ARCO OIL and GAS COMPANY

BAYOU SALE FIELD

ST. MARY PARISH, LOUISIANA

OXIDES OF NITROGEN and CARBON MONOXIDE

5A COMPRESSOR

OCTOBER 6, 1987

Submitted By :

EMISSION TESTING SERVICES, INC.

POST OFFICE BOX 15075

BATON ROUGE, LOUISIANA 70895

87037

EMISSION TESTING SERVICES, INC.

POST OFFICE BOX 15075

BATON ROUGE, LOUISIANA 70895

CONFIRMATION OF INFORMATION

EMISSION TEST REPORT

FOR

ARCO OIL and GAS COMPANY

BAYOU SALE FIELD

ST. MARY PARISH, LOUISIANA

OXIDES OF NITROGEN and CARBON MONOXIDE

5A COMPRESSOR

OCTOBER 6, 1987

I certify that I have personally examined and am familiar with the information submitted herein, and based on my inquiries of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete.

Brad Latham

B. Latham
Project Leader

Barry Gipson

Barry Gipson
Manager

OXIDES OF NITROGEN and CARBON MONOXIDE

EMISSIONS TESTING

5A COMPRESSOR

for

ARCO OIL and GAS COMPANY

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I. INTRODUCTION

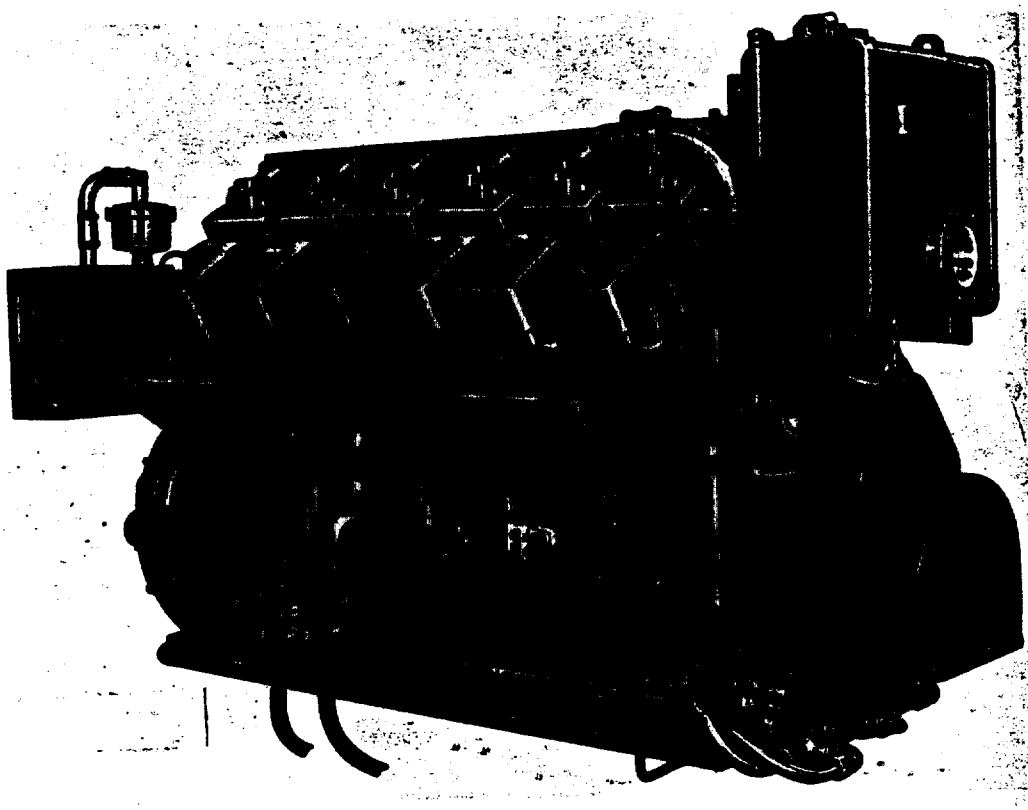
Emission Testing Services, Inc. was contracted by Arco Oil and Gas Company to perform emissions testing on the 5A Compressor located at the Bayou Sale Field gas compression station near Franklin, Louisiana. Testing was conducted for oxides of nitrogen and carbon monoxide emissions in order to demonstrate compliance with Louisiana Department of Environmental Quality permit number 2660-00053-00. The 5A Compressor is permitted as source number 13.

The 5A Compressor is a Waukesha model 7042 rated at 1100 horsepower, natural gas fired, and is used to boost gas pressures in the pipeline. Two Clark R4-A engines at the site have been replaced with the new 5A Compressor. A source description and diagram follows at the end of this section.

Oxides of nitrogen testing was done by EPA Method 20 as modified by proposed Subpart FF, "Standards of Performance for Stationary Internal Combustion Engines". Carbon Monoxide testing was by EPA Method 10 and EPA Methods 1-4 were used to determine the number of traverse points, stack gas velocity, molecular weight and moisture. EPA methodology is found in Title 40, Part 60, Appendix A of the Code of Federal Regulations.

Testing was conducted on October 6, 1987 by the testing team consisting of Barry Gipson, Brad Latham, and Kevin Thibodoux. Barry Gipson was responsible for testing of oxides of nitrogen and carbon monoxide. Brad Latham was responsible for determining stack gas moisture, molecular weight and velocity.

Three test runs were completed at different compressor load conditions. The 5A Compressor operated at 58 pounds suction during Run 1, 50 pounds suction during Run 2, and 44 pounds suction during Run 3. Compressor operating data were recorded during the test.

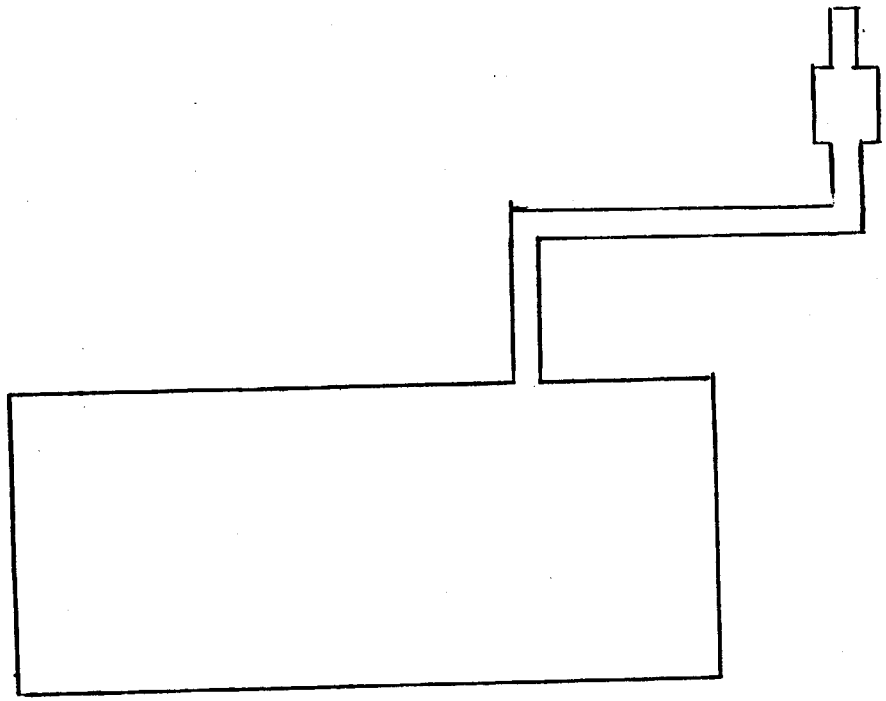


L5790G illustrated

L5108G - L5790G - L7042G SERIES NATURAL OR LIQUIFIED PETROLEUM (LPG) GAS FUEL ENGINES

ENGINE MODEL SERIES		L5108G	L5790G	L7042G
Displacement	cu. in. liters	5108 83,7	5788 94,9	7040 115,4
Bore	inches mm	8-1/2 216	8-1/2 216	9-3/8 238
Stroke	inches mm	7-1/2 191	8-1/2 216	8-1/2 216
Speed Range	rpm	400-1200 (nat. asp.); 600-1200 (turbo)		
Maximum Continuous Horsepower - Turbocharged 85° Intercooler Water In		1122 @ 1200 rpm	1272 @ 1200 rpm	1547 @ 1200 rpm
Normal Oil Pressure	psi	45 ± 5	45 ± 5	45 ± 5
Normal Oil Temperature	°F °C	185 88	185° 88°	185° 88°
Normal Coolant Temperature	°F °C	180 85	180° 85°	180° 85°
Standard Spark Plug		Waukesha 69512 - Gap .015		

BAYOU SALE 5A COMPRESSOR
BAYOU SALE FIELD- St. MARY PARISH, La.



WAUKESHA MODEL 7042
SERIAL No. 366534

Stack Test proformed to comply with State Permit No. 2660-00053-00

NOT TO SCALE

P.O. BOX 337
FRANKLIN, LA. 70538

II. SUMMARY

Results of the emissions testing on October 6, 1987 are tabulated below. Oxides of nitrogen data are reported corrected as required in proposed Subpart FF. A copy of the Louisiana Department of Environmental Quality permit number 2660-00053-00 follows at the end of this section.

5A COMPRESSOR

PARAMETER	EMISSION RATES lb/ Hr RUN 1	RUN 2	RUN 3	PERMITTED
CARBON MONOXIDE	1.574	1.249	1.171	3.4
OXIDES OF NITROGEN	72.494	48.362	42.840	26.4
% OXYGEN CONCENTRATION	3.11	2.97	2.50	
COMPRESSOR SUCTION (lb)	58	50	44	
ENGINE SPEED - RPM	910	910	910	
ENGINE TIMING	24.0	24.0	24.0	

PHYSICAL DATA ON STACK GAS

RUN NO.	TEMPERATURE DEG. R	MOISTURE %	VELOCITY ft/ sec	VOLUMETRIC FLOW DSCFM
1	1408	5.36	120.78	2113.1
2	1414	16.67	109.68	1684.9
3	1414	18.41	104.82	1574.0

MARTHA A. MADDEN
SECRETARY

OFFICE OF AIR QUALITY AND NUCLEAR ENERGY

GUSTAVE A. VON BODUNGEN
ASSISTANT SECRETARY

March 20, 1987

CERTIFIED - P 575 632 583

Mr. J. T. Siblo
EST Coordinator
ARCO Oil and Gas Company
Southeastern District
Post Office Box 51408, Oil Center Station
Lafayette, Louisiana 70505

Dear Mr. Siblo:

RE: Permit for the Bayou Sale Production Facility, Franklin, St. Mary Parish, Louisiana.

This is to inform you that the permit request for the above referenced project has been approved under Section 6.1 of the Louisiana Air Quality Regulations. The submittal was approved on the basis of the emissions reported and the approval in no way guarantees the design scheme presented will be capable of controlling the emissions as to the types and quantities stated. A new application must be submitted if the reported emissions are exceeded after operation begins. The synopsis, data sheets and conditions are attached herewith.

It will be considered a violation of the permit if all proposed control measures and/or equipment are not installed and properly operated and maintained as specified in the application. This permit is subject to the attached specific conditions and emission limitations.

The permit number cited below should be referenced in future correspondence regarding this subject.

Done this 23rd day of March, 1987.

Permit No.: 2660-00053-00

Very truly yours,

Gustave Von Bodungen

Gustave A. Von Bodungen
Assistant Secretary

GVB/LD/bpw
cc: Acadian Regional Office

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
BRIEFING SHEET

ARCO OIL AND GAS COMPANY
BAYOU SALE PRODUCTION FACILITY
FRANKLIN, ST. MARY PARISH, LOUISIANA

I. BACKGROUND:

The ARCO Oil and Gas Company, a division of Atlantic Richfield Company, owns and operates a gas compression facility, Bayou Sale Production, near Franklin, Louisiana. Since all compressors were in operation prior to 1969, this site has no air permit at present.

II. ORIGIN:

ARCO submitted an application and an Emissions Inventory Questionnaire on February 20, 1987, to replace two 400 HP compressors with an 1100 HP unit. A variance for construction was approved February 24, 1987.

Documentation of the actual emissions from the two units to be dismantled for 1985 and 1986 was received February 26, 1987.

III. DESCRIPTION:

The Bayou Sale site has operated with twelve, natural gas fueled, engine driven compressors to boost pipeline gas up to required pressure. ARCO proposes to replace two existing Clark RA-4 engines (400 HP each) with one Waukesha 7042 (1100 HP).

In order to minimize the emissions of NO_x and CO from the new unit, an air/fuel ratio monitor will be installed. The change in emissions from the facility is shown in the following summary:

EMISSION SUMMARY
TONS PER YEAR

	Permitted Emissions Before	Increase From One *New Engine	Decrease From Two **Old Engines	Permitted Emissions After	Net Increase
PM	Neg.	Neg.	Neg.	Neg.	-
SO_2	0.1	Neg.	Neg.	0.1	-
NO_x	648.9	+115.6	-84.1	680.4	+31.5
CO	83.8	+14.9	-10.9	87.8	+4.0
HC	262.2	+46.7	-34.0	274.9	+12.7

* Source I.D. No. 13
**Source I.D. Nos. 01 and 02

Fuel usage in 1985 substantiates that the actual NO_x emissions were qualified contemporaneous reductions, keeping the net NO_x increase below the PSD significance value of 40 tons per year.

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
BRIEFING SHEET

ARCO OIL AND GAS COMPANY
BAYOU SALE PRODUCTION FACILITY
FRANKLIN, ST. MARY PARISH, LOUISIANA
(CONTINUED)

IV. TYPE OF REVIEW:

This is a minor modification to a major source and was reviewed for compliance with the Louisiana Air Quality Regulations. PSD, NSPS and LESHAP regulations do not apply.

V. RECOMMENDATION:

Approval is recommended subject to the attached general and specific conditions.

VI. PUBLIC NOTICE:

Public notice is not required for minor modifications.

SPECIFIC CONDITIONS

ARCO OIL AND GAS COMPANY
BAYOU SALE PRODUCTION FACILITY
FRANKLIN, ST. MARY PARISH, LOUISIANA

1. The permittee shall burn only sweet natural gas.

2. An air/fuel ratio monitor shall be installed and used to set the carburation of the new engine, Source I.D. No. 13, for operation at stoichiometric conditions. This monitor shall be maintained and calibrated as recommended by the vendor. Monitor performance shall be checked at least once a week.

3. The permittee shall maintain the correct air/fuel ratio as determined by the monitor required in Specific Condition No. 2. Compliance shall be recorded at least once daily on the operator log sheet. These records shall comply with the general conditions of this permit. Noncompliance with the provisions of this specific condition shall be defined as any 24 hour period during which Source I.D. No. 13 operates outside of the optimum air/fuel ratio range.

4. Compliance with the NO_x emission limit of the permit for Source I.D. No. 13 shall be determined by Method 20, "Determination of Nitrogen Oxides from Stationary Gas Turbines", 40 CFR 60, Appendix A, as modified by the proposed "Standards of Performance for Stationary Internal Combustion Engines", 40 CFR 60, Subpart FF.

5. The permittee shall permanently shutdown and dismantle the two Clark RA-4 gas engines, Source I.D. Nos. 01 and 02, before the new gas engine, Source I.D. No. 13, begins operation.

6. The permittee shall comply with all applicable provisions of "Standards of Performance for Stationary Internal Combustion Engines", 40 CFR 60, Subpart FF, if promulgated.

LOUISIANA AIR EMISSION PERMIT
GENERAL CONDITIONS

I. This permit is issued on the basis of the emissions reported in the application for approval of emissions and in no way guarantees that the design scheme presented will be capable of controlling the emissions to the type and quantities stated. Failure to install, properly operate and/or maintain all proposed control measures and/or equipment as specified in the application and supplemental information shall be considered a violation of the permit and regulation 6.0. If the emissions are determined to be greater than those allowed by the permit or if proposed control measures and/or equipment are not installed or do not perform according to design efficiency, an application to modify the permit must be submitted.

