AP-42 Section 12.2
Reference
Report Sect. 4
Reference 177

Pushing

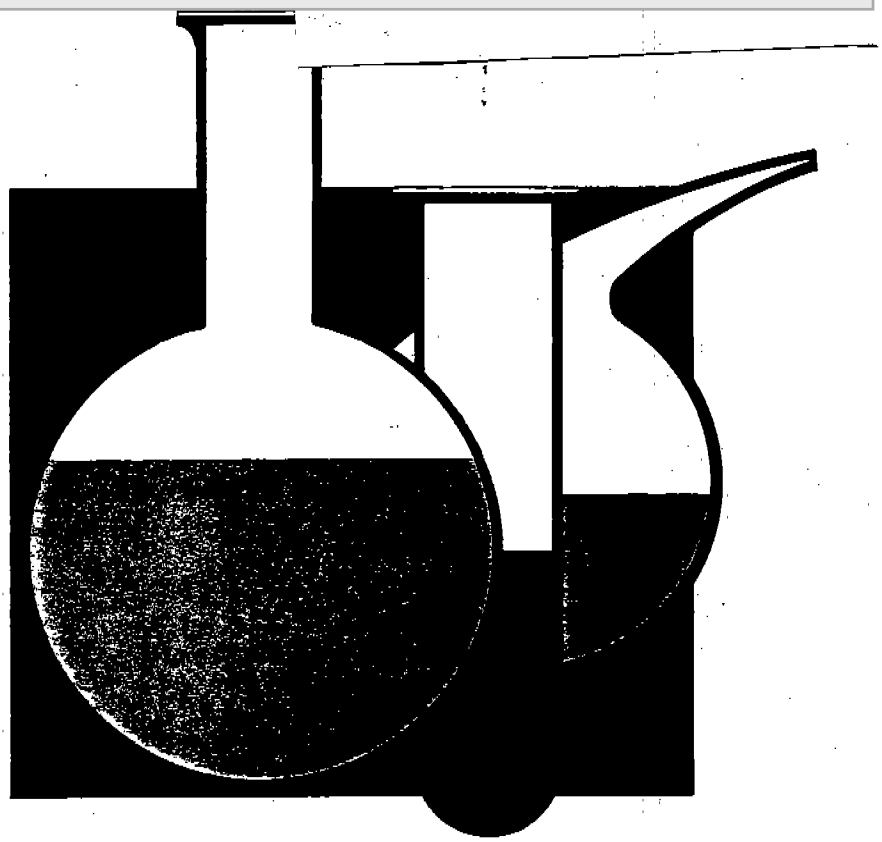
GUARDIAN SYSTEMS INC

P.O. Box 300
Leeds, Alabama
205/699-6647

Do not use - only ✓

Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.



Test Report

MASS EMISSION TESTS

CONDUCTED ON

COKE BATTERY #'s 5 & 6 POSITIVE PUSHING CONTROL SYSTEM

IN

TARRANT, ALABAMA

FOR

ALABAMA BY-PRODUCTS CORPORATION

ON

AUGUST 9, 1985

Approved by: _____
Tom Lotz
Director
Field Services Division

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I. INTRODUCTION AND TEST DESCRIPTION

On August 9, 1985, Guardian Systems, Inc. performed a short particulate emissions test on the Coke Battery #'s 5 & 6 Positive Pushing Control System of Alabama By-Products Corpration located in Tarrant, Alabama. The purpose of this short test was to determine if the same conditions existed as those during the compliance test. This test was conducted in accordance to the rules and regulating expressed in the Code of Federal Regulations, Title 40, Section 60, Reference Methods 1-5 as amended.

The Push Control System consists of a movable hood assembly which travels with the car and a baghouse for particulate removal. The damper on the baghouse fan is closed when not in use and is open by radio control when the coke is pushed. The sampling time for particulate emissions started when the pusher machine ram began moving forward and stopped when the emissions captured were collected by the baghouse. Only one push was sampled per traverse point and the sampling time varied for each push. Visible Emissions were monitored at the pushing emission control device outlet (stack) and at the pushing operation around the battery by Jefferson County Health Department Personnel.

The following personnel were present during the actual field sampling and represented the companies indicated:

Mr. J.D. Duren	Alabama By-Products Corporation
Mr. Buddy Wolfe	Alabama By-Products Corporation
Ms. Veda Hampton	Jefferson County Health Dept.
Mr. Frank Cargo	Jefferson County Health Dept.
Mr. Greg Karstens	Guardian Systems, Inc.
Mr. Mike Harvey	Guardian Systems, Inc.

II. SUMMARY OF TEST RESULTS

The following table gives the results of the tests conducted on the Coke Battery #'s 5 & 6 Positive Pushing Control System on August 9, 1985. The allowable emission rate 0.03 pounds per ton of coal charged. The figures are presented in two formats; one by calculation of coal and particulate in pounds per test and the second in pounds per hour.

RUN #	1
Sample time per test, Minutes	7.13
Coal charged per test, Tons	170
Particulate Mass Rate lbs/test	3.99
Emissions lbs/ton of coal charged	0.023
*Particulate Mass Rate lbs/hr	33.58
*Coal charged Tons/hour	1430.6
Emissions lbs/ton of coal charged	0.023

* The particulate mass rate and the coal charged are both presented in hourly rates even though the individual test times were less than an hour. This was accomplished by using a ratio of the time sampled to 60 minutes or one hour.

Visual Emissions Summaries
Around Push Control

RUN #	1
Sample time per test, Seconds	600
Time greater than 20% opacity, seconds	120
% greater than, 20 % opacity	20
Highest opacity, %	30

Data was taken from the VE Sheets found in the **Field Data** Section.

Stack Opacity

RUN #	1
Opacity, %	0

Table 1

G U A R D I A N ** S Y S T E M S ** I N C O R P O R A T E D
P.O. BOX 300
LEEDS, AL 35094
205-699-6647

Summarized Air Test Results for ALABAMA BY-PRODUCTS CORP
Job Number 54540

RUN NUMBER	1
DATE OF TEST	08/10/85
TIME OF TEST	1121-1320
LOCATION OF TEST	5&6
STACK GAS TEMPERATURE DEGREES F	114
MOISTURE CONTENT, % V/V	6.69
OXYGEN CONTENT, % V/V	18.50
CARBON DIOXIDE CONTENT, % V/V	1.50
STACK GAS VELOCITY FEET PER SECOND	48.36
VOLUMETRIC FLOW ACTUAL CUBIC FEET PER MINUTE	119,778
VOLUMETRIC FLOW DRY STANDARD CUBIC FEET PER MINUTE	103,419
CONCENTRATION GRAINS PER DRY STANCARD CUBIC FOOT	0.038
CONCENTRATION GRAINS PER ACTUAL CUBIC FOOT	0.033
PARTICULATE MASS RATE (#/HR.)	33.58
% ISOKINETIC	108.19

Table 1

GUARDIAN SYSTEMS inc

G U A R D I A N ** S Y S T E M S ** I N C O R P O R A T E D
P.O. BOX 300
LEEDS, AL 35094
205-699-6647

Computer Input Parameters for ALABAMA BY-PRODUCTS CORP
Job Number 54540

RUN NUMBER	1
DATE	08/10/85
LOCATION	5&6
TIME	1121-1320
BAROMETRIC PRESSURE (IN. HG)	30.12
STATIC PRESSURE (IN. H2O)	- 0.310
RUN TIME (MINUTES)	7.13
METER VOLUME (CORRECTED)	3.509
STACK TEMPERATURE (°F)	114.00
METER TEMPERATURE (°F)	87.00
METER PRESSURE (IN.H2O)	0.62
SQR VELOCITY PRESSURE	0.810
MASS OF PARTICULATE (MG.)	8.4
ML. OF WATER COLLECTED	5.2
% OXYGEN	18.5
% CARBON DIOXIDE	1.5
% CARBON MONOXIDE	0.0
STACK AREA (SQ. FT.)	41.28
PITOT CORRECTION FACTOR	0.85
NOZZLE DIAMETER (IN.)	0.180

GUARDIAN SYSTEMS inc

GUARDIAN ** SYSTEMS ** INCORPORATED
P.O. BOX 300
LEEDS, AL 35094
205-699-6647

Computed Air Test Results for ALABAMA BY-PRODUCTS CORP
Job Number 54540

RUN NUMBER	1
DATE OF TEST	08/10/85
LOCATION OF TEST	5&6
1. STACK PRESSURE	
INCHES HG	30.10
MILLIMETERS HG	764.47
2. METER PRESSURE	
INCHES HG	30.17
MILLIMETERS HG	766.21
3. METER VOLUME	
DRY STANDARD CUBIC FEET	3.415
DRY STANDARD CUBIC METERS	0.097
4. WATER VOLUME	
STANDARD CUBIC FEET	0.245
STANDARD CUBIC METERS	0.007
5. MOISTURE CONTENT (%)	6.69
6. MOLECULAR WEIGHT DRY	28.98
7. MOLECULAR WEIGHT WET	28.25
8. STACK VELOCITY	
FEET PER SECOND	48.36
METERS PER SECOND	14.74
9. VOLUMETRIC FLOW	
ACTUAL CUBIC FEET PER MINUTE	119,778
ACTUAL CUBIC METERS PER SECOND	56.53
10. VOLUMETRIC FLOW	
DRY STANDARD CUBIC FEET PER MINUTE	103,419
DRY STANDARD CUBIC METER PER SECOND	48.81

