Background Report Reference

AP-42 Section Number: 12.15

Background Chapter: 4

Reference Number: 21

Title: Lead Emission Rate, OSI Oven #1, Johnson Controls, Inc., Tampa, FL

PACE Laboratories

1988

(9)

Not NSPS

TEST REPORT

LEAD EMISSION RATE

OSI Oven #1
10215 North 30th Street
Tampa, Florida 33687

Test Date: February 4, 1988

Project Number: 280208.504

Report Prepared for:

Johnson Controls, Inc.
P. O. Box 16068
Tampa, Florida 33687

Report Prepared by:

PACE Laboratories, Inc.
5460 Beaumont Center Boulevard
Tampa, Florida 33634

March 1, 1988

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SECTION 1.0

TEST SUMMARY

On February 4, 1988, PACE Laboratories, Inc. conducted Lead emissions tests at Johnson Controls, Inc., Globe Battery Division, 10215 North 30th Street, Tampa, Florida. Tests were conducted on the OSI Oven #1 (S/N 146).

Test team personnel for this test include:

Thomas A. Jackman, Ph.D.	Technical Director
Michael C. Jackman	Team Leader
Gregory P. Allen	Technician
Michael F. Valder	V.E. Observer

The results of the Particulate and Lead emissions tests are summarized in the following table.

Date	Operation	Parameter	Actual Emission Rate*
2/4/88	OSI Oven #1	Lead	4.51×10^{-3}
2/4/88	OSI Oven #1	Opacity	0

* = gr/dscf except for opacity (%)

Respectfully submitted,

PACE Laboratories, Inc.

Timothy M. O'Dell

Timothy M. O'Dell
Project Manager

Thomas A. Jackman

Thomas A. Jackman, Ph.D.
Director, Florida Division

SECTION 2.0

Source Description

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa

Source Test Summary

Company Name: Johnson Controls, Inc.

Source Identification: OSI Oven #1 (S/N 146)

Test Parameter: Lead

Process Weight Rate: 4219 Pounds / Hour

Test Date: February 4, 1988

RUN NUMBER	1	2	3	Average
SCF	4.5907E+01	4.3494E+01	4.3753E+01	4.4385E+01
ACFM	1.42E+03	1.35E+03	1.30E+03	1.36E+03
WATER, %	4.78E+00	4.04E+00	3.32E+00	4.05E+00
ISOKINETIC, %	9.74E+01	9.64E+01	1.02E+02	9.88E+01
EMISSIONS, GR/DSCF	3.33E-03	5.39E-03	4.83E-03	4.51E-03
EMISSIONS, LB/HR	3.02E-02	4.69E-02	3.98E-02	3.90E-02

EMISSION SUMMARY:

Lead, gr/dscf

Actual: 4.51E-03 ✓

SOURCE DESCRIPTION

Johnson Controls, Inc., Globe Battery Division, operates a lead-acid storage battery manufacturing facility at 10215 North 30th Street, Tampa, Florida.

At this location, lead pigs are received, melted and cast to form lead grids. Bulk lead oxide is received from off site and is also produced on site in a ball mill. Lead oxide is mixed with sulfuric acid and is applied as a paste to the lead grids. These grids are then used in the production of lead-acid storage batteries for automotive and marine applications.

OSI Oven #1 (S/N 146)

OSI ovens are used to dry lead grid plates after a lead paste is applied. This drying oven is part of the Paste Mixing Line #1 and has no pollution control equipment. The emissions from the oven are discharged through the roof via an eighteen (18) inch circular duct.

SECTION 3.0

Methodology

3.1 GENERAL SAMPLING METHODOLOGY

Sampling methodologies as described in the latest revision of the Florida Department of Environmental Regulation publication Standard Sampling Techniques and Methods of Analysis for the Determination of Air Pollutants from Point Sources and U. S. Environmental Protection Agency Regulations found in 40CFR Part 60 (Standards of Performance for New Stationary Sources) Appendix A, Reference Methods, were used in conducting this test.

The test was conducted using a Lear Siegler Model PM100 Manual Stack Sampler.

Gas stream velocity is measured using a Type S pitot tube. Differential pressures for velocity determinations and in maintaining the proper orifice pressure are measured using a five inch incline manometer. The probe nozzle, filter holder, and pitot tubes are all constructed of type 316 stainless steel.

A Gelman glass fiber filter is supported on a stainless steel filter holder. The sampling nozzel is a conventional button hook design and attached directly to the stainless steel filter holder. A borosilicate glass probe liner is attached to the exit side of the filter holder and the condenser train. The condenser train consists of four impingers connected in series. The first, third, and fourth impingers are of the modified Greenburg-Smith type while the second impinger is of standard design. In all testing situations, the fourth impinger contains a known weight of silica gel (typically 200g). The contents of the first and second impingers depends on the nature of the test being conducted. The third impinger is usually empty. The condenser system is immersed in an ice bath to maintain the gas exit temperature at or below 68°F during all sampling runs. Both the nozzle and filter holder are inserted directly into the stack.

A leak check is performed before and after each run by blocking the nozzle and drawing the appropriate vacuum. All leakages are below 0.02 CFM at a vacuum exceeding the maximum vacuum encountered during the test cycle.

Prior to the first run, a velocity traverse was performed and appropriate calculations were made to determine the most suitable test conditions. The moisture content used for these calculations is based on the results of previous test on the same or similar sources.

