APPENDIX D

TEST METHOD CALIBRATION DATA

Onyx Pretest

TRC Environmental Corporation

Critical Orifice Calibration

Date: 10/13/2004 Metering System Indentification: 90610 Technician: K. Laakso

Critical Orifice Id No.:		DN-55				DN-63				DN-48			
Critical Vacuum		15				15				15			
K' factor		0.4541				0.569				0.3459			
Run Number		1		2		1		2		1		2	
DGM Final Reading	ft^3	966.054		971.52		978.335		985.149		993.048		1002.355	
DGM Initial Reading	ft^3	959.603		966.054		971.521		978.335		985.149		993.048	
Difference, Vm	ft^3	6.451		5.466		6.814		6.814		7.899		9.307	
Volume Criteria Met	> 5 ft^3	**Yes**		**Yes**		**Yes**		**Yes**		**Yes**		**Yes**	
Inlet/Outlet Temp.													
DGM Initial	°F	72	71	75	71	73	72	74	72	73	72	74	72
DGM Final	°F	75	71	75	72	74	72	75	72	74	72	75	72
Average Temp., Tm		72.25		73.25		72.75		73.25		72.75		73.25	
Time	min.	10.5		9		9		9		17		20	
Delta H	in. H_2O	1.1		1.1		1.7		1.7		0.64		0.64	
Pbar	in. Hg	29.78		29.78		29.78		29.78		29.78		29.78	
Ambient Temp.	°F	70		70		70		70		70		70	
Pump Vacuum	in. Hg	16		16		17.5		17.5		19		19	
Vm(std)	ft^3	6.384		5.399		6.747		6.741		7.801		9.183	
Vcr(std)	ft^3	6.168		5.287		6.624		6.624		7.607		8.949	
DGM Cal. Factor, Y		0.966		0.979		0.982		0.983		0.975		0.974	
Y Average		0.973				0.982				0.975			
Y Dev. from avg.[1]		0.67%				0.05%				0.03%			
Y Dev. from other[2]		Max Y	0.982			Min Y	0.973			Y deviation	**0.99%**	**good**	
Delta H@		1.802		1.799		1.772		1.771		1.806		1.804	
Delta H@ Average		1.801				1.772				1.805			
Delta H Dev. from avg.[3]		0.09%				0.05%				0.05%			

Average Y =	0.977
Average Delta H =	1.792

1 Y at each of the flow rates should not differ by more than +/- 2.0% from the average

2 If any critical orifice yields a DGM Y factor differing by more than 2% from others, recalibrate orifices

3 Average Delta H@ must be within 0.15 of the average

Vm(std) = 17.64 Vm (Pbar + deltaH/13.6) / (Tm + 460)

Vcr(std) = K' Pbar Time / SQRT(Tamb + 460)

Y = Vcr(std) / Vm(std)

