

Appendix D

Quality Assurance Data

Sampling Train Calibration Data

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-2

Date of Calibration : 7/11/2011

Calib. Technician: pls

Barometric Pressure : 28.92

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.020	5.000	84.5	82.0	75.5	12.289	1.0091	1.751
1.00	5.022	5.000	87.0	83.0	75.5	8.800	1.0107	1.793
1.75	5.024	5.000	83.5	82.0	75.5	6.740	1.0042	1.844
2.50	10.056	10.000	90.0	84.0	75.5	11.297	1.0094	1.843
3.50	10.043	10.000	90.5	84.5	75.5	9.629	1.0091	1.873

Average Meter Coefficient 1.0085

Average Orifice Coefficient 1.821



Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-21.0	0.9%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	1.0	0.2%	0	3.0	0.7%	0	3.0	0.7%
50	50.0	0.0%	25	27.0	0.4%	25	27.0	0.4%
100	99.0	-0.2%	50	51.0	0.2%	50	51.0	0.2%
200	201.0	0.2%	75	75.0	0.0%	75	75.0	0.0%
300	301.0	0.1%	100	100.0	0.0%	100	99.0	-0.2%
400	399.0	-0.1%	125	125.0	0.0%	125	124.0	-0.2%
500	498.0	-0.2%	150	150.0	0.0%	150	149.0	-0.2%
800	800.0	0.0%	175	175.0	0.0%	175	175.0	0.0%
1000	1001.0	0.1%	200	200.0	0.0%	200	200.0	0.0%
1500	1501.0	0.1%	225	225.0	0.0%	225	225.0	0.0%
1900	1901.0	0.0%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	0	2.0	0.4%	0	2.0	0.4%
0	3.0	0.7%	50	50.0	0.0%	50	50.0	0.0%
25	27.0	0.4%	100	99.0	-0.2%	100	99.0	-0.2%
50	51.0	0.2%	150	149.0	-0.2%	150	149.0	-0.2%
75	75.0	0.0%	200	199.0	-0.2%	200	199.0	-0.2%
100	100.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
125	125.0	0.0%	250	249.0	-0.1%	250	249.0	-0.1%
150	150.0	0.0%	275	275.0	0.0%	275	275.0	0.0%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	350.0	0.0%
225	225.0	0.0%	400	400.0	0.0%	400	400.0	0.0%
250	250.0	0.0%	500	500.0	0.0%	500	500.0	0.0%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-4

Date of Calibration : 5/27/2011

Calib. Technician: PLS

Barometric Pressure : 29.09

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.094	5.000	80.5	77.5	71.5	11.920	0.9941	1.628
1.00	5.090	5.000	82.0	78.0	71.5	8.569	0.9955	1.681
1.75	5.097	5.000	81.0	77.0	71.5	6.542	0.9904	1.717
2.50	10.164	10.000	85.0	79.0	71.5	11.024	0.9970	1.735
3.50	10.160	10.000	86.5	80.0	71.5	9.395	0.9972	1.761



Average Meter Coefficient 0.9949

Average Orifice Coefficient 1.704

Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-23.0	0.5%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	0.0	0.0%	0	3.0	0.7%	0	3.0	0.7%
50	48.0	-0.4%	25	27.0	0.4%	25	27.0	0.4%
100	98.0	-0.4%	50	51.0	0.2%	50	51.0	0.2%
200	200.0	0.0%	75	75.0	0.0%	75	75.0	0.0%
300	300.0	0.0%	100	100.0	0.0%	100	100.0	0.0%
400	398.0	-0.2%	125	125.0	0.0%	125	125.0	0.0%
500	498.0	-0.2%	150	150.0	0.0%	150	150.0	0.0%
800	800.0	0.0%	175	175.0	0.0%	175	175.0	0.0%
1000	1000.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
1500	1500.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
1900	1904.0	0.2%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	0	3.0	0.7%	0	3.0	0.7%
0	3.0	0.7%	50	51.0	0.2%	50	51.0	0.2%
25	27.0	0.4%	100	100.0	0.0%	100	100.0	0.0%
50	51.0	0.2%	150	150.0	0.0%	150	150.0	0.0%
75	75.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
100	100.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
125	125.0	0.0%	250	250.0	0.0%	250	250.0	0.0%
150	150.0	0.0%	275	275.0	0.0%	275	275.0	0.0%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	350.0	0.0%
225	225.0	0.0%	400	400.0	0.0%	400	400.0	0.0%
250	250.0	0.0%	500	500.0	0.0%	500	500.0	0.0%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-7

Date of Calibration : 7/7/2011

Calib. Technician: PLS

Barometric Pressure : 29.08

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.058	5.000	86.0	81.5	76.0	12.149	1.0016	1.707
1.00	5.058	5.000	89.0	82.5	76.0	8.615	1.0040	1.714
1.75	5.046	5.000	85.0	81.0	76.0	6.508	0.9994	1.716
2.50	10.096	10.000	91.0	83.5	76.0	10.897	1.0049	1.711
3.50	10.067	10.000	91.5	84.5	76.0	9.264	1.0067	1.728

Average Meter Coefficient 1.0033

Average Orifice Coefficient 1.715



Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-21.0	0.9%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	2.0	0.4%	0	3.0	0.7%	0	3.0	0.7%
50	50.0	0.0%	25	27.0	0.4%	25	27.0	0.4%
100	99.0	-0.2%	50	51.0	0.2%	50	51.0	0.2%
200	200.0	0.0%	75	75.0	0.0%	75	75.0	0.0%
300	301.0	0.1%	100	100.0	0.0%	100	100.0	0.0%
400	399.0	-0.1%	125	125.0	0.0%	125	125.0	0.0%
500	495.0	-0.5%	150	150.0	0.0%	150	150.0	0.0%
800	800.0	0.0%	175	175.0	0.0%	175	175.0	0.0%
1000	1001.0	0.1%	200	200.0	0.0%	200	200.0	0.0%
1500	1500.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
1900	1901.0	0.0%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	0	3.0	0.7%	0	3.0	0.7%
0	3.0	0.7%	50	51.0	0.2%	50	51.0	0.2%
25	27.0	0.4%	100	100.0	0.0%	100	100.0	0.0%
50	51.0	0.2%	150	150.0	0.0%	150	150.0	0.0%
75	75.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
100	100.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
125	125.0	0.0%	250	250.0	0.0%	250	250.0	0.0%
150	150.0	0.0%	275	275.0	0.0%	275	275.0	0.0%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	350.0	0.0%
225	225.0	0.0%	400	399.0	-0.1%	400	399.0	-0.1%
250	250.0	0.0%	500	500.0	0.0%	500	500.0	0.0%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-12