At the end of each test run, the volume of water collected in the first, second, and third impingers was measured. Where appropriate, the contents of the impingers is transferred to a container for laboratory analysis. The silica gel desiccant in the fourth impinger is transferred to a tared bottle for transfer to the laboratory. The filter is removed and transferred to a clean petri dish. The nozzle is rinsed with 0.1 N nitric acid or appropriate solution when specified by a particular methodology and the washings saved for further analysis. A fresh filter is installed and the train assembled for the next run.

3.2 SPECIFIC SAMPLING METHODOLOGY

OSI Oven #1 (S/N 146)

Two (2) sampling ports are installed in a 18 inch diameter circular duct. The ports are positioned at 90° angles and are located 1.5 duct diameters from the closest downstream disturbance and greater than 5.0 duct diameters from the closest upstream flow disturbance.

During each test run, 20 points are sampled along two (2) traverses. Each point was sampled for three (3) minutes.

3.3 ANALYTICAL METHODOLOGY

Lead Methodology

The analytical methodology employed is described below.

After the particulate determination described above, the filter and probe wash residue were retained for lead analysis. The volume of the impinger catch was reduced to approximately ten (10) milliliters. The probe wash residue and the particulate filter (cut in strips) and the impinger wash was taken to dryness. The dried residue of each sample was digested with 1:1 nitric acid and 3% hydrogen peroxide. The solutions were filtered and the filtrate diluted to 250 ml. A blank containing 0.1 N nitric acid and a blank filter was treated similarly.

The solutions generated above were analyzed for lead content by atomic absorption spectrophotometry using the Method of Standard Additions. The analysis was performed on an Instrumentation Laboratories Model 251 Atomic Absorption Spectrophotometer at the analytical wavelength for lead (217.0 nm).

3.4 STACK SAMPLING EQUIPMENT DESCRIPTION

a. Nozzle

Stainless steel, type 316, with a 0.490 inch diameter orifice as measure on site with a vernier caliper.

b. Probe

Five (5) foot type 316 stainless steel with a borosilicate glass liner.

c. Thermocouple

Chromel-Alumel K-type

d. Pitot Tube

Five foot type 316 stainless steel Strauschribe type.

e. Sample Collection Assembly

The nozzle is attached directly to the stainless steel filter holder and both are inserted directly into the stack. The exit of the filter holder consists of a borosilicate glass liner which is attached to the first impinger in the condensing train.

f. Lear Siegler Control Unit

This unit contains a diaphragm vacuum pump, dry gas meter, digital pyrometer, temperature controllers, and dual Dwyer Inclined Manometers (five inch).

3.5 LABORATORY PREPARATION

a. Glassware

Washed and dried prior to each stack test.

b. Filters

Oven dried at 105°C to constant weight (four hours minimum) and weighed to the nearest 0.5 mg. Tared filters are stored in a desiccator until used in a test.

c. Silica Gel

Dried at 250°F for two hours and stored in air tight containers until used.

d. Control Unit

Check operation of all systems.

3.6 SAMPLE RECOVER EQUIPMENT

a. Probe Brush

b. Water Wash Bottles

c. Sample Storage Bottles

d. Graduated Cylinder

e. Desiccator

f. Analytical Balances

    1. Mettler EL

    2. Mettler H10w

g. Filters

    Gelman borosilicate glass fiber filters (47 mm diameter)

h. Silica Gel

    Indicating type, 6-16 mesh, dried at 350°F immediately before test.

i. Nitric Acid, ACS, Reagent Grade

j. Water, Deionized

k. Ice

SECTION 4.0

Test Data and Calculations

Source Testing Nomenclature and Dimensions

ACFM	=	Actual ft^3/min
A_n	=	Probe nozzle tip area, ft^2
A_s	=	Area of stack, ft^2
B_{ws}	=	Proportion of water vapor in gas stream by volume, dimensionless
C_p	=	Pitot Coefficient
Delta H	=	Average pressure differential across the orifice meter
I	=	Percent of Isokinetic sampling
M_d	=	Molecular weight of stack gas, dry basis
M_s	=	Molecular weight of stack gas, wet basis
$(\text{Delta p})^{1/2}$	=	Square root of velocity head, inches of H_2O
P_b	=	Barometric pressure, inches of Hg
P_s	=	Absolute stack pressure, inches of Hg
Q_{std}	=	Dry volumetric stack gas flow rate corrected to standard conditions
θ	=	Sampling time, minutes
SCF	=	V_m (standard)
SCFM	=	Q_{std}
T_m	=	Absolute meter temperature
T_s	=	Absolute stack temperature
V_f	=	Final volume of condenser water, ml
V_i	=	Initial volume, if any, of condenser water
V_m	=	Volume of total sample metered under actual conditions, ft^3
V_m(std)	=	Dry gas volume measured by the dry gas meter, corrected to standard conditions (dscf)
V_s	=	Gas stream velocity, ft/sec.

$V_{wc}(std)$ = Volume of water vapor condensed corrected to standard conditions, scf.

