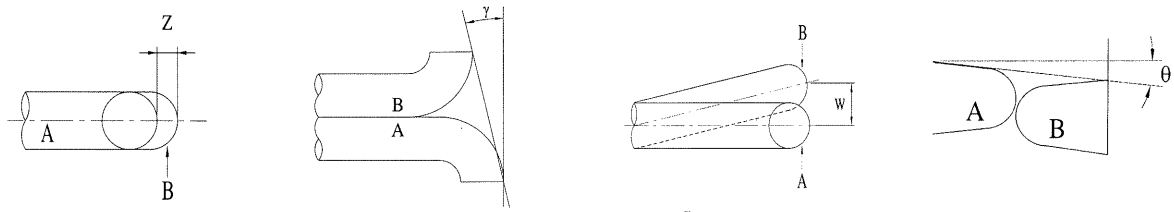
[2] $T_{abs;}$ (°R) = $T_F$ (°F) + 460

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

**Pitot ID:** P-302

**Caliper ID:** 700802

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

| | | |
|---|---|---|
| **General Pitot Tube Alignment** |  | A = 0.952"<br>$D_t$ = 0.372"<br>0.188"≤ $D_t$ ≤ 0.375"? Y (y/n)<br>1.05 ≤ $A/2D_t$ ≤ 1.50? Y (y/n) |
| **Misalignment** |  | $\alpha_1$ = 0.4 °<br>$\alpha_2$ = 0.7 °<br>$\alpha_1$≤10°? Y (y/n)<br>$\alpha_2$≤10°? Y (y/n) |
| |  | $\beta_1$ = 0.5<br>$\beta_2$ = 0.2<br>$\beta_1$≤5°? Y (y/n)<br>$\beta_2$≤5°? Y (y/n) |
| |  | γ = 0.9 °<br>θ = 1.2 °<br>Z = A tan(γ) = 0.015<br>W = A tan(θ) = 0.020<br>Z ≤ 0.125"? Y (y/n)<br>W ≤ 0.031"? Y (y/n) |
| **Acceptability for Use** (Circle Selection) | If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84 | If all answers except the first ($D_t$) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel. / Any other situation, the pitot tube must be removed from service. |

