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

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

Background Report Reference

AP-42 Section Number: 1.4

Background Chapter: 2

Reference Number: 15

Title: Emissions Source Test Report for Recirculation Gas By-Pass and Urea Compliance Testing Etiwanda Unit 3 Permit Application No. 261513

Acurex Environmental

Acurex Environmental

March 1994

AP-42 #15
Section 1.4
(BID Ch. 2)

EMISSIONS SOURCE TEST REPORT FOR

RECIRCULATION GAS BY-PASS AND UREA COMPLIANCE TESTING

ETIWANDA UNIT 3

PERMIT APPLICATION NO. 261513

Source Location:

Southern California Edison - Etiwanda Generating Station
8996 Etiwanda Avenue
Etiwanda, CA 91739

Submitted to:

Southern California Edison Company
Environmental Affairs
2244 Walnut Grove Avenue
Rosemead, California 91770

Submitted by:

Acurex Environmental
Southwest Regional Office
One Technology Drive, Suite F213
Irvine, California 92718

Project Engineer — Doug Urry

Quality Assurance — Mitchell R. Wool

TABLE OF CONTENTS

APPENDIX		PAGE

SECTION 1

INTRODUCTION

Acurex Environmental was contracted by Southern California Edison Company (SCE) to conduct emissions source testing on Unit No. 3 located at Edison's Etiwanda Generating Station. This test program was conducted to quantify the effect of recirculation gas by-pass (RGB) and urea injection on various stack emissions as required in the South Coast Air Quality Management District (SCAQMD) Permit to Construct (PTC) No. 261513 (Condition 14B). Emissions measured were nitrogen oxides (NO_X), carbon monoxide (CO), oxygen (O_2), reactive organic gases (ROG), and ammonia (NH_3).

This report summarizes results for the source tests performed as required by the PTC. Source tests were performed as specified in the conditionally approved Acurex Environmental source test protocol dated April 22, 1993; the conditional approval memorandum issued June 1, 1993 by the SCAQMD; and subsequent phone conversations between Mr. Michael Escarcega of Edison, and Mr. Darren Stroud and Mr. Glenn Kasai of the SCAQMD on January 18 and January 19, 1994, respectively. The most significant changes to the test scope as specified in the PTC, but approved by the SCAQMD were the elimination of particulate testing and the reduction of the ROG test requirement from all loads and test conditions to only full load baseline and full load RGB + Urea. A copy of the source test protocol, the District memorandum, and records of the referenced phone conversations are provided in Appendix A.

The results of this source test are summarized in Section 2. Section 3 provides a description of the SCE boiler and Sections 4 through 7 detail sampling and analysis procedures and results for each test parameter. Appendices B through H provide supporting documentation for data presented in Sections 4 through 7 and are specifically referenced where appropriate.

Key information pertaining to the emissions test series is summarized in Table 1-1, and the test matrix used at each of the three test loads (low, mid-, and high) is listed in Table 1-2.

Table 1-1. Etiwanda No. 3 Source Test Information

Source Tested	Southern California Edison's Etiwanda Generating Station, Utility Boiler No. 3
Test Location	8996 Etiwanda Ave. Etiwanda, CA 91739
Test Requested By	South Coast Air Quality Management District
Reason For Test	Addition of recirculation gas by-pass system (PTC Application No. 261513)
Test Dates	March 22-24, 1994
Tests Performed By	Acurex Environmental, Southwest Regional Office Project Engineer: Chad Garretson (714) 453-1264
Key Edison Contacts	Stafford Pease (818) 302-4034 Mike Escarcega (818) 302-4032

Table 1-2. Test Matrix for Etiwanda Unit No. 3

Boiler Operating Conditions		Test Parameter	Sampling Method	Analytical Method
Full Load	Baseline	NO_x,CO,O_2	SCAQMD 100.1	[a]Various
		Moisture	SCAQMD 4.1	Gravimetric
		Flow Rate	SCAQMD 1.1-3.1	NA
		[b]ROG	SCAQMD 25.1	[c]TCA/FID
	RGB On	NO_x,CO,O_2	SCAQMD 100.1	Various
		Moisture	SCAQMD 4.1	Gravimetric
		Flow Rate	SCAQMD 1.1-3.1	NA
	RGB and Urea Injection On	NO_x,CO,O_2	SCAQMD 100.1	Various
		Flow Rate	SCAQMD 1.1-3.1	NA
		ROG	SCAQMD 25.1	TCA/FID
		Ammonia Slip/ Moisture	[d]SCAQMD Draft Method 207.1	Colorimetric
Mid-Load	Baseline	NO_x,CO,O_2	SCAQMD 100.1	Various
		Moisture	SCAQMD 4.1	Gravimetric
		Flow Rate	SCAQMD 1.1-3.1	NA
	RGB On	NO_x,CO,O_2	SCAQMD 100.1	Various
		Moisture	SCAQMD 4.1	Gravimetric
		Flow Rate	SCAQMD 1.1-3.1	NA
	RGB and Urea Injection On	NO_x,CO,O_2	SCAQMD 100.1	Various
		Ammonia Slip/Moisture	SCAQMD Draft Method 207.1	Colorimetric
		Flow Rate	SCAQMD 1.1-3.1	NA

[a]Various: NO_X - chemiluminescence
CO - non-dispersive infared (NDIR)
O_2 - electrochemical

[b]SCAQMD Method 25.1 was performed at full load baseline and full load RGB plus urea injection conditions only

[c]TCA/FID - Total combustion analysis/flame ionization detector

[d]SCAQMD Draft Method 207.1 for Ammonia and Ammonium Compounds From Stationary Sources

NA - Not Applicable

Table 1-2. Test Matrix for Etiwanda Unit No. 3 (continued)

Boiler Operating Conditions		Test Parameter	Sampling Method	Analytical Method
Low Load	Baseline	NO_x,CO,O_2	SCAQMD 100.1	Various
		Moisture	SCAQMD 4.1	Gravimetric
		Flow Rate	SCAQMD 1.1-3.1	NA
	RGB On	NO_x,CO,O_2	SCAQMD 100.1	Various
		Moisture	SCAQMD 4.1	Gravimetric
		Flow Rate	SCAQMD 1.1-3.1	NA

NA - Not Applicable

SECTION 2

RESULTS SUMMARY

Boiler operating parameters (boiler output, fuel flow rate and air to fuel ratio), stack gas characteristics (flow rate, temperature and moisture content), and urea injection system data (urea injection rate and concentration) are summarized for each test condition in Table 2-1. Records of boiler operating parameters are provided in Appendix B.

NO_X, CO, O_2, ROG, and NH_3 emission measurement results are summarized in Table 2-2. No emission measurement results exceed PTC limits. For each test condition, Table 2-2 lists stack gas NO_X, CO, O_2, ROG, and NH_3 concentrations (corrected to 3 percent oxygen) and emission rates. ROG results presented in Table 2-2 represent an average of duplicate sampling and analysis results.

NO_X, CO, NH_3, and ROG mass emission rates were calculated based on measured concentration data and flow rate data collected during gaseous constituent concentration measurements. Documentation of NO_X, CO, NH_3, and ROG emission rate calculations is provided in Appendix D-7.

Table 2-1. Boiler Operating Conditions and Stack Gas Characteristics

Test Condition	Boiler Output (Net MW)	Fuel Flow Rate (mmscf/hr)	Air to Fuel Ratio	Urea		Stack Gas		
				Injection Rate (gal/hr)	Concentration (%)	Flow Rate (mmscf/hr)	Moisture Content (%)	Temperature (°F)
Full Load, Baseline	319	3.074	20.3	NA	NA	39.62	15.6	250
Full Load, RGB On	319	3.079	20.6	NA	NA	40.56	15.9	249
Full Load, RGB and Urea On	318	3.076	20.2	81	20	39.44	16.4	250
Mid-load, Baseline	249	2.376	20.0	NA	NA	30.97	15.3	225
Mid-load, RGB On	250	2.386	19.9	NA	NA	31.04	15.6	229
Mid-load, RGB and Urea On	250	2.389	19.6	39	20	30.85	16.0	230
Low Load, Baseline	122	1.266	17.3	NA	NA	15.50	14.7	182
Low Load, RGB On	123	1.271	17.5	NA	NA	15.72	15.0	182

Table 2-2. Source Test Results

Test Condition	Stack Gas O_2	Stack Gas NO_X		Stack Gas CO		Stack Gas ROG		Stack Gas NH_3	
	percent	[a]ppm	lb/hr	[a]ppm	lb/hr	[a]ppm	lb/hr	[a]ppm	lb/hr
Full Load, Baseline	3.1	62.0	297	197	574	130	217	NA	NA
Full Load, RGB On	3.3	54.3	263	217	639	NA	NA	NA	NA
Full Load, RGB and Urea On	3.2	46.3	219	206	595	160	265	6.6	12
Mid-load, Baseline	3.6	44.4	161	151	334	NA	NA	NA	NA
Mid-load, RGB On	3.7	32.5	118	150	330	NA	NA	NA	NA
Mid-Load, RGB and Urea On	3.7	28.1	101	148	324	NA	NA	4.2	5.5
Low Load, Baseline	4.8	23.1	39	0.8	1	NA	NA	NA	NA
Low Load, RGB On	4.8	14.8	25	10.1	11	NA	NA	NA	NA

NA - Not Applicable
ND - No Data
[a]ppm corrected to 3 percent O_2, ROG concentrations are reported as methane
Note: Urea injection not used below mid-load.

SECTION 3

BOILER DESCRIPTION

Etiwanda Unit 3 is rated at 320 MW net generation and has a tangentially fired, controlled-circulation boiler designed by Combustion Engineering (CE) to burn gas or oil fuel. Maximum capacity of the boiler is 2,305,000 lb/hr steam. Design steam conditions are 2450 psig, 1050 °F superheat, and 1000 °F reheat.

This boiler is one of six similar CE tangentially fired boilers in the SCE system. All six are fired from the top and have division walls and three tiers of burners consisting of eight burners in each tier. Each burner contains an oil gun and two injectors. The boiler is equipped with burner tilts which can be varied from +10 to -30 degrees from horizontal.

Combustion air is supplied by two forced draft fans through primary and secondary air ducts. Air flow to individual burners is controlled by dampers. Existing controls regulate the position of all primary dampers and all secondary dampers separately.

Unit 3 has two flue gas recirculation fans that mix flue gas with the primary and secondary air supply. The recirculated gases are therefore mixed with the bulk gas fires that are characteristic of tangentially fired units.

SECTION 4

SCAQMD METHOD 100.1, NO_X, CO, AND O_2 CONCENTRATION MEASUREMENTS

Section 4 summarizes SCAQMD Method 100.1 test procedures and results. A description of the sampling and analysis system is provided in Section 4.1. Method 100.1 concentration, stratification, and quality assurance/quality control (QA/QC) results are summarized in Sections 4.2, 4.3, and 4.4, respectively. Finally, SCAQMD Method 100.1 data reduction procedures are discussed in Section 4.5.

NO_X, CO, and O_2 concentration measurements were performed with strict adherence to Method 100.1 sampling and analysis procedures. Each constituent concentration was monitored continuously for 60 minutes, and sampling was performed concurrent with all other gaseous constituent concentration measurements. All measurements were performed at existing sampling facilities on the stack. Sampling locations and stack dimensions are shown in Figure 4-1.

4.1 Sampling System

Continuous emissions monitoring (CEM) instruments in the Acurex Environmental Mobile Laboratory were used to measure gaseous constituent concentrations present in the sample stream. The Acurex Environmental Mobile Laboratory is certified by the California Air Resources Board; a copy of the certificate is provided in Appendix I. A schematic of the CEM instrumentation is provided in Figure 4-2. The sample extraction and conditioning system consists of a stainless steel sampling probe connected to a heated teflon sample line located upstream of a Universal Analyzers gas sample conditioner. The sample line between the probe and the sample conditioner is heated to 250°F to maintain the gas stream temperature above the water dew point. The sampling system is constructed to avoid contact between the sample gas and moisture and therefore minimize nitrogen dioxide (NO_2) absorption.

From the sample gas conditioner, the sample stream passes through a flexible teflon sample line to a flow control system which meters the sample flow rate through the monitoring instruments. Sample flow rate is controlled with a bypass pressure regulator located at the instrument manifold. Flow to each monitoring instrument is controlled using individual flow control valves and meters. The CEM instrument specifications are summarized in Table 4-1. Instrument output is recorded by a strip chart recorder and an integrated data logging system. The logging device records 1 minute averages throughout each test.

All instrument calibrations were performed using National Bureau of Standards (NBS) traceable gas standards certified to ± 1 percent analytical accuracy. Copies of calibration gas certification sheets are provided in Appendix D-1.

ETIWANDA UNIT 3

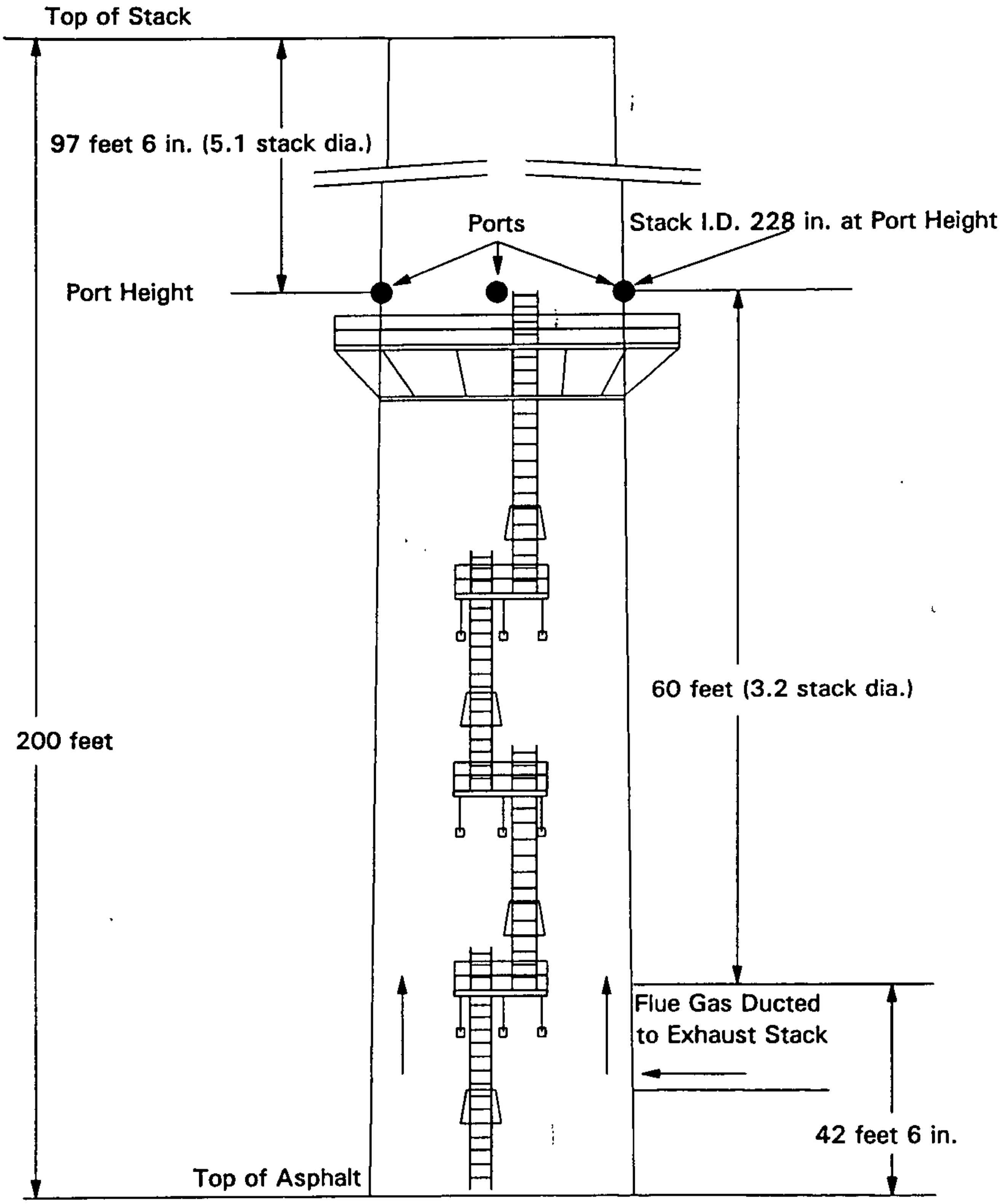


Figure 4-1. Diagram of Stack Dimensions and Sampling Locations

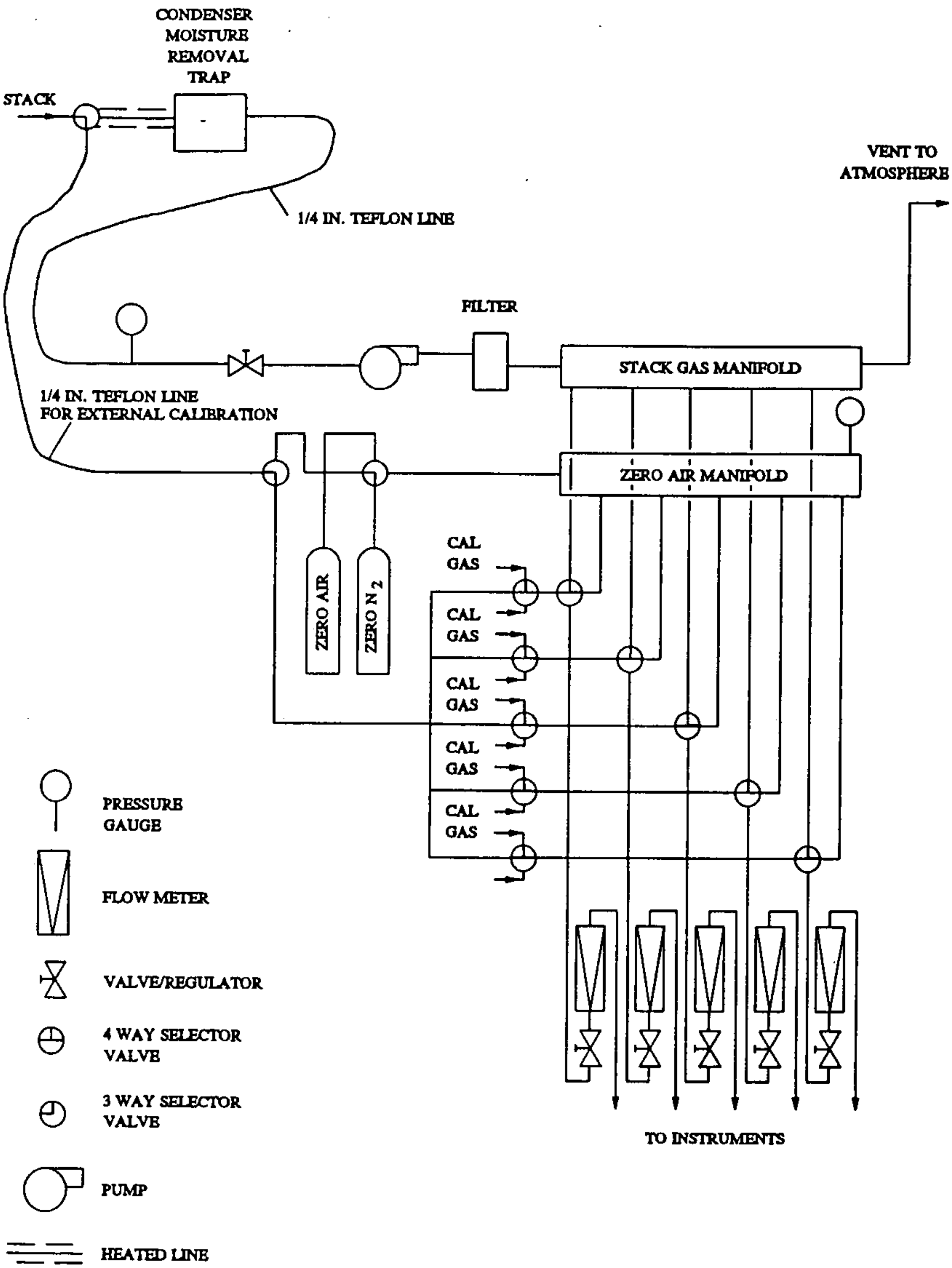


Figure 4-2. Schematic Diagram of CEM Instrumentation in the Acurex Environmental Mobile Laboratory

Table 4-1. Continuous Emissions Monitoring Instruments

NO_X CHEMILUMINESCENT ANALYZER—THERMO ELECTRON MODEL 10A	
Response Time (0-95%)	3 sec—NO_X mode
Zero Drift	Negligible after 1/2 hour warmup
Linearity	±1% of full scale
Accuracy	±1% of full scale
Output	0-10 V
Range	0-2.5, 10, 25, 100, 250, 1000, 2500, and 10,000 ppm
Sensitivity	0.1 ppm
O_2 ANALYZER, FUEL TYPE—TELEDYNE MODEL 326A	
Response Time (0-95%)	30 sec
Accuracy	±1% of scale at constant temperature; ±1% of scale at ±5% of reading, whichever is greater, over the operating temperature range
Output	0-100 mV
Range	0-5, 10, 25 %
CO INFRARED ANALYZER—TECO MODEL 48	
Response Time (0-95%)	30 sec
Zero Drift	±1%
Span Drift	±1%
Linearity	1%
Output	4-20 mA
Range	0-1, 2, 5, 10, 20, 50, 100, 200, 500, 1000 ppm

4.2 Method 100.1 Emissions Data

NO_X, CO, O_2, and carbon dioxide (CO_2) emissions data are summarized in Table 4-2, which lists stack gas constituent concentrations, and concentrations corrected to 3% O_2 for NO_X and CO, for each test condition. CO_2 concentration measurements were performed to provide data necessary to calculate stack gas molecular weight as prescribed in SCAQMD Method 3.1.

Table 4-2. Method 100.1 Test Results

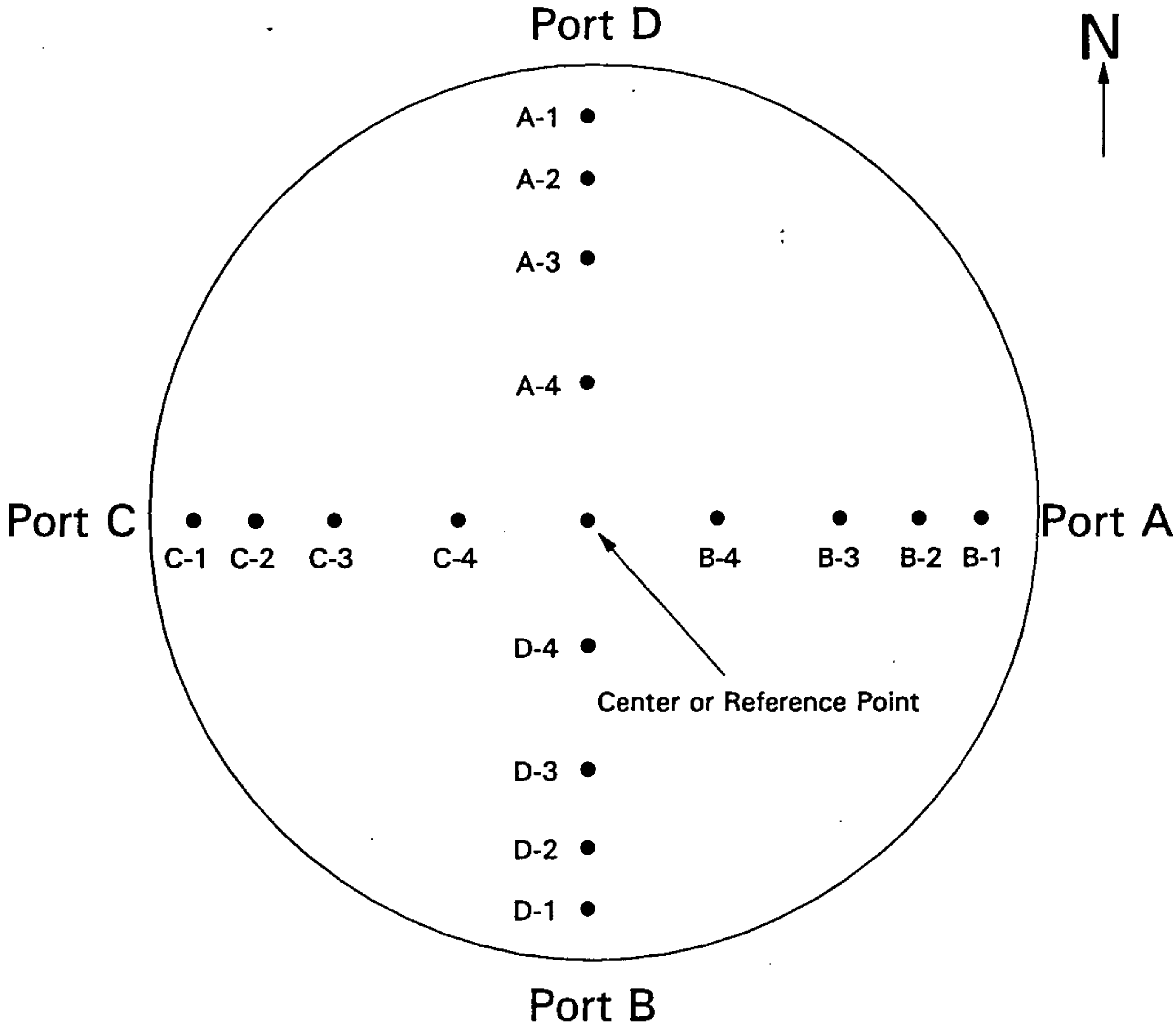
Test Condition	NO_X (ppm)	NO_X @ 3% O_2 (ppm)	CO (ppm)	CO @ 3% O_2 (ppm)	O_2 (%)	CO_2 (%)
Full Load, Baseline	61.7	62.0	196	197	3.1	10.0
Full Load, RGB On	53.4	54.3	213	217	3.3	10.0
Full Load, RGB and Urea On	45.8	46.3	204	206	3.2	10.0
Mid-load, Baseline	42.9	44.4	146	151	3.6	9.7
Mid-load, RGB On	31.2	32.5	144	150	3.7	9.7
Mid-load, RGB and Urea On	27.0	28.1	142	148	3.7	9.6
Low Load, Baseline	20.8	23.1	0.7	0.8	4.8	8.9
Low Load, RGB On	13.3	14.8	9.1	10.1	4.8	9.0

4.3 Stratification Measurement Data

Constituent concentration stratification was assessed prior to performing Method 100.1 sampling at mid- and low operating loads. Per agreement with the SCAQMD (Appendix A-4), full load stratification testing was not performed. Stratification was determined following procedures submitted in the source test protocol.

Each stratification determination was performed by measuring NO_X concentrations at the 16 traverse point locations illustrated in Figure 4-2. A copy of the field test data sheet documenting stratification test traverse point locations is provided in Appendix D-4. A stack diagram showing sampling port locations is provided in Appendix C. Through each sampling port, the sampling probe was first placed at the reference point (center point), followed by each traverse point, and then returned to the reference point. NO_X concentrations were measured at

Figure 4-2. Stratification Test Traverse Point Locations



Traverse Point Locations (inches)

Stack I.D.	228 inches
Point 4	73 5/8 inches
Point 3	44 ¼ inches
Point 2	24 inches
Point 1	7 ¼ inches

each sample location for at least 3 minutes.

NO_X concentration measurements performed to assess gaseous constituent stratification at mid- and low operating loads are summarized Tables 4-3 and 4-4, respectively. Stratification results were calculated following SCAQMD Source Test Manual, Chapter X, Section 13 procedures. Stratification was less than 10% at each operating load; therefore, all gaseous constituent concentration measurements, including ROG and NH_3, were performed at the center point of the exhaust stack.

Copies of stratification field test data sheets and strip chart records are provided in Appendix D-2 and D-3, respectively

Table 4-3. Mid-load (250 MW) Stratification Test Results

Time	Traverse Point	Measured NOx Conc. Tx (ppm)	Kx	Txn	Time	Traverse Point	Measured NOx Conc. Tx (ppm)	Kx	Txn
0744	reference	41.6			0850	reference	41.6		
0748	A−1	41.6	1.00	41.6	0854	C−1	41.4	1.00	41.4
0752	A−2	41.7	1.00	41.6	0859	C−2	41.7	1.00	41.8
0757	A−3	41.8	1.00	41.7	0903	C−3	41.2	0.99	41.2
0802	A−4	41.3	0.99	41.3	0908	C−4	41.1	0.99	41.1
0807	reference	41.7			0913	reference	41.5		
	reference avg:	41.7				reference avg:	41.6		
0816	reference	41.7			0921	reference	41.3		
0821	D−1	41.4	1.00	41.5	0926	B−1	41.0	0.99	41.0
0825	D−2	41.6	1.00	41.8	0930	B−2	41.2	0.99	41.2
0830	D−3	41.3	1.00	41.4	0934	B−3	41.3	0.99	41.3
0835	D−4	41.1	0.99	41.2	0938	B−4	41.8	1.00	41.8
0839	reference	41.2			0943	reference	41.6		
	reference avg:	41.5				reference avg:	41.5		

Statification Test Results:

Txn (avgerage):	41.4
Txn (maximum):	41.8
Txn (minimum):	41.0
Stratification:	1.9%

Where:

Kx = Proportionality Constant (conc. at traverse point x / avg. concentrationn at reference point)
Tx = Concentration at traverse point x
Txn = Normalized value of concentration at traverse point x

Table 4-4. Low load (120 MW) Stratification Test Results

Time	Traverse Point	Measured NOx Conc. Tx (ppm)	Kx	Txn	Time	Traverse Point	Measured NOx Conc. Tx (ppm)	Kx	Txn
2033	reference	20.1			2130	reference	20.7		
2037	B−1	20.3	1.00	20.1	2134	D−1	20.9	0.99	19.9
2041	B−2	20.3	1.00	20.1	2138	D−2	21.3	1.01	20.2
2045	B−3	20.4	1.00	20.2	2143	D−3	20.2	0.96	19.2
2049	B−4	19.9	0.98	19.7	2149	D−4	21.3	1.01	20.2
2054	reference	20.5			2153	reference	21.6		
	reference avg:	20.3				reference avg:	21.2		
2101	reference	20.5			2203	reference	21.1		
2105	A−1	20.6	1.00	20.1	2207	C−1	20.8	1.01	20.4
2110	A−2	20.5	1.00	20.0	2211	C−2	20.7	1.01	20.3
2114	A−3	20.7	1.00	20.2	2215	C−3	20.7	1.01	20.3
2118	A−4	20.7	1.00	20.2	2219	C−4	20.6	1.00	20.2
2122	reference	20.7			2224	reference	20.5		
	reference avg:	20.6				reference avg:	20.8		

Statification Test Results:

Txn (avgerage):	20.1
Txn (maximum):	20.4
Txn (minimum):	19.2
Stratification:	6.0%

Where:

Kx = Proportionality Constant (conc. at traverse point x / avg. concentrationn at reference point)
Tx = Concentration at traverse point x
Txn = Normalized value of concentration at traverse point x

4.4 Sampling System QA/QC

Sampling system and instrument performance measurements were recorded throughout this source test with strict adherence to Method 100.1 QA/QC procedures. Analyzer calibration error, instrument linearity, and system bias were assessed before and after each test run. Zero and calibration drift were assessed following each test run. In addition, sampling system leak checks were performed before and after each test run.

All NO_X, CO, and O_2 analyzer and sampling system performance measurements were within error tolerances listed in Method 100.1 procedures with the following exceptions. The CO linearity error for the low load tests ranged from 1.2 to 1.4 percent instead of < 1.0 percent. This minor deviation in CO instrument linearity for low load tests does not impact the test results in demonstrating compliance with the 500 ppm CO limit as the results are < 10 ppm. The CO_2 linearity error for several tests ranged from 1.0 to 1.2 percent instead of < 1.0 percent, and the CO_2 post-test analyzer calibration error for the mid-load RGB plus urea injection test was 2.1 percent instead of < 2.0 percent, as specified in the method. The CO_2 measurements were used only to calculate stack gas molecular weight; therefore, these slight deviations from the performance tolerance requirements have negligible impact on test results.

Strip charts of the semi-annual analyzer certifications for response time and NO_2 to nitrous oxide (NO) converter efficiency are provided in Appendix D-5. The TECO Model 10AR NO_X analyzer used for this test series was outfitted with a low temperature molybdenum (moly) converter. The moly converter demonstrated an acceptable NO_2 to NO conversion efficiency as evaluated following EPA Method 20, Section 5.6 procedures (see Appendix D-5).

4.5 Data Reduction Procedures

CEM data were permanently recorded on multichannel strip chart recorders; in addition, a data logging system recorded 1 minute average constituent concentrations. The data stored in the logging system was downloaded and used to derive the test results. All CEM data were corrected for instrument drift and sampling system bias per Method 100.1. The calibration responses recorded by the data logger were used to correct the data logger information, and derive the final results presented in Table 4-2 (copies of data logger output are provided in Appendix D-6). The following calculation was used for the correction.

$$C_{gas} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o}$$

where:

C_{gas} = Effluent gas concentration, dry basis, ppm

$\bar{C}$ = Average gas concentration indicated by gas analyzer, dry basis ppm

C_{ma} = Actual concentration of the upscale calibration gas, ppm

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm

C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm

Equations provided in Method 100.1, Section 3 were used to compute the NO_X and CO emission rates provided in Section 2.

SECTION 5

SCAQMD METHOD 25.1, ROG MEASUREMENTS

Section 5 provides a summary of SCAQMD Method 25.1 sampling and analysis procedures and results. An overview of the sampling and analysis procedures is provided in Section 5.1. ROG analytical and QA/QC data are summarized in Sections 5.2 and 5.3, respectively.

5.1 Sampling and Analysis Procedures

ROG concentrations in the stack gas were measured following Method 25.1 sampling and analysis procedures. Method 25.1 samples were collected in duplicate at the center of the exhaust stack, concurrently with all other gaseous constituent concentration measurements. ROG samples were collected over a 60 minute test period.

Method 25.1 specifies that sample gas be withdrawn at a constant rate throughout the test duration. Condensibles are collected in a condensate trap chilled with dry ice located upstream of the evacuated tank. The gas phase ROG component is collected in the evacuated tank. Sample gases are withdrawn through a pre-cleaned ⅛ inch stainless steel sampling probe positioned at the center of the exhaust stack. Each sampling line is purged for approximately one minute before initiating sampling.

ROG concentrations are determined through independent analysis of the condensate in the traps and the gases in the tanks. The mass of ROG collected in each condensate trap is measured by first removing all CO_2, and then oxidizing the ROG in the condensate to CO_2. This CO_2 fraction is collected in an evacuated cylinder and injected into the gas analysis module of the total combustion analyzer (TCA) and measured by a non-dispersive infrared (NDIR) detector.

ROG concentrations in the tanks are measured by injecting a portion of the sample gas into the gas analysis module of the TCA which uses a gas chromatograph (GC) column to separate non-methane organics (NMO) from CO, CO_2, and methane (CH_4). The NMO elutes off the GC as fore-flush and back-flush, and is oxidized to CO_2. A reduction catalyst is used to reduce this CO_2 fraction to CH_4, and finally, the CH_4 is measured using a FID.

A Method 25.1 sampling system field blank was collected to assess sampling apparatus cleanliness and to determined potential sample contamination during set-up, sampling, and recovery activities. The field blank was collected by passing ultra-pure nitrogen gas through the sampling apparatus for approximately 60 minutes.

Method 25.1 sample analyses were performed by Horizon Air Measurements located in Newbury Springs, California. A portion of the analyses were subcontracted by Horizon to AAtmAA Laboratories, located in Calabasas, California.

5.2 Method 25.1 Analytical Data

Method 25.1 analytical data are summarized in Table 5-1. For each test condition, duplicate analysis results are listed for ROG, CO, and CO_2. Table 5-1 lists actual and corrected ROG concentrations; corrections are made to 3 percent O_2. ROG emission rates (reported in pounds per hour as methane) are also included in Table 5-1. Emission rates were calculated based on volumetric flow rate data collected during the sampling period (Section 7). Copies of Method 25.1 analytical reports and field test data sheets are provided in Appendix E-1 and E-2, respectively.

The Method 25.1 post-test leak check for one of the tank/trap pairs did not pass during the full load RGB and Urea injection test, indicating that sample dilution occurred. The tank/trap pairs for this run were not analyzed and the entire test event was repeated. The results contained in this report for each parameter tested at this load and condition are from the second run. Field test data sheets for the invalid run are included in the appendices.

5.3 Method 25.1 QA/QC Results

Field blank analytical results indicate 27 ppm residual ROG (as methane) was present in the apparatus. Data presented in Table 5-1 were blank corrected to account for residual ROG present in the Method 25.1 sampling equipment.

Table 5-1. Method 25.1 Test Results

Test Condition	Sample	ROG Concentration (ppm as methane)		ROG Emission Rate (lb/hr as CH_4)	CO (ppm)	CO_2 (%)
		Actual	Corrected to 3 % O_2			
Full Load, Baseline	[a]Tray 1	142	143	238	195	9.5
	Tray 2	117	118	196	181	9.4
	Average	130	131	217	188	9.4
Full Load, RGB and Urea On	Tray 1	158	160	264	188	9.0
	Tray 2	159	161	265	190	9.3
	Average	159	160	265	189	9.2

[a]a tray constitutes one tank and condensate trap set

SECTION 6

DRAFT SCAQMD METHOD 207.1, AMMONIA CONCENTRATION MEASUREMENTS

Section 6 summarizes NH_3 concentration sampling and analysis procedures and results. An overview of the sampling and analysis procedures is provided in Section 6.1. NH_3 concentration results are summarized in Section 6.2.

6.1 Sampling and Analysis Procedures

NH_3 samples were collected and analyzed following SCAQMD Draft Method 207.1, "Analytical Procedures for Determining Ammonia and Ammonium Compounds from Stationary Sources." A copy of this Method is provided in Appendix F-1.

NH_3 concentration measurements were performed only when the urea injection system was in service. For each test, sample gas was collected at the center of the exhaust stack for a 60 minute period. NH_3 testing was performed concurrently with all other gaseous constituent concentration measurements.

NH_3 concentration samples are collected using a standard impinger train. Sample gas is withdrawn from the source at a constant rate through a ¼ teflon sample line and four impingers by a sample pump. The first two impingers contain 100 ml of 0.1 N sulfuric acid, the third is empty, and the fourth contains silica gel. A sampling console controls sample flow rate, and records sample volume and TC measurements.

A sampling system leak check was performed immediately before and after each test. After each test, the teflon sample line was rinsed with 0.1 N sulfuric acid. This probe wash was combined with the impinger catch for analysis.

NH_3 samples were analyzed in strict accordance to Draft Method 207.1 procedures. This colorimetric method uses a spectrophotometer to measure the absorbance of a sample aliquot after reaction with Nessler reagent. The absorbance of the sample aliquot was compared to calibration curve absorbencies developed by analyzing 6 standards of known concentration. The NH_3 concentration of the sample aliquot was interpolated from the calibration curve using linear regression.

6.2 Draft Method 207.1 Test Data

NH_3 concentration data are summarized in Table 6-1. For each urea test condition, Table 6-1 lists the analytical results, NH_3 concentration and NH_3 concentration corrected to 3 percent O_2. Also listed are NH_3 emission rates calculated based on flow rate data collected during the test period (Section 7). Copies of NH_3 analytical reports and field test data sheets are provided in Appendix F-2 and F-3, respectively.

Table 6-1. NH_3 Test Data

Test Condition	Analytical Results (mg NH_3/ sample)	Stack Gas Concentration		Stack Gas Emission Rate (lb/hr)
		(ppm)	Corrected to 3 % O_2 (ppm)	
Full Load, RGB and Urea On	3.31	6.6	6.6	12
Mid-load, RGB and Urea On	2.07	4.0	4.2	5.5

6.3 Draft Method 207.1 QA/QC

Calibration curve results were within Draft Method 207.1 QA/QC requirements; the correlation coefficient for the 6 point calibration curve was 0.9997, exceeding the 0.9995 requirement. Also, the 40 μg control sample deviated 4.0 percent from the calculated curve, within the $\pm$ 5 percent requirement.

Sampling system calibration records are provided in Appendix H.

SECTION 7

SCAQMD METHOD 1.1, 2.1, 3.1, AND 4.1, STACK GAS VOLUMETRIC FLOW RATE MEASUREMENTS

Section 7 summarizes stack gas volumetric flow rate sampling procedures and results. Flow rate measurements were performed during each gaseous constituent concentration test run per requirements cited in Section 1. An overview of the sampling procedure is provided in Section 7.1. Stack gas flow rate data are summarized in Section 7.2.

7.1 Volumetric Flow Rate Measurement Procedures

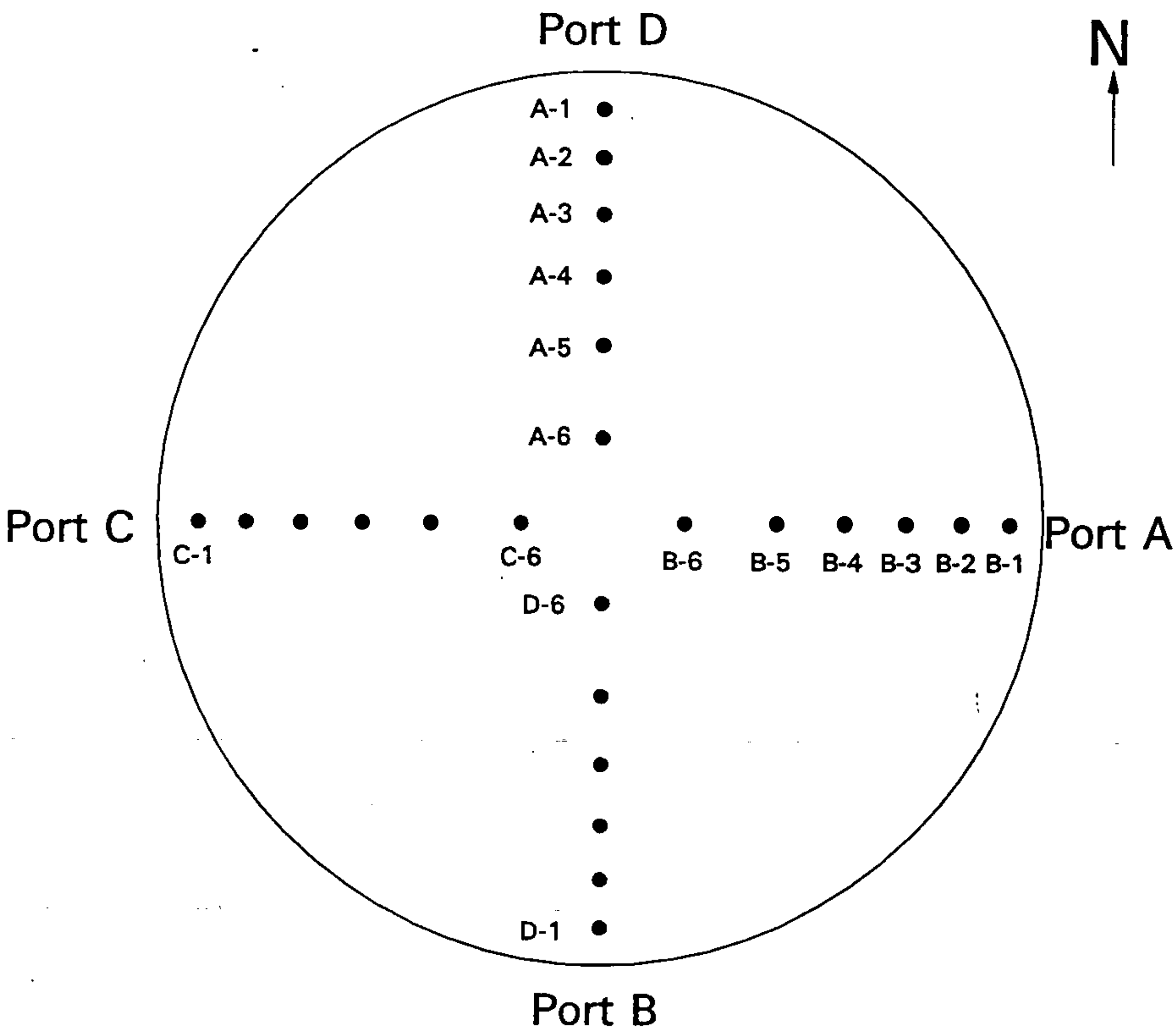
Traverse point locations and exhaust gas velocity, molecular weight, and moisture were determined following SCAQMD Methods 1.1, 2.1, 3.1, and 4.1, respectively. Data collected from Methods 1.1 through 4.1 were used to calculate stack gas volumetric flow rate. Method 1.1 outlines the procedures for choosing the proper traverse points, while Method 2.1 provides the methodology for measuring pressure differentials at each traverse point and calculating the stack gas velocity. For this test, exhaust gas molecular weight was determined from Method 100.1 data per Method 3.1. Exhaust gas moisture content was determined following SCAQMD Method 4.1 procedures.

For this test series, measurements were taken at 24 traverse points, exceeding the Method 1.1 requirement of 16 traverse points. Traverse point locations are illustrated in Figure 7-1. Exhaust stack cyclonic flow characteristics were assessed following SCAQMD Method 1.1, Section 2.4 for mid- and low load test conditions.

In accordance with Method 2.1, a calibrated Type S pitot tube and thermocouple were used in conjunction with a magnehelic gauge to measure stack gas velocity pressure and temperature. From these data, the exhaust gas velocity was calculated using standard equations.

Exhaust gas moisture content was measured according to Method 4.1 procedures. Using a standard impinger train, exhaust gas sample was collected at the center of the exhaust stack. During test conditions where the urea injection system was in service, moisture data was obtained from NH_3 sampling and analysis procedures.

Figure 7-1. Particulate Test Traverse Point Locations



Traverse Point Locations (inches)

Stack I.D.	228 inches
Point 6	81 ⅛ inches
Point 5	57 inches
Point 4	40 ⅜ inches
Point 3	26 ⅞ inches
Point 2	15 ¼ inches
Point 1	4 ¾ inches

7.2 Volumetric Flow Rate Test Data

Stack gas volumetric flow rate data are summarized in Table 7-1. For each test condition, stack gas flow rate, moisture content, temperature, and molecular weight is listed. Copies of flow rate and moisture calculation sheets, spreadsheets, and field data sheets are provided in Appendix G-1 and G-2, respectively. Copies of pitot and magnehelic calibration records are provided in Appendix H.

Table 7-1. Stack Gas Volumetric Flow Rate Results

Test Condition	Stack Gas Characteristics			
	Flow Rate (dscfm)	Moisture Content (%)	Temperature (°F)	Molecular Weight (lb/lb●mole)
Full Load, Baseline	660325	15.6	250	29.7
Full Load, RGB On	676063	15.9	249	29.7
Full Load, RGB and Urea On	657293	16.4	250	29.7
Mid-load, Baseline	516124	15.3	225	29.7
Mid-load, RGB On	517347	15.6	229	29.7
Mid-load, RGB and Urea On	514175	16.0	230	29.7
Low Load, Baseline	258370	14.7	182	29.6
Low Load, RGB On	262007	15.0	182	29.6

Exhaust stack cyclonic flow characteristics were assessed for mid- and low load test conditions. The average yaw angle results for mid- and low load test conditions are 7.9 and zero degrees, respectively, which is below the 20 degree method tolerance. Unstable yaw angles were observed at some traverse points nearest the stack wall (Point 1) for the mid-load test condition. Because Point 1 yaw angle measurement results are suspect and probably a result of air leakage at the port flange connector, Point 1 results were not included in the reported yaw angle average.

APPENDIX A

REFERENCED DOCUMENTS

APPENDIX A-1

SOURCE TEST PROTOCOL

EMISSIONS SOURCE TEST PROTOCOL:

PERMIT APPLICATION NO. 261513

Source Location:

Southern California Edison - Etiwanda Generating Station
8996 Etiwanda Avenue
Etiwanda, CA 91739

Submitted to:

Southern California Edison Company
Environmental Affairs
2244 Walnut Grove Avenue
Rosemead, California 91770

Submitted by:

Acurex Environmental
Southwest Regional Office
4879 East La Palma Avenue, Suite 201
Anaheim, California, 92817

Project Engineer — Chad Garretson

Quality Assurance — Jacqueline Ayer

TABLE OF CONTENTS

SECTION 1

INTRODUCTION

1.1 Background

Acurex Environmental was contracted by Southern California Edison Company (Edison) to conduct emissions source testing per the permit to construct (PTC) No. 261513. The source requiring emissions testing is Unit No. 3 located at Edison's Etiwanda Generating Station (Etiwanda #3). Key information for this project is summarized briefly in Table 1-1.

Table 1-1. Project Summary

Source Tested	Southern California Edison Etiwanda Generating Station, Unit No. 3
Test Location	8996 Etiwanda Avenue Etiwanda, CA 91739
Test Requested By	South Coast Air Quality Management District
Reason For Test	Alteration to Unit No. 3: addition of a recirculation gas by-pass system (RGB)
Tests To Be Performed By	Acurex Environmental, Southwest Regional Office Project Engineer: Chad Garretson (714) 970-5290
Key Edison Contacts	Stafford Pease (818) 302-4034 Michael Escarcega (818) 302-4032

This protocol summarizes source test procedures as required by PTC No. 261513. Section 2 presents the proposed test matrix. Section 3 describes sampling locations and procedures. Section 4 summarizes quality assurance (QA) procedures for the proposed test methods. The referenced PTC is provided in Appendix A. Acurex Environmental's California Air Resources Board (ARB) contractor's certification is provided in Appendix B.

SECTION 2

TEST MATRIX

2.1 Test Matrix

The proposed test procedures are presented in Table 2-1. For each boiler operating condition, the table identifies the test parameters, sampling and analysis methods, number of runs, and sample duration of each run. The test procedures presented in Table 2-1 will be performed for each of the following boiler load conditions; 50 MW, 100 MW, 200 MW, 275 MW, and 320 MW. Urea emissions testing will only be performed if urea is used in conjunction with the RGB system. Fuel flow rate, air to fuel ratio, and net boiler output (MW) data will be recorded for each test condition. All emissions testing will be performed while the boiler fires natural gas. Particulate testing will be performed at full load conditions only (320 MW) because redistributing the gas recirculation is not expected to have any impact on particulate emissions. In addition, previous urea particulate compliance testing on a similar 320 MW unit demonstrated no significant increase in particulate emissions due to the injection of urea (Reference - Alamitos Unit 4, CARNOT Report No. 84015/R106B215.T).

For each operating condition involving urea injection, the urea injection rate and concentration will be recorded, and the urea/water solution injected will contain no more than 35 percent urea by weight. Ammonia slip testing will be performed only while the urea injection system is operating.

Table 2-1. Test Matrix

Boiler Operating Conditions	Test Parameter	Sampling Method	Analytical Method	Sample Duration (min)	No. of Runs
Baseline	NO_x,CO,O_2	SCAQMD 100.1	[a]Various	60	1
	Moisture	SCAQMD 4.1	Gravimetric	30	1
	Flow Rate	SCAQMD 1.1-3.1	NA	30	2
	[b]Particulate	SCAQMD 5.2	Gravimetric	>60	2
	ROG	SCAQMD 25.2	[c]TCA/FID	30	2
RGB	NO_x,CO,O_2	SCAQMD 100.1	Various	60	1
	Moisture	SCAQMD 4.1	Gravimetric	30	1
	Flow Rate	SCAQMD 1.1-3.1	NA	30	2
	[b]Particulate	SCAQMD 5.2	Gravimetric	>60	2
	ROG	SCAQMD 25.2	TCA/FID	30	2
RGB and Urea Injection	NO_x,CO,O_2	SCAQMD 100.1	Various	60	1
	Flow Rate	SCAQMD 1.1-4.1	Gravimetric	30	2
	[b]Particulate	SCAQMD 5.2	Gravimetric	>60	2
	ROG	SCAQMD 25.2	TCA/FID	30	2
	Ammonia Slip/ Moisture	SCAQMD Draft Method 207.1	Colorimetric	30	2

[a]Various: NO_x - chemiluminescence
CO - non-dispersive infared (NDIR)
O_2 - electrochemical

[b]SCAQMD Method 5.2 will be performed at full load conditions only (320 MW)

[c]TCA/FID - Total combustion analysis/flame ionization detector

[d]SCAQMD Draft Method 207.1 for Ammonia and Ammonium Compounds From Stationary Sources

NA - Not Applicable

SECTION 3

SAMPLING LOCATIONS AND PROCEDURES

3.1 Sampling Locations

Extractive and integrated samples will be collected through four sample ports located on the Etiwanda #3 exhaust stack. A plan view illustrating the port locations is provided in Appendix C. The stack sampling location has been previously approved following SCAQMD Chapter X criteria for stratification and flow disturbance. Cross-sectional exhaust stack sampling locations are identified in Sections 3.2 through 3.6. General stack characteristics at the sampling port location follows:

Stack diameter	19 feet
Nearest upstream disturbance	3.2 diameters
Nearest downstream disturbance	5.1 diameters

3.2 SCAQMD Method 100.1, Gaseous Constituent Concentration Measurements

Gaseous constituent concentrations present in the sample stream are measured using the continuous emissions monitoring (CEM) instruments in the Acurex Environmental Mobile Laboratory in general accordance with SCAQMD Method 100.1. A schematic of the CEM instrumentation is provided in Figure 3-1. The sample extraction and conditioning system consists of a stationary stainless steel sampling probe connected to a heated teflon sample line located upstream of a Universal Analyzers gas sample conditioner. The sample line between the probe and the sample conditioner is heated to 250°F to maintain the gas stream temperature above the water dew point. The sample gas cooler is constructed to minimize NO_2 absorption.

From the sample gas conditioner, the sample stream passes through flexible teflon sample line to a flow control system which meters the sample flow rate through the various monitoring

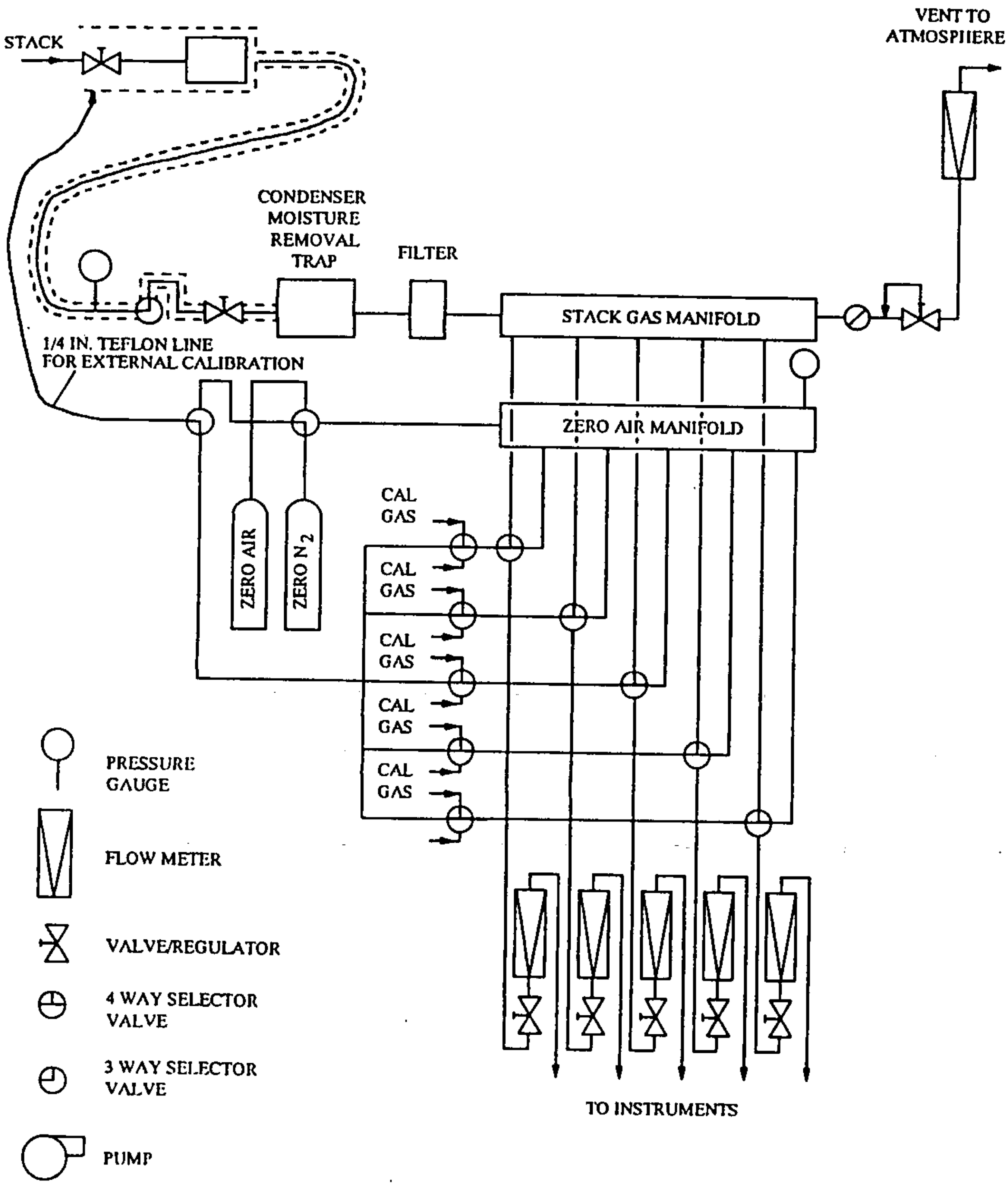


Figure 3-1. Schematic Diagram of CEM Instrumentation in the Acurex Environmental Mobile Laboratory

instruments. The sample flow rate is controlled using a bypass pressure regulator upstream of the instrument manifold. Flow to each instrument is controlled using individual flow control valves and meters. The CEM specifications are summarized in Table 3-1. Instrument output is recorded by a strip chart recorder and an integrated data logging system. The logging device records 1 minute averages throughout each test.

Gaseous constituent concentration measurements are measured in general accordance with SCAQMD Method 100.1 procedures. A leak check is performed prior to testing. Each CEM instrument is calibrated prior to performing system bias checks. System bias checks are performed before and after each test. Calibration results are recorded by both the stripchart instruments and the data logging system.

Extensive gaseous constituent stratification and flow disturbance tests have been previously performed at this test location following SCAQMD Chapter X guidelines (Reference - Etiwanda Unit No. 3, CARNOT Report No. 81915/R148B402.T). The test results show that the stack sampling location meets SCAQMD requirements by demonstrating that the stratification is less than 10 percent. Because the RGB and urea injection systems should have a negligible impact on gaseous stratification, Edison and Acurex Environmental propose the following for non-particulate tests:

(1) conduct a 16 point NO_X or O_2 traverse for the baseline condition of each load
(2) if stratification from the 16 point traverse is less than 10 percent, select a representative sampling location and perform single point sampling for NO_X, O_2, CO, ROG, ammonia, and moisture measurements for the RGB and RGB/urea test conditions at each load
(3) if stratification is greater than 10 percent, sample gas will be collected along an 8-point traverse for the parameters identified above

CEM data are permanently recorded on multichannel strip chart recorders; in addition, a data logging system records 1 minute average constituent concentrations. The data stored in the logging system is downloaded and used to derive emissions results. NO_X and CO emission data are corrected to 3 percent O_2, and all CEM data are corrected for instrument drift and linearity per SCAQMD Method 100.1. The calibration responses recorded by the data logger are used to correct the data logger information. The following calculation is used for the correction.

Table 3-1. Continuous Emissions Monitoring Instruments

NO_X CHEMILUMINESCENT ANALYZER—THERMO ELECTRON MODEL 10A	
Response Time (0-90%)	1.5 sec—NO mode 1.7 sec—NO_X mode
Zero Drift	Negligible after 1/2 hour warmup
Linearity	±1% of full scale
Accuracy	±1% of full scale
Output	0-10 V
Range	0-2.5 ppm, 0-10 ppm, 0-25 ppm, 0-100 ppm, 0-250 ppm, 0-1000 ppm, 0-2500 ppm, and 0-10,000 pm
Sensitivity	0.1 ppm
O_2 ANALYZER, FUEL TYPE—TELEDYNE MODEL 326A	
Response Time (0-90%)	60 sec
Accuracy	±1% of scale at constant temperature; ±1% of scale at ±5% of reading, whichever is greater, over the operating temperature range
Output	0-100 mV
Range	0-5, 0-10, and 0-25% O_2
CO INFRARED ANALYZER—HORIBA MODEL PIR 2000	
Response Time (0-90%)	5 sec
Zero Drift	±1%
Span Drift	±1%
Linearity	1%
Resolution	Less than 1% of full scale
Output	0-100 mV
Range	0-500, 0-1500, 0-2500

$$C_{gas} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} \qquad (4\text{-}1)$$

where:

C_{gas} = Effluent gas concentration, dry basis, ppm

$\bar{C}$ = Average gas concentration indicated by gas analyzer, dry basis ppm

C_{ma} = Actual concentration of the upscale calibration gas, ppm

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm

C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm

3.3 SCAQMD Methods 1.1, 2.1, 3.1, and 4.1, Flow Rate Measurements

Traverse point locations and exhaust gas velocity, molecular weight, and moisture are determined following SCAQMD Methods 1.1, 2.1, 3.1, and 4.1, respectively. Data collected from SCAQMD Methods 1.1 through 4.1 are used to calculate stack gas flow rate. Method 1.1 outlines the procedures for selecting the proper traverse points, while Method 2.1 provides the methodology for performing the actual traverse. The exhaust gas molecular weight is determined per Method 3.1 using Method 100.1 data. Exhaust gas moisture content is determined following SCAQMD Method 4.1 procedures.

Velocity is measured during the test at selected discrete sample points at a cross section of the stack according to SCAQMD Method 1.1 requirements. The cross section is divided into equal areas, to allow measurement of velocity and temperature profiles across the stack. Pressure differential measurements will be performed at 24 traverse point locations, exceeding the Method 1.1 requirements of 16 traverse point locations.

In Method 2.1, a calibrated Type S pitot tube and thermocouple are used, in conjunction with an inclined manometer or magnehelic gauge to measure exhaust gas velocity pressure and temperature. From these data, the exhaust gas velocity is calculated using standard equations.

Exhaust gas moisture content will be measured gravimetrically following Method 4.1 procedures. With a standard impinger train, exhaust gas sample will be collected within a 3 foot radius of the center of the stack. For each moisture test, at least 21 standard cubic feet of sample gas will be collected at a rate less than 0.75 cubic foot per minute.

3.4 SCAQMD Method 5.2, Particulate Emissions Measurements

SCAQMD Method 5.2 is used to measure flue gas particulate concentration and emission rates. A sample is withdrawn isokinetically from the source. Particulate matter and condensible material (such as water vapor, organic compounds, and/or sulfuric acid) are collected in impingers and on a glass fiber filter maintained at 248 ±25°F. The quantity of solid particulate collected in the probe, impingers, connecting tubing and on the filter is determined gravimetrically.

A schematic of the Method 5.2 sample train is illustrated in Figure 3-2. The sample is collected using a stainless steel goose-necked, sharp-edged nozzle attached to a stainless steel probe. A stainless steel sheathed Type K thermocouple (TC) is used to measure stack temperature, while a stainless-steel S-type pitot and magnehelic gauge is used to measure stack gas velocity. The impingers are placed in an ice bath to maintain the sample gas temperature exiting the last impinger at 60°F or less. The first two impingers contain deionized water, the third impinger is empty, and the fourth impinger contains silica gel.

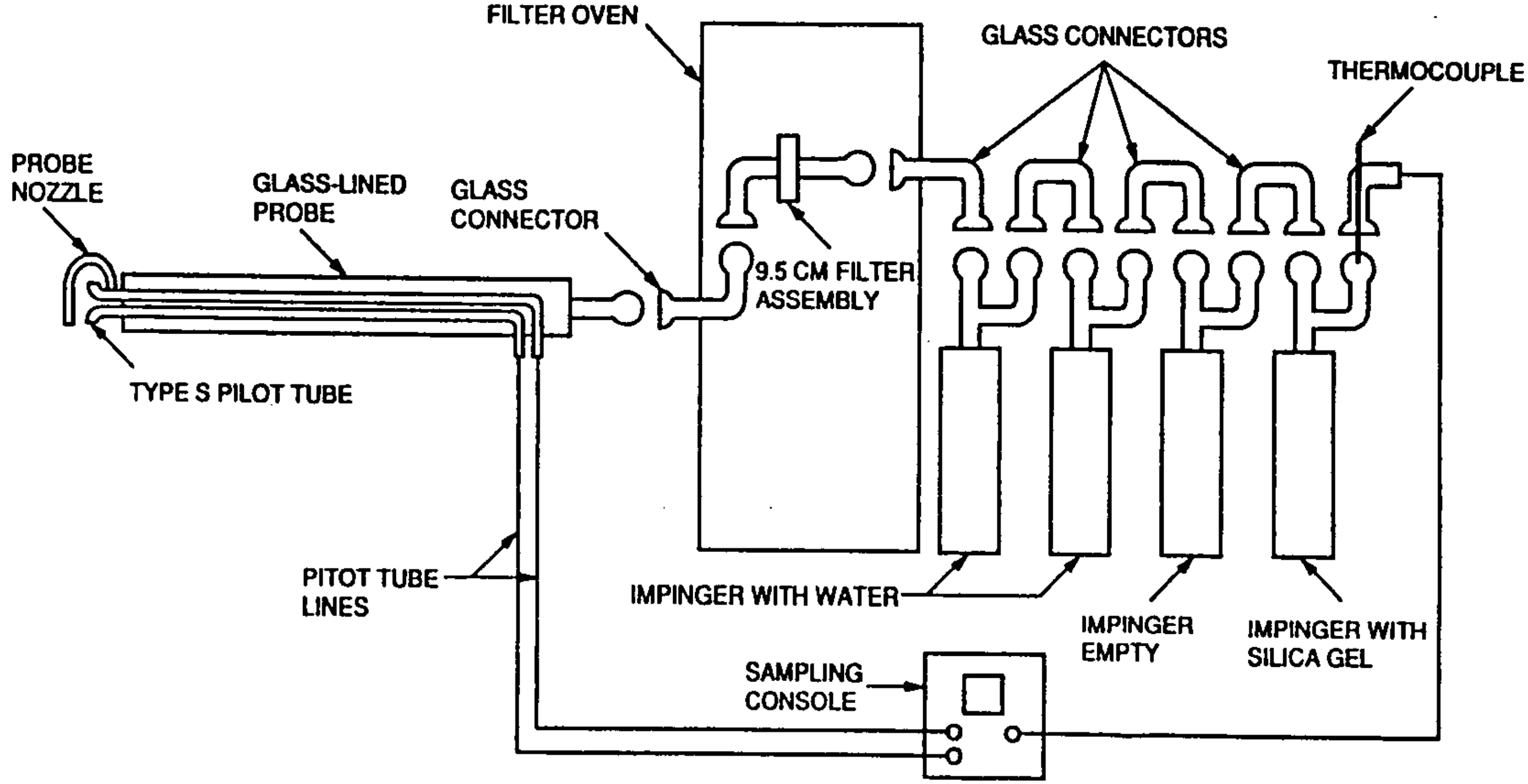
An air-tight pump equipped with a bypass and a shut-off valve maintains a controlled sample flow rate through the system. Sample flow rate is measured using a sharp-edged orifice with upstream and downstream pressure taps. The sample volume is measured using a dry gas meter.

All measurement devices (TC, TC readout, nozzle, pitot, balance for weighings, dry gas meter, orifice, and magnehelic gauges) are calibrated using National Bureau of Standards (NBS) traceable or equivalent techniques. The sample is collected isokinetically at each sample point by adjusting the sample flow rate according to the stack gas velocity and temperature conditions measured at that point.

The flue gas is sampled during the test at selected discrete sample points at a cross section of the stack, according to SCAQMD Method 1.1 requirements. The cross section is divided into 24 equal areas, and the sample is collected at the centroid of each equal area. This method is used to obtain a representative particulate sample across the stack cross section.

Pre-test and post-test leak checks are conducted for the sample train and pitot lines. The probe, sample line, and impingers are capped for return to the recovery area.

Figure 3-2. Particulate sampling train, Method 5.2



3.5 SCAQMD Draft Method 25.2, ROG Measurements

ROG exhaust gas concentrations will be determined as per SCAQMD Method 25.2. A copy of this method is submitted in Appendix D. This method requires duplicate exhaust gas samples to be withdrawn at a constant rate and collected in Tedlar bags. Draft Method 25.2 samples will be collected over a one hour period at a single point within a 3 foot radius of the center of the exhaust stack.

As specified by Draft Method 25.2, the integrated samples are analyzed via TCA/FID. In this procedure, an aliquot of the sample gas is injected into a gas chromatograph/flame ionization detector (GC/FID) unit which separates the CO, carbon dioxide (CO_2), and methane from the ROG present in the sample stream. The methane concentration is determined by the FID. The GC is then back-flushed to recover the ROG, which is subsequently oxidized and reduced to methane. The concentration of ROG (now in the form of methane) is then measured with an FID). Laboratory analyses will be performed by Truesdail Laboratories, Tustin, California, within 72 hours following sample collection.

3.6 SCAQMD Draft Method 207.1, Ammonia Slip Measurements

Ammonia slip samples will be collected and analyzed following SCAQMD "Draft Method 207.1, Analytical Procedures for Determining Ammonia and Ammonium Compounds from Stationary Sources." A copy of this method is submitted in Appendix E. To collect the ammonia slip sample, Acurex Environmental will follow the general sampling procedures specified in SCAQMD Method 5.2, with the following exceptions:

- No heated filter or probe will be used. Instead, a teflon sampling probe will run directly for the source to the first impinger.
- Immediately following the post-test leak check, the impingers will be capped and the sample line rinsed with 0.1 N sulfuric acid or hydrochloric acid (i.e. the absorbing solution). The probe wash will be added to the impinger catch and rinsate for analysis.
- Exhaust gas will be collected for 60 minutes at a rate of 0.5 cubic feet per minute.
- Exhaust gas will be collected at a single point in the stack. The sampling point will be located within a 3 foot radius of the center of the stack.

Ammonia slip analyses will be performed as specified in the draft method.

SECTION 4

ACUREX ENVIRONMENTAL QUALITY ASSURANCE PROCEDURES

There are several internal quality control/quality assurance (QA/QC) procedures that Acurex Environmental routinely implements to ensure accurate and representative results. These procedures are discussed briefly here, and include stringent internal QA audits and data validation requirements, rigorous sample chain of custody procedures, and the collection of adequate QA samples. QA procedures for SCAQMD Method 100.1 are discussed in Section 3.1.

4.1 Internal QA Auditing and Data Validation Procedures

Key elements of the standard Environmental QA auditing procedures include: field sample recovery and data sheet QA audits (conducted in the field); mandatory pre- and post-test equipment calibration checks; thorough QA reviews of the reduced field data and the chemistry laboratory sample analysis reports for completeness; and finally, a QA and peer review of the draft and final source test report. Data validation procedures include calculating relevant data quality indicators such as measurement precision and accuracy, and evaluating these indicators in terms of data quality requirements specified by the applicable method.

4.2 Sample QA and Chain of Custody Procedures

The key elements of the standard Acurex Environmental chain of custody procedures are:

- Recovery of the sample in an appropriate work area using sample containers appropriate to the method
- Collection of all completed field data sheets by the Project Engineer
- Sample identification using a two part sample label; each part is stamped with the same sample identification number. The large label is affixed to the sample and the small label is affixed to the field data sheet

- Completion of the chain of custody (COC) forms, which identify the sample type, identification number, and the required analytical procedures. The COC form accompanies the samples to the analytical laboratory, and are signed at each transfer point

- Examination of the samples at each transfer point for integrity (i.e. broken seals or damaged containers)

Upon completion of the analyses, the analytical laboratory returns the COC forms with the results to Acurex Environmental. All samples are accounted for by the project engineer.

4.3 QA Samples

In addition to the standard QA procedures discussed above, Acurex Environmental will include the collection of various QA samples (field and solution blanks) that are typically included in source test events of this type. For all integrated sampling methods, one field blank will be collected and analyzed for every 10 test events. A reagent blank will be collected and analyzed for each lot of chemicals used.

APPENDIX A

PERMIT TO CONSTRUCT, APPLICATION NO. 261513

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 East Copley Drive, Diamond Bar, CA 91765
PERMIT TO CONSTRUCT

Application No 261513
Page 1

G1

Legal Owner or Operator: SO. CALIFORNIA EDISON COMI
P. O. BOX 800
ROSEMEAD, CALIFORNIA 91770
ATTN: PETER R. WELSING

Equipment Location: 8998 ETIWANDA AVENUE, ETIWANDA, CA. 91739

The equipment described below and as shown on the approved plans and specifications are subject to the special condition, or conditions listed.

Equipment Description:

ALTERATION TO AN EXISTING UTILITY BOILER NO. 3, PERMIT NO. 11202B, BY THE ADDITION OF A RECIRCULATION GAS BYPASS (RGB) SYSTEM:

1.) A 45 FEET LONG BYPASS DUCT INSTALLED BETWEEN THE RECIRCULATION DUCT AND THE PRIMARY AIR DUCT.

2.) A BYPASS DAMPER LOCATED IN THE BYPASS DUCT.

Conditions:

1. OPERATION OF THIS BOILER SHALL BE CONDUCTED IN COMPLIANCE WITH ALL THE DATA, DRAWINGS, AND SPECIFICATIONS SUBMITTED WITH THE APPLICATION FOR ETIWANDA UNIT 3 UNLESS OTHERWISE NOTED BELOW.

2. THIS BOILER SHALL BE PROPERLY MAINTAINED AND KEPT IN GOOD CONDITION AT ALL TIMES.

3. THIS BOILER SHALL FIRE NATURAL GAS ONLY, EXCEPT AS ALLOWED BY RULE 1135 WHEN FUEL OIL SHALL BE FIRED.

4. FUEL OIL SUPPLIED AT THE BURNERS OF THIS BOILER SHALL CONTAIN 0.25 PERCENT OR LESS SULFUR BY WEIGHT.

5. THE MAXIMUM CONCENTRATION OF OXIDES OF NITROGEN (NO_x) EMISSIONS, AT THE EXHAUST STACK, AVERAGED OVER ONE HOUR, SHALL NOT EXCEED 110 PPM WHEN FIRING NATURAL GAS AND 200 PPM WHEN FIRING FUEL OIL, DRY AND CORRECTED TO 3% OXYGEN (O_2).

   THESE NO_x LIMITS ARE VALID THROUGH THE ENTIRE PERMIT TO CONSTRUCT PHASE. SUBSEQUENT NO_x LIMITS WILL BE ESTABLISHED AT THE PERMIT TO OPERATE PHASE DEPENDING ON SOURCE TESTING RESULTS.

ORIGINAL

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 East Copley Drive, Diamond Bar, CA 91765

PERMIT TO CONSTRUCT

Application 261513
Page

6. THE MAXIMUM CONCENTRATION OF CARBON MONOXIDE (CO) EMISSIONS, AT THE EXHAUST STACK, AVERAGED OVER ONE HOUR, SHALL NOT EXCEED 500 PPM WHEN FIRING NATURAL GAS AND 500 PPM WHEN FIRING FUEL OIL, DRY AND CORRECTED TO 3% OXYGEN (O_2).

   THESE CO LIMITS ARE VALID THROUGH THE ENTIRE PERMIT TO CONSTRUCT PHASE. SUBSEQUENT CO LIMITS WILL BE ESTABLISHED AT THE PERMIT TO OPERATE PHASE DEPENDING ON SOURCE TESTING RESULTS.

7. ONCE THE INSTALLATION AND TESTING OF THE RECIRCULATION GAS BYPASS (RGB) SYSTEM HAS BEEN COMPLETED, THE SOUTHERN CALIFORNIA EDISON (SCE) SHALL SUBMIT TO THE DISTRICT BY DECEMBER 30, 1992, A FINAL REPORT CONSISTING OF THE FOLLOWING INFORMATION:

   A) A DETAILED DESCRIPTION OF HOW THE RGB MODIFICATION HAS REDUCED NO_x AND THE AMOUNT OF NO_x REDUCTION ACHIEVED OVER THE FULL BOILER LOAD RANGE OF OPERATION.

   B) A QUANTITATIVE ANALYSIS DISCUSSING THE EFFECT OF THE INSTALLATION RGB SYSTEM ON THE EMISSIONS OF CO, NO_x, ROG, AND PARTICULATE MATTER AT VARIOUS BOILER LOADS AND OPERATING CONDITIONS. THIS ANALYSIS SHALL INCLUDE SOURCE TESTS CONDUCTED UNDER THE FOLLOWING CRITERIA:

      I) SOURCE TESTING SHALL BE CONDUCTED WITHIN 60 CALENDAR DAYS AFTER NORMAL OPERATION OF THIS BOILER HAS BEEN ESTABLISHED, BUT NO LATER THAN 180 DAYS AFTER INITIAL START-UP OF THE BOILER.

      II) THE SOURCE TEST SHALL MEASURE CO, NO_x, AND O_2 BY USING DISTRICT METHOD 100.1; ROG BY USING DISTRICT METHOD 25.1; AND PARTICULATE MATTER BY USING DISTRICT METHOD 5.1.

      III) THE SOURCE TESTS FOR MEASURING CO, NO_x, O_2, ROG, AND PARTICULATE MATTER SHALL BE CONDUCTED AT BOILER LOADS OF 50 MW, 100 MW, 200 MW, 275 MW AND 320 MW WHEN THE RGB IS IN OPERATION AND WHEN THE RGB IS NOT IN OPERATION. THE SAMPLING TIME AT EACH LOAD SHALL BE AT A MINIMUM FOR ONE CONSECUTIVE HOUR.

      IV) A SOURCE TEST PROTOCOL SHALL BE SUBMITTED TO THE DISTRICT NOT LATER THAT 45 DAYS BEFORE THE PROPOSED TEST DATE AND SHALL BE APPROVED BY THE DIRECTOR OF ENGINEERING BEFORE THE SOURCE TESTS COMMENCE.

V) A TESTING LABORATORY CERTIFIED BY THE CALIFORNIA AIR RESOURCES BOARD AND IN COMPLIANCE WITH DISTRICT RULE 304 (NO CONFLICT OF INTEREST) SHALL CONDUCT THE TEST.

VI) DURING SOURCE TESTING, THE FOLLOWING DATA SHALL BE COLLECTED FOR EACH TEST LOAD:

a) FUEL FLOW RATE (MMSCF/HR FOR GAS AND GAL/HR FOR OIL) AT EACH LOAD,
b) AIR/FUEL RATIO AT EACH LOAD,
c) FLUE GAS FLOW RATE (MMSCF/HR) AT EACH LOAD,
d) MOISTURE CONTENT (%) AT EACH LOAD,
e) BOILER EXHAUST STACK TEMPERATURE (°F) AT EACH LOAD,
f) BOILER OUTPUT (NET MW) AT EACH LOAD,

VII) THE SOURCE TEST REPORT SHALL PRESENT ALL EMISSION DATA IN UNITS OF POUNDS PER HOUR (LB/HR), AND PARTS PER MILLION (PPM), ON A DRY BASIS CORRECTED TO 3% OXYGEN.

C) A QUANTITATIVE ANALYSIS OF NO_x AND CO EMISSIONS BEFORE AND AFTER THE INSTALLATION OF THE RGB WHILE FIRING NATURAL GAS AND FIRING FUEL OIL, (IF FUEL OIL IS AVAILABLE). SUCH AN ANALYSIS SHALL COMPARE THE NO_x AND CO EMISSIONS DATA, IN PPM (DRY CORRECTED TO 3 PERCENT OXYGEN), OVER A ONE HOUR BASIS, FOR ANY SEVEN (7) DAYS OF OPERATION BEFORE AND AFTER THE INSTALLATION OF THE UREA INJECTION SYSTEM. EACH DAY OF OPERATION SHALL BE FOR A TWENTY-FOUR (24) HOUR PERIOD. THE AVERAGE UTILITY BOILER LOAD SHALL ACCOMPANY EACH NO_x AND CO DATA POINT. THE DATA SHALL BE SUBMITTED IN TABULAR FORM CONTAINED ON A 3.5" DISKETTE THAT IS FORMATTED FOR LOTUS 123.

8. IF THE UREA INJECTION SYSTEM IS OPERATED IN CONJUNCTION WITH THE RGB SYSTEM, THE MAXIMUM CONCENTRATION OF AMMONIA (NH_3) SLIP AT THE EXHAUST DUCT, SHALL NOT EXCEED 20 PPM, CORRECTED TO 3% DRY OXYGEN (O_2) AND AVERAGED OVER ONE HOUR, FOR BOTH GASEOUS FUEL AND FUEL OIL FIRING.

THIS NH_3 LIMIT IS VALID THROUGH THE ENTIRE PERMIT TO CONSTRUCT PHASE. A SUBSEQUENT NH_3 LIMIT WILL BE ESTABLISHED AT THE PERMIT TO OPERATE PHASE DEPENDING ON SOURCE TESTING RESULTS.

9. IF THE UREA INJECTION SYSTEM IS OPERATED IN CONJUNCTION WITH THE RGB SYSTEM, THE CONCENTRATION OF UREA IN THE UREA/WATER SOLUTION INJECTED INTO THIS UTILITY BOILER SHALL CONTAIN NO MORE THAN THIRTY-FIVE (50) PERCENT UREA BY WEIGHT. ?

10. IF THE UREA INJECTION SYSTEM IS OPERATED IN CONJUNCTION WITH THE RGB INJECTION SYSTEM, THE UREA/WATER SOLUTION RATE OF INJECTION INTO THIS BOILER SHALL NOT EXCEED THIRTY (30) GALLONS PER MINUTE (GPM) FOR EACH OF THE THREE INJECTION LOOPS.

11. IF THE UREA INJECTION SYSTEM IS OPERATED IN CONJUNCTION WITH THE RGB SYSTEM, THE OPERATOR OF THIS UTILITY BOILER SHALL INSTALL FLOW METERS THAT MEASURE THE UREA/WATER SOLUTION FLOW RATE IN GALLONS PER MINUTE.

12. IF THE UREA INJECTION SYSTEM IS OPERATED IN CONJUNCTION WITH THE RGB SYSTEM, THE OPERATOR OF THIS UTILITY BOILER SHALL MAINTAIN RECORDS OF THE CONCENTRATION OF UREA IN THE UREA/WATER SOLUTION AND THE UREA/WATER SOLUTION INJECTION FLOW RATES FOR THE VARIOUS BOILER LOADS. THE MANNER OF RECORD KEEPING SHALL BE APPROVED IN WRITING BY THE DIRECTOR OF THE COMPLIANCE DIVISION. ALL RECORDS SHALL BE RETAINED FOR A PERIOD OF TWO YEARS AND BE MADE AVAILABLE TO DISTRICT PERSONNEL UPON REQUEST.

13. IF THE UREA INJECTION SYSTEM IS OPERATED IN CONJUNCTION WITH THE RGB SYSTEM, THE FLOW RATE OF THE UREA/WATER SOLUTION SHALL BE REGULATED ACCORDING TO THE LOAD OF THE BOILER VIA A FULLY MODULATING AUTOMATIC CONTROL SYSTEM.

14. ONCE THE INSTALLATION AND TESTING OF THE RGB SYSTEM HAS BEEN COMPLETED AND IF THE UREA INJECTION SYSTEM IS OPERATED IN CONJUNCTION WITH THE RGB SYSTEM, SCE SHALL SUBMIT TO THE DISTRICT BY DECEMBER 30, 1992, A FINAL REPORT CONSISTING OF THE FOLLOWING INFORMATION:

   A) A DESCRIPTION OF HOW THE UREA/WATER SOLUTION FLOW IS CONTROLLED AND REGULATED WHEN USED IN CONJUNCTION WITH THE RGB SYSTEM FOR VARIOUS BOILER LOADS.

