Calibration Data

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 9/13/2010

Operator: j burton

Meter Box ID M-2				Meter Box ΔH@			1.810	Meter Box Y_d			0.9904	Barometric Pressure (in. Hg.)		29.50
Time	Orifice Data				Meter Box Data								Results	
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3455	23.0	80	2.193	473.80	476.08	2.28	0.63	77	74	75.5	2.219	0.439	0.9882	1.789
5.0	0.3455	23.0	81	2.191	476.08	478.37	2.29	0.63	78	75	76.5	2.225	0.438	0.9849	1.776
5.0	0.3455	23.0	82	2.189	478.37	480.66	2.29	0.63	78	75	76.5	2.225	0.438	0.9839	1.776
5.0	0.4434	21.0	82	2.809	481.00	483.93	2.93	1.05	79	76	77.5	2.844	0.562	0.9877	1.812
5.0	0.4434	21.0	82	2.809	483.93	486.88	2.95	1.05	80	77	78.5	2.858	0.562	0.9829	1.791
5.0	0.4434	21.0	82	2.809	486.88	489.82	2.94	1.05	80	78	79.0	2.846	0.562	0.9871	1.805
5.0	0.5926	20.0	83	3.751	490.20	494.12	3.92	1.9	81	78	79.5	3.799	0.750	0.9874	1.838
5.0	0.5926	20.0	83	3.751	494.12	498.04	3.92	1.9	83	79	81.0	3.788	0.750	0.9901	1.844
5.0	0.5926	20.0	83	3.751	498.04	501.96	3.92	1.9	84	79	81.5	3.785	0.750	0.9910	1.845
5.0	0.7965	17.0	83	5.042	502.60	507.80	5.20	3.3	86	80	83.0	5.024	1.008	1.0035	1.826
5.0	0.7965	17.0	83	5.042	507.80	513.03	5.23	3.3	88	81	84.5	5.039	1.008	1.0005	1.810
5.0	0.7965	17.0	83	5.042	513.03	518.27	5.24	3.3	86	82	84.0	5.054	1.008	0.9976	1.802
													Average	0.9904	1.810

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)			
Standard	Vacuum Gauge	Standard	Ch. No 1	Ch. No 2	Ch. No 3
5	5.0	32	32	33	33
10	10.0	50	49	51	51
15	15.0	100	99	101	102
20	20.0	150	150	152	152
25	25.0	212	212	214	214
		250	249	252	252
		300	301	302	302
		350	350	352	352
		400	400	402	402
		500	500	502	502
		600	600	602	602

Equations

$$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460) * 0.5}$$

$$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H / 13.6))}{(T_{avg} + 460)}$$

$$Q = V_{cr} / \theta$$

$$Y_d = V_{cr} / V_{mstd}$$

$$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$$

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.500	Date	8/9/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.776	Meter ID	M-2

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	348.00	351.88	355.76
Final Volume (ft^3)	351.88	355.76	359.64
Volume Metered (ft^3)	3.88	3.88	3.88
DGM Inlet Temperature (°F)	84	85	85
DGM Outlet Temperature (°F)	80	81	81
Average DGM Temperature (°F)	82.0	83.0	83.0
Ambient Temperature (°F)	84	83	84
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.75	1.75	1.75
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	20	20	20
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.722	3.725	3.722
Vmstd (ft^3)	3.741	3.735	3.735
Post Test Yc	0.9947	0.9975	0.9965
Full Test Yd	0.9904	0.9904	0.9904
% Difference	-0.44	-0.71	-0.62
Average % Difference			-0.59

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 5/23/2011

Operator: j burton

Meter Box ID M-3				Meter Box ΔH@			1.807	Meter Box Y_d			0.9891	Barometric Pressure (in. Hg.)		29.50
Time	Orifice Data			Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3445	20.0	76	2.195	740.70	742.98	2.28	0.64	75	73	74	2.225	0.439	0.9863	1.817
5.0	0.3445	20.0	76	2.195	742.98	745.27	2.29	0.64	76	74	75.0	2.231	0.439	0.9838	1.804
5.0	0.3445	20.0	76	2.195	745.27	747.57	2.30	0.64	76	74	75.0	2.241	0.439	0.9795	1.789
5.0	0.4436	19.0	76	2.826	748.00	750.96	2.96	1.10	77	74	75.5	2.884	0.565	0.9798	1.858
5.0	0.4436	19.0	76	2.826	750.96	753.90	2.94	1.10	78	75	76.5	2.859	0.565	0.9884	1.887
5.0	0.4436	19.0	76	2.826	753.90	756.85	2.95	1.10	79	75	77.0	2.867	0.565	0.9859	1.876
5.0	0.5885	17.0	77	3.746	757.20	761.09	3.89	1.8	81	76	78.5	3.776	0.749	0.9920	1.770
5.0	0.5885	17.0	77	3.746	761.09	764.99	3.90	1.8	82	76	79.0	3.782	0.749	0.9904	1.763
5.0	0.5885	17.0	77	3.746	764.99	768.89	3.90	1.8	83	77	80.0	3.775	0.749	0.9922	1.766
5.0	0.7954	15.0	77	5.063	769.50	774.76	5.26	3.3	86	78	82.0	5.092	1.013	0.9943	1.786
5.0	0.7954	15.0	77	5.063	774.76	780.04	5.28	3.3	88	79	83.5	5.097	1.013	0.9933	1.778
5.0	0.7954	15.0	77	5.063	780.04	785.32	5.28	3.3	98	80	89.0	5.046	1.013	1.0033	1.796
													Average	0.9891	1.807

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch. No. 1	Ch. No 2	Ch. No 3	
5	5.0	32	33	33	33	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)\ ^\wedge 0.5}$
10	10.0	50	51	51	51	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$
15	15.0	100	101	101	102	
20	20.0	150	152	151	151	$Q = V_{cr} / \theta$
25	25.0	212	213	213	214	
		250	252	252	251	$Y_d = V_{cr} / V_{mstd}$
		300	301	301	302	
		350	352	352	351	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$
		400	401	402	402	
		500	502	502	501	
		600	602	602	602	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.500	Date	7/27/2011
Highest Field Vacuum (inches Hg)	5	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.784	Meter ID	M-3

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	248.00	251.92	255.84
Final Volume (ft^3)	251.92	255.84	259.75
Volume Metered (ft^3)	3.92	3.92	3.91
DGM Inlet Temperature (°F)	87	88	89
DGM Outlet Temperature (°F)	82	83	83
Average DGM Temperature (°F)	84.5	85.5	86.0
Ambient Temperature (°F)	80	80	80
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.80	1.80	1.80
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	18	18	18
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.735	3.735	3.735
Vmstd (ft^3)	3.763	3.756	3.743
Post Test Yc	0.9926	0.9945	0.9979
Full Test Yd	0.9891	0.9891	0.9891
% Difference	-0.36	-0.54	-0.89
Average % Difference			-0.60

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 5/23/2011

Operator: J Burton

Meter Box ID M-7				Meter Box ΔH@			1.815	Meter Box Y_d			0.9799	Barometric Pressure (in. Hg.)		29.50
Time	**Orifice Data**				**Meter Box Data**							**Results**		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3445	20.0	83	2.181	904.10	906.37	2.27	0.63	74	72	73	2.220	0.436	0.9824	1.835
5.0	0.3445	20.0	83	2.181	906.37	908.65	2.28	0.63	75	72	73.5	2.227	0.436	0.9790	1.820
5.0	0.3445	20.0	83	2.181	908.65	910.93	2.28	0.63	76	73	74.5	2.223	0.436	0.9808	1.824
5.0	0.4436	18.0	85	2.803	911.30	914.24	2.94	1.05	77	73	75.0	2.867	0.561	0.9775	1.830
5.0	0.4436	18.0	85	2.803	914.24	917.18	2.94	1.05	79	74	76.5	2.859	0.561	0.9803	1.835
5.0	0.4436	18.0	85	2.803	917.18	920.12	2.94	1.05	79	75	77.0	2.856	0.561	0.9812	1.837
5.0	0.5885	16.0	86	3.715	937.80	941.74	3.94	1.8	83	78	80.5	3.810	0.743	0.9749	1.764
5.0	0.5885	16.0	86	3.715	941.74	945.65	3.91	1.8	83	78	80.5	3.781	0.743	0.9824	1.792
5.0	0.5885	16.0	86	3.715	945.65	949.58	3.93	1.8	84	79	81.5	3.794	0.743	0.9792	1.777
5.0	0.7954	14.0	86	5.021	950.00	955.30	5.30	3.35	84	79	81.5	5.136	1.004	0.9776	1.818
5.0	0.7954	14.0	86	5.021	955.30	960.60	5.30	3.35	86	80	83.0	5.122	1.004	0.9803	1.823
5.0	0.7954	14.0	86	5.021	960.60	965.89	5.29	3.35	87	80	83.5	5.107	1.004	0.9831	1.832
													Average	0.9799	1.815

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch No 1	Ch No 2	Ch No 3	
5	5.0	32	33	32	33	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)} ^{0.5}$
10	10.0	50	51	50	51	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$
15	15.0	100	101	100	102	
20	20.0	150	151	150	150	$Q = V_{cr} / \theta$
25	25.0	212	213	212	213	
		250	251	250	251	$Y_d = V_{cr} / V_{mstd}$
		300	301	301	301	
		350	401	350	350	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m 2}$
		400	501	400	400	
		500	600	500	500	
		600	600	598	600	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.240	Date	7/27/2011
Highest Field Vacuum (inches Hg)	12	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.788	Meter ID	M-7