**Probe ID:** P-302

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

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

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

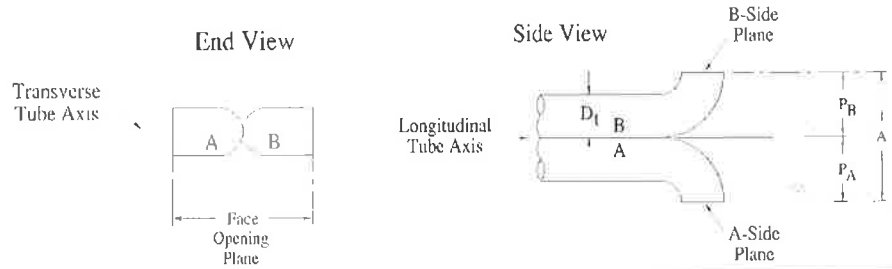
[2] $T_{abs;}$ (°R) = $T_F$ (°F) + 460

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

**Pitot ID:** P-529
**Caliper ID:** 701615

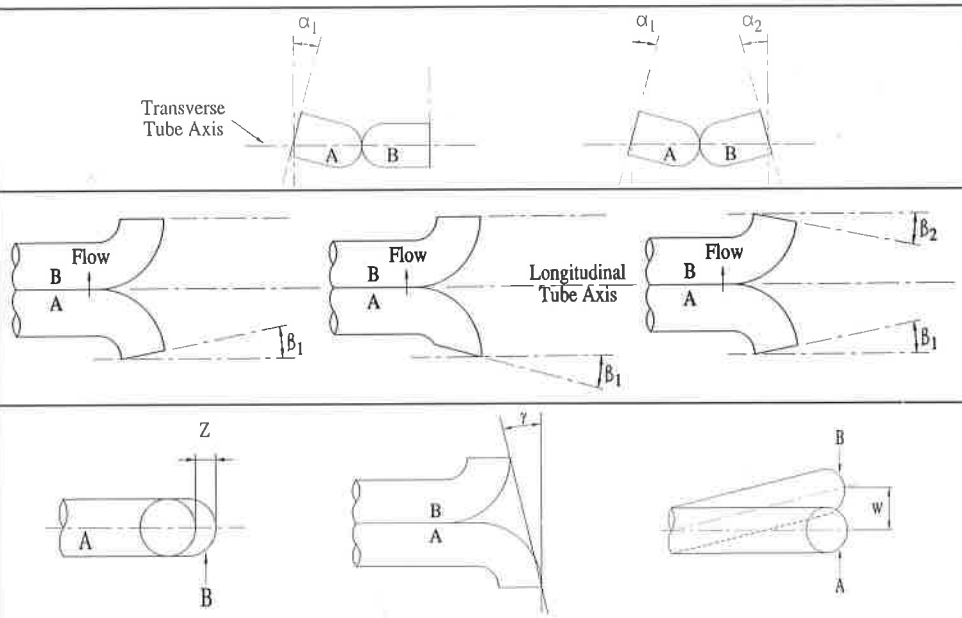
| Calibrated by | Initials | NMP | Reviewed by | Initials | DC |
|---|---|---|---|---|---|
| | Date | 10/4/13 | | Date | 10-4-13 |

**General Pitot Tube Alignment**




A = 0.919 "
$D_t$ = 0.373 "
$0.188" \le D_t \le 0.375"$? Y (y/n)
$1.05 \le A/2D_t \le 1.50$? Y (y/n)

**Misalignment**




$\alpha_1$ = 0.4 °
$\alpha_2$ = 0.8 °
$\alpha_1 \le 10°$? Y (y/n)
$\alpha_2 \le 10°$? Y (y/n)

$\beta_1$ = 0
$\beta_2$ = 0.8
$\beta_1 \le 5°$? Y (y/n)
$\beta_2 \le 5°$? Y (y/n)

$\gamma$ = 0.7 °
$\theta$ = 1.6 °
Z = A tan($\gamma$) = 0.011
W = A tan($\theta$) = 0.026
$Z \le 0.125"$? Y (y/n)
$W \le 0.031"$? Y (y/n)

**Acceptability for Use (Circle Selection)**

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

**Probe ID:** P-529

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

| Stack Thermocouple Calibration [1] | Reference Thermometer ID No. [2] | Thermocouple Readout ID No. | Compare thermocouple to reference thermometer | Calculate applicability range for thermocouple | |
|---|---|---|---|---|---|
| | ~~H185 8739~~ 150090343 $T_F$ 388 °F $T_{abs,RT}$ 848 °R | A161402 $T_F$ 385 °F $T_{abs,TC}$ 845 °R | $\frac{T_{abs,TC}}{T_{abs,RT}}$ = 0.996 Is this between 0.985 and 1.015? Y (y/n) | $Min_{abs} = 0.9 \times T_{abs,TC}$ 761 °R | $Min_F = Min_{abs} - 460$ 301 °F |
| | | | | $Max_{abs} = 1.1 \times T_{abs,TC}$ 930 °R | $Max_F = Max_{abs} - 460$ 470 °F |

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

# Calibration Data Sheet – Calipers

Caliper ID Number 700903

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

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

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

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

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

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

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

# Portable Barometer Calibration

Portable Barometer Identification BP-2

Reference Barometer Identification NIST 7485

| | | |
|---|---|---|
| Calibrated by | Initials | mlb |
| | Date | 8/28/13 |
| Reviewed by | Initials | EDF |
| | Date | 9/17/13 |

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

| |
|---|
| Notes: |
| |
| |

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

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

Bastrop Scale Co. Inc.
In Balance Since 1971

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

## CERTIFICATION OF CALIBRATION

CUSTOMER # : 132950 SCALE # : 100008310

CUSTOMER NAME : URS CORPORATION

SERVICE ADDRESS : 9400 AMBERGLEN BLVD.