GUARDIAN SYSTEMS inc

G U A R D I A N ** S Y S T E M S ** I N C O R P O R A T E D
P.O. BOX 300
LEEDS, AL 35094
205-699-6647

Computed Air Test Results for ALABAMA BY-PRODUCTS CORP
Job Number 54540

RUN NUMBER	1
DATE OF TEST	08/10/85
LOCATION OF TEST	5&6
11. CONCENTRATION	
GRAINS PER DRY STANCARD CUBIC FOOT	0.0379
GRAMS PER DRY STANDARD CUBIC METER	0.0867
15. PARTICULATE MASS RATE (#/HR.)	33.58
16. VOLUME AT NOZZLE	
ACTUAL CUBIC FEET	3.955
ACTUAL CUBIC METERS	0.112
17. CONCENTRATION	
GRAINS PER ACTUAL CUBIC FOOT	0.0327
GRAMS PER ACTUAL CUBIC METER	0.0748
18. % ISOKINETIC	108.19

GUARDIAN SYSTEMS inc

III. METHOD 5 SAMPLING AND ANALYTICAL PROCEDURES

General

All sampling and analytical procedures for determination of the particulate emissions from this source were conducted in strict adherence with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 1-5 as amended. The equipment used in this test was manufactured by Research Appliance Corporation and was properly calibrated before these tests (See **Calibrations**). The particulate mass was determined gravimetrically after removal of uncombined water.

METHOD 1

This method was used to determine the number of sampling points and the required matrix. The dimensions of the stack (see **Figure 1**) indicated that 24 points would be required to sample this source. For this short test we sampled 10 points (5 per diameter) for the time of a cycle at each point. Verification of absence of cyclonic flow was not determined because there was no tangential entry and cyclonic flow did not seem to exit from the stack exhaust.

METHOD 2

Velocity meaurements were taken using a properly calibrated S type pitot tube and a 0-10 inch inclined manometer.

METHOD 3

Gas analysis for CO_2, O_2, and N_2 by difference was performed by using the grab sample technique twice during each test and analyzed with a Fyrite Gas Analyzer (0-20% scale with 0.5% divisions).

METHOD 4

Moisture content of the stack gases was determined in conjunction with Method 5 for each test by measuring the amount of water collected in the condenser and the increase in weight of the silica gel. These weights were combined to give the total amount of water collected.

METHOD 5

Sampling Techniques

Previous data was used to determine stack temperature, pressure, range of velocity heads, moisture content and stack gas dry molecular weight prior to sampling. A Monroe 1830 programable calculator or a Radio Shack PC-4 computer and a TI55 were used to calculate the sampling rate for isokinetic sampling. The particulate determinations were made by utilizing the sample train in **Figure 2.** The meter box was leak checked from the pump to the orifice and initial and final leak checks of the sampling system and pitot lines were performed as outlined in Method 5 and were recorded on the data sheets (**See Field Data**). The nozzle (stainless steel 316 with an angle of taper of 30^{o} and of button hook design) was calibrated before and after each test using a micrometer and was also recorded on the data sheets.

The sampling probe was placed at each sampling point and the gases were drawn through a stainless steel nozzle attached to a heated glass lined probe. The probe was maintained at the proper setting to obtain an exit temperature of 248 $\pm$ 25 ^{o}F (See **Calibrations**). The gases then pass through a glass fiber filter (Gelman, Class A) of 0.3 micron retention to remove particulate matter. The filter was maintained at a temperature of 248 $\pm$ 25 ^{o}F. Theses temperatures were recorded at each point on the data sheets.

The gases then pass through a condenser placed in an ice bath to maintain a maximum exit temperature of 68^{o} F. This temperature was also recorded on the data sheets. The gases then pass through a pre-weighed drying column filled with indicating silica gel to remove any remaining moisture. The clean and cool gases then entered the meter box where the gas flow and temperature were measured and recorded.

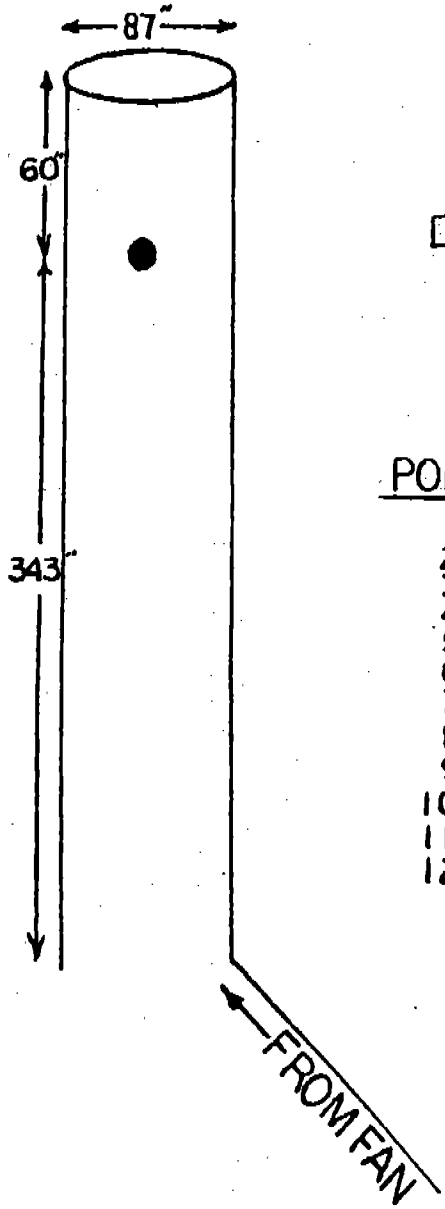
Upon completion of the sampling and the final leak checks the gel column and the probe nozzle-filter holder assembly was transfered to the cleanup area making sure no particulate was lost. The cleanup data was recorded on **Particulate Sample Recovery and Intergrity Sheet** located in the Field Data Section. Particulate catches were placed in sealed petri dishes. Each acetone rinse from the nozzle, probe, and filter holder was combined and placed in a sealed container. For the group of tests an acetone blank of approximately 200 milliliters was placed in a sealed container. These containers were clearly marked and transported to our laboratory for analysis.

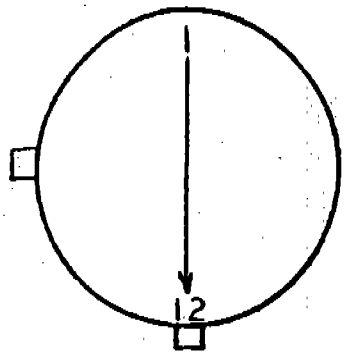
Analysis

The Filter (Gelman, Class A, without organic binder, minimum 99.9% retention for particules of 0.3 microns as determined by DOP tests) were prepared for the field test by first heating for 2 hours 220 ^{o}F then desiccating at 68 $\pm$ 10 ^{o}F at ambient pressure for 24 hours and weighing at intervals of at least six (6) hours to a constant weight to the nearest 0.1 milligrams (less than 0.5 milligrams change from previous reading). Upon return to the laboratory, the filters were subjected to the same procedures as outlined above. The weights were recorded in a bound laboratory book and transferred to the sheets in this report (**Method 5 Train Analytical Particulate Data**). During each weighing the filter was not exposed to laboratory atmosphere for more than two (2) minutes and a relative humidity of less than fifty percent (50%).

The acetone blank (reagent grade, 0.001 % residue, in glass bottles) (**Blank Analytical Data**) for the group of tests and the acetone rinses for each test were evaporated to dryness in tared glass beakers. They were then desiccated for twenty-four (24) hour and weighed to a constant weight as describe above.