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	416.80	420.74	424.70
Final Volume (ft^3)	420.74	424.7	428.64
Volume Metered (ft^3)	3.94	3.96	3.94
DGM Inlet Temperature (°F)	83	84	86
DGM Outlet Temperature (°F)	78	79	80
Average DGM Temperature (°F)	80.5	81.5	83.0
Ambient Temperature (°F)	78	78	77
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.90	1.90	1.90
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	16	16	16
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.742	3.742	3.746
Vmstd (ft^3)	3.811	3.824	3.794
Post Test Yc	0.9819	0.9788	0.9874
Full Test Yd	0.9799	0.9799	0.9799
% Difference	-0.21	0.12	-0.76
	Average % Difference		-0.28

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 2/1/2011 Operator: j burton

Meter Box ID M-9	Meter Box ΔH@ 1.856	Meter Box Y_d 0.9891	Barometric Pressure (in. Hg.) 29.50

Time	Orifice Data				Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3455	22.0	64	2.226	310.10	312.38	2.28	0.66	67	65	66	2.259	0.445	0.9854	1.845
5.0	0.3455	22.0	65	2.224	312.38	314.65	2.27	0.66	68	67	67.5	2.243	0.445	0.9916	1.867
5.0	0.3455	22.0	66	2.222	314.65	316.92	2.27	0.66	68	67	67.5	2.243	0.444	0.9906	1.867
5.0	0.4434	21.0	66	2.852	317.20	320.13	2.93	1.10	69	67	68.0	2.896	0.570	0.9848	1.869
5.0	0.4434	21.0	66	2.852	320.13	323.07	2.94	1.10	70	68	69.0	2.900	0.570	0.9833	1.860
5.0	0.4434	21.0	66	2.852	323.07	325.99	2.92	1.10	71	68	69.5	2.878	0.570	0.9910	1.888
5.0	0.5926	19.0	66	3.811	326.20	330.11	3.91	1.9	72	68	70.0	3.857	0.762	0.9881	1.820
5.0	0.5926	19.0	67	3.808	330.11	334.02	3.91	1.9	72	69	70.5	3.854	0.762	0.9881	1.822
5.0	0.5926	19.0	67	3.808	334.02	337.93	3.91	1.9	74	70	72.0	3.843	0.762	0.9909	1.827
5.0	0.7965	17.0	66	5.123	338.30	343.56	5.26	3.5	77	71	74.0	5.171	1.025	0.9907	1.867
5.0	0.7965	17.0	66	5.123	343.56	348.82	5.26	3.5	79	71	75.0	5.161	1.025	0.9926	1.870
5.0	0.7965	17.0	66	5.123	348.82	354.09	5.27	3.5	80	72	76.0	5.161	1.025	0.9925	1.866
													Average	0.9891	1.856

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch. No. 1	Ch. No. 2	Ch. No. 3	
5	5.0	32	31	31	32	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)\ ^\wedge 0.5}$
10	10.0	50	49	50	49	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$
15	15.0	100	99	100	100	$Q = V_{cr} / \theta$
20	20.0	150	150	150	150	$Y_d = V_{cr} / V_{mstd}$
25	25.0	212	212	212	212	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta\ ^\wedge 2}{P_b * Y_d\ ^\wedge 2 * V_m\ ^\wedge 2}$
		250	250	251	250	
		300	299	301	301	
		350	350	350	350	
		400	399	401	401	
		500	500	501	501	
		600	599	600	601	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.300	Date	7/27/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.778	Meter ID	M-9

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	244.50	248.39	252.29
Final Volume (ft^3)	248.39	252.29	256.19
Volume Metered (ft^3)	3.89	3.90	3.90
DGM Inlet Temperature (°F)	82	84	84
DGM Outlet Temperature (°F)	79	80	80
Average DGM Temperature (°F)	80.5	82.0	82.0
Ambient Temperature (°F)	84	83	84
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.90	1.90	1.90
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	20	20	20
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.722	3.725	3.722
Vmstd (ft^3)	3.763	3.762	3.762
Post Test Yc	0.9890	0.9901	0.9892
Full Test Yd	0.9891	0.9891	0.9891
% Difference	0.01	-0.11	-0.01
Average % Difference			**-0.04**

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 9/13/2010 Operator: j burton

Meter Box ID M-14				Meter Box ΔH@			1.802	Meter Box Y_d			1.0087	Barometric Pressure (in. Hg.)			29.50
Time	**Orifice Data**				**Meter Box Data**								**Results**		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3455	22.0	83	2.187	510.30	512.57	2.27	0.63	82	89	85.5	2.169	0.437	1.0083	1.772
5.0	0.3455	22.0	83	2.187	512.57	514.83	2.26	0.63	83	80	81.5	2.175	0.437	1.0054	1.775
5.0	0.3455	22.0	83	2.187	514.83	517.09	2.26	0.63	84	81	82.5	2.171	0.437	1.0072	1.778
5.0	0.4434	20.0	84	2.804	517.40	520.33	2.93	1.05	85	82	83.5	2.813	0.561	0.9969	1.766
5.0	0.4434	20.0	84	2.804	520.33	523.27	2.94	1.05	87	82	84.5	2.817	0.561	0.9954	1.757
5.0	0.4434	20.0	84	2.804	523.27	526.17	2.90	1.05	89	83	86.0	2.771	0.561	1.0119	1.811
5.0	0.5926	18.0	84	3.748	526.60	530.50	3.90	1.9	91	84	87.5	3.724	0.750	1.0062	1.817
5.0	0.5926	18.0	84	3.748	530.50	534.40	3.90	1.9	93	85	89.0	3.714	0.750	1.0090	1.822
5.0	0.5926	18.0	84	3.748	534.40	538.30	3.90	1.9	94	86	90.0	3.707	0.750	1.0108	1.826
5.0	0.7965	15.0	84	5.037	538.90	544.13	5.23	3.4	97	87	92.0	4.972	1.007	1.0130	1.823
5.0	0.7965	15.0	84	5.037	544.13	549.36	5.23	3.4	100	89	94.5	4.950	1.007	1.0176	1.831
5.0	0.7965	15.0	84	5.037	549.36	554.58	5.22	3.4	102	90	96.0	4.927	1.007	1.0223	1.843
													Average	1.0087	1.802

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch. No 1	Ch. No 2	Ch. No 3	
5	5.0	32	32	33	32	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)^{0.5}}$
10	10.0	50	51	51	50	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$
15	15.0	100	100	101	100	$Q = V_{cr} / \theta$
20	20.0	150	151	151	150	$Y_d = V_{cr} / V_{mstd}$
25	25.0	212	213	213	212	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$
		250	251	251	250	
		300	300	301	300	
		350	350	350	349	
		400	400	400	399	
		500	500	500	498	
		600	600	599	598	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.300	Date	7/27/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.754	Meter ID	M-14

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	603.10	606.87	610.63
Final Volume (ft^3)	606.87	610.63	614.40
Volume Metered (ft^3)	3.77	3.76	3.77
DGM Inlet Temperature (°F)	82	83	84
DGM Outlet Temperature (°F)	78	78	78
Average DGM Temperature (°F)	80.0	80.5	81.0
Ambient Temperature (°F)	86	87	88
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.80	1.80	1.80
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	18	18	18
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.715	3.711	3.708
Vmstd (ft^3)	3.649	3.636	3.643
Post Test Yc	1.0180	1.0207	1.0180
Full Test Yd	1.0087	1.0087	1.0087
% Difference	-0.92	-1.19	-0.92
Average % Difference			-1.01

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 2/3/2011 Operator: j burton

Meter Box ID M-15				Meter Box ΔH@			1.843	Meter Box Y_d			1.0159	Barometric Pressure (in. Hg.)			29.50
Time	Orifice Data				Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	$T_{a/g}$	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3455	22.0	76	2.201	23.00	25.19	2.19	0.65	71	68	69.5	2.156	0.440	1.0211	1.880
5.0	0.3455	22.0	76	2.201	25.19	27.38	2.19	0.65	72	68	70.0	2.154	0.440	1.0220	1.882
5.0	0.3455	22.0	76	2.201	27.38	29.56	2.18	0.65	73	69	71.0	2.140	0.440	1.0287	1.902
5.0	0.4434	21.0	76	2.825	30.50	33.36	2.86	1.10	73	71	72.0	2.805	0.565	1.0070	1.874
5.0	0.4434	21.0	76	2.825	33.36	36.22	2.86	1.10	74	72	73.0	2.800	0.565	1.0089	1.878
5.0	0.4434	21.0	76	2.825	36.22	39.07	2.85	1.10	75	72	73.5	2.788	0.565	1.0134	1.893
5.0	0.5926	19.0	76	3.775	39.60	43.43	3.83	1.9	77	73	75.0	3.743	0.755	1.0088	1.767
5.0	0.5926	19.0	76	3.775	43.43	47.22	3.79	1.9	78	73	75.5	3.700	0.755	1.0204	1.807
5.0	0.5926	19.0	76	3.775	47.22	51.05	3.83	1.9	80	74	77.0	3.729	0.755	1.0126	1.774
5.0	0.7965	17.0	76	5.075	51.40	56.55	5.15	3.4	83	74	78.5	5.019	1.015	1.0111	1.808
5.0	0.7965	17.0	76	5.075	56.55	61.68	5.13	3.4	84	75	79.5	4.990	1.015	1.0169	1.826
5.0	0.7965	17.0	76	5.075	61.68	66.81	5.13	3.4	86	76	81.0	4.976	1.015	1.0197	1.831
													Average	1.0159	1.843

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
$T_{a/g}$	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch. No 1	Ch. No 2	Ch. No 3	
5	5.0	32	31	32	32	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)^{0.5}}$
10	10.0	50	49	50	50	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H / 13.6))}{(T_{avg} + 460)}$
15	15.0	100	99	101	100	$Q = V_{cr} / \theta$
20	20.0	150	150	151	150	$Y_d = V_{cr} / V_{mstd}$
25	25.0	212	212	213	213	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$
		250	250	252	251	
		300	300	302	301	
		350	350	352	351	
		400	400	402	401	
		500	500	502	501	
		600	600	602	601	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.500	Date	8/9/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.75	Meter ID	M-15