Oxygen
Post test

TRC Environmental Corporation

Critical Orifice Calibration

Date: 5/12/2006 Metering System Indentification: 90610 Technician: R. Mennillo

Critical Orifice Id No.:		DN-48				DN-55				DN-63			
Critical Vacuum		15				15				15			
K' factor		0.3476				0.4582				0.5937			
Run Number		1		2		1		2		1		2	
DGM Final Reading	ft^3	530.287		535.919		541.503		548.335		618.287		623.852	
DGM Initial Reading	ft^3	524.654		530.287		535.919		541.503		612.712		618.287	
Difference, Vm	ft^3	5.633		5.632		5.584		6.832		5.575		5.565	
Volume Criteria Met	> 5 ft^3	**Yes**		**Yes**		**Yes**		**Yes**		**Yes**		**Yes**	
Inlet/Outlet Temp.													
DGM Initial	°F	75	74	75	75	75	76	75	75	75	75	75	75
DGM Final	°F	75	75	75	75	75	77	76	75	75	75	75	75
Average Temp., Tm		74.75		75		75.75		75.25		75		75	
Time	min.	12		12		9		11		7		7	
Delta H	in. H_2O	0.58		0.58		1.1		1.1		1.8		1.8	
Pbar	in. Hg	29.81		29.81		29.81		29.81		29.81		29.81	
Ambient Temp.	°F	70		70		70		70		70		70	
Pump Vacuum	in. Hg	19.5		19		16		16		16		16	
Vm(std)	ft^3	5.547		5.544		5.496		6.730		5.504		5.494	
Vcr(std)	ft^3	5.401		5.401		5.340		6.526		5.381		5.381	
DGM Cal. Factor, Y		0.974		0.974		0.972		0.970		0.978		0.979	
Y Average		0.974				0.971				0.979			
Y Dev. from avg.[1]		0.03%				0.10%				0.09%			
Y Dev. from other[2]		Max Y	0.979			Min Y	0.971			Y deviation	**0.82%**	**good**	
Delta H@		1.609		1.609		1.753		1.755		1.711		1.711	
Delta H@ Average		1.609				1.754				1.711			
Delta H Dev. from avg.[3]		0.02%				0.05%				0.00%			

Average Y =	0.974
Average Delta H =	1.691

1 Y at each of the flow rates should not differ by more than +/- 2.0% from the average

2 If any critical orifice yields a DGM Y factor differing by more than 2% from others, recalibrate orifices

3 Average Delta H@ must be within 0.15 of the average

Vm(std) = 17.64 Vm (Pbar + deltaH/13.6) / (Tm + 460)

Vcr(std) = K' Pbar Time / SQRT(Tamb + 460)

Y = Vcr(std) / Vm(std)

Omega
Pre test

TRC Environmental Corporation

Critical Orifice Calibration

Date: 3/20/2006 Metering System Indentification: 80836 Technician: Evan Bali

Critical Orifice Id No.:		DN 48				DN 55				DN63			
Critical Vacuum		15				15				15			
K' factor		0.3476				0.4582				0.5937			
Run Number		1		2		1		2		1		2	
DGM Final Reading	ft^3	960.212		965.438		971.726		977.729		984.162		990.732	
DGM Initial Reading	ft^3	954.55		960.212		965.741		971.726		977.774		984.162	
Difference, Vm	ft^3	5.662		5.226		5.985		6.003		6.388		6.570	
Volume Criteria Met	> 5 ft^3	**Yes**		**Yes**		**Yes**		**Yes**		**Yes**		**Yes**	
Inlet/Outlet Temp.													
DGM Initial	°F	74	75	75	75	75	76	76	77	76	77	77	78
DGM Final	°F	73	74	74	74	74	74	74	75	75	75	75	75
Average Temp., Tm		74		74.5		74.75		75.5		75.75		76.25	
Time	min.	12.5		11.5		10		10		8		8.5	
Delta H	in. H_2O	0.65		0.65		1.2		1.2		1.9		1.9	
Pbar	in. Hg	30.01		30.01		30.01		30.01		30.01		30.01	
Ambient Temp.	°F	69		69		69		69		69		69	
Pump Vacuum	in. Hg	17		17		16		16		16		16	
Vm(std)	ft^3	5.622		5.184		5.942		5.952		6.341		6.516	
Vcr(std)	ft^3	5.669		5.216		5.979		5.979		6.197		6.585	
DGM Cal. Factor, Y		1.008		1.006		1.006		1.004		0.977		1.011	
Y Average		1.007				1.005				0.994			
Y Dev. from avg.[1]		0.12%				0.08%				1.67%			
Y Dev. from other[2]		Max Y	1.007			Min Y	0.994			Y deviation	**1.35%**	**good**	
Delta H@		1.760		1.759		1.868		1.865		1.758		1.756	
Delta H@ Average		1.759				1.866				1.757			
Delta H Dev. from avg.[3]		0.05%				0.07%				0.05%			

Average Y =	1.002
Average Delta H =	1.794

1 Y at each of the flow rates should not differ by more than +/- 2.0% from the average

2 If any critical orifice yields a DGM Y factor differing by more than 2% from others, recalibrate orifices

3 Average Delta H@ must be within 0.15 of the average

Vm(std) = 17.64 Vm (Pbar + deltaH/13.6) / (Tm + 460)