SAMPLING POINTS





POINT	*DISTANCE FROM WALL
1	5.9
2	9.8
3	14.3
4	19.4
5	25.8
6	34.9
7	60.1
8	69.3
9	75.6
10	80.7
11	85.2
12	89.1

*INCLUDES 4" NIPPLE

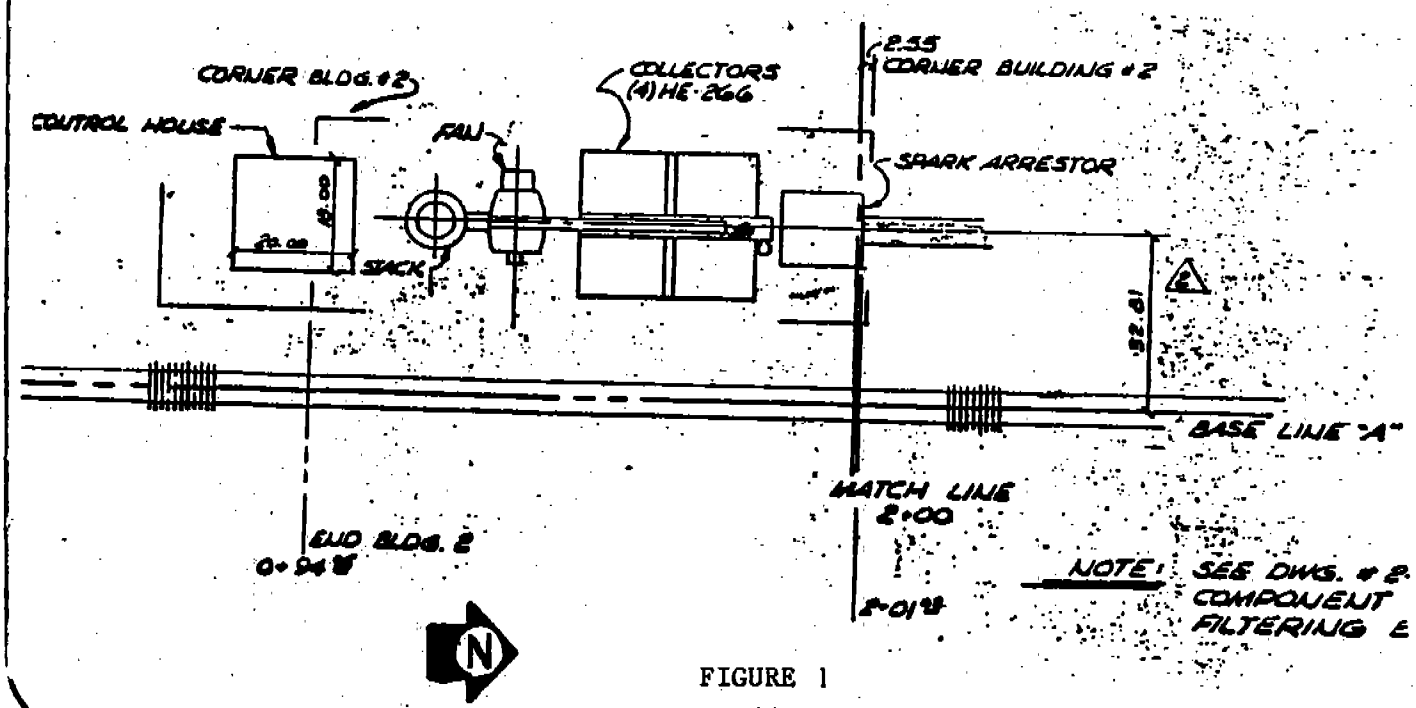
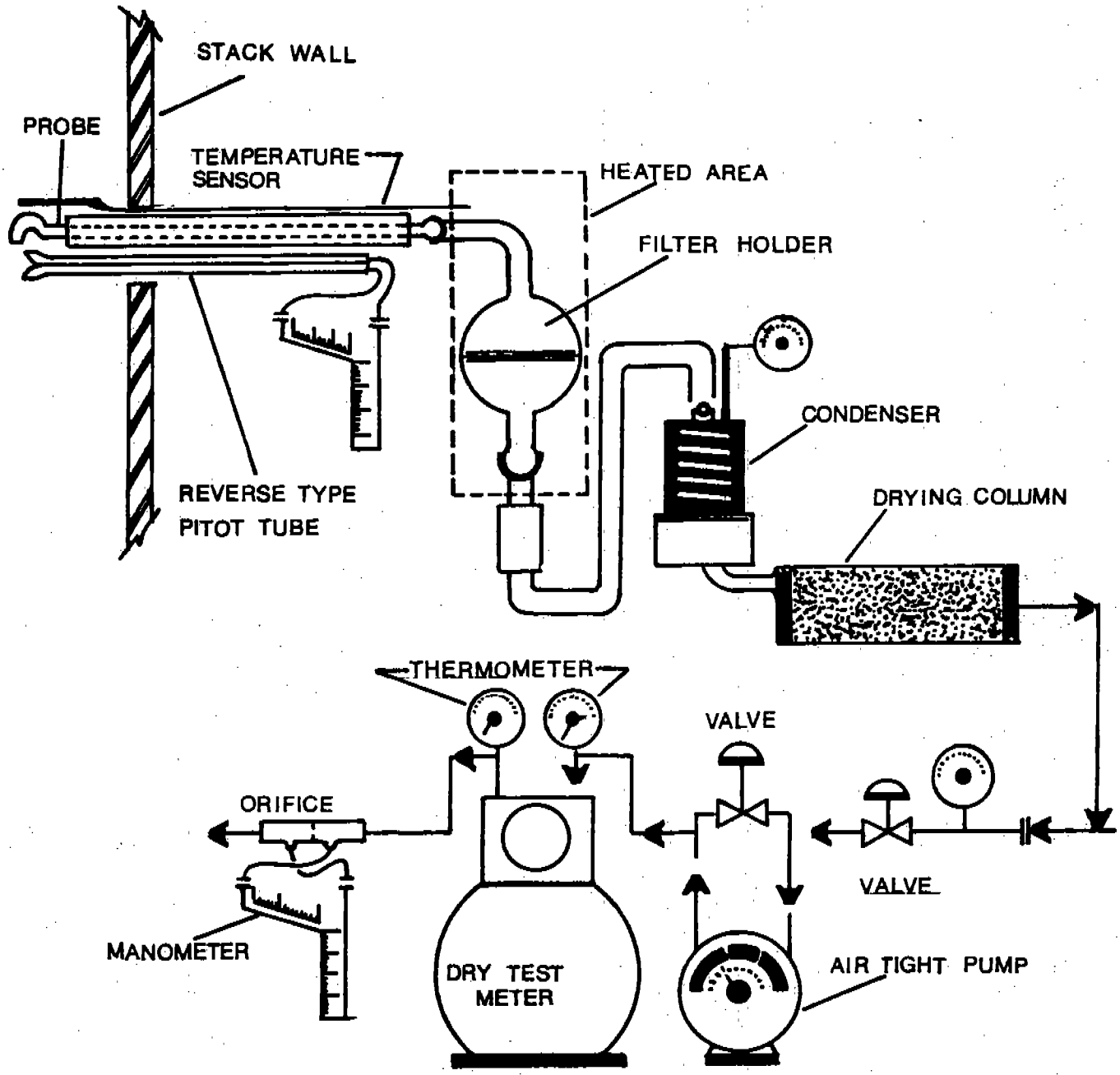


FIGURE 1



PARTICULATE SAMPLING TRAIN.. METHOD 5

Figure 2

NOMENCLATURE

ACF - Actual Cubic Feet

ACFM - Actual Cubic Feet per minute

ACM - Actual Cubic Meters

ACMS - Actual Cubic Meters per second

An - Cross sectional area of nozzle, (ft^2)

As - Area of Stack, (ft^2)

Bws - Water vapor in the gas stream, proportion by volume (dimensionless)

Ca - Acetone blank residue concentration, mg/g

c_a - Particulate Concentration, ACF

CFM - Cubic feet per minute

Cp - Pitot tube coefficient, (dimensionless)

c_s - Particulate Concentration, grains/DSCF

Cso_2 - Concentration of sulfur dioxide (dry basis) corrected to standard conditions, lb/DSCF

C_{12} - Particulate concentration (c_s adjusted to 12% excess air), grains/DSCF

C_{50} - Particulate concentration (c_s adjusted to 50% excess air), grains/DSCF

DSCF - Dry Standard Cubic Feet

DSCFM - Dry Standard Cubic Feet per minute

DSCM - Dry Standard Cubic Meters

DSCMS - Dry Standard Cubic Meters per second

EA - Excess Air, %

I - Isokinetic Sampling, %

Km - Orifice Correction Factor, (dimensionless)

Kp - Pitot tube constant, 85.49 $\left[\frac{(lb/lb\text{-}mole)(in.\ Hg)}{(^{o}R)\ (in.\ H_2O)}\right]$ 1/2

La - Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.02 CFM or 4 percent of the average sampling rate, whichever is less.

Li - Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change ($i = 1,2,3,...n$), CFM.

Lp - Leakage rate observed during the post test leak check, $ft^3/min.$ (cfm).

Ma - Mass of residue of acetone after evaporation, mg.

Md - Molecular weight of stack gas; dry basis, lb/lb-mole.

Mn - Total amount of particulate matter collected, mg.

Ms - Molecular weight of stack gas; wet basis, lb/lb-mole.

Mw - Molecular weight of water, 18.0 g/g-mole (18.01 lb/lb-mole)

ΔP - Velocity head of stack gas, in. H_2O

Pa - Density of acetone, mg/ml

Pbar - Barometric pressure at the sampling site, in. Hg

Pg - Stack static pressure, in. H_2O

Pm - Meter pressure, in. Hg

PMR - Particulate Mass Rate, lbs per hour

Ps - Absolute stack pressure, in. Hg

Pstd - Standard absolute pressure, 29.92 in. Hg

Pw - Density of water, 0.9982 g/ml (0.002201 lb/ml)

Qa - Volumetric flow rate, ACFM

Qs - Volumetric flow rate, DSCFM

R - Ideal gas constant, 0.06236 mm Hg - $m^3/^oK$-g-mole (21.85 in. Hg-$ft^3/^oR$-lb-mole)

SCF - Standard Cubic Foot

ta - Ambient Temperature, ^oF

tm - Average Temperature of meter, ^oF

t_s - Average Temperature of stack, ^oF

tstd - Standard Temperature, $68^{\circ}F$

NOTE: Capital "T" denotes degrees Rankin

Va - Volume of acetone blank, ml

Vaw - Volume of acetone used in wash, ml

Vlc - Total volume of liquid collected in condenser and silica gel, ml

Vm - Volume of gas sample, as measured by the dry gas meter, ACF

Vmc - Volume of gas sample, corrected for leak, ACF

Vm(std) - Volume of gas sample measured by the dry gas meter, corrected to standard conditions, DSCF

Vn - Volume collected at stack conditions through nozzle, ACF

Vs - Average stack gas velocity, ft/sec.

