METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(214) 931-7127

SOURCE EMISSIONS SURVEY OF FIRESTONE SYNTHETIC RUBBER & LATEX COMPANY BOILER EB-114 EXHAUST STACK TACB PERMIT R-2565 ORANGE, TEXAS

NOVEMBER 1990

FILE NUMBER 90-22

METCO ENVIRONMENTAL

Company Name Firstone Rubber & Latex Co. TACB Account No. _____

City Orange County Orange TACB Region 10

Testing required by: TACB Permit

TACB Permit No. R-2565

PSD Permit No. _____

NSPS Subpart _____

(INCLUDE A COPY OF PERMIT SPECIAL PROVISIONS)

Source Tested Boiler EB-114 TACB E. I. Point No. EB-114

Stack Height 45 feet Stack Diameter 4 feet 10 1/8 inches

Sampling Ports Location:

Downstream Distance to Obstruction 6 feet 6 inches

Upstream Distance to Obstruction 7 feet 10 1/2 inches

Checked for Cyclonic Flow? X Yes ____ No

Cyclonic Flow Present? ____ Yes X No

(INCLUDE A DRAWING OF STACK SHOWING SAMPLING PORTS AND MEASUREMENTS)

Design Operating Rate _____ Maximum Operating Rate _____

Normal Operating Rate _____ Operating Schedule _____

TACB Test Observer _____

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BOILER EB-114 EXHAUST STACK
TACB PERMIT R-2565
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INTRODUCTION

METCO Environmental, Dallas, Texas, conducted a source emissions survey of Firestone Synthetic Rubber & Latex Company located in Orange, Texas, on November 5, 6, 7, 8, and 9, 1990. The purpose of these tests was to determine the concentrations of oxides of nitrogen, carbon monoxide, and total hydrocarbons being emitted to the atmosphere via the exhaust stack of Boiler EB-114 under different operating conditions.

The sampling followed the procedures set forth in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3, 4, 7E, 10, and 25A, and in the "Sampling Procedures Manual, Texas Air Control Board, January 1983."

SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack

Condition	Fuel	Steam Load (lbs/hr)	Run Number	Oxides of Nitrogen Emissions (ppm)	Oxides of Nitrogen Emissions (lbs/hr)	Carbon Monoxide Emissions (ppm)	Carbon Monoxide Emissions (lbs/hr)	Total Hydrocarbons Emissions as Propane (ppm)	Total Hydrocarbons Emissions as Propane (lbs/hr)
I	Gas	30,000	1	140	6.6	5	0.1	<0.5	<0.02
			2	133	6.1	5	0.1	2.0	0.09
			3	135	6.1	5	0.1	<0.5	<0.02
			Average	136	6.3	5	0.1	<1.0	<0.04
		90,000	4	162	23.1	35	3.0	4.0	0.55
			5	161	21.8	35	2.9	3.5	0.45
			6	161	21.1	35	2.8	3.0	0.38
			Average	161	22.0	35	2.9	3.5	0.46
II	Gas & Stream 1	30,000	1	280	16.2	5	0.2	<0.5	<0.03
			2	140	7.3	<5	<0.2	<0.5	<0.02
			3	155	7.6	<5	<0.1	<0.5	<0.02
			Average	192	10.4	<5	<0.2	<0.5	<0.02
		70,000	4	132	14.0	5	0.3	2.0	0.20
			5	134	15.2	12	0.8	2.0	0.22
			6	134	14.9	20	1.4	2.5	0.27
			Average	133	14.7	12	0.8	2.2	0.23
			Allowable Emission Rate		36.6		13.97		0.19

SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack

Condition	Fuel	Steam Load (lbs/hr)	Run Number	Oxides of Nitrogen Emissions (ppm)	Oxides of Nitrogen Emissions (lbs/hr)	Carbon Monoxide Emissions (ppm)	Carbon Monoxide Emissions (lbs/hr)	Total Hydrocarbons Emissions as Propane (ppm)	Total Hydrocarbons Emissions as Propane (lbs/hr)
III	Gas & Stream 3	70,667	1	78	9.0	20	1.4	1.0	0.11
			2	113	12.4	15	1.0	0.5	0.05
			3	96	10.2	12	0.8	1.5	0.15
			Average	96	10.5	16	1.1	1.0	0.10
		30,000	4	87	4.9	12	0.4	3.5	0.19
			5	85	5.1	15	0.6	2.5	0.14
			6	60	3.5	20	0.7	3.5	0.20
			Average	77.3	4.5	16	0.6	3.2	0.18
IV	Gas & Stream 2	72,000	1	88	9.4	13	0.8	1.0	0.10
			2	97	10.6	8	0.5	0.5	0.05
			3	95	10.0	5	0.3	<0.5	<0.05
			Average	93	10.0	9	0.5	<0.7	<0.07
			Allowable Emission Rate		36.6		13.97		0.19

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SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack
Condition I

Run Number	1	2	3
Date	11/6/90	11/6/90	11/6/90
Time	0850-0950	1030-1130	1145-1245
Stack Flow Rate - ACFM	11,250	10,955	10,649
Stack Flow Rate - DSCFM*	6,541	6,450	6,299
% Water Vapor - % Vol.	18.75	17.72	17.18
% CO_2 - % Vol.	9.5	9.0	9.5
% O_2 - % Vol.	2.5	2.0	2.5
% Excess Air @ Sampling Point	12	9	12
Stack Temperature - °F	283	283	284
Stack Pressure - "Hg	30.00	30.00	30.00
Oxides of Nitrogen Emissions - ppm	140	133	135
Oxides of Nitrogen Emissions - lbs/hr	6.6	6.1	6.1
Carbon Monoxide Emissions - ppm	5	5	5
Carbon Monoxide Emissions - lbs/hr	0.1	0.1	0.1
Total Hydrocarbons Emissions as Propane - ppm	<0.5	2.0	<0.5
Total Hydrocarbons Emissions as Propane - lbs/hr	<0.02	0.09	<0.02
Production Rate Steam Load - lbs/hr	30,000	30,000	30,000

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack
Condition I

Run Number	4	5	6
Date	11/6/90	11/6/90	11/6/90
Time	1542-1642	1700-1800	1810-1910
Stack Flow Rate - ACFM	37,025	35,809	35,631
Stack Flow Rate - DSCFM*	19,929	18,909	18,322
% Water Vapor - % Vol.	16.65	17.34	18.43
% CO_2 - % Vol.	9.3	8.0	8.3
% O_2 - % Vol.	2.8	2.5	3.1
% Excess Air @ Sampling Point	14	12	15
Stack Temperature - °F	366	375	386
Stack Pressure - "Hg	30.11	30.11	30.11
Oxides of Nitrogen Emissions - ppm	162	161	161
Oxides of Nitrogen Emissions - lbs/hr	23.1	21.8	21.1
Carbon Monoxide Emissions - ppm	35	35	35
Carbon Monoxide Emissions - lbs/hr	3.0	2.9	2.8
Total Hydrocarbons Emissions as Propane - ppm	4.0	3.5	3.0
Total Hydrocarbons Emissions as Propane - lbs/hr	0.55	0.45	0.38
Production Rate Steam Load - lbs/hr	90,000	90,000	90,000

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack
Condition II

Run Number	1	2	3
Date	11/7/90	11/7/90	11/7/90
Time	0905-1005	1020-1120	1136-1236
Stack Flow Rate - ACFM	13,678	12,050	11,418
Stack Flow Rate - DSCFM*	8,101	7,268	6,830
% Water Vapor - % Vol.	16.30	15.03	16.11
% CO_2 - % Vol.	9.5	9.8	9.5
% O_2 - % Vol.	3.2	2.8	3.0
% Excess Air @ Sampling Point	16	14	15
Stack Temperature - °F	294	292	289
Stack Pressure - "Hg	30.14	30.14	30.14
Oxides of Nitrogen Emissions - ppm	280	140	155
Oxides of Nitrogen Emissions - lbs/hr	16.2	7.3	7.6
Carbon Monoxide Emissions - ppm	5	<5	<5
Carbon Monoxide Emissions - lbs/hr	0.2	<0.2	<0.1
Total Hydrocarbons Emissions as Propane - ppm	<0.5	<0.5	<0.5
Total Hydrocarbons Emissions as Propane - lbs/hr	<0.03	<0.02	<0.02
Production Rate Steam Load - lbs/hr	30,000	30,000	30,000

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack
Condition II

Run Number	4	5	6
Date	11/7/90	11/7/90	11/7/90
Time	1412-1512	1522-1622	1630-1730
Stack Flow Rate - ACFM	25,500	26,921	26,484
Stack Flow Rate - DSCFM*	14,845	15,816	15,511
% Water Vapor - % Vol.	13.76	14.06	14.31
% CO_2 - % Vol.	11.2	11.6	11.8
% O_2 - % Vol.	3.3	3.0	3.3
% Excess Air @ Sampling Point	17	15	17
Stack Temperature - °F	330	320	320
Stack Pressure - "Hg	30.11	30.11	30.11
Oxides of Nitrogen Emissions - ppm	132	134	134
Oxides of Nitrogen Emissions - lbs/hr	14.0	15.2	14.9
Carbon Monoxide Emissions - ppm	5	12	20
Carbon Monoxide Emissions - lbs/hr	0.3	0.8	1.4
Total Hydrocarbons Emissions as Propane - ppm	2.0	2.0	2.5
Total Hydrocarbons Emissions as Propane - lbs/hr	0.20	0.22	0.27
Production Rate Steam Load - lbs/hr	70,000	70,000	70,000

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack
Condition III

Run Number	1	2	3
Date	11/8/90	11/8/90	11/8/90
Time	0846-0946	1002-1105	1120-1220
Stack Flow Rate - ACFM	29,079	26,988	26,609
Stack Flow Rate - DSCFM*	16,113	15,306	14,801
% Water Vapor - % Vol.	15.38	14.05	15.85
% CO_2 - % Vol.	11.4	11.2	11.4
% O_2 - % Vol.	2.8	3.0	3.0
% Excess Air @ Sampling Point	14	15	15
Stack Temperature - °F	351	344	341
Stack Pressure - "Hg	29.99	29.95	29.90
Oxides of Nitrogen Emissions - ppm	78	113	96
Oxides of Nitrogen Emissions - lbs/hr	9.0	12.4	10.2
Carbon Monoxide Emissions - ppm	20	15	12
Carbon Monoxide Emissions - lbs/hr	1.4	1.0	0.8
Total Hydrocarbons Emissions as Propane - ppm	1.0	0.5	1.5
Total Hydrocarbons Emissions as Propane - lbs/hr	0.11	0.05	0.15
Production Rate Steam Load - lbs/hr	70,667	70,667	70,667

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack
Condition III

Run Number	4	5	6
Date	11/8/90	11/8/90	11/8/90
Time	1307-1407	1417-1517	1530-1630
Stack Flow Rate - ACFM	13,538	14,408	13,977
Stack Flow Rate - DSCFM*	7,916	8,405	8,248
% Water Vapor - % Vol.	16.60	16.77	16.19
% CO_2 - % Vol.	9.6	9.6	10.2
% O_2 - % Vol.	3.0	3.0	3.5
% Excess Air @ Sampling Point	15	15	18
Stack Temperature - °F	293	293	290
Stack Pressure - "Hg	29.80	29.80	29.80
Oxides of Nitrogen Emissions - ppm	87	85	60
Oxides of Nitrogen Emissions - lbs/hr	4.9	5.1	3.5
Carbon Monoxide Emissions - ppm	12	15	20
Carbon Monoxide Emissions - lbs/hr	0.4	0.6	0.7
Total Hydrocarbons Emissions as Propane - ppm	3.5	2.5	3.5
Total Hydrocarbons Emissions as Propane - lbs/hr	0.19	0.14	0.20
Production Rate Steam Load - lbs/hr	30,000	30,000	30,000

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

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SUMMARY OF RESULTS

Boiler EB-114 Exhaust Stack
Condition IV

Run Number	1	2	3
Date	11/9/90	11/9/90	11/9/90
Time	0800-0905	0915-1015	1024-1124
Stack Flow Rate - ACFM	27,238	27,363	26,522
Stack Flow Rate - DSCFM*	14,890	15,207	14,628
% Water Vapor - % Vol.	16.26	14.67	15.04
% CO_2 - % Vol.	10.4	11.0	11.4
% O_2 - % Vol.	2.8	2.9	2.6
% Excess Air @ Sampling Point	14	15	13
Stack Temperature - °F	348	350	353
Stack Pressure - "Hg	29.79	29.79	29.79
Oxides of Nitrogen Emissions - ppm	88	97	95
Oxides of Nitrogen Emissions - lbs/hr	9.4	10.6	10.0
Carbon Monoxide Emissions - ppm	13	8	5
Carbon Monoxide Emissions - lbs/hr	0.8	0.5	0.3
Total Hydrocarbons Emissions as Propane - ppm	1.0	0.5	<0.5
Total Hydrocarbons Emissions as Propane - lbs/hr	0.10	0.05	<0.05
Production Rate Steam Load - lbs/hr	72,000	72,000	72,000

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

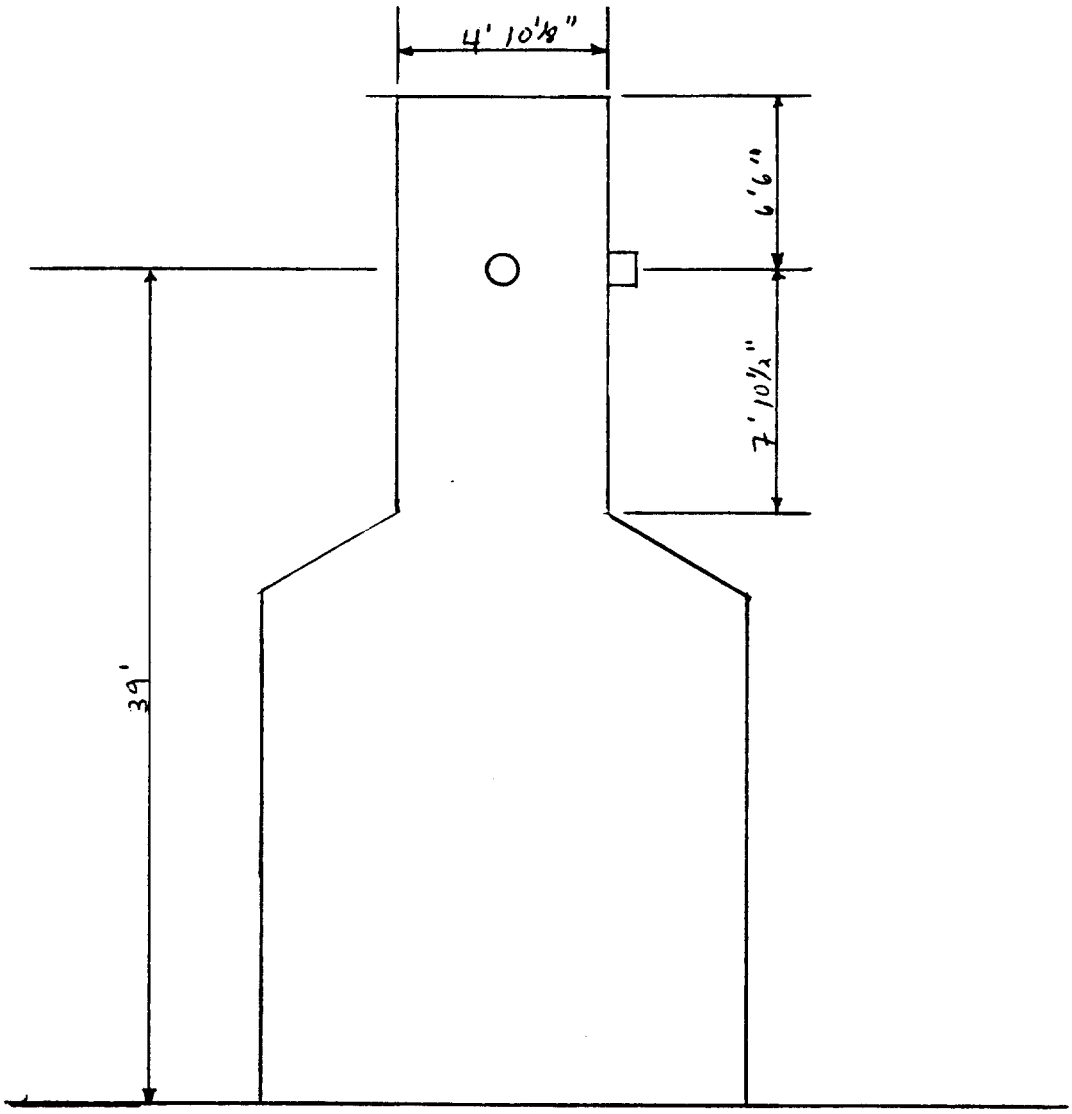
DISCUSSION OF RESULTS

The three tests for oxides of nitrogen, carbon monoxide, and total hydrocarbons taken at each of the seven operating conditions appeared to be valid representations of the actual emissions during the tests. The indicative parameters calculated from the field data were in close agreement. The variations in moisture percentages from the mean value at each operating condition were less than 6.9 percent. The variations in the measured flow rates (Q_s) from the mean value at each operating condition were less than 9.5 percent.

DESCRIPTION OF SAMPLING LOCATION

The sampling location on the stack is approximately 39 feet above the ground. The sampling ports are located 7 feet 10 1/2 inches (1.63 stack diameters) downstream from the inlet to the stack and 6 feet 6 inches (1.34 stack diameters) upstream from the outlet of the stack.

SAMPLING LOCATION



SAMPLING AND ANALYTICAL PROCEDURES

The sampling followed the procedures outlined in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3, 4, 7E, 10, and 25A, and in the "Sampling Procedures Manual, Texas Air Control Board, January 1983."

A velocity traverse was made at each of the two ports on the stack, in order to determine the uniformity and magnitude of the flow during each test. All traverse points were checked for cyclonic flow and the average angle of cyclonic flow was equal to 2.1 degrees. Eight traverse points were sampled from each of the two ports for a total of sixteen traverse points.

On all tests, the moisture sampling train was leak-checked at the nozzle at 15 inches of mercury vacuum before each test, and leak-checked at the nozzle after each test at the highest vacuum reading recorded during the test. This was done to predetermine the possibility of a diluted sample.

Also before and after each test, the pitot tube lines were checked for leaks under both a vacuum and a pressure. The lines were also checked for clearance and the manometer was zeroed before each test.

The "front-half" of the moisture sampling train consisted of a heated, glass-lined probe and a heated filter. The "back-half" of the sampling train contained the following impingers:

Impinger Number	Contents	Amount	Parameter Collected
1	Deionized Water	100 ml	Moisture
2	Deionized Water	100 ml	Moisture
3	Empty	------	Moisture
4	Silica Gel	200 g	Moisture

An integrated orsat sample was taken during each test and analyzed according to EPA Method 3.

For all of the gas sampling, the gas was drawn continuously through a stainless steel probe into a dry impinger to condense moisture. The sample was then drawn through a teflon sample line and delivered to the monitors. A Thermo Electron Model 10S Chemiluminescent NO-NO_2-NO_x

Analyzer was used for the Method 7E sampling. The analyzer was operated at ranges of 0 o 250 parts per million and 0 to 1,000 parts per million. The following calibration gases were used to calibrate the monitor:

Zero Nitrogen

49.6 ppm NO in N_2 (BAL 4381)

124.3 ppm NO in N_2 (ALM 5430)

229.1 ppm NO in N_2 (CAL 3086)

The carbon monoxide samples were taken and analyzed according to EPA Method 10 using both the integrated and continuous sampling procedures. The samples were analyzed on a Thermo Electron Model 48 Carbon Monoxide Analyzer operated at ranges of 0 to 500 parts per million and 0 to 1,000 parts per million. The calibration gases were as follows:

Zero Nitrogen

29.6 ppm CO in N_2 (CAL 12581)

49.4 ppm CO in N_2 (CAL 9911)

499.5 ppm CO in N_2 (CAL 1606)

894.3 ppm CO in N_2 (CAL 11768)

The total hydrocarbons samples were taken and analyzed according to EPA Method 25A. The samples were analyzed on a Ratfisch Model RS55 Total Hydrocarbon Analyzer. The analyzer was operated at a range of 0 to 100 parts per million using the following calibration gases:

Zero Nitrogen

9.9 ppm C_3H_8 in N_2 (CAL 9194)

51.3 ppm C_3H_8 in N_2 (CAL 10045)

91.8 ppm C_3H_8 in N_2 (CLM 2304)

Calibration gas certifications are included in Appendix C.

DESCRIPTION OF TESTS

Personnel from METCO Environmental arrived at the plant at 1:30 p.m. on Monday, November 5, 1990. After meeting with plant personnel and obtaining a vehicle entry permit, the sampling van was parked at the base of the Boiler EB-114 Exhaust Stack. The sampling equipment was moved onto the stack and the monitors were set up in the sampling van. All work was completed at 5:30 p.m.

On Tuesday, November 6, work began at 7:00 a.m. The sampling equipment was prepared for testing and the monitors were calibrated. The first test for oxides of nitrogen, carbon monoxide, and total hydrocarbons at the first condition began at 9:11 a.m. Testing continued without interruption until the completion of the sixth test at 7:00 p.m. The monitors were calibrated and all work was completed at 8:30 p.m.

On Wednesday, November 7, work began at 7:00 a.m. The first test for oxides of nitrogen, carbon monoxide, and total hydrocarbons at the second condition began at 9:05 a.m. Testing continued without interruption until the completion of the sixth test at 5:30 p.m. The monitors were calibrated and all work was completed at 6:00 p.m.

On Thursday, November 8, work began at 7:00 a.m. The equipment was prepared for testing and the monitors were calibrated. The first test for oxides of nitrogen, carbon monoxide, and total hydrocarbons at the third condition began at 8:46 a.m. Testing continued without interruption until the completion of the sixth test at 4:30 p.m. The monitors were calibrated and all work was completed at 5:00 p.m.

On Friday, November 9, work began at 6:00 a.m. The equipment was prepared for testing and the monitors were calibrated. Testing was delayed due to plant operational problems. The first test for oxides of nitrogen, carbon monoxide, and total hydrocarbons at the fourth condition began at 8:00 a.m. Testing continued without interruption until the completion of the third test at 11:24 a.m. Plant personnel decided not to run the low load condition on the fourth fuel.

The equipment was moved off of the stack and loaded into the sampling van. The monitors were calibrated and secured for transport. The data was transported to METCO Environmental's laboratory in Dallas, Texas, for further analysis and evaluation.

Operations at Firestone Synthetic Rubber & Latex Company, Boiler EB-114 Exhaust Stack, located in Orange, Texas, were completed at 1:00 p.m. on Friday, November 9, 1990.

Billy J. Mullins, Jr., P.E.
President

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APPENDICES

A. Location of Sampling Points

B. Source Emissions Calculations

C. Calibration Data

D. Field Testing Data

E. Oxides of Nitrogen Monitor Data

F. Carbon Monoxide Monitor Data

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H. Plant Operational Data

I. TACB Permit

J. Resumes of Test Personnel

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APPENDIX A

Location of Sampling Points

Boiler EB-114 Exhaust Stack

The sampling ports are located 7 feet 10 1/2 inches (1.63 stack diameters) downstream from the inlet to the stack and 6 feet 6 inches (1.34 stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:

Port and Wall Thickness = 6 1/4 inches

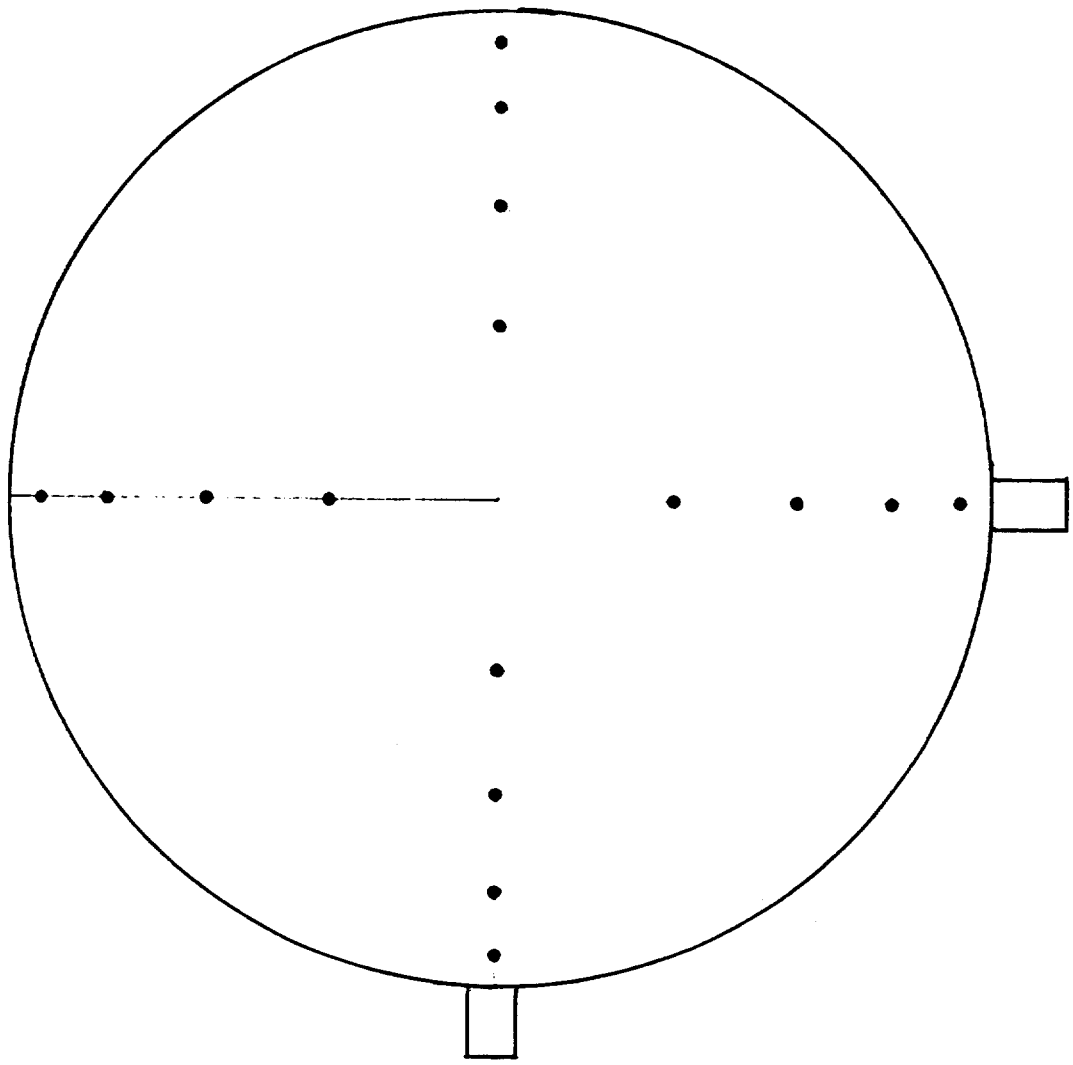
Inside Stack Diameter = 58 1/8 inches

Point Number	Percent of Diameter From Wall	Distance From Wall
1	3.2	1 7/8"
2	10.5	6 1/8"
3	19.4	11 1/4"
4	32.3	18 3/4"
5	67.7	39 3/8"
6	80.6	46 7/8"
7	89.5	52 "
8	96.8	56 1/4"

APPENDIX A

Location of Sampling Points

Boiler EB-114 Exhaust Stack



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APPENDIX B

Nomenclature and Equations

for

Calculation of Source Emissions

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Nomenclature for Particulate Calculations

Symbol	English Units	Metric Units	Description
A_s	$in.^2$	m^2	Stack Area
C_{an}	gr/dscf*	g/dscm*	Particulate - probe, cyclone and filter
C_{ao}	gr/dscf*	g/dscm*	Particulate - total
C_{at}	gr/CF @ stack conditions	g/m^3	Particulate - probe, cyclone and filter
C_{au}	gr/CF @ stack conditions	g/m^3	Particulate - total
C_{aw}	lbs/hr	kg/hr	Particulate - probe, cyclone and filter
C_{ax}	lbs/hr	kg/hr	Particulate - total
C_p			Pitot Tube Calibration Factor
D_n	in.	m	Sampling Nozzle Diameter
%EA			Percent Excess Air at sampling point
g	$32.2\ ft/sec^2$		Acceleration of gravity
%I			Percent isokinetic
%M			Percent moisture in the stack gas by volume
M_d			Mole fraction of dry gas
m_f	mg	mg	Particulate - probe, cyclone and filter
M_{H_2O}	18 lb/lb-mole		Molecular Weight of Water
m_t	mg	mg	Particulate - total

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
MW	lb/lb-mole	g/g-mole	Molecular Weight of stack gas
MW_{air}	28.95 lb/ lb-mole		Molecular Weight of air
MW_d	lb/lb-mole	g/g-mole	Molecular Weight of dry stack gas
P_b	"Hg Absolute	mm Hg	Barometric Pressure
P_m	"H_2O	mm H_2O	Orifice Pressure drop
P_s	"Hg Absolute	mm Hg	Stack Pressure
ΔP	"H_2O	mm H_2O	Velocity Head of stack gas
P_{std}	29.92 "Hg	760 mm Hg	Standard Barometric Pressure
Q_a	ACFM	m^3/hr	Stack Gas Volume at Actual Stack Conditions
Q_s	DSCFM*	dscm/hr*	Stack Gas Volume at 29.92 "Hg, 528°R, dry
R	21.83 "Hg-ft^3/lb-mole°R		Universal Gas Constant
T_m	°F	°C	Average Gas Meter Temperature
T_t	min	min	Net time of test
T_s	°F	°C	Stack Temperature
T_{std}	528°R	293°K	Standard Temperature
V_m	ft^3	m^3	Volume of dry gas sampled at meter conditions
$V_{m_{std}}$	dscf*	dscm*	Volume of dry gas sampled @ standard conditions
V_s	fpm	m/sec	Stack velocity @ stack conditions
V_w	ml	ml	Total Water Collected in Impingers and Silica Gel

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
$V_{w_{gas}}$	scf*	scm*	Volume of Water Vapor Collected @ standard conditions
ρ_{air}	0.0748 lbs/ft^3		Density of Air
ρ_{H_2O}	1 g/ml		Density of Water
ρ_{man}	51.63 lbs/ft^3		Density of Manometer Oil

Standard Conditions: 29.92 "Hg, 68°F (760 mm Hg, 20°C)

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

Example Particulate Calculations

1. Volume of dry gas sampled at standard conditions.*

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m + 460}\right) \left[\frac{P_b + \frac{P_m}{13.6}}{P_{std}}\right]$$

$$V_{m_{std}} = 17.65\ V_m \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = \text{dscf}$$

$$V_{m_{std}} = \text{dscf} \times 0.028317 = \text{dscm}$$

2. Volume of water vapor collected at standard conditions.*

$$V_{w_{gas}} = \frac{(V_w - \text{gms } SO_2 - \text{gms } H_2S)\ \rho_{H_2O}\ R\ T_{std}}{P_{std}\ M_{H_2O}\ 453.6}$$

$$V_{w_{gas}} = 0.0472\ (V_w - \text{gms } SO_2 - \text{gms } H_2S) = \text{scf}$$

$$V_{w_{gas}} = \text{scf} \times 0.028317 = \text{scm}$$

3. Percent moisture in stack gas.

$$\%M = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \%$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

4. Mole fraction of dry gas.

$$M_d = \frac{100 - \%M}{100}$$

5. Average molecular weight of dry stack gas.

$$MW_d = \left[\%CO_2 \times \frac{44}{100}\right] + \left[\%O_2 \times \frac{32}{100}\right] + \left[\%N_2 \times \frac{28}{100}\right] + \left[\%CO \times \frac{28}{100}\right] = \text{lb/lb-mole} = \text{g/g-mole}$$

6. Molecular weight of stack gas.

$$MW = MW_d \times M_d + 18\ (1-M_d) = \frac{\text{lb}}{\text{lb-mole}} = \text{g/g-mole}$$

7. Percent excess air at sampling point.

$$\%EA = \frac{100\ (\%O_2 - 0.5\%\ CO)}{0.265\ (\%N_2) - (\%O_2) + 0.5\ (\%CO)}$$

8. Stack Pressure.

$$P_s = P_b + \frac{\text{stack pressure } "H_2O}{13.6} = "\text{Hg Absolute}$$

$$P_s = "\text{Hg Abs.} \times 25.4 = \text{mm Hg}$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

9. Stack velocity at stack conditions.

$$V_s = C_p\ 60 \left[\frac{2g \times \rho_{man} \times P_{std} \times MW_{air} \times (T_s + 460) \times \Delta P_s}{12 \times \rho_{air} \times P_s \times MW \times T_{std}} \right]^{\frac{1}{2}}$$

$$V_s = 5123.8\ C_p \left[\frac{(T_s + 460) \times \Delta P_s}{P_s \times MW} \right]^{\frac{1}{2}} = \text{fpm}$$

$$V_s = \text{fpm} \times 0.00508 = \text{m/sec}$$

10. Dry stack gas volume at standard conditions.*

$$Q_s = \frac{1}{144} V_s \times A_s \times M_d \times \frac{T_{std}}{T_s + 460} \times \frac{P_s}{P_{std}}$$

$$Q_s = \frac{0.123\ V_s \times A_s \times M_d \times P_s}{T_s + 460} = \text{DSCFM}$$

$$Q_s = \text{DSCFM} \times 1.6990 = \text{dscm/hr}$$

11. Actual stack gas volume at stack conditions.

$$Q_a = \frac{V_s \times A_s}{144} = \text{ACFM}$$

$$Q_a = \text{ACFM} \times 1.6990 = m^3/\text{hr}$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

12. Percent isokinetic.

$$\%I = \frac{V_{m_{std}} \times (T_s + 460) \times P_{std} \times 100 \times 144}{M_d \times T_{std} \times P_s \times T_t \times V_s \times \frac{\pi D_n^2}{4}}$$

$$\%I = \frac{1039\ V_{m_{std}} \times (T_s + 460)}{M_d \times P_s \times T_t \times V_s \times D_n^2}$$

13. Particulate - probe, cyclone and filter.

$$C_{an} = \frac{m_f}{V_{m_{std}}} \times \frac{1\ gr}{64.8\ mg}$$

$$C_{an} = 0.0154 \frac{m_f}{V_{m_{std}}} = gr/dscf*$$

$$C_{an} = gr/dscf \times 2.290 = g/dscm*$$

14. Particulate total.

$$C_{ao} = 0.0154 \times \frac{m_t}{V_{m_{std}}} = gr/dscf*$$

$$C_{ao} = gr/dscf \times 2.290 = g/dscm*$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

15. Particulate - probe, cyclone and filter at stack conditions.

$$C_{at} = C_{an} \times \frac{P_s}{P_{std}} \times \frac{(T_{std})}{(T_s + 460)} \times M_d$$

$$C_{at} = \frac{17.65 \times C_{an} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{at} = gr/CF \times 2.290 = g/m^3$$

16. Particulate - total, at stack conditions.

$$C_{au} = \frac{17.65 \times C_{ao} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{au} = gr/CF \times 2.290 = g/m^3$$

17. Particulate - probe, cyclone and filter.

$$C_{aw} = C_{an} \times Q_s \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ lb}}{7000 \text{ gr}}$$

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = lbs/hr$$

$$C_{aw} = lbs/hr \times 0.4536 = kg/hr$$

18. Particulate - total.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = lbs/hr$$

$$C_{ax} = lbs/hr \times 0.4536 = kg/hr$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	90-22
JOB NAME:	FIRESTONE
LOCATION:	ORANGE, TEXAS
UNIT TESTED:	EB-114 EXHAUST, CONDITION #1

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			11-6-90	11-6-90	11-6-90
BEGIN TIME			911	1030	1145
END TIME			941	1100	1215
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	30.00 (762)	30.00 (762)	30.00 (762)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	2.000 (50.8)	2.000 (50.8)	2.000 (50.8)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	22.526 (0.638)	23.208 (0.657)	23.551 (0.667)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	67 (19)	75 (24)	78 (26)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	22.744 (0.644)	23.082 (0.654)	23.293 (0.660)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	111.2	105.3	102.4
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	5.249 (0.149)	4.970 (0.141)	4.833 (0.137)
%M	MOISTURE IN STACK GAS BY VOLUME	%	18.75	17.72	17.18
Tt	NET TIME OF TEST	MINUTES	30	30	30

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

FIRESTONE
ORANGE, TEXAS
EB-114 EXHAUST, CONDITION #1

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.8125	0.8228	0.8282
CO2		%	9.5	9.0	9.5
O2		%	2.5	2.0	2.5
CO		%	0.0	0.0	0.0
N2		%	88.0	89.0	88.0
%EA	EXCESS AIR @ SAMPLING POINT	%	12.0	9.3	12.0
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.62 (29.62)	29.52 (29.52)	29.62 (29.62)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.44 (27.44)	27.48 (27.48)	27.62 (27.62)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.025 (0.6)	0.024 (0.6)	0.023 (0.6)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	283 (139)	283 (139)	284 (140)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	30.00 (762)	30.00 (762)	30.00 (762)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	611 (3.10)	595 (3.02)	578 (2.94)
As	STACK AREA	(SQ.INCHES) (SQ.METERS)	2,653 (1.71)	2,653 (1.71)	2,653 (1.71)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	6,541 (11,113)	6,450 (10,959)	6,299 (10,702)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	11,250 (19,114)	10,955 (18,613)	10,649 (18,093)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	90-22
JOB NAME:	FIRESTONE
LOCATION:	ORANGE, TEXAS
UNIT TESTED:	EB-114 EXHAUST (CONDITION #1)

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			4	5	6
DATE			11-6-90	11-6-90	11-6-90
BEGIN TIME			1604	1706	1812
END TIME			1634	1736	1842
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	30.10 (765)	30.10 (765)	30.10 (765)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	2.000 (50.8)	2.000 (50.8)	2.000 (50.8)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	24.379 (0.690)	23.612 (0.669)	24.080 (0.682)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	85 (29)	87 (31)	87 (31)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	23.881 (0.676)	23.045 (0.653)	23.582 (0.666)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	101.1	102.4	112.5
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	4.772 (0.135)	4.833 (0.137)	5.310 (0.150)
%M	MOISTURE IN STACK GAS BY VOLUME	%	16.65	17.34	18.43
Tt	NET TIME OF TEST	MINUTES	30	30	30

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

FIRESTONE
ORANGE, TEXAS
EB-114 EXHAUST (CONDITION #1)

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.8335	0.8266	0.8157
CO2		%	9.3	8.0	8.3
O2		%	2.8	2.5	3.1
CO		%	0.0	0.0	0.0
N2		%	87.9	89.5	88.6
%EA	EXCESS AIR @ SAMPLING POINT	%	13.7	11.8	15.2
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.60 (29.60)	29.38 (29.38)	29.45 (29.45)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.67 (27.67)	27.41 (27.41)	27.34 (27.34)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H20)	0.244 (6.2)	0.224 (5.7)	0.219 (5.6)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	366 (186)	375 (191)	386 (197)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	30.11 (765)	30.11 (765)	30.11 (765)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	2,010 (10.21)	1,944 (9.88)	1,934 (9.82)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	2,653 (1.71)	2,653 (1.71)	2,653 (1.71)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	19,929 (33,859)	18,909 (32,126)	18,322 (31,129)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	37,025 (62,905)	35,809 (60,839)	35,631 (60,537)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	90-22
JOB NAME:	FIRESTONE
LOCATION:	ORANGE, TEXAS
UNIT TESTED:	EB-114 EXHAUST (CONDITION #2)

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			11-7-90	11-7-90	11-7-90
BEGIN TIME			910	1025	1138
END TIME			940	1055	1208
P(b)	BAROMETRIC PRESSURE	"Hg Abs.	30.14	30.14	30.14
		(mm Hg)	(766)	(766)	(766)
P(m)	ORIFICE PRESSURE DROP	"H2O	2.000	2.000	2.000
		(mm H2O)	(50.8)	(50.8)	(50.8)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3	23.325	23.642	23.886
		(m^3)	(0.660)	(0.669)	(0.676)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F	76	80	84
		(DEG.C)	(24)	(27)	(29)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF	23.263	23.404	23.472
		(DSCM)	(0.659)	(0.663)	(0.665)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	96.0	87.7	95.5
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF	4.531	4.139	4.508
		(SCM)	(0.128)	(0.117)	(0.128)
%M	MOISTURE IN STACK GAS BY VOLUME	%	16.30	15.03	16.11
Tt	NET TIME OF TEST	MINUTES	30	30	30

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

FIRESTONE
ORANGE, TEXAS
EB-114 EXHAUST (CONDITION #2)

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.8370	0.8497	0.8389
CO2		%	9.5	9.8	9.5
O2		%	3.2	2.8	3.0
CO		%	0.0	0.0	0.0
N2		%	87.3	87.4	87.5
%EA	EXCESS AIR @ SAMPLING POINT	%	16.1	13.8	14.9
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.65 (29.65)	29.68 (29.68)	29.64 (29.64)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.75 (27.75)	27.92 (27.92)	27.76 (27.76)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.037 (0.9)	0.029 (0.7)	0.026 (0.7)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	294 (146)	292 (144)	289 (143)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	30.14 (766)	30.14 (766)	30.14 (766)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	742 (3.77)	654 (3.32)	620 (3.15)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	2,653 (1.71)	2,653 (1.71)	2,653 (1.71)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	8,101 (13,764)	7,268 (12,348)	6,830 (11,604)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	13,678 (23,239)	12,050 (20,473)	11,418 (19,399)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER: 90-22
JOB NAME: FIRESTONE
LOCATION: ORANGE, TEXAS
UNIT TESTED: EB-114 EXHAUST (CONDITION #2)

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			4	5	6
DATE			11-7-90	11-7-90	11-7-90
BEGIN TIME			1416	1526	1633
END TIME			1446	1556	1703
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	30.10 (765)	30.10 (765)	30.10 (765)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	2.000 (50.8)	2.000 (50.8)	2.000 (50.8)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	23.595 (0.668)	24.263 (0.687)	24.105 (0.683)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	84 (29)	89 (32)	90 (32)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	23.155 (0.656)	23.594 (0.668)	23.398 (0.663)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	78.3	81.8	82.8
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	3.696 (0.105)	3.861 (0.109)	3.908 (0.111)
%M	MOISTURE IN STACK GAS BY VOLUME	%	13.76	14.06	14.31
Tt	NET TIME OF TEST	MINUTES	30	30	30

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

FIRESTONE
ORANGE, TEXAS
EB-114 EXHAUST (CONDITION #2)

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.8624	0.8594	0.8569
CO2		%	11.2	11.6	11.8
O2		%	3.3	3.0	3.3
CO		%	0.0	0.0	0.0
N2		%	85.5	85.4	84.9
%EA	EXCESS AIR @ SAMPLING POINT	%	17.0	15.3	17.2
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE	29.92	29.98	30.02
		(g/g-MOLE)	(29.92)	(29.98)	(30.02)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE	28.28	28.29	28.30
		(g/g-MOLE)	(28.28)	(28.29)	(28.30)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O	0.124	0.140	0.136
		(mm H2O)	(3.1)	(3.6)	(3.5)
Ts	STACK TEMPERATURE	DEG. F	330	320	320
		(DEG. C)	(166)	(160)	(160)
Ps	STACK PRESSURE	"Hg Abs.	30.11	30.11	30.11
		(mm Hg)	(765)	(765)	(765)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM	1,384	1,461	1,437
		(m/SEC.)	(7.03)	(7.42)	(7.30)
As	STACK AREA	(SQ.INCHES)	2,653	2,653	2,653
		(SQ.METERS)	(1.71)	(1.71)	(1.71)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM	14,845	15,816	15,511
		(DSCM/HR)	(25,222)	(26,871)	(26,353)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM	25,500	26,921	26,484
		(m^3/HR)	(43,325)	(45,739)	(44,996)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	90-22
JOB NAME:	FIRESTONE
LOCATION:	ORANGE, TEXAS
UNIT TESTED:	EB-114 EXHAUST (CONDITION #3)

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			11-8-90	11-8-90	11-8-90
BEGIN TIME			850	1032	1138
END TIME			920	1102	1208
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.98 (761)	29.94 (760)	29.89 (759)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	2.000 (50.8)	2.000 (50.8)	2.000 (50.8)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	23.561 (0.667)	23.528 (0.666)	23.325 (0.660)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	73 (23)	75 (24)	78 (26)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	23.585 (0.666)	23.354 (0.661)	22.985 (0.651)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	90.5	80.9	91.7
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	4.272 (0.121)	3.818 (0.108)	4.328 (0.123)
%M	MOISTURE IN STACK GAS BY VOLUME	%	15.38	14.05	15.85
Tt	NET TIME OF TEST	MINUTES	30	30	30

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

FIRESTONE
ORANGE, TEXAS
EB-114 EXHAUST (CONDITION #3)

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.8462	0.8595	0.8415
CO2		%	11.4	11.2	11.4
O2		%	2.8	3.0	3.0
CO		%	0.0	0.0	0.0
N2		%	85.8	85.8	85.6
%EA	EXCESS AIR @ SAMPLING POINT	%	14.0	15.2	15.2
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.94 (29.94)	29.91 (29.91)	29.94 (29.94)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.10 (28.10)	28.24 (28.24)	28.05 (28.05)
DELTA P	VELOCITY HEAD OF STACK GAS	"H20 (mm H20)	0.156 (4.0)	0.136 (3.5)	0.131 (3.3)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	351 (177)	344 (173)	341 (172)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.99 (762)	29.95 (761)	29.90 (759)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	1,578 (8.02)	1,465 (7.44)	1,444 (7.34)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	2,653 (1.71)	2,653 (1.71)	2,653 (1.71)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	16,113 (27,376)	15,306 (26,005)	14,801 (25,147)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	29,079 (49,405)	26,988 (45,853)	26,609 (45,209)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION SURVEY

JOB NUMBER: 90-22
JOB NAME: FIRESTONE
LOCATION: ORANGE, TEXAS
UNIT TESTED: EB-114 EXHAUST (CONDITION #3)

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			4	5	6
DATE			11-8-90	11-8-90	11-8-90
BEGIN TIME			1312	1418	1535
END TIME			1342	1448	1605
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.80 (757)	29.80 (757)	29.80 (757)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	2.000 (50.8)	2.000 (50.8)	2.000 (50.8)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	23.552 (0.667)	24.389 (0.691)	23.800 (0.674)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	79 (26)	81 (27)	83 (28)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	23.096 (0.654)	23.828 (0.675)	23.167 (0.656)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	97.4	101.7	94.8
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	4.597 (0.130)	4.800 (0.136)	4.475 (0.127)
%M	MOISTURE IN STACK GAS BY VOLUME	%	16.60	16.77	16.19
Tt	NET TIME OF TEST	MINUTES	30	30	30

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

FIRESTONE
ORANGE, TEXAS
EB-114 EXHAUST (CONDITION #3)

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.8340	0.8323	0.8381
CO2		%	9.6	9.6	10.2
O2		%	3.0	3.0	3.5
CO		%	0.0	0.0	0.0
N2		%	87.4	87.4	86.3
%EA	EXCESS AIR @ SAMPLING POINT	%	14.9	14.9	18.1
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.66 (29.66)	29.66 (29.66)	29.77 (29.77)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.72 (27.72)	27.70 (27.70)	27.87 (27.87)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.036 (0.9)	0.040 (1.0)	0.038 (1.0)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	293 (145)	293 (145)	290 (143)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.80 (757)	29.80 (757)	29.80 (757)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	735 (3.73)	782 (3.97)	759 (3.86)
As	STACK AREA	(SQ.INCHES) (SQ.METERS)	2,653 (1.71)	2,653 (1.71)	2,653 (1.71)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	7,916 (13,449)	8,405 (14,280)	8,248 (14,013)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	13,538 (23,001)	14,408 (24,479)	13,977 (23,747)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION SURVEY

JOB NUMBER: 90-22
JOB NAME: FIRESTONE
LOCATION: ORANGE, TEXAS
UNIT TESTED: EB-114 EXHAUST (CONDITION #4)

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			11-9-90	11-9-90	11-9-90
BEGIN TIME			805	918	1030
END TIME			835	948	1100
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.78 (756)	29.78 (756)	29.78 (756)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	2.000 (50.8)	2.000 (50.8)	2.000 (50.8)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	22.789 (0.645)	23.465 (0.664)	23.470 (0.665)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	73 (23)	75 (24)	77 (25)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	22.584 (0.640)	23.167 (0.656)	23.086 (0.654)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	92.9	84.4	86.6
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	4.385 (0.124)	3.984 (0.113)	4.088 (0.116)
%M	MOISTURE IN STACK GAS BY VOLUME	%	16.26	14.67	15.04
Tt	NET TIME OF TEST	MINUTES	30	30	30

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

FIRESTONE
ORANGE, TEXAS
EB-114 EXHAUST (CONDITION #4)

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.8374	0.8533	0.8496
CO2		%	10.4	11.0	11.4
O2		%	2.8	2.9	2.6
CO		%	0.0	0.0	0.0
N2		%	86.8	86.1	86.0
%EA	EXCESS AIR @ SAMPLING POINT	%	13.9	14.6	12.9
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.78 (29.78)	29.88 (29.88)	29.93 (29.93)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.86 (27.86)	28.13 (28.13)	28.13 (28.13)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.134 (3.4)	0.137 (3.5)	0.128 (3.3)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	348 (176)	350 (177)	353 (178)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.79 (757)	29.79 (757)	29.79 (757)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	1,478 (7.51)	1,485 (7.54)	1,440 (7.32)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	2,653 (1.71)	2,653 (1.71)	2,653 (1.71)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	14,890 (25,298)	15,207 (25,837)	14,628 (24,853)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	27,238 (46,277)	27,363 (46,490)	26,522 (45,061)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

APPENDIX C

Calibration Data

Equipment	Calibration Factor	Calibration Date
Pitot Tube #5	0.799	7/13/90
Dry Gas Meter #10	1.016	7/11/90
Stack Unit Orifice #10		7/11/90
Digital Temperature Indicator #10		7/11/90
Barometer #15		8/17/90
Oxides of Nitrogen Monitor		11/ 6/90 11/ 7/90 11/ 8/90 11/ 9/90
Carbon Monoxide Monitor		11/ 6/90 11/ 7/90 11/ 8/90 11/ 9/90
Total Hydrocarbons Monitor		11/ 6/90 11/ 7/90 11/ 8/90 11/ 9/90

PITOT TUBE CALIBRATION

Date: 13 JULY 1990

Time: 1500

Pitot No. 5
5' x 1/4"

P_b: 29.46 "Hg P_s: — "H_2O

T_s: 78 °F C_{pstd}: 0.99

Motor Setting	fps mark	CALIBRATOR STANDARD START	CALIBRATOR STANDARD END	$\sqrt{\text{STANDARD}}$ AVERAGE	HIGH	$\sqrt{\text{HIGH}}$	CAL. FACTOR	LOW	$\sqrt{\text{LOW}}$	CAL. FACTOR
39	20	0.10	0.10	0.316	0.15	0.387	0.808	0.15	0.387	0.808
48	30	0.22	0.22	0.469	0.33	0.574	0.808	0.33	0.574	0.808
55	40	0.34	0.34	0.583	0.53	0.728	0.793	0.53	0.728	0.793
63	50	0.54	0.54	0.735	0.84	0.917	0.794	0.83	0.911	0.799
70	60	0.80	0.81	0.897	1.25	1.118	0.794	1.25	1.118	0.794
76	70	1.00	1.00	1.000	1.55	1.245	0.795	1.55	1.245	0.795
84	80	1.30	1.30	1.140	2.00	1.414	0.798	2.00	1.414	0.798
100	90	1.60	1.60	1.265	2.45	1.565	0.800	2.45	1.565	0.800
63	50	054	054	0.735	0.83	0.911	0.799	0.83	0.911	0.799
63	50	0.54	0.55	0.738	0.83	0.911	0.802	0.83	0.911	0.802
Average							0.799			0.799

Summary of Results:

Normal high side calibration factor 0.799
variation 1.13%, -0.75

Normal low side calibration factor 0.799
variation 1.13%, -0.75

Mark Glica
Signature of Calibrator

METCO ENVIRONMENTAL

Dry Gas Meter Calibration

Dry Gas Meter Number 10

Date: 11 July 1990

ΔH ("H_2O)	C_{DG}
0.5	1.013
1.0	1.014
1.5	1.017
2.0	1.018
3.0	1.016
4.0	1.015
Average	1.016

Variation: + 0.20 %

- 0.30 %

Calibrator: John Pellegrino

Checked by: R. Patterson

C_{DG} @ 2 liters/min. = 1.016

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 10
Date: 11 July 1990

Calibrator: John Pellegrino

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 at 0.50 "H_2O

P_b: 29.40 "Hg
Control Module Vacuum 5.4 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1017	4.976 cf	72 °F	0.90 "H_2O	103.686 cf	79 °F	77 °F	0.50 "H_2O
Start	1005	0.000 cf	72 °F	0.90 "H_2O	98.743 cf	79 °F	76 °F	0.50 "H_2O
	12.0	4.976 cf	72 °F	0.90 "H_2O	4.943 cf	79 °F (78)	77 °F	0.50 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 4.976 \left(\frac{29.40 + \frac{-0900}{13.6}}{72 + 460} \right) \times \underset{(C_f)}{0.999} = 4838 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 4.943 \left(\frac{29.40 + \frac{0.50}{13.6}}{78 + 460} \right) = 4.774 \text{ dscf}$$

$$C_{DG} = \frac{4.838}{4.774} = \boxed{1.013}$$

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 16
Date: 11 July 1990

Calibrator: John Pellegrino

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 at 1.00" H_2O

P_b: 29.40 "Hg
Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1030	5.253 cf	72 °F	-1.80 "H_2O	109.469 cf	80 °F	78 °F	1.00 "H_2O
Start	1021	0.000 cf	72 °F	-1.80 "H_2O	104.260 cf	80 °F	78 °F	1.00 "H_2O
	9.0	5.253 ✓ cf	72 ✓ °F	-1.80 ✓ "H_2O	5.209 ✓ cf	80 °F	78 ✓ °F	1.00 ✓ "H_2O
						79 ✓		

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.253 \left(\frac{29.40 + \frac{-1.80}{13.6}}{72 + 460} \right) \times \underset{(C_f)}{0.999} = 5.096 \checkmark \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 5.209 \left(\frac{29.40 + \frac{1.000}{13.6}}{79 + 460} \right) = 5.027 \checkmark \text{ dscf}$$

$$C_{DG} = \frac{5.096}{5.027} = \boxed{1.014 -}$$

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 10
Date: 11 July 1990

Calibrator: John Pellegrino

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 at 1.50

P_b: 29.40 "Hg
Control Module Vacuum 5.5 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1047	10.524 cf	72 °F	-2.30 "H_2O	120.738 cf	85 °F	79 °F	1.50 "H_2O
Start	1033	0.000 cf	72 °F	-2.30 "H_2O	110.320 cf	81 °F	78 °F	1.50 "H_2O
	14.0	10.524 cf	72 °F	-2.30 "H_2O	10.418 cf	83 °F	79 °F	1.50 "H_2O
						81		

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.524 \left(\frac{29.40 + \frac{-2.30}{13.6}}{72 + 460} \right) \times \underset{(C_f)}{0.999} = 10.196 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.418 \left(\frac{29.40 + \frac{1.500}{13.6}}{81 + 460} \right) = 10.030 \text{ dscf}$$

$$C_{DG} = \frac{10.196}{10.030} = \boxed{1.017}$$

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 10
Date: 11 July 1990

Calibrator: John Pellegrini

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 at 2.00" H_2O

P_b: 29.40 "Hg
Control Module Vacuum 5.5 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1103	10.595 cf	72 °F	-2.80 "H_2O	131.729 cf	87 °F	79 °F	2.00 "H_2O
Start	1050	0.000 cf	72 °F	-2.80 "H_2O	121.240 cf	85 °F	79 °F	2.00 "H_2O
	13.0	10.595 cf	72 °F	-2.80 "H_2O	10.489 cf	86 °F	79 °F	2.00 "H_2O
						83		

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.595 \left(\frac{29.40 + \frac{-2.80}{13.6}}{72 + 460} \right) \times \underset{(C_f)}{0.999} = 10.252 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.489 \left(\frac{29.40 + \frac{2.00}{13.6}}{83 + 460} \right) = 10.074 \text{ dscf}$$

$$C_{DG} = \frac{10.252}{10.074} = \boxed{1.018}$$

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 10 Calibrator: John Pellegrino

Date: 11 July 1990

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 at 3.00 "H_2O P_b: 29.40 "Hg

Control Module Vacuum 5.9 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1116	10.075 cf	72 °F	-3.95 "H_2O	141.910 cf	88 °F	80 °F	3.00 "H_2O
Start	1106	0.000 cf	72 °F	-3.95 "H_2O	131.950 cf	86 °F	80 °F	3.00 "H_2O
	10.0	10.075 cf	72 °F	-3.95 "H_2O	9.960 cf	87 °F (84 -)	80 °F	3.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.075 \left(\frac{29.40 + \frac{-3.95}{13.6}}{72 + 460} \right) \times \underset{(C_f)}{0.999} = 9.720 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.960 \left(\frac{29.40 + \frac{3.00}{13.6}}{84 + 460} \right) = 9.572 \text{ dscf}$$

$$C_{DG} = \frac{9.720}{9.572} = \boxed{1.016}$$

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 10 Calibrator: John Pellegrino

Date: 11 July 1990

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 at 4.00 "H_2O

P_b: 29.40 "Hg

Control Module Vacuum 5.8 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1127	10.439 cf	72 °F	-5.05 "H_2O	152.491 cf	90 °F	81 °F	4.00 "H_2O
Start	1118 9.0	0.000 cf	72 °F	-5.05 "H_2O	142.200 cf	88 °F	79 °F	4.00 "H_2O
		10.439 cf	72 °F	-5.05 "H_2O	10.291 cf	89 °F 85	80 °F	4.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.439 \left(\frac{29.40 \overset{-5.05}{+ 13.6}}{72 + 460} \right) \times \underset{(C_f)}{0.999} = 10.043 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.291 \left(\frac{29.40 \overset{4.00}{+ 13.6}}{85 + 460} \right) = 9.896 \text{ dscf}$$

$$C_{DG} = \frac{10.043}{9.896} = \boxed{1.015}$$

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 10

Date: 11 July 1990

Calibrator: John Pellegrino

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 at 2 l/min.