Date of Calibration : 6/30/2011

Calib. Technician: pls

Barometric Pressure : 28.91

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.051	5.000	84.5	84.5	74.5	11.644	1.0071	1.560
1.00	5.041	5.000	86.0	84.0	74.5	8.307	1.0088	1.589
1.75	5.066	5.000	84.5	85.0	74.5	6.329	1.0014	1.611
2.50	10.089	10.000	86.5	84.0	74.5	10.603	1.0047	1.618
3.50	10.065	10.000	86.5	84.0	74.5	9.016	1.0046	1.638

Average Meter Coefficient 1.0053

Average Orifice Coefficient 1.603



Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-23.0	0.5%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	0.0	0.0%	0	3.0	0.7%	0	4.0	0.9%
50	48.0	-0.4%	25	27.0	0.4%	25	27.0	0.4%
100	98.0	-0.4%	50	51.0	0.2%	50	51.0	0.2%
200	199.0	-0.2%	75	75.0	0.0%	75	76.0	0.2%
300	300.0	0.0%	100	100.0	0.0%	100	100.0	0.0%
400	398.0	-0.2%	125	125.0	0.0%	125	125.0	0.0%
500	497.0	-0.3%	150	150.0	0.0%	150	150.0	0.0%
800	799.0	-0.1%	175	175.0	0.0%	175	175.0	0.0%
1000	999.0	-0.1%	200	200.0	0.0%	200	200.0	0.0%
1500	1499.0	-0.1%	225	225.0	0.0%	225	225.0	0.0%
1900	1902.0	0.1%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-20.0	1.1%	0	3.0	0.7%	0	3.0	0.7%
0	3.0	0.7%	50	51.0	0.2%	50	51.0	0.2%
25	26.0	0.2%	100	100.0	0.0%	100	100.0	0.0%
50	50.0	0.0%	150	150.0	0.0%	150	150.0	0.0%
75	75.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
100	99.0	-0.2%	225	225.0	0.0%	225	225.0	0.0%
125	124.0	-0.2%	250	250.0	0.0%	250	250.0	0.0%
150	149.0	-0.2%	275	275.0	0.0%	275	275.0	0.0%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	350.0	0.0%
225	225.0	0.0%	400	400.0	0.0%	400	400.0	0.0%
250	250.0	0.0%	500	501.0	0.1%	500	501.0	0.1%

Flint Hills Resources Pine Bend LLC
Rosemount, MN
Pace Project No. 1108-200

Appendix D
Support Equipment Calibrations

Barometer Calibration (Recent History)

Barometer Number: B-5
Barometer Type: Digital
Reference Standard Mercury Barometer

Lastest Cal. Date: 6/7/11
Calibration Tech: P Shorb

	Past Cal	Past Cal	Past Cal	Past Cal	Current	
Calibration Date	7/20/09	12/18/09	1/4/11	3/18/11	6/7/11	
Reference Pb ("Hg)	29.12	29.18	29.13	29.21	28.75	"Hg
Intial Reading	29.12	29.15	29.91	29.65	28.88	"Hg
Final Reading	29.12	29.18	29.12	29.21	28.76	"Hg
Adjusted?	No	Yes	Yes	Yes	Yes	
Variance	0.00	0.00	-0.01	0.00	0.01	"Hg

Digital Thermocouple Readout

Digital Number: TC-2
Reference Standard Omega CL23A

Calibration Date: 12/27/10
Calibration Tech: P SHORB

Acceptance Criteria: 2%

Ref. Value	-25	0	100	200	300	400	500	700	900	1100	1300	1500	1700	1900
Ch 1 Rdg	-25	0	99	201	302	400	500	701	903	1106	1307	1508	1707	1909
Ch 1 Dif%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ch 2 Rdg	-25	0	100	202	302	401	501	701	903	1107	1308	1509	1708	1910
Ch 2 Dif%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Scales and Balances

Balance Number: Bal-10
Reference Standard Wgt. Set 41151

Calibration Date: 3/18/11
Calibration Tech: P Shorb

Acceptance Criteria: 2%

Actual Weight	200	300	500	1000	1500
Balance Reading	200	300	499	999	1499
Difference %	0.0%	0.0%	-0.2%	-0.1%	-0.1%

Flint Hills Resources Pine Bend LLC
Rosemount, MN
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Appendix D
Support Equipment Calibrations

Digital Thermocouple Readout

Digital Number: TC-8 Calibration Date: 12/27/10 Acceptance Criteria: 2%
Reference Standard Omega CL23A Calibration Tech: P SHORB

Ref. Value	-25	0	100	200	300	400	500	700	900	1100	1300	1500	1700	1900
Ch 1 Rdg	-25	0	100	200	300	400	500	700	901	1101	1301	1501	1701	1901
Ch 1 Dif%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ch 2 Rdg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ch 2 Dif%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Flint Hills Resources Pine Bend LLC
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Appendix D
Support Equipment Calibrations

Digital Thermocouple Readout

Digital Number: TC-14 Calibration Date: 12/27/10 Acceptance Criteria: 2%
Reference Standard Omega CL23A Calibration Tech: P SHORB

Ref. Value	-25	0	100	200	300	400	500	700	900	1100	1300	1500	1700	1900
Ch 1 Rdg	-25	0	99	201	301	400	499	700	902	1105	1306	1506	1704	1905
Ch 1 Dif%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ch 2 Rdg	-25	0	99	201	302	400	500	700	902	1105	1307	1507	1705	1905
Ch 2 Dif%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