II. The permittee is subject to all applicable provisions of the Louisiana Air Quality Regulations. Violation of the terms and conditions of the permit constitutes a violation of these regulations.

III. The permit application and the attached data sheets establish the emission and operating limitations and are a part of the permit. The synopsis and data sheets are based on the application and emissions inventory questionnaire dated February 20, 1987.

IV. This permit shall become invalid, for the sources not constructed, if:

(a) construction is not commenced, or binding agreements or contractural obligations to undertake a program of construction of the project are not entered into, within two (2) years (18 months for PSD permits) after issuance of this permit, or;

(b) if construction is discontinued for a period of two (2) years (18 months for PSD permits) or more.

The administrative authority may extend this time period upon a satisfactory showing that an extension is justified.

This provision does not apply to the time period between construction of the approved phases of a phased construction project. However, each phase must commence construction within two (2) years (18 months for PSD permits) of its projected and approved commencement date.

V. The permittee shall submit semi-annual reports of progress outlining the status of construction, noting any design changes, modifications or alterations in the construction schedule which have or may have an effect on the emission rates or ambient air quality levels. These reports shall continue to be submitted until such time as construction is certified as being complete. Furthermore, for any significant change in the design, prior approval shall be obtained from the Louisiana Air Quality Division.

LOUISIANA AIR EMISSION PERMIT
GENERAL CONDITIONS

VI. The permittee shall notify the Department of Environmental Quality, Air Quality Division within ten (10) calendar days from the date that construction is certified as complete and the estimated date of start-up of operation. The appropriate Regional Office shall also be so notified within the same time frame.

VII. Any emissions testing performed for purposes of demonstrating compliance with the limitations set forth in paragraph III shall be conducted in accordance with the methods described in the Division's test manual or any other methods approved by the U.S. EPA. Any deviation from or modification of the methods used for testing shall have prior approval from the Louisiana Air Quality Division.

VIII. The emission testing described in paragraph VII above, or established in the specific conditions of this permit, shall be conducted within sixty (60) days after achieving normal production rate, but in no event later than 180 days after initial start-up (or restart-up after modification). The Air Quality Division Surveillance Section shall be notified at least thirty (30) days prior to testing and shall be given the opportunity to conduct a pretest meeting and observe the emission testing. The test results shall be submitted to the Air Quality Division within forty-five (45) days after the complete testing. As required by Section 8.7 and 17.5 of the Louisiana Air Quality Regulations, the permittee shall provide necessary sampling ports in stacks or ducts and such other safe and proper sampling and testing facilities for proper determination of the emission limits.

IX. The permittee shall, within 180 days after start-up of each project or unit, report to the Louisiana Air Quality Division any significant difference in operating emission rates as compared to those limitations specified in paragraph III. This report shall also include, but not be limited to, malfunctions and upsets.

X. The permittee shall retain records of all information resulting from monitoring activities and information indicating operating parameters as specified in the specific conditions of this permit for a minimum of at least two (2) years.

XI. If for any reason the permittee does not comply with, or will not be able to comply with, the emission limitations specified in this permit, the permittee shall provide the Air Quality Division with the following information in writing within five (5) days of such conditions:

a. Description of noncomplying emission(s);
b. Cause of noncompliance;
c. Anticipated time the noncompliance is expected to continue, or, if corrected, the duration of the period of noncompliance;
d. Steps taken by the permittee to reduce and eliminate the noncomplying emissions; and
e. Steps taken by the permittee to prevent recurrences of the noncomplying emissions.

LOUISIANA AIR EMISSION PERMIT
GENERAL CONDITIONS

XII. Permittee shall allow the authorized officers and employees of the Department of Environmental Quality, at all reasonable times and upon presentation of identification, to:

1) Enter upon the permittee's premises where regulated facilities are located, regulated activities are conducted or where records required under this permit are kept;

2) Have access to and copy any records that are required to be kept under the terms and conditions of this permit, the Louisiana Air Quality Regulations, or the Act;

3) Inspect any facilities, equipment (including monitoring methods and an operation and maintenance inspection), or operations regulated under this permit; and,

4) Sample or monitor, for the purpose of assuring compliance with this permit or as otherwise authorized by the Act or regulations adopted thereunder, any substances or parameters at any location.

XIII. If samples are taken under Section XII. 4) above, the officer or employee obtaining such samples shall give the owner, operator or agent in charge a receipt describing the sample obtained. If requested prior to leaving the premises, a portion of each sample equal in volume or weight to the portion retained shall be given to the owner, operator or agent in charge. If an analysis is made of such samples, a copy of the analysis shall be furnished promptly to the owner, operator or agent in charge.

XIV. The permittee shall allow authorized officers and employees of the Department of Environmental Quality, upon presentation of identification, to enter upon the permittee's premises to investigate potential or alleged violations of the Act or the rules and regulations adopted thereunder. In such investigations, the permittee shall be notified at the time entrance is requested of the nature of the suspected violation. Inspections under this subsection shall be limited to the aspects of alleged violations. However, this shall not in any way preclude prosecution of all violations found.

XV. The permittee shall comply with the reporting requirements specified under Section 17.13 as well as notification requirements specified under Section 17.11 of the Louisiana Air Quality Regulations.

XVI. In the event of any change in ownership of the source described in this permit, the permittee and the succeeding owner shall notify the Louisiana Air Quality Division, within ninety (90) days after the event, to amend this permit.

AIR QUALITY DATA SHEET
PAGE 1

ARCO OIL AND GAS COMPANY
BAYOU SALE PRODUCTION FACILITY
FRANKLIN, ST. MARY PARISH, LOUISIANA

Location of plant: 15 UTM: 642.7 Km E 3275.4 Km N

Description of location: Off Highway 317 near Franklin in St. Mary Parish.

Estimated starting date of construction: February 25, 1987

Estimated date operation will begin: March 16, 1987

Type of Dispersion Calculations Used: N/A

EFFECTS ON AMBIENT AIR

Pollutant	Time Period	Calculated Maximum Ground Level Concentration	Louisiana Air Quality Standard

NEW ____ OR MODIFIED X EMISSION SOURCES

Gas Compression Facility
(Type of Source)

Stack I.D.#	Description	Operating Rate (Maximum) Annual	Operating Schedule Hrs/Day	Days/Wk	Wks/Yr
03	Gas Engine (529 HP)	21 mmscf/yr	24	7	52
04	Gas Engine (529 HP)	20 mmscf/yr	24	7	52
05	Gas Engine (608 HP)	34 mmscf/yr	24	7	52
06	Gas Engine (495 HP)	29 mmscf/yr	24	7	52
07	Gas Engine (725 HP)	24 mmscf/yr	24	7	52
08	Gas Engine (369 HP)	17 mmscf/yr	24	7	52
09	Gas Engine (1135 HP)	69 mmscf/yr	24	7	52

AIR QUALITY DATA SHEET
PAGE 1 (CONTINUED)

ARCO OIL AND GAS COMPANY
BAYOU SALE PRODUCTION FACILITY
FRANKLIN, ST. MARY PARISH, LOUISIANA

Stack I.D.#	Description	Operating Rate (Maximum) Annual	Operating Schedule Hrs/Day	Days/Wk	Wks/Yr
10	Gas Engine (250 HP)	12 mmscf/yr	24	7	52
11	Gas Engine (520 HP)	38 mmscf/yr	24	7	52
12	Gas Engine (175 HP)	13 mmscf/yr	24	7	52
13	Gas Engine (1100 HP)	70 mmscf/yr	24	7	52

AIR QUALITY DATA SHEET - PAGE 2

ARCO OIL AND GAS COMPANY
BAYOU SALE PRODUCTION FACILITY
FRANKLIN, ST. MARY PARISH, LOUISIANA

MAXIMUM/AVERAGE EMISSIONS ARE LISTED USING THE UNITS LBS/HR

STACK ID	PERMITTED EMISSIONS TSP	SO_2	NO_X	HC	CO	FEET HEIGHT	°F TEMP.	CFM FLOW RATE
03	Neg.	.002/.002	13.2/13.2	5.3/5.3	1.7/1.7	20	1070	2326
04	Neg.	.002/.002	13.2/13.2	5.3/5.3	1.7/1.7	20	1070	2326
05	Neg.	.002/.002	14.6/14.6	5.9/5.9	1.9/1.9	20	980	2784
06	Neg.	.002/.002	11.9/11.9	4.8/4.8	1.5/1.5	15	1100	2595
07	Neg.	.003/.003	17.4/17.4	7.0/7.0	2.2/2.2	20	1050	2326
08	Neg.	.001/.001	8.9/8.9	3.6/3.6	1.1/1.1	14	1103	1945
09	Neg.	0.005/0.005	27.2/27.2	11.0/11.0	3.5/3.5	20	1076	5243
10	Neg.	0.001/0.001	6.0/6.0	2.4/2.4	0.8/0.8	25	700	2326
11	Neg.	0.002/0.002	12.5/12.5	5.0/5.0	1.6/1.6	17	1000	1945
12	Neg.	0.001/0.001	4.2/4.2	1.7/1.7	0.5/0.5	11.5	700	2326
13	Neg.	0.004/0.004	26.4/26.4	10.7/10.7	3.4/3.4	20	1076	5243

AIR QUALITY DATA SHEET
PAGE 3

ARCO OIL AND GAS COMPANY
BAYOU SALE PRODUCTION FACILITY
FRANKLIN, ST. MARY PARISH, LOUISIANA

	TONS PER YEAR					
STACK I.D.	TSP	SO_2	NO_x	HC	CO	OTHER
03	Neg.	0.009	57.6	23.3	7.4	-
04	Neg.	0.009	57.6	23.3	7.4	-
05	Neg.	0.010	63.9	25.8	8.3	-
06	Neg.	0.009	52.0	21.0	6.7	-
07	Neg.	0.013	76.2	30.8	9.8	-
08	Neg.	0.006	38.8	15.7	5.1	-
09	Neg.	0.020	119.3	48.2	15.4	-
10	Neg.	0.004	26.3	10.6	3.4	-
11	Neg.	0.009	54.7	22.1	7.1	-
12	Neg.	0.003	18.4	7.4	2.4	-
13	Neg.	0.019	115.6	46.7	14.9	-
TOTAL	Neg.	0.11	680.4	274.9	87.9	-

III. PROCEDURE

Reference Methods 1 - 4 were followed to establish traverse points, stack gas velocity, dry gas molecular weight and moisture content of the gas stream. Method 20 was used to determine oxides of nitrogen and oxygen concentration, and method 10 was used to determine carbon monoxide concentration. A brief description of each method used follows.

METHOD 1: SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

Sampling and velocity measurements were performed at a point meeting the "8 and 2" requirement.

METHOD 2: DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

The average gas velocity in the stack was determined from the gas molecular weight, moisture content and the measurement of the average velocity head with a type "S" pitot tube. Dry volumetric flow rate was determined from the velocity and stack diameter.

METHOD 3: GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

The dry molecular weight of the stack gas was determined using an Orsat analyzer. The Orsat measures the concentration of oxygen, carbon monoxide and carbon dioxide. The remaining gas components are assumed to be nitrogen.

METHOD 4: DETERMINATION OF MOISTURE CONTENT IN STACK GASES

A gas sample was extracted from the stack using a heated glass probe fitted with a particulate filter. The sample gas then passed through a series of four impingers immersed in an ice bath. The first two impingers contained measured volumes of water, the third was empty, and the fourth contained a known weight of silica gel. Any water vapor in the gas stream was condensed and trapped in the impingers. Moisture was determined gravimetrically.

METHOD 10: DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

An continuous gas sample was extracted from the stack at a centroidal sampling point. The sample was transferred through a heated sample line to a carbon dioxide scrubber and then to a Luft-type nondispersive infrared analyzer (NDIR) for analysis of carbon monoxide.

METHOD 20: DETERMINATION OF NITROGEN OXIDES, SULFUR DIOXIDE, AND OXYGEN EMISSIONS FROM STATIONARY GAS FIRED TURBINES

A continuous gas sample was extracted from the stack at a centroidal sampling point. The sample was transferred through a heated sample line to a chemiluminescence analyzer for analysis of nitrogen oxides concentration.

IV. ANALYTICAL TECHNIQUE

All samples collected were analyzed in the field using continuous analyzers. Oxides of nitrogen concentration was determined using a chemiluminescence analyzer and carbon monoxide concentration was determined using a nondispersive infrared analyzer.

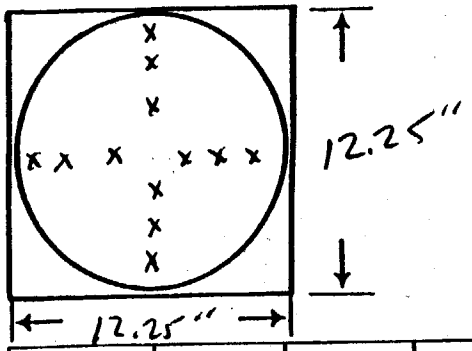
V. CHAIN of CUSTODY

No samples were transported to the laboratory for analysis.

VI. TEST DATA & CALCULATIONS

All data obtained during testing are contained in this section along with the associated data reduction calculations. Compressor operating data collected during testing and a fuel analysis are also included in this section.

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT ARCO
DATE 10-6-87
LOCATION Bayou Sallo
OPERATOR K. Thibodeaux
STACK NO. Compressor ID #13
RUN NO. 1

SAMPLE BOX NO. JJ
METER BOX NO. 500
AMBIENT TEMPERATURE 75°F
BAROMETRIC PRESSURE 30.02
FILTER TARE wt mg —
NOZZLE DIAMETER, in. —

STACK DIAMETER, in. 12.25"
PITOT TUBE NO. P-3-2
PITOT FACTOR .852
METER Δ H@ 1.508
D.G.M.C. FACTOR 1.038
K FACTOR —

TRAVERSE POINT NUMBER	SAMPLING TIME (Θ), min.	STATIC PRESSURE (in.H2O)	STACK TEMPERATURE (Ts), °F	VELOCITY HEAD (ΔPs)	(√ΔPs)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in., H2O ACTUAL	DESIRED	904 GAS SAMPLE VOLUME (Vm), ft3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tmin), °F	OUTLET (Tmout), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge
1	1003		920	1.100	1.048	1.500	1.500	883.914	74	69	228	65	9.0
2	1	+.195	958	1.250	1.118	1	1	1	1	1	1	1	1
3	1033		970	1.300	1.140	1.500	1.500	905.717	90	78	300	61	8.0
4			969	1.750	1.322								
5			969	1.800	1.341								
6			969	1.750	1.322								
7			851	1.100	1.048								
8			946	1.500	1.224								
9			948	1.550	1.244								
10			955	1.950	1.396								
11			960	2.850	1.688								
12			960	3.100	1.760								
AVERAGE	30 min		947.91/1407.91°R			1.304	1.500	21.803	77.75/537.75°R				

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL	573.6	534.9	425.7	570.7	
INITIAL	560.3	530.0	423.7	564.2	
LIQUID COLLECTED	13.3	4.9	2.0	6.5	
TOTAL VOLUME COLLECTED					26.7