   B) A QUANTITATIVE ANALYSIS OF THE EFFECT OF UREA INJECTION ON THE EMISSIONS OF CO, NO_x, NH_3, ROG, AND PARTICULATE MATTER AT WHEN USED IN CONJUNCTION WITH THE RGB SYSTEM AT VARIOUS BOILER LOADS. THIS ANALYSIS SHALL INCLUDE SOURCE TESTS CONDUCTED UNDER THE FOLLOWING CRITERIA:

      I) SOURCE TESTING SHALL BE CONDUCTED WITHIN 60 CALENDAR DAYS AFTER NORMAL OPERATION OF THIS BOILER HAS BEEN ESTABLISHED WITH ITS ASSOCIATED UREA INJECTION SYSTEM, BUT NO LATER THAN 180 DAYS AFTER INITIAL START-UP OF THE BOILER WITH ITS ASSOCIATED UREA INJECTION SYSTEM.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 East Copley Drive, Diamond Bar, CA 91765

PERMIT TO CONSTRUCT

II) THE SOURCE TEST SHALL MEASURE CO, NO_x, AND O_2 BY USING DISTRICT METHOD 100.1; ROG BY USING DISTRICT METHOD 25.1; PARTICULATE MATTER BY USING DISTRICT METHOD 5.1; AND NH_3 SAMPLE EXTRACTION BY USING EPA METHOD 17 AND NH_3 ANALYSIS BY USING EPA METHOD 350.2.

III) THE SOURCE TESTS FOR MEASURING CO, NO_x, O_2, ROG, NH_3 AND PARTICULATE MATTER SHALL BE CONDUCTED AT BOILER LOADS OF 50 MW, 100 MW, 200 MW, 275 MW AND 320 MW WHEN THE UREA INJECTION SYSTEM IS USED IN CONJUNCTION WITH THE RGB SYSTEM. THE SAMPLING TIME AT EACH LOAD SHALL BE AT A MINIMUM FOR ONE CONSECUTIVE HOUR.

IV) A SOURCE TEST PROTOCOL SHALL BE SUBMITTED TO THE DISTRICT NOT LATER THAT 45 DAYS BEFORE THE PROPOSED TEST DATE AND SHALL BE APPROVED BY THE DIRECTOR OF ENGINEERING BEFORE THE SOURCE TESTS COMMENCE.

V) A TESTING LABORATORY CERTIFIED BY THE CALIFORNIA AIR RESOURCES BOARD AND IN COMPLIANCE WITH DISTRICT RULE 304 (NO CONFLICT OF INTEREST) SHALL CONDUCT THE TEST.

VI) DURING SOURCE TESTING, THE FOLLOWING DATA SHALL BE COLLECTED FOR EACH TEST LOAD WHEN THE UREA INJECTION SYSTEM IS USED IN CONJUNCTION WITH THE RGB SYSTEM :

a) FUEL FLOW RATE (MMSCF/HR FOR GAS AND GAL/HR FOR OIL) AT EACH LOAD,
b) AIR/FUEL RATIO AT EACH LOAD,
c) FLUE GAS FLOW RATE (MMSCF/HR) AT EACH LOAD,
d) UREA INJECTION FLOW RATE (GAL/HR) AT EACH LOAD,
e) UREA CONCENTRATION (%) BY WEIGHT AT EACH LOAD
f) MOISTURE CONTENT (%) OF THE FLUE GASES AT EACH LOAD,
g) BOILER EXHAUST DUCT TEMPERATURE (°F) AT EACH LOAD,
h) BOILER OUTPUT (NET MW) AT EACH LOAD,

VII) THE SOURCE TEST REPORT SHALL PRESENT ALL EMISSION DATA IN UNITS OF POUNDS PER HOUR (LB/HR), AND PARTS PER MILLION (PPM), ON A DRY BASIS AT 3% OXYGEN.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 East Copley Drive, Diamond Bar, CA 91765

PERMIT TO CONSTRUCT

C) A QUANTITATIVE ANALYSIS OF NO_x EMISSIONS BEFORE AND AFTER THE INSTALLATION OF THE RGB SYSTEM WHEN USED IN CONJUNCTION WITH THE RGB SYSTEM WHILE FIRING GASEOUS FUEL AND FIRING FUEL OIL (IF FUEL OIL IS AVAILABLE). SUCH AN ANALYSIS SHALL COMPARE THE NO_x EMISSIONS DATA, IN PPM (DRY CORRECTED TO 3 PERCENT OXYGEN), OVER A ONE HOUR BASIS, FOR ANY SEVEN (7) DAYS OF OPERATION BEFORE AND AFTER THE INSTALLATION OF THE UREA INJECTION SYSTEM. EACH DAY OF OPERATION SHALL BE FOR A TWENTY-FOUR (24) HOUR PERIOD. THE AVERAGE UTILITY BOILER LOAD SHALL ACCOMPANY EACH NO_x DATA POINT. THE DATA SHALL BE SUBMITTED IN TABULAR FORM CONTAINED ON A 3.5" DISKETTE THAT IS FORMATTED FOR LOTUS 123.

15. THE OWNER OR OPERATOR OF THIS BOILER SHALL INSTALL, OPERATE, AND MAINTAIN IN CALIBRATION AS REQUIRED BY RULE 1135, A CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) FOR NO_x AND A REMOTE TERMINAL UNIT (RTU) FOR DATA GATHERING THAT HAVE BEEN APPROVED BY THE DIRECTOR OF THE APPLIED SCIENCE AND TECHNOLOGY DIVISION TO DEMONSTRATE COMPLIANCE WITH THE DISTRICT-WIDE DAILY LIMITS AS STIPULATED IN RULE 1135.

Approval or denial of this application for permit to operate the above equipment will be made after an inspection to determine if the equipment has been constructed in accordance with the approved plans and specifications and if the equipment can be operated in compliance with all Rules of the South Coast Air Quality Management District.

Please notify D. W. STROUD at 714/396-2526 when construction of equipment is complete.

This Permit to Construct is based on the plans, specifications, and data submitted as it pertains to the release of air contaminants and control measures or reduce air contaminants. No approval or opinion concerning safety and other factors in design, construction or operation of the equipment is expressed or implied.

This Permit to Construct shall serve as a temporary Permit to Operate provided the Executive Officer is given prior notice of such intent to operate.

This Permit to Construct will become invalid if the Permit to Operate is denied or if this application is cancelled. THIS PERMIT TO CONSTRUCT SHALL EXPIRE ONE YEAR FROM THE DATE OF ISSUANCE unless an extension is granted by the Executive Officer.

By Dorris M. Bailey
DORRIS M. BAILEY
Principal Office Assistant

DMB/eb

ORIGINAL

APPENDIX A-2

SCAQMD CONDITIONAL APPROVAL MEMORANDUM

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
APPLIED SCIENCE & TECHNOLOGY
SOURCE TESTING & ENGINEERING BRANCH

PROTOCOL REVIEW

S/T I.D.: P93072

COMPANY: Southern California Edison
P.O. Box 800
Rosemead, CA 91770

EQUIPMENT: Etiwanda Boiler #3
(A/N 261513)

LOCATION: 8998 Etiwanda Avenue
Etiwanda, CA 91739

EVALUATE: NOx, CO, O_2, ROG, Particulate Matter

REQUESTOR: Ben Shaw/ Darren Stroud

TYPE EVAL:

☐	CEMS APPL.	☐	CEMS PROT.	☐	CEMS RPRT.
[x]	PERF. PROT.	☐	PERF. RPRT.	☐	OTHER:

☐ The document indicated above has been reviewed by the Evaluations Unit staff and has been determined to contain sufficient information, as presented (see Discussion/ Remediation below for specific instructions, if any).

[x] The document indicated above has been reviewed by the Evaluations Unit staff and has been determined to contain insufficient information, or requires further explanation, in the following area(s) (see complete Discussion/Remediation below):

- ☐ Completeness of Application/Protocol/Report.
- [x] Representativeness of Data & Process.
- [x] Rule/Permit Fulfillment.
- [x] Sampling & Analytical Methods.
- ☐ Quality Assurance
- ☐ Calculations.

DISCUSSION

Representativeness of Data & Process

OK 1) Procedures and schedule for calibrating thermocouples, pressure measurement devices, pitot tubes, and gas meters shall in accordance with Chapter III of the District Source Test Manual.

Talk to Darren S. 2) Acurex offers to test for particulates at full load conditions only since gas recirculation redistribution and urea injection is not expected to impact particulate emissions. It is the District's experience however, that urea injection may cause excessive particulate emissions. Particulate measurements shall be measured at each test condition as required by the Permit Conditions.

OK 3) NOx, CO, O_2, and ROG shall be sampled concurrently. Moisture content shall be measured during the gas sampling.

OK 4) The sensitivity of the differential pressure gauge for the velocity measurement device shall conform with Section 2.1.2 of District Method 2.1.

$\Delta P < .05$

Rule/Permit Fulfillment

Mike E. To respond 5) The protocol does not test for NOx and CO District Permit limits when firing fuel oil.

OK 6) ROG and ammonia slip measurements shall be sampled for one consecutive hour to satisfy Permit Condition 7.B.III. rather than for 30 minutes as proposed by the protocol.

* OK 7) ROG shall be sampled using SCAQMD Method 25.1 to satisfy Permit Condition 7.B.II, rather than using SCAQMD Draft Method 25.2 as proposed by the protocol. In addition to ROG, the gas sample shall be analyzed and reported for carbon dioxide and carbon monoxide as outlined by SCAQMD Method 25.1.

Sampling & Analytical Methods

? 8) Exhaust flow shall be calculated using the Flue Factor Method (District Source Test Manual, Chapter 10, Section 2). Reference point velocities shall be recorded at five minute intervals.

OK 9) The District requires a strict adherence, rather than a "general" accordance, to SCAQMD Method 100.1.

? OK 10) Since ammonia is present in the exhaust, a molybdenum NO_2 to NO converter will be necessary.

[illegible] SCE respond to District letter 11) The method for determining stratification, according to District Procedures, requires 48 points for stacks greater than 107.6 ft^2 in cross sectional area. The sampling procedure of alternating between a traverse point and a sampling point is

Mid & low

to be observed. Refer to District Source Test Manual, Chapter 10, Section 13) for sampling and calculation procedures.

mid & low
By Edwards
1 to 2 response

12) In addition to testing for stratification, a test for the absence of cyclonic flow should be performed per District Method 1.1.

13) Should stratification using the above method prove to be greater than 10 percent, gaseous concentrations may be calculated on a weighted average basis, but only in the absence of cyclonic flow. For example, the following procedure would be acceptable:

At every traverse point, the concentration of each gaseous constituent (excluding moisture) and velocity will be determined. Moisture may be determined at each point by the following relation:

$$\%H_20 = [1 - \frac{1}{1 + 0.018\,(\%CO_2 + \%CO)}] \times 100$$

The total mass flow rate of the constituent may then be calculated by :

$$Lbs/hr = (1.583 \times 10^{-7})(MW)\,\Sigma\,(Flow)_i(ppm)_i$$

where "i" denotes a traverse point, and "Flow" is flue factor corrected flow in units of dry standard cubic feet per minute.

If average flow rate is determined by dividing the summation of the traverse flow rates by the number of traverse points, then the average concentration is calculated by:

$$Avg\ ppm = \frac{Total\ Mass\ Flow\ Rate}{(1.583 \times 10^{-7})(MW)(Avg\ Flow\ Rate)}$$

? * 14) For particulate sampling using District Method 5.2, the glass fiber filter is to be maintained between 180°-200°F, rather than 248 ± 25°F as specified in the protocol.

OK 15) Permit Condition 14.A.II requires EPA Method 17 for sampling ammonia. Traverse sampling however, is not required for non-stratified conditions.

General Continuous Gas Monitoring Requirements

* The District requires continuous gas monitoring equipment employing sample extraction and conditioning, and electronic detection, to be conducted strictly according to District Method 100.1, with the emphasis upon representativeness, documentation, and quality assurance. This includes, in part:

✓ OK 1. Gas analyzers must meet minimum acceptable standards for method of detection, sensitivity, noise, precision, linearity, and interference (see TABLE 100.1-1 for details). Also, the gas sample extraction and conditioning equipment (probe, filter, pump, conditioner, connective plumbing, etc., and data acquisition and logging equipment shall meet minimum acceptable specifications, as described in Method 100.1.

2. The entire sampling system for continuous gas monitoring instruments should be leak checked before and after each test run by evacuating the system to a minimum of 20" in. Hg vacuum, and plugging for a period of five minutes. The resultant loss of vacuum can not exceed 1" Hg during this period.

3. Calibration of all analyzers must be accomplished at zero, mid span (40-60% of full scale range), and high span (80-95% of full scale range). The lowest practicable range should be selected for monitoring, so that the measured emission values are within 20-95% of the range. If a significant amount of the data are outside of this range, the data may be rejected, depending upon the application.

4. The calibration gases must be certified according to EPA Protocol Number 1, or certified to an analytical accuracy of ± 1% and be NIST traceable (except cal gases used for system bias check). Generally, if cal gases are more than 18 months old, they must be recertified (superblends, 6 months).

5. A calibration error check, and zero/span drift check must be performed before and after each test run. Calibration error must be less than ± 2% of the range of measurement for zero, mid, and high range calibration gases. Zero/span drift must be less than ± 3% of the range of measurement.

6. A system bias check must be performed before and after each test run by alternately introducing cal gases to the entire sampling system, then to the gas analyzer(s), for comparison. The difference can not exceed ± 5% of the analyzer range.

7. Semi-annual analyzer certifications consisting of linearity plot, calibration curve, response time, interference response, and NO_2 to NO converter efficiency, must be furnished with the other calibrations to satisfy Q/A documentational requirements.

8. NOx measurement must be performed in the NOx mode of the analyzer. An NO_2 to NO converter is required if NO_2 constitutes 5% or more of the total NOx in the sample stream, or the rule or permit condition requires "NOx" monitoring. The NO_2 to NO converter must be at least 90% efficient (as demonstrated by EPA Method 20, Sect. 5.6). The converter should be high temperature (650°C) stainless steel, if no NH_3 is present. If NH_3 is present in the sample stream, then a low temperature (350°C) molybdenum catalyst must be used in the converter.

9. The connective tubing from the probe to the sample conditioner must be heated above the dewpoint and the dewpoint reported. The sample conditioner must be able to maintain a dewpoint temperature below 35° F. A particulate filter, as described by District Method 100.1, shall also be installed.

10. Data recorder resolution must be at least 0.5% of the range of measurement. A data point for each contaminant/diluent monitored must be recorded at least once/minute. Analog chart recorders must have a minimum 10-inch chart width.

OK 11. All facets of testing must be continuously recorded. This includes the 3-point calibration, system bias, calibration error, and zero/span drift checks, which must precede and conclude each test run.

OK 12. All chart traces, or digital printouts, must be included in the final report and must be clearly identified as to:

-location/source	-range changes
-operator initials	-range of measurement
-date/running times	-calibrations
-actual test interval	-cal gas concentration/cyl. no.
-contaminant/diluent	-range of calibration

When more than one gas trace is shown on a chart, the individual traces must be distinguishable by color coding or some other means (original charts may be submitted, and returned following evaluation). If a gas measurement range has been "offset" from zero, or zero has been "transposed to the right side of the recorder chart, it must be clearly identified.

OK 13. Gaseous measurements must be conducted a minimum of 60 continuous minutes at each load or specified condition, after the readings have stabilized.

Final Test Report

The final Source Test Report must include the following data:

1. A summary of the Source Test results, including applicable rules and permit conditions (show allowable standards) and source test data computed so as to satisfy these requirements.

2. A brief process description. Indicate equipment operation during testing; as well as any other information which may influence the final report.

3. A simple schematic diagram of the process, showing the sampling location, with respect to the upstream and downstream flow disturbances. Also include a cross-sectional diagram of the stack or duct at the sampling location, depicting the sampling points with respect to compass direction.

4. The sampling and analytical procedures. Be specific about all aspects of sampling and analysis. Include diagrams of test equipment and methods.

5. Complete raw field data, including production data indicative of the testing interval, lab analyses, and the test results (show all calculations).

6. Calibration data regarding all sampling and measuring equipment utilized during testing (see District Source Testing Manual, Chapter III or "Quality Assurance Handbook For Air Pollution Measurement Systems", Vol. III, U.S. EPA-600/4-77-027b).

7. A detailed chain-of-custody sheet containing all pertinent test equipment documentation from lab to field and back to the lab, including any change of hand in between.

REMEDIATION

Testing may proceed as described in the protocol with the implementation of the measures discussed in this evaluation.

The above measures must be implemented in the test protocol prior to testing.

Modifications to the approved protocol, without written consent from the District, may result in rejection of the final report.

EVALUATOR:	Glenn Kasai	EXT:	2271	DATE:	June 1, 1993

P93072.DOC

APPENDIX A-3

COMMUNICATION MEMO DATED JANUARY 18, 1994

TELEPHONE CONFERENCE RECORD

TIME	DATE
7:55 AM	1/18/94

PROJECT ETIWANDA UNIT 3 FGR + UREA COMPLIANCE TESTING

SUBJECT SOURCE TEST DETAILS A/N 261513

CONFEREES SCE	TELEPHONE AGENCY
MIKE ESCARCEGA	DARREN STROUD (SCAQMD) (909) 396-2526

CONFERENCE HIGHLIGHTS

SUMMARY

THE BELOW ITEMS WERE DISCUSSED & AGREED TO:

- NO PARTICULATE TESTING IS REQUIRED AT ANY OF THE TEST LOADS (LOW, MID & HIGH) OR TEST CONDITIONS (BASELINE, FGR ON, FGR + UREA) AS FGR & UREA ARE EXPECTED TO HAVE NEGLIGIBLE IMPACTS.
- ROGS - BECAUSE FGR IS EXPECTED TO HAVE NEGLIGIBLE IMPACTS ON ROGS & BECAUSE PREVIOUS ROG TESTS ON OTHER SCE UNITS WITH UREA HAVE DEMONSTRATED NEGLIGIBLE IMPACTS, IT WAS AGREED THAT ROGS WOULD ONLY BE SAMPLED AT THE HIGH LOAD FGR + UREA CONDITION AND THE HIGH LOAD BASELINE.

NOTE: THE ABOVE TWO AGREED UPON ITEMS SUPERCEDE

ADDITIONAL COMMENTS

ITEMS 2 & 6 OF MY LETTER TO YOU DATED OCT. 21, 1993 RE. SOURCE TEST DETAILS.

ACTION REQUIRED

CC: P.R. WELSING
S.D. PEASE
DARREN STROUD (SCAQMD)
GLENN KASAI (SCAQMD)

PREPARED BY Michael D. Escarcega (818) 302-4032

PAX

SCE 64-300 NEW 3/77

APPENDIX A-4

COMMUNICATION MEMO DATED JANUARY 19, 1994

TELEPHONE CONFERENCE RECORD

TIME 3:30 PM

DATE 1/19/94

PROJECT
ETIWANDA UNIT 3 FGR + UREA COMPLIANCE TESTING

SUBJECT
SOURCE TEST DETAILS A/N 261513

CONFEREES

SCE
MIKE ESCARCEGA

TELEPHONE AGENCY
GLENN KASAI (SCAQMD)
(909) 396-2271

SUMMARY

THE BELOW ITEM WAS DISCUSSED & AGREED TO:

- SIXTEEN POINT ABBREVIATED STRATIFICATION & CYCLONIC FLOW TESTS AT LOW AND MID-LOADS WOULD BE ACCEPTABLE INSTEAD OF THE FULL CHAPTER X 48-POINT TESTS. ALSO, THE FULL LOAD REQUIREMENT WOULD BE MET BY A PREVIOUS 48-POINT STRATIFICATION & CYCLONIC FLOW TEST THAT WAS PERFORMED AS PART OF THE RULE 1135 COMPLIANCE PROGRAM.

NOTE: THE ABOVE AGREED UPON ITEM SUPERCEDES ITEMS 11 & 12 OF MY LETTER TO DARREN STROUD DATED OCT. 21, 1993 REGARDING SCE'S RESPONSE

CONFERENCE HIGHLIGHTS

ADDITIONAL COMMENTS

TO YOUR PROTOCOL REVIEW.

ACTION REQUIRED

CC: P.R. WELSING
S.D. PEASE
GLENN KASAI (SCAQMD)
DARREN STROUD (SCAQMD)

PREPARED BY
Michael D. Escarcega
(818) 302-4032

PAX

SCE 26-305 NEW 3/79

APPENDIX B

RECORDS OF BOILER OPERATING PARAMETERS

Test Description:	Flue Gas Recir. Bypass Compliance Test									
Unit:	Etiwanda Unit #3									
Data By:	S. Pease									
Date	m\d\yr	3/22/94				3/22/94				
Test No.		2	Run (0915 - 1015)			2	Run (1100-1200)			
Time	hrs	0930		1000		1115		1145		
Load	MW	320		320		320		320		
Aux. Power	MW	9.2		9.2		8.8		9.2		
BOOS		None		None		None		None		
Steam Flow	Klbs\hr	1889		1886		1889		1886		
FDWater Flow	Klbs\hr	2005		1999		1995		2001		
S. H. Temp.	deg F	1055		1053		1053		1053		
R.H. Temp. E|W	deg F	1002/999		1002/1001		1002/1002		1003/1002		
Total Fuel Flow	%	73.5		73.6		74.0		74.0		
Air Flow	%	79.5		80.2		80.1		79.9		
O2 ~~North~~ - East	%	1.2		1.1		1.0		1.1		
O2 ~~South~~ - West	%	0.9		0.9		.9		0.8		
FD Fans ~~N\S~~ - E\W	Amps	220/218		220/218		220/218		220/218		
FGR ~~N\S~~ - E\W	Amps	83/78		83/78		83/78		83/78		
APH Outlet Temp. E|W	°F	285/268		237/268		240/271		240/271		
FGR Dampers E|W	%	105/105		105/105		105/105		105/105		
FGR O2 E|W	%	17.4/17.6		17.7/17.6		17.7/17.6		17.4/17.7		
Urea Flow	GPM	OFF		OFF		1.3		1.3		
Water Flow	GPM	↓		↓		4.7		4.7		
Water Pressure	[illegible]					60.1		60.0		
KVB Reference Time	hrs	0930	0945	1000	1015	1115	1130	1145	1200	
KVB Fuel Flow	KSCFH	3076.7	3080.9	3078.6	3080.9	3085.5	3083.8	3082.9	3085.8	
KVB Stack Flow	KSCFM	579.1	578.9	576.8	575.9	575.3	575.9	575.2	576.1	
KVB O2	%	3.97	3.94	3.90	3.86	3.81	3.84	3.83	3.84	
KVB NOx raw.	ppm	49.1	50.1	49.6	49.5	42.6	42.8	42.9	43.1	
KVB NOx corr.	ppm	52.0	52.8	52.2	51.9	44.6	44.9	45.0	45.2	
KVB NOx	lbs\hr	204	208	205	204	176	177	177	178	
KVB Load	[illegible]	318.1	319.0	318.9	318.8	318.6	318.7	318.5	318.7	

Urea - Sp. Grv. 1.055 Urea to NOx Mole Ratio = 0.75
Conc. 20%

Test Description: Flue Gas Recir. Bypass Compliance Test
Unit: Etiwanda Unit #3
Data By: S. Pease

SCE Environmental Engineering

Date	m\d\yr	3/22/94							
Test No.		3 *	Run(	1300- 1400)		4	Run(	1500- 1600)	
Time	hrs	1315		1345		1515		1545	
Load	MW	320		320		320		320	
Aux. Power	MW	9.2		9.1		9.1		9.0	
BOOS		None		None		None		None	
Steam Flow	Klbs\hr	1883		1813		1889		1889	
FDWater Flow	Klbs\hr	1999		1988		2005		2002	
S. H. Temp.	deg F	1053		1053		1053		1056	
R.H. Temp.	deg F	1003/1002		1003/1003		1002/1004		1003/1002	
Total Fuel Flow	%	73.9		73.6		73.6		73.7	
Air Flow	%	80.2		79.2		79.4		79.3	
O2 ~~North~~ - East	%	1.2		1.2		1.0		0.8	
O2 ~~South~~ - West	%	0.9		0.9		1.0		0.9	
FD Fans ~~N\S~~ - E\W	Amps	219/218		219/218		214/212		214/214	
FGR ~~N\S~~ - E\W	Amps	83/78		83/78		82/77		82/76	
APH Outlet Temp E\W	°F	240/272		239/272		237/268		237/267	
FGR Dampers E\W	%	105/105		105/105		off		off	
FGR O2 E\W	%	17.4/17.6		17.9/17.7		↓		↓	
Urea Flow	GPM	1.3		1.4					
Water Flow	GPM	4.7		4.7					
Water Pressure	PSI	59.6		60.2					
KVB Reference Time	hrs	1315	1330	1345	1400	1515	1530	1545	1600
KVB Fuel Flow	KSCFH	3078.3	3073.3	3076.4	3076.4	3072.9	3074.3	3075.4	3072.1
KVB Stack Flow	KSCFM	575.1	574.9	575.7	575.0	569.4	569.5	569.5	568.5
KVB O2	%	3.85	3.87	3.88	3.86	3.71	3.70	3.70	3.68
KVB NOx raw.	ppm	43.1	43.4	43.5	43.2	57.4	57.7	58.0	57.9
KVB NOx corr.	ppm	45.2	45.6	45.7	45.4	59.8	60.1	60.3	60.2
KVB NOx	lbs\hr	179	179	179	178	234	236	236	236
KVB Load	MW	318.4	318.2	318.5	318.5	318.8	318.9	319.5	319.6

* test rerun due to a bad ROG test during first run (1100 - 1200)

1.05

SCE Environmental Engineering

Test Description: Flue Gas Recir. Bypass Compliance Test
Unit: Etiwanda Unit #3
Data By: S. Pease / L. Miller

Date	m\d\yr.	3/23/94								
Test No.		5 →					6 →			
Time	hrs	07:45		08:45		0945	10:30			11:30
Load	MW	250		250		250	250			250
Aux. Power	MW	7.9		7.9		7.9	7.9			7.9
BOOS		None		None		None	None			None
Steam Flow	Klbs\hr.	1439		1429		1439	1433			1432
FDWater Flow	Klbs\hr.	1576		1569		1559	1559			1561
S. H. Temp.	deg F	1053		1052		1052	1051			1053
R.H. Temp.	deg F	1005		1004		1004	1003			1003
Total Fuel Flow	%	54.7		54.3		55.2	55.0			54.6
Air Flow	%	61.8		61.4		61.9	61.8			61.5
O2 ~~North~~ - East	%	1.3		1.2		1.2	1.0			1.2
O2 ~~South~~ - West	%	1.0		1.0		1.0	.9			1.0
FD Fans ~~N\S~~ - E\W	Amps	160/150		160/150		160/150	160/150			160/150
FGR ~~N\S~~ - E\W	Amps	82/79		82/79		83/79	83/79			82/79
APH Outlet Temp E\W	°F	214/236		217/233		219/234	220/235			220/236
FGR Dampers E\W	%	—								
FGR O2 E\W	%	—								
Urea Flow	GPM	—								
Water Flow	GPM	—								
Water Pressure	PSI	—								
KVB Reference Time	hrs	08:00	08:15	9:00	09:15	10:00	10:45	11:00	11:15	
KVB Fuel Flow	KSCFH	2384.3	2384.9	2373.2	2369.5	2375.5	2375.2	2374.5	2377.1	
KVB Stack Flow	KSCFM	462.1	461.4	459.4	458.4	458.2	459.0	459.8	460.4	
KVB O2	%	4.46	4.43	4.44	4.44	4.38	4.42	4.45	4.45	
KVB NOx raw.	ppm	40.9	40.6	40.6	40.3	40.4	40.5	40.9	41.3	
KVB NOx corr.	ppm	44.5	44.2	44.2	43.8	43.8	44.0	44.5	45.0	
KVB NOx	lbs\hr.	135	134	134	132	133	133	135	136	
KVB Load	MW	250.5	250.4	249.2	248.6	249.3	249.1	249.0	249.6	

Urea Sp Gr 1.05
Concent. 20%

Test Description:	Flue Gas Recir. Bypass Compliance Test								
Unit:	Etiwanda Unit #3								
Data By:	S. Pease								
Date	m\d\yr.	3/23/94				3/23/94			
Test No.		7	→	→	→	8	→	→	→
Time	hrs	12:30			13:30	14:17			15:17
Load	MW	250			250	250			250
Aux. Power	MW	7.9			7.9	7.9			7.9
BOOS		None			None	None			None
Steam Flow	Klbs\hr.	1439			1432	1433			1435
FDWater Flow	Klbs\hr.	1545			1541	1545			1534
S. H. Temp.	deg F	1052			1052	1053			1052
R.H. Temp.	deg F	1010			1013	1013			1012
Total Fuel Flow	%	55.5			55.2	55.0			55.4
Air Flow	%	62.2			62.2	62.1			62.4
O2 ~~North~~ - East	%	1.2			1.1	1.1			1.0
O2 ~~South~~ - West	%	1.0			.9	1.0			.7
FD Fans ~~N\S~~ - E\W	Amps	160/150			160/150	160/150			160/150
FGR ~~N\S~~ - E\W	Amps	85/82			85/82	85/82			85/82
APH Outlet Temp E\W	°F	224/238			226/239	226/240			227/240
FGR Dampers E\W	[illegible]	105			105	105			105
FGR O2 E\W	%	16.8 16.7			16.6/17.0	16.5/16.7			16.6/16.9
Urea Flow	GPM	—				.7	.7	.6	.6
Water Flow	GPM	—				5.8	5.8	5.7	5.8
Water Pressure	PSI	—				54.8	54.5	54.6	54.3
KVB Reference Time	hrs	12:45	13:00	13:15	13:45	14:30	14:45	15:00	15:30
KVB Fuel Flow	KSCFH	2386.3	2388.2	2386.1	2385.2	2386.9	2390.3	2394.1	2385.3
KVB Stack Flow	KSCFM	460.9	461.8	460.5	461.4	461.9	461.5	462.4	459.8
KVB O2	%	4.41	4.42	4.39	4.43	4.44	4.40	4.40	4.37
KVB NOx raw.	ppm	24.1	29.3	29.2	28.3	25.2	25.1	25.3	25.8
KVB NOx corr.	ppm	31.6	31.9	31.7	30.8	27.4	27.2	27.4	27.9
KVB NOx	lbs\hr.	96	97	96	94	83	83	84	85
KVB Load	[illegible]	250.4	250.3	250.2	249.9	249.8	250.2	250.1	249.6

SCE Environmental Engineering

Test Description:	Flue Gas Recir. Bypass Compliance Test	SCE Environmental Engineering
Unit:	Etiwanda Unit #3	
Data By:	S. Pease	

Date	m\d\yr.	3/23/94								
Test No.		9								
Time	hrs	2030		2100		2130		2200		
Load	MW	118		118		119		120		
Aux. Power	MW	6.8		6.8		6.8		6.8		
BOOS		None		None		None		None		
Steam Flow	Klbs\hr	713		713		717		720		
FDWater Flow	Klbs\hr	773		787		783		802		
S. H. Temp.	deg F	1052		1052		1052		1052		
R.H. Temp.	deg F	1003/1000		1001/1003		1002/1001		1003/1002		
Total Fuel Flow	%	28.9		28.6		29.1		28.6		
Air Flow	%	29.6		29.4		29.7		29.8		
O2 ~~North~~ - East	%	0.8		1.0		0.9		0.9		
O2 ~~South~~ - West	%	1.2		1.3		1.3		1.3		
FD Fans ~~N\S~~ - E\W	Amps	103/90		103/90		103/90		103/90		
FGR ~~N\S~~ - E\W	Amps	80/80		80/80		81/79		81/79		
APH Outlet Temp E\W	°F	201/189		199/188		198/188		198/188		
FGR Dampers E\W	[illegible]	off		off		off		off		
FGR O2 E\W	[illegible]	↓		↓		↓		↓		
Urea Flow	[illegible]	↓		↓		↓		↓		
Water Flow	[illegible]	↓		↓		↓		↓		
Water Pressure	[illegible]	↓		↓		↓		↓		
KVB Reference Time	hrs	2045	2100	2115	2130	2145	2200	2215		
KVB Fuel Flow	KSCFH	1261.8	1262.7	1265.0	1266.8	1261.3	1289.1	1266.1		
KVB Stack Flow	KSCFM	260.2	260.8	261.1	261.3	260.6	265.3	261.3		
KVB O2	%	5.45	5.48	5.47	5.45	5.48	5.42	5.46		
KVB NOx raw.	ppm	19.5	19.5	19.7	19.8	19.7	20.3	19.8		
KVB NOx corr.	ppm	22.6	22.7	22.8	22.9	22.8	23.5	23.0		
KVB NOx	lbs\hr	36	37	37	37	37	39	37		
KVB Load	[illegible]	121.5	121.4	121.6	122.1	121.5	123.8	122.1		

Test Description:	Flue Gas Recir. Bypass Compliance Test									
Unit:	Etiwanda Unit #3									
Data By:	S. Pease									

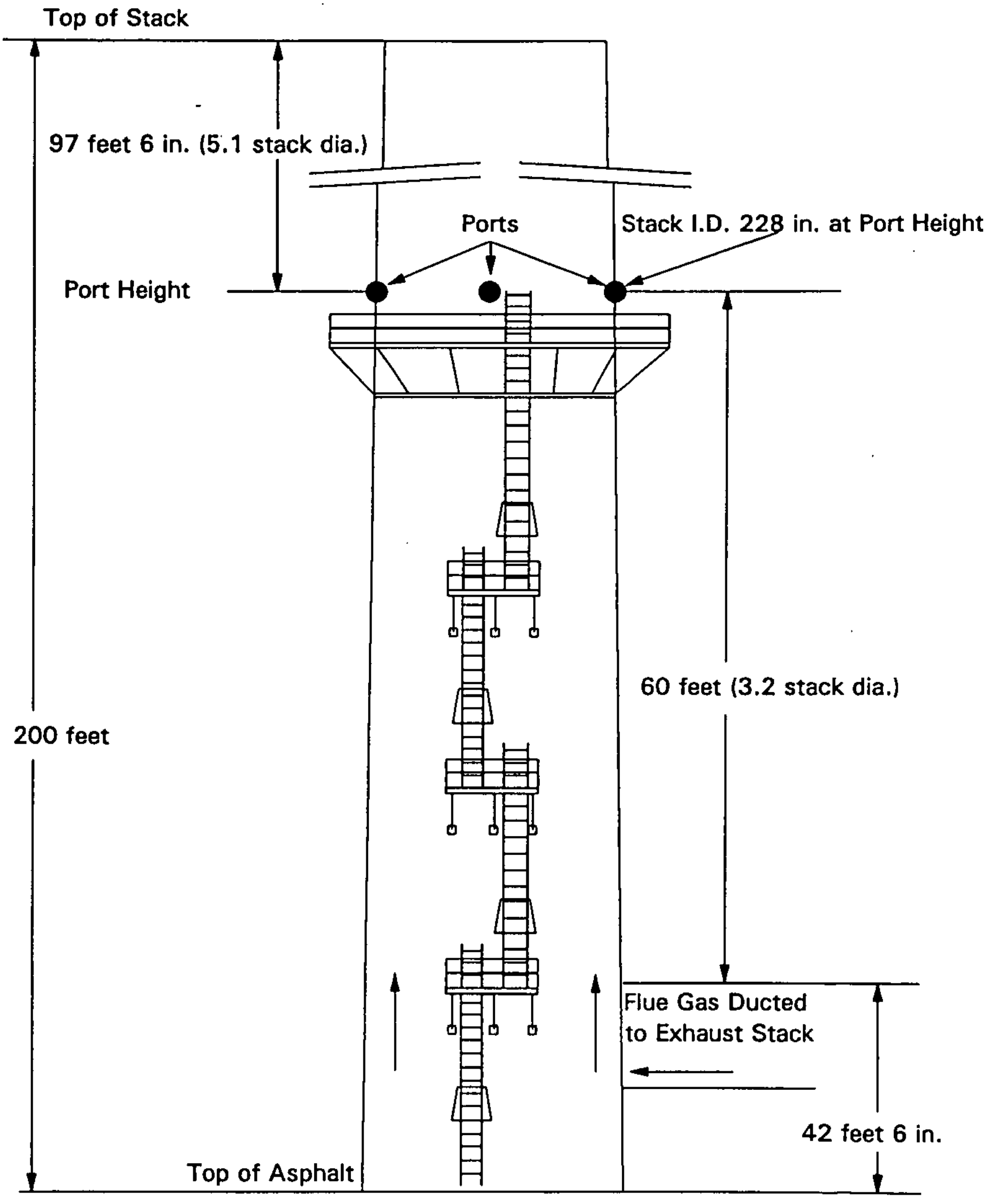
SCE Environmental Engineering

Parameter	Units									
Date	m\d\yr	3/23/94		3/24/94		3/24/94				
Test No.		10	Run (2330-0030)			11	Run (0115-0215)			
Time	hrs	2330		00:00		0115		0145		
Load	MW	119		119		120		120		
Aux. Power	MW	6.8		6.8		6.8		6.8		
BOOS		None		None		None		None		
Steam Flow	Klbs\hr	713		714		717		717		
FDWater Flow	Klbs\hr	790		790		783		773		
S. H. Temp.	deg F	1053		1058		1052		1054		
R.H. Temp.	deg F	1006/1002		1004/1003		1006/1003		1005/1003		
Total Fuel Flow	%	29.0		28.6		293		287		
Air Flow	%	29.8		29.3		291		298		
O2 ~~North~~ - East	%	1.1		1.0		1.2		1.1		
O2 ~~South~~ - West	%	1.0		0.9		0.9		0.9		
FD Fans ~~N\S~~ - E\W	Amps	103/90		105/90		103/89		103/89		
FGR ~~N\S~~ - E\W	Amps	81/79		81/79		81/79		81/79		
APH Outlet Temp E\W	°F	195/188		192/189		191/191		191/191		
FGR Dampers E\W	%	Off		Off		60/60		60/60		
FGR O2 E\W	%	↓		↓		16.1/16.3		16.5/16.1		
Urea Flow	GPM	↓		↓		Off		Off		
Water Flow	GPM	↓		↓		↓		↓		
Water Pressure	PSI	↓		↓		↓		↓		
KVB Reference Time	hrs	2345	0000	00:15	0030	0130	0145	0200	0215	
KVB Fuel Flow	KSCFH	1264.8	1265.5	1265.4	1266.8	1272.6	1271.0	1270.3	1271.1	
KVB Stack Flow	KSCFM	260.3	260.1	260.3	260.3	262.0	261.6	261.6	261.7	
KVB O2	%	5.42	5.4	5.41	5.39	5.42	5.42	5.43	5.43	
KVB NOx raw.	ppm	19.2	19.2	19.1	18.7	12.8	12.9	12.7	12.7	
KVB NOx corr.	ppm	22.2	22.1	22.1	21.6	14.8	14.9	14.7	14.7	
KVB NOx	lbs\hr	36	36	36	35	24	24	24	24	
KVB Load	MW	121.9	122.0	122.0	121.9	122.7	122.7	122.6	122.7	

APPENDIX C

STACK DIAGRAM ILLUSTRATING SAMPLING PORT LOCATIONS

ETIWANDA UNIT 3



APPENDIX D

RECORDS SUPPORTING SCAQMD METHOD 100.1 MEASUREMENTS

APPENDIX D-1

CALIBRATION GAS CERTIFICATION SHEETS

SCOTT-MARRIN, INC.
6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (714) 653-6780 • FAX (714) 653-2430

REPORT OF ANALYSIS
NIST TRACEABLE GAS MIXTURES

ACUR01
TO: CHAD GARRETTSON
ACUREX
4879 E LA PALMA AVE
STE 201
ANAHEIM, CA 92807-

DATE: 02/19/93

CUSTOMER ORDER NUMBER: EV40239Z

PAGE 1

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CYLINDER NUMBER	COMPONENT	CONCENTRATION(v/v)	NIST TRACEABLE REFERENCE STANDARD
CC66796	Oxygen Nitrogen	17.04 ± 0.17 % Balance	SRM 2659
CC51254	Oxygen Nitrogen	9.14 ± 0.09 % Balance	SRM 2658a
CC28267	Oxygen Nitrogen	4.20 ± 0.04 % Balance	SRM 2658a

ppm = umole/mole % = mole-%

The above analyses are traceable to the National Institute of Standards and Technology by intercomparison with the reference standards listed above.
Where indicated, volumetric and gravimetric reference standards are traceable thru use of our analytical balance. NIST Report No. MMAP 232.09/202491.

Analyst: M.S. Calhoun

Approved: J.T. Marrin

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

STANDARD CALIBRATION GASES IN ALUMINUM CYLINDERS

Scott Specialty Gases, Inc.

~~2600 CAJON BOULEVARD, SAN BERNARDINO, CA 92411~~ ~~(909) 887-2571 FAX: (909) 887-0540~~

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS RECERTIFICATION

Customer
ACUREX CORPORATION
CHAD GARRETSON
4879 E LA PALMA AVE
SUITE 201
ANAHEIM CA 92807

Assay Laboratory
Scott Specialty Gases
2600 Cajon Boulevard
San Bernardino, CA 92411

Purchase Order NV30371SC
Scott Project # 0227883#002

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number AAL5362
Cylinder Pressure 950PSIG
Certification Date 10-05-93
Previous Certification Dates 12-30-91
Acid Rain Exp.
General Exp.10-05-95

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
NITRIC OXIDE	91.87PPM	±1% NIST Traceable

Balance Gas: Nitrogen

NOX	92.18PPM	

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
GMIS	09-94	ALM33883	99.20PPM

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
TECO / 10AR-38644-258	07-26-93	Chemi-Luminescent

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: NITRIC OXIDE

Previous Certification

Date:12-30-91	Response Units:mv	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.	91.42PPM	

Third Triad Analysis

Date:10-05-93	Response Units:mv	
Z1= 0.00	R1= 96.6	T1= 89.2
R2= 96.6	Z2= 0.00	T2= 89.2
Z3= 0.00	T3= 89.2	R3= 96.6
Avg. Conc. of Cust Cyl.	91.87PPM	

Calibration Curve

Concentration= Ax + B
A =1.026289
B =0.328756

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Concentration=

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Concentration=

SPECIAL NOTES: IF THIS PRODUCT IS USED FOR ACID RAIN COMPLIANCE, THE ACID RAIN DATE NOTED ABOVE APPLIES PER 40 CFT PART 75, APPENDIX H. OTHERWISE THE GENERAL EXPIRATION DATE APLLIES.

Analyst

Scott Specialty Gases, Inc.

~~2600 CAJON BOULEVARD, SAN BERNARDINO, CA 92411~~ ~~(909) 887-2571 FAX: (909) 887-0549~~

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS RECERTIFICATION

Customer
ACUREX CORPORATION
CHAD GARRETSON
4879 E LA PALMA AVE
SUITE 201
ANAHEIM CA 92807

Assay Laboratory
Scott Specialty Gases
2600 Cajon Boulevard
San Bernardino, CA 92411

Purchase Order NV30371SC
Scott Project # 0227883#003

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number AAL14063
Cylinder Pressure 1400PSIG
Certification Date 10-05-93
Previous Certification Dates 12-30-91
Acid Rain Exp.
General Exp. 10-05-95

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
NITRIC OXIDE	47.78PPM	±1% NIST Traceable

Balance Gas: Nitrogen

NOX	47.95PPM	

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
GMIS	09-94	ALM33883	99.20PPM

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
TECO / 10AR-38644-258	07-26-93	Chemi-Luminescent

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: NITRIC OXIDE

Previous Certification

Date: 12-30-91	Response Units: mv	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.	47.80PPM	

Third Triad Analysis

Date: 10-05-93	Response Units: mv	
Z1= 0.00	R1= 96.6	T1= 46.2
R2= 96.6	Z2= 0.00	T2= 46.3
Z3= 0.00	T3= 46.2	R3= 96.6
Avg. Conc. of Cust Cyl.	47.78PPM	

Calibration Curve

Concentration= Ax + B
A = 1.026289
B = 0.328756

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Concentration=

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Date:	Response Units:	
Z1=	R1=	T1=
R2=	Z2=	T2=
Z3=	T3=	R3=
Avg. Conc. of Cust Cyl.		

Concentration=

SPECIAL NOTES: IF THIS PRODUCT IS USED FOR ACID RAIN COMPLIANCE, THE ACID RAIN DATE NOTED ABOVE APPLIES PER 40 CFT PART 75, APPENDIX H OTHERWISE THE GENERAL EXPIRATION DATE APLLIES.

Analyst

AIR PRODUCTS AND CHEMICALS, INC.
901 WEST 12TH STREET
LONG BEACH, CA 908[illegible]
([illegible]) 4[illegible]-[illegible]
PHONE ([illegible]) [illegible]

DATE: 10/27/93
TIME: 11:00
PAGE: 1

*** CERTIFICATE OF ANALYSIS ***

[illegible] ENVIRONMENTAL CORP
ONE TECHNOLOGY DRIVE SUITE F213
IRVINE CA 92718

CUSTOMER ACCOUNT	: T5819
CUSTOMER ORDER NO	: NV303745C
ORDER NO	: 235-052029
ORDER DETAIL SEQ	: [illegible]
SHIPPER NUMBER	: 235-9-53499

REMARKS : GAS MIXTURE(S) LISTED BELOW ARE TRACEABLE TO NIST CLASS S WEIGHTS AND/OR NIST GAS MIXTURE STANDARD REFERENCE MATERIALS (SRM's) - REFERENCE APCI SGD FIELD DIRECTIVE BOOK I PART A-3.

PRIMARY GAS MIXTURE : CARBON MONOXIDE IN NITROGEN

BATCH NO	ANALYSIS DATE	BAR CODE	CYLINDER NO	COMPONENT REQUESTED	CONCENTRATION REQUESTED	ANALYTICAL RESULT	UNIT OF MEASURE
[illegible]	1[illegible]/[illegible]/9[illegible]	PKD531	SG1650NB	CARBON MONOXIDE	450	451	MOLAR PPM
				Nitrogen		BALANCE	

CERTIFICATION

THIS ANALYSIS HAS BEEN PERFORMED UTILIZING APPROVED ANALYTICAL METHOD(S) AND IS CORRECT TO WITHIN THE ANALYTICAL ACCURACIES OF THIS (THESE) METHOD(S).

Eileen Black Rodriguez

AUTHORIZED SIGNATURE

AIR PRODUCTS AND CHEMICALS, INC.
901 WEST 12TH STREET
LONG BEACH, CA 90813
(310) 437-0461
TELEPHONE (800) 350-0461

DATE: 12/21/93
TIME: 17:38

****
* CERTIFICATE OF ANALYSIS *
****

ACCUREX ENVIRONMENTAL CORP
ONE TECHNOLOGY DRIVE SUITE F213
IRVINE CA 92718

CUSTOMER ACCOUNT : T5819
CUSTOMER ORDER NO :
ORDER NO : 235-053976
ORDER DETAIL SEQ : 1

REMARKS : GAS MIXTURE(S) LISTED BELOW ARE TRACEABLE TO NIST CLASS S WEIGHTS AND/OR NIST GAS MIXTURE STANDARD REFERENCE MATERIALS (SRM's) - REFERENCE APCI SGD FIELD DIRECTIVE BOOK I PART A-3.

PRIMARY GAS MIXTURE : CARBON MONOXIDE IN NITROGEN

BATCH NO	ANALYSIS DATE	BAR CODE	CYLINDER NO	COMPONENT REQUESTED	CONCENTRATION REQUESTED	ANALYTICAL RESULT	UNIT OF MEASURE
12295	12/20/93	BQN829	SG860091NB	CARBON MONOXIDE	250	250	MOLAR PPM
				Nitrogen		BALANCE	

CERTIFICATION

THIS ANALYSIS HAS BEEN PERFORMED UTILIZING APPROVED ANALYTICAL METHOD(S) AND IS CORRECT TO WITHIN THE ANALYTICAL ACCURACIES OF THIS (THESE) METHOD(S).

Eileen Black Rodriguez

AUTHORIZED SIGNATURE

SCOTT-MARRIN, INC.
6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (714) 653-6780 • FAX (714) 653-2430

REPORT OF ANALYSIS
NIST TRACEABLE GAS MIXTURES

ACURØ1
TO: CHAD GARRETTSON
ACUREX
4879 E LA PALMA AVE
SUITE 2Ø1
ANAHEIM, CA 928Ø7-

DATE: Ø2/19/93

CUSTOMER ORDER NUMBER: EV4Ø239Z

PAGE 1

CYLINDER NUMBER	COMPONENT	CONCENTRATION(v/v)	NIST TRACEABLE REFERENCE STANDARD
CC28992	Carbon Dioxide Nitrogen	17.75 ± Ø.18 % Balance	SRM 1675b
CCØ0241	Carbon Dioxide Nitrogen	9.89 ± Ø.1Ø % Balance	SRM 1675b

ppm = umole/mole   % = mole-%

The above analyses are traceable to the National Institute of Standards and Technology by intercomparison with the reference standards listed above.
Where indicated, volumetric and gravimetric reference standards are traceable thru use of our analytical balance, NIST Report No. MMAP 232.Ø9/2Ø2491.

Analyst: M.S. Calhoun   Approved: J.T. Marrin

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

AIR PRODUCTS AND CHEMICALS, INC.
901 WEST 12TH STREET
LONG BEACH, CA 90813
(310) 437-0461
TELEPHONE (800) 350-0461

DATE: 12/27/93
TIME: 11:16
PAGE: 1

****
* CERTIFICATE OF ANALYSIS *
****

ACCUREX ENVIRONMENTAL CORP
ONE TECHNOLOGY DRIVE SUITE F213
IRVINE CA 92718

CUSTOMER ACCOUNT : T5819
CUSTOMER ORDER NO : NV305225C
235 053726
ORDER DETAIL SEQ : 1

REMARKS : GAS MIXTURE(S) LISTED BELOW ARE TRACEABLE TO NIST CLASS S WEIGHTS AND/OR NIST GAS MIXTURE STANDARD REFERENCE MATERIALS (SRM's) - REFERENCE APCI SGD FIELD DIRECTIVE BOOK I PART A-3.

PRIMARY GAS MIXTURE : CARBON MONOXIDE IN NITROGEN

BATCH NO	ANALYSIS DATE	BAR CODE	CYLINDER NO	COMPONENT REQUESTED	CONCENTRATION REQUESTED	ANALYTICAL RESULT	UNIT OF MEASURE
12303	12/21/93	BJA601	SG881575	CARBON MONOXIDE	90	90	MOLAR PPM
				Nitrogen		BALANCE	

CERTIFICATION

THIS ANALYSIS HAS BEEN PERFORMED UTILIZING APPROVED ANALYTICAL METHOD(S) AND IS CORRECT TO WITHIN THE ANALYTICAL ACCURACIES OF THIS (THESE) METHOD(S).

AUTHORIZED SIGNATURE

AIR PRODUCTS AND CHEMICALS, INC.
901 WEST 12TH STREET
LONG BEACH, CA 90813
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DATE: 12/27/93
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****
* CERTIFICATE OF ANALYSIS *
****

ACCUREX ENVIRONMENTAL CORP
ONE TECHNOLOGY DRIVE SUITE F213
IRVINE CA 92718

CUSTOMER ACCOUNT : T5819
CUSTOMER ORDER NO : NV305225C
235 053726
ORDER DETAIL SEQ : 2

REMARKS : GAS MIXTURE(S) LISTED BELOW ARE TRACEABLE TO NIST CLASS S WEIGHTS AND/OR NIST GAS MIXTURE STANDARD REFERENCE MATERIALS (SRM's) - REFERENCE APCI SGD FIELD DIRECTIVE BOOK I PART A-3.

PRIMARY GAS MIXTURE : CARBON MONOXIDE IN NITROGEN

BATCH NO	ANALYSIS DATE	BAR CODE	CYLINDER NO	COMPONENT REQUESTED	CONCENTRATION REQUESTED	ANALYTICAL RESULT	UNIT OF MEASURE
12296	12/21/93	BNE00B	SG9103300BAL	CARBON MONOXIDE	50	50	MOLAR PPM
				Nitrogen		BALANCE	

CERTIFICATION

THIS ANALYSIS HAS BEEN PERFORMED UTILIZING APPROVED ANALYTICAL METHOD(S) AND IS CORRECT TO WITHIN THE ANALYTICAL ACCURACIES OF THIS (THESE) METHOD(S).

AUTHORIZED SIGNATURE

APPENDIX D-2

FIELD TEST DATA SHEETS

CEM CALIBRATION SHEET

DATE 3/22/94

PLANT Etiwanda G.S.

LOCATION Unit 3

TEST NUMBER TEST # 1 - FGR on

OPERATOR D. Urry

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14		4.20	0-10%		
CO_2(%)	17.75		9.89	0-20%		
CO(ppm)	451		250	0-500 ppm		
HC(ppm)						
NO_x(ppm)	92.18		47.95	0-100 ppm		
SO_2(ppm)						

Time	Concentration	Data Logger O_2 (%)	Data Logger CO_2 (%)	Data Logger CO (ppm)	Data Logger SO_2 (ppm)	Data Logger NO_x (ppm)	Data Logger HC as methane	Strip Chart O_2 (%)	Strip Chart CO_2 (%)	Strip Chart CO (ppm)	Strip Chart SO_2 (ppm)	Strip Chart NO_x (ppm)	Strip Chart HC as methane	~~COMMENTS~~ leak check
Pre	High	0754	0754	0754		0754		92.7	94.0	~~[illegible]~~		95.6		22.0" HG @ 0754
	Mid									94.0 D.4				22.0" @ 0759
	Low	0707	0707	0707		0707		43.2	54.0	55.3		50.0		
	Zero	0703	0703	0703		0703		2.0	5.1	5.0		1.2		system response
	External	0813	0809	0818		0815		43.9	53.4	55.0		49.0		= 45 seconds
	Zero Bias	0804	0804	0804		0804		2.2	5.3	5.0		1.2		
Post	High	1046	1046	1046		1046		91.9	94.0	94.9		94.7		
	Mid													23.4" HG @ 1034
	Low	1042	1042	1042		1042		42.7	54.0	55.3		49.7		23.2" HG @ 1039
	Zero	1039	1039	1039		1039		1.5	5.0	5.0		1.7		
	External	1024	1027	1032		1029		42.5	53.5	55.2		49.0		
	Zero Bias	1021	1021	1021		1021		1.9	5.4	5.0		20		

CEM CALIBRATION SHEET

DATE 3/22/94

PLANT ETIWANDA - SCE

LOCATION Unit 3

TEST NUMBER TEST 2 - FGR+UREA

OPERATOR D. URRY

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14		4.20	0-10%		
CO_2(%)	17.75		9.89	0-20%		
CO(ppm)	451		250	0-500ppm		
HC(ppm)						
NO_x(ppm)	92.2		48.0	0-100ppm		
SO_2(ppm)						

Time	Concentration	Data Logger O_2 (%)	Data Logger CO_2 (%)	Data Logger CO (ppm)	Data Logger SO_2 (ppm)	Data Logger NO_x (ppm)	Data Logger HC as methane	Strip Chart O_2 (%)	Strip Chart CO_2 (%)	Strip Chart CO (ppm)	Strip Chart SO_2 (ppm)	Strip Chart NO_x (ppm)	Strip Chart HC as methane	COMMENTS Leak check
Pre	High	1046	1046	1046		1046		91.9	94.0	94.9		94.7		23.4" HG @ 1034
	Mid													23.2" HG @ 1035
	Low	1042	1042	1042		1042		42.7	54.0	55.3		49.7		
	Zero	1039	1039	1039		1039		1.5	5.0	5.0		1.7		
	External	1024	1027	1032		1029		425	53.5	55.2		49.0		
	Zero Bias	1021	1021	1021		1021		1.9	5.4	5.0		2.0		
Post	High	1244	1244	1244		1244		92.5	93.7	95.0		94.2		
	Mid													21.7" HG @ 1229
	Low	1239	1239	1239		1239		43.0	53.7	55.8		49.5		21.6" HG @ 1234
	Zero	1234	1234	1234		1234		1.6	4.9	5.0		2.0		
	External	1217	1219	1226		1222		42.7	53.3	55.8		48.9		
	Z[illegible] Bias	1217	1213	1213		1213		0	5.0	5.1		2.0		

CEM CALIBRATION SHEET

DATE 3/22/94

PLANT SCE - Etiwanda

LOCATION Unit 3

TEST NUMBER #3 - FGR +UREA

OPERATOR D. URRY

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14		4.20	0-10%		
CO_2(%)	17.75		9.89	0-20%		
CO(ppm)	451		250	0-500ppm		
HC(ppm)						
NO_x(ppm)	92.2		48.0	0-100ppm		
SO_2(ppm)						

Time	Concentration	Data Logger O_2 (%)	Data Logger CO_2 (%)	Data Logger CO (ppm)	Data Logger SO_2 (ppm)	Data Logger NO_x (ppm)	Data Logger HC as methane	Strip Chart O_2 (%)	Strip Chart CO_2 (%)	Strip Chart CO (ppm)	Strip Chart SO_2 (ppm)	Strip Chart NO_x (ppm)	Strip Chart HC as methane	COMMENTS leak check
Pre	High	1244	1244	1244		1244		92.5	93.7	95.0		94.2		21.7' Hg @ 1229
	Mid													21.6" Hg @ 1234
	Low	1239	1239	1239		1239		43.0	53.7	55.8		49.5		
	Zero	1234	1234	1234		1234		1.6	4.9	5.0		2.0		
	External	1217	1219	1226		1222		42.7	53.3	55.8		48.9		
	Zero Dri	1213	1213	1213		1213		2.0	5.0	5.1		2.0		
Post	High	1439	1439	1439		1439		92.6	93.6	96.5		94.0		
	Mid													21.8 "Hg @ 1430
	Low	1434	1434	1434		1434		43.0	53.7	55.8		49.4		21.5 "Hg @ 1435
	Zero	1430	1430	1430		1430		1.1	4.9	5.0		2.0		
	External	1418	1421	1427		1424		42.7	53.0	55.3		48.7		
	Zero Dri	1412	1412	1412		1412		1.7	5.1	5.0		2.0		

CEM CALIBRATION SHEET

DATE 3/22/94

PLANT SCE Etiwanda

LOCATION Unit 3

TEST NUMBER #4 – Baseline

OPERATOR D. URAY

Constituent	Actual Gas Concentration			Instrument Range	Percent-of-Range	
	High	Mid	Low		High	Low
O_2(%)	91.4		4.20	0-10%		
CO_2(%)	17.75		9.89	0-20%		
CO(ppm)	451		250	0-500ppm		
HC(ppm)						
NO_x(ppm)	92.2		48.0	0-100ppm		
SO_2(ppm)						

Time	Concentration	Data Logger Measurements O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)	HC as methane	Strip Chart Measurements (divisions) O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)	HC as methane	COMMENTS Leak check
Pre	High	1439	1439	1439	3	1439		92.6	93.6	96.5		94.0		
	Mid													21.8" Hg @ 1430
	Low	1434	1434	1434		1434		43.0	53.7	55.8		49.4		21.5" Hg @ 1435
	Zero	1430	1430	1430		1430		1.1	4.9	5.0		2.0		
	External	1418	1421	1427		1424		42.7	53.0	55.3		48.7		
	Zero Bias	1412	1412	1412		1412		1.7	5.1	5.0		2.0		
Post	High	1639	1639	1639		1639		92.8	93.7	96.5		93.8		
	Mid													23.5" Hg @ 1628
	Low	1636	1636	1636		1636		43.0	53.8	55.5		49.3		23.4" Hg @ 1633
	Zero	1634	1634	1634		1634		1.3	5.0	5.0		2.0		
	External	1617	1620	1626		1623		42.9	53.1	55.5		48.8		
	Z[illegible] BIAS	1613	1613	1613		1613		[illegible]7	5.1	5.0		2.0		

TEST VAN DATA SHEET

DATE 3/22/94 PLANT Etiwanda - SCE OPERATOR D. Urry

LOCATION Unit 3 OPERATING LOAD 320 MW

Time Start/Stop	NH_3 Slip	Strip Chart measurements						COMMENTS
		O_2 (%)	CO_2 (%)	CO (ppm)	CO @3% O_2 (ppm)	NO_x (ppm)	NO_x @3% O_2 (ppm)	BP. = 29.91
0915/1015		3.1	9.9	220	221	52.0	52.3	TEST 1 - FGR + DU.
1100/1200		3.1	9.9	220	221	44.0	44.2	TEST 2 - FGR + UREA
1301/1401		3.1	9.9	205	206	44.5	44.8	TEST 3 - FGR + UREA
~~1500~~/ 1500/1600		3.0	9.9	195	195	60.0	60.0	TEST 4 - Baseline

CEM CALIBRATION SHEET

DATE 3/23/94

PLANT SCE Etiwanda

LOCATION Unit 3

TEST NUMBER #5 - Mid Load Stratification

OPERATOR C&M

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14		4.20	0-10%		
CO_2(%)	17.75		9.89	0-20%		
CO(ppm)	451		250	0-500 ppm		
HC(ppm)						
NO_x(ppm)	92.2		48.0	0-100 ppm		
SO_2(ppm)						

Time	Concentration	Data Logger O_2 (%)	Data Logger CO_2 (%)	Data Logger CO (ppm)	Data Logger SO_2 (ppm)	Data Logger NO_x (ppm)	Data Logger HC as methane	Strip Chart O_2	Strip Chart CO_2	Strip Chart CO	Strip Chart SO_2	Strip Chart NO_x	Strip Chart HC as methane	COMMENTS
Pre	High	0705	0705	0705		0711		93.2	94.0	95.0		95.6		
	Mid	0700	0700	0700		0708		43.6	53.3	55.0		49.8		21.0 @ 0649
	Low													20.6 @ 0654
	Zero	0655	0655	0655		~~0655~~ [illegible]	0706	2.0	5.0	5.0		1.0		
	External	0738	0720	0723		0725		43.5	53.0	55.0		49.0		
	zero bias	0718	0718	0718		0718		2.6	5.2	5.0		1.0		
Post	High	1011	1011	1011		1011		93.0	95.2	95.7		94.5		
	Mid	1015	1015	1015		1015		43.5	54.7	55.4		849.3		24.0 @ 1003
	Low													23.5 @ 1008
	Zero	1006	1006	1006		1006		1.5	5.7	5.0		1.2		
	External	1002	0953	0956		0958		[illegible]	54.0	55.0		48.6		
	bias	0951	0951	0951		0951		[illegible]	5.8	5.0		1.5		

CEM CALIBRATION SHEET

DATE 3/23/94

PLANT SCE Etiwanda

LOCATION Unit # 3

TEST NUMBER #6 Mid-Load Baseline

OPERATOR Cdk

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14	4.20		0-10%		
CO_2(%)	17.75	9.89		0-20%		
CO(ppm)	451	250		0-500		
HC(ppm)						
NO_x(ppm)	92.2	48.0		0-100		
SO_2(ppm)						

Time	Concentration	Data Logger Measurements O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)	HC as methane	Strip Chart Measurements (divisions) O_2 ~~(%)~~	CO_2 ~~(%)~~	CO ~~(ppm)~~	SO_2 ~~(ppm)~~	NO_x ~~(ppm)~~	HC as ~~methane~~	COMMENTS
Pre	High	1011	1011	1011		1011		93.0	95.2	95.7		94.5		24.0 @ 1003
	Mid	1015	1015	1015		1015		43.5	54.7	55.4		49.3		23.5 @ 1008
	Low													
	Zero	1006	1006	1006		1006		1.5	5.7	5.0		1.2		
	External	1002	0953	0956		0958		43.1	54.0	55.0		48.6		
	Zero bias	0951	0951	0951		0951		2.2	5.8	5.0		1.5		
Post	High	1159	1158	1158		1158		93.1	95.7	96.2		93.9		
	Mid	1155	1155	1155		1155		43.3	54.8	55.5		49.0		
	Low													
	Zero	1151	1151	1151		1151		1.3	5.6	5.0		1.5		23.7 @ 1149
	External	1147	1140	1142		1144		43.0	54.0	55.2		48.3		23.4 @ 1154
	Zero bias	1138	1138	1138		1138		1.9	5.7	5.0		1.7		

CEM CALIBRATION SHEET

314 682
250 252 254 254 216 8670

DATE 3/23/94

PLANT SCE Etiwanda

LOCATION Unit #3

TEST NUMBER #6 7 D.U. Mid-load FGRON

OPERATOR CG

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14	4.20		0-10%		
CO_2(%)	17.75	9.89		0-20%		
CO(ppm)	451	250		0-500		
HC(ppm)						
NO_x(ppm)	92.2	48.0		0-100		
SO_2(ppm)						

Time	Concentration	Data Logger Measurements O_2 (%)	Data Logger CO_2 (%)	Data Logger CO (ppm)	Data Logger SO_2 (ppm)	Data Logger NO_x (ppm)	Data Logger HC as methane	Strip Chart Measurements (divisions) O_2 (%)	Strip Chart CO_2 (%)	Strip Chart CO (ppm)	Strip Chart SO_2 (ppm)	Strip Chart NO_x (ppm)	Strip Chart HC as methane	COMMENTS
Pre	High	1158	1158	1158		1158		93.1	95.7	96.2		93.9		
	Mid	1155	1155	1155		1155		43.3	54.8	55.5		49.0		23.7@1149
	Low													23.4@1154
	Zero	1151	1151	1151		1151		1.3	5.6	5.0		1.5		
	External	1147	1140	1142		1146		43.0	54.0	55.2		48.3		
	zero bias	1138	1138	1138		1138		1.9	5.7	5.0		1.7		
Post	High	1402	1402	1402		1402		93.3	95.8	96.2		93.0		
	Mid	1358	1358	1358		1358		43.4	55.0	55.7		48.7		
	Low													
	Zero	1354	1354	1354		1354		1.5	5.9	5.0		1.9		23.1 Hg"@1349
	External	1351	1340	1343		1347		43.0	54.5	55.5		48.0		22.6"@1355
	o bias	1337	1337	1337		1337		1.9	5.9	5.0		2.0		

CEM CALIBRATION SHEET

DATE 3/23/94

PLANT SCE Etiwanda

LOCATION Unit #3

TEST NUMBER #~~7~~ 8 D.U. Mid Load, FGR & UREA ON

OPERATOR C4

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14	4.20		0-10%		
CO_2(%)	17.75	9.89		0-20%		
CO(ppm)	451	250		0-500		
HC(ppm)						
NO_x(ppm)	92.2	48.0		0-100		
SO_2(ppm)						

Time	Concentration	Data Logger O_2 (%)	Data Logger CO_2 (%)	Data Logger CO (ppm)	Data Logger SO_2 (ppm)	Data Logger NO_x (ppm)	Data Logger HC as methane	Strip Chart O_2 (%)	Strip Chart CO_2 (%)	Strip Chart CO (ppm)	Strip Chart SO_2 (ppm)	Strip Chart NO_x (ppm)	Strip Chart HC as methane	COMMENTS
Pre	High	1402	1402	1402		1402		93.3	95.8	96.2		93.0		23.1" @ 1349
	Mid	1358	1358	1358		1358		43.4	55.0	55.7		48.7		22.6" @ 1355
	Low													
	Zero	1354	1354	1354		1354		1.5	5.9	5.0		1.9		
	mid External	1351	1340	1343		1347		43.0	54.5	55.5		48.0		
	zero bias	1337	1337	1337		1337		1.9	5.9	5.0		2.0		
Post	High	1543	1543	1543		1543		93.3	96.2	96.5		92.9		23.5" @ 1533
	Mid	1538	1538	1538		1538		43.2	55.2	55.9		48.7		23.0" @ 1534
	Low													
	Zero	1536	1536	1536		1536		1.2	5.9	5.0		2.0		
	mid External	1532	1525	1527		1529		43.0	54.7	54.3		47.6		
	zero bias	1523	1523	1523		1523		1.8	6.2	5.0		2.0		

TEST VAN DATA SHEET

DATE 3/23/94 PLANT SCE Etiwanda OPERATOR C.G.

LOCATION Unit No. 3 OPERATING LOAD Mid-Load Stratification (Test 5)

Time Start/Stop	NH_3 Slip	Strip Chart measurements divisions (not corrected for off-set)						COMMENTS
		O_2 (%)	CO_2 (%)	CO (ppm)	CO @3%O_2 (ppm)	NO_x ~~(ppm)~~	NO_x @3%O_2 (ppm)	
0742/0744						43.4		Port A - Reference (center)
0746/0748						43.4		A-1
0750/0752						43.5		A-2
0755/0757						43.5		A-3
0800/0802						43.1		A-4
0805/0807						43.4		Port A - Reference (Center)
0814/0816						43.5		PORT D - Reference (Center)
0819/0821						43.3		D - 1
0823/0825						43.5		D - 2
0828/0830						43.1		D - 3
0833/0835						43.0		D - 4
0837/0839						43.0		PORT D - Reference (Center)
0847/0850						43.4		PORT C - Reference (Center)
0852/0854						43.2		C - 1
0857/0859						43.6		C - 2
0901/0903						43.0		C - 3
0906/0908						43.0		C - 4
0911/0913						43.4		PORT C - Reference (center)

TEST VAN DATA SHEET

DATE 3/23/94 PLANT SCE Etiwanda OPERATOR C[illegible]

LOCATION Unit No. 3 OPERATING LOAD MID-LOAD Stratif. (Test 5 cont.)

Time Start/Stop	NH_3 Slip	Strip Chart measurements O_2 (%)	CO_2 (%)	CO (ppm)	CO @3%O_2 (ppm)	NO_x (ppm)	NO_x @3%O_2 (ppm)	COMMENTS
0919/0921						43.0		PORT B - Reference (center)
0924/0926						42.8		B-1
0928/0930						43.0		B-2
0932/0934						43.0		B-3
0936/0938						43.5		B-4
0941/0943						43.5		PORT B - Reference (center
			System	bias	response			39 seconds

TEST VAN DATA SHEET

DATE 3/23/94 PLANT SCE Etiwanda OPERATOR CJ

LOCATION Unit #3 OPERATING LOAD Mid-Load: Conditions: - Baseline (TEST #6)
- FGR ON (Test #7)
- FGR and UREA ON (Test #8)

Time Start/Stop	NH_3 Slip	Strip Chart measurements (divisions)						COMMENTS
		O_2 ~~(%)~~ stet.	CO_2 ~~(%)~~ stet.	CO ~~(ppm)~~ stet.	CO @3%O_2 ~~(ppm)~~ stet.	NO_x ~~(ppm)~~ stet.	NO_x @3%O_2 ~~(ppm)~~ stet.	
1030/1130		3.6	9.6	150	155	42.5	44	TEST #6 BASELINE
1230/1330		3.6	9.7	150	155	30.3	31	TEST #7 FGR ON
1417/1517		3.6	9.7	145	150	25.8	26.7	TEST #8 FGR and UREA ON

CEM CALIBRATION SHEET

DATE 3/23/94

PLANT SCE Etiwanda

LOCATION Unit #3

TEST NUMBER Low Load, Stratification

OPERATOR Cdf

Constituent	Actual Gas Concentration			Instrument Range	Percent-of-Range	
	High	Mid	Low		High	Low
O_2(%)	9.14	4.20		0-10%		
CO_2(%)	17.75	9.89		0-20%		
CO(ppm)	451	250		0-500		
HC(ppm)						
NO_x(ppm)	92.2	48.0		0-100		
SO_2(ppm)						

Time	Concentration	Data Logger Measurements						Strip Chart Measurements (divisions)						COMMENTS
		O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)	HC as methane	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)	HC as methane	
Pre	High	1954	1956	1954		1958		93.2	93.8	95.0		94.2		23.5" @ 1533
	Mid	1950	1954	1950		1956		43.5	53.5	55.0		49.3		23.0" @ 1539
	Low													
	Zero	1946	1953	1946		1954		2.0	5.0	5.0		1.9		
	External	2028	2022	2025		2020		43.5	53.1	54.8		49.0		
	zero bias	2016	2016	2016		2016		2.3	5.0	5.0		1.7		
Post	High	2250				2250		92.7				95.0		24.7" @ 2243
	Mid	2247	Did not calib. post	CO was ~0 changed range to 0-100		2247		43.0				49.3		24.5" @ 2248
	Low													
mid bias	~~Zero~~	2241				2239		43.0				49.0		
zero bias	External	2235				2235		2.3				1.5		
zero		2244				2244		1.6				1.3		

CEM CALIBRATION SHEET

DATE 3/23/94

PLANT Edison EGS

LOCATION Unit # 3

TEST NUMBER Test 10 Low Load, Baseline

OPERATOR Cdf

Constituent	Actual Gas Concentration: High	Mid	Low	Instrument Range	Percent-of-Range: High	Low
O_2(%)	9.14	4.20		0-10%		
CO_2(%)	17.75	9.89		0-20%		
CO(ppm)	90	50		0-100		
HC(ppm)						
NO_x(ppm)	21.0	12.3		0-25		
SO_2(ppm)						

Time	Concentration	Data Logger Measurements: O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)	HC as methane	Strip Chart Measurements (divisions): O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_x (ppm)	HC as methane	COMMENTS
Pre	High	2308	2308	2308		2308		93.4	95.0	95.0		86.8		24.7" @ 2243
	Mid	2304	2304	2304		2304		43.3	54.1	54.0		51.6		24.5" @ 2248
	Low											5		
	Zero	2300	2300	2300		2300		1.4	5.2	5.0		1.8		
	External	2323	2314	2318		2320		43.2	53.7	53.9		86.2		
zero bias		2312	2312	2312		2312		2.0	5.4	5.0		1.9		
Post	High	0054	0054	0054		0054		93.4	94.8	90.0		86.5		24.1" @ 0044
	Mid	0050	0050	0050		0050		43.2	54.2	54.0		50.8		23.9" @ 0049
	Low													
	Zero	0046	0046	0046		0046		1.3	5.3	5.0		1.3		
	External	0042	0033	0036		0039		43.1	53.8	53.8		85.8		
zero bias		0031	0031	0031		0031		9	5.5	5.1		2.0		

CEM CALIBRATION SHEET

DATE 3/23/94

PLANT SCE

LOCATION Unit # 3

TEST NUMBER #11 Low Load FGR ON

OPERATOR Cdf

Constituent	Actual Gas Concentration High	Actual Gas Concentration Mid	Actual Gas Concentration Low	Instrument Range	Percent-of-Range High	Percent-of-Range Low
O_2(%)	9.14	4.20		0-10%		
CO_2(%)	17.75	9.89		0-20%		
CO(ppm)	90	50		0-100		
HC(ppm)						
NO_x(ppm)	21.0	12.3		0-25		
SO_2(ppm)						

Time	Concentration	Data Logger O_2 (%)	Data Logger CO_2 (%)	Data Logger CO (ppm)	Data Logger SO_2 (ppm)	Data Logger NO_x (ppm)	Data Logger HC as methane	Strip Chart O_2 (%)	Strip Chart CO_2 (%)	Strip Chart CO (ppm)	Strip Chart SO_2 (ppm)	Strip Chart NO_x (ppm)	Strip Chart HC as methane	COMMENTS
Pre	High	0054	0054	0054		0054		93.4	94.8	90.0		86.5		24.1"@0044
	Mid	0050	0050	0050		0050		43.2	54.2	54.0		50.8		23.9"@0049
	Low													
	Zero	0046	0046	0046		0046		1.3	5.3	5.0		1.3		
	External	0042	0033	0036		0039		43.1	53.8	53.8		85.8		
zero bias		0031	0031	0031		0031		1.9	5.5	5.1		2.0		
Post	High	0242	0242	0242		0242		93.4	94.6	94.7		86.4		23.8"@
	Mid	0246	0246	0246		0246		43.4	54.1	53.8		50.5		23.5"@
	Low													
	Zero	0238	0238	0238		0238		1.3	5.3	5.1		0.5		
	External	0235	0225	0228		0231		43.3	53.9	53.5		85.8		
zero bias		0222	0222	0222		0222		1.8	5.7	5.1		1.1		

TEST VAN DATA SHEET

DATE 3/23/94 PLANT EGS #3 OPERATOR [illegible initials]

LOCATION Unit #3 OPERATING LOAD Low Load Stratification Test #9

Time Start/Stop	NH_3 Slip	Strip Chart measurements divisions raw O_2 (%)	CO_2 (%)	CO (ppm)	CO @3%O_2 (ppm)	NO_x ~~(ppm)~~	NO_x @3%O_2 (ppm)	COMMENTS
2031/2033						22.0		PORT - B - Reference (Center)
2035/2037						22.2		B-1
2039/2041						22.2		B-2
2043/2045						22.3		B-3
2047/2049		Stack pressure negative, believe minor dilution occurred → ↓ O2 conc. also up.				21.9		B-4
2052/2054						22.4		PORT B - Reference (Center)
2058/2101						22.5		PORT A - Reference (Center)
2103/2105						22.5		A-1
2108/2110						22.5		A-2
2112/2114						22.6		A-3
2116/2118						22.7		A-4
2120/2122						22.9		Port A - Reference (Center)
2127/2130						22.7		Port D - Reference (Center)
2132/2134						22.8		D-1
2136/2138						23.3		D-2
2140/2143						22.4		D-3
2146/2149						23.2		D-4
2151/2153						23.5		Port D - Reference (Center)

TEST VAN DATA SHEET

DATE 3/23/94 PLANT EGS OPERATOR CG

LOCATION Unit #3 OPERATING LOAD Low-Load Stratification Test #9 cont'

Time Start/Stop	NH_3 Slip	Strip Chart measurements: O_2 (%)	CO_2 (%)	CO (ppm)	CO @3%O_2 (ppm)	NO_x (ppm)	NO_x @3%O_2 (ppm)	COMMENTS
2201/2203						23.0		PORT C - Reference (Center)
2205/2207						22.7		C-1
2209/2211						22.6		C-2
2213/2215						22.6		C-3
2217/2219						22.6		C-4
2222/2224						22.5		PORT C - Reference (Center)
			System response time 35 seconds					

TEST VAN DATA SHEET

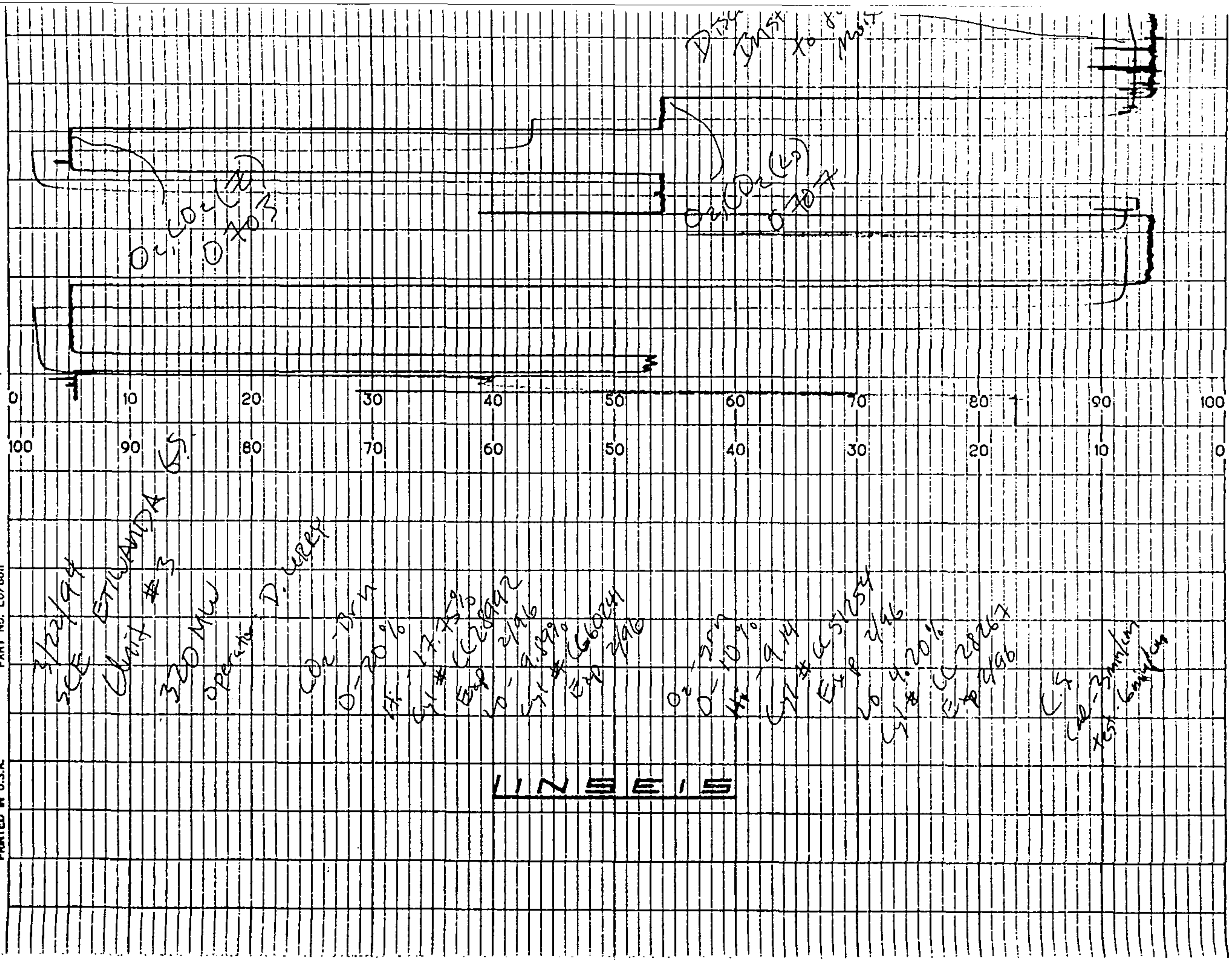
DATE 3/23+24/94   PLANT SCE Etiwanda   OPERATOR CG

LOCATION Unit #3   OPERATING LOAD Low Load   Test 10 - Baseline
Test 11 - FGR ON

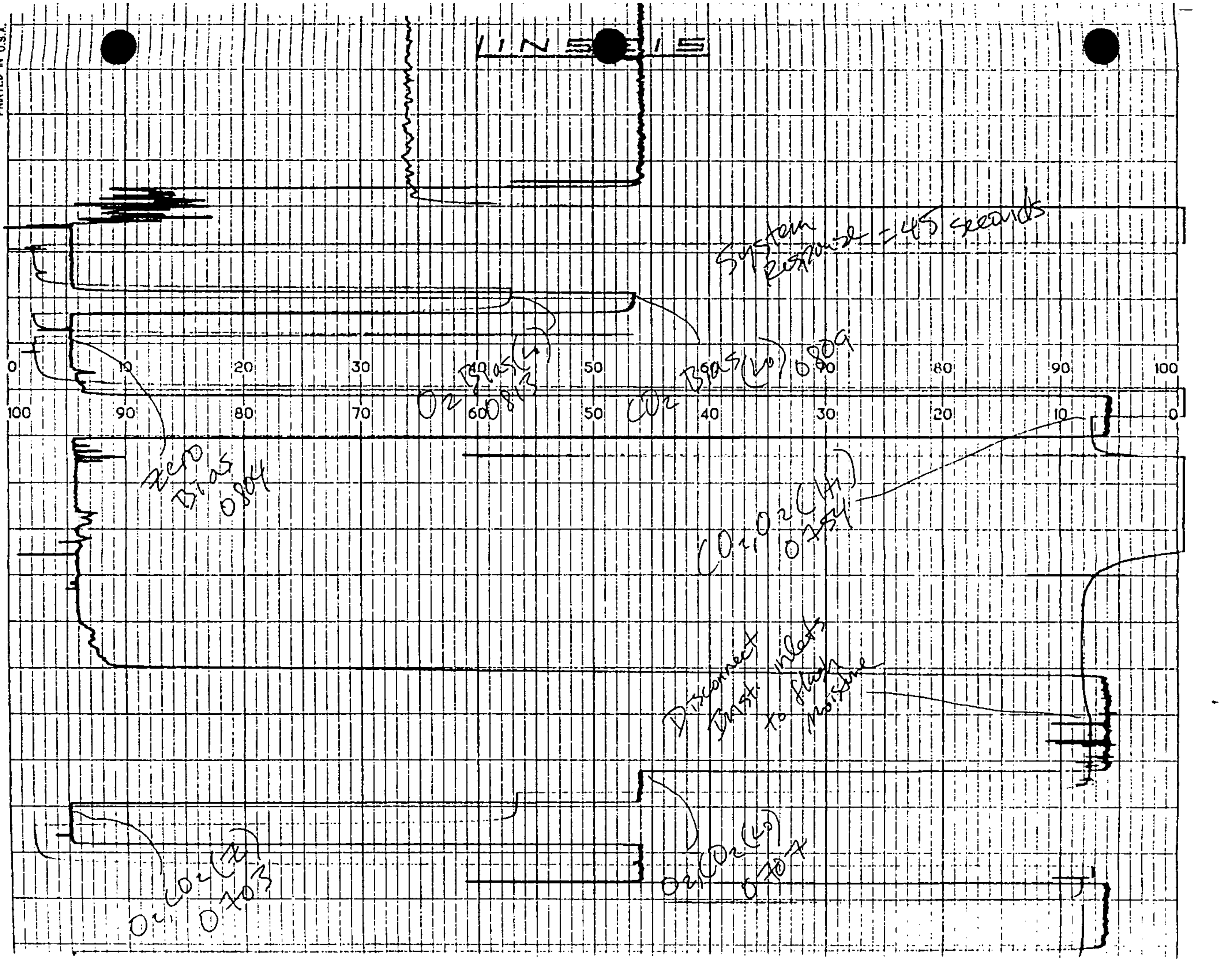
Time Start/Stop	NH_3 Slip	Strip Chart measurements O_2 (%)	CO_2 (%)	CO (ppm)	CO @3% O_2 (ppm)	NO_x (ppm)	NO_x @3% O_2 (ppm)	COMMENTS
2326/0026		4.7	9.0	∅	∅	20.8	23	Test 10 Baseline
		~~4.7~~	~~9.0~~	~~7~~		1'		
0117/0216		4.7	9.0	7	7	13.3	14.6	Test 11 FGR ON

APPENDIX D-3

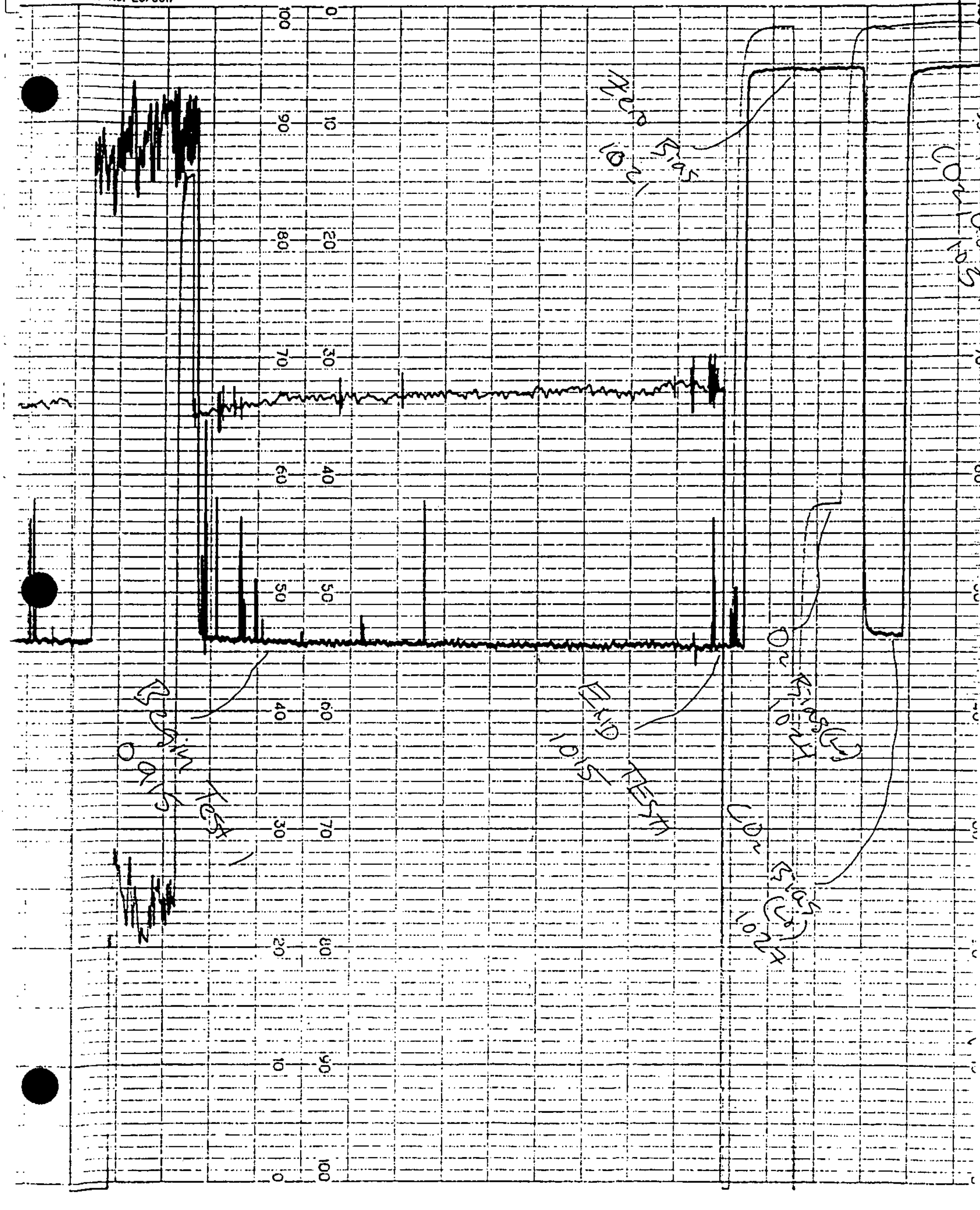
STRIP CHART RECORDS


PRINTED IN U.S.A.
PART NO. L0/8011
LINSEIS
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
3/22/94
SCE ETIWANDA G.S.
Unit #3
320 MW
Operator: D.
CO2 - Dry
0-20%
Hi: 17.X%
Cyl #
Exp 2/96
Lo - 9.89%
Cyl # CC60244
Exp 2/96
O2 - Dry
0-10%
Hi 9.14
Cyl # CC51054
Exp 2/96
Lo 4.20%
Cyl # CC28267
Exp 2/96
Cal - 3mm/cm
Test 6mm/cm
O2 CO2 (Hi)
O2 CO2 (Lo)

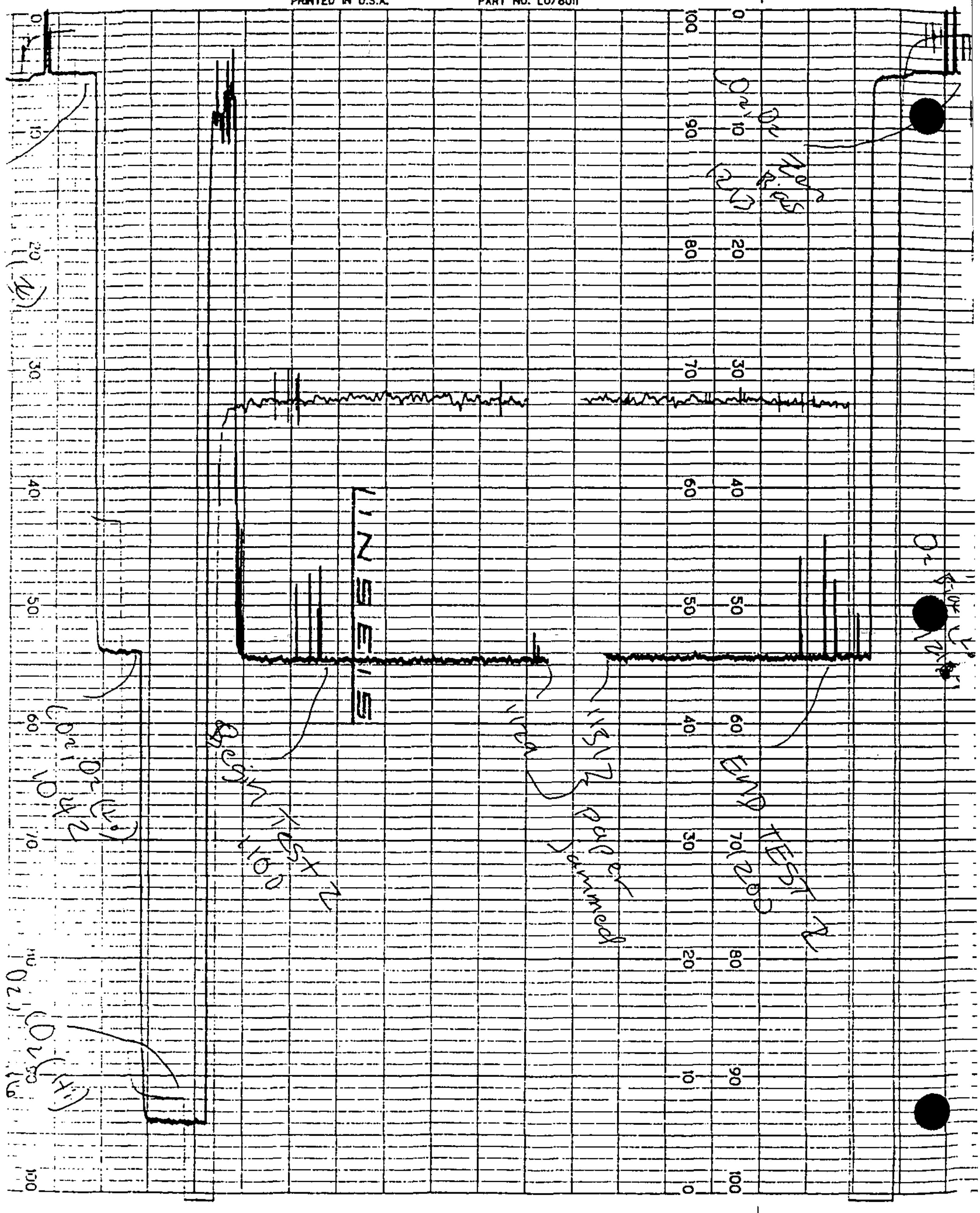
PRINTED IN U.S.A.