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Appendix D
Support Equipment Calibrations

Digital Thermocouple Readout

Digital Number: TC-24 Calibration Date: 12/16/10 Acceptance Criteria: 2%
Reference Standard Signal Simulator Calibration Tech: P SHORB

Ref. Value	-25	0	100	200	300	400	500	700	900	1100	1300	1500	1700	1900
Ch 1 Rdg	-25	0	100	200	300	400	500	700	899	1099	1299	1499	1698	1899
Ch 1 Dif%	0.0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ch 2 Rdg	-25	0	100	200	300	400	500	700	899	1099	1299	1499	1699	1899
Ch 2 Dif%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Dry Test Meter/Orifice Calibration

Control Module Number MC-1

Calib. Technician: pls

Date of Calibration : 6/24/2011

Barometric Pressure 28.98

Sampling Set Rate <u>LPM</u>	Dry Test Meter Vol. <u>Cubic Ft.</u>	Wet Test Meter Vol. <u>Cubic Ft.</u>	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time <u>Minutes</u>	Gas Meter Coefficient <u>a</u>	Actual Sample Rate-LPM
			<u>Inlet</u>	<u>Outlet</u>				
0.50	0.505	0.500	76.50	75.50	72.50	27.29	0.9966	0.52
1.00	0.500	0.500	75.50	75.00	72.50	15.13	1.0052	0.94
3.00	1.210	1.200	75.50	75.00	72.50	13.08	0.9969	2.60



Average Meter Coefficie 0.9995

Control Module Number MC-2

Calib. Technician: pls

Date of Calibration : 6/17/2011

Barometric Pressure 28.91

Sampling Set Rate <u>LPM</u>	Dry Test Meter Vol. <u>Cubic Ft.</u>	Wet Test Meter Vol. <u>Cubic Ft.</u>	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time <u>Minutes</u>	Gas Meter Coefficient <u>a</u>	Actual Sample Rate-LPM
			<u>Inlet</u>	<u>Outlet</u>				
0.50	0.514	0.500	89.50	87.00	74.50	29.83	0.9978	0.47
1.00	0.509	0.500	85.00	81.50	74.50	16.34	0.9984	0.87
3.00	1.023	1.000	88.50	84.50	74.50	11.57	0.9995	2.45



Average Meter Coefficie 0.9985

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Dry Test Meter/Orifice Calibration

Control Module Number MC-3

Calib. Technician: pls

Date of Calibration : 6/20/2011

Barometric Pressure 28.85

Sampling Set Rate	Dry Test Meter Vol.	Wet Test Meter Vol.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient	Actual Sample Rate-LPM
<u>LPM</u>	<u>Cubic Ft.</u>	<u>Cubic Ft.</u>	<u>Inlet</u>	<u>Outlet</u>			<u>a</u>	
0.50	0.518	0.500	80.50	80.00	73.50	32.27	0.9775	0.44
1.00	0.509	0.500	82.50	81.50	73.50	15.65	0.9980	0.90
3.00	1.017	1.000	80.50	80.00	73.50	11.15	0.9957	2.54



Average Meter Coefficie 0.9904

Geometric Verification Sheet S-Type Pitot Tube

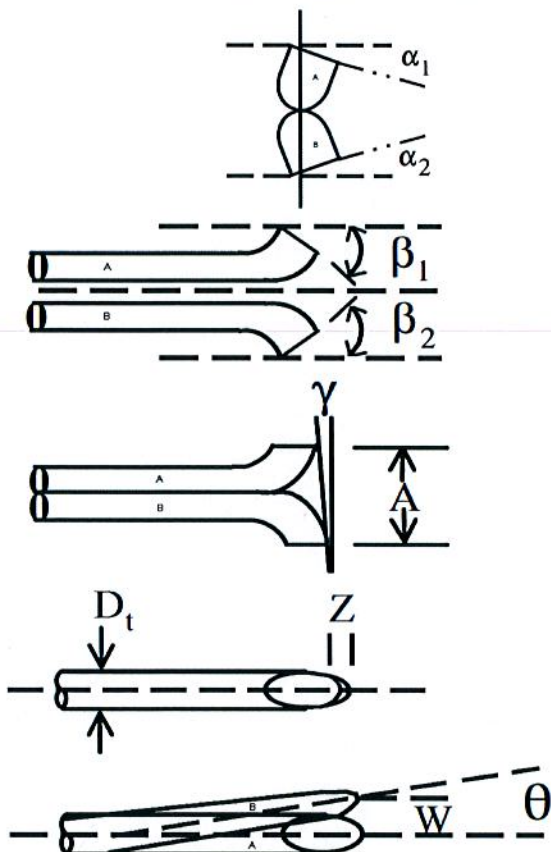
S-Type Pitot Tube ID 4-01
SOP No. S-FSD-E-006

Verification Date 10-13-10
Next Verification Date 10-13-11
annually

Free of Obstructions ☒ Yes ☐ No
Free of Damage ☒ Yes ☐ No

Level on both axes ☒ Yes ☐ No
Pitot Tube Part of Assembly ☒ Yes* ☐ No

*If Yes, verify assembly is acceptable (see SOP section 11.3)



Coefficient Verification		
Dimension	Result	Criteria
α_1 — degrees	0.5	$-10^\circ \leq \alpha_1 \leq +10^\circ$
α_2 — degrees	1.0	$-10^\circ \leq \alpha_2 \leq +10^\circ$
β_1 — degrees	1	$-5^\circ \leq \beta_1 \leq +5^\circ$
β_2 — degrees	1	$-5^\circ \leq \beta_2 \leq +5^\circ$
D_t — inches	0.313	$0.1875" \leq D_t \leq 0.3750"$
A — inches	0.450	$2.10D_t \leq A \leq 3.00D_t$
γ — degrees	1	
θ — degrees	0	
$Z = A (\tan \gamma)$ — inches	0.01658	$Z \leq 0.125"$
$W = A (\tan \theta)$ — inches	0	$W \leq 0.03125"$

Results Meet Criteria ☒ Yes ☐ No

Comments None

Acceptance Criteria: If results meet criteria, the pitot tube is assigned a coefficient (C_p) of 0.84.