ORSAT MEASUREMENT

	TIME	CO2	O2	CO	N2
1		8.9	4.7	0.0	86.4
2					
3					
4					

COMMENTS: Pre-Leak Check Good @ 10" HG
CFM 0.00

Post-Leak Check Good @ 10" HG

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87
Run Number 1

Determination of Moisture Content

B_{ws} - Moisture fraction content
M_w - Molecular weight of water, 18.0 lb/ lb-mole
P_m - Absolute pressure at meter, in-Hg
P_s - Standard absolute pressure, 29.92 in-Hg
R - Ideal gas constant, 21.85 in-Hg ft^3/ lb-mole deg R
T_m - Absolute temperature at meter, deg R
T_s - Standard absolute temperature, 528 deg R
V_m - Dry gas volume measured by meter, DCF
V_{ms} - Dry gas volume at standard conditions, DSCF
V_{wc} - Volume of water vapor collected by impingers, SCF
V_{wsg} - Volume of water vapor collected by silica gel, SCF
W_c - Total weight of impinger water, lb
W_{sg} - Total weight of silica gel water, lb
Y - Dry gas meter calibration factor

$$W_c = (13.3\ g)+(4.9\ g)+(2.0\ g)/(453.6\ g/lb) = 0.044533$$

$$W_{sg} = (6.5\ g)/(453.6\ g/lb) = 0.014330$$

$$V_{wc} = \frac{W_c\ R\ T_s}{P_s\ M_w} = \frac{(0.044533)(21.85)(528)}{(29.92)(18.0)} = 0.95396$$

$$V_{wsg} = \frac{W_{sg}\ R\ T_s}{P_s\ M_w} = \frac{(0.014330)(21.85)(528)}{(29.92)(18.0)} = 0.30697$$

$$V_{ms} = V_m\ Y\ \frac{P_m\ T_s}{P_s\ T_m} = (21.803)(1.038)\frac{(30.02)(528)}{(29.92)(538)} = 22.28509$$

$$B_{ws} = \frac{V_{wc} + V_{wsg}}{V_{wc} + V_{wsg} + V_{ms}} =$$

$$= \frac{(0.95396) + (0.30697)}{(0.95396) + (0.30697) + (22.28509)} = 0.0536$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87
Run Number 1

Determination of Dry Molecular Weight

M_d - Dry molecular weight, lb/lb-mole
$\%CO_2$ - Percent CO_2 by volume (dry basis)
$\%O_2$ - Percent O_2 by volume (dry basis)
$\%CO$ - Percent CO by volume (dry basis)
$\%N_2$ - Percent N_2 by volume (dry basis)
0.280 - Molecular weight of N_2 or CO, divided by 100
0.320 - Molecular weight of O_2 divided by 100
0.440 - Molecular Weight of CO_2 divided by 100

$$M_d = 0.440(\ \%CO_2\ ) + 0.320(\ \%O_2\ ) + 0.280(\ \%N_2 + \%CO\ )$$

$$= 0.440(\ 8.9\ ) + 0.320(\ 4.7\ ) + 0.280(\ 86.4 + 0.0\ )$$

$$= 29.612$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-97
Run Number 1

Determination of Stack Gas Velocity and Volumetric Flow Rate

A - Cross-sectional area of stack, ft^2
B_{ws} - Moisture fraction of stack gas
C_p - Pitot tube coefficient
dP - Average, square root of Velocity head of stack gas, $(\text{in-}H_2O)^{0.5}$
K_p - Pitot tube constant, $85.49 \frac{ft}{sec} \left(\frac{lb/lb\text{-}mole \quad in\text{-}Hg}{deg\ R \quad in\text{-}Hg}\right)^{0.5}$
M_d - Molecular weight of stack gas, dry basis, lb/lb-mole
M_s - Molecular weight of stack gas, wet basis, lb/lb-mole
P_{bar} - Barometric pressure at measurement site, in-Hg
P_g - Stack static pressure, in-Hg
P_s - Absolute stack gas pressure, in-Hg
P_{std} - Standard absolute pressure, 29.92 in-Hg
Q_{sd} - Dry volumetric stack gas flow rate Standard conditions , DSCF/Hr
T_s - Average stack gas temperature, deg R
T_{std} - Standard absolute temperature, 528 deg R
V_s - Average stack gas velocity, ft/sec
3600 - Conversion factor, sec/Hr
18.0 - Molecular weight of water, lb/lb-mole

$$M_s = M_d\ (1 - B_{ws}) + 18.0\ (B_{ws}) =$$

$$= (29.612)(1 - 0.0536) + (18.0)(0.0536) = 28.990$$

$$V_s = K_p\ C_p\ dP \left(\frac{T_s}{P_s\ M_s}\right)^{1/2} =$$

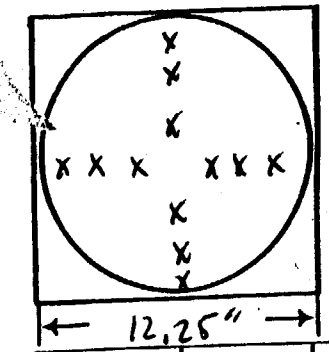
$$= (85.49)(0.852)(1.304)\left(\frac{1408}{[30.034][28.990]}\right)^{1/2} = 120.782$$

$$Q_{sd} = 3600\ (1 - B_{ws})\ V_s\ A\ \frac{T_{std}}{T_s}\ \frac{P_s}{P_{std}} =$$

$$Q_{sd} = 3600\ (1 - 0.0536)(120.782)(0.818463)\ \frac{(528)}{(1408)}\ \frac{(30.034)}{(29.92)}$$

$$= 126783.1$$

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT ARCO
DATE 10-6-87
LOCATION Bayou - Sale
OPERATOR K. Thibodeaux
STACK NO. Compressor ID #13
RUN NO. 2

SAMPLE BOX NO. CC
METER BOX NO. 500
AMBIENT TEMPERATURE 80°F
BAROMETRIC PRESSURE 30.059
FILTER TARE wt mg —
NOZZLE DIAMETER, in. —

STACK DIAMETER, in. 12.25"
PITOT TUBE NO. P-3-2
PITOT FACTOR .852
METER Δ H@ 1.508
D.G.M.C. FACTOR 1.078
K FACTOR

TRAVERSE POINT NUMBER	SAMPLING TIME (Θ), min.	STATIC PRESSURE (in.H2O)	STACK TEMPERATURE (Ts), °F	VELOCITY HEAD (ΔPs)	(√ΔPs)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in., H2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft3 (928)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tmin), °F	OUTLET (Tmout), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge
1	1140	+0.295	951	1.150	1.072	1.500	1.500	907.967	94	88	230	68	10.0
2	1		954	1.150	1.072	1	1	1	1	1	1	1	1
3	1210		968	1.450	1.204	1.500	1.500	929.850	101	92	275	64	12.2
4			971	1.550	1.244								
5			973	2.150	1.072								
6			974	2.400	1.549								
7			888	1.050	1.024								
8			942	1.100	1.048								
9			951	1.150	1.072								
10			957	1.250	1.118								
11			958	1.350	1.161								
12			956	1.600	1.264								
AVERAGE	30 min		953.58/413.58°R		1.158	1.500		21.883	93.75/553.75°R				

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g.
FINAL	731.3	519.5	448.5	577.8	
INITIAL	570.3	598.0	445.2	571.5	
LIQUID COLLECTED	161.0	-78.5	3.3	6.3	
TOTAL VOLUME COLLECTED					92.1

ORSAT MEASUREMENT

	TIME	CO2	O2	CO	N2
1		10.3	2.8	0.0	86.9
2					
3					
4					

COMMENTS: Pre-Leak Check Good @ 10" HG.
Post-Leak Check Good @ 10" HG

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87
Run Number 2

Determination of Moisture Content

B_{ws} - Moisture fraction content
M_w - Molecular weight of water, 18.0 lb/ lb-mole
P_m - Absolute pressure at meter, in-Hg
P_s - Standard absolute pressure, 29.92 in-Hg
R - Ideal gas constant, 21.85 in-Hg ft^3/ lb-mole deg R
T_m - Absolute temperature at meter, deg R
T_s - Standard absolute temperature, 528 deg R
V_m - Dry gas volume measured by meter, DCF
V_{ms} - Dry gas volume at standard conditions, DSCF
V_{wc} - Volume of water vapor collected by impingers, SCF
V_{wsg} - Volume of water vapor collected by silica gel, SCF
W_c - Total weight of impinger water, lb
W_{sg} - Total weight of silica gel water, lb
Y - Dry gas meter calibration factor

$$W_c = (161.0\ g)+(-78.5\ g)+(3.3\ g)/(453.6\ g/lb) = 0.18915$$

$$W_{sg} = (6.3\ g)/(453.6\ g/lb) = 0.01389$$

$$V_{wc} = \frac{W_c\ R\ T_s}{P_s\ M_w} = \frac{(0.18915)(21.85)(528)}{(29.92)(18.0)} = 4.05196$$

$$V_{wsg} = \frac{W_{sg}\ R\ T_s}{P_s\ M_w} = \frac{(0.01389)(21.85)(528)}{(29.92)(18.0)} = 0.29752$$

$$V_{ms} = V_m\ Y\ \frac{P_m\ T_s}{P_s\ T_m} = (21.883)(1.038)\frac{(30.059)(528)}{(29.92)(554)} = 21.74910$$

$$B_{ws} = \frac{V_{wc} + V_{wsg}}{V_{wc} + V_{wsg} + V_{ms}} =$$

$$= \frac{(4.05196) + (0.29752)}{(4.05196) + (0.29752) + (21.74910)} = 0.1667$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87
Run Number 2

Determination of Dry Molecular Weight

M_d - Dry molecular weight, lb/lb-mole
$\%CO_2$ - Percent CO_2 by volume (dry basis)
$\%O_2$ - Percent O_2 by volume (dry basis)
$\%CO$ - Percent CO by volume (dry basis)
$\%N_2$ - Percent N_2 by volume (dry basis)
0.280 - Molecular weight of N_2 or CO, divided by 100
0.320 - Molecular weight of O_2 divided by 100
0.440 - Molecular Weight of CO_2 divided by 100

$$M_d = 0.440(\ \%CO_2\ ) + 0.320(\ \%O_2\ ) + 0.280(\ \%N_2 + \%CO\ )$$

$$= 0.440(\ 10.3\ ) + 0.320(\ 2.8\ ) + 0.280(\ 86.9 + 0.0\ )$$

$$= 29.760$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87
Run Number 2

Determination of Stack Gas Velocity and Volumetric Flow Rate

A - Cross-sectional area of stack, ft^2
B_{ws} - Moisture fraction of stack gas
C_p - Pitot tube coefficient
dP - Average, square root of Velocity head of stack gas, $(\text{in-}H_2O)^{0.5}$
K_p - Pitot tube constant, $85.49 \frac{ft}{sec} \left(\frac{lb/lb\text{-}mole \quad in\text{-}Hg}{deg\ R \quad in\text{-}Hg} \right)^{0.5}$
M_d - Molecular weight of stack gas, dry basis, lb/lb-mole
M_s - Molecular weight of stack gas, wet basis, lb/lb-mole
P_{bar} - Barometric pressure at measurement site, in-Hg
P_g - Stack static pressure, in-Hg
P_s - Absolute stack gas pressure, in-Hg
P_{std} - Standard absolute pressure, 29.92 in-Hg
Q_{sd} - Dry volumetric stack gas flow rate Standard conditions , DSCF/Hr
T_s - Average stack gas temperature, deg R
T_{std} - Standard absolute temperature, 528 deg R
V_s - Average stack gas velocity, ft/sec
3600 - Conversion factor, sec/Hr
18.0 - Molecular weight of water, lb/lb-mole

$$M_s = M_d (1 - B_{ws}) + 18.0 (B_{ws}) =$$

$$= (29.760)(1 - 0.1667) + (18.0)(0.1667) = 27.800$$

$$V_s = K_p C_p dP \left(\frac{T_s}{P_s M_s} \right)^{\frac{1}{2}} =$$

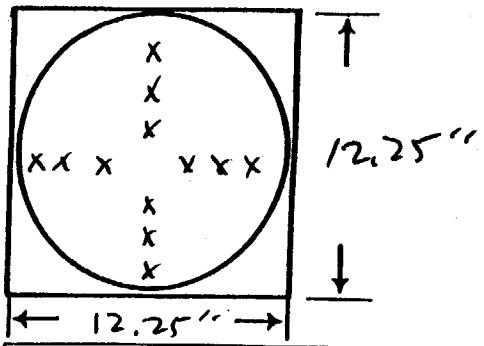
$$= (85.49)(0.852)(1.158)\left(\frac{1414}{[30.081][27.800]} \right)^{\frac{1}{2}} = 109.678$$

$$Q_{sd} = 3600 (1 - B_{ws}) V_s A \frac{T_{std}}{T_s} \frac{P_s}{P_{std}} =$$

$$Q_{sd} = 3600 (1 - 0.1667)(109.678)(0.818463) \frac{(528)}{(1414)} \frac{(30.081)}{(29.92)}$$

$$= 101096.9$$

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT Arco
DATE 10-6-87
LOCATION Bayou-Sallé
OPERATOR K. Thibodaux
STACK NO. Compressor ID #13
RUN NO. 3

SAMPLE BOX NO. JJ
METER BOX NO. 500
AMBIENT TEMPERATURE 81°F
BAROMETRIC PRESSURE 30.01
FILTER TARE wt mg —
NOZZLE DIAMETER, in. —

STACK DIAMETER, in. 12.25"
PITOT TUBE NO. P-3-2
PITOT FACTOR .852
METER Δ H@ 1.508
D.G.M.C. FACTOR 1.038
K FACTOR —

TRAVERSE POINT NUMBER	SAMPLING TIME (Θ), min.	STATIC PRESSURE (in.H2O)	STACK TEMPERATURE (Ts), °F	VELOCITY HEAD (ΔPs)	(√ΔPs)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in., H2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft3 (951)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tmin), °F	OUTLET (Tmout), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge
1	1335	+0.285	936	0.945	0.972	1.500	1.500	930.479	102	98	229	62	10.1
2	1		964	1.050	1.024	1	1	1	1	1	1	1	1
3	1410		970	1.100	1.048	1.500	1.500		100	95	302	67	15.0
4			970	1.150	1.072			956.193					
5			969	1.150	1.072								
6			966	1.500	1.224								
7			892	0.950	0.974								
8			948	1.150	1.072								
9			955	1.250	1.118								
10			960	1.400	1.183								
11			961	1.500	1.224								
12			961	1.550	1.244								
AVERAGE		+0.285	954.33 / 1414.33 OR		1.102	1.500		25.714	98.75°F 558.75°R				

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL	695.4	534.4	430.2		591.4
INITIAL	573.6	534.9	425.7		582.2
LIQUID COLLECTED	121.8	-14.7	4.5		9.2
TOTAL VOLUME COLLECTED					120.9

ORSAT MEASUREMENT

	TIME	CO2	O2	CO	N2
1		10.6	2.1	0.0	87.3
2					
3					
4					

COMMENTS: Pre-Leak Check Good @ 10" HG.

Post-Leak Check Good @ 15" H.G.