P_b: 29.41 "Hg

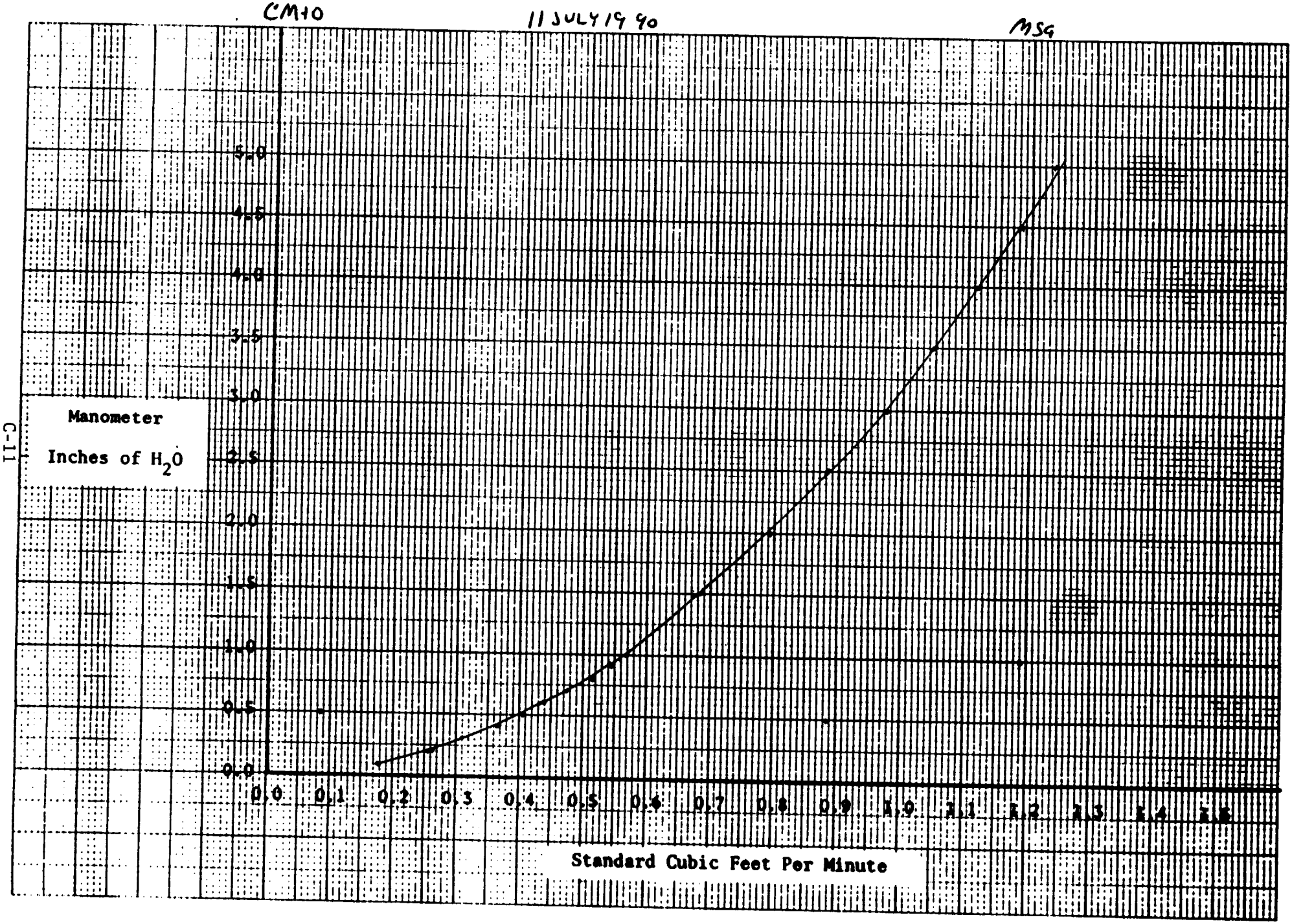
Control Module Vacuum 5.5 "Hg

	WET TEST METER (No. 1)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1224	2039 cf	74 °F	-0.40 "H_2O	156380 cf	81 °F	81 °F	0.00 "H_2O
Start	1155	0.000 cf	74 °F	-0.40 "H_2O	154.350 cf	82 °F	81 °F	0.00 "H_2O
	29.0	2.039 cf	74 °F	-0.40 "H_2O	2.030 cf	82 °F	81 °F	0.00 "H_2O
						81		

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 2.039 \left(\frac{29.41 + \frac{-0.40}{13.6}}{74 + 460} \right) \times \underset{(C_f)}{0.999} = 1.978 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 2.030 \left(\frac{29.41 + \frac{0.000}{13.6}}{81 + 460} \right) = 1.948 \text{ dscf}$$

$$C_{DG} = \frac{1.978}{1.948} = \boxed{1.016}$$



METCO ENVIRONMENTAL

DIGITAL TEMPERATURE INDICATOR NO. 10

CALIBRATION DATA

Date: 11 July 1990

Media	Time	Mercury Thermometer (°F)	DTI (°F)
Ice Bath	1010	33	33
Ambient Air	1009	75	75
Boiling Water	1012	212	212
Oven	1035	158	159
Oven	1102	260	260
Oven	1115	301	303
Oven	1138	389	390

Meter Adjusted? Yes _____ No ✓

John Pellegrini
Signature of Calibrator

METCO ENVIRONMENTAL

BAROMETER CALIBRATION

Barometer No. 15

Date: 8/17/90

Time: 1543

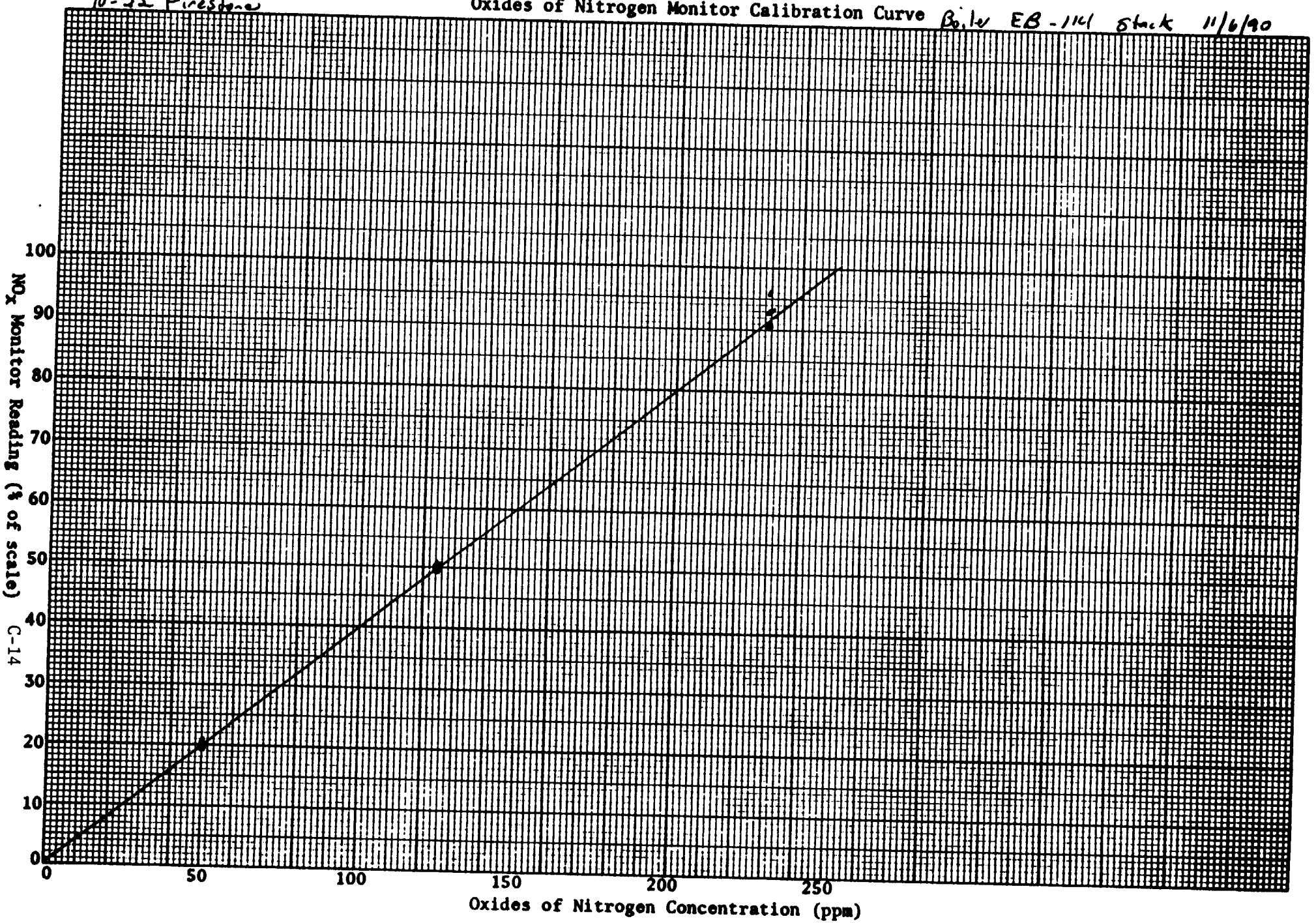
Barometric Pressure @ Addison Field @ 719 ft.	=	29.97
	-	0.719
Absolute Pressure at Addison Field	=	29.251
	+	0.083
Absolute Pressure @ METCO @ 636 ft.	=	29.334
Barometer Reading	=	29.34
Variation	=	-0.006

Barometer Adjusted? Yes ____ No ✓

John R. Smith
Signature of Calibrator

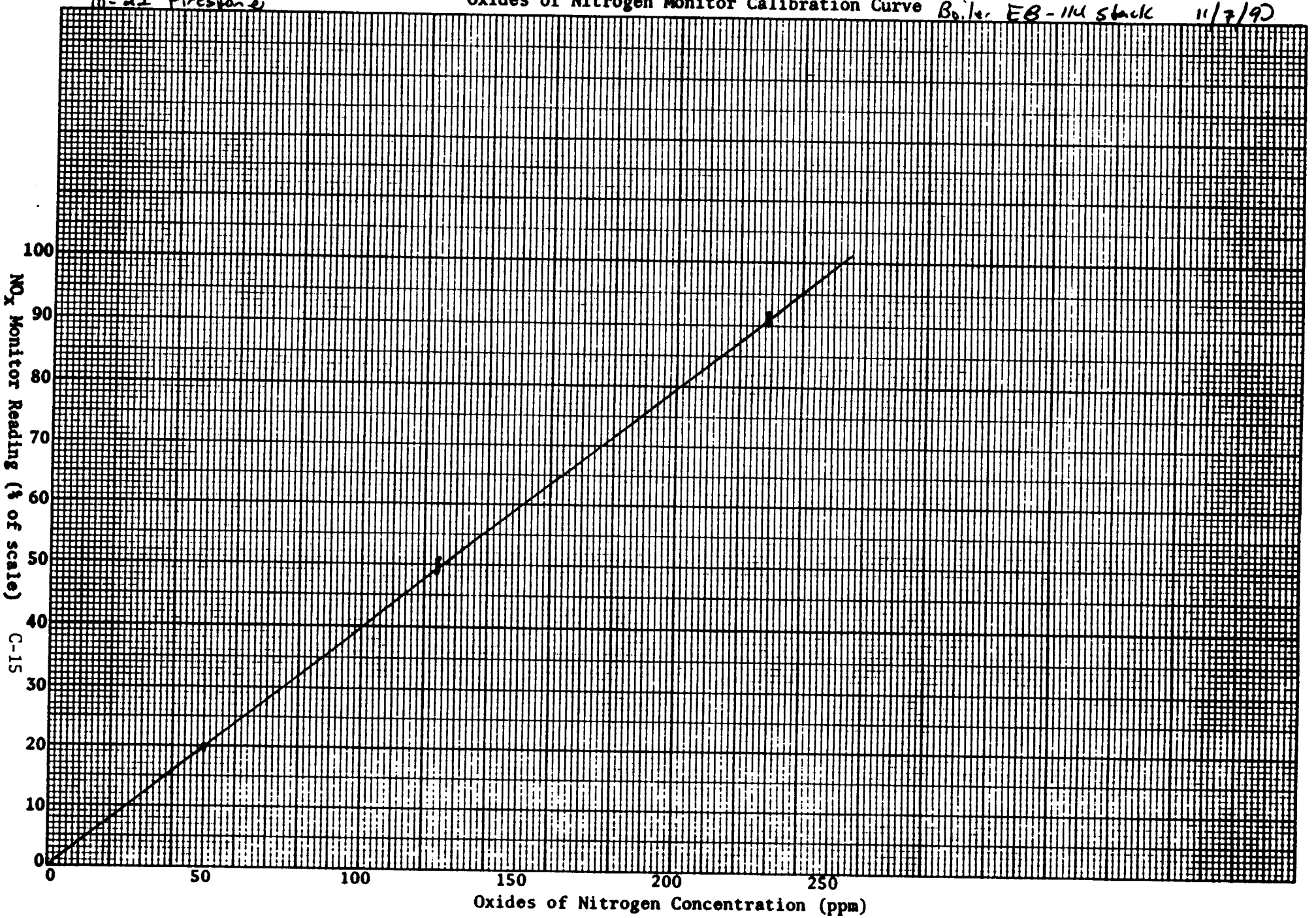
90-22 Firestone

Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/6/90



90-22 Firestone

Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/7/90

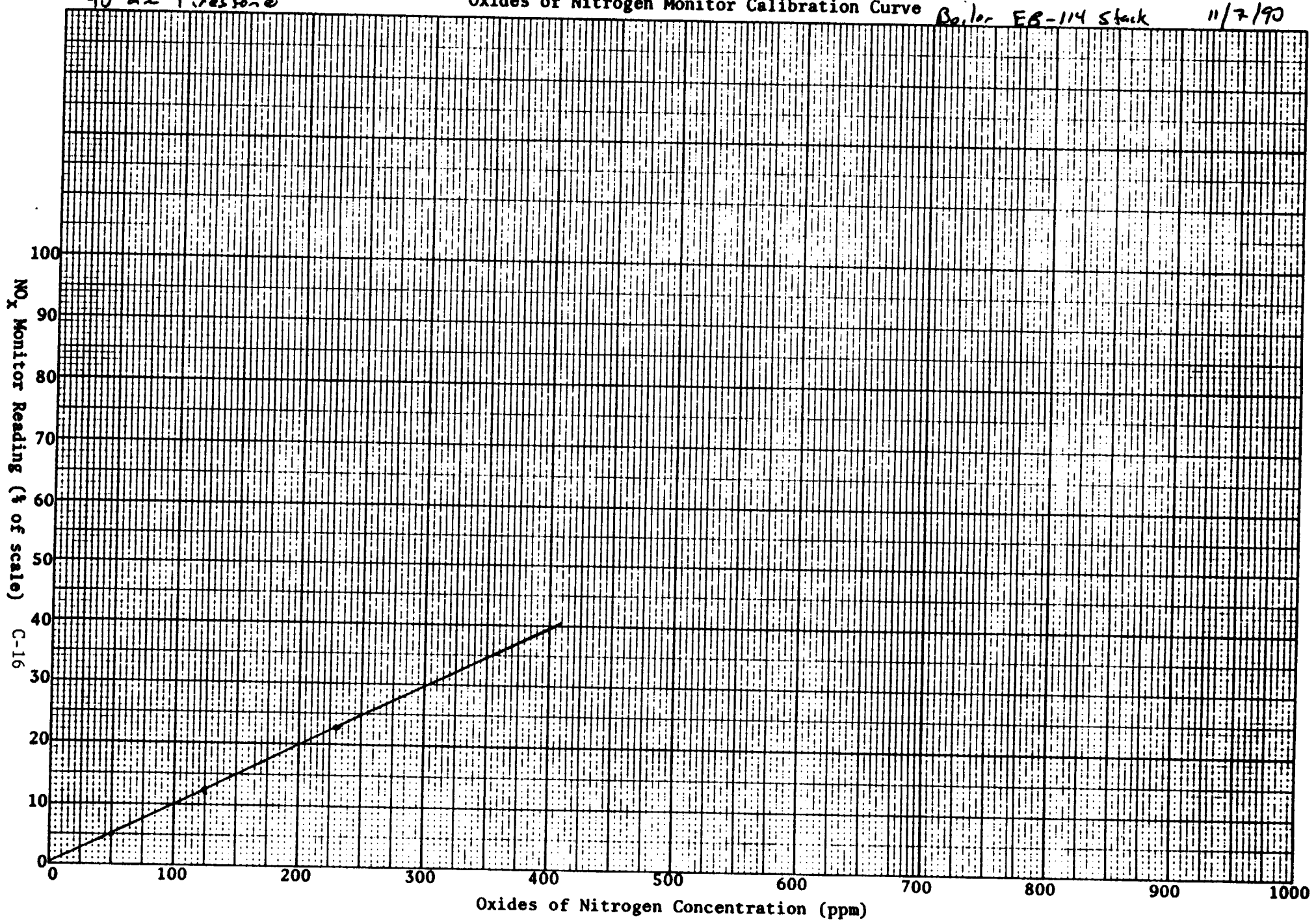


46 1240

99-22 Firestone

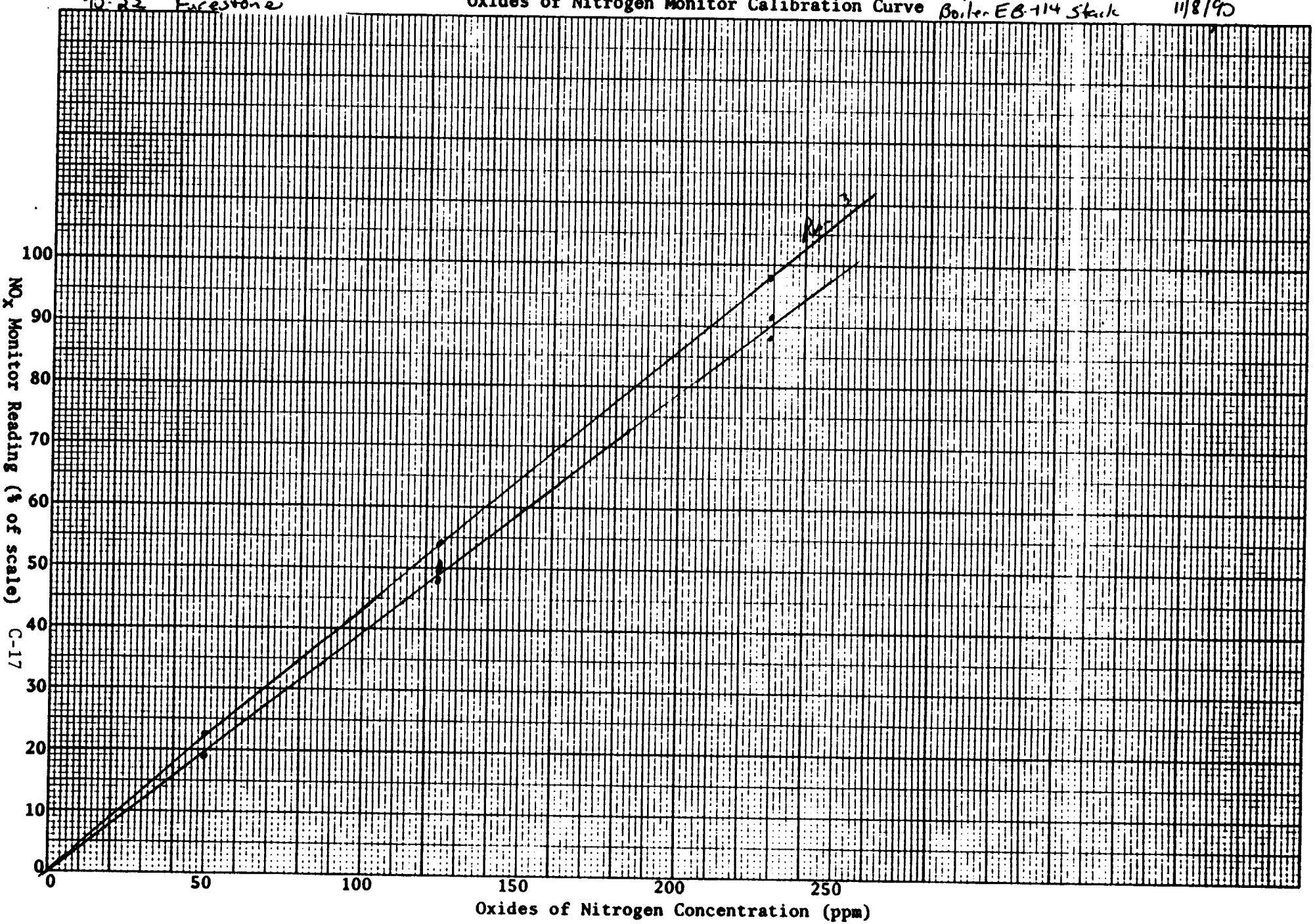
Oxides of Nitrogen Monitor Calibration Curve

Boiler EB-114 Stack 11/7/90



90-23 Firestone

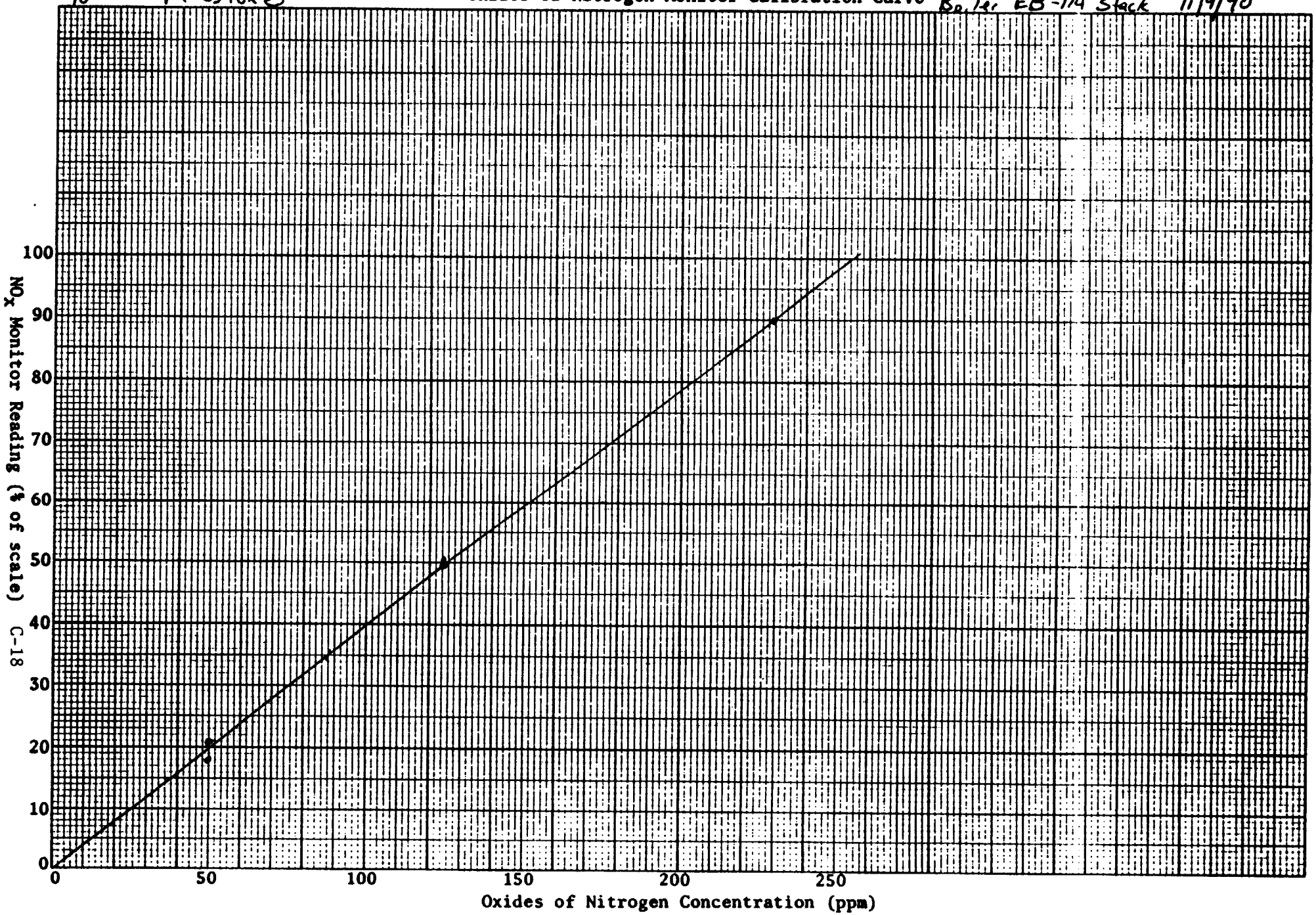
Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/8/90



46 1240

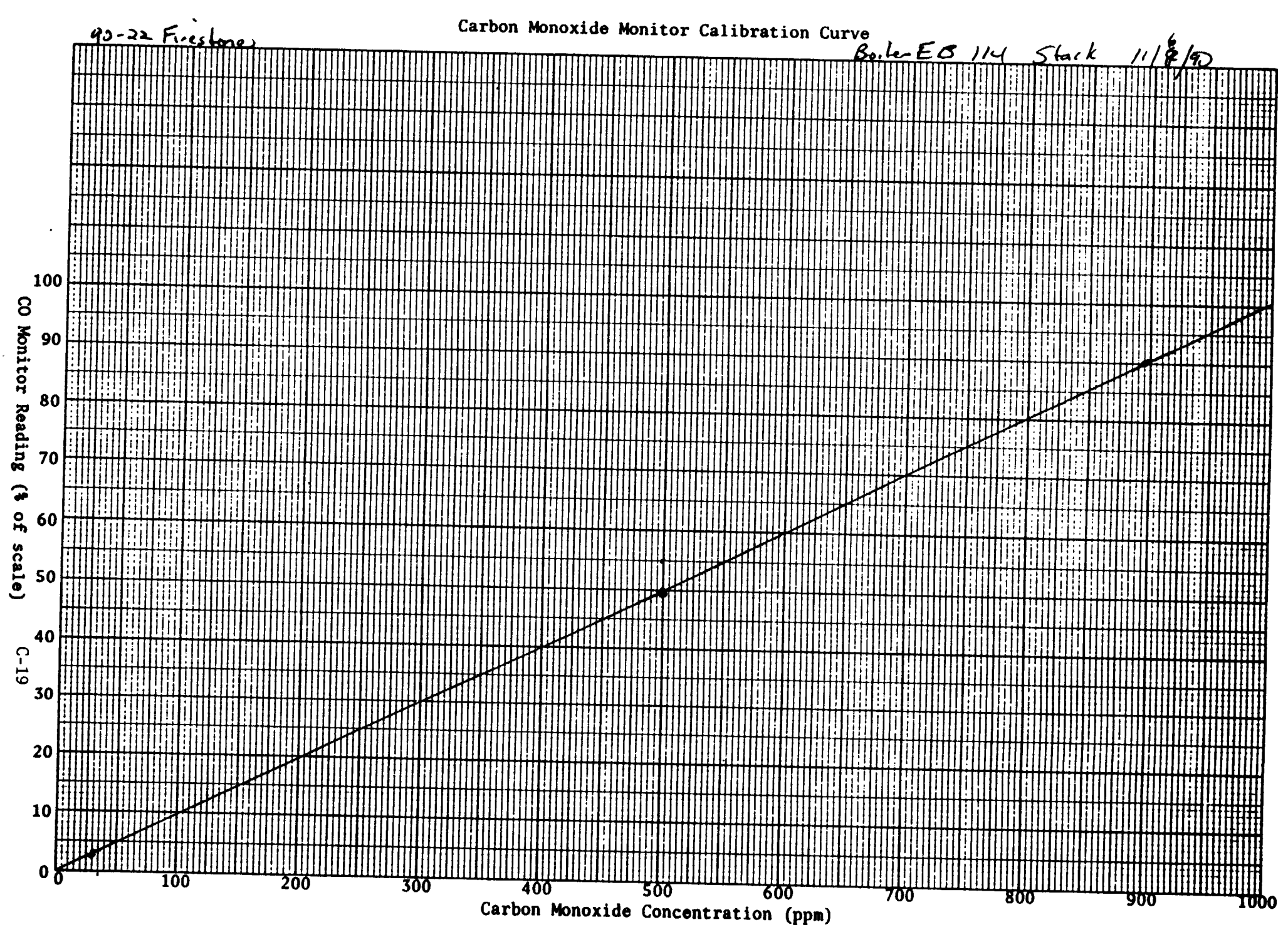
90-22 Firestone

Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/9/90



C-18

46 1240

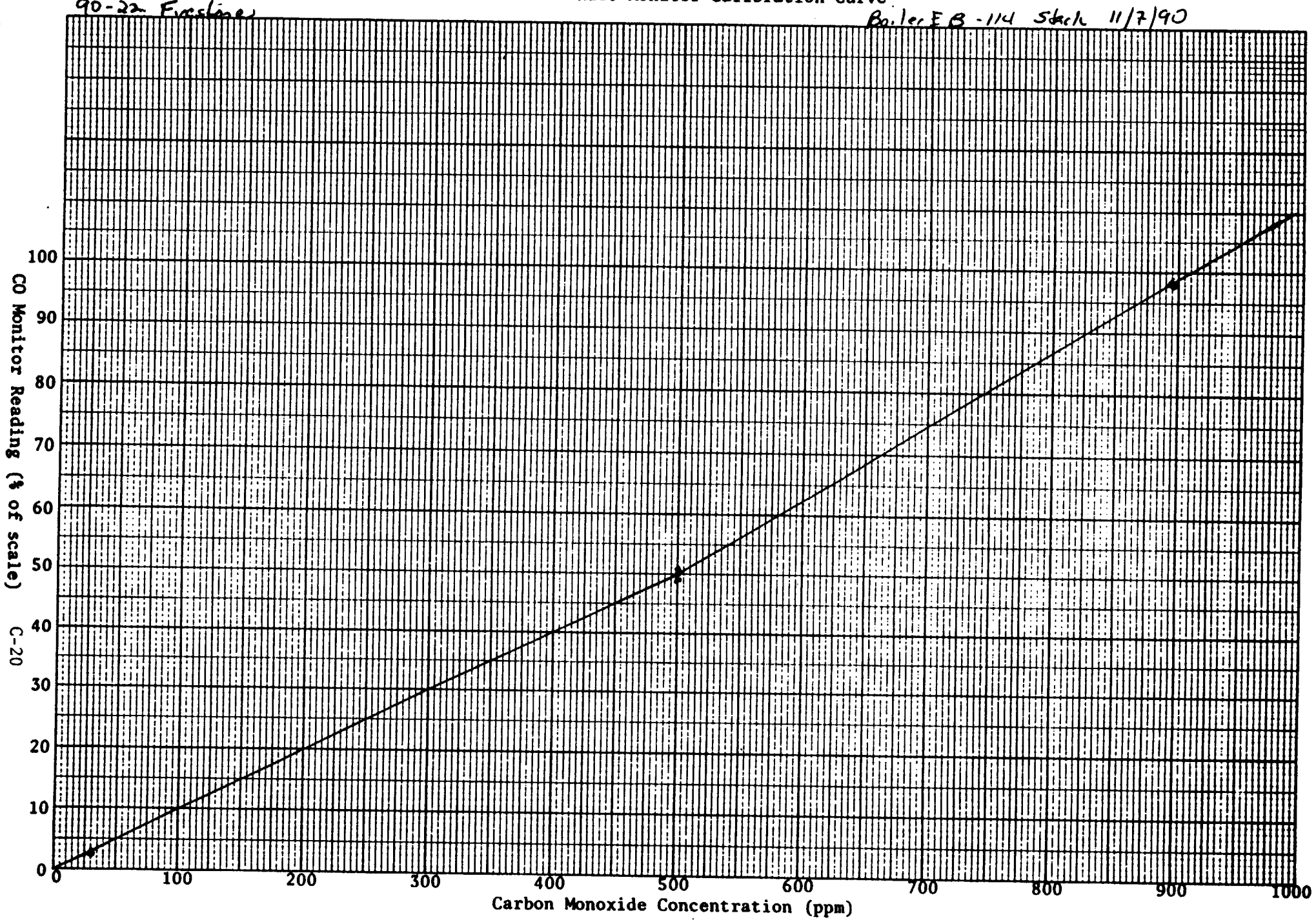


46 1240

Carbon Monoxide Monitor Calibration Curve

90-22 Fireline

Boiler EB-114 Stack 11/7/90

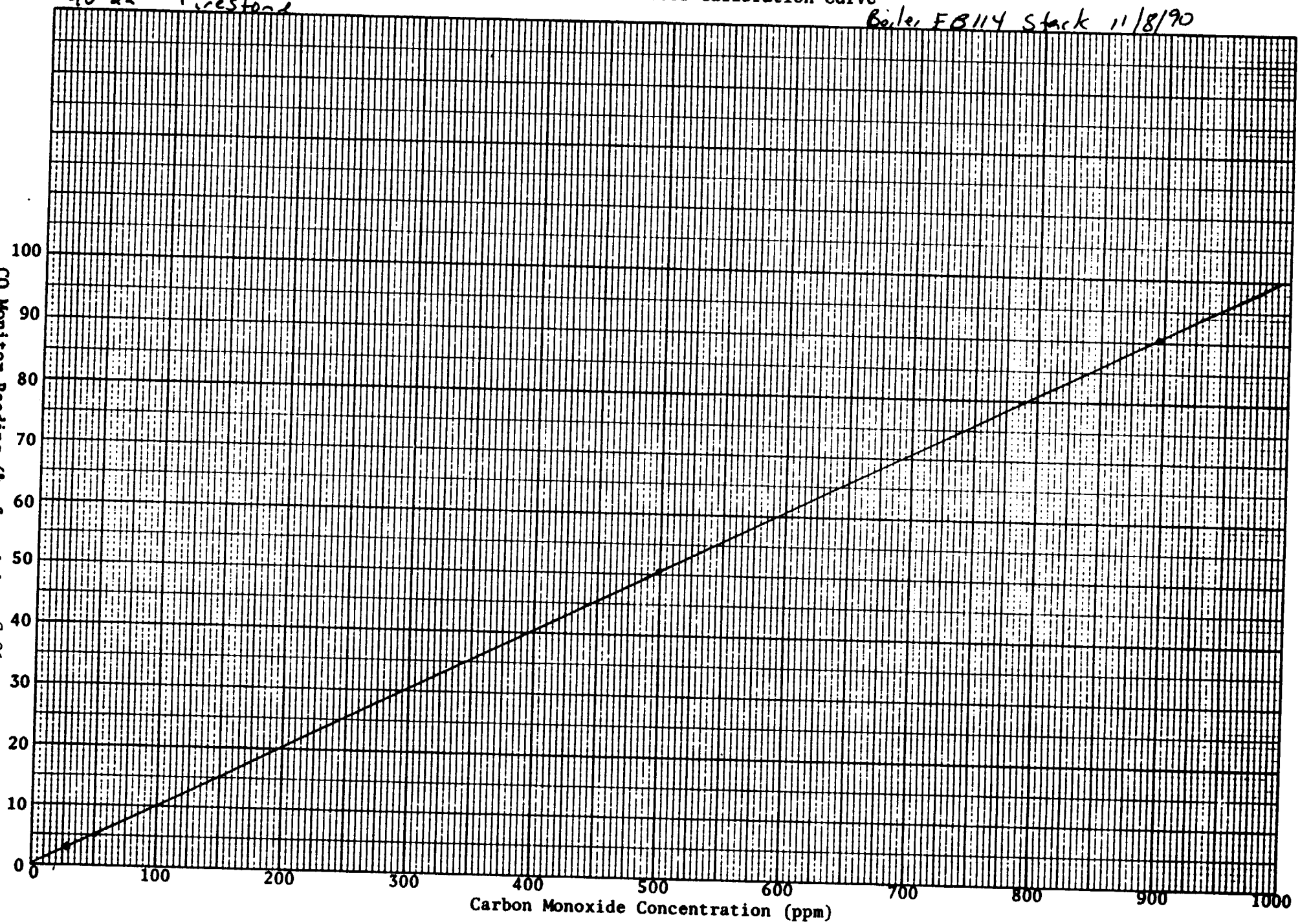


C-20

90-22 Firestone

Carbon Monoxide Monitor Calibration Curve

Boiler FB114 Stack 11/8/90



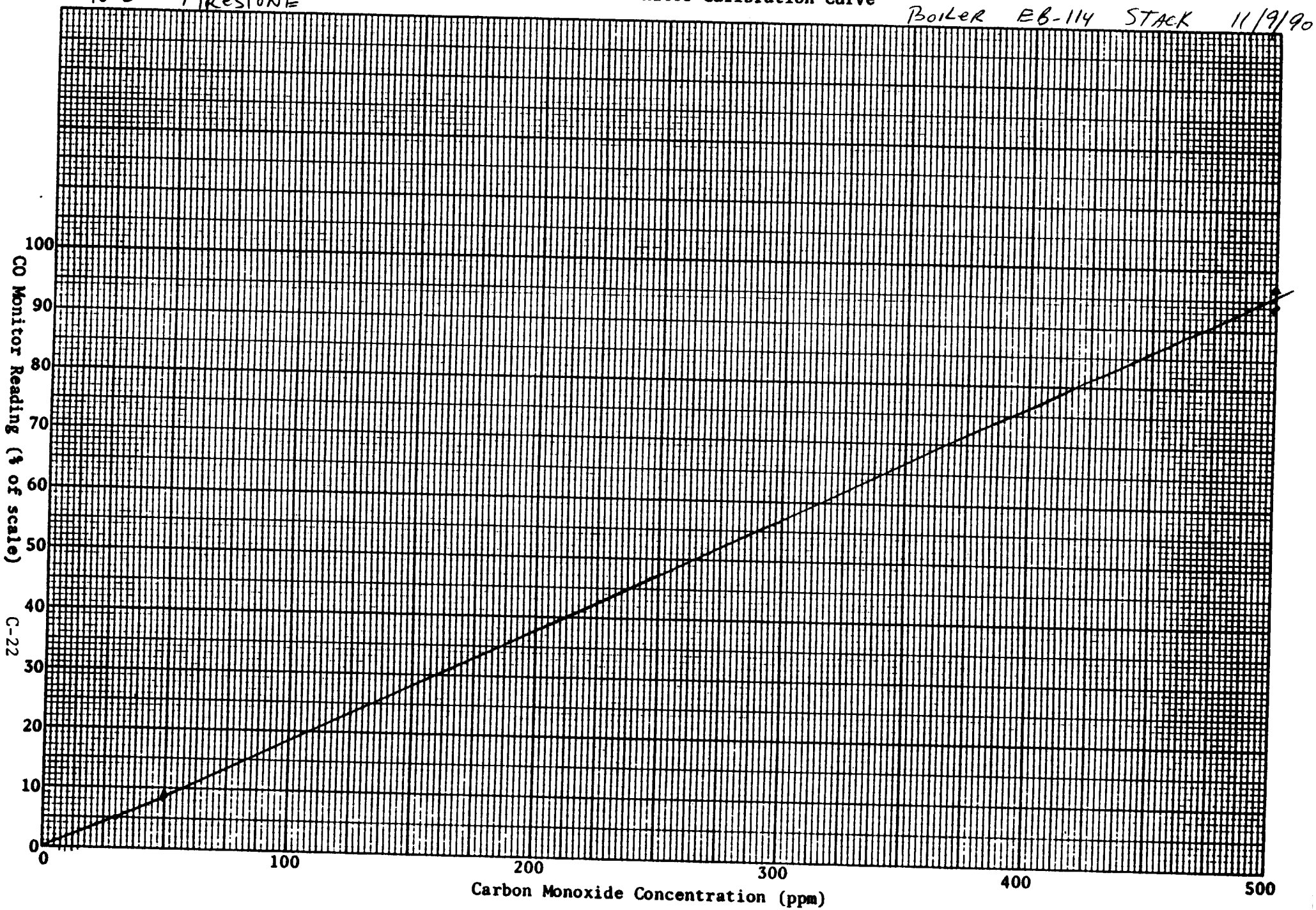
C-21

46 1240

90-22 FIRESTONE

Carbon Monoxide Monitor Calibration Curve

BOILER EB-114 STACK 11/9/90

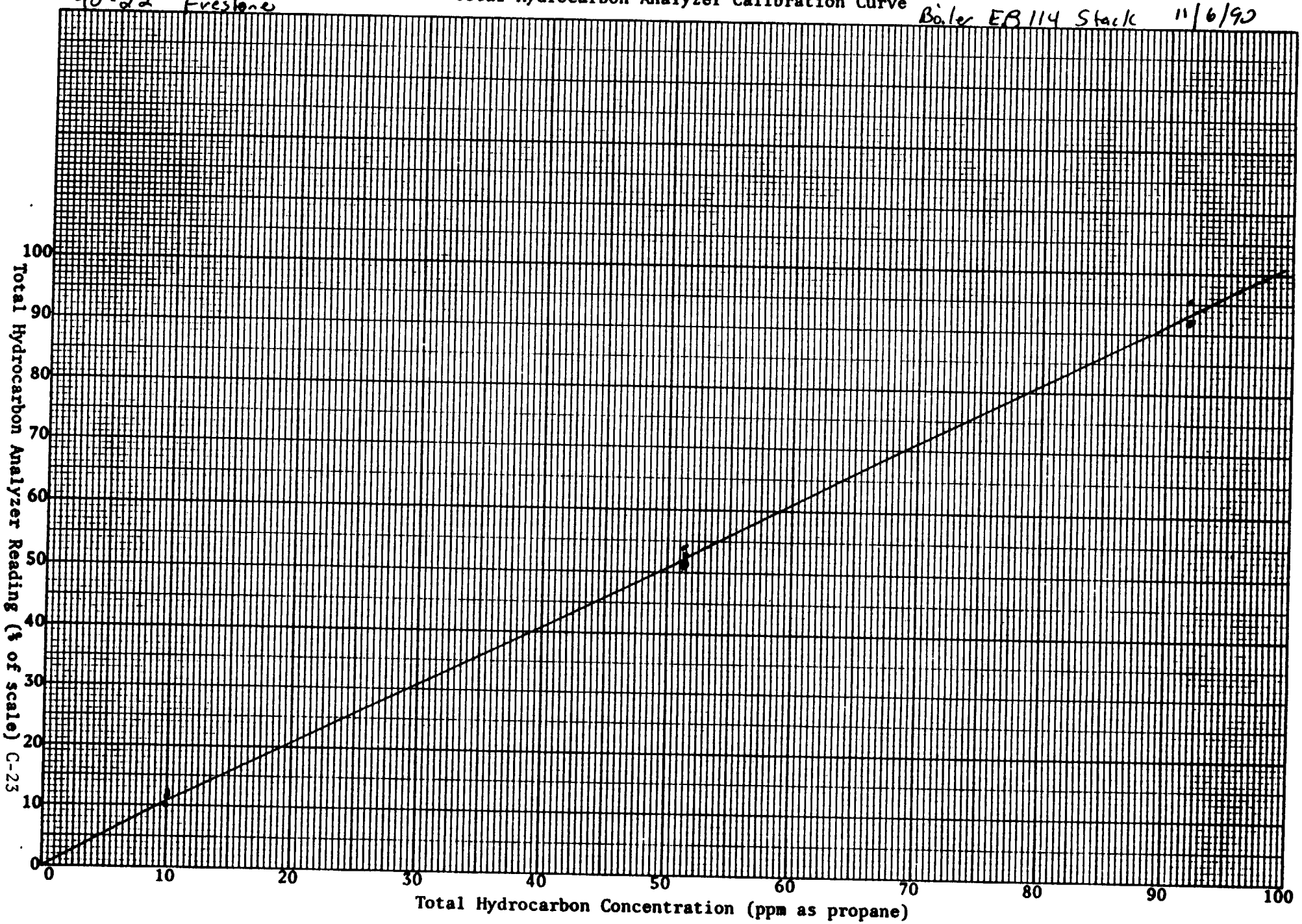


C-22

90-22 Fresbone

Total Hydrocarbon Analyzer Calibration Curve

Boiler EB 114 Stack 11/6/90

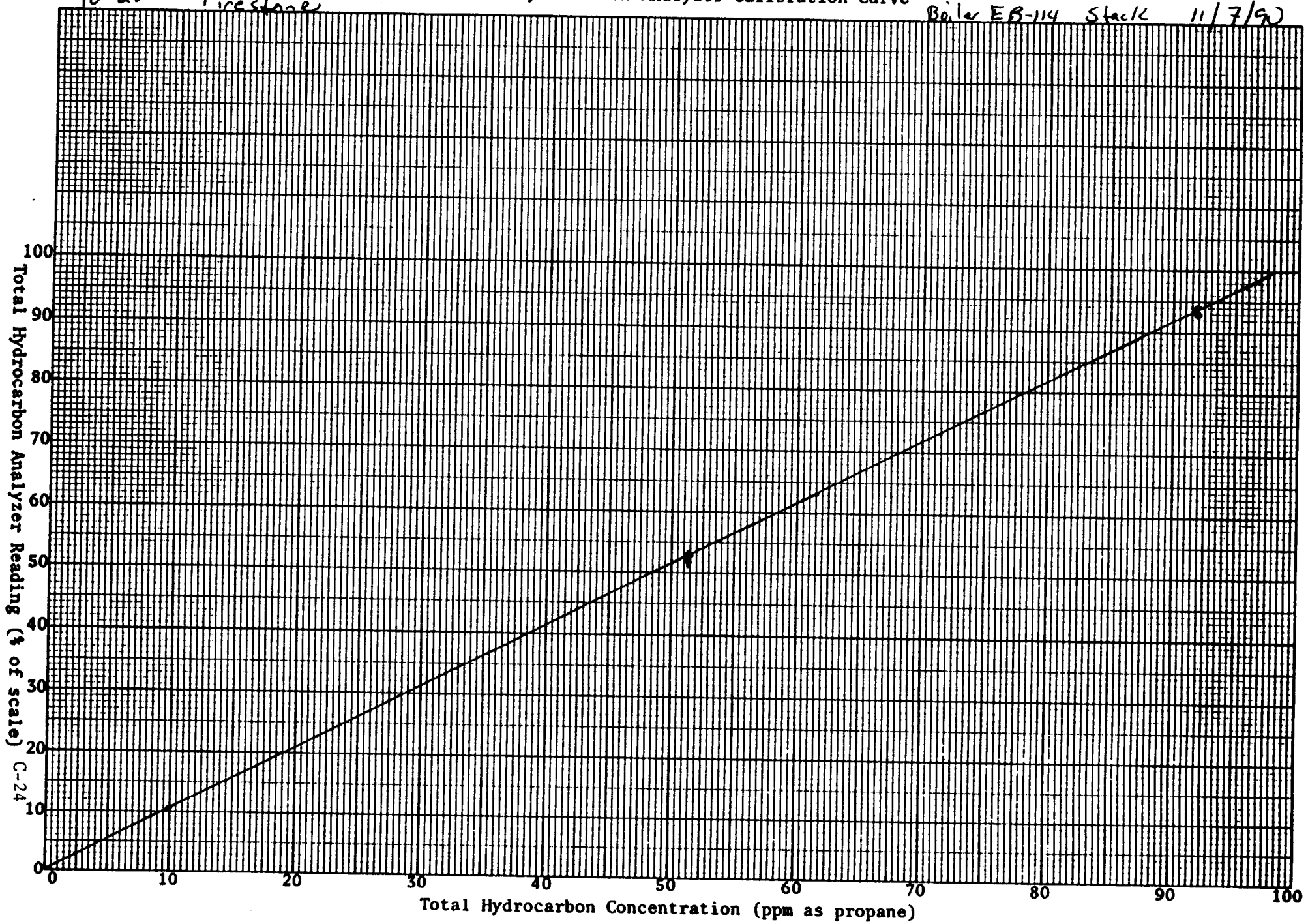


C-23

90-22 Firestone

Total Hydrocarbon Analyzer Calibration Curve

Boiler EB-114 Stack 11/7/90



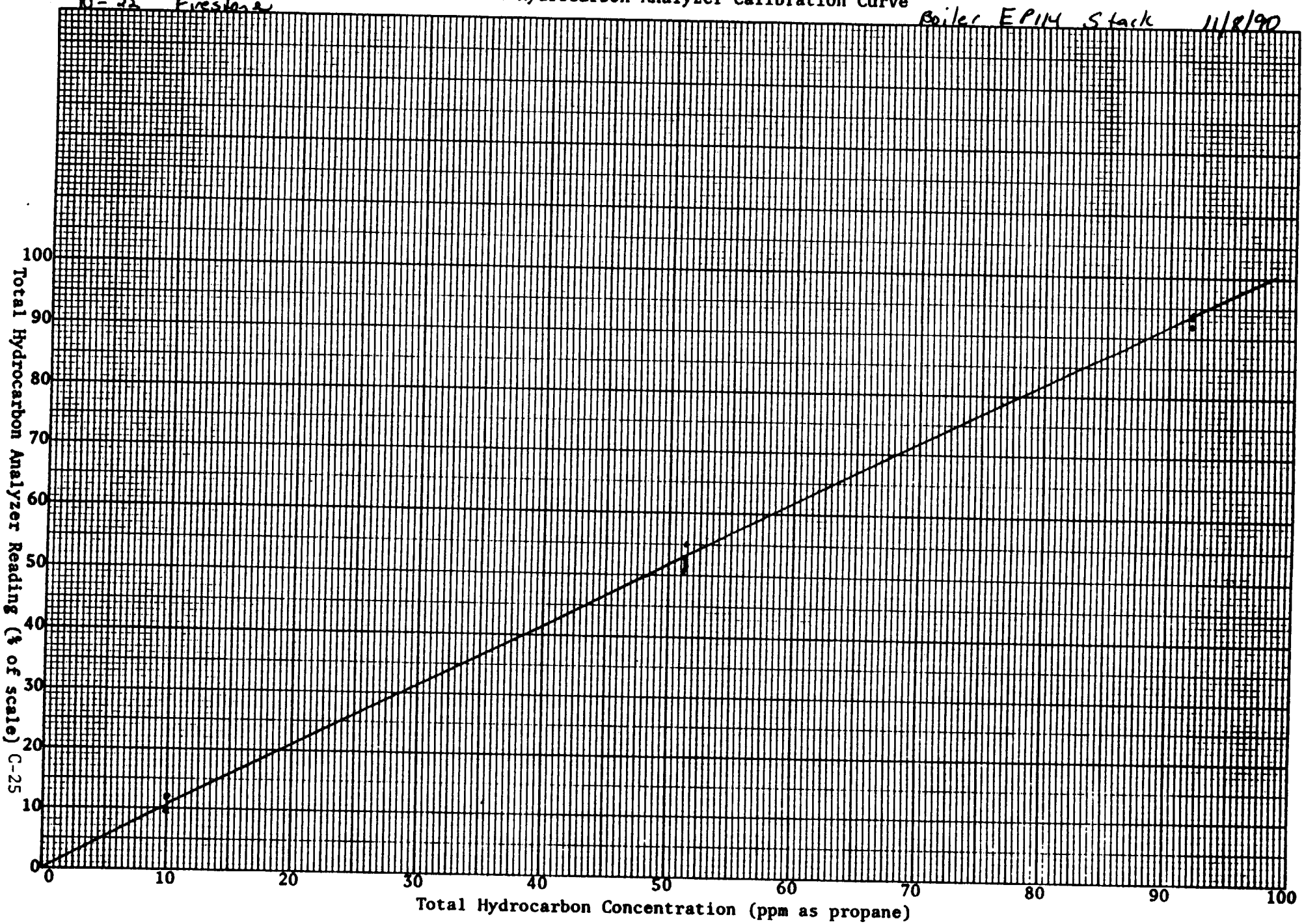
C-24

46 1240

90-22 Evershed

Total Hydrocarbon Analyzer Calibration Curve

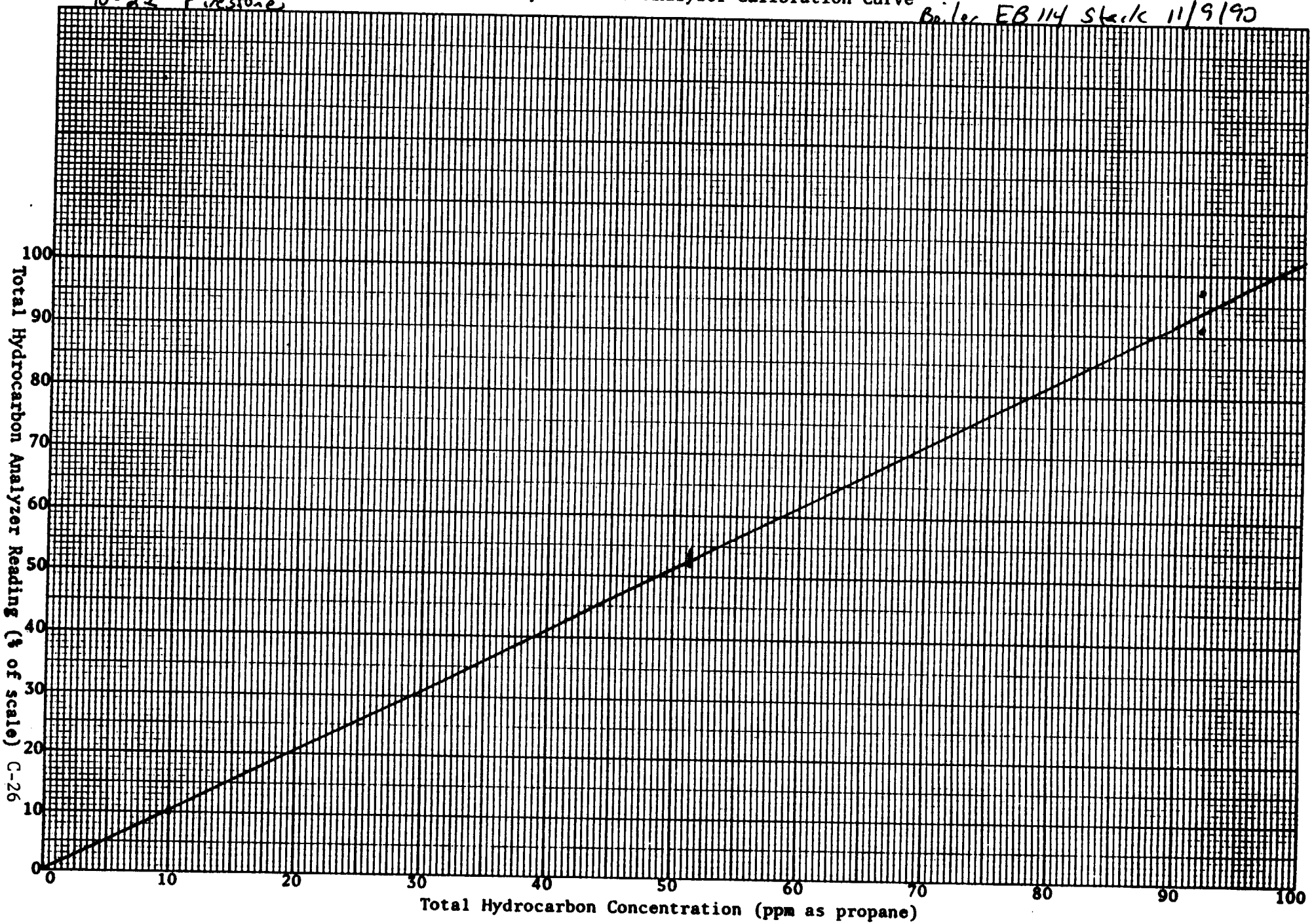
Boiler EP114 Stack 11/8/90



90-23 Firestone

Total Hydrocarbon Analyzer Calibration Curve

Boiler EB 114 Stack 11/9/93



Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Our Project # : 10630

Your P.O. # : 918

Customer :
METCO ENVIRONMENTAL
FORMERLY MULLENS ENV.
16115 DOOLEY RD
DALLAS TX 75244

*** * * * CERTIFICATE OF ANALYSIS - EPA PROTOCOL BASED * * * ***

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1

Procedure # G1

File # P04967

Certified Accuracy 1 % NBS Traceable

Expiration Date : 10-9-91

Cylinder Number DAL-4381

Cylinder Pressure 1900 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL	GAS ANALYZER: LAST CALIBRATION DATE	GAS ANALYZER: ANALYTICAL PRINCIPLE
NITRIC OXIDE	49.62 PPM	1685	AAL-9851	236.00 PPM	BECKMAN 951A	4-2-90	CHEMILUMINESCENCE
		GMIS*	AAL-14484	145.30 PPM			
		1684	ALM-003623	97.28 PPM			