Caliper ID G-CL-5

Protactor ID 1

Performed By P. Shal
Reviewed By Adam Koshik

Date 10-13-10
Date 11-9-10

Geometric Verification Sheet S-Type Pitot Tube

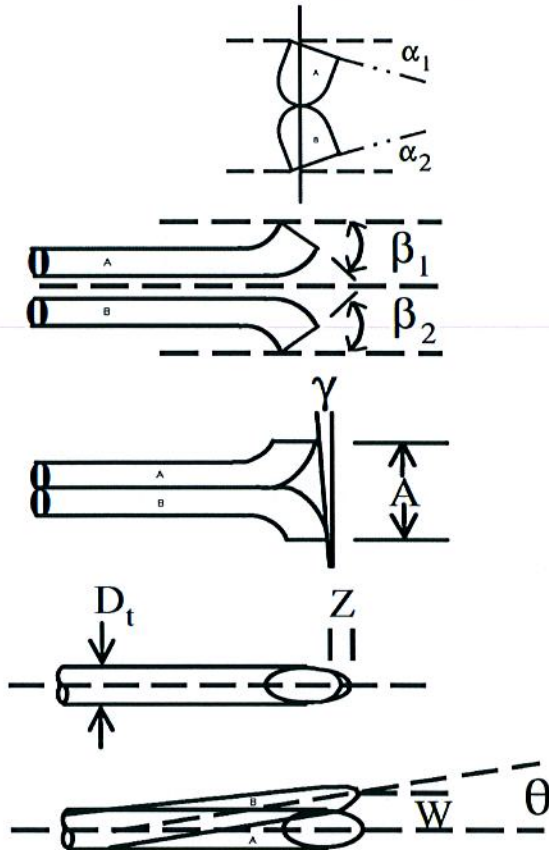
S-Type Pitot Tube ID 4-02
SOP No. S-FSD-E-006

Verification Date 10-13-10
Next Verification Date 10-13-11
annually

Free of Obstructions ☒ Yes ☐ No
Free of Damage ☒ Yes ☐ No

Level on both axes ☒ Yes ☐ No
Pitot Tube Part of Assembly ☒ Yes* ☐ No

*If Yes, verify assembly is acceptable (see SOP section 11.3)



Coefficient Verification		
Dimension	Result	Criteria
α_1 — degrees	0.5	$-10^\circ \leq \alpha_1 \leq +10^\circ$
α_2 — degrees	1	$-10^\circ \leq \alpha_2 \leq +10^\circ$
β_1 — degrees	1	$-5^\circ \leq \beta_1 \leq +5^\circ$
β_2 — degrees	0.5	$-5^\circ \leq \beta_2 \leq +5^\circ$
D_t — inches	0.314	$0.1875'' \leq D_t \leq 0.3750''$
A — inches	0.433	$2.10D_t \leq A \leq 3.00D_t$
γ — degrees	1.5	
θ — degrees	1.0	
$Z = A (\tan \gamma)$ — inches	0.02443	$Z \leq 0.125''$
$W = A (\tan \theta)$ — inches	0.01629	$W \leq 0.03125''$

Results Meet Criteria ☒ Yes ☐ No

Comments None

Acceptance Criteria: If results meet criteria, the pitot tube is assigned a coefficient (C_p) of 0.84.

Caliper ID G-C1-5

Protactor ID #1

Performed By P. Slurk
Reviewed By Adam Kiedrich

Date 10-13-10
Date 11-9-10

Geometric Verification Sheet S-Type Pitot Tube

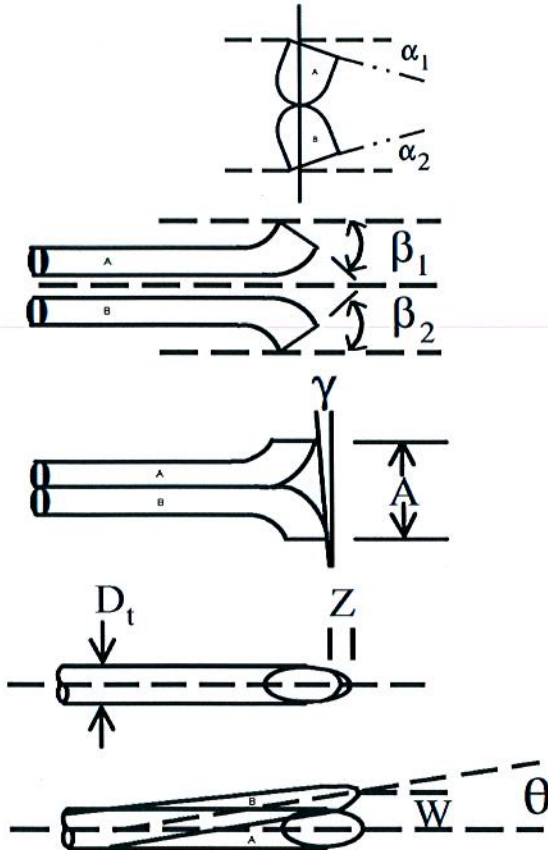
S-Type Pitot Tube ID 4-04
SOP No. S-FSD-E-006

Verification Date 10-25-10
Next Verification Date 10-25-11
annually

Free of Obstructions ☒ Yes ☐ No
Free of Damage ☒ Yes ☐ No

Level on both axes ☒ Yes ☐ No
Pitot Tube Part of Assembly ☒ Yes* ☐ No

*If Yes, verify assembly is acceptable (see SOP section 11.3)



Coefficient Verification		
Dimension	Result	Criteria
α_1 — degrees	2.5	$-10^\circ \leq \alpha_1 \leq +10^\circ$
α_2 — degrees	3	$-10^\circ \leq \alpha_2 \leq +10^\circ$
β_1 — degrees	2	$-5^\circ \leq \beta_1 \leq +5^\circ$
β_2 — degrees	1	$-5^\circ \leq \beta_2 \leq +5^\circ$
D_t — inches	0.312	$0.1875'' \leq D_t \leq 0.3750''$
A — inches	0.431	$2.10D_t \leq A \leq 3.00D_t$
γ — degrees	1.5	
θ — degrees	0	
$Z = A (\tan \gamma)$ — inches	0.02438	$Z \leq 0.125''$
$W = A (\tan \theta)$ — inches	0	$W \leq 0.03125''$

Results Meet Criteria ☒ Yes ☐ No

Comments None

Acceptance Criteria: If results meet criteria, the pitot tube is assigned a coefficient (C_p) of 0.84.