Vw(std) - Volume of water in the gas sample, corrected to standard conditions, SCF

Wa - Weight of residue in acetone wash, mg

Y - Dry gas meter calibration factor, (dimensionless)

ΔH - Average pressure differential across the calibrated orifice, in. H_2O

ΔH_a - Value of ΔH measured for a specific orifice when operated under the following conditions: 0.75 cfm of dry air (M.W. = 29) at $68^{\circ}F$, 29.92 in. Hg.

$\sqrt{\Delta P}$ - Average of the square roots of the velocity pressure, in. H_2O

Θ - Total sampling time, min.

Θ_1 - Sampling time interval from the beginning of a run until the first component change, min.

Θ_i - Sampling time interval between two successive component changes, beginning with the interval between the first and second changes, min.

Θp - Sampling time interval from the final (n^{th}) component change until the end of the sampling run, min.

$\%CO_2$, $\%O_2$, $\%N_2$, %CO - Number percent (%) by volume (dry basis) of each compound in the stack gas.

EQUATIONS

1. $P_s = P_{bar} + \frac{P_g}{13.6}$

2. $P_m = P_{bar} + \frac{\overline{\Delta H}}{13.6}$

3. $V_{m(std)} = V_m Y \left(\frac{Tstd}{Tm}\right) \left[\frac{Pbar + \frac{\overline{\Delta H}}{13.6}}{Pstd}\right]$

4. $V_w(std) = 0.04707\ V_{lc}$

5. $B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$

6. $M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$

7. $M_s = M_d\ (1 - B_{ws}) + 18(B_{ws})$

8. $v_s = K_p C_p\ (\sqrt{\Delta p})\ \text{avg.} \sqrt{\frac{T_s}{M_s P_s}}$

9. $Q_a = (v_s)\ (A_s)\ (60)$

10. $Q_s = Q_a\ (1 - B_{ws}) \left(\frac{528}{T_s}\right) \left(\frac{P_s}{29.92}\right)$

11. $c_s = \left[0.0154\ (Mn/Vmstd)\right]$

12. $EA = \left[\frac{\%O_2 - 0.5\ \%CO}{0.264\ \%N_2\ (\%O_2 - 0.5\ \%CO)}\right] 100$

13. $c_{50} = \frac{c_s}{1 - \left[\frac{(1.5)(\%O_2) - 0.133(\%N_2) - 0.75\ (\%CO)}{21}\right]}$

14. $c_{12} = c_s \frac{12}{\%\ CO_2}$

15. $$PMR = (c_s)(Q_s)\ (\frac{60}{7000})$$

16. $$V_n = \frac{T_s}{P_s}\left[(0.002669)(V_{1c}) + \frac{V_m}{T_m}\ (P_{bar} + \frac{\overline{\Delta H}}{13.6})\right]$$

17. $$C_a = (0.0154)(M_n)\ /V_n$$

18. $$I = \frac{100\ V_n}{60\ \Theta\ v_s\ An}$$

19. $$V_{mc} = V_m - (L_p - L_a)\ \Theta$$

20. $$W_a = Ca\ Vaw\ p_a$$

FIELD DATA SHEET JCHO 8/9/85

PLANT ABC RUN # 1

LOCATION Tarrant DATE 8/10/85

BARO. PRES. 30.12 TIME 1121 – 1520

GUARDIAN SYSTEMS INC.
P. O. Box 300
Leeds, Alabama 35094
205/699-6647

	TIME MIN	TIME DUR	METER VOL FT 3	STACK TEMP °F	METER TEMP °F IN	METER TEMP °F OUT	METER TEMP °F AVG	IMP TEMP °F	BOX TEMP °F	METER PRESSURE "H2O	VELOCITY PRESSURE "H2O	VACUUM PRESSURE "Hg
A			876.088	(1)	(2)	(3)		(4)	(5)			
1	39	53	876.4	101	87	87	87	40	229	.68	.71	
2	37	92	876.7	109	86	86	86	40	232	.75	.79	
3	39	77	877.0	118	86	86	86	41	236	.61	.65	
4	38	39	877.3	116	88	88	88	40	241	.54	.57	
5	1:44	46	877.9	120	86	84	85	40	242	.58	.63	
B												
1	38	98	878.2	119	90	88	89	43	237	.62	.66	
2	41	78	878.5	112	88	89	89	45	228	.54	.57	
3	39	15	878.9	115	88	88	88	50	231	.53	.56	
4	39	24	879.2	119	90	90	90	52	245	.60	.64	
5	38	53	879.579	115	86	87	87	56	261	.75	.80	
10	7.13	25	3.551	114			87			.62	.810	
			.985 2									
			3.509									

STATIC PRESSURE "H2O -.31

PROBE TIP SIZE

BEFORE	AFTER
.180	.180
.180	.180
.180	.180

WATER

ml. 340

gram 2.2

Total 5.2

OPERATOR

Karstens / Harvey

Sample Box No. 4

Meter Box No. 400

Meter ΔH@ 1.71

Pitot, CP .84

Temp. Device S II

Probe No. 8-1

Probe Liner Glass

Probe Htr. Set 70%

Ambient Temp. 85

% O_2 18.5

% CO_2 1.5

NOTES

Orifice

Pitot

Meter

R 6.8
S 7.4
FINAL LEAK AT 5" Hg
.008

BLANK ANALYTICAL DATA

Plant ABC

Sample location SYSTEM 5+6

Relative humidity 20%

Type of blank ACETONE

Liquid level at mark and container sealed ✓

Density of blank (ρa) .7857 g/ml

Blank volume (Va) 200 ml

Date and time of wt. 0800 8-12-85 Gross wt. 110.5859 mg

Date and time of wt. 1400 8-12-85 Gross wt. 110.5861 mg

Average gross wt. 110.5860 mg

Tare wt. 110.5858 mg

Weight of blank (ma) .2 mg

$$Ca = \frac{ma}{Va\ \rho a} = \frac{(.2)}{(200)(.7857)} = .001273 \text{ mg/g}$$

Note: In no case shall a blank residue greater than (0.01 mg/g) or 0.001% of the weight of blank used be subtracted from the sample weight.

Remarks: _____

Signature of analyst Ellen A. Karstens

Signature of reviewer _____

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: ABC Sample date: 8-10-85

Sample location: SYSTEM 5+6 Run no.: #1

Sample recovery person: KARSTENS Recovery date: SAME

Filter(s) no.: C-15

MOISTURE

Impingers			Silica gel		
Final volume (wt)	3	ml(gm)	Final wt.	945.7 g	g
Initial volume (wt)	0	ml(gm)	Initial wt.	943.5 g	g
Net volume (wt)	3	ml(gm)	Net wt.	2.2 g	g

Total moisture 5.2 g

Color of silica gel BLUE

Description of impinger water CLEAR

RECOVERED SAMPLE

Filter container no. C-15 sealed ✓

Description of particulate on filter CLEAN

Acetone rinse container no. RUN #1 Liquid level marked ✓

Acetone blank container no. BLK Liquid level marked ✓

Samples stored and locked

Remarks:

Date of laboratory custody

Laboratory personnel taking custody

Remarks:

GUARDIAN SYSTEMS inc

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant ABC Run No. #1

Sample location SYSTEM 5+6

Relative humidity 20%

Density of acetone (ρa) .7857 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
Filter(s)	✓	✓

Acetone rinse container no. #4

Acetone rinse volume (Vaw) 175 ml

Acetone blank residue concentration (Ca) .001273 mg/g

Wa = Ca Vaw ρa = (.001273)(175)(.7857) = .2 mg

Date and time of wt 0800 8-12-85 Gross wt 106.721 mg

Date and time of wt 1400 8-12-85 Gross wt 106.717 mg

Average gross wt 106.719 mg

Tare wt 106.700 mg

Less acetone blank wt (Wa) .2 mg

Weight of particulate in acetone rinse 11.7 mg

Filter(s) container no. C-15

Date and time of wt 0800 8-12-85 Gross wt 170.0 mg

Date and time of wt 1400 8-12-85 Gross wt 170.0 mg

Average gross wt 170.0 mg

Tare wt 173.3 mg

Weight of particulate on filter(s) -3.3 mg

Weight of particulate in acetone rinse 11.7 mg

Total weight of particulate 8.4 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks: _____

Signature of analyst Greg A Kajstura

Signature of reviewer _____

Alabama By Products August 9 1985
Pushing Emission Study

Oven No.	Times Start / Stop	Opacity	Capture	Duration
*2	11:33 / 11:34	30%	70%	60sec.
12	11:54 / 11:55	25%	75%	60sec
22	12:14 / 12:15	20%	80%	50sec.
32	12:44 / 12:45	15%	85%	25sec.
52	1:18 / 1:19	5%	95%	-
4	1:39 / 1:40	10%	90%	-
14	1:56 / 1:57	5%	95%	-
24	2:11 / 2:12	20%	80%	10sec.
34	2:39 / 2:40	20%	80%	4sec
44	2:53 / 2:54	10%	90%	-

17 Tons of coal per oven

Observer: Vicki Hampton, JCHD

* Emissions from Coke door

Pushes Observed: 10

Total Pushes Recv 85% Capture. 5

Total Pushes Less than 85%. 5

JCHP

JEFFERSON COUNTY DEPARTMENT OF HEALTH
BUREAU OF ENVIRONMENTAL HEALTH
AIR POLLUTION CONTROL PROGRAM

VISIBLE EMISSIONS OBSERVATION REPORT

Company Name Alabama By Products V.E.E. No. [ ][ ][ ][ ][ ]

Source #5th Pushcarted Treatment Permit No. [0][0][0][0][0][1][8][5][0][3]

Start/Stop Time _____ Sky Condition 50% clouds Date [0][8][0][9][7][5]

Observation Point E of source Distance from Source 125'

Stack Height 40' Background sky Plume Color black

Method of Evaluation [ ] Wind Direction So.