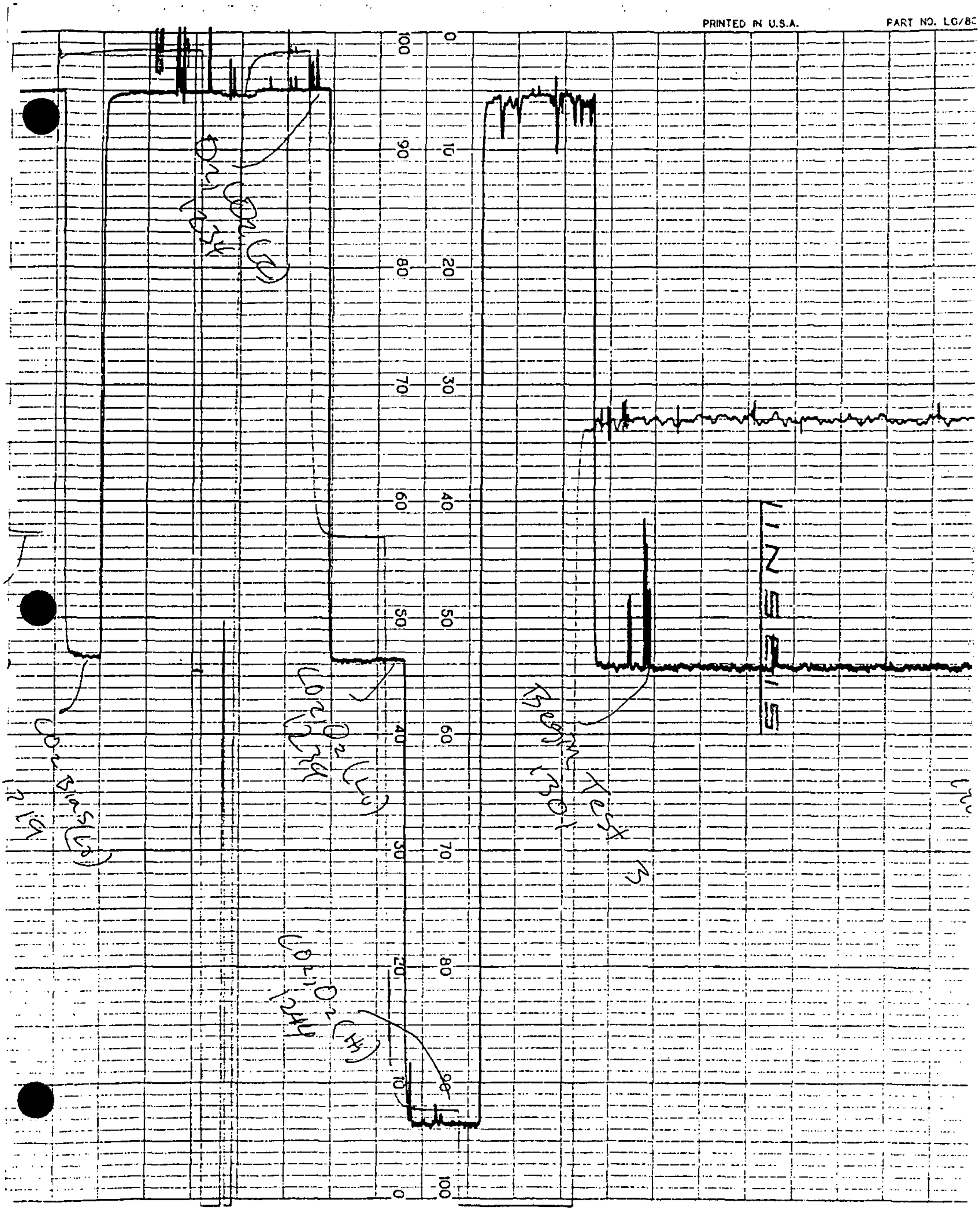


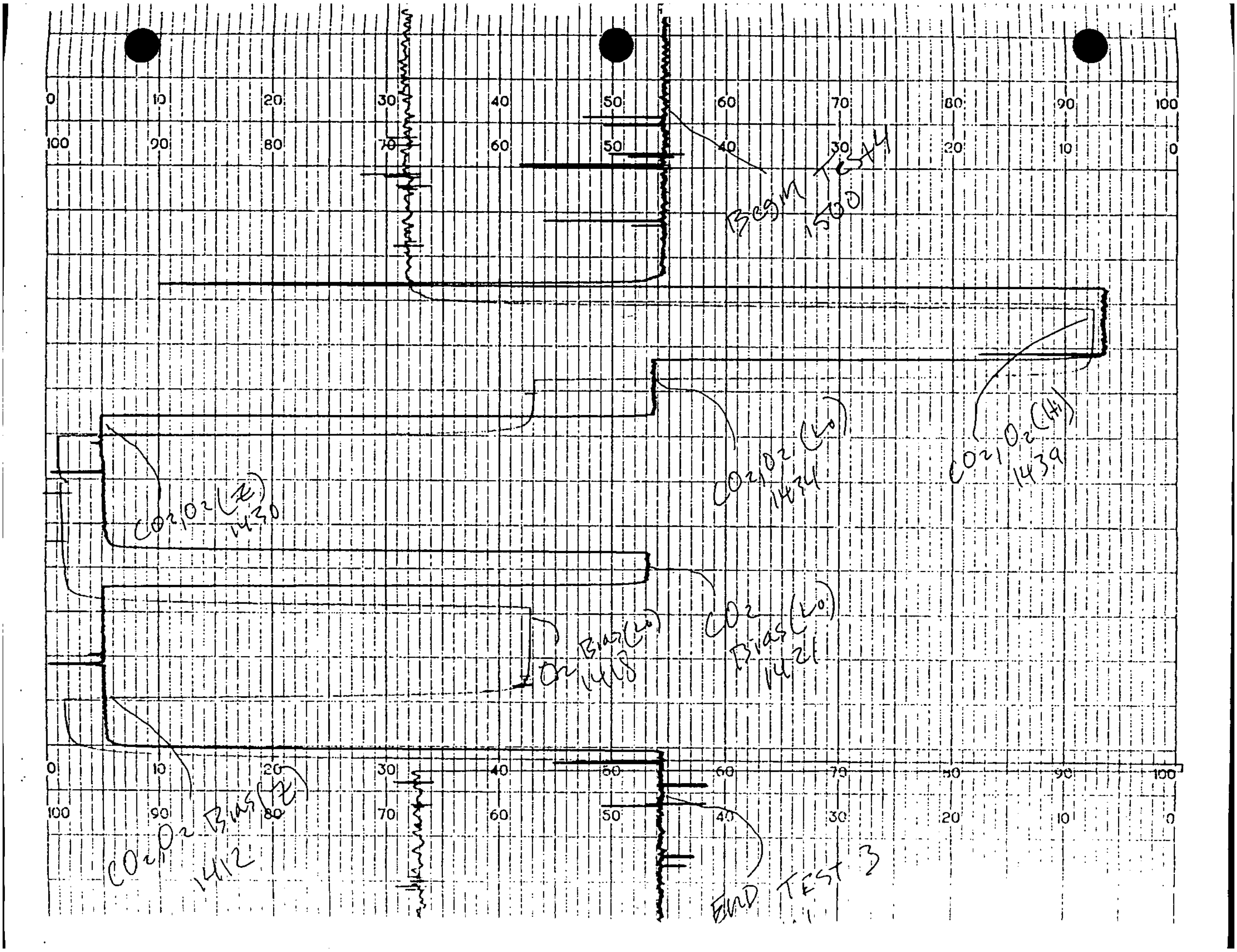
PART NO. L0/8011



PRINTED IN U.S.A. PART NO. LO/8011

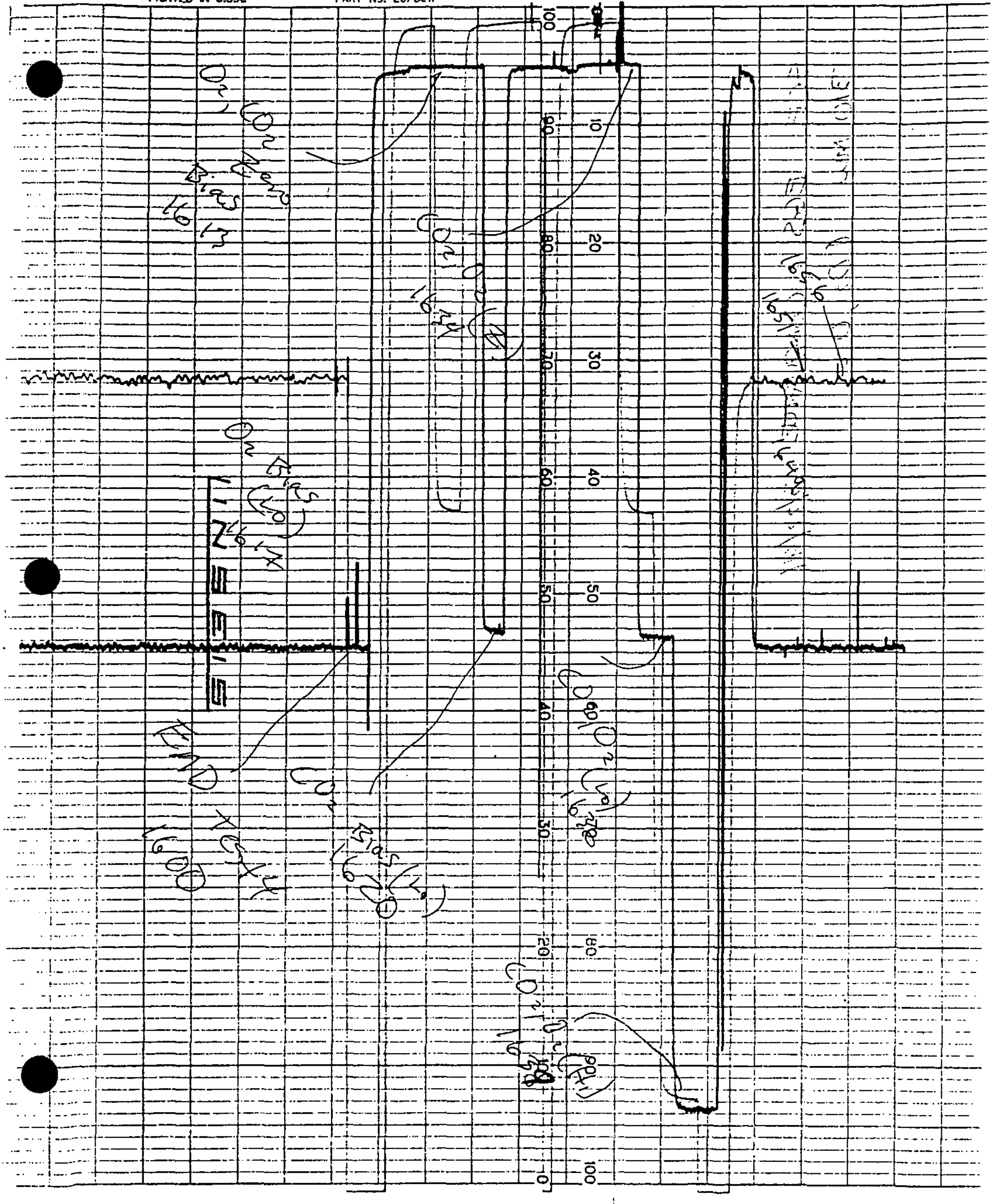


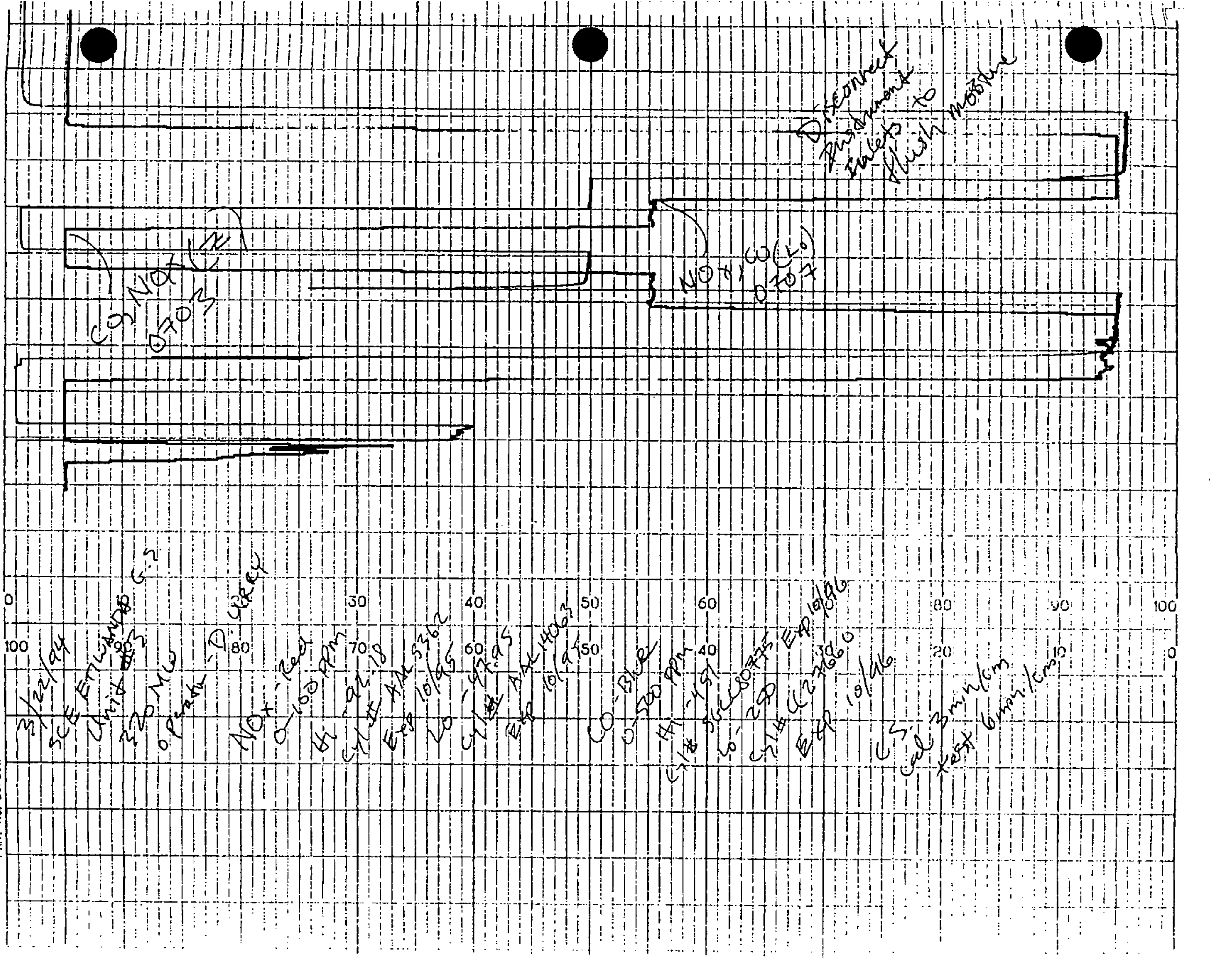

PRINTED IN U.S.A.
PART NO. LG/8
CO2 Bias (Lo)
1219
O2 / CO2 (Z)
1234
CO2 / O2 (Lo)
1239
CO2 / O2 (Hi)
1244
Begin Test 13
1301
11NSE15



Begin Test 4
1500
CO2/O2 (Hi)
1439
CO2/O2 (Lo)
1434
CO2/O2 (Z)
1430
CO2 Bias (Lo)
1421
O2 Bias (Lo)
1418
CO2/O2 Bias (Z)
1412
End Test 3

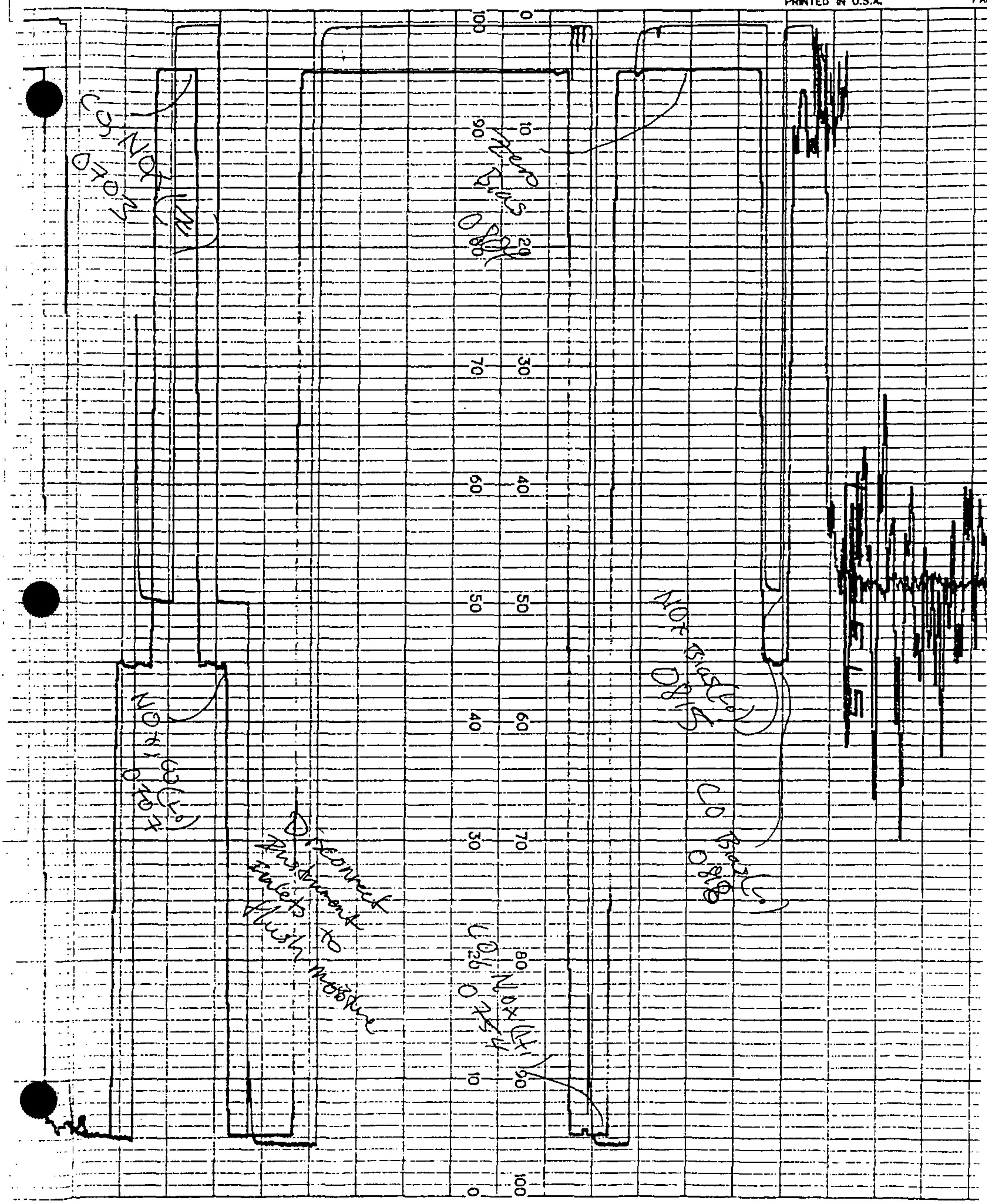
PRINTED IN U.S.A. PART NO. L0/8C11



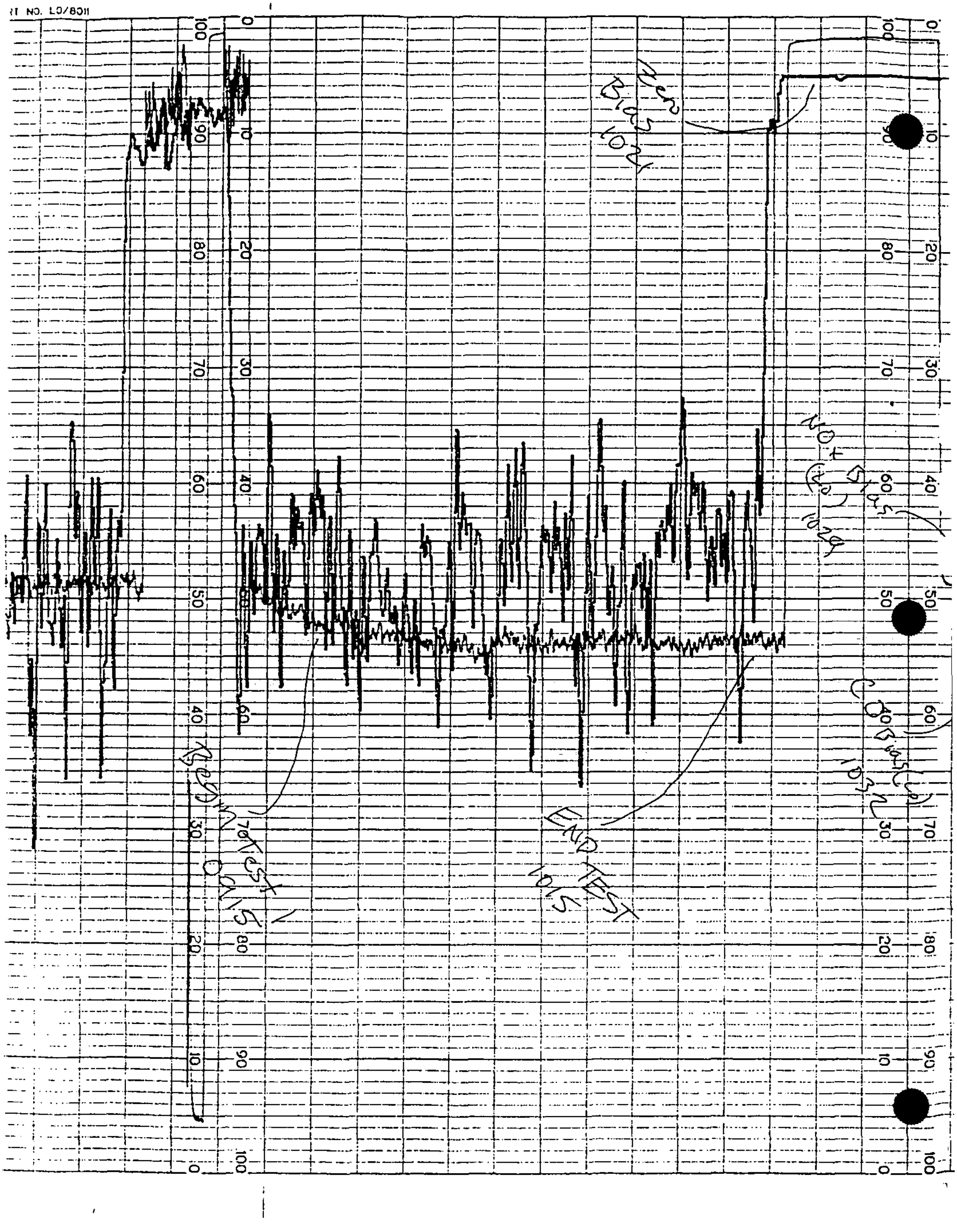


PART NO. L0/8011

PRINTED IN U.S.A.

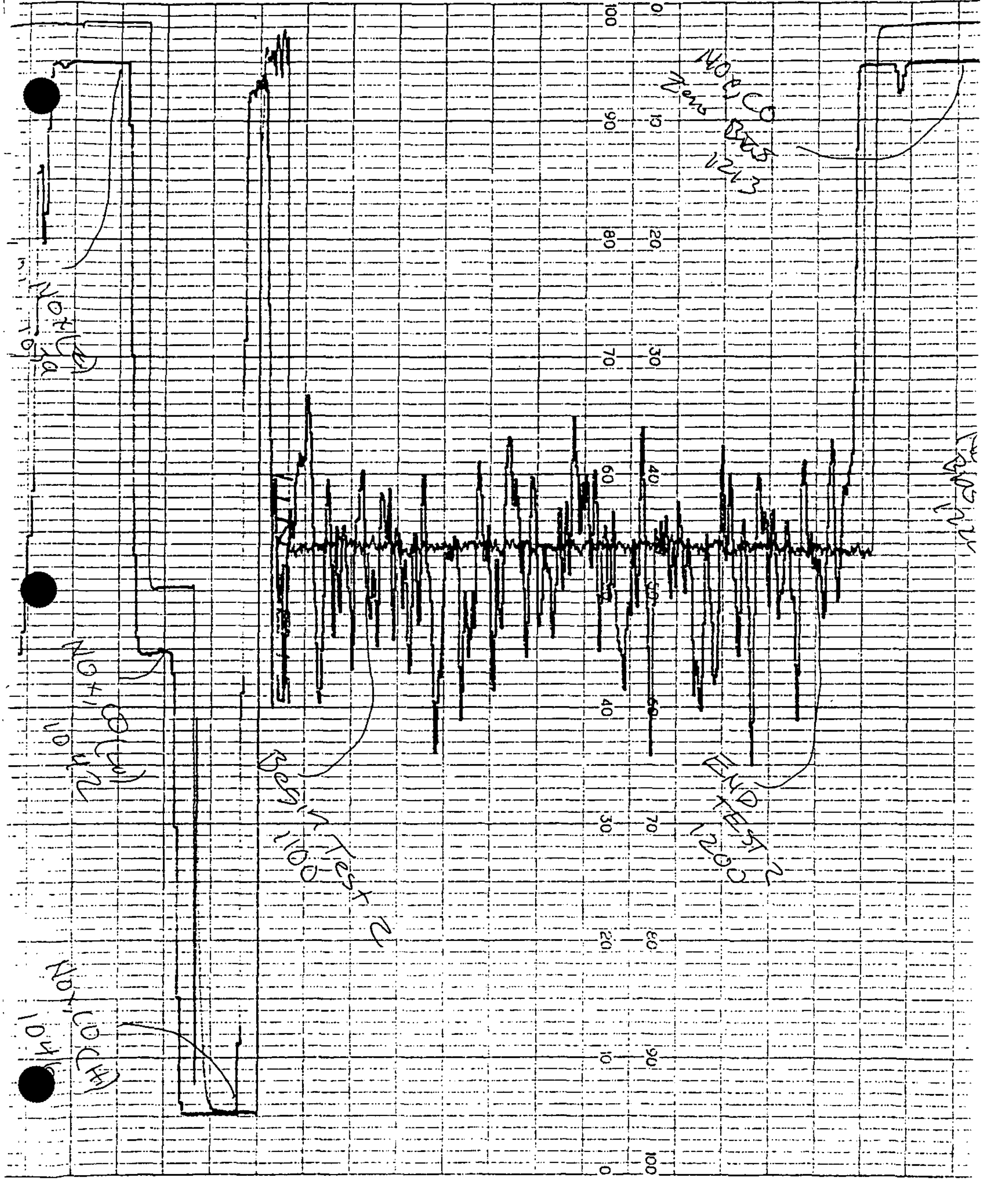


RT NO. L0/8011

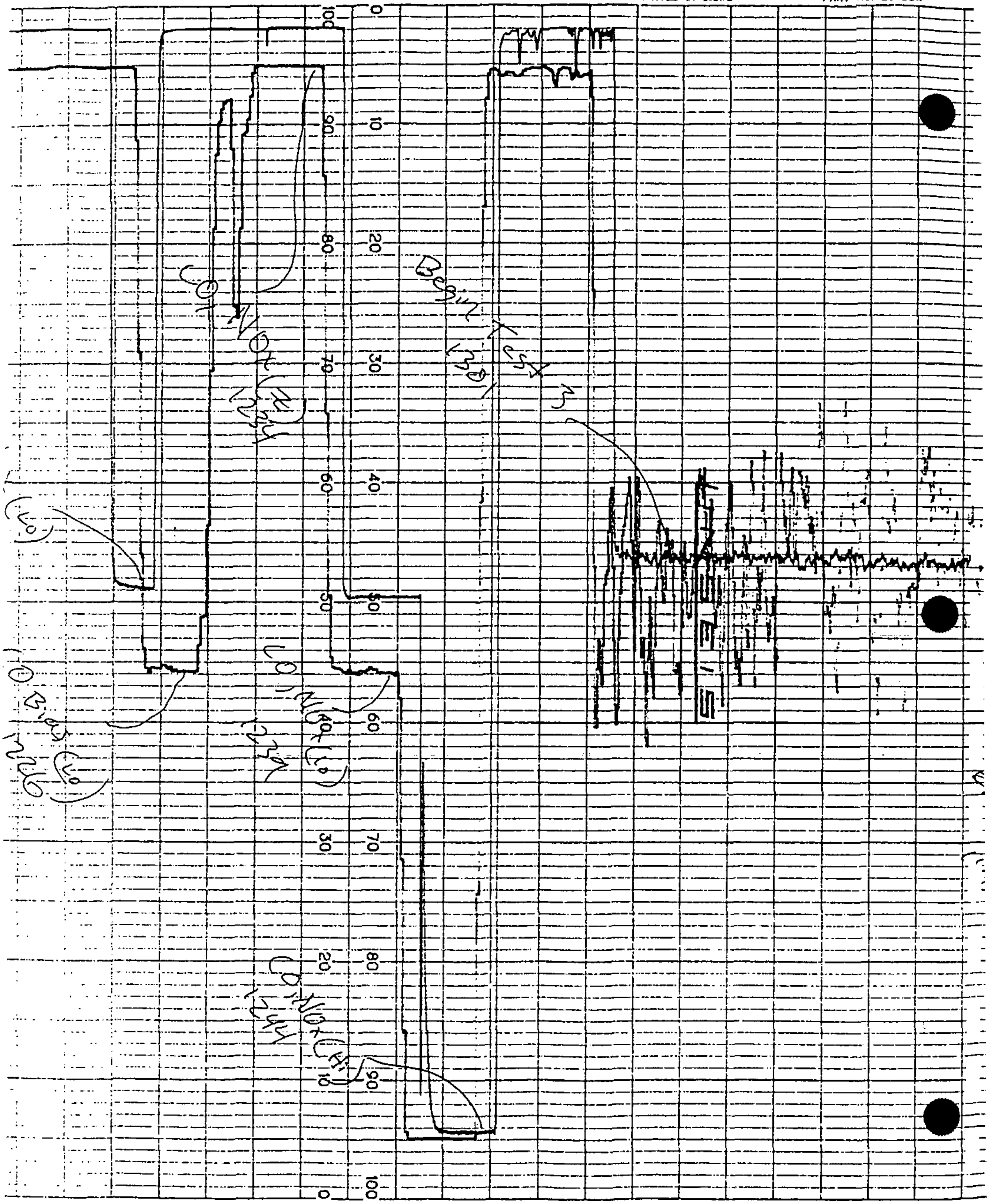


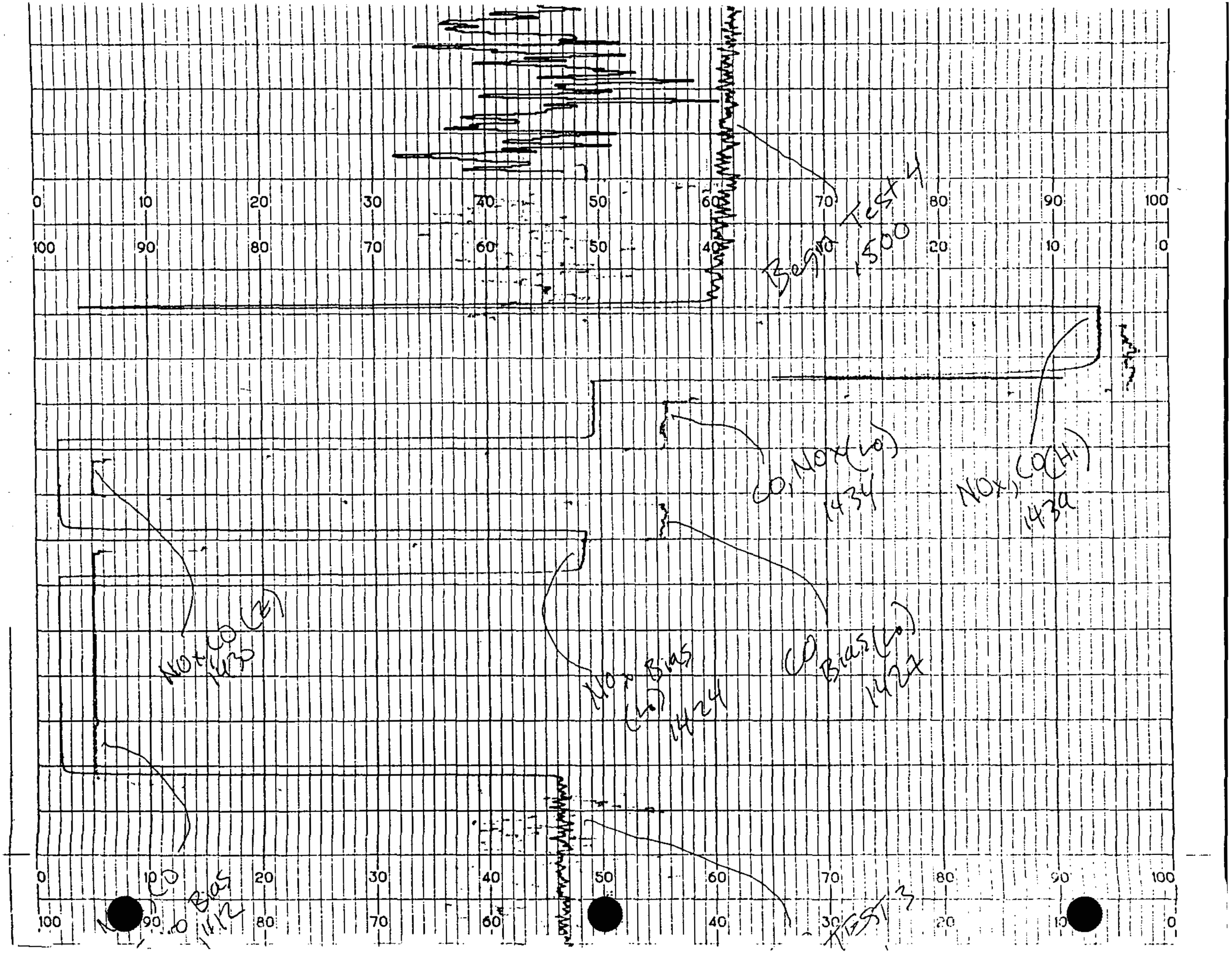
Zero Bias 1024
NO+ Span (up) 1029
CO Span (up) 1032
Begin Test 0915
END TEST 1015

PRINTED IN U.S.A. PART NO. LO/8011



PRINTED IN U.S.A. PART NO. L0/6011




Begin Test 4
1500
CO, NOx (lo)
1434
NOx, CO (Hi)
1432
NOx CO (Hi)
1430
NOx Bias (lo)
1424
CO Bias (lo)
1422
CO Bias
1412
TEST 3

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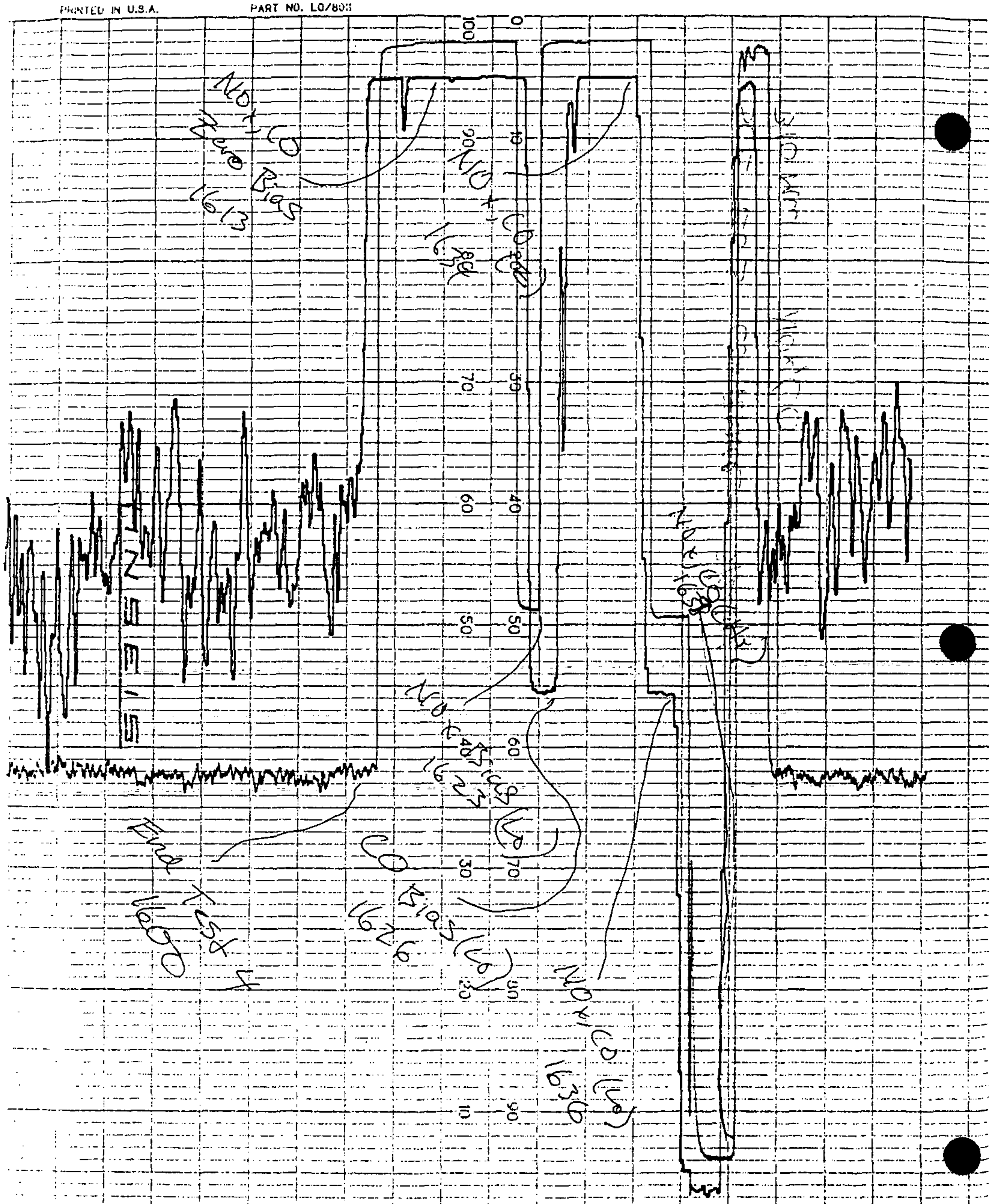


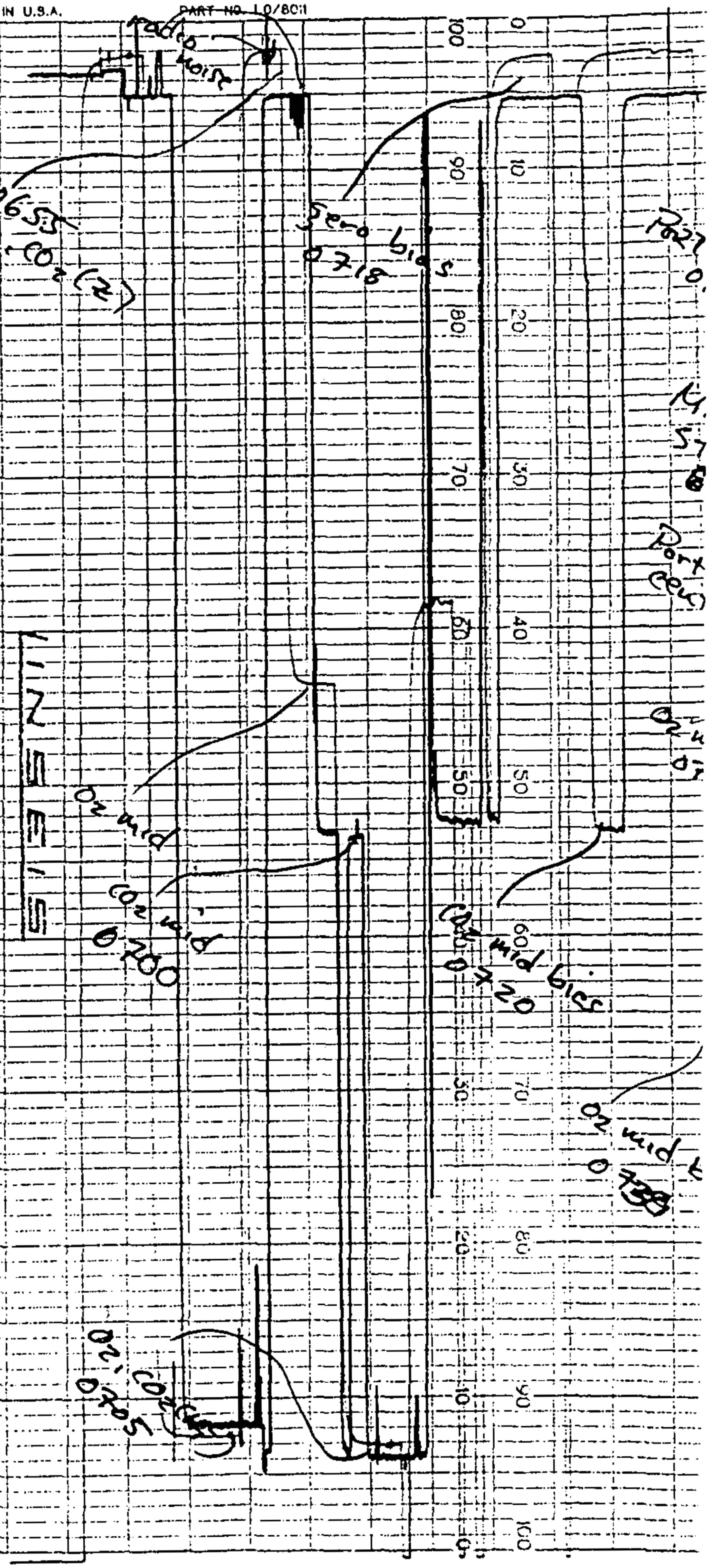
PRINTED IN U.S.A. PART NO. L0/8011

3/23/94
SCE EGS #3
Mid Load
C. Garretson

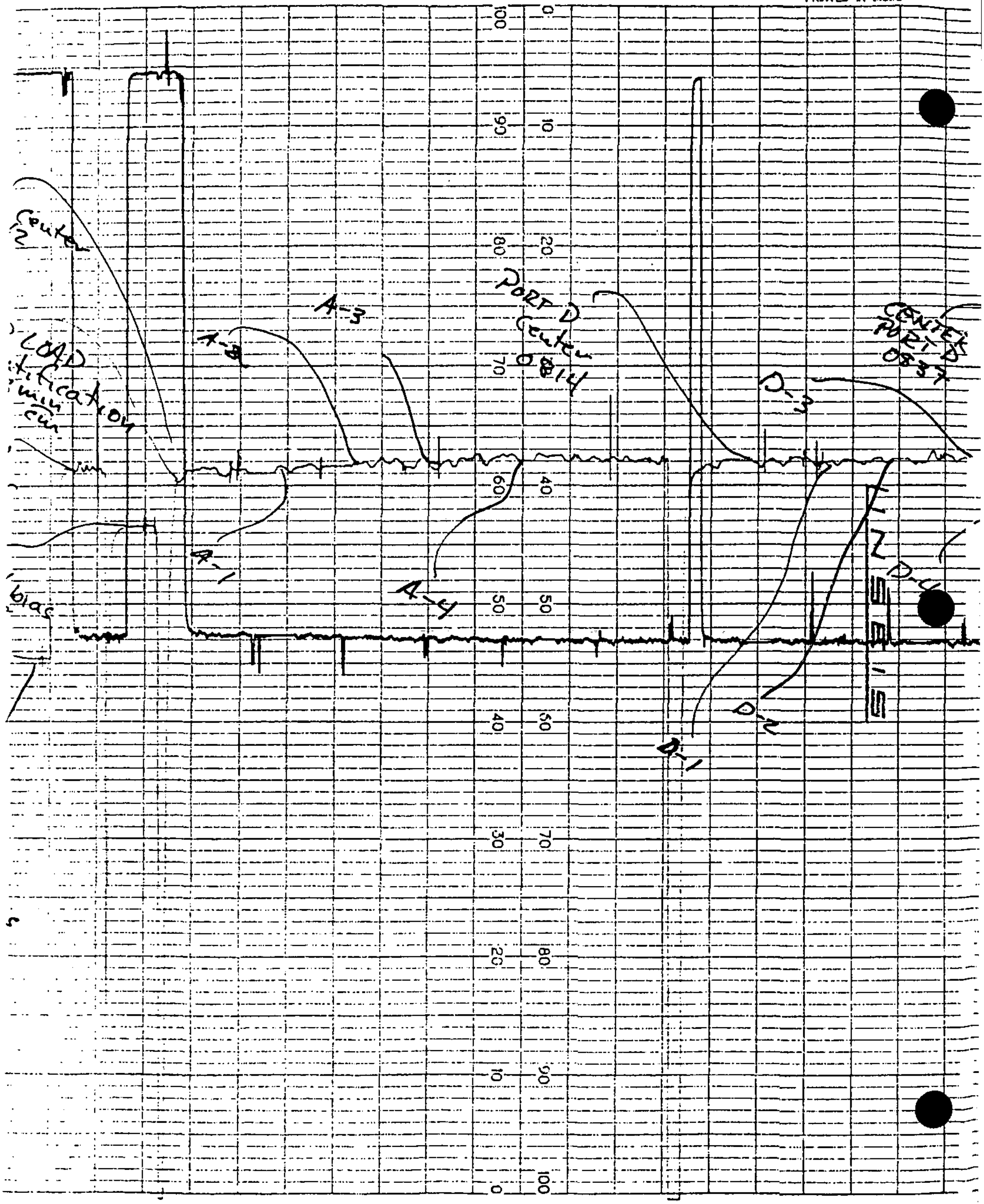
CO_2 - brown
0-20%
Hi 17.75%
Cyl. # CC78992
Exp 2/96
Mid 9.89%
Cyl. # CC60241
Exp 2/96

O_2 0-10% green
Hi 9.14%
Cyl # CC51524
Exp 2/96
Mid 4.20%
Cyl. # CC 78267
Exp. 2/96

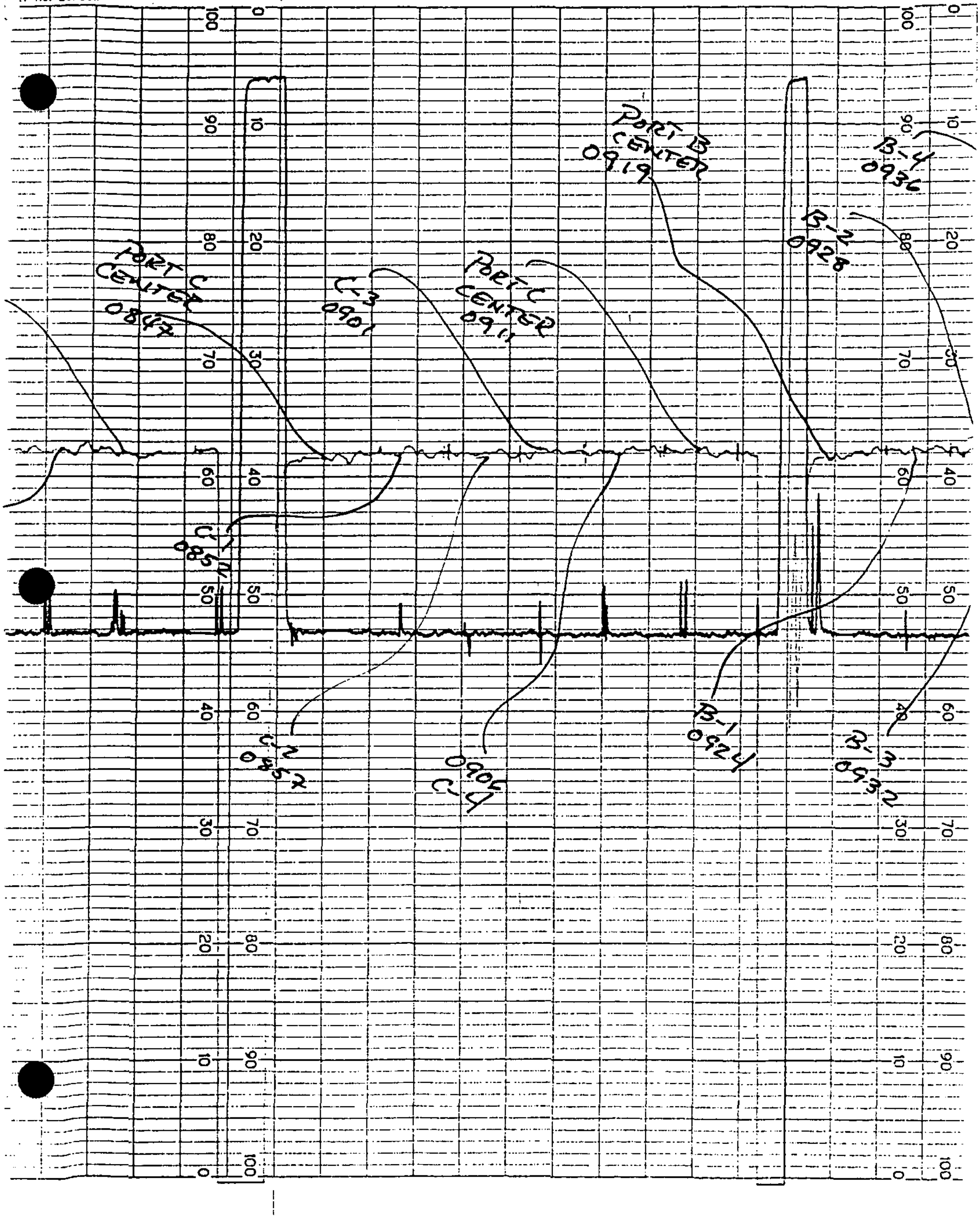
Chart Speed
Cal. 3 min/cm
test 6 min/cm



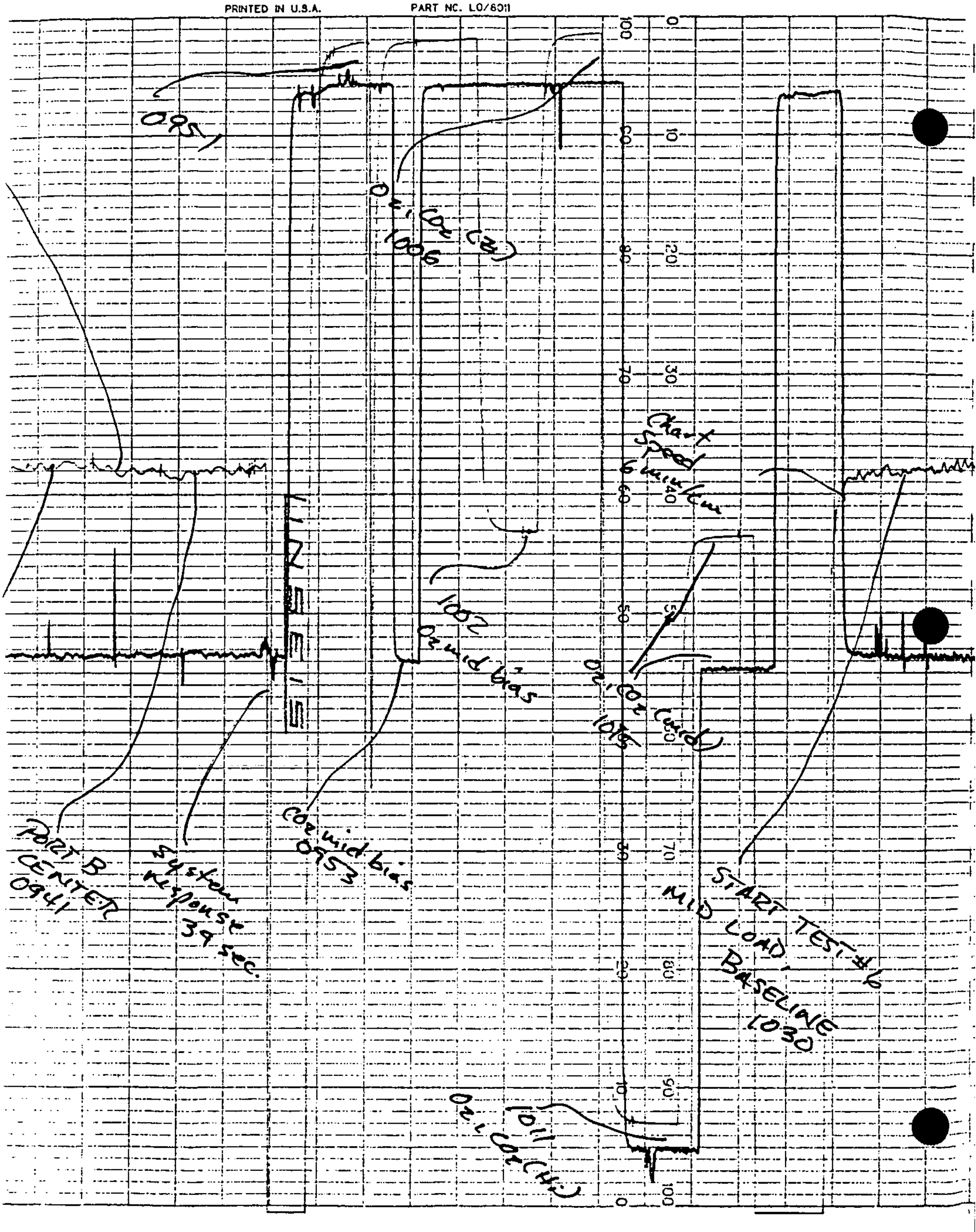
PRINTED IN U.S.A.



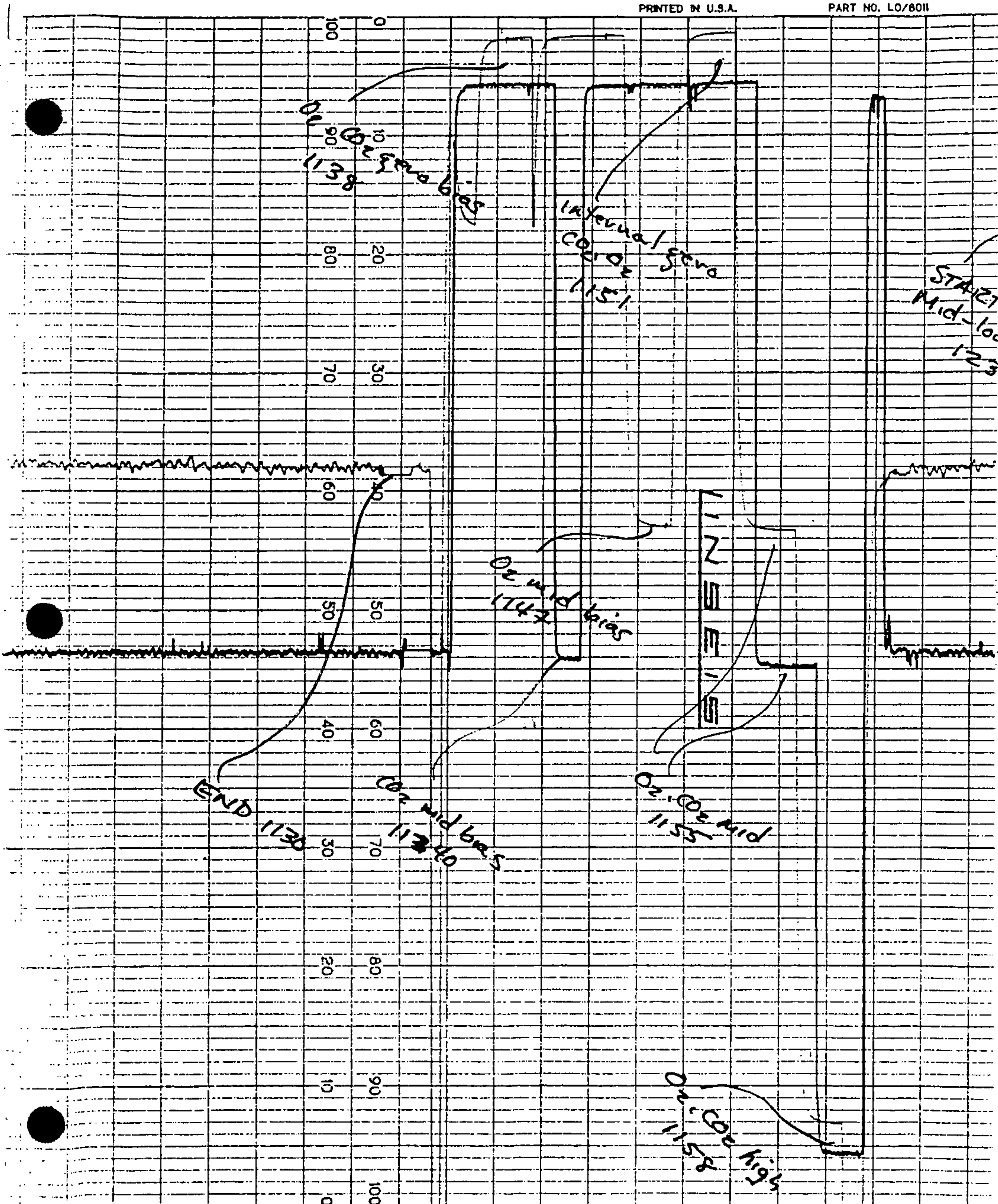
T NO. LO/8011

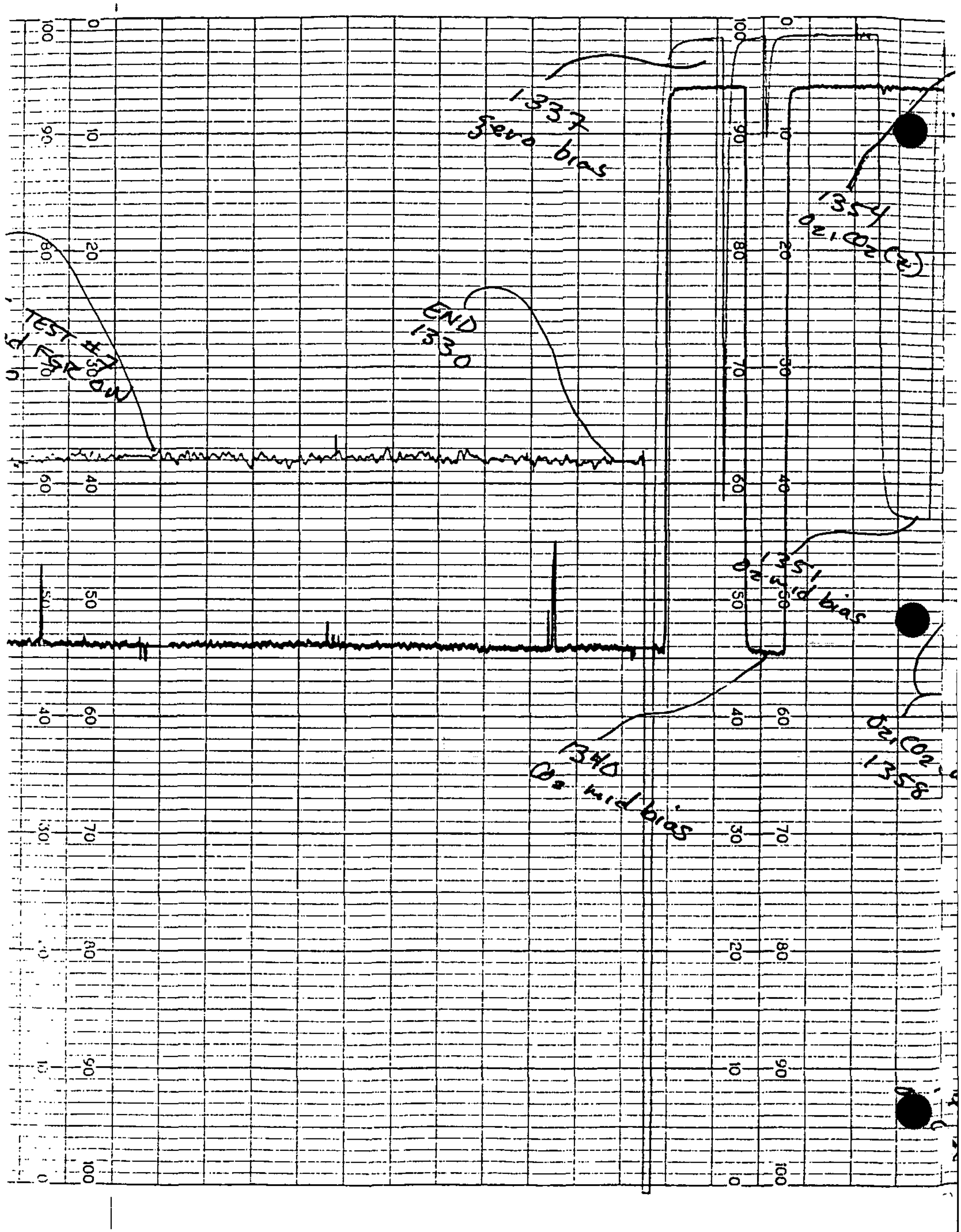

PORT C CENTER 0847
C-1 0850
C-2 0852
C-3 0901
0906 C-4
PORT C CENTER 0911
PORT B CENTER 0919
B-1 0924
B-2 0928
B-3 0932
B-4 0936

PRINTED IN U.S.A. PART NO. L0/6011



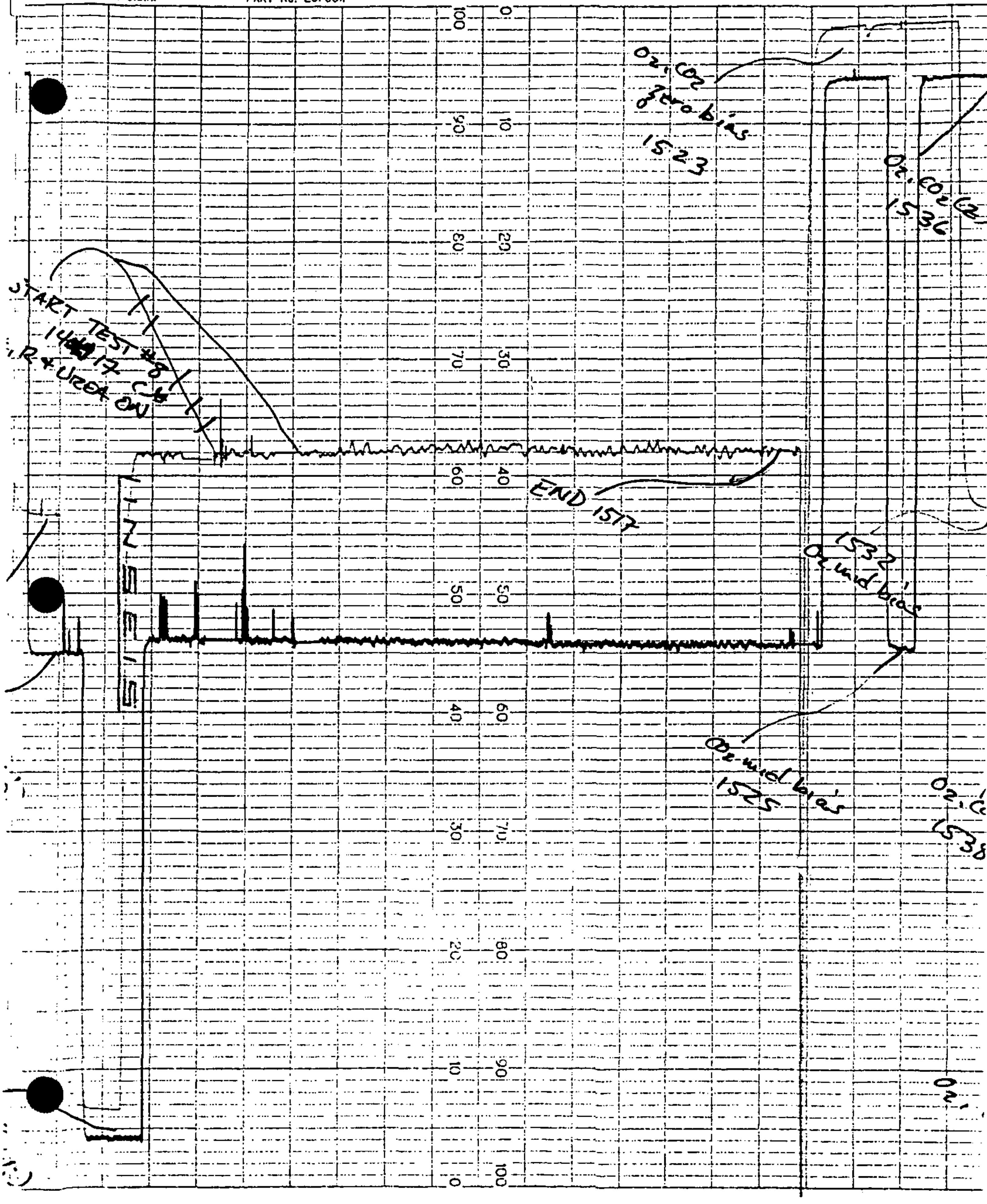
PRINTED IN U.S.A. PART NO. L0/8011



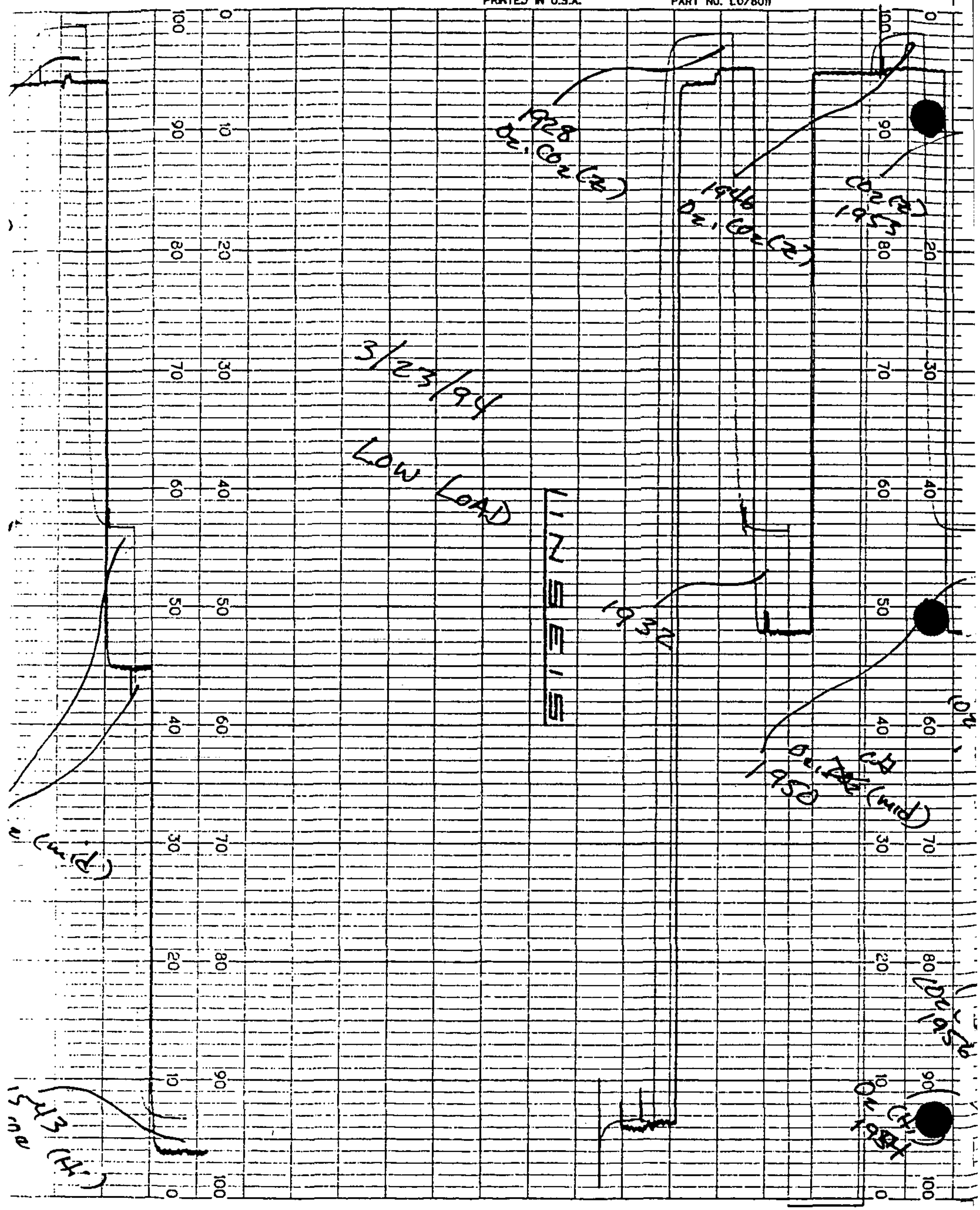


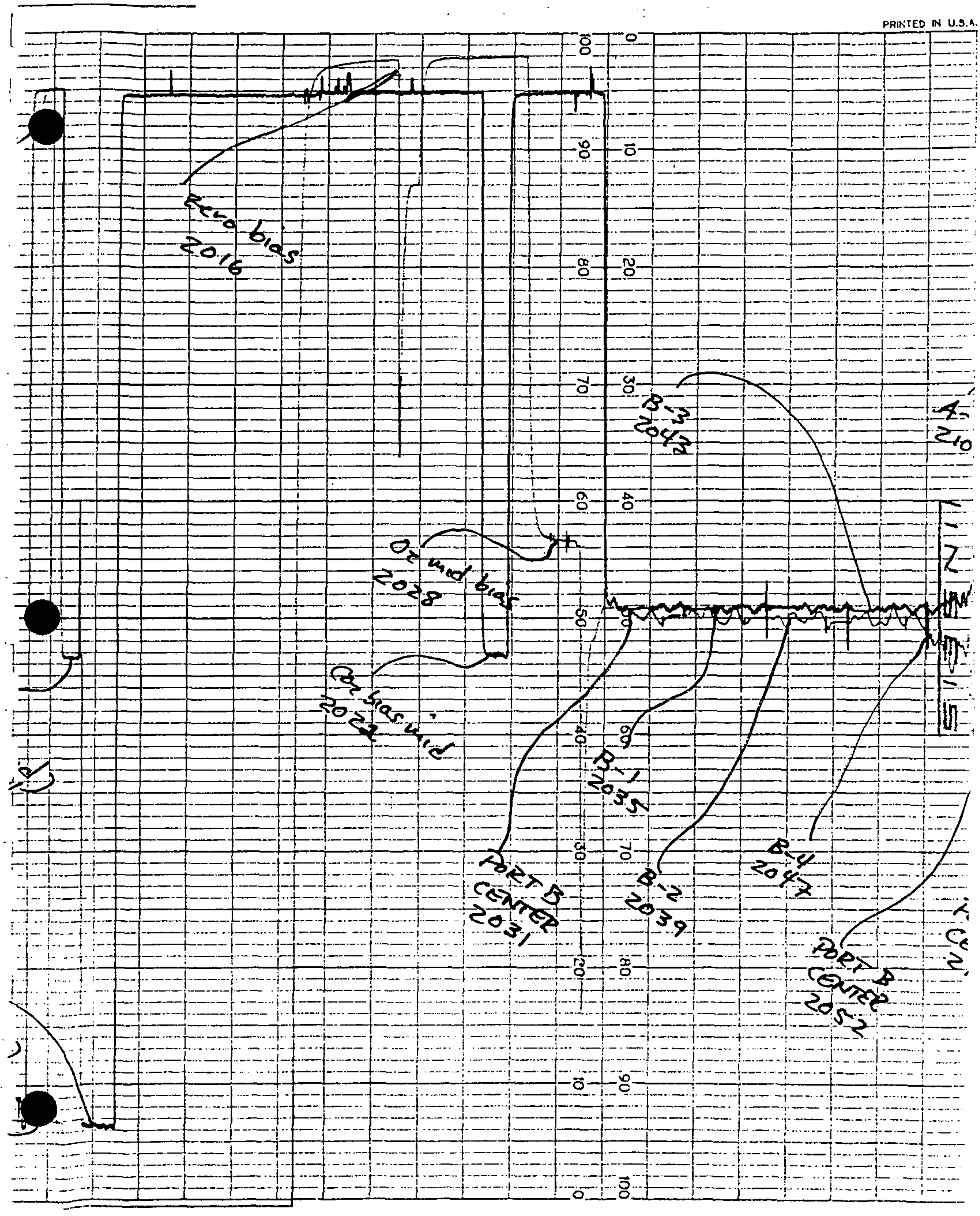
1337
zero bias
1354
END
1330
1340
mid bias
1351
1358