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 0.30 PPM

C-27

FIRST ANALYSIS DATE : 4-2-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	16.70	49.37	236.00 PPM	80.00	236.00
0.00	16.80	49.67		80.00	236.00
0.00	16.80	49.67		80.00	236.00

CALCULATED RESULTS: 49.37, 49.67, 49.67

AVERAGE : 49.57 PPM

SECOND ANALYSIS DATE : 4-9-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	16.80	49.67	236.00 PPM	80.00	236.00
0.00	16.80	49.67		80.00	236.00
0.00	16.80	49.67		80.00	236.00
0.00	16.90 NOX	49.96			

CALCULATED RESULTS: 49.67, 49.67, 49.67, 49.96 PPM NOX

AVERAGE : 49.67 PPM

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	SPN (mV)	FITTED VALUE	PERCENT ERROR
1685	236.00	100	80.00	236.00	.00
	207.60	88	70.50	208.08	0.23
	145.30	62	49.10	145.06	-0.17
1684	97.28	41	33.00	97.54	0.27
	0.00	0	0.00	0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
1685	97.28	LOW	33.00	97.54	0.27
N/A	145.30 GMIS*		49.10	145.06	-0.17

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : [signature]

Approved By : J. Shapiro

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Our Project # : 10630

Your P.O. # : 918

Customer :
METCO ENVIRONMENTAL
FORMERLY MULLENS ENV
16115 DOOLEY RD
DALLAS TX 75244

*** * * * CERTIFICATE OF ANALYSIS - EPA PROTOCOL BASED * * * ***

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1

Procedure # G1

File # P04958

Certified Accuracy 1 % NBS Traceable

Expiration Date : 10-9-91

Cylinder Number ALM-005430

Cylinder Pressure 1900 psig

		REFERENCE STD			GAS ANALYZER		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	MAKE/MODEL	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
NITRIC OXIDE	124.26 PPM	1685	AAL-9851	236.00 PPM	BECKMAN	4-2-90	CHEMILUMINESCENCE
		GMIS*	AAL-14484	145.30 PPM	951A		
		1684	ALM-003623	97.28 PPM			
BALANCE GAS : NITROGEN							
NITROGEN DIOXIDE	0.59 PPM						

C-28

FIRST ANALYSIS DATE : 4-2-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	42.00	124.11	236.00 PPM	80.00	236.00
0.00	42.00	124.11		80.00	236.00
0.00	42.00	124.11		80.00	236.00
CALCULATED RESULTS		124.11			
		124.11			
		124.11			
AVERAGE :		124.11 PPM			

SECOND ANALYSIS DATE : 4-9-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	42.00	124.11	236.00 PPM	80.00	236.00
0.00	42.10	124.41		80.00	236.00
0.00	42.20	124.70		80.00	236.00
0.00	42.30 NOX	125.00			
CALCULATED RESULTS		124.11			
		124.41			
		124.70	125.00 PPM NOX		
AVERAGE :		124.41 PPM			

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1685	236.00	100	80.00	236.00	.00
	207.60	88	70.50	208.08	0.23
	145.30	62	49.10	145.06	-0.17
1684	97.28	41	33.00	97.54	0.27
	0.00	0	0.00	0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
1685	97.28	LOW	33.00	97.54	0.27
N/A	145.30	GMIS*	49.10	145.06	-0.17

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : G Hobbs

Approved By : J. Shapiro

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Our Project # : 10638

Your P.O. # : 918

Customer :
METCO ENVIRONMENTAL
FORMERLY MULLENS ENV.
16115 DOOLEY RD
DALLAS TX 75244

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****
PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1

Procedure # G1

File # P04966

Certified Accuracy 1 % NBS Traceable

Expiration Date : 10-9-91

Cylinder Number BAL-3086

Cylinder Pressure 1900 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL	GAS ANALYZER: LAST CALIBRATION DATE	GAS ANALYZER: ANALYTICAL PRINCIPLE
NITRIC OXIDE	229.10 PPM	1685	AAL-9851	236.00 PPM	BECKMAN 951A	4-2-90	CHEMILUMINESCENCE
		SRM*	AAL-14484	145.30 PPM			
		1684	ALM-003623	97.28 PPM			

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 2.06 PPM

C-29

FIRST ANALYSIS DATE : 4-2-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	77.60	228.95	236.00 PPM	80.00	236.00
0.00	77.60	228.95		80.00	236.00
0.00	77.60	228.95		80.00	236.00

CALCULATED RESULTS 228.95
228.95
228.95

AVERAGE : 228.95 PPM

SECOND ANALYSIS DATE : 4-9-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	77.70	229.24	236.00 PPM	80.00	236.00
0.00	77.70	229.24		80.00	236.00
0.00	77.70	229.24		80.00	236.00
0.00	78.40 NOX	231.30			

CALCULATED RESULTS 229.24
229.24
229.24

231.30 PPM NOX

AVERAGE : 229.24 PPM

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1685	236.00	100	80.00	236.00	.00
	207.60	88	70.50	208.08	0.23
	145.30	62	49.10	145.06	-0.17
1684	97.28	41	33.00	97.54	0.27
	0.00	0	0.00	0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
1685	97.28	LOW	33.00	97.54	0.27
N/A	145.30	SRM*	49.10	145.06	-0.17

* SRM - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : _____

Approved By : _____

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Shipped From : Scott Troy

Our Project # : 19A7E

Your P.O. # : 919

Expiration Date : 10-4-91

Cylinder Number CAL-12581

Cylinder Pressure 2000 psig

Customer :
MEICO ENVIROMENTAL
FORMERLY MULLENS ENV.
16115 DOOLEY RD.
DALLAS TX. 75244

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****
PERFORMED ACCORDING TO SECTION 3.0, 4
Certified For Traceability Procedure # G1
Protocol # 1
File # F04921
Certified Accuracy ± 1 % NBS Traceable

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL/SERIAL #	GAS ANALYZER: LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	29.60 PPM	1678Q	AAL 5521	47.20 PPM	HORIBA	3-12-90	NON-DISPERSIVE INFRARED
		GMIS*	ALM 002917	29.79 PPM	CFE 144E/560172153		

BALANCE GAS : NITROGEN

C-30

FIRST ANALYSIS DATE : 3-30-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	INTERNAL STANDARD (GMIS*)	REFERENCE GAS (mV)	RESULTS PPM
0.00	62.70	29.60	47.20 PPM	100.00	47.20
0.00	62.70	29.60		100.00	47.20
0.00	62.70	29.60		100.00	47.20
CALCULATED RESULTS		29.60			
		29.60			
		29.60			
AVERAGE :		29.60 PPM			

SECOND ANALYSIS DATE : 4-4-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	62.70	29.60	47.20 PPM	100.00	47.20
0.00	62.70	29.60		100.00	47.20
0.00	62.70	29.60		100.00	47.20
CALCULATED RESULTS		29.60			
		29.60			
		29.60			
AVERAGE :		29.60 PPM			

CALIBRATION CURVE 3 rd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1678A	47.20	100	100.00	47.20	.00
	24.31	52	51.80	24.40	0.36
	20.79	44	44.00	20.67	-0.56
	9.90	21	21.40	9.95	0.46
	0.00	0	0.00	0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
1677	9.90	LOW	21.40	9.95	0.46
N/A	20.79	GMIS*	44.00	20.67	-0.56

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

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Our Project # : [illegible]

Your P.O. # : [illegible]

Expiration Date : 10-4-91

Cylinder Number CAL-9911

Cylinder Pressure 2000 psig

Customer :

METCO ENVIRONMENTAL
FORMERLY MULLENS ENV.
15115 DOOLEY RD.
DALLAS TX. 75244

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****
PERFORMED ACCORDING TO SECTION 3.0. 4

Certified Per Traceability Procedure # G1
Protocol # 1

File # 504925

Certified Accuracy ± 2 %RS Traceable

COMPONENT	CERTIFIED CONC.	REFERENCE GAS # (SRM #)	REFERENCE GAS CYLINDER NUMBER	REFERENCE GAS CONC.	REFERENCE GAS MFR/MODEL/SERIAL #	LAST CALIBRATION DATE
CARBON MONOXIDE	49.41 PPM	1679A	AA-5[illegible]	[illegible]	MONITOR	3-12-90
		GMIS*	ALM-00[illegible]	[illegible]	OPT-[illegible]	

GAS ANALYZER

ANALYTICAL PRINCIPLE: NON-DISPERSIVE INFRARED

BALANCE GAS : NITROGEN

C-31

FIRST ANALYSIS DATE : 3-29-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	INTERNAL STANDARD (GMIS*)	REFERENCE GAS (mV)	RESULTS PPM
0.00	104.90	49.41	47.20 PPM	100.00	47.20
0.00	104.90	49.41		100.00	47.20
0.00	104.90	49.41		100.00	47.20
CALCULATED RESULTS		49.41			
		49.41			
		49.41			
AVERAGE :		49.41 PPM			

SECOND ANALYSIS DATE : 4-4-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	104.90	49.41	47.20 PPM	100.00	47.20
0.00	104.90	49.41		100.00	47.20
0.00	104.90	49.41		100.00	47.20
CALCULATED RESULTS		49.41			
		49.41			
		49.41			
AVERAGE :		49.41 PPM			

CALIBRATION CURVE 3 rd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1679A	47.20	100	100.00	47.20	.00
	24.31	52	51.80	24.42	0.34
	20.79	44	44.00	20.67	-0.56
	9.90	21	21.40	9.95	0.46
	0.00	0	0.00	0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
1677	9.90	LOW	21.40	9.95	0.46
N/A	20.79	GMIS*	44.00	20.67	-0.56

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : [signature]

Approved By : S. Shapiro

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

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Shipped From : Scott Troy

Our Project # : 5150

Your P.O. # : 740

Expiration Date : 10-5-91

Cylinder Number CAL-1606

Cylinder Pressure 2000 psig

Customer :
METCO ENVIROMENTAL
FORMERLY MULLENS AVE
16115 DOOLEY RD
DALLAS TX 75244

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES
PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Procedure # G1
Protocol # 1

File # F03227

Certified Accuracy 1 % NBS Traceable

COMPONENT	CERTIFIED CONC.	REFERENCE STD SRM # (CRM #)	REFERENCE STD CYLINDER NUMBER	REFERENCE STD CONC.	GAS ANALYZER MAKE/MODEL/SERIAL #	GAS ANALYZER LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	499.5 PPM	1681	AAL-6540	970.5 PPM	HORIBA/APE-144E/560172153	3-1-89	NON-DISPERSIVE INFRARED
		GMIS#	AAL-19066	1000 PPM			

BALANCE GAS : NITROGEN

C-32

FIRST ANALYSIS DATE : 9-29-89

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC	REFERENCE GAS (mV)	RESULTS PPM
0.00	52.00	402.2	970.5 PPM	98.00	781.4
0.00	52.00	402.2		98.00	781.4
0.00	52.00	402.2		98.00	781.4
	CALCULATED RESULTS	499.5			
		499.5			
		499.5			
	AVERAGE :	499.5 PPM			

SECOND ANALYSIS DATE : 10-5-89

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC	REFERENCE GAS (mV)	RESULTS PPM
0.00	52.00	402.2	970.5 PPM	98.00	781.4
0.00	52.00	402.2		98.00	781.4
0.00	52.00	402.2		98.00	781.4
	CALCULATED RESULTS	499.5			
		499.5			
		499.5			
	AVERAGE :	499.5 PPM			

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT FT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	1000	100	123.10	997.5	-0.27
1681	970.5	97	120.00	970.5	.00
	750.2	75	94.00	747.6	-0.35
	499.4	50	64.00	499.0	-0.08
	244.0	24	32.00	244.1	0.03
	0.0000	0	0.00	0.0000	0.00
		0		0.00	0.00
2636	244.0	LOW	32.00	244.1	0.03
	1000	GMIS#	123.10	997.5	-0.27

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Rohit G. Patel

Approved By : L Shapiro

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Our Project # : 08552

Your P.O. # : 855

Customer :
METCO ENVIRONMENTAL
FORMERLY MULLENS ENV
16115 DOOLEY ROAD
DALLAS TX 75244

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES
PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1 — Procedure # G1

File # PQ4586

Certified Accuracy ± 1 % NBS Traceable

Expiration Date : 8-6-91

Cylinder Number CAL-11769

Cylinder Pressure 1900 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL/SERIAL #	GAS ANALYZER: LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	894.32 PPM	1681	CAL-7913	970.00 PPM	HORIBA/OPE-144E/560172153	1-30-90	NON-DISPERSIVE INFRARED
		GMIS#	XA-9163	1001.00 PPM			

BALANCE GAS : NITROGEN

C-33

FIRST ANALYSIS — DATE : 1-31-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	89.80	892.98	970.00 PPM	97.20	971.21
0.00	90.10	896.14		97.20	971.21
0.00	90.10	896.14		97.20	971.21
CALCULATED RESULTS		891.86			
		895.02			
		895.02			
AVERAGE :		893.97 PPM			

SECOND ANALYSIS — DATE : 2-6-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE STANDARD CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	90.10	896.14	970.00 PPM	97.20	971.21
0.00	90.00	895.08		97.20	971.21
0.00	90.10	896.14		97.20	971.21
CALCULATED RESULTS		895.02			
		893.97			
		895.02			
AVERAGE :		894.67 PPM			

CALIBRATION CURVE — 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	1001.00	100	100.00	1001.00	.00
1681	970.00	97	97.20	971.21	0.13
	244.00	24	25.60	243.87	-0.05
	100.40	10	10.70	100.82	0.42
	0.00	0	0.00	0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
GMIS	100.40	LOW	10.70	100.82	0.42
N/A	1001.00	GMIS#	100.00	1001.00	.00

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Baker

Approved By : J Shapiro

Scott Specialty Gases, Inc.

PLUMSTEADVILLE, PA 18949 PHONE: 215-766-8861 FAX: 215-766-0320

Date Shipped 8-8-90

Our Project No: 21243

Your P.O. No: 1031

Page 1 of 1

METCO ENVIRONMENTAL
FORMERLY MULLENS ENV
16115 DOOLEY ROAD
DALLAS TX 75244

ATTN: DOUG SATHOFF

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number CAL 8568 CP = 2000PSIG Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 8-6-90 Last NR

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
PROPANE	9.85 PPM	2-6-92	FID	1666b	9.832 PPM	
					9.850 PPM	
					9.860 PPM	
NITROGEN	BALANCE					

Cylinder Number CAL 9194 CP = 2000PSIG Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 8-6-90 Last NR

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
PROPANE	9.85 PPM	2-6-92	FID	1666b	9.847 PPM	
					9.852 PPM	
					9.846 PPM	
NITROGEN	BALANCE					

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: 1 PROCEDURE G1

Analyst Fred Neeme Approved By MARK SIRINIDES

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

Scott Specialty Gases

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

METCO ENVIROMENTAL

Date Shipped 1-4-90
Our Project No: 15947
Your P.O. No: 819
Page 2 of 4

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number CAL 9925 cp=2000psig Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 12-20-89 Last NR

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
PROPANE	51.1ppm	6-20-91	FID	1667B	51.11ppm	
					51.24ppm	
					51.07ppm	
NITROGEN	BAL					

Cylinder Number CAL 10045 cp=2000psig Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 12-20-89 Last NR

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
PROPANE	51.3ppm	6-20-91	FID	1667B	51.37ppm	
					51.28ppm	
					51.31ppm	
NITROGEN	BAL					

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: 1 PROCEDURE G1

Analyst Jennifer Mease JENNIFER MEASE Approved By Mark S. Sirinides MARK S. SIRINIDES

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

Scott Specialty Gases, Inc.

PLUMSTEADVILLE, PA 18949 PHONE: 215-766-8861 FAX: 215-766-0320

Date Shipped 10-11-90
Our Project No: 22777
Your P.O. No: 1072
Page 2 of 4

METRO ENVIRONMENTAL

ADDISON TX

ATTN: DOUG SATHOFF

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

Cylinder Number CLM 002304 Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 10-10-90 Last N.R.
CP = 2000 psig

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
PROPANE	91.8 ppm	4-10-92	F.I.D.	2651	91.33 ppm	
					91.96 ppm	
					92.03 ppm	
NITROGEN	BALANCE					

Cylinder Number CAL 12258 Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 10-10-90 Last N.R.
CP = 2000 psig

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	REPLICATE CONCENTRATIONS SECOND
PROPANE	91.7 ppm	4-10-92	F.I.D.	2651	91.94 ppm	
					91.85 ppm	
					91.31 ppm	
NITROGEN	BALANCE					

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: 1 Procedure G1

Analyst Ted Adams Approved By MARK S. SIRINIDES

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

APPENDIX D

Field Testing Data

Job No. 90-22

Job Name FIRESTONE

Run No. 1 (COND. #1)

Location EB-114 EXHAUST

Date 6 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/MOIST FIELD DATA

Read and record at the start of each test point.

Purge to: ———

Purge time: ———

METCO ENVIRONMENTAL

Ambient Temp. °F 68

Assumed Moisture % 14.0

Probe Length 3'

C Factor ——— to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A8	0911	804.129	0.02	2.00	2.00	5.0	240	260	254	65	66	67	
A7	0916	807.18	0.03	2.00	2.00	5.0	264	262	254	60	67	66	
A6	0921	811.03	0.03	2.00	2.00	5.0	273	262	255	56	67	66	
A5	0926	815.26	0.03	2.00	2.00	5.0	280	263	258	56	68	66	
A4	0931	818.62	0.02	2.00	2.00	5.0	285	261	253	58	69	66	
A3	0936	822.80	0.02	2.00	2.00	5.0	310	262	256	59	70	67	
A2	0941	826.300	0.03	—	—	—	312	—	—	—	—	—	
A1	END	—	0.02	—	—	—	275	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B8			0.02				278						
B7			0.03				290						
B6			0.03				286						
B5			0.03				290						
B4			0.02				287						
B3			0.02				282						
B2			0.02				282						
B1			0.03				276						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 22.526 ft^3 Baro. Press. P_b 30.00 "Hg

Water Collected V_w 111.2 ml Probe Tip Dia. D_n ——— in.

Time of Test T_t 30 min. % CO_2 2.5 4.5 4.5 % CO 0.0 0.0

Stack Pressure P_s +0.03 "H_2O % O_2 2.5 2.5 2.5 % N_2 88.0 88.0 88.0

Area Stack A_s 2653 in^2

Pitot Tube No. 5 Barometer No. 15

Probe Tip No. ———

V_m = Dry Gas Meter Calibration Factor 1.016 X 22.171

[Dry Gas Meter Reading ——— ft^3 - (T_t ——— min X Leak Rate ——— cfm)]

M_F = ——— M_T = ———

D-2

Impinger Box No. 30

Impinger 1	Final Weight	672.5
	Initial Weight	610.6
	Increase	
Impinger 2	Final Weight	640.8
	Initial Weight	611.6
	Increase	
Impinger 3	Final Weight	511.1
	Initial Weight	501.8
	Increase	
Impinger 4	Final Weight	890.7
	Initial Weight	879.9
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	61.9
Impinger 2	29.2
Impinger 3	9.3
Impinger 4	10.8
Impinger 5	
Impinger 6	
Total	111.2 = V_w

V_w =
g SO_2 = -
V_w =

P_b = 30.00 ✓ %CO_2 = 9.5 ✓
V_m = 22.526 ✓ %O_2 = 2.5 ✓
V_w = 111.2 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ %N_2 = 88.0 ✓
Avg ΔP = 0.025 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.157 ✓ D_n = ____
C_p = 0.799 ✓ T_t = 30 ✓
P_s = +0.03 "H_2O 30.00 "Hg ✓
T_m = 67 °F ✓ 527 °R ✓
T_s = 283 °F ✓ 743 °R ✓

Moisture Content: %M = 18.75 ✓ M_d = 0.8125 ✓ MW_d = 29.620 ✓ MW = 27.44

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 22.526 \left(\frac{30.00 + \frac{2.00}{13.6}}{67 + 460} \right) = 22.744 \text{ sft}^3 \checkmark$$

0.758 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 111.2 = 5.249 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{5.249}{5.249 + 22.744} \times 100 = 18.75 \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{743}{30.00 \times 27.44}} \times 0.157 = 611 \text{ fpm} \checkmark$$

ACFM: 11250 ✓

SCFM: 6537 (41) ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

%EA: 20.8 (12.0) ✓

Job No. 90-22

Job Name FIRESTONE

Run No. 2 (COND. #1)

Location EB-1A EXHAUST

Date 6 NOVEMBER 1990

Operator RANDOLPH, B.II

Sample Box No. 30 Meter Box No. 10

VELOCITY/HOST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 73

Assumed Moisture % 14.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 8.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A8	1030	826.257	0.02	2.00	2.00	4.5	267	265	255	60	25	71	INTER
A7	1035	830.15	0.02	2.00	2.00	4.5	267	263	257	60	76	71	ORSAT
A6	1040	834.72	0.02	2.00	2.00	5.0	274	265	260	58	78	72	
A5	1045	838.36	0.02	2.00	2.00	5.0	281	263	265	58	80	72	
A4	1050	842.00	0.03	2.00	2.00	5.0	295	260	254	59	81	72	
A3	1055	846.05	0.03	2.00	2.00	5.0	313	254	256	60	82	73	
A2	1100	849.600	0.02	—	—	—	314	—	—	—	—	—	
A1	END	—	0.01	—	—	—	281	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B8			0.02				261						
B7			0.03				281						
B6			0.03				282						
B5			0.03				288						
B4			0.03				288						
B3			0.03				285						
B2			0.02				283						
B1			0.02				271						
END ALL	—	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.208 ft^3

Water Collected V_w 105.3 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.03 "H_2O

Baro. Press. P_b 30.00 "Hg

Probe Tip Dia. D_n — in.

% CO_2 9.0 / 9.0 / 2.0

% CO 0.0 / 0.0 / 0.0

% O_2 2.0 / 2.0 / 2.0

% N_2 89.0 / 89.0 / 89.0

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 22.843

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = — / —

M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	753.1
	Initial Weight	672.5
	Increase	
Impinger 2	Final Weight	657.2
	Initial Weight	640.8
	Increase	
Impinger 3	Final Weight	514.0
	Initial Weight	511.1
	Increase	
Impinger 4	Final Weight	896.1
	Initial Weight	890.7
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

V_w =
g SO_2 = -____
V_w =

Impinger 1	80.6
Impinger 2	16.4
Impinger 3	2.9
Impinger 4	5.4
Impinger 5	
Impinger 6	
Total	105.3 ✓ = V_w

P_b = 30.00 ✓ $\%CO_2$ = 9.0 ✓
V_m = 23.208 ✓ $\%O_2$ = 2.0 ✓
V_w = 105.3 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ $\%N_2$ = 89.0 ✓
Avg ΔP = 0.024 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.153 ✓ D_n = ____
C_p = 0.799 ✓ T_t = 30 ✓
P_s = -0.03 "H_2O 30.00 "Hg ✓
T_m = 75 °F ✓ 535 °R ✓
T_s = 283 °F ✓ 743 °R ✓

Moisture Content: %M = 17.64 ✓ M_d = 0.8236 ✓ MW_d = 29.520 ✓ MW = 27.18

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.208 \left(\frac{30.00 + \frac{2.00}{13.6}}{75 + 460} \right) = 23.082 \text{ sft}^3 \checkmark$$

0.769 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 105.3 = 4.970 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.970}{4.970 + 23.082} \times 100 = 17.64\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{743}{30.00 \times 27.18}} \times 0.153 = 595 \text{ fpm} \checkmark$$

ACFM: 1095 ✓
SCFM: 645 ✓
%EA: 9.3 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-202

Job Name FIRESTONE

Run No. 3 (COND. #1)

Location EB-114 EXHAUST

Date 6 NOVEMBER 1990

Operator RANDOLPH, B.11

Sample Box No. 30 Meter Box No. 10

VELOCITY/EMOIST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 77

Assumed Moisture % 18.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	T_m Dry Gas Temp. °F Outlet	PITOT TUBE LEAK CHECK OR Remarks
B8	1145	850.190	0.02	2.00	2.00	5.0	275	263	258	68	75	75	WTER
B7	1150	864.12	0.03	2.00	2.00	5.0	278	267	262	69	78	75	ORSAT
B6	1155	868.25	0.03	2.00	2.00	5.0	288	262	260	69	80	75	
B5	1200	861.30	0.02	2.00	2.00	5.0	291	265	257	70	83	76	
B4	1205	865.65	0.02	2.00	2.00	5.0	287	263	257	70	82	76	
B3	1210	869.56	0.02	2.00	2.00	5.0	283	261	258	71	83	76	
B2	1215	873.370	0.02	—	—	—	281	—	—	—	—	—	
B1	END	—	0.01	—	—	—	265	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
A8			0.02				267						
A7			0.02				266						
A6			0.02				270						
A5			0.02				276						
A4			0.03				300						
A3			0.03				306						
A2			0.03				311						
A1			0.02				300						
END ALL	—	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.551 ft^3

Water Collected V_w 102.4 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.03 "H_2O

Baro. Press. P_b 30.00 "Hg

Probe Tip Dia. D_n — in.

% CO_2 9.5 / 9.5 % CO 0.0 / 0.0

% O_2 2.5 / 2.5 % N_2 88.0 / 88.0

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.180

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = —

M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	834.4
	Initial Weight	768.1
	Increase	
Impinger 2	Final Weight	671.5
	Initial Weight	657.2
	Increase	
Impinger 3	Final Weight	515.5
	Initial Weight	514.0
	Increase	
Impinger 4	Final Weight	901.4
	Initial Weight	896.1
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	81.3
Impinger 2	14.3
Impinger 3	1.5
Impinger 4	5.3
Impinger 5	
Impinger 6	
Total	102.4 = V_w

V_w =
g SO_2 = -____
V_w =

P_b = 30.00 ✓ %CO_2 = 9.5 ✓
V_m = 23.551 ✓ %O_2 = 2.5 ✓
V_w = 102.4 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ %N_2 = 88.0 ✓
Avg ΔP = 0.023 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.149 ✓ D_n = —
C_p = 0.799 ✓ T_t = 30 ✓
P_s = +0.03 "H_2O 30.00 "Hg ✓
T_m = 78 °F ✓ 538 °R ✓
T_s = 284 °F ✓ 744 °R ✓

Moisture Content: %M = 17.18 ✓ M_d = 0.8282 ✓ MW_d = 29.620 ✓ MW = 27.62

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 23.551 \left(\frac{30.00 + \frac{2.00}{13.6}}{78 + 460}\right) = 23.293\ sft^3 \checkmark$$

0.776 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 102.4 = 1.833\ sft^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{1.833}{1.833 + 23.293} \times 100 = 17.18\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{744}{30.00 \times 27.62}} \times 0.149 = 578\ fpm \checkmark$$

ACFM: 1064.9 ✓

SCFM: 629.9 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

%EA: 304 12.0 ✓

Job No. 90-22

Job Name FIRESTONE

Run No. 4 (CONDITION #1)

Location EB-114 EXHAUST

Date 6 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/TRAVERSE FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 65

Assumed Moisture % 18.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
B 8	1604	902.620	0.24	2.00	2.00	7.0	340	238	252	54	82	82	WATER
B 7	1609	906.85	0.25	2.00	2.00	7.0	351	255	255	54	84	83	OKSA
B 6	1614	910.47	0.25	2.00	2.00	7.0	364	260	251	57	85	83	
B 5	1619	915.00	0.24	2.00	2.00	7.0	372	263	252	60	87	84	
B 4	1624	918.52	0.24	2.00	2.00	7.0	355	267	254	62	90	87	
B 3	1629	922.35	0.25	2.00	2.00	7.0	338	262	255	64	91	85	
B 2	1634	926.615	0.25	—	—	—	341	—	—	—	—	—	
B 1	END	—	0.18	—	—	—	342	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
A 8			0.24				317						
A 7			0.25				323						
A 6			0.25				325						
A 5			0.25				335						
A 4			0.28				411						
A 3			0.30				449						
A 2			0.25				459						
A 1			0.18				435						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

T_m PITOT TUBES CHECKED

D-8

Pitot Tube Calibration Factor C_p 0.749

Volume Collected V_m 24.379 ft^3 Baro. Press. P_b 30.10 "Hg

Water Collected V_w 101.1 ml Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. % CO_2 9.5 9.0 % CO 0.0 87.5

Stack Pressure P_s +0.15 "H_2O % O_2 3.0 2.5 3.8 % N_2 88.0 88.5

Area Stack A_s 2652 in^2

Pitot Tube No. 5 Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.995

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = — M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	799.6
	Initial Weight	722.5
	Increase	
Impinger 2	Final Weight	670.5
	Initial Weight	652.9
	Increase	
Impinger 3	Final Weight	520.9
	Initial Weight	518.8
	Increase	
Impinger 4	Final Weight	836.4
	Initial Weight	828.2
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	
Filter #	Final Weight	
	Initial Weight	
	Increase	

Water Weight Gain

V_w =

g SO_2 = -

V_w =

Impinger 1	74.1
Impinger 2	17.6
Impinger 3	1.2
Impinger 4	8.2
Impinger 5	
Impinger 6	
Total	101.1 = V_w

P_b =	30.10	$\%CO_2$ =	9.3
V_m =	24.379	$\%O_2$ =	2.8
V_w =	101.1	%CO =	0.0
P_m =	2.00	$\%N_2$ =	87.9
Avg ΔP =	0.244	A_s =	2653
Avg $\sqrt{\Delta P}$ =	0.493	D_n =	—
C_p =	0.799	T_t =	30
P_s =	+0.15 H_2O	30.11	"Hg
T_m =	85 °F	545	°R
T_s =	366 °F	826	°R

Moisture Content: %M = 16.65 M_d = 0.8335 MW_d = 29.600 MW = 27.67

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 24.379 \left(\frac{30.10 + \frac{2.00}{13.6}}{85 + 460} \right) = 23.881 \text{ sft}^3$$

0.796 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 101.1 = 4.772 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.772}{4.772 + 23.881} \times 100 = 16.65\ \%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{826}{30.11 \times 27.67}} \times 0.493 = 2010 \text{ fpm}$$

ACFM: 370251

SCFM: 19925

%EA: 13.7

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 5 (CONDITION #1)

Location EB-1A EXHAUST

Date 6 NOVEMBER 1990

Operator RANDOLPH, B.11

Sample Box No. 30 Meter Box No. 10

VELOCITY TRAVERSE FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 75

Assumed Moisture % 18.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 9.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A 8	1706	927.000	0.19	2.00	2.00	7.0	325	242	257	58	85	85	PITOT TUBES LEAK CHECKED OK
A 7	1711	930.60	0.19	2.00	2.00	7.0	329	250	257	57	87	85	ORSAT
A 6	1716	934.57	0.17	2.00	2.00	7.0	333	257	256	57	89	86	
A 5	1721	938.40	0.21	2.00	2.00	7.0	341	260	261	60	90	87	
A 4	1726	942.73	0.24	2.00	2.00	7.0	421	259	258	62	91	87	
A 3	1731	946.37	0.29	2.00	2.00	7.0	459	262	257	63	90	86	
A 2	1736	950.240	0.31	—	—	—	469	—	—	—	—	—	
A 1	END	—	0.20	—	—	—	440	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.22				349						
B 7			0.23				360						
B 6			0.23				371						
B 5			0.23				385						
B 4			0.23				367						
B 3			0.25				350						
B 2			0.24				350						
B 1			0.16				355						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.612 ft^3

Water Collected V_w 102.4 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.17 "H_2O

Baro. Press. P_b 30.10 "Hg

Probe Tip Dia. D_n — in.

% CO_2 8.0 / 8.0 / 8.0

% CO 0.0

% O_2 2.5 / 2.5 / 2.5

% N_2 89.5 / 89.5 / 89.5

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.240

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = —

M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	823.0
	Initial Weight	794.6
	Increase	
Impinger 2	Final Weight	732.0
	Initial Weight	670.5
	Increase	
Impinger 3	Final Weight	523.2
	Initial Weight	520.0
	Increase	
Impinger 4	Final Weight	845.7
	Initial Weight	836.4
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	28.4
Impinger 2	61.5
Impinger 3	3.2
Impinger 4	9.3
Impinger 5	
Impinger 6	
Total	102.4 = V_w

V_w =
g SO_2 = -
V_w =

P_b = 30.10 ✓ %CO_2 = 8.0 ✓
V_m = 23.612 ✓ %O_2 = 2.5 ✓
V_w = 102.4 ✓ %CO = ~~0.0~~ 0.0 ✓
P_m = 2.001 ✓ %N_2 = 89.5 ✓
Avg ΔP = 0.224 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.472 ✓ D_n = ____
C_p = 0.799 ✓ T_t = 30 ✓
P_s = ~~+~~0.17 "H_2O 30.11 "Hg ✓
T_m = 87 °F ✓ 547 °R ✓
T_s = 375 °F ✓ 835 °R ✓

Moisture Content: %M = 17.34 ✓ M_d = 0.8266 ✓ MW_d = 29.380 ✓ MW = 27.41

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.612 \left(\frac{30.10 + \frac{2.00}{13.6}}{87 + 460} \right) = 23.045 \text{ sft}^3 \checkmark$$

0.768 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 102.4 = 4.833 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.833}{4.833 + 23.045} \times 100 = 17.34\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{835}{30.11 \times 27.41}} \times 0.472 = 1944 \text{ fpm} \checkmark$$

ACFM: 35809 ✓

SCFM: 18905 ✓

%EA: 11.8 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 6 (CONDITION #1)

Location EB-1A EXHAUST

Date 6 NOVEMBER 1990

Operator RADDOCK, B.11

Sample Box No. 30 Meter Box No. 10

VELOCITY/MOIST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 72

Assumed Moisture % 17.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 9.0 "Hg = 0.002 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A 8	1812	950.615	0.18	2.00	2.00	7.0	340	260	252	68	87	85	PITOT TUBES LEAK CHECK OK
A 7	1817	954.47	0.18	2.00	2.00	7.0	343	261	250	65	87	85	INTER
A 6	1822	958.14	0.19	2.00	2.00	7.0	345	260	253	65	90	85	ORSAT
A 5	1827	962.38	0.21	2.00	2.00	7.0	350	259	255	66	91	85	
A 4	1832	966.15	0.27	2.00	2.00	7.0	434	259	255	65	92	86	
A 3	1837	970.18	0.26	2.00	2.00	7.0	469	260	255	65	92	83	
A 2	1842	974.316	0.27	—	—	—	480	—	—	—	—	—	
A 1			0.14				456						
END			—				—						
B 8			0.33				362						
B 7			0.23				374						
B 6			0.23				382						
B 5			0.21				394						
B 4			0.23				378						
B 3			0.24				356						
B 2			0.25				359						
B 1			0.18				350						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 24.080 ft^3 Baro. Press. P_b 30.10 "Hg

Water Collected V_w 112.5 ml Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. % CO_2 8.5 / 8.0 % CO 0.0 / 0.0

Stack Pressure P_s +0.17 "H_2O % O_2 3.0 / 3.0 / 3.2 % N_2 88.5 / 88.8

Area Stack A_s 2653 in^2

Pitot Tube No. 5 Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.701'

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = — M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	899.5
	Initial Weight	823.0
	Increase	
Impinger 2	Final Weight	756.8
	Initial Weight	732.0
	Increase	
Impinger 3	Final Weight	525.4
	Initial Weight	523.2
	Increase	
Impinger 4	Final Weight	854.7
	Initial Weight	845.7
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

V_w =
g SO_2 = -____
V_w =

Impinger 1	76.5
Impinger 2	24.8
Impinger 3	2.2
Impinger 4	9.0
Impinger 5	
Impinger 6	
Total	112.5 ✓ = V_w

P_b = 30.10 ✓ $\%CO_2$ = 8.3 ✓
V_m = 24.080 ✓ $\%O_2$ = 3.1 ✓
V_w = 112.5 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ $\%N_2$ = 88.6 ✓
Avg ΔP = 0.219 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = ~~0.466~~ ✓ D_n = —
C_p = 0.799 ✓ T_t = 30 ✓
P_s = +0.17 "H_2O 30.11 "Hg ✓
T_m = 87 °F ✓ 547 °R ✓
T_s = ~~407~~ °F ~~867~~ 846 °R ✓

Moisture Content: %M = 18.13 ✓ M_d = 0.8157 ✓ MW_d = 29.452 ✓ MW = 27.34 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 24.080 \left(\frac{30.10 + \frac{2.00}{13.6}}{87 + 460}\right) = 23.502\ sft^3 \checkmark$$

0.783 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 112.5 = 5.310\ sft^3 \checkmark$$

$$\%\ Moisture = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{5.310}{5.310 + 23.502} \times 100 = 18.13\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{867}{30.11 \times 27.34}} \times 0.466 = 1958\ fpm \checkmark$$

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad\%$$

ACFM: ~~36074~~ 35631 ✓
SCFM: ~~18099~~ 18322 ✓
%EA: 15.2 ✓

Job No. 90-22

Job Name FIRESTONE

Run No. 1 CONDITION #2

Location EB-11A EXHAUST

Date 7 NOVEMBER 1990

Operator RANDOLPH, B. II

Sample Box No. 30 Meter Box No. 10

VELOCITY/HOST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 77

Assumed Moisture % 18.0

Probe Length 8 1

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 9.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	PITOT TUBES LEAK CHECK OK Remarks
A 8	0910	974.542	0.03	2.00	2.00	6.5	265	244	250	65	72	72	WATER
A 7	0915	976.50	0.03	2.00	2.00	6.5	277	241	255	63	74	73	OILSET
A 6	0920	982.21	0.03	2.00	2.00	7.0	282	244	258	63	76	73	
A 5	0925	986.45	0.04	2.00	2.00	7.0	286	245	264	57	80	74	
A 4	0930	989.90	0.04	2.00	2.00	7.0	301	250	260	57	81	74	
A 3	0935	993.80	0.05	2.00	2.00	7.0	316	252	260	58	84	74	
A 2	0940	997.500	0.05	—	—	—	322	—	—	—	—	—	
A 1	END	—	0.03	—	—	—	300	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.04				265						
B 7			0.04				280						
B 6			0.04				293						
B 5			0.04				303						
B 4			0.04				303						
B 3			0.04				303						
B 2			0.03				296						
B 1			0.02				290						
END	ALL	—	—	—	—	—	—	—					

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.325 ft^3 Baro. Press. P_b 30.14 "Hg

Water Collected V_w 96.0 ml Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. % CO_2 9.5 / 9.5 / 3.2 % CO 0.0 / 87.3

Stack Pressure P_s +0.03 "H_2O % O_2 3.2 / 3.2 % N_2 87.3 / 87.3

Area Stack A_s 26.53 in^2

Pitot Tube No. 5 Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 22.958

[Dry Gas Meter Reading ____ ft^3 - ((T_t ____ min X Leak Rate ____ cfm)]

M_F = — M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	677.7
	Initial Weight	611.0
	Increase	
Impinger 2	Final Weight	634.2
	Initial Weight	614.0
	Increase	
Impinger 3	Final Weight	506.5
	Initial Weight	502.9
	Increase	
Impinger 4	Final Weight	555.7
	Initial Weight	550.2
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	66.7
Impinger 2	20.2
Impinger 3	3.6
Impinger 4	5.5
Impinger 5	
Impinger 6	
Total	96.0 = V_w

V_w =
g SO_2 = -____
V_w =

P_b = 30.14 ✓ %CO_2 = 9.5 ✓
V_m = 23.325 ✓ %O_2 = 3.2 ✓
V_w = 96.0 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ %N_2 = 87.3 ✓
Avg ΔP = 0.037 ✓ A_s = 2653
Avg $\sqrt{\Delta P}$ = 0.191 ✓ D_n = ____
C_p = 0.799 ✓ T_t = 30 ✓
P_s = +0.03 "H_2O 30.14 "Hg ✓
T_m = 76 °F ✓ 536 °R ✓
T_s = 294 °F ✓ 754 °R ✓

Moisture Content: %M = 16.30 ✓ M_d = 0.8370 ✓ MW_d = 29.648 ✓ MW = 27.75 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.325 \left(\frac{30.14 + \frac{2.00}{13.6}}{76 + 460} \right) = 23.263 \text{ sft}^3 \checkmark$$

0.775 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 96.0 = 4.531 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.531}{4.531 + 23.263} \times 100 = 16.30\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{754}{30.14 \times 27.75}} \times 0.191 = 742 \text{ fpm} \checkmark$$

ACFM: 13 678 ✓

SCFM: 8106 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \text{____}\ \%$$

%EA: 16.1 ✓

Job No. 90-22

Job Name FIRESTONE

Run No. 2 CONDITION #2

Location EB-114 EXHAUST

Date 7 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/MOISTURE FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 81

Assumed Moisture % 18.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 5.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.001 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m PITOT TUBES LEAK CHECK OK Dry Gas Temp. °F Inlet	Outlet	Remarks
A 8	1025	997.830	0.02	2.00	2.00	6.5	~~233~~	201	255	65	77	77	
A 7	1030	2.000	0.03	2.00	2.00	6.5	272	208	253	63	80	77	
A 6	1035	5.82	0.03	2.00	2.00	6.5	279	238	255	60	83	77	
A 5	1040	9.60	0.03	2.00	2.00	6.5	284	247	252	60	85	77	
A 4	1045	13.65	0.03	2.00	2.00	6.5	297	250	254	61	87	78	
A 3	1050	17.58	0.05	2.00	2.00	7.0	318	254	253	61	89	78	
A 2	1055	21.100	0.01	—	—	—	321	—	—	—	—	—	
A 1	END	—	0.01	—	—	—	320	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.03				283						
B 7			0.03				285						
B 6			0.03				295						
B 5			0.03				300						
B 4			0.03				299						
B 3			0.02				297						
B 2			0.02				292						
B 1			0.01				280						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.622 ft^3 Baro. Press. P_b 30.14 "Hg

Water Collected V_w 87.7 ml Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. % CO_2 ~~9.8~~ ~~9.8~~ 9.8 % CO 0.0

Stack Pressure P_s +0.03 "H_2O % O_2 ~~2.8~~ ~~2.8~~ 2.8 % N_2 ~~87.4~~ ~~87.4~~ 87.4

Area Stack A_s 2653 in^2

Pitot Tube No. 5 Barometer No. 5

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.270

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = — M_T = —

Impinger Box No. 30

			Water Weight Gain	
Impinger 1	Final Weight	750.3		Impinger 1 72.6
	Initial Weight	677.7		
	Increase			Impinger 2 12.3
Impinger 2	Final Weight	646.5		Impinger 3 1.8
	Initial Weight	634.2		
	Increase		V_w =	Impinger 4 1.0
Impinger 3	Final Weight	508.3	g SO_2 = -	Impinger 5
	Initial Weight	506.5	V_w =	
	Increase			Impinger 6
Impinger 4	Final Weight	856.7		Total 87.7 = V_w
	Initial Weight	855.7		
	Increase			
Impinger 5	Final Weight			
	Initial Weight			
	Increase			
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

Filter # _____ Final Weight _____
Initial Weight _____
Increase _____

P_b = 30.14 $\%CO_2$ = 9.8
V_m = 23.642 $\%O_2$ = 2.8
V_w = 87.7 %CO = 0.0
P_m = 2.000 $\%N_2$ = 87.4
Avg ΔP = 0.029 A_s = 2653
Avg $\sqrt{\Delta P}$ = 0.169 D_n = —
C_p = 0.799 T_t = 30
P_s = -0.03 $"H_2O$ 30.14 "Hg
T_m = 80 °F 540 °R
T_s = 292 °F 752 °R

Moisture Content: %M = 15.03 M_d = 0.8497 MW_d = 29.680 MW = 27.92

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 23.642 \left(\frac{30.14 + \frac{2.00}{13.6}}{80 + 460}\right) = 23.404 \text{ sft}^3$$

0.780 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 87.7 = 4.139 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.139}{4.139 + 23.404} \times 100 = 15.03\ \%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{752}{30.14 \times 27.92}} \times 0.169 = 654 \text{ fpm}$$

ACFM: 12050

SCFM: 7268

%EA: 13.8

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 3 CONDITION #2

Location EB-114 EXHAUST

Date 7 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/ISOKST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 75

Assumed Moisture % 18.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.002 cfm

Final Leak @ 8.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m PITOT TUBES LEAK CHECK OK Dry Gas Temp. °F Inlet	Outlet	Remarks
A 8	1138	21.355	0.03	2.00	2.00	7.0	265	247	251	58	80	80	WATER
A 7	1143	25.23	0.03	2.00	2.00	7.0	274	250	253	58	82	80	ORSAT
A 6	1148	29.11	0.03	2.00	2.00	7.0	279	251	256	57	85	81	
A 5	1153	32.99	0.03	2.00	2.00	7.0	286	254	257	56	87	82	
A 4	1158	36.83	0.03	2.00	2.00	7.0	303	255	256	57	88	83	
A 3	1203	41.02	0.03	2.00	2.00	7.0	317	256	260	58	89	84	
A 2	1208	44.865	0.03	—	—	—	322	—	—	—	—	—	
A 1	END	—	0.01	—	—	—	314	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.03				260						
B 7			0.03				278						
B 6			0.03				293						
B 5			0.03				290						
B 4			0.03				291						
B 3			0.02				285						
B 2			0.02				287						
B 1			0.01				278						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.886 ft^3

Water Collected V_w 95.5 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.03 "H_2O

Baro. Press. P_b 30.14 "Hg

Probe Tip Dia. D_n — in.

% CO_2 9.5 / 9.5

% CO 0.0 / 87.5

% O_2 3.0 / 3.0

% N_2 87.5 / 87.5

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.510

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = —

M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	825.1
	Initial Weight	750.3
	Increase	
Impinger 2	Final Weight	657.4
	Initial Weight	646.5
	Increase	
Impinger 3	Final Weight	509.0
	Initial Weight	508.3
	Increase	
Impinger 4	Final Weight	865.8
	Initial Weight	856.7
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	
Filter #	Final Weight	
	Initial Weight	
	Increase	

Water Weight Gain

Impinger 1	74.8
Impinger 2	10.9
Impinger 3	0.7
Impinger 4	9.1
Impinger 5	
Impinger 6	
Total	95.5 = V_w

V_w =
g SO_2 = -
V_w =

P_b = 30.14 ✓ $\%CO_2$ = 9.5 ✓
V_m = 23.886 ✓ $\%O_2$ = 3.0 ✓
V_w = 95.5 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ $\%N_2$ = 87.5 ✓
Avg ΔP = 0.026 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.160 ✓ D_n = —
C_p = 0.799 ✓ T_t = 30 ✓
P_s = +0.03 "H_2O 30.14 "Hg ✓
T_m = 84 °F ✓ 544 °R ✓
T_s = 289 °F ✓ 749 °R ✓

Moisture Content: %M = 16.11 ✓ M_d = 0.8389 ✓ MW_d = 29.640 ✓ MW = 27.76

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.886 \left(\frac{30.14 + \frac{2.00}{13.6}}{84 + 460} \right) = 23.472 \text{ sft}^3 \checkmark$$

0.782 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 95.5 = 4.508 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.508}{4.508 + 23.472} \times 100 = 16.11\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{749}{30.14 \times 27.76}} \times 0.160 = 620 \text{ fpm} \checkmark$$

ACFM: 11418 ✓

SCFM: 6827 ✓ (30)

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

%EA: 14.9 ✓

Job No. 90-22

Job Name FIRESTONE

Run No. 4 CONDITION #2

Location EB-114 EXHAUST

Date 7 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/LOAD FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 78

Assumed Moisture % 18.0

Probe Length 3'

C Factor —— to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 9.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks (PITOT TUBES LEAK CHECK OK)
B8	1416	45.120	0.12	2.00	2.00	7.0	310	243	260	70	80	80	WATER
B7	1421	48.92	0.12	2.00	2.00	7.0	322	248	258	60	83	81	ON
B6	1426	52.70	0.11	2.00	2.00	7.0	320	254	256	56	84	83	
B5	1431	56.72	0.13	2.00	2.00	7.0	319	258	255	56	85	83	
B4	1436	60.53	0.12	2.00	2.00	7.0	316	256	259	58	89	84	
B3	1441	64.68	0.13	2.00	2.00	7.0	310	257	260	60	91	85	
B2	1446	68.343	0.14	—	—	—	315	—	—	—	—	—	
B1	END	—	0.08	—	—	—	311	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
A8			0.10				287						
A7			0.11				303						
A6			0.11				307						
A5			0.11				309						
A4			0.16				320						
A3			0.18				323						
A2			0.17				300						
A1			0.10				285						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

D-20

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.595 ft^3 Baro. Press. P_b 30.10 "Hg

Water Collected V_w 78.3 ml Probe Tip Dia. D_n —— in.

Time of Test T_t 30 min. % CO_2 11.2 / 11.2 / 11.2 % CO 0.0 / 85.5

Stack Pressure P_s +0.10 "H_2O % O_2 3.3 / 3.3 / 3.3 % N_2 85.5 / 85.5

Area Stack A_s 265.3 in^2

Pitot Tube No. 5 Barometer No. 15

Probe Tip No. ——

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.223

[Dry Gas Meter Reading —— ft^3 - (T_t —— min X Leak Rate —— cfm)]

M_F = —— M_T = ——

Impinger Box No. 30

Impinger 1	Final Weight	874.6
	Initial Weight	825.1
	Increase	
Impinger 2	Final Weight	679.2
	Initial Weight	657.4
	Increase	
Impinger 3	Final Weight	510.8
	Initial Weight	504.0
	Increase	
Impinger 4	Final Weight	871.0
	Initial Weight	865.8
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	49.5
Impinger 2	21.8
Impinger 3	1.8
Impinger 4	5.2
Impinger 5	
Impinger 6	
Total	78.3 = V_w

V_w =
g SO_2 = -____
V_w =

P_b = 30.10 $\%CO_2$ = 11.2
V_m = 23.595 $\%O_2$ = 3.3
V_w = 78.3 %CO = 0.0
P_m = 2.00 $\%N_2$ = 85.5
Avg ΔP = 0.624 A_s = 2653
Avg $\sqrt{\Delta P}$ = 0.351 D_n = —
C_p = 0.799 T_t = 30
P_s = +0.10 "H_2O 30.11 "Hg
T_m = 84 °F 544 °R
T_s = 330 °F 790 °R

Moisture Content: %M = 13.76 M_d = 0.8624 MW_d = 29.924 MW = 28.28

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.595 \left(\frac{30.10 + \frac{2.00}{13.6}}{84 + 460} \right) = 23.135 \text{ sft}^3$$

0.772 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 78.3 = 3.696 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{3.696}{3.696 + 23.135} \times 100 = 13.76\ \%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{790}{30.11 \times 28.28}} \times 0.351 = 1384 \text{ fpm}$$

ACFM: 25500

SCFM: 14846

%EA: 17.0

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 5 CONDITION '02

Location EB-114 EXHAUST

Date 7 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/MOIST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 76

Assumed Moisture % 14.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
			REVERSE				REVERSE				PUMP TUBES KEPT CHECK OF		
A 8	1526	68.752	0.11	2.00	2.00	7.0	292	220	259	53	86	86	WIRE
A 7	1531	72.85	0.12	2.00	2.00	7.0	303	234	258	56	89	86	OKAY
A 6	1536	77.00	0.13	2.00	2.00	7.0	304	240	258	56	91	87	
A 5	1541	81.15	0.13	2.00	2.00	7.0	303	259	256	59	93	87	
A 4	1546	84.65	0.15	2.00	2.00	7.0	298	264	260	60	95	87	
A 3	1551	88.60	0.17	2.00	2.00	7.0	299	263	257	61	95	87	
A 2	1556	92.633	0.18	—	—	—	322	—	—	—	—	—	
A 1	END	—	0.15	—	—	—	367	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.13				322						
B 7			0.14				323						
B 6			0.15				337						
B 5			0.15				345						
B 4			0.14				333						
B 3			0.14				330						
B 2			0.14				322						
B 1			0.11				324						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 24.263 ft^3

Water Collected V_w 81.8 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.13 "H_2O

Baro. Press. P_b 30.10 "Hg

Probe Tip Dia. D_n — in.

% CO_2 11.6 / 11.6

% CO 0.0

% O_2 3.0 / 3.0

% N_2 85.4 / 85.4

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.881

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = — M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	673.5
	Initial Weight	612.7
	Increase	
Impinger 2	Final Weight	694.5
	Initial Weight	679.2
	Increase	
Impinger 3	Final Weight	512.4
	Initial Weight	510.8
	Increase	
Impinger 4	Final Weight	875.1
	Initial Weight	871.0
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	60.8
Impinger 2	15.3
Impinger 3	1.6
Impinger 4	4.1
Impinger 5	
Impinger 6	
Total	81.8 = V_w

V_w =
g SO_2 = -
V_w =

P_b = 30.10 ✓ $\%CO_2$ = 14.6 ✓
V_m = 24.263 ✓ $\%O_2$ = 3.0 ✓
V_w = 81.8 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ $\%N_2$ = 85.4 ✓
Avg ΔP = 0.140 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.373 ✓ D_n = ____
C_p = 0.799 ✓ T_t = 30 ✓
P_s = -0.13 "H_2O 30.11 "Hg ✓
T_m = 89 °F ✓ 549 °R ✓
T_s = 320 °F ✓ 780 °R ✓

Moisture Content: %M = 14.06 ✓ M_d = 0.8594 ✓ MW_d = 29.976 ✓ MW = 28.29

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 24.263 \left(\frac{30.10 + \frac{2.00}{13.6}}{89 + 460} \right) = 23.594\ sft^3 ✓$$

0.786 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 81.8 = 3.861\ sft^3 ✓$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{3.861}{3.861 + 23.594} \times 100 = 14.06\ \% ✓$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{780}{30.11 \times 28.29}} \times 0.373 = 1461\ fpm ✓$$

ACFM: 26921 ✓
SCFM: 15819 ✓
%EA: 15.3 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-82

Job Name FIRESTONE

Run No. 6 CONDITION #2

Location EB-119 EXHAUST

Date 7 NOVEMBER 1990

Operator RANDOLPH, B.11

Sample Box No. 30 Meter Box No. 10

VELOCITY/MOIST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 76

Assumed Moisture % 16.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.002 cfm

Final Leak @ 10.0 "Hg = 0.00 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s REVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s REVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m PITOT TUBE LEAK CHECK OR Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A8	1633	93.050	0.10	2.00	2.00	6.0	300	243	259	62	88	88	WATER
A7	1638	97.05	0.11	2.00	2.00	6.0	300	250	259	62	89	88	CLEAR
A6	1643	101.02	0.13	2.00	2.00	6.0	313	254	256	65	93	88	
A5	1648	105.10	0.13	2.00	2.00	6.0	311	259	260	67	94	88	
A4	1653	109.23	0.14	2.00	2.00	6.0	320	258	261	68	94	88	
A3	1658	112.92	0.17	2.00	2.00	6.0	320	259	259	70	94	88	
A2	1703	116.775	0.18	—	—	—	323	—	—	—	—	—	
A1	END	—	0.16	—	—	—	300	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B8			0.12				313						
B7			0.15				330						
B6			0.15				338						
B5			0.15				346						
B4			0.14				330						
B3			0.15				335						
B2			0.14				330						
B1			0.11				310						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 24.105 ft^3

Water Collected V_w 82.8 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.14 "H_2O

Baro. Press. P_b 30.10 "Hg

Probe Tip Dia. D_n — in.