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87
Run Number 3

Determination of Moisture Content

B_{ws} - Moisture fraction content
M_w - Molecular weight of water, 18.0 lb/ lb-mole
P_m - Absolute pressure at meter, in-Hg
P_s - Standard absolute pressure, 29.92 in-Hg
R - Ideal gas constant, 21.85 in-Hg ft^3/ lb-mole deg R
T_m - Absolute temperature at meter, deg R
T_s - Standard absolute temperature, 528 deg R
V_m - Dry gas volume measured by meter, DCF
V_{ms} - Dry gas volume at standard conditions, DSCF
V_{wc} - Volume of water vapor collected by impingers, SCF
V_{wsg} - Volume of water vapor collected by silica gel, SCF
W_c - Total weight of impinger water, lb
W_{sg} - Total weight of silica gel water, lb
Y - Dry gas meter calibration factor

$$W_c = (121.8\ g)+(-14.7\ g)+(4.5\ g)/(453.6\ g/lb) = 0.24603$$

$$W_{sg} = (9.2\ g)/(453.6\ g/lb) = 0.02028$$

$$V_{wc} = \frac{W_c\ R\ T_s}{P_s\ M_w} = \frac{(0.24603)(21.85)(528)}{(29.92)(18.0)} = 5.27039$$

$$V_{wsg} = \frac{W_{sg}\ R\ T_s}{P_s\ M_w} = \frac{(0.02028)(21.85)(528)}{(29.92)(18.0)} = 0.43448$$

$$V_{ms} = V_m\ Y\ \frac{P_m\ T_s}{P_s\ T_m} = (25.714)(1.038)\frac{(30.01)(528)}{(29.92)(559)} = 25.28678$$

$$B_{ws} = \frac{V_{wc} + V_{wsg}}{V_{wc} + V_{wsg} + V_{ms}} =$$

$$= \frac{(5.27039) + (0.43448)}{(5.27039) + (0.43448) + (25.28678)} = 0.1841$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87
Run Number 3

Determination of Dry Molecular Weight

M_d - Dry molecular weight, lb/lb-mole
$\%CO_2$ - Percent CO_2 by volume (dry basis)
$\%O_2$ - Percent O_2 by volume (dry basis)
$\%CO$ - Percent CO by volume (dry basis)
$\%N_2$ - Percent N_2 by volume (dry basis)
0.280 - Molecular weight of N_2 or CO, divided by 100
0.320 - Molecular weight of O_2 divided by 100
0.440 - Molecular Weight of CO_2 divided by 100

$$M_d = 0.440(\ \%CO_2\ ) + 0.320(\ \%O_2\ ) + 0.280(\ \%N_2 + \%CO\ )$$

$$= 0.440(\ 10.6\ ) + 0.320(\ 2.1\ ) + 0.280(\ 87.3 + 0.0\ )$$

$$= 29.780$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-97
Run Number 3

Determination of Stack Gas Velocity and Volumetric Flow Rate

A - Cross-sectional area of stack, ft^2
B_{ws} - Moisture fraction of stack gas
C_p - Pitot tube coefficient
dP - Average, square root of Velocity head of stack gas, $(\text{in-}H_2O)^{0.5}$
K_p - Pitot tube constant, $85.49 \frac{ft}{sec} \left(\frac{lb/lb\text{-}mole \quad in\text{-}Hg}{deg\ R \quad in\text{-}Hg} \right)^{0.5}$
M_d - Molecular weight of stack gas, dry basis, lb/lb-mole
M_s - Molecular weight of stack gas, wet basis, lb/lb-mole
P_{bar} - Barometric pressure at measurement site, in-Hg
Pg - Stack static pressure, in-Hg
P_s - Absolute stack gas pressure, in-Hg
P_{std} - Standard absolute pressure, 29.92 in-Hg
Q_{sd} - Dry volumetric stack gas flow rate Standard conditions , DSCF/Hr
T_s - Average stack gas temperature, deg R
T_{std} - Standard absolute temperature, 528 deg R
V_s - Average stack gas velocity, ft/sec
3600 - Conversion factor, sec/Hr
18.0 - Molecular weight of water, lb/lb-mole

$$M_s = M_d (1 - B_{ws}) + 18.0 (B_{ws}) =$$

$$= (29.780)(1 - 0.1841) + (18.0)(0.1841) = 27.611$$

$$V_s = K_p C_p dP \left(\frac{T_s}{P_s M_s} \right)^{1/2} =$$

$$= (85.49)(0.852)(1.102) \left(\frac{1414}{[30.031][27.611]} \right)^{1/2} = 104.818$$

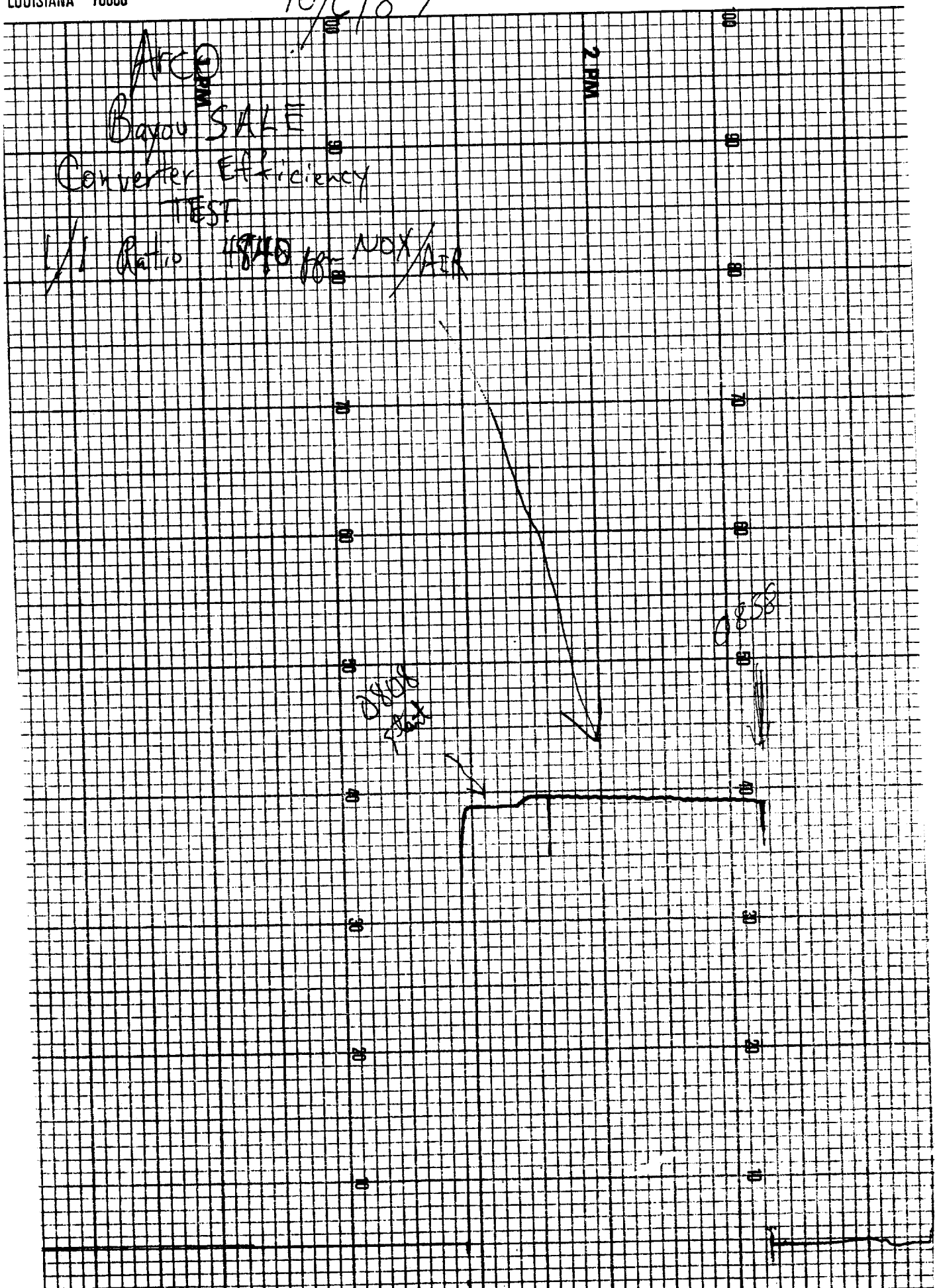
$$Q_{sd} = 3600 (1 - B_{ws}) V_s A \frac{T_{std}}{T_s} \frac{P_s}{P_{std}} =$$

$$Q_{sd} = 3600 (1 - 0.1841)(104.818)(0.818463) \frac{(528)}{(1414)} \frac{(30.031)}{(29.92)}$$

$$= 94442.4$$

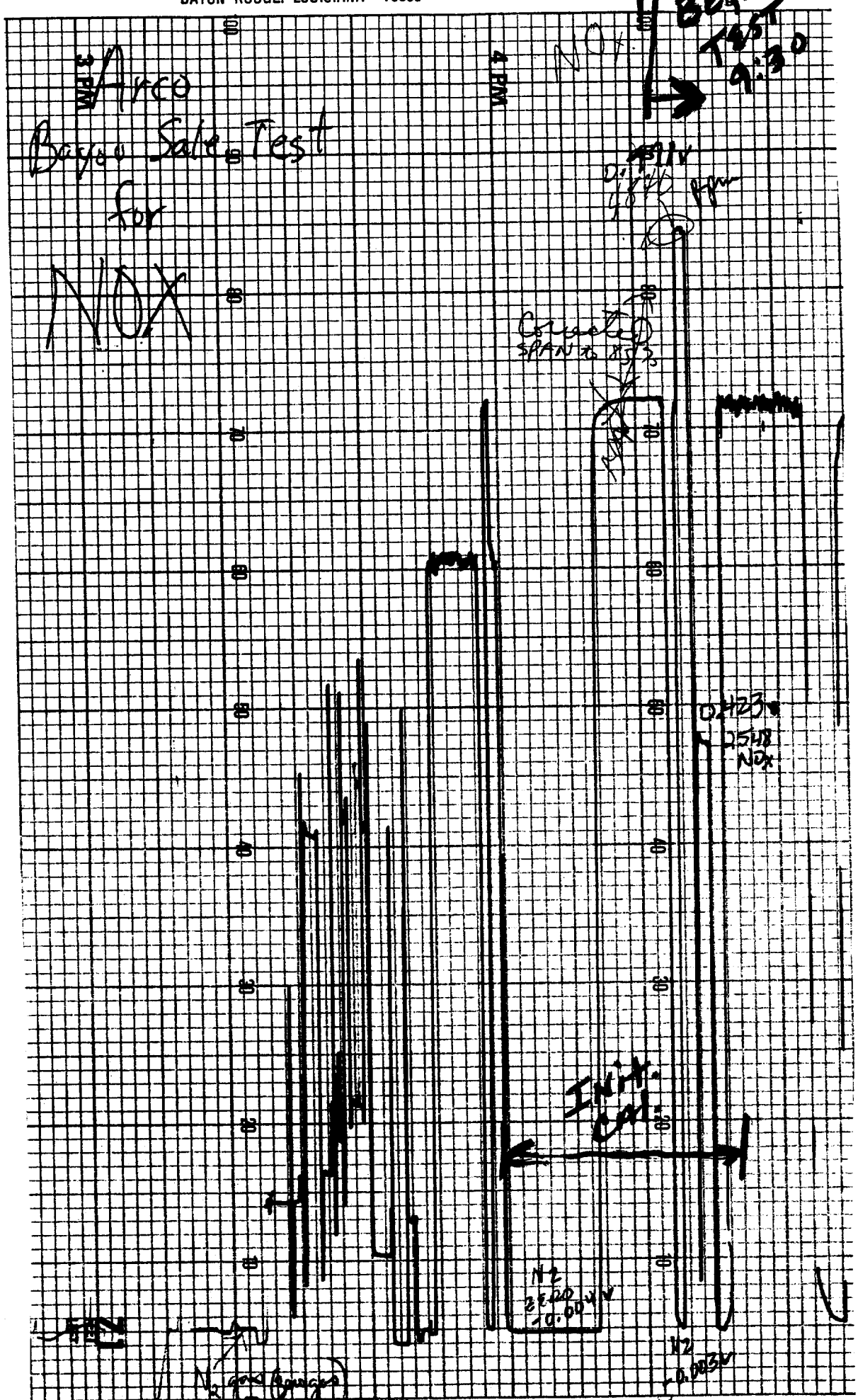
ORATORIES INC.
AND RD. Rt. 3
LOUISIANA 70809

