AP42 Section:	9.12.1
Background Chapter	4
Reference:	23
Title:	Volatile Organic Compound Emissions Source Test Report for Coors Brewing Company, Air Pollution Testing, Inc., Lakewood, CO, August, 1993.

(23)

Section 4 Reference COORS 13
AP-42 Reference ___

Emission Test Report Review Checklist--Short Form

Reviewer: BRIAN SHRAGER
Review Date: 9/14/94

A. Background Information

1. Facility name: COORS
   Location: GOLDEN, CO
2. Source category: MALT BEVERAGES
3. Test date: 4/21/93, 8/31/93
4. Test sponsor: COORS
5. Testing contractor: Air Pollution Testing, Inc.
6. Purpose of test: To determine VOC emissions reduction following process modifications
7. Pollutants measured (include test method and indicate if valid): VOC — Method 25A
   converted to ethanol using factor of 2.506 which was developed through calibration w/ ethanol performed on same instrument.
8. Process overview: Attach a process description and a block diagram. Identify processes tested with letters from the beginning of the alphabet (A, B, C, etc...) and APC systems with letters from the end of the alphabet (V, W, X, etc...). Also identify test locations with Arabic numerals (1,2,3, ...). Using the ID symbols from the diagram, complete the table below.

Test ID	Process	Process ID	Emissions tested		APCD (controlled emissions only)
			Uncontrolled	Controlled	
1	Bottle Crusher	A	✓		ID: Type: Model #:
2	Bottle Crusher	A		✓	ID: Type: Water sprays Model #:
					ID: Type: Model #:
					ID: Type: Model #:

B. Process Information .

1. Provide a brief narrative description of the process and attach process flow diagram. (Note: If the process description provided in the test report is adequate, attach a copy here.)

COORS REPORT 13 TEST DATA SUMMARY

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	
1	Stack temperature	Deg F				
BOTTLE CRUSHER	Moisture	%	ASSUMED 0			
	Oxygen	%	ASSUMED 20.9%			
	Volumetric flow, actual	acfm				
	Volumetric flow, standard	dscfm	1579	1610	1667	
	Isokinetic variation	%	NA	NA	NA	
Production rate: DATA ON LBS/CRUSH NOT PROVIDED		CRUSHES/HR	2.00	4.74	2.50	
	Pollutant concentrations:					
	TOC as propane	ppmwv	41.7	57.7	47.2	
	Pollutant mass emissions:					
	TOC as propane	lb/hr	0.452	0.638	0.540	
	Ethanol (conversion=2.506)	lb/hr	1.13	1.60	1.35	
	Emission factors:					Average
	TOC as propane	lb/crush	0.226	0.135	0.216	0.192
	ETHANOL	lb/crush	0.567	0.338	0.542	0.482

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	
2	Stack temperature	Deg F				
BOTTLE CRUSHER WITH WATER SPRAYS AND MODIFICATIONS	Moisture	%	ASSUMED 0			
	Oxygen	%	ASSUMED 20.9%			
	Volumetric flow, actual	acfm				
	Volumetric flow, standard	dscfm	1198	1281	1343	
	Isokinetic variation	%	NA	NA	NA	
Production rate: DATA ON LBS/CRUSH NOT PROVIDED		CRUSHES/HR	3.00	4.00	3.95	
	Pollutant concentrations:					
	TOC as propane	ppmwv	19.1	22.4	22	
	Pollutant mass emissions:					
	TOC as propane	lb/hr	0.157	0.197	0.203	
	Ethanol (conversion=2.506)	lb/hr	0.394	0.494	0.508	
	Emission factors:					Average
	TOC as propane	lb/crush	0.0524	0.0493	0.0514	0.0510
	ETHANOL	lb/crush	0.131	0.123	0.129	0.128

AP42 Section:	9.12.1
Background Chapter	4
Reference:	24
Title:	Crushed Can Conveyor Unit Compliance VOC Test Report for Coors Brewing Company, Air Pollution Testing, Inc., Lakewood, CO, October 21, 1993.

AP-42 Section 9.12.1
Reference 16
Report Sect. 4
Reference 24

AIR POLLUTION TESTING, INC.

Crushed Can Conveyor Unit
Compliance VOC Test Report for
Coors Brewing Company

Report prepared for:
Coors Brewing Company
Crushed Can Coveyor Unit
Golden, Colorado

Report reviewed by:
Paul Ottenstein
Project Manager

Test Dates:
October 21, 1993

Project Code:
CB30148

7711 WEST 6TH AVE. SUITE I
LAKEWOOD, CO 80215
(303) 232-5213 · FAX 232-5313

A
P
T

Table of Contents

Introduction

Air Pollution Testing, Inc. was contracted by Coors Brewing Company to conduct a series of source emissions tests on the two atmospheric vents of the crushed can conveyer unit at the Golden, Colorado facility. The purpose of the testing was to determine mass flow rates for volatile organic compounds (VOCs), believed to be primarily ethanol, at the two locations. The upper duct (Stack #1) was flowing ambient air from the crusher room, and the lower duct (Stack #2) was flowing air directly from the crushed can conveyer. The testing was conducted October 21, 1993 and observed by Mr. Charles Cox of the Colorado Department of Health, Air Pollution Control Division (CDH, APCD).

Summary of Procedures

Testing was conducted in accordance with EPA methods 1, 2, 3, 4 and 25A as detailed in *Code of Federal Regulations, Title 40, Part 60, Appendix A*. Methods 1 and 2 were used to determine the volumetric flow rate in the ducts. Methods 3 and 4 were used to determine the oxygen, carbon dioxide, and moisture content of the duct gases. Method 25A was used to determine the concentration of VOCs. The data from the aforementioned methods was then combined to determine mass flow rates of VOCs for each location for each of three sixty-minute sample runs.

Each sixty-minute method 25A sampling period consisted of extracting a gas sample from the ducts through heated sample lines and running them directly into the inlet ports of two JUM Model 3-100 Flame Ionization Analyzers with a range of 0 to 100 ppm full-scale selected. The Stack #2 analyzer was also calibrated and switched to 0 to 1000 ppm full-scale for occasional off-scale peak readings. The organic concentration (expressed as parts per million on a volume basis as propane) was displayed on the front panel of the analyzers and recorded on a strip chart. At the beginning of the test program, the analyzers were calibrated with zero air and a 95.5 ppm propane calibration gas, and then challenged with 44.2 ppm and 15.24 ppm propane calibration gases to verify linearity of response. Following each sampling period, the analyzers were again challenged with the zero air and the calibration gas closest to the average stack concentration for the previous sampling period to quantify zero and span drift for the previous period. The analyzers were recalibrated at this point as necessary. Additionally, the Stack #2 analyzer was challenged with 301.6 ppm propane calibration gas to verify the linearity of the analyzer's range multiplier. To ensure accurate data collection, all calibration gases were prepared and certified in accordance with EPA Protocol 1, and were introduced to the analyzers at the sampling probe tips at ambient pressure. The recorded data from each sampling period were averaged in one minute increments, with all data corrected for analyzer span and zero drift.

Concurrent with each method 25A sampling period, a temperature and differential pressure traverse of the ducts was conducted in accordance with method 2 along a grid of sampling points determined in accordance with method 1. Method 3 Orsat measurements of an integrated Tedlar bag sample from Stack #2 were taken to determine concentrations of oxygen and carbon dioxide. Stack #1 gas was assumed to contain ambient concentrations of carbon dioxide (0.0%) and oxygen (20.9%). Water vapor concentration was measured in accordance with Method 4 for Stack #2. The ambient air flow in Stack #1 was assumed to have negligible moisture content. The molecular weight (calculated from the oxygen, carbon dioxide, and water vapor content) was combined with the differential pressure and temperature data to calculate the velocity and volumetric flow rate of the duct gas in each duct.

Additional Notes

Moisture Data

The Method 4 moisture measurement for Stack #2, run #1 was disregarded as it was apparent that beer droplets had biased the sample. An average of run #2 and run #3 is used for run #1 in the *Results* section to provide a more accurate characterization. This procedure was approved by the CDH, APCD observer.

Velocity Data

The Methods 1 and 2 velocity traverses were only performed on each stack for runs #1 and #2. The average of runs #1 and #2 was used for run #3. This procedure was approved by the CDH, APCD observer.

VOC Data

In the results section, mass flow rates of VOCs are presented in terms of pounds per hour as propane and pounds per hour as ethanol. The propane values are calculated directly from the analyzer and flow data, and make no assumptions as to the molecular species of the organic compounds. The ethanol values use an empirical constant of 2.506 to convert mass per volume concentrations of propane data to ethanol. The constant was determined experimentally in an earlier testing program using the same flame ionization analyzers used in the current program.

Results

The results of the testing are presented in the following tables. Any testing parameters not found in the tables are presented in *Appendix 1 - Sample Calculations / Testing Parameters.*

The following abbreviations are used in Table 1:

dscfm - dry standard (1 atmosphere pressure, 68 °F) cubic feet per minute
vol. % - volume percent, wet basis
ppmv - parts per million, wet volume basis
lb/hr - pounds per hour

Run #	1	2	3	Average
start time	09:10	10:45	12:00	
stop time	10:10	11:45	13:00	
Stack #1				
stack flow (dscfm)	1774	1860	1817	1817
water vapor (vol. %)	0.00	0.00	0.00	0.00
VOC conc. (ppmv)	6.2	7.7	8.5	7.5
VOC emissions (lb/hr as propane)	0.076	0.098	0.106	0.093
VOC emissions (lb/hr as ethanol)	0.19	0.25	0.27	0.23
Stack #2				
stack flow (dscfm)	3670	3488	3579	3579
water vapor (vol. %)	0.95	0.74	1.16	0.95
VOC conc. (ppmv)	46.4	57.5	39.4	47.8
VOC emissions (lb/hr as propane)	1.2	1.4	0.98	1.2
VOC emissions (lb/hr as ethanol)	3.0	3.5	2.4	3.0

Table 1 - VOC Mass Flow Results
Stacks #1 and #2

Appendix 1
Testing Parameters
Sample Calculations

Coors Brewing Company
Crushed Can Conveyor - Stack #1
10-21-93
VOC Mass Emission Rates

Field Data

	Run #1	Run #2	Run #3	Averages
start time	09:10	10:45	12:00	
stop time	10:10	11:45	13:00	
VOC conc. (ppm wet)	6.2	7.7	8.5	7.5
% H2O*	0.0	0.0	0.0	0.0
volumetric flow rate (dscfm)*	1774	1860	1817	1817
total time (min)	75	60	60	65
volume beer (gal)**	479	15	337	277
volume water (gal)**	71	2	54.6	43
volume beer + volume water (gal)	550	17	391.6	320

Calculations

VOC emissions (lb/hr as propane)	0.076	0.098	0.106	0.093
VOC emissions (tons/year as propane)****	0.331	0.431	0.464	0.409
VOC emissions (lb propane/gallon of beer)	0.0002	0.0066	0.0003	0.0024
VOC emissions (lb propane/gallon of mix)	0.0002	0.0058	0.0003	0.0021
VOC emissions (lb/hr as ethanol)***	0.189	0.246	0.266	0.234
VOC emissions (tons/year as ethanol)***	0.829	1.079	1.164	1.024
VOC emissions (lb ethanol/gal beer)***	0.0005	0.0164	0.0008	0.0059
VOC emissions (lb ethanol/gal mix)***	0.0004	0.0145	0.0007	0.0052

* - from concurrent flow data collected in accordance with methods 1-2 sampling.

** - provided by Coors Brewing Company personnel

***- mass emission calculations expressed as ethanol use empirical conversion factor of 2.506

**** - tons/year calculations use 8760 hours per year operation.

Coors Brewing Company
Crushed Can Conveyor - Stack #2
10-21-93
VOC Mass Emission Rates

Field Data

	Run #1	Run #2	Run #3	Averages
start time	09:10	10:45	12:00	
stop time	10:10	11:45	13:00	
VOC conc. (ppm wet)	46.4	57.5	39.4	47.8
% H2O*	0.95	0.74	1.16	0.95
volumetric flow rate (dscfm)*	3670	3488	3579	3579
total time (min)	75	60	60	65
volume beer (gal)**	479	15	337	277
volume water (gal)**	71	2	54.6	43
volume beer + volume water (gal)	550	17	391.6	320

Calculations

VOC emissions (lb/hr as propane)	1.18	1.39	0.98	1.18
VOC emissions (tons/year as propane)****	5.17	6.08	4.29	5.18
VOC emissions (lb propane/gallon of beer)	0.0031	0.0925	0.0029	0.0328
VOC emissions (lb propane/gallon of mix)	0.0027	0.0816	0.0025	0.0289
VOC emissions (lb/hr as ethanol)***	2.96	3.48	2.45	2.96
VOC emissions (tons/year as ethanol)***	13.0	15.2	10.8	13.0
VOC emissions (lb ethanol/gal beer)***	0.0077	0.2318	0.0073	0.0823
VOC emissions (lb ethanol/gal mix)***	0.0067	0.2045	0.0063	0.0725

* - from concurrent flow data collected in accordance with methods 1-4 sampling.

** - provided by Coors Brewing Company personnel

***- mass emission calculations expressed as ethanol use empirical conversion factor of 2.506

**** - tons/year calculations use 8760 hours per year operation.

Coors Brewing Company

Crushed Can Conveyor - Stack #1

10-21-93

EPA Methods 1-2 : Determination of Volumetric Flow Rate and Molecular Weight

Field Data	Run #1	Run #2	Run #3	Averages
stack temp. (oF)	66	78	N/A*	72
barometric pressure (mbar)	837	837	N/A*	837
barometric pressure (" Hg)	24.722	24.722	N/A*	24.722
static press. (in. water)	9.2	9.2	N/A*	9.2
oxygen (%)	20.9	20.9	N/A*	20.9
carbon dioxide (%)	0.0	0.0	N/A*	0.0
(delta p)^1/2	0.7259	0.7697	N/A*	0.7478
pitot tube constant	0.84	0.84	0.84	0.84
stack diameter (inches)	12.0	12.0	12.0	12.0
Calculations	Run #1	Run #2	Run #3	Averages
molecular weight (dry)	28.836	28.836	N/A*	28.836
gas velocity (ft/sec)	44.2	47.4	N/A*	45.8
gas flow (acfm)	2082	2233	N/A*	2157
gas flow (dscfm)	1774	1860	N/A*	1817

* - average of runs #1 and #2 used for run #3.

Coors Brewing Company

Crushed Can Conveyor - Stack #2

10-21-93

EPA Methods 1-4 : Determination of Volumetric Flow Rate and Molecular Weight

Field Data	Run #1	Run #2	Run #3	Averages
start time	N/A*	10:45	12:00	
stop time	N/A*	11:15	12:30	
sample volume (ft3)	N/A*	26.474	25.715	26.095
sampling time (minutes)	N/A*	30	30	30
stack temp. (oF)	66	78	N/A**	72
meter temp. (oF)	N/A*	77	94	86
barometric pressure (mbar)	837	837	837	837
barometric pressure (" Hg)	24.722	24.722	24.722	24.722
static press. (in. water)	8.6	8.6	N/A**	8.6
moisture (grams)	N/A*	3.5	5.2	4.4
oxygen (%)	20.5	20.5	20.5	20.5
carbon dioxide (%)	0.0	0.0	0.0	0.0
delta H	N/A*	2.0	2.0	2.0
(delta p)^1/2	1.5140	1.4530	N/A**	1.4835
meter box Y	1.0257	1.0257	1.0257	1.0257
delta H@	1.78	1.78	1.78	1.78
pitot tube constant	0.84	0.84	0.84	0.84
stack diameter (inches)	12.0	12.0	12.0	12.0

Calculations	Run #1	Run #2	Run #3	Averages
sample volume (dscf)	N/A*	22.186	20.888	21.537
moisture volume (scf)	N/A*	0.165	0.245	0.205
moisture content (%/100)	N/A*	0.0074	0.0116	0.0095
molecular weight (dry)	N/A*	28.820	28.820	28.820
molecular weight (actual)	N/A*	28.740	28.695	28.717
gas velocity (ft/sec)	92.4	89.7	N/A**	91.0
gas flow (acfm)	4355	4225	N/A**	4290
gas flow (dscfm)	3670	3488	N/A**	3579

* - average of moisture train data from runs #2 and #3 was used for run #1.