% CO_2 11.8 / 11.8

% CO 0.0 / 84.9

% O_2 3.3 / 3.3 / 3.3

% N_2 84.9 / 84.9

Area Stack A_s 26.53 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.725

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = —

M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	740.7
	Initial Weight	673.5
	Increase	
Impinger 2	Final Weight	704.3
	Initial Weight	694.5
	Increase	
Impinger 3	Final Weight	513.5
	Initial Weight	512.4
	Increase	
Impinger 4	Final Weight	879.8
	Initial Weight	875.1
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	
Filter #	Final Weight	
	Initial Weight	
	Increase	

Water Weight Gain

V_w =

g SO_2 = -

V_w =

Impinger 1	67.2
Impinger 2	9.8
Impinger 3	1.1
Impinger 4	4.7
Impinger 5	
Impinger 6	
Total	82.8 = V_w

P_b =	30.10	$\%CO_2$ =	11.8
V_m =	24.105	$\%O_2$ =	3.3
V_w =	82.8	%CO =	0.0
P_m =	2.00	$\%N_2$ =	84.9
Avg ΔP =	0.136	A_s =	2653
Avg $\sqrt{\Delta P}$ =	0.367	D_n =	—
C_p =	0.799	T_t =	30
P_s =	+0.14 "H_2O	30.11	"Hg
T_m =	90 °F	550	°R
T_s =	320 °F	780	°R

Moisture Content: %M = 14.09 (31) M_d = 0.8591 (69) MW_d = 30.020 MW = 28.38 (0)

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 24.105 \left(\frac{30.10 + \frac{2.00}{13.6}}{90 + 460}\right) = 23.831\ (398)\ \text{sft}^3 = 0.799\ (80)\ \text{scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 82.8 = 3.908\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{3.908}{3.908 + 23.831\ (398)} \times 100 = 14.09\ (31)\ \%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{780}{30.11 \times 28.38\ (0)}} \times 0.367 = 1437\ \text{fpm}$$

ACFM: 26478 (84)

SCFM: 15548 (11)

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

%EA: 17.2

Job No. 90-22

Job Name FIRESTONE

Run No. 1 CONDITION #3

Location EB-1H EXHAUST

Date 8 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/HAUST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 69

Assumed Moisture % 14.0

Probe Length 31

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A 8	0850	118.180	0.14	2.00	2.00	4.5	309	261	252	64	72	72	WATER
A 7	0855	122.05	0.14	2.00	2.00	4.5	317	262	250	65	72	72	ORSAT
A 6	0900	126.10	0.14	2.00	2.00	4.5	322	265	256	65	74	72	
A 5	0905	129.70	0.15	2.00	2.00	4.5	326	265	256	65	74	72	
A 4	0910	133.90	0.17	2.00	2.00	4.5	324	265	259	67	77	73	
A 3	0915	137.31	0.20	2.00	2.00	4.5	409	265	260	67	78	73	
A 2	0920	141.370	0.20	—	—	—	415	—	—	—	—	—	
A 1	END	—	0.17	—	—	—	404	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.14				333						
B 7			0.16				343						
B 6			0.15				350						
B 5			0.15				358						
B 4			0.15				355						
B 3			0.17				335						
B 2			0.16				338						
B 1			0.10				332						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.56 / ft^3

Water Collected V_w 90.5 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.14 "H_2O

Baro. Press. P_b 29.98 "Hg

Probe Tip Dia. D_n — in.

% CO_2 11.4 / 11.4

% CO 0.0 / 65.8

% O_2 2.8 / 2.8 / 2.8

% N_2 65.8 / 66.8

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.190

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = —

M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	657.3
	Initial Weight	604.3
	Increase	
Impinger 2	Final Weight	625.1
	Initial Weight	600.0
	Increase	
Impinger 3	Final Weight	519.5
	Initial Weight	514.0
	Increase	
Impinger 4	Final Weight	848.2
	Initial Weight	841.3
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	
Filter #	Final Weight	
	Initial Weight	
	Increase	

Water Weight Gain

V_w =

g SO_2 = -

V_w =

Impinger 1	53.0
Impinger 2	25.1
Impinger 3	5.5
Impinger 4	6.9
Impinger 5	
Impinger 6	
Total	90.5 = V_w

P_b =	29.98	$\%CO_2$ =	11.4
V_m =	23.561	$\%O_2$ =	2.8
V_w =	90.5	%CO =	0.0
P_m =	2.000	$\%N_2$ =	85.8
Avg ΔP =	0.156	A_s =	2653
Avg $\sqrt{\Delta P}$ =	0.393	D_n =	—
C_p =	0.799	T_t =	30
P_s =	0.14 "H_2O	29.99	"Hg
T_m =	73 °F	533	°R
T_s =	351 °F	811	°R

Moisture Content: %M = 15.38 M_d = 0.8462 MW_d = 29.936 MW = 28.10

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.561 \left(\frac{29.98 + \frac{2.00}{13.6}}{73 + 460} \right) = 23.505 \text{ sft}^3$$

0.784 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 90.5 = 4.272 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.272}{4.272 + 23.505} \times 100 = 15.38\ \%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{811}{29.99 \times 28.10}} \times 0.393 = 1578 \text{ fpm}$$

ACFM: 29079

SCFM: 1611

%EA: 14.0

$$\%I = \frac{1039 \times \quad x}{x \quad x \quad x \quad x(\quad)^2} = \quad \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 2 CONDITION #3

Location EB-114 EXHAUST

Date 8 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/MOIST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 73

Assumed Moisture % 16.0

Probe Length — 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 9.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks (PITOT TUBES LEAK CHECK OK)
A 8	1032	141.591	0.10	2.00	2.00	5.0	300	245	260	64	74	74	INTER
A 7	1037	145.07	0.12	2.00	2.00	5.0	310	250	258	64	75	74	OKSA
A 6	1042	148.92	0.13	2.00	2.00	5.0	316	246	258	65	76	74	
A 5	1047	152.73	0.13	2.00	2.00	5.0	320	256	251	67	77	74	
A 4	1052	156.65	0.14	2.00	2.00	5.0	323	260	255	67	78	74	
A 3	1057	160.57	0.17	2.00	2.00	5.0	407	261	267	68	78	74	
A 2	1102	164.648	0.18	—	—	—	411	—	—	—	—	—	
A 1	END	—	0.10	—	—	—	400	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.11				318						
B 7			0.14				336						
B 6			0.15				346						
B 5			0.15				350						
B 4			0.15				333						
B 3			0.15				330						
B 2			0.15				331						
B 1			0.10				326						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.528 ft^3 Baro. Press. P_b 29.94 "Hg

Water Collected V_w 80.9 ml Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. % CO_2 11.2 / 11.2 / 3.0 % CO 0.0 / 0.0

Stack Pressure P_s +0.14 "H_2O % O_2 3.0 / 3.0 % N_2 85.8 / 85.8

Area Stack A_s 2653 in^2

Pitot Tube No. 5 Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.157

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = — M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	723.2	
	Initial Weight	657.3	
	Increase		
Impinger 2	Final Weight	635.3	
	Initial Weight	625.1	
	Increase		
Impinger 3	Final Weight	520.7	
	Initial Weight	519.5	
	Increase		
Impinger 4	Final Weight	851.8	
	Initial Weight	848.2	
	Increase		
Impinger 5	Final Weight		
	Initial Weight		
	Increase		
Impinger 6	Final Weight		
	Initial Weight		
	Increase		
Filter #	Final Weight		
	Initial Weight		
	Increase		

Water Weight Gain

Impinger 1	65.9
Impinger 2	10.2
Impinger 3	1.2
Impinger 4	3.6
Impinger 5	
Impinger 6	
Total	80.9 = V_w

V_w =
g SO_2 = -
V_w =

P_b = 29.94 ✓ %CO_2 = 11.2 ✓
V_m = 23.528 ✓ %O_2 = 2.0 ✓
V_w = 80.9 ✓ %CO = 0.0 ✓
P_m = 2.00 ✓ %N_2 = 85.8 ✓
Avg ΔP = 0.136 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.367 ✓ D_n = —
C_p = 0.799 ✓ T_t = 30 ✓
P_s = +0.14 $^{"}H_2O$ 29.95 "Hg ✓
T_m = 75 °F ✓ 535 °R ✓
T_s = 344 °F ✓ 804 °R ✓

Moisture Content: %M = 14.05 ✓ M_d = 0.8595 ✓ MW_d = 29.962 ✓ MW = 28.24

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.528 \left(\frac{29.94 + \frac{2.00}{13.6}}{75 + 460} \right) = 23.354 \text{ sft}^3 \checkmark$$

0.778 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 80.9 = 3.818 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{3.818}{3.818 + 23.354} \times 100 = 14.05\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{804}{29.95 \times 28.24}} \times 0.367 = 1465 \text{ fpm} \checkmark$$

ACFM: 26988 ✓

SCFM: 1530.6 ✓

%EA: 15.2 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 3 CONDITION #3

Location EB-1A EXHAUST

Date 8 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/TRAVERSE FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 79

Assumed Moisture % 16.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 8.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
A8	1138	165.000	0.11	2.00	2.00	5.0	303	246	258	71	77	75	WATER
A7	1143	168.75	0.13	2.00	2.00	5.0	309	248	258	69	77	75	CHECK
A6	1148	172.95	0.13	2.00	2.00	5.0	314	250	260	70	79	76	
A5	1153	176.62	0.15	2.00	2.00	5.0	318	250	262	70	80	76	
A4	1158	180.75	0.14	2.00	2.00	5.0	321	253	260	71	81	76	
A3	1203	184.60	0.17	2.00	2.00	5.0	402	254	257	70	83	76	
A2	1208	187.958	0.17	—	—	—	407	—	—	—	—	—	
A1	END	—	0.10	—	—	—	390	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B8			0.13				320						
B7			0.13				330						
B6			0.13				343						
B5			0.13				347						
B4			0.13				340						
B3			0.13				325						
B2			0.12				326						
B1			0.10				324						
END ALL	—	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.325 ft^3

Water Collected V_w 91.7 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.14 "H_2O

Baro. Press. P_b 29.89 "Hg

Probe Tip Dia. D_n — in.

% CO_2 11.4 / 11.4 / 3.0

% CO 0.0 / 85.6

% O_2 3.0 / 3.0

% N_2 85.6 / 85.6

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 22.958

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = —

M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	789.2
	Initial Weight	723.2
	Increase	
Impinger 2	Final Weight	649.3
	Initial Weight	635.3
	Increase	
Impinger 3	Final Weight	523.2
	Initial Weight	520.7
	Increase	
Impinger 4	Final Weight	861.0
	Initial Weight	851.8
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	
Filter #	Final Weight	
	Initial Weight	
	Increase	

Water Weight Gain

Impinger 1	66.0
Impinger 2	14.0
Impinger 3	2.5
Impinger 4	9.2
Impinger 5	
Impinger 6	
Total	91.7 ✓ = V_w

V_w =

g SO_2 = -

V_w =

P_b = 29.89 ✓ $\%CO_2$ = 11.4 ✓

V_m = 23.325 ✓ $\%O_2$ = 3.0 ✓

V_w = 91.7 ✓ %CO = 0.0 ✓

P_m = 2.000 ✓ $\%N_2$ = 85.6 ✓

Avg ΔP = 0.131 ✓ A_s = 2653 ✓

Avg $\sqrt{\Delta P}$ = 0.361 ✓ D_n = —

C_p = 0.799 ✓ T_t = 30 ✓

P_s = +0.14 ✓ "H_2O 29.90 "Hg ✓

T_m = 78 °F ✓ 538 °R ✓

T_s = 341 °F ✓ 801 °R ✓

Moisture Content: %M = 15.85 ✓ M_d = 0.8415 ✓ MW_d = 29.944 ✓ MW = 28.05

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.325 \left(\frac{29.89 + \frac{2.00}{13.6}}{78 + 460} \right) = 22.985 \text{ sft}^3 \checkmark$$

0.766 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 91.7 = 4.328 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.328}{4.328 + 22.985} \times 100 = 15.85\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{801}{29.90 \times 2825}} \times 0.361 = 1444 \text{ fpm} \checkmark$$

ACFM: 26609 ✓

SCFM: 14808 ✓

%EA: 15.2 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 4 CONDITION #3

Location EB-114 EXHAUST

Date 8 NOVEMBER 1990

Operator RANDOLPH, B. II

Sample Box No. 30 Meter Box No. 10

VELOCITY/HOAST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 79

Assumed Moisture % 16.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Δ P_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A8	1312	188.377	0.03	2.00	2.00	5.0	280	241	260	68	77	77	PITOT TUBES LEAK CHECK OK
A7	1317	192.40	0.03	2.00	2.00	5.0	281	245	259	67	78	76	
A6	1322	196.39	0.03	2.00	2.00	5.0	283	250	260	66	79	77	
A5	1327	200.42	0.01	2.00	2.00	5.0	285	253	261	64	81	77	
A4	1332	203.95	0.04	2.00	2.00	5.0	303	258	262	62	83	77	
A3	1337	208.01	0.04	2.00	2.00	5.0	315	267	260	64	85	77	
A2	1342	211.558	0.04	—	—	—	320	—	—	—	—	—	
A1	END	—	0.02	—	—	—	300	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B8			0.04				282						
B7			0.04				288						
B6			0.04				293						
B5			0.04				297						
B4			0.04				295						
B3			0.01				290						
B2			0.03				291						
B1			0.03				283						
END ALL	—	—	—	—	—	—	—						

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.552 ft^3

Water Collected V_w 97.4 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.03 "H_2O

Baro. Press. P_b 29.80 "Hg

Probe Tip Dia. D_n — in.

% CO_2 3.6 / 4.2 — % CO 0.0 / 87.4

% O_2 3.0 / 3.0 / 3.0 — % N_2 87.4 / 87.4

Area Stack A_s 2653 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.181

[Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = — M_T = —

Impinger Box No. 30

			Water Weight Gain	
Impinger 1	Final Weight	869.6		Impinger 1 80.4
	Initial Weight	789.2		
	Increase			Impinger 2 10.7
Impinger 2	Final Weight	659.7		Impinger 3 1.4
	Initial Weight	644.3		
	Increase			Impinger 4 5.2
Impinger 3	Final Weight	529.6	V_w =	
	Initial Weight	523.2	g SO_2 = -	Impinger 5
	Increase		V_w =	
Impinger 4	Final Weight	866.2		Impinger 6
	Initial Weight	861.0		Total 97.4 ✓ = V_w
	Increase			
Impinger 5	Final Weight			
	Initial Weight			
	Increase			
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 29.80 ✓ $\%CO_2$ = 9.6 ✓
V_m = 23.552 ✓ $\%O_2$ = 3.0 ✓
V_w = 97.4 ✓ %CO = 0.0 ✓
P_m = 2.00 ✓ $\%N_2$ = 87.4 ✓
Avg ΔP = 0.0386 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.188 ✓ D_n = —
C_p = 0.799 ✓ T_t = 30 ✓
P_s = -0.03 ✓ "H_2O 29.80 "Hg ✓
T_m = 79 °F ✓ 539 °R ✓
T_s = 293 °F ✓ 753 °R ✓

Moisture Content: %M = 16.60 ✓ M_d = 0.8340 ✓ MW_d = 29.656 ✓ MW = 27.72 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 23.552 \left(\frac{29.80 + \frac{2.00}{13.6}}{79 + 460}\right) = 23.096 \text{ sft}^3 \checkmark$$

0.770 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 97.4 = 4.597 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.597}{4.597 + 23.096} \times 100 = 16.60\ \% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{753}{29.80 \times 27.72}} \times 0.188 = 735 \text{ fpm} \checkmark$$

ACFM: 13,538 ✓

SCFM: 7916 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

%EA: 14.9 ✓

Job No. 90-22

Job Name FIRESTONE

Run No. 5 CONDITION #3

Location EB-11A EXHAUST

Date 8 NOVEMBER 1990

Operator RANDOLPH, B.II

Sample Box No. 30 Meter Box No. 10

VELOCITY/ANALYST FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

METCO ENVIRONMENTAL

Ambient Temp. °F 79

Assumed Moisture % 16.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 7.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
A 8	1418	211.975	0.03	2.00	2.00	5.0	270	249	254	67	80	79	PITOT LINES LEAK CHECK OK
A 7	1423	215.87	0.04	2.00	2.00	5.0	275	256	253	65	81	79	
A 6	1428	220.00	0.04	2.00	2.00	5.0	282	257	255	63	82	79	
A 5	1433	224.80	0.04	2.00	2.00	5.0	288	256	257	63	85	79	
A 4	1438	228.53	0.04	2.00	2.00	5.0	302	258	258	65	86	79	
A 3	1443	232.35	0.05	2.00	2.00	5.0	317	258	258	65	86	79	
A 2	1448	235.980	0.05	—	—	—	321	—	—	—	—	—	
A 1	END	—	0.04	—	—	—	293	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B 8			0.04				290						
B 7			0.04				295						
B 6			0.04				298						
B 5			0.04				300						
B 4			0.04				298						
B 3			0.04				295						
B 2			0.04				294						
B 1			0.03				275						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 24.389 ft³ Baro. Press. P_b 29.80 "Hg

Water Collected V_w 101.7 ml Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. % CO_2 3.0 / 3.0 / 3.0 % CO 0.0 / 87.4

Stack Pressure P_s +0.04 "H_2O % O_2 3.0 / 3.0 / 3.0 % N_2 87.4 / 87.4

Area Stack A_s 2653 in²

Pitot Tube No. 5 Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 24.005

[Dry Gas Meter Reading — ft³ - (T_t — min X Leak Rate — cfm)]

M_F = — M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	870.9	
	Initial Weight	869.6	
	Increase		
Impinger 2	Final Weight	752.5	
	Initial Weight	659.7	
	Increase		
Impinger 3	Final Weight	526.8	
	Initial Weight	524.6	
	Increase		
Impinger 4	Final Weight	871.6	
	Initial Weight	866.2	
	Increase		
Impinger 5	Final Weight		
	Initial Weight		
	Increase		
Impinger 6	Final Weight		
	Initial Weight		
	Increase		

Filter # _____ Final Weight _____
Initial Weight _____
Increase _____

Water Weight Gain

Impinger 1	1.3
Impinger 2	92.8
Impinger 3	2.2
Impinger 4	5.4
Impinger 5	
Impinger 6	
Total	101.7 $= V_w$

V_w =
g SO_2 = -_____
V_w =

P_b = 29.80 ✓ $\%CO_2$ = 9.6 ✓
V_m = 24.389 ✓ $\%O_2$ = 3.0 ✓
V_w = 101.7 ✓ %CO = 0.0 ✓
P_m = 2.000 ✓ $\%N_2$ = 87.4 ✓
Avg ΔP = 0.040 ✓ A_s = 2653 ✓
Avg $\sqrt{\Delta P}$ = 0.200 ✓ D_n = —
C_p = 0.799 ✓ T_t = 30 ✓
P_s = +0.04 ✓ H_2O 29.80 "Hg ✓
T_m = 81 °F ✓ 541 °R ✓
T_s = 293 °F ✓ 753 °R ✓

Moisture Content: %M = 16.77 ✓ M_d = 0.8323 ✓ MW_d = 29.656 ✓ MW = 27.70 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 24.389 \left(\frac{29.80 + \frac{2.00}{13.6}}{81 + 460}\right) = 23.828 \text{ sft}^3 \checkmark$$

0.799 scfm ✓

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 101.7 = 4.800 \text{ sft}^3 \checkmark$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.800}{4.800 + 23.828} \times 100 = 16.77\% \checkmark$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{753}{29.80} \times \frac{}{27.70}} \times 0.200 = 782 \text{ fpm} \checkmark$$

ACFM: 14408 ✓
SCFM: 8405 ✓
%EA: 14.9 ✓

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \_\_\_\_ \%$$

Job No. 90-22

Job Name FIRESTONE

Run No. 6 CONDITION #3

Location EB-11A EXHAUST

Date 8 NOVEMBER 1990

Operator RANDOLPH, BILL

Sample Box No. 30 Meter Box No. 10

VELOCITY/ISOKST FIELD DATA

Read and record at the start of each test point.

Purge to: ——

Purge time: ——

METCO ENVIRONMENTAL

Ambient Temp. °F 79

Assumed Moisture % 16.0

Probe Length 3'

C Factor —— to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 8.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp °F Inlet	Outlet	Pitot Tubes Leak Check OK Remarks
A8	1535	236.230	0.04	2.00	2.00	5.0	260	253	254	68	81	81	WTR
A7	1540	240.18	0.03	2.00	2.00	5.0	273	254	259	63	82	81	DUST
A6	1545	244.17	0.03	2.00	2.00	5.0	280	257	259	62	83	81	
A5	1550	248.35	0.04	2.00	2.00	5.0	286	258	259	63	85	81	
A4	1555	252.10	0.04	2.00	2.00	5.0	300	259	260	65	86	81	
A3	1600	256.25	0.04	2.00	2.00	5.0	316	259	260	66	87	81	
A2	1605	259.655	0.04	—	—	—	320	—	—	—	—	—	
A1	END	—	0.04	—	—	—	288	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B8			0.04				280						
B7			0.04				287						
B6			0.04				293						
B5			0.04				299						
B4			0.04				295						
B3			0.04				291						
B2			0.04				292						
B1			0.03				281						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.800 ft^3

Water Collected V_w 94.8 ml

Time of Test T_t 30 min.

Stack Pressure P_s +0.04 "H_2O

Baro. Press. P_b 29.80 "Hg

Probe Tip Dia. D_n —— in.

% CO_2 10.2 / 10.2 / 10.2

% CO 0.0 / 86.3

% O_2 3.5 / 3.5 / 3.5

% N_2 86.3 / 86.3

Area Stack A_s 265.3 in^2

Pitot Tube No. 5

Barometer No. 15

Probe Tip No. ——

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.425

[Dry Gas Meter Reading —— ft^3 - (T_t —— min X Leak Rate —— cfm)]

M_F = ——

M_T = ——

V_s = 5123.8 x 0.744 $\sqrt{\frac{20}{29.50 \times 27.87}}$ x 0.195^2 = 759 fpm ✓

ACFM: 13977 ✓

SCFM: 8247 ✓

%I = 1039 X X / X X X X( )^2 = — %

%EA: 18.1 ✓

Job No. 90-22 — VELOCITY/EMIST FIELD DATA

Job Name FIRESTONE

Run No. 1 CONDITION #4 (HIGH LOAD) — Read and record at the start of each test point.

Location EB-11A EXHAUST

Date 9 NOVEMBER 1990 — Purge to: —

Operator RANDOLPH, BILL — Purge time: —

Sample Box No. 30 Meter Box No. 10

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F
5	0505	260.150	0.11	2.00	2.00	5.0	317	233
7	0510	263.60	0.11	2.00	2.00	5.0	317	250
6	0515	267.55	0.13	2.00	2.00	5.0	319	251
5	0520	271.20	0.13	2.00	2.00	5.0	324	253
4	0525	275.28	0.14	2.00	2.00	5.0	380	256
3	0530	278.93	0.16	200	2.00	5.0	410	256
2	0535	282.580	0.16	—	—	—	411	—
1	END	—	0.14	—	—	—	402	—
12	—	—	—	—	—	—	—	—
8			0.12				321	
7			0.13				335	
6			0.13				340	
5			0.14				356	
4			0.13				337	
3			0.13				336	
2			0.13				331	
1			0.14				334	
END		—	—	—	—	—	—	—

D-38

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 22.789 ft^3 — Baro. Press. P_b 29.78 "Hg

Water Collected V_w 92.9 ml — Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. — % CO_2 10.4 / 10.2 / 10.6 — % CO 0.0 / 86.7

Stack Pressure P_s +0.14 "H_2O" — % O_2 2.9 / 3.6 / 2.8 — % N_2 87.2 / 86.6

Area Stack A_s 2653 in^2

Pitot Tube

Probe Tip

V_m = Dry Cal

Dry Ga Meter

M

Impinger Box No. 30

Impinger 1	Final Weight	722.0	
	Initial Weight	671.6	
	Increase		
Impinger 2	Final Weight	641.5	
	Initial Weight	615.6	
	Increase		
Impinger 3	Final Weight	535.3	
	Initial Weight	529.3	
	Increase		
Impinger 4	Final Weight	883.5	
	Initial Weight	872.9	
	Increase		
Impinger 5	Final Weight		
	Initial Weight		
	Increase		
Impinger 6	Final Weight		
	Initial Weight		
	Increase		
Filter # ____	Final Weight		
	Initial Weight		
	Increase		

Water Weight Gain

Impinger 1	50.1
Impinger 2	25.9
Impinger 3	6.0
Impinger 4	10.6
Impinger 5	
Impinger 6	
Total	92.9 = V_w

V_w =

g SO_2 = -

V_w =

P_b =	29.78	$\%CO_2$ =	10.4
V_m =	22.789	$\%O_2$ =	2.8
V_w =	92.9	%CO =	0.0
P_m =	2.00	$\%N_2$ =	86.8
Avg ΔP =	0.134	A_s =	0.658
Avg $\sqrt{\Delta P}$ =	0.366	D_n =	—
C_p =	0.799	T_t =	30
P_s =	+0.14 "H_2O	29.79	"Hg
T_m =	73 °F	533	°R
T_s =	348 °F	808	°R

Moisture Content: %M = 16.26 M_d = 0.8374 MW_d = 29.776 MW = 27.86

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 22.789 \left(\frac{29.78 + \frac{2.00}{13.6}}{73 + 460} \right) = 22.584 \text{ sft}^3$$

0.753 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 92.9 = 4.385 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.385}{4.385 + 22.584} \times 100 = 16.26\ \%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{808}{29.78 \times 27.86}} \times 0.366 = 1478 \text{ fpm}$$

ACFM: 27238

SCFM: 14898

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

%EA: 13.9

Job No. 90-22 — VELOCITY/HOAST FIELD DATA — METCO ENVIRONMENTAL

Job Name FIRESTONE

Run No. 2 CONDITION #4 (HIGH LOAD) — Read and record at the start of each test point.

Location EB-114 EXHAUST

Date 9 NOVEMBER 1990 — Purge to: —

Operator RANDOLPH, B.H. — Purge time: —

Sample Box No. 30 Meter Box No. 10

Ambient Temp. °F 70

Assumed Moisture % 16.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 5.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks (PITOT TUBES LEAK CHECK OR)
B8	0918	284.350	0.13	2.00	2.00	5.0	330	238	260	65	74	73	WTER
B7	0923	288.13	0.13	2.00	2.00	5.0	340	246	252	60	75	73	ORSAT
B6	0928	292.05	0.14	2.00	2.00	5.0	348	254	256	59	76	73	
B5	0933	296.00	0.14	2.00	2.00	5.0	358	258	253	59	78	74	
B4	0938	299.68	0.14	2.00	2.00	5.0	345	258	252	59	79	74	
B3	0943	303.60	0.15	2.00	2.00	5.0	340	258	256	60	79	74	
B2	0948	307.445	0.15	—	—	—	337	—	—	—	—	—	
B1	END	—	0.14	—	—	—	340	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
A8			0.09				282						
A7			0.11				317						
A6			0.11				322						
A5			0.12				327						
A4			0.14				381						
A3			0.16				408						
A2			0.17				416						
A1			0.17				408						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.465 ft^3 — Baro. Press. P_b 29.78 "Hg

Water Collected V_w 84.4 ml — Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. — % CO_2 11.0 11.0 — % CO 0.0

Stack Pressure P_s +0.14 "H_2O" — % O_2 2.9 2.9 2.4 — % N_2 86.1 86.1

Area Stack A_s 2653 in^2

Pitot Tube No. 5 — Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.095

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = — M_T = —

Impinger Box No. 30

Impinger 1	Final Weight	783.5
	Initial Weight	722.0
	Increase	
Impinger 2	Final Weight	656.8
	Initial Weight	641.5
	Increase	
Impinger 3	Final Weight	537.2
	Initial Weight	535.3
	Increase	
Impinger 4	Final Weight	889.2
	Initial Weight	883.5
	Increase	
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

V_w =

g SO_2 = -____

V_w =

Water Weight Gain

Impinger 1	61.5
Impinger 2	15.3
Impinger 3	1.9
Impinger 4	5.7
Impinger 5	
Impinger 6	
Total	84.4 = V_w

P_b =	29.78	$\%CO_2$ =	11.0
V_m =	23.465	$\%O_2$ =	2.9
V_w =	84.4	%CO =	0.0
P_m =	2.000	$\%N_2$ =	86.1
Avg ΔP =	0.137	A_s =	2653
Avg $\sqrt{\Delta P}$ =	0.369	D_n =	—
C_p =	0.799	T_t =	30
P_s =	+0.14 "H_2O	29.79	"Hg
T_m =	75 °F	535	°R
T_s =	350 °F	810	°R

Moisture Content: %M = 14.67 M_d = 0.8533 MW_d = 29.876 MW = 28.13

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 23.465 \left(\frac{29.78 + \frac{2.00}{13.6}}{75 + 460}\right) = 23.167 \text{ sft}^3$$

0.772 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 84.4 = 3.984 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{3.984}{3.984 + 23.167} \times 100 = 14.67\%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{810}{29.79 \times 28.13}} \times 0.369 = 1485 \text{ fpm}$$

ACFM: 27363

SCFM: 15207

$$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times (\quad)^2} = \quad \%$$

%EA: 14.6

Job No. 90-22 — VELOCITY TRAVERSE FIELD DATA — METCO ENVIRONMENTAL

Job Name FIRESTONE

Run No. 3 CONDITION #4 (HIGH LOAD) — Read and record at the start of each test point.

Location EB-114 EXHAUST

Date 9 NOVEMBER 1990 — Purge to: —

Operator RANDOLPH, B.C.L. — Purge time: —

Sample Box No. 30 Meter Box No. 10

Ambient Temp. °F 70

Assumed Moisture % 16.0

Probe Length 3'

C Factor — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 11.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	ΔP_s TRAVERSE Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s TRAVERSE Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m PITOT TUBES & METER BOX Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
A8	1030	307.900	0.10	2.00	2.00	5.5	315	245	253	63	76	75	WATER
A7	1035	311.50	0.11	2.00	2.00	5.5	320	256	258	58	76	75	ORSAT
A6	1040	315.65	0.11	2.00	2.00	5.5	324	265	255	56	77	75	
A5	1045	319.26	0.12	2.00	2.00	5.5	330	263	259	56	79	75	
A4	1050	323.15	0.13	2.00	2.00	5.5	400	268	260	57	80	75	
A3	1055	327.20	0.15	2.00	2.00	5.5	413	265	257	59	81	75	
A2	1100	331.000	0.15	—	—	—	418	—	—	—	—	—	
A1	END	—	0.13	—	—	—	404	—	—	—	—	—	
END	—	—	—	—	—	—	—	—	—	—	—	—	
B8			0.12				327						
B7			0.13				344						
B6			0.14				350						
B5			0.14				357						
B4			0.14				344						
B3			0.14				336						
B2			0.14				337						
B1			0.10				334						
END	ALL	—	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.799

Volume Collected V_m 23.470 ft^3 — Baro. Press. P_b 29.78 "Hg

Water Collected V_w 86.6 ml — Probe Tip Dia. D_n — in.

Time of Test T_t 30 min. — % CO_2 11.4 / 11.4 — % CO 0.0 / 86.0

Stack Pressure P_s +0.14 "H_2O — % O_2 2.6 / 2.6 — % N_2 86.0 / 86.0

Area Stack A_s 2653 in^2

Pitot Tube No. 5 — Barometer No. 15

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.016 X 23.100 [Dry Gas Meter Reading — ft^3 - (T_t — min X Leak Rate — cfm)]

M_F = — M_T = —

Impinger Box No. 30

			Water Weight Gain	
Impinger 1	Final Weight	805.8		Impinger 1 22.3
	Initial Weight	783.5		Impinger 2 57.2
	Increase			Impinger 3 2.1
Impinger 2	Final Weight	719.0		Impinger 4 5.0
	Initial Weight	656.8	V_w =	Impinger 5 ____
	Increase		g SO_2 = - ____	Impinger 6 ____
Impinger 3	Final Weight	539.3	V_w =	Total 86.6 = V_w
	Initial Weight	537.2		
	Increase			
Impinger 4	Final Weight	894.2		
	Initial Weight	889.2		
	Increase			
Impinger 5	Final Weight	____		
	Initial Weight	____		
	Increase			
Impinger 6	Final Weight	____		
	Initial Weight	____		
	Increase			
Filter # ____	Final Weight	____		
	Initial Weight	____		
	Increase	____		

P_b =	29.78	$\%CO_2$ =	11.4
V_m =	23.470	$\%O_2$ =	2.6
V_w =	86.6	%CO =	0.0
P_m =	2.000	$\%N_2$ =	86.0
Avg ΔP =	0.128	A_s =	2653
Avg $\sqrt{\Delta P}$ =	0.357	D_n =	____
C_p =	0.799	T_t =	30
P_s =	+0.14 "H_2O	29.79	"Hg
T_m =	77 °F	537	°R
T_s =	353 °F	813	°R

Moisture Content: %M = 15.04 M_d = 0.8496 MW_d = 29.928 MW = 28.13

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 23.470 \left(\frac{29.78 + \frac{2.00}{13.6}}{77 + 460} \right) = 23.086 \text{ sft}^3$$

0.770 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 86.6 = 4.088 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.088}{4.088 + 23.086} \times 100 = 15.04\%$$

$$V_s = 5123.8 \times 0.799 \sqrt{\frac{813}{29.79 \times 28.13}} \times 0.357 = 1440 \text{ fpm}$$

ACFM: 26522

SCFM: 14628

%EA: 12.9

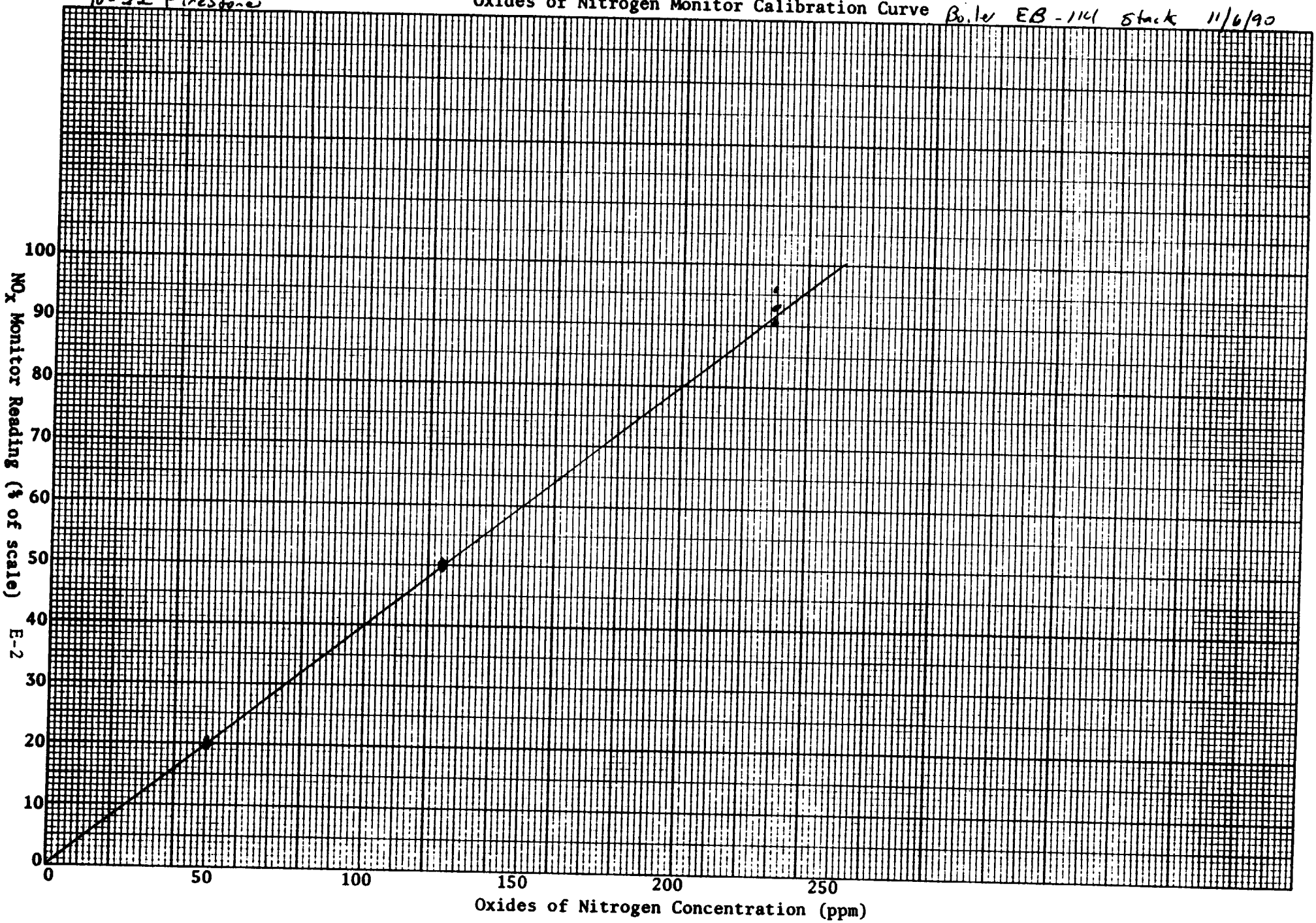
$$\%I = \frac{1039 \times \quad x}{x \quad x \quad x \quad x(\quad)^2} = \quad \%$$

APPENDIX E

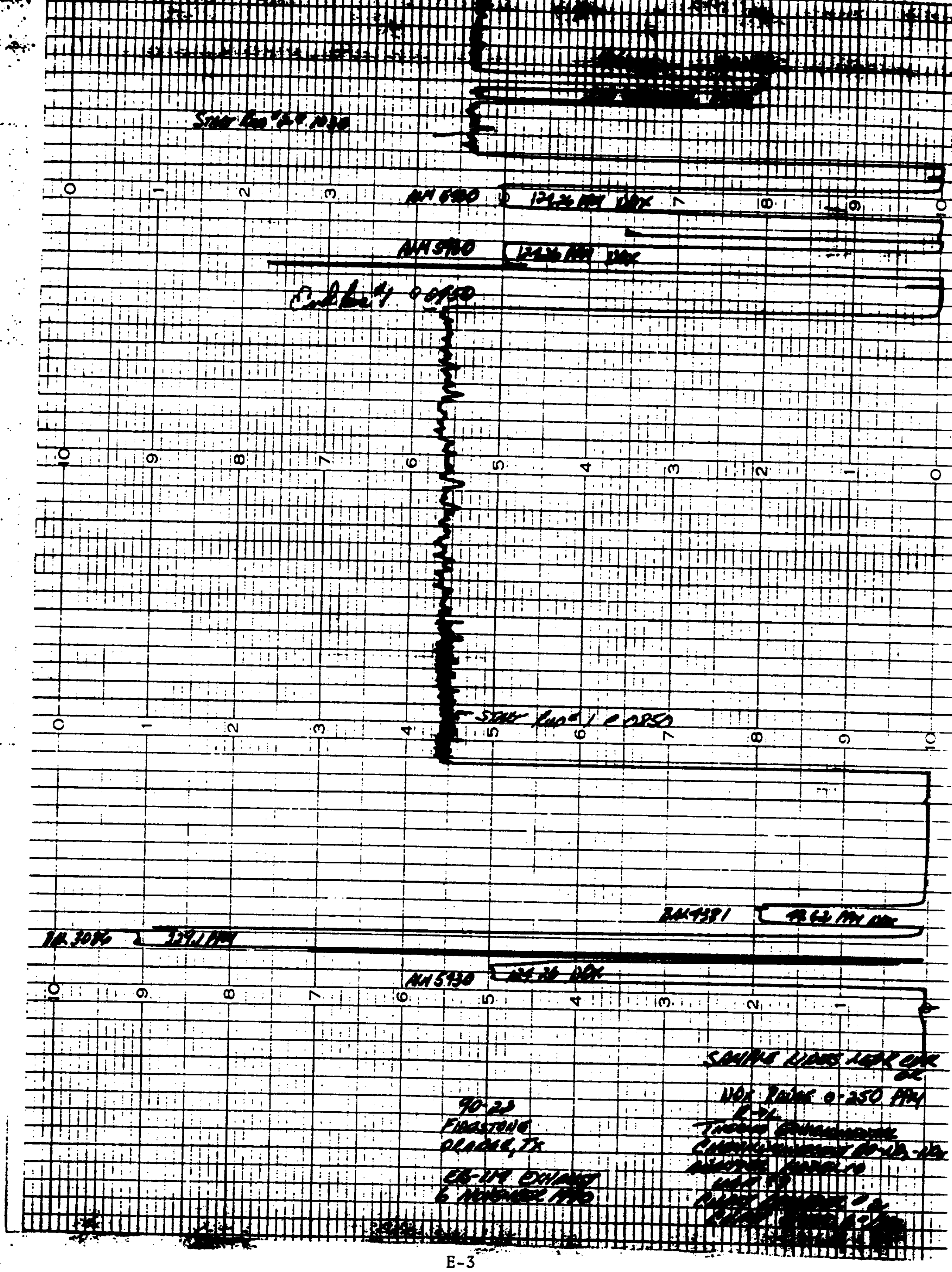
Oxides of Nitrogen Monitor Data

90-22 Firestone

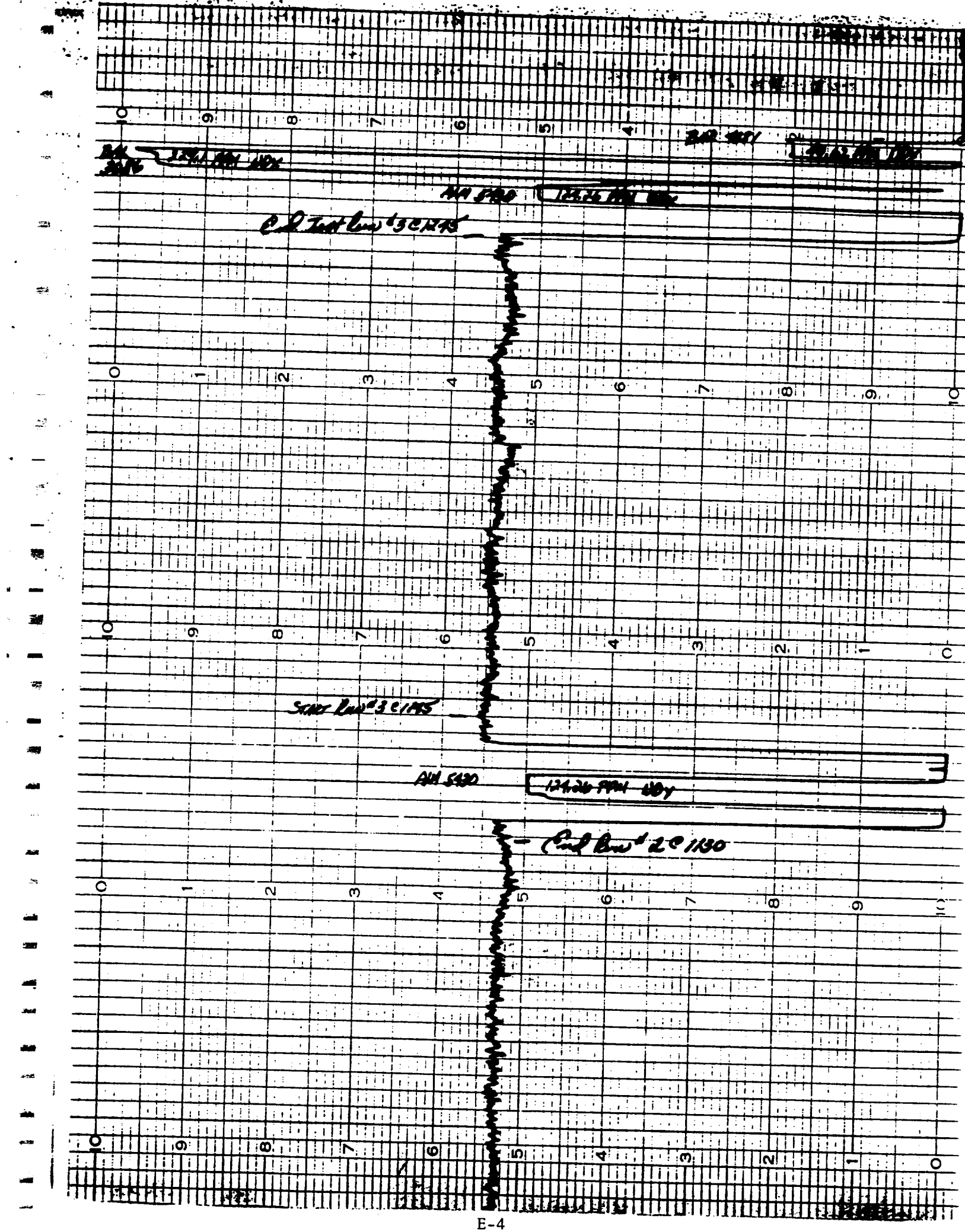
Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/6/90