Minutes Exceeding:

Total Minutes Observed [ ][ ] 10% Opacity = [ ][ ]

Highest 6 Minute Average [ ][ ] 20% Opacity = [ ][ ]

Violation Observed [ ] 60% Opacity = [ ][ ]

Notice Number [ ][ ][ ][ ][ ][ ] [ ][ ] % Opacity = [ ][ ]

Min.	Seconds 0	15	30	45	Min.	Seconds 0	15	30	45	Min.	Seconds 0	15	30	45	Min.	Seconds 0	15	30	45
0	11:32	0	0	0	15					30					45				
1	0	0	0	0	16	1:31	0	0	0	31					46				
2	11:53	0	0	0	17	0	0	0	0	32					47				
3	0	0	0	0	18	2:53	0	0	0	33					48				
4	12:13	0	0	0	19	0	0	0	0	34					49				
5	0	0	0	0	20					35					50				
6	12:94	0	0	0	21					36					51				
7	0	0	0	0	22					37					52				
8	1:18	0	0	0	23					38					53				
9	0	0	0	0	24					39					54				
10	1:39	0	0	0	25					40					55				
11	0	0	0	0	26					41					56				
12	1:55	0	0	0	27					42					57				
13	0	0	0	0	28					43					58				
14					29					44					59				

Results and Recommendations:

Observer Cargo [43]

Time Analysis [ ]

ENV-AP-008-12/84 Revised

VL METHOD 5 CALIBRATIONS

Meter Box

The meter box shall be initially calibrated every 6 months at the fixed settings of 0.5, 1.0, 1.5, 2.0, and 2.5 inches of water. Upon return to the laboratory from this test the meter box was recalibrated using the average meter pressure for the test series. The recalibration point shall be the closest point to the initial calibration (for an average meter pressure of 1.40 a 1.50 "H_20 was used as the recalibration point). These recalibrations produced a single point MCF and a H@ which shall be compared to the original calibration to see if they are within the 5% allowed at the highest vacuum seen. These recalibration sheets are located behind the original calibration sheets and were used to modify the meter volumes.

Pitot Tubes

The S type pitot tubes shall be calibrated against a standard pitot tube (C_p = 0.99) every six months in a wind tunnel with a capacity to generate a test section velocity of approximately 3000 feet/ minute. Additionally the pitot tube shall be measured as to its specifications and alignment. Upon return, the intercomponent spacings and the face opening alignment of the pitot tube assembly shall be rechecked and if no changes are noticed; it shall be assumed that the cofficient of the assembly had not changed.

Temperature measurments

All temperature devices (impinger, meter box, hot box and stack) shall be calibrated every 6 months against an ASTM mercury-in-glass reference therometer or a reference thermocouple and potentiometer calibrated by fixed points, e.g., ice bath and boiling water (corrected to barometric pressure). Upon return the stack temperature device shall be recalibrated within 10% of the average absolute stack temperarure. If the device being tested agrees within 1.5% of the reference device, the temperature data taken in the field shall be considered valid.

VI. METHOD 5 CALIBRATIONS CONTINUED

Barometric Pressure

An aneroid barometer capable of measuring atmospheric pressure to within 0.1 inches Hg shall be used. If this device is defective the following alternate method shall be used. The barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 0.1 inches Hg per 100 feet elevation increase or vice versa for elevation decrease.

Specific Test equipment and measurements

The equipment used during these tests was as follows:

Probe: 8-1
Meter Box: #400
Stack Temperature: OMEGA II
Sample Box: #4
Condenser: #1

The average temperature of the stack was 114 ^{o}F. The OMEGA II was recalibrated at 115 ^{o}F and agreed exactly with an ASTM mercury-in-glass reference thermometer. The intercomponent spacings and the face opening alignment of the Pitot Tube assembly was rechecked and no changes were noticed; therefore, it was assumed that the cofficient of the assembly had not changed.

Type A Glass Fiber Filters

FEATURES

■ High tensile strength. ■ Excellent handling characteristics. ■ Good wetting properties. ■ Minimum of 99.9% retention for particles of .3 μm as determined by DOP tests. ■ Binder free.

This is the original glass fiber filter pioneered by Gelman Instrument Company over 15 years ago. It continues to be widely used for high volume sampling. Since zinc is one of the raw materials incorporated in the glass fibers, Type A Filters have a variable zinc content. Another component of the filter, sulfuric acid, is used as a dispersion medium, making the sheets unsuitable for measurement of sulfates.

Type A Glass Fiber Filters are less likely to develop static charge or tear than other glass fiber media types. They are used extensively in applications where zinc and iron content is not important, or where sulfate content is not being determined.

Size	37 mm	47 mm	102 mm	8"x10"
Product No.	61715	61694	61696	61701
Filters/Pkg.	500	100	100	100

TYPE A GLASS FIBER FILTER SPECIFICATION REPORT

The following physical/chemical properties represent typical, average values obtained in accordance with accepted test methods. They are subject to normal manufacturing variations and are supplied as a technical service. *The analysis has been made in accordance with EPA procedures (micrograms/8" x 10" sheet).*

ELEMENTS:

Antimony	30	Manganese	200
Arsenic	30	Mercury	100
Beryllium	1	Molybdenum	10
Bismuth	10	Nickel	10
Cadmium	5	Selenium	5000
Chromium	10	Tin	10
Cobalt	10	Titanium	170
Copper	2	Vanadium	10
Iron	2300	Zinc	5000 to 25,000
Lead	20		

OTHER PHYSICALS:

BSO	522	Flow Resistance (Max.) @ 320 cm/min.	80 mm
*pH	8.5	Flow Rate (air) lpm/cm² @ 70 cm Hg	50
DOP @320/cm/min (ASTM Method 2986	99.9%	Max. Use Temp.	400°C
Tensile Strength (Fed. Spec. UUP31B)	750 gr	Static Properties	Low
Weight, 8"x10" sheet	4.0±.3 gr.	Ability to Fold	Excellent

WATER EXTRACTABLE IONS:

Sulfate	100	Chloride	1500
Nitrate	50	Fluoride	15
Ammonia	20		

*pH—Gelman Procedure:

A. 500 ml distilled water.
B. Add 15 drops saturated KCl solution
C. Shred one 8"x10" sheet and soak in prepared water for one hour.
D. Run pH at ambient temperature.

Type A/E Glass Fiber Filters

FEATURES

■ Low trace metals. ■ Medium Handling characteristics. ■ Available in all sizes. ■ Minimum of 99.9% retention for particles of .3 μm as determined by DOP tests. ■ Binder free.

Type A/E Glass Fiber Filters are composed of low acid soluble glass fiber. They contain low levels of both zinc and iron. The filters do react with atmospheric sulfur dioxide; and therefore, when high levels of sulfur are expected, corrections for this reaction should be accounted for.

Type A/E Glass Fiber Filters are binder free and ideal for gravimetric analysis of air pollutants. This pure, organic free filter is the basis for procedures widely used in determining municipal and industrial air polluting substances.

Size	25 mm	37 mm	47 mm	102 mm	8"x10"
Product No.	61630	61652	61631	61633	61638
Filters/Pkg.	500	500	100	100	100

TYPE A/E GLASS FIBER FILTER SPECIFICATION REPORT

The following physical/chemical properties represent typical, average values obtained in accordance with accepted test methods. They are subject to normal manufacturing variations and are supplied as a technical service. *The analysis has been made in accordance with EPA procedures (micrograms/8" x 10" sheet).*

ELEMENTS:

Antimony	20	Manganese	2
Arsenic	20	Mercury	80
Beryllium	1	Molybdenum	10
Bismuth	10	Nickel	10
Cadmium	2	Selenium	200
Chromium	10	Tin	10
Cobalt	10	Titanium	10
Copper	2	Vanadium	10
Iron	100-1800	Zinc	90
Lead	10		

OTHER PHYSICALS:

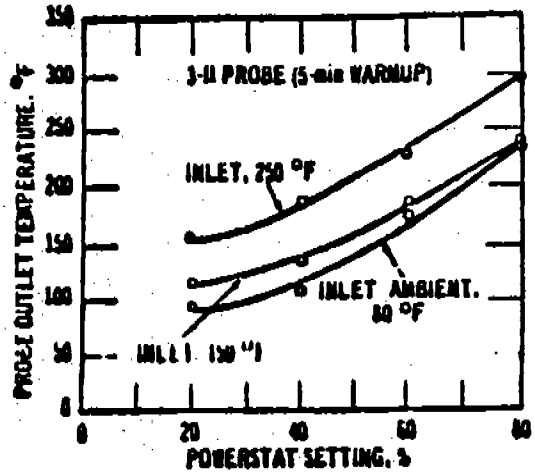
BSO	522	Flow Resistance (Max.) @ 320 cm/min.	80 mm
*pH	9.0	Flow Rate (air) lpm/cm² @ 70 cm Hg	60
DOP @320/cm/min ASTM Methods 2986)	99.9%	Max. Use Temp.	400°C
Tensile Strength (Fed. Spec. UUP31B)	600 gr.	Static Properties	Medium
Weight 8"x10"sheet	4.0±.3 gr.	Ability to Fold	Good