Y = Dry gas meter calibration factor

EQUATIONS

Water Vapor Volume of Moisture Condensate

$$V_{wc}(std) = 0.047\ (V_t - V_i)$$

Moisture in Gas Stream

$$B_{ws} = \frac{V_{wc}(std)}{V_{wc}(std) + V_m\ (std)}$$

Wet Molecular Weight of Gas

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

Gas Stream Velocity

$$V_s = 85.49\ (C_p)\ (\text{Delta P})^{1/2}\text{avg}\ \left(\frac{T_s}{P_s M_s}\right)^{1/2}$$

Sample Gas Volume Corrected to Std. Conditions

$$V_m(std) = \frac{17.64\ V_m Y\ (P_b + \text{Delta H}/13.6)}{T_m}$$

% Isokinetic

$$I = 0.09450\ \frac{T_s V_m(std)}{P_s V_s A_n \theta\ (1-B_{ws})}$$

Stack Volumetric Flow Rate (ACFM)

$$ACFM = A_s \times V_s \times 60$$

Stack Volumetric Flow Rate (SCFM) corrected to std. cdts.

$$Q_{sd} = 60\ (1-B_{ws}) V_s A_s\ \left(\frac{528}{T_s}\right)\ \left(\frac{P_s}{29.92}\right)$$

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Phone: (813) 884-8268

TRAVERSE - Point Location and Velocity Data

CLIENT Johnson Controls

BY MCJ DATE 2-4-8

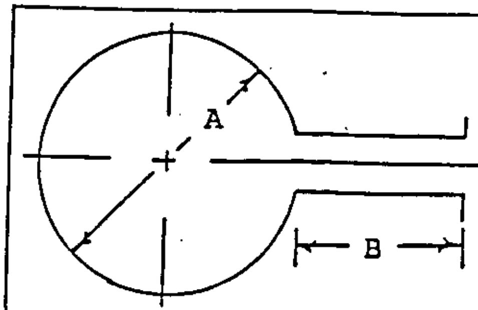
Sampling Location OSI # 1

Stack Diameter (A) 18"

Inside of Near Wall to Outside of Nipple (B) —

Closest Upstream Disturbance >5.0 s.D

Closest Downstream Disturbance 1.5 s.D



Schematic of Sampling Location

West

PT. NO.	% STK DIA	TRAV PT LOC	VEL HEAD ΔP	STACK TEMP	
1	2.6	1/2	0.020	111	
2	8.2	1 1/2	0.025	177	
3	14.6	2 5/8	0.035	210	
4	22.6	4 1/16	0.040	227	
5	34.2	6 1/8	0.045	233	
6	65.8	11 13/16	0.050	242	
7	77.4	13 15/16	0.055	248	
8	85.4	15 3/8	0.055	250	
9	91.8	16 1/2	0.050	242	
10	97.4	17 1/2	0.050	242	
11	2.6	1/2	0.020	137	
12	8.2	1 1/2	0.035	188	
13	14.6	2 5/8	0.045	233	
14	22.6	4 1/16	0.055	239	
15	34.2	6 1/8	0.050	245	
16	65.8	11 13/16	0.055	248	
17	77.4	13 15/16	0.045	250	
18	85.4	15 3/8	0.055	251	
19	91.8	16 1/2	0.045	250	
20	97.4	17 1/2	0.045	250	
			0.044	(224	

North

static @ 0.070

Ave 0.065

static @ 0.060

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PROJECT
SUBJECT Globe Battery
COMPUTED BY MCJ DATE 2-4-88

NOMOGRAPH DATA

PLANT Globe Battery

DATE 2-4-88

SAMPLING LOCATION OSI #1

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.67
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m\,avg.}$	95
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	3
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.92
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	29.92
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.00
AVERAGE STACK TEMPERATURE, °F	$T_{s\,avg.}$	224
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	0.044
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	0.055
C FACTOR	1.00	
CALCULATED NOZZLE DIAMETER, in.	0.483	
ACTUAL NOZZLE DIAMETER, in.	0.490	
REFERENCE Δp, in. H_2O	0.042	

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EPA Method 5 Field Data Sheet

Project Johnson Controls
Sample Location OSI #1
Date 2-4-88 Test 1 Run 1
Operators Jackman, Allen

Train No. ______
C Factor 1.00
ΔP_R 0.042
Nozzle No. S#2276 D_n 0.090

Pitot Tube No. ______ C_p ______
Bar. Pres. ______ Ins. Hg
Static Pres. ______ Ins. H_2O
Estimated MC ______ %

Leak Check:
Pretest: 0.000 @ 15 Ins. Hg
Post-test: 0.000 @ 10 Ins. Hg

Point Number	Time ΔT	Meter Vol. V_m cu. ft.	Velocity Head $-\Delta P$ Ins. H_2O	$\sqrt{\Delta P}$	ORIFACE ΔH		Vacuum Ins. Hg	Stack Temp. °F	Filter	Probe	Imp. Out	M/In	M/Out	Clock Time	
	(300)	(719.897)													
1	3	721.0	0.020	0.14	0.86		0	116			56	100	79	1130	
2	6	723.2	0.030	0.17	1.30		0	193			56	108	77	1133	
3	9	725.1	0.030	0.17	1.30		0	210			57	109	80	1136	
4	12	727.3	0.045	0.21	1.95		2	228			56	111	81	1139	
5	15	729.7	0.050	0.22	2.16		3	232			58	111	82	1142	
6	18	732.2	0.060	0.24	2.60		3	238			58	113	84	1145	
7	21	735.0	0.070	0.26	3.00		5	238			59	114	85	1148	
8	24	737.9	0.070	0.26	3.00		5	238			60	114	86	1151	
9	27	740.6	0.070	0.26	3.00		5	234			61	114	87	1154	
10	30	743.5	0.070	0.26	3.00		5	233			60	114	88	1157	
11	33	745.0	0.015	0.12	0.65		0	166			62	102	92	1209	
12	36	746.9	0.040	0.20	1.85		2	170			55	114	92	1212	
13	39	749.2	0.045	0.21	1.95		2	215			56	118	93	1215	
14	42	751.5	0.045	0.21	1.45		3	230			58	119	94	1218	
15	45	753.9	0.050	0.22	2.16		3	242			59	120	94	1221	
16	48	756.3	0.050	0.22	2.16		3	244			60	120	96	1224	
17	51	758.8	0.055	0.23	2.40		4	243			59	121	97	1227	
18	54	761.4	0.055	0.23	2.40		4	242			60	120	98	1230	
19	57	764.0	0.055	0.23	2.40		4	242			60	120	98	1233	
20	60	766.613	0.055	0.23	2.40		4	240			60	120	98	1236	
														~~1239~~	
				0.21	2.12			220						~~1242~~	