** - velocity traverse average of runs #1 and #2 used for run #3.

Coors Brewing Company

Crushed Can Conveyor - Stack #1

10-21-93

Method 25A : Measurement of Total Organic Concentration Using a Flame Ionization Analyzer

Strip Chart Data

Run #1

		Zero (%FS)	Span (%FS)	Actual Span (ppm)
Start	09:10	0.0	8.0	15.24
Stop	10:10	-1.0	7.0	

point #	%FS VOC	ppm VOC	point #	%FS VOC	ppm VOC
1	3.0	6.7	31	2.5	5.7
2	3.0	6.7	32	2.5	5.7
3	3.0	6.7	33	2.5	5.7
4	3.0	6.7	34	2.5	5.7
5	3.0	6.7	35	2.5	5.7
6	3.0	6.7	36	2.5	5.7
7	3.0	6.7	37	2.5	5.7
8	3.0	6.7	38	2.5	5.7
9	3.0	6.7	39	2.5	5.7
10	3.0	6.7	40	2.5	5.7
11	3.0	6.7	41	2.5	5.7
12	3.0	6.7	42	2.5	5.7
13	2.5	5.7	43	2.5	5.7
14	2.5	5.7	44	2.5	5.7
15	2.5	5.7	45	2.5	5.7
16	2.5	5.7	46	2.5	5.7
17	2.5	5.7	47	2.5	5.7
18	2.5	5.7	48	2.5	5.7
19	2.5	5.7	49	2.5	5.7
20	2.5	5.7	50	2.5	5.7
21	2.5	5.7	51	3.0	6.7
22	2.5	5.7	52	3.0	6.7
23	2.5	5.7	53	3.0	6.7
24	2.5	5.7	54	3.0	6.7
25	2.5	5.7	55	3.0	6.7
26	2.5	5.7	56	3.5	7.6
27	2.5	5.7	57	3.5	7.6
28	2.5	5.7	58	4.0	8.6
29	2.5	5.7	59	4.0	8.6
30	2.5	5.7	60	4.5	9.5
averages:	2.7	6.1		2.8	6.3

Drift Cal. Avg. VOC (ppm as propane) 6.2

Coors Brewing Company

Crushed Can Conveyor - Stack #1

10-21-93

Method 25A : Measurement of Total Organic Concentration Using a Flame Ionization Analyzer

Strip Chart Data

Run #2

		Zero (%FS)	Span (%FS)	Actual Span (ppm)
Start	10:45	-1.0	7.0	15.24
Stop	11:45	-1.0	7.0	

point #	%FS VOC	ppm VOC	point #	%FS VOC	ppm VOC
1	4.0	9.5	31	3.5	8.6
2	4.0	9.5	32	3.5	8.6
3	3.5	8.6	33	3.5	8.6
4	3.5	8.6	34	3.5	8.6
5	3.5	8.6	35	3.0	7.6
6	3.0	7.6	36	3.0	7.6
7	3.0	7.6	37	3.0	7.6
8	3.0	7.6	38	3.0	7.6
9	3.0	7.6	39	3.0	7.6
10	3.0	7.6	40	3.0	7.6
11	3.0	7.6	41	2.5	6.7
12	3.0	7.6	42	2.5	6.7
13	3.0	7.6	43	2.5	6.7
14	3.5	8.6	44	2.5	6.7
15	3.5	8.6	45	2.5	6.7
16	3.5	8.6	46	3.0	7.6
17	3.5	8.6	47	2.5	6.7
18	3.5	8.6	48	2.5	6.7
19	3.5	8.6	49	2.0	5.7
20	3.5	8.6	50	2.0	5.7
21	4.0	9.5	51	2.0	5.7
22	4.0	9.5	52	2.0	5.7
23	4.0	9.5	53	2.0	5.7
24	4.0	9.5	54	2.0	5.7
25	4.0	9.5	55	2.0	5.7
26	4.0	9.5	56	2.0	5.7
27	4.0	9.5	57	2.0	5.7
28	4.0	9.5	58	2.0	5.7
29	4.0	9.5	59	2.0	5.7
30	4.0	9.5	60	2.0	5.7
averages:	3.6	8.7		2.6	6.8

Drift Cal. Avg. VOC (ppm as propane) 7.7

Coors Brewing Company

Crushed Can Conveyor - Stack #1

10-21-93

Method 25A : Measurement of Total Organic Concentration Using a Flame Ionization Analyzer

Strip Chart Data

Run #3

		Zero (%FS)	Span (%FS)	Actual Span (ppm)
Start	12:00	-1.0	7.0	15.24
Stop	13:00	-1.0	7.0	

point #	%FS VOC	ppm VOC	point #	%FS VOC	ppm VOC
1	3.5	8.6	31	2.5	6.7
2	3.5	8.6	32	2.5	6.7
3	3.5	8.6	33	2.5	6.7
4	3.5	8.6	34	2.5	6.7
5	3.5	8.6	35	2.5	6.7
6	3.5	8.6	36	2.5	6.7
7	3.5	8.6	37	4.0	9.5
8	4.0	9.5	38	4.0	9.5
9	4.0	9.5	39	4.0	9.5
10	4.0	9.5	40	4.0	9.5
11	4.0	9.5	41	4.0	9.5
12	4.0	9.5	42	4.0	9.5
13	4.0	9.5	43	4.0	9.5
14	3.5	8.6	44	4.0	9.5
15	3.5	8.6	45	3.5	8.6
16	3.5	8.6	46	3.5	8.6
17	3.5	8.6	47	3.0	7.6
18	3.0	7.6	48	3.5	8.6
19	3.0	7.6	49	4.0	9.5
20	3.0	7.6	50	4.0	9.5
21	3.0	7.6	51	4.0	9.5
22	3.0	7.6	52	4.0	9.5
23	2.5	6.7	53	4.0	9.5
24	2.5	6.7	54	4.0	9.5
25	3.0	7.6	55	4.0	9.5
26	3.0	7.6	56	4.0	9.5
27	3.0	7.6	57	4.0	9.5
28	3.0	7.6	58	3.5	8.6
29	2.5	6.7	59	3.5	8.6
30	2.5	6.7	60	3.5	8.6
averages:	3.3	8.2		3.6	8.7

Drift Cal. Avg. VOC (ppm as propane) 8.5

Coors Brewing Company

Crushed Can Conveyor - Stack #2

10-21-93

Method 25A : Measurement of Total Organic Concentration Using a Flame Ionization Analyzer

Strip Chart Data

Run #1

		Zero (%FS)	Span (%FS)	Actual Span (ppm)
Start	09:10	0.0	47.5	95.5
Stop	10:10	0.0	47.0	

point #	%FS VOC	ppm VOC	point #	%FS VOC	ppm VOC
1	30.0	60.6	31	35.0	70.7
2	23.0	46.5	32	22.5	45.5
3	22.0	44.5	33	17.0	34.4
4	19.0	38.4	34	13.5	27.3
5	16.0	32.3	35	12.0	24.3
6	17.0	34.4	36	11.0	22.2
7	15.5	31.3	37	19.5	39.4
8	20.0	40.4	38	14.0	28.3
9	15.0	30.3	39	11.0	22.2
10	15.0	30.3	40	10.0	20.2
11	12.0	24.3	41	10.0	20.2
12	13.0	26.3	42	10.0	20.2
13	13.0	26.3	43	22.0	44.5
14	13.5	27.3	44	20.0	40.4
15	12.0	24.3	45	18.0	36.4
16	17.0	34.4	46	10.5	21.2
17	16.0	32.3	47	9.5	19.2
18	13.5	27.3	48	8.5	17.2
19	12.5	25.3	49	9.0	18.2
20	11.5	23.2	50	17.0	34.4
21	160.0	323.4	51	19.0	38.4
22	160.0	323.4	52	17.0	34.4
23	70.0	141.5	53	16.0	32.3
24	51.5	104.1	54	12.5	25.3
25	36.5	73.8	55	11.0	22.2
26	29.0	58.6	56	14.0	28.3
27	22.5	45.5	57	18.0	36.4
28	22.0	44.5	58	13.0	26.3
29	32.0	64.7	59	12.0	24.3
30	23.5	47.5	60	12.5	25.3
averages:	31.1	62.9		14.8	30.0

Drift Cal. Avg. VOC (ppm as propane) 46.4

Coors Brewing Company

Crushed Can Conveyor - Stack #2

10-21-93

Method 25A : Measurement of Total Organic Concentration Using a Flame Ionization Analyzer

Strip Chart Data

Run #2

		Zero (%FS)	Span (%FS)	Actual Span (ppm)
Start	10:45	0.0	47.0	95.5
Stop	11:45	0.0	45.0	

point #	%FS VOC	ppm VOC	point #	%FS VOC	ppm VOC
1	7.0	14.5	31	12.0	24.9
2	6.5	13.5	32	10.0	20.8
3	7.0	14.5	33	10.0	20.8
4	6.5	13.5	34	9.5	19.7
5	6.5	13.5	35	110.0	228.4
6	7.0	14.5	36	80.0	166.1
7	7.0	14.5	37	39.0	81.0
8	7.0	14.5	38	50.0	103.8
9	7.0	14.5	39	27.0	56.1
10	7.0	14.5	40	21.5	44.6
11	7.0	14.5	41	18.0	37.4
12	40.0	83.0	42	15.0	31.1
13	41.0	85.1	43	15.0	31.1
14	34.5	71.6	44	14.0	29.1
15	25.0	51.9	45	260.0	539.8
16	15.0	31.1	46	120.0	249.1
17	18.0	37.4	47	90.0	186.8
18	11.0	22.8	48	60.0	124.6
19	8.5	17.6	49	35.5	73.7
20	35.5	73.7	50	25.0	51.9
21	24.0	49.8	51	20.5	42.6
22	20.5	42.6	52	18.0	37.4
23	13.0	27.0	53	16.0	33.2
24	9.0	18.7	54	16.5	34.3
25	80.0	166.1	55	13.0	27.0
26	8.0	16.6	56	12.5	26.0
27	9.5	19.7	57	10.0	20.8
28	10.0	20.8	58	9.0	18.7
29	10.0	20.8	59	8.0	16.6
30	20.0	41.5	60	8.0	16.6
averages:	16.9	35.2		38.4	79.8

Drift Cal. Avg. VOC (ppm as propane) 57.5

Coors Brewing Company

Crushed Can Conveyor - Stack #2

10-21-93

Method 25A : Measurement of Total Organic Concentration Using a Flame Ionization Analyzer

Strip Chart Data

Run #3

		Zero (%FS)	Span (%FS)	Actual Span (ppm)
Start	12:00	0.0	45.0	95.5
Stop	13:00	0.0	49.0	

point #	%FS VOC	ppm VOC	point #	%FS VOC	ppm VOC
1	9.0	18.3	31	17.5	35.6
2	11.0	22.4	32	17.0	34.5
3	13.0	26.4	33	27.0	54.9
4	15.5	31.5	34	23.0	46.7
5	10.0	20.3	35	12.0	24.4
6	15.0	30.5	36	14.0	28.4
7	10.0	20.3	37	10.0	20.3
8	18.0	36.6	38	12.0	24.4
9	16.0	32.5	39	10.0	20.3
10	13.5	27.4	40	12.5	25.4
11	10.0	20.3	41	14.5	29.5
12	8.0	16.3	42	12.0	24.4
13	13.5	27.4	43	9.0	18.3
14	19.0	38.6	44	8.5	17.3
15	12.5	25.4	45	8.0	16.3
16	11.5	23.4	46	8.0	16.3
17	13.0	26.4	47	8.0	16.3
18	13.0	26.4	48	11.5	23.4
19	10.0	20.3	49	19.0	38.6
20	9.0	18.3	50	13.5	27.4
21	12.5	25.4	51	27.0	54.9
22	230.0	467.3	52	10.5	21.3
23	80.0	162.6	53	8.0	16.3
24	41.5	84.3	54	12.0	24.4
25	30.0	61.0	55	16.0	32.5
26	23.0	46.7	56	16.0	32.5
27	20.0	40.6	57	17.0	34.5
28	40.0	81.3	58	13.5	27.4
29	17.5	35.6	59	10.0	20.3
30	14.0	28.4	60	8.0	16.3
averages:	25.3	51.4		13.5	27.4

Drift Cal. Avg. VOC (ppm as propane) 39.4

EPA Method 2 : Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

Sample Calculations

molecular weight dry (grams/mole)

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

$= 0.440(0.0\ \%CO_2) + (0.320)(20.9\ \%O_2) + (0.280)(79.1\ \%N_2)$

$= 28.836$ grams/mole

molecular weight actual (grams/mole)

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

$=$ (28.836 grams/mole)(1 - 0.0) + (18.0)(0.0)

$= 28.836$ grams/mole

gas velocity (ft/sec)

$= \{85.49\ ft/sec\ [(lb/lb\text{-}mole)(in.\ Hg)/(^{o}R)(in.\ H_2O)]^{1/2}\}C_p(\Delta p^{1/2})_{avg}(T_{s(avg)}/P_sM_s)^{1/2}$

$= (85.49)(0.84)(0.7259)\{(66+460)/[(24.722+9.2/13.6)(28.836)]\}^{1/2}$

$= 44.2$ ft/sec

gas flow (acfm)

$= A_{vs}$(60 seconds/minute)

$= (\Pi)(12.0/12\ ft)^2(44.2\ ft/sec)(60)/4$

$= 2082$ acfm

gas flow (dscfm)

$=$ (60 seconds/minute)$(1 - B_{ws})v_sAT_{std}P_s/(T_{s(avg)}P_{std})$

$= (60)(1\text{-}0.0)(44.2)(\Pi)(12.0/12\ ft)^2(528)(24.722+9.2/13.6)/[(66+460)(29.92)(4)]$

$= 1774$ dscfm

EPA Method 2 : Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

Variables

A = Stack cross-sectional area (ft^2)
B_{ws} = Water vapor in the gas stream, proportion by volume
C_p = S-type Pitot coefficient (0.84 dimensionless)
Δp = Velocity head of stack gas (in. H_2O)
M_d = Molecular weight of dry stack gas (lb/lb mole)
M_s = Molecular weight of wet stack gas (lb/lb mole)
P_{bar} = Barometric pressure (in. Hg)
P_g = Stack pressure relative to ambient (in. H_2O)
P_s = Absolute stack pressure (in. Hg)
P_{std} = Standard atmospheric pressure (29.92 in. Hg)
Q_a = Actual volumetric air flow out of stack (acfm)
Q_{std} = Volumetric air flow out of stack corrected to standard conditions (dscfm)
$T_{s(avg)}$ = Average stack temperature (°F + 460 = °R)
T_{std} = Standard temperature (528 °R)
v_s = Stack gas velocity (ft/sec)

EPA Methods 1 - 4 : Determination of Volumetric Flow Rate and Molecular Weight

Sample Calculations

sample volume (dscf)

= [17.64 (°R/in Hg)]$V_m Y[P_{bar} + (\Delta H/13.6)]/T_m$

= (17.64 °R/in Hg)(26.474 ft^3)(1.0257)[24.722+(2.0/13.6) inches Hg]/(77+460 °R)

= 22.186 dscf

moisture volume (scf)

= (0.04707 ft^3/ml)V_{lc}

= (0.04707 ft^3/ml)(3.5)

= 0.165 scf

moisture content (%/100)

= $V_{w(std)}/(V_{m(std)} + V_{w(std)})$

= (0.165 scf)/(22.186 dscf + 0.165 scf)

= 0.0074

molecular weight dry (grams/mole)

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

= $0.440(0.0\ \%CO_2) + (0.320)(20.5\ \%O_2) + (0.280)(79.5\ \%N_2)$

= 28.820 grams/mole

molecular weight actual (grams/mole)

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

= (28.820 grams/mole)(1 - 0.0074) + (18.0)(0.0074)

= 28.740 grams/mole

gas velocity (ft/sec)

= {85.49 ft/sec [(lb/lb-mole)(in. Hg)/(°R)(in. H_2O)]$^{1/2}$}$C_p(\Delta p^{1/2})_{avg}(T_{s(avg)}/P_s M_s)^{1/2}$

= (85.49)(0.84)(1.4530){(78+460)/[(24.722+8.6/13.6)(28.740)]}$^{1/2}$

= 89.7 ft/sec

gas flow (acfm)

= A_{vs}(60 seconds/minute)

= (Π)(12.0/12 ft)^2(89.7 ft/sec)(60)/4

= 4225 acfm

EPA Methods 1 - 4 : Determination of Volumetric Flow Rate and Molecular Weight

gas flow (dscfm)

$$= (60 \text{ seconds/minute})(1 - B_{ws})v_s A T_{std} P_s / (T_{s(avg)} P_{std})$$

$$= (60)(1-0.0074)(89.7)(\Pi)(12.0/12 \text{ ft})^2(528)(24.722+8.6/13.6)/[(78+460)(29.92)(4)]$$

$$= 3488 \text{ dscfm}$$

Variables

A = Stack cross-sectional area (ft^2)
B_{ws} = Water vapor in the gas stream, proportion by volume
C_p = Pitot coefficient (0.84 dimensionless)
ΔH = Average pressure differential across the orifice meter (in. H_2O)
Δp = Velocity head of stack gas (in. H_2O)
M_d = Molecular weight of dry stack gas (lb/lb mole)
M_s = Molecular weight of wet stack gas (lb/lb mole)
P_{bar} = Barometric pressure (in. Hg)
P_g = Sack pressure relative to ambient (in. H_2O)
P_s = Absolute stack pressure (in. Hg)
P_{std} = Standard atmospheric pressure (29.92 in. Hg)
Q_a = Actual volumetric air flow out of stack (acfm)
Q_{std} = Volumetric air flow out of stack corrected to standard conditions (dscfm)
T_m = Average meter temperature (°F + 460 = °R)
$T_{s(avg)}$ = Average stack temperature (°F + 460 = °R)
T_{std} = Standard temperature (528 °R)
V_{lc} = volume of moisture collected from gas sample (ml)
v_s = Stack gas velocity (ft/sec)
V_m = Volume of gas through dry gas meter (ft^3)
$V_{m(std)}$ = Volume of gas through dry gas meter corrected to standard conditions (dscf)
$V_{w(std)}$ = Volume of water vapor in gas sample at standard conditions (scf)
Y = Dry gas meter calibration factor (dimensionless)
Q = Total sampling time (minutes)