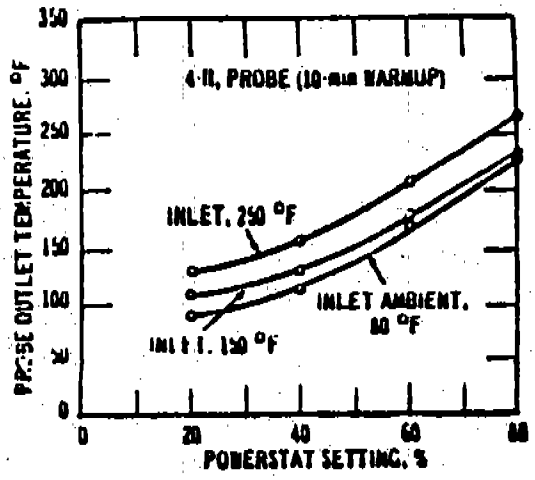
WATER EXTRACTABLE IONS:

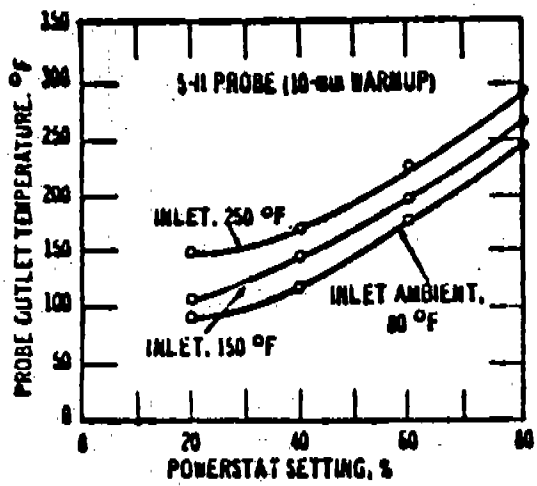
Sulfate	600	Chloride	1500
Nitrate	115	Fluoride	87
Ammonia	13		

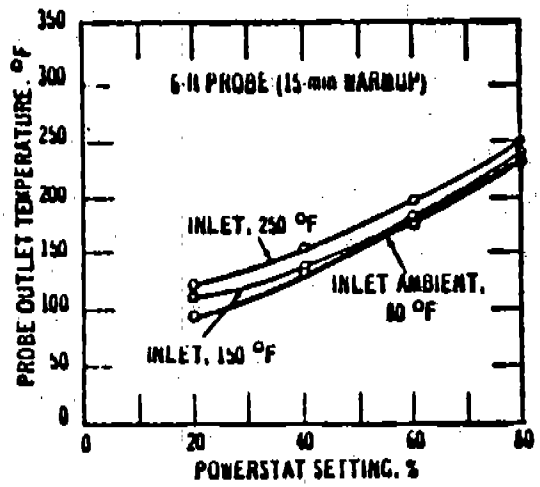
*pH—Gelman Procedure:

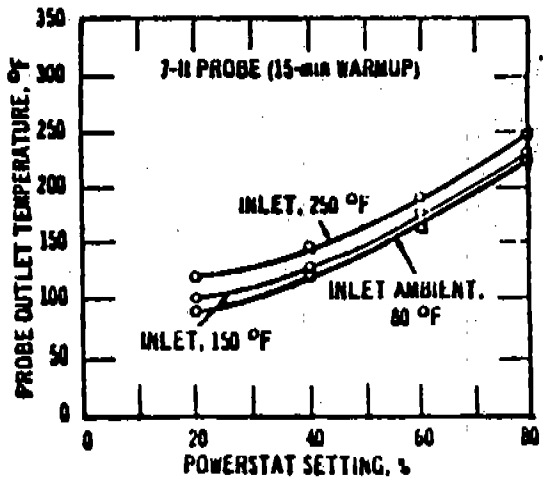
A. 500 ml distilled water.
B. Add 15 drops saturated KCl solution.
C. Shread one 8"x10" sheet and soak in prepared water for one hour.
D. Run pH at ambient temperature.











NOTE: Flow rate held constant at 0.75; 50% change in flow rate has little effect on probe temperature.

METER CALIBRATION FORM

Date 3/18/85 Box No. 400

P_{bar} = 30.00 in. Hg Calibrated by LDT L

Orifice Manometer Setting ΔH (in. H_2O)	Δ wtm (in. H_2O)	Gas Volume Wet Test Meter		Gas Volume Dry Gas Meter		Temperature Wet Test Meter		Avg. Temp. Dry Gas Meter	
		Initial	Final	Initial	Final	Initial	Final	Inlet	Outlet
2.0	-1.03	0.006	13.515	736.625	750.348	12 L	12.5	75/94	64/72
2.5	-1.25	13.515	26.765	750.348	763.984	12.5	13.0	90/101	72/78
1.5	-0.78	26.765	37.010	763.984	774.52L	13.0	13.L	97/98	78/51
1.0	-0.58	37.010	45.505	774.52L	783.237	13.L	13.5	96/97	51/52
0.5	-0.36	45.505	51.557	783.237	789.459	13.5	13.5	95/94	52/5L

Pump must be operated for at least 15 minutes at each ΔH setting (.5, 1, 1.5, 2 and 3)

T_{dgm} = average temperature of dry gas meter (inlet and outlet) + 460°F

T_{wtm} = average temperature of wet test meter + 460°F

$P_{wtm} = P_{bar} - \frac{\Delta wtm}{13.6}$

$P_{dgm} = P_{bar} + \frac{\Delta H}{13.6}$

1.0082
1.0046
1.0132
1.0179
1.0210
1.0130

Δwtm = pressure on wet test meter in inches of H_2O

Y = meter calibration factor

28.316 = conversion factor when using a wet test meter calibrated in liters

Calculations

$$Y = \frac{(\text{wet final} - \text{wet initial})(T_{dgm})(P_{wtm})}{(\text{dry final} - \text{dry initial})(28.316)(T_{wtm})(P_{dgm})} \quad \text{or (1)}$$

$$\bar{Y} = \frac{\Sigma Y}{5}$$

Meter Tolerance = 1.00 ± 0.01

If the meter calibration factor is not within the allowable tolerance, the calibration factory Y may be used to mathematically correct the gas meter dial readings to the proper values instead of physically adjusting the dry gas meter dials to correspond to the wet test meter readings.

POST TEST METER CALIBRATION

PROJECT ABC STACK 5+6

Date 8-12-85 Box No. 402

P_{bar} = 30.08 in. Hg Calibrated by _____ Signature

Orifice Manometer Setting ΔH (in. H_2O)	Δ wtm (in. H_2O)	Gas Volume Wet Test Meter Initial	Gas Volume Wet Test Meter Final	Gas Volume Dry Gas Meter Initial	Gas Volume Dry Gas Meter Final	Temperature Wet Test Meter Initial	Temperature Wet Test Meter Final	Avg. Temp. Dry Gas Meter Inlet	Avg. Temp. Dry Gas Meter Outlet
.5 @ 6 "Hg	-0.38	0	6.375	896 313	902.778	26.0	25.8	101/101	89/91
.5 @ 6 "Hg	-0.38	0	6.377	902.778	905.223	25.8	25.6	101/105	91/93
.5 @ 6 "Hg	-0.38	0	6.327	909.223	915.78	25.6	25.5	103/105	91/92

Pump must be operated for at least 15 minutes at each ΔH setting

T_{dgm} = average temperature of dry gas meter (inlet and outlet) + 460°F

T_{wtm} = average temperature of wet test meter + 460°F

$P_{wtm} = P_{bar} - \frac{\Delta wtm}{13.6}$ (includes vapor pressure of water at saturation at the temperature of the wet test meter)

$P_{dgm} = P_{bar} + \frac{\Delta H}{13.6}$

Δwtm = pressure on wet test meter in inches of H_2O

Y = meter calibration factor

28.316 = conversion factor when using a wet test meter calibrated in liters

Calculations

$$Y = \frac{(\text{wet final} - \text{wet initial})(T_{dgm})(P_{wtm})}{(\text{dry final} - \text{dry initial})(28.316)(T_{wtm})(P_{dgm})} \quad \text{or (1)}$$

$\bar{Y} = \frac{\Sigma Y}{3}$ = .9882

Pre test Y 1.0210

% Difference -3.21

GUARDIAN SYSTEMS inc

ORIFICE CALIBRATION FORM

Date 3/18/85 Meter Box No. 4D

P_{bar} 29.92 Calibrated By LDT2

ΔH	V_1	V_2	θ	t_1	t_2	$V_2 - V_1$	Q_m	K_m	
in. H_2O	CF	CF	Sec.	°F	°F	CF			
2.0	736.675	750.348	1020	84.5	68	13.673	.7584	.7265	1.79
2.5	750.348	763.984	900	95.5	75	13.636	.8561	.7249	1.75
1.5	763.984	774.522	900	97.5	79.5	10.538	.7001	.7273	1.74
1.0	774.522	783.237	900	96.5	81.5	8.715	.5833	.7403	1.68
0.5	783.237	789.459	900	94.5	82	6.222	.4187	.7506	1.63
							Average K_m	.7339	
									1.71