PRINTED IN U.S.A. PART NO. LO/8011

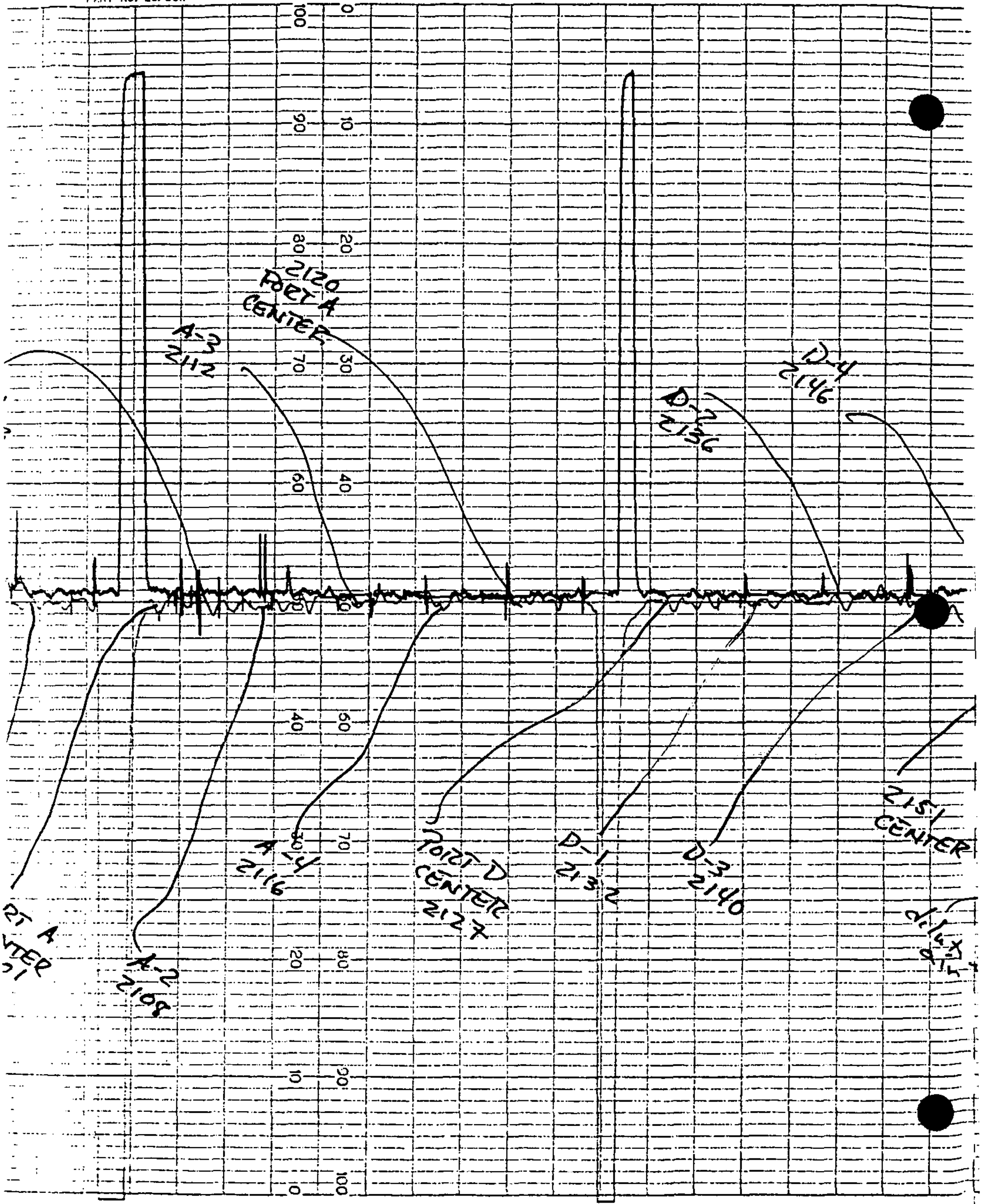


PRINTED IN U.S.A. PART NO. LO/8011

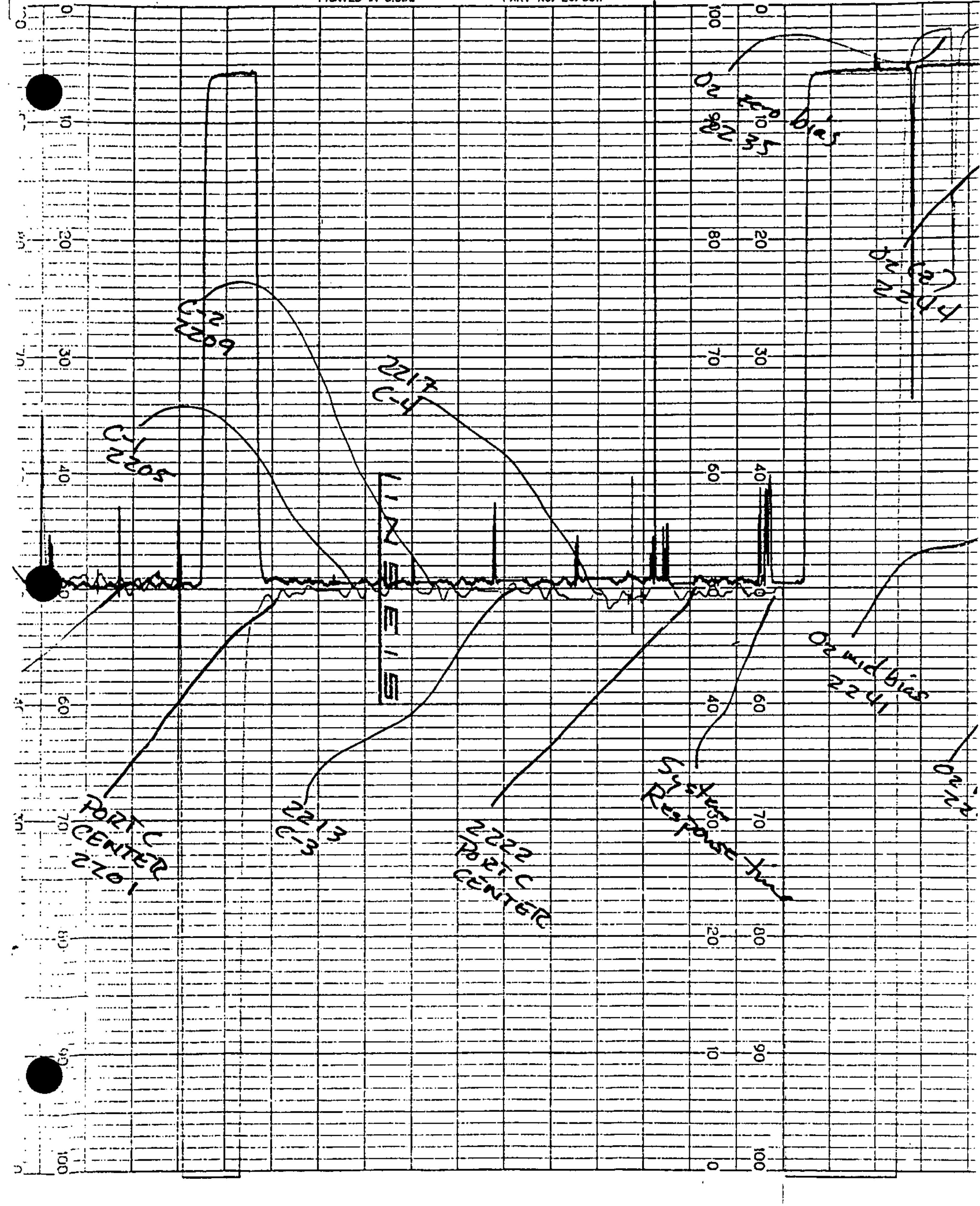



PRINTED IN U.S.A.
zero bias
2016
DZ mid bias
2028
B-3
2043
B-1
2035
PORT B
CENTER
2031
B-2
2039
B-4
2047
PORT B
CENTER
2052

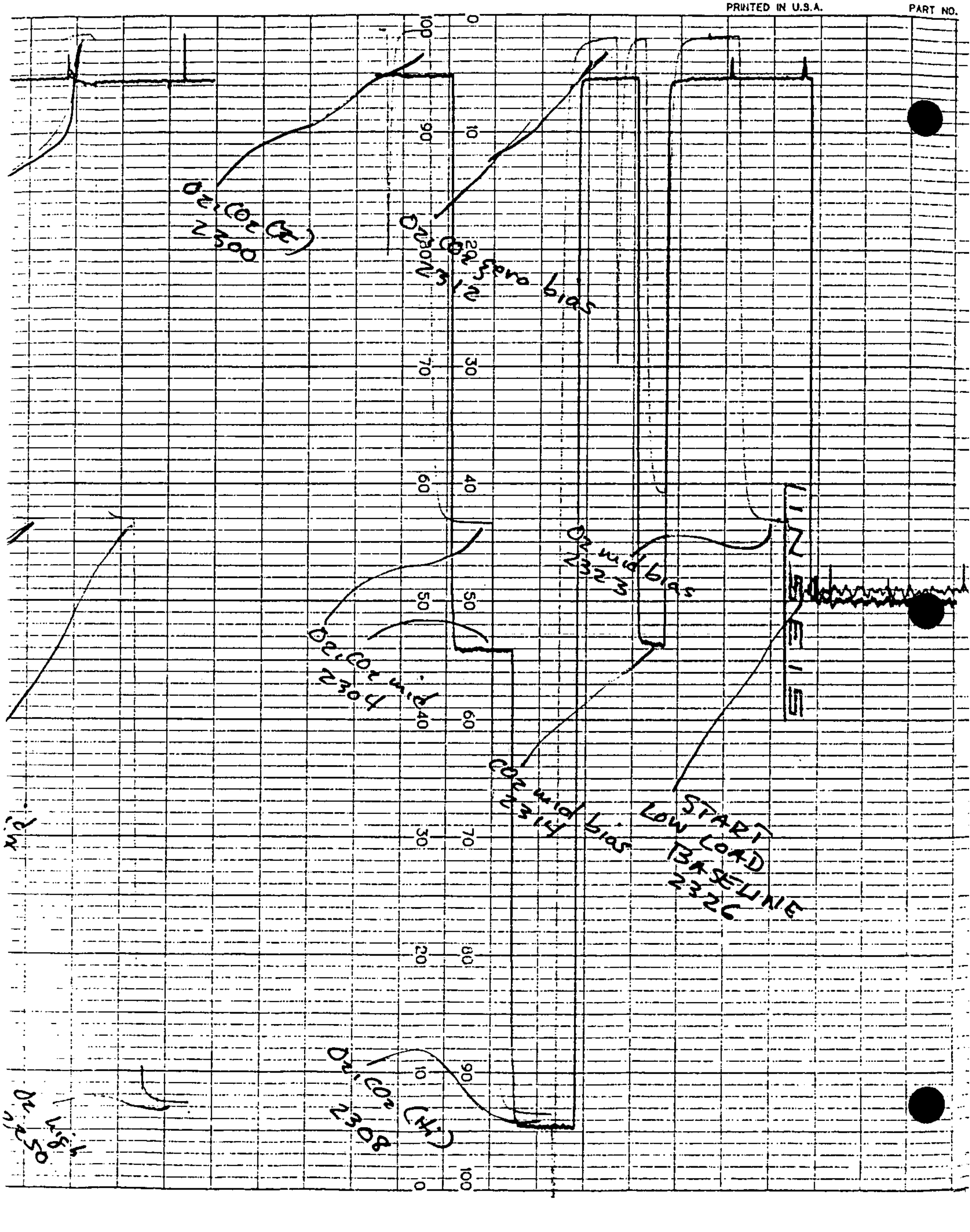
PART NO. L0/8011

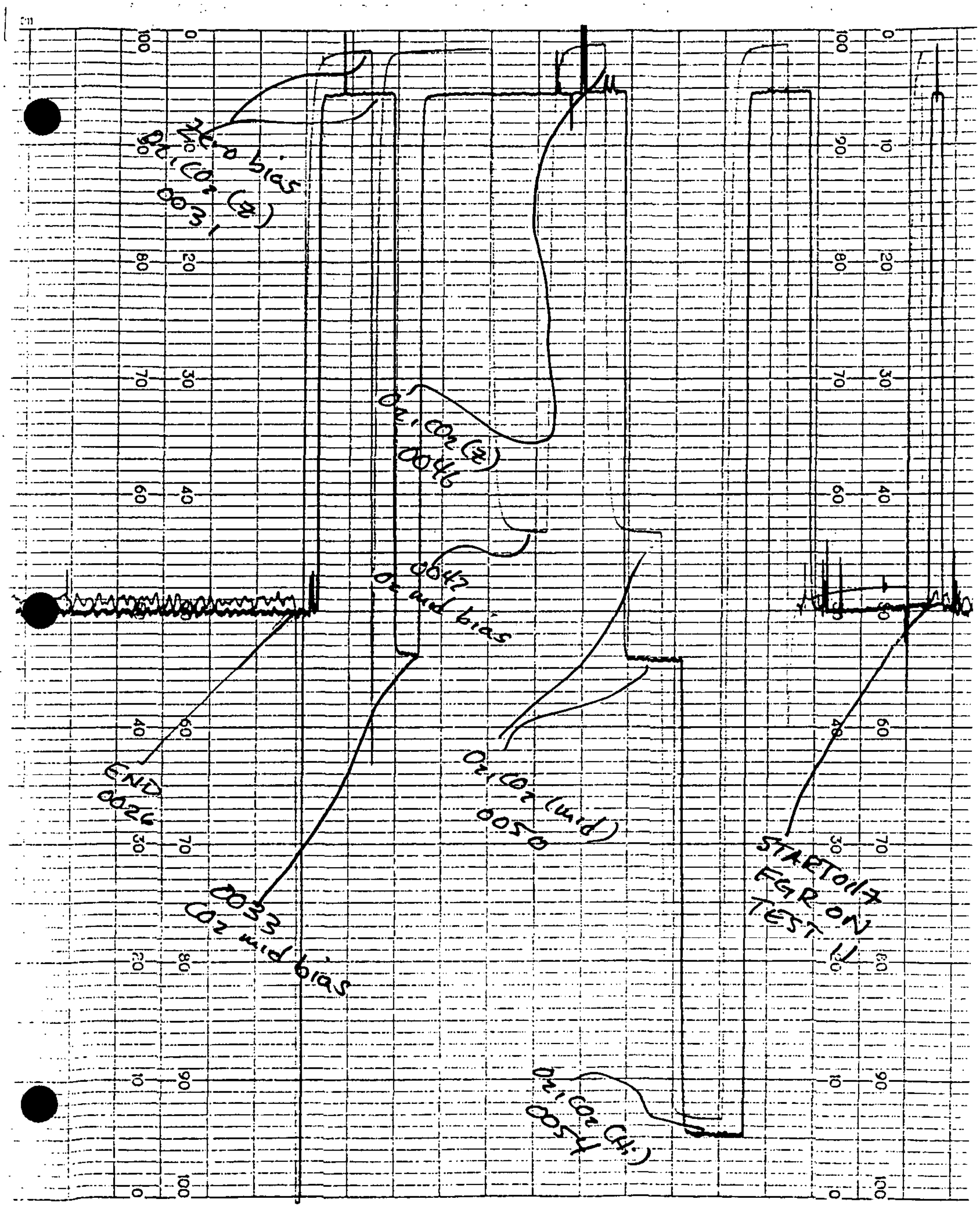


PRINTED IN U.S.A. PART NO. L0/8011

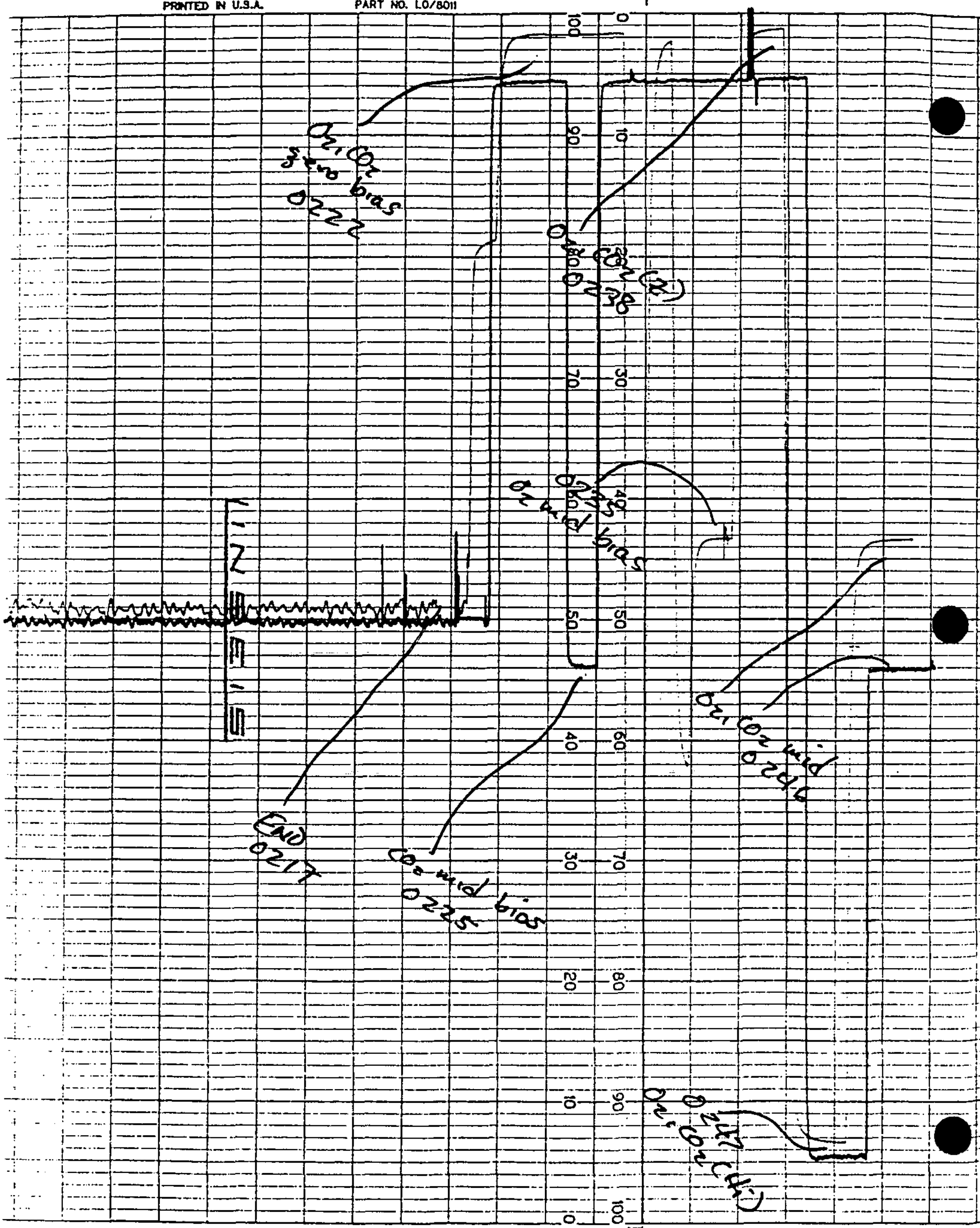


PRINTED IN U.S.A. PART NO.

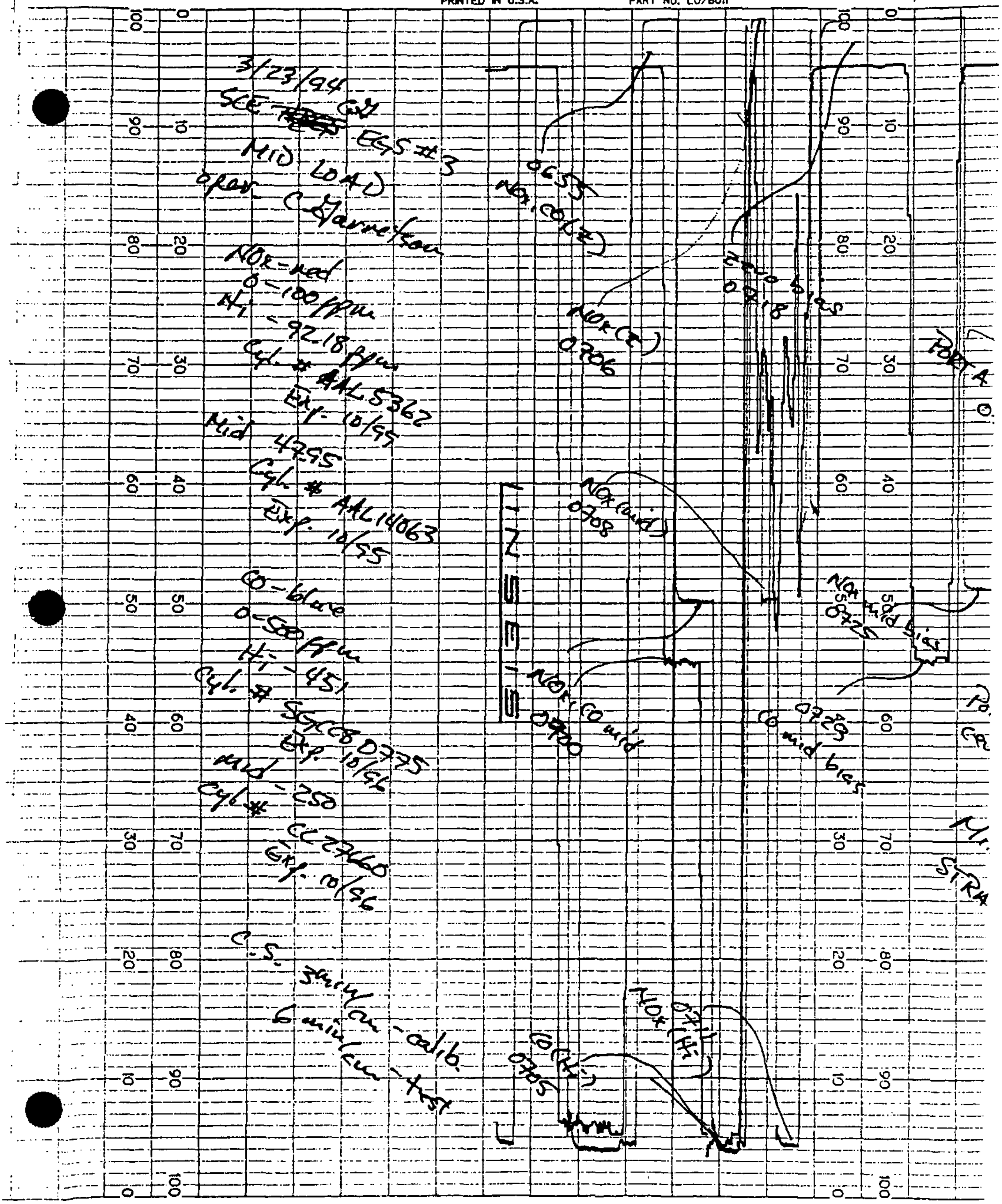



Zero bias
O2, CO2 (z)
0031
O2, CO2 (z)
0046
0047
O2 mid bias
O2, CO2 (mid)
0050
O2, CO2 (Hi)
0054
START 0017
EGR ON
TEST 1
0033
CO2 mid bias
END
0026

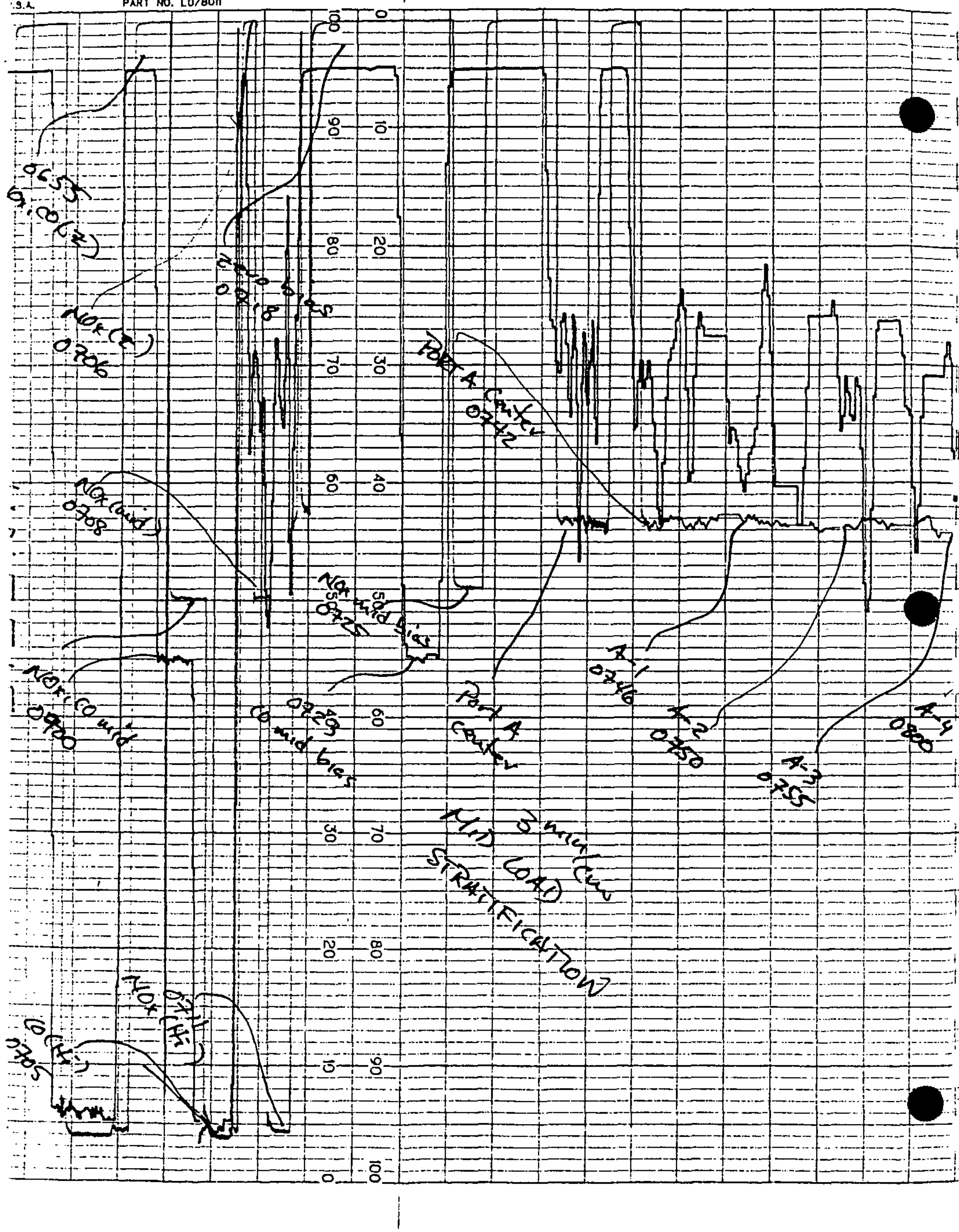
PRINTED IN U.S.A. PART NO. LO/8011



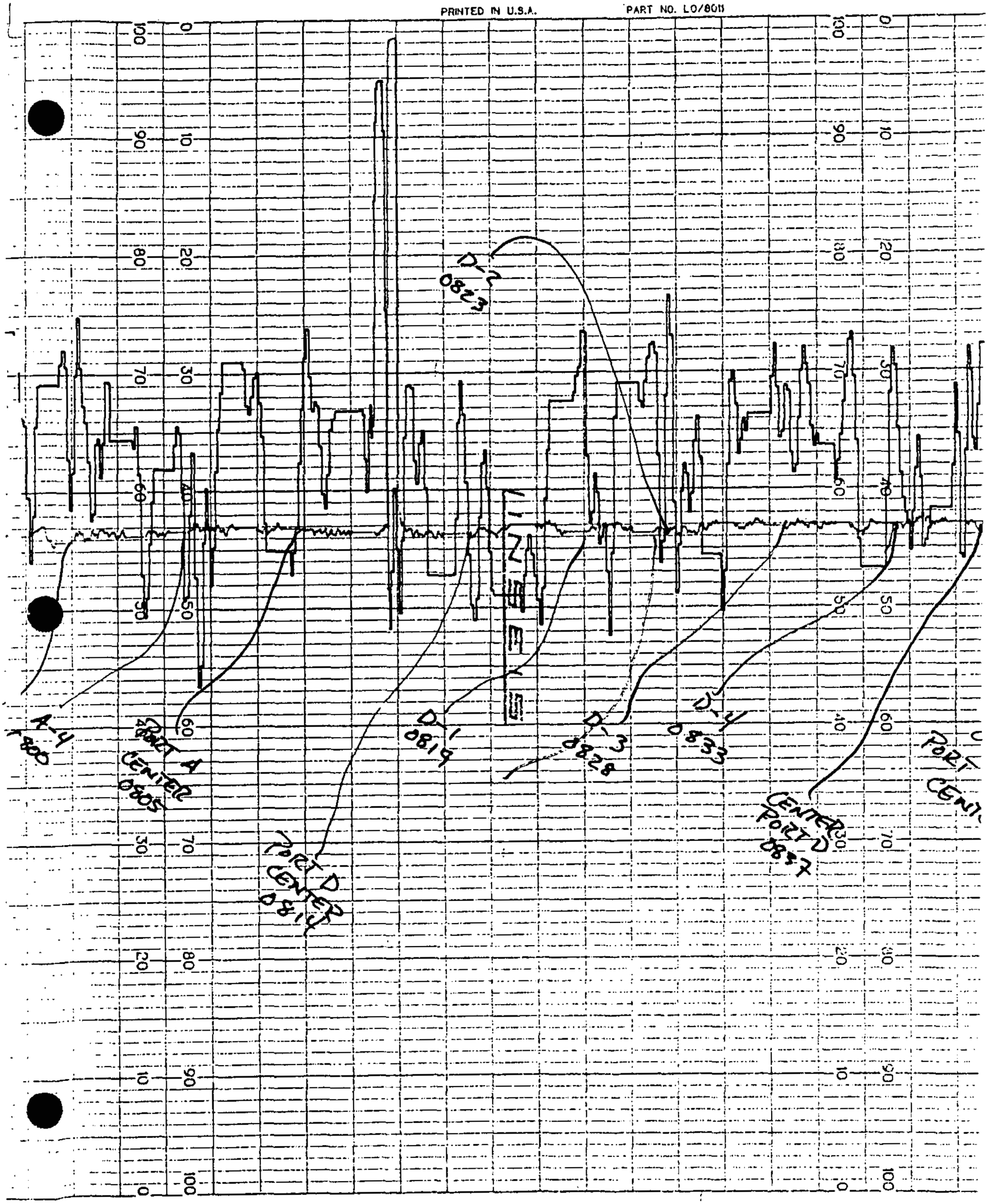
PRINTED IN U.S.A. PART NO. L0/8011



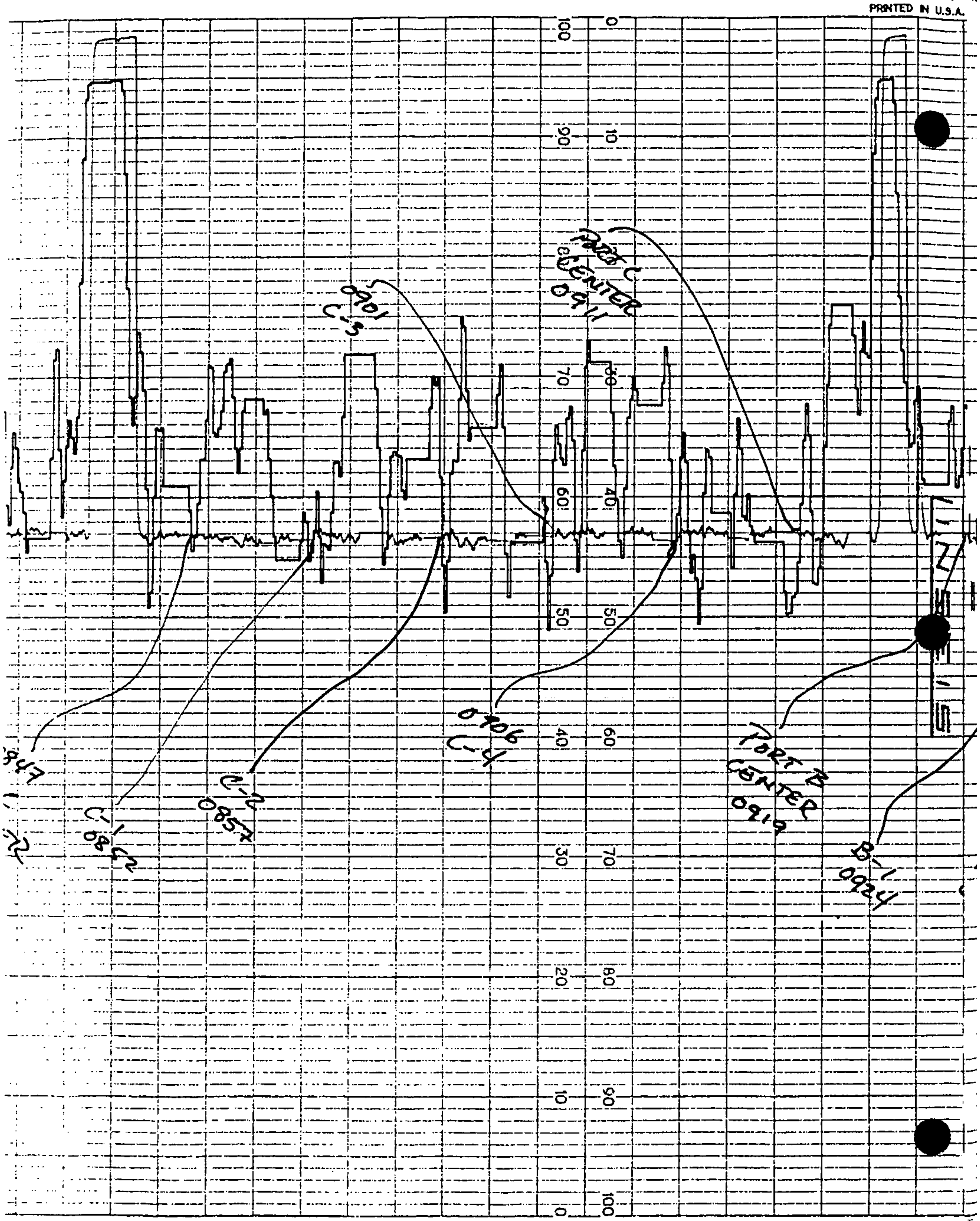
U.S.A. PART NO. L0/8011



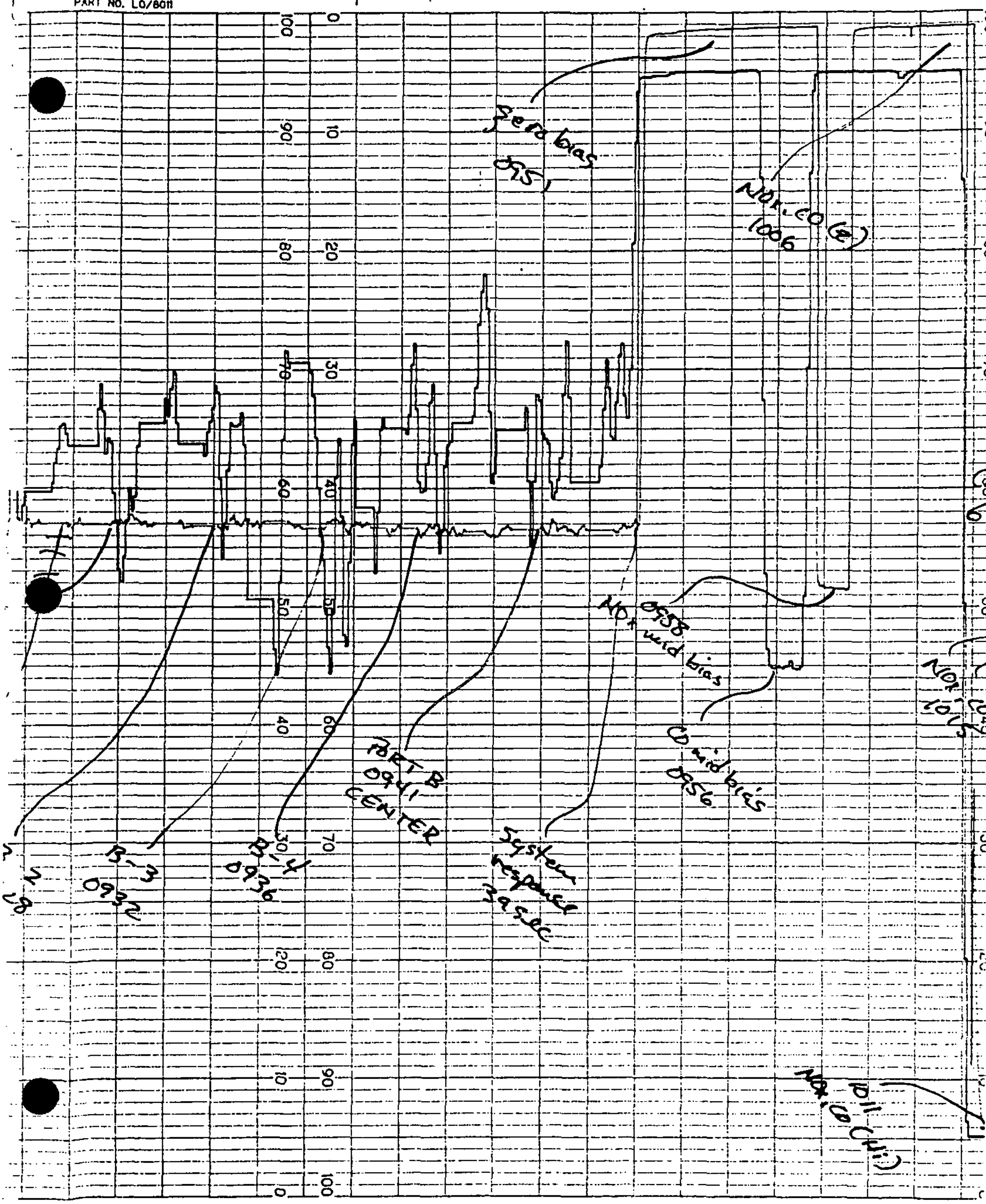
PRINTED IN U.S.A. PART NO. LO/8011



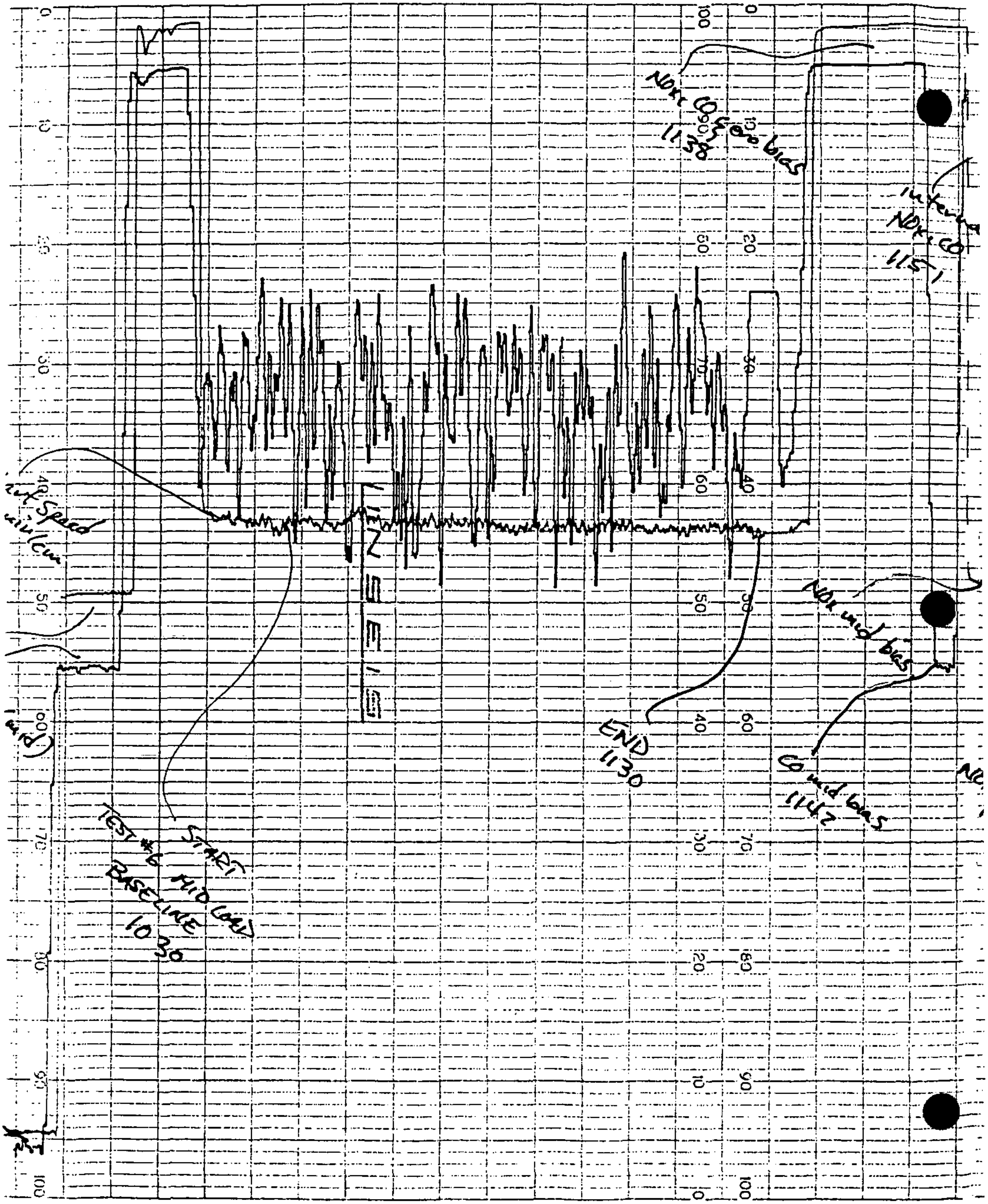
PRINTED IN U.S.A.

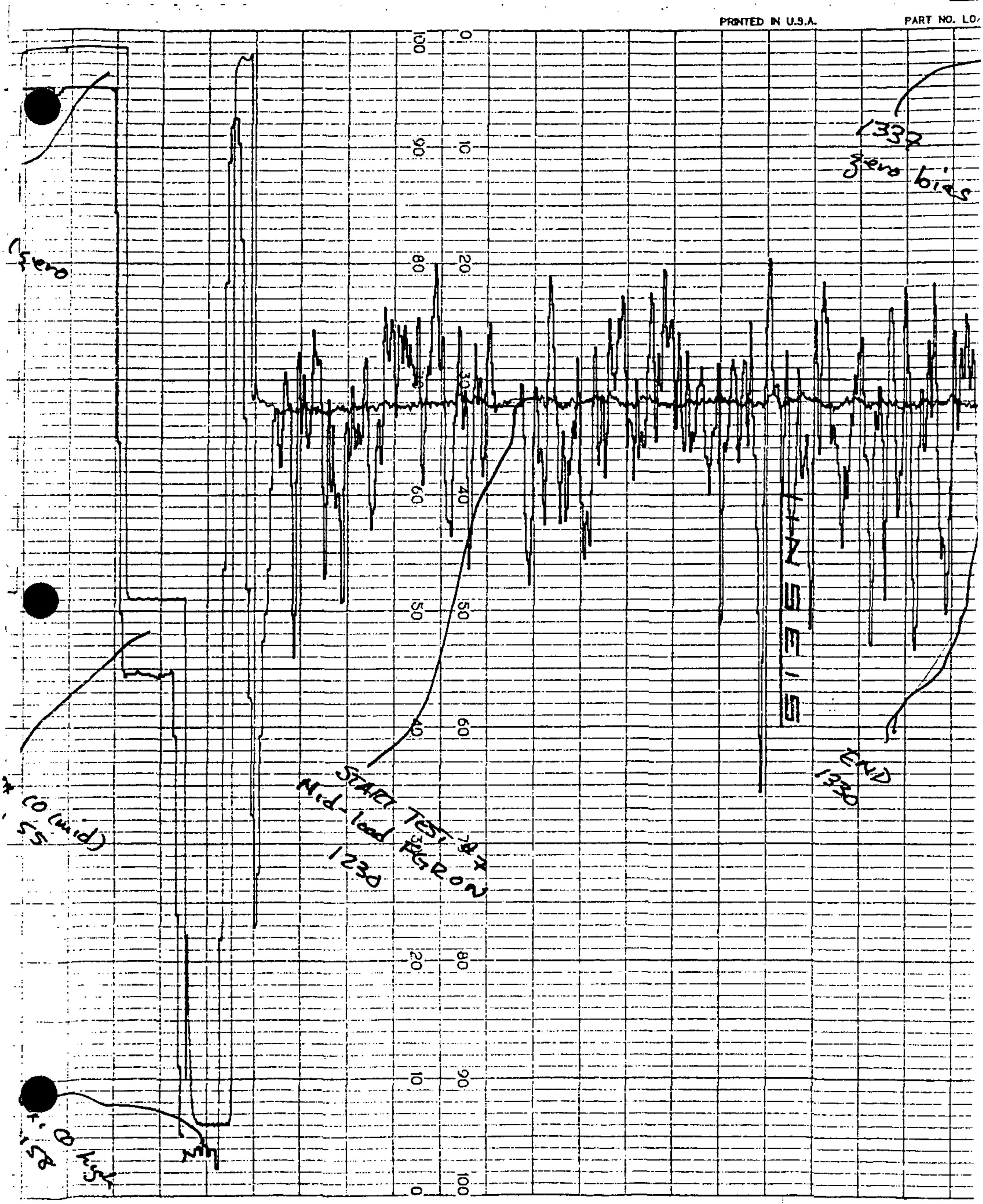


PART NO. LO/8011

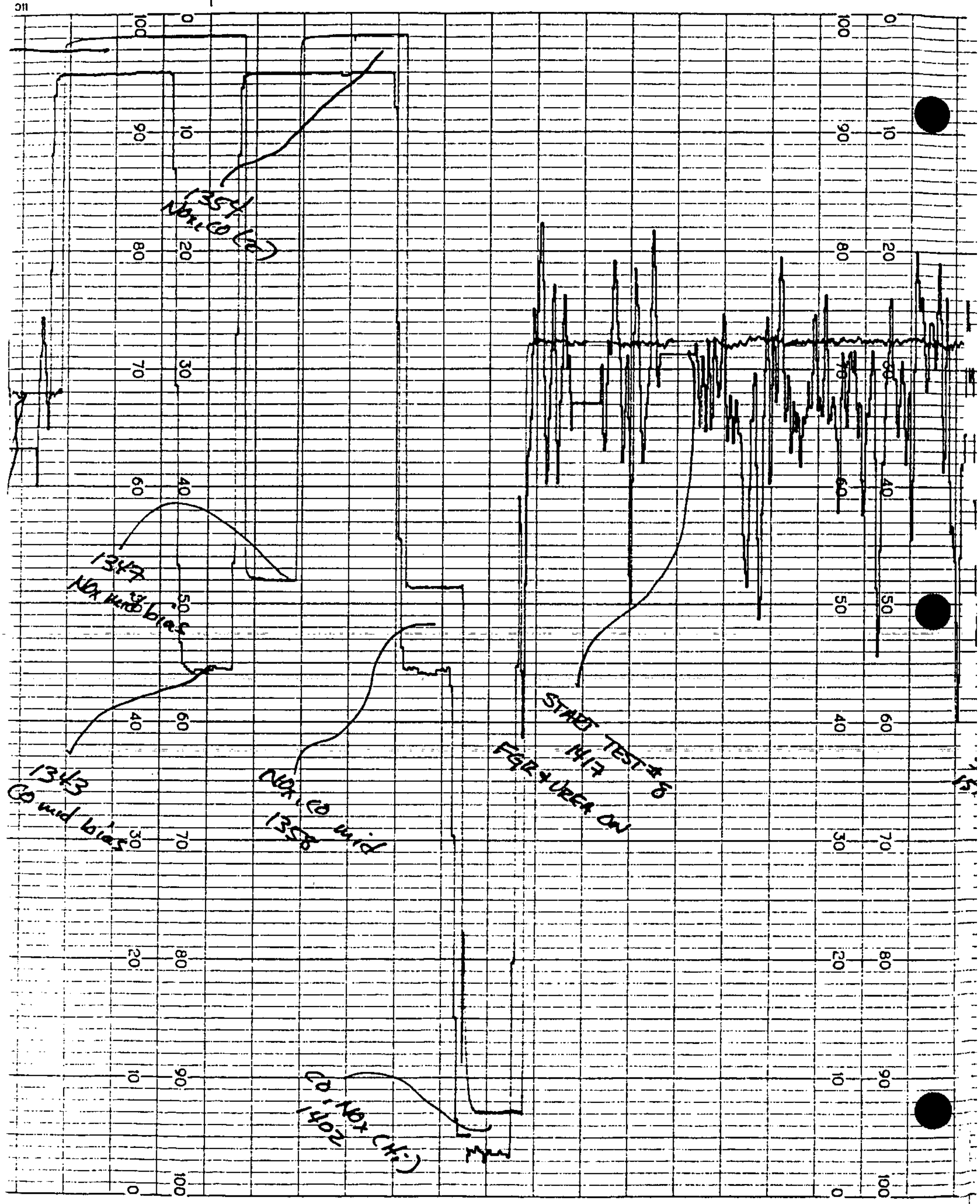


PRINTED IN U.S.A. PART NO. 1.0/8011

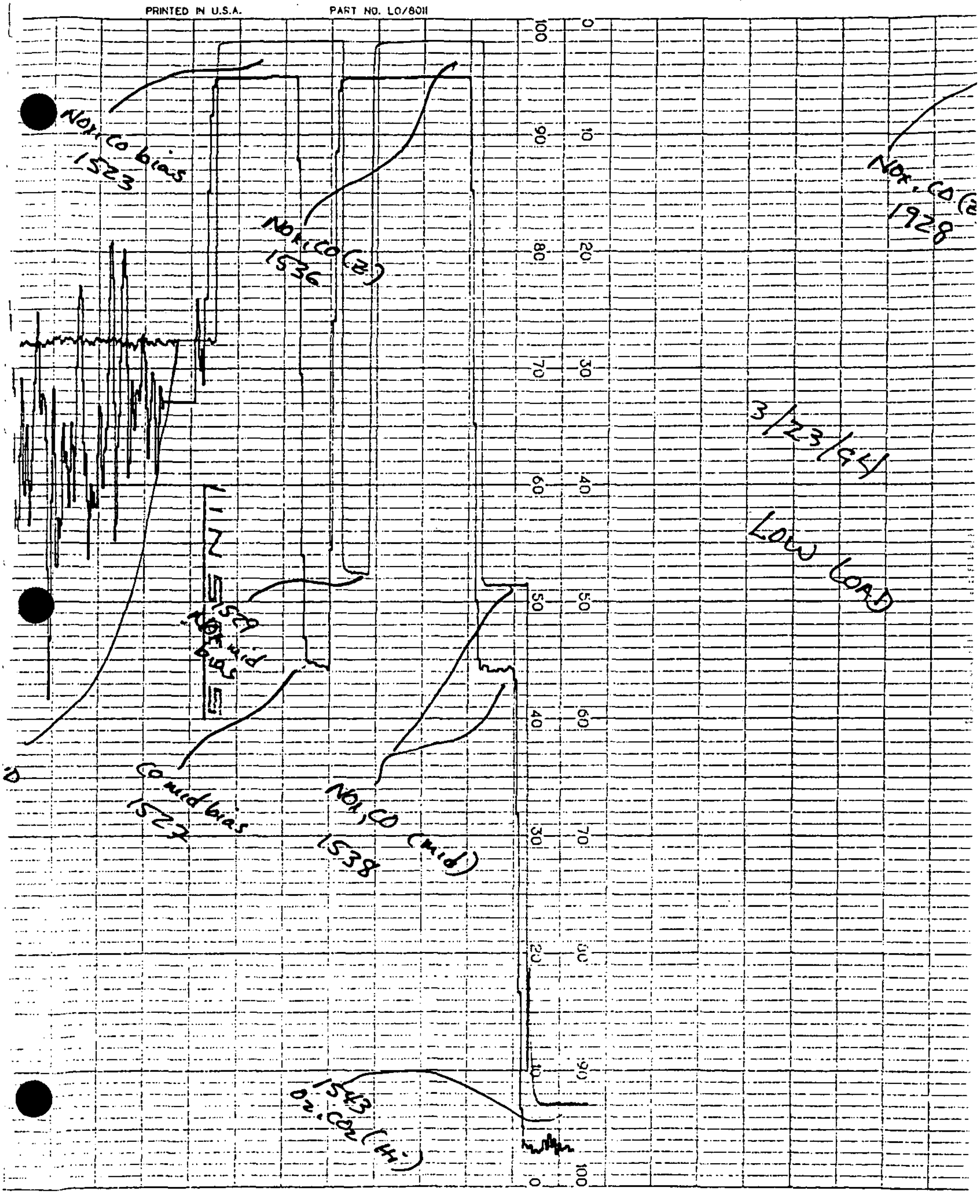




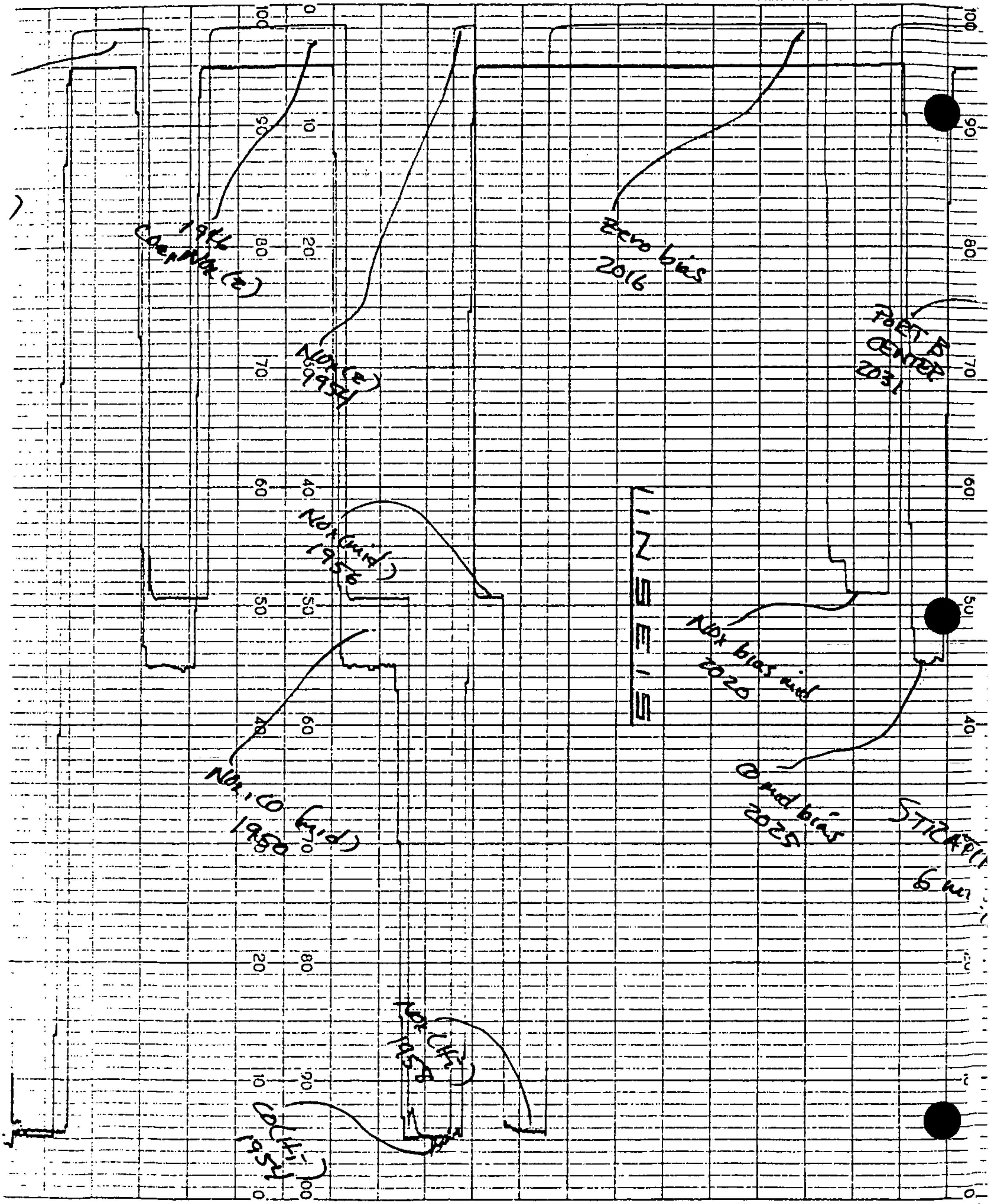
PRINTED IN U.S.A.
PART NO. LO
1332 zero bias
zero
CO (mid)
START TEST
Mid-load
1230
END
1330
CO high

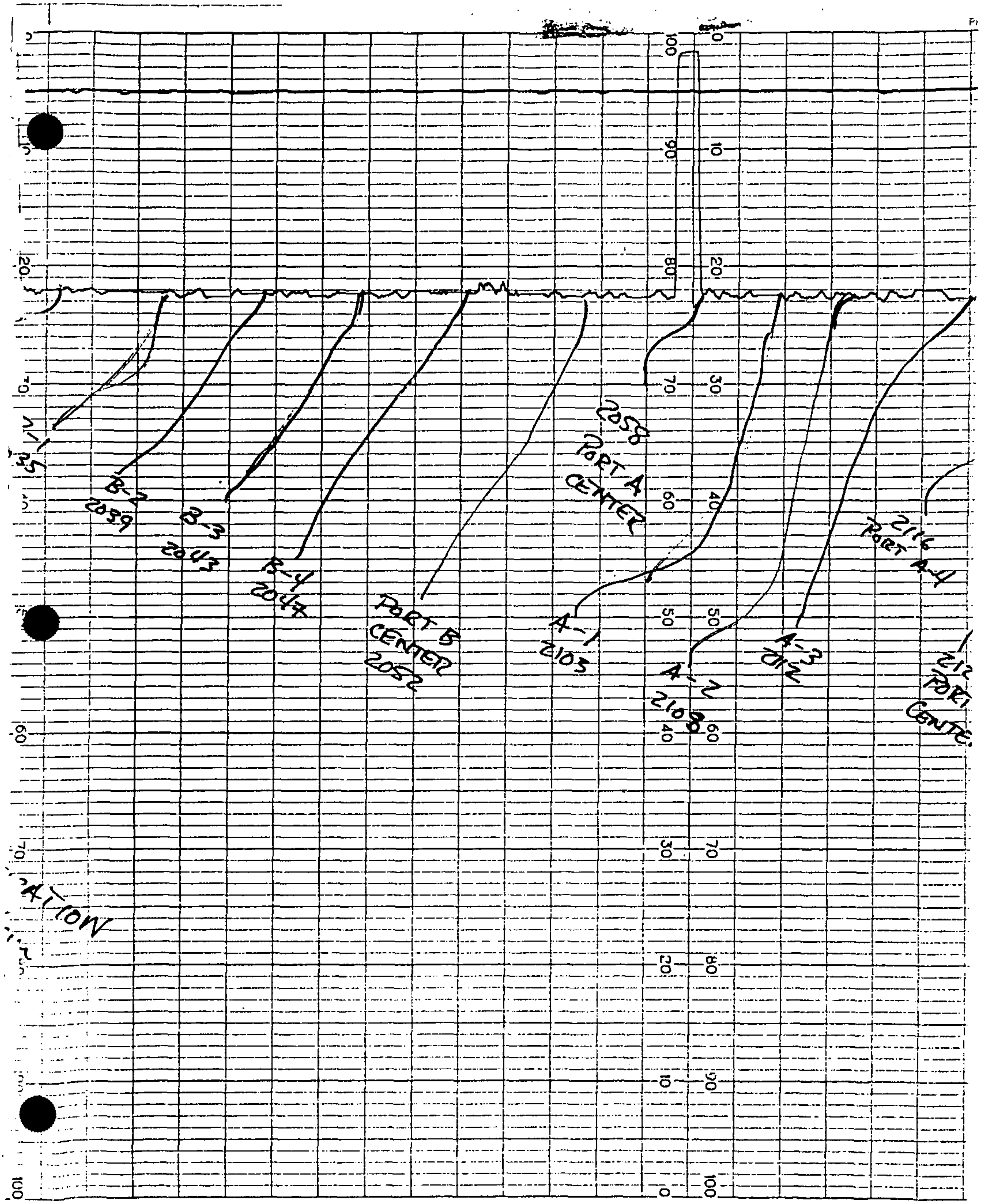

1354 NOx, CO (lo)
1347 NOx mid bias
1343 CO mid bias
NOx, CO mid 1358
START TEST #8 1417 FGR + UREA ON
CO, NOx (Hi) 1402

PRINTED IN U.S.A. PART NO. L0/8011

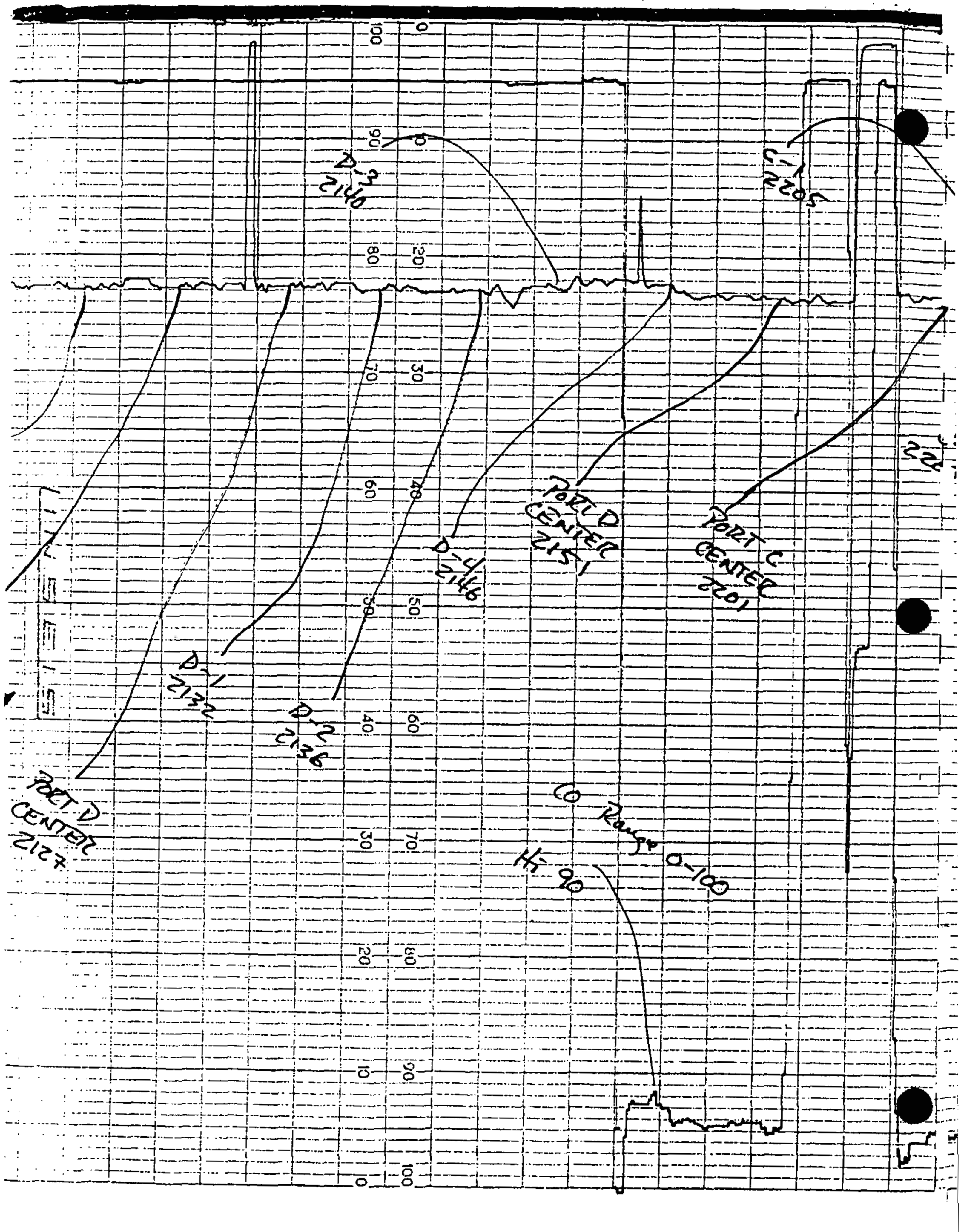


PRINTED IN U.S.A. PART NO. L0/8011

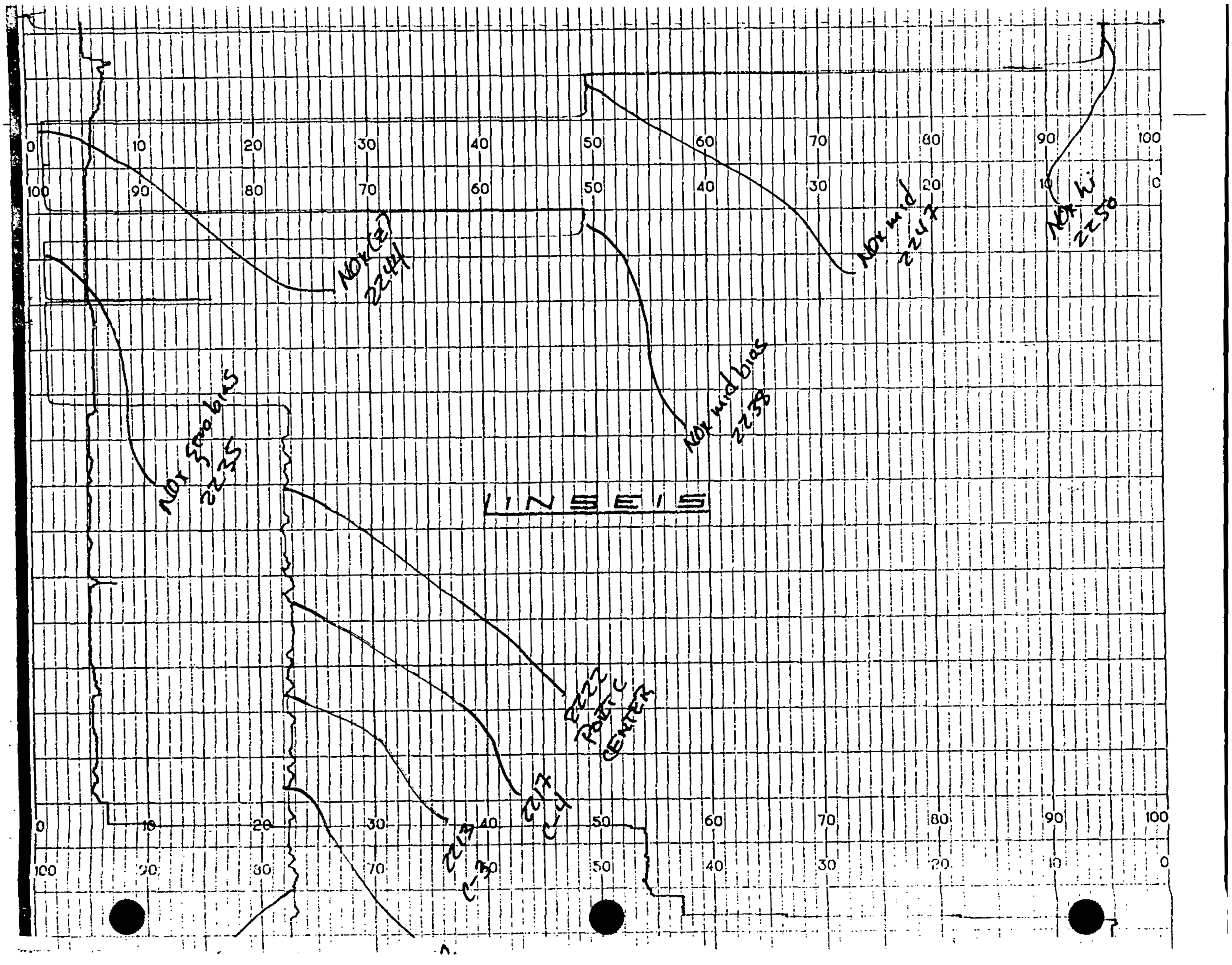




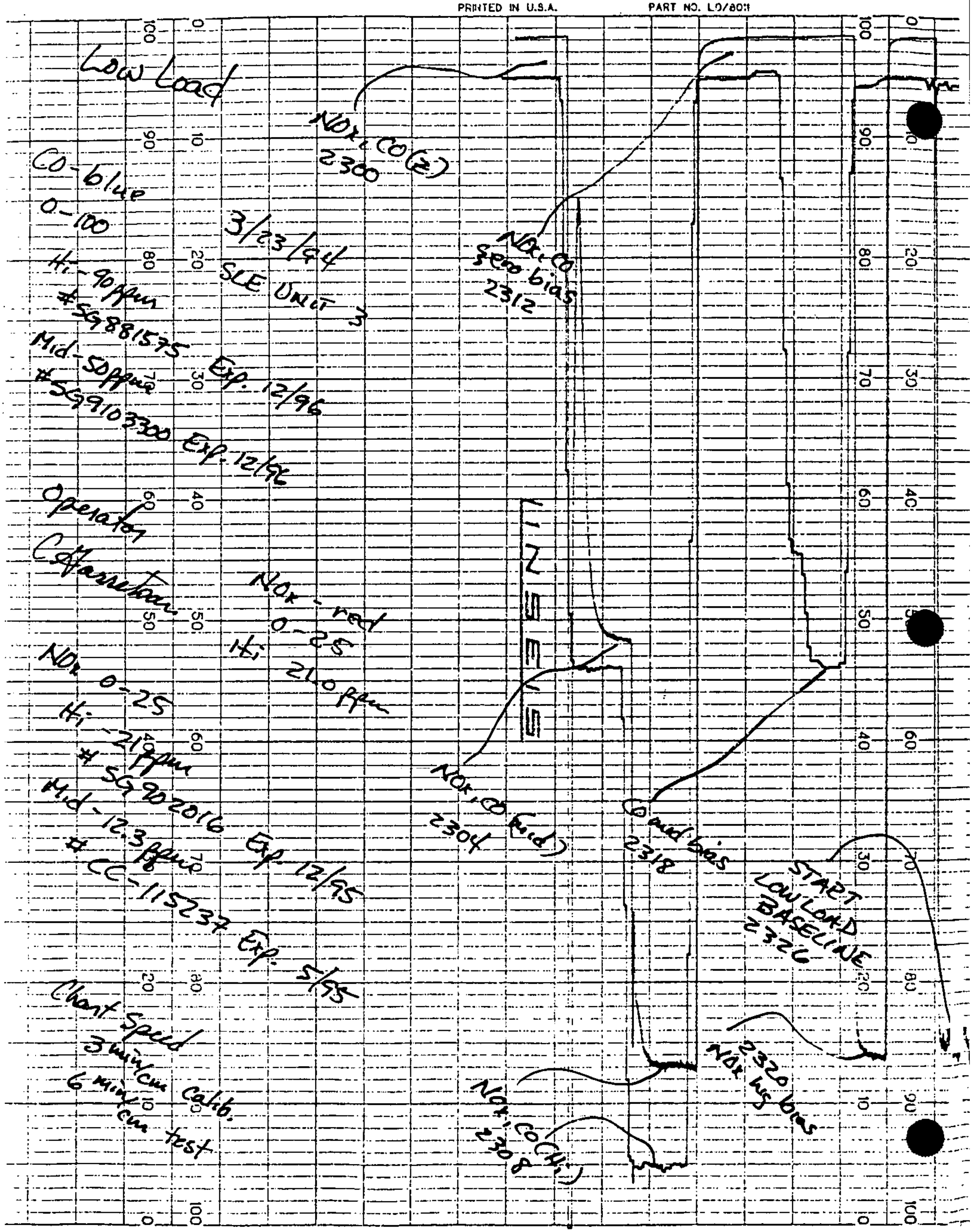
B-2
2039
B-3
2043
B-4
2047
PORT B
CENTER
2052
2058
PORT A
CENTER
A-1
2103
A-2
2108
A-3
2112
2116
PORT A-4
ATION

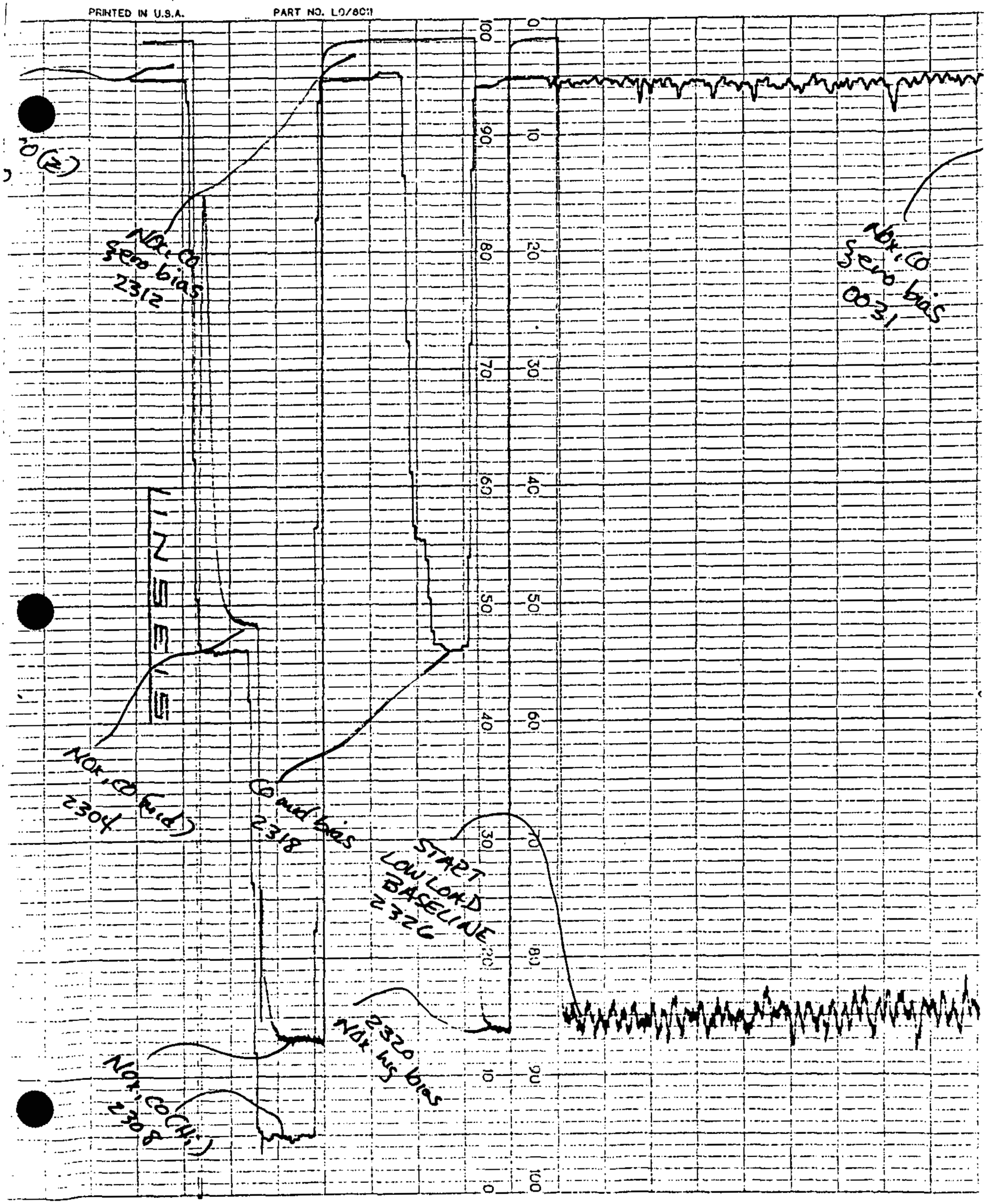


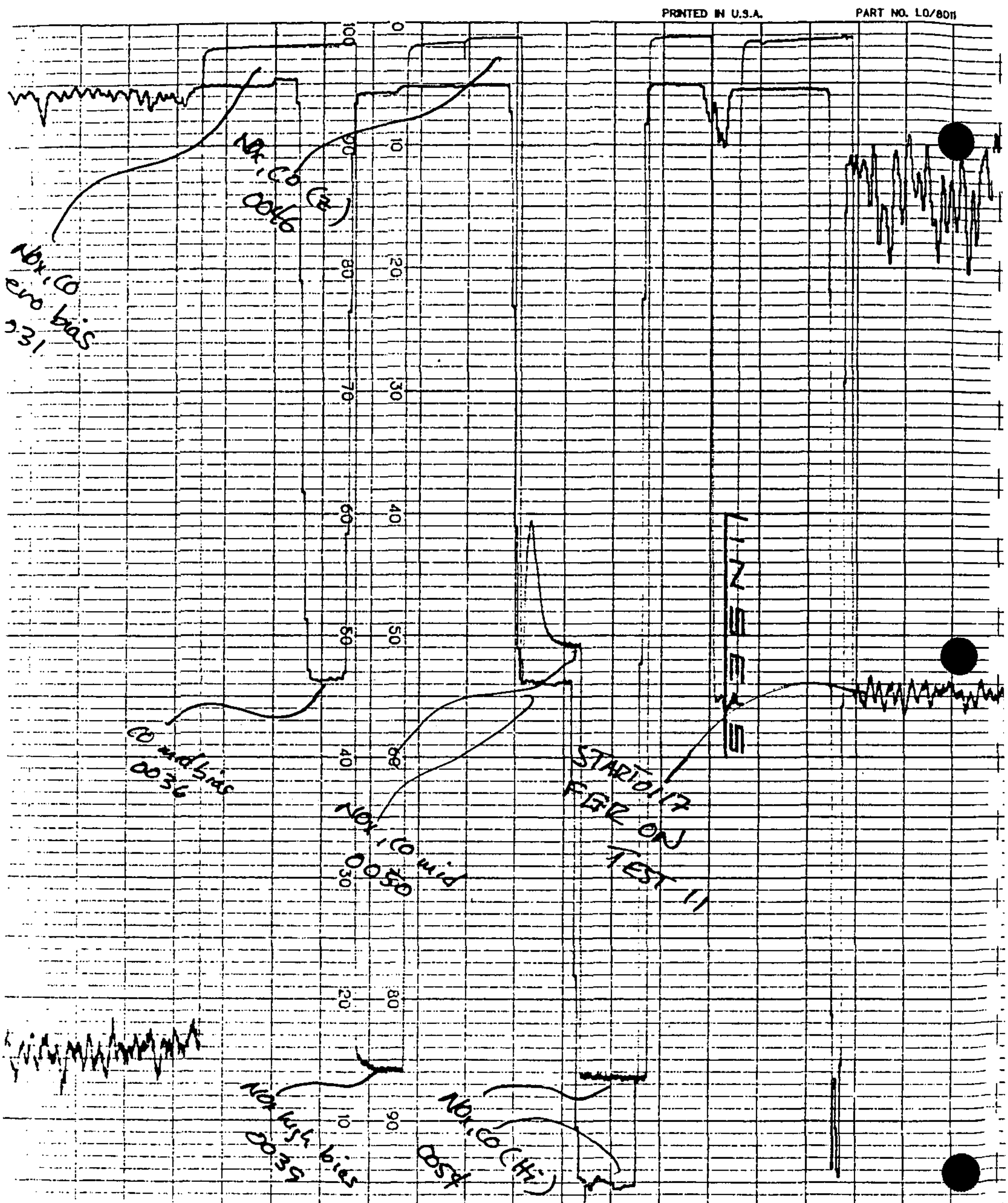
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
D-3 2140
C-1 2205
PORT D CENTER 2127
D-1 2132
D-2 2136
D-4 2146
PORT D CENTER 2151
PORT C CENTER 2201
22
CO Range 0-100
Hi 90



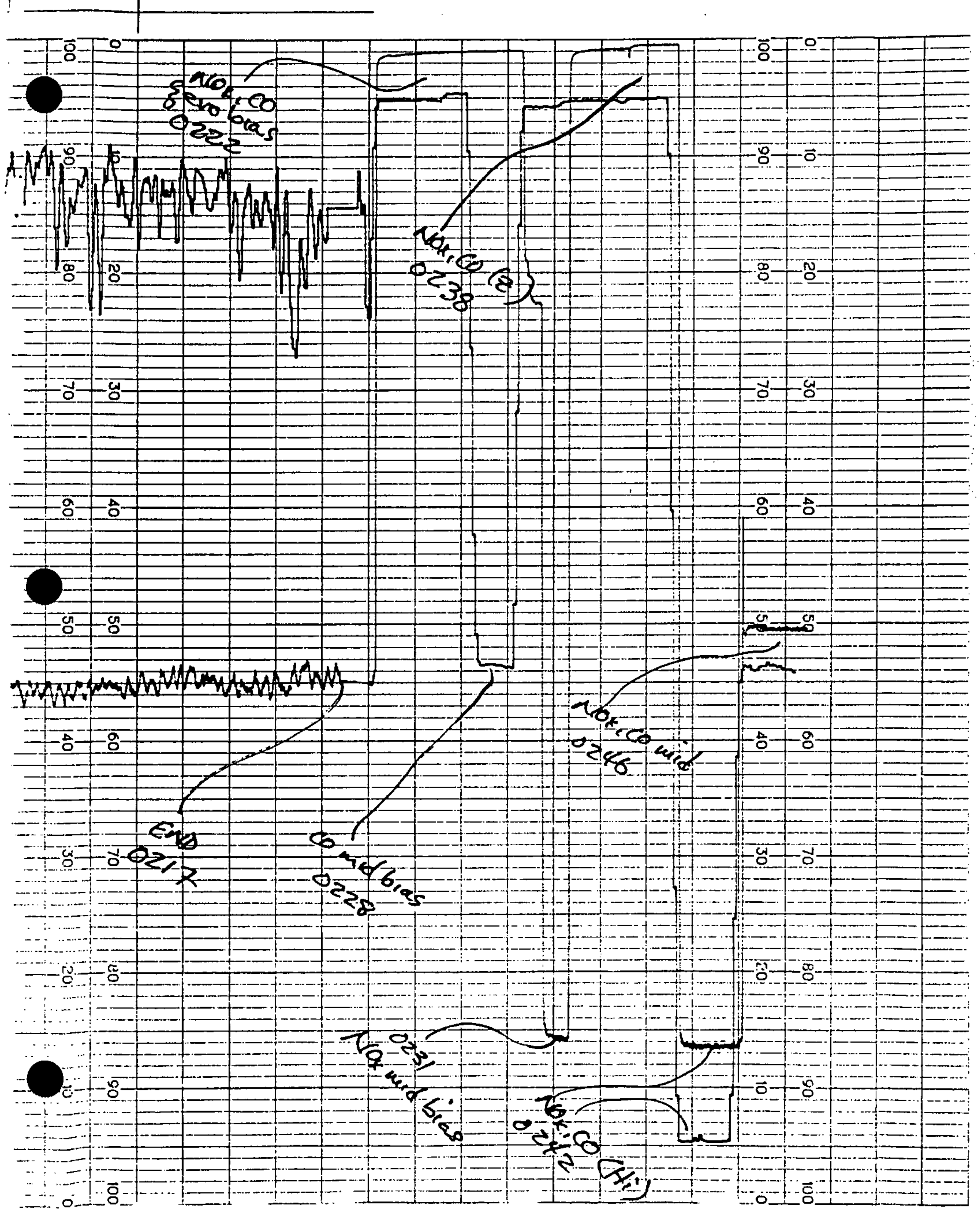
LINSEIS
NOx zero bias
2235
NOx (2)
2244
NOx mid bias
2238
NOx mid
2247
NOx hi
2250
2222
Port C
CENTER
2217
C-4
2213
C-30


Low Load
CO-blue
0-100
Hi-90ppm
#SG881575 Exp. 12/96
Mid-50ppm
#SG9103300 Exp. 12/96
Operator
C Harrelson
NOx 0-25
Hi-21ppm
#SG902016 Exp. 12/95
Mid-12.3ppm
#CC-115237 Exp. 5/95
Chart Speed
3 min/cm Calib.
6 min/cm test
3/23/94
SLE Unit 3
NOx-red
0-25
Hi 21.0 ppm
NOx, CO (z)
2300
NOx, CO zero bias
2312
NOx, CO (mid)
2304
NOx, CO (Hi)
2308
CO and bias
2318
2320
NOx hs bias
START
LOW LOAD
BASELINE
2326
LINSEIS


PRINTED IN U.S.A.
PART NO. L0/8011
NOx, CO zero bias 2312
NOx, CO zero bias 0031
INSERTS
NOx, CO (mid) 2304
CO mid bias 2318
START LOW LOAD BASELINE 2326
2320 NOx hi bias
NOx, CO (hi) 2308



PRINTED IN U.S.A.
PART NO. L0/8011
NOx, CO zero bias 0.31
NOx, CO (z) 0046
CO mid bias 0036
NOx, CO mid 0050
START 0117 EGR ON TEST 1.1
NOx high bias 0039
NOx, CO (Hi) 0054



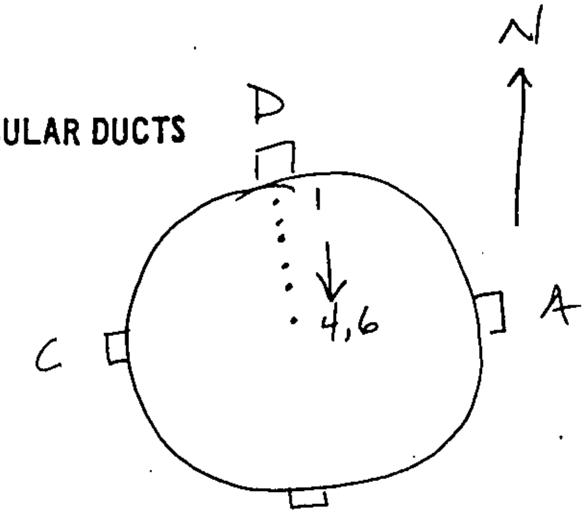
NOx+CO zero bias 0222
NOx+CO 0238
END 0217
CO mid bias 0228
0231 NOx mid bias
NOx+CO mid 0240
NOx+CO (Hi) 0242

APPENDIX D-4

STRATIFICATION TEST TRAVERSE POINT LOCATIONS

0.125
0.25
0.375
0.5
0.625
0.75
0.875

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS



SCHEMATIC OF SAMPLING LOCATION

B

PLANT Etiwanda G.S.
DATE 3/21/94
SAMPLING LOCATION Unit NO. 3 Stack
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A)
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 14"
STACK I.D., (DISTANCE A - DISTANCE B) 19.0' = 228"
NEAREST UPSTREAM DISTURBANCE >1/2 diam.
NEAREST DOWNSTREAM DISTURBANCE >2 diam
CALCULATOR CG