EPA Method 25A : Measurement of Total Organic Concentration Using a Flame Ionization Aanlyzer

Sample Calculations

drift cal. ppm as propane

= [(%FS analyzer stack value) - (%FS analyzer average 0 value)](span gas value ppm)
[(%FS analyzer average span value) - (%FS analyzer average 0 value)]

= (2.8 %FS) - [(0.0 %FS - 1.0 %FS) / 2](15.24 ppm)
[(8.0 %FS + 7.0 %FS) / 2]-[(0.0 %FS - 1.0 %FS)/2]

= 6.2 ppm VOC as propane

VOC emissions (lb/hr)

= [avg. VOC conc. (ppm)][stack flow (dscfm)](60 min/hr)(28.317 liter/ft^3)(44.09 g/mole)(2.205 lb/kg)
(24.055 liters/mole @ STP)(1000 g/kg)(1x10^6)(1 - %H_2O/100)

= (6.2 ppm)(1774 dscfm)(60)(28.317)((44.09)(2.205)
(24.055)(1000)(1x10^6)(1 - 0.0)

= 0.076 lb/hr VOC

VOC emissions (tons/year)

= [VOC (lb/hr)](8760 hours/year)
(2000 lbs/ton)

=[0.076](8760)
(2000)

= 0.331 tons/yr VOC

VOC emissions (lb propane/gallon beer)

= [VOC emissions (lb/hr)]
[beer flow (gallons/hr)]

= (0.076 lb/hr)(75/60 hours)
(479 gallons)

= 0.000198 lb propane/gallon beer

VOC emissions (lb propane/gallon mix)

= [VOC emissions (lb/hr)]
[mix flow (gallons/hr)]

= (0.076 lb/hr)(75/60 hours)
(550 gallons)

= 0.000173 lb propane/gallon mix

VOC emissions (lb/hr as ethanol)

= [VOC emissions (lb/hr as propane)][2.506 (empirical conversion factor)]

= (0.076)(2.506)

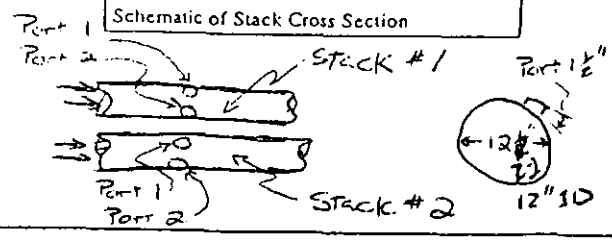
= 0.189 lb/hr as ethanol

Appendix 2
Field Data

Plant	COORS
Location	GOLDEN CAN CRUSHER
Stack ID	#1
Project Code	CB 30148
Date	10-21-93
Operator	MM - RL
Probe ID	
Pilot Constant	0.84

Air Pollution Testing, Inc.

Schematic of Stack Cross Section



Notes

VELOCITIES STACK 1

Run #	1		
O2 (%)		CO2 (%)	
H2O (%)		Measured / Assumed (circle)	
Ps (inches H2O)	+9.2	Pb (mbar)	837
start time		stop time	

point #	DP (" H2O)	Ts (oF)	Notes
1-1	.53	66	Points 2.5"
2	.42	66	3.3"
3	.49	66	5.2"
4	.57	66	10.3"
5	.54	66	12.2"
6	.52	66	13.0"
2-1	.20	66	
2	.58	66	
3	.60	66	
4	.59	66	
5	.54	66	
6	.46	66	
	Avg ΣΔ		
Averages	[illegible]	.7259	

Run #	2		
O2 (%)		CO2 (%)	
H2O (%)		Measured / Assumed (circle)	
Ps (inches H2(		Pb (mbar)	
start time		stop time	

point #	DP (" H2O)	Ts (oF)	Notes
1-1	.52		
2	.58		
3	.65		
4	.68		
5	.63		
6	.58		
2-1	.54		
2	.57		
3	.59		
4	.60		
5	.63		
6	.55		
Averages	.7677		

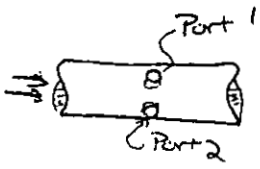
Run #	3		
O2 (%)		CO2 (%)	
H2O (%)		Measured / Assumed (circle)	
Ps (inches H2O)		Pb (mbar)	
start time		stop time	

point #	DP (" H2O)	Ts (oF)	Notes
	AVG Runs		
	1 + 2		
Averages			

Plant	COORS
Date	10-21-93
Location	GOLDEN CAN CRUSHER
Operator	MM-RL
Run Number	1
Pitot Tube Coefficient	0.84
Sample Box ID#	
Meter Box ID#	#1 MS-1
Meter ΔH@	
C Factor	
Pre-Test Pitot Leak Check	
Post-Test Pitot Leak Check	
Pre-Test Pump Leak Check	
Post-Test Pump Leak Check	

Air Pollution Testing, Inc.

Schematic of Stack Cross Section



STACK #2 (LOWER)

CO2 (%)	0.0
O2 (%)	20.5
Assumed Moisture (%)	
Barometric Pressure (mbar)	837
Ambient Temperature (oF)	
Probe Material	
Probe Length (ft)	
Filter Temperature (oF)	
Probe Temperature (oF)	
Moisture (grams)	
Nozzle Diameter (in)	
MOISTURE Start Time	09:30
Static Pressure (in H2O) +8.6	
MOISTURE Stop Time	10:06 *
Filter ID#	
Method	

Traverse Point Number	Sampling Time (minutes)	Vacuum (in Hg)	Pitot Velocity Head (in H2O)	Pressure Differential (in H2O)	Gas Volume (ft3) Initial Volume 938.024	Stack Temp. (oF)	Probe Temp. (oF)	Filter Temp. (oF)	Gas Temp. Inlet (oF)	Gas Temp. Outlet (oF)	Condenser Temp. (oF)
1-1	10		2.0	2.0	945.4	66°			60	54	48
2	20		2.3		952.3	66°			61	55	48
3	30		2.4		961.7	66			67	56	50
4	36		2.4	2.0	964.726				68	57	51
5			2.2								
6			1.8								
2-1			2.2	##							
2			2.4								
3			2.4								
4			2.8								
5			2.6								
6			2.0			66°					
			AVG 1.514		26.702	66°			60		49

* - 36 MINUTE MOISTURE RUN

Notes
- silica gain + 5.7 g
- water gain 134 ml
- 139.7 TOTAL **

** Probable Drops IN LINE

Production Data Run 1

- Beer/H2O Vol mix 550 gal or 17.74 barrels
- H2O 71 gal
- Total Beer 479 gal (550-71)

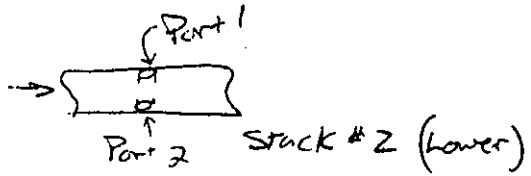
9:00 - 10:15 * CORRECT TO 1 Hour

CALCULATE AVG MOISTURE GAIN OF RUNS #2 + #3

Plant	COORS
Date	10-21-93
Location	GOLDEN
Operator	MM-RL
Run Number	2
Pitot Tube Coefficient	0.84
Sample Box ID#	
Meter Box ID#	MS-1
Meter ΔH@	
C Factor	
Pre-Test Pitot Leak Check	
Post-Test Pitot Leak Check	
Pre-Test Pump Leak Check	
Post-Test Pump Leak Check	

Air Pollution Testing, Inc.

Schematic of Stack Cross Section



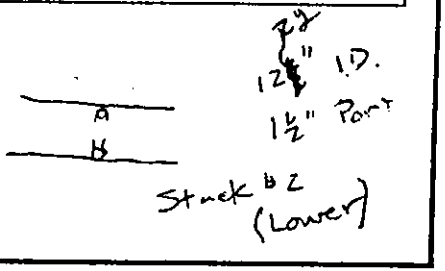
CO2 (%)	O2 (%) 20.5
Assumed Moisture (%)	Barometric Pressure (mbar) 837
Ambient Temperature (oF)	Probe Material
Probe Length (ft)	Filter Temperature (oF)
Probe Temperature (oF)	Moisture (grams)
Nozzle Diameter (in)	Start Time 10:45
Static Pressure (in H2O)	Stop Time 11:45
Filter ID#	Method

Traverse Point Number	Sampling Time (minutes)	Vacuum (in Hg)	Velocity Head (in H2O)	Pressure Differential (in H2O)	Gas Volume (ft3) Initial Volume 964.726	Stack Temp. (oF)	Probe Temp. (oF)	Filter Temp. (oF)	Gas Temp. Inlet (oF)	Gas Temp. Outlet (oF)	Condenser Temp. (oF)	Notes
												Moisture silica 35g water 0 ml 3.5 ml
1-1	10		1.9	2.0	974.1	78			78	70	48	Production Data (Bueb)
2	20		1.9	2.0	982.6	78			81	72	46°	17 gal Beer/H2O
3	30		2.2	2.0	991.20	78			85	75	46°	2 gal H2O
4			2.4									15 gal Bear Total
5			2.1									60 minute 10:45-11:45
6			2.0									
2-1			2.2	2.0								
2			1.8									
3			2.2									
4			2.5									
5			2.2									
6			2.0									
			1.453		26.474	78			77		47°	

Plant	COORS
Date	10-21-93
Location	GOLDEN
Operator	MM - RL
Run Number	3
Pitot Tube Coefficient	0.84
Sample Box ID#	
Meter Box ID#	MS-1
Meter ΔH@	
C Factor	
Pre-Test Pitot Leak Check	
Post-Test Pitot Leak Check	
Pre-Test Pump Leak Check	
Post-Test Pump Leak Check	

Air Pollution Testing, Inc.

Schematic of Stack Cross Section



CO2 (%)	O2 (%) 20.5
Assumed Moisture (%)	Barometric Pressure (mbar) 837
Ambient Temperature (oF)	Probe Material
Probe Length (ft)	Filter Temperature (oF)
Probe Temperature (oF)	Moisture (grams)
Nozzle Diameter (in)	Start Time 12:00
Static Pressure (in H2O)	Stop Time 12:30
Filter ID#	Method

Traverse Point Number	Sampling Time (minutes)	Vacuum (in Hg)	Velocity Head (in H2O)	Pressure Differential (in H2O)	Gas Volume (ft3) Initial Volume 991.20	Stack Temp. (oF)	Probe Temp. (oF)	Filter Temp. (oF)	Gas Temp. Inlet (oF)	Gas Temp. Outlet (oF)	Condenser Temp. (oF)	Notes
												Moisture Silica 4.2 g Water 1 ml 5.2
1-1	10			2.0	9999	~~[illegible]~~79			96	90	51	Production Data Run #3
2	20			2.0	1008.5				96	91	52	Beer/H2O 391.6 gal
3	30			2.0	1016.915				97	91	52	H_2O 54.6 H2O
4												Total Beer 337.0
5												60 min 12:00-1:00pm
6												
2-1				2.0								
2												
3												
4												
5												
6												
			AVG Runs 1,2		25.715	79			94		52	

APT

Client	COORS
Plant	
Date	10-21
Analyst	MM

Location CAN CRUSH Date 10/21	CO_2	$CO_2 + O_2$	O_2
Run # 1	0	20.6	20.6
Notes	0	20.4	20.4

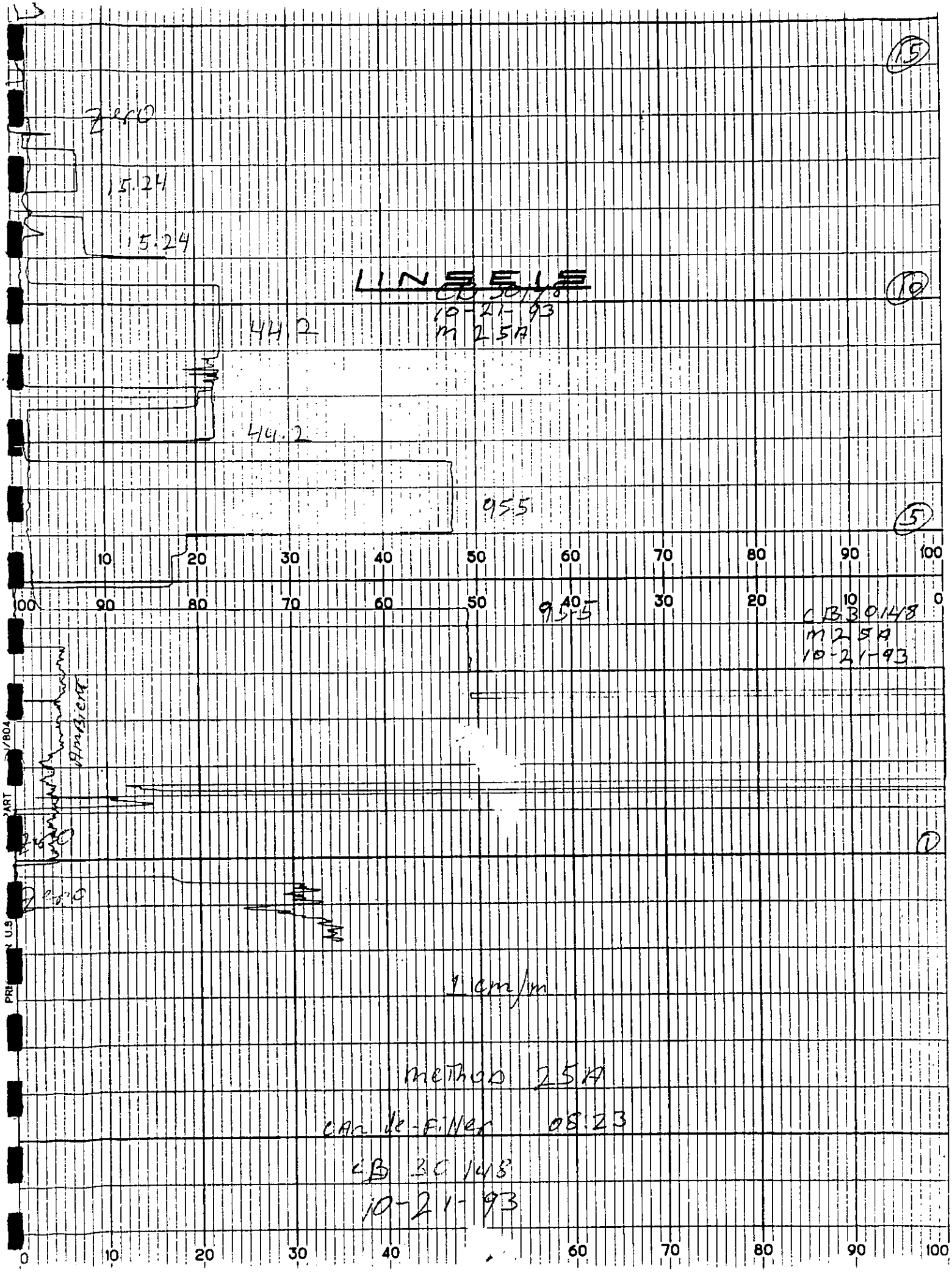
Location Date	CO_2	$CO_2 + O_2$	O_2
Run #	0	20.6	20.6
Notes	0	20.4	20.4

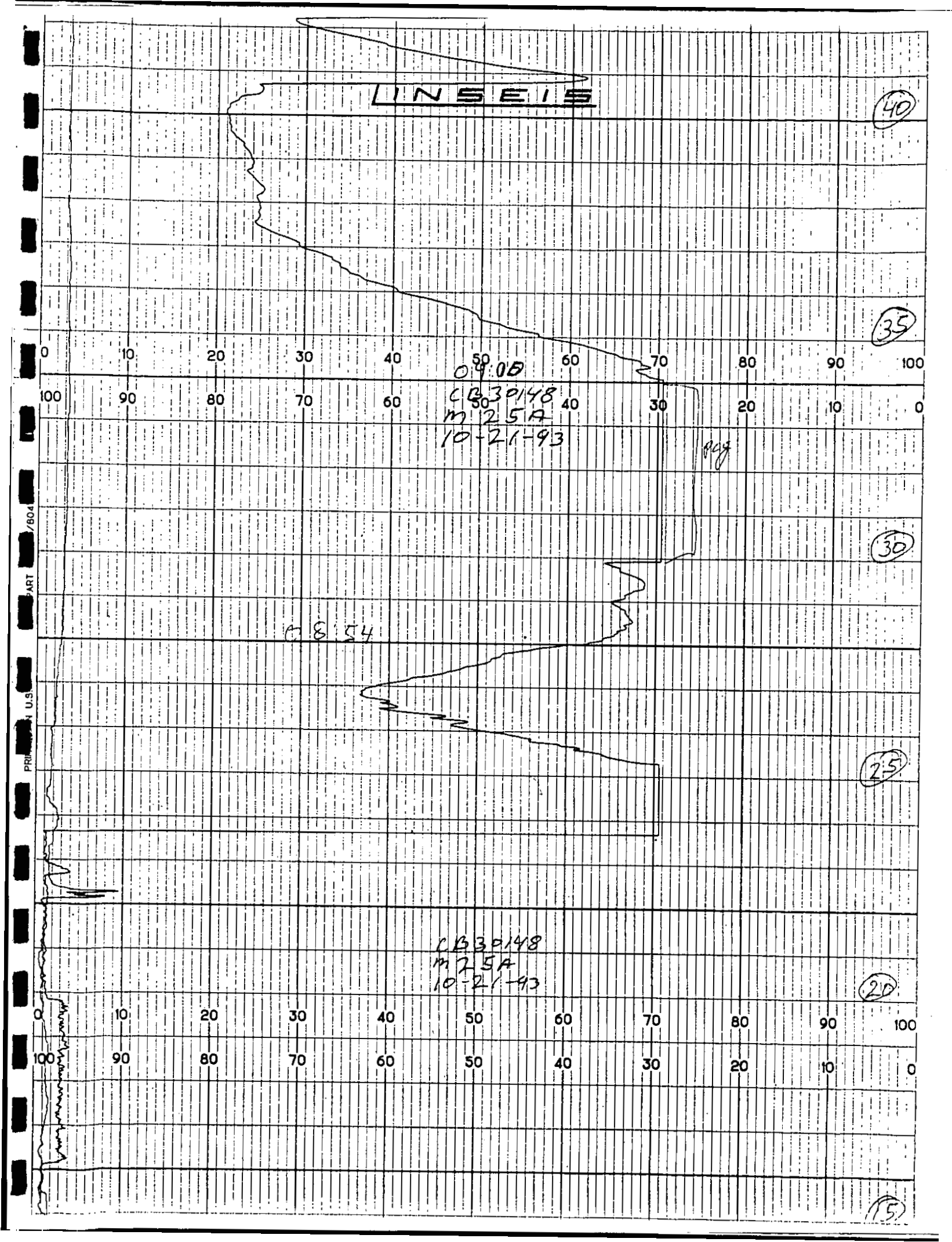
Location Date	CO_2	$CO_2 + O_2$	O_2
Run #	0	20.6	20.6
Notes	0	20.4	20.4