Vcr(std) = K' Pbar Time / SQRT(Tamb + 460)

Y = Vcr(std) / Vm(std)

Onyx
Post test

TRC Environmental Corporation
Critical Orifice Calibration

Date: 5/15/2006 Metering System Indentification: 80836 Technician E. Bali

Critical Orifice Id No.:		DN 55					
Critical Vacuum		15		15		15	
K' factor				0.4582			
Run Number		1		2		3	
DGM Final Reading	ft^3	976.506		982.512		988.525	
DGM Initial Reading	ft^3	969.314		976.506		982.512	
Difference, Vm	ft^3	7.192		6.006		6.013	
Inlet/Outlet Temp.							
DGM Initial	°F	72	70	73	71	74	72
DGM Final	°F	73	71	75	72	76	73
Average Temp., Tm		71.5		72.75		73.75	
Time	min.	12		10		10	
Delta H	in. H_2O	1.1		1.1		1.1	
Pbar	in. Hg	30.07		30.07		30.07	
Ambient Temp.	°F	70		70		70	
Pump Vacuum	in. Hg	17		17		17	
Vm(std)	ft^3	7.197		5.996		5.992	
Vcr(std)	ft^3	7.182		5.985		5.985	
DGM Cal. Factor, Y		0.998		0.998		0.999	
Y Average		0.998					
Y Dev. from avg.[1]		0.04%		0.02%		0.06%	
Delta H@		1.722		1.718		1.715	
Delta H@ Average		1.718					
H@ Dev. from avg.[2]		0.22%		0.02%		0.20%	

Average Y =	0.998
Average Delta H =	1.718

Initial DGM Y =	1.002
Acceptable Cal[3]	YES

1 Y at each of the flow rates should not differ by more than +/- 2.0% from the average
2 Average Delta H@ must by within 0.15 of the average
3 The post DGM Y calibration has to be within 5% of the initial calibration

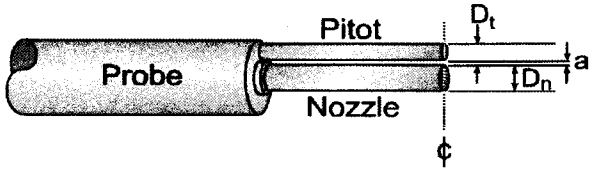
Vm(std) = 17.64 Vm (Pbar + deltaH/13.6) / (Tm + 460)
Vcr(std) = K' Pbar Time / SQRT(Tamb + 460)
Y = Vcr(std) / Vm(std)

TRC

S-Type Pitot Geometric Calibration
Part 1 - Probe Configuration

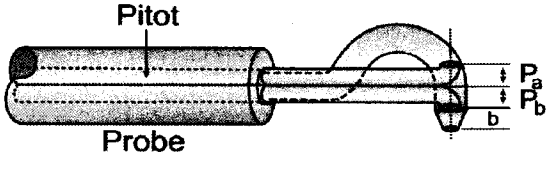
TRC Probe Identification: 4-1
Technical Specialist: R. Mennillo
Date: Dec. 27,2005

A.



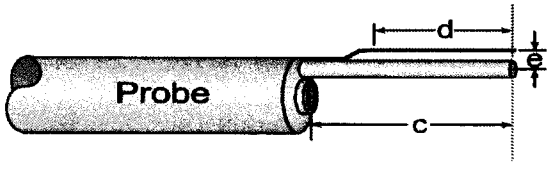
D_t = 0.371
D_n = 0.500
a = 0.921

B.



P_a = 0.489
P_b = 0.489
b = 0.315

C.