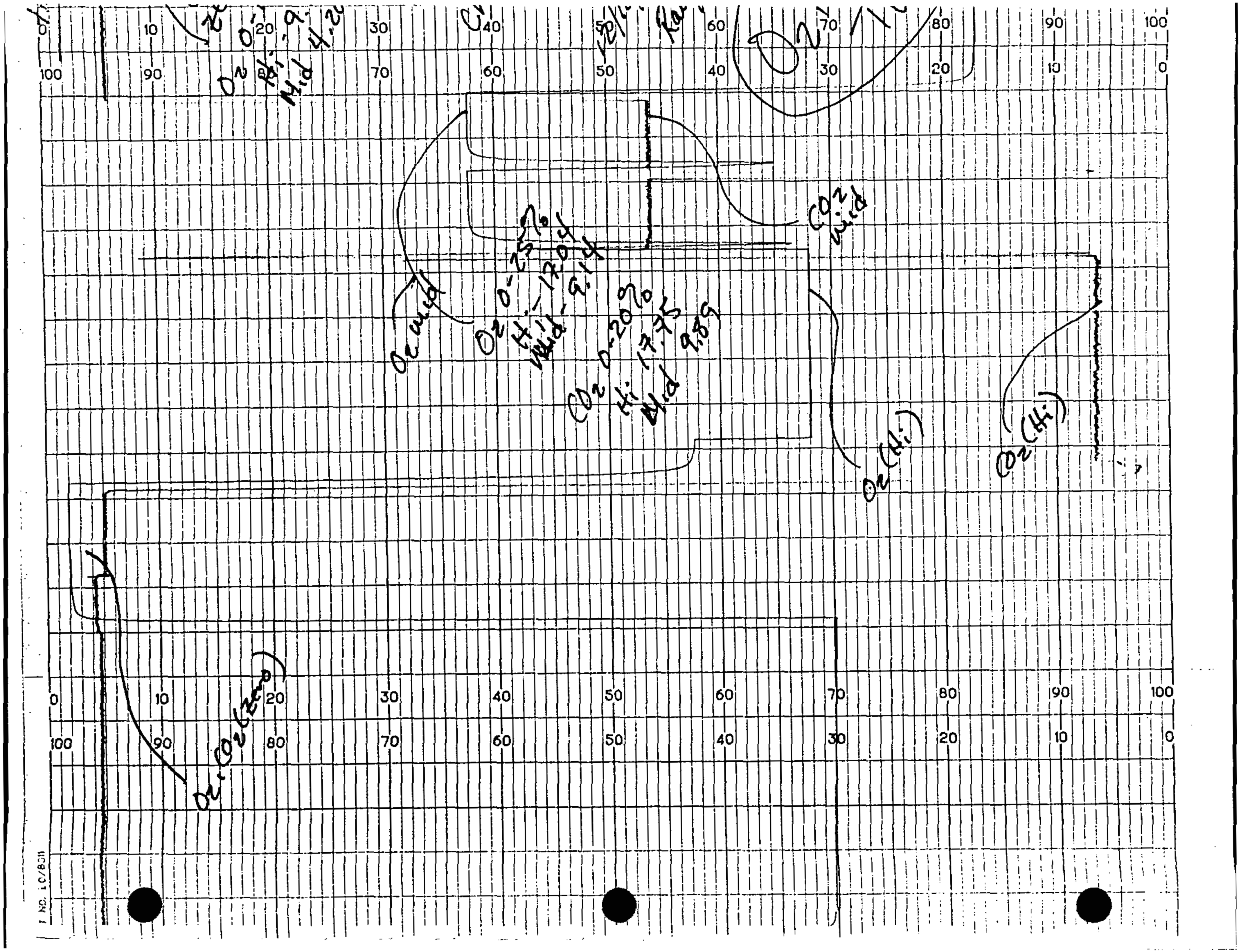
TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
X-1	0.032	228"	7 1/4	28 1/4	14"
-2	0.105		24	38	
-3	0.194		44 1/4	58 1/4	
-4	0.323		73 5/8	87 5/8	
=> 16 pt. traverse (CEM strat)					
X-1	0.021		4 3/4	18 3/4	
-2	0.067		15 1/4	29 1/4	
-3	0.118		26 7/8	40 7/8	
-4	0.177		40 3/8	54 3/8	
-5	0.250		57	71	
-6	0.356		81 1/8	95 1/8	
=> 24 pt. traverse (Flowrate)					
STACK CENTER	0.5		114	128	

M strat (X-1 to -4, first set)
w rate meas. (X-1 to -6, second set)

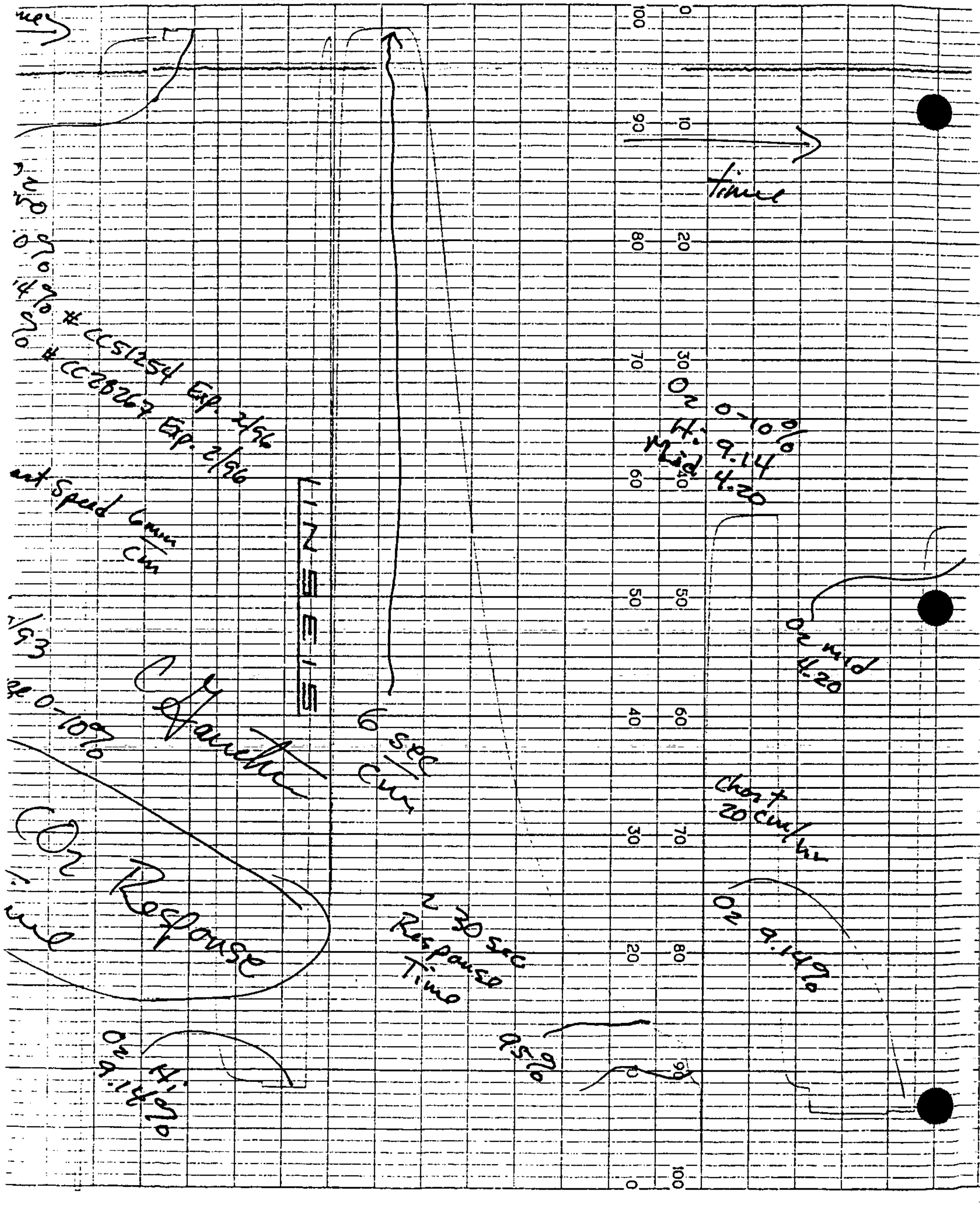
EPA (Dur) 232

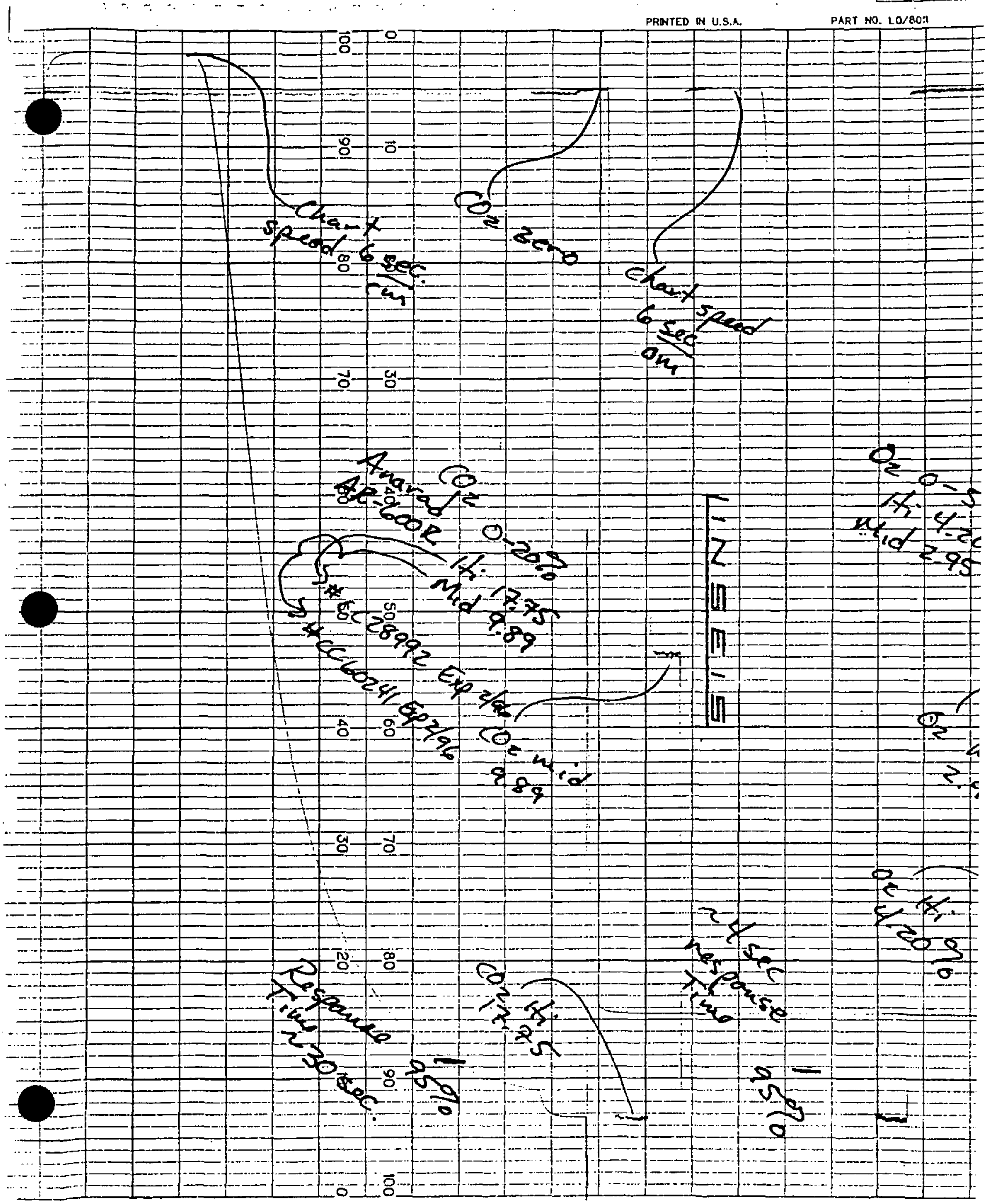
APPENDIX D-5

SEMI-ANNUAL INSTRUMENT CALIBRATION RECORDS

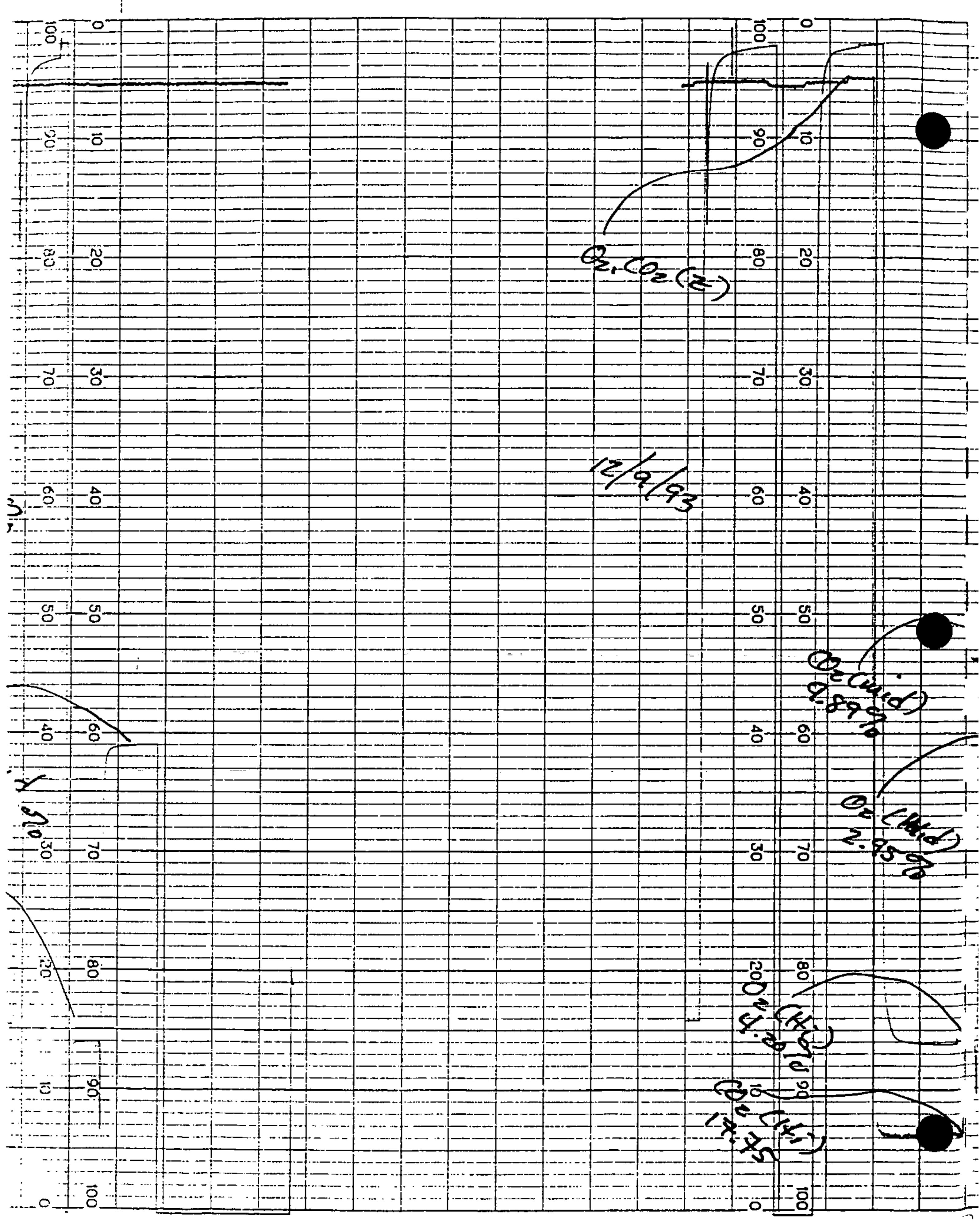

O2, CO2 (zero)
O2 Mid
O2 0-25%
Hi: 17.04
Mid: 9.14
CO2 0-20%
Hi: 17.75
Mid 9.85
CO2 Mid
O2 (Hi)
CO2 (Hi)

PRINTED IN U.S.A. PART NO. L0/8011

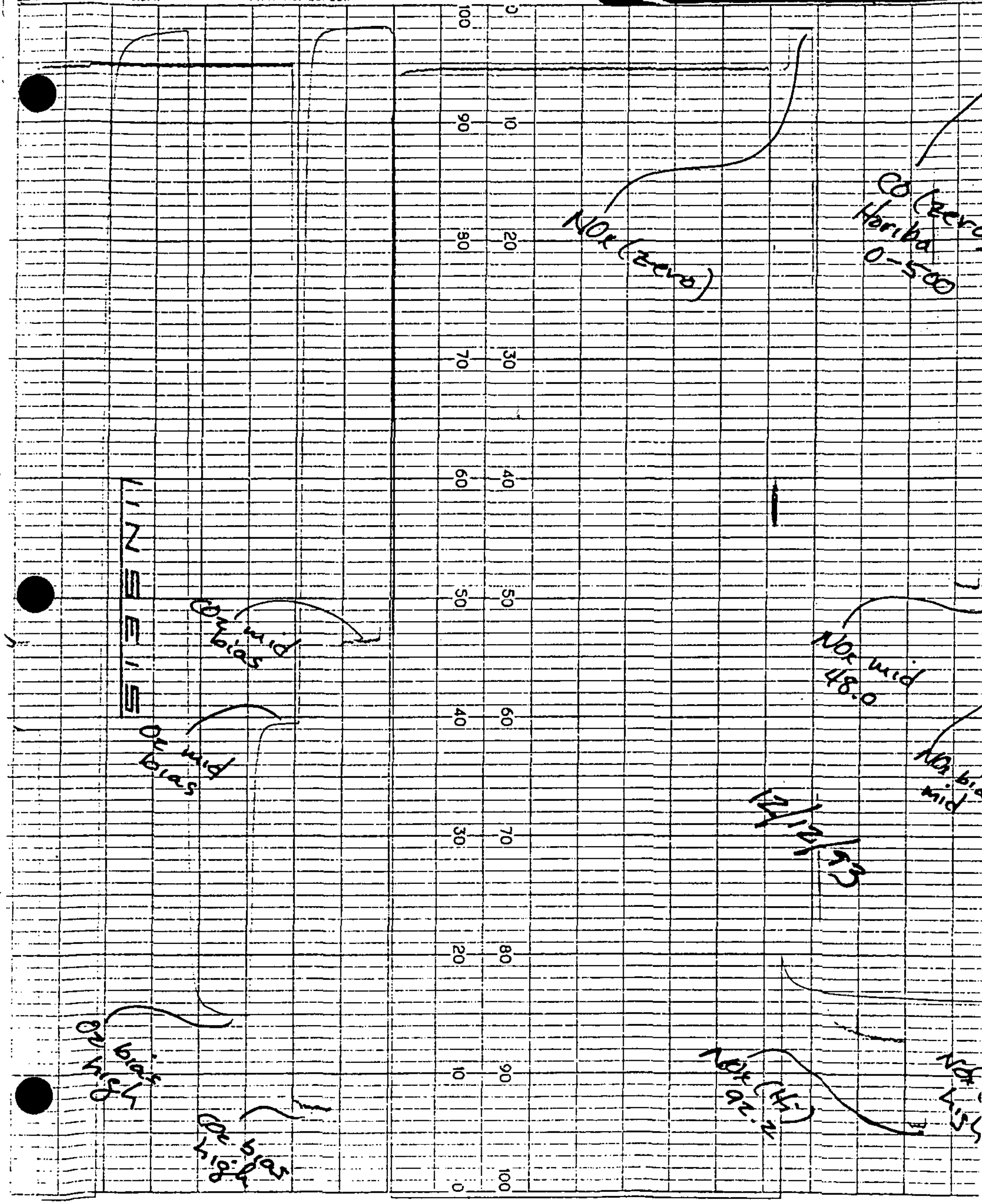


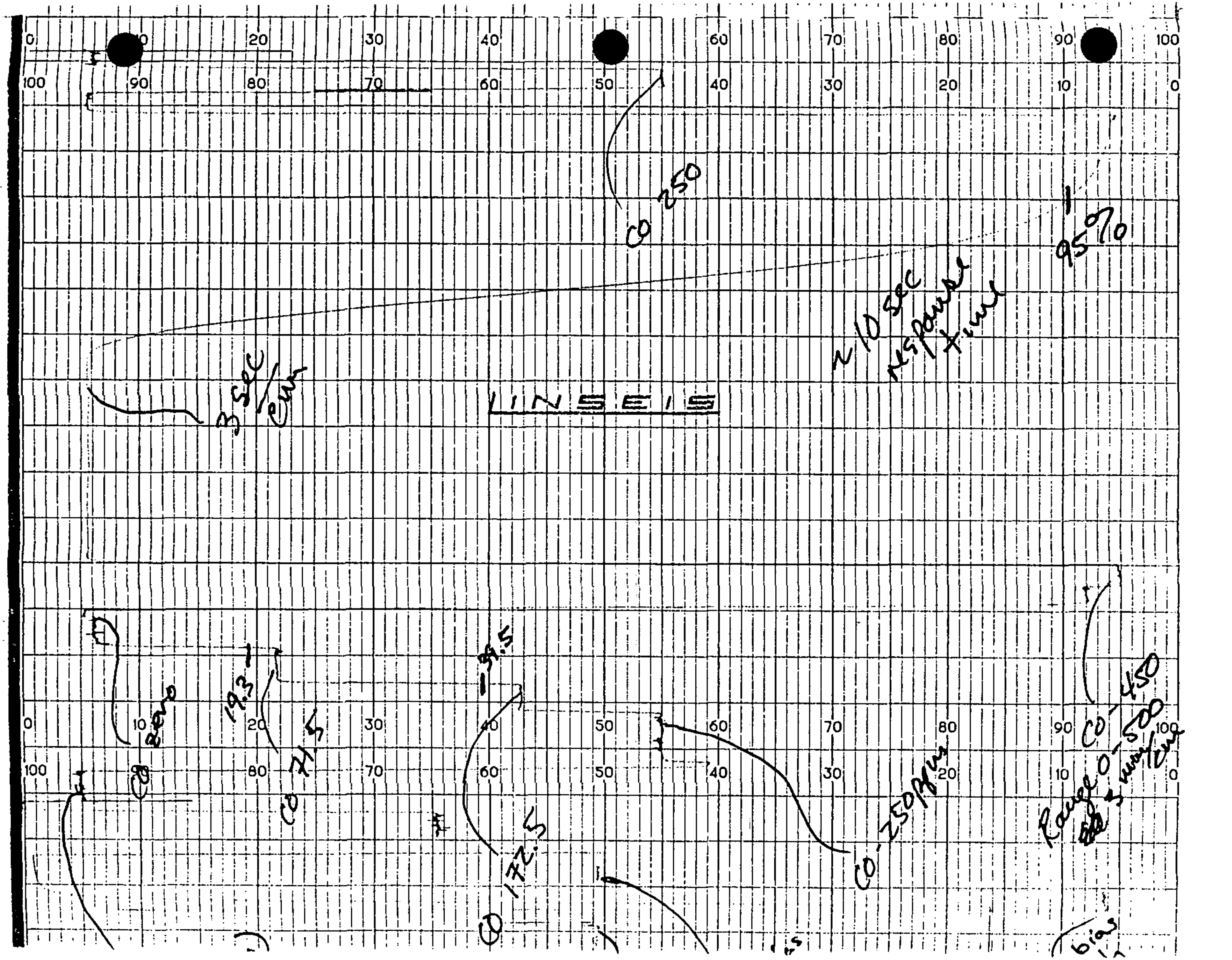


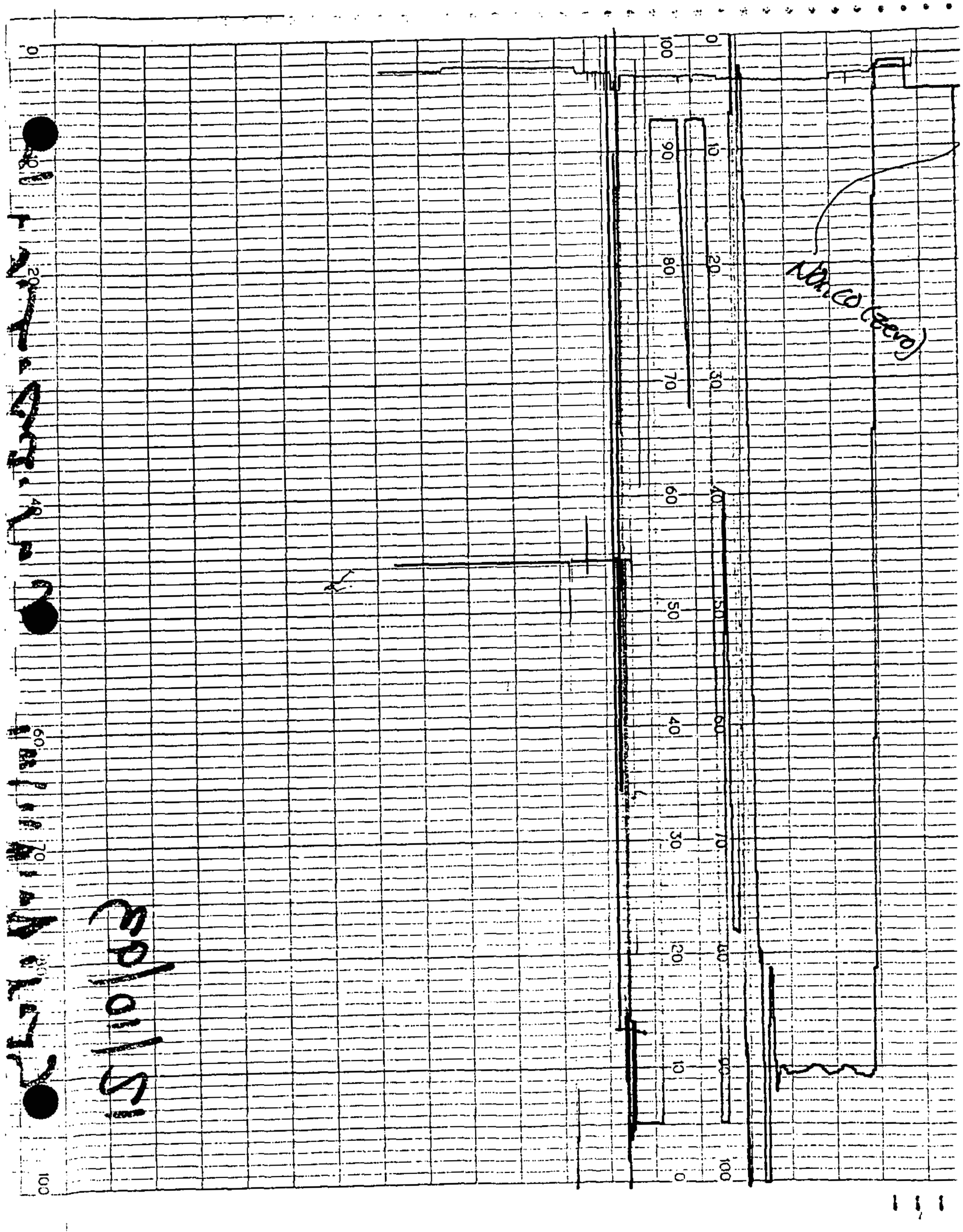
PRINTED IN U.S.A.
PART NO. LO/801
LINSEIS
Chart speed 6 sec/cm
CO2 zero
Chart speed 6 sec/cm
CO2 Anarad AR-600R 0-20%
Hi 17.75
Mid 9.89
#CC28992 Exp 2/00
#CC60241 Exp 2/96
CO2 mid 9.89
O2 0-5
Hi 4.20
Mid 2.95
O2 Hi 4.20%
~4 sec response time
95%
CO2 Hi 17.75
Response time ~30 sec.
95%


O2, CO2 (N2)
12/9/93

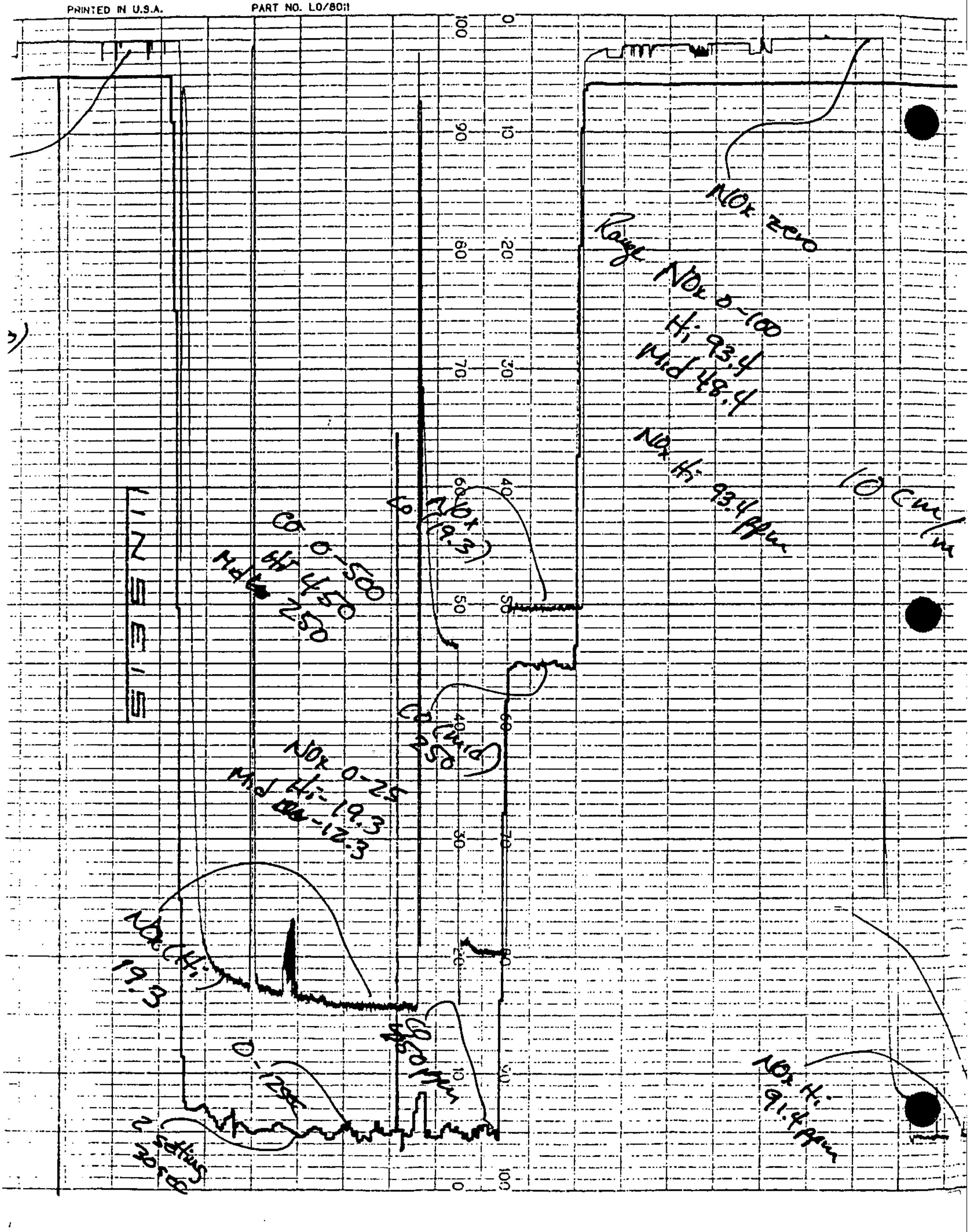
PRINTED IN U.S.A. PART NO. L0/8011



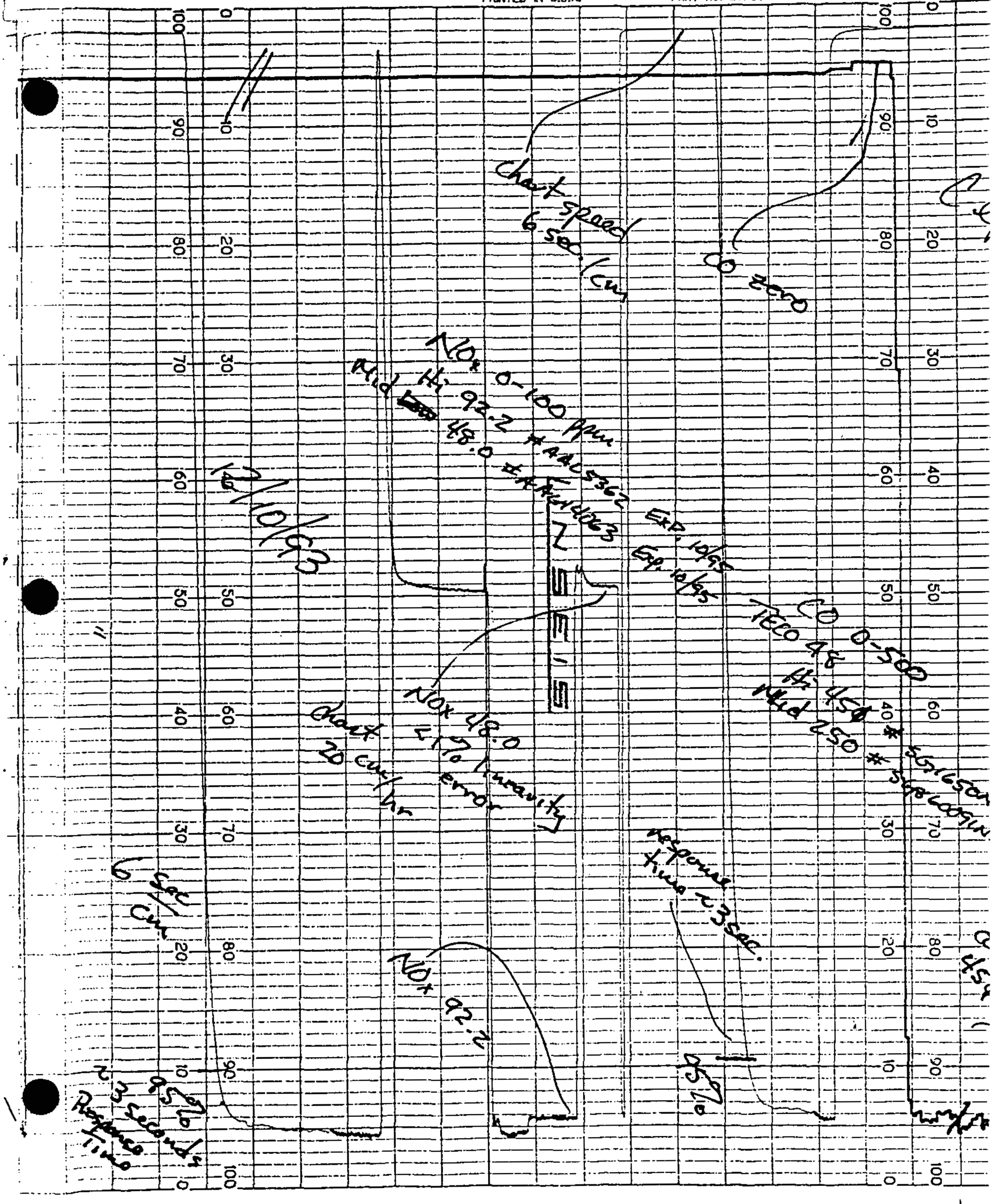

LINSEIS
3 sec/cm
CO 250
~10 sec response time
95%
CO zero
19.3
CO 71.5
39.5
CO 172.5
CO 250 ppm
CO 450
Range 0-500
bias

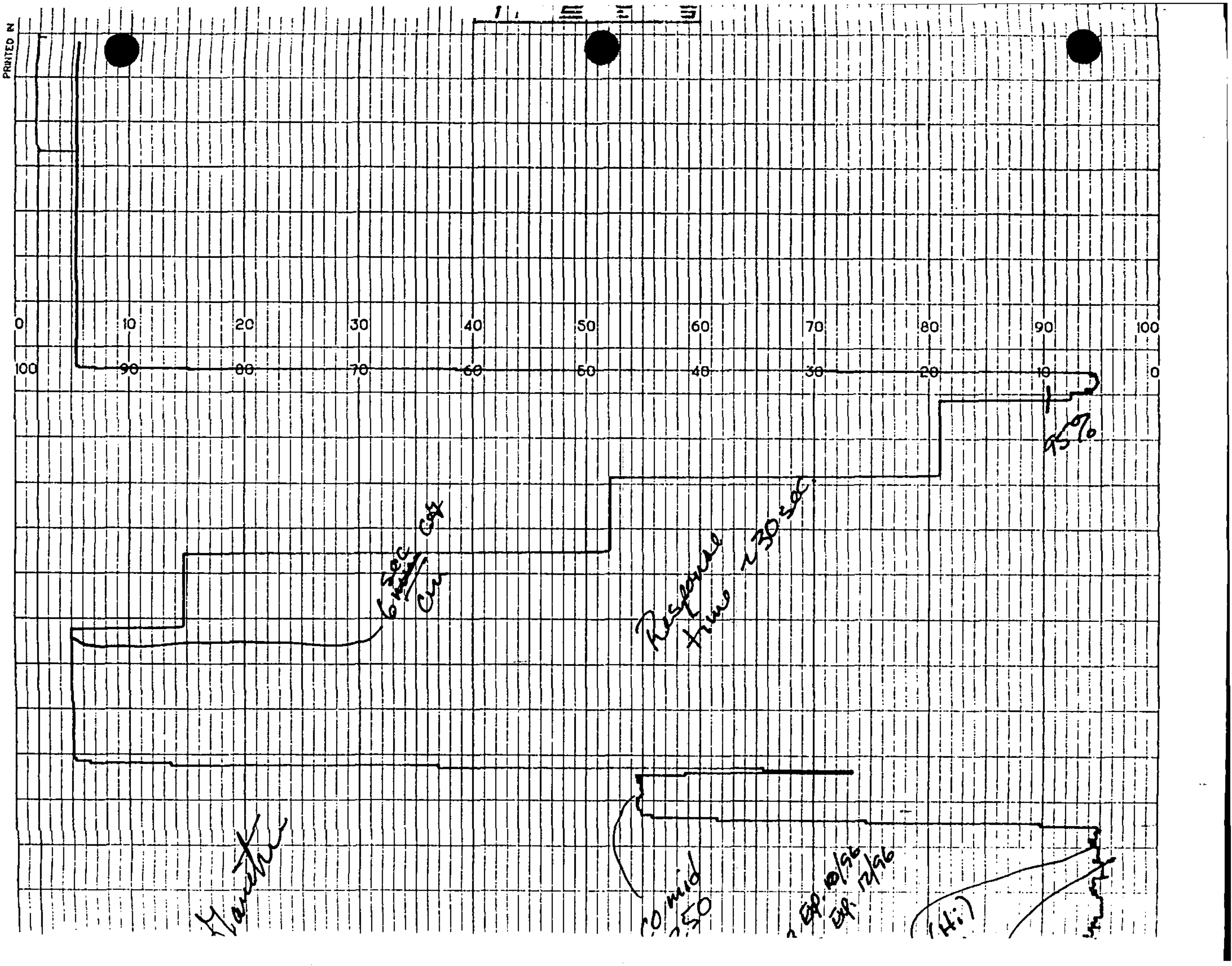


PRINTED IN U.S.A. PART NO. L0/8011

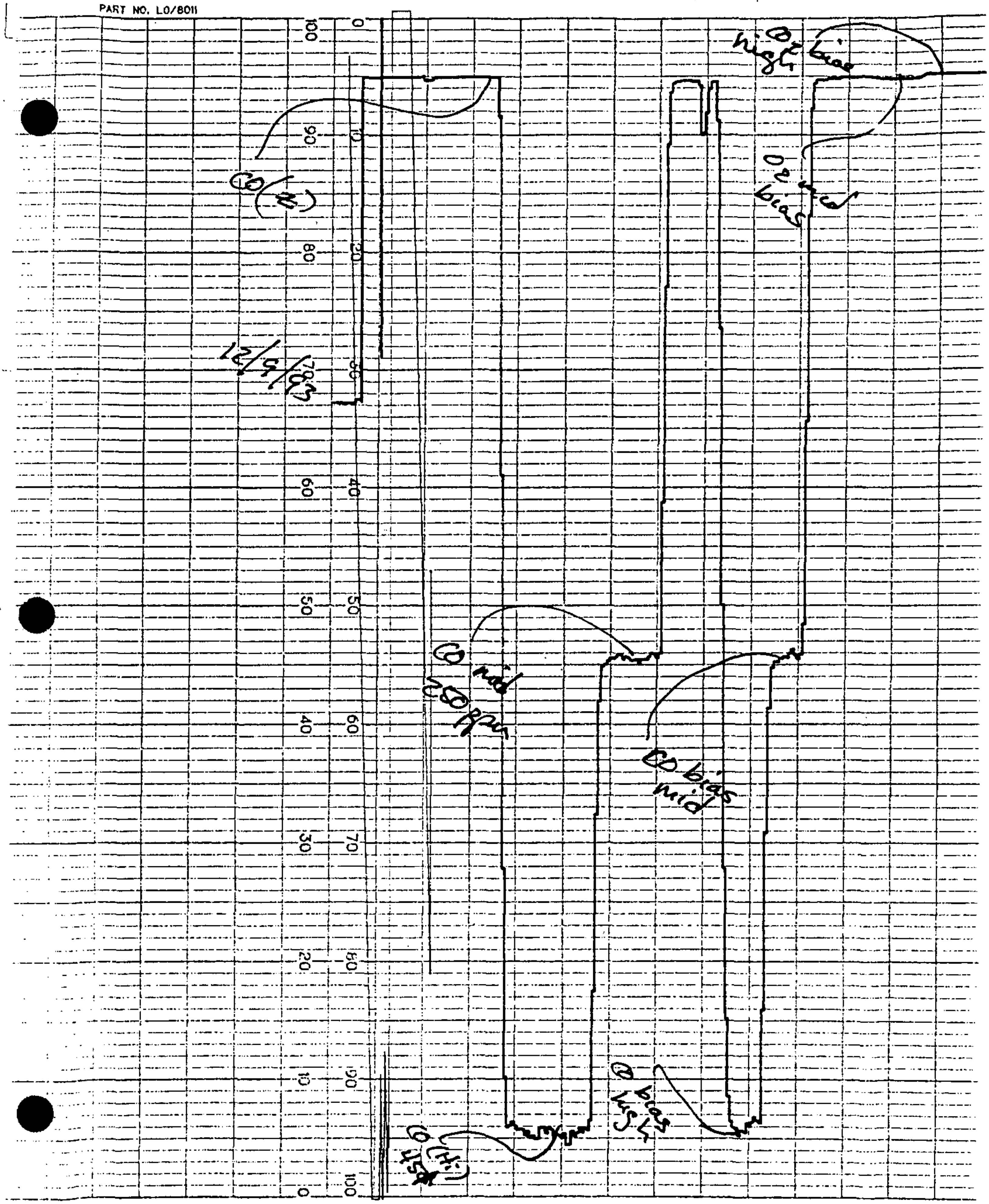


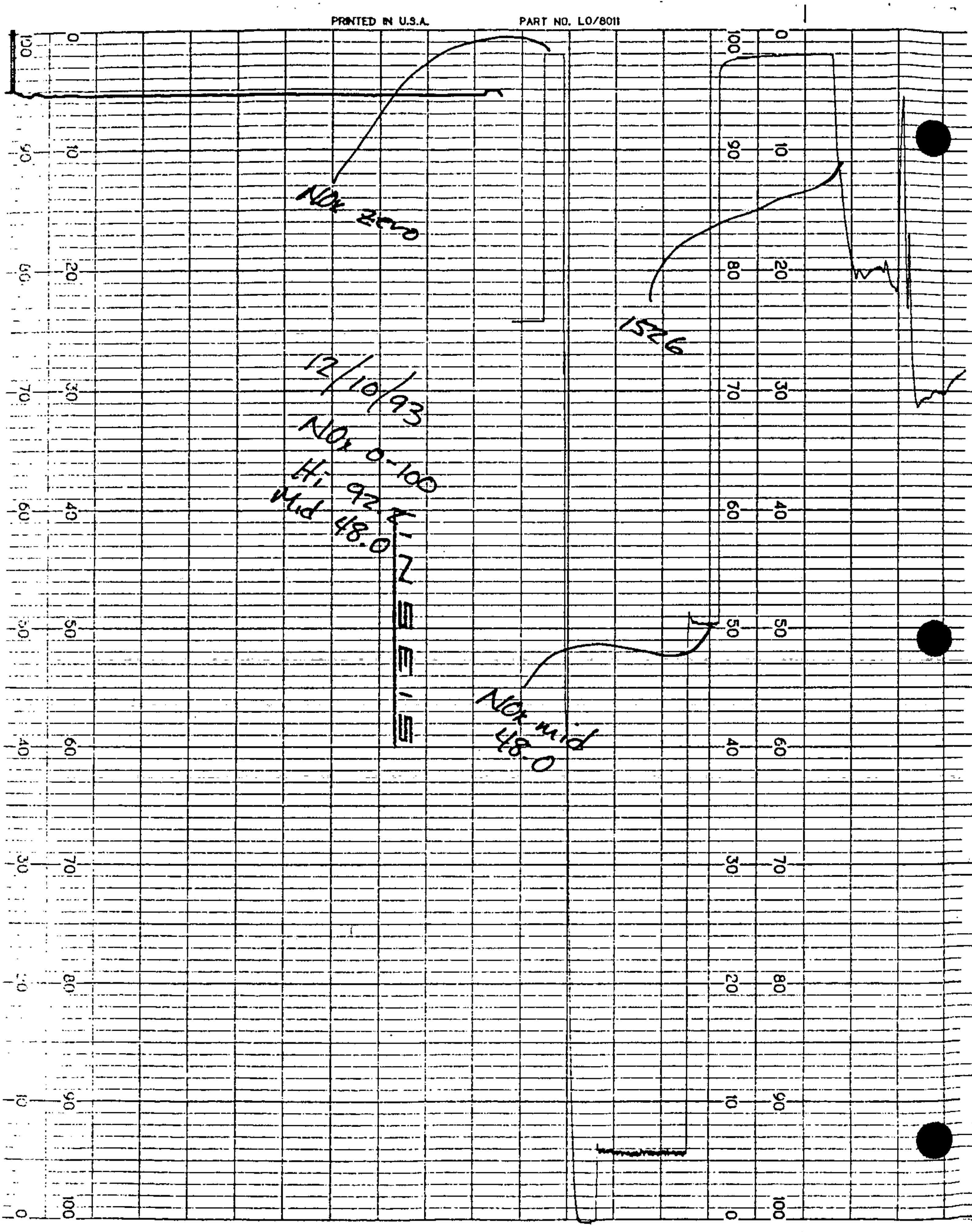
PRINTED IN U.S.A. PART NO. L0/8011



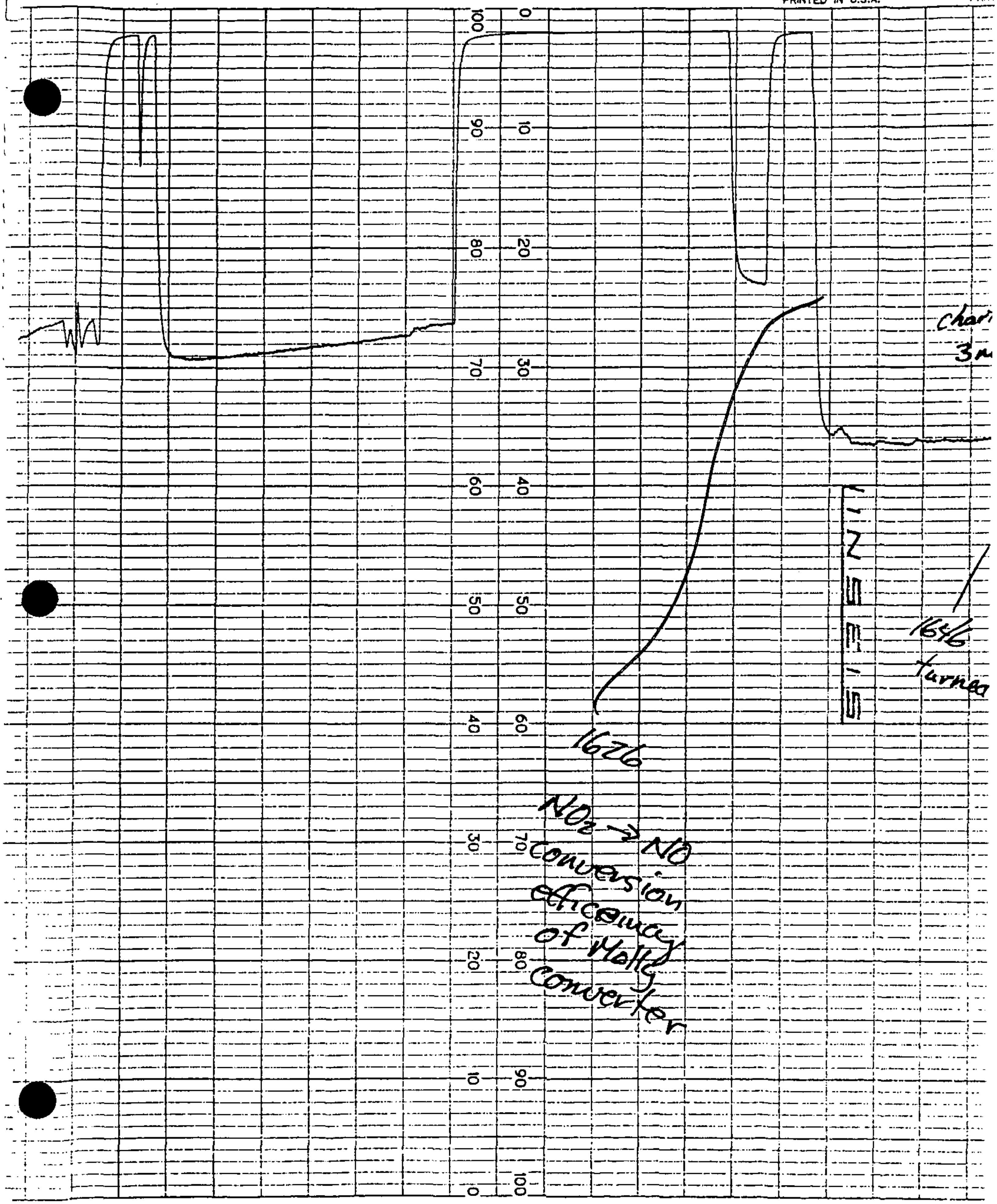

PRINTED IN
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
6 sec / cm
Response time ~30 sec.
95%
10 mid
Exp. 10/96
Exp. 12/96
(Hi:)

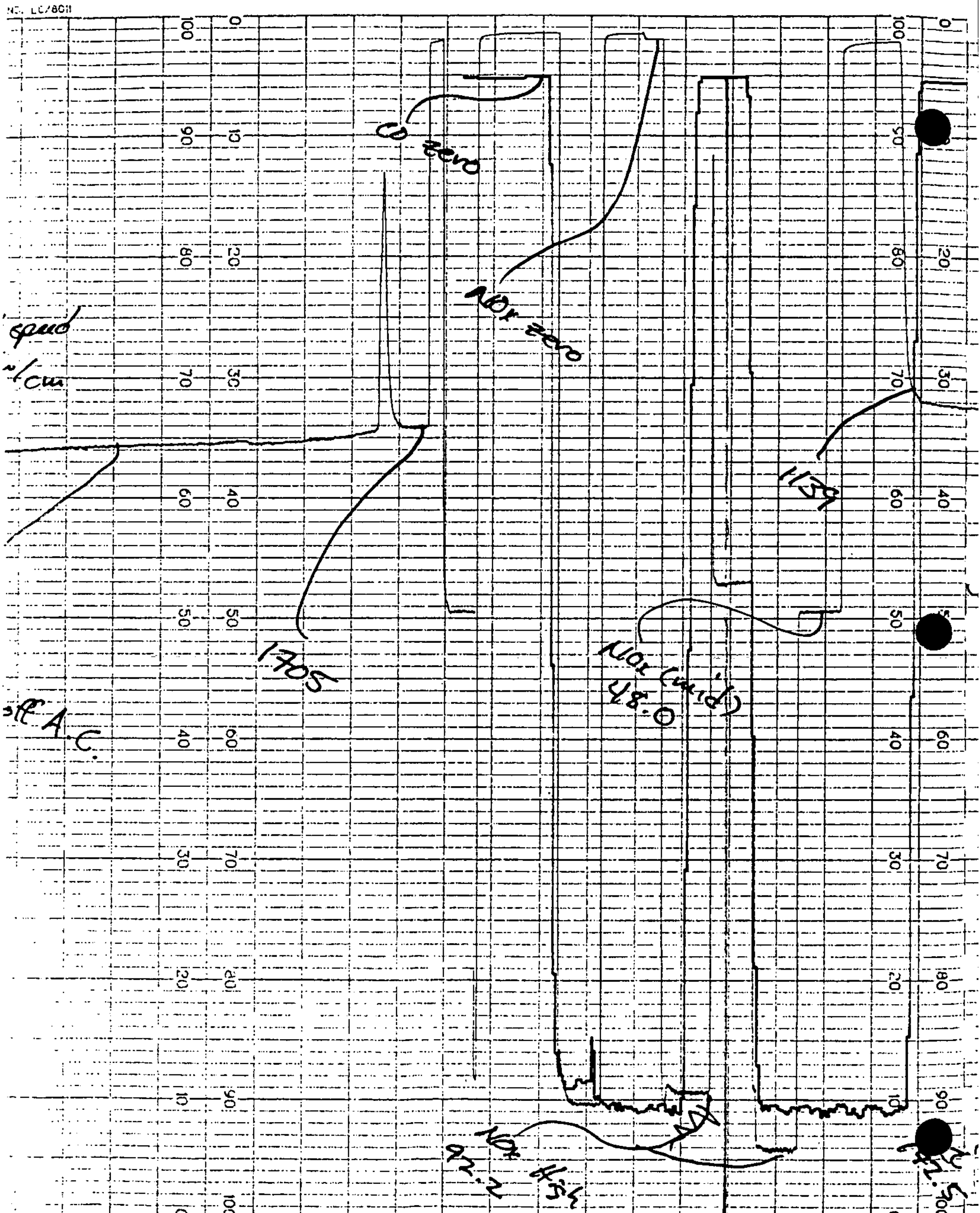
PART NO. L0/8011



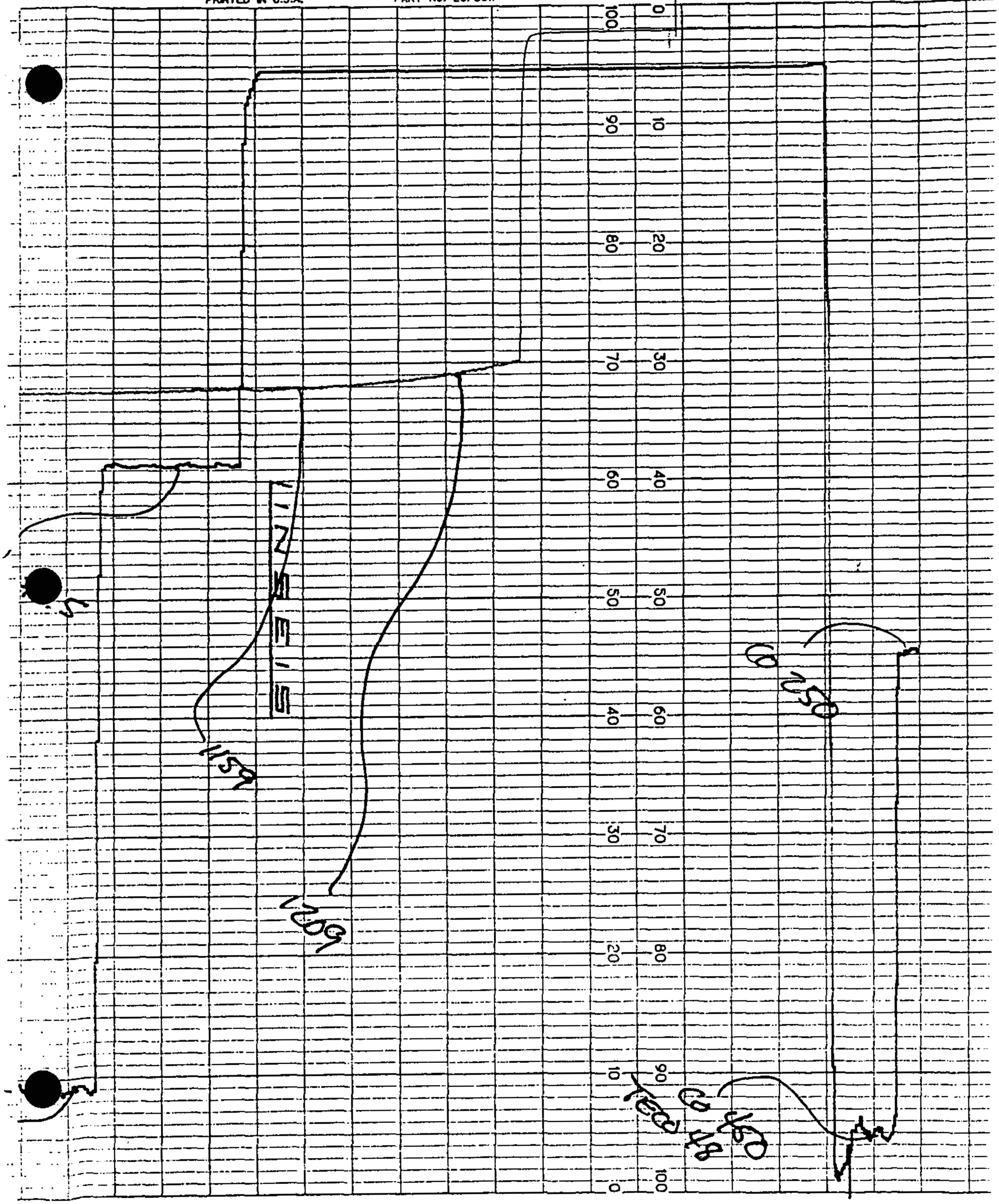

PRINTED IN U.S.A.
PART NO. L0/8011
NOx zero
1526
12/10/93
NOx 0-100
Hi 92.2
Mid 48.0
NOx mid
48.0

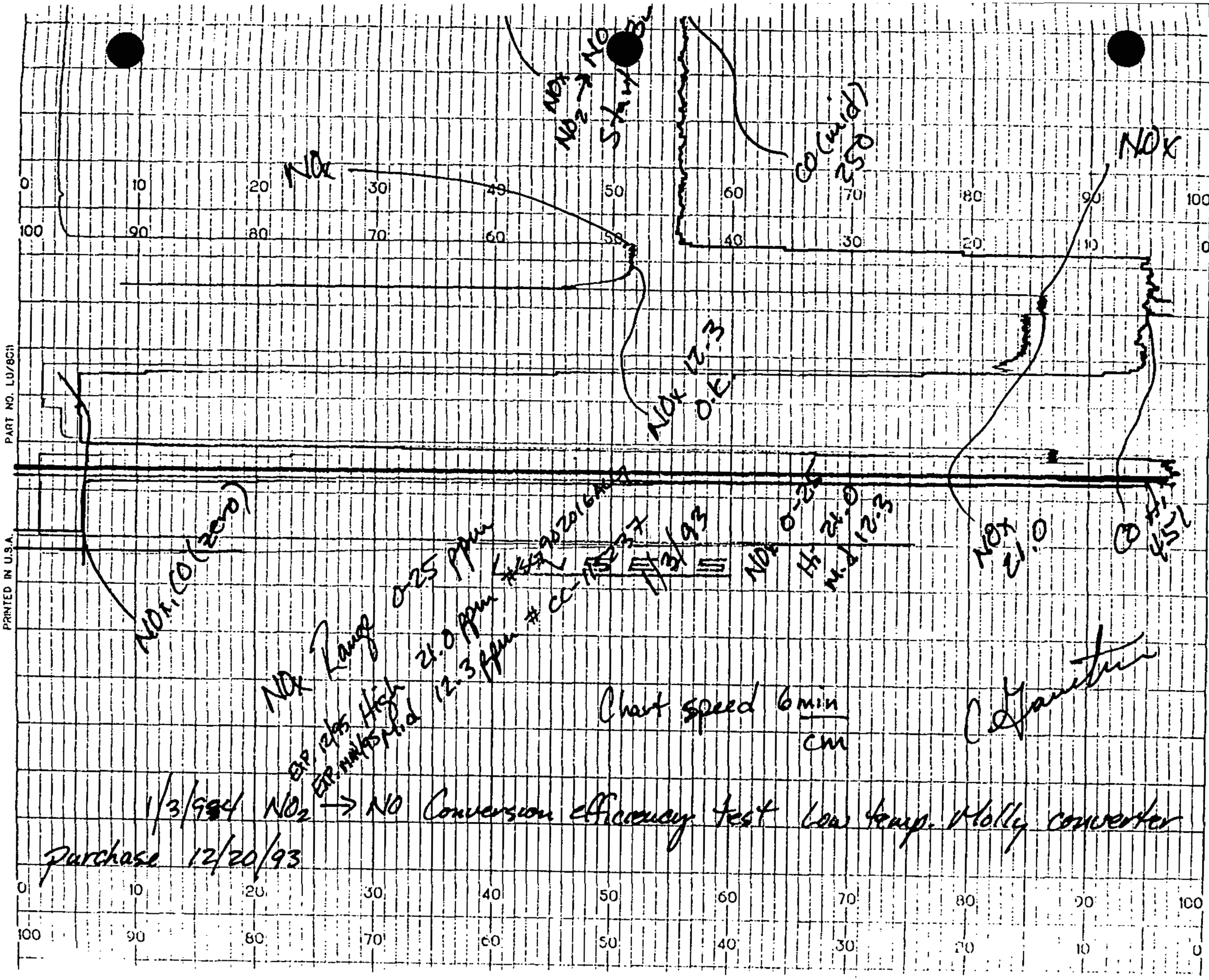
PRINTED IN U.S.A.



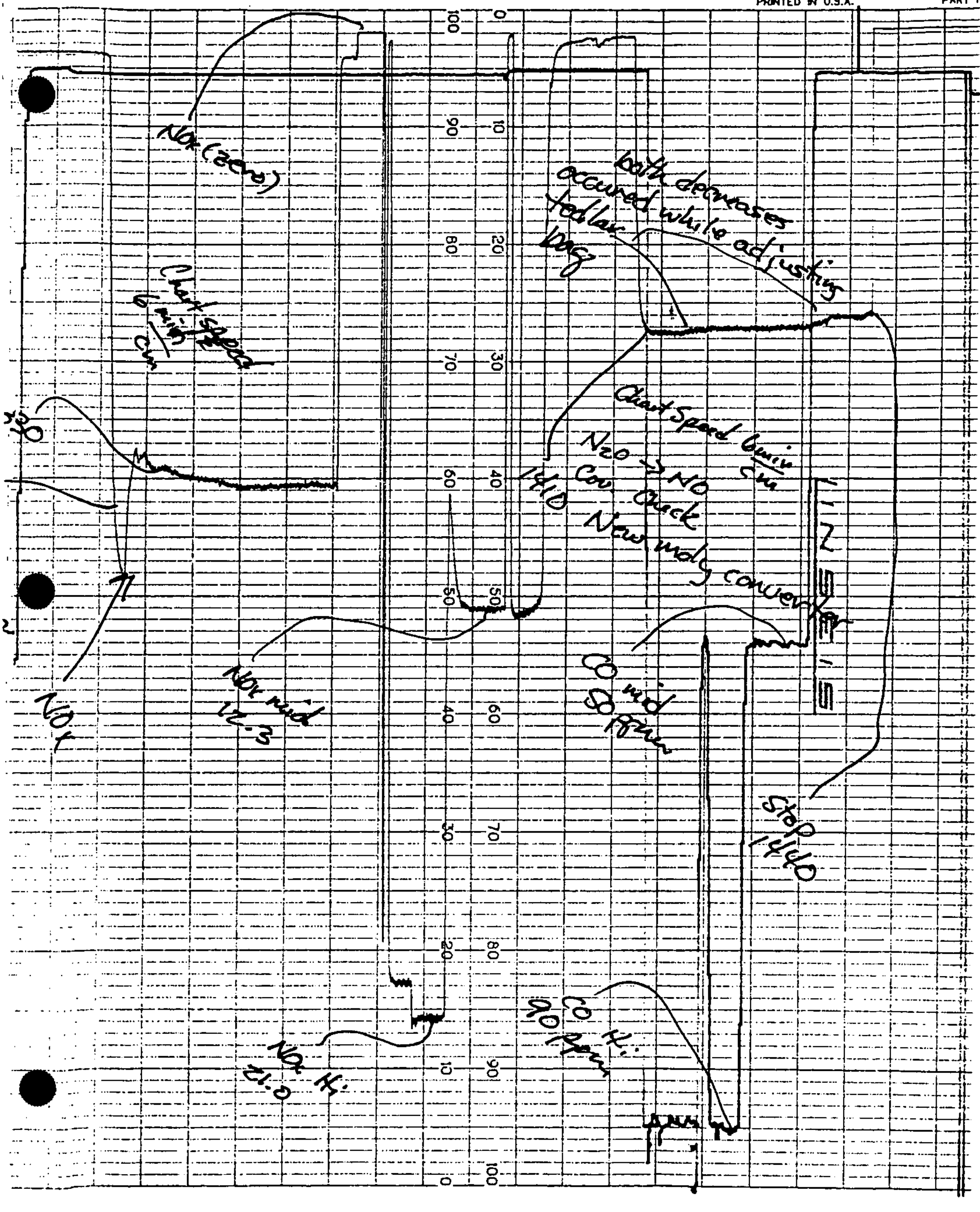

CO zero
NOx zero
1705
1139
NOx (mid)
48.0
NOx High
97.2
97.5
A.C.

PRINTED IN U.S.A. PART NO. L0/8011





PRINTED IN U.S.A.
PART NO. LU/8011
NOx, CO (zero)
NOx
NOx NO2 → NO
CO (mid) 250
NOx
NOx 12.3 O.K
NOx Range 0-25 ppm
High 21.0 ppm
Mid 12.3 ppm # CC-115837
1/3/93
NOx 0-25
Hi 21.0
Mid 12.3
NOx 21.0
CO 452
Chart speed 6 min/cm
1/3/94 NO2 → NO Conversion efficiency test Low temp. Molly converter
Purchase 12/20/93


0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
LINSEIS
NOx (zero)
Chart Speed 6 min/cm
both decreases occurred while adjusting tedlar bag
Chart Speed 6 min/cm
N2O → NO Conv Check
New moly converter
1410
NOx
NOx mid 12.3
CO mid 50 ppm
stop 1440
NOx Hi 21.0
CO Hi 90 ppm

APPENDIX D-6

DATA LOGGER OUTPUT

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
628	8.1	0.1	−1.1	−0.9	−0.5	
629	8.1	0.1	−1.1	−1.5	−0.8	
630	8.1	0.1	−1.1	−1.5	−0.8	
631	8.1	0.1	−1.1	−1.5	−0.8	
632	8.1	0.1	−1.1	−1.5	−1.0	
633	8.1	0.1	−1.1	−1.5	−0.9	
634	5.5	7.6	30.3	34.7	34.7	
635	3.9	9.5	37.3	39.2	92.9	
636	1.9	2.7	8.8	9.3	79.6	
637	0.1	−0.0	−1.1	−1.0	−1.1	
638	0.1	−0.0	−1.1	−1.0	−1.5	
639	0.1	−0.1	−1.1	−1.0	−1.5	
640	0.1	−0.1	−1.1	−1.0	−1.6	
641	0.0	−0.1	−1.2	−1.0	−1.6	
642	0.0	−0.1	−1.2	−1.0	−1.5	
643	0.0	−0.1	−1.1	−0.9	−1.5	
644	0.8	2.6	3.7	3.5	7.9	
645	8.5	17.4	74.9	108.7	386.7	
646	9.0	17.6	92.5	138.9	443.9	
647	9.0	17.7	92.8	139.7	444.5	
648	9.0	17.7	92.8	139.9	443.5	
649	9.0	17.7	92.9	140.0	444.3	
650	9.0	17.7	93.0	140.1	445.8	
651	9.0	17.7	93.1	140.3	453.7	
652	9.0	17.7	93.2	140.4	450.4	
653	8.5	15.0	75.3	111.8	444.9	
654	8.2	9.7	46.3	65.3	270.5	
655	9.0	9.7	47.9	72.2	250.4	
656	9.0	9.7	48.0	72.4	250.8	
657	9.1	9.7	48.2	72.9	250.0	
658	8.2	7.4	35.1	53.4	244.7	
659	0.5	−0.0	−0.7	−0.6	28.7	
700	0.1	−0.0	−0.7	−0.6	−1.4	
701	0.0	−0.0	−0.7	−0.6	−1.5	
702	0.0	−0.0	−0.7	−0.6	−1.6	
703	0.0	−0.0	−0.8	−0.6	−1.5	zero
704	2.7	7.7	40.6	40.8	113.1	
705	4.1	9.7	48.3	51.6	250.3	
706	4.2	9.7	48.3	51.7	249.8	
707	4.2	9.7	48.3	51.7	251.4	mid
708	6.5	15.0	77.9	99.5	324.8	
709	9.0	17.7	93.3	140.5	454.6	
710	9.1	17.7	93.7	141.8	453.1	
711	9.1	17.7	93.7	141.9	453.1	
712	9.1	17.6	93.7	142.0	452.7	
713	9.1	17.7	93.8	142.1	452.5	

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
714	9.1	17.7	93.8	142.1	452.2
715	9.1	17.7	93.8	142.2	452.1
716	9.1	17.7	93.8	142.2	451.7
717	9.1	17.7	46.0	69.6	218.7
718	9.1	17.7	−0.4	−0.6	−0.7
719	9.1	17.7	−0.6	−0.9	−0.5
720	9.0	17.3	−0.6	−0.9	−0.4
721	9.0	7.8	−0.7	−1.0	−0.5
722	9.0	0.7	−0.7	−1.0	−0.5
723	9.0	0.5	−0.7	−1.0	−0.4
724	9.0	0.4	−0.6	−1.0	−0.5
725	9.0	0.4	−0.7	−1.0	−0.4
726	9.0	0.4	−0.7	−1.1	−0.4
727	9.0	0.2	−0.7	−1.0	−0.5
728	9.0	0.2	−0.7	−1.0	−0.6
729	9.0	0.1	−0.7	−1.0	−0.6
730	9.0	0.1	−0.7	−1.1	−0.4
731	9.0	0.1	−0.7	−1.0	−0.5
732	9.0	0.1	−0.7	−1.1	−0.5
733	9.0	0.1	−0.7	−1.1	−0.5
734	9.1	0.1	−0.7	−1.0	−0.5
735	9.1	0.1	−0.7	−1.1	−0.4
736	9.1	0.1	−0.7	−1.1	−0.4
737	9.2	0.2	−0.7	−1.1	−0.4
738	9.4	0.2	−0.7	−1.1	−0.5
739	9.8	0.1	−0.7	−1.1	−0.6
740	10.2	0.2	−0.7	−1.2	−0.6
741	10.5	0.3	−0.7	−1.2	−0.5
742	11.0	0.1	−0.7	−1.3	−0.4
743	11.7	0.1	−0.7	−1.4	−0.5
744	12.6	0.1	−0.7	−1.5	−0.6
745	13.3	0.1	−0.7	−1.7	−0.5
746	13.9	0.1	−0.7	−1.9	−0.4
747	14.3	0.1	−0.7	−1.9	−0.5
748	15.5	0.1	−0.7	−2.5	−0.5
749	20.1	0.2	−0.1	−2.6	−0.5
750	20.4	0.1	−0.6	−21.3	0.4
751	17.4	8.2	42.1	362.1	64.7
752	8.2	17.7	92.8	134.6	439.1
753	9.1	17.7	93.8	142.4	451.2
754	9.1	17.7	93.8	142.3	449.4 Hi
755	9.1	17.7	93.8	142.3	452.2
756	9.1	17.7	93.8	142.3	450.6
757	13.9	1.6	9.9	15.3	160.2
758	19.6	0.2	−0.1	−2.9	−0.5
759	20.3	0.1	−0.4	−13.1	−0.4

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
800	18.5	0.1	−0.4	−8.0	0.5	
801	1.5	0.0	−0.7	−0.6	−1.0	
802	0.1	0.0	−0.7	−0.6	−1.2	
803	0.1	0.0	−0.7	−0.6	−1.1	
804	0.1	0.0	−0.7	−0.6	−1.5	
805	0.1	−0.0	−0.7	−0.6	−1.2	zero bias
806	0.0	0.0	−0.7	−0.6	−1.3	
807	1.4	1.6	−0.7	−0.7	−1.1	
808	0.6	9.5	−0.7	−0.6	−1.6	
809	0.1	9.6	−0.7	−0.6	−1.6	
810	0.5	7.0	−0.7	−0.6	−1.6	
811	3.9	0.1	−0.7	−0.8	−1.4	
812	4.1	0.0	−0.7	−0.8	−1.4	
813	4.1	0.0	0.6	−0.6	−1.5	
814	1.1	0.0	45.9	41.8	−1.4	
815	0.1	0.0	46.1	39.7	−1.3	
816	0.1	0.0	−0.1	−0.1	159.3	
817	0.0	0.0	−0.6	−0.5	248.9	
818	0.0	0.0	−0.7	−0.6	250.3	mid bias
819	2.4	0.1	0.2	0.8	238.4	
820	17.9	1.1	3.5	24.5	46.4	
821	18.7	1.2	4.7	39.2	12.2	
822	17.6	1.6	6.7	36.9	31.2	
823	18.1	1.4	5.2	33.6	21.9	
824	11.7	6.7	33.4	87.8	75.8	
825	3.5	9.5	46.3	47.7	193.7	
826	3.3	9.7	46.7	47.5	210.1	
827	3.3	9.7	46.8	47.6	242.7	
828	3.3	9.7	46.9	47.7	200.4	
829	3.3	9.7	47.3	48.0	182.6	
830	3.3	9.7	46.2	46.9	244.3	
831	3.2	9.7	46.9	47.6	206.6	
832	3.3	9.7	47.1	47.8	179.6	
833	3.3	9.7	46.7	47.5	227.4	
834	3.2	9.8	46.6	47.2	261.8	
835	3.2	9.7	46.5	47.1	192.5	
836	3.2	9.7	46.5	47.1	243.9	
837	3.3	9.8	46.9	47.5	225.0	
838	3.3	9.7	47.1	47.8	235.1	
839	3.3	9.7	46.9	47.6	249.9	
840	3.3	9.7	46.8	47.5	218.3	
841	3.3	9.7	46.7	47.4	231.9	
842	3.3	9.7	46.9	47.6	202.6	
843	3.3	9.7	47.0	47.7	204.7	
844	3.3	9.7	47.1	47.8	194.8	
845	3.3	9.7	47.3	48.1	228.8	

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
846	3.3	9.7	47.1	47.9	222.1
847	3.3	9.8	46.9	47.6	203.6
848	3.3	9.7	46.9	47.6	276.0
849	3.2	9.7	47.0	47.7	234.2
850	3.3	9.7	47.2	47.9	207.6
851	3.3	9.7	46.8	47.6	228.6
852	3.3	9.3	46.7	47.4	232.6
853	3.3	9.7	47.1	47.8	214.8
854	3.3	9.7	46.9	47.6	192.4
855	3.3	9.7	47.0	47.7	219.2
856	3.2	9.8	47.0	47.6	203.4
857	3.3	9.7	46.9	47.6	232.6
858	3.2	9.8	46.7	47.3	226.7
859	3.2	9.7	47.4	48.1	225.6
900	10.6	3.9	16.9	25.3	130.7
901	17.9	1.6	6.2	37.9	27.9
902	17.8	1.8	7.2	42.3	32.4
903	17.8	1.5	5.8	32.7	29.7
904	18.4	1.3	4.9	35.6	26.2
905	12.1	1.1	4.0	13.0	16.6
906	7.2	1.5	62.1	81.1	32.5
907	7.5	1.2	93.0	124.0	18.5
908	7.4	1.1	55.4	73.2	19.4
909	7.7	0.7	−0.5	−0.7	14.8
910	7.7	0.9	1.3	1.7	11.1
911	7.4	1.2	4.5	6.0	13.7
912	7.5	1.1	3.8	5.2	17.6
913	7.5	1.2	5.1	6.8	15.8
914	2.8	9.1	46.2	46.6	106.5
908	1.3	9.4	47.5	43.4	206.1
909	2.0	9.6	47.9	45.3	241.2
910	3.3	9.6	48.4	49.4	229.2
911	3.3	9.7	49.2	50.1	207.5
912	3.3	9.7	49.5	50.3	202.4
913	3.3	9.4	49.5	50.4	188.0
914	3.3	9.7	49.4	50.1	228.6
915	3.3	9.6	50.2	51.0	215.8
916	3.3	9.7	50.5	51.3	189.4
917	3.3	9.7	50.7	51.4	204.2
918	3.2	9.7	50.5	51.2	199.7
919	3.2	9.7	50.4	51.1	182.7
920	3.2	9.8	50.4	51.0	208.8
921	3.2	9.8	51.2	51.7	210.5
922	3.2	9.8	52.0	52.5	206.6
923	3.2	9.8	51.5	52.1	229.8
924	3.2	9.8	51.2	51.8	249.1

Start FGR ON

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
925	3.2	9.8	51.5	52.1	233.3
926	3.2	9.8	51.5	52.1	207.0
927	3.2	9.8	51.4	52.0	214.4
928	3.2	9.7	52.0	52.7	224.1
929	3.2	9.8	51.9	52.4	236.5
930	3.2	9.8	52.2	52.7	232.0
931	3.2	9.8	52.4	53.0	239.2
932	3.2	9.8	52.2	52.7	237.8
933	3.2	9.8	52.4	53.0	200.1
934	3.2	9.8	52.2	52.8	220.0
935	3.2	9.8	52.1	52.6	253.8
936	3.2	9.7	52.6	53.1	217.4
937	3.2	9.8	53.2	53.7	196.1
938	3.2	9.8	52.8	53.3	190.5
939	3.2	9.8	52.3	52.9	208.2
940	3.2	9.8	51.9	52.4	200.3
941	3.2	9.8	51.5	52.0	247.8
942	3.2	9.8	51.9	52.4	253.2
943	3.2	9.8	52.3	52.8	213.4
944	3.2	9.8	52.3	52.9	193.8
945	3.1	9.8	52.4	52.9	189.5
946	3.2	9.8	52.5	53.1	188.4
947	3.2	9.8	51.9	52.3	270.5
948	3.2	9.8	52.1	52.6	218.2
949	3.2	9.8	52.2	52.7	201.7
950	3.2	9.8	52.0	52.4	199.1
951	3.2	9.8	51.8	52.2	210.4
952	3.2	9.8	52.0	52.5	195.8
953	3.1	9.8	51.8	52.2	257.2
954	3.1	9.8	52.0	52.4	240.9
955	3.1	9.8	51.7	52.2	220.3
956	3.1	9.8	51.9	52.3	170.5
957	3.1	9.8	51.7	52.0	210.9
958	3.1	9.8	51.4	51.7	238.5
959	3.1	9.8	52.2	52.5	204.1
1000	3.1	9.8	51.9	52.2	249.7
1001	3.1	9.8	52.4	52.8	214.0
1002	3.1	9.8	52.0	52.4	225.2
1003	3.1	9.8	52.2	52.6	241.9
1004	3.2	9.8	52.6	53.1	198.2
1005	3.2	9.8	52.5	53.0	188.6
1006	3.2	9.8	52.4	52.9	186.7
1007	3.1	9.8	51.9	52.3	158.0
1008	3.2	9.8	52.1	52.6	190.0
1009	3.1	9.8	52.0	52.3	182.3
1010	3.1	9.8	51.9	52.1	198.0

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	Notes
1011	3.1	9.8	52.0	52.3	203.8	
1012	3.1	9.9	51.7	51.9	196.9	
1013	3.1	9.7	51.9	52.2	193.2	
1014	3.1	9.8	51.6	51.9	246.1	END FGR ON; 3.2 / 9.8 / 51.9 / 213.4 ← avgs
1015	3.1	9.8	52.2	52.6	207.8	
1016	3.1	9.6	52.1	52.3	209.0	
1017	3.2	9.2	47.8	48.1	164.5	
1018	11.3	0.2	0.6	1.3	41.8	
1019	0.4	0.1	0.0	0.0	1.0	
1020	0.0	0.1	−0.1	−0.1	−1.1	
1021	0.0	0.1	−0.1	−0.1	−1.1	zero bias
1022	3.3	0.1	−0.1	−0.1	−1.0	
1023	4.6	0.0	−0.2	−0.2	−0.5	
1024	4.1	0.0	−0.2	−0.2	−1.2	
1025	3.6	2.9	−0.2	−0.3	−1.3	
1026	0.2	9.6	−0.3	−0.2	−1.7	
1027	0.0	9.6	−0.3	−0.2	−1.7	
1028	0.0	3.8	29.7	25.5	−1.6	
1029	−0.0	0.1	47.1	40.3	−1.1	
1030	−0.0	0.0	23.7	20.3	40.5	
1031	−0.0	0.1	−0.2	−0.2	243.9	
1032	−0.0	0.0	−0.3	−0.2	250.8	mid bias
1033	−0.0	−0.1	−0.3	−0.2	229.4	
1034	3.3	0.1	−0.2	−0.2	91.9	
1035	16.9	0.1	−0.2	−1.1	7.0	
1036	2.2	−0.1	−0.4	−0.4	−0.4	
1037	0.1	−0.2	−0.4	−0.4	−1.6	
1038	−0.0	−0.0	−0.4	−0.4	−1.5	
1039	−0.0	−0.1	−0.4	−0.4	−1.6	zero
1040	2.2	6.9	35.4	35.2	91.9	
1041	4.1	9.7	48.0	51.1	251.0	
1042	4.1	9.7	48.0	51.2	250.2	mid
1043	6.8	15.8	75.2	98.2	348.3	
1044	9.0	17.7	92.5	138.7	454.3	
1045	9.0	17.7	92.8	139.8	457.1	
1046	9.0	17.7	92.8	139.9	454.8	high
1047	13.3	7.1	31.2	51.8	306.3	
1048	19.2	0.7	2.4	25.3	12.8	
1049	19.6	0.5	1.7	22.5	8.3	
1050	13.8	5.3	27.5	100.2	48.5	
1051	3.5	9.7	44.8	46.2	191.5	
1052	3.2	9.8	44.5	45.0	238.3	
1053	3.2	9.8	44.5	44.9	207.1	
1054	3.2	9.8	44.5	44.9	176.6	
1055	3.1	9.8	44.1	44.4	159.7	
1056	3.1	9.8	44.0	44.4	185.3	

full load, 22 march, 1994

START GR+UREA, RUN 1

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1057	3.1	9.8	43.8	44.0	255.1
1058	3.1	9.8	44.1	44.4	194.3
1059	3.1	9.8	44.5	44.8	223.4
1100	3.1	9.7	44.3	44.6	210.0
1101	3.1	9.7	44.2	44.5	231.9
1102	3.1	9.8	44.5	44.8	186.9
1103	3.1	9.8	44.1	44.4	208.1
1104	3.1	9.8	44.4	44.7	228.7
1105	3.1	9.8	44.9	45.2	197.3
1106	3.1	9.8	44.8	45.1	200.2
1107	3.1	9.8	44.7	44.9	212.5
1108	3.1	9.8	44.5	44.7	222.7
1109	3.1	9.8	44.5	44.7	227.0
1110	3.1	9.8	44.5	44.7	213.2
1111	3.1	9.8	44.5	44.7	206.5
1112	3.1	9.9	44.4	44.6	271.5
1113	3.1	9.8	44.4	44.6	231.6
1114	3.1	9.8	44.2	44.5	207.7
1115	3.1	9.8	44.3	44.5	235.8
1116	3.1	9.8	44.4	44.6	239.8
1117	3.1	9.9	44.5	44.7	220.2
1118	3.1	9.9	44.5	44.7	190.7
1119	3.1	9.8	44.3	44.5	229.8
1120	3.1	9.8	44.2	44.4	229.9
1121	3.1	9.8	44.4	44.8	189.4
1122	3.1	9.8	44.6	44.9	177.2
1123	3.1	9.8	44.6	44.9	213.3
1124	3.1	9.8	44.6	44.9	210.7
1125	3.1	9.8	44.2	44.5	212.8
1126	3.1	9.8	44.3	44.6	215.9
1127	3.1	9.8	44.5	44.8	230.3
1128	3.1	9.8	44.6	44.8	205.8
1129	3.1	9.8	44.3	44.6	195.9
1130	3.1	9.8	44.4	44.7	175.2
1131	3.1	9.8	44.5	44.8	181.1
1132	3.1	9.8	44.5	44.8	194.9
1133	3.1	9.9	44.5	44.7	215.5
1134	3.1	9.9	44.6	44.8	212.1
1135	3.1	9.8	44.2	44.5	221.7
1136	3.1	9.8	44.2	44.4	254.2
1137	3.1	9.8	44.4	44.7	220.5
1138	3.1	9.8	44.5	44.8	197.6
1139	3.1	9.8	44.3	44.5	222.1
1140	3.1	9.8	44.1	44.2	237.1
1141	3.1	9.8	44.3	44.6	201.1
1142	3.1	9.8	44.5	44.7	211.8