SERVICE CITY ST ZIP : AUSTIN TX. 78729

MAKE : SARTORIUS CAPACITY : 4100G

MODEL : TE4101 GRADUATION SIZE : .1 G

S.N. : 21450056 TOLERANCE :

LOCATION / DEPT. : MOBILE

**BEFORE SERVICE:**

Corner or Section Error: 0 @ 1000g

**AFTER SERVICE:**

Corner or Section Error: 0 @ 1000g

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

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

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

**Certificate #s of weights used:** 1931701, 1931696

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

# Balance Calibration

**Balance ID** TE 4101A

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

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

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

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

Did not use mlb 6/27/13

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

1 Use only calibration weights greater than 20 g.

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

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory**

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

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

**Customer**

URS CORPORATION

9400 AMBERGLEN BLVD
AUSTIN TX 78729
US

## ANALYTICAL INFORMATION

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

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

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

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

## REFERENCE STANDARD

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

## INSTRUMENTATION

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

## ANALYZER READINGS

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

**First Triad Analysis**

**PROPANE**

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

**Second Triad Analysis**

**Calibration Curve**

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

**Special Notes:**

APPROVED

Download as...

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

# RATA CLASS

***Dual-Analyzed Calibration Standard***

# CERTIFICATE OF ACCURACY: EPA Protocol Gas

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

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

**Customer**
URS
ITEM# URS005

## ANALYTICAL INFORMATION Gas Type : NONE

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

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

**Certification Date:** 21Apr2010

**Exp. Date:** 22Apr2018
**Batch No:** LAP0015199

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

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

## REFERENCE STANDARD

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

## INSTRUMENTATION

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

## ANALYZER READINGS

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

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

**Second Triad Analysis**

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

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

## QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

# 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**

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

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

**Customer**
URS CORPORATION

9400 AMBERGLEN BLVD
AUSTIN TX 78729
US

## ANALYTICAL INFORMATION Gas Type : NONE

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

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

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

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

### REFERENCE STANDARD

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

### INSTRUMENTATION

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

### ANALYZER READINGS

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

**First Triad Analysis**

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

**Second Triad Analysis**

**Calibration Curve**

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

**Special Notes:** URS-004

APPROVED BY: ROGER NGUYEN

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

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

## QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

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

# RATA CLASS

***Dual-Analyzed Calibration Standard***

# CERTIFICATE OF ACCURACY: EPA Protocol Gas

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

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

**Customer**
URS CORPORATION

## ANALYTICAL INFORMATION Gas Type : NONE

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

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

**Certification Date:** 16Apr2010

**Exp. Date:** 17Apr2018
**Batch No:** SBO0018223

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

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

## REFERENCE STANDARD

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

## INSTRUMENTATION

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

## ANALYZER READINGS

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

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

**Second Triad Analysis**

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

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

## QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory - PGVP Vendor ID: A22012**

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

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

**Customer**
CLEAN AIR INSTRUMENT RENTAL

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

### ANALYTICAL INFORMATION Gas Type : OC2

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

**Cylinder Number:** CC43355 **Certification Date:** 16May2012 **Exp. Date:** 16May2015
**Cylinder Pressure***:** 2000 PSIG **Batch No:** 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 + Cx2 + Dx3 + Ex4
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 + Cx2 + Dx3 + Ex4
r = 0.999987
Constants: A = -0.00518415
B = 0.136464952 C = -0.0002272
D = 1.23741E-05 E = 0

APPROVED BY: JEFF CROTEAU

I-43

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory**

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

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

**Customer**

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

## ANALYTICAL INFORMATION

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

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

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

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

## REFERENCE STANDARD

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

## INSTRUMENTATION

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

## ANALYZER READINGS

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

**First Triad Analysis**

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

**Second Triad Analysis**

**Calibration Curve**

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

APPROVED BY: ROBERT LESNIAK

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory - PGVP Vendor ID: A22012**

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

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

**Customer**
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

### ANALYTICAL INFORMATION Gas Type : NONE

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

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

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

**Second Triad Analysis**

**Calibration Curve**

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

**Special Notes:** DELIVERY DOC# IS 46607392

APPROVED BY: HILARY THATCHER

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory - PGVP Vendor ID: A22012**