V_1 = Dry gas meter reading at the start of each test

V_2 = Dry gas meter reading at the end of each test

t_1 = Dry gas meter inlet temperature

t_2 = Dry gas meter outlet temperature

Calculations

1. Q_m = (for each ΔH) $$\frac{V_2 - V_1}{\theta}\left[\frac{t_2 + 460}{\frac{t_1 + t_2}{2} + 460}\right](60)(Y)$$

2. K_m = (for each ΔH) $$Q_m\sqrt{\frac{P_m M_m}{T_m \Delta H}}$$

$M_m = 29$
$T_m = t_2 + 460$
$P_m = P_{bar} + \frac{\Delta H}{13.6}$
Y = meter calibration factor

3. Calculate the average K_m as follows:

$$\bar{K}_m = \frac{\Sigma K_m}{5}$$

4. Calculate ΔH_a as follows:

$$\Delta H_a = \frac{Q@^2\ P@\ M@}{T@}\left[\frac{1}{\bar{K}_m^2}\right] = \frac{0.921}{\bar{K}_m^2}$$

Q@ = 0.75 cfm
T@ = 528°R
P@ = 29.92 in.Hg
M@ = 29

5. Orifice Tolerance = 1.84 ± .25

POST TEST ORIFICE CALIBRATION

Date 8-12-85 Meter Box No. 450

P_{bar} 30.08 Calibrated By _____ Signature

ΔH	V_1	V_2	θ	t_1	t_2	$V_2 - V_1$	Q_m	K_m
in. H_2O	CF	CF	Sec.	°F	°F	CF		
0.5	898.313	902.778	900	101	90	6.465	.4158	.7464
0.5	902.778	909.223	900	103	92	6.445	.4210	.7489
0.5	909.223	915.708	900	105.5	94	6.485	.4219	.7452

Average K_m .7482

Average H@ 1.66

Pre test H@ 1.63

% Difference 0.94

V_1 = Dry gas meter reading at the start of each test

V_2 = Dry gas meter reading at the end of each test

t_1 = Dry gas meter inlet temperature

t_2 = Dry gas meter outlet temperature

Calculations

1. Q_m = (for each ΔH) $\dfrac{V_2 - V_1}{\theta}\left[\dfrac{t_2 + 460}{\frac{t_1 + t_2}{2} + 460}\right](60)(Y)$

2. K_m = (for each ΔH) $Q_m\sqrt{\dfrac{P_m M_m}{T_m \Delta H}}$

$M_m = 29$

$T_m = t_2 + 460$

$P_m = P_{bar} + \dfrac{\Delta H}{13.6}$

Y = meter calibration factor

3. Calculate the average K_m as follows:

$$\bar{K}_m = \frac{\Sigma K_m}{3}$$

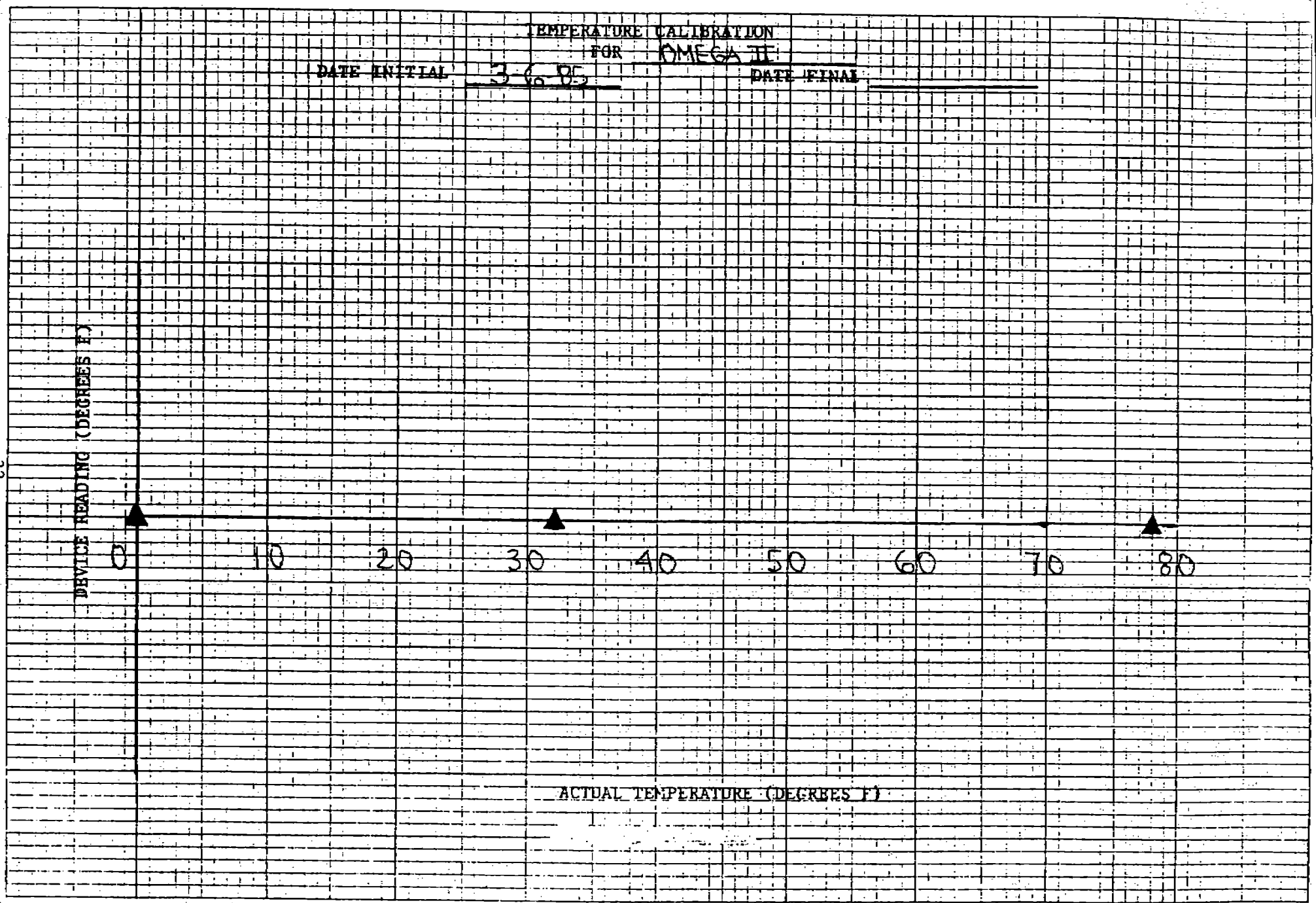
4. Calculate ΔH_a as follows:

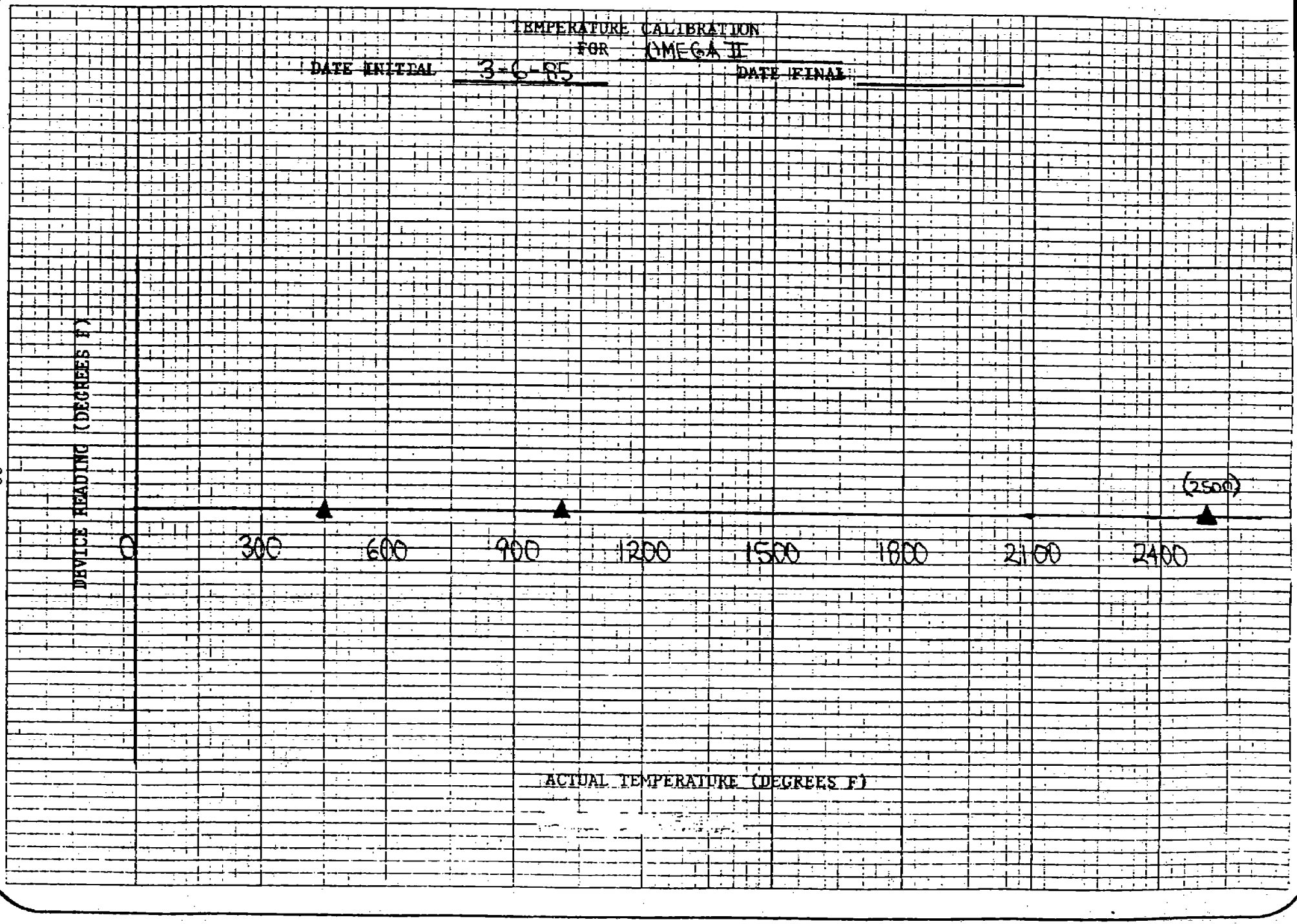
$$\Delta H_a = \frac{Q@^2\ P@\ M@}{T@}\left[\frac{1}{\bar{K}_m^2}\right] = \frac{0.921}{\bar{K}_m^2}$$