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	174.50	178.25	182.02
Final Volume (ft^3)	178.25	182.02	185.78
Volume Metered (ft^3)	3.75	3.77	3.76
DGM Inlet Temperature (°F)	85	86	87
DGM Outlet Temperature (°F)	79	80	80
Average DGM Temperature (°F)	82.0	83.0	83.5
Ambient Temperature (°F)	85	85	85
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.80	1.80	1.80
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	19	19	19
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.718	3.718	3.718
Vmstd (ft^3)	3.617	3.629	3.616
Post Test Yc	1.0281	1.0246	1.0282
Full Test Yd	1.0159	1.0159	1.0159
% Difference	-1.20	-0.85	-1.21
	Average % Difference		**-1.09**

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 12/14/2010 Operator: j.burton

Meter Box ID M-17	Meter Box ΔH@	1.772	Meter Box Y_d	1.0141	Barometric Pressure (in. Hg.)	29.50

Time	Orifice Data				Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{a-g}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3455	22.0	76	2.201	780.30	782.52	2.22	0.63	72	68	70	2.183	0.440	1.0083	1.781
5.0	0.3455	22.0	76	2.201	782.52	784.73	2.21	0.63	73	69	71.0	2.169	0.440	1.0147	1.801
5.0	0.3455	22.0	76	2.201	784.73	786.94	2.21	0.63	73	69	71.0	2.169	0.440	1.0147	1.801
5.0	0.4434	20.0	75	2.828	787.30	790.15	2.85	1.05	74	69	71.5	2.798	0.566	1.0107	1.806
5.0	0.4434	20.0	75	2.828	790.15	793.01	2.86	1.05	74	70	72.0	2.805	0.566	1.0081	1.795
5.0	0.4434	20.0	75	2.828	793.01	795.86	2.85	1.05	75	70	72.5	2.792	0.566	1.0126	1.810
5.0	0.5926	18.0	76	3.775	796.20	800.01	3.81	1.8	76	70	73.0	3.736	0.755	1.0104	1.737
5.0	0.5926	18.0	76	3.775	800.01	803.81	3.80	1.8	78	71	74.5	3.716	0.755	1.0159	1.751
5.0	0.5926	18.0	76	3.775	803.81	807.63	3.82	1.8	79	71	75.0	3.732	0.755	1.0116	1.735
5.0	0.7965	16.0	78	5.065	808.20	813.27	5.07	3.2	81	72	76.5	4.957	1.013	1.0218	1.756
5.0	0.7965	16.0	78	5.065	813.27	818.37	5.10	3.2	83	73	78.0	4.972	1.013	1.0187	1.740
5.0	0.7965	16.0	78	5.065	818.37	823.46	5.09	3.2	84	73	78.5	4.958	1.013	1.0216	1.748
													Average	1.0141	1.772

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{a-g}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch. No. 1	Ch. No. 2	Ch. No. 3	
5	5.0	32	33	33	33	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)} - 0.5$
10	10.0	50	51	51	51	
15	15.0	100	101	102	102	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{a-g} + 460)}$
20	20.0	150	151	152	152	
25	25.0	212	213	214	214	$Q = V_{cr} / \theta$
		250	251	252	252	
		300	301	303	303	$Y_d = V_{cr} / V_{mstd}$
		350	352	353	353	
		400	401	402	403	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$
		500	501	503	503	
		600	601	602	603	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.500	Date	8/8/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.754	Meter ID	M-17

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	267.50	271.27	275.05
Final Volume (ft^3)	271.27	275.05	278.81
Volume Metered (ft^3)	3.77	3.78	3.76
DGM Inlet Temperature (°F)	93	93	94
DGM Outlet Temperature (°F)	86	86	87
Average DGM Temperature (°F)	89.5	89.5	90.5
Ambient Temperature (°F)	85	85	86
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.80	1.80	1.80
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	19	19	19
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.718	3.718	3.715
Vmstd (ft^3)	3.586	3.596	3.570
Post Test Yc	1.0368	1.0341	1.0405
Full Test Yd	1.0141	1.0141	1.0141
% Difference	-2.24	-1.97	-2.60
	Average % Difference		-2.27

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 11/1/2010 Operator: j burton

Meter Box ID M-20				Meter Box ΔH@			1.785	Meter Box Y_d			0.9952	Barometric Pressure (in. Hg.)		29.50
Time	Orifice Data			Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3455	22.0	67	2.220	956.60	958.89	2.29	0.64	73	67	70	2.252	0.444	0.9857	1.766
5.0	0.3455	22.0	67	2.220	958.89	961.17	2.28	0.64	75	69	72.0	2.234	0.444	0.9938	1.788
5.0	0.3455	22.0	67	2.220	961.17	963.46	2.29	0.64	77	70	73.5	2.237	0.444	0.9922	1.777
5.0	0.4434	20.0	67	2.849	963.70	966.67	2.97	1.05	79	72	75.5	2.894	0.570	0.9845	1.740
5.0	0.4434	20.0	67	2.849	966.67	969.63	2.96	1.05	80	72	76.0	2.881	0.570	0.9888	1.753
5.0	0.4434	20.0	67	2.849	969.63	972.59	2.96	1.05	82	74	78.0	2.871	0.570	0.9925	1.760
5.0	0.5926	18.0	68	3.804	993.00	997.01	4.01	1.9	90	81	85.5	3.843	0.761	0.9897	1.759
5.0	0.5926	18.0	68	3.804	997.01	1001.01	4.00	1.9	93	82	87.5	3.820	0.761	0.9958	1.775
5.0	0.5926	18.0	68	3.804	1001.01	1005.05	4.04	1.9	94	83	88.5	3.851	0.761	0.9878	1.743
5.0	0.7995	16.0	68	5.132	1005.70	1011.05	5.35	3.5	95	84	89.5	5.111	1.026	1.0042	1.834
5.0	0.7995	16.0	69	5.127	1011.05	1016.36	5.31	3.5	98	85	91.5	5.054	1.025	1.0145	1.869
5.0	0.7995	16.0	69	5.127	1016.36	1021.69	5.33	3.5	99	86	92.5	5.064	1.025	1.0125	1.858
													Average	0.9952	1.785

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_i	Gas Meter Volume (ft^3)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch. No. 1	Ch. No. 2	Ch. No. 3	
5	5.0	32	33	31	31	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460) \wedge 0.5}$
10	10.0	50	51	50	49	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$
15	15.0	100	101	100	100	
20	20.0	150	151	151	150	$Q = V_{cr} / \theta$
25	25.0	212	213	213	213	
		250	251	251	251	$Y_d = V_{cr} / V_{mstd}$
		300	300	301	301	
		350	350	352	351	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$
		400	400	402	402	
		500	501	502	501	
		600	601	602	602	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (ΔH)	1.500	Date	8/8/2011
Highest Field Vacuum (inches Hg)	5	Client	BREC
Critical Orifice ID	AA-63	Project No.	3648
Orifice Flow Rate (cfm)	0.766	Meter ID	M-20

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	825.60	829.43	833.26
Final Volume (ft^3)	829.43	833.26	837.08
Volume Metered (ft^3)	3.83	3.83	3.82
DGM Inlet Temperature (°F)	90	90	90
DGM Outlet Temperature (°F)	84	84	84
Average DGM Temperature (°F)	87.0	87.0	87.0
Ambient Temperature (°F)	90	89	88
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.80	1.80	1.80
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	18	18	18
K'	0.5885	0.5885	0.5885
Vcr (ft^3)	3.701	3.705	3.708
Vmstd (ft^3)	3.660	3.660	3.650
Post Test Yc	1.0113	1.0122	1.0158
Full Test Yd	0.9952	0.9952	0.9952
% Difference	-1.62	-1.71	-2.07
Average % Difference			-1.80

R-20028

Meter Box Full Test Calibration

DATE: 7/10/2011

Operator: Joe Ward

Meter Box No: DB30B-0711-2019				Meter Box H@: 0.0000						Meter Box Yd 1.0072						Barometric Pressure: 29.79		
#1				Standard Meter Gas Volume			Meter Box Gas Volume (ft( )			Std. Meter Temperature (ÞF)			Meter Box Temperature (ÞF)					
Q	P	H	Yds	Initial	Final	Vf	Initial	Final	Vf	Inlet	Outlet	Avg.	Inlet	Outlet	Avg.	Time	Yd	H@
0.04	-0.30	0.00	1.0000	0.0	1.000	1.000	.000	1.018	1.018	75.0	75.0	75.0	91.0	91.0	91.0	26.40	1.0124	0.0000
0.04	-0.30	0.00	1.0000	0.0	1.000	1.000	0.000	1.019	1.019	75.0	75.0	75.0	91.0	91.0	91.0	26.38	1.0115	0.0000
0.02	-0.30	0.00	1.0000	0.0	.520	.520	.000	.536	.536	75.0	75.0	75.0	93.0	93.0	93.0	22.14	1.0035	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.516	.516	75.0	75.0	75.0	94.0	94.0	94.0	22.09	1.0041	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.523	.523	76.0	76.0	76.0	104.0	104.0	104.0	32.22	1.0067	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.524	.524	76.0	76.0	76.0	104.0	104.0	104.0	32.20	1.0048	0.0000
															AVERAGE		1.0072	0.0000

Millennium Instruments Inc.
2402 Springridge Drive unit A
Spring Grove IL. 60081
PHONE#(815)675-3225
FAX#(815)675-6965
E-mail millennium@millinst.com
www.millinst.com