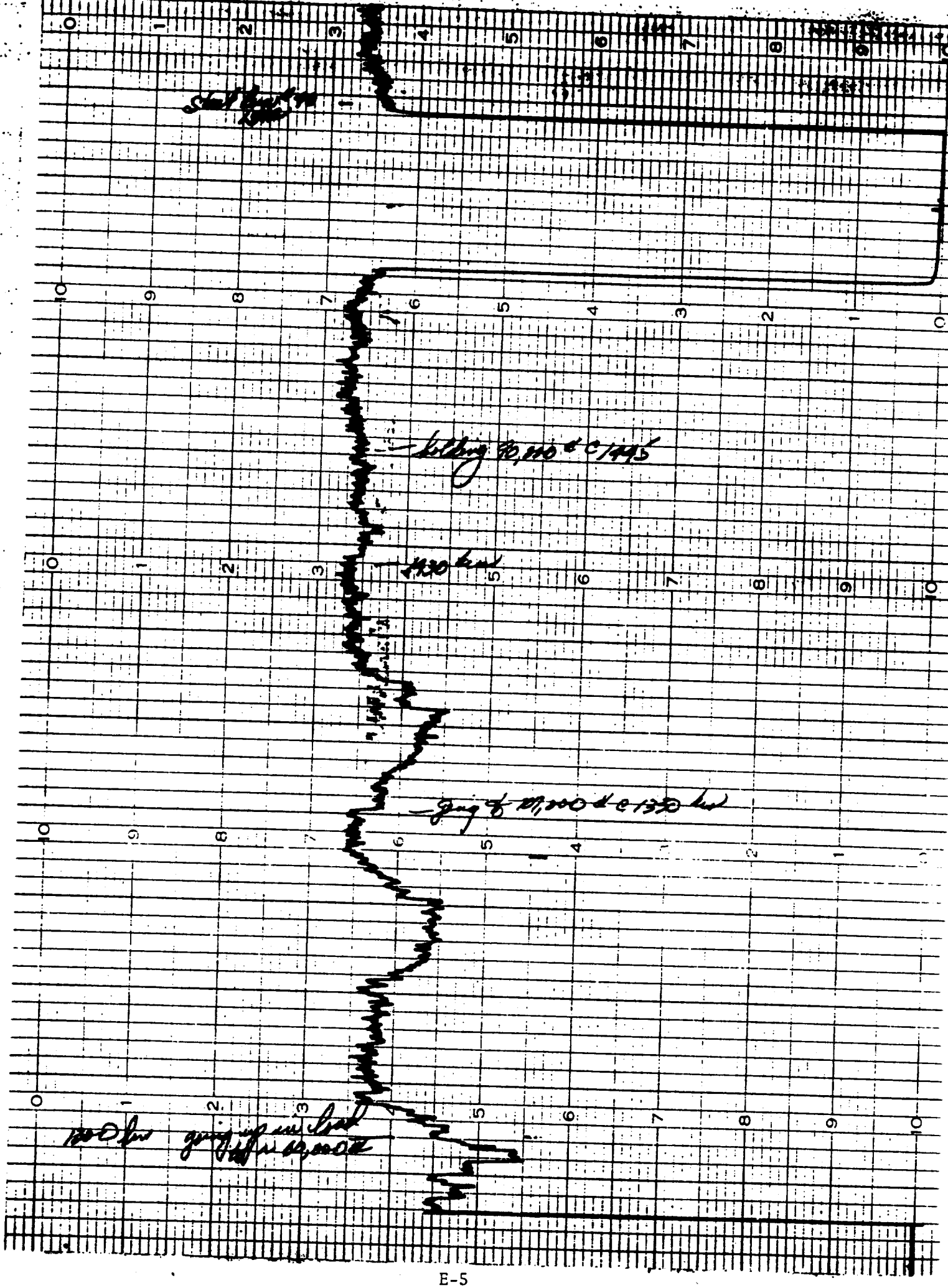


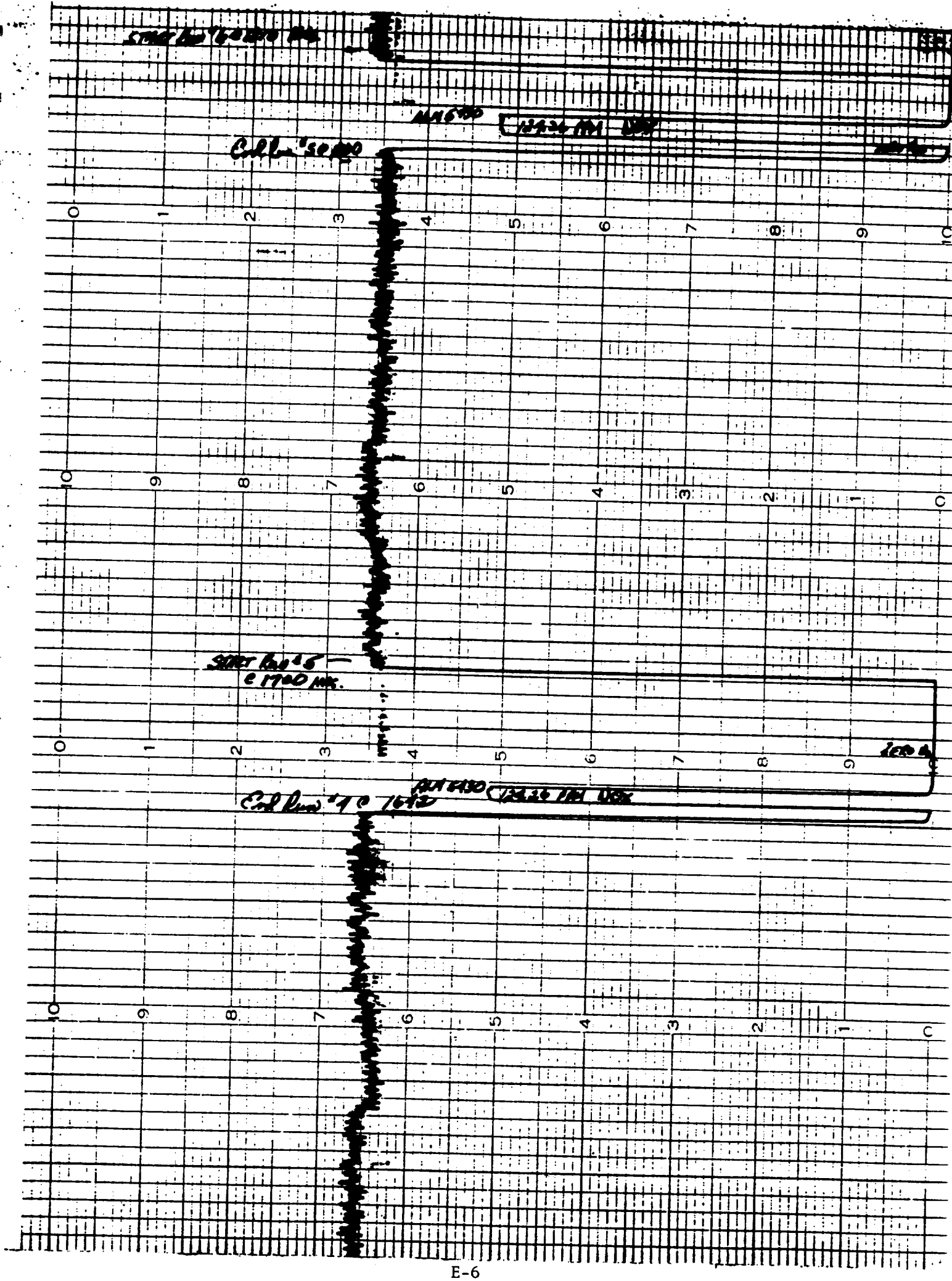
E-2

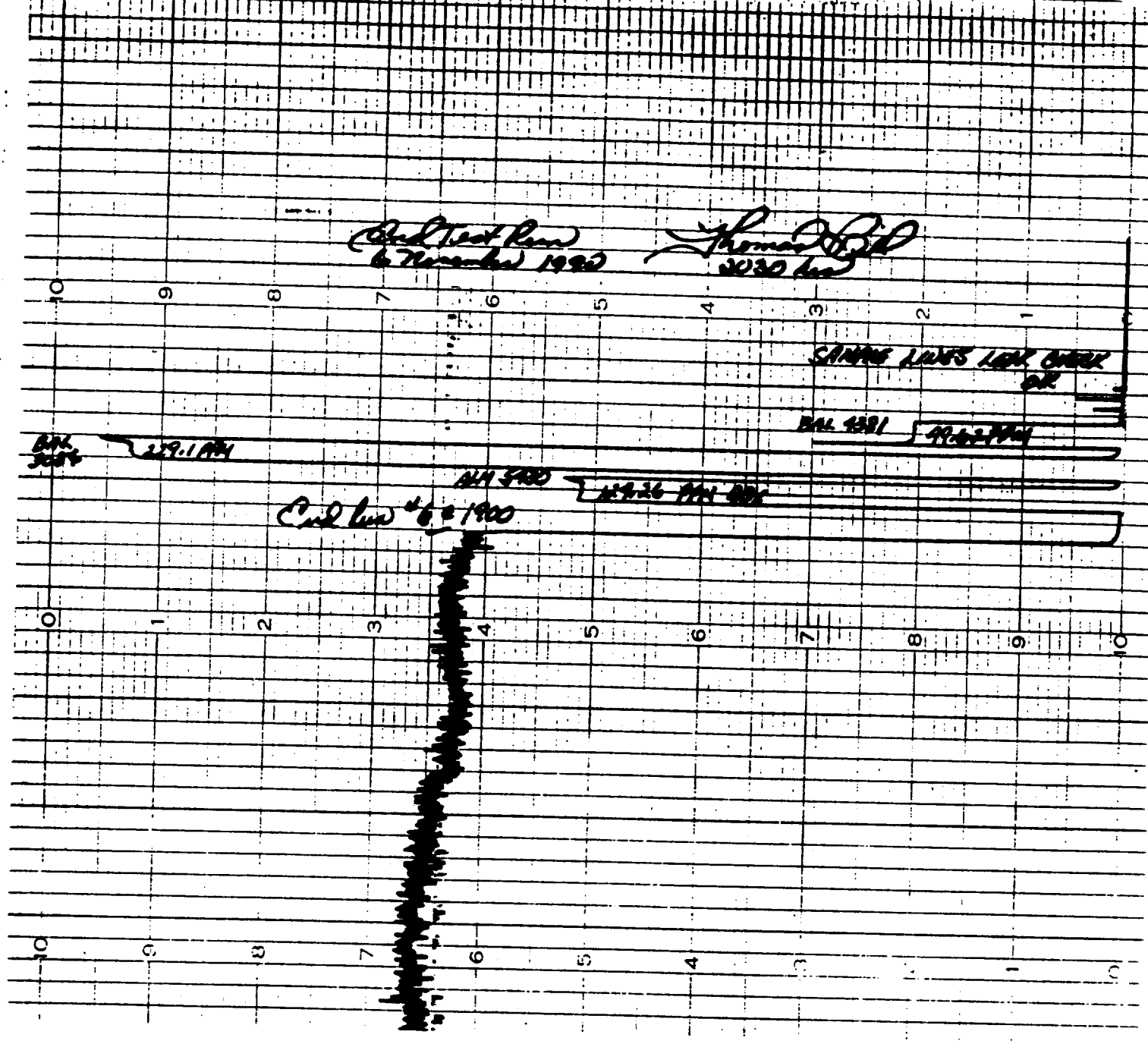


AM 5930
BAK 4381
NOx Range 0-250 PPM
90-23
Firestone
Orange, TX
6 November 1990



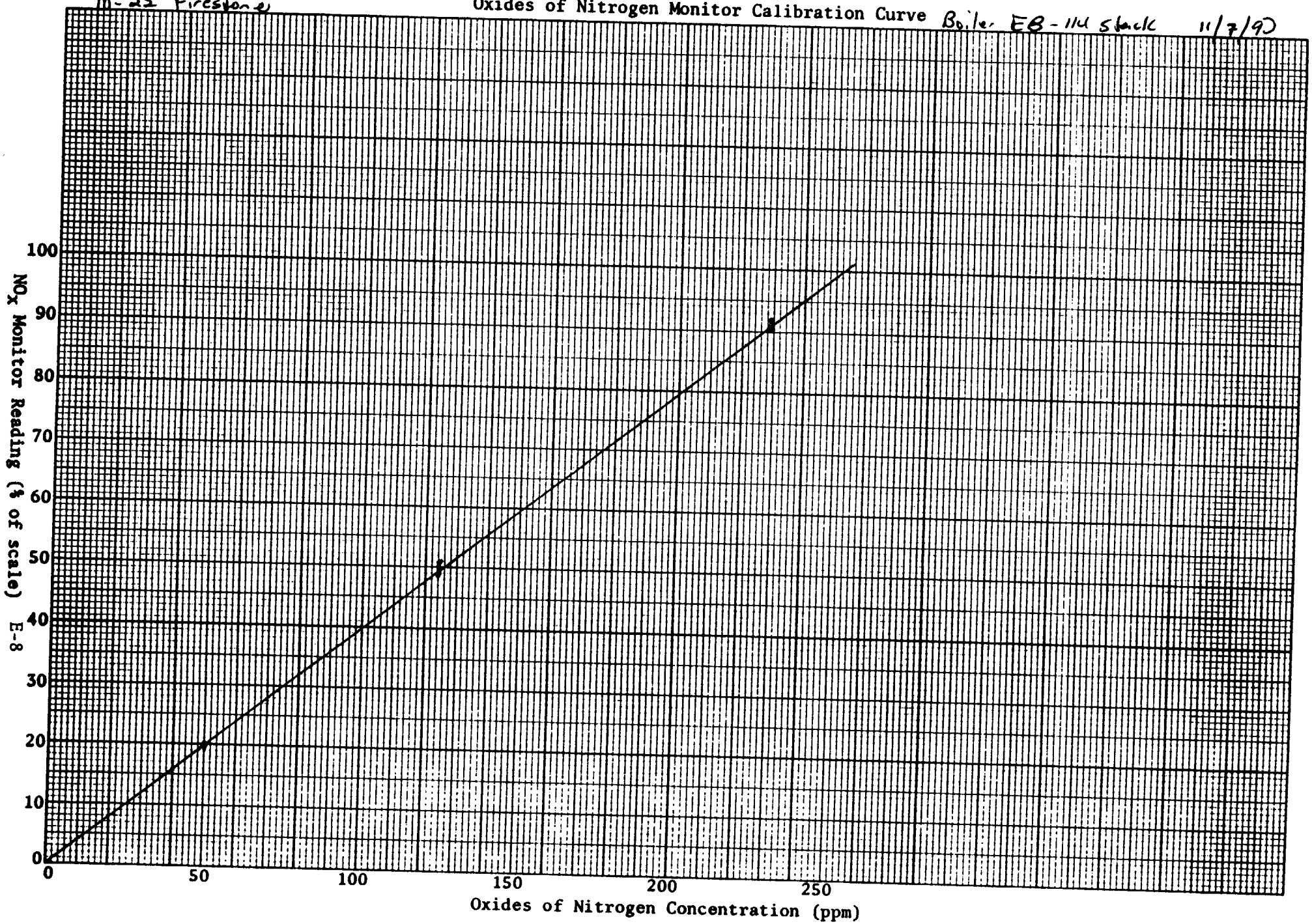




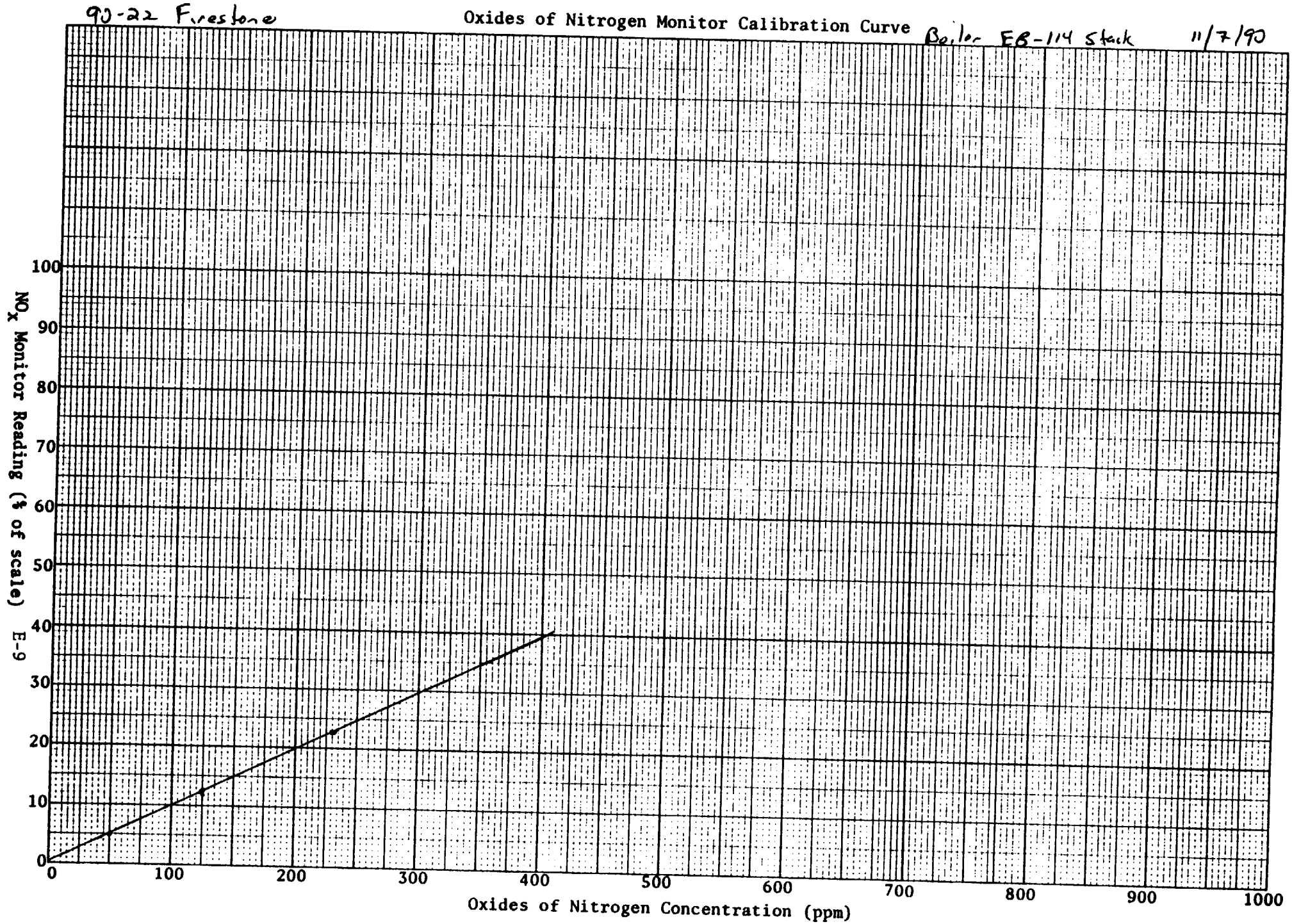


90-22 Firestone

Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/7/90



E-8



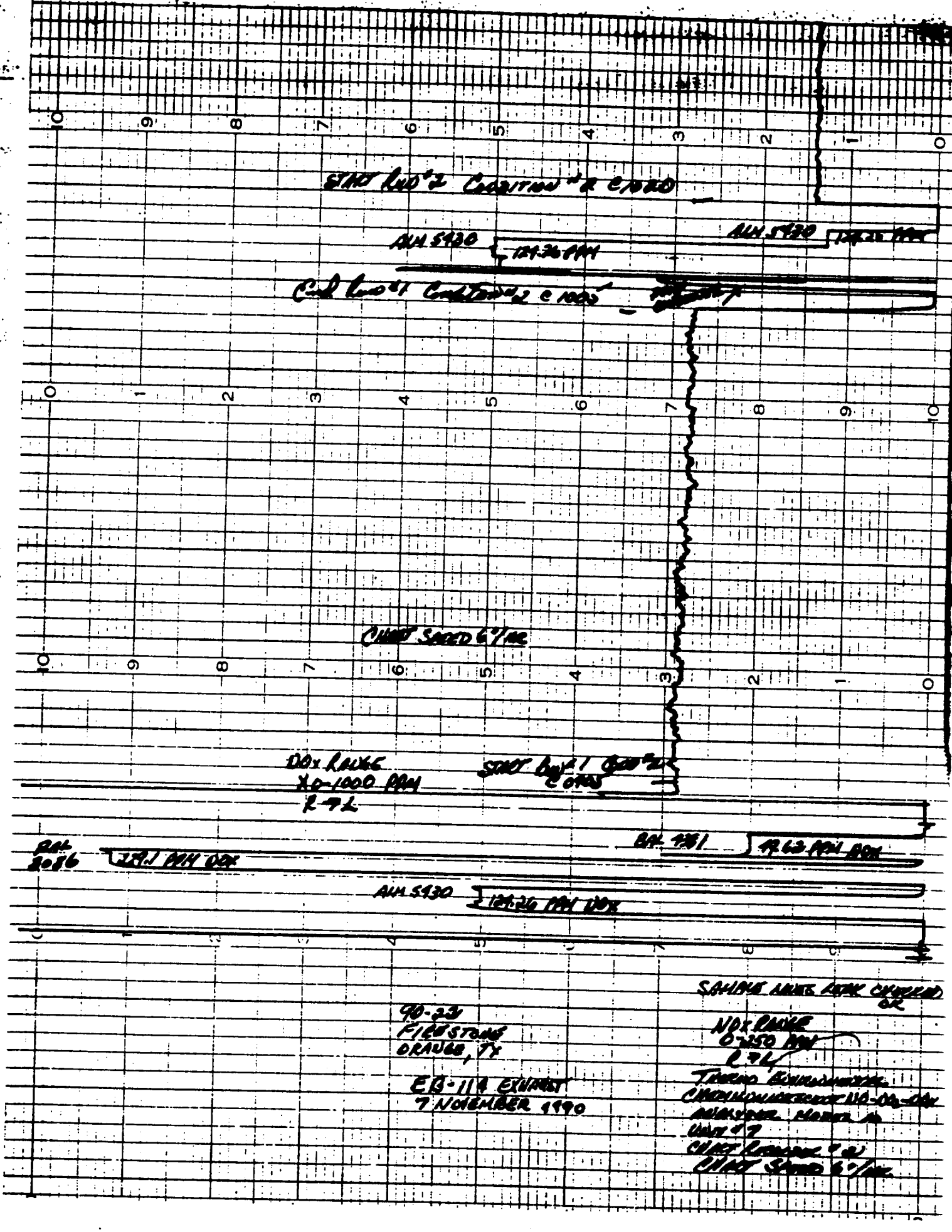
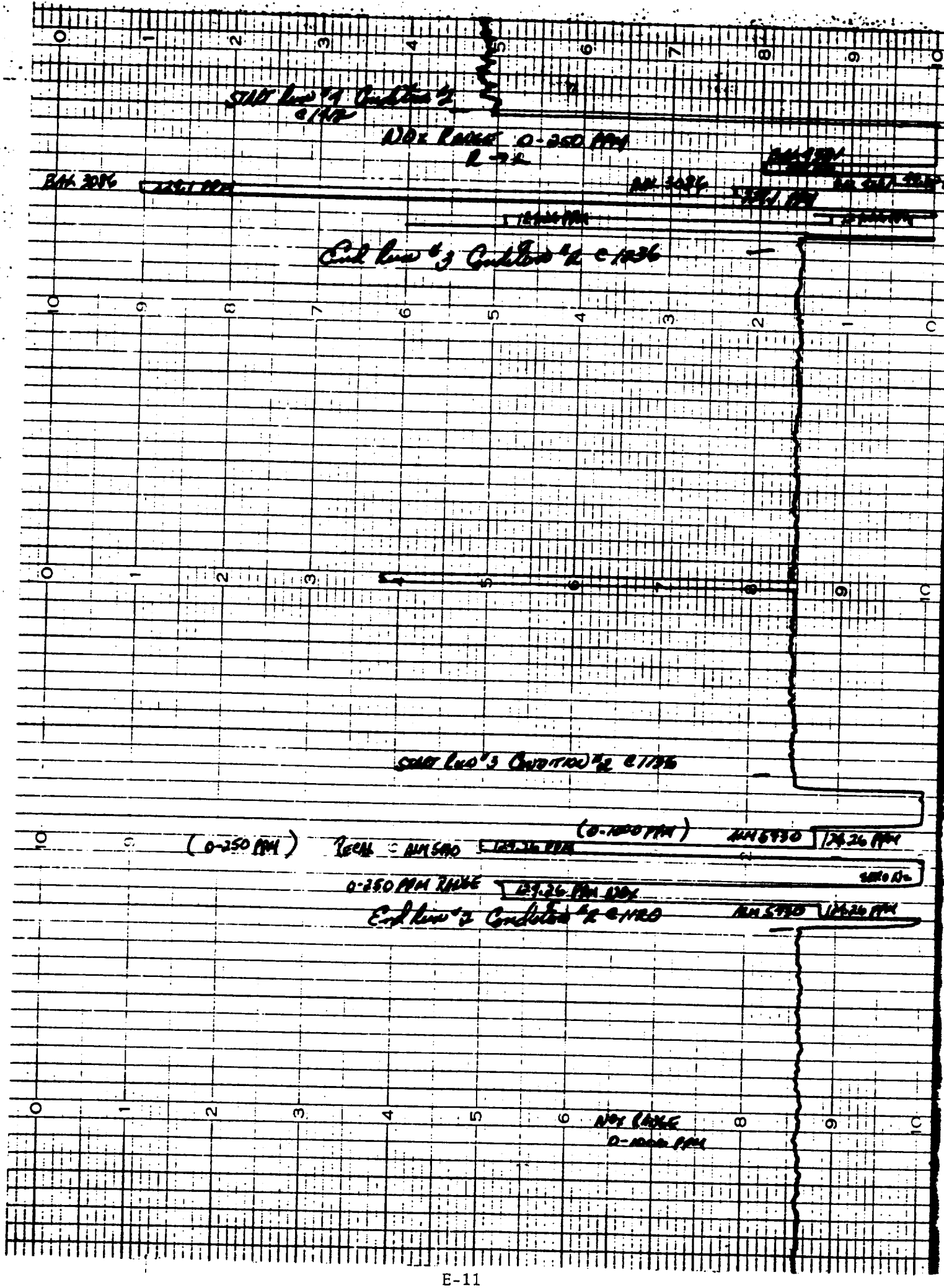
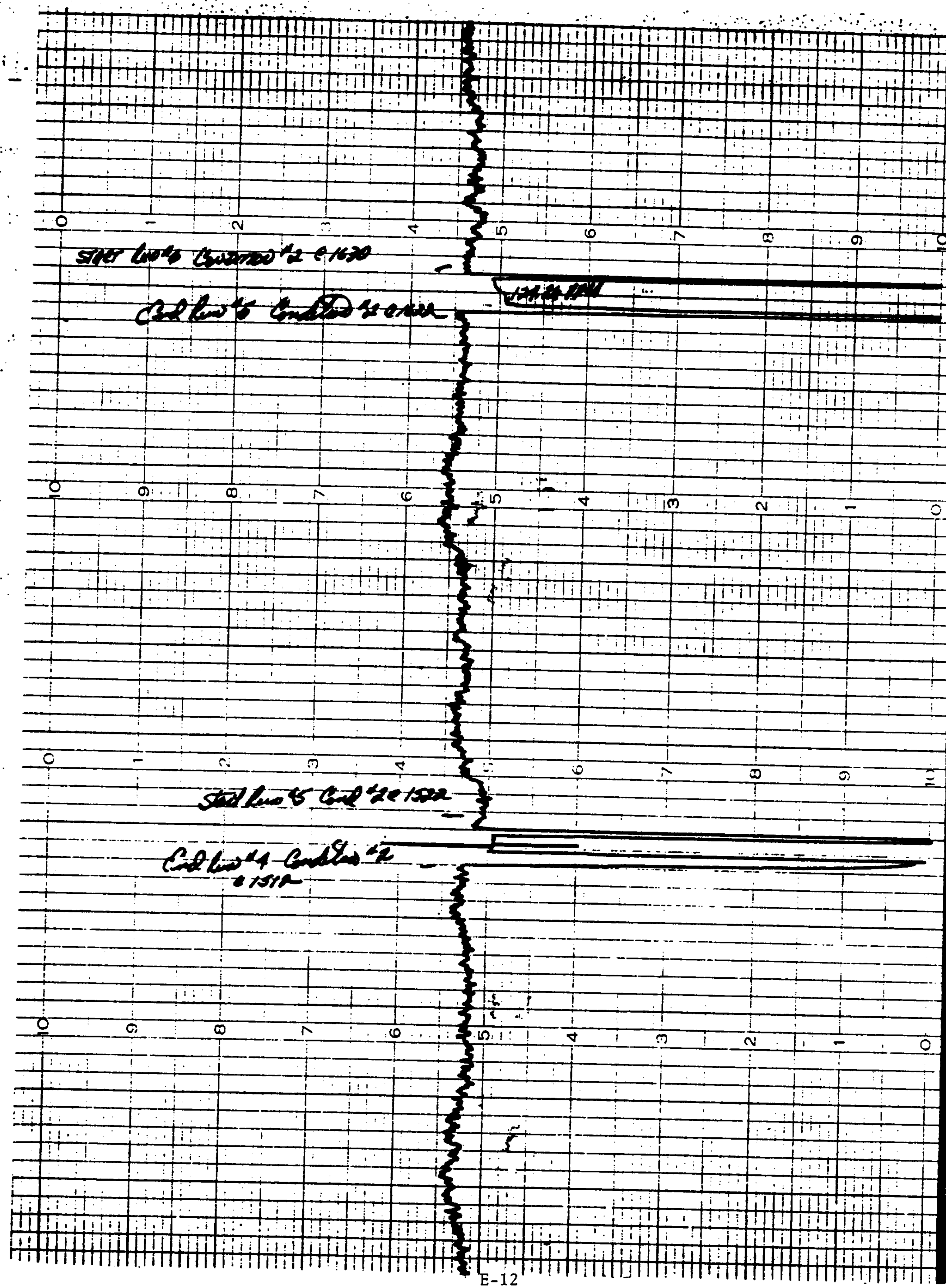
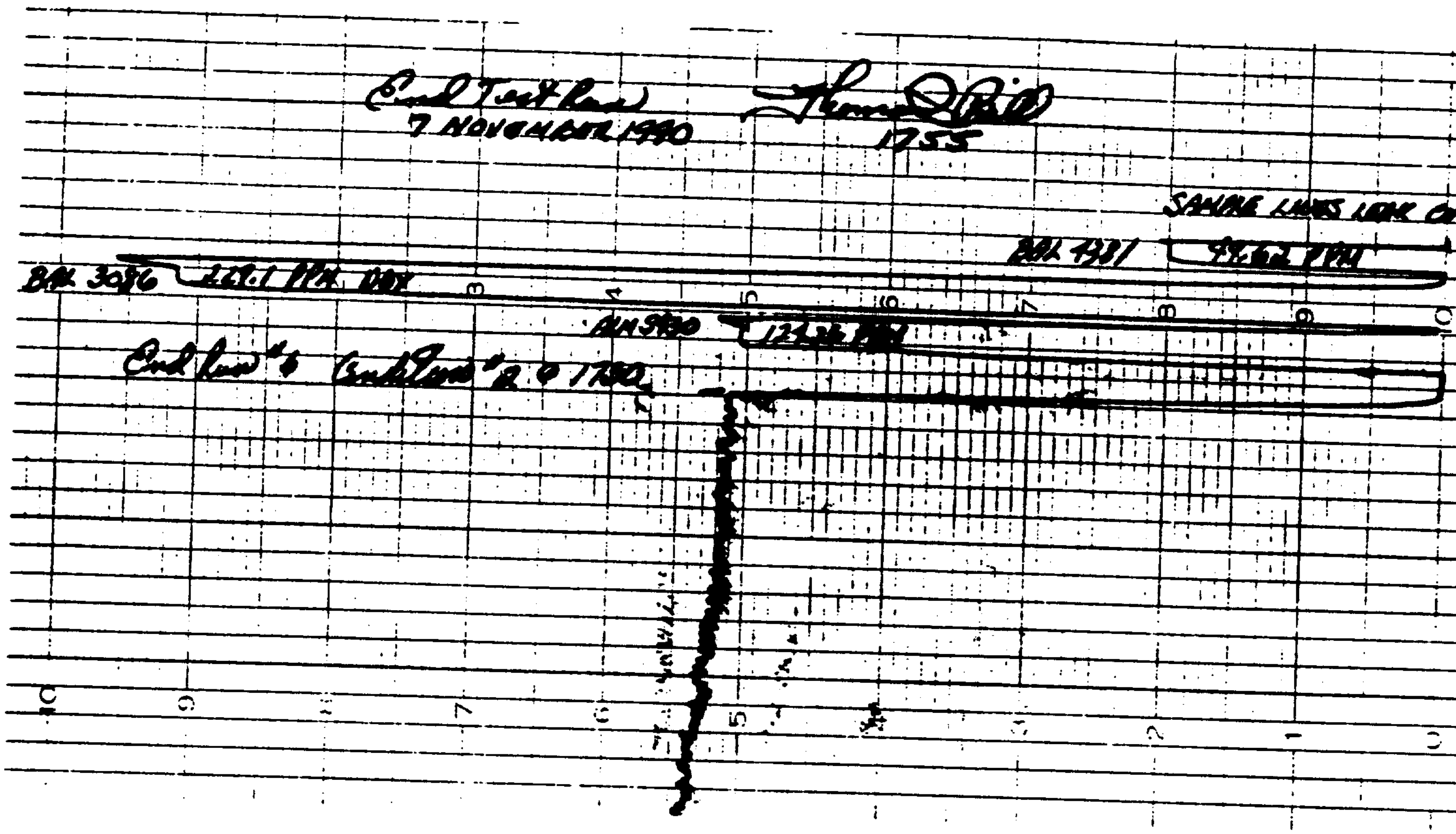


CHART SPEED 6"/MIN
AUX 5430
AUX 5430
90-23
FIELDSTONE
ORANGE, TX
EB-114 EXHAUST
7 NOVEMBER 1990

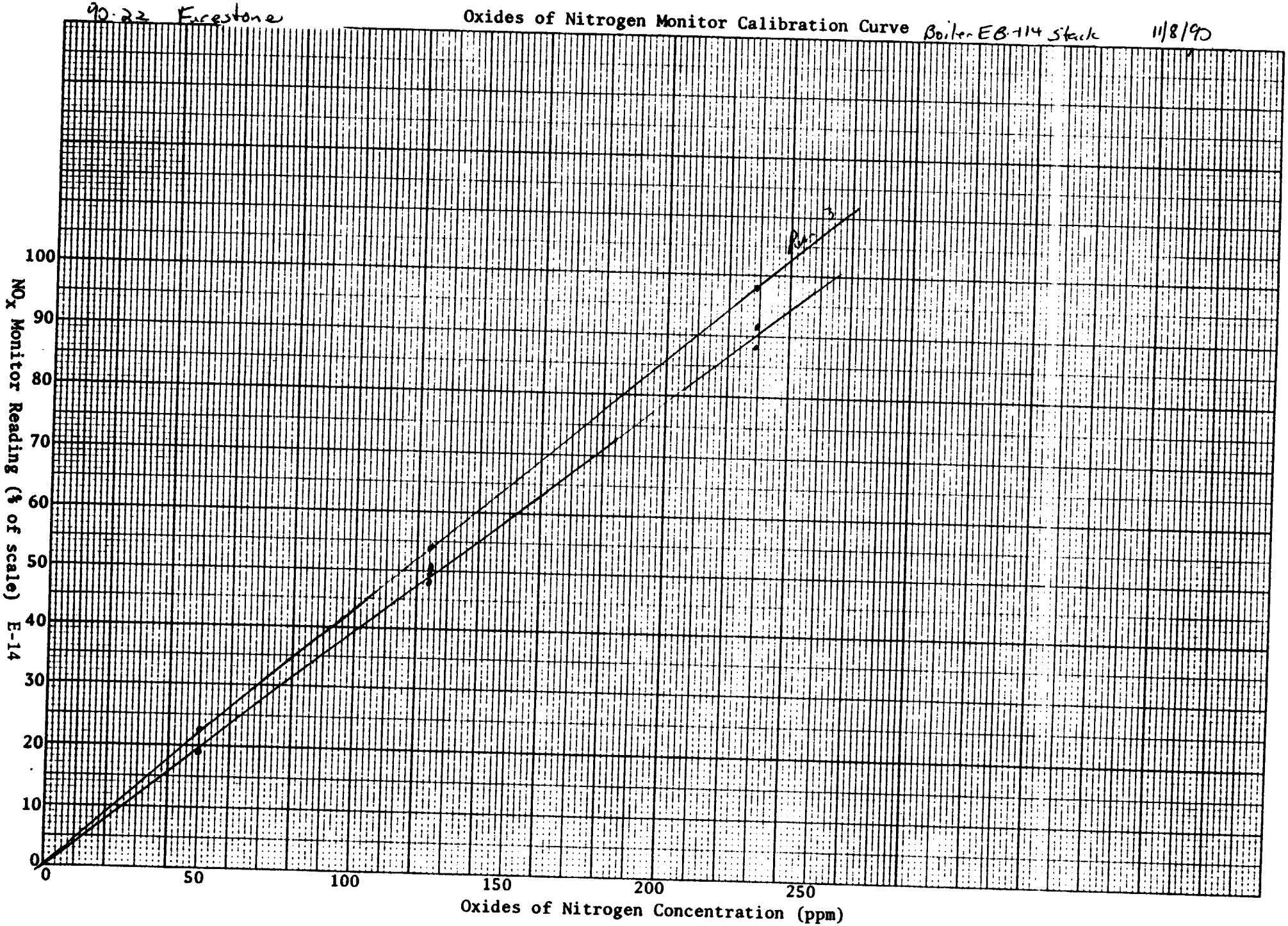

NOx RANGE 0-250 PPM
(0-250 PPM)
0-250 PPM RANGE
NOx RANGE
0-1000 PPM

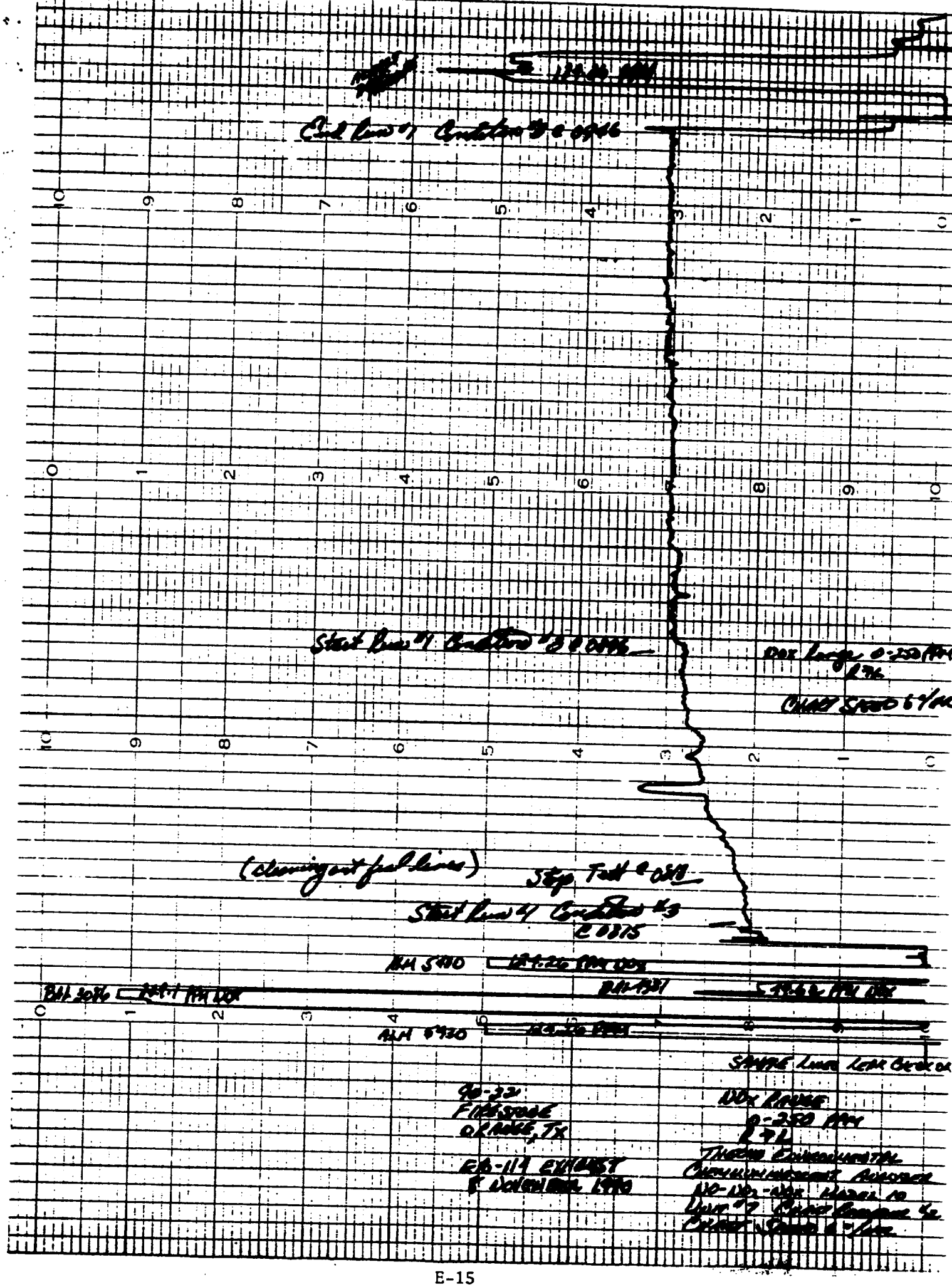

Start Run #5 Cond #2 @ 1522
End Run #4 Condition #2 @ 1518

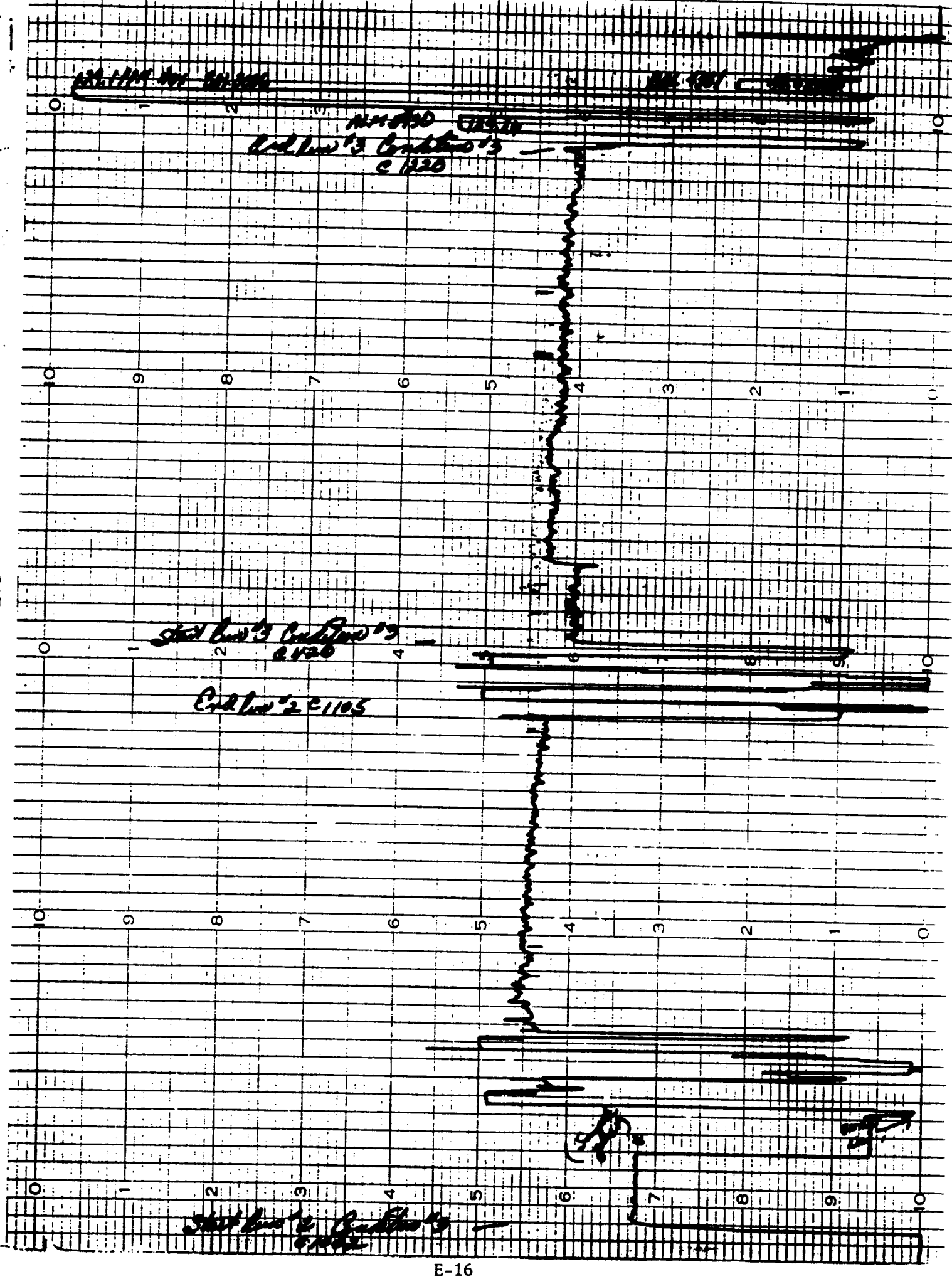

End Test Run
7 NOVEMBER 1990
1755

90-22 Firestone

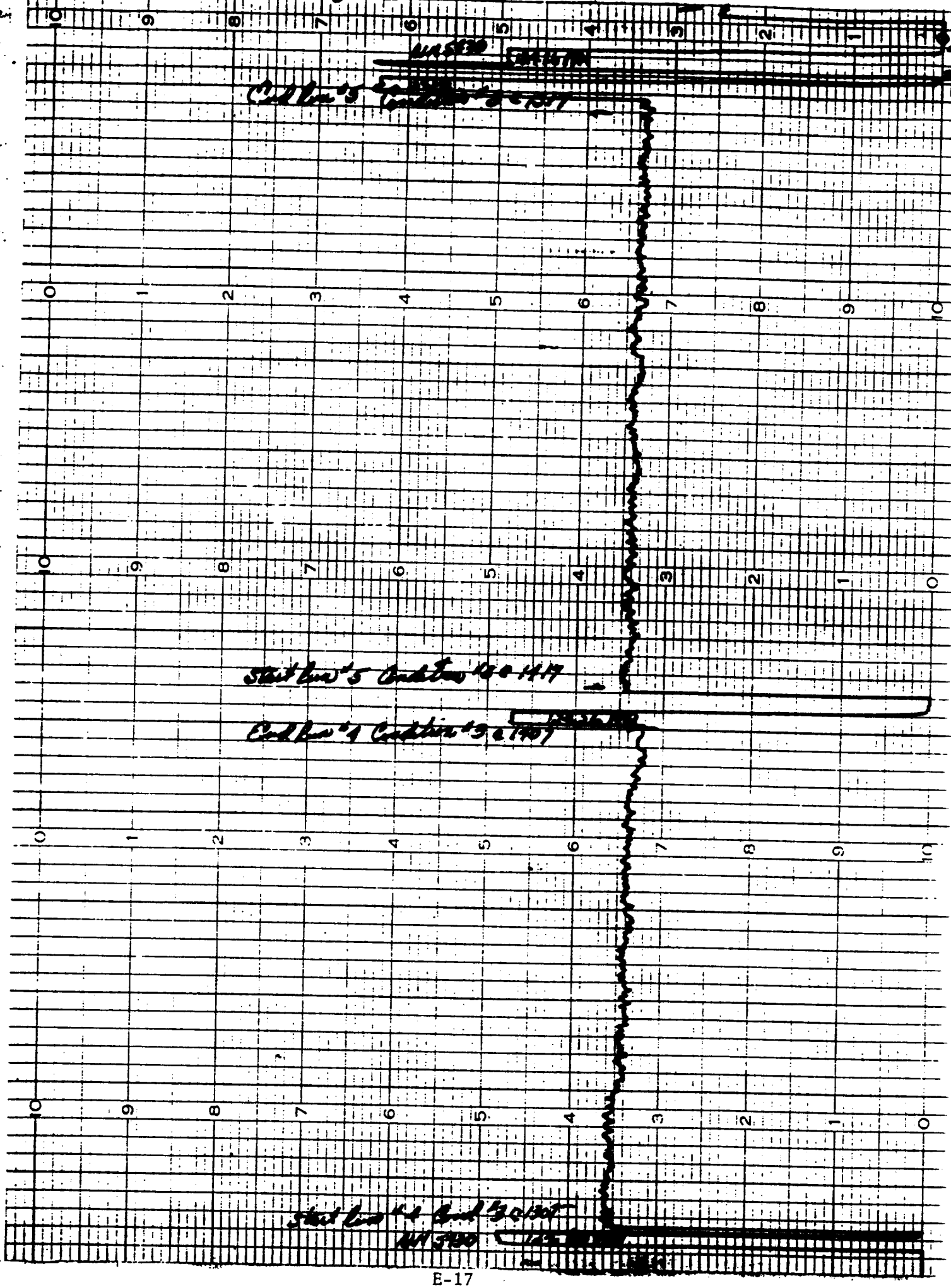
Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/8/90

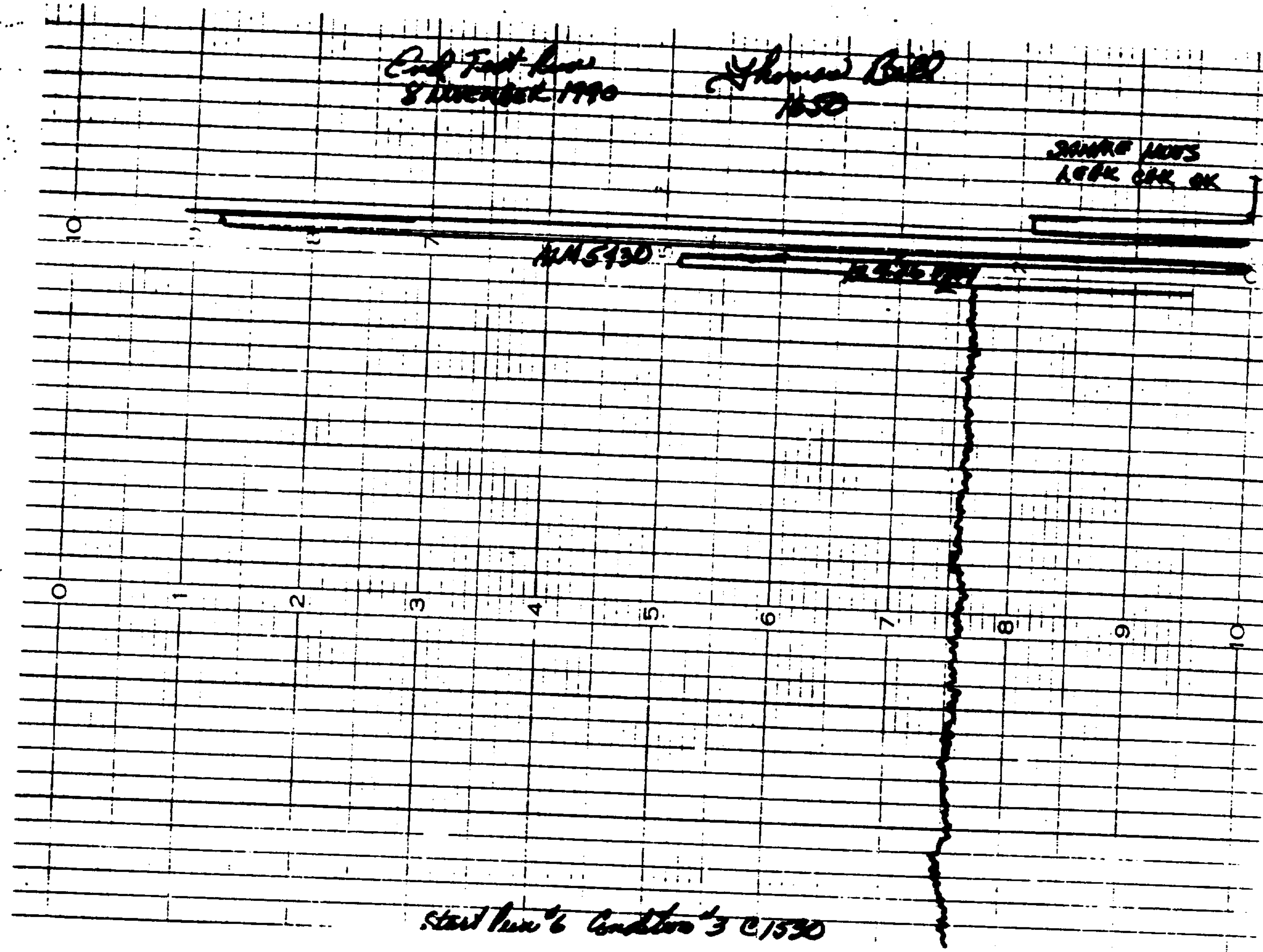






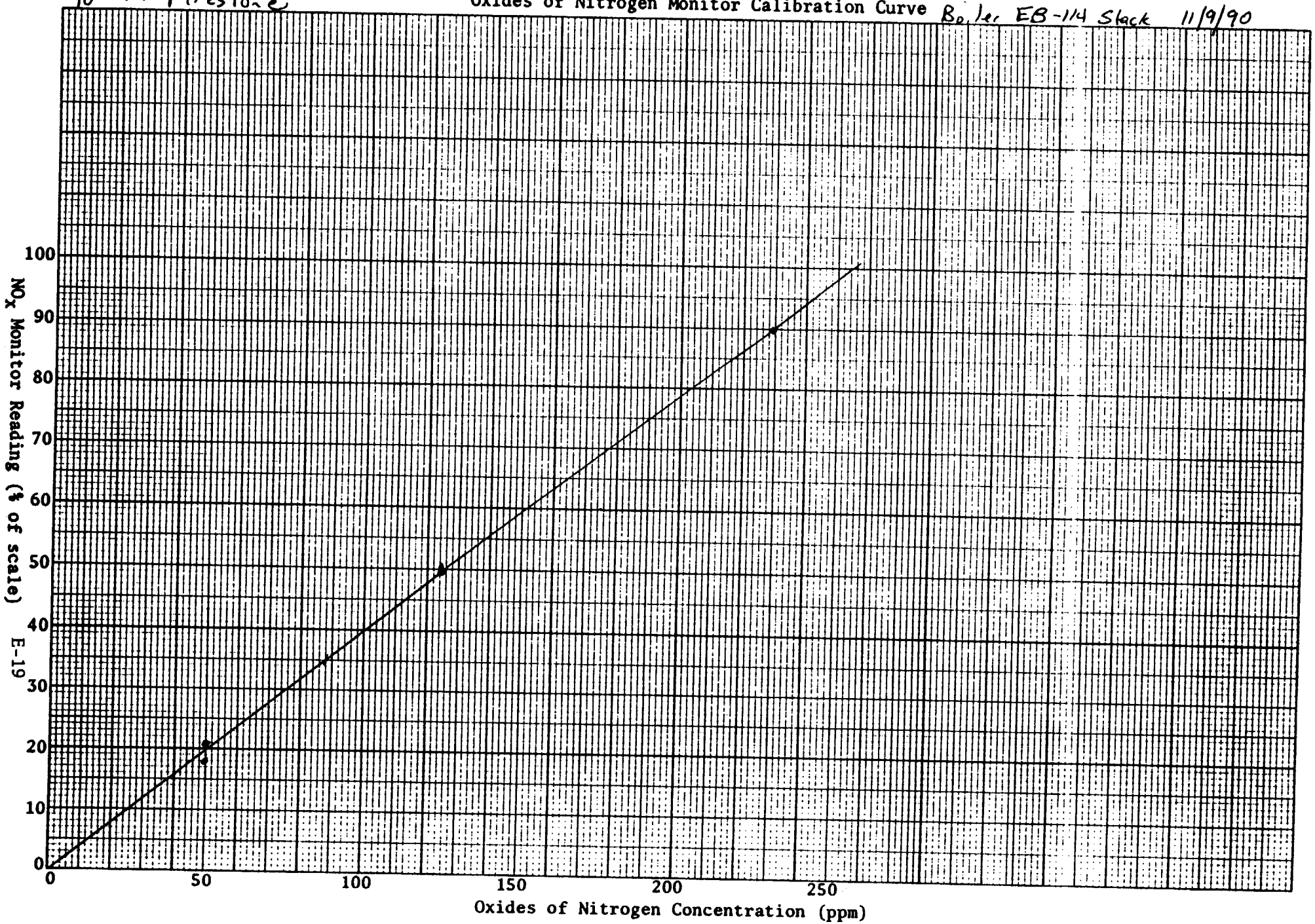
E-16

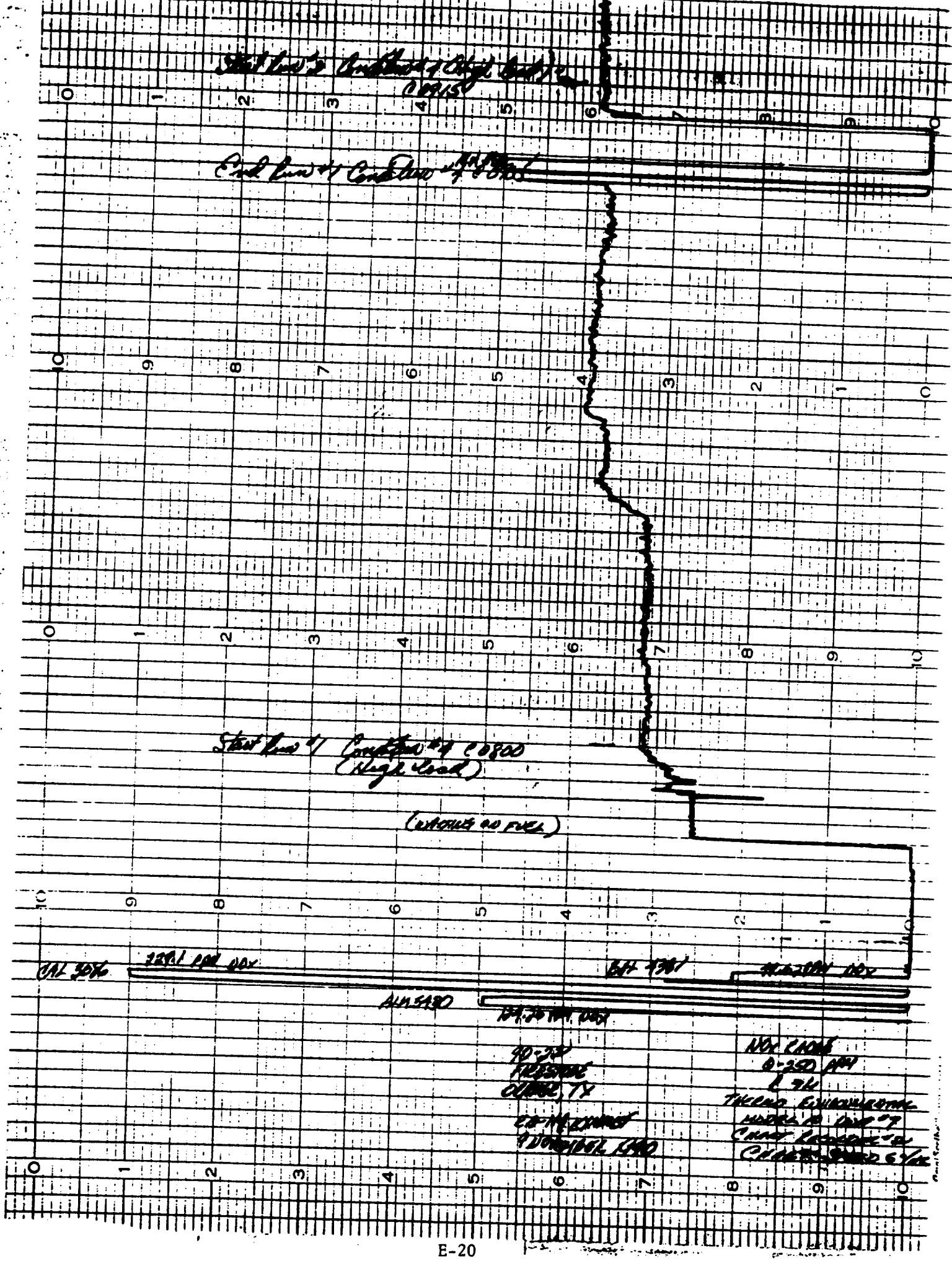


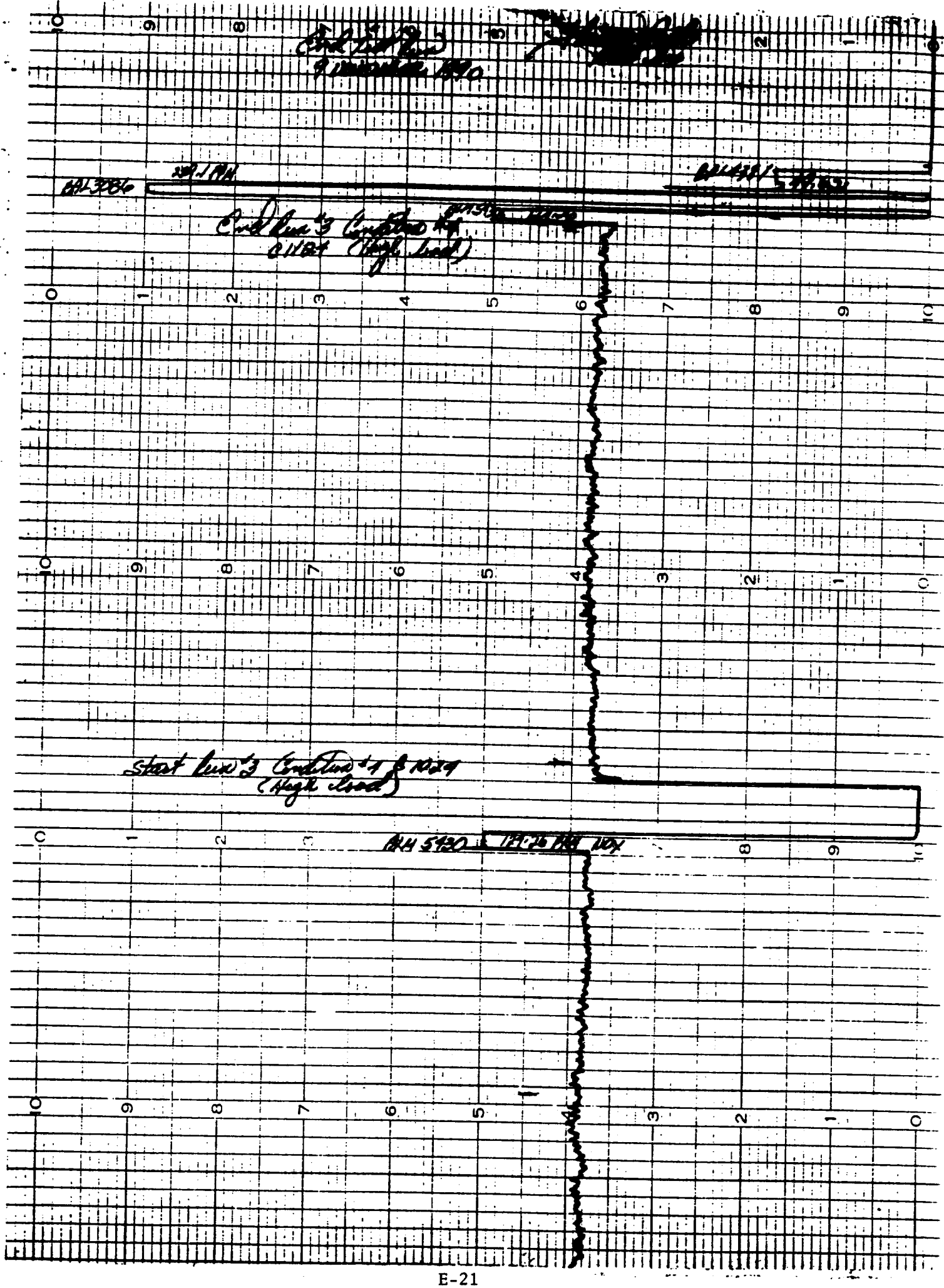

End Test Run
8 December 1990
1650
0
1
2
3
4
5
6
7
8
9
10
Start Run #6 Condition #3 @1530