θ = ______ V_m = 46.734 ~~$\overline{\Delta H}$ = 0.2h~~ $\overline{T_s}$ = 220 $\overline{T_m}$ = 102

Samples Recovered: Filter Number ______ ; ☒ Probe Wash ; ☐ Wet Catch ; ☐ ______

Gas Sampling Data:

Box No. ______
Bag No. ______
Bag Vol. ______ Liters

Bag Material ______
Leak Check ______ cc @ 15" Hg
Post Test O_2 Reading ______ %
320 P No. ______

Moisture Recovery Data:

Impinger No.	1	2	3	4	Desiccant	Total
Final Vol.	130	109	0		[illegible]	
Initial Vol.	100	100	1		[illegible]	
Difference	+30	+9	+1		9.4	49

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EPA Method 5 Field Data Sheet

Project Johnson Controls
Sample Location OSI #1
Date 2-4-88 Test 1 Run 2
Operators Jackman, Allen

Train No. ______
C Factor 1.00
ΔP_R 0.042
Nozzle No. ~~#27~~ D_n 0.490

Pitot Tube No. ______ C_p ______
Bar. Pres. ______ Ins. Hg
Static Pres. ______ Ins. H_2O
Estimated MC ______ %

Leak Check:
Pretest: 0.000 @ 15 Ins. Hg
Post-test: 0.000 @ 15 Ins. Hg

Point Number	Time ΔT	Meter Vol. V_m cu. ft.	Velocity Head-ΔP Ins. H_2O	$\sqrt{\Delta P}$	ORIFACE ΔH		Vacuum Ins. Hg	Stack Temp. °F	Filter	Probe	Imp. Out	M/In	M/Out	Clock Time	
	( )	(768.727)													
1	3	770.3	0.020	0.14	0.86		1	151			53	104	94	1336	
2	6	771.8	0.020	0.14	0.86		1	204			53	108	94	1339	
3	9	773.6	0.035	0.19	1.50		4	218			55	112	95	1342	
4	12	772.7	0.040	0.20	1.75		5	233			55	113	95	1345	
5	15	777.8	0.040	0.20	1.75		6	238			55	113	95	1348	
6	18	780.1	0.050	0.22	2.16		7	247			57	111	95	1351	
7	21	782.6	0.060	0.24	2.60		12	249			58	107	94	1354	
8	24	785.1	0.055	0.23	2.40		13	247			60	104	95	1357	
9	27	787.7	0.055	0.23	2.40		14	245			62	103	95	1400	
10	30	790.2	0.055	0.23	2.40		14	244			63	100	95	1403	
		791.8													
11	33	~~0.0200~~	0.020	0.14	0.86		1	179			59	99	94	1412	
12	36	793.6	0.030	0.17	1.30		3	210			60	106	94	1415	
13	39	795.6	0.035	0.19	1.50		4	219			60	108	94	1418	
14	42	797.9	0.045	0.21	1.95		8	237			60	107	94	1421	
15	45	800.3	0.050	0.22	2.16		9	232			62	107	94	1424	
16	48	802.7	0.050	0.22	2.16		10	197			62	107	94	1427	
17	51	805.3	0.055	0.23	2.40		14	140			62	104	94	1430	
18	54	807.8	0.055	0.23	2.40		14	209			63	101	95	1433	
19	57	810.3	0.050	0.22	2.16		14	230			64	100	95	1436	
20	60	812.472	0.050	0.22	2.16		13	232			64	100	95	1439	

θ = ______ V_m = 44.145 $\overline{\Delta H}$ = 0.2c 1.89 T_s = 221 T_m = 100

Samples Recovered: Filter Number ______ ; ☐ Probe Wash ; ☐ Wet Catch ; ☐ ______

Gas Sampling Data:

Box No. ______
Bag No. ______
Bag Vol. ______ Liters

Bag Material ______
Leak Check ______ cc @ 15" Hg
Post Test O_2 Reading ______ %
320 P No. ______

Moisture Recovery Data:

Impinger No.	1	2	3	4	Desiccant	Total
Final Vol.	185	43	1		231.0	
Initial Vol.	100	100	0		220.4	
Difference	85	-57	1		10.2	39

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EPA Method 5 Field Data Sheet

Project Johnson Controls
Sample Location OST #1
Date 2-4-88 Test 1 Run 3
Operators Jackman, Allen

Train No. ______
C Factor 1.00
ΔP_R 0.042
Nozzle No. ______ D_n ______

Pitot Tube No. ______ C_p ______
Bar. Pres. ______ Ins. Hg
Static Pres. ______ Ins. H_2O
Estimated MC ______ %