Vacuum Gauge

(in. Hg)	Gauge
5.0	5.5
10.0	10.5
15.0	16.0
20.0	21.0

New Ashtead

R-20078

Meter Box Full Test Calibration

DATE: 7/11/2011

Operator: Joe Ward

Meter Box No: DB30B-0711-2019				Meter Box H@: 0.0000						Meter Box Yd 0.9985						Barometric Pressure: 29.69		
#2				Standard Meter Gas Volume			Meter Box Gas Volume (ft)			Std. Meter Temperature (ÞF)			Meter Box Temperature (ÞF)					
Q	P	H	Yds	Initial	Final	Vf	Initial	Final	Vf	Inlet	Outlet	Avg.	Inlet	Outlet	Avg.	Time	Yd	H@
0.03	-0.30	0.00	1.0000	0.0	1.000	1.000	.000	1.024	1.024	75.0	75.0	75.0	92.0	92.0	92.0	30.56	1.0083	0.0000
0.03	-0.30	0.00	1.0000	0.0	1.000	1.000	0.000	1.025	1.025	75.0	75.0	75.0	92.0	92.0	92.0	30.48	1.0074	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.518	.518	75.0	75.0	75.0	94.0	94.0	94.0	22.10	1.0003	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.518	.518	75.0	75.0	75.0	94.0	94.0	94.0	21.90	1.0003	0.0000
0.01	-0.30	0.00	1.0000	0.0	.500	.500	.000	.528	.528	76.0	76.0	76.0	98.0	98.0	98.0	38.94	0.9866	0.0000
0.01	-0.30	0.00	1.0000	0.0	.500	.500	.000	.527	.527	76.0	76.0	76.0	98.0	98.0	98.0	38.85	0.9884	0.0000
															AVERAGE		0.9985	0.0000

Millennium Instruments Inc.
2402 Springridge Drive unit A
Spring Grove IL. 60081
PHONE#(815)675-3225
FAX#(815)675-6965
E-mail millennium@millinst.com
www.millinst.com

Vacuum Gauge

(in. Hg)	Gauge
5.0	5.0
10.0	10.0
15.0	15.0
20.0	20.0

R-20078

Pyrometer Calibration Sheet

Pyrometer No.:001

Office: Spring Grove
Client: Ashtead Technology Rentals
Job or Reference No.:DB30B-0711-2019

Temperature Scale Used ☑ Fahrenheit ☐ Celsius

☑ Full Test ☐ Post Test

Calibration Reference Settings for Fahrenheit Scale	Pyrometer Reading	Calibration Reference Settings for Celsius Scale
50° F	50° F	10°C
100° F	100° F	38°C
150° F	150° F	66°C
200° F	200° F	93°C
250° F	250° F	121°C
300° F	300° F	149°C
350° F	350° F	177°C
400° F	400° F	204°C
450° F	450° F	232°C
500° F	500° F	260°C
550° F	550° F	288°C
600° F	600° F	316°C

Method 30B Post-Test Meter Calibration

Average Field Sample Rate (lpm)	0.5	Date	8/8/2011
Highest Field Vacuum (inches Hg)	10.0	Client	BREC
Critical Orifice ID	.5LPM	Project No.	3648
Orifice Flow Rate (lpm)	0.473	Meter ID	R-20078A

	Run 1	Run 2	Run 3	
Initial Volume (l^3)	0.000	4.676	9.411	
Final Volume (l^3)	4.676	9.411	14.181	
Volume Metered (l^3)	4.676	4.735	4.770	
DGM Temperature (^oF)	106	108	112	
Ambient Temperature (^oF)	87	88	88	
Elapsed Time (min.)	10.0	10.0	10.0	
Setting (l/min)	0.4	0.4	0.4	
Barometric Pressure (inches Hg)	29.50	29.50	29.50	
Pump Vacuum (inches Hg)	20.0	20.0	20.0	
K'	0.012	0.012	0.012	
Vcr (l^3)	4.285	4.281	4.281	
Vmstd (l^3)	4.303	4.342	4.344	
Post Test Yc	0.99572	0.98589	0.98555	
Full Test Yd	1.0072	1.0072	1.0072	
% Difference	1.14	2.12	2.15	
	Average Difference		1.80	

Method 30B Post-Test Meter Calibration

Average Field Sample Rate (lpm)	0.5	Date	8/8/2011
Highest Field Vacuum (inches Hg)	10.0	Client	BREC
Critical Orifice ID	.5LPM	Project No.	3648
Orifice Flow Rate (lpm)	0.487	Meter ID	R-20078B

	Run 1	Run 2	Run 3	
Initial Volume (l^3)	0.000	4.891	9.779	
Final Volume (l^3)	4.891	9.779	14.623	
Volume Metered (l^3)	4.891	4.888	4.844	
DGM Temperature (°F)	116	116	115	
Ambient Temperature (°F)	87	87	86	
Elapsed Time (min.)	10.0	10.0	10.0	
Setting (l/min)	0.5	0.5	0.5	
Barometric Pressure (inches Hg)	29.50	29.50	29.50	
Pump Vacuum (inches Hg)	18.0	18.0	18.0	
K'	0.012	0.012	0.012	
Vcr (l^3)	4.285	4.285	4.289	
Vmstd (l^3)	4.424	4.422	4.389	
Post Test Yc	0.96853	0.96912	0.97712	
Full Test Yd	0.9985	0.9985	0.9985	
% Difference	3.00	2.94	2.14	
	Average Difference		2.69	

Airtech Environmental Services, Inc.
30B Meter Box Full Test Calibration

Date: 1/5/2011 **Operator:** S. Behanish

Meter Box	M-25 A							Meter Box Y_d				Barometric Pressure (in. Hg.)			24.57
Time	Orifice Data				Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	LPM			T_m	V_{mstd}	Q	Y_d	ΔH@
10.0	0.012	15.0	75	3.610	0.00	4.84	4.84	0.48			115	3.654	0.361	0.9880	1.544
10.0	0.012	15.0	75	3.610	4.84	9.63	4.79	0.48			115	3.616	0.361	0.9983	1.560
10.0	0.012	15.0	75	3.610	9.63	14.47	4.84	0.48			116	3.647	0.361	0.9897	1.547
10.0	0.028	14.0	75	8.422	0.00	10.95	10.95	1.10			115	8.281	0.842	1.0171	0.683
10.0	0.028	14.0	75	8.422	10.95	22.03	11.08	1.11			115	8.379	0.842	1.0051	0.675
10.0	0.028	14.0	75	8.422	22.03	33.00	10.97	1.10			116	8.282	0.842	1.0170	0.683
10.0	0.051	12.5	76	15.326	0.00	20.30	20.30	2.03			116	15.368	1.533	0.9973	0.369
10.0	0.051	12.5	77	15.312	20.30	40.68	20.38	2.04			116	15.429	1.531	0.9925	0.367
10.0	0.051	12.5	78	15.298	40.68	61.10	20.42	2.04			116	15.459	1.530	0.9896	0.367
													Average	0.9994	0.866

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (L)
V_d	Gas Meter Volume (L)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (L)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Gauge (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch. No. Stack	Ch. No. Aux 1	Ch. No. Aux 2	
5	5.0	32	33	34	34	$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)^{0.5}}$
10	10.0	50	50	51	51	$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$
15	15.0	100	101	102	102	
20	20.0	150	151	152	152	$Q = V_{cr} / \theta$
25	25.0	212	213	214	214	
		250	251	252	252	$Y_d = V_{cr} / V_{mstd}$
		300	300	302	302	
		350	350	352	352	$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$
		400	401	402	402	
		500	502	502	502	
		600	601	602	602	

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	0.500	Date	8/12/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	.5LPM	Project No.	3648
Orifice Flow Rate (lpm)	0.4486	Meter ID	M-25-A

	Run 1	Run 2	Run 3
Initial Volume (l)	0.00	4.486	9.072
Final Volume (l)	4.486	9.072	13.869
Volume Metered (l)	4.486	4.586	4.797
DGM Inlet Temperature (°F)	94	99	104
DGM Outlet Temperature (°F)	94	99	104
Average DGM Temperature (°F)	94.0	99.0	104.0
Ambient Temperature (°F)	79	78	79
Elapsed Time (min.)	10	10	10
ΔH (inches H_2O)	0.40	0.40	0.40
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	18	18	18
K'	0.0120	0.0120	0.0120
Vcr (l)	4.318	4.322	4.318
Vmstd (l)	4.218	4.273	4.430
Post Test Yc	1.0237	1.0113	0.9746
Full Test Yd	0.9994	0.9994	0.9994
% Difference	-2.43	-1.19	2.48
Average % Difference			-0.38

Airtech Environmental Services, Inc.
30B Meter Box Full Test Calibration

Date: 3/29/2011

Operator: j burton

Meter Box	M-25B								Meter Box Y_d	1.0017	Barometric Pressure (in. Hg.)	29.50	
Time	**Orifice Data**				**Meter Box Data**							**Results**	
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	LPM	T_m	V_{mstd}	Q	Y_d	ΔH@
10.0	0.012	21.0	70	4.354	0.000	4.634	4.634	0.46	100	4.311	0.435	1.0100	1.293
10.0	0.012	21.0	70	4.354	4.634	9.253	4.619	0.46	99	4.305	0.435	1.0115	1.299
10.0	0.012	21.0	70	4.354	9.253	13.827	4.574	0.46	98	4.271	0.435	1.0196	1.322
10.0	0.019	20.0	68	6.907	0.000	7.530	7.530	0.75	97	7.048	0.691	0.9800	0.794
10.0	0.019	20.0	69	6.901	7.530	14.961	7.431	0.74	96	6.968	0.690	0.9904	0.803
10.0	0.019	20.0	70	6.894	14.961	22.428	7.467	0.75	96	7.002	0.689	0.9846	0.806
10.0	0.028	20.0	69	10.169	0.000	10.753	10.753	1.08	96	10.091	1.017	1.0078	0.560
10.0	0.028	20.0	69	10.169	10.753	21.576	10.823	1.08	96	10.157	1.017	1.0012	0.552
10.0	0.028	20.0	68	10.179	21.576	32.297	10.721	1.07	95	10.079	1.018	1.0099	0.557
10.0	0.041	19.0	68	14.905	0.000	15.482	15.482	1.55	95	14.572	1.491	1.0228	0.387
10.0	0.041	19.0	68	14.905	15.482	30.965	15.483	1.55	95	14.573	1.491	1.0228	0.387
10.0	0.041	19.0	68	14.905	30.985	46.450	15.465	1.55	95	14.556	1.491	1.0240	0.388
											Average	1.0017	0.887