90-22 Firestone

Oxides of Nitrogen Monitor Calibration Curve Boiler EB-114 Stack 11/9/90







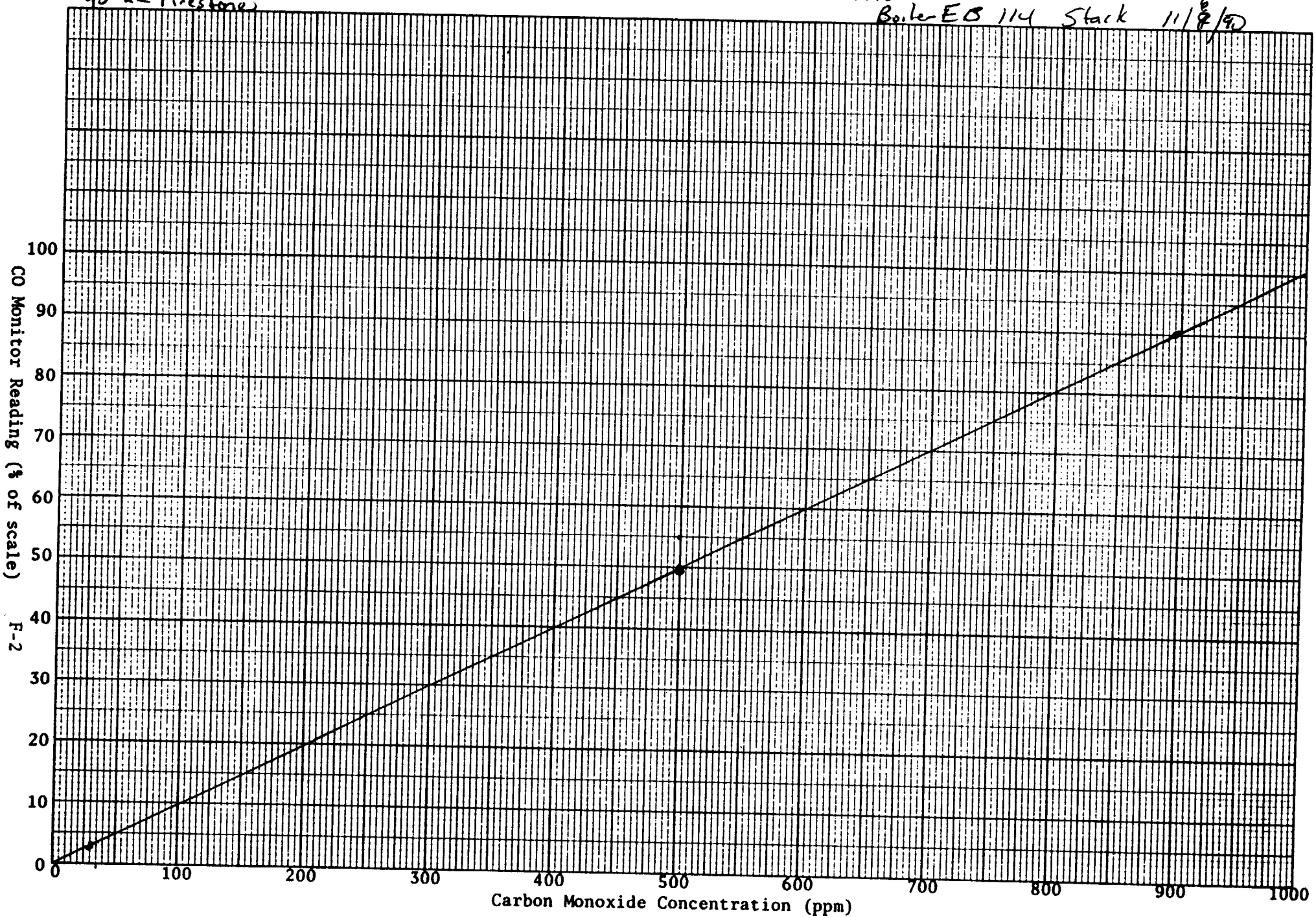
APPENDIX F

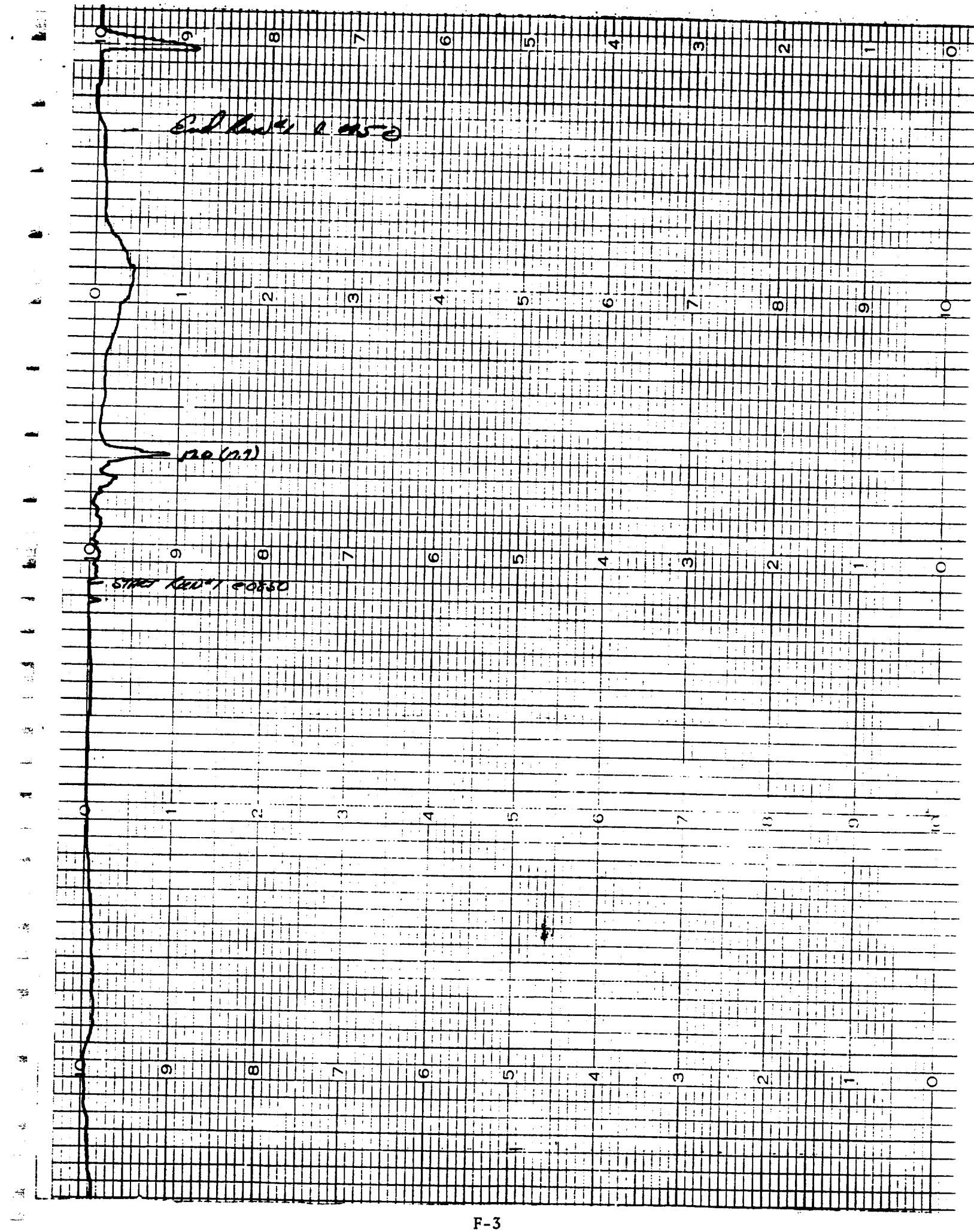
Carbon Monoxide Monitor Data

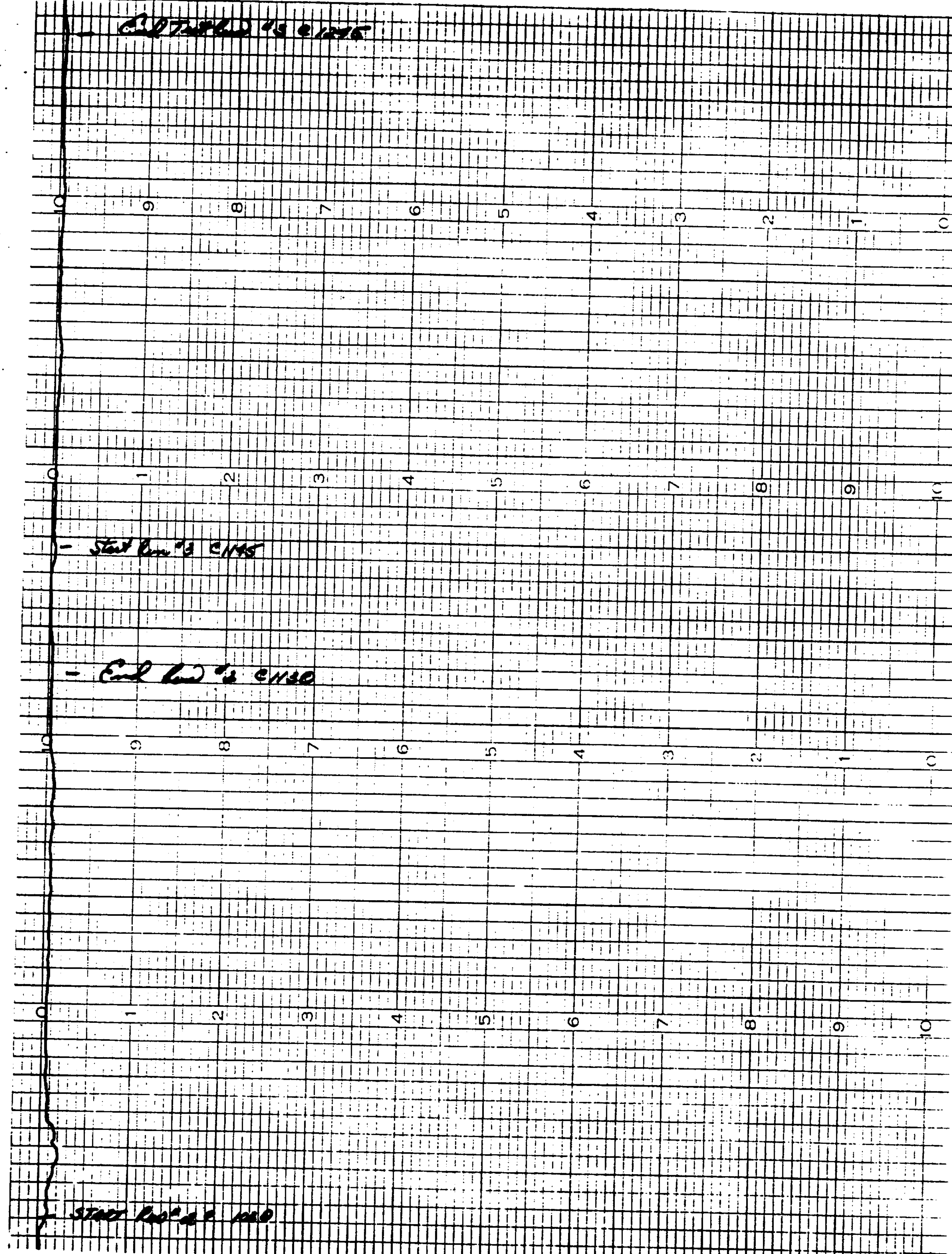
Carbon Monoxide Monitor Calibration Curve

90-22 Firestone

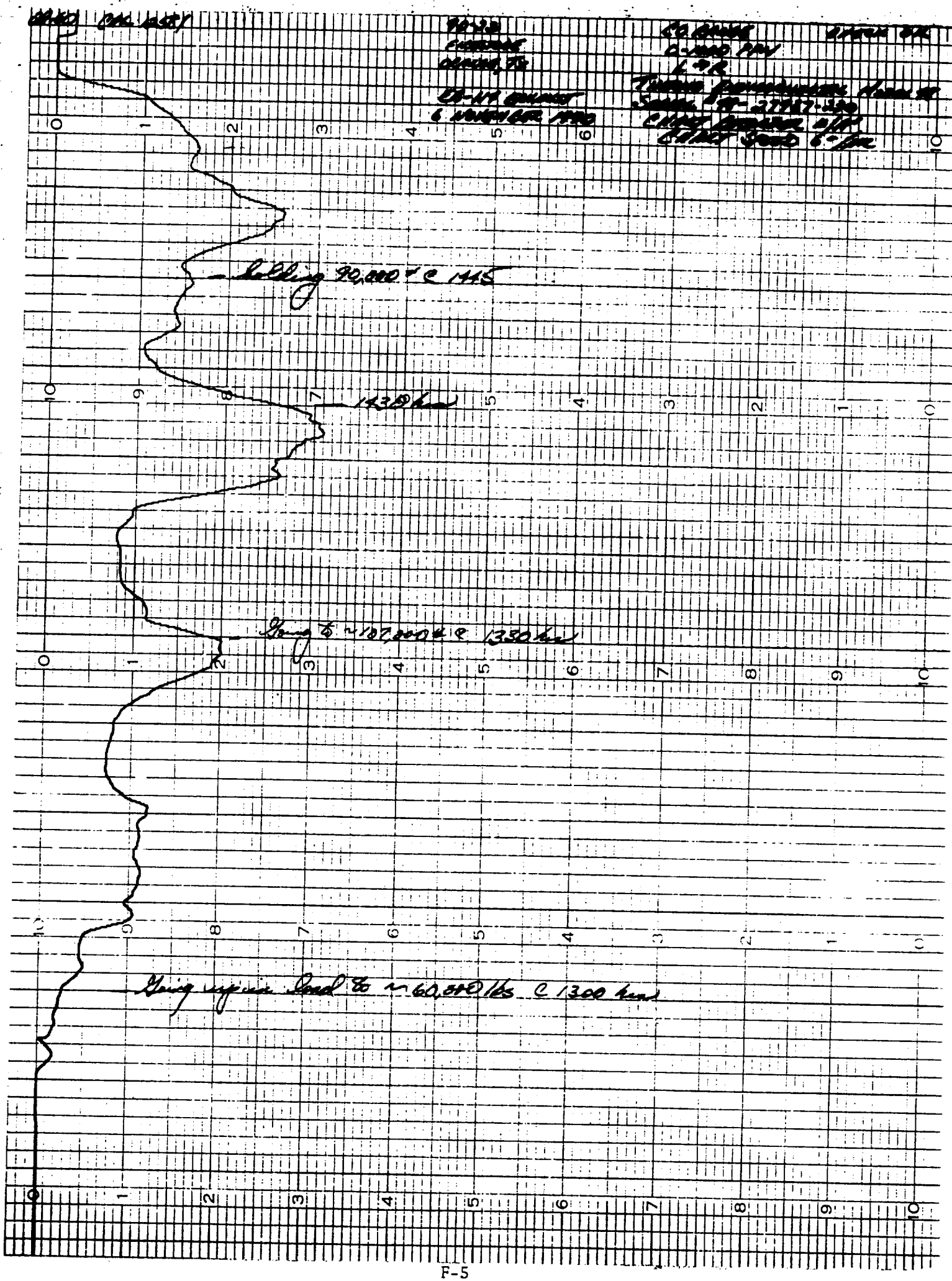
Boiler EB 114 Stack 11/8/90

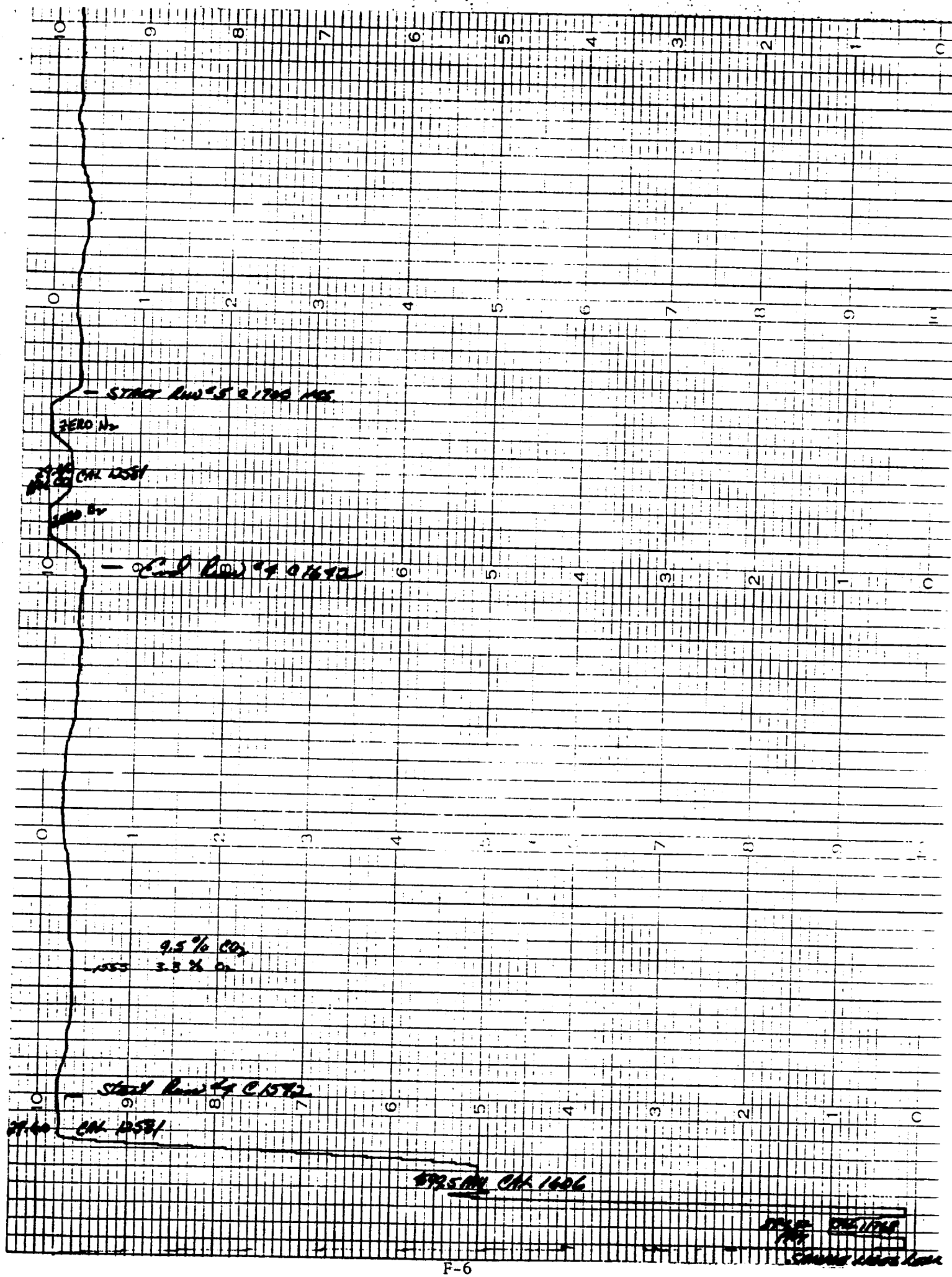


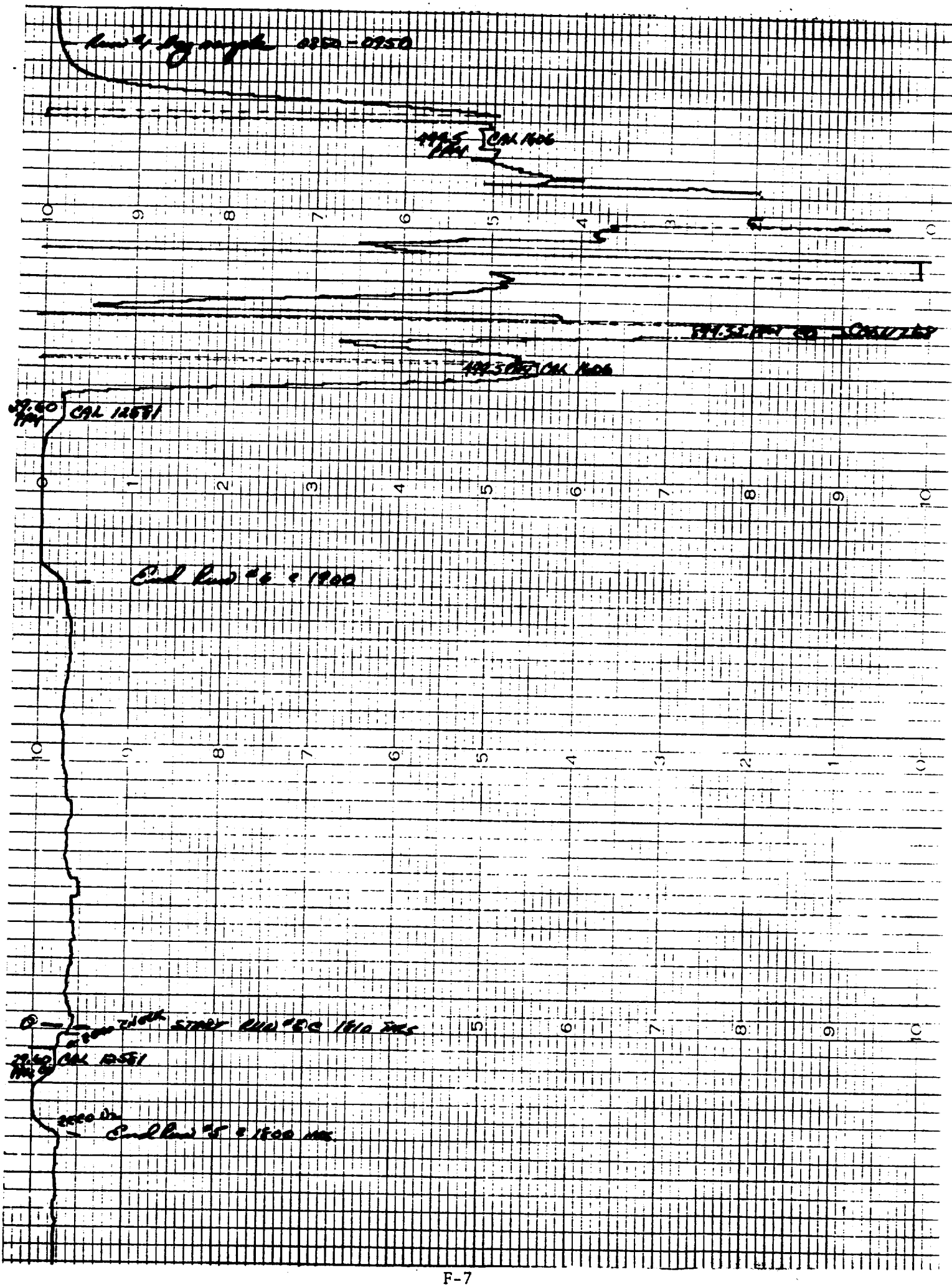


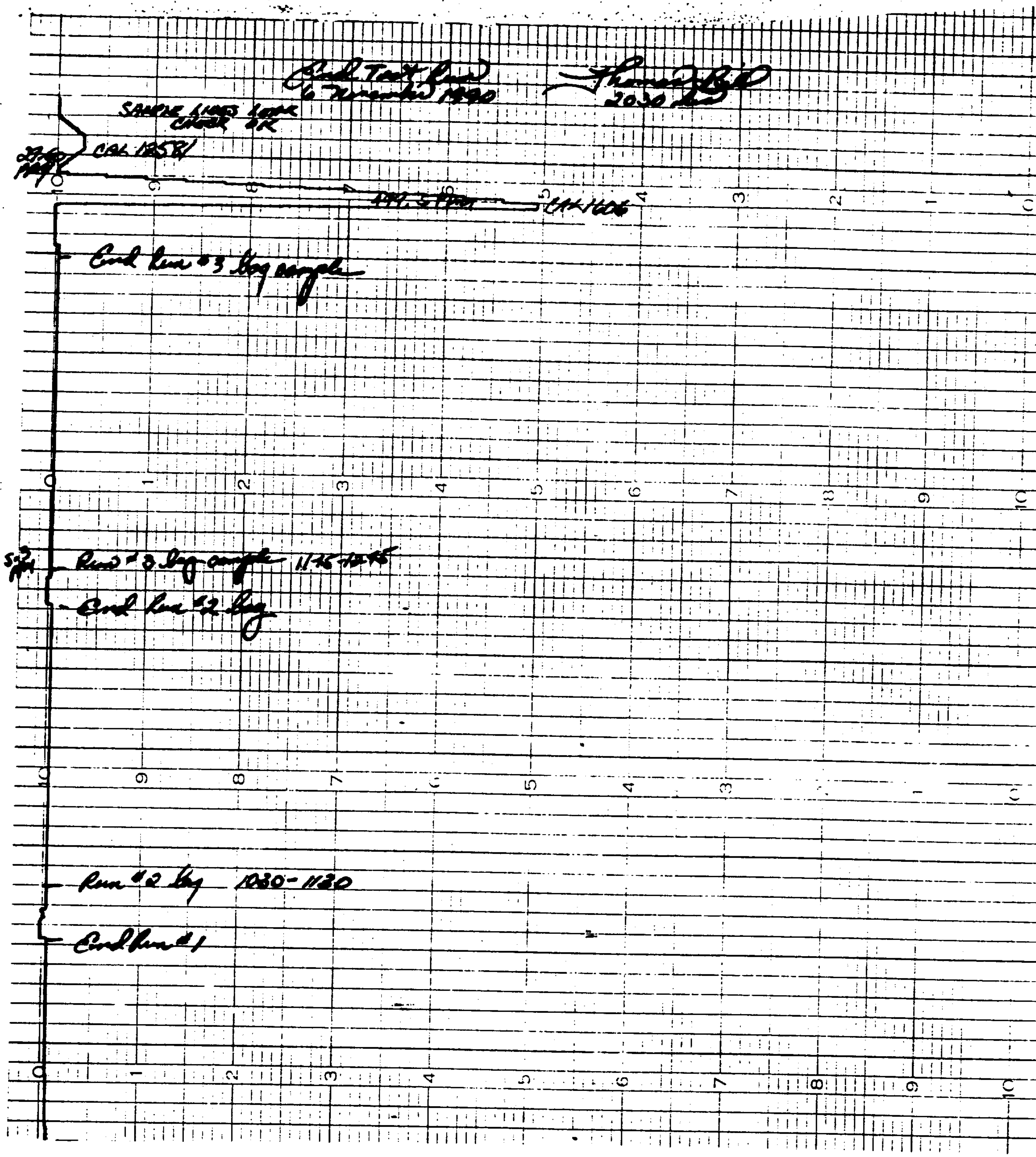


Start Run #3 @ 1145
End Run #2 @ 1130


Yielding 90,000 ± @ 145
1439 kms
Young's ≈ 107,000 ± @ 1350 kms
Young upper limit ≈ 60,000 lbs @ 1300 kms


ZERO N2
9.5 % CO2
3.3 % O2

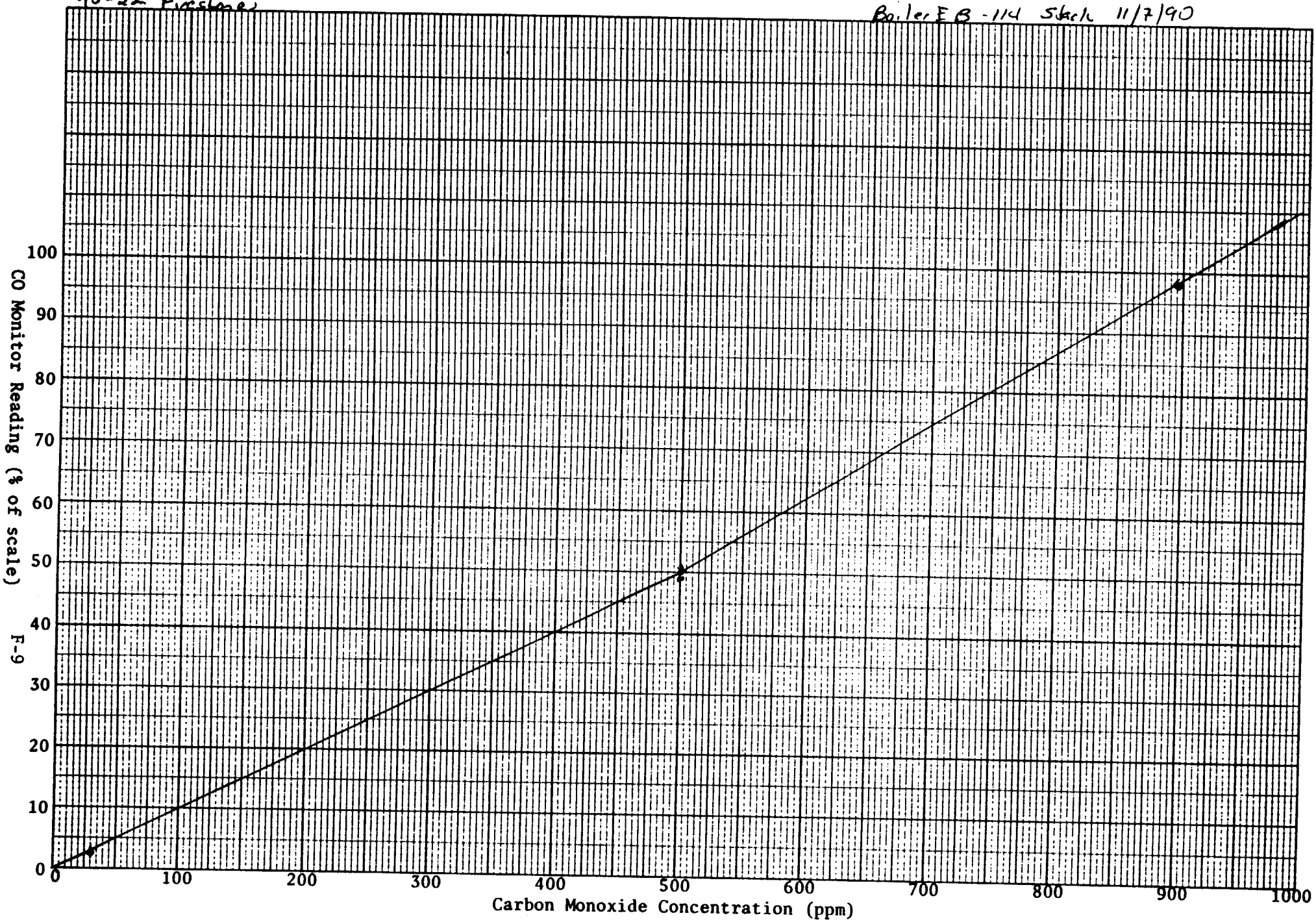


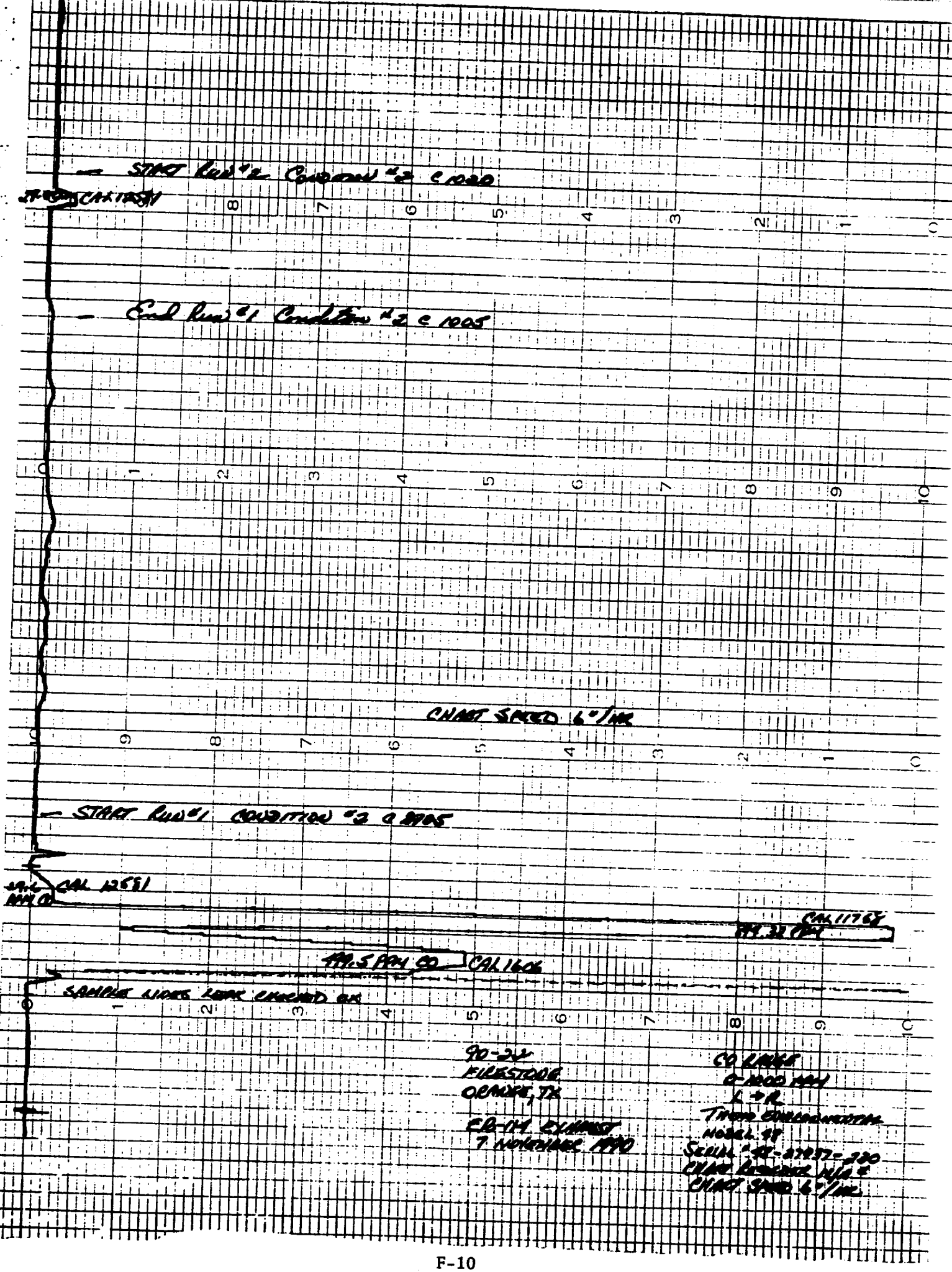

End Test Run
6 November 1990
2030
SAMPLE LINES LOOK
CHECK OK
CAL 1858
CAL 1606
End Run #3 bag sample
Run #3 bag sample 1145-1245
End Run #2 bag
Run #2 bag 1030-1130
End Run #1

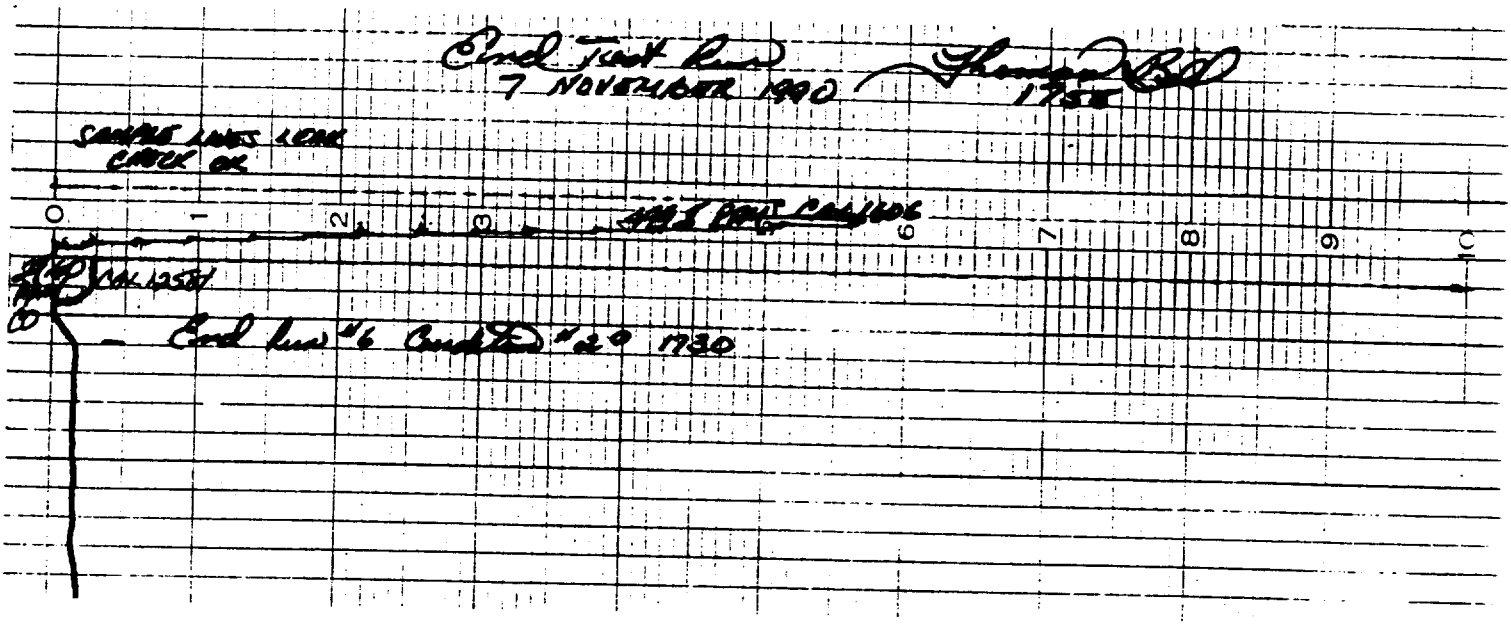
Carbon Monoxide Monitor Calibration Curve

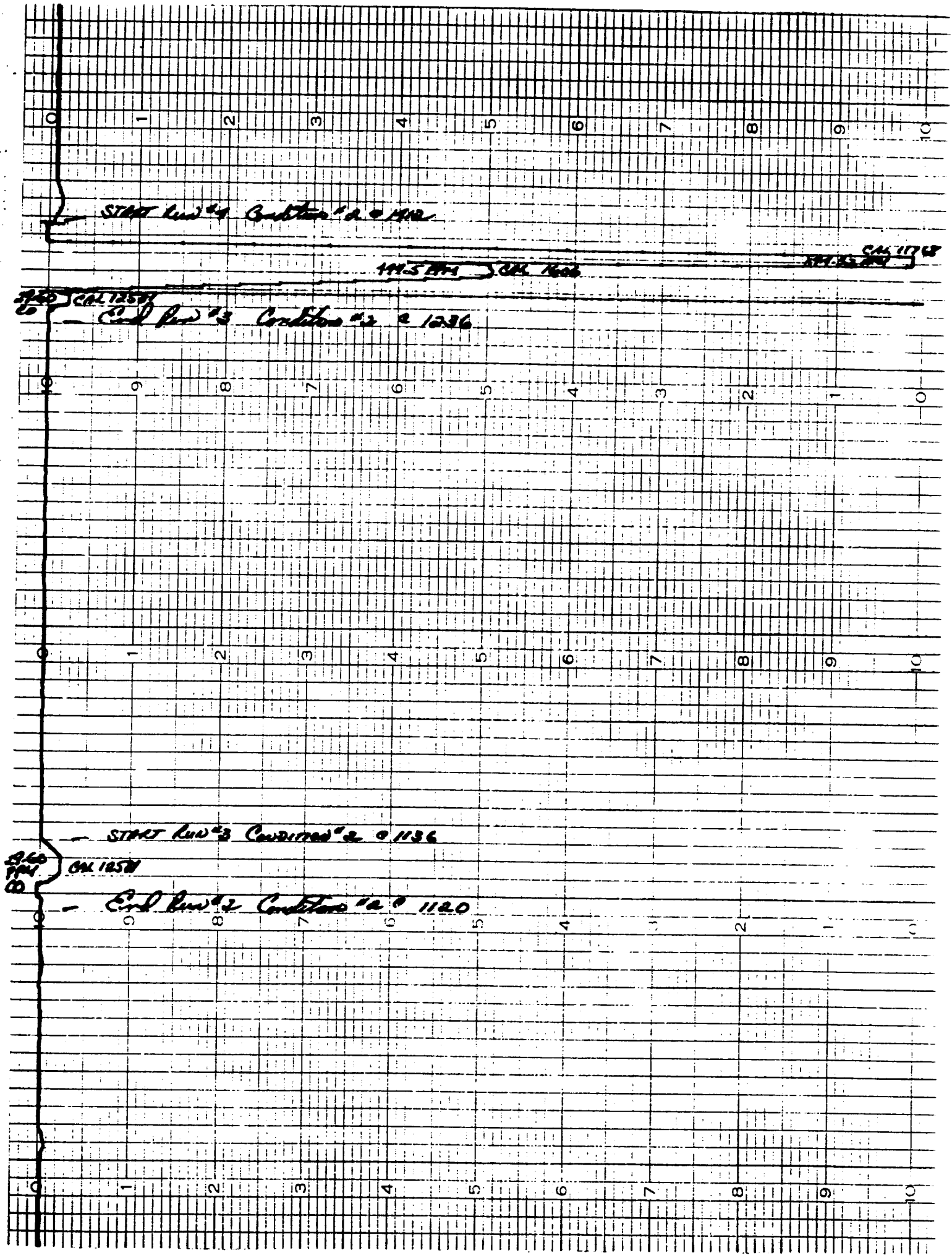
90-22 Firestone

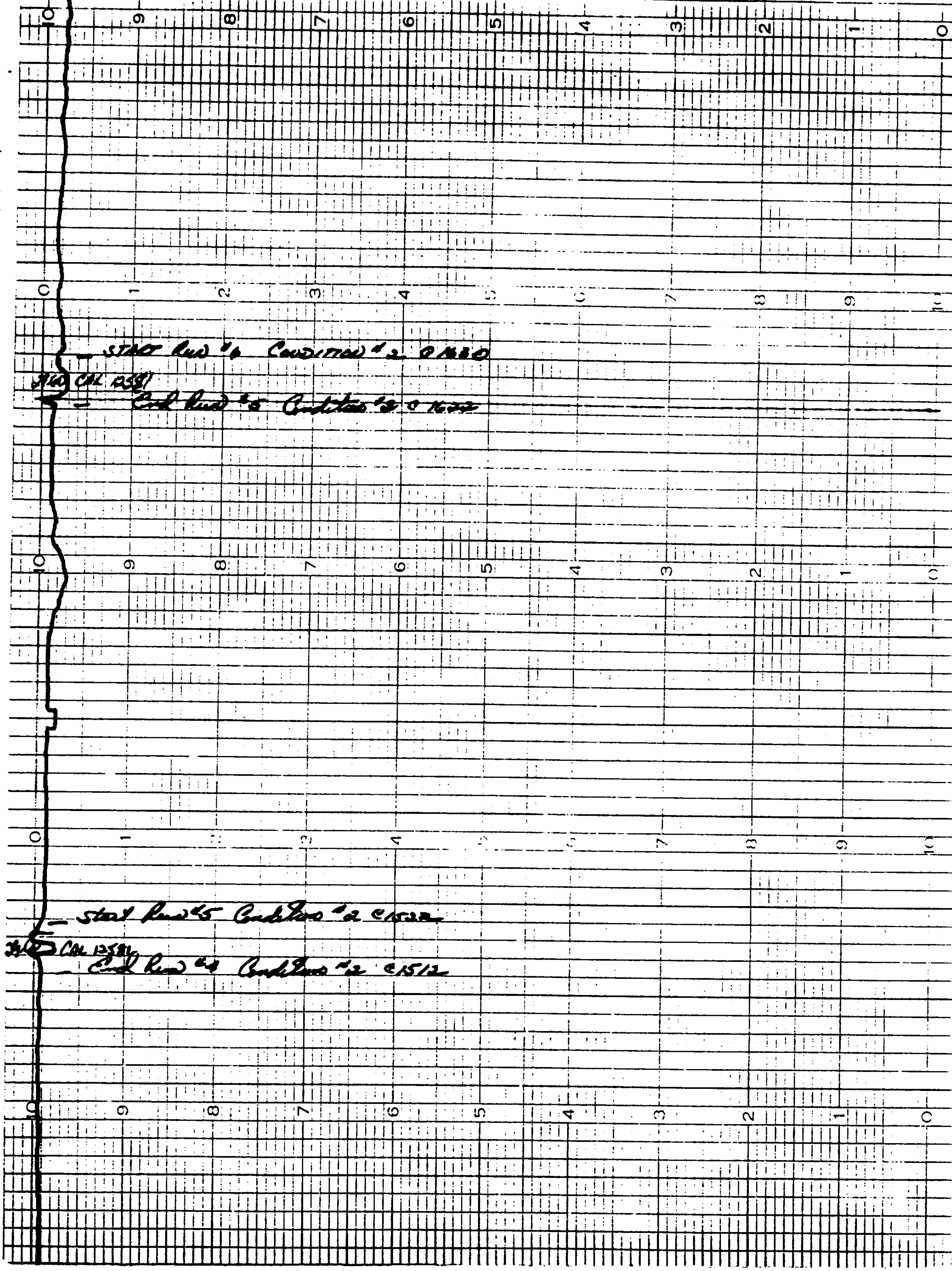
Boiler EB-114 Stack 11/7/90




START Run #2 Condition #2 @ 1020
CAL 11768
END Run #1 Condition #2 @ 1005
CHART SPEED 6"/MIN
START Run #1 CONDITION #2 @ 0905
CAL 12581
CAL 11768
CAL 1606
SAMPLE LINES LEAK CHECKED OK
90-24
FIRESTONE
ORANGE, TX
CO LINEAR
0-1000 PPM
L → R
TRACOR INSTRUMENTS
MODEL 48
SERIAL # 48-17937-220
CHART DIRECTION L → R
CHART SPEED 6"/MIN


Cond Test Run
7 NOVEMBER 1990
SAMPLES TAKEN LOWER CHECK OK
0
1
2
3
6
7
8
9
10
Cond Run #6 Conducted #29 1730

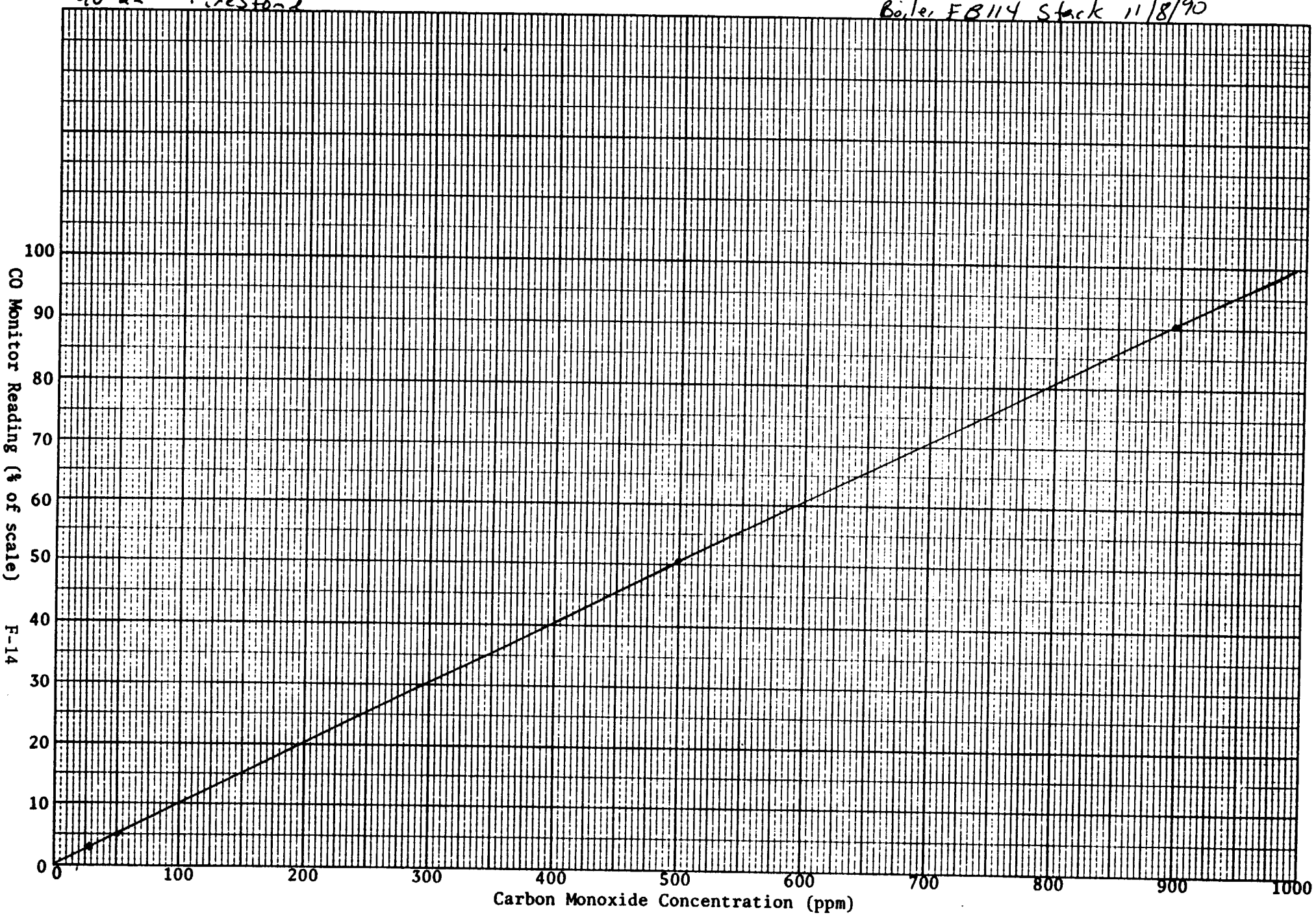

START Run #4 Conductor "a" @ 1412
1443 TMH
CAL 1608
CAL 1258
End Run #3 Conductor "a" @ 1236
START Run #3 Continued "a" @ 1136
CAL 1258
End Run #2 Conductor "a" @ 1120

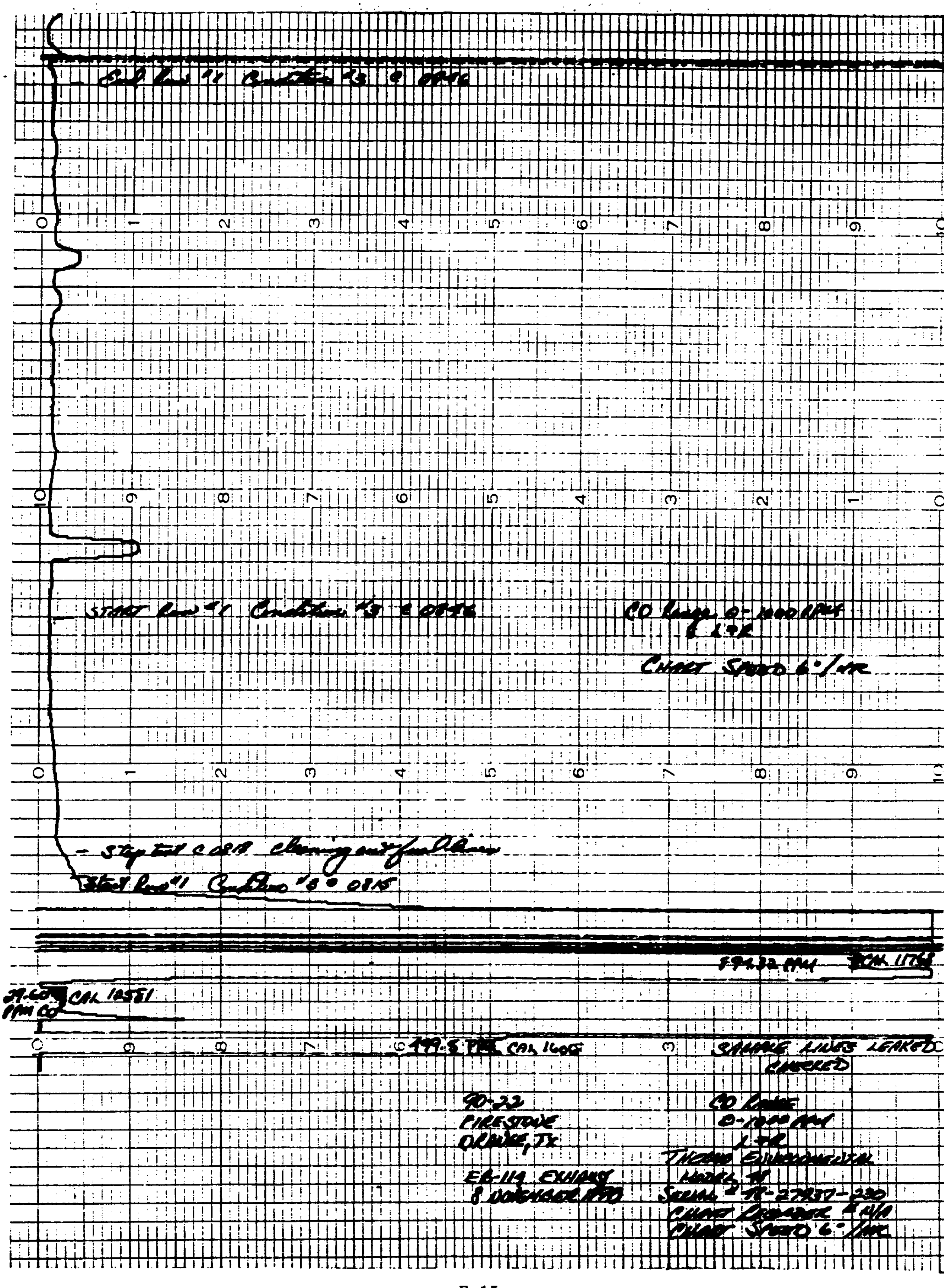

START Run #6 Condition #2
End Run #5 Condition #2
Start Run #5 Condition #2
End Run #4 Condition #2 @1512