Caliper ID G-CL-5

Protactor ID 1

Performed By P. Short
Reviewed By Adam Friedman

Date 10-25-10
Date 11-9-10

Geometric Verification Sheet S-Type Pitot Tube

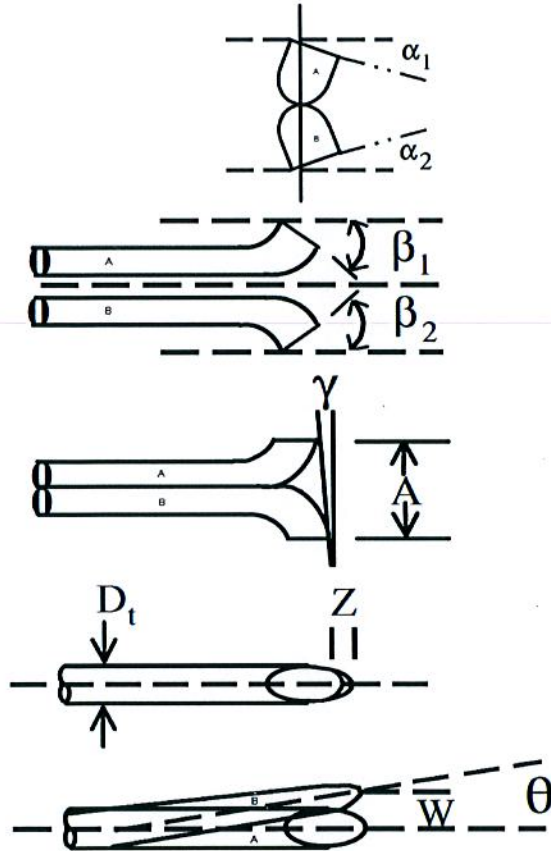
S-Type Pitot Tube ID 4-06
SOP No. S-FSD-E-006

Verification Date 10-13-10
Next Verification Date 10-13-11
annually

Free of Obstructions ☒ Yes ☐ No
Free of Damage ☒ Yes ☐ No

Level on both axes ☒ Yes ☐ No
Pitot Tube Part of Assembly ☒ Yes* ☐ No

*If Yes, verify assembly is acceptable (see SOP section 11.3)



Coefficient Verification		
Dimension	Result	Criteria
α_1 — degrees	0	$-10^\circ \leq \alpha_1 \leq +10^\circ$
α_2 — degrees	1	$-10^\circ \leq \alpha_2 \leq +10^\circ$
β_1 — degrees	1	$-5^\circ \leq \beta_1 \leq +5^\circ$
β_2 — degrees	2	$-5^\circ \leq \beta_2 \leq +5^\circ$
D_t — inches	0.315	$0.1875" \leq D_t \leq 0.3750"$
A — inches	0.937	$2.10D_t \leq A \leq 3.00D_t$
γ — degrees	2	
θ — degrees	0.5	
$Z = A (\tan \gamma)$ — inches	0.03272	$Z \leq 0.125"$
$W = A (\tan \theta)$ — inches	0.00818	$W \leq 0.03125"$

Results Meet Criteria ☒ Yes ☐ No

Comments None

Acceptance Criteria: If results meet criteria, the pitot tube is assigned a coefficient (C_p) of 0.84.

Caliper ID U-CL-5

Protactor ID #1

Performed By P. Shorts
Reviewed By Adam Shedd

Date 9-13-10
Date 11-9-10

Post Calibration Data

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-2

Date of Calibration : 8/19/2011

Calib. Technician: pls

Barometric Pressure : 28.97

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.031	5.000	79.0	80.5	75.0	12.344	1.0014	1.766
1.00	5.042	5.000	79.5	81.0	75.0	8.845	0.9989	1.812
1.75	5.060	5.000	78.5	79.5	75.0	6.735	0.9911	1.843
2.50	10.064	10.000	80.5	81.5	75.0	11.292	0.9984	1.844
3.50	10.032	10.000	81.0	82.0	75.0	9.612	1.0000	1.869



Average Meter Coefficient 0.9980

Average Orifice Coefficient 1.827

Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	3.0	0.7%	0	4.0	0.9%	0	3.0	0.7%
50	52.0	0.4%	25	27.0	0.4%	25	27.0	0.4%
100	101.0	0.2%	50	51.0	0.2%	50	51.0	0.2%
200	200.0	0.0%	75	75.0	0.0%	75	76.0	0.2%
300	303.0	0.4%	100	100.0	0.0%	100	100.0	0.0%
400	401.0	0.1%	125	125.0	0.0%	125	125.0	0.0%
500	500.0	0.0%	150	150.0	0.0%	150	150.0	0.0%
800	801.0	0.1%	175	175.0	0.0%	175	175.0	0.0%
1000	1001.0	0.1%	200	200.0	0.0%	200	200.0	0.0%
1500	1500.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
1900	1900.0	0.0%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	0	3.0	0.7%	0	3.0	0.7%
0	4.0	0.9%	50	50.0	0.0%	50	50.0	0.0%
25	27.0	0.4%	100	100.0	0.0%	100	100.0	0.0%
50	51.0	0.2%	150	150.0	0.0%	150	150.0	0.0%
75	75.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
100	100.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
125	125.0	0.0%	250	250.0	0.0%	250	250.0	0.0%
150	150.0	0.0%	275	275.0	0.0%	275	275.0	0.0%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	350.0	0.0%
225	226.0	0.1%	400	400.0	0.0%	400	400.0	0.0%
250	250.0	0.0%	500	500.0	0.0%	500	500.0	0.0%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-4