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
1143	3.1	9.8	44.6	45.0	203.2	
1144	3.1	9.8	44.6	44.9	211.3	
1145	3.1	9.9	44.2	44.4	242.0	
1146	3.1	9.8	44.6	44.8	262.8	
1147	3.1	9.8	44.9	45.2	218.5	
1148	3.1	9.8	44.6	44.9	247.3	
1149	3.1	9.8	44.5	44.8	189.0	
1150	3.1	9.8	44.5	44.7	196.7	
1151	3.1	9.8	44.4	44.7	227.2	
1152	3.1	9.8	44.4	44.7	231.1	
1153	3.1	9.8	44.6	44.8	232.1	
1154	3.1	9.8	44.3	44.6	190.4	
1155	3.1	9.8	44.8	45.2	206.8	
1156	3.1	9.8	44.7	45.1	222.3	
1157	3.1	9.8	45.0	45.3	205.2	
1158	3.1	9.8	44.6	44.9	239.0	
1159	3.1 / 3.1	9.7 / 9.8	44.7 / 44.5	45.1	197.5 / 215.3	END; ← Averages
1200	3.1	9.8	44.8	45.1	204.7	
1201	3.1	9.7	44.8	45.1	213.0	
1202	3.1	9.8	44.9	45.3	214.8	
1203	3.1	9.8	44.6	44.9	183.4	
1204	3.1	9.8	45.0	45.4	207.5	
1205	3.2	9.6	41.4	41.8	175.9	
1206	16.6	0.7	0.9	2.1	51.1	
1207	20.3	0.1	−0.0	−0.4	−0.2	
1208	20.4	0.1	−0.1	−2.2	−0.4	
1209	14.8	0.1	−0.2	−3.2	3.6	
1210	0.5	−0.0	−0.2	−0.2	0.4	
1211	0.1	−0.0	−0.2	−0.2	−1.1	
1212	0.0	−0.1	−0.2	−0.1	−1.2	
1213	0.0	0.0	−0.2	−0.2	−1.1	zero bias
1214	0.3	0.0	−0.2	−0.1	−1.0	
1215	3.8	0.0	−0.2	−0.2	−0.8	
1216	4.1	0.0	−0.2	−0.2	−1.2	
1217	4.1	0.0	−0.2	−0.2	−1.2	
1218	2.4	5.9	−0.2	−0.2	−1.4	
1219	0.1	9.6	−0.2	−0.2	−1.6	
1220	0.0	8.6	5.3	4.5	−1.5	
1221	−0.0	0.2	46.5	39.8	−1.3	
1222	−0.0	0.0	47.0	40.2	−1.1	
1223	−0.0	0.0	36.9	31.5	3.2	
1224	−0.0	0.0	0.1	0.1	213.0	
1225	−0.0	−0.2	−0.1	−0.1	250.9	
1226	−0.0	−0.0	−0.1	−0.1	252.2	mid bias
1227	−0.0	−0.1	−0.2	−0.1	251.4	
1228	3.6	0.0	−0.1	−0.1	153.8	

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
1229	17.8	0.0	−0.0	−0.2	18.7	
1230	9.8	0.0	−0.1	0.0	58.3	
1231	0.5	−0.1	−0.2	−0.2	1.9	
1232	0.0	−0.1	−0.2	−0.2	−1.6	
1233	−0.0	−0.1	−0.2	−0.2	−1.6	
1234	−0.0	−0.1	−0.2	−0.2	−1.6	zero
1235	1.0	4.0	20.4	19.4	25.9	
1236	4.0	9.7	47.8	50.7	242.1	
1237	4.1	9.7	47.8	51.1	252.9	
1238	4.2	9.7	47.8	51.1	252.1	
1239	4.2	9.7	47.8	51.1	252.9	mid
1240	5.3	13.1	61.4	71.9	288.3	
1241	8.9	17.6	90.8	135.6	452.4	
1242	9.1	17.6	92.4	139.6	455.5	
1243	9.1	17.6	92.5	139.8	456.4	
1244	9.1	17.7	92.4	139.9	457.0	high
1245	12.7	8.6	38.5	59.2	338.4	
1246	20.1	0.2	0.7	18.0	4.9	
1247	20.3	0.2	0.6	16.8	2.5	
1248	20.4	0.1	−0.0	−0.5	1.2	
1249	20.5	0.1	0.0	0.0	−0.7	
1250	20.3	0.3	0.9	25.6	1.4	
1251	20.4	0.1	0.0	1.1	2.7	
1252	20.5	0.1	0.2	9.1	−0.1	
1253	20.3	0.2	0.5	15.6	2.7	
1254	20.3	0.2	0.5	13.7	3.1	
1255	18.1	2.9	14.2	124.6	15.8	
1256	4.1	9.7	44.1	47.6	245.5	
1257	3.2	9.8	44.3	44.9	224.3	
1258	3.2	9.8	44.6	45.1	222.2	
1259	3.2	9.8	44.4	44.8	224.0	
1300	3.2	9.6	44.7	45.1	183.1	
1301	3.2	9.8	44.8	45.2	208.2	
1302	3.1	9.4	44.3	44.6	255.4	
1303	3.1	9.7	44.5	44.9	244.9	
1304	3.1	9.8	44.4	44.8	207.2	
1305	3.2	9.8	44.5	44.9	204.0	
1306	3.1	9.8	44.5	44.9	235.7	
1307	3.2	9.8	44.5	44.9	230.8	
1308	3.1	9.8	44.4	44.7	221.2	
1309	3.2	9.8	44.5	45.0	183.9	
1310	3.2	9.8	44.6	45.0	192.3	
1311	3.1	9.8	44.3	44.7	208.8	
1312	3.1	9.8	44.3	44.6	234.3	
1313	3.1	9.8	44.6	45.0	185.9	
1314	3.1	9.8	44.5	44.8	240.7	

TART FGR+
LEA ON;
UN #2

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1315	3.1	9.8	44.5	44.8	224.5
1316	3.1	9.8	44.4	44.7	209.8
1317	3.2	9.8	44.6	45.0	204.1
1318	3.1	9.8	44.5	44.8	223.2
1319	3.1	9.8	44.8	45.2	223.4
1320	3.2	9.8	44.9	45.3	181.6
1321	3.1	9.8	44.6	45.0	187.4
1322	3.1	9.8	44.6	44.9	180.9
1323	3.2	9.8	44.7	45.1	182.4
1324	3.2	9.8	44.3	44.7	192.6
1325	3.2	9.8	44.4	44.8	189.4
1326	3.1	9.8	44.2	44.6	225.9
1327	3.1	9.8	44.5	44.8	226.2
1328	3.2	9.8	45.1	45.6	164.7
1329	3.2	9.8	44.9	45.3	204.6
1330	3.2	9.8	44.6	45.0	191.2
1331	3.1	9.8	44.8	45.2	211.7
1332	3.1	9.8	45.1	45.5	243.2
1333	3.2	9.8	45.2	45.7	176.0
1334	3.1	9.8	45.1	45.4	188.2
1335	3.1	9.8	44.6	45.0	241.0
1336	3.1	9.8	44.8	45.2	223.3
1337	3.2	9.8	45.1	45.5	208.2
1338	3.2	9.8	45.1	45.6	164.8
1339	3.2	9.8	45.0	45.4	183.2
1340	3.2	9.8	44.9	45.3	203.1
1341	3.2	9.8	44.7	45.1	196.7
1342	3.1	9.8	44.8	45.1	197.9
1343	3.1	9.8	44.6	44.9	214.2
1344	3.2	9.8	45.0	45.5	189.6
1345	3.2	9.8	44.7	45.1	207.6
1346	3.1	9.8	44.8	45.2	191.0
1347	3.1	9.8	44.8	45.1	188.4
1348	3.2	9.8	44.7	45.0	219.3
1349	3.1	9.8	44.6	45.0	218.0
1350	3.1	9.8	44.7	45.0	199.2
1351	3.2	9.8	44.9	45.3	207.3
1352	3.2	9.8	44.9	45.3	195.2
1353	3.1	9.8	44.3	44.7	176.7
1354	3.1	9.8	44.6	45.0	177.7
1355	3.1	9.9	44.5	44.8	213.8
1356	3.1	9.8	44.5	44.9	198.6
1357	3.1	9.8	44.4	44.7	182.3
1358	3.1	9.8	44.5	44.8	233.8
1359	3.2	9.8	45.1	45.5	176.7
D 1400	3.1 / 3.1	9.8 / 9.8	44.4 / 44.7	44.7	217.4 / 205.2

full load, 22 march, 1994

time	O_2 (%)	CO_2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
1401	3.1	9.8	44.8	45.1	216.6	
1402	3.1	9.8	44.8	45.2	193.3	
1403	3.1	9.8	44.5	44.8	197.1	
1404	3.1	9.9	44.6	44.9	182.5	
1405	3.1	9.8	44.3	44.6	183.9	
1406	3.2	9.8	44.8	45.2	197.5	
1407	3.1	9.6	44.6	44.9	242.5	
1408	3.1	9.8	44.4	44.7	220.7	
1409	9.6	3.6	15.5	16.1	160.6	
1410	1.4	0.1	0.1	0.1	8.4	
1411	0.0	0.0	0.1	0.1	−1.1	
1412	0.0	0.0	0.0	0.0	−1.1	zero bias
1413	−0.0	−0.0	0.0	0.0	−1.2	
1414	2.9	−0.0	0.1	0.1	−0.7	
1415	4.1	−0.1	0.0	0.0	−1.2	
1416	4.1	0.0	0.0	0.0	−1.2	
1417	4.1	0.0	0.0	0.0	−1.2	
1418	4.1	0.0	0.0	0.0	−1.1	
1419	4.1	0.0	0.0	0.0	−1.2	
1420	2.0	6.9	0.0	0.0	−1.5	
1421	0.0	9.6	0.0	0.0	−1.7	
1422	−0.0	6.1	17.9	15.4	−1.6	
1423	−0.0	0.1	46.6	39.8	−1.1	
1424	−0.0	0.1	46.8	40.0	−1.2	
1425	−0.0	−0.0	27.5	23.5	26.4	
1426	−0.0	0.0	0.2	0.2	240.3	
1427	−0.0	−0.0	0.1	0.1	251.5	mid bias
1428	−0.0	−0.0	0.0	0.0	226.4	
1429	−0.1	−0.1	−0.0	−0.0	9.0	
1430	−0.1	−0.1	−0.0	−0.0	−1.6	zero
1431	0.5	2.8	14.7	13.5	9.6	
1432	4.0	9.7	47.7	50.3	230.3	
1433	4.1	9.7	47.6	50.9	251.8	
1434	4.2	9.7	47.7	50.9	252.6	mid
1435	5.4	13.0	62.1	73.0	288.1	
1436	9.0	17.6	90.5	135.6	453.4	
1437	9.1	17.6	92.0	139.2	458.2	
1438	9.1	17.6	92.1	139.5	457.6	
1439	9.1	17.7	92.0	139.5	456.0	high
1440	6.7	11.6	58.1	78.5	385.8	
1441	3.1	9.8	58.3	58.7	182.3	
1442	3.0	9.8	58.5	58.6	202.7	
1443	3.0	9.8	58.7	58.9	195.0	
1444	3.0	9.8	59.0	59.1	214.8	
1445	3.0	9.8	59.4	59.5	194.4	
1446	3.0	9.7	59.1	59.2	181.9	

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1447	3.0	9.8	58.9	58.9	208.6
1448	3.0	9.8	59.0	59.1	194.5
1449	3.0	9.8	59.4	59.5	174.0
1450	3.0	9.8	59.3	59.4	195.5
1451	3.0	9.8	59.5	59.5	184.2
1452	3.0	9.8	59.6	59.7	177.5
1453	3.0	9.2	60.2	60.3	180.6
1454	3.0	9.8	59.9	60.0	180.6
1455	3.0	9.8	59.1	59.1	258.0
1456	3.0	9.9	59.2	59.3	250.9
1457	3.0	9.9	59.3	59.3	184.8
1458	3.0	9.8	60.1	60.1	176.1
1459	3.0	9.7	59.7	59.8	162.7
START BASELINE 1500	3.0	9.7	59.5	59.5	205.3
1501	3.0	9.9	59.2	59.3	197.0
1502	3.0	9.8	59.7	59.8	195.2
1503	3.0	9.8	59.9	59.9	178.4
1504	3.0	9.8	60.0	60.1	177.3
1505	3.0	9.9	59.9	59.9	206.0
1506	3.0	9.9	59.4	59.3	233.6
1507	3.0	9.9	59.7	59.7	202.8
1508	3.0	9.8	59.5	59.5	217.1
1509	3.0	9.9	59.6	59.6	229.4
1510	3.0	9.9	59.8	59.7	230.6
1511	3.0	9.8	59.8	59.8	193.5
1512	3.0	9.8	60.0	60.0	210.7
1513	3.0	9.8	60.1	60.1	165.5
1514	3.0	9.8	59.9	59.9	216.4
1515	3.0	9.8	60.1	60.1	190.1
1516	3.0	9.8	60.3	60.4	161.8
1517	3.0	9.8	59.9	59.9	182.4
1518	3.0	9.8	60.1	60.2	198.3
1519	3.0	9.8	60.2	60.2	191.6
1520	3.0	9.8	60.4	60.4	203.2
1521	3.0	9.9	60.2	60.2	214.4
1522	3.0	9.8	60.1	60.2	204.1
1523	3.0	9.9	59.9	59.9	233.1
1524	3.0	9.9	59.6	59.5	239.8
1525	3.0	9.9	60.2	60.2	233.3
1526	3.0	9.9	60.0	60.0	228.1
1527	3.0	9.8	60.0	60.0	221.4
1528	3.0	9.9	60.1	60.1	216.9
1529	3.0	9.9	60.3	60.3	198.4
1530	3.0	9.9	60.0	60.0	188.9
1531	3.0	9.8	60.2	60.2	194.4
1532	3.0	9.8	60.2	60.2	204.3

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
1533	3.0	9.8	60.2	60.2	183.1	
1534	3.0	9.8	61.1	61.1	153.2	
1535	3.0	9.8	60.9	61.1	161.1	
1536	3.0	9.9	60.5	60.6	172.8	
1537	3.0	9.8	60.4	60.4	190.3	
1538	3.0	9.8	60.5	60.6	165.1	
1539	3.0	9.8	60.5	60.5	194.7	
1540	3.0	9.8	61.2	61.4	149.7	
1541	3.0	9.8	60.6	60.7	186.2	
1542	3.0	9.8	60.7	60.6	217.5	
1543	3.0	9.8	60.6	60.6	188.6	
1544	3.0	9.9	60.2	60.2	219.0	
1545	3.0	9.8	60.2	60.2	193.2	
1546	3.0	9.8	60.3	60.3	215.0	
1547	3.0	9.9	60.3	60.3	215.6	
1548	3.0	9.9	60.5	60.5	205.9	
1549	3.0	9.9	61.1	61.2	158.6	
1550	3.0	9.9	60.2	60.2	205.5	
1551	3.0	9.8	60.6	60.6	189.4	
1552	3.0	9.9	60.5	60.5	182.0	
1553	3.0	9.9	60.5	60.5	192.1	
1554	3.0	9.9	61.0	61.0	194.9	
1555	3.0	9.9	61.0	61.0	210.1	
1556	3.0	9.9	61.1	61.0	178.7	
1557	3.0	9.8	61.0	61.1	171.0	
1558	3.0	9.8	60.4	60.4	166.8	
END 1559	3.0 / 3.0	9.9 / 9.8	59.9 / 60.2	59.9	208.1 / 197.2	
1600	3.0	9.9	59.9	59.9	205.1	
1601	3.0	9.8	60.5	60.5	175.2	
1602	3.0	9.7	60.2	60.2	172.7	
1603	3.1	9.6	54.4	54.4	157.1	
1604	16.9	0.7	1.7	9.4	40.1	
1605	20.5	0.1	0.6	22.3	−0.4	
1606	20.5	0.1	0.5	22.4	−0.5	
1607	20.6	0.1	0.4	20.8	−0.9	
1608	19.5	0.1	0.3	15.0	0.6	
1609	1.8	0.0	0.2	0.2	7.0	
1610	0.1	0.0	0.2	0.1	−1.2	
1611	0.0	0.0	0.1	0.1	−1.2	
1612	0.0	0.0	0.1	0.1	−1.2	
1613	−0.0	−0.0	0.1	0.1	−1.1	zero bias
1614	0.2	0.0	0.1	0.1	−1.2	
1615	3.8	−0.0	0.1	0.1	−0.6	
1616	4.1	−0.0	0.1	0.1	−1.1	
1617	4.1	0.0	0.0	0.1	−1.1	mid bias
1618	2.8	4.9	0.1	0.1	−1.5	

full load, 22 march, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
1619	0.1	9.5	0.1	0.1	−1.8	
1620	−0.0	9.6	0.1	0.1	−1.8	
1621	−0.0	3.6	30.7	26.3	−1.6	
1622	−0.0	0.1	46.8	40.0	−1.3	
1623	−0.0	0.0	46.9	40.1	−1.3	
1624	−0.0	0.0	13.0	11.1	93.6	
1625	−0.0	−0.0	0.1	0.1	250.1	
1626	−0.0	−0.0	0.1	0.1	251.9	mid bias
1627	−0.0	−0.0	0.1	0.1	250.9	
1628	1.8	0.0	0.1	0.1	150.8	
1629	13.9	0.1	0.1	0.6	53.8	
1630	7.4	0.0	0.0	0.3	14.8	
1631	0.1	−0.0	−0.0	−0.0	−1.6	
1632	−0.0	−0.0	−0.0	−0.0	−1.6	
1633	−0.0	−0.2	−0.0	−0.0	−1.6	
1634	−0.0	−0.1	−0.0	−0.0	−1.6	zero
1635	2.7	8.1	41.0	41.1	126.7	
1636	4.1	9.7	47.5	50.7	251.7	mid
1637	5.4	13.3	62.7	73.9	289.3	
1638	9.0	17.7	90.7	136.0	451.7	
1639	9.1	17.7	91.8	139.2	457.0	high
1640	10.2	10.2	45.9	69.8	342.9	
1641	19.3	0.2	0.8	11.6	23.2	
1642	17.5	3.3	22.4	169.2	19.7	
1643	3.7	9.8	60.2	63.4	196.9	
1644	3.1	9.8	60.3	60.6	196.8	
1645	3.0	9.9	60.3	60.3	192.5	
1646	3.0	9.9	60.8	60.9	198.1	
1647	3.0	9.9	60.7	60.7	181.5	
1648	3.0	9.8	61.1	61.2	162.0	
1649	3.0	9.8	60.7	60.8	151.1	
1650	3.0	9.8	60.5	60.7	169.9	
1651	3.0	9.9	60.3	60.3	216.1	
1652	3.0	9.9	60.6	60.6	181.5	
1653	3.0	9.8	61.1	61.2	157.7	
1654	3.0	9.8	61.1	61.1	164.6	
1655	3.0	9.8	60.8	60.9	159.1	
1656	3.0	9.8	60.4	60.4	193.0	
1657	3.0	9.8	60.7	60.8	166.2	
1658	3.0	9.9	60.6	60.7	156.2	
1659	3.0	9.9	60.7	60.6	166.6	
1700	3.0	9.8	61.2	61.3	142.0	
1701	3.0	9.8	60.7	60.8	164.8	
1702	3.2	9.2	54.6	54.7	173.3	
1703	17.8	0.4	1.5	11.3	52.5	
1704	20.4	0.1	0.7	22.9	0.6	

mid load, 23 March, 1994

time	O_2 (%)	CO_2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
642	8.09	17.11	91.9	78.7	326.6	
643	8.8	17.24	93.6	138.1	438.4	
644	9.06	17.27	94.2	142.3	444.7	
645	9.08	17.29	94.2	142.6	444.4	
646	9.08	17.32	94.2	142.7	444.5	
647	9.09	17.31	94.2	142.8	445.1	
648	9.09	17.3	94.2	142.7	444.8	
649	9.09	17.3	93.8	142.1	445.2	
650	9.08	17.01	93.7	142	449.1	
651	7.51	11.67	57.63	87.1	409.1	
652	0.423	0.002	−1.043	−0.914	18.79	
653	0.065	0	−1.129	−0.97	−1.024	
654	0.04	0.022	−1.151	−0.988	−1.393	
655	0.026	0.136	−1.167	−1.001	−1.067	zero
656	1.964	5.699	37.55	36.4	122.2	
657	4.152	9.59	48.01	51.3	249.4	
658	4.203	11.71	48.02	51.48	250	
659	4.207	14.62	48.16	51.64	248.8	
700	4.207	9.61	48.17	51.65	250.2	mid
701	6.825	16.42	85.4	111	353.6	
702	9.09	17.72	94.2	142.6	453.2	
703	9.14	17.76	94.3	143.5	451.2	
704	9.15	17.74	82.5	125.6	453.1	
705	9.15	17.68	37.18	56.64	451.2	high
706	9.15	17.62	−1.139	−1.734	387.3	
707	11.49	4.509	37.99	82.7	20.54	zero
708	5.736	9.22	47.99	59.96	118.3	mid
709	3.761	9.43	81	84.6	134.6	
710	3.7	9.45	93.8	97.6	187.7	
711	3.669	9.45	93.8	97.5	168.8	high
712	4.629	7.62	43.54	45.29	138.3	
713	9.06	7.74	34.47	61.15	142.6	
714	8.85	4.513	18.97	19.47	105.1	
715	6.9	0.105	−0.866	−2.116	2.264	
716	0.215	0.022	−1.025	−0.887	−1.475	
717	0.082	0.011	−1.083	−0.932	−1.504	
718	0.065	0.018	−1.138	−0.977	−1.523	zero bias
719	4.974	4.907	−1.145	−1.389	−1.147	
720	0.431	9.59	−1.152	−1.011	−2.043	
721	0.077	2.123	−1.152	−0.991	104.9	
722	0.059	0.034	−1.159	−0.996	248.9	
723	0.054	0.036	−1.211	−1.04	248.5	
724	0.063	0.025	41.58	35.72	113.8	
725	0.076	0.022	47.19	40.56	−1.047	Mid Bias
726	3.022	0.031	6.456	5.404	−1.076	
727	5.177	0.022	−1.118	−1.273	−1.149	

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
728	5.28	0.054	−1.152	−1.32	−1.135
729	5.305	0.025	−1.153	−1.324	−1.398
730	5.279	1.329	4.983	5.678	−1.072
731	3.926	9.44	41.47	43.85	95.4
732	3.685	9.47	41.49	43.14	122.5
733	3.697	9.47	41.65	43.33	140.7
734	3.697	9.47	41.77	43.46	137.3
735	3.718	9.42	41.45	43.18	124
736	5.552	0.398	−0.049	−0.14	60.83
737	4.219	0.074	−0.911	−0.977	−0.98
738	4.181	0.063	−1.013	−1.085	−1.474
739	4.779	0.123	−0.873	−0.912	−1.223
740	7.05	8.46	39.08	53.98	65.59
741	3.784	9.44	41.95	43.89	137
742	3.702	9.46	41.43	43.12	154.9
743	3.707	9.46	41.68	43.39	130.2
744	3.732	9.51	41.77	43.55	126.4
745	3.706	9.49	41.33	43.03	117.9
746	3.702	9.46	41.27	42.95	158.9
747	3.682	9.48	41.66	43.31	161.4
748	3.689	9.52	41.75	43.42	109.2
749	3.669	9.48	42.03	43.66	163
750	3.664	9.49	41.98	43.6	125.9
751	3.636	9.49	41.4	42.93	141.6
752	3.642	9.53	41.76	43.31	186
753	3.665	9.51	41.62	43.24	127.4
754	3.653	9.49	42.02	43.61	162.5
755	3.657	9.5	41.89	43.49	143
756	3.639	9.52	41.71	43.26	132.2
757	3.608	9.58	41.76	43.23	166.7
758	3.63	9.55	41.69	43.21	146
759	3.59	9.57	41.73	43.15	200
800	3.601	9.54	41.3	42.73	176
801	3.594	9.57	41.24	42.65	210.1
802	3.615	9.55	41.41	42.88	183.5
803	3.619	9.55	41.51	43	131.7
804	3.619	9.55	41.34	42.82	152.2
805	3.621	9.56	41.57	43.07	173
806	3.621	9.55	41.75	43.25	132.5
807	3.626	9.51	41.75	43.26	160.4
808	3.635	9.56	41.71	43.24	156.9
809	8.98	4.788	17.83	18.15	106.1
810	19.33	1.695	8.1	102.2	3.61
811	5.482	9.46	41.25	50.57	178
812	3.719	9.56	41.88	43.65	173.8
813	3.672	9.55	41.92	43.56	155.7

Mid Bias (4.181)

Port A

Center =

A-1 =

A-2 =

A-3 =

A-4 =

center =

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	PORT D
814	3.647	9.57	41.98	43.55	171.7	
815	3.637	9.57	41.65	43.2	204.3	Center =
816	3.64	9.49	41.58	43.13	187.8	
817	3.605	9.57	41.2	42.64	207.8	
818	3.653	9.52	41.59	43.16	193	
819	3.647	9.56	41.47	43.03	125.2	
820	3.622	9.58	41.26	42.75	183.6	D-1 =
821	3.644	9.49	41.45	43	187	
822	3.618	9.59	41.77	43.26	125.2	
823	3.628	9.58	41.82	43.33	151.6	D-2 =
824	3.639	9.58	41.77	43.32	171.9	
825	3.592	9.56	41.35	42.77	164.9	
826	3.607	9.59	41.42	42.87	177.2	
827	3.612	9.58	41.12	42.57	147.7	
828	3.619	9.59	41.31	42.79	134.6	D-3 =
829	3.613	9.59	41.29	42.75	149.2	
830	3.614	9.47	41.4	42.87	136.5	
831	3.606	9.59	41.61	43.06	151.9	
832	3.612	9.59	41.47	42.94	148.3	
833	3.629	9.59	41.32	42.82	145.2	D-4 =
834	3.571	9.6	40.88	42.23	184.3	
835	3.601	9.42	41.13	42.56	181.7	
836	3.632	9.57	41.43	42.94	169.8	
837	3.643	9.59	41.31	42.85	135.7	Center =
838	3.66	9.58	41.2	42.78	152.9	
839	3.633	9.59	40.94	42.44	175.6	
840	3.617	9.54	41.27	42.74	149.6	
841	6.005	6.79	26.58	27.57	140.6	
842	19.61	0.244	−0.432	−9.28	9.3	
843	20.51	0.206	−0.499	−22.97	−0.506	
844	16.74	3.956	18.71	140.9	18.12	PORT C
845	4.341	9.57	41.63	45.33	125	
846	3.711	9.58	41.28	42.99	178.2	
847	3.674	9.58	41.37	42.99	175.7	
848	3.684	9.57	41.54	43.19	142.3	Center =
849	3.642	9.59	41.78	43.34	132.9	
850	3.634	9.56	41.75	43.29	145.7	
851	3.648	9.6	41.59	43.15	164.7	
852	3.604	9.61	41.16	42.59	191	C-1 =
853	3.643	9.59	41.41	42.95	192.6	
854	3.636	9.59	41.54	43.08	156.5	
855	3.636	9.62	41.71	43.25	170.5	
856	3.642	9.59	41.6	43.15	162.7	
857	3.635	9.6	41.36	42.89	140.2	C-2 =
858	3.62	9.6	41.95	43.45	185.3	
859	3.659	9.6	41.84	43.44	128	

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
900	3.64	9.6	41.49	43.03	165.9	
901	3.608	9.6	41.27	42.72	187.8	
902	3.619	9.6	41.11	42.58	150.3	C-3 =
903	3.614	9.55	41.24	42.71	163.4	
904	3.628	9.59	41.07	42.56	161.6	
905	3.621	9.59	41.16	42.63	141.6	
906	3.617	9.62	41.26	42.74	148.9	
907	3.603	9.61	41.12	42.55	173.3	C-4 =
908	3.601	9.56	41.06	42.48	197.5	
909	3.611	9.56	41.34	42.8	169	
910	3.616	9.61	41.18	42.64	183.7	
911	3.606	9.6	41.25	42.7	215.1	Center =
912	3.647	9.59	41.55	43.11	167.2	
913	3.629	9.6	41.81	43.33	169	
914	3.642	9.6	41.46	43	114.6	
915	13.31	2.364	6.595	5.344	60.94	
916	19.82	1.373	6.714	97.7	0.855	
917	6.256	9.04	39.15	51.78	108.5	PORT B
918	3.907	9.59	41.33	43.66	149	
919	3.659	9.6	41.5	43.09	154.5	
920	3.627	9.6	41.09	42.58	180.4	Center =
921	3.614	9.59	41.33	42.8	219	
922	3.603	9.61	41.08	42.51	178.4	
923	3.62	9.61	41.22	42.7	157.7	
924	3.606	9.61	41.1	42.54	147.1	
925	3.593	9.63	40.83	42.23	189.5	B-1 =
926	3.606	9.63	41.2	42.64	173.1	
927	3.625	9.59	41.32	42.82	139.7	
928	3.617	9.6	41.35	42.83	144.6	
929	3.606	9.62	41.02	42.46	170.5	B-2 =
930	3.602	9.58	41.23	42.67	164.8	
931	3.595	9.63	41.33	42.75	187.1	
932	3.585	9.64	41.16	42.55	161.9	
933	3.578	9.6	41.43	42.8	213.4	B-3 =
934	3.581	9.57	41.23	42.61	195.8	
935	3.609	9.6	41.7	43.17	170.1	
936	3.652	9.61	41.8	43.38	137.2	
937	3.633	9.6	41.75	43.28	159.7	B-4 =
938	3.625	9.6	41.94	43.46	176.8	
939	3.673	9.61	42.1	43.74	131.2	
940	3.672	9.59	41.73	43.36	134	
941	3.645	9.59	41.55	43.11	159.4	
942	3.621	9.61	41.62	43.11	163.4	Center =
943	3.64	9.6	41.75	43.3	148.1	
944	3.62	9.59	41.62	43.11	144.9	
945	4.34	8.31	33.03	34.25	130	

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
946	18.67	0.344	−0.172	−3.592	22.18	
947	20.42	0.293	−0.316	−11.8	0.222	
948	9.08	0.15	−0.524	−5.737	−0.556	
949	0.268	0.072	−0.601	−0.522	−1.497	
950	0.071	0.132	−0.673	−0.579	−1.547	
951	0.042	0.143	−0.7	−0.601	−1.598	zero bias
952	1.886	4.734	−0.742	−0.708	−1.619	
953	0.183	9.72	−0.765	−0.661	−1.974	
954	0.037	2.742	−0.801	−0.687	97.1	
955	0.025	0.145	−0.813	−0.697	249.9	
956	0.018	0.134	−0.812	−0.696	249.7	mid bias
957	0.013	0.134	40.61	34.8	115.3	
958	0.003	0.134	46.74	40.04	−1.044	
959	2.11	0.134	12.22	10.42	−1.178	
1000	4.094	0.134	−0.722	−0.769	−1.465	
1001	4.145	0.134	−0.77	−0.823	−1.466	
1002	4.151	0.152	−0.81	−0.865	−1.532	
1003	1.351	0.179	−0.827	−0.76	−0.128	
1004	0.005	0.121	−0.883	−0.757	−1.545	
1005	−0.033	0.119	−0.878	−0.75	−1.599	
1006	−0.044	0.127	−0.879	−0.751	−1.618	zero
1007	5.524	14.69	75.8	94.9	241.1	
1008	9.04	17.96	92.5	139.5	454.4	
1009	9.11	18.05	92.6	140.6	454.6	
1010	9.12	17.94	92.6	140.7	454	
1011	9.13	17.96	92.6	140.8	453.7	high
1012	6.157	11.08	55.24	71.1	354.1	
1013	4.232	9.86	47.52	51.05	251.4	
1014	4.194	9.86	47.46	50.86	251.7	
1015	4.187	9.86	47.43	50.8	250.9	mid
1016	4.21	8.75	44.22	47.36	248.8	
1017	14.8	0.335	0.717	3.142	46.32	
1018	17.88	0.273	0.094	0.41	4.385	
1019	19.59	0.282	−0.216	−3.565	0.743	
1020	19.93	0.268	−0.612	−11.27	−0.071	
1021	10.27	8.11	36.25	114.4	75.7	
1022	3.878	9.6	41.09	43.26	138.6	
1023	3.71	9.63	41.16	42.86	142.4	
1024	3.686	9.46	41.13	42.77	138.3	
1025	3.688	9.6	41.37	43.03	136.6	
1026	3.659	9.65	41.42	43	154	
1027	3.663	9.6	41.38	42.98	129.4	
1028	3.625	9.66	41.54	43.04	137.6	
1029	3.672	9.65	42.23	43.87	117.7	
1030	3.662	9.61	41.69	43.29	134.8	
1031	3.651	9.66	41.13	42.68	118.6	

Start baseline

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1032	3.629	9.67	41.3	42.81	126.8
1033	3.635	9.67	41.21	42.73	168.6
1034	3.641	9.66	41.68	43.22	133.6
1035	3.625	9.68	41.6	43.11	137.3
1036	3.622	9.66	41.76	43.26	116
1037	3.593	9.69	41.54	42.96	163.8
1038	3.593	9.71	41.21	42.63	151.5
1039	3.593	9.71	40.69	42.09	155.4
1040	3.562	9.72	40.81	42.14	193.4
1041	3.599	9.7	41.15	42.57	111.2
1042	3.586	9.7	41.48	42.88	137.1
1043	3.593	9.69	41.7	43.12	133.9
1044	3.613	9.67	41.41	42.88	124
1045	3.611	9.69	41.26	42.72	150.7
1046	3.59	9.72	41.26	42.67	182.7
1047	3.604	9.69	41.43	42.88	173.3
1048	3.607	9.71	41.47	42.92	170.3
1049	3.609	9.68	41.33	42.78	173.1
1050	3.622	9.68	41.53	43.02	119.6
1051	3.629	9.69	41.41	42.92	112.2
1052	3.599	9.7	41.49	42.92	165.2
1053	3.607	9.69	41.5	42.95	151.9
1054	3.628	9.68	41.64	43.15	118.7
1055	3.62	9.69	41.47	42.96	123.3
1056	3.614	9.7	41.47	42.95	186
1057	3.629	9.68	41.63	43.14	125.4
1058	3.609	9.7	41.82	43.3	175.1
1059	3.63	9.68	42.09	43.62	131.4
1100	3.63	9.69	41.93	43.46	129.6
1101	3.608	9.69	41.9	43.37	125.6
1102	3.589	9.69	41.65	43.07	146.3
1103	3.61	9.68	41.9	43.37	135.1
1104	3.606	9.71	41.94	43.41	156.1
1105	3.595	9.69	41.84	43.29	123.4
1106	3.595	9.72	41.64	43.08	163.2
1107	3.615	9.69	41.83	43.32	148.1
1108	3.606	9.68	41.88	43.34	173.3
1109	3.639	9.67	41.85	43.4	135.2
1110	3.623	9.7	41.69	43.2	138.4
1111	3.615	9.7	41.57	43.05	174.9
1112	3.61	9.71	41.7	43.17	171.7
1113	3.646	9.69	41.69	43.25	161.9
1114	3.615	9.7	41.67	43.14	134.1
1115	3.633	9.69	41.76	43.3	114.6
1116	3.657	9.67	42.08	43.67	166.2
1117	3.647	9.69	41.97	43.55	147.8

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	Notes
1118	3.651	9.69	42.06	43.65	128.8	
1119	3.639	9.68	41.9	43.46	151.7	
1120	3.657	9.65	42.12	43.73	177.1	
1121	3.639	9.69	42.13	43.68	126.5	
1122	3.636	9.69	41.78	43.33	142.6	
1123	3.649	9.67	41.83	43.41	131.7	
1124	3.639	9.71	41.88	43.43	110.6	
1125	3.63	9.68	41.8	43.32	116	
1126	3.648	9.69	41.96	43.54	144.7	
1127	3.644	9.7	41.92	43.49	132.3	
1128	3.634	9.7	41.76	43.29	166.9	
1129	3.632 / 3.6	9.7 / 9.7	41.92 / 41.6	43.45	171.6 / 145.2	
1130	3.655	9.72	42.38	43.99	160.1	END
1131	3.677	9.64	42.24	43.9	119.9	
1132	3.665	9.5	40.13	41.66	157.6	
1133	10.33	0.588	0.752	1.022	47.01	
1134	1.073	0.197	−0.177	−0.16	−1.351	
1135	1.469	0.197	−0.243	−0.224	−1.248	
1136	0.147	0.197	−0.358	−0.309	−1.565	
1137	0.011	0.177	−0.443	−0.379	−1.433	
1138	−0.004	0.183	−0.478	−0.409	−1.562	zero bias
1139	0.433	5.495	−0.483	−0.423	−1.642	
1140	0.015	9.79	−0.493	−0.423	−2.049	
1141	−0.012	1.956	−0.498	−0.426	119.9	
1142	−0.019	0.201	−0.528	−0.452	250.6	mid bias
1143	−0.017	0.197	38.34	32.81	127.7	
1144	−0.019	0.212	46.45	39.75	−0.899	
1145	2.554	0.201	6.062	5.151	−1.187	
1146	4.097	0.194	−0.458	−0.488	−1.233	
1147	4.13	0.206	−0.506	−0.54	−1.484	
1148	2.037	0.203	−0.559	−0.534	0.153	
1149	0.01	0.17	−0.607	−0.521	−1.531	
1150	−0.04	0.145	−0.61	−0.521	−1.558	
1151	−0.05	0.134	−0.603	−0.515	−1.631	zero
1152	2.164	7.74	36.2	35.72	104.5	
1153	4.122	9.92	47.11	50.25	251	
1154	4.164	9.93	47.12	50.39	251.4	
1155	4.17	9.93	47.09	50.39	251.7	mid
1156	7.06	16.49	82	108.6	360.5	
1157	9.09	18.08	91.9	139.2	455.6	
1158	9.13	18.09	91.9	139.8	454.7	high
1159	13.76	3.791	15.38	24.06	208.1	
1200	12.43	6.002	19.09	50.71	70.7	
1201	3.87	9.66	30.18	31.76	296.8	
1202	3.696	9.73	30.75	32	175.2	
1203	3.681	9.69	30.81	32.03	136.4	

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1204	3.657	9.69	30.53	31.7	186.7
1205	3.647	9.71	30.65	31.8	138.9
1206	3.681	9.68	30.79	32	141.1
1207	3.683	9.67	30.93	32.16	114.9
1208	3.667	9.7	30.56	31.75	167.5
1209	3.66	9.71	30.62	31.8	155.8
1210	3.649	9.69	30.43	31.57	190.4
1211	3.636	9.71	30.42	31.54	155.8
1212	3.655	9.68	30.42	31.57	142.1
1213	3.643	9.71	30.43	31.56	136.7
1214	3.628	9.73	30.03	31.12	169.1
1215	3.65	9.68	30.29	31.43	154.2
1216	3.66	9.59	30.39	31.56	113.7
1217	3.662	9.52	30.44	31.61	116
1218	3.626	9.74	30.23	31.33	107.6
1219	3.649	9.72	30.09	31.22	113.2
1220	3.628	9.72	30.09	31.19	116
1221	3.61	9.75	30.15	31.22	142.5
1222	3.638	9.71	30.1	31.21	99.7
1223	3.615	9.74	29.95	31.02	104
1224	3.587	9.74	29.61	30.62	172.6
1225	3.61	9.73	29.87	30.92	136.2
1226	3.614	9.73	29.69	30.74	129.6
1227	3.623	9.75	30	31.08	175
1228	3.624	9.74	30.35	31.45	128.1
1229	3.618	9.75	30.26	31.34	133
1230	3.606	9.81	29.96	31.01	123.9
1231	3.608	9.73	29.61	30.66	161.9
1232	3.592	9.75	29.94	30.96	169.6
1233	3.6	9.77	29.81	30.84	156.1
1234	3.648	9.72	30.36	31.5	126.3
1235	3.598	9.73	30.05	31.09	127.2
1236	3.605	9.75	30.16	31.21	170.5
1237	3.606	9.74	29.93	30.98	154.5
1238	3.621	9.72	29.68	30.74	149.3
1239	3.601	9.74	29.59	30.62	191.8
1240	3.599	9.76	29.6	30.63	137.5
1241	3.593	9.76	29.76	30.78	149
1242	3.617	9.74	30.17	31.25	120.2
1243	3.642	9.71	30.25	31.37	110.7
1244	3.655	9.73	29.84	30.98	121.9
1245	3.6	9.76	29.63	30.66	147.2
1246	3.629	9.72	29.86	30.94	148.6
1247	3.635	9.73	30.19	31.3	111
1248	3.648	9.71	30.28	31.41	128.2
1249	3.678	9.71	30.41	31.61	100.1

START GR ON

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1250	3.628	9.73	30.1	31.19	112.5
1251	3.645	9.69	29.96	31.08	129.5
1252	3.609	9.72	29.97	31.02	138
1253	3.62	9.74	29.91	30.99	140.8
1254	3.609	9.74	29.78	30.83	138
1255	3.576	9.78	29.87	30.87	156.9
1256	3.618	9.76	29.93	31	166.3
1257	3.614	9.74	30.26	31.33	155.8
1258	3.621	9.77	30.02	31.1	126.7
1259	3.606	9.79	30.25	31.31	134
1300	3.631	9.77	30.14	31.24	129.6
1301	3.582	9.77	29.43	30.43	212.9
1302	3.613	9.75	30.14	31.21	145.2
1303	3.615	9.77	29.97	31.04	109.3
1304	3.606	9.77	29.84	30.89	147.2
1305	3.605	9.77	29.5	30.54	156.1
1306	3.579	9.78	29.79	30.79	156.1
1307	3.6	9.77	29.87	30.9	158.9
1308	3.618	9.78	30.32	31.41	182.6
1309	3.633	9.77	30.48	31.59	123.8
1310	3.652	9.78	30.36	31.5	101.2
1311	3.585	9.8	29.9	30.91	149.3
1312	3.573	9.8	29.72	30.7	175.3
1313	3.606	9.79	30.09	31.14	158.5
1314	3.645	9.79	30.34	31.47	123.2
1315	3.628	9.79	30.1	31.19	135.6
1316	3.629	9.78	30.06	31.15	196.6
1317	3.603	9.8	30.13	31.18	139.1
1318	3.636	9.79	30.5	31.62	159.2
1319	3.606	9.8	30.31	31.37	133.8
1320	3.638	9.21	30.38	31.5	142.6
1321	3.635	9.77	29.96	31.07	137.9
1322	3.621	9.79	30.29	31.38	200.6
1323	3.636	9.79	30.1	31.21	135.6
1324	3.649	9.78	30.08	31.21	113.1
1325	3.627	9.79	29.73	30.81	181.7
1326	3.657	9.78	30.2	31.35	195.5
1327	3.656	9.78	30.47	31.63	127.7
1328	3.655	9.78	30.49	31.65	111.8
1329	3.655/3.6	9.79/9.8	30.3/30.0	31.45	121.5/144.4
1330	3.631	9.79	30.17	31.27	175.1
1331	3.645	9.84	30.15	31.27	142.4
1332	3.627	9.8	30.1	31.19	116.4
1333	12.71	2.28	5.151	6.791	73.1
1334	1.765	0.237	0.105	0.115	−0.983
1335	0.052	0.206	−0.073	−0.063	−1.137

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1336	0.003	0.201	−0.146	−0.125	−1.195
1337	−0.01	0.201	−0.19	−0.162	−1.424
1338	1.009	3.929	−0.19	−0.172	−1.402
1339	0.109	9.83	−0.203	−0.175	−1.997
1340	−0.01	9.88	−0.21	−0.18	−1.767
1341	0.216	2.912	−0.203	−0.176	94.6
1342	−0.018	0.237	−0.209	−0.179	251.3
1343	−0.026	0.201	−0.221	−0.189	252.2
1344	−0.028	0.206	−0.24	−0.206	251.3
1345	−0.027	0.201	41.49	35.49	109.5
1346	−0.03	0.203	46.14	39.46	−1.038
1347	−0.031	0.223	46.15	39.47	−1.1
1348	0.993	0.206	25.63	21.92	−1.068
1349	4.006	0.201	−0.071	−0.076	−1.117
1350	4.118	0.201	−0.147	−0.157	−1.422
1351	4.13	0.203	−0.176	−0.188	−1.187
1352	1.427	0.235	−0.214	−0.196	−0.836
1353	−0.013	0.201	−0.263	−0.225	−1.577
1354	−0.046	0.199	−0.254	−0.217	−1.548
1355	1.178	4.635	24.54	23.43	44.92
1356	4.079	9.97	46.8	49.76	248.2
1357	4.165	9.91	46.8	50.06	253
1358	4.173	9.9	46.8	50.08	252.6
1359	6.944	16.13	78.4	103.6	348.3
1400	9.1	18.1	90.9	137.8	457.2
1401	9.14	18.1	90.9	138.4	455.8
1402	9.15	18.1	90.8	138.3	456.4
1403	5.265	10.7	30.92	38.22	290.9
1404	3.668	9.61	25.65	26.66	211.1
1405	3.645	9.57	25.79	26.76	115.9
1406	3.653	9.75	25.75	26.73	93.2
1407	3.661	9.73	25.76	26.74	139.7
1408	3.65	9.75	25.92	26.89	136.3
1409	3.656	9.58	25.88	26.87	112.8
1410	3.665	9.69	25.87	26.86	135.5
1411	3.654	9.64	26.01	27	132.3
1412	3.643	9.73	25.97	26.94	96.1
1413	3.653	9.76	25.89	26.86	140.6
1414	3.643	9.77	25.87	26.84	163.8
1415	3.648	9.7	25.85	26.82	109.1
1416	3.656	9.74	25.96	26.95	144.3
1417	3.669	9.72	25.85	26.86	90.7
1418	3.652	9.77	25.68	26.65	120.7
1419	3.647	9.78	25.72	26.69	130.5
1420	3.634	9.75	26.09	27.04	135.5
1421	3.664	9.76	26.14	27.15	124.9

zero bias

mid bias

zero

mid

high

FGR and Urea ON

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1422	3.661	9.77	25.94	26.93	121.3
1423	3.63	9.78	25.76	26.7	144.7
1424	3.634	9.79	25.53	26.48	159.7
1425	3.616	9.78	25.47	26.38	193.4
1426	3.614	9.78	25.58	26.5	163.1
1427	3.627	9.76	25.64	26.56	152
1428	3.641	9.77	25.93	26.89	136.1
1429	3.634	9.78	25.84	26.79	105.4
1430	3.602	9.79	25.84	26.74	136.1
1431	3.637	9.78	25.75	26.7	145.4
1432	3.616	9.79	25.79	26.71	152.9
1433	3.626	9.78	25.74	26.67	131.2
1434	3.614	9.78	25.73	26.64	128.9
1435	3.593	9.78	25.7	26.58	120.9
1436	3.612	9.78	25.67	26.58	143.7
1437	3.599	9.79	25.61	26.5	146.2
1438	3.621	9.79	25.71	26.64	128.1
1439	3.592	9.79	25.74	26.62	135.3
1440	3.603	9.79	25.67	26.56	162.8
1441	3.6	9.78	25.77	26.66	144.8
1442	3.621	9.77	25.73	26.66	199.7
1443	3.628	9.78	25.78	26.71	120.1
1444	3.605	9.78	25.57	26.46	134.8
1445	3.59	9.81	25.58	26.46	140
1446	3.586	9.81	25.75	26.61	157.9
1447	3.65	9.67	25.83	26.81	90.4
1448	3.611	9.82	25.84	26.76	116.6
1449	3.626	9.81	26.02	26.96	110.6
1450	3.623	9.81	25.89	26.82	120.8
1451	3.623	9.83	25.76	26.68	146.5
1452	3.618	9.82	25.79	26.71	228.3
1453	3.636	9.8	25.96	26.92	146.2
1454	3.648	9.81	26.04	27.02	130.5
1455	3.652	9.79	25.97	26.95	168.9
1456	3.653	9.81	26.03	27.02	97.1
1457	3.636	9.83	26.08	27.05	154.8
1458	3.647	9.8	26.07	27.04	107.5
1459	3.619	9.82	26.04	26.97	173.4
1500	3.646	9.81	26.12	27.1	154.5
1501	3.617	9.82	26.07	27.01	163.4
1502	3.623	9.84	25.83	26.77	124.9
1503	3.6	9.83	25.69	26.58	188.1
1504	3.599	9.83	25.66	26.55	173.9
1505	3.618	9.81	25.8	26.72	175.8
1506	3.627	9.83	25.77	26.7	164.2
1507	3.643	9.83	25.93	26.9	127

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
1508	3.646	9.81	25.65	26.61	145.5	
1509	3.619	9.83	25.66	26.58	185.3	
1510	3.635	9.81	25.64	26.58	162	
1511	3.629	9.83	25.85	26.79	130.2	
1512	3.639	9.84	25.89	26.85	137.2	
1513	3.664	9.79	26.04	27.05	100.6	
1514	3.624	9.85	25.74	26.67	142.8	
1515	3.625	9.87	25.92	26.86	137.4	
END 1516	3.636 / 3.6	9.87 / 9.8	25.83 / 25.8	26.78	126.2 / 142.3	
1517	3.635	9.85	25.9	26.85	142.2	
1518	3.64	9.77	25.77	26.72	145	
1519	3.64	9.72	25.38	26.32	112.7	
1520	3.755	0.501	0.274	0.314	52.14	
1521	0.064	0.259	−0.082	−0.071	−1.049	
1522	0.006	0.226	−0.104	−0.089	−1.063	
1523	−0.008	0.241	−0.104	−0.089	−1.153	zero bias
1524	0.012	7.85	−0.117	−0.101	−1.75	
1525	−0.021	9.92	−0.132	−0.113	−1.593	
1526	−0.026	1.455	−0.119	−0.101	133.8	
1527	−0.03	0.288	−0.121	−0.103	250.8	mid bias
1528	−0.028	0.221	33.65	28.78	149.3	
1529	−0.031	0.215	45.71	39.09	−0.703	
1530	2.602	0.226	6.286	5.388	−1.171	
1531	4.101	0.21	−0.046	−0.049	−1.236	
1532	4.13	0.217	−0.088	−0.094	−1.166	
1533	1.894	0.215	−0.121	−0.115	−1.205	
1534	−0.007	0.179	−0.152	−0.13	−1.567	
1535	−0.047	0.201	−0.149	−0.127	−1.608	
1536	−0.056	0.201	−0.121	−0.103	−1.67	zero
1537	2.213	7.22	35.3	35.04	102.6	
1538	4.138	10.06	46.78	49.94	252.7	mid
1539	4.176	10.05	46.8	50.09	253	
1540	5.929	16.06	77.6	95	345.2	
1541	9.08	18.19	90.9	137.5	457.8	
1542	9.15	18.17	90.9	138.5	455.8	
1543	9.16	18.18	90.9	138.6	457.9	high
1544	9.14	17.71	91.9	139.9	454.8	
1545	17.66	1.734	3.457	8.14	169.7	
1546	20.54	0.333	0.112	5.555	−0.564	
1547	20.55	0.337	0.13	6.686	−0.486	
1548	20.58	0.333	0.052	2.792	−0.498	
1549	20.62	0.311	−0.005	−0.285	−0.565	
1550	20.64	0.313	−0.043	−2.98	−1.123	
1551	20.65	0.282	−0.05	−3.569	−1.153	
1552	20.65	0.295	−0.054	−3.962	−1.17	
1553	20.66	0.286	−0.055	−4.037	−1.145	

mid load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1554	20.66	0.279	−0.042	−3.06	−1.176
1555	20.65	0.288	−0.025	−1.747	−0.763
1556	20.65	0.317	−0.038	−2.743	−0.602
1557	20.66	0.277	−0.05	−3.718	−1.174
1558	20.66	0.259	−0.044	−3.279	−1.182
1559	20.64	0.317	−0.016	−1.029	−0.628
1600	20.66	0.295	−0.054	−4.033	−0.992
1601	20.66	0.317	−0.053	−3.949	−0.896
1602	20.66	0.326	−0.045	−3.352	−0.8
1603	20.66	0.313	−0.059	−4.44	−1.068
1604	20.66	0.328	−0.053	−4.023	−1.1
1605	20.67	0.311	−0.055	−4.237	−1.111
1606	20.63	0.324	0.044	3.147	−0.635
1607	20.66	0.29	−0.024	−1.804	−1.181
1608	20.65	0.326	0.001	0.121	−0.949
1609	20.65	0.317	−0.015	−1.031	−1.069

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
1922	9.16	17.56	92.2	79	453.2
1923	9.16	17.61	92.5	141	450.5
1924	6.232	9.07	38.31	58.66	320
1925	0.208	0.201	−0.13	−0.112	2.463
1926	0.055	0.179	−0.19	−0.163	−1.59
1927	0.036	−0.051	−0.213	−0.183	−1.621
1928	0.026	−0.06	−0.228	−0.196	−1.653
1929	1.937	6.141	32.55	32.06	78.3
1930	4.164	9.32	47.52	50.8	248.6
1931	4.204	9.37	47.5	50.93	249.2
1932	4.206	9.36	47.5	50.93	250
1933	16.37	0.574	0.612	−0.785	87.7
1934	20.64	0.067	−0.191	−13.51	−1.008
1935	20.69	0.06	−0.22	−18.73	−0.992
1936	20.69	0.065	−0.23	−19.83	−0.776
1937	20.69	0.058	−0.256	−22.01	−0.454
1938	20.7	0.067	−0.268	−24.17	−1.09
1939	20.69	0.067	−0.263	−22.93	−0.949
1940	20.7	0.067	−0.278	−24.3	−1.066
1941	20.69	0.009	−0.284	−24.79	−1.144
1942	17.05	0.02	−0.305	−18.04	−1.162
1943	0.771	−0.054	−0.336	−0.302	−1.624
1944	0.084	−0.058	−0.349	−0.3	−1.617
1945	0.042	−0.067	−0.37	−0.318	−1.553
1946	0.027	−0.047	−0.375	−0.321	−1.528
1947	2.692	7.84	41.93	41.92	129.9
1948	4.178	9.37	47.53	50.87	249.2
1949	4.199	9.37	47.55	50.96	249.8
1950	4.201	9.36	47.57	50.99	249
1951	6.799	15.46	81.3	106.2	339.8
1952	9.1	3.768	92.8	140.7	449.6
1953	9.14	−0.065	91.7	139.5	449.5
1954	9.15	6.838	0.053	0.081	450.4
1955	9.15	11.27	26.55	40.45	374.9
1956	18.33	17.63	47.48	1024	10.45
1957	20.69	17.66	80.3	6986	−1.113
1958	20.72	0.784	92.3	6999	−1.062
1959	20.71	0.065	92.2	6999	−1.133
2000	20.69	0.067	0.739	63.82	−1.095
2001	20.69	0.049	−0.345	−29.37	−1.065
2002	20.69	0.065	−0.365	−30.89	−1.114
2003	20.69	0.067	−0.396	−33.61	−1.125
2004	20.69	0.065	−0.424	−35.99	−1.04
2005	20.69	0.063	−0.42	−35.66	−1.118
2006	20.69	0.065	−0.426	−36.15	−1.134
2007	20.69	0.067	−0.435	−37.2	−1.089

zero (1946) · mid (1950) · high (1954) · z (1953 CO2, 1954 NOx) · mid (1956) · high (1958)

no: CO2 mid data logger value

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
2008	20.63	0.067	−0.461	−32.84	−0.853	
2009	20.61	0.063	−0.457	−28.88	−0.964	
2010	20.48	0.058	−0.448	−31.89	−1.118	
2011	3.198	0.027	−0.478	−0.589	−1.376	
2012	0.195	−0.042	−0.494	−0.428	−1.521	
2013	0.109	−0.038	−0.494	−0.426	−1.586	
2014	0.085	0.022	−0.487	−0.418	−1.616	
2015	0.073	0.009	−0.508	−0.437	−1.538	
2016	0.068	0.034	−0.508	−0.437	−1.556	zero bias
2017	0.899	−0.02	11.62	11.52	−1.541	
2018	1.26	0.007	44.59	40.73	−1.63	
2019	0.259	0.009	47.1	40.92	−1.628	
2020	0.054	0	47.17	40.51	−1.638	
2021	0.046	2.519	34.3	29.44	−1.555	
2022	0.042	9.56	−0.388	−0.333	−1.95	
2023	0.041	4.638	−0.478	−0.41	38.72	mid bias
2024	0.035	0.047	−0.514	−0.441	241.8	
2025	0.033	0.022	−0.526	−0.451	247.6	
2026	3.12	0.02	−0.536	−0.539	90.2	
2027	4.169	0.018	−0.544	−0.582	−1.145	
2028	4.194	−0.031	−0.549	−0.588	−1.496	PORT B
2029	5.451	3.073	7.08	9.27	0.278	
2030	5.038	8.7	20.21	22.86	0.297	
2031	4.8	8.73	20.11	22.35	−1.065	
2032	4.835	8.75	20.07	22.37	−0.826	Center =
2033	4.868	8.73	20.25	22.61	−1.215	
2034	4.825	8.76	20.17	22.46	−0.584	
2035	4.823	8.76	20.25	22.54	−0.827	
2036	4.862	8.76	20.46	22.84	−1.277	B-1 =
2037	4.854	8.74	20.24	22.58	−1.415	
2038	4.864	8.73	20.23	22.58	−1.088	
2039	4.856	8.77	20.27	22.62	−1.033	
2040	4.867	8.75	20.35	22.72	−1.477	B-2 =
2041	4.861	8.79	20.27	22.62	−1.27	
2042	4.851	8.79	20.44	22.8	−1.486	
2043	4.876	8.72	20.34	22.72	−1.459	B-3 =
2044	4.86	8.77	20.48	22.86	−1.415	
2045	4.871	8.78	20.43	22.81	−1.624	
2046	4.865	8.74	20.22	22.57	−1.306	
2047	5.032	8.63	20.14	22.72	−1.501	
2048	5.183	8.55	19.72	22.45	−1.127	B-4 =
2049	5.102	8.61	19.95	22.62	−1.53	
2050	5.075	8.59	20.43	23.11	−1.623	
2051	4.887	8.74	20.43	22.84	−0.919	
2052	4.855	8.77	20.35	22.71	−1.424	
2053	4.871	8.75	20.48	22.87	−1.461	Center =

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
2054	4.894	8.74	20.57	23.01	−1.105	
2055	4.84	8.7	20.35	22.68	−1.395	PORT A
2056	6.011	6.931	15.63	17.5	−1.449	
2057	19.38	0.154	−0.421	−9.54	−1.14	
2058	13.03	6.066	14.48	76.8	−1.271	
2059	5.087	8.74	20.43	23.16	−1.378	
2100	4.9	8.75	20.59	23.04	−1.452	Center =
2101	4.84	8.83	20.46	22.81	−1.555	
2102	4.876	8.73	20.6	23.01	−1.169	
2103	4.873	8.77	20.56	22.95	−1.574	
2104	4.896	8.75	20.55	22.99	−1.535	A-1 =
2105	4.903	8.7	20.59	23.05	−1.477	
2106	4.888	8.72	20.43	22.83	−1.249	
2107	4.887	8.7	20.71	23.15	−1.426	
2108	4.893	8.74	20.59	23.03	−1.627	
2109	4.86	8.78	20.44	22.81	−1.23	A-2 =
2110	4.867	8.81	20.58	22.98	−1.188	
2111	4.858	8.82	20.56	22.94	−1.301	
2112	4.862	8.78	20.74	23.15	−1.546	
2113	4.825	8.8	20.58	22.92	−0.951	A-3 =
2114	4.829	8.82	20.84	23.22	−1.439	
2115	4.854	8.79	20.65	23.03	−1.594	
2116	4.851	8.83	20.9	23.31	−1.558	
2117	4.829	8.81	20.72	23.07	−1.509	A-4 =
2118	4.82	8.81	20.48	22.79	−1.39	
2119	4.854	8.78	20.62	23	−1.056	
2120	4.835	8.81	20.74	23.11	−1.615	Center =
2121	4.824	8.82	20.5	22.83	−1.593	
2122	4.858	8.79	20.73	23.13	−1.639	
2123	5.986	6.952	15.65	17.51	−1.462	
2124	17.38	2.687	6.304	47.13	−1.216	PORT D
2125	5.689	8.75	20.7	24.75	−1.627	
2126	4.927	8.77	20.83	23.35	−1.382	
2127	4.887	8.78	20.63	23.06	−1.223	
2128	4.86	8.79	20.63	23.02	−1.625	Center =
2129	4.851	8.81	20.67	23.06	−1.598	
2130	4.867	8.77	20.69	23.11	−1.542	
2131	4.871	8.77	20.94	23.39	−1.572	
2132	4.862	8.77	20.76	23.17	−1.288	
2133	4.831	8.83	20.82	23.2	−1.494	D-1 =
2134	4.843	8.79	21.04	23.45	−1.504	
2135	4.84	8.81	20.99	23.39	−1.438	
2136	4.872	8.81	21	23.46	−1.556	D-2 =
2137	4.82	8.82	21.42	23.84	−1.575	
2138	4.778	8.84	21.48	23.86	−0.839	
2139	4.854	8.74	20.54	22.9	−0.738	

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
2140	4.956	8.73	20.77	23.32	−1.404	
2141	4.956	8.73	20.11	22.57	−1.322	
2141	4.892	8.79	20.16	22.62	−0.863	$\overline{\text{D-3}}$ =
2142	4.948	8.71	19.94	22.37	−0.997	
2143	4.96	8.67	20.14	22.62	−1.163	
2144	5.537	8.18	18.86	21.91	30.38	
2145	5.4	8.59	20.4	23.73	91.9	
2146	4.904	8.81	20.9	23.39	88.1	
2147	4.815	8.84	21.44	23.86	89.6	$\overline{\text{D-4}}$ =
2148	4.747	8.86	21.32	23.63	89.9	
2149	4.782	8.81	21.43	23.8	90.5	
2150	4.804	8.84	21.44	23.84	90.2	
2151	4.831	8.82	21.55	24	90.5	
2152	4.822	8.83	21.68	24.14	86.8	$\overline{\text{Center}}$ =
2153	4.76	8.78	21.45	23.79	9.32	
2154	4.808	8.84	21.74	24.18	−1.214	
2155	13.54	2.191	4.187	2.745	28.4	
2156	20.46	0.15	−0.571	−24.81	49.37	PORT C
2157	20.61	0.123	−0.611	−38.22	31.14	
2158	18.66	2.645	6.13	47.28	−0.948	
2159	5.866	8.74	21.09	25.58	27.95	
2200	4.979	8.77	21.31	23.97	91.8	
2201	4.922	8.78	21.13	23.67	91.3	
2201	4.906	8.85	21.11	23.64	86.6	
2201	4.892	8.79	21.48	24.02	1128	$\overline{\text{Center}}$ =
2201	4.905	8.72	21.17	23.69	89.5	
2202	4.904	8.79	21.19	23.71	89.5	
2202	4.825	8.79	20.97	23.37	90.1	
2203	4.856	8.84	20.77	23.17	89.8	
2204	4.9	8.81	21	23.5	78.5	
2205	4.88	8.81	21.05	23.52	48.65	
2206	4.859	8.81	20.79	23.2	48.21	$\overline{\text{C-1}}$ =
2207	4.864	8.8	20.62	23.02	48.35	
2208	4.893	8.8	20.64	23.08	35.45	
2209	4.883	8.8	20.53	22.95	−0.179	
2210	4.88	8.77	20.67	23.09	−0.765	$\overline{\text{C-2}}$ =
2211	4.887	8.69	20.77	23.22	−0.726	
2212	4.865	8.82	20.85	23.28	−0.71	
2213	4.884	8.8	20.71	23.15	−0.832	
2214	4.881	8.81	20.57	22.98	−0.494	$\overline{\text{C-3}}$ =
2215	4.891	8.77	20.72	23.17	−0.789	
2216	4.932	8.78	21	23.54	−1.091	
2217	4.944	8.74	20.54	23.04	−0.984	
2218	4.945	8.77	20.85	23.4	−1.041	$\overline{\text{C-4}}$ =
2219	4.94	7.98	20.51	23	−0.729	
2220	4.908	8.69	20.26	22.67	−0.944	

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
2221	4.924	8.79	20.55	23.03	−1.056	
2222	4.911	8.78	20.54	23	−0.973	
2223	4.892	8.8	20.59	23.02	−1.015	Center =
2224	4.865	8.67	20.51	22.9	−0.806	
2225	4.892	8.24	20.57	23.01	−1.004	
2226	12.98	2.493	4.545	3.205	−0.759	
2227	20.44	0.148	−0.526	−21.7	−0.427	
2228	20.6	0.121	−0.547	−32.9	−0.432	
2229	20.63	0.125	−0.548	−35.72	−0.457	
2230	20.63	0.096	−0.559	−37.59	−0.446	
2231	20.64	0.083	−0.628	−42.77	−0.443	
2232	20.64	0.094	−0.626	−42.72	−0.402	
2233	12.19	0.635	0.745	49.67	−0.576	
2234	0.438	0.067	−0.629	−0.552	−0.953	
zero bias 2235	0.1	0.065	−0.656	−0.565	−0.916	
2236	0.065	0.056	−0.679	−0.583	−0.933	
2237	0.679	0.067	39.77	35.42	−0.908	
2238	0.07	0.058	47.33	40.68	−0.924	
2239	2.819	0.063	2.539	2.115	−0.994	
2240	4.142	0.054	−0.628	−0.671	−0.932	
mid bias 2241	4.168	0.058	−0.673	−0.72	−0.943	
2242	2.17	0.036	−0.683	−0.658	−0.901	
2243	0.042	0.118	−0.745	−0.64	−0.518	
zero 2244	−0.005	0.087	−0.749	−0.641	−0.441	
2245	1.316	0.083	40.48	37.39	−0.42	
2246	4.08	0.094	47.64	50.67	0.014	
mid 2247	4.166	0.094	47.68	50.98	0.423	
2248	7.35	0.107	86.5	116.1	0.6	
2249	9.08	0.094	93	140.8	0.77	
high 2250	9.12	0.092	93.1	141.4	−0.744	
2250	9.12	0.067	0.108	0.165	−1.036	
2250	9.12	0.134	−0.322	−0.489	−1.044	
2251	9.16	0.073	−0.361	−0.55	−1.04	
2252	2.869	0.049	2.25	1.869	−1.057	
2253	0.047	0.013	19.31	16.6	−1.057	
2254	0	−0.157	16.13	13.81	−1.059	
2254	−0.012	0	8.26	7.07	−0.954	
2254	−0.012	0	20.74	17.75	−0.952	
2255	−0.012	0	20.78	17.78	−0.952	
2256	−0.016	0.007	10.3	8.82	−1.034	
2257	−0.021	0.013	−0.051	−0.044	−1.049	
2258	0.492	0.004	−0.066	−0.058	−1.04	
2259	−0.006	0.013	−0.081	−0.069	−1.034	
2300	−0.031	0.02	−0.089	−0.077	−1.022	zero
2301	2.84	7.61	11.46	10.88	11.79	
2302	4.172	9.74	10.11	10.82	47.85	

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)	
2303	4.201	9.76	12.31	13.19	48.34	
2304	4.207	9.74	12.46	13.36	48.21	mid
2305	6.648	16.01	18.9	24.23	68.94	
2306	9.14	17.83	21.18	32.21	89.8	
2307	9.19	17.85	21.26	32.5	89.7	
2308	9.2	17.84	21.27	32.53	89.7	high
2309	6.745	5.715	6.324	9.67	56.13	
2310	0.276	0.067	0	0	−0.791	
2311	0.063	0.065	−0.047	−0.041	−0.888	
2312	0.041	0.06	−0.068	−0.059	−0.961	zero bias
2313	0.855	7.44	−0.073	−0.065	−1.197	
2314	0.062	9.66	−0.07	−0.06	−1.47	
2315	2.818	0.883	−0.068	−0.067	20.25	
2316	2.697	0.078	−0.082	−0.081	40.72	
2317	0.118	0.065	−0.094	−0.081	47.82	
2318	0.035	0.072	−0.095	−0.081	48.22	mid/high bias
2319	0.024	0.02	18.33	15.72	22.87	
2320	0.018	0.067	21.08	18.07	−0.305	
2321	2.622	0.063	2.438	2.091	−0.678	
2322	4.149	0.065	−0.056	−0.06	−0.924	
2323	4.184	0.011	−0.081	−0.087	−0.959	
2324	4.336	4.431	10.49	11.42	−0.829	
2325	4.726	8.83	20.78	23	−0.499	
2326	4.806	8.88	20.93	23.28	−0.362	
2327	4.736	8.93	20.84	23.08	−0.546	
2328	4.783	8.9	20.92	23.24	−0.493	
2329	4.784	8.87	20.88	23.19	−0.598	
2330	4.764	8.93	20.89	23.17	−0.826	
2331	4.786	8.92	20.82	23.13	−0.648	
2332	4.783	8.88	20.86	23.16	−0.774	
2333	4.765	8.93	20.88	23.17	−0.577	
2334	4.786	8.89	20.87	23.18	−0.623	
2335	4.775	8.92	20.95	23.26	−0.618	
2336	4.78	8.91	20.8	23.1	0.032	
2337	4.765	8.93	20.94	23.24	−0.461	
2338	4.79	8.92	20.9	23.23	−0.401	
2339	4.789	8.9	20.79	23.1	−0.549	
2340	4.769	8.92	20.88	23.17	−0.673	
2341	4.797	8.91	20.84	23.16	0.1	
2342	4.783	8.92	20.75	23.05	−0.342	
2343	4.769	8.94	21.04	23.35	−0.608	
2344	4.785	8.92	20.75	23.04	−0.599	
2345	4.763	8.93	20.76	23.03	−0.185	
2346	4.773	8.92	20.89	23.19	0.022	
2347	4.749	8.95	20.82	23.08	−0.626	
2348	4.798	8.89	21.05	23.4	−0.42	

BASELINE START

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
2349	4.767	8.95	20.72	22.99	−0.142
2350	4.751	8.94	20.54	22.77	−0.23
2351	4.778	8.93	20.64	22.91	0.239
2352	4.775	8.91	20.7	22.98	−0.575
2353	4.807	8.89	20.79	23.13	−0.146
2354	4.773	8.92	21	23.31	0.067
2355	4.792	8.93	20.87	23.19	−0.403
2356	4.751	8.94	20.71	22.96	0
2357	4.739	8.96	20.84	23.08	0.093
2358	4.8	8.93	20.97	23.32	−0.687
2359	4.779	8.91	20.76	23.05	−0.459
2400	4.767	8.93	20.87	23.16	0.116
1	4.773	8.94	20.8	23.09	−0.028
2	4.787	8.9	20.62	22.9	−0.186
3	4.778	8.93	20.57	22.83	−0.153
4	4.78	8.94	20.96	23.28	−0.496
5	4.767	8.92	20.71	22.98	0.006
6	4.775	8.9	20.57	22.83	−0.343
7	4.77	8.95	20.68	22.95	−0.477
8	4.778	8.94	20.62	22.89	0.666
9	4.77	8.92	20.75	23.03	0.622
10	4.81	8.93	21.09	23.47	−0.446
11	4.791	8.92	20.61	22.9	−0.228
12	4.782	8.93	20.73	23.02	−0.408
13	4.788	8.91	20.54	22.82	−0.582
14	4.789	8.94	20.79	23.1	−0.693
15	4.789	8.93	20.93	23.26	−0.56
16	4.785	8.93	20.37	22.62	−0.416
17	4.787	8.94	20.62	22.9	−0.285
18	4.79	8.92	20.68	22.98	−0.521
19	4.78	8.94	20.53	22.79	−0.234
20	4.769	8.96	20.51	22.77	−0.63
21	4.8	8.92	20.54	22.83	−0.071
22	4.76	8.95	20.75	23.01	0.406
23	4.779	8.91	20.54	22.8	−0.12
24	4.749	8.96	20.38	22.59	−0.049
END 25	4.777 / 4.8	8.94 / 8.9	20.5 / 20.8	22.76	0 / −0.3
26	4.754	8.74	20.23	22.43	0.42
27	10.12	2.207	4.675	5.31	−0.33
28	1.255	0.107	0.016	0.016	−0.937
29	0.072	0.04	−0.005	−0.004	−0.987
30	0.029	0.072	−0.026	−0.022	−0.925
31	0.017	0.069	−0.039	−0.033	−0.927 zero bias
32	1.832	5.099	−0.04	−0.038	−1.074
33	0.154	9.7	−0.053	−0.046	−1.508
34	0.028	1.992	−0.066	−0.056	19.51

mid bias

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
35	0.017	0.107	−0.075	−0.064	47.88
36	0.014	0.074	−0.088	−0.076	47.88
37	0.012	0.114	19.19	16.44	20.8
38	0.008	0.076	20.98	17.97	−0.362
39	0.004	0.078	20.99	17.98	−0.406
40	2.605	0.072	2.428	2.076	−0.626
41	4.145	0.081	−0.088	−0.094	−0.914
42	4.183	0.025	−0.11	−0.118	−0.93
43	3.92	0.101	−0.122	−0.129	−0.932
44	0.314	−0.315	−0.2	−0.175	−0.943
45	−0.019	0.034	−0.215	−0.184	−1.023
46	−0.034	−0.038	−0.218	−0.186	−1.048
47	1.68	6.212	6.903	6.722	13.04
48	4.12	9.77	11.02	11.76	47.83
49	4.187	9.8	12.15	13.02	48.14
50	4.196	9.78	12.25	13.13	48.12
51	7.24	16.6	20.41	27.09	70.7
52	9.15	17.88	21.15	32.2	89.6
53	9.19	17.89	21.15	32.31	89.5
54	9.19	17.89	21.15	32.35	89.9
55	3.834	2.451	3.809	5.905	45.3
56	0.061	0.054	−0.226	−0.195	−0.997
57	−0.015	0.029	−0.24	−0.205	−1.051
58	−0.028	0.009	−0.244	−0.209	−1.058
59	4.357	6.977	11.05	12.47	0.367
100	4.8	8.7	13.51	15.02	1.953
101	4.761	8.91	9.48	10.51	3.125
102	4.737	8.82	−0.047	−0.052	−0.379
103	4.719	8.91	−0.154	−0.17	−0.689
104	4.704	8.9	−0.121	−0.134	−0.677
105	4.691	8.89	−0.147	−0.162	−0.687
106	4.682	8.87	−0.154	−0.171	−0.665
107	4.673	8.87	−0.162	−0.178	−0.695
108	4.666	8.86	−0.171	−0.189	−0.681
109	4.66	8.85	−0.181	−0.2	−0.709
110	4.657	8.84	−0.193	−0.212	−0.708
111	4.65	8.99	−0.192	−0.211	−0.665
112	4.652	8.81	−0.192	−0.212	−0.658
113	4.652	8.83	−0.197	−0.217	−0.588
114	2.882	2.277	−0.216	−0.218	31.97
115	0.278	1.454	2.206	1.943	84.8
116	4.208	8.85	13.24	14.14	21.57
117	4.76	8.7	13.33	14.79	5.467
118	4.767	8.9	13.17	14.61	5.932
119	4.758	8.94	13.27	14.72	6.957
120	4.763	8.95	13.21	14.66	9.07

mid bias

high bias

zero

Mid

High

IGR ON START

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
121	4.799	8.94	13.25	14.73	10.5
122	4.789	8.95	13.47	14.96	7.53
123	4.739	8.96	13.16	14.57	7.91
124	4.773	8.96	13.21	14.66	4.803
125	4.761	8.96	13.29	14.74	7.37
126	4.755	8.96	13.21	14.65	6.455
127	4.722	8.99	13.13	14.52	10.52
128	4.754	8.95	13.2	14.64	9.3
129	4.77	8.96	13.33	14.79	8.86
130	4.767	8.98	13.37	14.84	9.05
131	4.773	8.98	13.28	14.74	9
132	4.778	8.96	13.22	14.68	10.49
133	4.785	8.94	13.28	14.74	7.7
134	4.795	8.94	13.25	14.72	6.147
135	4.791	8.97	13.42	14.92	4.438
136	4.782	8.96	13.33	14.8	6.645
137	4.782	8.99	13.61	15.12	5.65
138	4.785	8.97	13.41	14.89	7.1
139	4.786	8.97	13.49	14.98	4.878
140	4.768	8.96	13.37	14.83	5.343
141	4.813	8.96	13.6	15.13	3.753
142	4.779	8.97	13.52	15.02	4.822
143	4.773	8.94	13.49	14.97	9.87
144	4.749	8.99	13.41	14.86	8.99
145	4.772	8.96	13.47	14.95	8.22
146	4.788	8.97	13.42	14.9	6.39
147	4.761	8.98	13.34	14.8	11.05
148	4.765	8.98	13.34	14.8	10.91
149	4.788	8.95	13.39	14.87	9.22
150	4.805	8.96	13.51	15.03	4.161
151	4.801	8.93	13.37	14.86	7.06
152	4.796	8.95	13.34	14.84	8.42
153	4.801	8.95	13.33	14.82	6.701
154	4.794	8.96	13.32	14.81	8.48
155	4.767	8.97	13.24	14.69	6.469
156	4.79	8.96	13.27	14.75	7.59
157	4.761	8.99	13.17	14.61	7.05
158	4.777	8.97	13.22	14.67	7.12
159	4.772	8.96	13.05	14.49	7.91
200	4.779	8.97	13.3	14.77	6.519
201	4.776	8.96	13.22	14.68	6.409
202	4.773	8.96	13.26	14.71	6.007
203	4.779	8.95	13.41	14.89	8.13
204	4.765	8.96	13.32	14.78	6.05
205	4.797	8.94	13.42	14.91	6.085
206	4.784	8.95	13.41	14.9	9.04

low load, 23 March, 1994

time	O2 (%)	CO2 (%)	NOx (ppm)	NOx 3% (ppm)	CO (ppm)
207	4.765	8.99	13.31	14.76	11.05
208	4.789	8.98	13.41	14.91	7.74
209	4.791	8.96	13.4	14.89	8.79
210	4.778	8.95	13.23	14.69	8.06
211	4.832	8.9	13.47	15	9.41
212	4.791	8.96	13.18	14.64	11.03
213	4.759	9.01	13.16	14.59	12.04
214	4.77	8.96	13.07	14.51	18.71
215	4.776	8.95	13.17	14.62	13.36
216	4.804 / 4.8	8.98 / 9.0	13.31 / 13.3	14.8	8.8 / 8.0
217 (END)	4.777	8.99	13.19	14.64	10.5
218	4.767	8.75	13.17	14.61	9.11
219	3.76	3.977	5.846	6.485	11.42
220	1.758	0.134	−0.193	−0.181	0.654
221	0.784	0.128	−0.221	−0.197	−0.918
222	0.039	0.119	−0.243	−0.209	−0.905 (zero bias)
223	0.016	0.128	−0.254	−0.218	−0.969
224	0.022	7.72	−0.262	−0.225	−1.056
225	0.022	9.73	−0.272	−0.233	−1.494
226	0.019	1.68	−0.283	−0.243	22.05
227	0.014	0.13	−0.297	−0.254	47.78
228	0.012	0.094	−0.305	−0.261	47.9 (mid bias)
229	7.02	0.134	3.838	5.815	24.54
230	7.07	0.119	14.93	19.26	−0.38
231	0.251	0.087	21 (high bias)	18.23	−0.373
232	3.829	0.128	1.968	1.643	−0.684
233	5.168	0.101	−0.306	−0.35	−0.862
234	4.217	0.092	−0.33	−0.354	−0.906
235	4.199	−0.293	−0.325	−0.349	−0.915
236	1.145	0.094	−0.389	−0.356	−0.844
237	0.002	0.029	−0.407	−0.349	−1.014
238	−0.029	0.058	−0.41	−0.35	−1.059 (zero)
239	5.003	13.5	17.42	21.33	40.48
240	9.08	17.87	21.16	32.04	89.4
241	9.18	17.84	21.17	32.33	89.2
242	9.19	17.85	21.16	32.35	89.6 (Hi)
243	6.406	10.72	14.26	18.7	68.97
244	4.267	9.73	12.16	13.09	48.14
245	4.219	9.74	12.2	13.09	47.92
246	4.213	9.75	12.21	13.09	48.07 (Mid)
247	4.213	9.73	12.19	13.08	48.24

APPENDIX D-7

EMISSION RATE CALCULATIONS

SCE EGS COMPLIANCE

PPM TO LB/HR WORKSHEET

Test #	Load	Condition	Run #	flow rate (dscf/min)	NOx ppm	NOx lb/hr	CO ppm	CO lb/hr	TGNMO ppm	TGNMO lb/hr	NH3 ppm	NH3 lb/hr
1	Full	FGR on	Average:	676063	53.4	263	213	639				
2	Full	FGR + Urea	Average:	665233	45.4	220	214	631			5.5	10
3	Full	FGR + Urea	Tray 1	657293					158	264		
			Tray 2	657293					159	265		
			Average:	657293	45.8	219	204	595	159	265	6.6	12
4	Full	Baseline	Tray 1	660325					142	238		
			Tray 2	660325					117	196		
			Average:	660325	61.7	297	196	574	130	217		
6	Mid	Baseline	Average:	516124	42.9	161	146	334				
7	Mid	FGR on	Average:	517347	31.2	118	144	330				
8	Mid	FGR + Urea	Average:	514175	27.0	101	142	324			4.0	5.5
10	Low	Baseline	Average:	258370	20.8	39	0.7	1				
11	Low	FGR on	Average:	262007	13.3	25	9.1	11				
M = Molecular Weight =					46.01		28.01		16.04		17.03	

$$E = \frac{C_g \cdot M}{379 \times 10^6} \cdot Q \cdot 60 \frac{min}{hr}$$

E = Emission Rate, lb/hr

C_g = Gas Concentration, ppm

Q = Stack Gas Flowrate, dscfm

379×10^6 = conversion factor, scf/lb-mole

SCAQMD METHOD 100.1, CORRECTED TEST AVERAGES

Test #/Description	Time Start/Stop	Measurement Parameter	Bias Results: Zero Bias Pre	Bias Results: Zero Bias Post	Bias Results: Calibration Bias Pre	Bias Results: Calibration Bias Post	Calibration Gas Actual	Constituent Average Raw	Constituent Average Corrected	@ 3%
Full Load FGR ON (Test 1)	0915/1014	O2 (%)	0.1	0.0	4.1	4.1	4.2	3.2	3.3	
		NOx (ppm)	−0.7	−0.1	46.1	47.1	48.0	51.9	53.4	54
		CO (ppm)	−1.5	−1.1	250.3	250.8	250.0	213.4	213.1	21
		CO2 (%)	0.0	0.1	9.6	9.6	9.8	9.8	10.0	
Full Load FGR and Urea ON Run #1 (Test 2)	1100/1159	O2 (%)	0.0	0.0	4.1	4.1	4.2	3.1	3.2	
		NOx (ppm)	−0.1	−0.2	47.1	47.0	48.0	44.5	45.4	45.
		CO (ppm)	−1.1	−1.1	250.8	252.2	250.0	215.3	214.2	21
		CO2 (%)	0.1	0.0	9.6	9.6	9.8	9.8	10.0	
Full Load FGR and Urea ON Run #2 (Test 3)	1301/1400	O2 (%)	0.0	0.0	4.1	4.1	4.2	3.1	3.2	
		NOx (ppm)	−0.2	0.0	47.0	46.8	48.0	44.7	45.8	46.
		CO (ppm)	−1.1	−1.1	252.2	251.5	250.0	205.2	203.9	20
		CO2 (%)	0.0	0.0	9.6	9.6	9.8	9.8	10.0	
Full Load Baseline (Test 4)	1500/1559	O2 (%)	0.0	0.0	4.1	4.1	4.2	3.0	3.1	
		NOx (ppm)	0.0	0.1	46.8	46.9	48.0	60.2	61.7	62
		CO (ppm)	−1.1	−1.1	251.5	251.9	250.0	197.2	196.1	19
		CO2 (%)	0.0	0.0	9.6	9.6	9.8	9.8	10.0	
Mid−Load Baseline (Test 6)	1030/1129	O2 (%)	0.0	0.0	4.2	4.1	4.2	3.6	3.6	
		NOx (ppm)	−0.7	−0.5	46.7	46.5	48.0	41.6	42.9	44.
		CO (ppm)	−1.6	−1.6	249.7	250.6	250.0	145.2	145.8	15
		CO2 (%)	0.1	0.2	9.7	9.8	9.8	9.7	9.7	
Mid−Load FGR ON (Test 7)	1230/1329	O2 (%)	0.0	0.0	4.1	4.1	4.2	3.6	3.7	
		NOx (ppm)	−0.5	−0.2	46.5	46.2	48.0	30.0	31.2	32
		CO (ppm)	−1.6	−1.4	250.6	252.2	250.0	144.4	144.2	15C
		CO2 (%)	0.2	0.2	9.8	9.9	9.8	9.8	9.7	
Mid−Load FGR and Urea ON (Test 8)	1417/1516	O2 (%)	0.0	0.0	4.1	4.1	4.2	3.6	3.7	
		NOx (ppm)	−0.2	−0.1	46.2	45.7	48.0	25.8	27.0	28
		CO (ppm)	−1.4	−1.2	252.2	250.8	250.0	142.3	142.0	148
		CO2 (%)	0.2	0.2	9.9	9.9	9.8	9.8	9.6	