10/6/87



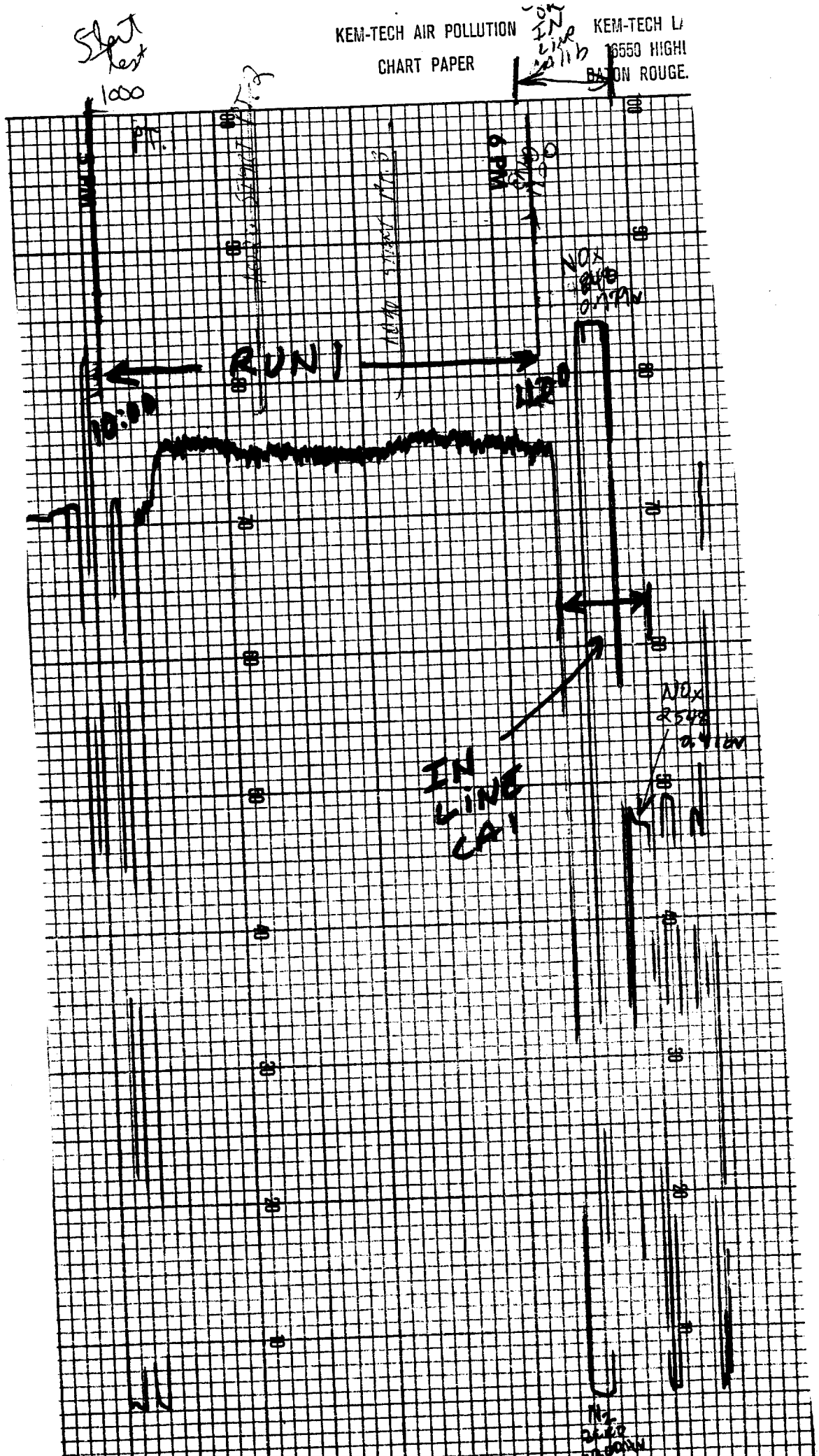
AIR POLLUTION
RT PAPER

KEM-TECH LABORATORIES INC.
16550 HIGHLAND RD. Rt. 3
BATON ROUGE. LOUISIANA 70808

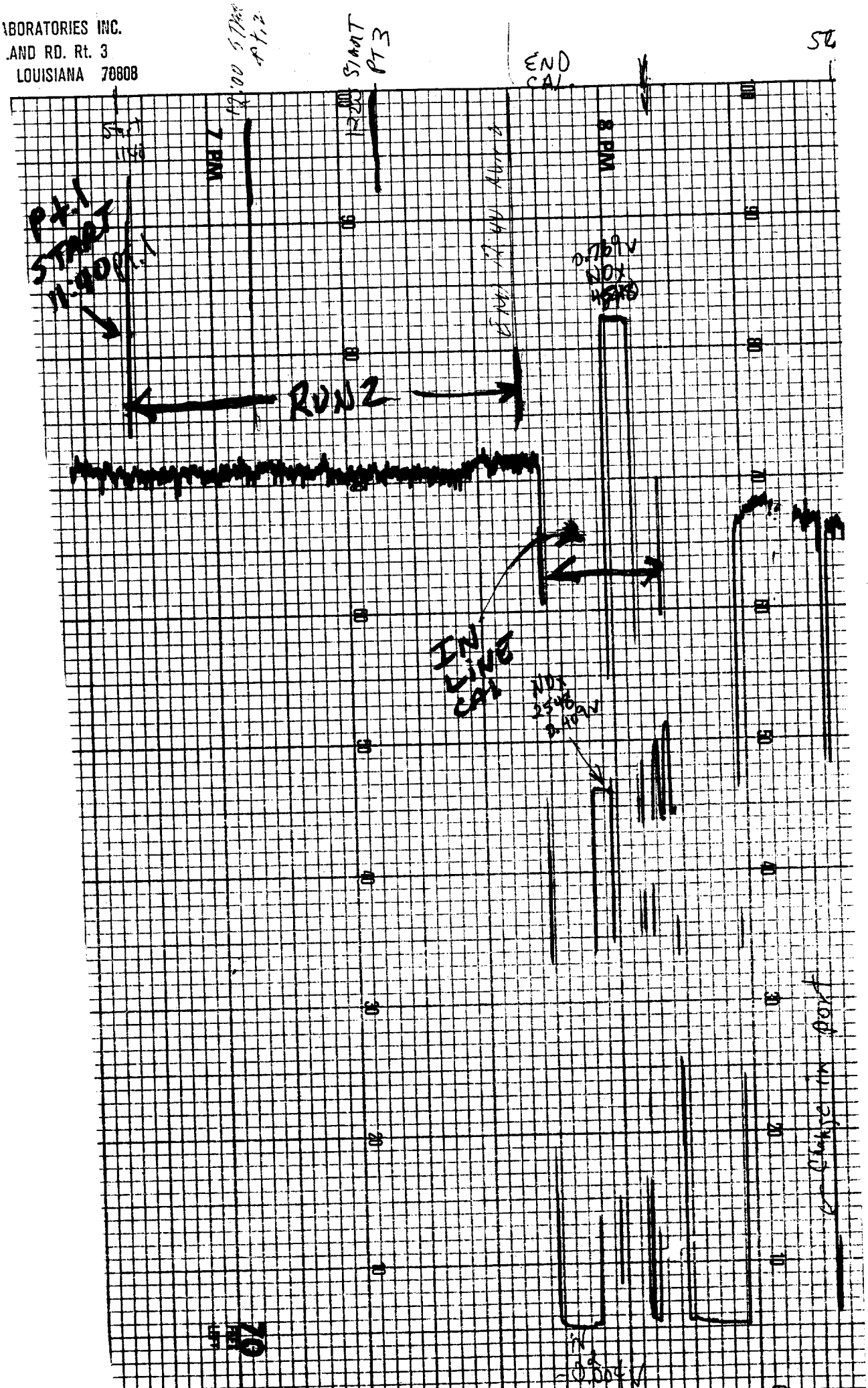


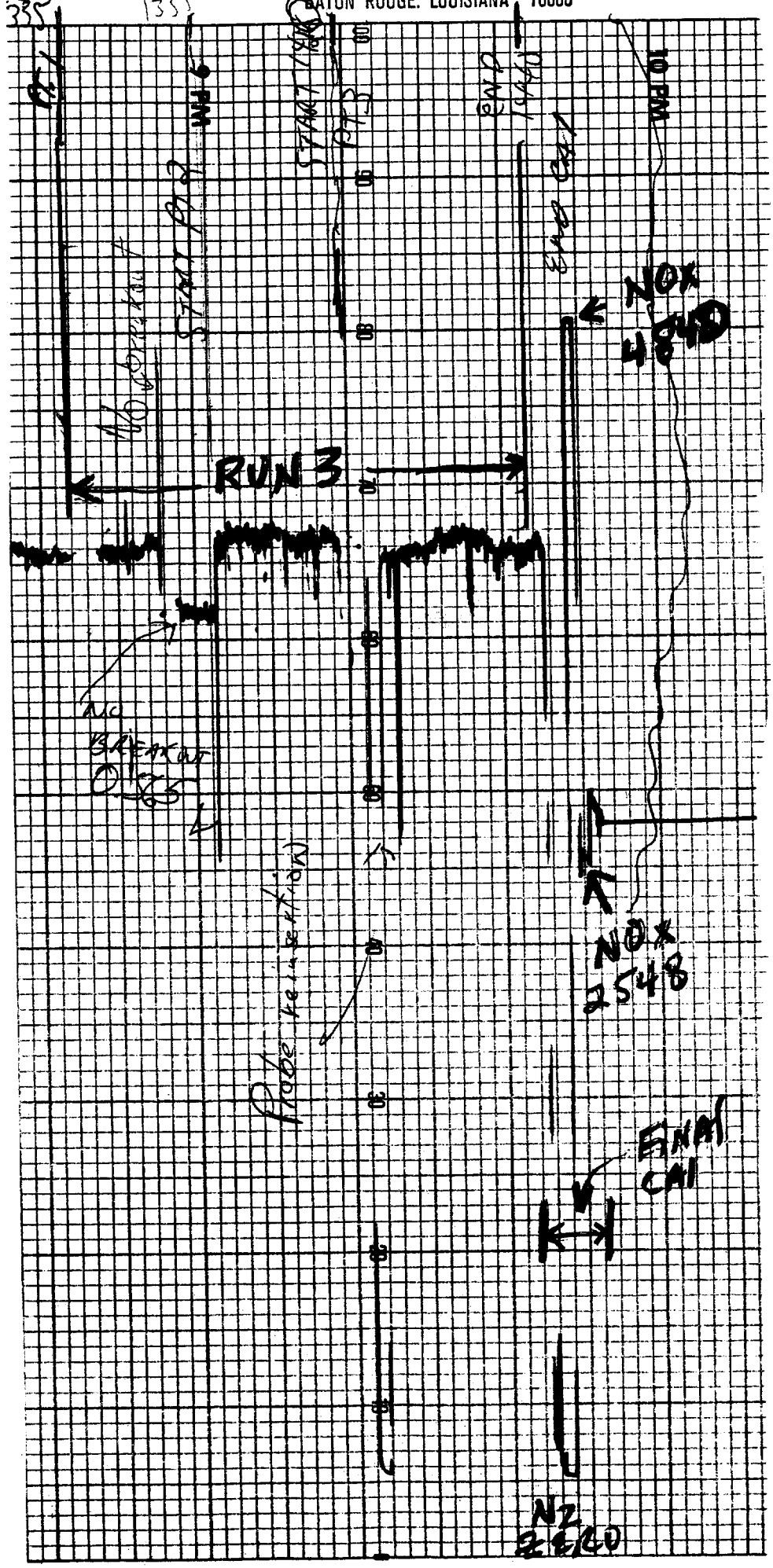
KEM-TECH AIR POLLUTION
CHART PAPER

KEM-TECH L
6550 HIGHI
BATON ROUGE.



ABORATORIES INC.
AND RD. Rt. 3
LOUISIANA 70808




RUN 3
NOX 4840
NOX 2548
NO BREAKOUT 0.85
Probe heat tape
FINAL CAL
N2 2.2/40

ETS
EMISSION TESTING SERVICES, INC.

METHOD 6C & 7E DATA SHEET

COMPANY Arco SOURCE # _____ DATE 10/6/87

PARAMETER N_{Ox} LOAD% 58 lbs/section RUN NUMBER 1

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	ppm	Absolute Difference mv	ppm	% Span ±2%
Zero	N_2	-0.003	0	-0.004	0	-0.1
Mid	2548	0.423	2625.0	0.416	2581.3	-0.7
High	4840	0.771	4797.6	0.774	4847.6	0.8

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 6243.2 Intercept -15.9 Span Range 6227.3

Analyzer Cal		Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Span Drift ±3
Zero	N_2	0.001	0	0.5				
Mid	2548	0.427	2648	-0.4				
High	4840	0.765	4784.2	0.6				

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm) - analyzer cal. (ppm)}}{\text{Span (ppm)}}$ X 100

%Drift = $\frac{\text{Final sys. resp. (ppm) - Initial sys. resp. (ppm)}}{\text{span (ppm)}}$ X 100

TEST DATA

Start time 1000 Finish time 1100 Minutes per point 2

Sample port _____

Test Point	mv				
1	0.662	11	0.694	21	0.701
2	0.663	12	0.655	22	0.700
3	0.664	13	0.690	23	0.702
4	0.702	14	0.696	24	0.704
5	0.711	15	0.689	25	0.698
6	0.708	16	0.690	26	0.695
7	0.705	17	0.689	27	0.699
8	0.700	18	0.693	28	0.696
9	0.696	19	0.698	29	0.693
10	0.687	20	0.698	30	0.694

Ave. mv 0.694

Ave. conc. 4316.9 ppm

COMMENTS:

NO_x CORRECTION

RUN #1

DB = 79.5 °F

WB = 68.5 °F

From psychrometric chart: H = 87 %

$k = k_H k_T$

$k_H = 0.844 + 0.151(0.87) + 0.075(0.87)^2$

$\therefore k_H = 1.032$

$k_T = 1 - (79.5 - 85)(0.0135)$

$\therefore k_T = 1.07425$

THEN: $k = (1.032)(1.07425) = 1.1086$

AND: $NO_{x\,ppm} = (1.1086)(4316.9) = 4785.7$ ppm

ETS
EMISSION TESTING SERVICES, INC.

METHOD 6C & 7E DATA SHEET

COMPANY Arco SOURCE # 13 DATE 10/6/87

PARAMETER NO_x LOAD% 58th section RUN NUMBER 2

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	ppm	Absolute Difference mv	ppm	% Span ±2%
Zero	N_2	-0.004	0	-0.004	0	0
Mid	2548	0.416	2580.1	0.409	2536.8	-0.7
High	4840	0.774	4822.8	0.769	4761.0	-0.99

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 6178 Intercept 9.85 Span Range 6188.2

Analyzer Cal		Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Span ±3	Drift
Zero									
Mid	2548	0.427	2648.0	-1.1					
High									

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm) - analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm) - Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time 1140 Finish time 1240 Minutes per point 2

Sample port

Test Point	mv TP.1		TP2		TP3
1	0.658	11	0.662	21	0.656
2	0.655	12	0.660	22	0.656
3	0.652	13	0.656	23	0.655
4	0.657	14	0.661	24	0.650
5	0.659	15	0.665	25	0.650
6	0.658	16	0.651	26	0.654
7	0.654	17	0.651	27	0.654
8	0.658	18	0.651	28	0.661
9	0.656	19	0.650	29	0.664
10	0.659	20	0.655	30	0.660

Ave. mv 0.656

Ave. conc. 4060.4 ppm

COMMENTS:

NO_x correction
RUN #2

DB = 88.5 °F
WB = 71.5 °F

From psychrometric chart : H = 88%

$k = k_H k_T$

$k_H = 0.844 + (0.151)(0.88) + 0.075(0.88)^2$
$\therefore k_H = 1.03496$

$k_T = 1 - (88.5 - 85)(0.0135)$
$\therefore k_T = 0.98606$

AND: $k = (1.03496)(0.98606) = 0.98606$

THEN: NO_x ppm $= (0.98606)(4060.4) = 4003.8$ ppm

ETS
EMISSION TESTING SERVICES, INC.

METHOD 6C & 7E DATA SHEET

COMPANY Arco SOURCE # 13 DATE 10/6/87

PARAMETER Nox LOAD% 44 lbs/auction RUN NUMBER 3

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	ppm	Absolute Difference mv	ppm	% Span ±2%
Zero	N2	-0.004	0	-0.003	0	0
Mid	2548	0.409	2573.2	0.404	2541.9	-0.5
High	4840	0.769	4826.5	0.751	4713.8	-1.8

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 6259.1 Intercept 13.28 Span Range 6272.4

Analyzer Cal	Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Span ±3	Drift
Zero								
Mid								
High								

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm) - analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm) - Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time 1335 Finish time 1440 Minutes per point 2

Sample port

Test Point	mv TP.1		TP.2		TP.3
1	0.601	11	0.609	21	0.606
2	0.601	12	0.615	22	0.606
3	0.601	13	0.616	23	0.604
4	0.608	14	0.608	24	0.608
5	0.602	15	0.614	25	0.612
6	0.602	16	0.607	26	0.609
7	0.611	17	0.608	27	0.600
8	0.565	18	0.609	28	0.601
9		19	0.610	29	0.601
10		20	0.608	30	0.609

No Breakout

Ave. mv 0.607

Ave. conc. 3812.5 ppm

COMMENTS:

NO_x CORRECTION
RUN #3

WB = 71.5 °F
DB = 88.0 °F

From psychrometric chart: H = 89%

$k = k_H \, k_T$

$k_H = 0.844 + (0.151)(0.89) + 0.075(0.89)^2$
$\therefore k_H = 1.0378$

$k_T = 1 - (88 - 25)(0.0135)$
$\therefore k_T = 0.9595$

THEN: $k = (1.0378)(0.9595) = 0.9958$

AND: NO_x ppm $= (0.9958)(3812.5) = 3796.5$ ppm

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A compressor
Testing Date 10-6-87

OXIDES OF NITROGEN EMISSION RATE

ENOX - Oxides of nitrogen as nitrogen dioxide emission rate, lb/Hr
F - Conversion factor for nitrogen dioxide, (lb/ft^3)/(PPM)
M_{no2} - Molecular weight of nitrogen dioxide, 46.00 lb/lb-mole
NOX_{vv} - Concentration, NOX as nitrogen dioxide - PPM
NOX_{wv} - Concentration, NOX as nitrogen dioxide - lb/ ft^3
Q_{sd} - Dry volumetric stack gas flow rate, DSCF/Hr
385 - Volume of an ideal gas, ft^3, at 528 deg R, 29.92 in-Hg

$$F = \frac{\frac{M_{no}}{385}}{1000000} = 1.1948 \times 10^{-7}$$

RUN # 1

$NOX_{wv} = NOX_{vv} \; F = (4785.7)(1.1948 \times 10^{-7}) = 5.718 \times 10^{-4}$

$ENOX = Q_{sd} \; NOX_{wv} = (126783.1)(5.718 \times 10^{-4}) = 72.494$

RUN # 2

$NOX_{wv} = NOX_{vv} \; F = (4003.8)(1.1948 \times 10^{-7}) = 4.784 \times 10^{-4}$

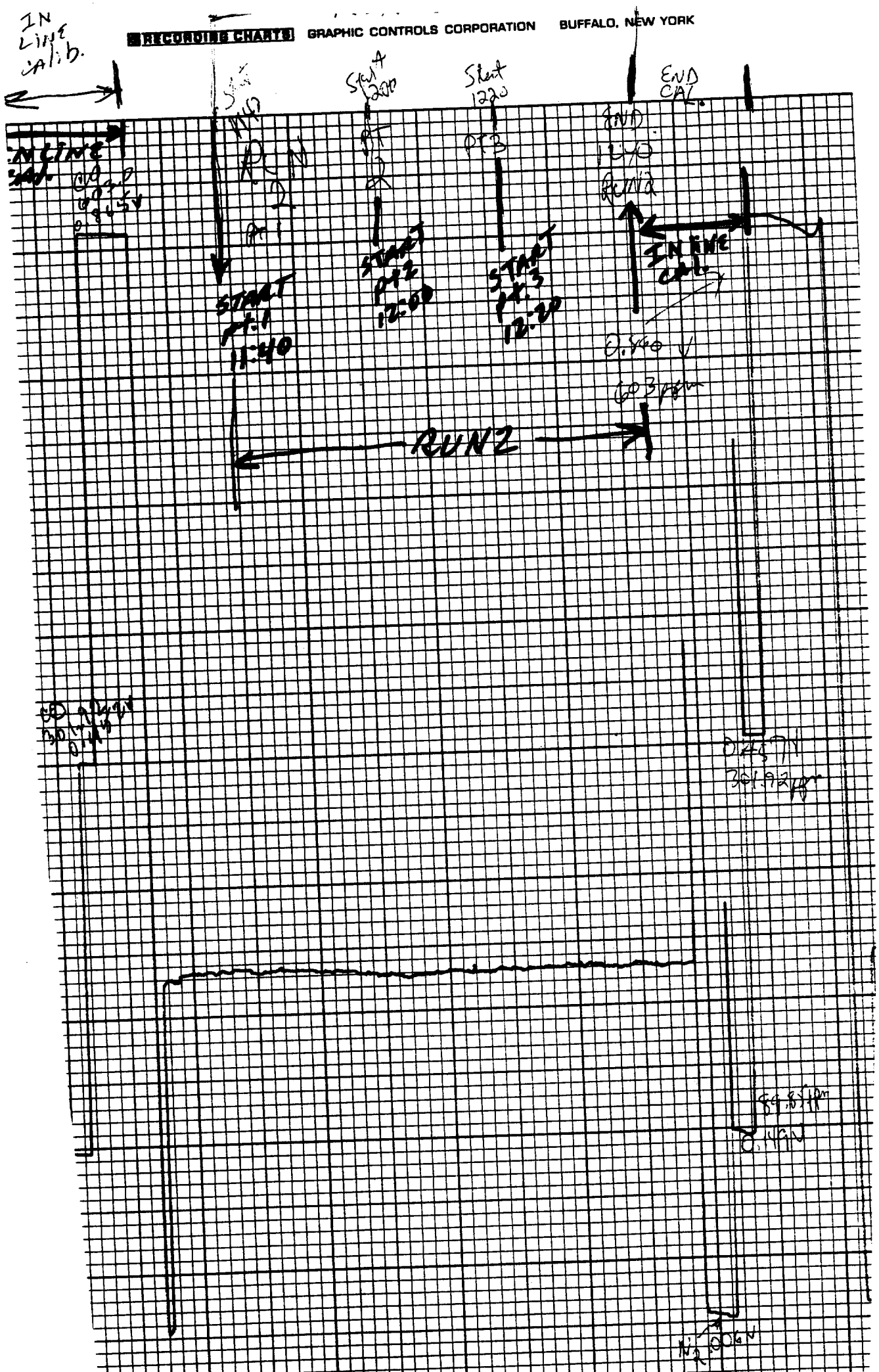
$ENOX = Q_{sd} \; NOX_{wv} = (101096.9)(4.784 \times 10^{-4}) = 48.362$