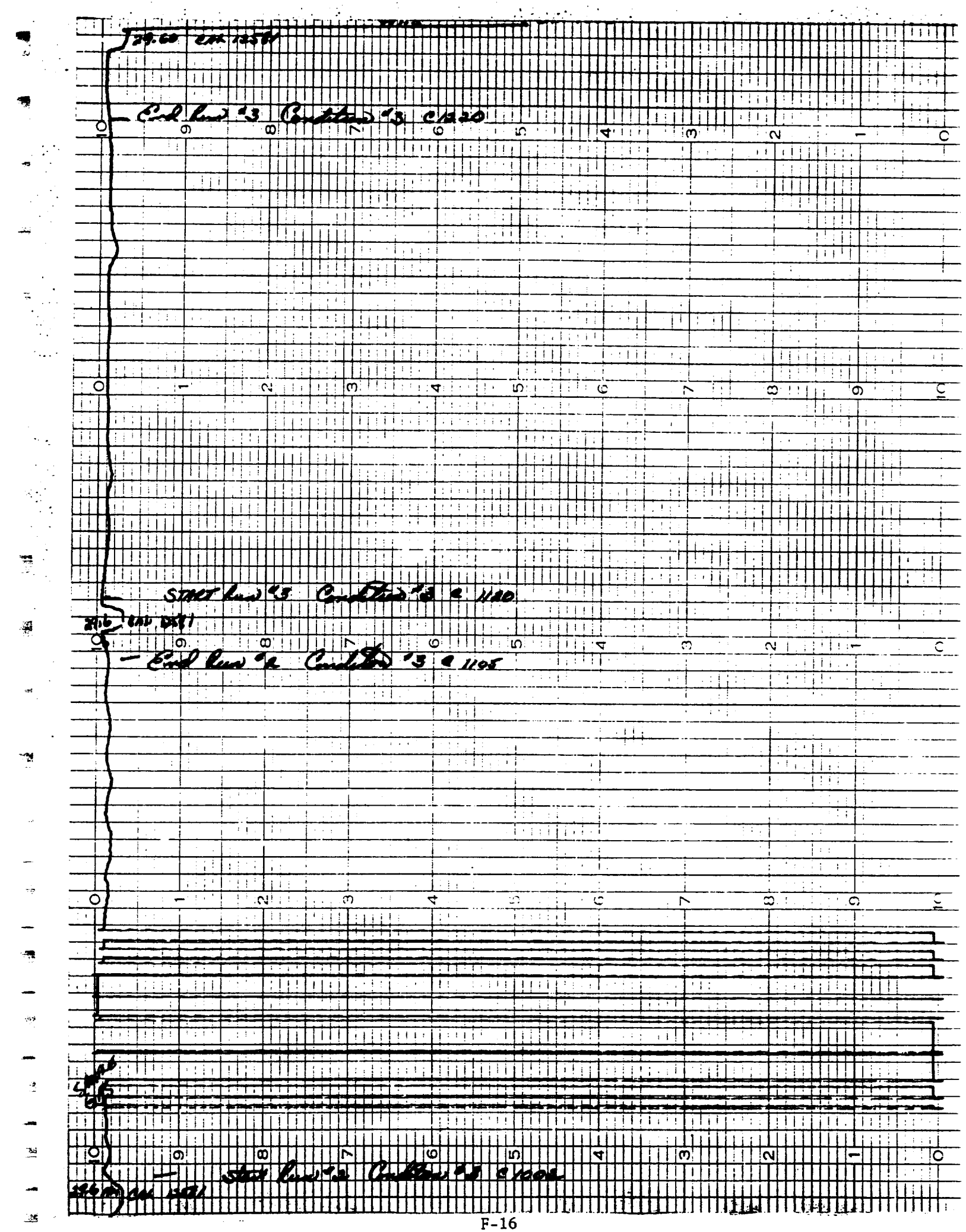
90-22 Firestone

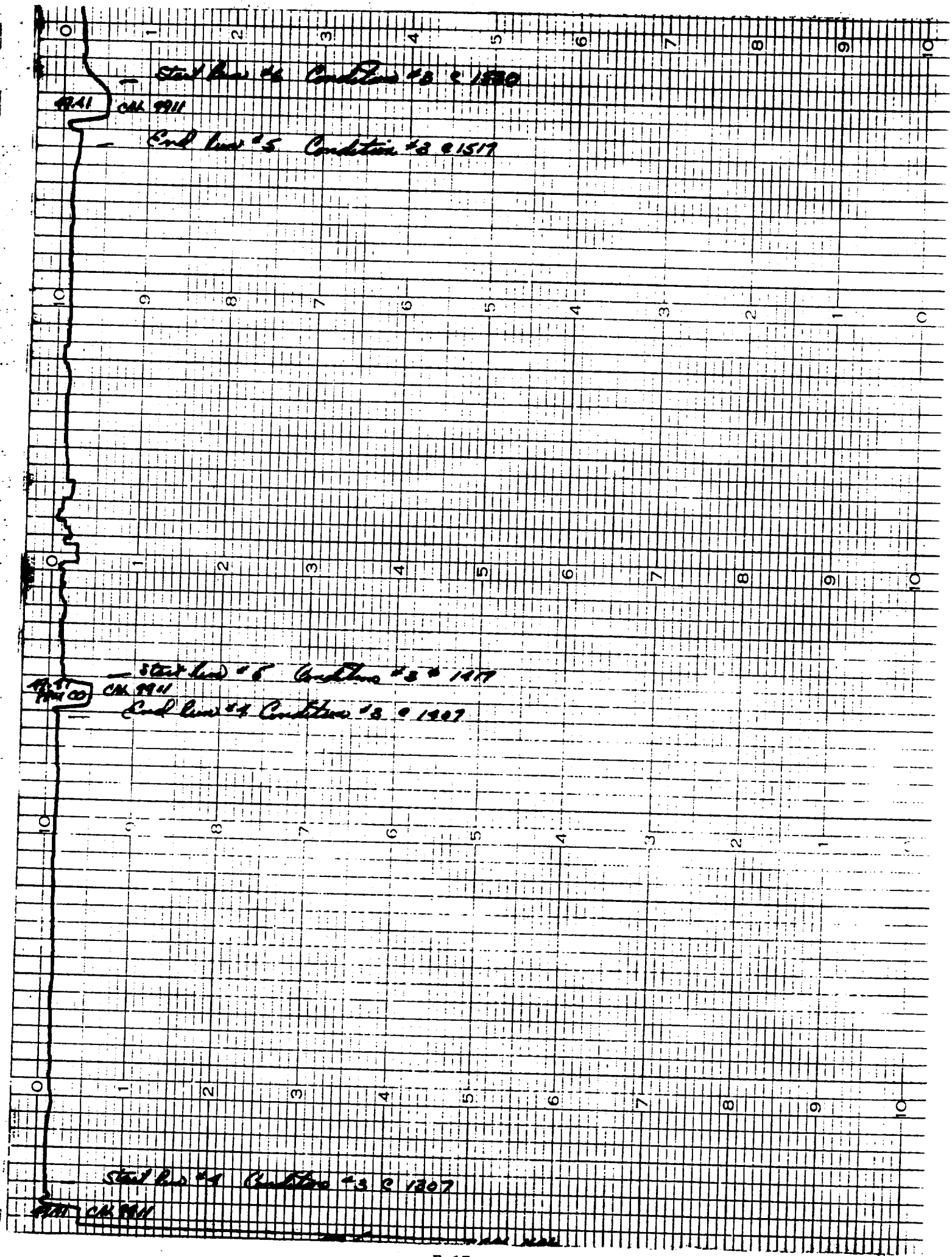
Carbon Monoxide Monitor Calibration Curve

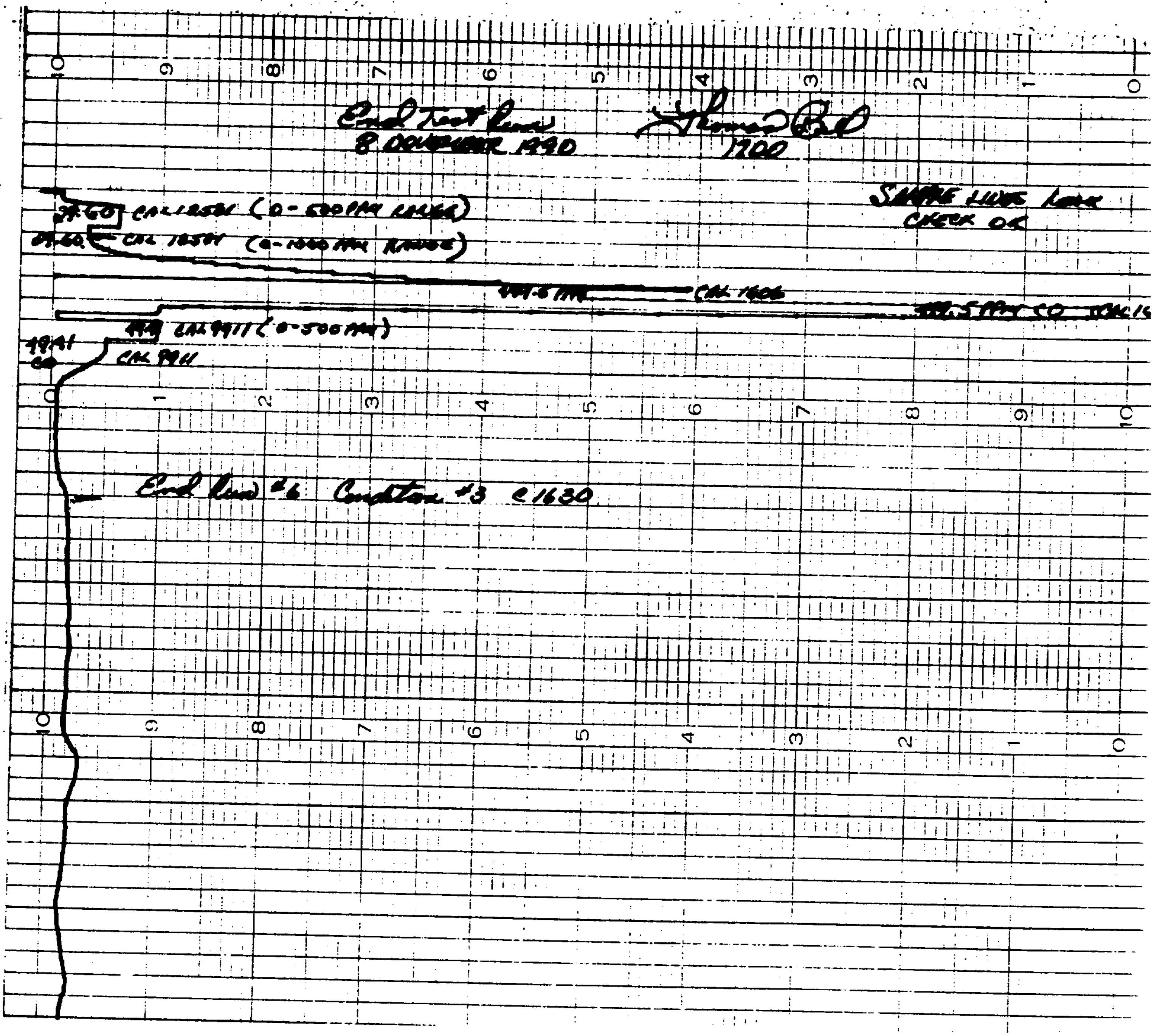
Boiler FB114 Stack 11/8/90



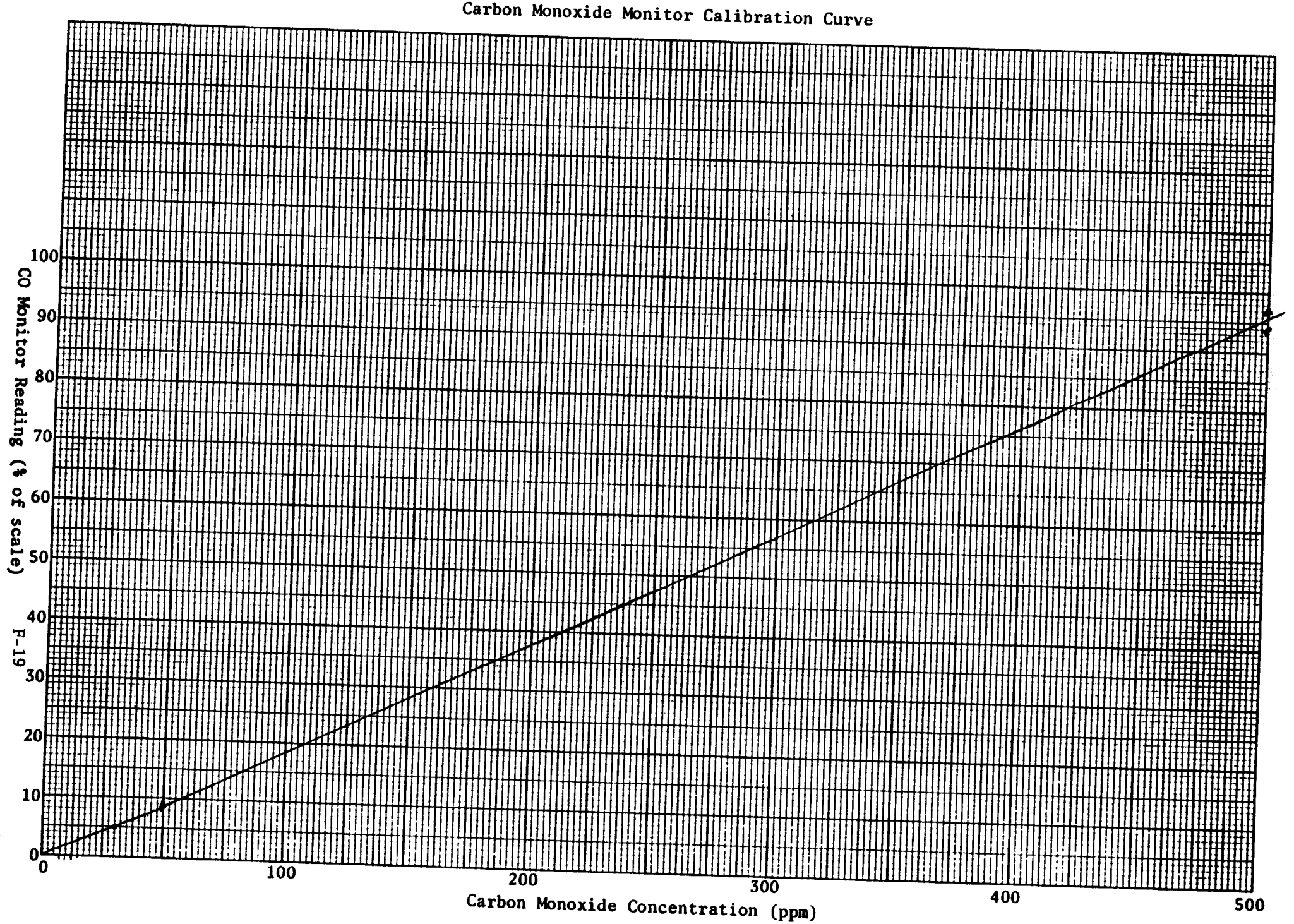

End Run #1 Condition #3 @ 0946
START Run #1 Condition #3 @ 0846
CO Range 0-1000 PPM
CHART SPEED 6"/HR
- Stop test @ 0818 cleaning out fuel lines
Start Run #1 Condition #3 @ 0815
594.32 PPM CAL 1176
29.60 PPM CO CAL 10551
449.5 PPM CAL 1606
SAMPLE LINES LEAKED CHECKED
90-22
FIRESTONE
ORANGE, TX
EB-114 EXHAUST
8 NOVEMBER 1990
CO RANGE
0-1000 PPM
THERMO ENVIRONMENTAL
MODEL 48
SERIAL # 48-27837-230
CHART SPEED 6"/HR

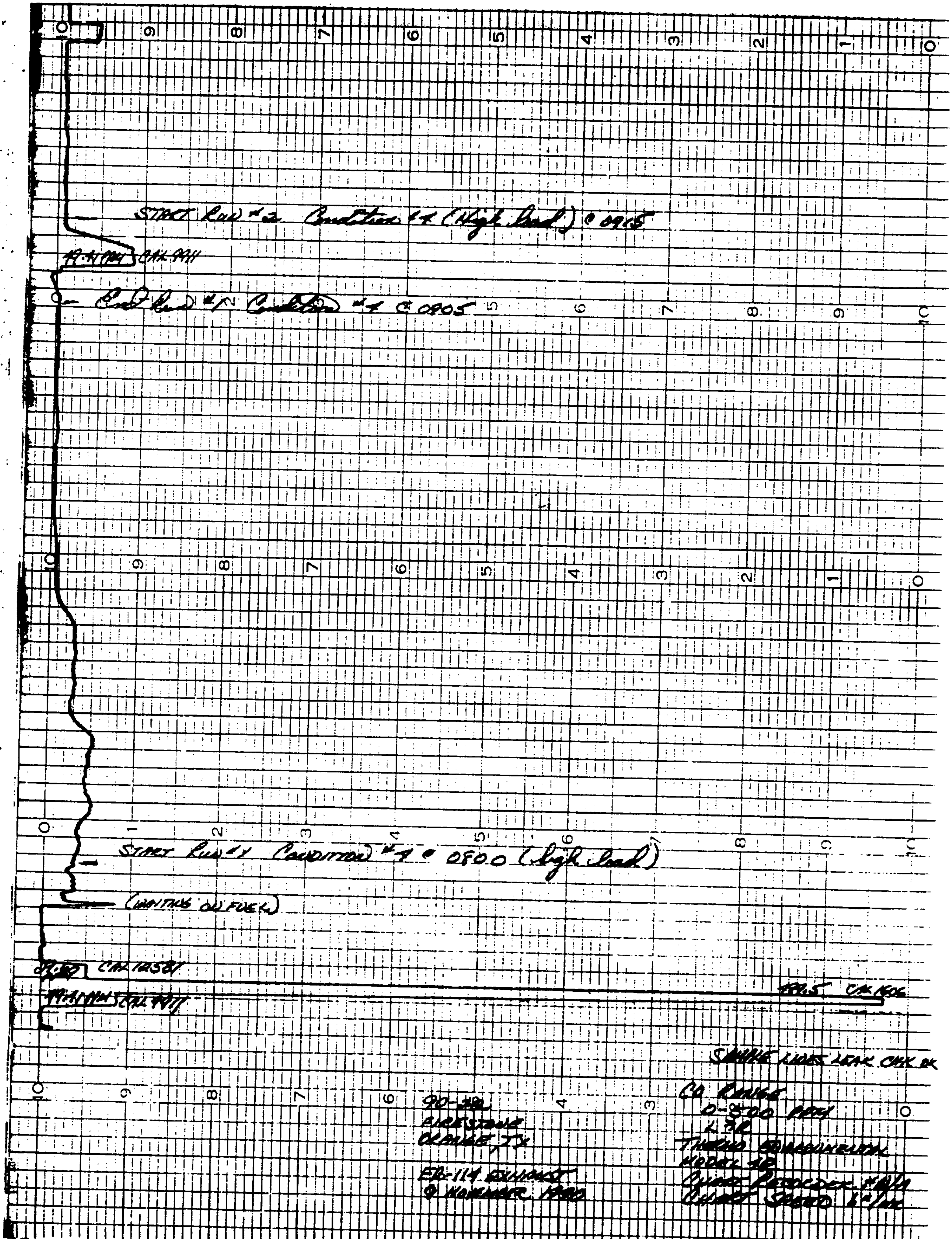

29.60 cm 1250
End Run #3 Condition #3 @ 1120
START Run #3 Condition #3 @ 1120
End Run #2 Condition #3 @ 1105

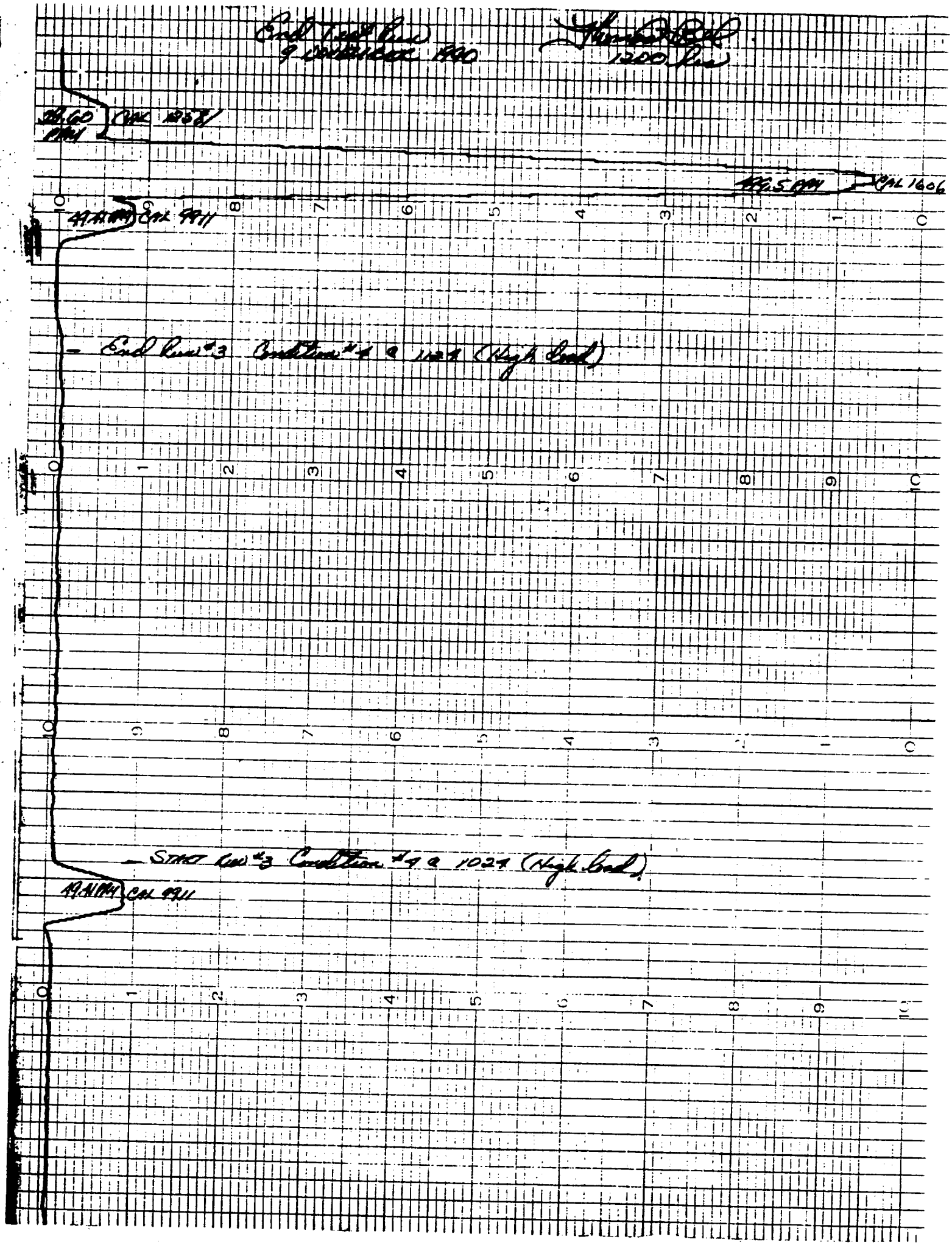

Stud Run #4 Condition #3 @ 1530
CAL 9911
Stud Run #5 Condition #3 @ 1517
Stud Run #6 Condition #3 @ 1447
CAL 9911
Stud Run #4 Condition #3 @ 1307
Stud Run #4 Condition #3 @ 1307
CAL 9911


End Test Run
8 DECEMBER 1990
1700
SAMPLE LINES LEAK CHECK OK
CAL 1250 (0-500 PPM RANGE)
CAL 1250 (0-1000 PPM RANGE)
CAL 1606
CAL 9911 (0-500 PPM)
CAL 9911
End Run #6 Condition #3 @ 1630

46 1240




START RUN #2 Condition #4 (High Load) @ 0915
End Run #1 Condition #4 @ 0805
START RUN #1 CONDITION #4 @ 0800 (High Load)
(WAITING ON FUEL)
SAMPLE LINES LEAK CHK OK
CO RANGE
0-500 PPM
EB-114 EXHAUST


End Run #3 Condition #4 @ 1124 (High Load)
Start Run #3 Condition #4 @ 1024 (High Load)

METCO ENVIRONMENTAL

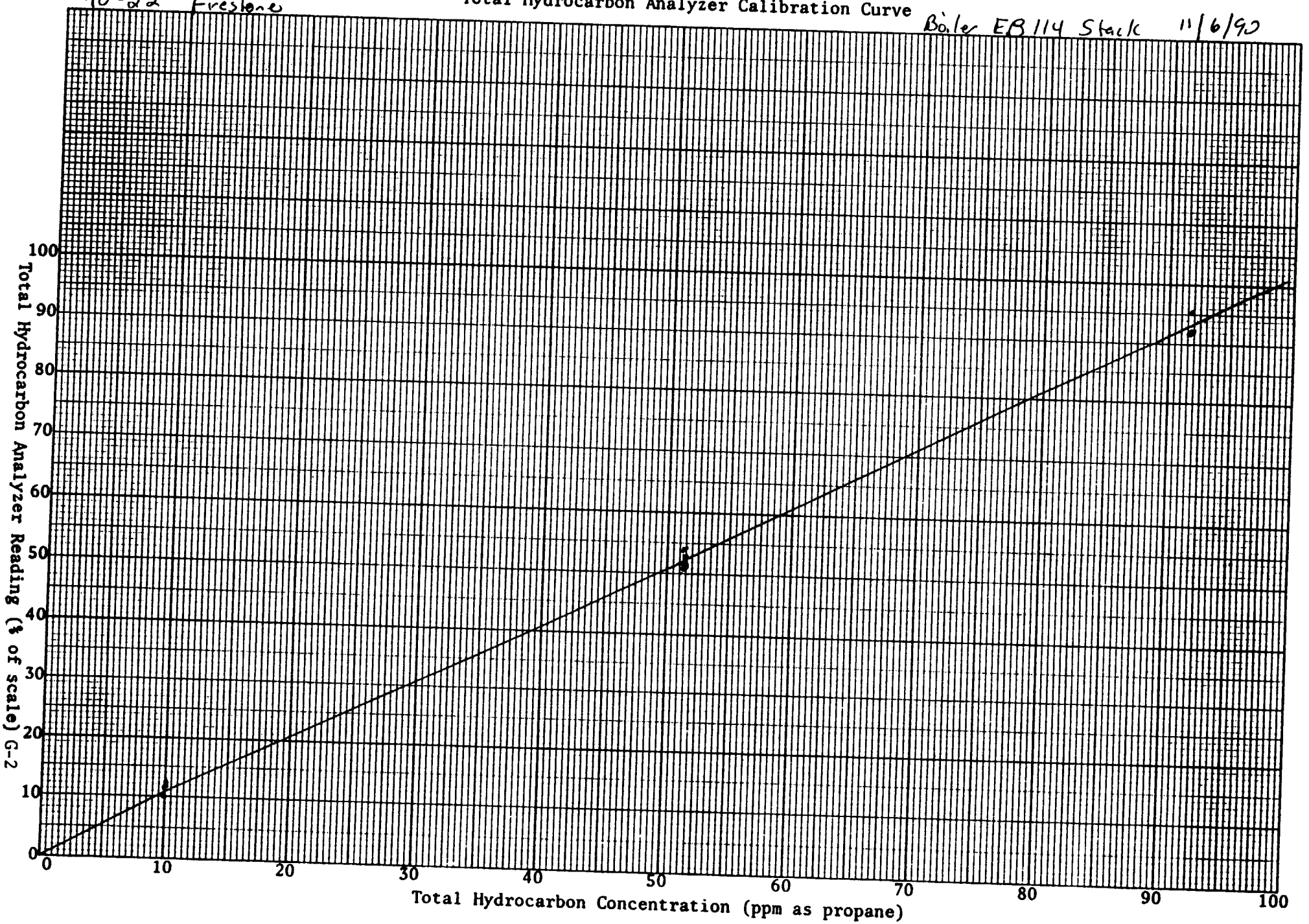
APPENDIX G

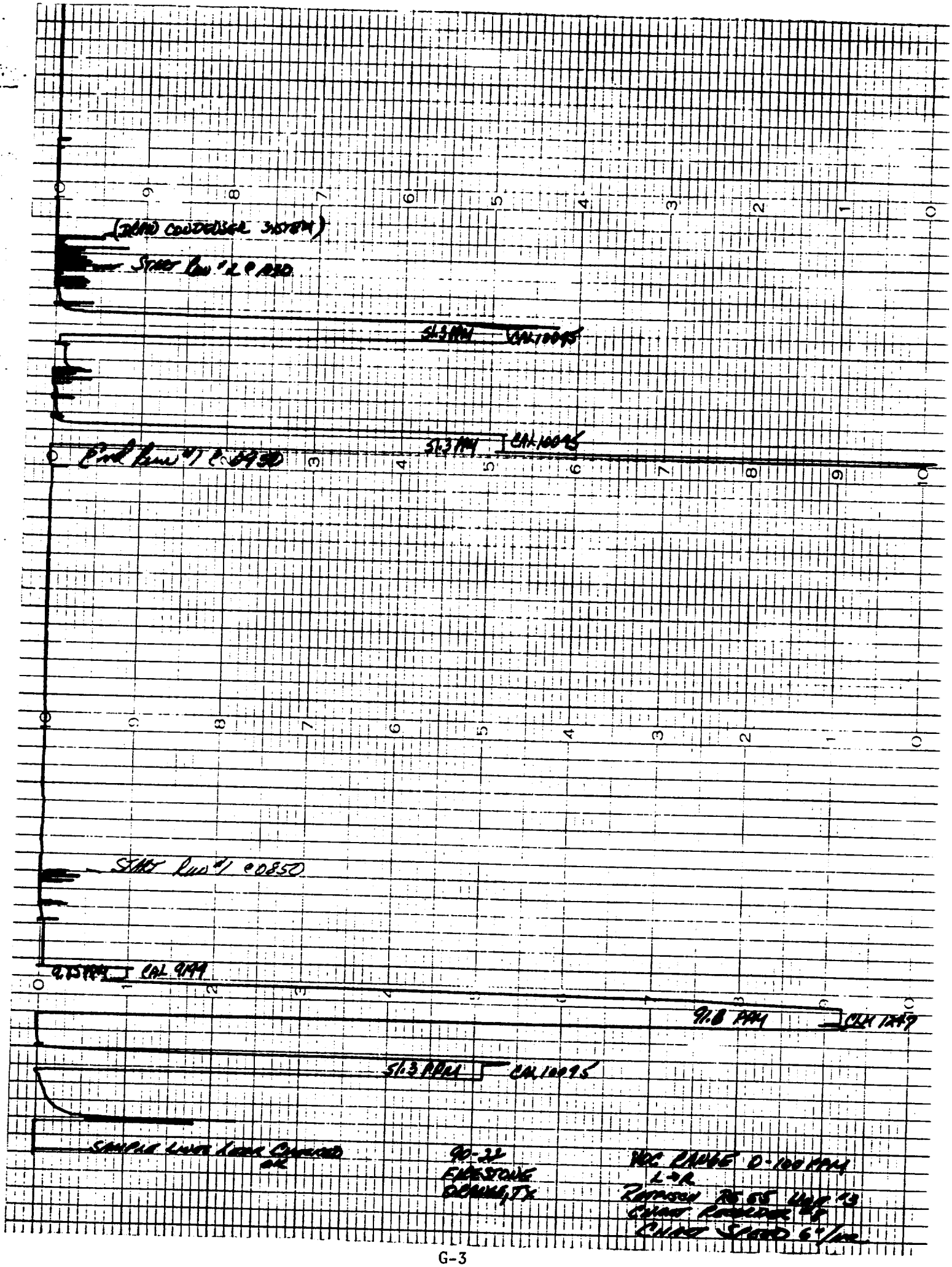
Total Hydrocarbons Monitor Data

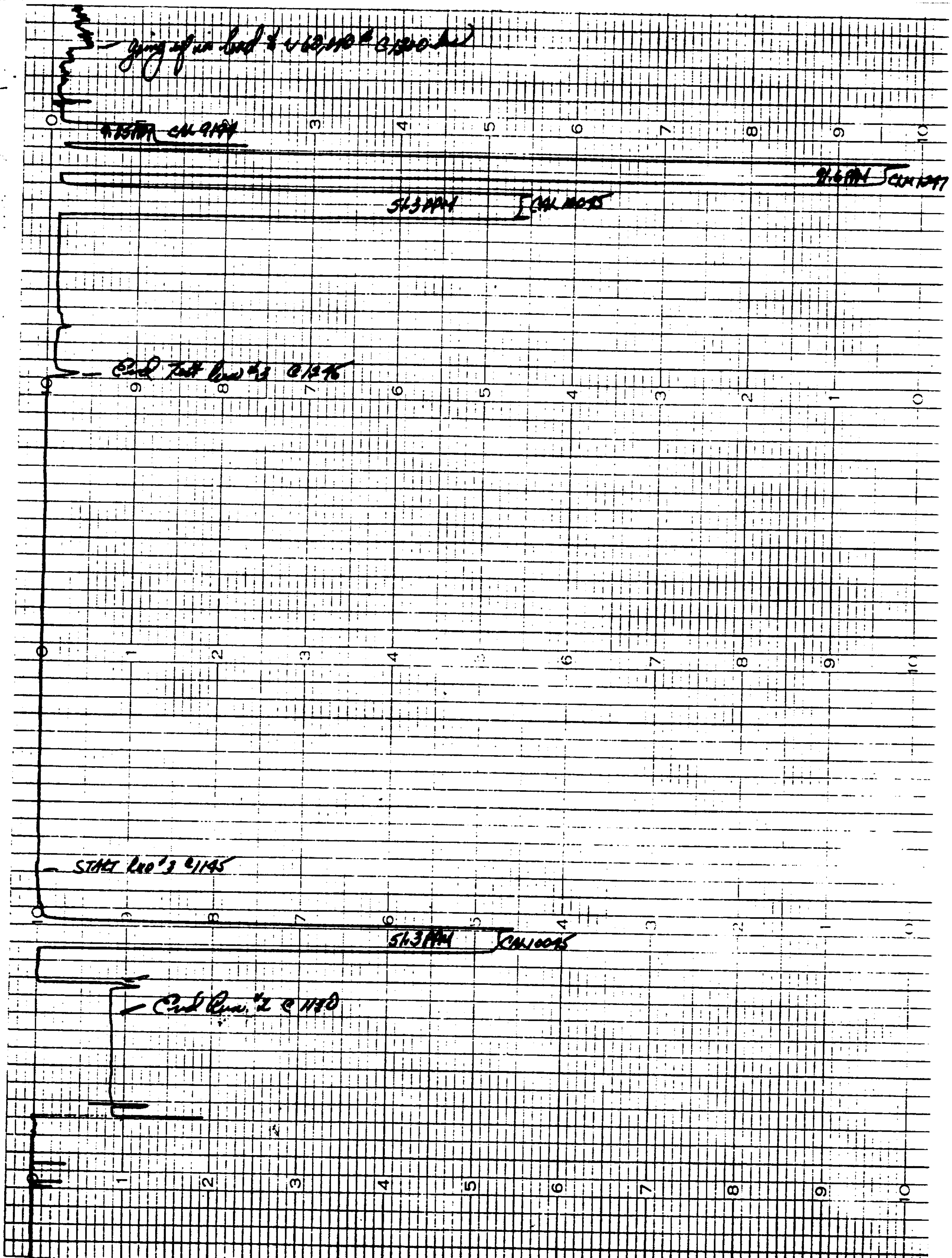
90-22 Freshaire

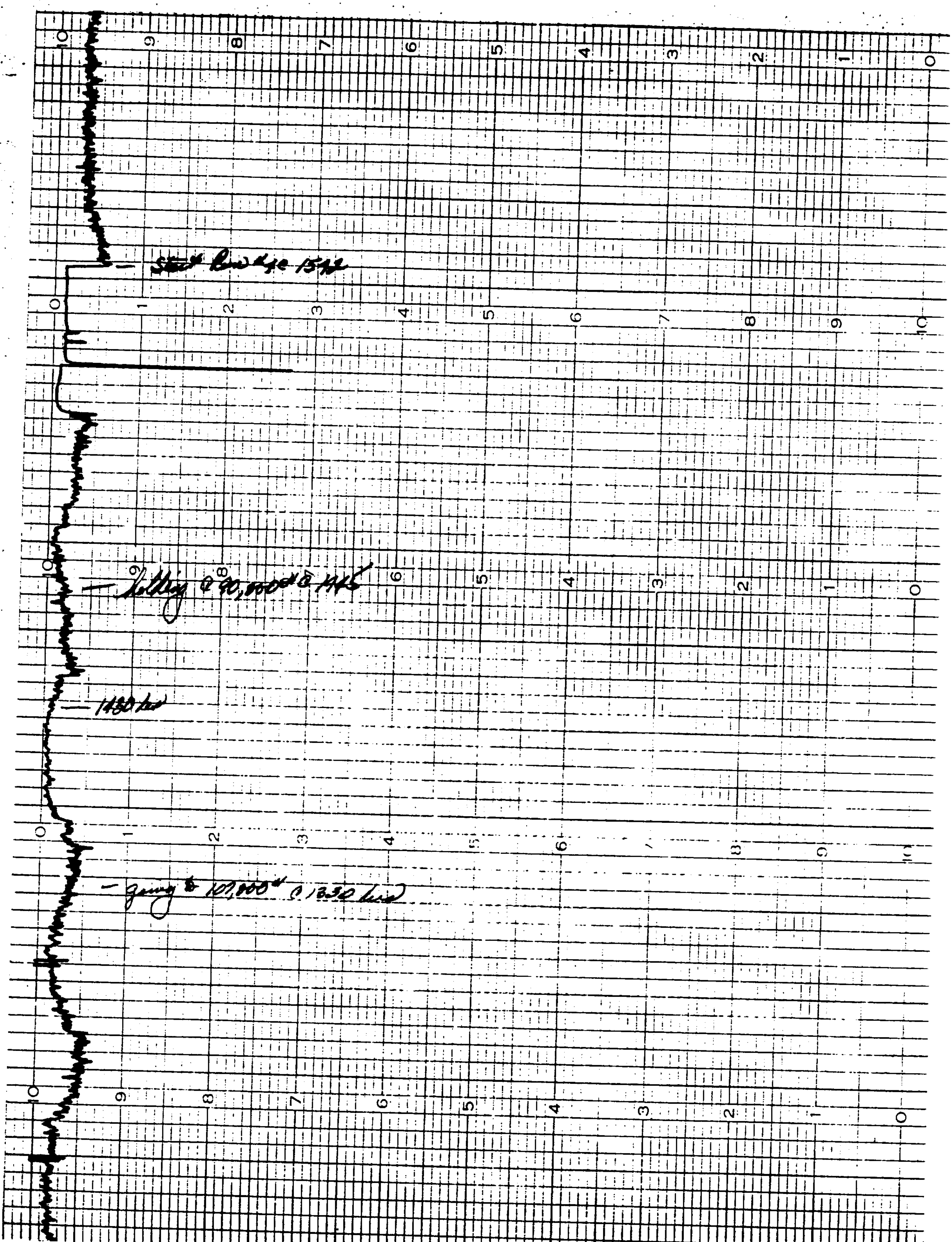
Total Hydrocarbon Analyzer Calibration Curve

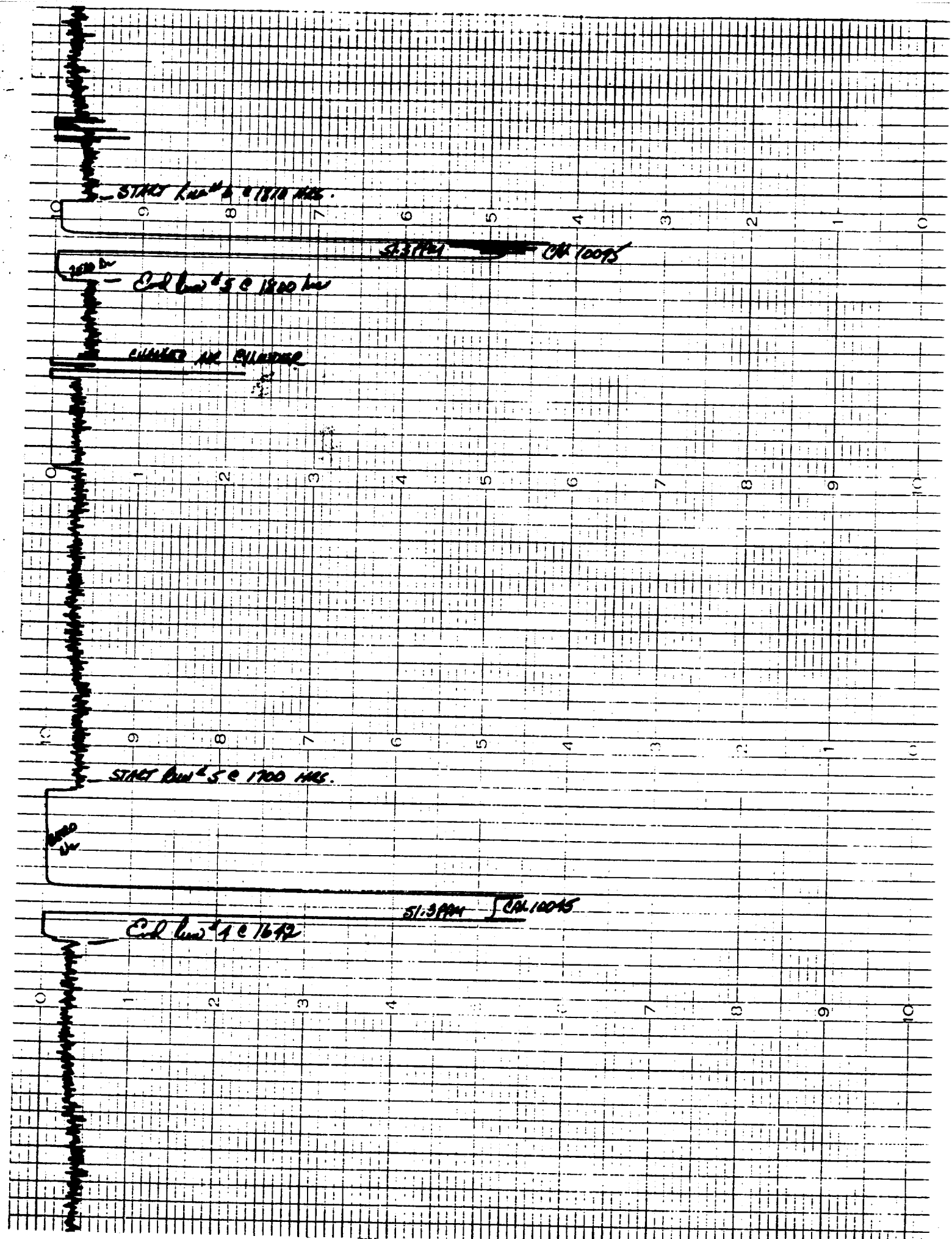
Boiler EB 114 Stack 11/6/90

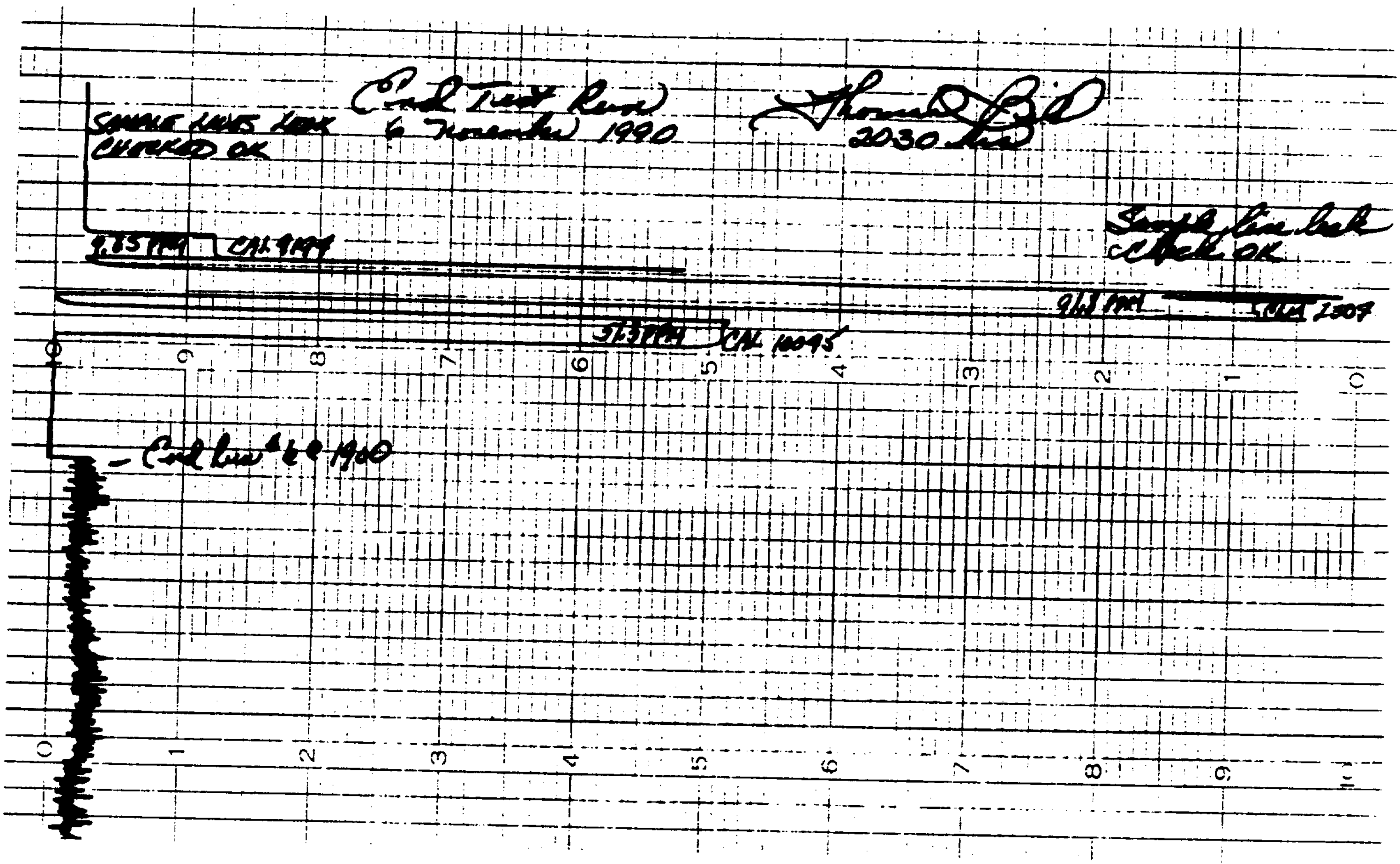



(ZERO CALIBRATION 3:07 PM)
START RUN #2 @ 0830
51.3 PPM
CAL 100 PPM
END RUN #1 @ 0850
START RUN #1 @ 0850
91.8 PPM
CAL 99 PPM
51.3 PPM
CAL 100 PPM
SAMPLE LINE LEAK CHECKED OK
90-22
FIRESTONE
DEER PARK, TX
VOC CALIBRATION 0-100 PPM
L+R
RECORDER RANGE 0-5 VOLTS
CHART SPEED 6"/HR




Settling @ 90,000# @ 1445
1430 hrs
going to 100,000# @ 1330 hrs

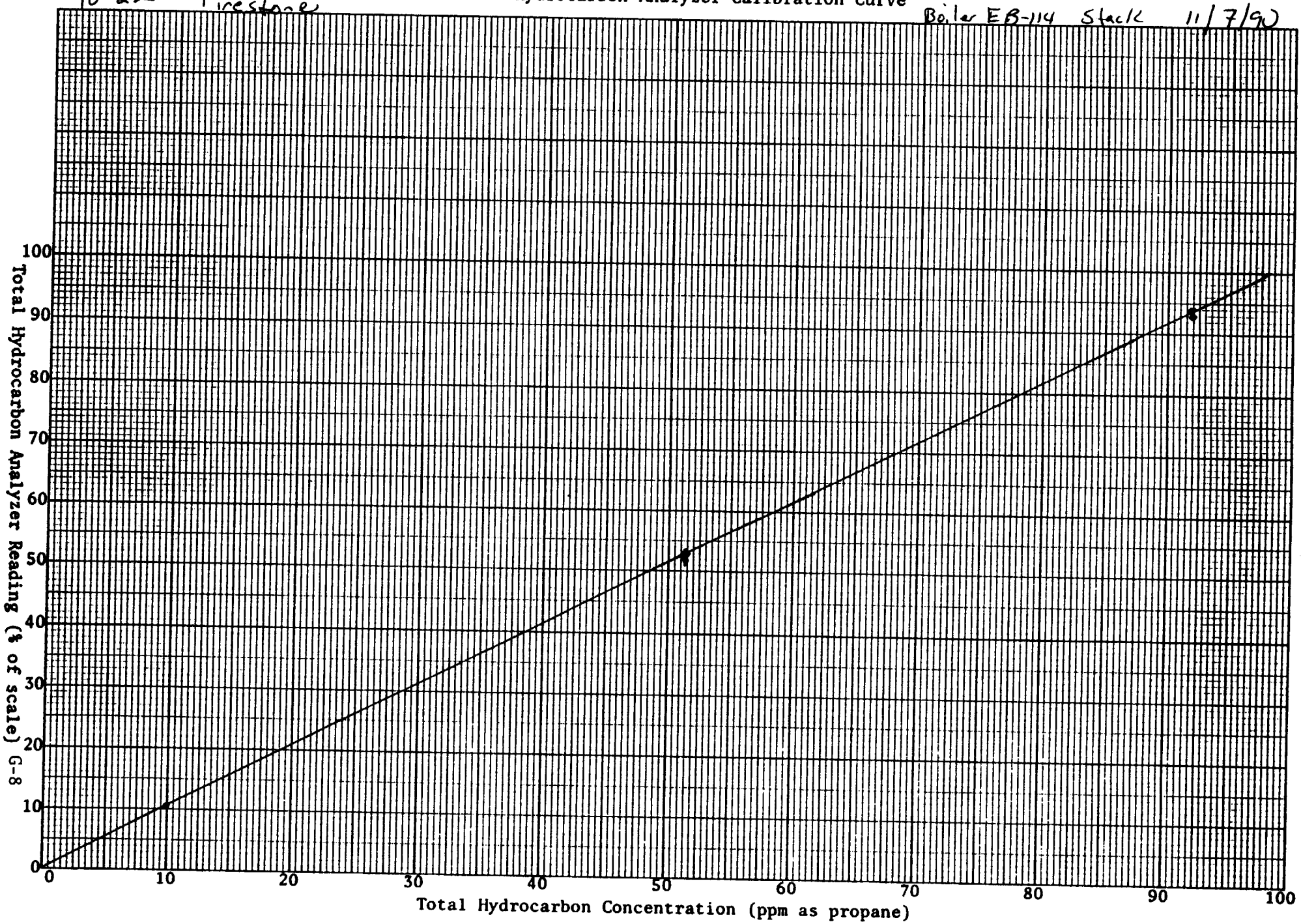

START Run #4 @ 1810 HRS.
SL:3PPM
CAL 10075
Cool Run #5 @ 1800 hrs
CHANGE AIR CYLINDER
START Run #5 @ 1700 HRS.
SL:3PPM
CAL 10045
Cool Run #4 @ 1642

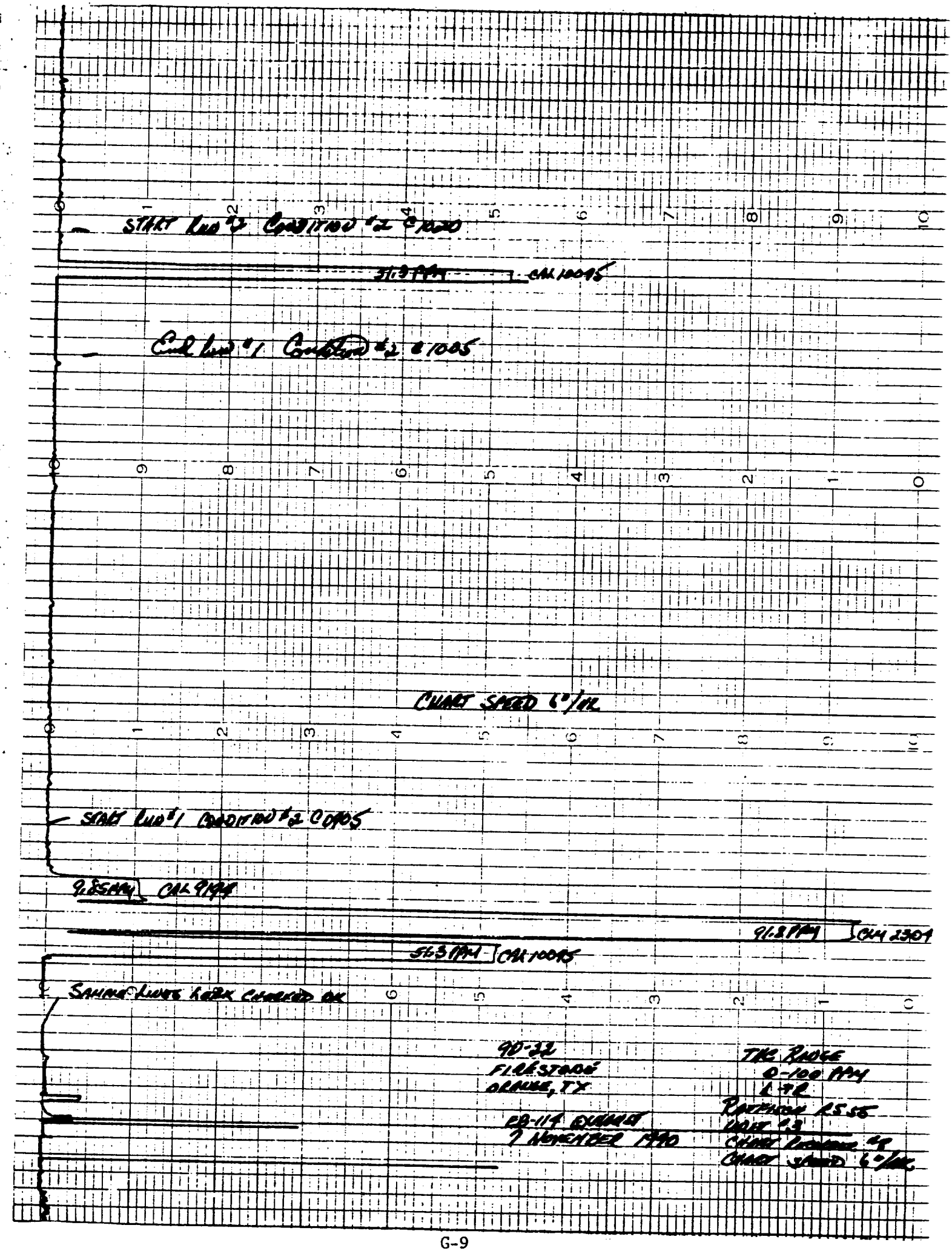

2030

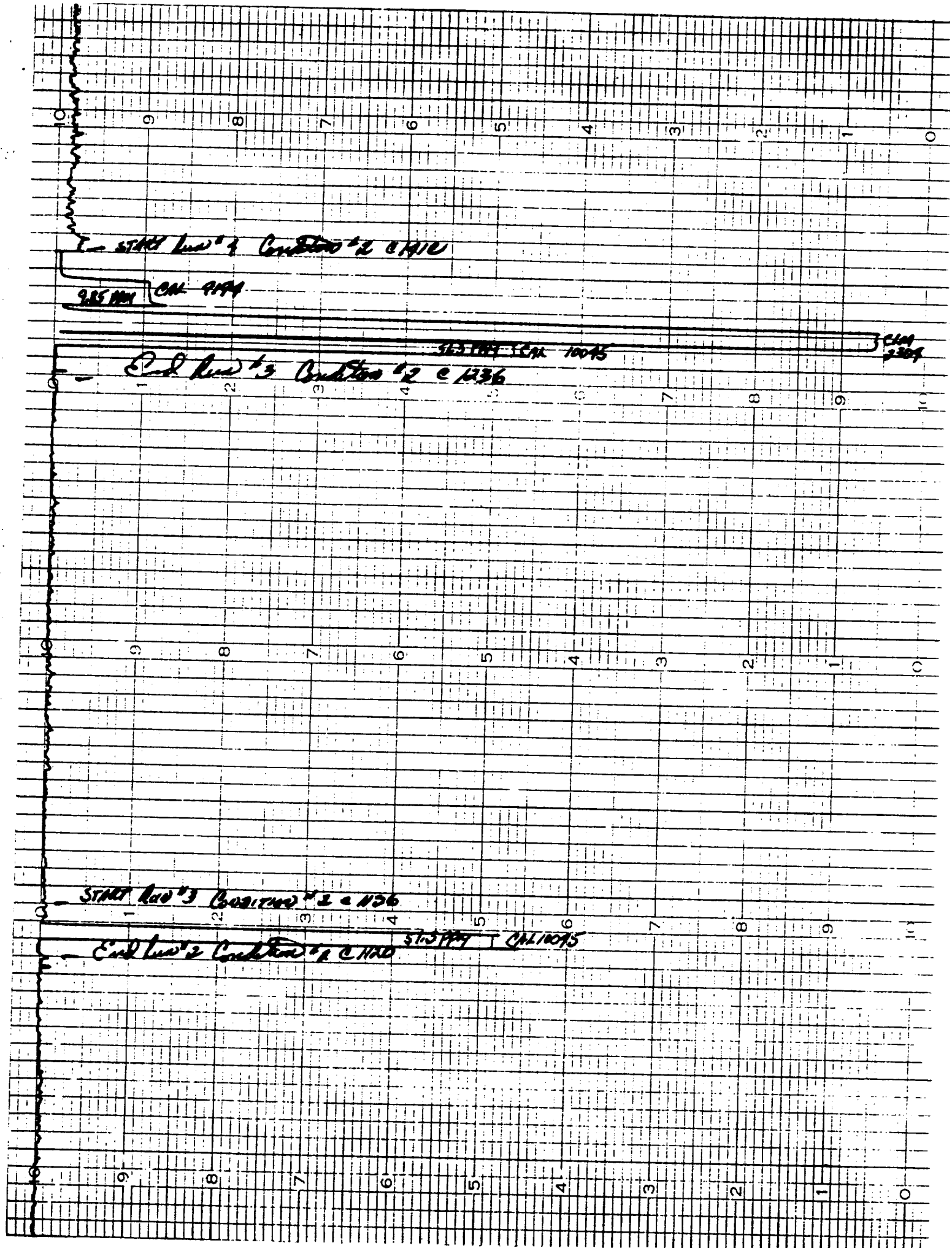
90-22 Firestone

Total Hydrocarbon Analyzer Calibration Curve

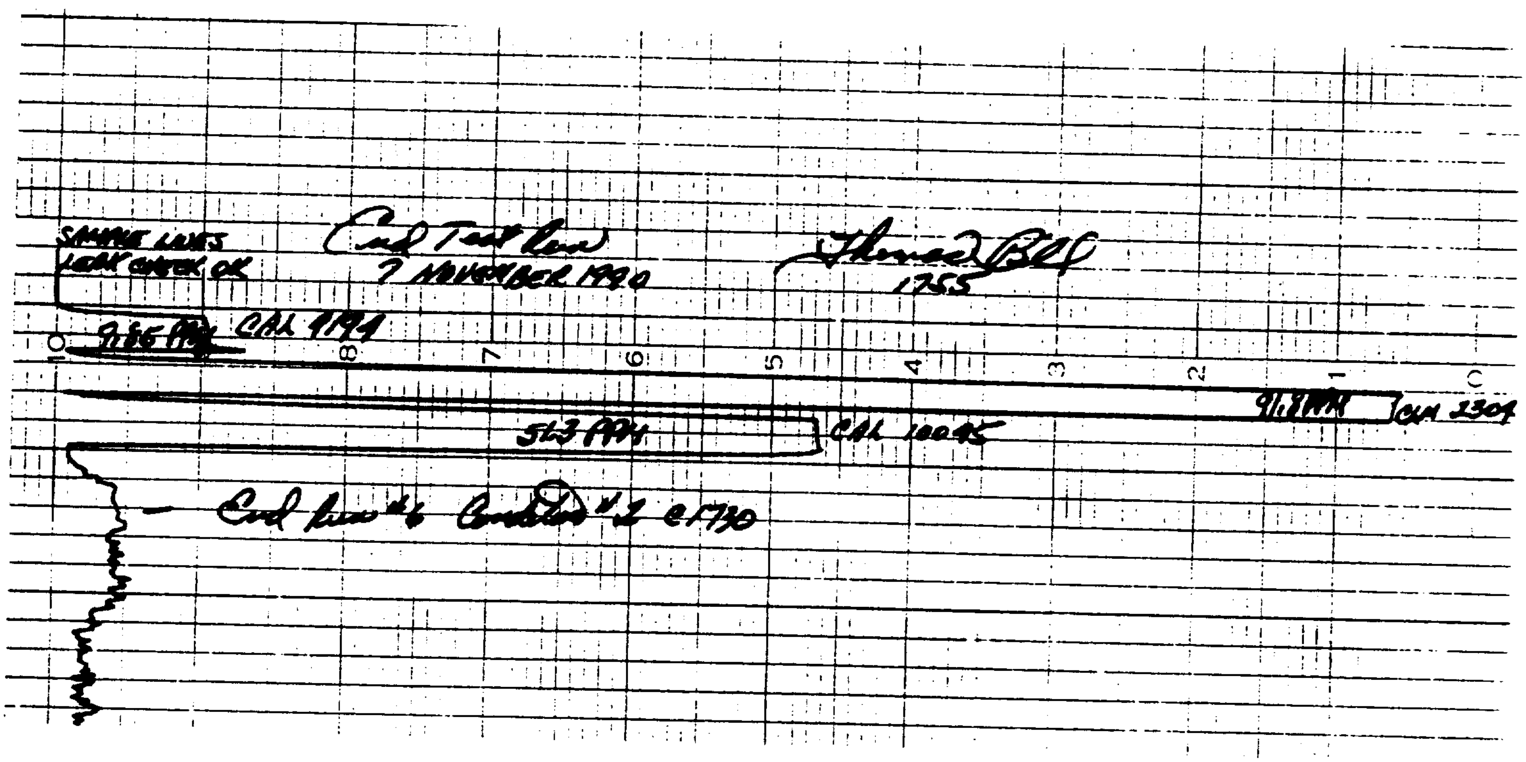
Boiler EB-114 Stack 11/7/90




START Lot #2 Condition #2 @1000
CAL 1004
End Lot #1 Condition #2 @1005
CHART SPEED 6"/HR
START Lot #1 Condition #2 @1005
CAL 1304
563 PPM
CAL 1004
SAMPLE LINES KEPT CLOSED OK
90-32
FLAGSTAFF
ORANGE, TX
CB-114 EXAMS
7 NOVEMBER 1990
THE RANGE
0-100 PPM
1-92
RAYTHEON RS-55
LINE 23
CHART SPEED 6"/HR