Date of Calibration : 8/15/2011

Calib. Technician: PLS

Barometric Pressure : 29.07

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.053	5.000	80.5	81.0	73.0	11.965	1.0026	1.639
1.00	5.057	5.000	81.0	81.0	73.0	8.564	1.0010	1.680
1.75	5.066	5.000	80.0	81.0	73.0	6.536	0.9964	1.712
2.50	10.098	10.000	81.0	81.0	73.0	11.001	0.9988	1.732
3.50	10.081	10.000	81.0	81.0	73.0	9.360	0.9980	1.756



Average Meter Coefficient 0.9994

Average Orifice Coefficient 1.704

Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-23.0	0.5%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	0.0	0.0%	0	3.0	0.7%	0	3.0	0.7%
50	49.0	-0.2%	25	27.0	0.4%	25	27.0	0.4%
100	98.0	-0.4%	50	51.0	0.2%	50	51.0	0.2%
200	200.0	0.0%	75	75.0	0.0%	75	75.0	0.0%
300	300.0	0.0%	100	100.0	0.0%	100	100.0	0.0%
400	398.0	-0.2%	125	125.0	0.0%	125	125.0	0.0%
500	498.0	-0.2%	150	150.0	0.0%	150	150.0	0.0%
800	800.0	0.0%	175	175.0	0.0%	175	175.0	0.0%
1000	1000.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
1500	1500.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
1900	1904.0	0.2%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	0	3.0	0.7%	0	4.0	0.9%
0	3.0	0.7%	50	51.0	0.2%	50	52.0	0.4%
25	27.0	0.4%	100	100.0	0.0%	100	101.0	0.2%
50	51.0	0.2%	150	150.0	0.0%	150	150.0	0.0%
75	75.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
100	100.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
125	125.0	0.0%	250	250.0	0.0%	250	250.0	0.0%
150	150.0	0.0%	275	275.0	0.0%	275	275.0	0.0%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	350.0	0.0%
225	225.0	0.0%	400	400.0	0.0%	400	400.0	0.0%
250	250.0	0.0%	500	501.0	0.1%	500	500.0	0.0%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-7

Date of Calibration : 9/9/2011

Calib. Technician: PLS

Barometric Pressure : 29.17

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.034	5.000	85.0	79.0	73.5	12.318	1.0078	1.742
1.00	5.052	5.000	89.5	79.5	73.5	8.716	1.0076	1.742
1.75	5.052	5.000	82.5	78.0	73.5	6.584	0.9978	1.745
2.50	10.124	10.000	93.5	81.0	73.5	11.042	1.0069	1.743
3.50	10.147	10.000	95.0	82.5	73.5	9.415	1.0048	1.769



Average Meter Coefficient 1.0050

Average Orifice Coefficient 1.748

Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-21.0	0.9%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	2.0	0.4%	0	3.0	0.7%	0	3.0	0.7%
50	50.0	0.0%	25	27.0	0.4%	25	27.0	0.4%
100	100.0	0.0%	50	51.0	0.2%	50	51.0	0.2%
200	201.0	0.2%	75	75.0	0.0%	75	75.0	0.0%
300	301.0	0.1%	100	100.0	0.0%	100	100.0	0.0%
400	399.0	-0.1%	125	124.0	-0.2%	125	125.0	0.0%
500	499.0	-0.1%	150	150.0	0.0%	150	150.0	0.0%
800	801.0	0.1%	175	175.0	0.0%	175	175.0	0.0%
1000	1001.0	0.1%	200	200.0	0.0%	200	200.0	0.0%
1500	1501.0	0.1%	225	225.0	0.0%	225	225.0	0.0%
1900	1901.0	0.0%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	0	3.0	0.7%	0	3.0	0.7%
0	3.0	0.7%	50	51.0	0.2%	50	51.0	0.2%
25	27.0	0.4%	100	100.0	0.0%	100	100.0	0.0%
50	51.0	0.2%	150	150.0	0.0%	150	150.0	0.0%
75	75.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
100	100.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
125	124.0	-0.2%	250	250.0	0.0%	250	250.0	0.0%
150	150.0	0.0%	275	275.0	0.0%	275	274.0	-0.1%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	349.0	-0.1%
225	225.0	0.0%	400	399.0	-0.1%	400	399.0	-0.1%
250	250.0	0.0%	500	500.0	0.0%	500	500.0	0.0%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Isokinetic Control Module Calibration

Control Module Number C-12

Date of Calibration : 9/8/2011

Calib. Technician: pls

Barometric Pressure : 29.36

Orifice Diff Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient α	Orifice Coefficient ΔH@
			Inlet	Outlet				
0.50	5.073	5.000	82.0	75.5	72.5	11.827	0.9959	1.599
1.00	5.093	5.000	86.5	77.0	72.5	8.436	0.9963	1.623
1.75	5.053	5.000	79.5	74.5	72.5	6.363	0.9935	1.623
2.50	10.242	10.000	90.5	78.5	72.5	10.697	0.9922	1.626
3.50	10.268	10.000	92.0	80.5	72.5	9.111	0.9904	1.645



Average Meter Coefficient 0.9937

Average Orifice Coefficient 1.623

Thermocouple Reading Devices

Note: Readings are in °F, % Dif. calculated from °R.