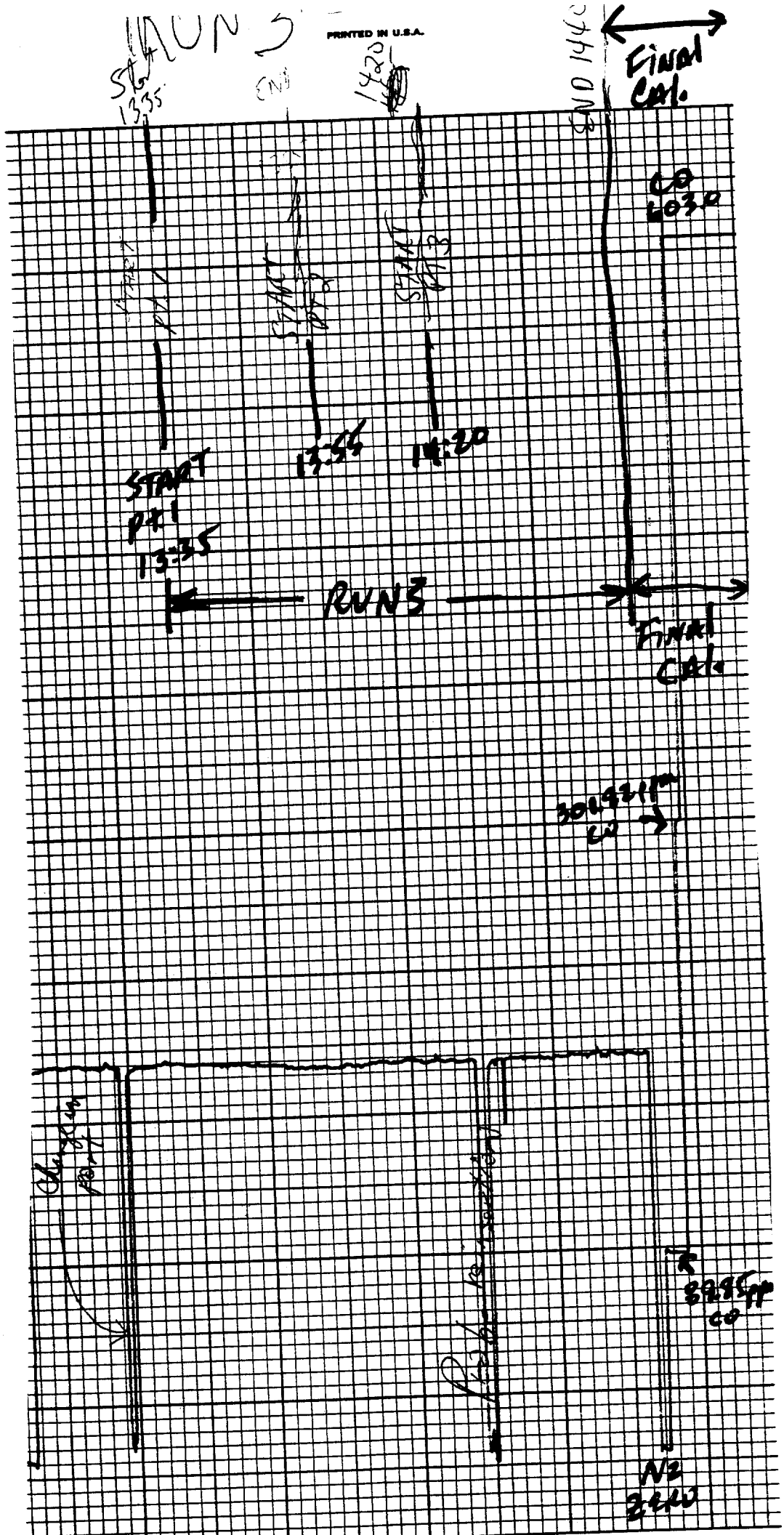
RUN # 3

$NOX_{wv} = NOX_{vv} \; F = (3796.5)(1.1948 \times 10^{-7}) = 4.536 \times 10^{-4}$

$ENOX = Q_{sd} \; NOX_{wv} = (94442.4)(4.536 \times 10^{-4}) = 42.840$

No. RC-109


RECORDING CHARTS
GRAPHIC CONTROLS CORPORATION
BUFFALO, NEW YORK
IN LINE calib.
START PT.1 11:40
START PT.2 12:00
START PT.3 12:20
END CAL.
END 12:40 RUN 2
IN LINE CAL.
RUN 2
0.540 V
603 ppm
0.475 V
301.92 ppm
0.149 V
94.85 ppm
N2 100%


RUN 3
PRINTED IN U.S.A.
Stg 1335
(N)
1420
Final Cal.
CO 1030
START 1335
START 1356
START 1420
13:35
13:56
14:20
START P&I 13:35
RUN 3
Final Cal.
30.9241 CO
Pad Mark
Pad Mark
38.85 CO
N2 3240

ETS
EMISSION TESTING SERVICES, INC.

METHOD 10 DATA SHEET

COMPANY ARCO SOURCE # 13 DATE 10/6/87

PARAMETER CO LOAD% 58 16/suction RUN NUMBER 1

CALIBRATION STATISTICS

	Cylinder Value	Initial Analyzer Response mv	Initial Analyzer Response ppm	Final Analyzer Response mv	Final Analyzer Response ppm	%Drift
Zero	N_2	0.006	-6.996	0.005	-7.692	-0.1
Low	89.85	0.151	94.16	0.147	91.37	-0.4
Mid	301.92	0.459	309.04	0.452	304.2	-0.7
High	603.0	0.874	598.6	0.865	592.3	-0.9

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 697.7 Intercept -11.18 Span Range 686.52

$$\%Drift = \frac{\text{Final response (ppm)} - \text{Initial response (ppm)}}{\text{SPAN}} \times 100$$

~~Initial response~~ (ppm)

TEST DATA

Start time 10:00 Finish time 11:00 Minutes per point 2

Sample port _____

Test Point mv.

	T.P.1		T.P.2		T.P.3
1	0.294	11	0.287	21	0.280
2	0.295	12	0.286	22	0.280
3	0.292	13	0.287	23	0.280
4	0.289	14	0.289	24	0.279
5	0.287	15	0.286	25	0.282
6	0.286	16	0.287	26	0.279
7	0.287	17	0.285	27	0.281
8	0.283	18	0.283	28	0.281
9	0.284	19	0.284	29	0.281
10	0.283	20	0.281	30	0.282

Ave. mv 0.2846

Ave. conc. 187.41 ppm

COMMENTS:

T.P. is TRAVERSE POINT

WB = 68.5 °F

DB = 79.5 °F

ETS
EMISSION TESTING SERVICES, INC.

METHOD 10 DATA SHEET

COMPANY ARCO SOURCE # 13 DATE 10/6/87

PARAMETER CO LOAD% 581b/suction RUN NUMBER 2

CALIBRATION STATISTICS

	Cylinder Value	Initial Analyzer Response mv	Initial Analyzer Response ppm	Final Analyzer Response mv	Final Analyzer Response ppm	%Drift
Zero	N_2	0.005	-6.27	0.006	-5.57	0.1
Low	89.85	0.147	93.67	0.149	95.08	1.5
Mid	301.92	0.452	308.3	0.457	311.86	1.2
High	603.0	0.865	599.0	0.860	595.5	-0.6

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 703.8 Intercept -9.79 Span Range 694.01

$$\%Drift = \frac{\text{Final response (ppm)} - \text{Initial response (ppm)}}{\text{SPAN}} \times 100$$

~~Initial response~~ (ppm)

TEST DATA

Start time 11:40 Finish time 12:40 Minutes per point 2

Sample port _____

Test Point	mv. T.P. 1		mv. T.P. 2		mv. T.P. 3
1	0.286	11	0.280	21	0.283
2	0.286	12	0.281	22	0.284
3	0.287	13	0.283	23	0.282
4	0.284	14	0.282	24	0.283
5	0.285	15	0.283	25	0.283
6	0.285	16	0.282	26	0.281
7	0.284	17	0.281	27	0.281
8	0.283	18	0.284	28	0.283
9	0.281	19	0.284	29	0.283
10	0.282	20	0.282	30	0.281

Ave. mv 0.283

Ave. conc. 189.4 ppm

COMMENTS:

T.P. is TRAVERSE POINT

WB = 71.5 °F
DB = 88.5 °F

ETS
EMISSION TESTING SERVICES, INC.

METHOD 10 DATA SHEET

COMPANY ARCO SOURCE # 13 DATE 10/6/87

PARAMETER CO LOAD% 44 16/suction RUN NUMBER 3

CALIBRATION STATISTICS

	Cylinder Value	Initial Analyzer Response mv	Initial Analyzer Response ppm	Final Analyzer Response mv	Final Analyzer Response ppm	%Drift
Zero	N2	0.006	-7.73	0.007	-7.02	0.1
Low	89.85	0.149	93.57	0.147	92.15	-0.2
Mid	301.92	0.457	311.73	0.451	307.48	-0.6
High	603.0	0.860	597.2	0.861	597.9	0.1

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 708.33 Intercept -11.98 Span Range 696.35

$$\%\text{Drift} = \frac{\text{Final response (ppm)} - \text{Initial response (ppm)}}{\text{SPAN}} \times 100$$

TEST DATA

Start time 13:35 Finish time 14:40 Minutes per point 2

Sample port _____

Test Point	mv. T.P. 1		T.P. 2		T.P. 3
1	0.292	11	0.286	21	0.287
2	0.290	12	0.287	22	0.288
3	0.290	13	0.288	23	0.288
4	0.289	14	0.289	24	0.287
5	0.289	15	0.287	25	0.288
6	0.289	16	0.290	26	0.289
7	0.289	17	0.289	27	0.290
8	0.285	18	0.288	28	0.291
9	0.286	19	0.287	29	0.288
10	0.286	20	0.287	30	0.287

Ave. mv 0.288

Ave. conc. 190.7 ppm

COMMENTS:

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client ARCO
Source 5A Compressor
Testing Date 10-6-87

Carbon Monoxide Emission Rate

ECO - Carbon Monoxide emission rate, lb/Hr
F - Conversion factor for carbon monoxide, (lb/ft^3)/(PPM)
M_{co} - Molecular weight of carbon monoxide, 28.00 lb/lb-mole
CO_{vv} - Concentration of carbon monoxide - PPM
CO_{wv} - Concentration of carbon monoxide - lb/ft^3
Q_{sd} - Dry volumetric stack gas flow rate, DSCF/Hr
385 - Volume of an ideal gas, ft^3, at 528 deg R, 29.92 in-Hg
$CO2_f$ - Volume fraction of carbon dioxide in sample
CO_{meas} - Concentration of carbon monoxide as measured, PPM

$$CO_{vv} = CO_{meas} (1 - CO2_f)$$

$$F = \frac{\frac{M_{co}}{385}}{1,000,000} = \frac{(28.00 / 385)}{1,000,000} = 7.2727 \times 10-8$$

RUN # 1

CO_{vv} = (187.41)(1 - 0.089) = 170.73

$CO_{wv} = CO_{vv}$ F = (170.73)(7.2727 X 10-8) = 1.2416×10^{-5}

ECO = Q_{sd} CO_{wv} = (126783.1)(1.2416×10^{-5}) = 1.574

RUN # 2

CO_{vv} = (189.4)(1 - 0.103) = 169.892

$CO_{wv} = CO_{vv}$ F = (169.892)(7.2727 X 10-8) = 1.2355×10^{-5}

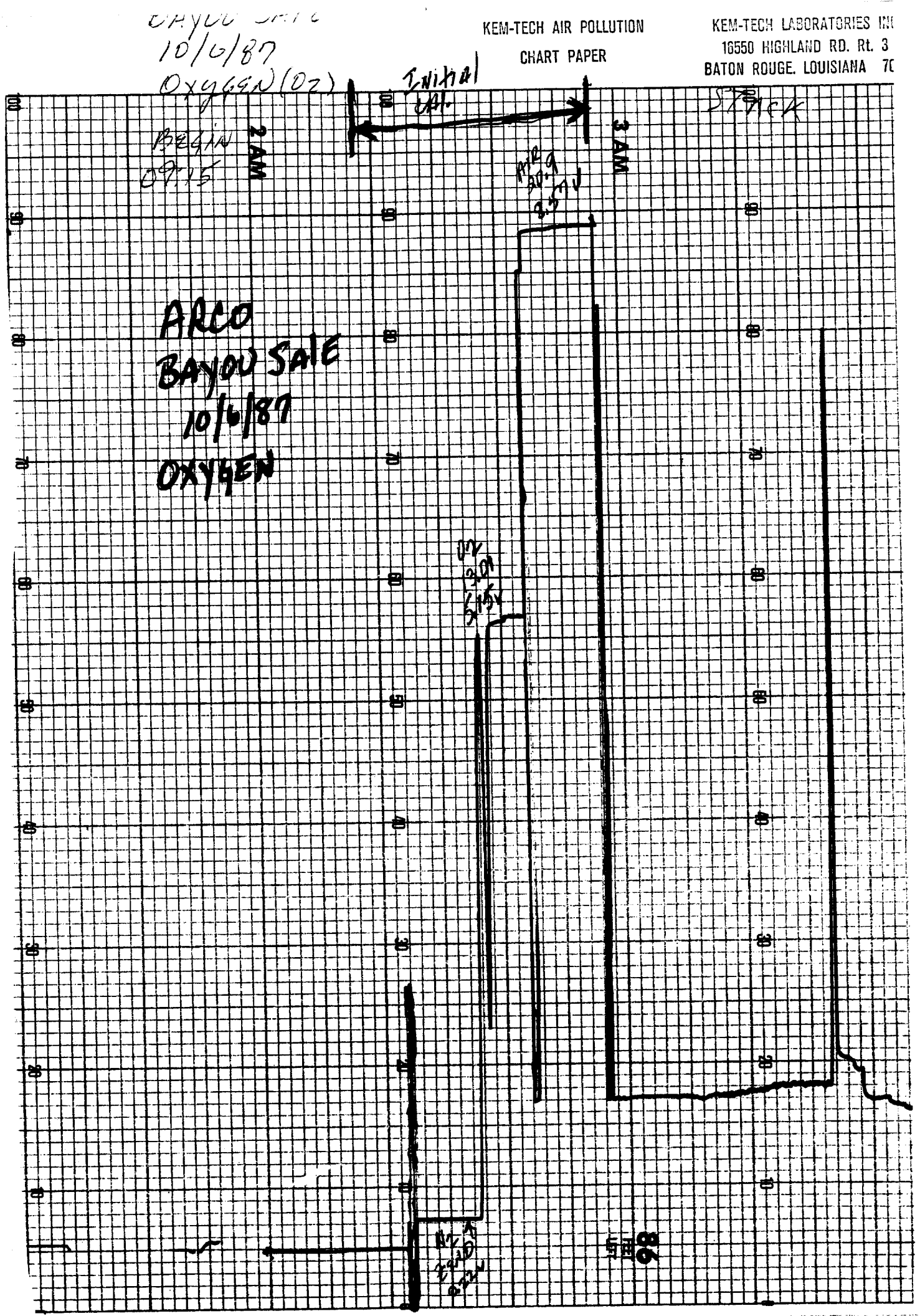
ECO = Q_{sd} CO_{wv} = (101096.9)(1.2355×10^{-5}) = 1.249