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

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

**Customer**
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

### ANALYTICAL INFORMATION Gas Type : NONE

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

Cylinder Number: ALM057529 Certification Date: 27Jun2012 Exp. Date: 27Jun2015
Cylinder Pressure***: 1950 PSIG Batch No: TR00060970

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

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

### REFERENCE STANDARD

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

### INSTRUMENTATION

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

### ANALYZER READINGS

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

**First Triad Analysis**

PROPANE
Date: 27Jun2012 Response Unit: 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

**Second Triad Analysis**

**Calibration Curve**

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

Special Notes: DELIVERY DOC# IS 46607392

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

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

## QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory - PGVP Vendor ID: A22012**

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

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

**Customer**
CLEAN AIR INSTRUMENT RENTAL

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

### ANALYTICAL INFORMATION Gas Type : OC2

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

**Cylinder Number:** CC43355 **Certification Date:** 16May2012 **Exp. Date:** 16May2015
**Cylinder Pressure***:** 2000 PSIG **Batch No:** 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 + Cx2 + Dx3 + Ex4
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 + Cx2 + Dx3 + Ex4
r = 0.999987
Constants: A = -0.00518415
B = 0.136464952 C = -0.0002272
D = 1.23741E-05 E = 0

APPROVED BY: JEFF CROTEAU

I-48

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory**

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

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

**Customer**

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

## ANALYTICAL INFORMATION

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

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

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

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

## REFERENCE STANDARD

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

## INSTRUMENTATION

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

## ANALYZER READINGS

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

**First Triad Analysis**

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

**Second Triad Analysis**

**Calibration Curve**

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

APPROVED BY: ROBERT LESNIAK

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory - PGVP Vendor ID: A22012**

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

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

**Customer**
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

### ANALYTICAL INFORMATION Gas Type : NONE

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

**Cylinder Number:** ALM028646
**Cylinder Pressure***:** 1950 PSIG
**Certification Date:** 27Jun2012
**Exp. Date:** 27Jun2015
**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**

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

**Second Triad Analysis**

**Calibration Curve**

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

**Special Notes:** DELIVERY DOC# IS 46607392

APPROVED BY: HILARY THATCHER

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory - PGVP Vendor ID: A22012**

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

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

**Customer**
CLEAN AIR ENGINEERING

500 WEST WOOD STREET
PALATINE IL 60067
US

### ANALYTICAL INFORMATION Gas Type : NONE

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

Cylinder Number: ALM057529 Certification Date: 27Jun2012 Exp. Date: 27Jun2015
Cylinder Pressure***: 1950 PSIG Batch No: TR00060970

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

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

### REFERENCE STANDARD

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

### INSTRUMENTATION

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

### ANALYZER READINGS

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

**First Triad Analysis**

PROPANE
Date: 27Jun2012 Response Unit: 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

**Second Triad Analysis**

**Calibration Curve**

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

Special Notes: DELIVERY DOC# IS 46607392

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

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

## QUALITY ASSURANCE

APPROVED BY: SARAH HERBERT
(signature on file)

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

# RATA CLASS

*Dual-Analyzed Calibration Standard*

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

## CERTIFICATE OF ACCURACY: EPA Protocol Gas

**Assay Laboratory - PGVP Vendor ID: A22012**

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

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

**Customer**
CLEAN AIR INSTRUMENT RENTAL

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

### ANALYTICAL INFORMATION Gas Type : OC2

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

**Cylinder Number:** CC43355 **Certification Date:** 16May2012 **Exp. Date:** 16May2015
**Cylinder Pressure***:** 2000 PSIG **Batch No:** 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 + Cx2 + Dx3 + Ex4
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 + Cx2 + Dx3 + Ex4
r = 0.999987
Constants: A = -0.00518415
B = 0.136464952 C = -0.0002272
D = 1.23741E-05 E = 0

APPROVED BY: JEFF CROTEAU

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