SCAQMD METHOD 100.1, CORRECTED TEST AVERAGES

Test #/Description	Time Start/Stop	Measurement Parameter	Bias Results				Calibration Gas	Constituent Average		@3%
			Zero Bias		Calibration Bias					
			Pre	Post	Pre	Post	Actual	Raw	Corrected	O2
Low Load Baseline (Test 10)	2326/0025	O2 (%)	0.0	0.0	4.2	4.2	4.2	4.8	4.8	
		NOx (ppm)	−0.1	0.0	21.1	21.0	21.0	20.8	20.8	23.
		CO (ppm)	−1.0	−0.9	48.2	47.9	50.0	−0.3	0.7	0.8
		CO2 (%)	0.1	0.1	9.7	9.7	9.8	8.9	8.9	
Low Load FGR ON (Test 11)	0117/0216	O2 (%)	0.0	0.0	4.2	4.2	4.2	4.8	4.8	
		NOx (ppm)	0.0	−0.2	21.0	21.0	21.0	13.3	13.3	14.
		CO (ppm)	−0.9	−0.9	47.9	47.9	50.0	8.0	9.1	10.1
		CO2 (%)	0.1	0.1	9.7	9.7	9.8	9.0	9.0	

APPENDIX D-8

QA/QC PERFORMANCE MEASUREMENTS SUMMARY TABLES

Table D-8-1. SCAQMD Method 100.1 instrument calibration results, full load, FGR ON, 3/22/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	0.0	0.0	-1.5	-0.8
Post-Test Response	0.0	-0.1	-1.6	-0.4
High Range Calibration Response				
Pre-Test Response	9.1	17.7	449.4	93.8
Post-Test Response	9.0	17.7	454.8	92.8
Mid Range Calibration Response				
Pre-Test Response	4.2	9.7	251.4	48.3
Post-Test Response	4.1	9.7	250.2	48.0
Zero Gas System Bias Respose				
Pre-Test Response	0.1	0.0	-1.5	-0.7
Post-Test Response	0.0	0.1	-1.1	-0.1
Cal-Gas System Bias Respose				
Pre-Test Response	4.1	9.6	250.3	46.1
Post-Test Response	4.1	9.6	250.8	47.1
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.4%	0.3%	0.3%	1.6%
Pre-Test Mid	0.0%	1.0%	0.3%	0.3%
Pre-Test Zero	0.0%	0.0%	0.3%	0.8%
Post-Test High	1.4%	0.3%	0.8%	0.6%
Post-Test Mid	1.0%	1.0%	0.0%	0.0%
Post-Test Zero	0.0%	0.5%	0.3%	0.4%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	1.0%	0.5%	0.2%	2.2%
Post-Test	0.0%	0.5%	0.1%	0.9%
Linearity (criteria: 1%)				
Pre-Test	0.2%	0.8%	0.6%	0.1%
Post-Test	0.4%	0.6%	0.2%	0.1%
Zero Calibration Drift (criteria: 3%)				
Full Load, FGR ON	0.0%	0.5%	0.0%	0.4%
Calibration Drift (criteria: 3%)				
Full Load, FGR ON	1.0%	0.0%	0.2%	0.3%

Table D-8-2. SCAQMD Method 100.1 instrument calibration results, full load FGR and UREA ON, 3/22/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	0.0	-0.1	-1.6	-0.2
Post-Test Response	-0.1	-0.1	-1.6	0.0
High Range Calibration Response				
Pre-Test Response	9.1	17.7	457.0	92.4
Post-Test Response	9.1	17.7	456.0	92.0
Mid Range Calibration Response				
Pre-Test Response	4.2	9.7	252.9	47.8
Post-Test Response	4.2	9.7	252.6	47.7
Zero Gas System Bias Respose				
Pre-Test Response	0.0	0.0	-1.1	-0.2
Post-Test Response	0.0	0.0	-1.1	0.0
Cal-Gas System Bias Respose				
Pre-Test Response	4.1	9.6	252.2	47.0
Post-Test Response	4.1	9.6	251.5	46.8
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.4%	0.3%	1.2%	0.2%
Pre-Test Mid	0.0%	1.0%	0.6%	0.2%
Pre-Test Zero	0.0%	0.5%	0.3%	0.2%
Post-Test High	0.4%	0.3%	1.0%	0.2%
Post-Test Mid	0.0%	1.0%	0.5%	0.3%
Post-Test Zero	1.0%	0.5%	0.3%	0.0%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	1.0%	0.5%	0.1%	0.8%
Post-Test	1.0%	0.5%	0.2%	0.9%
Linearity (criteria: 1%)				
Pre-Test	0.2%	0.6%	0.1%	0.2%
Post-Test	0.7%	0.6%	0.1%	0.2%
Zero Calibration Drift (criteria: 3%)				
Full Load, FGR and UREA ON	1.0%	0.0%	0.0%	0.2%
Calibration Drift (criteria: 3%)				
Full Load, FGR and UREA ON	0.0%	0.0%	0.1%	0.1%

Table D-8-3. SCAQMD Method 100.1 instrument calibration results, full load Baseline, 3/22/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	-0.1	-0.1	-1.6	0.0
Post-Test Response	0.0	-0.1	-1.6	0.0
High Range Calibration Response				
Pre-Test Response	9.1	17.7	456.0	92.0
Post-Test Response	9.1	17.7	457.0	91.8
Mid Range Calibration Response				
Pre-Test Response	4.2	9.7	252.6	47.7
Post-Test Response	4.1	9.7	251.7	47.5
Zero Gas System Bias Respose				
Pre-Test Response	0.0	0.0	-1.1	0.0
Post-Test Response	0.0	0.0	-1.1	0.1
Cal-Gas System Bias Respose				
Pre-Test Response	4.1	9.6	251.5	46.8
Post-Test Response	4.1	9.6	251.9	46.9
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.4%	0.3%	1.0%	0.2%
Pre-Test Mid	0.0%	1.0%	0.5%	0.3%
Pre-Test Zero	1.0%	0.5%	0.3%	0.0%
Post-Test High	0.4%	0.3%	1.2%	0.4%
Post-Test Mid	1.0%	1.0%	0.3%	0.5%
Post-Test Zero	0.0%	0.5%	0.3%	0.0%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	1.0%	0.5%	0.2%	0.9%
Post-Test	0.0%	0.5%	0.0%	0.6%
Linearity (criteria: 1%)				
Pre-Test	0.7%	0.6%	0.1%	0.2%
Post-Test	0.8%	0.6%	0.2%	0.3%
Zero Calibration Drift (criteria: 3%)				
Full Load, Baseline	1.0%	0.0%	0.0%	0.0%
Calibration Drift (criteria: 3%)				
Full Load, Baseline	1.0%	0.0%	0.2%	0.2%

Table D-8-4. SCAQMD Method 100.1 instrument calibration results, mid load Stratification, 3/23/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	0.0	NR	NR	-1.1
Post-Test Response	0.0	NR	NR	-0.9
High Range Calibration Response				
Pre-Test Response	9.2	NR	NR	93.8
Post-Test Response	9.1	NR	NR	92.6
Mid Range Calibration Response				
Pre-Test Response	4.2	NR	NR	48.0
Post-Test Response	4.2	NR	NR	47.4
Zero Gas System Bias Respose				
Pre-Test Response	0.1	NR	NR	-1.1
Post-Test Response	0.0	NR	NR	-0.7
Cal-Gas System Bias Respose				
Pre-Test Response	4.2	NR	NR	47.2
Post-Test Response	4.2	NR	NR	46.7
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.1%			1.6%
Pre-Test Mid	0.1%			0.0%
Pre-Test Zero	0.3%			1.1%
Post-Test High	0.1%			0.4%
Post-Test Mid	0.1%			0.6%
Post-Test Zero	0.4%			0.9%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	0.3%			0.8%
Post-Test	0.4%			0.7%
Linearity (criteria: 1%)				
Pre-Test	0.1%			0.3%
Post-Test	0.2%			0.4%
Zero Calibration Drift (criteria: 3%)				
Mid Load, Stratification	0.7%			0.3%
Calibration Drift (criteria: 3%)				
Mid Load, Stratification	0.2%			0.6%

Table D-8-5. SCAQMD Method 100.1 instrument calibration results, mid load Baseline, 3/23/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	0.0	0.1	-1.6	-0.9
Post-Test Response	-0.1	0.1	-1.6	-0.6
High Range Calibration Response				
Pre-Test Response	9.1	18.0	453.7	92.6
Post-Test Response	9.1	18.1	454.7	91.9
Mid Range Calibration Response				
Pre-Test Response	4.2	9.9	250.9	47.4
Post-Test Response	4.2	9.9	251.7	47.1
Zero Gas System Bias Respose				
Pre-Test Response	0.0	0.1	-1.6	-0.7
Post-Test Response	0.0	0.2	-1.6	-0.5
Cal-Gas System Bias Respose				
Pre-Test Response	4.2	9.7	249.7	46.7
Post-Test Response	4.1	9.8	250.6	46.5
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.1%	1.1%	0.5%	0.4%
Pre-Test Mid	0.1%	0.2%	0.2%	0.6%
Pre-Test Zero	0.4%	0.6%	0.3%	0.9%
Post-Test High	0.1%	1.7%	0.7%	0.3%
Post-Test Mid	0.3%	0.2%	0.3%	0.9%
Post-Test Zero	0.5%	0.7%	0.3%	0.6%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	0.4%	0.7%	0.2%	0.7%
Post-Test	0.4%	0.7%	0.2%	0.6%
Linearity (criteria: 1%)				
Pre-Test	0.2%	1.0%	0.0%	0.4%
Post-Test	0.0%	1.0%	0.1%	0.5%
Zero Calibration Drift (criteria: 3%)				
Mid Load, Baseline	0.1%	0.0%	0.0%	0.3%
Calibration Drift (criteria: 3%)				
Mid Load, Baseline	0.2%	0.4%	0.2%	0.3%

Table D-8-6. SCAQMD Method 100.1 instrument calibration results, mid load FGR ON, 3/23/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	-0.1	0.1	-1.6	-0.6
Post-Test Response	0.0	0.2	-1.5	-0.3
High Range Calibration Response				
Pre-Test Response	9.1	18.1	454.7	91.9
Post-Test Response	9.2	18.1	456.4	90.8
Mid Range Calibration Response				
Pre-Test Response	4.2	9.9	251.7	47.1
Post-Test Response	4.2	9.9	252.6	46.8
Zero Gas System Bias Respose				
Pre-Test Response	0.0	0.2	-1.6	-0.5
Post-Test Response	0.0	0.2	-1.4	-0.2
Cal-Gas System Bias Respose				
Pre-Test Response	4.1	9.8	250.6	46.5
Post-Test Response	4.1	9.9	252.2	46.2
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.1%	1.7%	0.7%	0.3%
Pre-Test Mid	0.3%	0.2%	0.3%	0.9%
Pre-Test Zero	0.5%	0.7%	0.3%	0.6%
Post-Test High	0.1%	1.7%	1.1%	1.4%
Post-Test Mid	0.3%	0.2%	0.5%	1.2%
Post-Test Zero	0.5%	1.0%	0.3%	0.3%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	0.4%	0.7%	0.2%	0.6%
Post-Test	0.4%	0.2%	0.1%	0.6%
Linearity (criteria: 1%)				
Pre-Test	0.0%	1.0%	0.1%	0.5%
Post-Test	0.1%	1.2%	0.1%	0.3%
Zero Calibration Drift (criteria: 3%)				
Mid Load, FGR ON	0.0%	0.3%	0.0%	0.3%
Calibration Drift (criteria: 3%)				
Mid Load, FGR ON	0.0%	0.0%	0.2%	0.3%

Table D-8-7. SCAQMD Method 100.1 instrument calibration results, mid load FGR and UREA ON, 3/23/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	0.0	0.2	-1.5	-0.3
Post-Test Response	-0.1	0.2	-1.7	-0.1
High Range Calibration Response				
Pre-Test Response	9.2	18.1	456.4	90.8
Post-Test Response	9.2	18.2	457.9	90.9
Mid Range Calibration Response				
Pre-Test Response	4.2	9.9	252.6	46.8
Post-Test Response	4.1	10.1	252.7	46.8
Zero Gas System Bias Respose				
Pre-Test Response	0.0	0.2	-1.4	-0.2
Post-Test Response	0.0	0.2	-1.2	-0.1
Cal-Gas System Bias Respose				
Pre-Test Response	4.1	9.9	252.2	46.2
Post-Test Response	4.1	9.9	250.8	45.7
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.1%	1.7%	1.1%	1.4%
Pre-Test Mid	0.3%	0.2%	0.5%	1.2%
Pre-Test Zero	0.5%	1.0%	0.3%	0.3%
Post-Test High	0.2%	2.1%	1.4%	1.3%
Post-Test Mid	0.6%	0.8%	0.5%	1.2%
Post-Test Zero	0.6%	1.0%	0.3%	0.1%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	0.4%	0.2%	0.1%	0.6%
Post-Test	0.1%	0.7%	0.4%	1.1%
Linearity (criteria: 1%)				
Pre-Test	0.1%	1.2%	0.1%	0.3%
Post-Test	0.4%	0.8%	0.1%	0.5%
Zero Calibration Drift (criteria: 3%)				
Mid Load, FGR and UREA ON	0.1%	0.0%	0.0%	0.1%
Calibration Drift (criteria: 3%)				
Mid Load, FGR and UREA ON	0.4%	0.7%	0.0%	0.0%

Table D-8-8. SCAQMD Method 100.1 instrument calibration results, low load Stratification, 3/23/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 500	0- 100
High Range	9.14	17.75	451	92.2
Mid Range	4.20	9.89	250	48.0
Zero Calibration Response				
Pre-Test Response	0.0	NR	NR	0.1
Post-Test Response	0.0	NR	NR	-0.7
High Range Calibration Response				
Pre-Test Response	9.2	NR	NR	92.3
Post-Test Response	9.1	NR	NR	93.1
Mid Range Calibration Response				
Pre-Test Response	4.2	NR	NR	47.5
Post-Test Response	4.2	NR	NR	47.7
Zero Gas System Bias Respose				
Pre-Test Response	0.1	NR	NR	-0.5
Post-Test Response	0.1	NR	NR	-0.7
Cal-Gas System Bias Respose				
Pre-Test Response	4.2	NR	NR	47.2
Post-Test Response	4.2	NR	NR	47.3
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.1%			0.1%
Pre-Test Mid	0.0%			0.5%
Pre-Test Zero	0.3%			0.1%
Post-Test High	0.2%			0.9%
Post-Test Mid	0.3%			0.3%
Post-Test Zero	0.1%			0.7%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	0.1%			0.3%
Post-Test	0.0%			0.3%
Linearity (criteria: 1%)				
Pre-Test	0.2%			0.6%
Post-Test	0.2%			0.4%
Zero Calibration Drift (criteria: 3%)				
Low Load, Stratification	0.3%			0.8%
Calibration Drift (criteria: 3%)				
Low Load, Stratification	0.3%			0.2%

Table D-8-9. SCAQMD Method 100.1 instrument calibration results, low load, Baseline, 3/23/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 100	0- 25
High Range	9.14	17.75	90	21.0
Mid Range	4.20	9.89	50	12.3
Zero Calibration Response				
Pre-Test Response	0.0	0.0	-1.0	-0.1
Post-Test Response	0.0	0.0	-1.0	-0.2
High Range Calibration Response				
Pre-Test Response	9.2	17.8	89.7	21.3
Post-Test Response	9.2	17.9	89.9	21.2
Mid Range Calibration Response				
Pre-Test Response	4.2	9.7	48.2	12.5
Post-Test Response	4.2	9.8	48.1	12.3
Zero Gas System Bias Respose				
Pre-Test Response	0.0	0.1	-1.0	-0.1
Post-Test Response	0.0	0.1	-0.9	0.0
Cal-Gas System Bias Respose				
Pre-Test Response	4.2	9.7	48.2	21.1
Post-Test Response	4.2	9.7	47.9	21.0
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.6%	0.4%	0.3%	1.1%
Pre-Test Mid	0.1%	0.8%	1.8%	0.6%
Pre-Test Zero	0.3%	0.1%	1.0%	0.4%
Post-Test High	0.5%	0.7%	0.1%	0.6%
Post-Test Mid	0.0%	0.6%	1.9%	0.2%
Post-Test Zero	0.3%	0.2%	1.0%	0.9%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	0.2%	0.4%	0.0%	0.8%
Post-Test	0.1%	0.4%	0.2%	0.6%
Linearity (criteria: 1%)				
Pre-Test	0.0%	1.0%	1.2%	0.2%
Post-Test	0.1%	0.9%	1.4%	0.2%
Zero Calibration Drift (criteria: 3%)				
Low Load, Baseline	0.0%	0.3%	0.0%	0.5%
Calibration Drift (criteria: 3%)				
Low Load, Baseline	0.1%	0.2%	0.1%	0.8%

Table D-8-10. SCAQMD Method 100.1 instrument calibration results, low load, FGR ON, 3/24/94

	O2 (%)	CO2 (%)	CO (ppm)	NOx (ppm)
Calibration Gas Concentration				
Operating Range	0- 10	0- 20	0- 100	0- 25
High Range	9.14	17.75	90	21.0
Mid Range	4.20	9.89	50	12.3
Zero Calibration Response				
Pre-Test Response	0.0	0.0	-1.0	-0.2
Post-Test Response	0.0	0.1	-1.1	-0.4
High Range Calibration Response				
Pre-Test Response	9.2	17.9	89.9	21.2
Post-Test Response	9.2	17.9	89.6	21.2
Mid Range Calibration Response				
Pre-Test Response	4.2	9.8	48.1	12.3
Post-Test Response	4.2	9.8	48.1	12.2
Zero Gas System Bias Respose				
Pre-Test Response	0.0	0.1	-0.9	0.0
Post-Test Response	0.0	0.1	-0.9	-0.2
Cal-Gas System Bias Respose				
Pre-Test Response	4.2	9.7	47.9	21.0
Post-Test Response	4.2	9.7	47.9	21.0
Analyzer Calibration Error (criteria: 2%)				
Pre-Test High	0.5%	0.7%	0.1%	0.6%
Pre-Test Mid	0.0%	0.6%	1.9%	0.2%
Pre-Test Zero	0.3%	0.2%	1.0%	0.9%
Post-Test High	0.5%	0.5%	0.4%	0.6%
Post-Test Mid	0.1%	0.7%	1.9%	0.4%
Post-Test Zero	0.3%	0.3%	1.1%	1.6%
Sampling System Bias Error (criteria: 5%)				
Pre-Test	0.1%	0.4%	0.2%	0.6%
Post-Test	0.1%	0.1%	0.2%	0.6%
Linearity (criteria: 1%)				
Pre-Test	0.1%	0.9%	1.4%	0.2%
Post-Test	0.1%	1.1%	1.2%	0.1%
Zero Calibration Drift (criteria: 3%)				
Low Load FGR ON	0.1%	0.5%	0.0%	0.8%
Calibration Drift (criteria: 3%)				
Low Load FGR ON	0.2%	0.1%	0.0%	0.2%

APPENDIX E

RECORDS SUPPORTING SCAQMD METHOD 25.1 MEASUREMENTS

APPENDIX E-1

ANALYTICAL REPORTS

HORIZON
AIR MEASUREMENT SERVICES, INC.

M25-023-FR

April 5, 1994

Mr. Chad Garretson
Acurex Environmental Coporation
555 Clyde Avenue
Mountain View, California 94039

RE: SCAQMD METHOD 25.1 RESULTS

Dear Mr. Garretson:

Please find enclosed the corrected results of the SCAQMD Method 25.1 testing you conducted on March 22, 1994.

If you have any questions concerning the results, please call me at (805) 498-8781. HORIZON appreciates the opportunity to provide Acurex Enviornmental with our services and we look forward to working with you again in the future.

Sincerely,

HORIZON AIR MEASUREMENT SERVICES, INC.

Edward S. Swede
Air Quality Technician

ES:lmg

Enclosures

996 LAWRENCE DR., SUITE 108, NEWBURY PARK, CALIFORNIA 91320 • (805) 498-8781 • FAX (805) 498-3173

TOTAL COMBUSTION ANALYSIS RESULTS

	TEST #4		TEST #3		
Tank #	19	17	76	77	79
Trap #	18	17	13	33	19
Methane in Tank	1.9	1.5	2.2	2.2	<1
TNMHC,Tank (noncond.)	2.3	2.4	2.7	3.1	2.4
TNMHC - condensables	167.1	141.4	182	183	25
TNMHC - Total	169.4	143.9	184.7	186.3	27.2
CO Concentration	195.0	181.0	188.0	190.0	<1
CO2 Concentration	94700	93900	89900	93100	37
Sample Tank Vol.	12.245	12.328	12.211	12.300	12.338
Initial Pressure	1.3	1.3	1.3	1.3	1.3
Initial Temperature	292	292	292	292	292
Final Pressure	652	688	650	637	561
Final Temperature	292	292	292	292	292
Sample Volume	10.52	11.18	10.46	10.33	9.12
Analysis Pressure	800	800	800	800	800
Analysis Temperature	292	292	292	292	292
ICV Volume	2.266	2.266	2.266	2.266	2.266
ICV Final Pressure	800	800	800	800	800
ICV Final Temp.	292	292	292	292	292
CO2 in ICV	776.0	698.0	840.0	835.0	100.0
TNMHC,Trap(cond.)	167	141	182	183	25
Stack Total TNMHC	169	144	185	186	27

NOTE: All hydrocarbon values are in terms of ppm, v/v, as methane.

AtmAA Inc.
23917 Craftsman Rd., Calabasas, CA 91302 • (818) 223-3277 • FAX (818) 223-8250

environmental consultants
laboratory services

LABORATORY ANALYSIS REPORT

CO, CH4, CO2, & Total Gaseous Non-Methane Organics (TGNMO)
Analysis in Tanks and Traps by SCAQMD Method 25 (FID/TCA)

Report Date: March 30, 1994
Client: Horizon\Acurex
P.O. No.: Verbal
Client Project No.: M25-023
Source Location: Horizon
Source ID: Not Given

Date Received: March 25, 1994
Date Analyzed: March 25, 1994

AtmAA Lab No.	Sample ID			CO	CH4	CO2	TGNMO	CO2 in ICV	P1	P2
	Tank	Trap	ICV	(Concentration in ppmv)						
90844-6	19	18	28	195	1.92	94700	2.32	776	652	800
90844-7	17	17	40	181	1.54	93900	2.42	698	688	800
90844-8	76	13	M1	188	2.15	89900	2.74	840	650	800
90844-9	77	33	13	190	2.16	93100	3.06	835	637	800
90844-10	79	19	24	<1	<1	36.8	2.37	100	561	800
90844-11 System blank			21					12.0		

P1 - Initial Pressure, mm Hg
P2 - Final Pressure, mm Hg

Michael L. Porter
Laboratory Director

QUALITY ASSURANCE SUMMARY
(Repeat Analysis)

Client Proj. No.: M25-023
Date Received: March 25, 1994
Date Analyzed: March 25, 1994

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppmv)			
CO	TK-19	195	195	195	0.0
	TK-77	190	190	190	0.0
CH4	TK-77	2.13	2.20	2.16	1.6
CO2	No Repeat				
TGNMO	TK-77	2.81	3.30	3.06	8.0
CO2 in ICV (in trap, transfer tanks)	ICV-40	682	713	698	2.2

A set of 5 TCA samples, laboratory numbers 90844-(6-10) was analyzed for CO, CH4, CO2, & TGNMO. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean." Repeat analyses are an important part of AtmAA's quality assurance program. The average % Difference from Mean for 5 repeat measurements from the sample set of 5 TCA samples is 2.4%.

Gas standards (containing CO, CH4, CO2 and propane) used for TCA analyses, were prepared and certified by Scott Specialty Gases.

Acurex Environmental CORPORATION *A Geraghty & Miller Company*

CHAIN OF CUSTODY

P.O. Number: ______ Page 1 of 1

Company Name:	Project Manager:
Edison EGS	Garretson
Project Number: 9585.011	Project Name: Unit 3 Compliance

Sampled by: (Printed and Written Signature) C Garretson / B Davy

ANALYSIS

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION	NO. OF CONTAINERS	TGNMO	CH4, CO2, CO	Trap #	R2	R4	R5		REMARKS (preservation, special analytical or turnaround requirements, duplicate sample, etc.)
Tank #19	3/22	1500	Air	Full Load, Baseline	1	X	X	18	X	X	X		
Tank #17	↓	↓			1	X	X	17	X	X	X		
Tank #76		1300		Full Load, FGR and Urea On	1	X	X	13	X	X	X		
Tank #77	↓	↓			1	X	X	28	X	X	X		
Tank #79	3/23		↓	Field Blank	1	X	X	19	X	X	X		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	REMARKS:
C Garretson	3/24 1100hrs	Steve W[illegible]	Do not analyze other Tray but recondition tanks & traps Tanks 10 + 13 (714) 453-1264
Relinquished by: (Signature)	Date/Time	Received by: (Signature) —	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time

Acurex Environmental Corporation
One Technology Drive, Suite F213
Irvine, CA 92718
(714) 753-0444

CHAIN OF CUSTODY RECORD

Client/Project Name: Acurex

Project Location: Horizon

Project No.: M25-023

Field Logbook No.:

Sampler: (Signature) [signature]

Chain of Custody Tape No.:

ANALYSES

Sample No./ Identification	Date	Time	Lab Sample Number	Type of Sample	CO2	Trap #	Tank #				REMARKS
ICV# 21	3/25/94		90844-11	Trap Burn	✓						system blank
" 13	↓		" -9	↓	✓	33	77				
" M1			" -8		✓	13	76				
" 24			" -10		✓	19	79				Field Blank
" 40			" -7		✓	17	17				
28			" -6		✓	18	19				

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	3/25/94	1200			
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received for Laboratory: (Signature)	Date	Time
			[signature]	3/25/94	1200
Sample Disposal Method:			Disposed of by: (Signature)	Date	Time

SAMPLE COLLECTOR

HORIZON AIR MEASUREMENT SERVICES
996 Lawrence Drive, Suite 108
Newbury Park, CA 91320 (805) 498-8781

ANALYTICAL LABORATORY

Atm A.A.

Nº 2237

SCAQMD METHOD 25.1

Sample and Equipment Receipt Form

Client: Acurex

Job #: M25-023

	Tank #	Trap #	P(i)	P(f)	P(s)	Comments
10844-6	19	18	1.3	652	800	} port C
-7	17	17	1.3	688	800	
-8	76	13	1.3	650	800	} port C
-9	77	33	1.3	637	800	
-10	79	19	1.3	561	800	Field Blank

Rotameters & Other Equipment

Analysis:

TCA Complete O$_2$

Turnaround Time Requested:

15 10 5 2 (days)

Date Received: 3/24/94 By: [signature]

Relinquished by: [signature] Date: 3/25/94

Received by: ____ Date: ____

Relinquished by: ____ Date: ____

AtmAA, Inc.
Received by: [signature] Date: 3/25/94

SCAQMD METHOD 25.1

Rental Equipment Preparation Form
and Packing List

Client/Contact: Chad Garretson	# of Tanks: 7
Shipping Destination:	# of Traps: 7
Shipped Via:	# of Rotos: 0
Turn Around Requested:	

	PAIRS		INITIAL PRESSURE (Torr)		LEAK CHECK		DATE RECONDITIONED	
TANKS	10	13			✓	✓	3/16/94	3/11/94
	76	77			✓	✓	"	"
	17	19			✓	✓	"	"
	79	80			✓	✓	"	"
TRAPS	14	12			✓	✓	"	"
	13	33			✓	✓	"	"
	17	18			✓	✓	"	"
		19			✓	✓		"
ROTOS								

MISC	Data Sheets: 4
	Ice Chests: 0
	Dry Ice (lbs.): 0

Prepared by: [illegible] Date: 3/16/94 Horizon Air Measurement Services, Inc.

APPENDIX E-2

FIELD TEST DATA SHEETS

TOTAL COMBUSTION ANALYSIS
SCAQMD METHOD 25
FIELD SAMPLING DATA SHEET

Job #: 9585

Facility : SCE Etiwanda

Location : Port C

Date: 3/22/94

Operator: B. Day

Control Device:

Sample Location: Port C

Ambient Temperature:

Barometric Pressure: 29.91

SAMPLE A

Tank #: 76 Trap #: 13

Initial Vacuum: 26

Final Vacuum: 1.8/17 650

Roto #2 800

TIME	VACUUM ("Hg)	FLOW (cc/min)
1301	26	243
1311	26	↓
13.21	26	
1331	24	
1341	18	
1351	6.5	
1401	3.0	

SAMPLE B

Tank #: 77 Trap #: 33

Initial Vacuum: 28

Final Vacuum: 4" 637

Roto #1 800

TIME	VACUUM ("Hg)	FLOW (cc/min)
1301	28	245
1311	27	↓
1321	26	
1331	23.5	
1341	18	
1351	6.5	
1401	3.0	

Leak Rate Pre Test: Pass

Post Test: ✓

TOTAL COMBUSTION ANALYSIS
SCAQMD METHOD 25
FIELD SAMPLING DATA SHEET

Job #: 9585
Facility : SCE Etiwanda
Location : C Port
Date: 3/22/94
Operator: B. Day

Control Device:
Sample Location: Port C
Ambient Temperature:
Barometric Pressure: 29.91

SAMPLE A

Tank #: 19 Trap #: 18
Initial Vacuum: 26
Final Vacuum: 3.4 652
800

Roto 2

TIME	VACUUM ("Hg)	FLOW (cc/min)
1500	26	243
1510	26	↓
1520	23.5	
1530	18	
1540	9.5	
1547 ~~1550~~	3.0	
1600		
		↓

SAMPLE B

Tank #: 17 Trap #: 17
Initial Vacuum: 27
Final Vacuum: 2" 688

Roto 1 800

TIME	VACUUM ("Hg)	FLOW (cc/min)
1500	27	245
1510	25	↓
1520	22	
1530	16	
1540	8.0	
1550	1.0	
1560		
		↓

Leak Rate Pre Test: pass
Post Test: ✓

7"
FB = 56 (1ft)

TOTAL COMBUSTION ANALYSIS
SCAQMD METHOD 25
FIELD SAMPLING DATA SHEET

Job #: 9585

Facility : SCE Etiwanda

Location : Unit 3

Date: 3/22/94

Operator: B. Day

Control Device:

Sample Location: Port C

Ambient Temperature: 59°F

Barometric Pressure: 29.91

SAMPLE A

Tank #: 10 Trap #: 14

Initial Vacuum: 25"

Final Vacuum:

Roto #2 243cc/min = .6

TIME	VACUUM ("Hg)	FLOW (cc/min)
1100	25"	243
1110	19"	
1120	14"	
1130	5.5	
1140		
1150		
1200		

SAMPLE B

Tank #: 13 Trap #: 12

Initial Vacuum: 27.5"

Final Vacuum:

Roto #1 245cc/min = .6

TIME	VACUUM ("Hg)	FLOW (cc/min)
1100	27.5"	245
1110	26.3	
1120	24.7	
1130	20.0	
1140	12.5	
1150	4.0	
1200	3.0	

Leak Rate Pre Test: Good/Pass

Post Test:

Reduced Flow @ 1120

Rot #2 200 cc/min

Roto #1 200 cc/min

TOTAL COMBUSTION ANALYSIS
SCAQMD METHOD 25
FIELD SAMPLING DATA SHEET

Job #: 9585

Facility : SCE

Location : EGS #3

Date: 3/23/94

Operator: CSJ

Control Device: ——

Sample Location: ——

Ambient Temperature: ——

Barometric Pressure: 29.91

SAMPLE A

Tank #: 79 Trap #: 19

Initial Vacuum: 28.0"

Final Vacuum: 6.5"

SAMPLE B

Tank #:
Trap #:

Initial Vacuum:

Final Vacuum:

Blank was collected by pass N_2 in tank; trap was submitted as is

CSJ

TIME	VACUUM ("Hg)	FLOW (cc/min)
1310	28.0	250
1317	26.4	↓
1320	22.2	
1330	16.4	
1341	10.8	
1350	6.5	

TIME	VACUUM ("Hg)	FLOW (cc/min)

Leak Rate Pre Test: ok

Post Test: ✓

APPENDIX F

RECORDS SUPPORTING AMMONIA CONCENTRATION MEASUREMENTS

APPENDIX F-1

DRAFT METHOD 207.1

DRAFT 3/93

SCAQMD METHOD 207.1

ANALYTICAL METHOD FOR AMMONIA AND AMMONIUM COMPOUNDS FROM STATIONARY SOURCES NESSLER COLORIMETRY

1. Principle and Applicability

1.1 Principle

Free and combined ammonia are withdrawn from the source using a Smith-Greenburg impinger train. The gas or particulate is collected in the train probe and impingers containing sulfuric acid solution. The solution is analyzed for ammonia by colorimetry after reaction with Nessler reagent.

1.2 Applicability

This method is applicable for the determination of ammonia and ammonium ion in furnace stacks, catalytic cracking plant regenerator emissions, galvanizing operations, and other stationary sources when approved by the Executive Officer. The recommended range is 0.4 mg/m^3 to 20 mg/m^3 for a sample of one cubic meter.

1.3 The range and sensitivity of the method has not been established. Commercially prepared, APHA approved reagent has been found with a response of about 430 ug NH_3 in a 50 mL aliquot per optical density (OD) at 440 nm using a 1 cm cell. This factor applies from 20 to 160 ug NH_3. A slightly reduced sensitivity was found at higher concentrations. Very high concentrations shift the absorbance to the 450 to 500 nm range. Based on the above response and a train recovery volume of 500 mL, the estimated sensitivity is approximately 0.1 mg NH_3.

1.4 Interferences

Calcium, iron, magnesium, and sulfide interfere by causing turbidity after the addition of Nessler reagent. Inherent sample color and suspended matter also interfere with direct Nesslerization. Because direct Nesslerization is subject to a number of possible interferences, at least one sample per set must be checked for color and/or turbidity prior to reagent addition, and by spike and recovery to confirm that no interferences exist. In this case, a set of samples is a sample or series of samples taken from one sampling point during one day of testing.

However, blanking and spike recovery may need to be performed more often if emission characteristics are expected to change frequently during one day.

When interferences exist, distill the sample prior to analysis. (See Standard Methods for the Examination of Water and Wastewater, 17th Edition).

1.5 Precision and Accuracy

Precision and accuracy have not been determined.

2. Field Procedures

A copy of the field procedures can be found in the District's Source Test Manual.

3. Laboratory Procedures

3.1 Apparatus

3.1.1 A schematic of the sampling train is shown in Figure 207.1L.

a. Impinger Train

The train consists of four impingers connected in series with leak-fr non-contaminating fittings. The first and second Smith-Greenburg impingers shall have standard tips, the third and fourth impingers shall have a modified tip (one-half in. ID glass tube) extending to about one-half in. from the bottom of the flask. The first two impingers each contain 100 mL of 0.1 N H_2SO_4. The third impinger is empty. The fourth (last) impinger contains silica gel.

b. Probe

Probe may be of 316 stainless steel, quartz, or glass. Quartz and glass must be used for corrosive samples.

c. Pre-filter (optional)

A pre-filter may be inserted to remove particulate matter from the sampling train.

3.1.2 Sample Recovery

a. Wash bottle.

b. 500 mL or 1000 mL graduated cylinder, with stopper.

c. Polyethylene bottles, 500 mL or 1000 mL

3.1.3 Sample Analysis

a. Perkin Elmer 552 Spectrophotometer, or equivalent.

b. Spectrophotometer cells, 1 cm.

c. Volumetric flasks, 50 mL, one for each sample, standard and blank.

d. Pipettes, Class A, 2 mL, 4 mL, 8 mL, 10 mL, 12 mL, and 14 mL, or burette for calibration curve.

e. Graduated cylinders, 25 mL, 50 mL, 100 mL, and 250 mL.

3.2 Reagents

3.2.1 Sampling

Unless otherwise indicated, all reagents are to conform to the specifications established by the Committee on Reagents of the American Chemical Society, where such specifications are available. Otherwise, use best available grade.

a. Water

Deionized or distilled to conform to ASTM specifications D-1193-74, Type 3. At the option of the analyst, the KMnO4 test for oxidizable matter may be omitted when high concentrations of organic matter are not expected to be present.

b. Absorbing Solution

Dilute 2.8 mL of concentrated sulfuric acid (18M) to 1 liter with deionized water to form 0.1 N sulfuric acid.

c. Silica Gel

Indicating type. Fresh or dried at 175^{o}C (350^{o}F) for 2 hours, 6 to 16 mesh.

d. Stopcock grease

3.2.2 Sample Recovery

a. Rinse Solution. See absorbing Solution.

3.2.3 Sample analysis

a. Water. See above.

b. Nessler Reagent:
Purchase from a laboratory chemicals supplier (APHA approved) or prepare as follows:

Dissolve 35 grams of mercuric chloride in 500 mL of hot water. Filter and allow to cool. Dissolve 62.5 grams of potassium iodide in 260 mL of cold water. Gradually add the mercuric chloride solution to 250 mL of the iodide solution until a slight permanent red precipitate is formed. Dissolve the precipitate with the remaining iodide solution and again add mercuric chloride slowly until a red precipitate remains.

Dissolve 150 grams of potassium hydroxide in 250 mL of distilled water. Caution: Corrosive. Add solution to the potassium iodide mercuric chloride solution and make up to 1 liter with distilled water. Stir thoroughly and allow to stand a day or so, and decant the clear liquid. Warning: The Nessler reagent should be handled with caution because of its toxicity and corrosive properties.

c. Stock Standard Ammonium Sulfate Solution:
Dissolve 0.194 g of ammonium sulfate in absorbing solution and make up to 500 mL with absorbing solution. One mL of this solution contains 100 ug of ammonia. Discard this solution after one month.

d. Intermediate Standard
Dilute 10 mL of the stock standard solution to 100 mL with absorbing solution. 1 mL of this solution contains 10 ug of ammonia. Discard after one week.

e. Stock Absorbing Solution
Dilute 2.8 mL of concentrated sulfuric acid (19M) to 1 liter with distilled water to form 0.1 N sulfuric acid.

f. Potassium Iodide.

g. Mercuric Chloride

h. Potassium Hydroxide.

i. Ammonium Sulfate.

j. Calibration Standards
Dilute 0 mL, 2 mL, 4 mL, 8 mL, 10 mL, 12 mL and 14 mL of intermediate standard to 50 mL with absorbing solution in a volumetric flask and shake well to mix. This corresponds to 0 ug, 20 ug, 40 ug, 80 ug, 100 ug, 120 ug and 140 ug of ammonia in each flask.

NOTE 1: The calibration standards used in this method are based on experience using an APHA approved Nessler reagent. The prepared Nessler reagent may require calibration standards that differ in concentrations by an order of magnitude.

3.3 Pre-Test Preparation
No special pre-test preparation is required.

3.4 Sample Collection Train Preparation
During the preparation and assembly, keep all opening covered wherever contamination can occur until just prior to assembly. Assemble the impingers in the tray. Load each of the first two impingers with exactly 100 mL of absorbing solution. Leave the third impinger empty. Load the last impinger with approximately 200 to 300 grams of silica gel. If moisture content is to be performed gravimetrically, weight each impinger plus contents to the nearest 0.5 g and record the weights. Reserve about 200 mL of the absorbing solution as a reagent blank.

3.5 Sample Collection Train leak Check
The sample collection train may be leak checked in the Laboratory after assembly using the procedure in the Source Test Manual.

3.6 Sample Recovery
Inspect the train for general condition. Note if the silica gel is completely expended, and if the train or its components are sealed. Note anything other than a colorless, odorless, clear impinger catch, and any other condition that may be reflected in the

analysis. Working in a area protected from the wind and free from dust and ammonia, carefully disconnect the probe and the impingers. Weigh each impinger plus contents to the nearest 0.5 g and record these weights.

Transfer the impinger catch to a 500 mL graduated cylinder (1000 mL if necessary). Rinse the inside of the probe, the impingers and all connecting glassware into the graduated cylinder at least three time using the rinse solution. Be sure to contact all interior surfaces with each rinse.

Dilute the sample to 500 mL with the rinse solution (1000 mL if necessary). Stopper the cylinder and mix well. Transfer the sample to a container. Seal it well, mark the level of the liquid and label the container to clearly identify it contents.

Take 200 mL of the reagent blank, and dilute it to the sample volume with rinse solution. Stopper the cylinder, and mix will. Transfer the blank to a container. Seal it well, mark the level of the liquid and label the container to clearly identify it contents.

3.7 Sample Analysis

Shake the sample well. Transfer 50.0 mL to a volumetric flask. Add 2.0 mL of Nessler reagent to the flask, mix well, and allow the color to develop for a least 10 minutes. Read the absorbance of the sample in a 1 cm cell at 440 nm. Use water in the reference cell. If the sample exceeds the linear range of the spectrophotometer, use a smaller sample aliquot and dilute it to 50.0 mL. Analyze the reagent blank using the same procedure.

3.8 Calculations and Reporting

Using the calibration factor (obtained in Section 3.9), calculate total mg of ammonia as follows:

$$mg = AF \times (ODspl - OD\ blank) \times M$$

Where:

AF	= Aliquot factor (sample volume/aliquot volume)
ODspl	= Optical density of the sample
OD blank	= Optical density of the reagent blank
M	= Nessler response factor, mg per OD.

Report ammonia to the nearest 0.1 mg.

Report moisture gain to the nearest gram or mL.

3.9 Calibrations

Each bottle of Nessler reagent must be calibrated on opening.

Dilute 0 mL, 2 mL, 4 mL, 8 mL, 10 mL, 12 mL and 14 mL of intermediate standard solution to 50.0 mL with absorbing solution, and shake well. Add 2.0 mL of Nessler reagent to each, mix well, and allow the color to develop for at least 10 minutes. Read the absorbance of each standard in a 1 cm cell at 440 nm. Use water in the reference cell.

Subtract the blank (0 mL standard) from each reading, and calculate the curve of ug of ammonia vs. the corrected absorbance. Correlation coefficient of this curve should be at least 0.9995. Any standard that is more than 7% from the calculated curve must be remade and rerun. Label the Nessler's reagent with the response factor (mg per OD), blank reading, date of calibration and reference to the calibration data. The Nessler's reagent must be recalibrated when control values indicate a change in response or every six months, whichever occurs first.

3.10 Quality Control

Nessler reagent may deteriorate during storage and must be checked frequently. Analyze a 40 ug control solution every set of samples, or every ten samples, whichever occurs first. This control solution must be obtained independently from the calibration standards. Calculate the ammonium content using the corrected absorbance and latest response factor. Measured value should be within $\pm 5\%$ of theoretical. If control values indicate a change, recalibrate the reagent and recalculate the control results. If the recalculated values are still out of range, void the previous analysis and investigate the procedure until it is under control.

Check the reagent blank against previous blank readings. A significant increase in the blank reading (more than 10%) indicates absorbing solution contamination or Nessler reagent deterioration. Investigate this problem until blank is brought to normal levels.

APPENDIX F-2

ANALYTICAL RESULTS

12-Apr-94

Date	standard (ml)	(mg)	Blank Absorb.	Absorb.	Absorb. corrected	Percent Deviation
3/19/94	2	0.02	0.005	0.035	0.030	1.8%
3/19/94	4	0.04	0.005	0.083	0.078	0.7%
3/19/94	8	0.08	0.005	0.180	0.175	0.4%
3/19/94	10	0.10	0.005	0.230	0.225	1.2%
3/19/94	12	0.12	0.005	0.275	0.270	0.1%
3/19/94	14	0.14	0.005	0.320	0.315	0.8%
Control (4/4/94)		0.04	0.006	0.081	0.075	4.0%

Regression Output:

Constant		0.007087
Std Err of Y Est		0.000873
R Squared		0.9997
No. of Observations		6
Degrees of Freedom		4
Degrees of Freedom		5
X Coefficient(s)	0.418552	
Std Err of Coef.	0.003529	
Std Err of Coef.	0.004978	

Test	Analysis	Blank Absorb.	Absorb.	Abosob. (-blank)	Slope (M)	volume used in analysis (ml)	sample aliquot (ml)	volume collected (ml)	Aliquot Factor	mass collected (mg)
Mid-Load	Run 1	0.003	0.105	0.102	0.42	52	10	500	50	2.13
	Run 2	0.006	0.102	0.096	0.42	52	10	500	50	2.01
									avg:	2.07
Full Load Test 1	Run 1	0.003	0.136	0.133	0.42	52	10	500	50	2.78
	Run 2	0.006	0.139	0.133	0.42	52	10	500	50	2.78
									avg:	2.78
Full Load Test 2	Run 1	0.003	0.16	0.157	0.42	52	10	500	50	3.29
	Run 2	0.006	0.165	0.159	0.42	52	10	500	50	3.33
									avg:	3.31

GERAGHTY & MILLER, INC.
Environmental Services

SUBJECT: SLIP ANALYSES
PROJECT: HBGS/EGS Compliance
CLIENT/PROJECT NO: Edison 9585

BY: CG DATE: 4/4/94
CHKD: DATE:
REV: DATE:

SHEET 1

(S1) => Initial Stock Standard mixed 3/19/94 + curve also run on 3/19/94
↳ was mixed from Fisher Brand Ammonium Sulfate

4/4/94 => Mixed Second Standard (S2); also by dissolving 0.194 g of VWR Brand Ammonium Sulfate in 500 ml of reagent

	Aliquot	Absorbance Run 1 / Run 2	Total mg Run 1 / Run 2
blank	∅	0.003/0.006	
Etiwanda #3, Mid-Load	10 ml	0.105/0.102	2.13/2.[illegible] (2.0[illegible])
Etiwanda #3, Full Load, Test #1	10 ml	0.136/0.139	2.78/2.78 (2.78)
Etiwanda #3, Full Load, Test #2	10 ml	0.160/0.165	3.29/3.33 (3.31)

{Control Sample (S2) 40 ug 0.081 4.0% deviation
{Blank → 0.006

APPENDIX F-3

SPREADSHEETS AND FIELD TEST DATA SHEETS

AMMONIA SLIP CALCULATIONS

Plant: SCE, EGS		Sample Location:	UNIT 3
Date : 3/22/94		Test No./Type:	RUN 1/AMMONIA
Performed by: BD		Start/Stop Time:	1100/1200
	Conditions:	FULL LOAD, FGR & UREA	

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.02
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.0)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		298.00
Gas Meter Final Reading (cu ft)		322.64
Net Gas Sample Volume (cu ft)	V(m)	(24.64)
Vol of Liquid Collected (ml)	Vl(c)	102.6
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.829)
Measure O2 Concentration @KVB	(%)	3.2

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.500
Avg Stack Temperature (degF)	T(s avg)	=	251.3
Average Meter Temperature (degF)	T(m avg)	=	68.1

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	25.11
Stack Gas Water Vapor Proportion	B(wo)	=	0.161
Total Mass: (mg NH3)		=	2.78
NH3 Concentration (ppmv air)		=	5.5
NH3 Concentration (ppmv air @3.0% O2)		=	5.5

Sample Point	dClock Time	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Meter Temp (degF) in	Gas Meter Temp (degF) out
1	15	0.50	250	67	67
2	15	0.50	251	70	68
3	15	0.50	252	68	67
4	15	0.50	252	70	68
TOTALS	60.0	2.00	1005.0	275.0	270.0

AMMONIA SLIP CALCULATIONS

Plant: SCE, EGS
Date : 3/22/94
Performed by: BD

Sample Location: UNIT 3
Test No./Type: RUN 2/AMMONIA
Start/Stop Time: 1301/1401
Conditions: 310 MW, FGR, UREA

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.02
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.0)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		323.16
Gas Meter Final Reading (cu ft)		347.65
Net Gas Sample Volume (cu ft)	V(m)	(24.49)
Vol of Liquid Collected (ml)	Vl(c)	103.2
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.858)
Measure O2 Concentration @KVB	(%)	3.2

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.500
Avg Stack Temperature (degF)	T(s avg)	=	251.0
Average Meter Temperature (degF)	T(m avg)	=	70.4

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	24.85
Stack Gas Water Vapor Proportion	B(wo)	=	0.164
Total Mass: (mg NH3)		=	3.31
NH3 Concentration (ppmv air)		=	6.6
NH3 Concentration (ppmv air @3.0% O2)		=	6.6

Sample Point	dClock Time	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Meter Temp (degF) in	Gas Meter Temp (degF) out
1	15	0.50	252	68	68
2	15	0.50	251	71	70
3	15	0.50	251	72	71
4	15	0.50	250	72	71
TOTALS	60.0	2.00	1004.0	283.0	280.0

AMMONIA SLIP CALCULATIONS

Plant: SCE, EGS
Date : 3/23/94
Performed by: BD

Sample Location: UNIT 3
Test No./Type: AMMONIA
Start/Stop Time: 1417/1517
Conditions: MID-LOAD, FGR & UREA ON

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.02
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.0)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		470.21
Gas Meter Final Reading (cu ft)		495.14
Net Gas Sample Volume (cu ft)	V(m)	(24.93)
Vol of Liquid Collected (ml)	Vl(c)	102.2
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.811)
Measure O2 Concentration @KVB	(%)	3.6

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.500
Avg Stack Temperature (degF)	T(s avg)	=	230.8
Average Meter Temperature (degF)	T(m avg)	=	70.4

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	25.31
Stack Gas Water Vapor Proportion	B(wo)	=	0.160
Total Mass: (mg NH3)		=	2.07
NH3 Concentration (ppmv air)		=	4.0
NH3 Concentration (ppmv air @3.0% O2)		=	4.2

Sample Point	dClock Time	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Meter Temp (degF) in	Gas Meter Temp (degF) out
1	15	0.50	231	67	68
2	15	0.50	230	70	68
3	15	0.50	231	74	70
4	15	0.50	231	75	71
TOTALS	60.0	2.00	923.0	286.0	277.0

FULL LOAD, FGR + UREA ON, RUN 1 NH3

PARTICULATE TEST FIELD DATA SHEET

Plant: EDISON EGS #3
Date: 3/22/94
Test Location: UNIT #3
Run Number: ~~BASELINE~~ Test 2 Slip #1
Stack Diameter ~~inches~~: 19'
Duct Dimensions In. x In.: NA
Start Time: 1100
Operator: B. Day

Barometric Pressure: 29.91
Static Pressure: 0.22
Stack Pressure:
Probe Number: NA
Pitot Coefficient: NA
Pitot Number: NA
Meter Box Number: 20151
Orifice Coefficient: 1.019

Nozzle Size & Number: NA
Molecule Weight: NA
BWO: NA

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		CO_2	O_2	CO
568.9	659.6			
570.0	573.4			
479.3	480.5			
SILICA GEL				
745.6	752.9		102.6	

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP In. wg.	ORIFICE METER ΔH In. wg.	GAS METER VOLUME FT3	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM In. Hg	√ΔP	GAS METER LEAK CHECK RATE (CFM)
1	0	—	0.50	297.998	250	—	60	—	—	67	67	6"	—	PRE- 0.012 @ 8"
2	15	—	0.50	304.050	251	—	52	—	—	70	68	6"	—	POST- 0.009 @ 15"
3	30	—	0.50	310.100	252	—	55	—	—	68	67	6"	—	
4	45	—	0.50	316.207	252	—	58	—	—	70	68	6"	—	PITOT LEAK CHECK
Stop	60	—	—	322.675	—	—	—	—	—	—	—	—	—	
AVG/TOTAL														

FULL LOAD, GR + UREA ON, RUN 2 NH_3

PARTICULATE TEST FIELD DATA SHEET

Plant: SCE Etiwanda
Date: 3/22/94
Test Location: Port C
Run Number: # Slip #2 (Test 3)
Stack Diameter ~~Inches~~: 19'
Duct Dimensions in. x in.:
Start Time: 1301
Operator: B. Day

Barometric Pressure: 29.91
Static Pressure: 0.22
Stack Pressure: 30.13
Probe Number: NA
Pitot Coefficient: NA
Pitot Number: NA
Meter Box Number: 20157
Orifice Coefficient: 1.019

Nozzle Size & Number: NA
Molecule Weight: NA
BWO:

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		CO_2	O_2	CO
596.0	689.8			
579.4	582.3			
480.5	480.9			
SILICA GEL				
752.9	759.0			

(circled: 103.2)

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP In. wg.	ORIFICE METER ΔH In. wg.	GAS METER VOLUME FT^3	TEMPERATURE °F: STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM In. Hg	$\sqrt{\Delta P}$	GAS METER LEAK CHECK RATE (CFM)
1	0	—	0.5	323.162	252	—	60	—	—	68	68	6	—	PRE- 0.004 @ 23"
2	15	—	0.5	329.126	251	—	54	—	—	71	70	6	—	POST-
3	30	—	0.5	335.138	251	—	56	—	—	72	71	6	—	
4	45	—	0.5	341.565	250	—	58	—	—	72	71	6	—	PITOT LEAK CHECK
4top	60	—	—	347.647	—	—	—	—	—	—	—	—	—	
AVG/TOTAL														

#5214 7/92

PARTICULATE TEST FIELD DATA SHEET

Plant: SCE Etiwanda
Date: 3/23/94
Test Location: Unit 3 Port C
Run Number: Mid load FGR & Urea On
Stack Diameter Inches: 19'
Duct Dimensions In. x In.:
Start Time: 1417
Operator: B. Day

Barometric Pressure: 29.91
Static Pressure: +0.05
Stack Pressure: 29.96
Probe Number: NA
Pitot Coefficient: NA
Pitot Number: NA
Meter Box Number: 20151
Orifice Coefficient: 1.019

Nozzle Size & Number: NA
Molecule Weight: NA
BWO:

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		CO_2	O_2	CO
561.6	652.2		102.2	
571.2	574.3			
480.2	481.4			
SILICA GEL				
767.6	774.9			

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP In. wg.	ORIFICE METER ΔH In. wg.	GAS METER VOLUME FT^3	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM in. Hg	$\sqrt{\Delta P}$	GAS METER LEAK CHECK RATE (CFM)
1	0	—	0.50	470.205	231	—	55	—	—	67	68	7	—	PRE- 0.005 @ 20"
2	15	—	0.50	476.430	230	—	50	—	—	70	68	6	—	POST- 0.003 @ 20"
3	31	—	0.50	483.035	231	—	52	—	—	74	70	6	—	
4	45	—	0.50	488.855		—	55	—	—	75	71	6	—	PITOT LEAK CHECK
Stop	60	—	—	495.138	—	—	—	—	—	—	—	—	—	
AVG/TOTAL														

#5214 7/92

APPENDIX G

RECORDS SUPPORTING VOLUMETRIC FLOW RATE MEASUREMENTS

APPENDIX G-1

VOLUMETRIC FLOW RATE CALCULATION SHEET

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant____________________ Performed by________________

Date ____________________

Sample Location________________

Test No./Type________________

Barometric Pressure (in. Hg)	P_b	
Meter volume (std), $$17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$$ $$17.64 \left(\frac{(\_\_\_)}{(\_\_\_)}\right)\left(\frac{(\_\_\_) + \frac{(\_\_\_)}{13.6}}{(\_\_\_) + 460}\right)$$	$V_{m\ std}$	
Volume of liquid collected (grams)	Vl_c	
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	
Stack gas proportion of water vapor $$\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}, \frac{(\_\_\_)}{(\_\_\_) + (\_\_\_)}$$	B_{wo}	
Molecular weight, stack gas dry (lb/lb-mole) $(\% CO_2 \times 0.44) + (\% O_2 \times 0.32) + (\% N_2 + \% CO \times 0.28)$ $(\_\_\_ \times 0.44) + (\_\_\_ \times 0.32) + (\_\_\_ + \_\_\_ \times 0.28)$	M_d	
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo}),\ (\_\_\_)(1-\_\_\_) + 18(\_\_\_)$	M_s	
Absolute stack pressure (in. Hg) $$P_b + \frac{P_{stack}\ (\text{in. } H_2O)}{13.6},\ (\_\_\_) + \frac{(\_\_\_)}{13.6}$$	P_s	

Temperature stack gas, average (°F)	T_s	
Stack velocity (fps) $85.49\,(C_p)\,(\sqrt{\Delta P_{s\ avg}})\,\sqrt{\dfrac{T_s avg + 460}{P_s\ \ M_s}}$ $85.49\,(\_\_\_)(\sqrt{\quad})\,\sqrt{\dfrac{(\_\_\_) + 460}{(\_\_\_)(\_\_\_)}}$	$V_{s(avg)}$	
Total sample time (minutes)	θ	
Nozzle diameter, actual (inches)	N_d	
Percent isokinetic (%) $\dfrac{17.33\,(T_s + 460)(V_w\ std + V_m\ std)}{\theta\ \ V_s\ \ P_s\ \ N_d^2}$ $\dfrac{17.33\,(\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_^2)}$	%I	
Area of stack (ft²) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(\_\_\_)^2 \div 144$	A_s	
Stack gas volume at standard conditions (dscfm) $60\,(1 - B_{wo})Vs_{avg}\,A_s\left(\dfrac{528}{T_s\ avg + 460}\right)\left(\dfrac{Ps}{29.92}\right)$ $60\,(1 - \_\_\_)(\_\_\_)(\_\_\_)\left(\dfrac{528}{\_\_\_ + 460}\right)\left(\dfrac{(\_\_\_)}{(29.92)}\right)$	Q_s	
Particulate matter concentration, dry (gr/dscf) $15.432\,\dfrac{M_p(grams)}{Vm_{std}}$, $15.432\,\dfrac{(\_\_\_)}{(\_\_\_)}$	$C_{s(std)}$	
Emission rate of particulate matter (lb/hr) $0.00857\,(Q_s)\,C_{s(std)}$, $0.00857\,(\_\_\_)(\_\_\_)$	E_p	

APPENDIX G-2

SPREADSHEETS AND FIELD TEST DATA SHEETS

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/22/94
Sample Location: UNIT 3
Performed by: CG/BD

Conditions: FULL LOAD, FGR ON
Start/Stop: 0915/1015

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	0.22
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114
Length (if rectangular)	L	
Width (if rectangular)	W	
Area of Stack (sq ft)	A(s)	(283.53)
O2 Concentration	% O2	3.3
CO2 Concentration	% CO2	10.0
CO Concentration	% CO	0.213
N2 Concentration (by diff.)	% N2	(86.49)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A-1	0.85	249	0.92	61.0
2	1.05	249	1.02	67.8
3	1.05	249	1.02	67.8
4	0.95	249	0.97	64.5
5	0.95	249	0.97	64.5
6	0.95	249	0.97	64.5
B-1	0.90	249	0.95	62.8
2	0.85	249	0.92	61.0
3	0.85	249	0.92	61.0
4	0.90	249	0.95	62.8
5	0.85	249	0.92	61.0
6	0.85	249	0.92	61.0
C-1	0.80	249	0.89	59.2
2	0.75	249	0.87	57.3
3	0.80	249	0.89	59.2
4	0.80	249	0.89	59.2
5	0.90	249	0.95	62.8
6	0.90	249	0.95	62.8
D-1	0.90	249	0.95	62.8
2	0.90	249	0.95	62.8
3	1.00	249	1.00	66.2
4	1.10	249	1.05	69.4
5	1.10	249	1.05	69.4
6	1.15	249	1.07	71.0
TOTALS	22.10	5976	22.99	1522.6

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.921
Avg Stack Temperature (degF)	T(s avg)	=	249.0
Avg SQRT(dP)		=	0.958

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.159
Mol. Wt., Stack Gas Dry	M(d)	=	29.73
Mol. Wt., Stack Gas Wet	M(s)	=	27.87
Abs Stack Pressure (in Hg)	P(s)	=	29.93
Avg Stack Velocity (ft/sec)	V(s avg)	=	63.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	676063
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	1079230

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/22/94
Sample Location: UNIT 3
Performed by: CG/BD

Conditions: FULL LOAD, FGR AND UREA ON, RUN 1
Start/Stop: 1100/1200

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	0.22
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114
Length (if rectangular)	L	
Width (if rectangular)	W	
Area of Stack (sq ft)	A(s)	(283.53)
O2 Concentration	% O2	3.2
CO2 Concentration	% CO2	10.0
CO Concentration	% CO	0.214
N2 Concentration (by diff.)	% N2	(86.59)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A-1	0.90	251	0.95	62.9
2	0.95	251	0.97	64.7
3	0.95	251	0.97	64.7
4	0.90	251	0.95	62.9
5	0.95	251	0.97	64.7
6	0.95	251	0.97	64.7
B-1	0.85	251	0.92	61.2
2	0.85	251	0.92	61.2
3	0.85	251	0.92	61.2
4	0.90	251	0.95	62.9
5	0.85	251	0.92	61.2
6	0.85	251	0.92	61.2
C-1	0.85	251	0.92	61.2
2	0.80	251	0.89	59.3
3	0.85	251	0.92	61.2
4	0.85	251	0.92	61.2
5	0.80	251	0.89	59.3
6	0.85	251	0.92	61.2
D-1	0.85	251	0.92	61.2
2	0.95	251	0.97	64.7
3	0.90	251	0.95	62.9
4	1.00	251	1.00	66.3
5	1.00	251	1.00	66.3
6	1.05	251	1.02	68.0
TOTALS	21.50	6024	22.70	1506.0

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.896
Avg Stack Temperature (degF)	T(s avg)	=	251.0
Avg SQRT(dP)		=	0.946

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.161
Mol. Wt., Stack Gas Dry	M(d)	=	29.73
Mol. Wt., Stack Gas Wet	M(s)	=	27.84
Abs Stack Pressure (in Hg)	P(s)	=	29.93
Avg Stack Velocity (ft/sec)	V(s avg)	=	62.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	665233
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	1067476

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/22/94
Sample Location: UNIT 3
Performed by: CG/BD

Conditions: FULL LOAD, FGR AND UREA ON, RUN 2
Start/Stop: 1301/1400

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	0.22
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114
Length (if rectangular)	L	
Width (if rectangular)	W	
Area of Stack (sq ft)	A(s)	(283.53)
O2 Concentration	% O2	3.2
CO2 Concentration	% CO2	10.0
CO Concentration	% CO	0.204
N2 Concentration (by diff.)	% N2	(86.60)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A-1	0.85	250	0.92	61.2
2	0.90	250	0.95	62.9
3	0.90	250	0.95	62.9
4	0.90	250	0.95	62.9
5	0.95	250	0.97	64.7
6	0.85	250	0.92	61.2
B-1	0.85	250	0.92	61.2
2	0.85	250	0.92	61.2
3	0.85	250	0.92	61.2
4	0.85	250	0.92	61.2
5	0.85	250	0.92	61.2
6	0.90	250	0.95	62.9
C-1	0.80	250	0.89	59.3
2	0.80	250	0.89	59.3
3	0.75	250	0.87	57.4
4	0.80	250	0.89	59.3
5	0.80	250	0.89	59.3
6	0.80	250	0.89	59.3
D-1	0.85	250	0.92	61.2
2	0.90	250	0.95	62.9
3	1.00	250	1.00	66.3
4	1.00	250	1.00	66.3
5	1.00	250	1.00	66.3
6	1.10	250	1.05	69.6
TOTALS	21.10	6000	22.48	1491.2

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.879
Avg Stack Temperature (degF)	T(s avg)	=	250.0
Avg SQRT(dP)		=	0.937

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.164
Mol. Wt., Stack Gas Dry	M(d)	=	29.73
Mol. Wt., Stack Gas Wet	M(s)	=	27.80
Abs Stack Pressure (in Hg)	P(s)	=	29.93
Avg Stack Velocity (ft/sec)	V(s avg)	=	62.1
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	657293
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	1057031

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/22/94
Sample Location: UNIT 3
Performed by: CG/BD

Conditions: FULL LOAD, BASLINE
Start/Stop: 1500/1455

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	0.22
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114
Length (if rectangular)	L	
Width (if rectangular)	W	
Area of Stack (sq ft)	A(s)	(283.53)
O2 Concentration	% O2	3.1
CO2 Concentration	% CO2	10.0
CO Concentration	% CO	0.196
N2 Concentration (by diff.)	% N2	(86.70)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A-1	0.90	250	0.95	62.8
2	0.85	250	0.92	61.1
3	0.90	250	0.95	62.8
4	0.85	250	0.92	61.1
5	0.90	250	0.95	62.8
6	0.90	250	0.95	62.8
B-1	0.85	250	0.92	61.1
2	0.90	250	0.95	62.8
3	0.80	250	0.89	59.2
4	0.85	250	0.92	61.1
5	0.85	250	0.92	61.1
6	0.90	250	0.95	62.8
C-1	0.80	250	0.89	59.2
2	0.80	250	0.89	59.2
3	0.75	250	0.87	57.4
4	0.80	250	0.89	59.2
5	0.85	250	0.92	61.1
6	0.80	250	0.89	59.2
D-1	0.85	250	0.92	61.1
2	0.95	250	0.97	64.6
3	0.90	250	0.95	62.8
4	1.00	250	1.00	66.2
5	0.95	250	0.97	64.6
6	1.05	250	1.02	67.9
TOTALS	20.95	6000	22.41	1483.9

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.873
Avg Stack Temperature (degF)	T(s avg)	=	250.0
Avg SQRT(dP)		=	0.934

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.156
Mol. Wt., Stack Gas Dry	M(d)	=	29.72
Mol. Wt., Stack Gas Wet	M(s)	=	27.90
Abs Stack Pressure (in Hg)	P(s)	=	29.93
Avg Stack Velocity (ft/sec)	V(s avg)	=	61.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	660325
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	1051841

FLOWRATE CALCULATIONS – CYCLONIC

Plant: SCE, ETIWANDA GENERATING STATION
Date: 3/23/94
Condition: Mid-load Baseline
Sample Location: UNIT NO. 3
Performed by: ROBERT M.

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.81
Barometric Pressure (in Hg)	P(b)	29.91
Stack Pressure (in H2O)	P(stack)	0.050
# of Sample Points	#	20
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114
Length (if rectangular)	L	
Width (if rectangular)	W	
Area of Stack (sq ft)	A(s)	(283.53)
O2 Concentration	% O2	3.6
CO2 Concentration	% CO2	9.7
CO Concentration	% CO	0.146
N2 Concentration (by diff.)	% N2	(86.55)

Sample Point	Angle of Cyclonic Flow	Velocity Head, dP (in H2O)	Cyclonic Velocity Head	Stack Temp (degF)	SQRT(dP)	Cyclonic SQRT(dP)
D-6	-7	0.50	0.50	230	0.7071	0.7045
5	-5	0.51	0.51	229	0.7141	0.7128
4	0	0.65	0.65	229	0.8062	0.8062
3	4	0.65	0.65	230	0.8062	0.8052
2	10	0.59	0.58	230	0.7681	0.7623
					0.0000	0.0000
C-6	-22	0.48	0.45	228	0.6928	0.6671
5	-10	0.40	0.39	231	0.6325	0.6276
4	-15	0.45	0.43	229	0.6708	0.6593
3	-8	0.51	0.51	229	0.7141	0.7107
2	5	0.48	0.48	230	0.6928	0.6915
					0.0000	0.0000
B-6	2	0.50	0.50	230	0.7071	0.7069
5	5	0.45	0.45	230	0.6708	0.6695
4	5	0.45	0.45	229	0.6708	0.6695
3	5	0.54	0.54	230	0.7348	0.7334
2	25	0.39	0.35	228	0.6245	0.5945
					0.0000	0.0000
A-6	0	0.51	0.51	230	0.7141	0.7141
5	5	0.59	0.59	230	0.7681	0.7667
4	0	0.48	0.48	230	0.6928	0.6928
3	8	0.59	0.58	230	0.7681	0.7644
2	17	0.55	0.53	230	0.7416	0.7252
					0.0000	0.0000
TOTALS	158	10.27	10.12	4592	14.2978	14.1844

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.514
Avg Stack Temperature (degF)	T(s avg)	=	229.6
Avg SQRT(dP)		=	0.715
Avg Yaw Angle (degrees)		=	7.9

CALCULATED VALUES

Stack Gas Water Vapor Proportion	B(wo)	=	0.153
Mol. Wt., Stack Gas Dry	M(d)	=	29.70
Mol. Wt., Stack Gas Wet	M(s)	=	27.91
Abs Stack Pressure (in Hg)	P(s)	=	29.91
Avg Stack Velocity (ft/sec)	V(s avg)	=	45.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	496281
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	765419

CYCLONIC FLOW CALCULATIONS

Avg Velocity Head (in H2O)	dP(avg)	=	0.506
Avg SQRT (dP)		=	0.709
Avg Stack Velocity (ft/sec)	V(s avg)	=	44.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	492345
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	759349

FLOWRATE CALCULATIONS – CYCLONIC

Plant: SCE, ETIWANDA GENERATING STATION
Date : 3/23/94
Sample Location: UNIT NO. 3
Performed by: ROBERT M.

Condition: Low Load Baseline

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.81
Barometric Pressure (in Hg)	P(b)	29.91
Stack Pressure (in H2O)	P(stack)	-0.24
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114
Length (if rectangular)	L	
Width (if rectangular)	W	
Area of Stack (sq ft)	A(s)	(283.53)
O2 Concentration	% O2	4.8
CO2 Concentration	% CO2	8.9
CO Concentration	% CO	0.000
N2 Concentration (by diff.)	% N2	(86.30)

Sample Point	Angle of Cyclonic Flow	Velocity Head, dP (in H2O)	Cyclonic Velocity Head	Stack Temp (degF)	SQRT(dP)	Cyclonic SQRT(dP)
D-6	0	0.14	0.14	185	0.3742	0.3742
5	0	0.16	0.16	187	0.4000	0.4000
4	0	0.16	0.16	187	0.4000	0.4000
3	0	0.18	0.18	186	0.4243	0.4243
2	0	0.15	0.15	185	0.3873	0.3873
1	0	0.12	0.12	183	0.3464	0.3464
C-6	0	0.16	0.16	183	0.4000	0.4000
5	0	0.15	0.15	183	0.3873	0.3873
4	0	0.16	0.16	185	0.4000	0.4000
3	0	0.16	0.16	183	0.4000	0.4000
2	0	0.14	0.14	184	0.3795	0.3795
1	0	0.13	0.13	179	0.3606	0.3606
B-6	0	0.16	0.16	183	0.4000	0.4000
5	0	0.14	0.14	184	0.3742	0.3742
4	0	0.16	0.16	185	0.4000	0.4000
3	0	0.14	0.14	187	0.3742	0.3742
2	0	0.14	0.14	186	0.3742	0.3742
1	0	0.12	0.12	183	0.3464	0.3464
A-6	0	0.14	0.14	185	0.3742	0.3742
5	0	0.15	0.15	186	0.3873	0.3873
4	0	0.18	0.18	186	0.4243	0.4243
3	0	0.19	0.19	185	0.4359	0.4359
2	0	0.17	0.17	187	0.4123	0.4123
1	0	0.15	0.15	185	0.3873	0.3873
TOTALS	0	3.65	3.65	4432	9.3496	9.3496

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.152
Avg Stack Temperature (degF)	T(s avg)	=	184.7
Avg SQRT(dP)		=	0.390
Avg Yaw Angle (degrees)		=	0.0

CALCULATED VALUES

Stack Gas Water Vapor Proportion	B(wo)	=	0.153
Mol. Wt., Stack Gas Dry	M(d)	=	29.62
Mol. Wt., Stack Gas Wet	M(s)	=	27.84
Abs Stack Pressure (in Hg)	P(s)	=	29.89
Avg Stack Velocity (ft/sec)	V(s avg)	=	23.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	279946
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	403919

CYCLONIC FLOW CALCULATIONS

Avg Velocity Head (in H2O)	dP(avg)	=	0.1[illegible]
Avg SQRT (dP)		=	0.390
Avg Stack Velocity (ft/sec)	V(s avg)	=	23.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	279946
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	403919

FLOW RATE CALCULATION USING FLUE FACTOR METHOD

Plant: EDISON EGS
Date : 3/23/94
Sample Location: UNIT 3
Performed by: RM/BD

Conditions: MID LOAD, BASELINE
Start/Stop: 1100/1200

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	*C(p)*	*0.84*
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	0.05
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.53)
O2 Concentration	% O2	3.6
CO2 Concentration	% CO2	9.7
CO Concentration	% CO	0.146
N2 Concentration (by diff.)	% N2	(86.55)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A-1	0.45	225	0.67	43.6
2	0.50	225	0.71	46.0
3	0.55	225	0.74	48.2
4	0.60	225	0.77	50.4
5	0.50	225	0.71	46.0
6	0.50	225	0.71	46.0
B-1	0.50	225	0.71	46.0
2	0.50	225	0.71	46.0
3	0.55	225	0.74	48.2
4	0.50	225	0.71	46.0
5	0.50	225	0.71	46.0
6	0.45	225	0.67	43.6
C-1	0.40	225	0.63	41.1
2	0.55	225	0.74	48.2
3	0.50	225	0.71	46.0
4	0.55	225	0.74	48.2
5	0.50	225	0.71	46.0
6	0.35	225	0.59	38.5
D-1	0.45	225	0.67	43.6
2	0.55	225	0.74	48.2
3	0.60	225	0.77	50.4
4	0.60	225	0.77	50.4
5	0.60	225	0.77	50.4
6	0.55	225	0.74	48.2
TOTALS	12.30	5400	17.15	1115.5

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.513
Avg Stack Temperature (degF)	T(s avg)	=	225.0
Avg SQRT(dP)		=	0.715

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.153
Mol. Wt., Stack Gas Dry	M(d)	=	29.70
Mol. Wt., Stack Gas Wet	M(s)	=	27.91
Abs Stack Pressure (in Hg)	P(s)	=	29.91
Avg Stack Velocity (ft/sec)	V(s avg)	=	46.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	516124
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	790713

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/23/94
Sample Location: UNIT 3
Performed by: RM/BD

Conditions: MID LOAD, FGR ON
Start/Stop: 1245/1345

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	0.05
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
O2 Concentration	% O2	3.7
CO2 Concentration	% CO2	9.7
CO Concentration	% CO	0.144
N2 Concentration (by diff.)	% N2	(86.46)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A-1	0.50	229	0.71	46.2
2	0.55	229	0.74	48.4
3	0.55	229	0.74	48.4
4	0.55	229	0.74	48.4
5	0.60	229	0.77	50.6
6	0.50	229	0.71	46.2
B-1	0.60	229	0.77	50.6
2	0.45	229	0.67	43.8
3	0.45	229	0.67	43.8
4	0.50	229	0.71	46.2
5	0.50	229	0.71	46.2
6	0.45	229	0.67	43.8
C-1	0.50	228	0.71	46.1
2	0.45	228	0.67	43.8
3	0.50	228	0.71	46.1
4	0.50	228	0.71	46.1
5	0.55	228	0.74	48.4
6	0.35	228	0.59	38.6
D-1	0.50	228	0.71	46.1
2	0.50	228	0.71	46.1
3	0.60	228	0.77	50.5
4	0.65	228	0.81	52.6
5	0.60	228	0.77	50.5
6	0.60	228	0.77	50.5
TOTALS	12.50	5484	17.28	1127.9

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.521
Avg Stack Temperature (degF)	T(s avg)	=	228.5
Avg SQRT(dP)		=	0.720

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.156
Mol. Wt., Stack Gas Dry	M(d)	=	29.70
Mol. Wt., Stack Gas Wet	M(s)	=	27.87
Abs Stack Pressure (in Hg)	P(s)	=	29.91
Avg Stack Velocity (ft/sec)	V(s avg)	=	47.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	517347
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	799469

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/23/94
Sample Location: UNIT 3
Performed by: RM/BD

Conditions: MID LOAD, FGR & UREA ON
Start/Stop: 1435/1530

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	0.05
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
O2 Concentration	% O2	3.7
CO2 Concentration	% CO2	9.6
CO Concentration	% CO	0.142
N2 Concentration (by diff.)	% N2	(86.56)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A-1	0.55	230	0.74	48.5
2	0.50	230	0.71	46.2
3	0.55	230	0.74	48.5
4	0.60	230	0.77	50.7
5	0.50	230	0.71	46.2
6	0.50	230	0.71	46.2
B-1	0.50	230	0.71	46.2
2	0.40	230	0.63	41.4
3	0.50	230	0.71	46.2
4	0.50	230	0.71	46.2
5	0.50	230	0.71	46.2
6	0.45	230	0.67	43.9
C-1	0.50	230	0.71	46.2
2	0.50	230	0.71	46.2
3	0.50	230	0.71	46.2
4	0.60	230	0.77	50.7
5	0.50	230	0.71	46.2
6	0.40	230	0.63	41.4
D-1	0.50	230	0.71	46.2
2	0.55	230	0.74	48.5
3	0.60	230	0.77	50.7
4	0.60	230	0.77	50.7
5	0.60	230	0.77	50.7
6	0.55	230	0.74	48.5
TOTALS	12.45	5520	17.26	1128.8

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.519
Avg Stack Temperature (degF)	T(s avg)	=	230.0
Avg SQRT(dP)		=	0.719

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.160
Mol. Wt., Stack Gas Dry	M(d)	=	29.68
Mol. Wt., Stack Gas Wet	M(s)	=	27.81
Abs Stack Pressure (in Hg)	P(s)	=	29.91
Avg Stack Velocity (ft/sec)	V(s avg)	=	47.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	514175
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	800090

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/23/94
Sample Location: UNIT 3
Performed by: BD

Conditions: LOW LOAD, BASELINE
Start/Stop: 2330/2415

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	−0.25
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
O2 Concentration	% O2	4.8
CO2 Concentration	% CO2	8.9
CO Concentration	% CO	0.001
N2 Concentration (by diff.)	% N2	(86.30)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A−1	0.13	183	0.36	22.7
2	0.13	183	0.36	22.7
3	0.14	183	0.37	23.6
4	0.13	183	0.36	22.7
5	0.12	183	0.35	21.8
6	0.07	183	0.26	16.7
B−1	0.15	183	0.39	24.4
2	0.10	183	0.32	19.9
3	0.10	183	0.32	19.9
4	0.11	183	0.33	20.9
5	0.09	183	0.30	18.9
6	0.07	183	0.26	16.7
C−1	0.13	180	0.36	22.7
2	0.13	180	0.36	22.7
3	0.11	180	0.33	20.9
4	0.10	180	0.32	19.9
5	0.11	180	0.33	20.9
6	0.10	180	0.32	19.9
D−1	0.13	180	0.36	22.7
2	0.13	180	0.36	22.7
3	0.12	180	0.35	21.8
4	0.17	180	0.41	25.9
5	0.17	180	0.41	25.9
6	0.13	180	0.36	22.7
TOTALS	2.87	4356	8.25	519.7

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.120
Avg Stack Temperature (degF)	T(s avg)	=	181.5
Avg SQRT(dP)		=	0.344

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.147
Mol. Wt., Stack Gas Dry	M(d)	=	29.62
Mol. Wt., Stack Gas Wet	M(s)	=	27.91
Abs Stack Pressure (in Hg)	P(s)	=	29.89
Avg Stack Velocity (ft/sec)	V(s avg)	=	21.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	258370
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	368357

FLOW RATE CALCULATION

Plant: EDISON EGS
Date : 3/24/94
Sample Location: UNIT 3
Performed by: BD

Conditions: LOW LOAD, FGR ON
Start/Stop: 0117/0210

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.84
Barometric Pressure (in Hg)	P(b)	29.91
Static Pressure (in H2O)	P(stack)	−0.25
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
O2 Concentration	% O2	4.8
CO2 Concentration	% CO2	9.0
CO Concentration	% CO	0.009
N2 Concentration (by diff.)	% N2	(86.19)

VELOCITY TRAVERSE MEASUREMENTS

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)	Stack Velocity (ft/sec)
A−1	0.14	182	0.37	23.6
2	0.15	182	0.39	24.4
3	0.14	182	0.37	23.6
4	0.13	182	0.36	22.7
5	0.12	182	0.35	21.8
6	0.07	182	0.26	16.7
B−1	0.15	182	0.39	24.4
2	0.12	182	0.35	21.8
3	0.14	182	0.37	23.6
4	0.12	182	0.35	21.8
5	0.10	182	0.32	19.9
6	0.05	182	0.22	14.1
C−1	0.12	182	0.35	21.8
2	0.13	182	0.36	22.7
3	0.11	182	0.33	20.9
4	0.12	182	0.35	21.8
5	0.12	182	0.35	21.8
6	0.08	182	0.28	17.8
D−1	0.13	182	0.36	22.7
2	0.14	182	0.37	23.6
3	0.16	182	0.40	25.2
4	0.16	182	0.40	25.2
5	0.15	182	0.39	24.4
6	0.13	182	0.36	22.7
TOTALS	2.98	4368	8.40	529.3

VELOCITY TRAVERSE AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.124
Avg Stack Temperature (degF)	T(s avg)	=	182.0
Avg SQRT(dP)		=	0.350

CALCULATED VALUES FROM VELOCITY TRAVERSE AND MOISTURE MEASUREMENTS

Stack Gas Water Vapor Proportion	B(wo)	=	0.150
Mol. Wt., Stack Gas Dry	M(d)	=	29.63
Mol. Wt., Stack Gas Wet	M(s)	=	27.89
Abs Stack Pressure (in Hg)	P(s)	=	29.89
Avg Stack Velocity (ft/sec)	V(s avg)	=	22.1
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	262007
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	375152

MOISTURE AND VOLUME CALCULATIONS

Plant: EDISON, EGS
Date : 3/22/94
Performed by: CG/BD

Sample Location: UNIT 3
Test No./Type: MOISTURE/FGR ON
Start/Stop Time: 0915/1015

CONDITIONS: **FULL LOAD, FGR ON**

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.019
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	6
Total Sampling Time (min)	(theta)	(60.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		263.49
Gas Meter Final Reading (cu ft)		296.72
Net Gas Sample Volume (cu ft)	V(m)	(33.23)
Vol of Liquid Collected (ml)	Vl(c)	137.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.472)

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.000
Avg Stack Temperature (degF)	T(s avg)	=	249.2
Average Meter Temperature (degF)	T(m avg)	=	64.6

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	34.14
Stack Gas Water Vapor Proportion	B(wo)	=	0.159

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1	10	1.00	249	62	63
2	10	1.00	248	64	63
3	10	1.00	248	65	64
4	10	1.00	250	66	64
5	10	1.00	249	67	64
6	10	1.00	251	68	65
TOTALS	60	6.0000	1495.0	392	383

MOISTURE AND VOLUME CALCULATIONS

Plant: EDISON, EGS
Date : 3/22/94
Performed by: CG/BD

Sample Location: UNIT 3
Test No./Type: MOISTURE/BASELINE
Start/Stop Time: 1500/1600

CONDITIONS: **FULL LOAD, BASELINE**

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.019
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		348.17
Gas Meter Final Reading (cu ft)		387.40
Net Gas Sample Volume (cu ft)	V(m)	(39.23)
Vol of Liquid Collected (ml)	Vl(c)	157.9
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.432)

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.500
Avg Stack Temperature (degF)	T(s avg)	=	250.0
Average Meter Temperature (degF)	T(m avg)	=	67.6

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	40.12
Stack Gas Water Vapor Proportion	B(wo)	=	0.156

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1	15	1.50	250	67	67
2	15	1.50	250	70	67
3	15	1.50	250	70	65
4	15	1.50	250	70	65
TOTALS	60	6.0000	1000.0	277	264

MOISTURE AND VOLUME CALCULATIONS

Plant: EDISON, EGS
Date : 3/23/94
Performed by: CG/BD

Sample Location: UNIT 1
Test No./Type: MOISTURE/BASELINE
Start/Stop Time: 1030/1130

CONDITIONS: **MID LOAD, BASELINE**

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.019
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(330.1)
Gas Meter Initial Reading (cu ft)		387.80
Gas Meter Final Reading (cu ft)		428.90
Net Gas Sample Volume (cu ft)	V(m)	(41.10)
Vol of Liquid Collected (ml)	Vl(c)	160.2
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.541)

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.500
Avg Stack Temperature (degF)	T(s avg)	=	225.3
Average Meter Temperature (degF)	T(m avg)	=	69.9

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	41.86
Stack Gas Water Vapor Proportion	B(wo)	=	0.153

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1	15	1.50	225	67	67
2	15	1.50	225	71	68
3	15	1.50	226	73	71
4	15	1.50	225	71	71
TOTALS	60	6.0000	901.0	282	277

MOISTURE AND VOLUME CALCULATIONS

Plant: EDISON, EGS
Date : 3/23/94
Performed by: CG/BD

Sample Location: UNIT 1
Test No./Type: MOISTURE/FGR ON
Start/Stop Time: 1245/1345

CONDITIONS: **MID LOAD, FGR ON**

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.019
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		429.22
Gas Meter Final Reading (cu ft)		469.26
Net Gas Sample Volume (cu ft)	V(m)	(40.04)
Vol of Liquid Collected (ml)	Vl(c)	159.6
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.512)

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.500
Avg Stack Temperature (degF)	T(s avg)	=	228.5
Average Meter Temperature (degF)	T(m avg)	=	71.9

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	40.62
Stack Gas Water Vapor Proportion	B(wo)	=	0.156

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1	15	1.50	227	71	71
2	15	1.50	230	72	72
3	15	1.50	228	73	71
4	15	1.50	229	73	72
TOTALS	60	6.0000	914.0	289	286

MOISTURE AND VOLUME CALCULATIONS

Plant: EDISON, EGS
Date : 3/23/94
Performed by: CG/BD

Sample Location: UNIT 1
Test No./Type: MOISTURE/BASELINE
Start/Stop Time: 2325/2425

CONDITIONS: **LOW LOAD, BASELINE**

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.019
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		495.38
Gas Meter Final Reading (cu ft)		534.12
Net Gas Sample Volume (cu ft)	V(m)	(38.74)
Vol of Liquid Collected (ml)	Vl(c)	148.9
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.009)

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.500
Avg Stack Temperature (degF)	T(s avg)	=	182.3
Average Meter Temperature (degF)	T(m avg)	=	53.3

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	40.73
Stack Gas Water Vapor Proportion	B(wo)	=	0.147

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1	15	1.50	183	52	54
2	15	1.50	182	54	53
3	15	1.50	182	56	53
4	15	1.50	182	53	51
TOTALS	60	6.0000	729.0	215	211

MOISTURE AND VOLUME CALCULATIONS

Plant: EDISON, EGS
Date : 3/24/94
Performed by: CG/BD

Sample Location: UNIT 1
Test No./Type: MOISTURE/FGR ON
Start/Stop Time: 0117/0217

CONDITIONS: **LOW LOAD, FGR ON**

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.019
Barometric Pressure (in Hg)	P(b)	29.91
# of Sample Points	#	4
Total Sampling Time (min)	(theta)	(60.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	114.0
Length (if rectangular)	L	0.0
Width (if rectangular)	W	0.0
Area of Stack (sq ft)	A(s)	(283.5)
Gas Meter Initial Reading (cu ft)		534.38
Gas Meter Final Reading (cu ft)		570.97
Net Gas Sample Volume (cu ft)	V(m)	(36.59)
Vol of Liquid Collected (ml)	Vl(c)	144.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.811)

FIELD DATA AVERAGES

Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.150
Avg Stack Temperature (degF)	T(s avg)	=	181.5
Average Meter Temperature (degF)	T(m avg)	=	49.8

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	38.70
Stack Gas Water Vapor Proportion	B(wo)	=	0.150

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1	15	1.20	182	49	49
2	15	1.20	181	51	49
3	15	1.10	182	51	49
4	15	1.10	181	51	49
TOTALS	60	4.6000	726.0	202	196

FULL LOAD, FGR ON **PRELIMINARY VELOCITY TRAVERSE**

Plant: SCE

Date: 3/22/94

Location: SCE Etiwanda

Stack I.D.: 19'

Barometric Pressure, in. Hg: 29.91

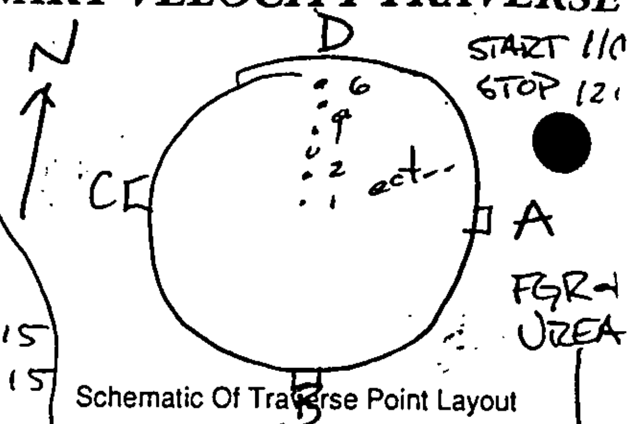
Static Pressure, in. H_2O: 0.22

Cp: 0.84 Time 0915

Operators: B.D. C.G. STOP 1015

Pito leak ck, OK

FGR ON



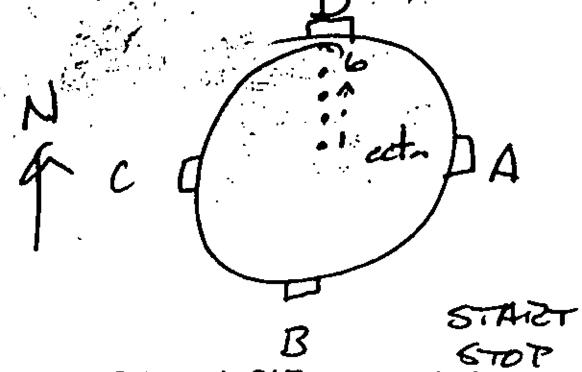
Schematic Of Traverse Point Layout

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F	TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
B-1	0.90	249	C-1	0.85	251
-2	0.85		2	0.90	
-3	0.85		3	0.85	
-4	0.90		4	0.85	
-5	0.85		5	0.80	
-6	0.85		6	0.85	
D-1	0.90		B-1	0.85	
-2	0.90		-2	0.85	
-3	1.00		-3	0.85	
-4	1.10		-4	0.90	
-5	1.10		-5	0.85	
-6	1.15		-6	0.85	
B-1	0.80		D-1	0.85	
-2	0.75		-2	0.95	
-3	0.80		-3	0.90	
-4	0.80		-4	1.00	
-5	0.90		-5	1.00	
-6	0.90 cds		-6	1.05	
A-1	0.85		A-1	0.90	
-2	1.05		-2	0.95	
-3	1.05		-3	0.95	
-4	0.95		-4	0.90	
-5	0.95		-5	0.95	
-6	0.95		-6	0.95	
AVERAGE			AVERAGE		

#5217 8/90

PRELIMINARY VELOCITY TRAVERSE

Plant: Edison EGS
Date: 3/22/94
Location: Unit 3
Stack I.D.: 19'
Barometric Pressure, in. Hg: 29.91
StaticPressure, in. H_2O: 0.22
Cp: 0.84
Operators: CG



START 1500
STOP 1455

Schematic Of Traverse Point Layout

EGR + Urea On – Run 2

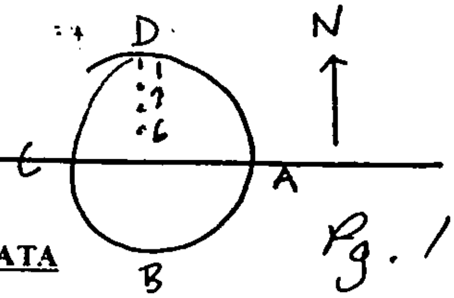
START 1301
STOP 1400

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
A-1	0.85	250
-2	0.90	↓
-3	0.90	
-4	0.90	
-5	0.95	
-6	0.85	
B-1	0.85	
-2	0.85	
-3	0.85	
-4	0.85	
-5	0.85	
-6	0.90	
C-1	0.80	
-2	0.80	
-3	0.75	
-4	0.80	
-5	0.80	
-6	0.80	
D-1	0.85	
-2	0.90	
-3	1.00	
-4	1.00	
-5	1.00	
-6	1.10	
AVERAGE		

BASELINE

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
A-1	0.90	250
-2	0.85	↓
-3	0.90	
-4	0.85	
-5	0.90	
-6	0.90	
⟷		
0.85	B-1	
0.90	-2	
0.80	-3	
0.85	-4	
0.85	-5	
0.90	-6	
C-1	0.80	
C-2	0.80	
-3	0.75	
-4	0.80	
-5	0.85	
-6	0.80	
D-1	0.85	
-2	0.95	
-3	0.90	
-4	1.00	
-5	0.95	
-6	1.05	
AVERAGE		

#5217 8/90



[redacted] VELOCITY DATA

Client/Location: SCE-Etiwanda
Sample Location: Stack
Unit No: 3
Test No: Mid/Cyclonic Flow
Barometric Pressure (in Hg): 29.91
Static Pressure in Stack (iwg): + 0.05

Date: 3-23-94
Data Taken By: Robt. M.
Test Description: Velocity
Pitot I.D. No.: 0.81 (Co-effecient)
Pre-Test Leak Check: ✓
Post-Test Leak Check:

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	~~Pitch~~ (P4-P5)	Temperature (F)
0759	D	6	-7	0.50		230
	↓	5	-5	0.51		229
		4	0	0.65		229
		3	+4	0.65		230
	↓	2	+10	0.59		230
0805	C	1	0	0.52		228
		6	-22	0.48		228
		5	-10	0.40		231
		4	-15	0.45		229
		3	-8	0.51		229
		2	+5	0.48		230
	↓	1	+20	0.41		231
0825	B	6	+2	0.50		230
		5	+5	0.45		230
		4	+5	0.45		229
		3	+5	0.54		230
		2	+25	0.39		228
	↓	1	+45	0.30		228

~~Note: Clockwise~~ rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.