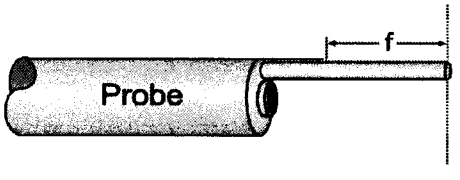


c = 4.393
d = 4.016
e = 1.110

OR

OR

D.



c =
f =

Specifications (EPA Method 2)

D_t = 3/16" to 3/8"	c ≥ 3"	$P_a = P_b$
D_n = 1/2"	d ≥ 3"	
a ≥ 3/4"	e ≥ 3/4"	$1.05\ D_t \le P \le 1.50\ D_t$
b ≥ 0	f ≥ 2"	

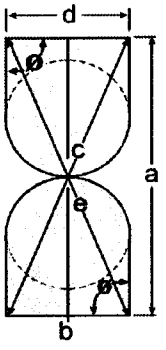
If these specifications are met, proceed with Part 2 Pitot alignment.

S-Type Pitot Geometric Calibration
Part 2 - Pitot Alignment

TRC Probe Identification: 4-1
Technical Specialist: R. Mennillo
Date: Dec. 27,2005

A. Transverse Tube Axis

($80^\circ < Ø < 100^\circ$)
($80^\circ < Ø' < 100^\circ$)

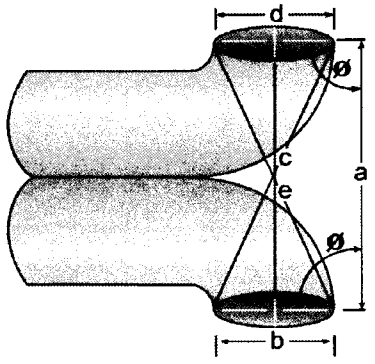


a = 0.977
b = 0.372
c = 1.034
d = 0.372
e = 1.033

Ø = 88.1
Ø' = 88.0

B. Longitudinal Tube Axis

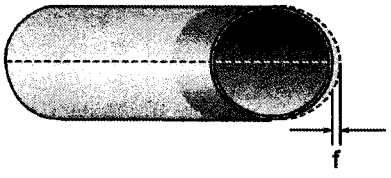
($85^\circ < Ø < 95^\circ$)
($85^\circ < Ø' < 95^\circ$)



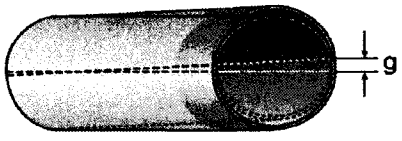
a = 0.977
b = 0.461
c = 1.087
d = 0.461
e = 1.087

Ø = 90.9
Ø' = 90.9

C. (f < 1/8")



D. (g,1/32")



f = 0
g = 0

Pitot Calibration = Good

NOTE: Values in parentheses are EPA Method 2 Specifications.

Probe Thermocouple Calibration

Thermocouple Identification: 4-1

			Tolerance °R = °F + 460	
Expected Stack Temperature(T_s)		°R	% Change	Allowable
Reference Thermometer(T_{ref}) boiling pt	672	°R		
Thermocouple Readout	672	°R	0.00%	1.50%
Reference Thermometer(T_{ref}) freezing pt	492	°R		
Thermocouple Readout	493	°R	-0.20%	1.50%

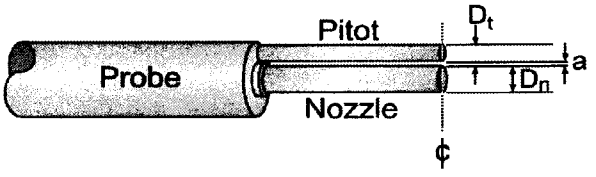
Technician: R. Mennillo Date: Dec. 27,2005

Reviewed By: _____ Date: Dec. 27,2005

S-Type Pitot Geometric Calibration
Part 1 - Probe Configuration

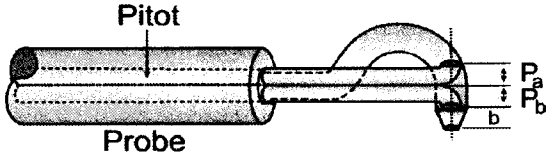
TRC Probe Identification: 4-3
Technical Specialist: R. Mennillo
Date: Dec. 27,2005

A.