Leak Check:
Pretest: 0.000 @ 15 Ins. Hg
Post-test: 0.000 @ 10 Ins. Hg

Point Number	Time ΔT	Meter Vol. V_m cu. ft.	Velocity Head - ΔP Ins. H_2O	$\sqrt{\Delta P}$	ORIFACE ΔH		Vacuum Ins. Hg	Stack Temp. °F	Filter	Probe	Imp. Out	M/In	M/Out	Clock Time	
	( )	(814.291)													
1	3	~~0.020~~ 815.9	0.020	0.14 ~~0.86~~	0.86		0	185			64	100	91	1521	
2	6	817.4	0.020	0.14	0.86		0	199			66	107	91	1524	
3	9	819.0	0.030	0.17	1.30		0	220			64	109	92	1527	
4	12	820.9	0.030	0.17	1.30		0	234			64	110	92	1530	
5	15	822.8	0.035	0.19	1.50		0	240			64	111	92	1533	
6	18	825.4	0.060	0.24	2.60		2	245			63	113	92	1536	
7	21	828.1	0.060	0.24	2.60		2	247			64	112	93	1539	
8	24	830.7	0.060	0.24	2.60		2	246			63	114	94	1542	
9	27	833.4	0.060	0.24	2.60		2	245			64	115	94	1545	
10	30	836.1	0.055	0.23	2.40		2	242			63	115	94	1548	
11	33	838.0	0.030	0.17	1.30		0	220			61	109	95	1600	
12	36	840.0	0.035	0.19	1.50		0	234			62	112	95	1603	
13	39	842.3	0.045	0.21	1.95		0	244			62	114	94	1609	
14	42	844.6	0.045	0.21	1.95		0	244			63	116	95	1612	
15	45	847.0	0.050	0.22	2.16		0	244			63	116	96	1615	
16	48	849.4	0.045	0.21	1.95		0	247			64	116	96	1618	
17	51	851.7	0.045	0.21	1.95		0	244			64	115	96	1621	
18	54	854.1	0.045	0.21	1.95		0	241			65	115	96	1624	
19	57	856.5	0.050	0.22	2.16		0	~~196~~ 240			65	115	96	1627	
20	60	858.937	0.050	0.22	2.16		1	237			65	115	97	1630	
				0.19											
					1.88										
θ = ______		V_m= 44.646		ΔH = ~~1.89~~				T_s= 235				T_m= 103			

Samples Recovered: Filter Number ______ ; ☐ Probe Wash ; ☐ Wet Catch ; ☐ ______

Gas Sampling Data:

Box No. ______
Bag No. ______
Bag Vol. ______ Liters

Bag Material ______
Leak Check ______ cc @ 15" Hg
Post Test O_2 Reading ______ %
320 P No. ______

Moisture Recovery Data:

Impinger No.	1	2	3	4	Desiccant	Total
Final Vol.	~~10~~ 124	33	~~4~~ 30	—	263.2	
Initial Vol.	100	100	0		217.9	
Difference	24	-67	30		45.3	32

pace laboratories, inc.

REPORT OF LABORATORY ANALYSIS

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa

Source Test Data Summation

Company Name: Johnson Controls, Inc.
Source Identification: OSI Oven #1 (S/N 146)
Source Test For: Lead
Test Date: February 4, 1988

	RUN NUMBER	1	2	3
V(w)	Volume of moisture collected, ml	4.90E+01	3.90E+01	3.20E+01
T(m)	Average Meter Temperature, °F	102	100	103
V(m)	Actual Sample Volume, cu. ft.	4.6734E+01	4.4145E+01	4.4646E+01
GC	Dry Gas Meter Coefficient	1.03E+00	1.03E+00	1.03E+00
P(b)	Barometric Pressure, inches Hg	30.14	30.14	30.14
P(m)	Pressure across orifice, in Hg	2.12	1.89	1.88
A(s)	Stack Diameter, inches	18.0	18.0	18.0
A(n)	Probe Nozzle Diameter, inches	0.490	0.490	0.490
T(s)	Stack Temperature, ave °F	220	221	235
mg	Weight of Lead, mg	9.9	15.2	13.7
t	Sampling Time, min.	60	60	60
√dP	Velocity Head, √(ave), in. water	0.210	0.200	0.190
P(s)	Stack Pressure, Ave inches Hg	30.15	30.15	30.15

CALCULATIONS

RUN NUMBER	1	2	3
SCF Sampled	4.5907E+01	4.3494E+01	4.3753E+01
Water, %	4.8	4.0	3.3
Gas Molecular Weight	28.44	28.52	28.60
Gas Stream Velocity	1.34E+01	1.28E+01	1.23E+01
ACFM	1.42E+03	1.35E+03	1.30E+03
SCFM	1.06E+03	1.02E+03	9.61E+02
Isokinetic, %	97	96	102
Emissions, gr/dscf	3.33E-03	5.39E-03	4.83E-03
Emissions, lb/hr	3.02E-02	4.69E-02	3.98E-02

SECTION 5.0

Opacity

pace laboratories, inc

State of Florida Visible Emissions Observation Form

COMPLIANCE STATUS: YES | NO | UN

Source/Process Information

FACILITY NAME: Johnson Controls

SOURCE NAME: OSI #1 — PERMIT NO:

LOCATION/ADDRESS: 10215 N 30th St Tpa

CONTACT: Bill Scott — PHONE NO: 971-1085

PROCESS/PRODUCTION RATE:

CONTROL EQUIPMENT: — OPERATING MODE:

FUEL TYPE/RATE: — MATERIAL TYPE/RATE: — PERMITTED RATE:

DESCRIBE EMISSION POINT: Open end Stack

HEIGHT ABOVE GROUND LEVEL: 45 FT — HEIGHT RELATIVE TO OBSERVER: 20 FT

Emissions Description

DESCRIBE EMISSIONS: START None — END None

PLUME COLOR: — — PLUME TYPE: —

WATER DROPLETS PRESENT? YES ☐ NO ☒ — IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐

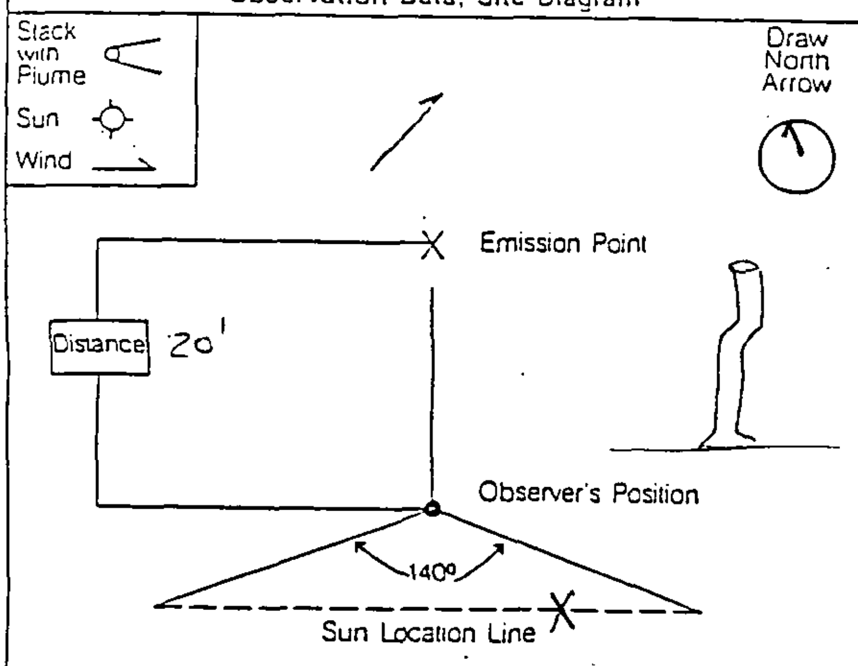
Meteorological Information

BACKGROUND: START Sky — END Sky + Clouds — BACKGROUND COLOR: START Blue — END Blue + white

SKY CONDITIONS/% CLOUD COVER: START 5 — END 20 — AMBIENT TEMP: START 72 — END 72

WIND SPEED: START 5-10 — END 5-10 — WIND DIRECTION: START SW — END SW

Observation Data, Site Diagram



Opacity Readings

OBSERVATION DATE: 2-4-88 — START TIME: 11/27/1209 — STOP TIME: 1157/1239

MIN	0	15	30	45	MIN	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

Compliance Information

RANGE OF OPACITY READINGS: MIN 0 — MAX 0

AVERAGE OF HIGHEST 24 CONSECUTIVE READINGS: 0

SHORT TERM AVERAGE DATA

AVERAGING PERIOD ________ MINUTES — ACTUAL AVERAGE ________ %

COMMENTS:

Certification Data, Signatures

OBSERVERS NAME: Michael F. Valder

OBSERVERS SIGNATURE: Michael F. Valder — DATE:

ORGANIZATION: Pace laboratories Inc

CERTIFIED BY: Eastern Technical Assoc — DATE:

I HAVE RECEIVED A COPY OF THESE OBSERVATIONS — SIGNATURE: — DATE:

APIS NUMBER:

APPENDIX A

Calibration Data

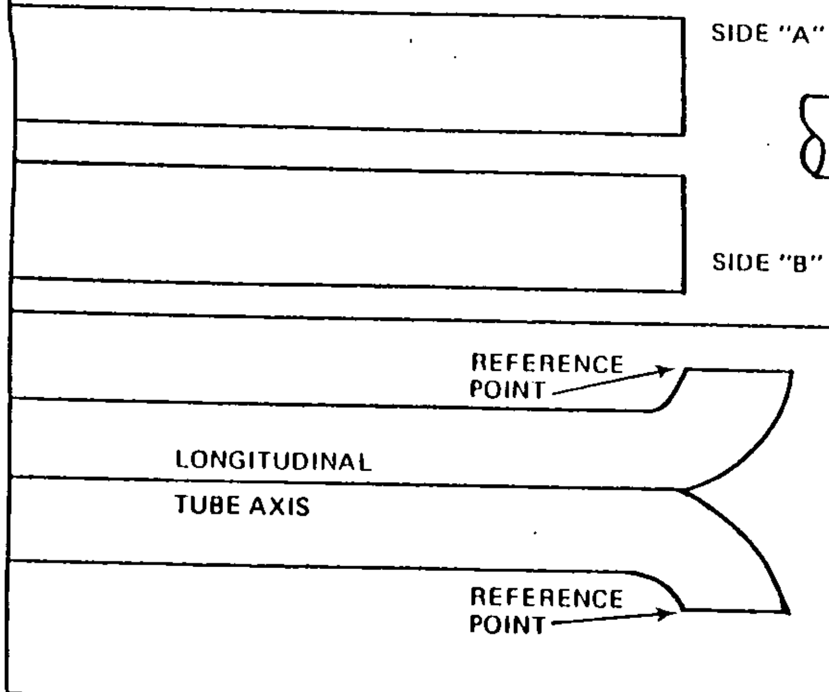
SUMMARY OF SAMPLING EQUIPMENT CALIBRATION

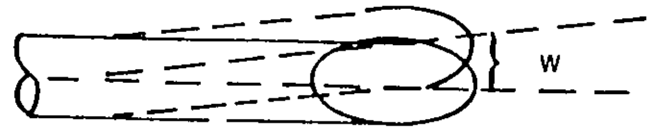
Equipment Calibration	Date of Calibration	Place of Calibration	Method of Calibration	Calibration Date
Nozzle	2/4/88	On Site	Vernier Caliper Ave.	See Following
Pitot Tube	2/3/88	PACE	FDER Alt. Method	$C_p = 0.84$
Dry Gas Meter and Orifice	3/1/88	PACE	Wet Test Meter JU	MCF = 1.033
Barometer	----	Tampa Airport	----------	@ 12 noon
Thermocouples	1/88	PACE	Calibrated at ambient and boiling water temperatures against ASTM mercury bulb thermometer	± 5°F
Nomograph Accuracy	1/88	PACE	EPA Pub. "Adjustments in the EPA Nomograph for different Pitot Tube Coeff. and Dry Molecular Weights	± 10%

NOZZLE DIAMETER CALIBRATION DATA

Client: Johnson Controls, Inc.
Source I.D.: OSI Oven #1
Test Date: February 4, 1988
Computed By: Michael C. Jackman

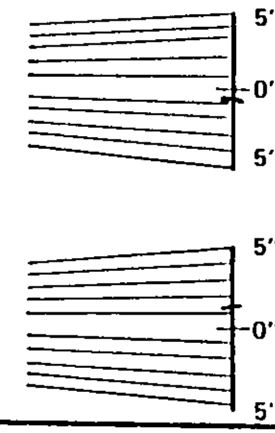
DATE	Nozzle Diameter						
	1	2	3	4	5	6	Average
2/4/88	0.490	0.491	0.491	0.489	0.490	0.490	0.490





W = <u><0.05</u> cm

W < 0.08cm

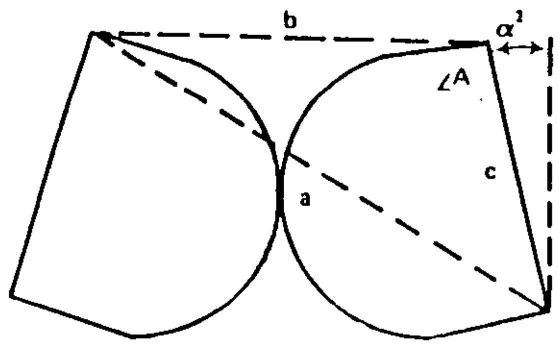


β^1 <u>0.7</u> o

$\beta^1 < 5''$

β^1 <u>1.3</u> o

SIDE "A"



a = <u>1.125</u> cm

b = <u>1.075</u> cm

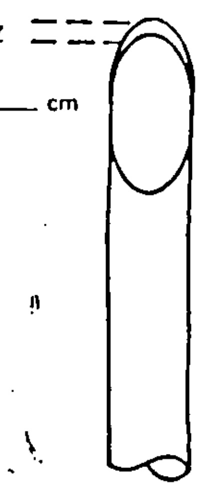
c = <u>0.460</u> cm

∠A = <u>84</u> o

$\alpha^2 = 180^o - (180^o - \angle A) + 90^o$

α^2 = <u>−6</u> o

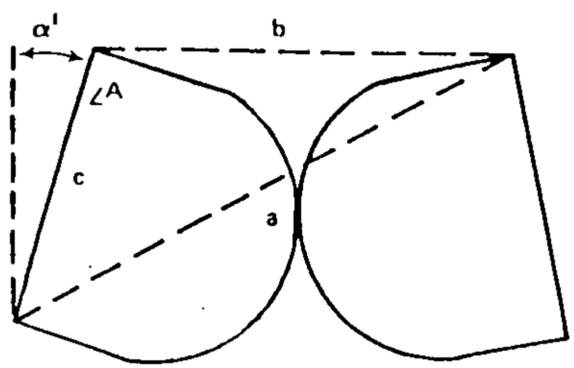
$\alpha^2 < 10^o$



Z = ______ cm

Z < 0.32cm

SIDE "B"



a = <u>1.135</u> cm

b = <u>1.075</u> cm

c = <u>0.490</u> cm

∠A = <u>84.1</u> o

$\alpha^1 = 180^o - (180^o - \angle A) + 90^o$

α^1 = <u>−5.9</u> o

$\alpha^2 < 10^o$

SOURCE SAMPLING PITOT TUBE CALIBRATION
ALIGNMENT MEASUREMENT OF FACE-OPENINGS

DATE: 2/3/88
S/N: 5' pitot tube

pace laboratories, inc.