3D_DATA.XLS
2/14/94
8:03 PM

Mid-load, Cyclonic Flow

[redacted] VELOCITY DATA

Client/Location ______ Date: ______

Sample Location: ______ Data Taken By: ______

Unit No: ______ Test Description: ______

Test No: ______ Pitot I.D. No.: ______

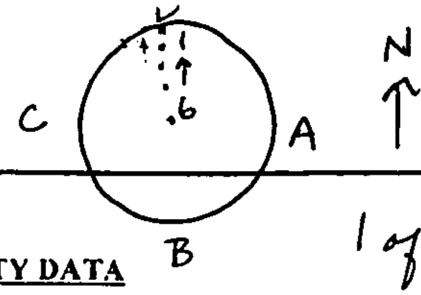
Barometric Pressure (in Hg): ______ Pre-Test Leak Check ______

Static Pressure in Stack (iwg): ______ Post-Test Leak ~~Check~~: ______

See Pg. 1

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	~~Pitch~~ (P4-P5)	Temperature (F)
0845	A	6	0	0.51		230
	↓	5	+5	0.59		230
		4	0	0.58		230
		3	+8	0.59		230
		2	+17	0.55		230
		1	+40	0.37		229
		~~6~~				
		~~5~~				
		~~4~~				
		~~3~~				
		~~2~~				
		~~1~~				

~~Note: Clockwise~~ rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.



[redacted]

[redacted] VELOCITY DATA

Client/Location: SCE/Etiwanda 3
Sample Location: Stack
Unit No: 3
Test No: Mid load Baseline
Barometric Pressure (in Hg): 29.91
Static Pressure in Stack (iwg): +0.05

Date: 3-23-94
Data Taken By: Robt. M.
Test Description: Velocity
Pitot I.D. No.: 0.84 (Coeffecient) #P12-02
Pre-Test Leak Check: ✓
Post-Test Leak Check:

Time	Port	Point	~~Yaw Angle~~ Velocity ~~(Degrees)~~	Velocity (P1-P2)	~~Pitch~~ (P4-P5)	Temperature (F)
1100	B	1 6 AD	0.50			225
		2 5	0.50			
		3 4	0.55			
		4 3	0.50			
		5 2	0.50			
		6 1	0.45			
1110	A	1 6 AD	0.45			
		2 5	0.50			
		3 4	0.55			
		4 3	0.60			
		5 2	0.50			
		6 1	0.50			

[redacted] rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.

Mid Load, Baseline [redacted] **VELOCITY DATA** 2 of 2

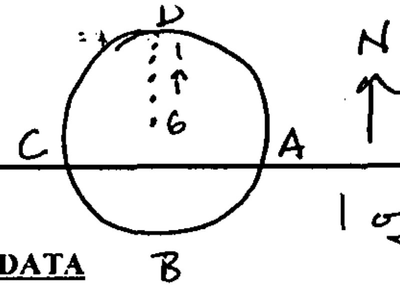
Client/Location ______
Sample Location: ______
Unit No: ______
Test No: ______
Barometric Pressure (in Hg): ______
Static Pressure in Stack (iwg): ______

Date: ______
Data Taken By: ______
Test Description: ______
Pitot I.D. No.: ______
Pre-Test Leak Check ______
Post-Test Leak Check: ______

See P. 1

Time	Port	Point	~~Yaw Angle~~ velocity ~~(Degrees)~~	Velocity (P1-P2)	~~[illegible]~~ (P4-P5)	Temperature (F)
1120	D	~~6~~ 1	0.45			225
	↓	~~5~~ 2	0.55			↓
		~~4~~ 3	0.60			
		~~3~~ 4	0.60			
		~~2~~ 5	0.60			
		~~1~~ 6	0.55			
1145	C	~~6~~ 1	0.40			
	↓	~~5~~ 2	0.55			
		~~4~~ 3	0.50			
		~~3~~ 4	0.55			
		~~2~~ 5	0.50			
		~~1~~ 6	0.35			

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.



[redacted]

[redacted] VELOCITY DATA

Client/Location: SCE Etiwanda
Sample Location: Unit 3
Unit No: 3
Test No: Mid load FGR ON
Barometric Pressure (in Hg): 29.91
Static Pressure in Stack (iwg): +0.05

Date: 3/23/94
Data Taken By: B. Day Robt. M
Test Description: Velocity
Pitot I.D. No.: 0.84 → #P12-02
Pre-Test Leak Check: ✓
Post-Test Leak Check:

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	Pitch (P4-P5)	Temperature (F)
1245	C	1 6	—	0.50		228
	↓	2 5	—	0.45		↓
		3 4	—	0.50		
		4 3	—	0.50		
		5 2	—	0.55		
	↓	6 1	—	0.35		
1300	D	1 6	—	0.50		
	↓	2 5	—	0.50		
		3 4	—	0.60		
		4 3	—	0.65		
		5 2	—	0.60		
	↓	6 1	—	0.60		↓

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.

3D_DATA.XLS
2/14/94
8:03 PM

Mid-load / FGR ON

[redacted]

[redacted] VELOCITY DATA

Client/Location:

Sample Location:

Unit No:

Test No:

Barometric Pressure (in Hg):

Static Pressure in Stack (iwg):

Date:

Data Taken By:

Test Description:

Pitot I.D. No.:

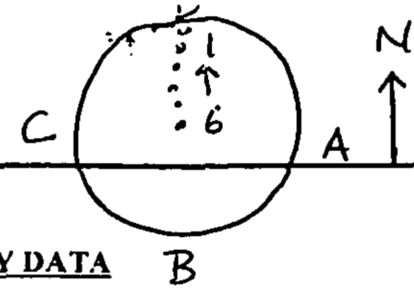
Pre-Test Leak Check

Post-Test Leak Check:

See Page (1)

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	Pitch (P4-P5)	Temperature (F)
1315	A	6 1	—	0.50		229
	↓	5 2	—	0.55		↓
	↓	4 3	—	0.55		↓
	↓	3 4	—	0.55		↓
	↓	2 5	—	0.60		↓
	↓	1 6	—	0.50		↓
1340	B	6 1	—	0.60		↓
	↓	5 2	—	0.45		↓
	↓	4 3	—	0.45		↓
	↓	3 4	—	0.50		↓
	↓	2 5	—	0.50		↓
	↓	1 6	—	0.45		↓

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.



[redacted] **VELOCITY DATA**

Client/Location: SCE Etiwanda
Sample Location: ~~[illegible]~~
Unit No: 3
Test No: Mid load FGR & Urea On
Barometric Pressure (in Hg): 29.91
Static Pressure in Stack (iwg): +0.05

Date: 3/23/94
Data Taken By: B.Day Kobt, M
Test Description: Velocity
Pitot I.D. No.: 0.84 (coefficient) → #P12-02
Pre-Test Leak Check: ✓
Post-Test Leak Check:

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	Pitch (P4-P5)	Temperature (F)
1435	B	1 6 BD	—	0.50		230
	↓	2 5	—	0.40		↓
	↓	3 4	—	0.50		↓
	↓	4 3	—	0.50		↓
	↓	5 2	—	0.50		↓
	↓	6 1	—	0.45		↓
1440	A	1 6	—	0.55		↓
	↓	2 5	—	0.50		↓
	↓	3 4	—	0.55		↓
	↓	4 3	—	0.60		↓
	↓	5 2	—	0.50		↓
	↓	6 1	—	0.50		↓

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.

Mid-Load, FGR + UREA ON [redacted] VELOCITY DATA

Client/Location__________ Date:__________

Sample Location:__________ Data Taken By:__________

Unit No:__________ Test Description:__________

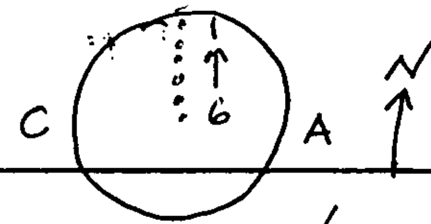
Test No:__________ Pitot I.D. No.:__________

Barometric Pressure (in Hg):__________ Pre-Test Leak Check__________

Static Pressure in Stack (iwg):__________ Post-Test Leak Check:__________

Time	Port	Point	~~Yaw~~ Angle Velocity (~~Degrees~~)	Velocity (P1-P2)	Pitch (P4-P5)	Temperature (F)
1455	D	1 6 (80)	0.50			230
	↓	2 5	0.55			↓
		3 4	0.60			
		4 3	0.60			
		5 2	0.60			
		6 1	0.55			
1530	C	1 6 (80)	0.50			
	↓	2 5	0.50			
		3 4	0.50			
		4 3	0.60			
		5 2	0.50			
		6 1	0.40			

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.



Low Load, Cyclonic Flow [redacted] **VELOCITY DATA**

Client/Location: SCE Etiwanda
Sample Location: Unit 3
Unit No: 3
Test No: Baseline low load
Barometric Pressure (in Hg): 29.91
Static Pressure in Stack (iwg): -0.24

Date: 3/23/94
Data Taken By: B. Day Robt M
Test Description: Velocity
Pitot I.D. No.: 0.81 coefficient
Pre-Test Leak Check: ✓
Post-Test Leak Check:

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	~~Pitch (P4-P5)~~	Temperature (F)
2110	D	6	0	0.14		185
		5		0.16		187
		4		0.16		187
		3		0.18		186
		2		0.15		185
		1		0.12		183
	C	6		0.16		183
		5		0.15		183
		4		0.16		185
		3		0.16		183
		2		0.14		184
		1		0.10 → 0.13		179

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.

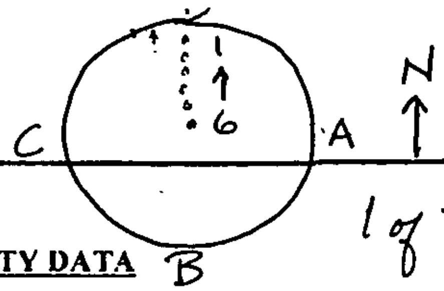
Low Load, Cyclonic Flow [redacted] VELOCITY DATA

Client/Location _____ Date: _____
Sample Location: _____ Data Taken By: _____
Unit No: _____ Test Description: _____
Test No: _____ Pilot I.D. No.: _____
Barometric Pressure (in Hg): _____ Pre-Test Leak Check _____
Static Pressure in Stack (iwg): _____ Post-Test Leak Check: _____

See Page 1

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	Pitch (P4-P5)	Temperature (F)
	B	6	0	0.16		183
		5	″	0.14		184
		4	″	0.16		185
		3	″	0.14		187
		2	″	0.14		186
		1	″	0.12		183
	A	6	″	0.14		185
		5	″	0.15		186
		4	″	0.18		186
		3	″	0.19		185
		2	″	0.17		187
		1	″	0.15		185

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.



1 of 2

[redacted]

[redacted] VELOCITY DATA

Client/Location: SCE Etiwanda
Sample Location:
Unit No: 3
Test No: Baseline Low load
Barometric Pressure (in Hg): 29.41
Static Pressure in Stack (iwg): -0.25

Date: 3/23/94
Data Taken By: R. Day
Test Description: Velocity
Pitot I.D. No.: 0.84 (coefficient) #P12-02
Pre-Test Leak Check: ✓
Post-Test Leak Check: ✓

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	Pitch (P4-P5)	Temperature (F)
2330	C	1 4 RD		0.13		180
	↓	2		RD [illegible] 0.13		↓
	↓	3		0.11		↓
	↓	4		0.10		↓
	↓	5		0.11		↓
	↓	6		0.10		↓
2345	D	1 4 RD		0.13		↓
	↓	2		0.13		↓
	↓	3		0.12		↓
	↓	4		0.17		↓
	↓	5		0.17		↓
	↓	6		0.13		↓

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.

Low Load, Baseline [redacted] **VELOCITY DATA** 2 of 2

Client/Location ______	Date: ______
Sample Location: ______	Data Taken By: ______
Unit No: ______	Test Description: ______
Test No: ______	Pitot I.D. No.: ______
Barometric Pressure (in Hg): ______	Pre-Test Leak Check ______
Static Pressure in Stack (iwg): ______	Post-Test Leak Check: ______

Time	Port	Point	Yaw Angle (Degrees)	Velocity (P1-P2)	Pitch (P4-P5)	Temperature (F)
2350	A	1 4 BD		0.13		183
		2 4		0.13		
		3 4		0.14		
		4 3		0.13		
		5 2		0.12		
~~[illegible]~~	~~B~~	6 1		0.07		
2415	B	1 6 BD		0.15		
		2 5		0.10		
		3 4		0.10		
		4 3		0.11		
		5 2		0.09		
		6 1		0.07		

Note: Clockwise rotation of the probe corresponds to a positive yaw angle: > 0 or > 90 degrees.

LOW LOAD, FGR ON

PRELIMINARY VELOCITY TRAVERSE

Plant SCE Etiwanda

Date 3/24/94

Location Unit 3

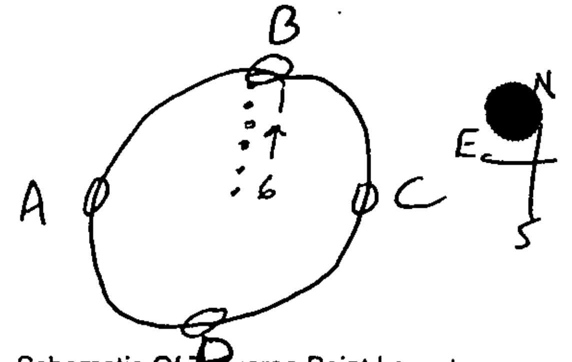
Stack I.D. 19'

Barometric Pressure, in. Hg 29.91

StaticPressure, in. H_2O -0.25

Cp 0.84

Operators B. Day



Schematic Of Traverse Point Layout

start: 0117
stop: 0210

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
A-6	0.14	182
5	0.15	↓
4	0.14	
3	0.13	
2	0.12	
↓ 1	0.07	
B-6	0.15	
5	0.12	
4	0.14	
3	0.12	
2	0.10	
↓ 1	0.05	↓
AVERAGE		

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
C-6 1	0.12	182
5 2	0.13	↓
4 3	0.11	
3 4	0.12	
2 5	0.12	
↓ 1 6	0.08	
D-6 1	0.13	
5 2	0.14	
4 3	0.16	
3 4	0.16	
2 5	0.15	
↓ 1 6	0.13	↓
AVERAGE		

#5217 8/90

MOISTURE - FULL LOAD, BASELINE

PARTICULATE TEST FIELD DATA SHEET

Plant SCE Etiwanda
Date 3/22/94
Test Location Port C
Run Number Baseline
Stack Diameter Inches 19'
Duct Dimensions In. x In. NA.
Start Time 1500
Operator B. Day

Barometric Pressure 29.91
Static Pressure 0.22
Stack Pressure 30.13
Probe Number NA
Pitot Coefficient N/A
Pitot Number NA
Meter Box Number 20151
Orifice Coefficient 1.019

Nozzle Size & Number NA
Molecule Weight NA
BWO 15.6%

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		CO_2	O_2	CO
681.4	788.1			
570.2	606.5			
472.3	475.5			
SILICA GEL				
774.8	786.5			

157.9

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg.	ORIFICE METER ΔH in. wg.	GAS METER VOLUME FT^3	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM in. Hg	$\sqrt{\Delta P}$	GAS METER LEAK CHECK RATE (CFM)
1	0	—	1.50	348.172	250	—	56	—	—	67	67	5"		PRE- 0.006 @ 23"
2	15	—	1.50	358.365	250	—	52	—	—	70	67	5"		POST- 0.005 @ 22"
3	30	—	1.50	368.270	250	—	55	—	—	70	65	5"		
4	45	—	1.50	377.550	250	—	58	—	—	70	65	15"		PITOT LEAK CHECK
Stop	60	—	—	387.401	—	—	—	—	—	—	—	—		
AVG/TOTAL														

MOISTURE

FULL LOAD, FGR ON

PARTICULATE TEST FIELD DATA SHEET

Cold Box #1

Plant: SCE Etiwanda
Date: 3/22/94
Test Location: Unit 3
Run Number: 1 Full FGR on
Stack Diameter: 19'
Duct dimensions in. x in.: NA
Start Time: 0915
Operator: B. Day

Barometric Pressure: 29.91
Static Pressure: 0.22
Stack Pressure: [illegible]
Probe Number: NA
Pilot Coefficient: NA
Pilot Number: NA
Meter Box Number: 20151
Orifice Coefficient: 1.019

Nozzle Size & Number: NA
Molecule Weight: NA
BWO: 15.9% NA

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		TIME	CO_2	O_2	CO
564.9	681.4				
560.0	578.2				
470.0	472.5				
SILICA GEL					
~~[illegible]~~ 766.3	774.8				

(137.5 circled)

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg.	ORIFICE METER ΔH in. wg.	GAS METER VOLUME FT3	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM in. Hg	~~ΔP~~	
1	0	—	1.00	263.488	249	—	62	—	—	62	63	10"		Pre leak
2	10	—	1.00	269.943	248	—	60	—	—	64	63	10"		0.002 at 15"
3	20	—	1.00	275.104	248	—	60	—	—	65	64	10"		
4	30	—	1.00	280.704	250	—	60	—	—	66	64	10"		
5	40	—	1.00	286.310	249	—	61	—	—	67	[illegible]	10"		
6	50	—	1.00	291.940	251	—	62	—	—	68	65	10"		
Stop	60	—	—	296.717	—	—	—	—	—	—	—	—		
														Post Leak
														0.003 at 21"
AVG/TOTAL														

#5214 8/90

MOISTURE - MID LOAD BASELINE

PARTICULATE TEST FIELD DATA SHEET

Plant: SCE
Date: 3/23/94
Test Location: Port C
Run Number: Mid-Load Baseline
Stack Diameter ~~Inches~~: 19'
Duct Dimensions In. x in.:
Start Time: 1030
Operator: R. Day

Barometric Pressure: 29.91
Static Pressure: 0.05
Stack Pressure: NA
Probe Number: NA
Pitot Coefficient: NA
Pitot Number: NA
Meter Box Number: 20151
Orifice Coefficient: 1.019

Nozzle Size & Number: NA
Molecule Weight: NA
BWO: NA

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		CO_2	O_2	CO
564.2	678.1			
552.4	568.5		160.2	
475.5	483.2			
SILICA GEL				
811.5	834.0			

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg.	ORIFICE METER ΔH in. wg.	GAS METER VOLUME FT³	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM In. Hg	$\sqrt{\Delta P}$	GAS METER LEAK CHECK RATE (CFM)
1	0	—	1.50	387.797	225	—	60	—	—	67	67	15	—	PRE- 0.007 @ 17
2	15	—	1.50	397.865	225	—	59	—	—	71	68	16	—	POST- 0.006 @ 2
3	30	—	1.50	408.095	226	—	61	—	—	73	71	16	—	
4	45	—	1.00	418.500	225	—	65	—	—	71	71	17	—	PITOT LEAK CHECK
Stop	60	—	—	428.899	—	—	—	—	—	—	—	—	—	
AVG/TOTAL														

#5214 7/92

MOISTURE - MID LOAD, FGR ON

PARTICULATE TEST FIELD DATA SHEET

Cold Box #2

Plant: SCE Etiwanda
Date: 3/23/94
Test Location: Port C
Run Number: Mid load FGR ON
Stack Diameter ~~inches~~: 14
Duct dimensions in. x in.:
Start Time: 1245
Operator: B. Day

Barometric Pressure: 29.91
Static Pressure: 0.05
Stack Pressure: 29.96
Probe Number: NA
Pilot Coefficient: NA
Pilot Number: NA
Meter Box Number: 20151
Orifice Coefficient: 1.019

Nozzle Size & Number: NA
Molecule Weight: NA
BWO:

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		TIME	CO_2	O_2	CO
574.7	688.8				
564.9	575.5				
~~458.6~~					
459.7	468.1				
SILICA GEL					
~~757~~ 751.3	775.8				

159.6

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg.	ORIFICE METER ΔH in. wg.	GAS METER VOLUME FT3	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM in. Hg	$\sqrt{\Delta P}$	
1	0	—	1.50	429.220	227	—	60	—	—	71	71	17	—	Pre leak
2	15	—	1.50	[illegible]	230	—	65	—	—	72	72	20	—	0.003@22"
3	30	—	1.50	449.100	228	—	70	—	—	73	71	20	—	Post Leak
4	45	—	1.50	459.170	229	—	75	—	—	73	72	20	—	0.004@26"
Stop	60	—	—	469.258	—	—	—	—	—	—	—	—	—	
AVG/TOTAL														

#5214 8/90

MOISTURE - LOW [illegible]D, BASELINE

PARTICULATE TEST FIELD DATA SHEET

Plant SCE Etiwanda
Date 3/23/92 Night
Test Location Port C
Run Number Baseline Low Load
Stack Diameter ~~inches~~ 19'
Duct Dimensions in. x in.
Start Time 2325
Operator B. Day

Barometric Pressure 29.91
Static Pressure -0.25
Stack Pressure 29.66
Probe Number NA
Pitot Coefficient NA
Pitot Number NA
Meter Box Number 20151
Orifice Coefficient 1.019

Nozzle Size & Number NA
Molecule Weight NA
BWO

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		CO_2	O_2	CO
567.5	696.8			
575.5	~~580~~ 580.3			
465.1	466.5	(148.9)		
SILICA GEL				
766.5	782.4			

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg.	ORIFICE METER ΔH in. wg.	GAS METER VOLUME FT^3	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	Exit ~~OVEN~~	GAS METER IN	GAS METER OUT	PUMP VACUUM in. Hg	$\sqrt{\Delta P}$	GAS METER LEAK CHECK RATE (CFM)
1	0	—	1.50	495.383	183	—	—	—	45	52	54	14	—	PRE- 0.005 @ 25
2	15	—	1.50	504.950	182	—	—	—	44	54	53	17	—	POST- 0.002 @ 25
3	30	—	1.50	514.560	182	—	—	—	49	56	53	19	—	
4	45	—	1.50	524.350	182	—	—	—	53	53	51	19	—	PITOT LEAK CHECK
Stop	60	—	—	534.123	—	—	—	—	—	—	—	—	—	
AVG/TOTAL														

MOISTURE - LOW LOAD, FGR ON

PARTICULATE TEST FIELD DATA SHEET

Plant: SCE Etiwanda
Date: 3/24/94
Test Location: @ Unit 3 Port C
Run Number: Low load FGR ON
Stack Diameter ~~inches~~: 19'
Duct Dimensions in. x in.:
Start Time: 0117
Operator: B. Day

Barometric Pressure: 29.91
Static Pressure: -0.25
Stack Pressure: 29.66
Probe Number: NA
Pitot Coefficient: NA
Pitot Number: NA
Meter Box Number: 20151
Orifice Coefficient: 1.014

Nozzle Size & Number: NA
Molecule Weight: NA
BWO:

FILTER DATA		
NUMBER	TARE	FINAL WT.

IMPINGER VOLUMES		CO_2	O_2	CO
574.9	701.8			
568.5	573.7			
483.2	488.2	144.7		
SILICA GEL				
774.0	781.6			

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg.	ORIFICE METER ΔH in. wg.	GAS METER VOLUME FT^3	TEMPERATURE °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM in. Hg	$\sqrt{\Delta P}$	GAS METER LEAK CHECK RATE (CFM)
1	0	—	1.20	534.375	182	—	44	—	—	49	49	20	—	PRE- 0.01@2
2	15	—	1.20	543.500	181	—	41	—	—	51	49	21	—	POST- 0.002@
3	30	—	1.10	552.660	182	—	44	—	—	51	49	21	—	
4	45	—	1.10	561.810	181	—	46	—	—	51	49	21	—	PITOT LEAK CHECK
Stop	60	—	—	570.968	—	—	—	—	—	—	—	—	—	
AVG/TOTAL														

#5214 7/92

APPENDIX H

SAMPLING EQUIPMENT CALIBRATION RECORDS

APPENDIX H-1

DRY GAS METER CALIBRATION RECORDS

CONSOLE METER POST-CALIBRATION

Client SCE Project No. 9585.011 Calibrated By B. Day Date 3/30/94

Barometric Pressure, P_b 29.50 in. Hg Pre-Test Meter Correction Factor 0.996 Date Calib.

Ambient Temperature 67 °F Post-Test Meter Correction Factor 0.997

Primary Test Meter No. 259453 Console No. 20151 Percent Difference $\left(\frac{Pre - Post}{Pre} \times 100 =\right)$ 0.1

Orifice Manometer Setting, (ΔH), in. H_2O	Gas Volume: Primary Meter (V_p), ft3	Gas Volume: Dry Gas Meter (V_d), ft3	Temperature: Primary Meter (t_p), °F	Temperature, Dry Gas Volume: Inlet (t_i), °F	Temperature, Dry Gas Volume: Outlet (t_o), °F	Temperature, Dry Gas Volume: Average (t_d), °F	Time (Θ), min	Vacuum Setting, in. Hg	Y	K_o	ΔH@
0.83	10.754	10.712	65 / 66	67 / 74	62 / 64	66.75	21	5"	0.996	0.716	1.783
2.00	9.220	9.229	66 / 66	71 / 79	65 / 67	70.50	12	5	0.997	0.689	1.899
								Average	0.997	0.703	1.841

	Primary Meter	Total	Dry Gas Meter	Total
Stop	745.240	10.754	585.462	10.712
Start	734.486		574.750	
Stop	756.505	9.220	596.729	9.229
Start	747.285		587.500	
Stop				
Start				

Calculations

$$Y = \frac{V_p (P_b) \quad (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right) \quad (t_p + 460)}$$

$$K_o \frac{V_p}{\Theta \sqrt{\frac{\Delta H \, (t_d + 460)}{P_b \, (28.96)}}}$$

$$\Delta H@ = \frac{0.0317 \, \Delta H}{P_b \, (t_o + 460)} \left[\frac{(t_p + 460) \, \Theta}{V_p}\right]^2$$

RM 5224 1/92

APPENDIX H-2

MAGNEHELIC CALIBRATION RECORDS

DATA SHEET FOR MAGNEHELIC GAGE
(<10" H_2O) CALIBRATION WITH INCLINED MANOMETER

Magnehelic Gauge I.D.# R80927

Reference Gauge I.D.# IM-1

Date 3/31/94

Calibrated by B. Day

Calibration for:
Semiannual ✓
Bimonthly ______
Other ______

Full Scale of Magnehelic Gauge 0-10 "H_2O

System Leak Test (Pass-Fail) (P) or F: 10" H_2O Press. 10" H_2O Vac.

Leak Test ~90%F.S. (Pass-Fail) (P) or F: " H_2O Press. "H_2O Vac.

Full Scale %	Magne. H_1 in. H_2O	Standard H_2 in. H_2O	$H_2'-H_2$ x p*	Differ. $H=H_2'-H_1$	Deviation $100\Delta H/H_2'$ %	Remarks**
20	2.0	1.96		0.04	2.0	
40	4.0	3.94		0.06	1.5	
60	6.0	5.98		0.02	0.3	
80						
100						
20	2.0	1.96		0.04	2.0	
40	4.0	3.98		0.02	0.5	
60	6.0	5.99		0.01	0.2	
80						
100						
20	2.0	1.96		0.04	2.0	
40	4.0	3.96		0.04	1.0	
60	6.0	5.98		0.02	0.3	
80						
100						
50	5.0					Vacuum

*1.0 in. for H_2O and Oil Manometer. 13.55 in. for Hg. Manometer

**Average Deviation, 95% CI. Correction Factor (0.95 F 1.05). Precision (± 3%)

Can only go to 60% of scale. Calibration above 60% will be done when dealing @ a source over 6 inches of water is tested

Figure III-13

Example Data Sheet for Differential Pressure Gauge

C... tion (... ...)

DATA SHEET FOR MAGNEHELIC GAGE
(<10" H_2O) CALIBRATION WITH INCLINED MANOMETER

Magnehelic Gauge I.D.# 80808

Reference Gauge I.D.# IM-1

Date 3/31/94

Calibrated by B. Day

Calibration for:
Semiannual ✓
Bimonthly ____
Other ____

Full Scale of Magnehelic Gauge 0.5 "H_2O

System Leak Test (Pass-Fail) (P) or F: | 6" H_2O Press. | 6" H_2O Vac.

Leak Test ~90%F.S. (Pass-Fail) (P) or F: | " H_2O Press. | "H_2O Vac.

Full Scale %%	Magne. H_1 in. H_2O	Standard H_2 in. H_2O	$H_2'-H_2$ x p*	Differ. $H=H_2'-H_1$	Deviation $100\Delta H/H_2'$ %	Remarks**
20	0.1	0.10		0	0	
40	0.2	0.20		0	0	
60	0.3	0.29		.01	3.4	
80	0.4	0.39		.01	2.6	
100	0.5	0.49		.01	2.0	
						9.63
20	0.1	0.10		0	0	
40	0.2	0.20		0	0	
60	0.3	0.29		0.1	3.4	
80	0.4	0.39		0.1	2.6	
100	0.5	0.49		0.1	2.0	
						19.27
20	0.1	0.10		0	0	
40	0.2	0.20		0	0	
60	0.3	0.29		0.1	3.4	
80	0.4	0.39		0.1	2.6	
100	0.5	0.48		0.2	4.2	
vac – 50%	0.25	0.24		0.01	4.2%	Vacuum

* 1.0 in. for H_2O and Oil Manometer. 13.55 in. for Hg. Manometer

** Average Deviation, 95% CI. Correction Factor (0.95 F 1.05). Precision (± 3%) No correction factor assigned; if no difference is ± 5%

Figure III-13

Example Data Sheet for Differential Pressure Gauge Calibration (English Units)

DATA SHEET FOR MAGNEHELIC GAGE
(<10" H_2O) CALIBRATION WITH INCLINED MANOMETER

Magnehelic Gauge I.D.# R91091LEU18

Reference Gauge I.D.# IM-1

Date 3/31/94

Calibrated by B. Day

Calibration for:
Semiannual ✓
Bimonthly ____
Other ____

Full Scale of Magnehelic Gauge 20 "H_2O

System Leak Test (Pass-Fail) (P) or F:	6" H_2O Press.	6" H_2O Vac.
Leak Test ~90%F.S. (Pass-Fail) (P) or F:	1.8 " H_2O Press.	1.8 "H_2O Vac.

Full Scale %	Magne. H_1 in. H_2O	Standard H_2 in. H_2O	$H_2'-H_2$ x P*	Differ. $H=H_2'-H_1$	Deviation $100\ H/H_2'$ %	Remarks**
20	0.4	0.38		0.02	5	
40	0.8	0.78		0.02	2.6	
60	1.2	1.17		0.03	2.6	
80	1.6	1.56		0.04	2.6	
100	2.0	1.95		0.05	2.6	
20	0.4	0.38		0.02	5	
40	0.8	0.78		0.02	2.6	
60	1.2	1.16		0.04	3.5	
80	1.6	1.56		0.04	2.6	
100	2.0	1.95		0.05	2.6	
20	0.4	0.38		0.02	5	
40	0.8	0.78		0.02	2.6	
60	1.2	1.15		0.05	4.3	
80	1.6	1.56		0.04	2.6	
100	2.0	1.95		0.05	2.6	
50	1.0	0.96		0.04	4.2	vacuum

*1.0 in. for H_2O and Oil Manometer. 13.55 in. for Hg. Manometer
**Average Deviation, 95% CI. Correction Factor (0.95 F 1.05). Precision (± 3%)

Figure III-13

Example Data Sheet for Differential Pressure Gauge Calibration (English Units)

APPENDIX H-3

THERMOCOUPLE CALIBRATION RECORDS

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

ROG Sampling Probe stack temp.

Date 3/30/94 Thermocouple number ROG P-1

Ambient temperature 69° F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury in glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0
	↓	100	100	0
		200	201	0.5
		300	300	0
		400	399	0.25
		500	500	0

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C + 273}) - (\text{test thermom temp, °C + 273})}{\text{ref temp, °C + 273}}\right] 100 \leq 1.5\%$

(°F + 460)

Quality Assurance Handbook M5-2.5

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Cold Box #1

Date 3/30/94 Thermocouple number CB1

Ambient temperature 67° F Barometric pressure 29.50 in Hg

Calibrator B. Day Reference: mercury-in-glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference, %[b]
	Simulator	0	0	0
	↓	100	100	0
		200	202	1
		300	300	0
		400	399	0.25
		500	500	0

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$

Quality Assurance Handbook M5-2.5

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Cold Box #2

Date 3/30/94 Thermocouple number CB2

Ambient temperature 71°F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass ______

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0
	↓	100	100	0
	↓	200	202	1
	↓	300	301	0.3
	↓	400	399	0.25
	↓	500	500	0

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$

°F + 460

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Cold Box #1

Date 3/30/94 Thermocouple number CB4

Ambient temperature 67° F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference, %[b]
	Simulator	0	0	0
	↓	100	100	0
		200	201	0.5
		300	301	0.3
		400	399	0.25
		500	500	0

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$

°F + 460

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

umbilical #1
stack temp · male end

Date 3/30/94 Thermocouple number U12A

Ambient temperature 67° F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury in-glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0
	↓	100	98	2
		200	200	0
		300	299	0.3
		400	397	0.8
		500	496	0.8

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \le 1.5\%$

Quality Assurance Handbook M5-2.5

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Umbilical #1
stack temp female end

Date 3/30/94 Thermocouple number U12B

Ambient temperature 67°F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference, %[b]
	Simulator	0	0	0
	↓	100	98	2
		200	200	0
		300	299	0.3
		400	397	0.8
		500	496	0.8

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

umbilical #1
exit temp Male end

Date 3/30/94 Thermocouple number U14A

Ambient temperature 67°F Barometric pressure 29.50 in Hg

Calibrator B. Day Reference: mercury-in-glass ______

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0.020
	↓	100	98	2
		200	200	0
		300	299	0.3
		400	397	0.8
		500	496	0.8

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$

(printed form: °C + 273, handwritten corrections to °F + 460) umbilical #1 exit FEMALE

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 3/30/94 Thermocouple number U14B

Ambient temperature 67 °F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass ______

other Simulator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0%
	↓	100	98	2%
		200	200	0%
		300	299	0.3%
		400	397	0.8%
		500	496	0.8%

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$

(Printed: °C + 273; handwritten corrections: °F + 460)

Quality Assurance Handbook M5-2.5

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

console stack temp # 201151

Date 3/30/94 Thermocouple number C27

Ambient temperature 67° F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0%
	↓	100	98	2%
		200	200	0%
		300	299	0.3%
		400	397	0.8%
		500	496	0.8%

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \le$ [illegible]

°F + 460

Quality Assurance Handbook M5-[illegible]

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

console # 2015 exit temp.

Date 3/30/94 Thermocouple number C47

Ambient temperature 67° F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass ____

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0%
	↓	100	98	2%
		200	200	0%
		300	299	0.3%
		400	397	0.8%
		500	496	0.8%

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C + 273}) - (\text{test thermom temp, °C + 273})}{\text{ref temp, °C + 273}}\right] 100 \leq 1.5\%$

°F + 460

Quality Assurance Handbook M5-2.5

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Gas meter In console 2015

Date 3/30/94 Thermocouple number C67

Ambient temperature 67° F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0%
	↓	100	98	2%
		200	200	0%
		300	299	0.3%
		400	397	0.8%
		500	497	0.6%

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \le 1.5\%$

Quality Assurance Handbook M2-5.5

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Gas Meter Out
console 20151

Date 3/30/94 Thermocouple number C 77

Ambient temperature 67° F Barometric pressure 29.50 in. Hg

Calibrator B. Day Reference: mercury-in-glass

other Simulator/calibrator

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
	Simulator	0	0	0 0%
	↓	100	98	2.0%
		200	200	0
		300	299	0.3%
		406	397	0.8%
		500	496	0.8%

[a] Type of calibration system used.

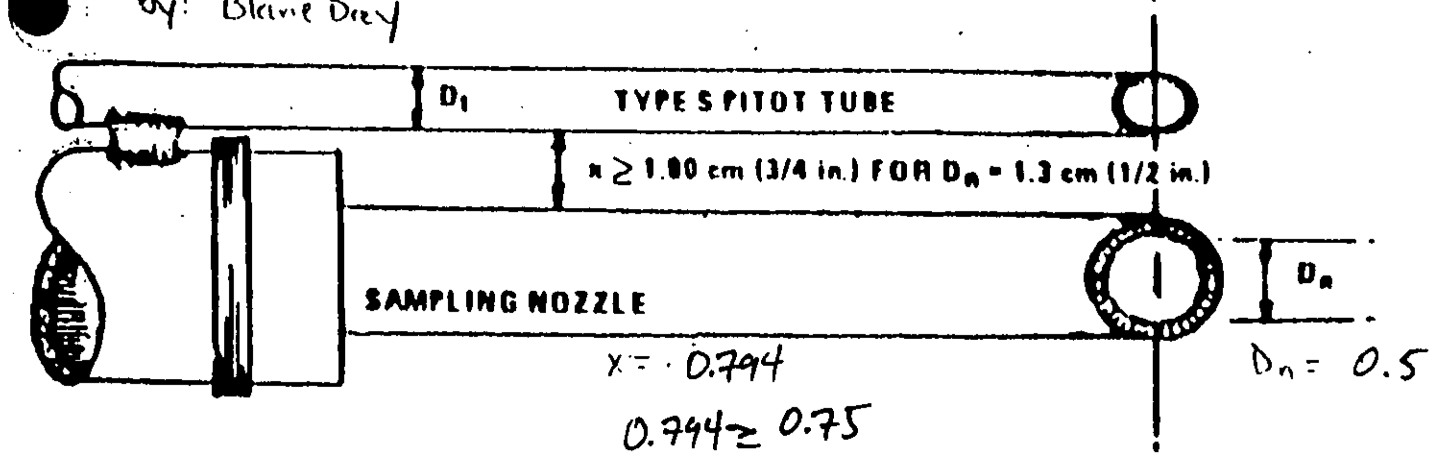
[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \le 1.5\%$ (handwritten corrections: °F + 460)

APPENDIX H-4

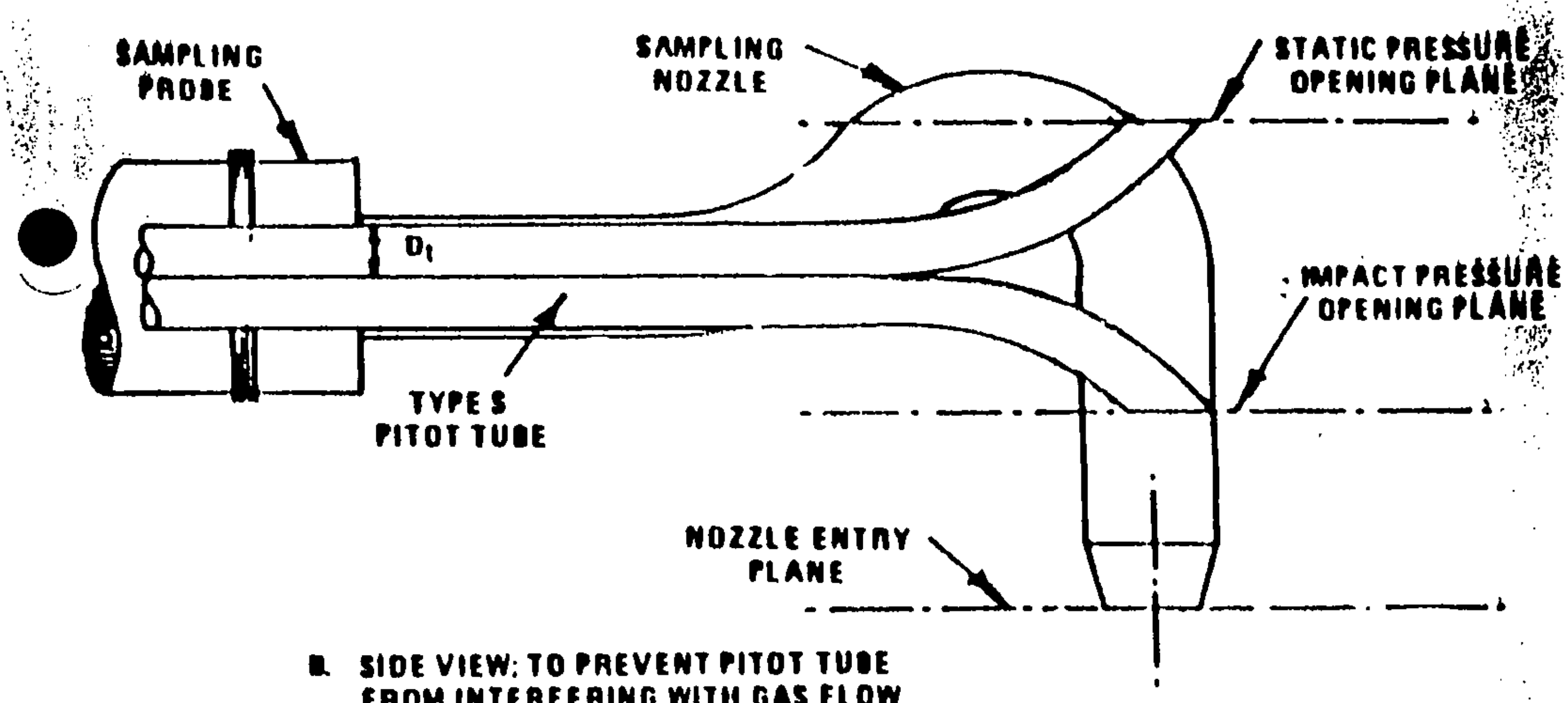
PITOT CALIBRATION RECORDS

Pitot # S 1202
Calibrated 12/13/93
by: Blane Day

semiannual cal. required



A. BOTTOM VIEW: SHOWING MINIMUM PITOT-NOZZLE SEPARATION.

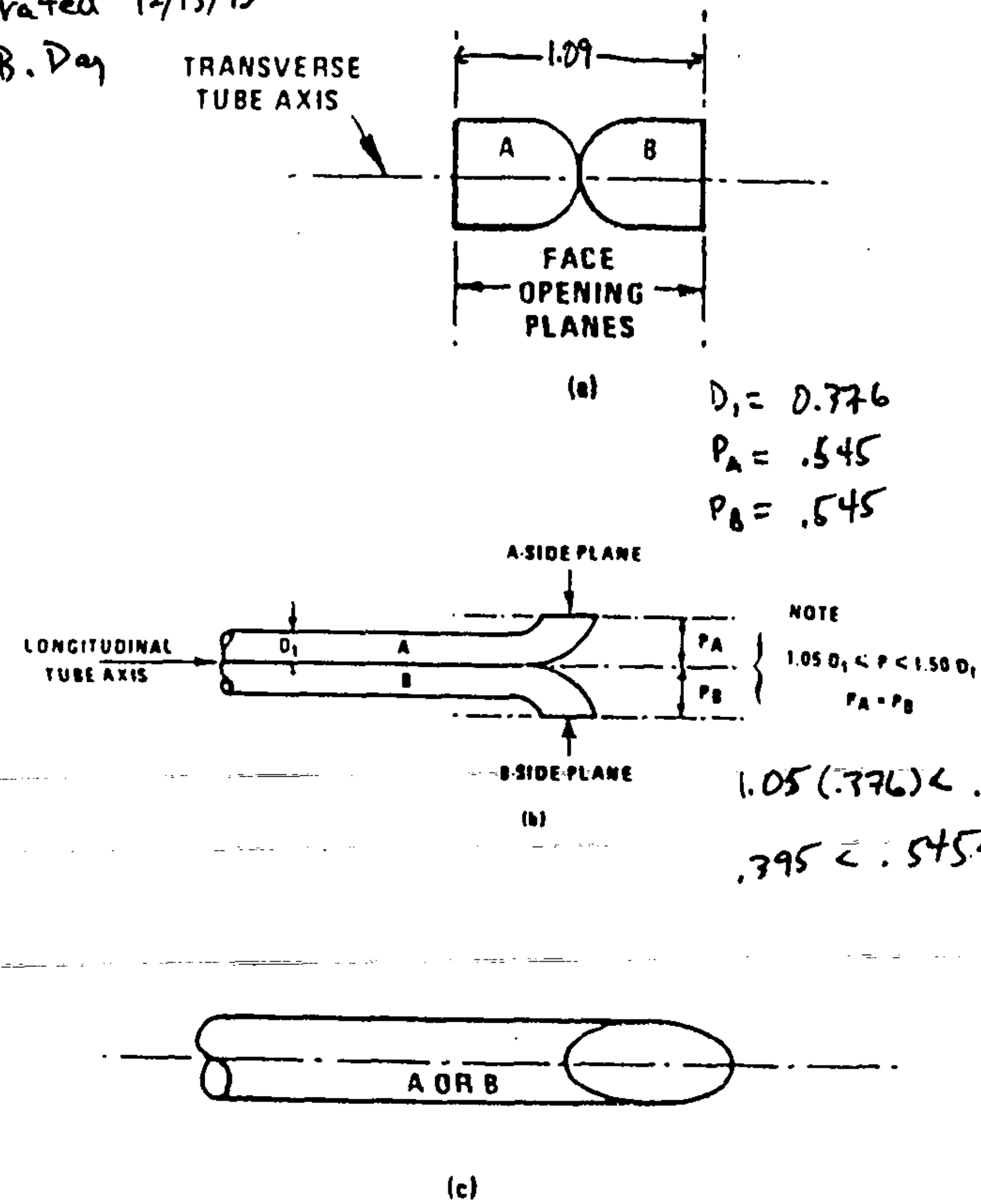


B. SIDE VIEW: TO PREVENT PITOT TUBE FROM INTERFERING WITH GAS FLOW STREAMLINES APPROACHING THE NOZZLE, THE IMPACT PRESSURE OPENING PLANE OF THE PITOT TUBE SHALL BE EVEN WITH OR ABOVE THE NOZZLE ENTRY PLANE.

gure 2-6. Proper pitot tube-sampling nozzle configuration to prevent aerodynamic interference hook-type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and 0.95 cm and 3/8 in.).

[Figure 2-6 amended by 52 FR 34639, September 14, 1987]

Pitot # S1202
calibrated 12/13/93
by: B. Day



$D_t = 0.376$
$P_A = .545$
$P_B = .545$

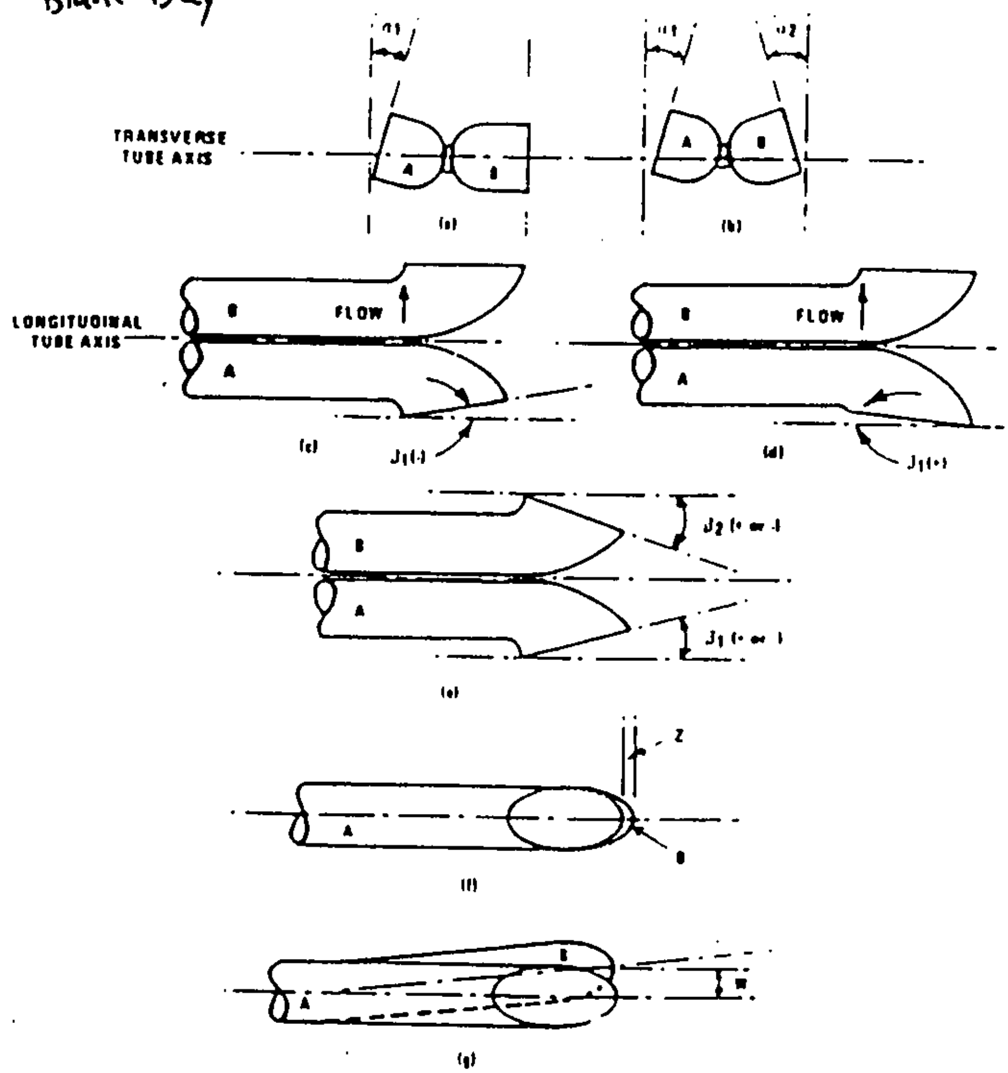
$1.05(.376) < .545 < 1.5(.376)$
$.395 < .545 < .564$

Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

Figure III-2

Proper Pitot Tube Configuration

Pitot # S 1202
calibrated 12/13/99
by: Blane Day



Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of Cp(s) so long as $\alpha 1$ and $\alpha 2$ 10° $\beta 1$ and $\beta 2$ 5°, z 0.32 cm (1/8 in.) and w 0.08 cm (1/32 in.) (citation 11 in Section 6).

$a_1 = 0°$ $B_1 = 0°$ $z = 0°$

$a_2 = 0°$ $B_2 = 0°$ $w = 0°$

Figure III-3

Improper Pitot Tube Configuration

Pitot #: S1202
calibrated 12/13/93
by:

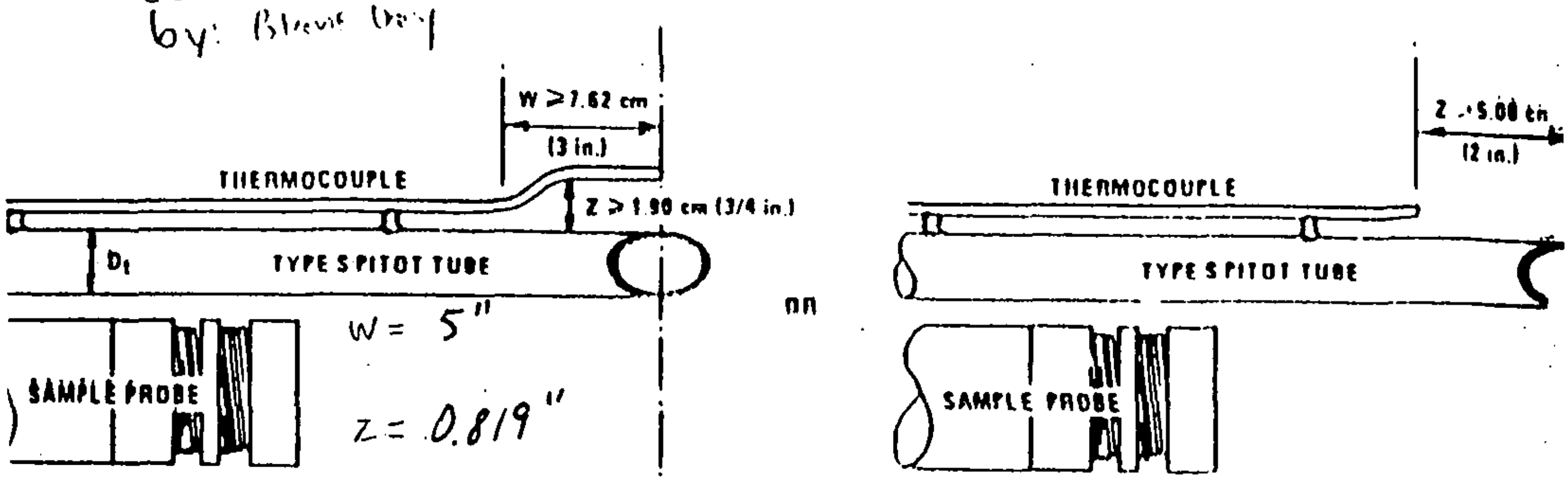
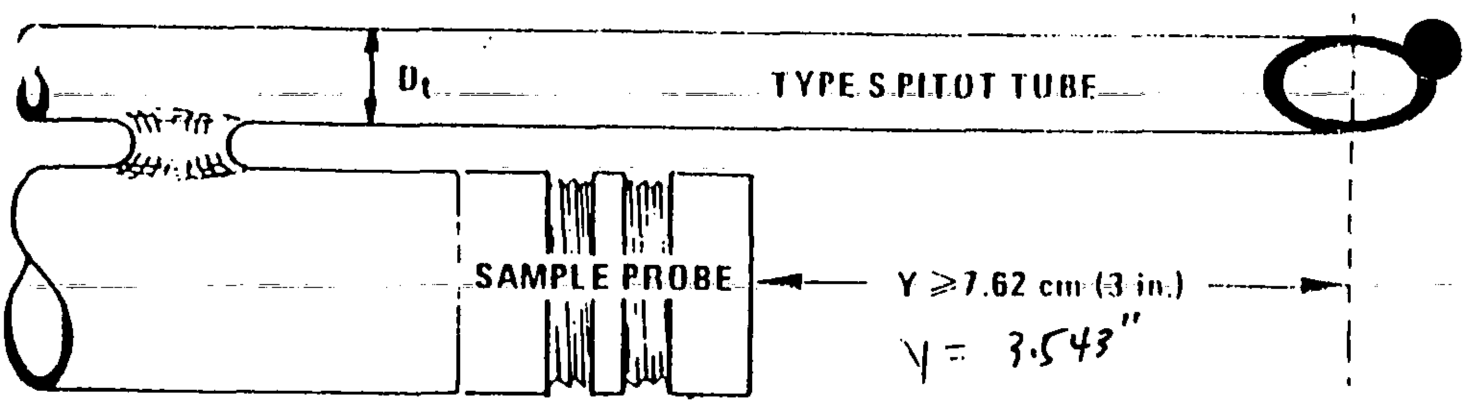


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).



gure 2-8. Minimum pitot-sample probe separation needed to prevent interfere
between 0.48 and 0.95 cm (3/16 and 3/8 in.).

Pitot # S 51201
calibrated 12/13/93
by: Blew Dry

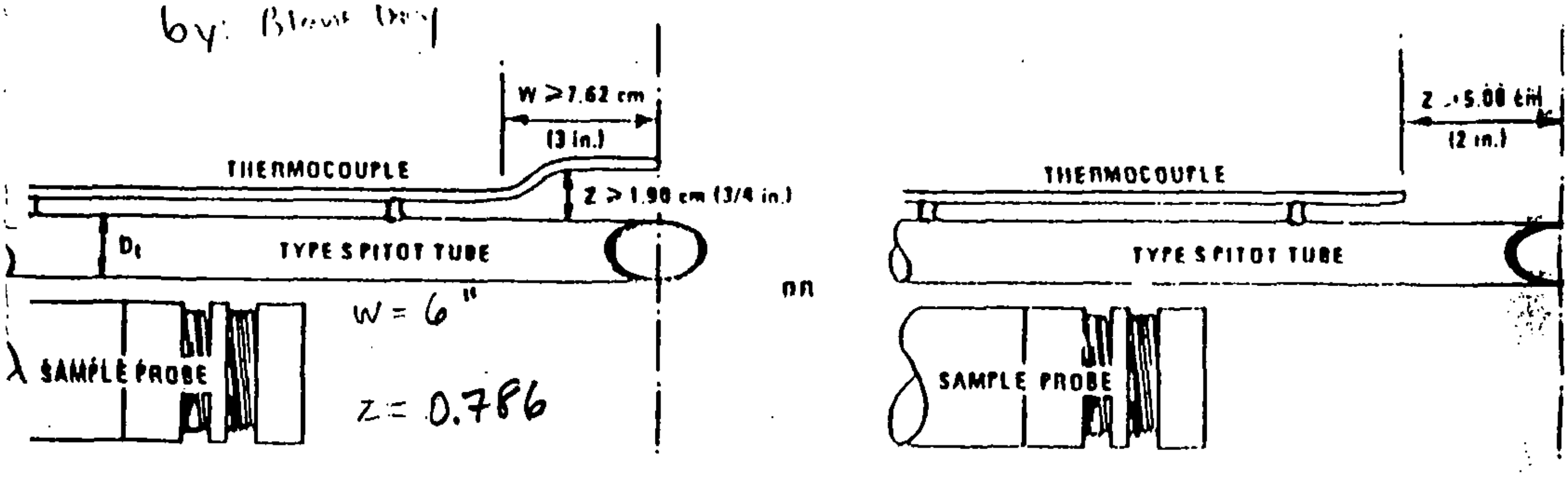
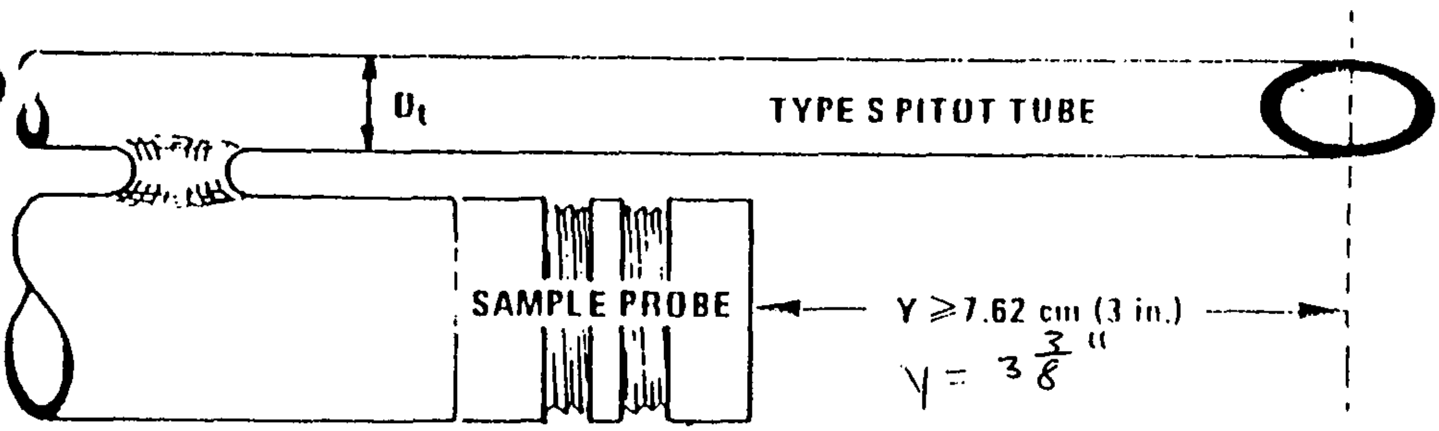
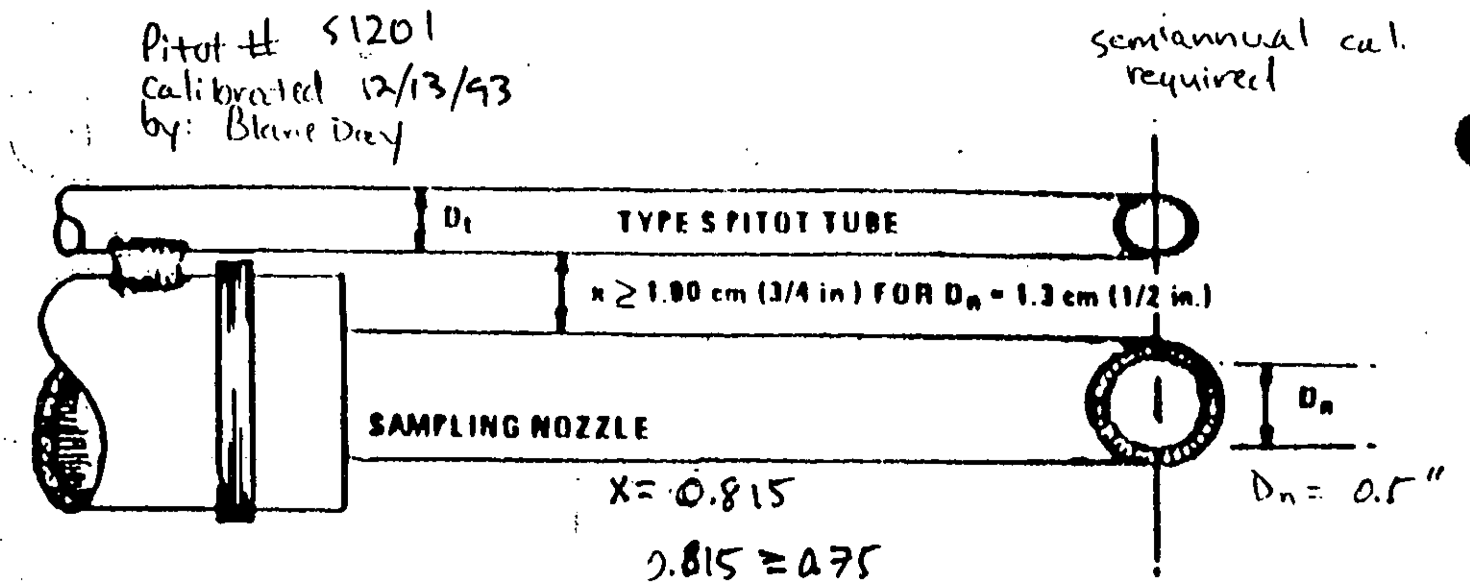


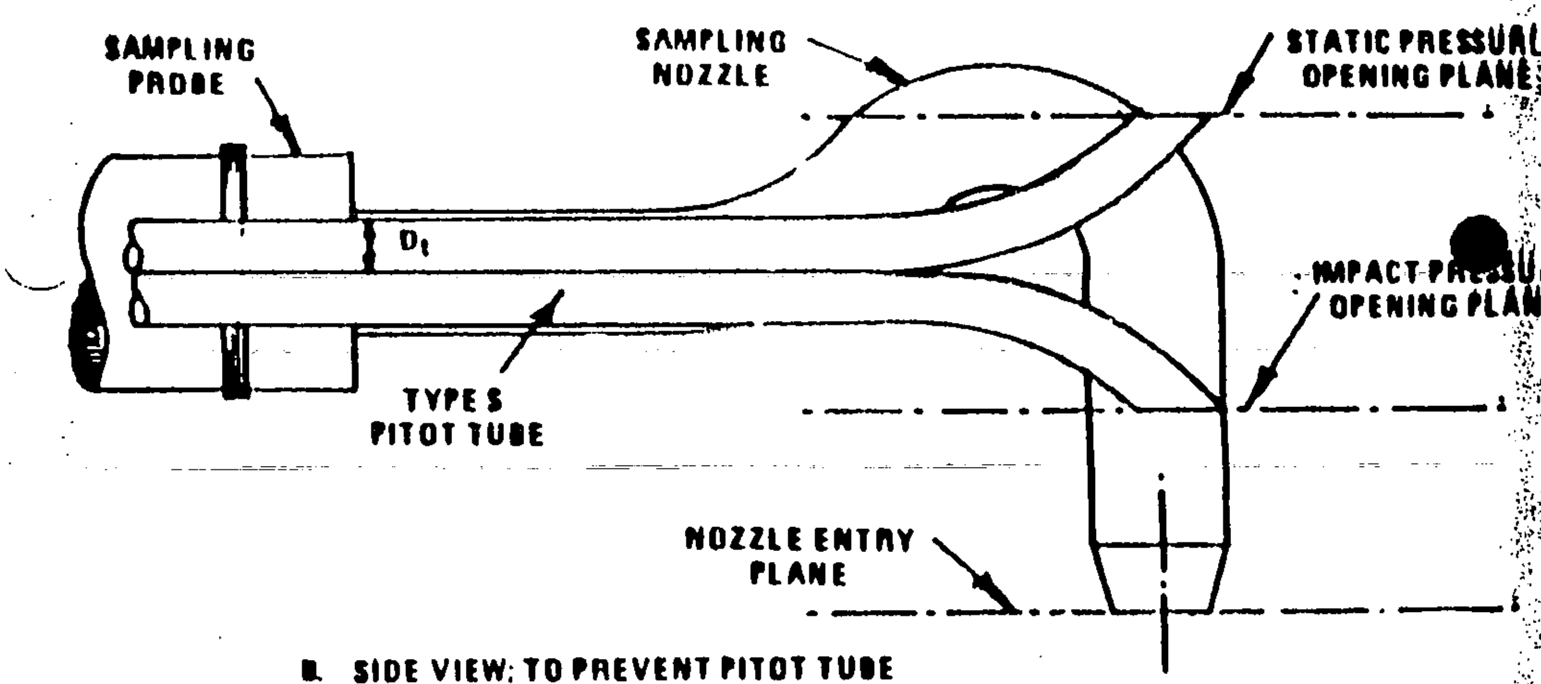
Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).



gure 2-8. Minimum pitot-sample probe separation needed to prevent interferenc
between 0.48 and 0.95 cm (3/16 and 3/8 in.).



A. BOTTOM VIEW; SHOWING MINIMUM PITOT-NOZZLE SEPARATION.



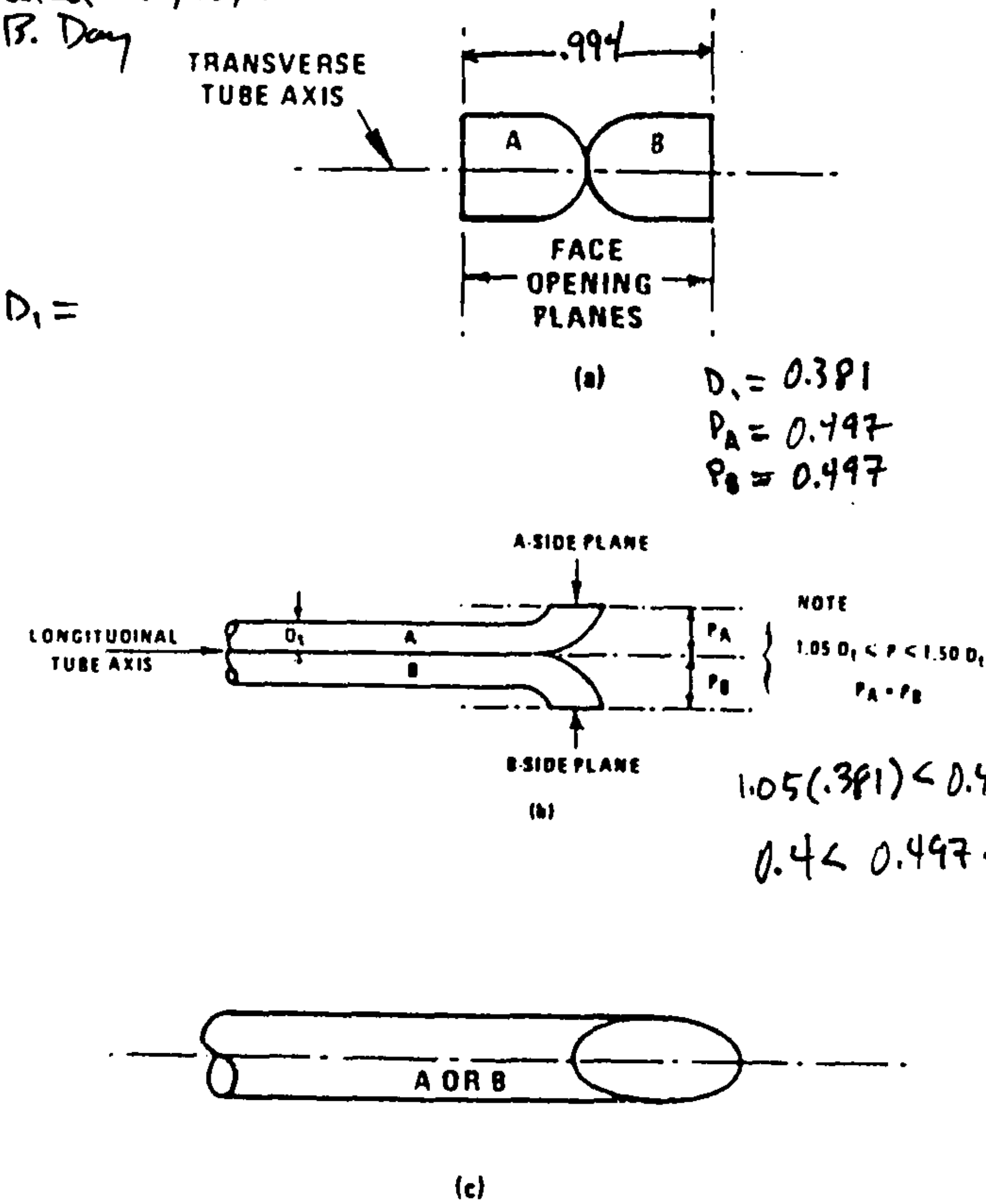
B. SIDE VIEW; TO PREVENT PITOT TUBE FROM INTERFERING WITH GAS FLOW STREAMLINES APPROACHING THE NOZZLE, THE IMPACT PRESSURE OPENING PLANE OF THE PITOT TUBE SHALL BE EVEN WITH OR ABOVE THE NOZZLE ENTRY PLANE.

Figure 2-6. Proper pitot tube-sampling nozzle configuration to prevent aerodynamic interfer[illegible] b[illegible]hook-type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and [illegible] ([illegible] and 3/8 in.).

[Figure 2-6 amended by 52 FR 34639, September 14, 1987]

Pitot # S1201
calibrated 12/13/93
by: B. Day

$D_1 =$



$D_1 = 0.381$
$P_A = 0.497$
$P_B = 0.497$

$1.05(.381) < 0.497 < 1.50(.381)$

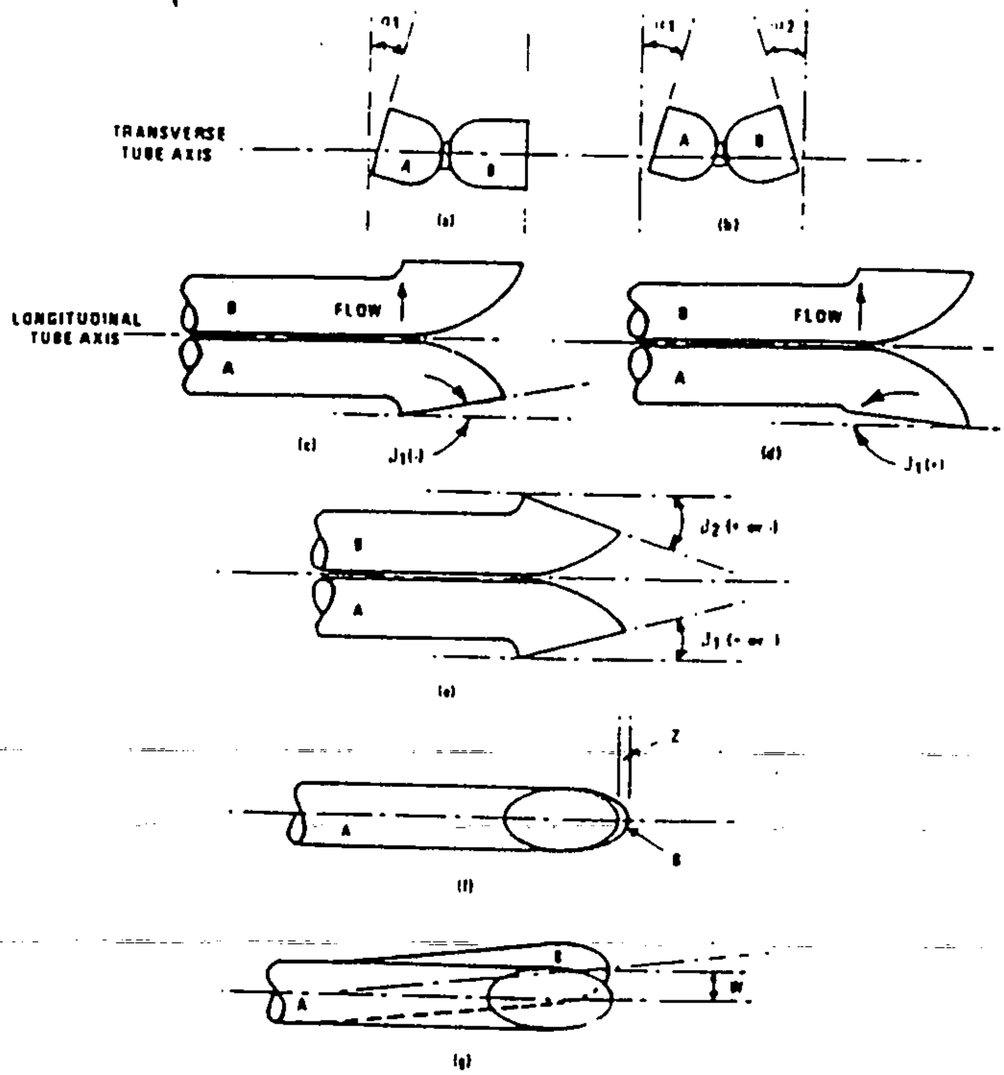
$0.4 < 0.497 < 0.572$

Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view: both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

Figure III-2

Proper Pitot Tube Configuration

Pitot # S1201
calibrated 12/13/93
by: Blane Day



Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of Cp(s) so long as α1 and α2 10° β1 and β2 5°, z 0.32 cm (1/8 in.) and w 0.08 cm (1/32 in.) (citation 11 in Section 6).

$a_1 = 0°$ $B_1 = 1°$ $z = 0°$

$a_2 = 0°$ $B_2 = 0°$ $w = 0°$

Figure III-3

Improper Pitot Tube Configuration

APPENDIX I

CALIFORNIA ARB CONTRACTORS PROGRAM CERTIFICATION CERTIFICATE

State of California

Air Resources Board

Approved Independent Contractor

Acurex Environmental Corporation

This is to certify that the company listed above has been approved by the Air Resources Board to conduct compliance testing pursuant to Section 91207, Title 17, California Code of Regulations, until June 30, 1994, for those test methods listed below:

ARB Source Test Methods:
1, 2, 3, 4, 5, 10, 100(CO_2, NO_x, O_2, SO_2, THC)
Visible Emissions Evaluation

James J. Morgester, Chief
Compliance Division

Laura McKinney, Manager
Investigation and Certification Section