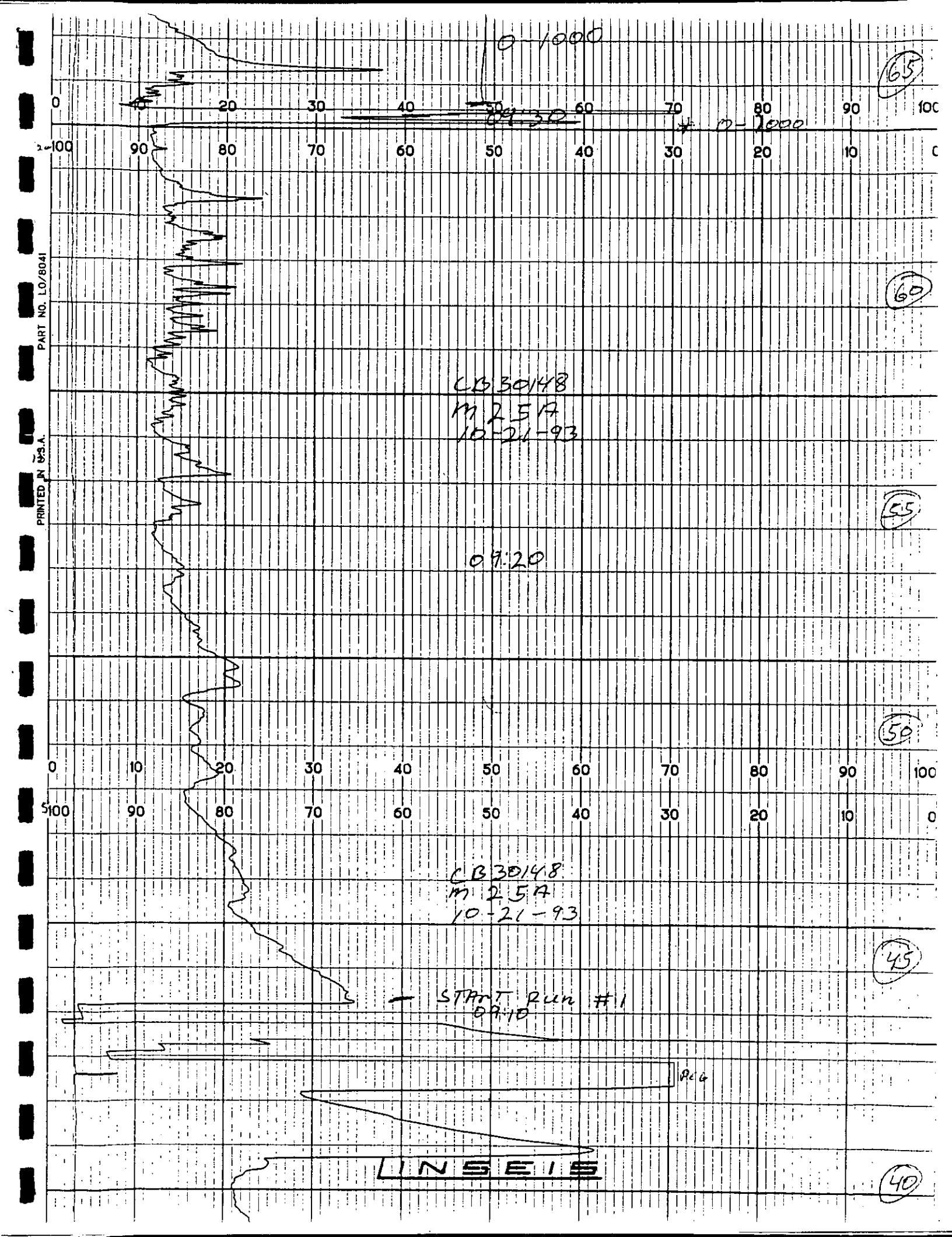
Location Date	CO_2	$CO_2 + O_2$	O_2
Run #			
Notes			

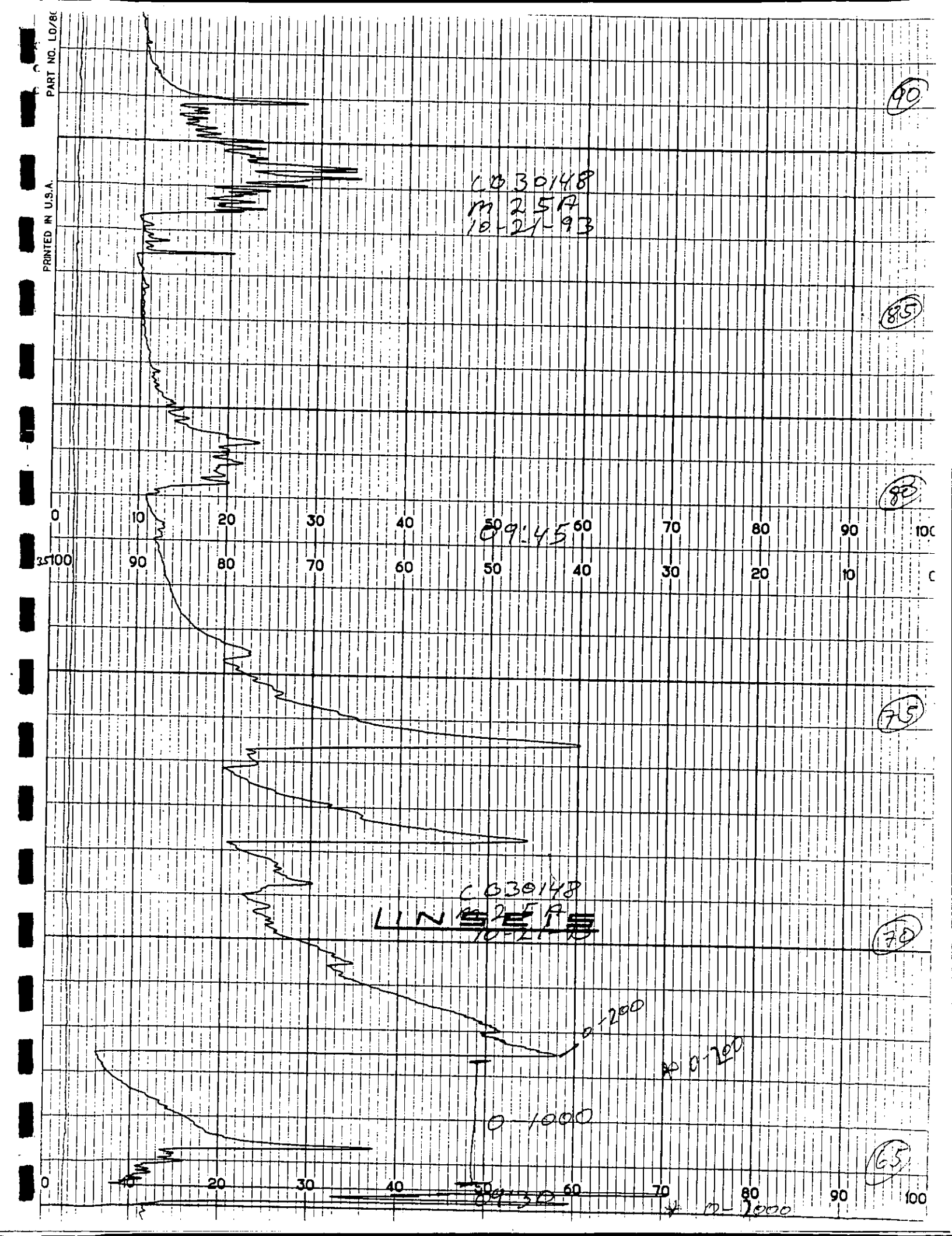
Location Date	CO_2	$CO_2 + O_2$	O_2
Run #			
Notes			

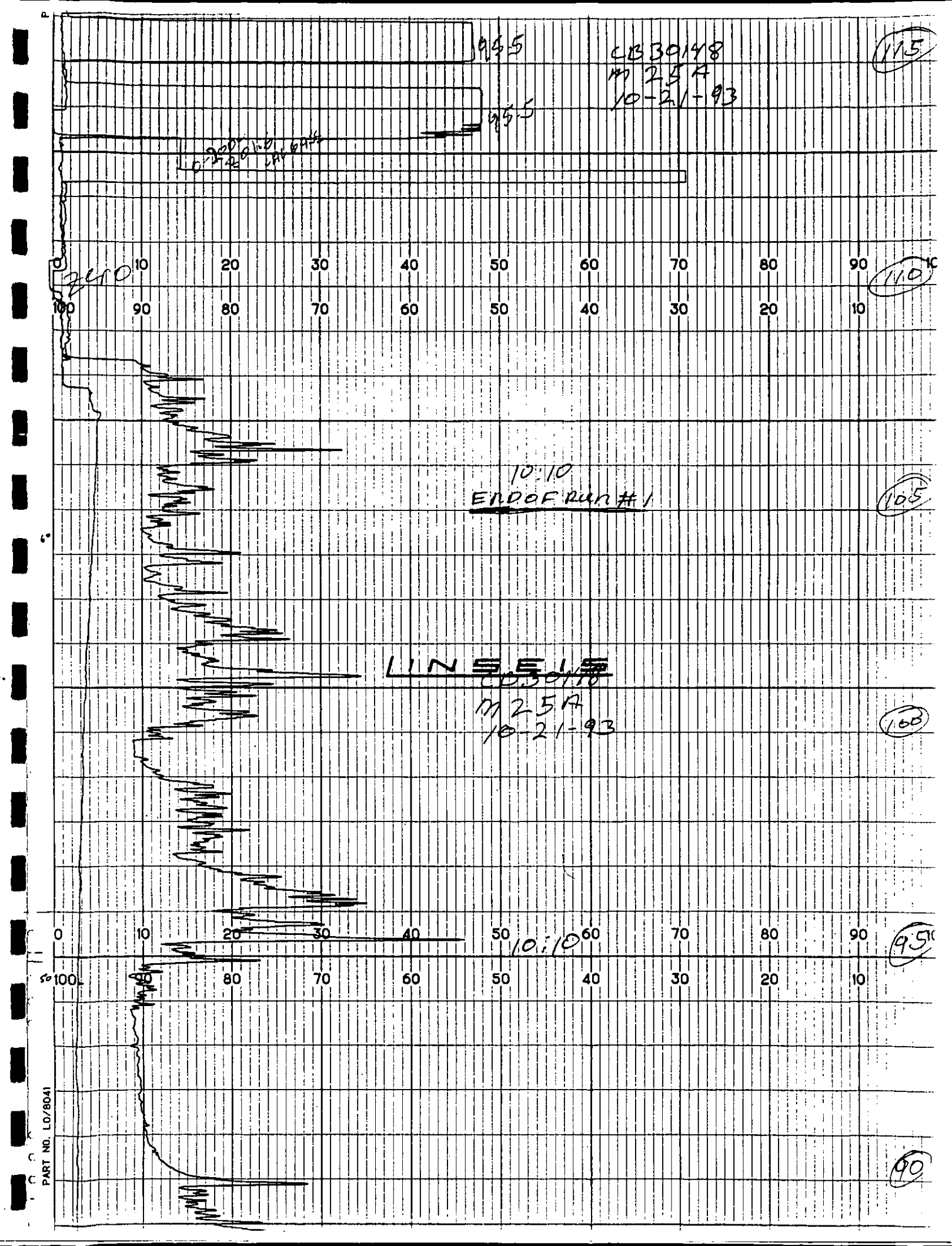
Location Date	CO_2	$CO_2 + O_2$	O_2
Run #			
Notes			

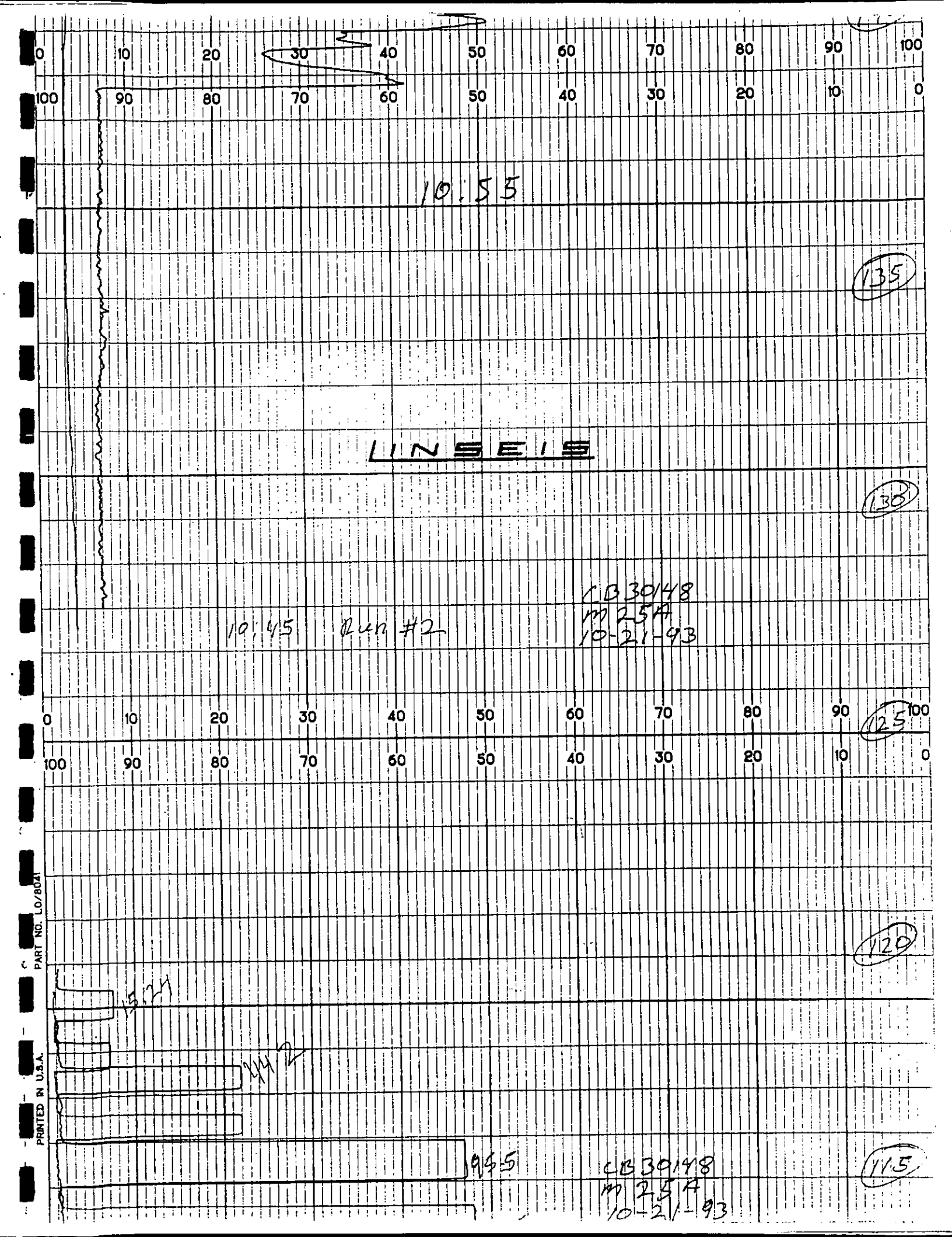

Zero
15.24
15.24
LINESS
CB 50/48
10-21-93
M 25A
44.2
44.2
955
955
CBB0148
M25A
10-21-93
Ambient
1 cm/m
method 25A
CAL de-FINer 08.23
CB BC 148
10-21-93
15
10
5
1
0
10
20
30
40
50
60
70
80
90
100