START Load #1 Condition #2 CH12
385 mm CAL 9999
END Load #3 Condition #2 CH36
START Load #3 Condition #2 CH36
END Load #2 Condition #2 CH20

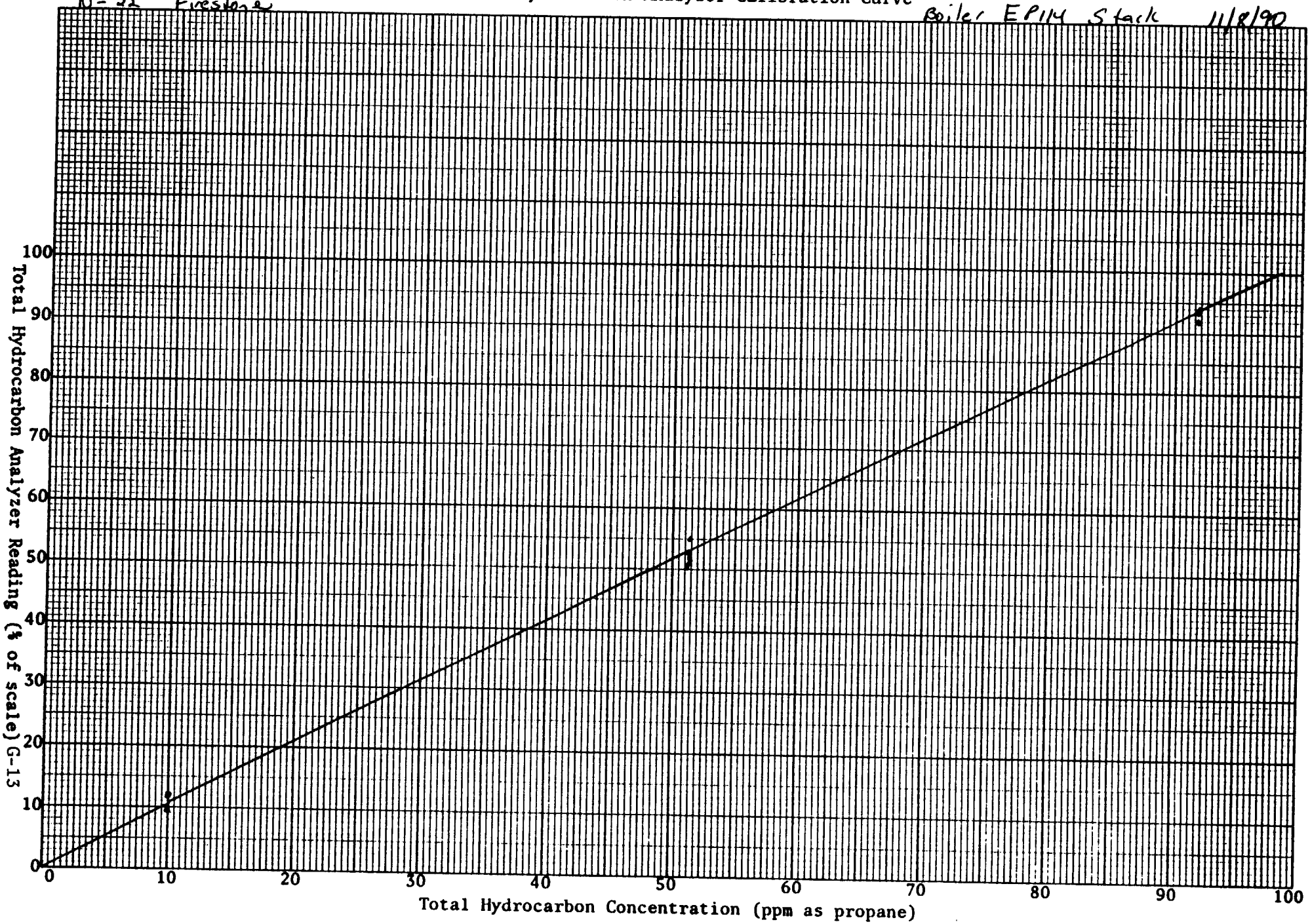
– Start Run #6 Condition #2 @ 1630
– End Run #3 Condition #2 @ 1822
CHL 10045
– Start Run #3 Condition #2 @ 1522
– End Run #1 Condition #2 @ 1518


SAMPLE LINES
LEAK CHECK OK
End Test Run
7 NOVEMBER 1990
1755
10
8
7
6
5
4
3
2
1
0
513 PPM
CAL 10045

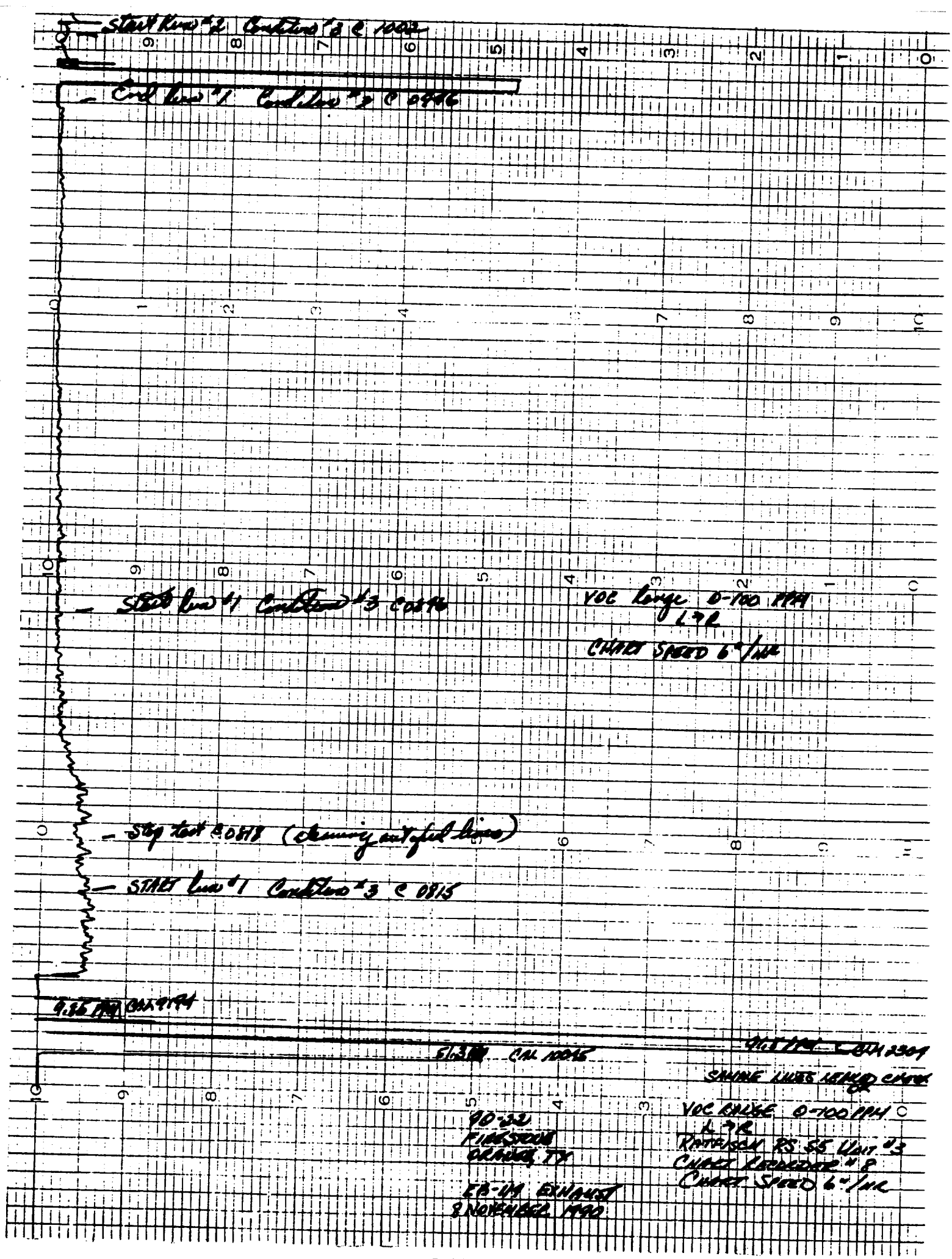
90-22 Fireshore

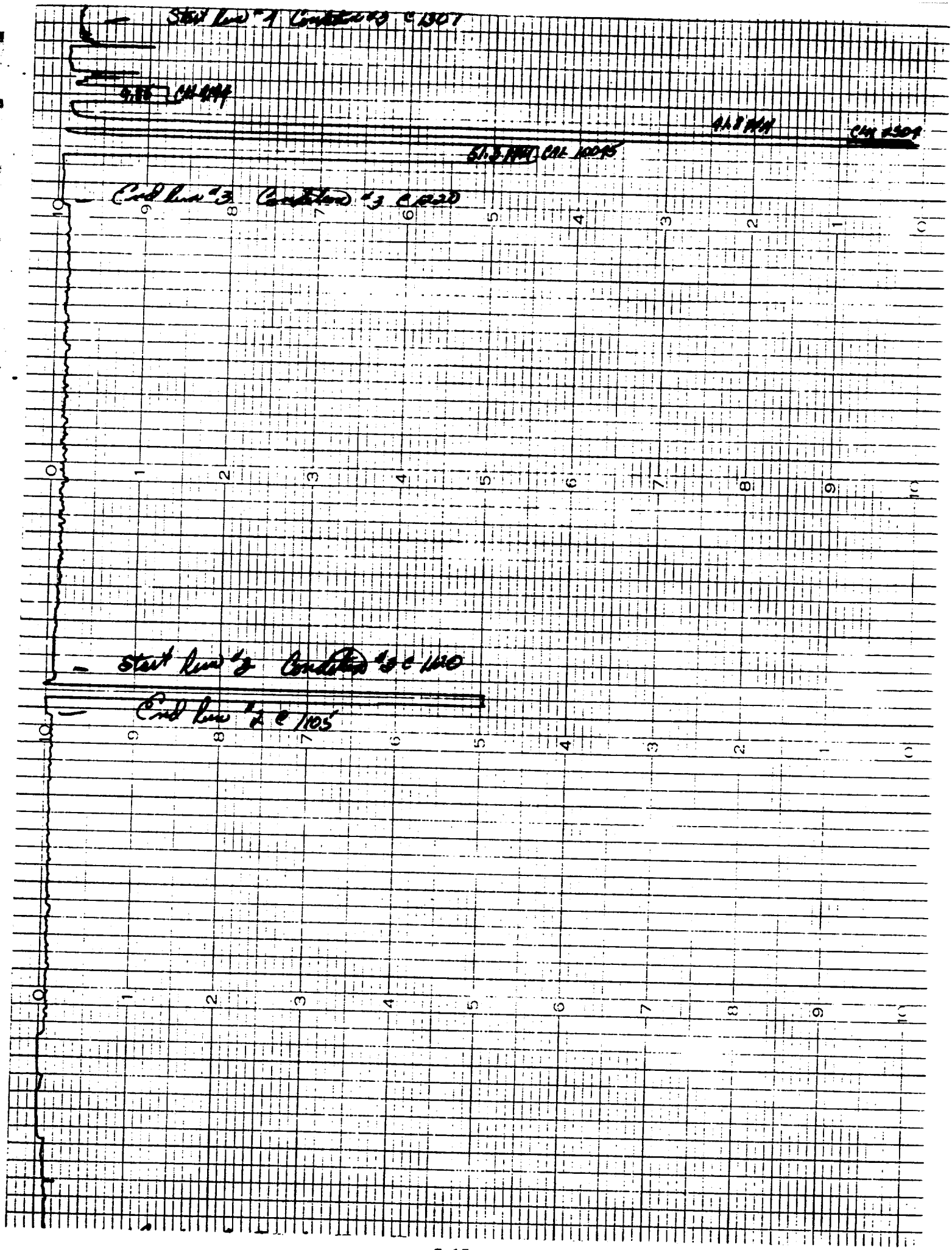
Total Hydrocarbon Analyzer Calibration Curve

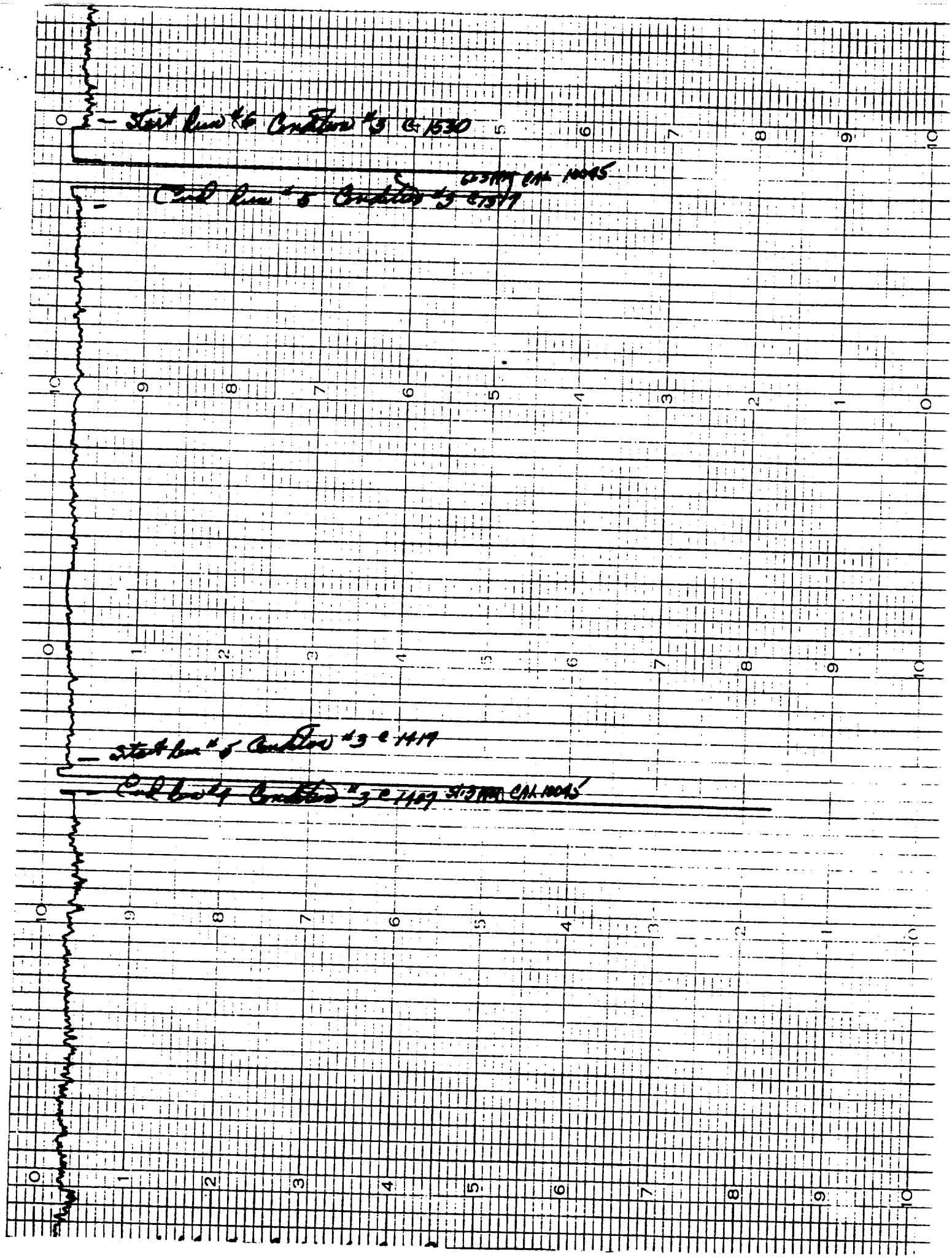
Boiler EP114 Stack 11/8/90

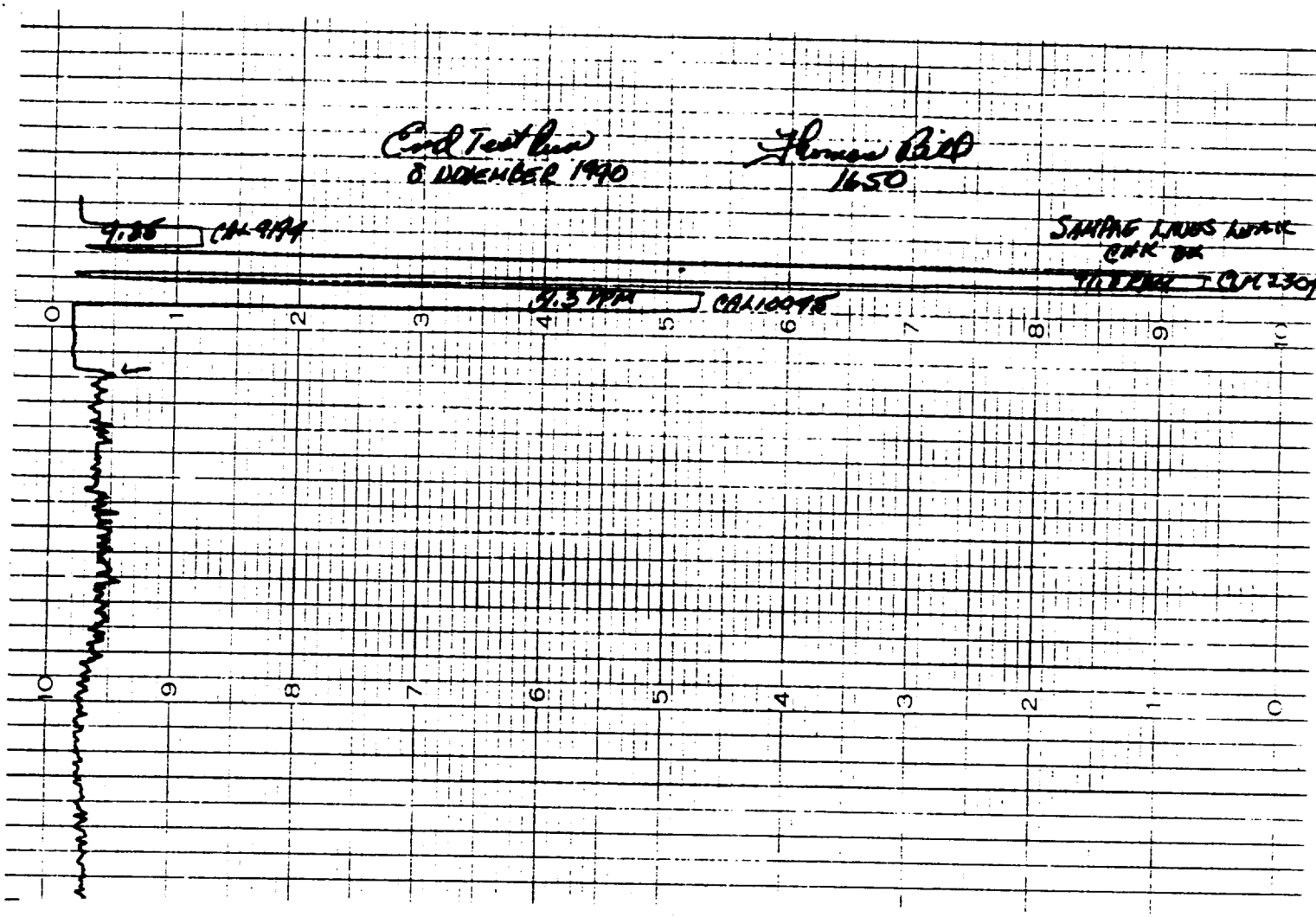


G-13


Start Run #2 Condition 2 @ 1004
End Run #1 Condition 2 @ 0946
Start Run #1 Condition #3 @ 0818
VOC Range 0-100 PPM
L-7R
Chart Speed 6"/hr
Stop test @ 0818 (cleaning out fuel lines)
START Run #1 Condition #3 @ 0815
9.55 PPM CALIBRATION
5.3 PPM CAL NOX
90-32
FIRESTONE
AKRON, OH
EB-1A EXHAUST
8 NOVEMBER 1990
SAMPLE LINES HEATED @ 250°F
VOC RANGE 0-100 PPM
L-7R
RENTSCH RS 55 UNIT #3
CHART RECORDER #8
CHART SPEED 6"/HR


Start Line "1" Condition @ 1307
Start Line "3" Condition @ 1320
End Line "3" @ 1105

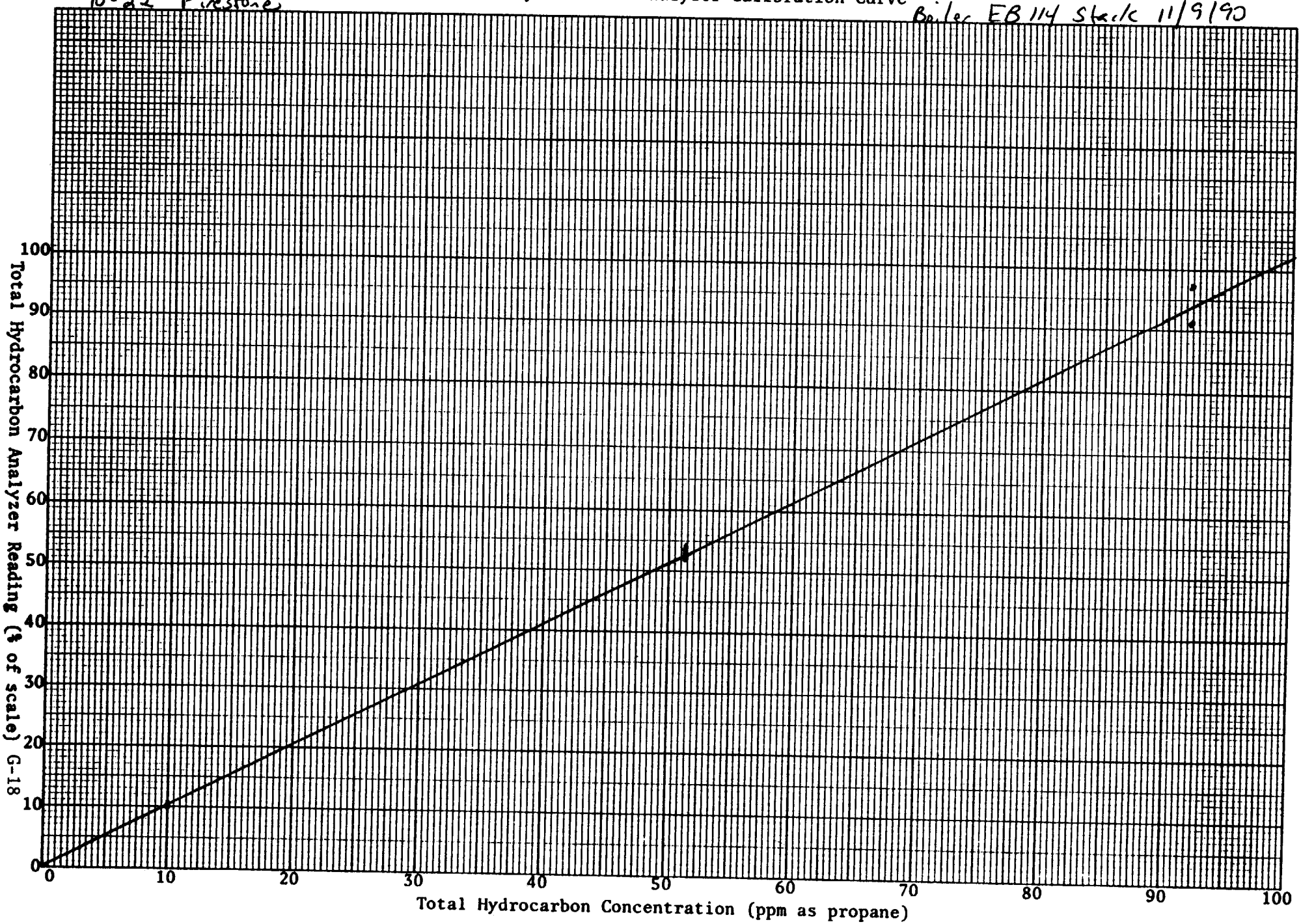

Start Run #6 Condition #3 @ 1530
Cont Run #5 Condition #3 @ 1517
Start Run #5 Condition #3 @ 1419
Cont Run #4 Condition #3 @ 1407


Cool Test Run
8 NOVEMBER 1990
Human Bird
1650
9.88 CAL 9.94
SAMPLE LINES LEAK
CHK OK
3.3 PPM CAL 10.15
0
1
2
3
4
5
6
7
8
9
10

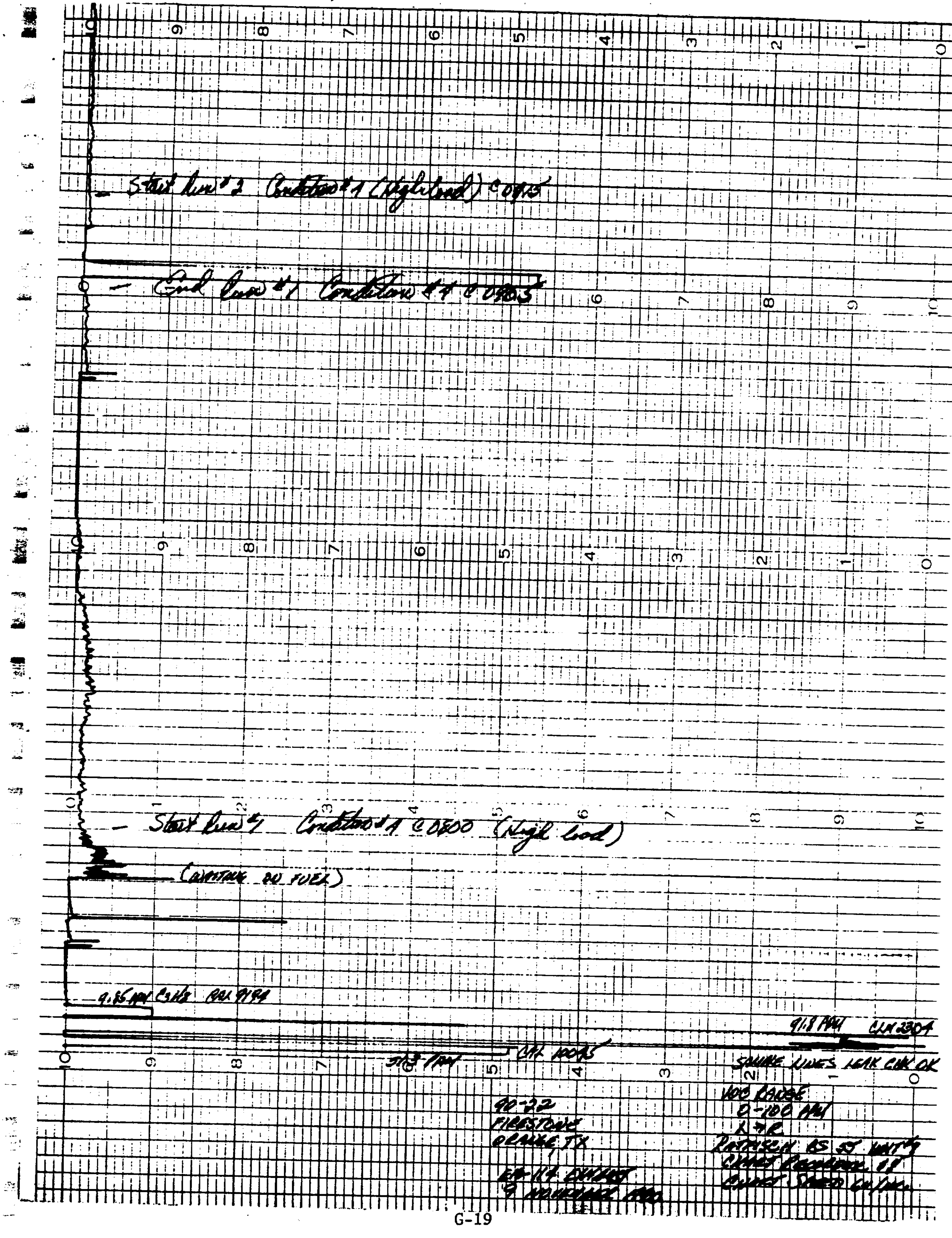
90-22 Firestone

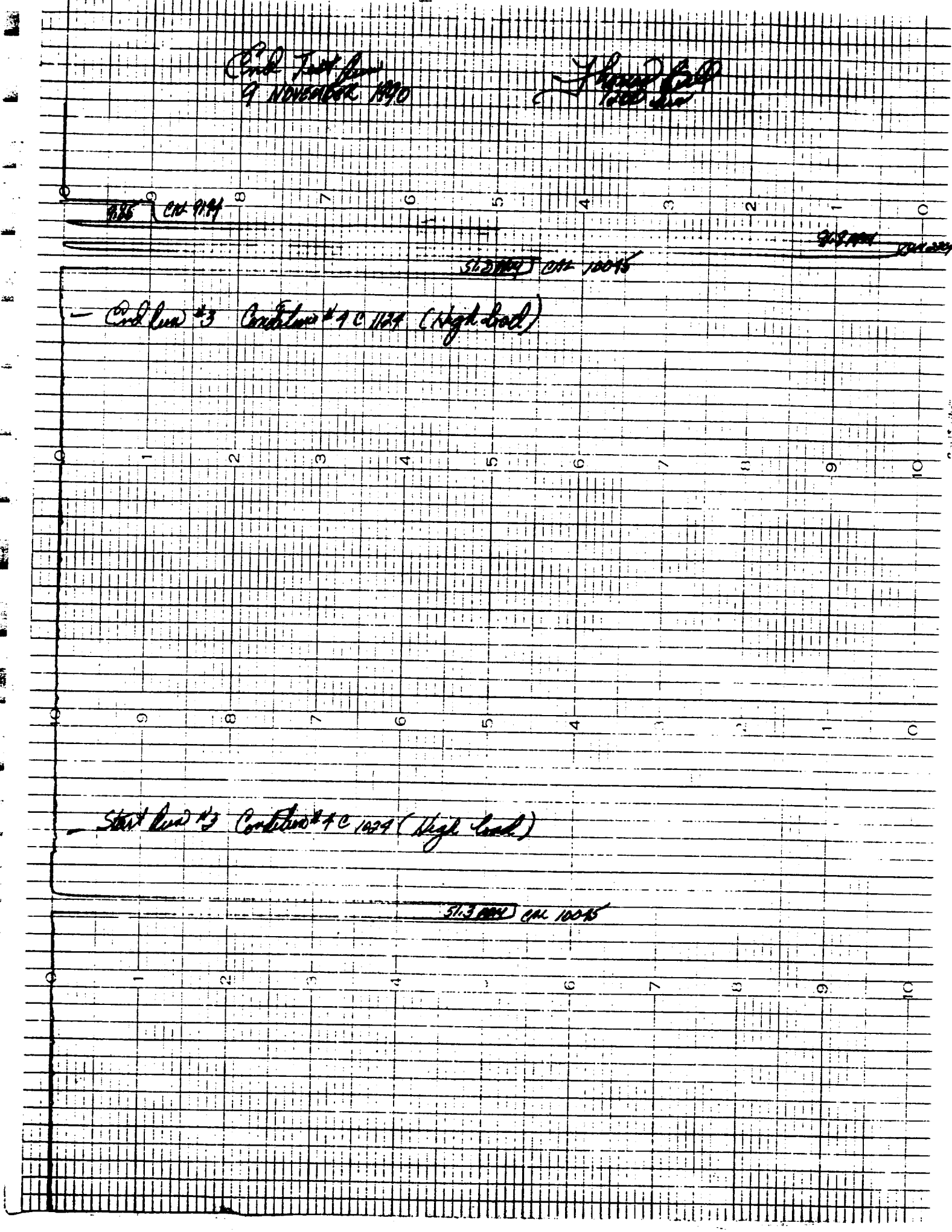
Total Hydrocarbon Analyzer Calibration Curve

Boiler EB 114 Stack 11/9/90



G-18


Start Run #2 Condition #1 (High load) @ 0915
End Run #1 Condition #1 @ 0903
Start Run #1 Condition #1 @ 0800 (High load)
(Waiting on fuel)
Sample lines leak chk OK
90-22
Firestone
Orange TX
VOC Range
0-100 ppm


End Test Run
9 November 1990
Cal 9184
Cal 10045
End Run #3 Condition #1 C 1184 (High Load)
Start Run #3 Condition #1 C 1034 (High Load)
Cal 10045

APPENDIX H

Plant Operational Data

BOILER COMBUSTION TESTS - FIRESTONE ORANGE PLANT NOV.1990

FUEL	TIME	DATE	OXYGEN-%	CO-PPM	STM. LOAD LB/HR	OIL RATE(GPM
GAS	11:45A	11/6	2.9	1	30000	0
GAS	3:30P	11/6	2.82	56	90000	0
GAS	3:40P	11/6	3.43	43	90000	0
GAS	3:50P	11/6	2.53	72	90000	0
GAS & STRM 1	9:50A	11/7	2.45	17	30000	1.8
GAS & STRM 1	11:05A	11/7	2.78	17	30000	1.6
GAS & STRM 1	2:15P	11/7	3.4	48	70000	4.8
GAS & STRM 1	3:30P	11/7	3.64	44	70000	4.5
GAS & STRM 1	4:05P	11/7	2.99	82	70000	4.5
GAS & STRM 3	8:45A	11/8	2.76	13	72000	5
GAS & STRM 3	8:50A	11/8	3.03	11	70000	5
GAS & STRM 3	9:00A	11/8	2.88	13	70000	5.5
GAS & STRM 3	1:15P	11/8	3.53	14	30000	1.9
GAS & STRM 3	2:15P	11/8	2.92	19	30000	1.7
GAS & STRM 2	8:05A	11/9	2.52	74	72000	5.1
GAS & STRM 2	8:15A	11/9	3.01	31	72000	5.1
GAS & STRM 2	8:50A	11/9	2.91	4	72000	5.1
GAS & STRM 2	9:50A	11/9	2.87	5	72000	5.1
GAS & STRM 2	10:15A	11/9	2.74	8	72000	5.1

APPENDIX I

TACB Permit

GENERAL PROVISIONS

R-2565

1. Equivalency of Methods - It shall be the responsibility of the holder of this permit to demonstrate or otherwise justify the equivalency of emission control methods, sampling or other emission testing methods and monitoring methods proposed as alternatives to methods indicated in the provisions of this permit. Alternative methods shall be applied for in writing and shall be reviewed and approved by the Executive Director prior to their use in fulfilling any requirements of this permit.

2. Sampling Requirements - If sampling of stacks or process vents is required, the holder of this permit must contact the Quality Assurance Division of the Texas Air Control Board (TACB) prior to sampling to obtain the proper data forms and procedures. The holder of this permit is also responsible for providing sampling facilities and conducting the sampling operations at his own expense.

3. Appeal - This permit may be appealed pursuant to Rule 103.81 of the Procedural Rules of the TACB and Section 6.01 of the Texas Clean Air Act. Failure to take such appeal constitutes acceptance by the applicant of all terms of the permit.

4. Construction Progress - Start of construction, construction interruptions exceeding 45 days and completion of construction shall be reported to the appropriate regional office of the TACB not later than 10 working days after occurrence of the event.. This provision shall not apply to operating permits.

5. Recordkeeping - Information and data concerning production, operating hours, sampling and monitoring data, if applicable, fuel type and fuel sulfur content, if applicable, shall be maintained in a file at the plant site and made available at the request of personnel from the TACB or any local air pollution control program having jurisdiction. The file shall be retained for at least two years following the date that the information or data is obtained.

6. Maintenance of Emission Control - The facilities covered by this permit shall not be operated unless all air pollution emission capture equipment and abatement equipment are maintained in good working order and operating properly during normal facility operations.

SPECIAL PROVISIONS

R-2565

1. This permit covers those sources of emissions listed in the attached tables entitled "Emissions Sources - Maximum Allowable Emissions Rates," and those sources are limited to the emission limits and other conditions specified in those attached tables. This permit also covers those other sources of emissions as originally permitted and amended which are not listed on the attached tables.

2. Upon request by the Executive Director of the Texas Air Control Board or any local air pollution control program having jurisdiction, the holder of this permit shall provide a sample and/or an analysis of the fuel(s) utilized in this facility or shall allow air pollution control agency representatives to obtain a sample for analysis.

3. Fuel for the 126.6 MM Btu boilers identified as Emission Points EB-110, EB-111, EB-113, and EB-114 shall be limited to natural gas, fuel oil, the waste from hexane drawdown residues, butane residues and pentane residues.

   A. The boiler(s) shall be operated at no less than 25 percent of maximum design load while firing waste stream residue.

   B. The natural gas fuel shall contain no more than 0.25 grains of hydrogen sulfide and 5 grains total sulfur per 100 dscf.

   C. The fuel oil shall contain no more than 0.5 weight percent sulfur.

   D. The typical composition of the waste fuel stream shall be as described in the attached table entitled "Waste Stream Composition." Individual compounds shall not exceed the maximum weight percent listed in the table.

   E. At least 50 percent of the fuel heat input being fired shall be either natural gas or fuel oil.

   F. Firing of the waste streams shall be limited to 2520 lbs/hr.

   G. Waste stream residue fuel shall not be fired during boiler start-up, shutdown, upset or malfunction.

   X H. Use of any other fuel will require modification of this permit.

   X I. The waste stream fuel shall be fired in only one boiler at any given time.

4. The concentration of carbon monoxide (CO) present in the exhaust stream shall be limited to a maximum of 100 parts per million by volume (ppmv) based on an 8-hour average.

5. The concentration of oxygen (O_2) present in the exhaust stream shall be limited to a maximum of 3.6 percent (dry basis) based on an 8-hour average.

6. Noncomplying emissions of CO are defined as each 8-hour period of boiler operation, except during start-up or shutdown, during which the average emissions of CO exceed the emission limitation of Special Provision No. 4. Such emissions shall also be considered a violation of the emission limitations of Special Provision No. 1.

7. For each boiler, records of boiler operating hours shall be made and maintained on-site for at least a two-year period (rolling retention basis) and shall include at least the following parameters.

   A. Type and quantity of each fuel fired in lb/hr.

   B. Percent of boiler design load.

   Records shall be made available to members of the TACB staff or any other air pollution control program with jurisdiction. Firing of waste stream fuels in excess of 2520 lb/hr. shall be considered to be an exceedance of the Volatile Organic Compound (VOC) emission limit.

[redacted] The holder of this permit shall perform stack sampling and other testing as required to establish the actual pattern and quantities of air contaminants being emitted into the atmosphere from the [redacted] conducted in accordance with appropriate procedures of the TACB Sampling Procedures Manual and in accordance with EPA Reference [redacted] The holder of this permit is responsible for providing sampling and testing facilities and conducting the sampling and testing operation at his expense.

[redacted] The applicable TACB Regional Office shall be contacted as soon as testing is scheduled, but not less than 45 days prior to sampling, to schedule a [redacted] The notice shall include:

1. Date for pretest meeting.
2. Date sampling will occur.
3. Name of firm conducting sampling.
4. Type of sampling equipment to be used.
5. Methods or procedures to be used in sampling.

The purpose of the pretest meeting is to review the necessary sampling and testing procedures, to provide the proper data forms for recording the pertinent data, and to review the format procedures for submitting the test reports.

A written proposed description of any deviation from sampling procedures specified in permit provisions or TACB sampling procedures shall be made available to the TACB at or prior to the pretest meeting. The Regional Director or the Director of the Quality Assurance Division shall approve or disapprove of any deviation from specified sampling procedures.

Air emissions from Emission Points EB-110, EB-111, EB-113 and EB-114 which shall be [redacted] include (but are not limited to) the following: CO, NO_x and VOC. The boiler(s) shall be tested while firing:

[redacted] Natural gas.
Fuel oil.
A fuel mixture of either natural gas or fuel oil and the waste stream residue fuel.

[redacted] If that boiler fails the performance test then one or more of the remaining boilers shall be tested at the discretion of the TACB regional office.

C. Sampling for natural gas and the waste stream residue fuel shall occur within 90 days after the date of approval of this amendment to the facilities and at such other times as may be required by the Executive Director of the TACB. Requests for additional time to perform sampling shall be submitted to the regional office.

D. Within 30 days of the commencement of burning fuel oil in these facilities, the holder of this permit shall submit a schedule for testing to the Executive Director and the appropriate regional office of the TACB. Air contaminants to be tested for shall be those specified in Special Provision No. 8. B. of the amended operating permit. The testing shall be completed and reports submitted within 60 days of the date of commencement of oil firing or as agreed upon by the regional office. If the facilities fail to meet the emission

limits for fuel oil burning as required by the operating permit, the holder of this permit shall cease burning oil immediately upon notification of such failure by the Executive Director. The Executive Director may specify retesting on an appropriate schedule.

The boiler(s) shall operate at design maximum load and the minimum point in the normal operating range during stack emission testing. Primary operating parameters that enable determination of load shall be monitored and recorded during the stack test. These parameters are to be determined at the pretest meeting. If the boiler is unable to operate at design maximum load during testing, then future rates may be limited to the rates established during testing. Additional stack testing may be required when higher load rates are achieved.

F. Two copies of the final sampling report shall be forwarded to the TACB within 30 days after sampling is completed. Sampling reports shall comply with the attached provisions of Chapter 14 of the TACB Sampling Procedures Manual. The reports shall be distributed as follows:

One copy to the appropriate TACB regional office.
One copy to the Quality Assurance Division, TACB, Austin Office.

[redacted] to:

A. Measure and record on the boiler firing the waste stream the concentrations of [redacted] in the exhaust stack. 8-hour average concentrations shall be calculated in percent concentration.

B. Measure and record on the boiler firing the waste stream the concentrations of [redacted] in the exhaust stack. 8-hour average concentrations shall be calculated in ppmv.

C. The CEMS required in Special Provision No. 9A and 9B shall comply with the following requirements:

1. The CEMS shall meet the design and performance specifications, pass the field tests and meet the installation requirements and data analysis and reporting requirements specified in the applicable Performance Specifications in 40 CFR 60, Appendix B. The Performance Specification tests shall be conducted during the sampling required by Special Provision No. 8 and written copies of the results shall be submitted within 60 days

of completion of the tests to the TACB Regional Office in Beaumont and the TACB Quality Assurance Division in Austin.

2. The system shall be zeroed and spanned daily and corrective action taken when the 24-hour span drift exceeds two times the amounts specified in 40 CFR 60, Appendix B. Each gaseous monitor shall be quality assured at least quarterly using cylinder gas audits (CGA). The CGA method to be used is contained in 40 CFR 60, Appendix F, Procedure 1, Section 5.1.2.

3. The gaseous monitoring data shall be reduced to 8-hour average concentrations at least once every day, using a minimum of eight equally spaced data points from each 8-hour period. Three 8-hour averages shall be generated per day.

4. All cylinder gas audit exceedances greater than ± 15 percent accuracy and any unscheduled CEMS downtime shall be reported to the TACB Regional Office in Beaumont and necessary corrective action shall be taken. Supplemental stack concentration measurements may be required at the discretion of the Regional Director.

10. The holder of this permit shall submit to the TACB Regional Office in Beaumont and the TACB Compliance Division in Austin quarterly reports as described in 40 CFR 60.7. Such reports are required for each emission unit which is required to be continuously monitored pursuant to Special Provision No. 9. In addition to the information specified in 40 CFR 60.7(c), each report shall contain the hours of operation of the facility and a report summary of the periods of noncomplying emissions and CEMS downtimes by cause.

Standards of Performance for New and Stationary Sources

Revised 12/29/89

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

R-2565

This table lists the maximum allowable emission rates and all sources of air contaminants on the applicant's property covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

Emission Point No. (1)	Source Name (2)	AIR CONTAMINANTS DATA Air Contaminant Name (3)	Emission Rates* #/hr	 TPY
Case I: Natural Gas Firing (4)				
EB-110	126.6 MM Btu/Hr Boiler	SO2	0.08	0.35
		NOX	36.6	160.5
		(5) CO	13.97	61.2
		VOC	0.19	0.82
		PM	0.4	1.75
EB-111	126.6 MM Btu/Hr Boiler	SO2	0.08	0.35
		NOX	36.6	160.5
		(5) CO	13.97	61.2
		VOC	0.19	0.82
		PM	0.4	1.75
EB-113	126.6 MM Btu/Hr Boiler	SO2	0.08	0.35
		NOX	36.6	160.5
		(5) CO	13.97	61.2
		VOC	0.19	0.82
		PM	0.4	1.75
EB-114	126.6 MM Btu/Hr Boiler	SO2	0.08	0.35
		NOX	36.6	160.5
		(5) CO	13.97	61.2
		VOC	0.19	0.82
		PM	0.4	1.75
Case II: Oil Firing (4)				
EB-110	126.6 MM Btu/Hr Boiler	SO2	76.95	337.0
		NOX	41.2	180.5
		(5) CO	13.97	61.2
		VOC	0.75	3.29
		PM	10.8	47.3
EB-111	126.6 MM Btu/Hr Boiler	SO2	-76.95	337.0
		NOX	41.2	180.5
		(5) CO	13.97	61.2
		VOC	0.75	3.29
		PM	10.8	47.3

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

Emission Point No. (1)	Source Name (2)	AIR CONTAMINANTS DATA Air Contaminant Name (3)	Emission Rates* #/hr	TPY
EB-113	126.6 MM Btu/Hr Boiler	SO2	76.95	337.0
		NOX	41.2	180.5
		(5) CO	13.97	61.2
		VOC	0.75	3.29
		PM	10.8	47.3
EB-114	126.6 MM Btu/Hr Boiler	SO2	76.95	337.0
		NOX	41.2	180.5
		(5) CO	13.97	61.2
		VOC	0.75	3.29
		PM	10.8	47.3

(1) Emission point identification - either specific equipment designation or emission point number from plot plan.
(2) Specific point source name.
(3) VOC - volatile organic compounds as defined in General Rule 101.1
NOx - total oxides of nitrogen
SO2 - sulfur dioxide
PM - particulate matter
CO - carbon monoxide
(4) As much as 50 percent of the fuel heat input may be obtained from waste stream residue firing as described in Special Provision 3D.
(5) CO emission limits are based on a maximum CO exhaust concentration of 100 ppmv.

* Emission rates are based on and the facilities are limited by the following maximum operating schedule:

Hrs/day_____Days/week_____Weeks/year_____or Hrs/year 8760

APPENDIX J

Resumes of Test Personnel

METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(214) 931-7127

BILLY J. MULLINS, JR., President

Education

Post Graduate Study in Environmental Engineering at Southern Methodist University, Dallas, Texas, 1970.

M.S. 1969, New York University, New York, New York, in Civil Engineering (Air Resources).

B.S. 1968, Texas Tech University, Lubbock, Texas, in Civil Engineering (Water Resources).

Studies in Engineering at U.S. Naval Academy, Annapolis, Maryland, 1963-1964.

Professional Training Courses

Attended Short Course on Air Pollution Engineering at the University of Texas at Austin, February 1970.

Attended four-week management course presented by the American Management Association, 1976.

Certification

Registered Professional Engineer
Certified Visible Emissions Evaluator
Certified Fallout Shelter Analyst
Licensed Private Pilot (Multi-Engine-Land, Instrument)
Diplomat in the American Academy of Environmental Engineers
Inductee into the Stack Sampling Hall of Fame

Professional Memberships

Air Pollution Control Association - Past Chairman, Southwest Section; Chairman - Consultants Committee
Source Evaluation Society - Past President
Texas Society of Professional Engineers
National Society of Professional Engineers
American Management Association

MULLINS

Technical Experience

Directed and performed stack sampling on over 1400 sources of which over 300 were sampled simultaneously using more than one sampling train at several points in the flue gas stream. 1972-present.

Directed and performed over 200 short-term ambient air studies using mobile sampling vans and various ambient air sampling equipment. 1972-present.

Designed, directed and operated over 20 permanent ambient air networks of various size and duration for a variety of parameters. 1972-present.

Designed surface and underground drainage systems for residential subdivisions, public works projects, and shopping centers. 1969-1972.

Designed several residential subdivisions including lot layout, street design, drainage design, and utility design. 1969-1972.

Research Projects

Supervised and conducted a study made by the Hawaiian Sugar Planters' Association to characterize the emissions for several bagasse-fired boilers. April-May 1976.

Supervised and conducted a study made by the Rio Grande Valley Sugar Growers, Inc. to determine the area affected by the burning of sugarcane fields prior to harvesting. November 1974-April 1975.

Supervised and conducted a study by a lightweight aggregate manufacturer to develop a material balance around the process through sampling and analysis of several parameters. November 1973.

Conducted a study in New York City to attempt to develop a correlation in the ambient air between carbon dioxide and sulfur dioxide to provide a tool for predicting air pollution episodes. January-May 1969.

MULLINS

Publications

Co-authored "Sulfur Compound Emissions of the Petroleum Production Industry," December 1974.

Co-authored "Field Procedure for Stabilizing Hydrogen Sulfide Samples to be Analyzed Using Modified Methylene Blue Technique," presented at the Conference on Ambient Air Quality Measurements, Austin, Texas, March 1975.

Co-authored "Atmospheric Emissions Survey of the Sour Gas Industry," October 1975.

Co-authored "Technique for Insuring the Validity of Samples for High Concentrations of Sulfur Dioxide Using the EPA Method 5 Sampling Train," presented at the Third National Conference on Energy and the Environment, College Corner, Ohio, September 1975.

Teaching Experience

Served as a lecturer in the Environmental Protection Agency's training course number 450, "Source Sampling for Particulate Pollutants," for two years from January 1974 to October 1975.

Conducted a two-day training course entitled "Technical Assistance in Source Sampling" at Iowa State University, Ames, Iowa, for the Environmental Protection Agency, October 1974.

Conducted EPA's training course number 450, "Source Sampling for Particulate Pollutants," for the EPA at Research Triangle Park, North Carolina, September 1975.

Conducted a two-day short course entitled "Performing and Observing Source Sampling" at Dallas, Texas, July 1976, May 1977, October 1977; at Lake Charles, Louisiana, May 1977; and at Casper, Wyoming, May 1977.

Served as a lecturer in the Environmental Protection Agency's two-day seminar entitled "Asphalt Industry Environmental Solutions," presented in Dallas, Texas, on March 21 and 22, 1979.

Conducted a two-day short course entitled "Performing and Observing Source Sampling" in Lincoln, Nebraska, in March 1980 for the State of Nebraska, Air Quality Control Division.

METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(214) 931-7127

THOMAS J. BILL, Senior Environmental Field Technician

Education

B.S. 1976, Kent State University, Kent, Ohio, in Chemistry with a minor in Psychology.

Technical Experience

Participated in the sampling of over 500 sources, including several of which were sampled simultaneously using more than one sampling train. Thoroughly trained in all EPA testing procedures. 1980-present.

Thoroughly trained and familiar with the operation of Hach/Carle Gas Chromatograph Model 100 (both TCD and FID), Shimadzu GC-Mini 2 Gas Chromatograph, Thermo Electron Model 48 Gas Correlation CO Analyzer, Thermo Electron Model 10AR Chemiluminescent NO_x Analyzer, Horiba CO Analyzer, Teledyne Oxygen Monitor, Western Research Institute Model 721 AT Sulfur Dioxide Analyzer, CEA CO_2 NDIR Analyzer, and Ratfisch RS 55 and RS 103 FID Total Hydrocarbon Analyzers.

Have performed on-site gravimetric particulate matter analysis, SO_2 analysis, and H_2S gas analysis.

Professional Training Courses

Industrial Management Council Seminar, Washington, D.C., 1979. Essential Skills for the Successful Manager, University of Toledo, 1981. Assertiveness Training for Managers, Wright State University, 1982. How to Make Better Decisions and Successful Delegation, AMA Extension Courses, 1985.

Inactive Hazardous Waste Sites Training Program (40 hours) given by The University of Texas Health Center at Tyler, Texas, May 1990.

BILL

Research Projects	Catalytic Reactions on High Temperature Dimer-Polyamides. Polymeric Materials Absorbance of Electrical and Thermal Target Sources.
Professional Memberships	Air and Waste Management Association

WASTE STREAM COMPOSITIONS

R-2565

Compound	Typical Percent by Weight	Maximum Percent by Weight
Stream 1 - Hexane Drawdown Residue		
Hexane	38.95	75.0
Methyl Cyclopentane	8.4	25.0
Cyclohexane	29.2	50.0
Heptane	0.2	1.0
4-Vinylcyclohexane-1	5.9	80.0
Styrene	16.0	80.0
Divinylbenzene	1.3	10.0
Di-tert-butyl-para cresol	0.06	6.0
Stream 2 - Butane Residue		
Trans & Cis Butene	60.02	95.0
Buadiene	33.03	60.0
2 & 3-Methylbutene-1	0.10	0.5
Ethyl Acetylene	7.74	10.0
Stream 3 - Pentane Residue		
Cis-butene 2	0.03	1.0
N & Isopentane	0.6	3.0
3-Methylbutene-1	56.89	75.0
C5 Isomers	38.49	50.0
Butadiene	4.0	8.0

Percentages may not add to 100% due to rounding errors.