Q@ = 0.75 cfm
T@ = 528°R
P@ = 29.92 in.Hg
M@ = 29

TEMPERATURE CALIBRATION
FOR OMEGA III

DATE INITIAL 3-6-02 DATE FINAL



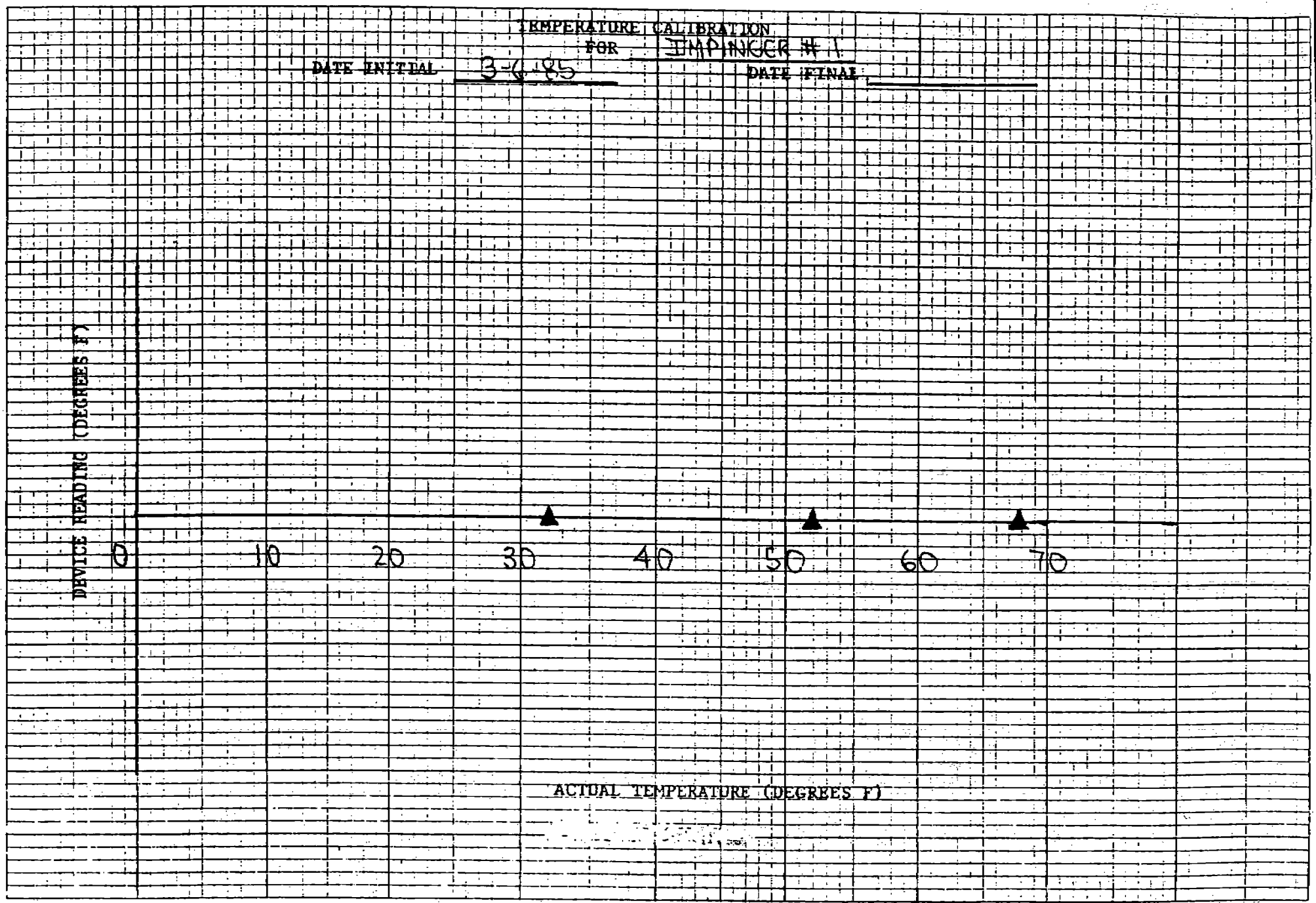


GUARDIAN SYSTEMS inc

TEMPERATURE CALIBRATION

FOR IMPINGER # 1

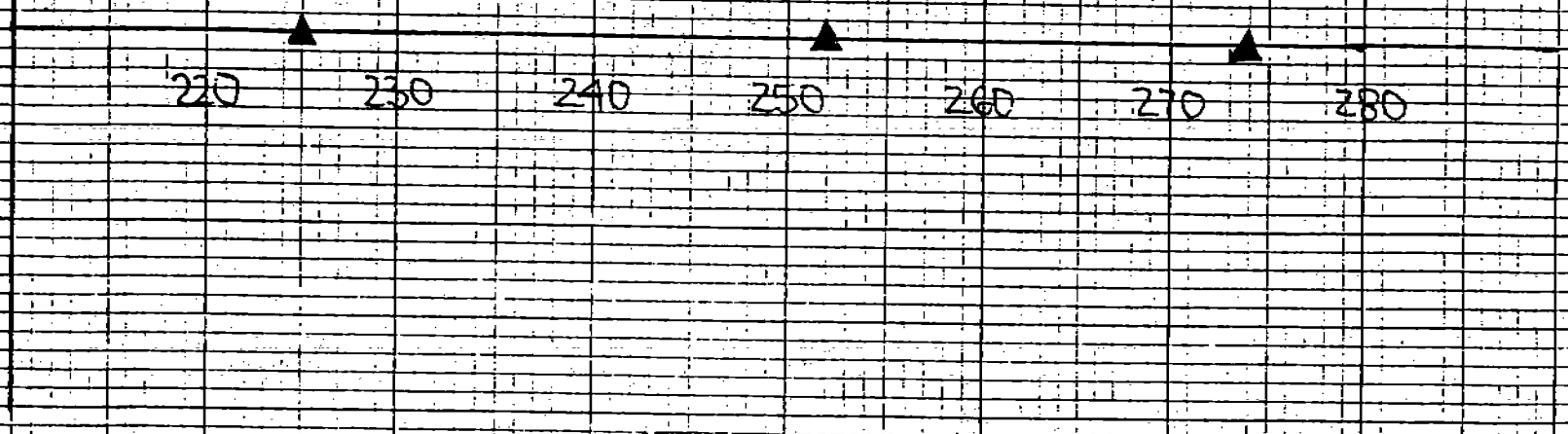
DATE INITIAL 3-6-85 DATE FINAL



GUARDIAN SYSTEMS INC

TEMPERATURE CALIBRATION
FOR HOT BOX # 4

DATE INITIAL 3-6-85 DATE FINAL



GUARDIAN SYSTEMS inc

PITOT CALIBRATION FORM

Date 3-6-85 Probe # 8-1

Calibrated By G KARSTENS

Nozzle Size N/A

SIDE A

Run #	ΔP_{std} (in. H_2O) Standard	$\Delta P(s)$ (in. H_2O) Type "s"	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(A)$
1	.483	.663	.845	-.002
2	.480	.653	.849	+.002
3	.480	.653	.849	+.002
		$\bar{C}_p(A)$	.847	

SIDE B

Run #	ΔP_{std} (in. H_2O) Standard	$\Delta P(s)$ (in. H_2O) Type "s"	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(B)$
1	.493	.673	.847	—
2	.480	.656	.847	—
3	.486	.666	.846	-.001
		$\bar{C}_p(B)$	.847	

CALCULATIONS

$$C_p(s) = C_{p(std)} \text{ (or 0.99)} \sqrt{\frac{\Delta P_{std}}{\Delta P(s)}}$$

$$\text{Average Deviation} = \frac{\Sigma \left| C_p(s) - \bar{C}_p(A \text{ or } B) \right|}{3}$$ ← Must be ≤ 0.01

$$\left| \bar{C}_p(A) - \bar{C}_p(B) \right|$$ ← Must be ≤ 0.01