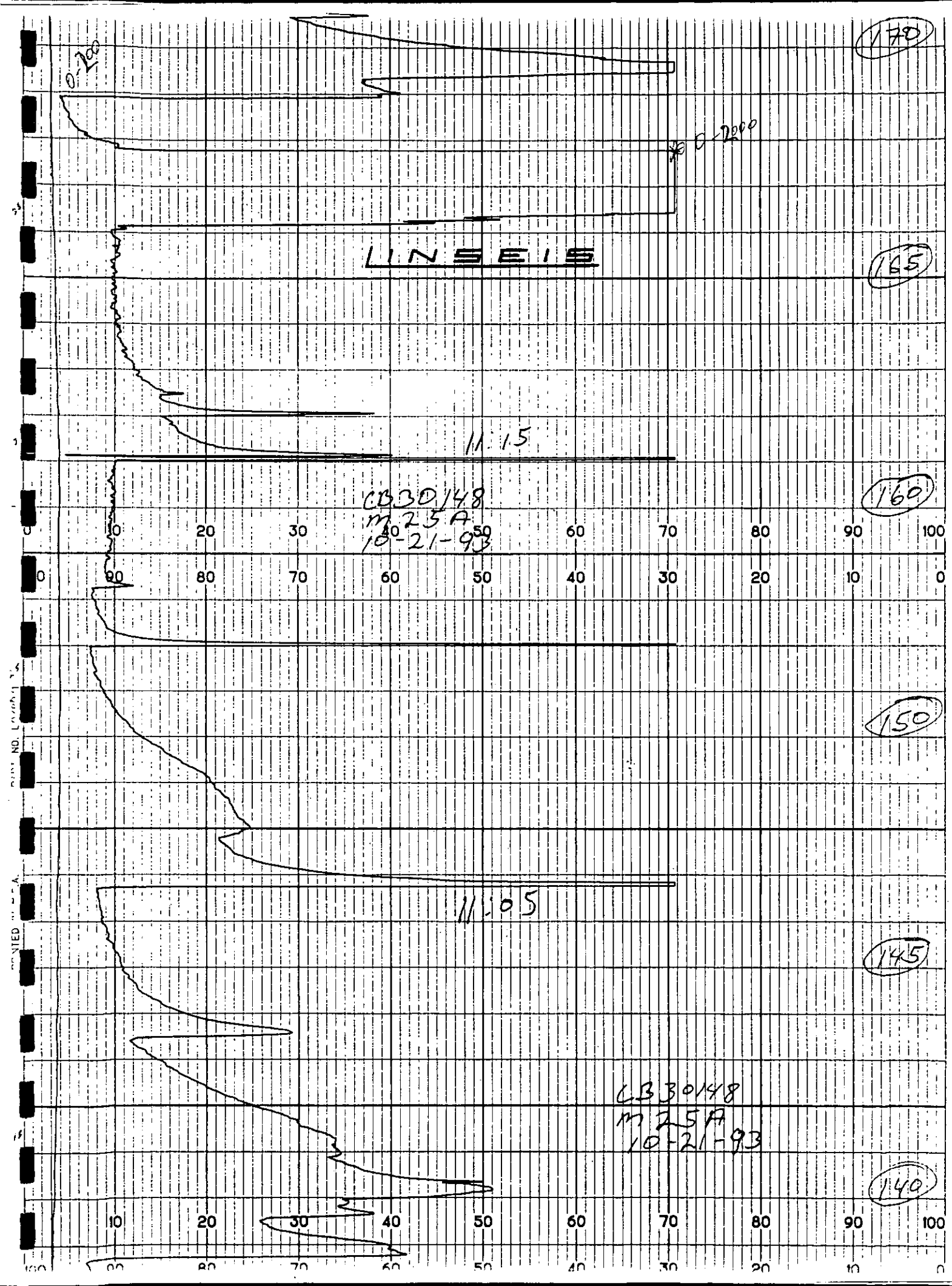

LINSEIS
40
35
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
0900
CB30148
m125A
10-21-93
pcg
30
CB54
25
CB30148
m75A
10-21-93
20
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
15

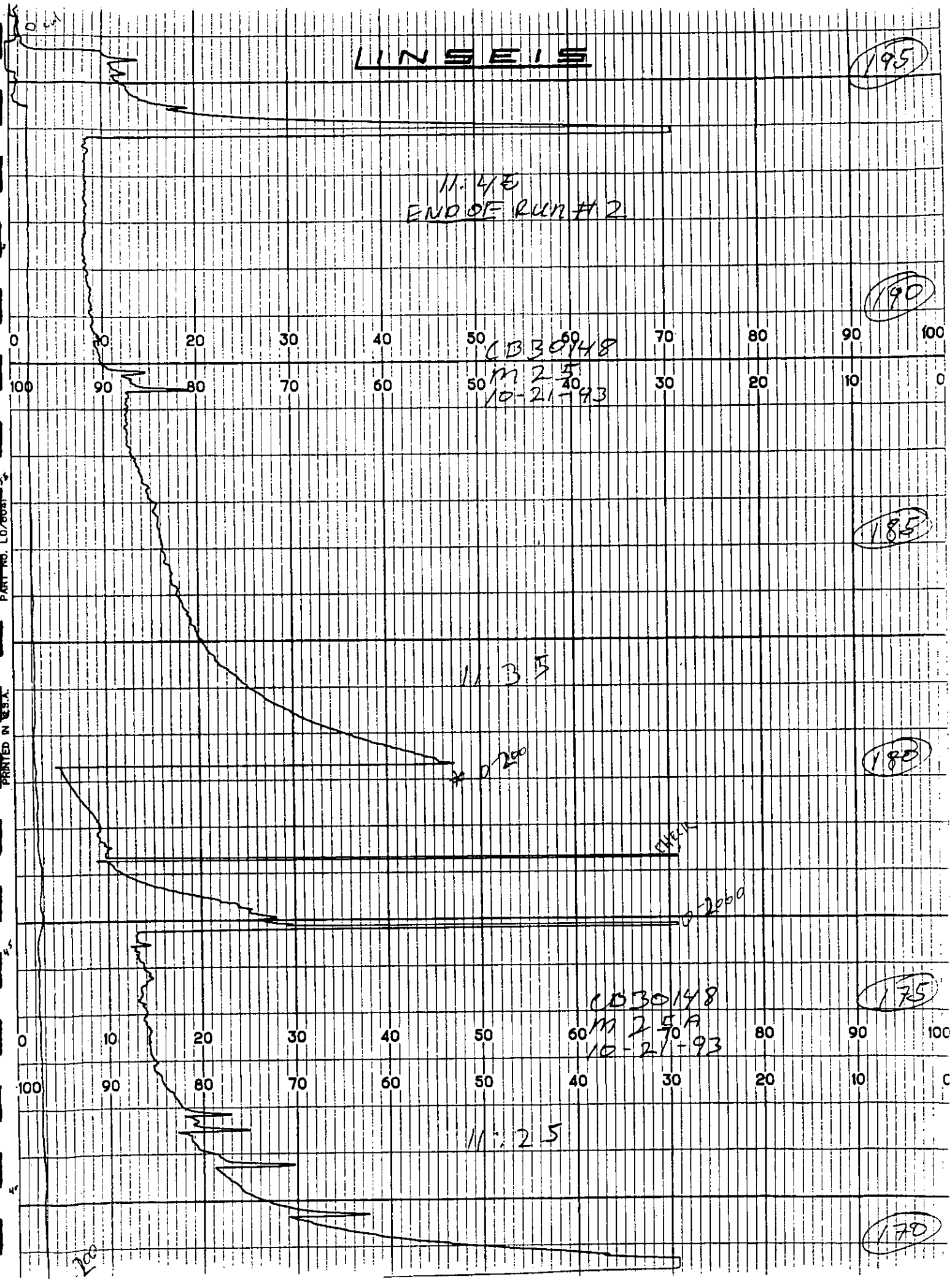

0-1000
65
0
10
20
30
40
50
60
70
80
90
100
09:30
0-1000
100
90
80
70
60
50
40
30
20
10
0
PART NO. LO/8041
PRINTED IN U.S.A.
60
CB30148
M 2.5A
10-21-93
55
09:20
50
0
10
20
30
40
50
60
70
80
90
100
100
90
80
70
60
50
40
30
20
10
0
CB30148
M 2.5A
10-21-93
45
START Run #1
09:10
Reg
LINSEIS
40

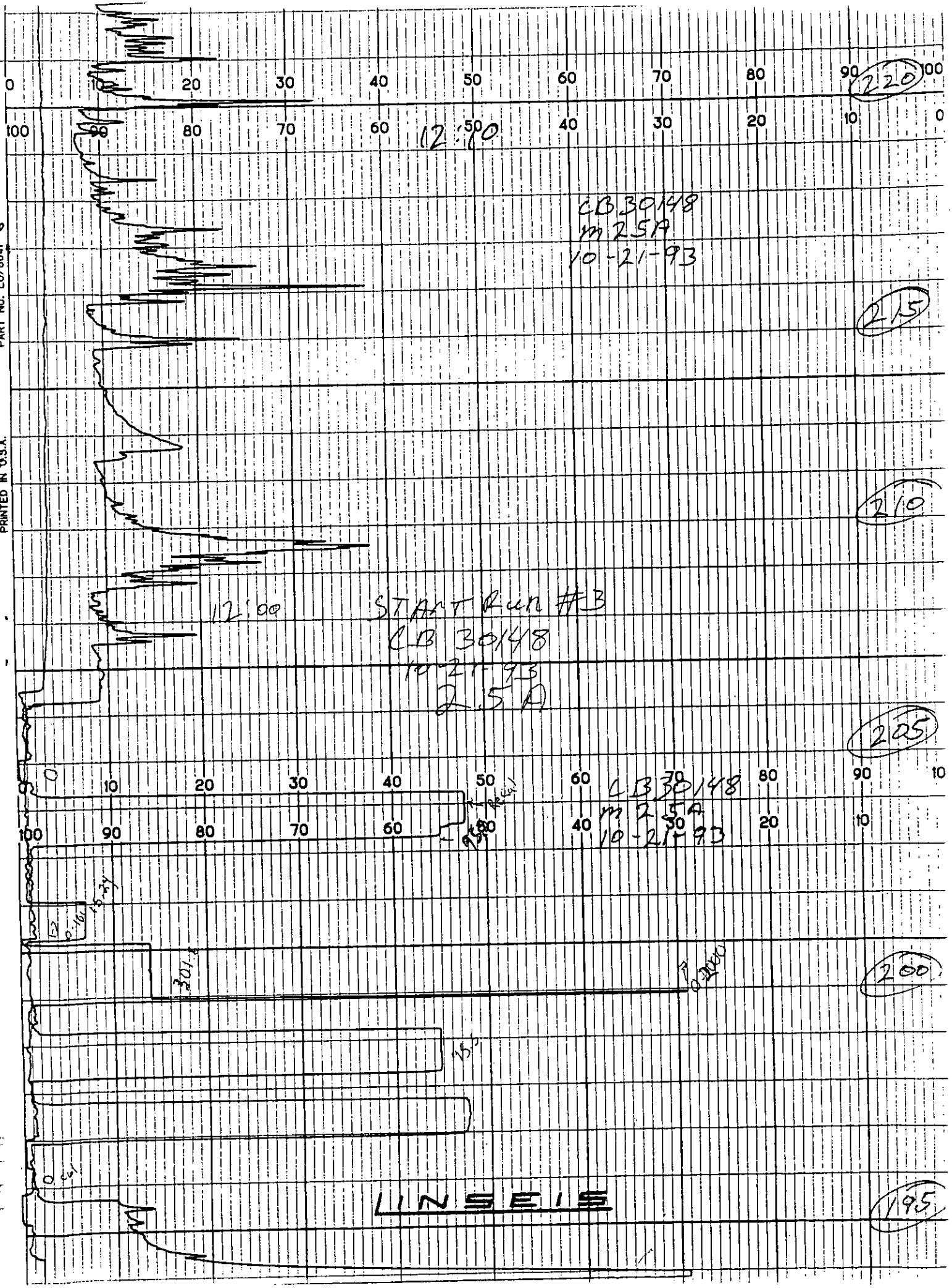

PART NO. LO/8
PRINTED IN U.S.A.
90
85
80
75
70
65
C 030148
M 25A
10-21-93
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
89.45
C 030148
LINEAR
10-21-93
0-200
0-1000
0-2000
89.30

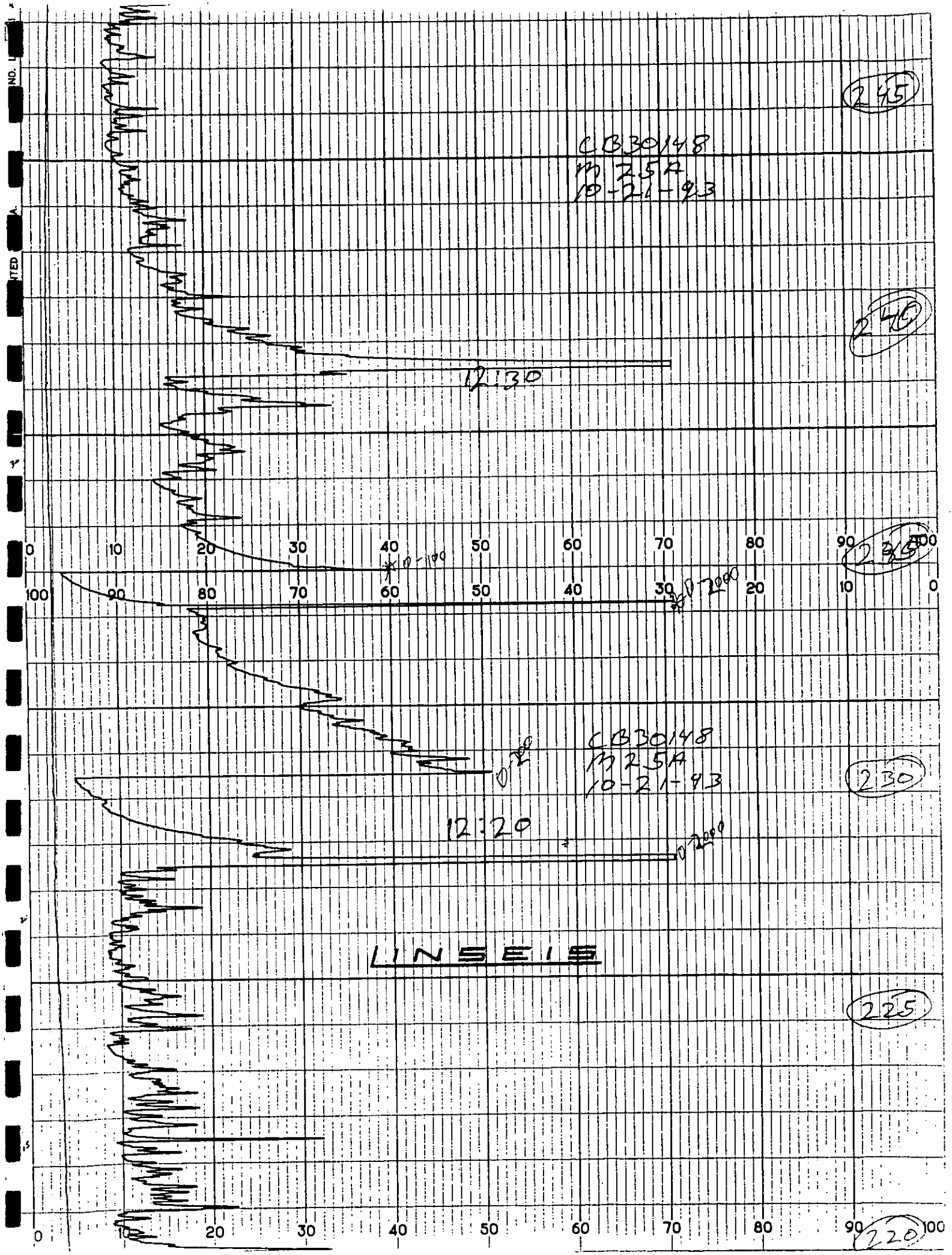

945
945
CB30148
#2.5A
10-21-93
115
2400
10
20
30
40
50
60
70
80
90
100
110
10:10
END OF RUN #1
105
LINSEIS
#2.5A
10-21-93
100
0
10
20
30
40
50
10:10
60
70
80
90
95
100
80
70
60
50
40
30
20
10
90
PART NO. LO/8041