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (L)
V_d	Gas Meter Volume (L)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (L)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Gauge (in. Hg.)		Thermometers (°F)				Equations
Standard	Vacuum Gauge	Standard	Ch No. 1	Ch No probe	Ch No	
5	5.0	32	32	32		$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)^{0.5}}$
10	10.0	50	50	49		$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$
15	15.0	100	100	101		$Q = V_{cr} / \theta$
20	20.0	150	152	152		$Y_d = V_{cr} / V_{mstd}$
25	25.0	212	213	213		$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_m^2}$
		250	250	251		
		300	299	301		
		350	350	351		
		400	401	400		
		500	501	501		
		600	601	599		

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	0.500	Date	8/12/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	.5LPM	Project No.	3648
Orifice Flow Rate (lpm)	0.4864	Meter ID	M-25-B

	Run 1	Run 2	Run 3
Initial Volume (l)	0.00	4.864	9.786
Final Volume (l)	4.864	9.786	14.644
Volume Metered (l)	4.864	4.922	4.858
DGM Inlet Temperature (°F)	113	115	116
DGM Outlet Temperature (°F)	113	115	116
Average DGM Temperature (°F)	113.0	115.0	116.0
Ambient Temperature (°F)	82	81	81
Elapsed Time (min.)	10	10	10
ΔH (inches H_2O)	0.40	0.40	0.40
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	19	19	19
K'	0.0120	0.0120	0.0120
Vcr (l)	4.306	4.310	4.310
Vmstd (l)	4.422	4.459	4.393
Post Test Yc	0.9738	0.9666	0.9810
Full Test Yd	1.0017	1.0017	1.0017
% Difference	2.79	3.51	2.07
Average % Difference			2.79

Meter Box Full Test Calibration

DATE: 7/8/2011 1426-

Operator: Joe Ward

Meter Box No: DB30B-0711-2018				Meter Box H@: 0.0000						Meter Box Yd 0.9958						Barometric Pressure: 29.78		
#1				Standard Meter Gas Volume			Meter Box Gas Volume (ft‹)			Std. Meter Temperature (ÞF)			Meter Box Temperature (ÞF)					
Q	P	H	Yds	Initial	Final	Vf	Initial	Final	Vf	Inlet	Outlet	Avg.	Inlet	Outlet	Avg.	Time	Yd	H@
0.04	-0.30	0.00	1.0000	0.0	1.000	1.000	.000	1.015	1.015	76.0	76.0	76.0	81.0	81.0	81.0	27.04	0.9951	0.0000
0.04	-0.30	0.00	1.0000	0.0	1.000	1.000	0.000	1.014	1.014	76.0	76.0	76.0	80.0	80.0	80.0	27.06	0.9943	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.503	.503	77.0	77.0	77.0	80.0	80.0	80.0	29.91	1.0003	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.502	.502	77.0	77.0	77.0	80.0	80.0	80.0	29.52	1.0023	0.0000
0.03	-0.30	0.00	1.0000	0.0	.500	.500	.000	.507	.507	78.0	78.0	78.0	81.0	81.0	81.0	17.92	0.9924	0.0000
0.03	-0.30	0.00	1.0000	0.0	.500	.500	.000	.508	.508	78.0	78.0	78.0	81.0	81.0	81.0	17.79	0.9905	0.0000
															AVERAGE		0.9958	0.0000

Millennium Instruments Inc.
2402 Springridge Drive unit A
Spring Grove IL. 60081
PHONE#(815)675-3225
FAX#(815)675-6965
E-mail millennium@millinst.com
www.millinst.com

Vacuum Gauge

(in. Hg)	Gauge
5.0	5.5
10.0	10.5
15.0	16.0
20.0	21.0
25.0	26.0

Method 30B Post-Test Meter Calibration

Average Field Sample Rate (lpm)	0.5	Date	8/8/2011
Highest Field Vacuum (inches Hg)	10.0	Client	BREC
Critical Orifice ID	.5LPM	Project No.	3648
Orifice Flow Rate (lpm)	0.479	Meter ID	M-26 A

	Run 1	Run 2	Run 3	
Initial Volume (l^3)	0.000	4.798	9.564	
Final Volume (l^3)	4.798	9.564	14.362	
Volume Metered (l^3)	4.798	4.766	4.798	
DGM Temperature (^oF)	104	105	107	
Ambient Temperature (^oF)	88	87	88	
Elapsed Time (min.)	10.0	10.0	10.0	
Setting (l/min)	0.4	0.4	0.4	
Barometric Pressure (inches Hg)	29.50	29.50	29.50	
Pump Vacuum (inches Hg)	19.0	19.0	19.0	
K'	0.012	0.012	0.012	
Vcr (l^3)	4.281	4.285	4.281	
Vmstd (l^3)	4.431	4.394	4.408	
Post Test Yc	0.96609	0.97519	0.97123	
Full Test Yd	0.9958	0.9958	0.9958	
% Difference	2.98	2.07	2.47	
	Average Difference		2.51	

Meter Box Full Test Calibration

DATE: 7/10/2011 M-26 —

Operator: Joe Ward

Meter Box No: DB30B-0711-2018				Meter Box H@: 0.0000						Meter Box Yd 0.9902						Barometric Pressure: 29.75		
#2				Standard Meter Gas Volume			Meter Box Gas Volume (ft( )			Std. Meter Temperature (ÞF)			Meter Box Temperature (ÞF)					
Q	P	H	Yds	Initial	Final	Vf	Initial	Final	Vf	Inlet	Outlet	Avg.	Inlet	Outlet	Avg.	Time	Yd	H@
0.01	-0.30	0.00	1.0000	0.0	.280	.280	.000	.294	.294	75.0	75.0	75.0	92.0	92.0	92.0	18.66	0.9834	0.0000
0.01	-0.30	0.00	1.0000	0.0	.285	.285	0.000	.299	.299	75.0	75.0	75.0	92.0	92.0	92.0	18.64	0.9842	0.0000
0.03	-0.30	0.00	1.0000	0.0	1.000	1.000	.000	1.033	1.033	75.0	75.0	75.0	93.0	93.0	93.0	29.14	1.0014	0.0000
0.03	-0.30	0.00	1.0000	0.0	1.000	1.000	.000	1.032	1.032	75.0	75.0	75.0	93.0	93.0	93.0	29.10	1.0023	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.527	.527	75.0	75.0	75.0	95.0	95.0	95.0	22.89	0.9850	0.0000
0.02	-0.30	0.00	1.0000	0.0	.500	.500	.000	.527	.527	75.0	75.0	75.0	95.0	95.0	95.0	22.80	0.9850	0.0000
															AVERAGE		0.9902	0.0000

Millennium Instruments Inc.
2402 Springridge Drive unit A
Spring Grove IL. 60081
PHONE#(815)675-3225
FAX#(815)675-6965
E-mail millennium@millinst.com
www.millinst.com

Vacuum Gauge

(in. Hg)	Gauge
5.0	5.0
10.0	10.0
15.0	15.0
20.0	20.0

Method 30B Post-Test Meter Calibration

Average Field Sample Rate (lpm)	0.5	Date	8/8/2011
Highest Field Vacuum (inches Hg)	10.0	Client	BREC
Critical Orifice ID	.5LPM	Project No	3648
Orifice Flow Rate (lpm)	0.480	Meter ID	M-26 B

	Run 1	Run 2	Run 3	
Initial Volume (l^3)	0.000	4.802	9.592	
Final Volume (l^3)	4.802	9.592	14.401	
Volume Metered (l^3)	4.802	4.790	4.809	
DGM Temperature (^oF)	106	108	107	
Ambient Temperature (^oF)	88	87	88	
Elapsed Time (min.)	10.0	10.0	10.0	
Setting (l/min)	0.4	0.4	0.4	
Barometric Pressure (inches Hg)	29.50	29.50	29.50	
Pump Vacuum (inches Hg)	20.0	20.0	20.0	
K'	0.012	0.012	0.012	
Vcr (l^3)	4.281	4.285	4.281	
Vmstd (l^3)	4.419	4.393	4.418	
Post Test Yc	0.96871	0.97546	0.96901	
Full Test Yd	0.9902	0.9902	0.9902	
% Difference	2.17	1.49	2.14	
	Average Difference		1.93	

APEX INSTRUMENTS METER CONSOLE CALIBRATION

APEX INSTRUMENTS

Meter Console Information					
Console Model	XC-260	Console Serial Number	0905008-A	Encoder Model	HEDS-9100-F00
Gas Meter Model	SK25	Totalizer Scale Factor (Initial)	1.0000	Totalizer Model	RED LION
Gas Meter Serial#	8005093	Totalizer Scale Factor (Final)	0.9728	Temp Display Model	JENCO

Calibration Conditions							
WTM ID	539783	Calibration Technician	EW			Calibration Date	16-Aug-10
WTM Cal Factor	1.0001	Barometric Pressure	(Pb)	735.5	mm Hg		