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa

REPORT OF LABORATORY ANALYSIS

DRY GAS METER AND ORIFICE CALIBRATION

Calibration Date: February 3, 1988
Calibrated by: Michael Jackman

Barometric Pressure: 30.24 in Hg
Calibration Time: 15 min

WET TEST METER					DRY GAS METER							CALIBRATION	
Initial Vol	Final Vol	Vw	dW	Tw °F	Initial Vol	Final Vol	Vm	dH	T in	T out	Tm ave	MCF	dH@
0.000	6.305	6.305	0.20	73.7	631.851	637.939	6.088	0.50	101	77	89.0	1.057	1.574
0.000	7.575	7.575	0.20	73.5	637.939	645.308	7.369	0.75	103	78	90.5	1.052	1.631
0.000	8.654	8.654	0.25	73.0	645.308	653.773	8.465	1.00	107	80	93.5	1.050	1.657
0.000	10.341	10.341	0.30	73.0	668.941	679.254	10.313	1.50	110	82	96.0	1.032	1.734
0.000	11.966	11.966	0.30	73.0	679.254	691.120	11.866	2.00	110	82	96.0	1.036	1.727
0.000	13.143	13.143	0.40	73.0	691.120	704.124	13.004	2.50	110	83	96.5	1.035	1.786
0.000	14.334	14.334	0.40	72.5	704.124	718.433	14.309	3.00	111	84	97.5	1.027	1.795
											AVERAGE	1.041	1.700

dH	= Orifice Pressure	inches water
dW	= Pressure (-) at Wet Test Meter	inches Hg
Vm	= Gas Volume, Dry Gas Meter	cubic feet
Vw	= Gas Volume, Wet Test Meter	cubic feet
Tw	= Temperature, Wet Test Meter	°F
Tm	= Temperature, Dry Gas Meter	°F
t	= Calibration Time	minutes
MCF	= Meter Correction Factor	
dH@	= Standard Orifice Pressure Differential 0.75 CFM dry air @70°F, 29.92 inches Hg	

MCF = [Vw*(Tm+460)*(Pb-dW)]/[Vm*(Tw+460)*(Pb+dH/13.6)]

dH@ = [(0.0317*dH/(Pb*(Tmout+460))] [(Tw+460)*t/Vw]^2

5460 Beaumont Center Blvd. □ Tampa, Florida 33634 □ (813) 884-8268

pace laboratories, inc.

REPORT OF LABORATORY ANALYSIS

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa

DRY GAS METER AND ORIFICE CALIBRATION

Calibration Date: March 1, 1988
Calibrated by: Michael Jackman

Barometric Pressure: 30.18 in Hg
Calibration Time: 15 min

WET TEST METER					DRY GAS METER							CALIBRATION	
Initial Vol	Final Vol	Vw	dW	Tw °F	Initial Vol	Final Vol	Vm	dH	T in	T out	Tm ave	MCF	dH@
0.000	6.192	6.192	0.30	71.3	722.278	728.281	6.003	0.50	97	71	84.0	1.044	1.638
0.000	7.598	7.598	0.35	71.3	728.281	735.697	7.416	0.75	101	76	88.5	1.044	1.617
0.000	8.509	8.509	0.40	71.2	735.697	744.072	8.375	1.00	104	76	90.0	1.035	1.718
0.000	10.209	10.209	0.40	71.3	744.072	754.207	10.135	1.50	106	77	91.5	1.028	1.788
0.000	11.715	11.715	0.45	71.3	754.207	765.845	11.638	2.00	108	79	93.5	1.028	1.804
0.000	13.221	13.221	0.50	71.5	780.303	793.252	12.949	2.50	99	75	87.0	1.027	1.785
0.000	14.354	14.354	0.50	71.5	807.505	821.799	14.294	3.00	110	79	94.5	1.023	1.803
											AVERAGE	1.033	1.736

dH = Orifice Pressure — inches water
dW = Pressure (-) at Wet Test Meter — inches Hg
Vm = Gas Volume, Dry Gas Meter — cubic feet
Vw = Gas Volume, Wet Test Meter — cubic feet
Tw = Temperature, Wet Test Meter — °F
Tm = Temperature, Dry Gas Meter — °F
t = Calibration Time — minutes
MCF = Meter Correction Factor
dH@ = Standard Orifice Pressure Differential
0.75 CFM dry air @70°F, 29.92 inches Hg

MCF = [Vw*(Tm+460)*(Pb-dW)]/[Vm*(Tw+460)*(Pb+dH/13.6)]

dH@ = [(0.0317*dH/(Pb*(Tmout+460))] [(Tw+460)*t/Vw] ^2

APPENDIX B

Process Weight Statement

STATEMENT OF PROCESS WEIGHT

COMPANY NAME Johnson Controls, Inc., Globe Battery Division

ADDRESS P. O. Box 16068, Tampa, Florida 33687

SOURCE IDENTIFICATION OSI Oven #1 (S/N 146)

SOURCE LOCATION 10215 North 30th Street, Tampa, Florida

DATE 2/4/88 SAMPLING TIME: 1130 TO: 1645

DATA ON OPERATING CYCLE TIME;

START OF OPERATION, TIME ______

END OF OPERATION, TIME ______

ELAPSED TIME ______

IDLE TIME DURING CYCLE ______

DESIGN PROCESS RATING;

PROCESS WEIGHT RATE (INPUT) ______ PRODUCT (OUTPUT) ______

DATA ON ACTUAL PROCESS RATE DURING OPERATION CYCLE;

MATERIAL Lead Oxide RATE 2593 lbs/hr

MATERIAL Cast Lead RATE 2122 lbs/hr

MATERIAL ______ RATE ______

TOTAL PROCESS WEIGHT RATE;

PRODUCT Dried Panels RATE 4219 lbs/hr

I certify that the above statement is true to the best of my knowledge and belief.

Signature William Scott

Title Managing Engineer