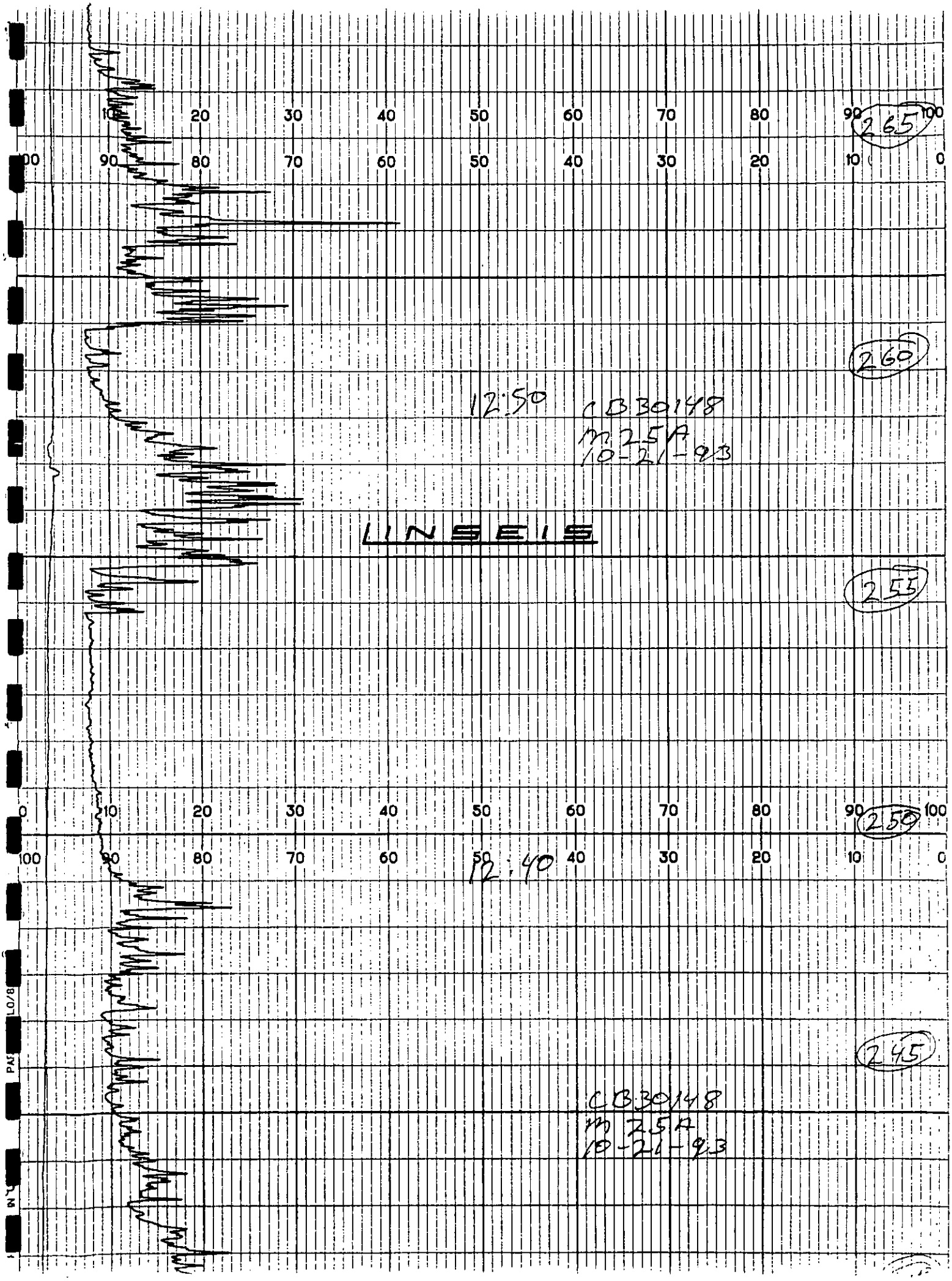

10:55
LINSEIS
10:45 Run #2
CB30148
MP 25A
10-21-93
135
130
125
120
115
9:45
CB30148
MP 25A
10-21-93
PART NO. LO/8041
PRINTED IN U.S.A.

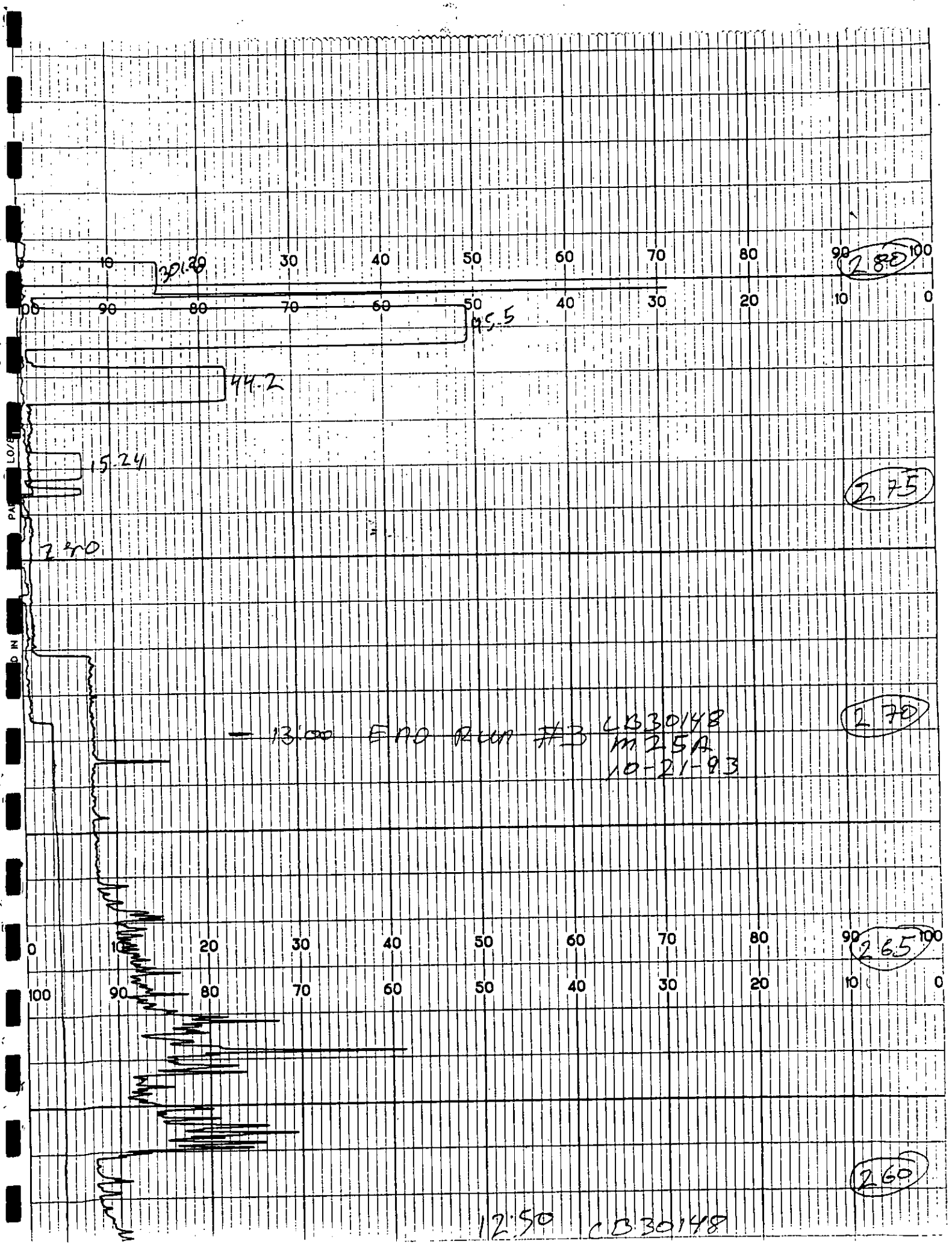

0-100
0-2000
LINSEIS
11.15
CB30148
M25A
10-21-93
11:05
CB30148
M25A
10-21-93
170
165
160
150
145
140
0
10
20
30
40
50
60
70
80
90
100


LINSEIS
11.45
END OF RUN #2
195
190
0 10 20 30 40 50 60 70 80 90 100
CB30148
M 2 5
10-21-93
100 90 80 70 60 50 40 30 20 10 0
185
11.35
180
0-200
0-2000
CB30148
M 2 5A
10-21-93
175
11:25
170
200
PART NO. L0/8041
PRINTED IN U.S.A.




2:45
CB30148
m 2.5A
10-21-93
2:40
12:30
0-1100
0-2000
2:35
2:30
0-2000
12:20
LINSEIS
2:25
2:20


265
260
12:50
CB30148
M2.5A
10-21-93
LINSEIS
255
250
12:40
245
CB30148
M2.5A
10-21-93


30.28
95.5
44.2
15.24
7.40
2.80
2.75
2.70
2.65
2.60
13.00 END RUN #3 CB30148
M125A
10-21-93
12.50 CB30148

Appendix 3
Calibration Certificates

Air Pollution Testing, Inc.

Dry Gas Meter Calibration

Meter Box ID M5-1

Laboratory Data (Pre-test)

run #	1	2	3	average
date	9-14-93	9-14-93	9-14-93	
barometric pressure (mbar)	848	848	848	848
ref. vol. (cubic feet)	17.955	14.050	24.926	18.977
meter vol. (cubic feet)	17.526	13.739	24.335	18.533
ref. temp. (oF)	61	66	68	65
meter inlet temp. (oF)	64	72	81	72
meter outlet temp. (oF)	61	66	70	66
delta H (inches water)	0.48	1.00	2.50	1.33
delta P (inches water)	0.12	0.13	0.24	0.16
time (minutes)	42	23	26	30.33
ref. calibration factor	0.9987	0.9987	0.9987	0.9987

Calculations (Pre-test)

meter calibration factor	1.0243	1.0237	1.0292	1.0257
meter delta H @ (inches water)	1.74	1.79	1.82	1.78

Laboratory Data (Post-test)

run #	1	2	3	average
date	10-22-93	10-22-93	10-22-93	
barometric pressure (mbar)	853	853	853	853
ref. vol. (cubic feet)	16.518	19.222	19.202	18.314
meter vol. (cubic feet)	15.847	18.597	18.686	17.710
ref. temp. (oF)	68	68	68	68
meter inlet temp. (oF)	67	76	81	75
meter outlet temp. (oF)	63	66	70	66
delta H (inches water)	1.90	2.00	2.00	1.97
delta P (inches water)	0.23	0.23	0.23	0.23
time (minutes)	20	23	23	22.00
ref. calibration factor	0.9987	0.9987	0.9987	0.9987

Calculations (Post-test)

meter calibration factor	1.0287	1.0314	1.0341	1.0314
meter delta H @ (inches water)	1.87	1.91	1.90	1.90

APT

Air Pollution Testing, Inc.
Dry Gas Meter Calibration Data

Pre-test Date: 9-14-93 848 meter BOX # 1

	DH	Vmet	Tin	Tout	Vref	Tref	DP	Time
Run #1	.5	728.168	58	58	159.136	58	.12	0
	.56	745.694	69	63	177.091	64	.12	42
	(.48)	(17.526)	(64)	(61)	(17.455)	(60)	(.12)	
Run #2	1.0	745.835	68	64	177.233	64	.13	0
	1.0	759.574	76	67	191.283	67	.13	23
	(1.0)	13.739	(72)	(66)	14.05	(66)	(13)	
Run #3	2.5	759.574	76	67	191.283	67	.24	0
	2.5	782.909	85	72	216.209	68	.24	26
	(2.5)	(24.335)	(80.5)	(69.5)	(24.926)	(68)	(24)	

	Run #1	Run #2	Run #3	Average
Yd	1.0243	1.0237	1.0292	1.0257
DH@	1.74	1.79	1.82	1.78

Post-test Date: 9-27-93 mom = 849

	DH	Vmet	Tin	Tout	Vref	Tref	DP	Time
Run #1	1.0	848.00	62	62	290.778	62	.17	09:18
	0.97	864.943	72	64	308.230	64	.16	09:47
	(.98)	(16.943)	(67)	(63)	(17.453)	(63)	.17	:29
Run #2	.98	864.943	72	64	308.230	64	.17	09:48
	.98	892.037	82	72	335.852	68	.17	10:34
	(.98)	(27.094)	(77)	(68)	(27.622)	(66)	.17	:46
Run #3	1.0	892.037	82	72	335.852	68	(.17)	10:35
	1.0	938.015	89	81	382.307	72	.17	11:51
	(1.0)	(45.978)	(86)	(77)	(46.455)	(70)	(.17)	:76

	Run #1	Run #2	Run #3	Average
Yd	1.0292	1.0273	1.0274	1.0280
DH@	1.80	1.80	1.77	1.79

APT

Air Pollution Testing, Inc.
Dry Gas Meter Calibration Data

Pre-test Date: 10-22-93 m51 MB = 853

	DH	Vmet	Tin	Tout	Vref	Tref	DP	Time
Run #1	2.0	16.918	61	62	382.370	68	.24	08:25 :35
	1.8	32.765	72	64	398.828	(68)	.22	08:45:35
	(1.9)	(15.847)	(67)	(63)	(16.518)	(68)	(.23)	(20)
Run #2	2.0	32.765	72	64	398.828	68	.23	0846:30
	2.0	51.362	80	68	418.050	68	.23	09:04:30
	(2.0)	(18.597)	(76)	(66)	(19.222)	(68)	(.23)	(23)
Run #3	2.0	51.362	80	68	418.050	68	.23	09:14
	2.0	70.045	81	72	437.252	68	.23	09:34
	(2.0)	(18.683)	(81)	(70)	(19.202)	(68)	(.23)	(23)

	Run #1	Run #2	Run #3	Average
Yd	1.0287	1.0314	1.0341	1.0314
DH@	1.87	1.91	1.9	1.89

Post-test Date:

	DH	Vmet	Tin	Tout	Vref	Tref	DP	Time
Run #1								
Run #2								
Run #3								

	Run #1	Run #2	Run #3	Average
Yd				
DH@				

APT

Air Pollution Testing, Inc.
K-type Thermocouple Calibration Data

Date 10-22-93

Thermocouple ID M2-3

Inspector RL

Thermocouple Reading (°F)	Thermometer Reading (°F)
T1 = 32°	T1 = 33°
T2 = 206°	T2 = 208°
T3 = 322°	T3 = 324°

Air Pollution Testing, Inc.
S-type Pitot Tube Geometric Calibration Data

All variables are as defined in *Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 2*.

Date 10-22-93

Pitot ID M2-3

Inspector RL

α^1 = 0°	$\alpha^1 \leq 10°$
α^2 = 0°	$\alpha^2 \leq 10°$
β^1 = 0°	$\beta^1 \leq 5°$
β^2 = 0°	$\beta^2 \leq 5°$
z = 0.000"	z ≤ 0.125"
w = 0.000"	w ≤ 0.031"

Pitot Constant = 0.84

Scott Specialty Gases, Inc.

6141 EASTON ROAD, P.O. BOX 310, PLUMSTEADVILLE, PA 18949-0310 (215) 766-8861 FAX: (215) 766-0320

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
Air Pollution Testing Inc
7711 W 6Th Ave
Suite 1
Lakewood, CO 80215

Assay Laboratory
Scott Specialty Gases, Inc.
6141 Easton Road
P.O. Box 310
Plumsteadville, PA 18949-0310

Purchase Order 931069
Scott Project # 01-47642-001

ANALYTICAL INFORMATION

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

Cylinder Number	ALM016727	**Certification Date**	05-26-93	**General Exp. Date**	11-26-93
Cylinder Pressure	1900 psig	**Previous Certification Dates**	None	**Acid Rain Exp. Date**	11-26-94

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Propane	**15.24 ppm**	**±1% NIST Directly Traceable**
Balance Gas: Nitrogen		

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

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
GMIS	07-29-93	A5794	18.15 ppm C_3H_8 in N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
C3H8: Varian/VA3300/7945	04-29-93	FID

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

Components	First Triad Analysis	Second Triad Analysis	Calibration Curve
Propane	Date: 05-26-93 Response Units: Area Z1=000000 R1=198861 T1=167061 R2=199263 Z2=000000 T2=166253 Z3=000000 T3=167304 R3=198263 Avg. Conc. of Cust. Cyl. 15.24 ppm		Concentration=$A+Bx+Cx^2+Dx^3+Ex^4$ r=0.99999 Constants: A=0.0000E+00 B=0.0000E+00 C=0.0000E+00 D=0.0000E+00 E=0.0000E+00

Special Notes If this product is used for Acid Rain Rule compliance under 40 CFR Part 75, the Acid Rain Expiration Date applies per Appendix H. If for use with other than 40 CFR Part 75 compliance, the General Expiration Date applies.

Analyst Robert K. Kufrovich

Scott Specialty Gases, Inc.

6141 EASTON ROAD, P.O. BOX 310, PLUMSTEADVILLE, PA 18949-0310 (215) 766-8861 FAX: (215) 766-0320

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
Air Pollution Testing Inc
7711 W 6Th Ave
Suite 1
Lakewood, CO 80215

Assay Laboratory
Scott Specialty Gases, Inc.
6141 Easton Road
P.O. Box 310
Plumsteadville, PA 18949-0310

Purchase Order 931069
Scott Project # 01-47642-003

ANALYTICAL INFORMATION

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

Cylinder Number	ALM032646	**Certification Date**	05-25-93	**General Exp. Date**	11-25-93
Cylinder Pressure	1900 psig	**Previous Certification Dates**	None	**Acid Rain Exp. Date**	11-25-94

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Propane	**95.5 ppm**	**±1% NIST Directly Traceable**
Balance Gas: Nitrogen		

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

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
GMIS	06-02-93	ALM029208	125.5 ppm C_3H_8 in N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
C3H8: Varian/VA3300/7945	03-02-93	FID

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

Components	First Triad Analysis	Second Triad Analysis	Calibration Curve
Propane	Date: 05-25-93 Response Units: Area Z1=000000 R1=357466 T1=272375 R2=358404 Z2=000000 T2=272526 Z3=000000 T3=273405 R3=359979 Avg. Conc. of Cust. Cyl. 95.5 ppm		Concentration=A+Bx+Cx^2+Dx^3+Ex^4 r=0.99999 Constants: A=0.0000E+00 B=0.0000E+00 C=0.0000E+00 D=0.0000E+00 E=0.0000E+00

Special Notes If this product is used for Acid Rain Rule compliance under 40 CFR Part 75, the Acid Rain Expiration Date applies per Appendix H. If for use with other than 40 CFR Part 75 compliance, the General Expiration Date applies.