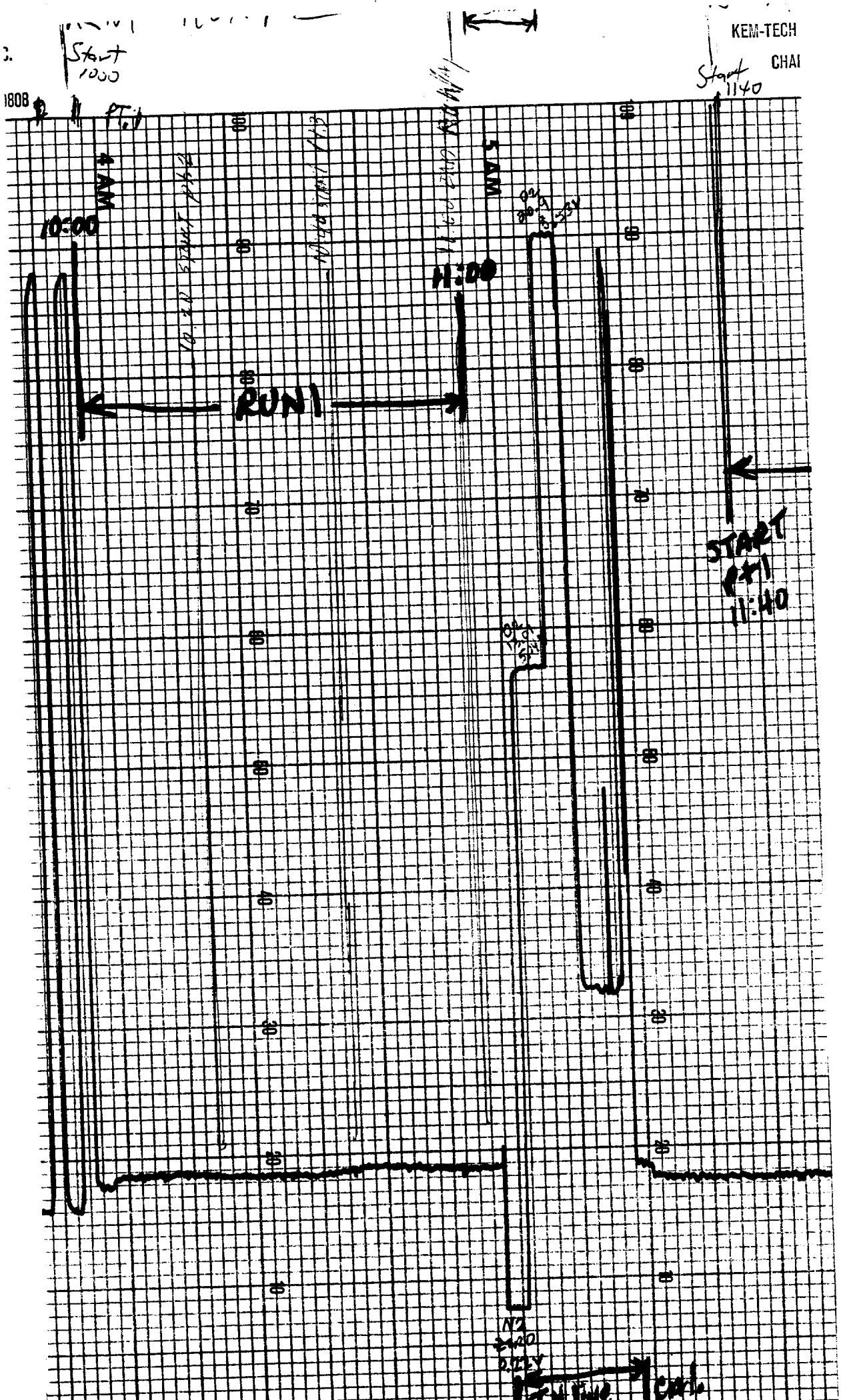
RUN # 3

CO_{vv} = (190.7)(1 - 0.106) = 170.486

$CO_{wv} = CO_{vv}$ F = (170.486)(7.2727 X 10-8) = 1.2398×10^{-5}

ECO = Q_{sd} CO_{wv} = (94442.4)(1.2398×10^{-5}) = 1.171

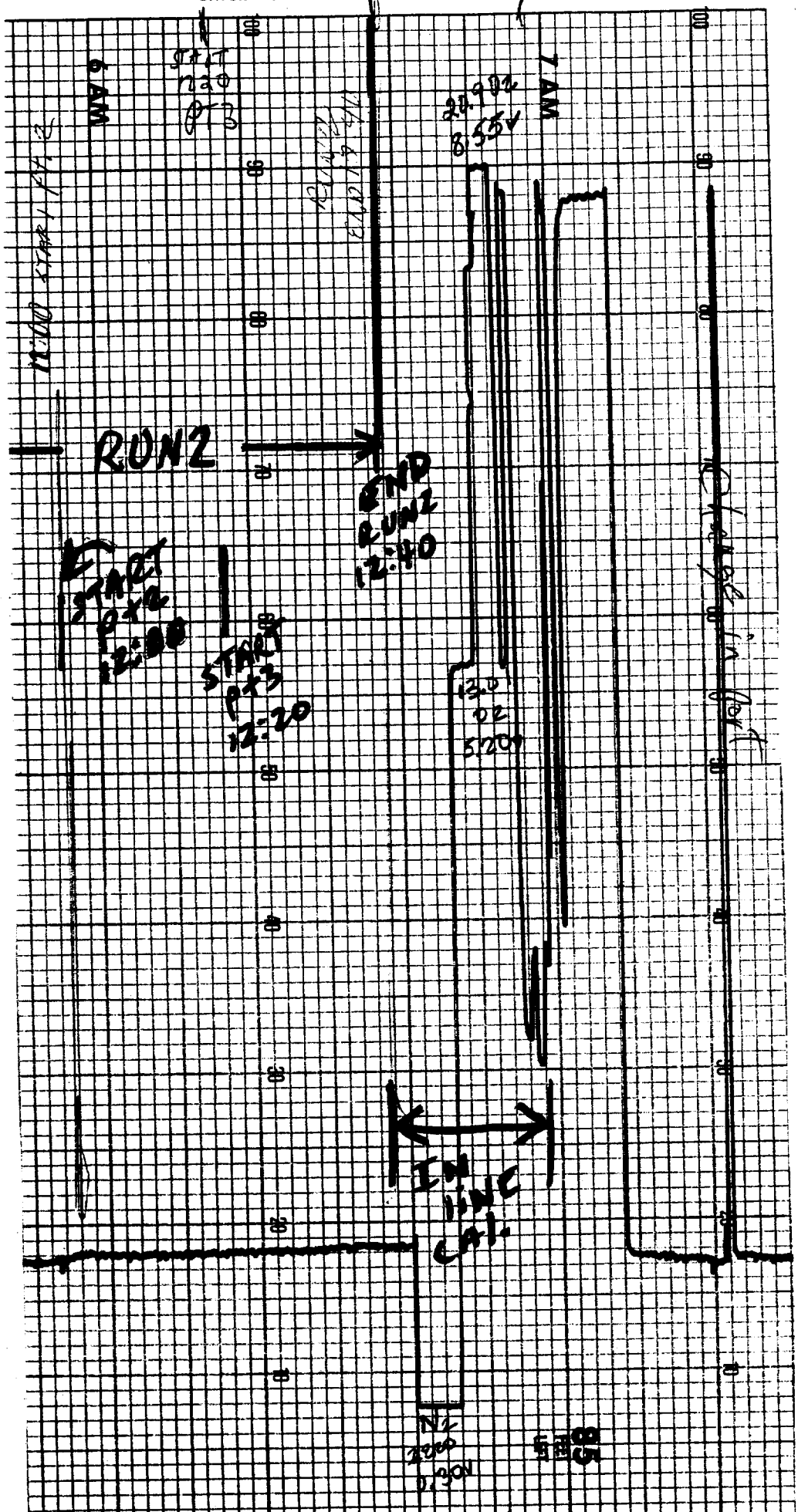

KEM-TECH AIR POLLUTION
CHART PAPER
KEM-TECH LABORATORIES IN
16550 HIGHLAND RD. Rt. 3
BATON ROUGE. LOUISIANA 70
10/6/87
OXYGEN (O2)
BEGIN
09:15
2 AM
3 AM
INITIAL CAL.
STACK
ARCO
BAYOU SALE
10/6/87
OXYGEN
100
90
80
70
60
50
40
30
20
10
0


KEM-TECH
CHAI
Start 1000
Start 1140
4 AM
5 AM
10:00
11:00
RUN1
START RX1 11:40
N2 2400 0.1%Y

AIR POLLUTION

RT PAPER

KEM-TECH LABORATORIES INC.
16550 HIGHLAND RD. Rt. 3
BATON ROUGE, LOUISIANA 70808



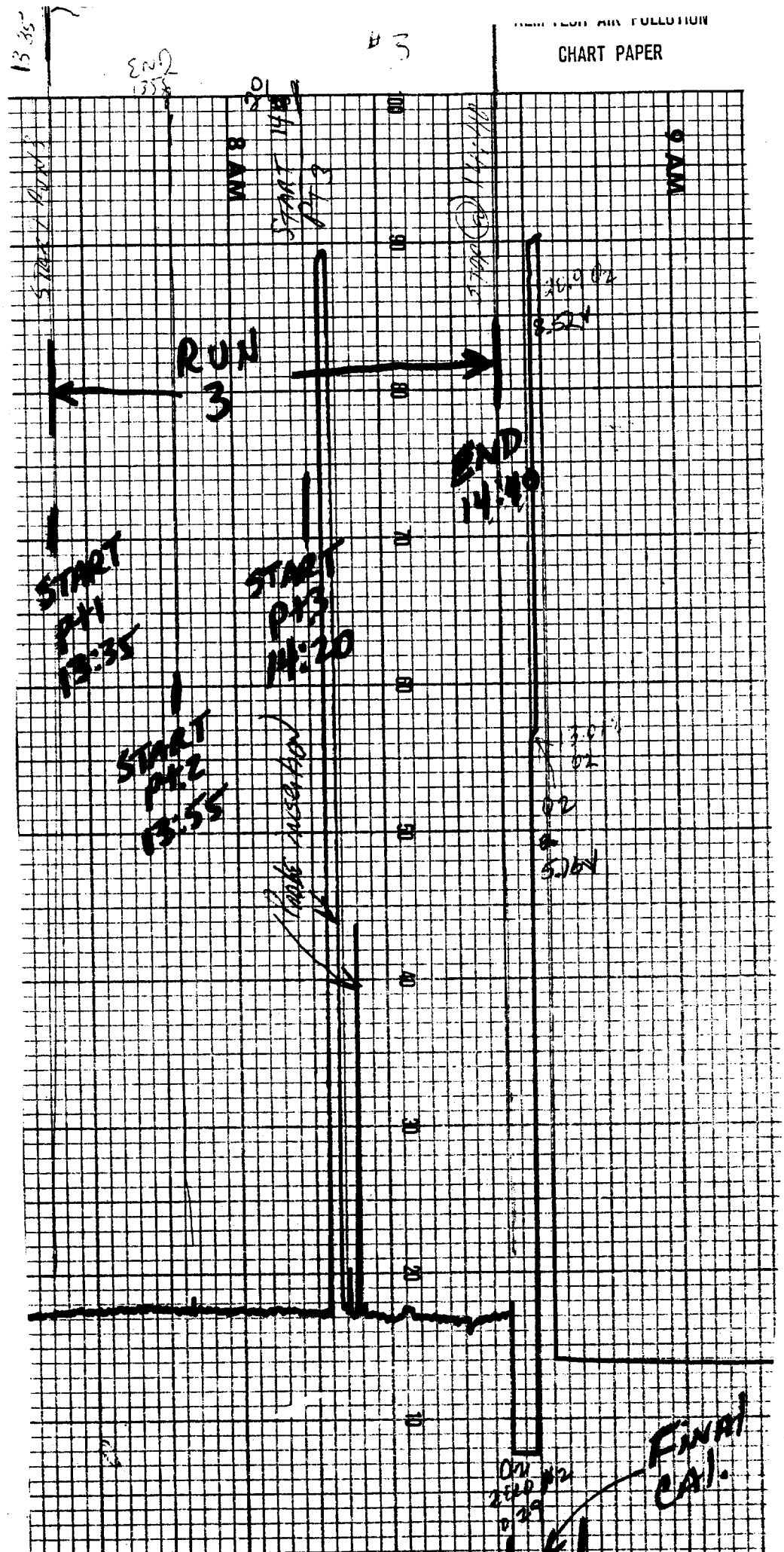


CHART PAPER
RUN 3
START PH1 13:35
START PH2 13:55
START PH3 14:20
END 14:40
WV 8
WV 6
Final Cal.

ETS
EMISSION TESTING SERVICES, INC.

METHOD 6C & 7E DATA SHEET

COMPANY Arco SOURCE # _____ DATE 10/6/87

PARAMETER O_2 LOAD% 58 Mw/auction RUN NUMBER 1

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	Analyzer Response ppm	Absolute Difference mv	Absolute Difference ppm	% Span ±2%
Zero	N_2	0.22	0.18	0.22	0.18	0
Mid	13.01	5.15	12.57	5.14	12.54	1.4
High	20.9	8.57	21.16	8.53	21.06	4.7

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 2.51 Intercept -0.372 Span Range 2.14

Analyzer Cal	Init. Analyzer Resp. mv	Init. Analyzer Resp. ppm	Bias ±5	Final Analyzer Resp. mv	Final Analyzer Resp. ppm	Bias ±5	Span Drift ±3
Zero							
Mid							
High							

$$\text{Sys. Cal. Bias} = \frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$$

$$\%\text{Drift} = \frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$$

TEST DATA

Start time 1000 Finish time 1100 Minutes per point 2

Sample port _____

Test Point	mv PT. 1		PT. 2		PT. 3
1	1.33	11	1.37	21	1.43
2	1.34	12	1.37	22	1.43
3	1.38	13	1.37	23	1.41
4	1.39	14	1.38	24	1.41
5	1.39	15	1.38	25	1.42
6	1.40	16	1.37	26	1.40
7	1.39	17	1.36	27	1.40
8	1.39	18	1.37	28	1.40
9	1.39	19	1.40	29	1.40
10	1.35	20	1.40	30	1.40

Ave. mv 1.39

Ave. conc. 3.11 ppm

COMMENTS:

ETS
EMISSION TESTING SERVICES, INC.