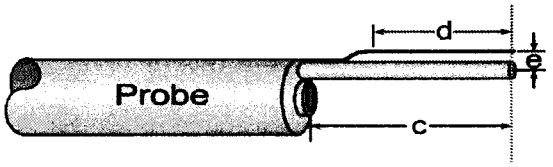
D_t = 0.369
D_n = 0.500
a = 0.996

B.



P_a = 0.501
P_b = 0.501
b = 0.423

C.

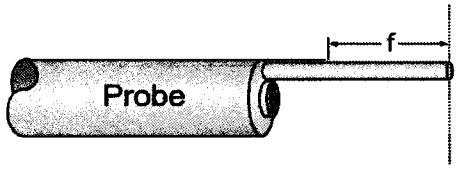


c = 4.638
d = 4.452
e = 1.036

OR

OR

D.



c =
f =

Specifications (EPA Method 2)

D_t = 3/16" to 3/8"	c ≥ 3"	$P_a = P_b$
D_n = 1/2"	d ≥ 3"	
a ≥ 3/4"	e ≥ 3/4"	$1.05\ D_t \le P \le 1.50\ D_t$
b ≥ 0	f ≥ 2"	

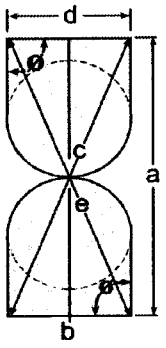
If these specifications are met, proceed with Part 2 Pitot alignment.

S-Type Pitot Geometric Calibration
Part 2 - Pitot Alignment

TRC Probe Identification: 4-3
Technical Specialist: R. Mennillo
Date: Dec. 27,2005

A. Transverse Tube Axis

($80^\circ < Ø < 100^\circ$)
($80^\circ < Ø' < 100^\circ$)

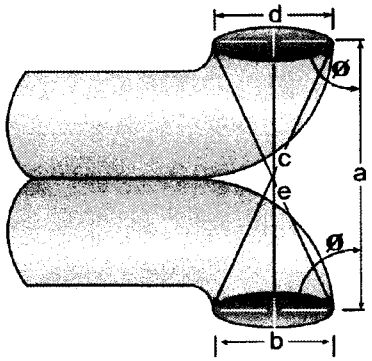


a = 1.002
b = 0.330
c = 1.051
d = 0.330
e = 1.053

Ø = 89.3
Ø' = 89.6

B. Longitudinal Tube Axis

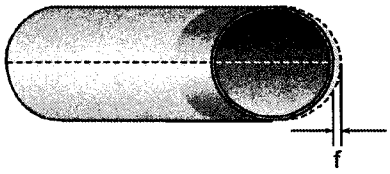
($85^\circ < Ø < 95^\circ$)
($85^\circ < Ø' < 95^\circ$)



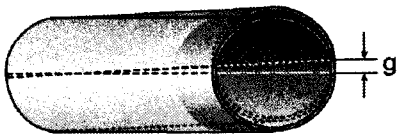
a = 1.002
b = 0.466
c = 1.111
d = 0.467
e = 1.110

Ø = 90.8
Ø' = 90.6

C. (f < 1/8")



D. (g,1/32")



f = 0
g = 0

Pitot Calibration = Good

NOTE: Values in parentheses are EPA Method 2 Specifications.

Probe Thermocouple Calibration

Tolerance
$^\circ R = ^\circ F + 460$

Thermocouple Identification	4-3			
Expected Stack Temperature(T_s)		°R	% Change	Allowable
Reference Thermometer(T_{ref}) boiling pt	672	°R		
Thermocouple Readout	671	°R	0.15%	1.50%
Reference Thermometer(T_{ref}) freezing pt	492	°R		
Thermocouple Readout	492	°R	0.00%	1.50%

Technician: R. Mennillo Date: Dec. 27,2005

Reviewed By: _____ Date: Dec. 27,2005