Analyst Robert K. Kufrovich

Scott Specialty Gases, Inc.

6141 EASTON ROAD, P.O. BOX 310, PLUMSTEADVILLE, PA 18949-0310 (215) 766-8861 FAX: (215) 766-0320

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
Air Pollution Testing Inc
7711 W 6Th Ave
Suite 1
Lakewood, CO 80215

Assay Laboratory
Scott Specialty Gases, Inc.
6141 Easton Road
P.O. Box 310
Plumsteadville, PA 18949-0310

Purchase Order 931069
Scott Project # 01-47642-002

ANALYTICAL INFORMATION

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

Cylinder Number	ALM031818	**Certification Date**	05-27-93	**General Exp. Date**	11-27-93
Cylinder Pressure	1900 psig	**Previous Certification Dates**	None	**Acid Rain Exp. Date**	11-27-94

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Propane	**44.2 ppm**	**±1% NIST Directly Traceable**
Balance Gas: Nitrogen		

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

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
SRM1667B	03-10-97	CLM004711	47.3 ppm C_3H_8 in N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
C3H8: Varian/VA3300/7945	05-27-93	FID

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

Components	First Triad Analysis	Second Triad Analysis	Calibration Curve
Propane	Date: 05-27-93 Response Units: Area Z1=000000 R1=521562 T1=487287 R2=521854 Z2=000000 T2=486512 Z3=000000 T3=488073 R3=521090 Avg. Conc. of Cust. Cyl. 44.2 ppm		Concentration=$A+Bx+Cx^2+Dx^3+Ex^4$ r=0.99999 Constants: A=0.0000E+00 B=0.0000E+00 C=0.0000E+00 D=0.0000E+00 E=0.0000E+00

Special Notes If this product is used for Acid Rain Rule compliance under 40 CFR Part 75, the Acid Rain Expiration Date applies per Appendix H. If for use with other than 40 CFR Part 75 compliance, the General Expiration Date applies.

Analyst: Robert K. Kufrovich

Scott Specialty Gases

500 WEAVER PARK ROAD, LONGMONT, COLORADO 80501 (303) 442-4700 Fax (303) 772-7673

Shipped From : Scott Colorado
Date Shipped : 8-18-92
Our Project # : 808272
Your P.O. # : 92-693
Page ____ of ____
Expiration Date : 02/07/94

Customer : AIR POLLUTION TESTING INC
4535 W. 68TH AVE
WESTMINSTER CO 80030

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****

Certified Per Traceability Protocol # 1 Section 3.0.4

File # APT301C3

Certified Accuracy 1 % NIST Traceable

Cylinder Number AAL-6506

Cylinder Pressure 2000 psig

CGA Fitting 350

QC Number 22139217

COMPONENT	CERTIFIED CONC.	REFERENCE STDS SRM # (CRM #)	CYLINDER NUMBER	CONC.	GAS ANALYZER MAKE/MODEL	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
PROPANE	301.6 PPM	2646	AAL-18342	973.0 PPM	HEWLETT-PACKARD/5890A 3115A34623	07-13-92	FLAME IONIZATION
		GMIS*	1L-14382	314.0 PPM			

BALANCE GAS : NITROGEN

FIRST ANALYSIS DATE : 07/31/92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	0.3020	302.0	314.0 PPM	0.3140	314.0
0.00	0.3020	302.0		0.3140	314.0
0.00	0.3020	302.0		0.3140	314.0

CALCULATED RESULTS 302.0, 302.0, 302.0

AVERAGE : 302.0 PPM

SECOND ANALYSIS DATE : 08/07/92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	0.3011	301.1	314.0 PPM	0.3140	314.0
0.00	0.3011	301.1		0.3140	314.0
0.00	0.3011	301.1		0.3140	314.0

CALCULATED RESULTS 301.1, 301.1, 301.1

AVERAGE : 301.1 PPM

CALIBRATION CURVE 1 st DEGREE

SRM # (CRM #)	CONC. %	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	0.00	0	0.00	0.00	0.00
	0.00	0	0.00	0.00	0.00
	0.00	0	0.00	0.00	0.00
	0.00	0	0.00	0.00	0.00
	0.00	0	0.00	0.00	0.00
	0.00			0.00	0.00

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : David Chapman
DAVID CHAPMAN

Approved By : RS
RIC SCHMELTEKOPF

Appendix 4
Ethanol / Propane Conversion

Ethanol / Propane Conversion

An empirical constant for conversion of propane calibrated FIA data to true ethanol values was experimentally determined. Tedlar gas bags were filled with known volumes of hydorcarbon-free air using an SKC personal sampling pump and an NIST traceable bubble flow calibrator. The bags were then injected with precisely known masses of reagent grade ethanol, using a syringe that was weighed on a certified 0.1 mg scale before and after injection. The bags were allowed time to mix thoroughly and were analyzed using the FIA used for all filler room data collection presented in this report. Immediately before and after each bag was analyzed, the analyzer was challenged with hydorcarbon-free air and calibration gas prepared and certified in accordance with EPA Protocol 1.

Coors Brewing Company
Ethanol / Propane Conversion

Strip Chart Data

run #1	zero %FS	span %FS	span ppm
start	0.0	69.8	701
stop	0.2	69.0	
	bag %FS	bag ppm	
	20.0	201.4	

run #2	zero %FS	span %FS	span ppm
start	0.0	70.0	701
stop	0.2	69.5	
	bag %FS	bag ppm	
	24.0	240.5	

run #3	zero %FS	span %FS	span ppm
start	0.0	69.5	701
stop	0.2	68.0	
	bag %FS	bag ppm	
	68.0	693.3	

run #4	zero %FS	span %FS	span ppm
start	0.0	68.0	701
stop	0.0	67.5	
	bag %FS	bag ppm	
	21.3	220.4	

run #5	zero %FS	span %FS	span ppm
start	0.0	69.5	701
stop	0.0	69.5	
	bag %FS	bag ppm	
	30.0	302.6	

Table A4:1
Ethanol Propane Conversion
Strip Chart Data

Ethanol / Propane Conversion (continued)

Coors Brewing Company
Ethanol / Propane Conversion Data
1-14-93

Laboratory Data

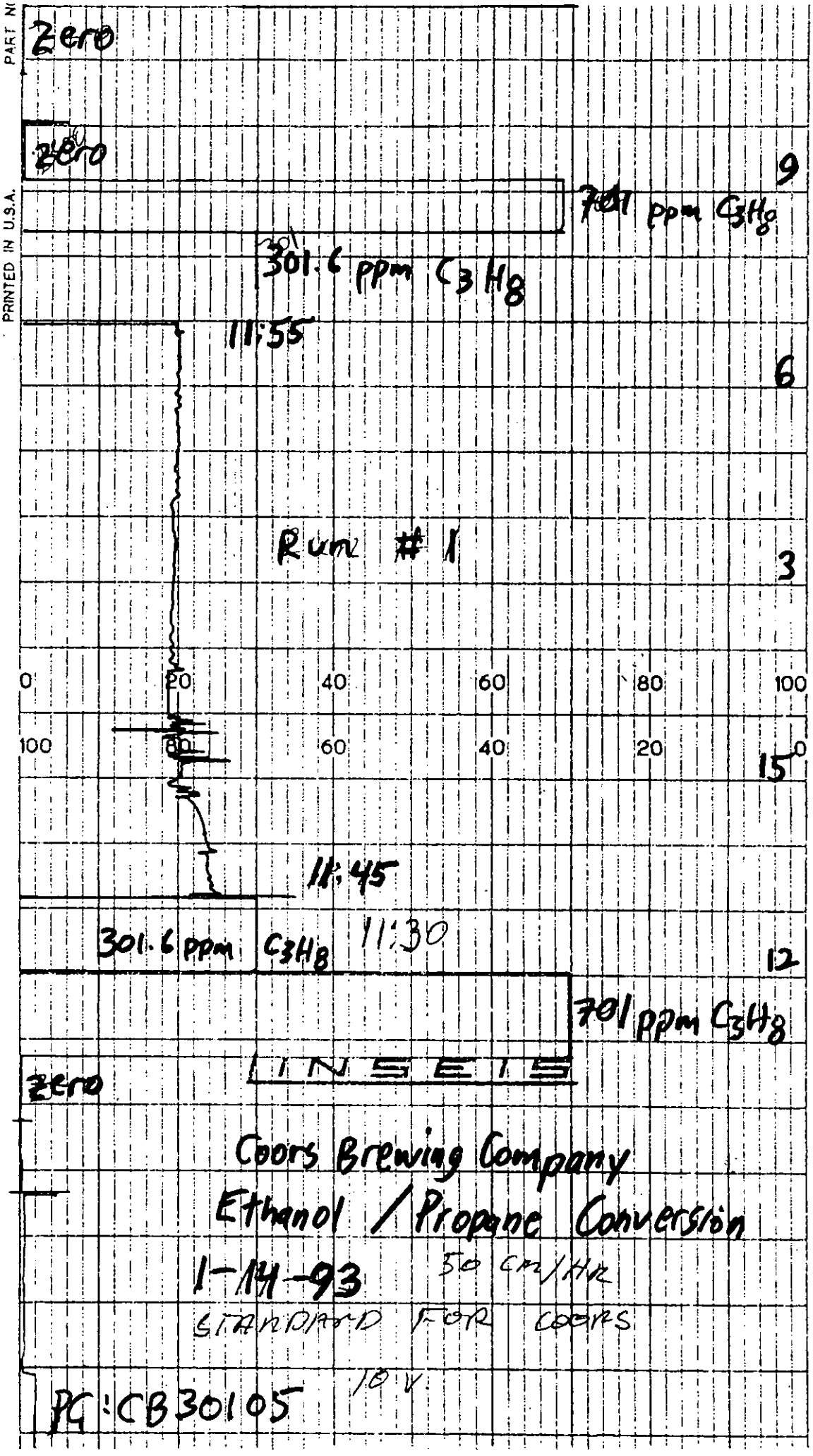
	Run #1	Run #2	Run #3	Run #4	Run #5	Averages
baro. press. (mbar)	842	842	842	842	842	842
temp. (oF)	70	70	70	70	70	70
flow (lpm)	1.85	1.89	1.90	2.37	2.32	2.07
time (min.)	15.0	16.0	15.0	18.0	17.0	16.2
ethanol (g)	0.0204	0.0281	0.0773	0.0350	0.0461	0.0414
propane (ppm)	201.4	240.5	693.3	220.4	302.6	331.6

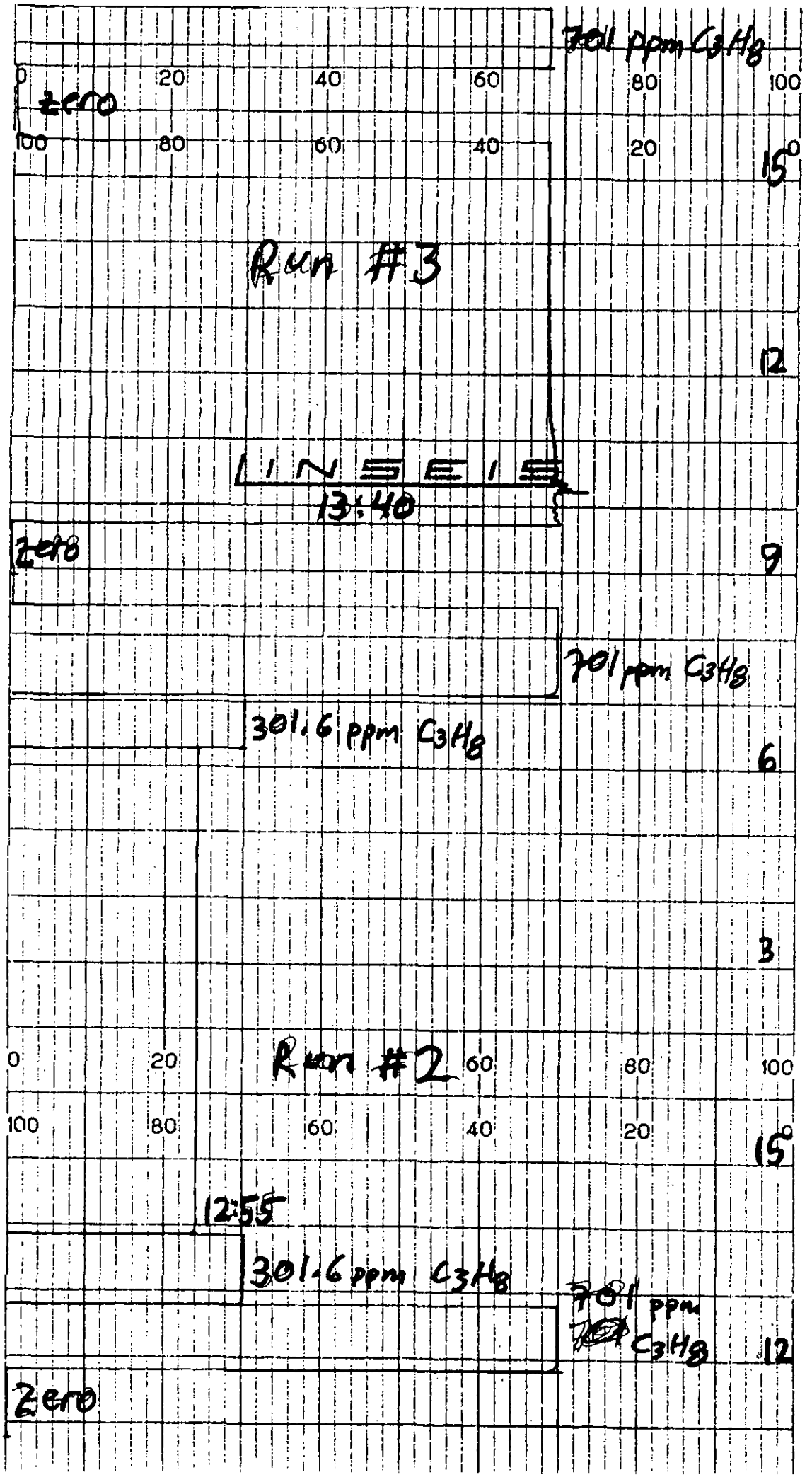
Calculations

	Run #1	Run #2	Run #3	Run #4	Run #5	Averages
ethanol (mg/scm)	890	1120	3275	991	1412	1538
propane (mg/scm)	369	441	1271	404	555	608
conversion factor	2.411	2.541	2.578	2.453	2.545	2.506

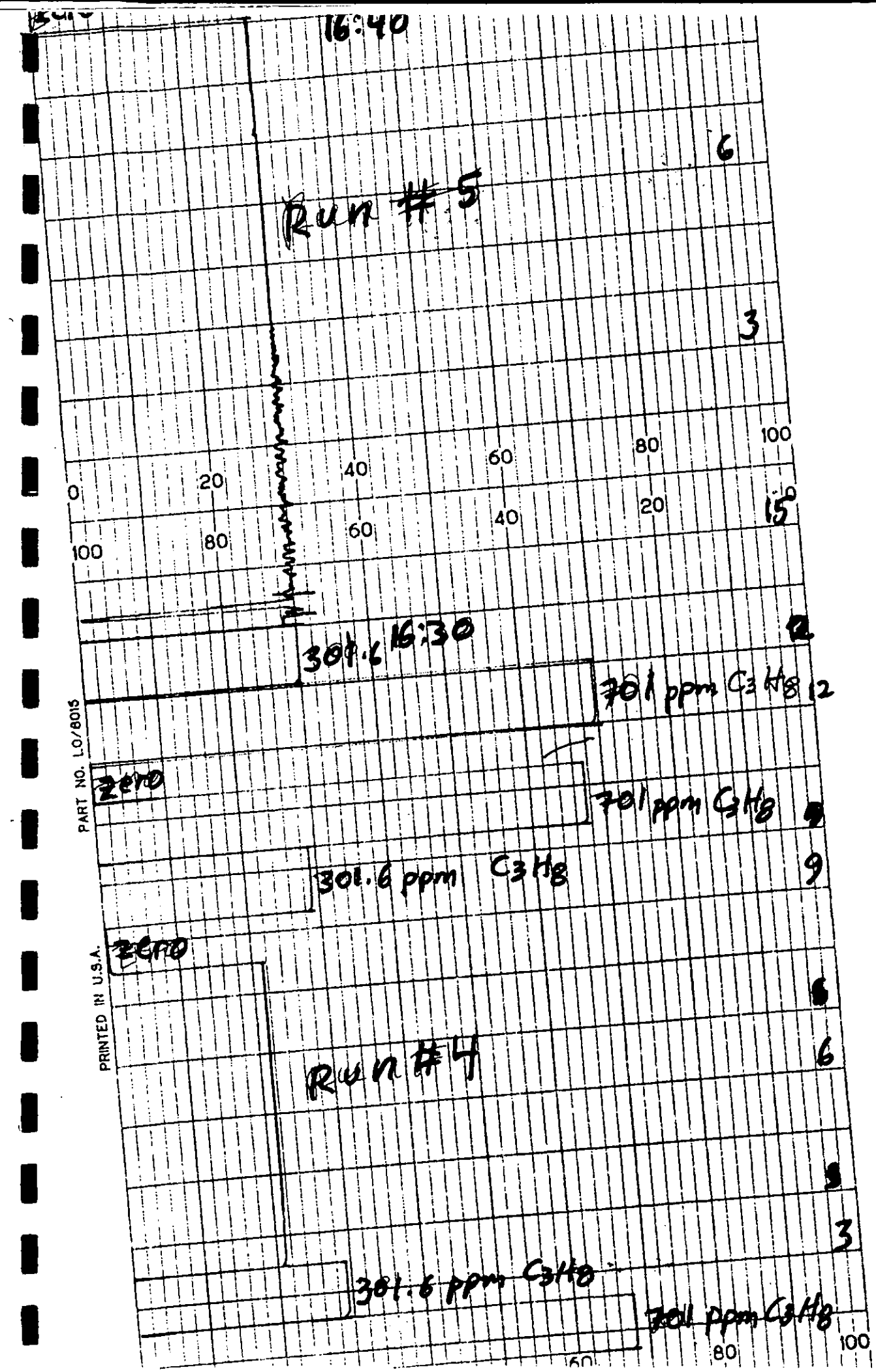
Table A4:2
Ethanol / Propane Conversion
Laboratory Data and Calculations