Calibration Data										Results		
Run Time	Dry Gas Meter				Wet Test Meter		Standardized Volumes			Totalizer Gamma		Corrected Flowrate
Elapsed	Gas Pressure	Gas Volume	Gas Temp	Totalizer Display	Gas Volume	Gas Temp	Totalizer Initial SF	Totalizer Final SF	Wet Test Meter	Final	Variation	
(Θ)	(P_m)	(V_m)	(t_m)		(V_w)	(t_w)	($V_{m(std)}$)	($V_{m(std)}$)	($V_{w(std)}$)	(Y)	(ΔY)	(Q_m)
min	mm H_2O	liters	°C	liters	liters	°C	std liters	std liters	std liters			slm
Run 1 - Initial	0.00	0	0	23.33	0.000	780.096	24.0					
Final	5.00	0	0	23.33	13.406	793.113	24.0					
Total/Avg	5.00	0	0	23.33	13.406	13.017	24.0	12.837	12.488	12.438	0.9960	-0.004	2.49
Run 2 - Initial	0.00	0	0	23.33	13.406	793.113	24.0					
Final	6.00	0	0	23.33	26.513	805.870	24.0					
Total/Avg	6.00	0	0	23.33	13.107	12.757	24.0	12.551	12.209	12.189	0.9984	-0.002	2.03
Run 3 - Initial	0.00	0	0	23.33	26.513	805.870	24.0					
Final	7.00	0	0	23.33	37.917	816.961	24.0					
Total/Avg	7.00	0	0	23.33	11.404	11.091	24.0	10.920	10.623	10.597	0.9976	-0.002	1.51
Run 4 - Initial	0.00	0	0	23.33	37.917	816.961	24.0					
Final	12.00	0	0	23.89	50.554	829.294	24.0					
Total/Avg	12.00	0	0	23.61	12.637	12.333	24.0	12.089	11.760	11.784	1.0020	0.002	0.98
Run 5 - Initial	0.00	0	0	23.89	50.554	829.294	24.0					
Final	24.00	0	0	23.89	63.375	841.845	24.0					
Total/Avg	24.00	0	0	23.89	12.821	12.551	24.0	12.254	11.920	11.993	1.0060	0.006	0.50

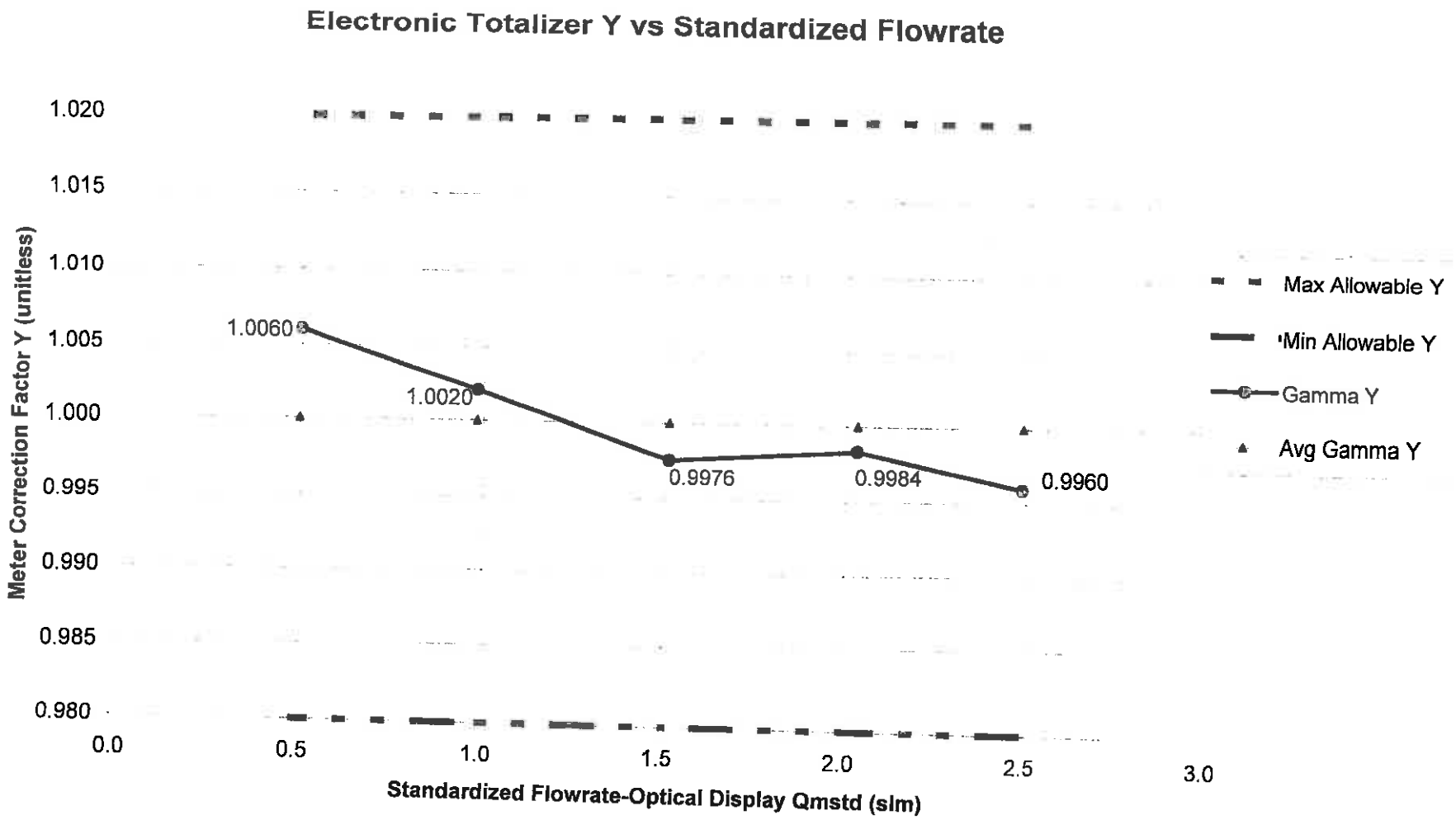
Average Meter Calibration Factor Y **1.0000**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using a Precision Wet Test Meter.
which in turn was calibrated using the American Bell Prover #3785, certificate # F207, which is traceable to the National Bureau of Standards (N I S T.)

Signature Date 8/16/10

219075



Console Serial: *0905008-A*

Pyrometer Calibration Sheet

Pyrometer No.:001

Office: Spring Grove
Client: Airtech Environmental
Job or Reference No.:DB30B-0711-2018

Temperature Scale Used
- ☑ Fahrenheit
- ☐ Celsius

- ☑ Full Test
- ☐ Post Test

Calibration Reference Settings for Fahrenheit Scale	Pyrometer Reading	Calibration Reference Settings for Celsius Scale
50° F	50° F	10°C
100° F	100° F	38°C
150° F	150° F	66°C
200° F	200° F	93°C
250° F	250° F	121°C
300° F	300° F	149°C
350° F	350° F	177°C
400° F	400° F	204°C
450° F	450° F	232°C
500° F	500° F	260°C
550° F	550° F	288°C
600° F	600° F	316°C

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	0.500	Date	8/1/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	.5LPM	Project No.	3648
Orifice Flow Rate (lpm)	0.4479	Meter ID	R19075A

	Run 1	Run 2	Run 3
Initial Volume (l)	0.00	4.479	8.984
Final Volume (l)	4.479	8.984	13.48
Volume Metered (l)	4.479	4.51	4.50
DGM Inlet Temperature (°F)	83	84	85
DGM Outlet Temperature (°F)	83	84	85
Average DGM Temperature (°F)	83.0	84.0	85.0
Ambient Temperature (°F)	80	80	80
Elapsed Time (min.)	10	10	10
ΔH (inches H_2O)	0.40	0.40	0.40
Barometric Pressure (inches Hg)	29.58	29.58	29.58
Pump Vacuum (inches Hg)	22	22	22
K'	0.0120	0.0120	0.0120
Vcr (l)	4.325	4.325	4.325
Vmstd (l)	4.308	4.325	4.313
Post Test Yc	1.0040	1.0000	1.0030
Full Test Yd	1.000	1.0000	1.0000
% Difference	-0.40	0.00	-0.30
Average % Difference			-0.23

APEX INSTRUMENTS METER CONSOLE CALIBRATION

APEX INSTRUMENTS SOURCE TESTING EQUIPMENT

Meter Console Information					
Console Model	XC-260	Console Serial Number	0905008-B	Encoder Model	HEDS-9100-F00
Gas Meter Model	SK25	Totalizer Scale Factor (Initial)	1.0000	Totalizer Model	RED LION
Gas Meter Serial#	8005094	Totalizer Scale Factor (Final)	**0.9756**	Temp Display Model	JENCO

Calibration Conditions							
WTM ID	539784	Calibration Technician	EW			Calibration Date	16-Aug-10
WTM Cal Factor	1.0024	Barometric Pressure	(Pb)	735.5	mm Hg		