METHOD 6C & 7E DATA SHEET

COMPANY Arco SOURCE # _____ DATE 10/6/87

PARAMETER O_2 LOAD% 50 lb/junction RUN NUMBER 2

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	ppm	Absolute Difference mv	ppm	% Span ±2%
Zero	N_2	0.22	0.17	0.30	0.373	9.5
Mid	13.01	5.14	12.59	5.20	12.74	7.0
High	20.9	8.53	21.15	8.55	21.20	2.3

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 2.52 Intercept −0.38 Span Range 2.14

Analyzer Cal	Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Span ±3	Drift
Zero								
Mid								
High								

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time 1140 Finish time 1240 Minutes per point 2

Sample port _____

Test Point	mv PT. 1		PT. 2		PT. 3
1	1.26	11	1.33	21	1.33
2	1.27	12	1.33	22	1.34
3	1.27	13	1.33	23	1.33
4	1.27	14	1.33	24	1.34
5	1.27	15	1.32	25	1.34
6	1.29	16	1.32	26	1.34
7	1.29	17	1.32	27	1.36
8	1.29	18	1.33	28	1.29
9	1.29	19	1.33	29	1.37
10	1.29	20	1.32	30	1.36

Ave. mv 1.33

Ave. conc. 2.57 ppm

COMMENTS:

ETS
EMISSION TESTING SERVICES, INC.

METHOD 6C & 7E DATA SHEET

COMPANY Arco SOURCE # _____ DATE 10/6/87

PARAMETER O_2 LOAD% 44 Unspecified RUN NUMBER 3

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	ppm	Absolute Difference mv	ppm	% Span ±2%
Zero	N_2	0.30	0.16	0.29	0.13	1.5
Mid	13.01	5.20	12.6	5.16	12.5	5.2
High	20.9	8.55	21.1	8.52	21.1	0

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 2.54 Intercept −0.60 Span Range 1.94

Analyzer Cal	Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Span Drift ±3
Zero							
Mid							
High							

$$\text{Sys. Cal. Bias} = \frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$$

$$\%\text{Drift} = \frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$$

TEST DATA

Start time 1335 Finish time 1440 Minutes per point 2

Sample port _____

Test Point	mv PT. 1		PT. 2		PT. 3
1	1.26	11	1.31	21	1.25
2	1.27	12	1.30	22	1.25
3	1.29	13	1.27	23	1.23
4	1.28	14	1.26	24	1.26
5	1.27	15	1.28	25	1.21
6	1.29	16	1.26	26	1.22
7	1.30	17	1.28	27	1.19
8	1.29	18	1.28	28	1.17
9	1.29	19	1.26	29	1.21
10	1.28	20	1.26	30	1.23

Ave. mv 1.22

Ave. conc. 2.50 ppm

COMMENTS:

UNIT 5A Driver - Waukesha L7042GSI S/N 366534

INTAKE MANIFOLD Pressure
Fuel header pressure
ENGINE SPEED
SPARK ignition timing
Horse power

ST RUN 4.4 MMCF AMBIENT TEMP. 87°

Time Press	INT. MAN. Press.	Fuel Header Press.	ENG. R.P.M.	Timing	INT. TEMP.	Sensor Reading
9:00 A.M. 50#	Lin. Vac.	100#	910	24° BTDC	98° F	1-L 2-L
9:15	1 in. Press.	100#	910	24° BTDC	100° F	1-L 2-L
10:30	½ in. Press.	100#	910	24° BTDC	100° F	1-L 2-L
10:45	1 in. Press.	100#	910	24° BTDC	100° F	1-L 2-L
11:00	¾ in. Press.	100#	910	24° BTDC	103° F	1-L 1-L
11:20	1½ in. Press.	100#	910	24° BTDC	104° F	1-L 2-L
	4.0 MMCF		AMB. Temp	90°		
ND RUN 3:34 50# 1060#	Lin. Vac.	105#	910	24° BTDC	102.5° F	1-L 2-L
1:50	1.5 in. Vac.	100#	910	24° BTDC	104° F	1-L 2-L
2:05	¾ in. Vac.	100#	910	24° BTDC	105° F	1-L 2-L
2:20	1.5 in. Vac.	100#	910	24° BTDC	103.5° F	1-L 2-L
T 2:35	1.0 in. Vac.	100#	910	24° BTDC	104° F	1-L 2-L
2:50	1½ in. Vac.	100#	910	24° BTDC	107° F	1-L 2-L
d Run	3.2 mmcf		AMB. Temp. 90°			Sensor
Time Press 44# 100#	Int. Mani. Press.	Fuel Header Press.	Engine RPM	Timing	int. temp.	Reading
1:05	3.5 in. Vac.	100#	910	24° BTDC	104.5° F	1-L 2-L
20	3.5 in. Vac.	100#	910	24° BTDC	104° F	1-L 2-L
T:35	3.0 in Vac.	100#	910	24° BTDC	106° F	1-L 2-L
:50	3.0 in Vac.	100#	910	24° BTDC	105° F	1-L 2-L
2:05	3.0 in Vac.	100#	910	24° BTDC	105° F	1-L 2-L

Time	Intake Man. Press	Fuel Head Press.	R.P.M.	Timing	Int. temp.	Sensor Reading
20	3.0 in. Voc.	100#	910	24° BTDC	105°F	2-L

ARCO OIL AND GAS COMPANY

BAYOU SALE GAS PROCESSING PLANT LABORATORY

Fuel Gas by 5A Compressor

FIELD: BAYOU SALE

SAMPLE DATE: 7\22\87

SAMPLE ID: SALES TO A.N.R.

STATION #: 040000101

SAMPLE POINT: METER RUN

DATE ANALYZED: 8\6\87

SAMPLE PRESS: 973

SAMPLE TEMPERATURE: 78

ANALYSIS #: 87-183

SAMPLED BY: A. LOUVIERE

ANALYZED BY: P. ADAMS

COMPONENT	MOL. PER CENT	GPM
NITROGEN	0.27	0.0000
METHANE	96.43	0.0000
CARBON DIOXIDE	1.09	0.0000
ETHANE	2.17	0.5588
PROPANE	0.04	0.0112
ISO-BUTANE	0.00	0.0000
N-BUTANE	0.00	0.0000
ISO-PENTANE	0.00	0.0000
N-PENTANE	0.00	0.0000
HEXANES PLUS	0.00	0.0000
TOTAL	100.00	0.5700

SPECIFIC GRAVITY @ 60 DEG F (AIR = 1): 0.5762

BTU (DRY @ 15.025 PSIA): 1036.41

BTU (WET @ 15.025 PSIA): 1018.38

VII. APPENDIX

Contained in this section are the dry gas meter calibration, pitot tube calibration, gas standard certifications and resumes of the persons performing the testing. Also included are excerpts from the instrument operations manuals for all analytical instruments used, showing the principle of operation, performance specifications, flow diagrams, etc..

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English Units)

Initial Dry Gas - 805.354

Date 9-26-87

Meter box number 500

Barometric pressure, P_b 30.21 in. Hg

Calibrated by K. Thibodeaux

Orifice manometer setting (ΔH), in. H_2O	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter Inlet (t_{d_i}), °F	Dry gas meter Outlet (t_{d_o}), °F	Dry gas meter Avg[a] (t_d), °F	Time (0), min.
0.5	5	810.210	82.4	105 / 118	99 / 102	106	11.20
1.0	5	815.207	82.6	120 / 129	105 / 109	116	8.26
1.5	10	825.517	82.9	127 / 139	111 / 116	123.25	13.66
2.0	10	836.088	83.1	126 / 147	121 / 125	130	12.10
3.0	10	847.019	83.3	142 / 151	127 / 131	138	10.25
4.0	10						

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \; H}{P_b (t_d + 460)} \left[\frac{(t_w + 460) \; 0}{V_w}\right]^2$
0.5	0.0368	1.073	1.378
1.0	0.0737	1.059	1.473
1.5	0.110	1.038	1.495
2.0	0.147	1.023	1.553
3.0	0.221	~~1.000~~ .999	1.642
4.0	0.294		
Average		1.039	1.508

Y = Ratio of reading of wet test meter to dry test meter; tolerance for individual values ± 0.02 from average.

$H_@$ = Orifice pressure differential that equates to 0.75 cfm of air @ 68 F and 29.92 inches of mercury, in. H_2O; tolerance for individual values ± 0.20 from average.

Calibrated by Kevin Thibodeaux

PITOT TUBE CALIBRATION

Pitot Tube Number P-3-2 Cp (std) 0.99

Calibrated By Brad Latham Date 08-21-87

Point Number	Standard Pitot Δp (in. H_2O)	"S" Type Pitot Δp (in. H_2O) "A" Side	"B" Side
1	0.945	1.540	1.510
2	0.645	0.845	0.780
3	0.090	0.111	0.110

Calculations:

$$Cp_{(s)} = Cp_{(std)} \times \sqrt{\frac{\Delta p\ (std)}{\Delta p\ (s)}}$$

Deviation $= Cp_{(s)} - \overline{Cp}$ (Side A or B)

Avg. Dev. $= \dfrac{\sum_{1}^{3} \left| Cp_{(s)} - \overline{Cp} \right|}{3}$ (Side A or B)

"A" Side $Cp_{(s)}$	"A" Side Deviation	"B" Side $Cp_{(s)}$	"B" Side Deviation
0.776	-0.068	0.783	-0.076
0.865	0.021	0.900	0.041
0.891	0.047	0.895	0.036

$\overline{Cp}$ = 0.844 = 0.859

$\left| \overline{Cp}\ (\text{Side A}) - \overline{Cp}\ (\text{Side B}) \right|$ = -0.015 (must be $\leq$ 0.01)

Avg. Dev. (Side A) = 0.00 (must be $\leq$ 0.01)

(Side B) = 0.00 (must be $\leq$ 0.01)

$Cp = \dfrac{\overline{Cp}\ (\text{Side A}) + \overline{Cp}\ (\text{Side B})}{2}$ (should be $0.80 \leq Cp \leq 0.85$) = 0.852

GAS STANDARDS USED FOR ARCO

	CO	O_2	NO_x
	1) 603 ppm CO	1) 20.9% AIR	1) 4835 ppm NO
			4840 ppm NO_x
TE	9/24/86		9/24/86
l. #	AAL-16169		AAL-5804
o. #	100572		100572
nl.	1%		2%
j. #	705274		705274
	2) 301.92 ppm CO	2) 13.01% O_2	2) 2548 NO_x
TE	5/4/87		
l. #	AAL-17874	CT 32168	IA-3438
o. #	921885		
nl.	1% P0439	NITROGEN	
j. #	verbal		
	3) 89.85 ppm CO		
ATE	9/2/87		
l. #	AAL-18938		
o. #	verbal		
nal.	1% P0702		
oj. #	923910		

OXYGEN CERTIFICATION

REFERENCE METHOD - ORSAT ANALYSIS

COMPONENT:	OXYGEN	DATE OF ANALYSIS:	8-Ø3-87
BALANCE:	NITROGEN	CYLINDER IDENT.:	CT32168
SAMPLING METHOD:	GRAB SAMPLE	ANALYSIS METHOD:	ORSAT

TEST NO.	% OXYGEN
1	13.Ø
2	13.Ø
3	13.Ø
4	13.Ø
5	13.1
6	13.Ø
7	13.Ø
8	13.Ø
9	13.Ø
TOTAL	117.1
MEAN	13.Ø1 %

CERTIFIED BY: Brad Fathom

DATE: 08-21-87

Scott Specialty Gases

TROY, MI. 48083 PHONE: 313-589-2950 FAX NO: 313-589-2134

Date Shipped 9/2/87
Our Project No: 923910
Your P.O. No: VERBAL
Page 1 of 1

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL-18938 Certified Accuracy 1 % NBS Traceable Analysis Dates: First 8/21/87 Last 8/31/87

P0702 CYLINDER PRESSURE 2000 PSIG

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
Carbon Monoxide	89.85 ppm	2/28/89	Beckman NDIR	1680B	89.58 ppm	89.99 ppm
				CAL2284 475 ppm	89.99 ppm	89.58 ppm
Nitrogen	Balance			1679C	89.58 ppm	89.99 ppm
				CAL5168 97.10 ppm		

Cylinder Number AAL-7912 Certified Accuracy 1 % NBS Traceable Analysis Dates: First 8/24/87 Last 8/31/87

P0703 CYLINDER PRESSURE 2000 PSIG

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
Carbon Monoxide	59.76 ppm	2/28/89	Beckman NDIR	1680B	60.16 ppm	59.76 ppm
				CAL2284 475 ppm	60.16 ppm	59.76 ppm
Nitrogen	Balance			1679C	60.16 ppm	59.76 ppm
				CAL5168 97.10 ppm		

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No:

Analyst Bob Pritchard Approved By J. Shapiro

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CERTIFIED REFERENCE MATERIALS ■ EPA PROTOCOL GASES ■ ACUBLEND® ■ CALIBRATION & SPECIALTY GAS MIXTURES
PURE GASES ■ ACCESSORY PRODUCTS ■ CUSTOM ANALYTICAL SERVICES

PLUMSTEADVILLE, PENNSYLVANIA / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS / WHEELING, ILLINOIS
SOUTH PLAINFIELD, NEW JERSEY / FREMONT, CALIFORNIA / WAKEFIELD, MASSACHUSETTS

Scott Specialty Gases a division of Scott Environmental Technology, Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

Date Shipped _____
Our Project No: _____
Our P.O. No: _____
Page 7 of 7

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*
(Concentrations are in mole % or ppm)

Cylinder Number AAL-17874 Certified Accuracy 1 % NBS Traceable Analysis Dates: First 4-23-87 Last 4-30-87

P0439

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
Carbon Monoxide	301.92 PPM	10-30-87	Beckman NDIR	1681B 1679C	301.92 PPM	301.92 PPM
					301.92 PPM	301.92 PPM
Nitrogen	Balance				301.92 PPM	301.92 PPM

Cylinder Number _____ Certified Accuracy _____ % NBS Traceable Analysis Dates: First _____ Last _____

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No:

Analyst Bob Patiff Approved By J. Shapiro

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CERTIFIED REFERENCE MATERIALS ■ EPA PROTOCOL GASES ■ ACUBLEND® ■ CALIBRATION & SPECIALTY GAS MIXTURES
PURE GASES ■ ACCESSORY PRODUCTS ■ CUSTOM ANALYTICAL SERVICES
TROY, MICHIGAN / SAN BERNARDINO CALIFORNIA / HOUSTON, TEXAS

ANALYTICAL REPORT — cont'd

Date: SEPTEMBER 24, 1986
Our Project No.: 705274
Your P.O. No.: 100572

DUPLICATE

OCT 20 1986 RECEIVED

Cyl. No. AAL16181 Analytical Accuracy ±1%

Component	Concentration
CARBON MONOXIDE	300ppm
NITROGEN	BALANCE

ANALYSIS USING STANDARDS PREPARED WITH NBS TRACEABLE WEIGHTS

Cyl. No. AAL16169 Analytical Accuracy ±1%

Component	Concentration
CARBON MONOXIDE	603ppm
NITROGEN	BALANCE

ANALYSIS USING STANDARD PREPARED WITH NBS TRACEABLE WEIGHTS

Cyl. No. AAL186 Analytical Accuracy ±2%

Component	Concentration
NITRIC OXIDE	962ppm
REPORT NO_x	965ppm
NITROGEN	BALANCE

Cyl. No. AAL10932 Analytical Accuracy ±1%

Component	Concentration
NITRIC OXIDE	1513ppm
REPORT NO_x	1517ppm
NITROGEN	BALANCE

ANALYSIS USING STANDARD PREPARED WITH NBS TRACEABLE WEIGHTS

Cyl. No. AAL5804 Analytical Accuracy ±2%

Component	Concentration
NITRIC OXIDE	4835ppm
REPORT no_x	4840ppm
NITROGEN	BALANCE

Cyl. No. A17192 Analytical Accuracy ±2%

Component	Concentration
CARBON MONOXIDE	915ppm
NITROGEN	BALANCE

Analyst Marc C. Brazelle

Approved By

CERTIFIED REFERENCE MATERIALS EPA PROTOCOL GASES
ACUBLEND® CALIBRATION & SPECIALTY GAS MIXTURES PURE GASES
ACCESSORY PRODUCTS CUSTOM ANALYTICAL SERVICES

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.