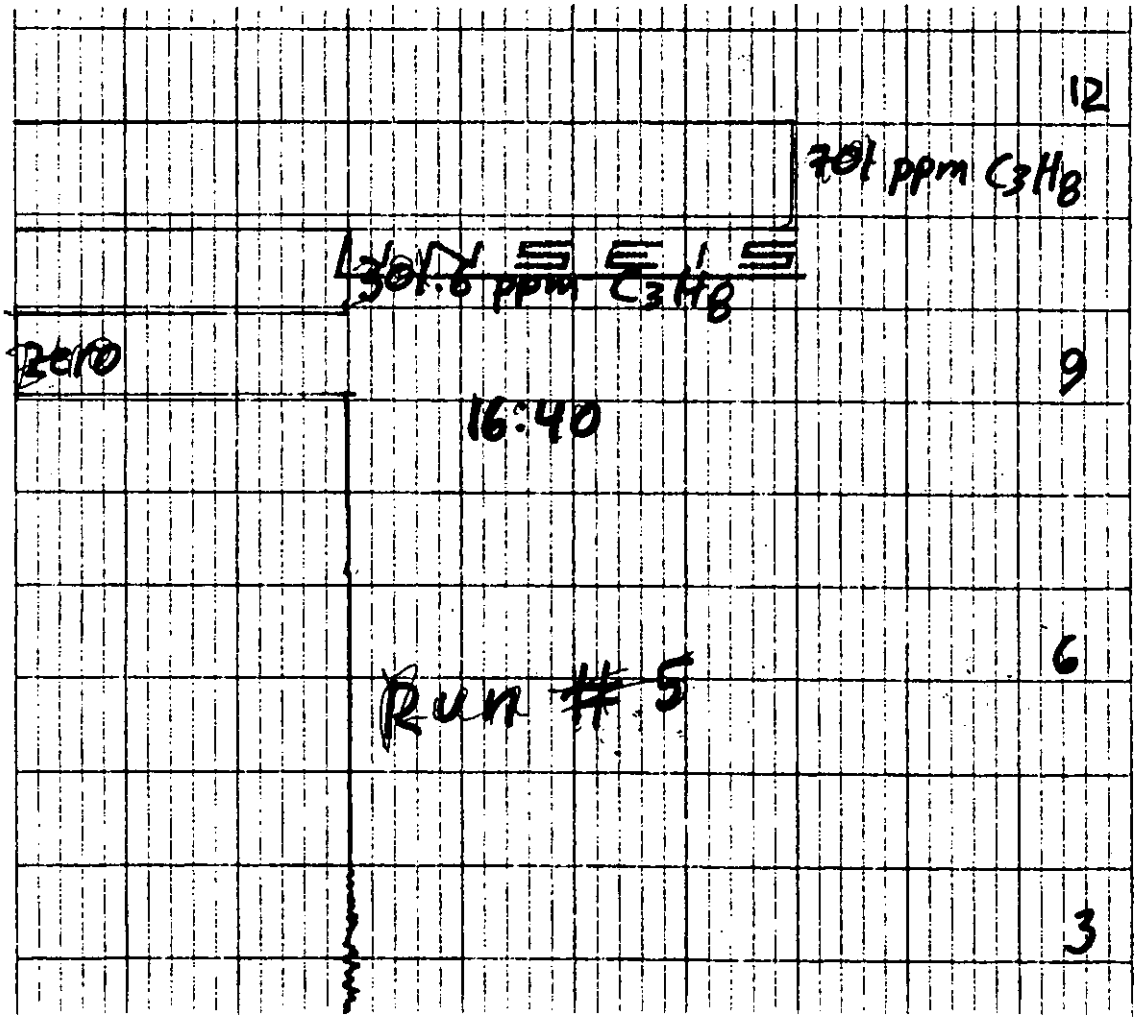
Ethanol / Propane Conversion
Laboratory Data


PART N
PRINTED IN U.S.A.
Zero
Zero
9
701 ppm C3H8
301.6 ppm C3H8
11:55
6
Run # 1
3
0
20
40
60
80
100
100
80
60
40
20
0
15
11:45
301.6 ppm C3H8
11:30
12
701 ppm C3H8
INSETS
Zero
Coors Brewing Company
Ethanol / Propane Conversion
1-14-93
50 cm/Hr
STANDARD FOR COORS
10 V
PG: CB30105



PART NO. LO/8015


16:40
Run #5
6
3
0
20
40
60
80
100
100
80
60
40
20
0
15
301.6 16:30
701 ppm C3H8
12
Zero
701 ppm C3H8
9
301.6 ppm C3H8
9
Zero
6
Run #4
6
3
301.6 ppm C3H8
701 ppm C3H8
60
80
100
PART NO. LO/8015
PRINTED IN U.S.A.


12
701 ppm C3H8
1301.6 ppm C3H8
Zero
9
16:40
Run #5
6
3

AIR POLLUTION TESTING, INC.

Client	Coors Brewing Co.
	Golden, CO
Date	1-14-93

Sketch Location 1	Sketch Location 2

Pump # PCXR7		Pre-test flow (liter/min)	Post-test flow (liter/min)	Mid-test flow (liter/min)	Notes: Run #1
Method # Ethanol → Propane		1.88	1.85		Syringe Mass
Ta 70	Pb 842	1.82	1.86		2.0275 tare
Start time 11:25	Stop time 11:40	1.86	1.85		2.0071 final
Average Flows (liter/min)	1.85	1.85	1.85		0.0204 diff

Pump # PCXR7		Pre-test flow (liter/min)	Post-test flow (liter/min)	Mid-test flow (liter/min)	Notes: Run #2
Method # Ethanol → Propane		1.89	1.90		Syringe Mass
Ta 70	Pb 842	1.89	1.88		2.0249 tare
Start time 12:34	Stop time 12:50	1.91	1.86		1.9968 final
Average Flows (liter/min)	1.89	1.90	1.88		0.0281 diff

AIR POLLUTION TESTING, INC.

Client	Coors Brewing Co
	Golden, Co
Date	1-14-93

Sketch Location 1	Sketch Location 2

Pump # PCXR7		Pre-test flow (liter/min)	Post-test flow (liter/min)	Mid-test flow (liter/min)	Notes: Run #3
Method # Ethanol → Propane		1.88	1.89		Syringe Mass
Ta 70	Pb 842	1.88	1.90		2.0783 tare
Start time 13:20	Stop time 13:35	1.96	1.89		2.0010 final
Average Flows (liter/min)	1.90	1.91	1.89		0.0773 diff

Pump # PCXR7		Pre-test flow (liter/min)	Post-test flow (liter/min)	Mid-test flow (liter/min)	Notes: Run #4
Method # Ethanol → Propane		2.41	2.35		Syringe Mass
Ta 70	Pb 842	2.40	2.36		2.0415 tare
Start time 14:25	Stop time 14:43	2.36	2.35		2.0065 final
Average Flows (liter/min)	2.37	2.39	2.35		0.0350 diff

AIR POLLUTION TESTING, INC.

Client	Coors Brewing Co
	Golden, Co
Date	1-14-93

Sketch Location 1	Sketch Location 2

Pump # PCXR7		Pre-test flow (liter/min)	Post-test flow (liter/min)	Mid-test flow (liter/min)	Notes: Run #5
Method # Ethanol → Propane		2.34	2.33		Syringe Mass
Ta 70	Pb 842	2.31	2.30		2.0334 tare
Start time 16:08	Stop time 16:25	2.29	2.33		1.9873 final
Average Flows (liter/min)	2.32	2.31	2.32		0.0461 diff

Pump #		Pre-test flow (liter/min)	Post-test flow (liter/min)	Mid-test flow (liter/min)	Notes:
Method #					
Ta	Pb				
Start time	Stop time				
Average Flows (liter/min)					

Hydrocarbon Response Factors

6/90

Component	Resp.-Factor JUM-1	Resp.-Factor JUM-2
Methane	1.02	1.04
Propane	1.00	1.00
Acetylene	0.92	0.94
n-Butane	0.98	0.98
n-Hexane	0.85	0.86
n-Heptane	0.91	0.95
iso-Octane	0.99	0.98
cyclo-Hexane	0.93	0.94
Methanol	0.69	0.68
Ethanol	0.65	0.67
iso-Propanol	0.82	0.81
Benzene	1.05	1.05
Toluene	1.02	1.03
4-Ethyltoluene	0.88	0.89
p-Xylene	0.91	0.90
Acetone	0.72	0.73
Diethylether	0.75	0.77
Acetic Acid	0.58	0.55
Acetic Acid Ethylester	0.70	0.72
Acetic Acid Isobutylester	0.88	0.89
Dichlormethane	1.09	1.06
Chloroform	0.82	0.78
1, 1, 1,-Trichlorethane	1.06	1.02
Trichlorethane	1.03	1.01
Tetrachlorethene	1.22	1.20
Chlorbenzene	1.01	1.04
Number of Compounds	26	26
Average	0.903	0.903
Standard Tolerance	0.154	0.152

Data Compiled By :Tuv
Analyzer Type :Model VE-7
Fuel Type :100% H_2
Calibration Gas :Propane

Note: The respons factors are calculated as mg (carbon) per m^3.

(24)

Section 4 Reference COORS 14
AP-42 Reference ___

Emission Test Report Review Checklist--Short Form

Reviewer: BRIAN SHRAGER
Review Date: SEPT. 15, 1994

A. Background Information

1. Facility name: COORS
   Location: GOLDEN, CO
2. Source category: MALT BEVERAGES
3. Test date: 10/21/93
4. Test sponsor: COORS
5. Testing contractor: APT, Inc.
6. Purpose of test: Compliance
7. Pollutants measured (include test method and indicate if valid): VOC - EPA Method 25A → converted to ethanol
8. Process overview: Attach a process description and a block diagram. Identify processes tested with letters from the beginning of the alphabet (A, B, C, etc...) and APC systems with letters from the end of the alphabet (V, W, X, etc...). Also identify test locations with Arabic numerals (1,2,3, ...). Using the ID symbols from the diagram, complete the table below.

Test ID	Process	Process ID	Emissions tested		APCD (controlled emissions only)
			Uncontrolled	Controlled	
1	CRUSHED CAN CONVEYOR	A	✓		ID: Type: Model #:
					ID: Type: Model #:
					ID: Type: Model #:
					ID: Type: Model #:

B. Process Information

1. Provide a brief narrative description of the process and attach process flow diagram. (Note: If the process description provided in the test report is adequate, attach a copy here.)

Introduction

Air Pollution Testing, Inc. was contracted by Coors Brewing Company to conduct a series of source emissions tests on the two atmospheric vents of the crushed can conveyer unit at the Golden, Colorado facility. The purpose of the testing was to determine mass flow rates for volatile organic compounds (VOCs), believed to be primarily ethanol, at the two locations. The upper duct (Stack #1) was flowing ambient air from the crusher room, and the lower duct (Stack #2) was flowing air directly from the crushed can conveyer. The testing was conducted October 21, 1993 and observed by Mr. Charles Cox of the Colorado Department of Health, Air Pollution Control Division (CDH, APCD).

Summary of Procedures

Testing was conducted in accordance with EPA methods 1, 2, 3, 4 and 25A as detailed in *Code of Federal Regulations, Title 40, Part 60, Appendix A*. Methods 1 and 2 were used to determine the volumetric flow rate in the ducts. Methods 3 and 4 were used to determine the oxygen, carbon dioxide, and moisture content of the duct gases. Method 25A was used to determine the concentration of VOCs. The data from the aforementioned methods was then combined to determine mass flow rates of VOCs for each location for each of three sixty-minute sample runs.

Each sixty-minute method 25A sampling period consisted of extracting a gas sample from the ducts through heated sample lines and running them directly into the inlet ports of two JUM Model 3-100 Flame Ionization Analyzers with a range of 0 to 100 ppm full-scale selected. The Stack #2 analyzer was also calibrated and switched to 0 to 1000 ppm full-scale for occasional off-scale peak readings. The organic concentration (expressed as parts per million on a volume basis as propane) was displayed on the front panel of the analyzers and recorded on a strip chart. At the beginning of the test program, the analyzers were calibrated with zero air and a 95.5 ppm propane calibration gas, and then challenged with 44.2 ppm and 15.24 ppm propane calibration gases to verify linearity of response. Following each sampling period, the analyzers were again challenged with the zero air and the calibration gas closest to the average stack concentration for the previous sampling period to quantify zero and span drift for the previous period. The analyzers were recalibrated at this point as necessary. Additionally, the Stack #2 analyzer was challenged with 301.6 ppm propane calibration gas to verify the linearity of the analyzer's range multiplier. To ensure accurate data collection, all calibration gases were prepared and certified in accordance with EPA Protocol 1, and were introduced to the analyzers at the sampling probe tips at ambient pressure. The recorded data from each sampling period were averaged in one minute increments, with all data corrected for analyzer span and zero drift.

Concurrent with each method 25A sampling period, a temperature and differential pressure traverse of the ducts was conducted in accordance with method 2 along a grid of sampling points determined in accordance with method 1. Method 3 Orsat measurements of an integrated Tedlar bag sample from Stack #2 were taken to determine concentrations of oxygen and carbon dioxide. Stack #1 gas was assumed to contain ambient concentrations of carbon dioxide (0.0%) and oxygen (20.9%). Water vapor concentration was measured in accordance with Method 4 for Stack #2. The ambient air flow in Stack #1 was assumed to have negligible moisture content. The molecular weight (calculated from the oxygen, carbon dioxide, and water vapor content) was combined with the differential pressure and temperature data to calculate the velocity and volumetric flow rate of the duct gas in each duct.

COORS REPORT 14 TEST DATA SUMMARY

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	
1	Stack temperature	Deg F				
CRUSHED CAN CONVEYOR STACK #1	Moisture	%	ASSUMED NEGLIGIBL			
	Oxygen	%	ASSUMED 20.9%			
	Volumetric flow, actual	acfm				
	Volumetric flow, standard	dscfm	1774	1860	1817	
	Isokinetic variation	%	NA	NA	NA	
Production rate: BEER RECOVERED???		gal/hr	383	15	337	
	Pollutant concentrations:					
	TOC as propane	ppmwv	6.2	7.7	8.5	
	Pollutant mass emissions:					Average
	TOC as propane	lb/hr	0.0755	0.0983	0.106	0.0933
	Ethanol (conversion=2.506)	lb/hr	0.189	0.246	0.266	0.234
	Emission factors:					Average
	TOC as propane	lb/gal	0.000197	0.00656	0.000315	0.00236
	ETHANOL	lb/gal	0.000494	0.0164	0.000789	0.00590

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	
2	Stack temperature	Deg F				
CRUSHED CAN CONVEYOR STACK #2	Moisture	%	0.95	0.74	1.16	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm				
	Volumetric flow, standard	dscfm	3670	3488	3579	
	Isokinetic variation	%	NA	NA	NA	
Production rate: BEER RECOVERED???		gal/hr	383	15	337	
	Pollutant concentrations:					
	TOC as propane	ppmwv	46.4	57.5	39.4	
	Pollutant mass emissions:					Average
	TOC as propane	lb/hr	1.18	1.39	0.980	1.18
	Ethanol (conversion=2.506)	lb/hr	2.96	3.48	2.45	2.96
	Emission factors:					Average
	TOC as propane	lb/gal	0.00308	0.0925	0.00291	0.0328
	ETHANOL	lb/gal	0.00772	0.232	0.00728	0.0823

TOTAL EMISSION RATES AND EMISSION FACTORS FOR BOTH STACKS

	TOC as propane	lb/hr	1.26	1.49	1.09	1.28
	ETHANOL	lb/hr	3.15	3.72	2.72	3.20
	TOC as propane	lb/gal	0.00328	0.0991	0.00322	0.0352
	ETHANOL	lb/gal	0.00821	0.248	0.00807	0.0882