Calibration Data										Results		
	Run Time	Dry Gas Meter				Wet Test Meter		Standardized Volumes			Totalizer Gamma		Corrected Flowrate
	Elapsed	Gas Pressure	Gas Volume	Gas Temp	Totalizer Display	Gas Volume	Gas Temp	Totalizer Initial SF	Totalizer Final SF	Wet Test Meter	Final	Variation	
	(Θ)	(P_m)	(V_m)	(t_m)		(V_w)	(t_w)	($V_{m(std)}$)	($V_{m(std)}$)	($V_{w(std)}$)	(Y)	(ΔY)	(Q_m)
	min	mm H_2O	liters	°C	liters	liters	°C	std liters	std liters	std liters			slm
Run 1 - Initial	0.00	0	0	23.89	0.000	195.508	24.0						
Final	5.00	0	0	24.44	13.356	208.479	24.0						
Total/Avg	5.00	0	0	24.17	13.356	12.971	24.0	12.753	12.443	12.422	0.9984	-0.002	2.49
Run 2 - Initial	0.00	0	0	24.44	13.356	208.479	24.0						
Final	6.00	0	0	25.00	26.505	221.226	24.0						
Total/Avg	6.00	0	0	24.72	13.149	12.747	24.0	12.532	12.227	12.208	0.9984	-0.002	2.04
Run 3 - Initial	0.00	0	0	25.00	26.505	221.226	24.0						
Final	7.00	0	0	25.00	37.866	232.244	24.0						
Total/Avg	7.00	0	0	25.00	11.361	11.018	24.0	10.818	10.554	10.552	0.9998	0.000	1.51
Run 4 - Initial	0.00	0	0	25.00	37.866	232.244	24.0						
Final	12.00	0	0	25.00	50.775	244.775	24.0						
Total/Avg	12.00	0	0	25.00	12.909	12.531	24.0	12.292	11.992	12.001	1.0007	0.001	1.00
Run 5 - Initial	0.00	0	0	25.00	50.775	244.775	24.0						
Final	24.00	0	0	25.56	64.499	258.111	24.0						
Total/Avg	24.00	0	0	25.28	13.724	13.336	24.0	13.056	12.738	12.772	1.0027	0.003	0.53

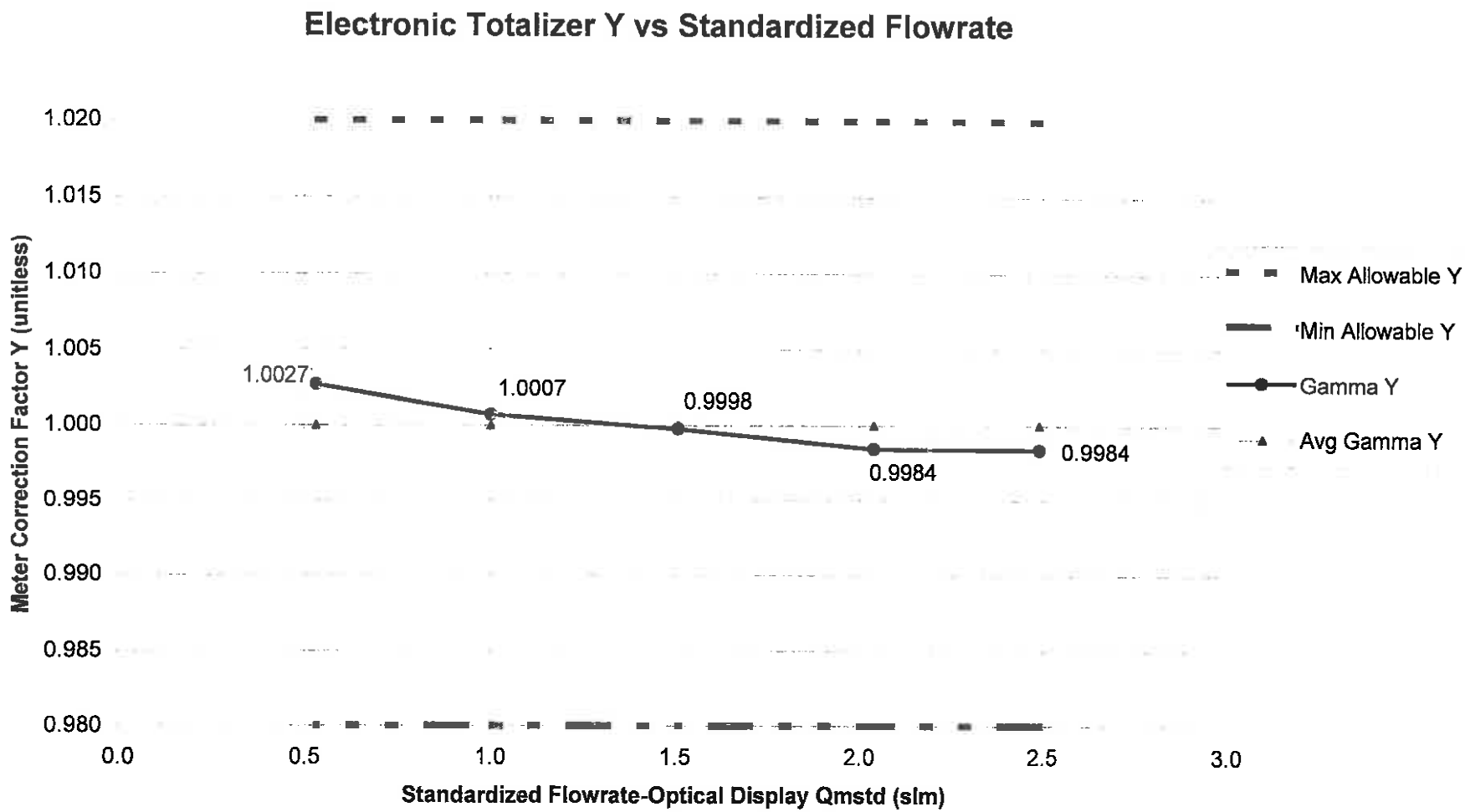
Average Meter Calibration Factor Y **1.0000**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using a Precision Wet Test Meter, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.)

Signature [signature] Date 8/16/10

R 19075


Electronic Totalizer Y vs Standardized Flowrate
Meter Correction Factor Y (unitless)
1.020
1.015
1.010
1.005
1.000
0.995
0.990
0.985
0.980
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Standardized Flowrate-Optical Display Qmstd (slm)
1.0027
1.0007
0.9998
0.9984
0.9984
Max Allowable Y
Min Allowable Y
Gamma Y
Avg Gamma Y
Console Serial:
0905008-B

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	0.500	Date	8/1/2011
Highest Field Vacuum (inches Hg)	10	Client	BREC
Critical Orifice ID	.5LPM	Project No.	3648
Orifice Flow Rate (lpm)	0.4553	Meter ID	R19075B

	Run 1	Run 2	Run 3
Initial Volume (l)	0.00	4.553	9.078
Final Volume (l)	4.553	9.078	13.65
Volume Metered (l)	4.553	4.53	4.57
DGM Inlet Temperature (°F)	87	87	87
DGM Outlet Temperature (°F)	87	87	87
Average DGM Temperature (°F)	87.0	87.0	87.0
Ambient Temperature (°F)	80	80	80
Elapsed Time (min.)	10	10	10
ΔH (inches H_2O)	0.40	0.40	0.40
Barometric Pressure (inches Hg)	29.58	29.58	29.58
Pump Vacuum (inches Hg)	21	21	21
K'	0.0120	0.0120	0.0120
Vcr (l)	4.325	4.325	4.325
Vmstd (l)	4.347	4.321	4.366
Post Test Yc	0.9949	1.0011	0.9908
Full Test Yd	1.000	1.0000	1.0000
% Difference	0.51	-0.11	0.92
Average % Difference			0.44

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date: January 18, 2011
Pitot ID: AE2-10-1
Operator: A. Kienitz

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.344	NA
Base To Opening Distance - Pb (inches)	0.359	NA
Pa/Dt	1.376	1.05-1.50
Pb/Dt	1.436	1.05-1.50
Angle, $\alpha 1(^{\circ})$	0	10
Angle, $\alpha 2(^{\circ})$	0	10
Angle, $B1(^{\circ})$	2	5
Angle, $B1(^{\circ})$	4	5
Opening to Opening Distance Pa+Pb (inches)	0.703	NA
Angle, $Z(^{\circ})$	92	NA
z (inches)	0.120	0.125
Angle, $W(^{\circ})$	89	NA
w (inches)	0.013	0.031
Pitot to Thermocouple Distance,W (inches)	2.50	≥ 2

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly **NO**

If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle,X (inches)	NA	0.75
Pitot to Sample Probe Distance,Y(inches)	NA	3

Does the Pitot Tube Meet the Above Requirements **Yes**
Is the Pitot Tube Free of Damage **Yes**

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date	1/26/11
Pitot ID	AE2-10-2
Operator	EA

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.367	NA
Base To Opening Distance - Pb (inches)	0.367	NA
Pa/Dt	1.47	1.05-1.50
Pb/Dt	1.47	1.05-1.50
Angle $\alpha 1(^{\circ})$	2.4	10
Angle $\alpha 2(^{\circ})$	1.9	10
Angle $B1(^{\circ})$	2.9	5
Angle $B1(^{\circ})$	3.1	5
Opening to Opening Distance Pa+Pb (inches)	0.734	NA
Angle Z $(^{\circ})$	1.2	NA
z (inches)	0.0154	0.125
Angle W $(^{\circ})$	0.3	NA
w (inches)	0.004	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes

If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	NA	0.75 in.
Pitot to Thermocouple Distance (inches)	2.5	2 in.
Pitot to Sample Probe Distance (inches)	5.5	3 in.

Does the Pitot Tube Meet the Above Requirements Yes

Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned

If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date 1/26/11
Pitot ID AE2-12-2
Operator EA

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.37	NA
Base To Opening Distance - Pb (inches)	0.37	NA
Pa/Dt	1.48	1.05-1.50
Pb/Dt	1.48	1.05-1.50
Angle $\alpha 1(^{\circ})$	1.1	10
Angle $\alpha 2(^{\circ})$	1.2	10
Angle $B1(^{\circ})$	1.5	5
Angle $B1(^{\circ})$	1.3	5
Opening to Opening Distance Pa+Pb (inches)	0.740	NA
Angle Z $(^{\circ})$	2.2	NA
z (inches)	0.028	0.125
Angle W $(^{\circ})$	0.6	NA
w (inches)	0.008	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes
If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	NA	0.75 in.
Pitot to Thermocouple Distance (inches)	2	2 in.
Pitot to Sample Probe Distance (inches)	6.25	3 in.