Stack Device			Meter Inlet Device			Meter Outlet Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-20.0	1.1%	-25	-19.0	1.4%	-25	-19.0	1.4%
0	3.0	0.7%	0	3.0	0.7%	0	3.0	0.7%
50	51.0	0.2%	25	27.0	0.4%	25	27.0	0.4%
100	100.0	0.0%	50	51.0	0.2%	50	51.0	0.2%
200	202.0	0.3%	75	75.0	0.0%	75	75.0	0.0%
300	302.0	0.3%	100	100.0	0.0%	100	100.0	0.0%
400	400.0	0.0%	125	125.0	0.0%	125	125.0	0.0%
500	499.0	-0.1%	150	150.0	0.0%	150	150.0	0.0%
800	800.0	0.0%	175	175.0	0.0%	175	175.0	0.0%
1000	1000.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
1500	1499.0	-0.1%	225	225.0	0.0%	225	225.0	0.0%
1900	1901.0	0.0%	250	250.0	0.0%	250	250.0	0.0%

Impinger Device			Oven Device			Probe Device		
Nominal	Result	%Dif.	Nominal	Result	%Dif.	Nominal	Result	%Dif.
-25	-19.0	1.4%	0	3.0	0.7%	0	3.0	0.7%
0	3.0	0.7%	50	51.0	0.2%	50	51.0	0.2%
25	27.0	0.4%	100	100.0	0.0%	100	100.0	0.0%
50	51.0	0.2%	150	150.0	0.0%	150	150.0	0.0%
75	75.0	0.0%	200	200.0	0.0%	200	200.0	0.0%
100	100.0	0.0%	225	225.0	0.0%	225	225.0	0.0%
125	125.0	0.0%	250	250.0	0.0%	250	250.0	0.0%
150	150.0	0.0%	275	275.0	0.0%	275	275.0	0.0%
175	175.0	0.0%	300	300.0	0.0%	300	300.0	0.0%
200	200.0	0.0%	350	350.0	0.0%	350	350.0	0.0%
225	225.0	0.0%	400	400.0	0.0%	400	400.0	0.0%
250	250.0	0.0%	500	501.0	0.1%	500	501.0	0.1%

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Dry Test Meter/Orifice Calibration

Control Module Number MC-1

Calib. Technician: pls

Date of Calibration : 9/13/2011

Barometric Pressure 29.08

Sampling Set Rate <u>LPM</u>	Dry Test Meter Vol. <u>Cubic Ft.</u>	Wet Test Meter Vol. <u>Cubic Ft.</u>	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time <u>Minutes</u>	Gas Meter Coefficient <u>a</u>	Actual Sample Rate-LPM
0.50	0.506	0.500	83.00	82.50	75.00	28.87	1.0025	0.49
1.00	0.500	0.500	78.00	75.00	75.00	14.86	1.0028	0.95
3.00	1.009	1.000	81.50	81.50	75.00	10.56	1.0031	2.68



Average Meter Coefficie 1.0028

Control Module Number MC-2

Calib. Technician: pls

Date of Calibration : 9/13/2011

Barometric Pressure 29.15

Sampling Set Rate <u>LPM</u>	Dry Test Meter Vol. <u>Cubic Ft.</u>	Wet Test Meter Vol. <u>Cubic Ft.</u>	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time <u>Minutes</u>	Gas Meter Coefficient <u>a</u>	Actual Sample Rate-LPM
0.50	0.513	0.500	84.00	81.00	75.00	29.97	0.9883	0.47
1.00	0.516	0.510	76.00	75.00	75.00	15.62	0.9893	0.92
3.00	1.002	1.000	81.50	77.50	75.00	11.54	1.0064	2.45



Average Meter Coefficie 0.9947

Flint Hills Resources Pine Bend LLC

Rosemount, MN

Pace Project No. 1108-200

Appendix D

Dry Test Meter/Orifice Calibration

Control Module Number MC-3

Calib. Technician: pls

Date of Calibration : 9/14/2011

Barometric Pressure 29.38

Sampling Set Rate	Dry Test Meter Vol.	Wet Test Meter Vol.	Dry Test Meter Temperature, °F		Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient	Actual Sample Rate-LPM
<u>LPM</u>	<u>Cubic Ft.</u>	<u>Cubic Ft.</u>	<u>Inlet</u>	<u>Outlet</u>			<u>a</u>	
0.50	0.519	0.500	81.50	79.00	72.50	32.35	0.9774	0.44
1.00	0.496	0.500	73.50	72.00	72.50	16.37	1.0085	0.86
3.00	1.008	1.000	79.00	75.00	72.50	11.87	1.0004	2.39



Average Meter Coefficie 0.9955

Calibration Gas Certifications

Propane - 98.1 ppm - Exp Jan 14

DocNumber: 000019028

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PRAXAIR WHSE ST PAUL MN
2136 WABASH AVE
ST PAUL MN 551140

Praxair Order Number: 15585465
Customer P. O. Number: 03200674
Customer Reference Number:

Fill Date: 1/11/2011
Part Number: EV AIPR95ME-AS
Lot Number: 109101002
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

Certified Concentration:

Expiration Date:	1/19/2014	NIST Traceable
Cylinder Number:	CC164335	Analytical Uncertainty:
98.1 ppm PROPANE		± 1 %
Balance AIR		

Certification Information: Certification Date: 1/19/2011 Term: 36 Months Expiration Date: 1/19/2014

This cylinder was certified according to the 1997 EPA Traceability Protocol, Document #EPA-600/R-97/121, using Procedure G1

Do Not Use this Standard if Pressure is less than 150 PSIG

O2 @ 21.03%

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: PROPANE

Requested Concentration: 95 ppm
Certified Concentration: 98.1 ppm
Instrument Used: HORIBA, FIA-510, 851135122
Analytical Method: Flame Ionization
Last Multipoint Calibration: 1/11/2011

Reference Standard Type: GMIS
Ref. Std. Cylinder #: CC 95262
Ref. Std. Conc: 100.4 ppm
Ref. Std. Traceable to SRM #: vs. 1668b
SRM Sample #: 82-13-H
SRM Cylinder #: CLM-006437

First Analysis Data:				Date:	1/19/2011
Z:	0	R:	275	C:	268
Conc:	98				
R:	275.1	Z:	0	C:	268.8
Conc:	98.1				
Z:	0	C:	269.1	R:	275
Conc:	98.1				
UOM:	ppm	Mean Test Assay:	98.1 ppm		

Second Analysis Data:				Date:	
Z:	0	R:	0	C:	0
Conc:	0				
R:	0	Z:	0	C:	0
Conc:	0				
Z:	0	C:	0	R:	0
Conc:	0				
UOM:	ppm	Mean Test Assay:	0 ppm		

Analyzed by:


Shameela Jiffrey

Certified by:


Rolonda Kaywood

Me 2-3-11



**MATHESON
TRI-GAS**

ask. . .The Gas Professionals™

Certificate of Analysis - EPA Protocol Mixtures

1650 Enterprise Parkway
Twinsburg, Ohio 44087
215-648-4000

Customer: VALLEY NATIONAL GASES

Cylinder Number: SX-20621

Cylinder pressure: 2000 psig

Last Analysis date: 7/30/2009

Expiration Date: 7/30/12

Protocol:

Reference #

Lot #

G1

494541

109-96-01345

DO NOT USE THIS CYLINDER WHEN THE
PRESSURE FALLS BELOW 150 PSIG

REPLICATE RESPONSES

Component: Propane

Certified Conc: 50.2 PPM ± 1% REL

Date: 7/30/2009

Date:

50.0 PPM

50.2 PPM

50.3 PPM

BALANCE GAS: Air

REFERENCE STANDARDS

Component: Propane

SRM #: SRM-1667b

Sample #: 83-i-48

Cylinder #: XF-003881B

Concentration: 49.54 ppm

CERTIFICATION INSTRUMENTS

Component: Propane

Make/Model: Varian 3800 GC

Serial Number: LR-92489

Measurement Principle: TC, FID

Last Calibration: 7/23/2009

Notes: T122110

He 8-17-09
This certification was performed according to EPA Traceability Protocol for Assay & Certification of Gaseous Calibration Standards September 1997, using procedure G1 and/or G2.

Analyst

Philip D. Mont.

Date 7/30/2009



Propane - 29.7 ppm - Exp Feb 14

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Telephone: (323) 585-2154
Facsimile: (714) 542-6689

DocNumber: 000020216

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PACE ANALYTICAL SERVICES IN
1700 ELM ST SE
MINNEAPOLIS MN 554140

Praxair Order Number: 15856097
Customer P. O. Number:
Customer Reference Number:

Fill Date: 2/8/2011
Part Number: EV AIPR30ME-AS
Lot Number: 109103904
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

Certified Concentration:

Expiration Date:	2/20/2014	NIST Traceable
Cylinder Number:	CC163035	Analytical Uncertainty:
29.7 ppm PROPANE		± 1 %
Balance AIR		

Certification Information: Certification Date: 2/20/2011 Term: 36 Months Expiration Date: 2/20/2014

This cylinder was certified according to the 1997 EPA Traceability Protocol, Document #EPA-600/R-97/121, using Procedure G1
Do Not Use this Standard if Pressure is less than 150 PSIG

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: PROPANE

Requested Concentration: 30.0 ppm
Certified Concentration: 29.7 ppm
Instrument Used: HORIBA, FIA-510, 851135122
Analytical Method: Flame Ionization
Last Multipoint Calibration: 2/11/2011

Reference Standard Type: GMIS
Ref. Std. Cylinder #: SA 9789
Ref. Std. Conc: 32.0 ppm
Ref. Std. Traceable to SRM #: vs. 1667b
SRM Sample #: 83-51-H
SRM Cylinder #: CAL-011857

First Analysis Data: Date: 2/18/2011
Z: 0 R: 84 C: 77.9 Conc: 29.7
R: 83.8 Z: 0 C: 77.9 Conc: 29.7
Z: 0 C: 77.9 R: 83.9 Conc: 29.7
UOM: ppm Mean Test Assay: 29.7 ppm

Second Analysis Data: Date:
Z: 0 R: 0 C: 0 Conc: 0
R: 0 Z: 0 C: 0 Conc: 0
Z: 0 C: 0 R: 0 Conc: 0
UOM: ppm Mean Test Assay: 0 ppm

Analyzed by:

Shameela Jiffrey

Certified by:

Rolonda Kaywood

Zero Air — CC 343912
PRAXAIR

Praxair Distribution, Inc.
2455 Rosegate
Roseville, MN 55113
Tel (651) 633-6781

To:

Issue Date: 02/22/11

Attn:

Praxair Order Number:
Customer Order Number:
Customer Reference Number:

Product Lot Number: 049J111
Product Part Number: AI 0.0Z-AS

CERTIFICATE OF BATCH ANALYSIS

Air - Synthetic - Zero

Cylinder Serial Number	Components	Requested Concentration	Certified Concentration	Analytical Uncertainty
CC344099	THC	< 1.0 ppm	0.06 ppm	± 1%
	O2	19.5 to 23.5 %	21.00 %	

Cylinder Style: AS
Cylinder Pressure @ 70°F(21°C): 2200psig
Cylinder Volume: 144cu ft

Valve Outlet Connection: CGA 590
Filling Method: Partial Pressure
Date of Fill: 02/18/11
Expiration Date: N/A

Cylinders Shipped:	CC344175	CC344174	CC344125	CC344110	CC343912	CC344162
	CC344160	CC344163	CC344176	CC344199	CC344172	CC344105
	CC344122	CC344120	CC344123	CC344111	CC344159	CC344100
	CC344121	CC344165	CC344186	CC344164	CC344168	CC344179

Approved Signer:

Jeremy Syverson
Lab Technician

This gas calibration cylinder standard prepared by Praxair Distribution is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted

*Key to Analytical Principle:

- | | | | |
|---|--|--|-------------------------------|
| A. Flame Ionization with Methanizer | F. Gas Chromatography with Helium Ionization Detector | K. Gas Chromatography with Ultrasonic Detector | P. Specific Water Analyzer |
| B. Gas Chromatography with Discharge Ionization Detector | G. Gas Chromatography with Methanizer Carbonizer | L. Gravimetric Methods | Q. Total Hydrocarbon Analyzer |
| C. Gas Chromatography with Electrolytic Conductivity Detector | H. Gas Chromatography with Photoionization Detector | M. Infrared - FTIR or NDIR | R. Wet Chemical |
| D. Gas Chromatography with Flame Ionization Detector | I. Gas Chromatography with Reduction Gas Analyzer | N. Mass Spectrometry - MS or GC/MS | S. Detector Tube |
| E. Gas Chromatography with Flame Photometric Detector | J. Gas Chromatography with Thermal Conductivity Detector | O. Paramagnetic | T. Odor |

IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution arising out of the use of the information contained herein exceed the fee established for providing such information.