Does the Pitot Tube Meet the Above Requirements Yes
Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date 1/25/11
Pitot ID AE-5-6-1
Operator EA

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.373	NA
Base To Opening Distance - Pb (inches)	0.373	NA
Pa/Dt	1.49	1.05-1.50
Pb/Dt	1.49	1.05-1.50
Angle $\alpha 1(^{\circ})$	2.4	10
Angle $\alpha 2(^{\circ})$	0.7	10
Angle $B1(^{\circ})$	2.3	5
Angle $B1(^{\circ})$	2.3	5
Opening to Opening Distance Pa+Pb (inches)	0.746	NA
Angle Z $(^{\circ})$	1.6	NA
z (inches)	0.0208	0.125
Angle W $(^{\circ})$	0.3	NA
w (inches)	0.004	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes
If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	0.75	0.75 in.
Pitot to Thermocouple Distance (inches)	2.25	2 in.
Pitot to Sample Probe Distance (inches)	5.25	3 in.

Does the Pitot Tube Meet the Above Requirements Yes
Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date 1/25/11
Pitot ID AE-5-6-7
Operator EA

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.362	NA
Base To Opening Distance - Pb (inches)	0.362	NA
Pa/Dt	1.45	1.05-1.50
Pb/Dt	1.45	1.05-1.50
Angle $\alpha 1(^{\circ})$	0.5	10
Angle $\alpha 2(^{\circ})$	1	10
Angle $B1(^{\circ})$	3	5
Angle $B1(^{\circ})$	4	5
Opening to Opening Distance Pa+Pb (inches)	0.744	NA
Angle Z $(^{\circ})$	2	NA
z (inches)	0.0260	0.125
Angle W $(^{\circ})$	0.5	NA
w (inches)	0.006	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes
If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	0.75	0.75 in.
Pitot to Thermocouple Distance (inches)	2	2 in.
Pitot to Sample Probe Distance (inches)	5.25	3 in.

Does the Pitot Tube Meet the Above Requirements Yes
Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date 1/25/11
Pitot ID AE5-6-11
Operator EA

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.37	NA
Base To Opening Distance - Pb (inches)	0.37	NA
Pa/Dt	1.48	1.05-1.50
Pb/Dt	1.48	1.05-1.50
Angle $\alpha 1(^{\circ})$	0.7	10
Angle $\alpha 2(^{\circ})$	1	10
Angle $B1(^{\circ})$	2.2	5
Angle $B1(^{\circ})$	1	5
Opening to Opening Distance Pa+Pb (inches)	0.740	NA
Angle Z $(^{\circ})$	1.3	NA
z (inches)	0.017	0.125
Angle W $(^{\circ})$	0.6	NA
w (inches)	0.008	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly? Yes

If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	0.75	0.75 in.
Pitot to Thermocouple Distance (inches)	2.5	2 in.
Pitot to Sample Probe Distance (inches)	6.25	3 in.

Does the Pitot Tube Meet the Above Requirements? Yes
Is the Pitot Tube Free of Damage? Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date: January 17, 2011
Pitot ID: AE5-10-1
Operator: A. Kienitz

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.363	NA
Base To Opening Distance - Pb (inches)	0.359	NA
Pa/Dt	1.452	1.05-1.50
Pb/Dt	1.436	1.05-1.50
Angle, $\alpha 1(^{\circ})$	2	10
Angle. $\alpha 2(^{\circ})$	2	10
Angle, $B1(^{\circ})$	2	5
Angle, $B1(^{\circ})$	4	5
Opening to Opening Distance Pa+Pb (inches)	0.722	NA
Angle, Z $(^{\circ})$	89	NA
z (inches)	0.015	0.125
Angle, W $(^{\circ})$	91	NA
w (inches)	0.010	0.031
Pitot to Thermocouple Distance,W (inches)	2.125	≥ 2

Note Any Damage, Nicks **or** Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly **Yes**

If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle,X (inches)	0.75	0.75
Pitot to Sample Probe Distance,Y(inches)	4.25	3

Does the Pitot Tube Meet the Above Requirements **Yes**
Is the Pitot Tube Free of Damage **Yes**

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date	1/26/11
Pitot ID	AE-5-10-3
Operator	EA

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.357	NA
Base To Opening Distance - Pb (inches)	0.357	NA
Pa/Dt	1.43	1.05-1.50
Pb/Dt	1.43	1.05-1.50
Angle $\alpha 1(^{\circ})$	2	10
Angle $\alpha 2(^{\circ})$	0.8	10
Angle $B1(^{\circ})$	2.5	5
Angle $B1(^{\circ})$	3.9	5
Opening to Opening Distance Pa+Pb (inches)	0.714	NA
Angle Z $(^{\circ})$	2.5	NA
z (inches)	0.0311	0.125
Angle W $(^{\circ})$	0.2	NA
w (inches)	0.002	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes

If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	0.75	0.75 in.
Pitot to Thermocouple Distance (inches)	2.5	2 in.
Pitot to Sample Probe Distance (inches)	4.25	3 in.

Does the Pitot Tube Meet the Above Requirements Yes

Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned

If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date 1/26/11
Pitot ID AE-5-10-4
Operator EA

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.358	NA
Base To Opening Distance - Pb (inches)	0.358	NA
Pa/Dt	1.43	1.05-1.50
Pb/Dt	1.43	1.05-1.50
Angle α1(°)	2.1	10
Angle α2(°)	0.1	10
Angle B1(°)	0.2	5
Angle B1(°)	0.2	5
Opening to Opening Distance Pa+Pb (inches)	0.716	NA
Angle Z (°)	2.2	NA
z (inches)	0.0275	0.125
Angle W (°)	0.5	NA
w (inches)	0.006	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes
If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	0.75	0.75 in.
Pitot to Thermocouple Distance (inches)	2	2 in.
Pitot to Sample Probe Distance (inches)	5.5	3 in.

Does the Pitot Tube Meet the Above Requirements Yes
Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.

S-Type Pitot Tube Inspection Form

Date: January 17, 2011
Pitot ID: AE5-10-5
Operator: A. Kienitz

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.332	NA
Base To Opening Distance - Pb (inches)	0.340	NA
Pa/Dt	1.328	1.05-1.50
Pb/Dt	1.360	1.05-1.50
Angle, $\alpha 1(^{\circ})$	2	10
Angle, $\alpha 2(^{\circ})$	3	10
Angle, $B1(^{\circ})$	3	5
Angle, $B1(^{\circ})$	5	5
Opening to Opening Distance Pa+Pb (inches)	0.672	NA
Angle, Z $(^{\circ})$	90	NA
z (inches)	0.000	0.125
Angle, W $(^{\circ})$	91	NA
w (inches)	0.005	0.031
Pitot to Thermocouple Distance,W (inches)	2.00	≥ 2

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly **YES**

If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle,X (inches)	0.75	0.75
Pitot to Sample Probe Distance,Y(inches)	4.25	3

Does the Pitot Tube Meet the Above Requirements **Yes**
Is the Pitot Tube Free of Damage **Yes**

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

CleanAir

CleanAir Instrument Rental
500 W. Wood Street
Palatine, IL 60067-4975
800-553-5511
www.cleanair.com

Pitot Tube Calibration

Probe Type: M5 with S-Type Pitot **I.D. Number:** M-10-1
Project Number:

Thermocouple Calibration

Reference Type: Thermometer Reference I.D. No: Pyrometer I.D. No: Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Within spec?
1	Ambient					
2	200°F-250°F					

* Based on Absolute Temperature (Rankine) %Difference ≤ 1.5

Geometric Pitot Calibration

Is pitot assembly in good repair? ◉ Yes ○ No If no, explain:

"S" Pitot

	Dimensions		Dimensions	Specifications	Within Spec?
α1=	-1	α2=	1	<=10 °	YES
β1=	-2	β2=	-1	<=5°	YES
γ=	2	θ=	0	None	N/A
A=	0.706			None	N/A
Dt=	0.250			0.1875"<=Dt<=0.375"	YES

	Calculations	Specifications	Within Spec?
A/2=Pa=Pb=	0.353 inches	None	N/A
Pa/Dt=Pb/Dt=	1.412 inches	1.05<P/Dt<1.5	YES
z = A sin γ =	0.025 inches	<=0.125"	YES
w = A sin θ =	0.000 inches	<=0.03125"	YES

Pitot Cp= 0.84 according to 40 CFR 60 section 10.1

Standard Pitot

	Measurement	Specification	Calculation	Within Spec?
Tube O.D.		None		
Static Hole I.D.		within 10% of (0.1*O.D.)		
Tip to Static		>=8*O.D.		
Static to Bend		>=8*O.D.		

Pitot Cp=

Calibrated by: Wayne Berry Date: 6/29/2011

Airtech Environmental Services, Inc.
Nozzle Calibration Form

Client	WKE	Job No.	3648
Plant	Coleman Station	Hawesville, Ky	

	Nozzle 1	Nozzle 2	Nozzle 3
Date	7-7-11	7-7-11	
Nozzle ID	.248	.249	
Operator	C.S	C.S	
Test Location	Stack	Stack	
Run Number (s)	1-3 M-29	1-3 M-26	
Diameter 1	.248	.250	
Diameter 2	.248	.249	
Diameter 3	.249	.249	
Average	.248	.249	

	Nozzle 4	Nozzle 5	Nozzle 6
Date			
Nozzle ID			
Operator			
Test Location			
Run Number (s)			
Diameter 1			
Diameter 2			
Diameter 3			
Average			

Notes:
Measurements must be made to the nearest 0.001 inches.
Three different diameters should be measured.
The difference between the high and low measurement must be **less** than 0.004 inches.

Signed _____ Date 7-7-11