BCM

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PARTICULATE EVALUATION

OF

COKE OVEN BATTERY NO. 4 COMBUSTION STACK

AT

SHENANGO INCORPORATED
NEVILLE ISLAND PLANT
PITTSBURGH, PENNSYLVANIA 15225

BCM NO. 00-4810-11

DECEMBER 27, 1984

PREPARED BY:

PAUL JADLOWIEC
SCIENTIST II

REVIEWED BY:

RICHARD G. BEER, P.E.
SECTION MANAGER

BCM EASTERN INC.
5777 BAUM BOULEVARD
PITTSBURGH, PENNSYLVANIA 15206

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Shenango Incorporated retained BCM Eastern Inc. (BCM) to perform a particulate emission tests on the Coke Oven Battery No. 4 Combustion Stack. Testing and analyses were conducted according to EPA Methods 1 through 5 and 9 of the Federal Register, Volume 42, August 1977, latest revision, with the exception of the use of a heated flexible probe extension. The test results are to be used to demonstrate compliance with limitations set forth by the Allegheny County Health Department. The compliance limits and measured particulate emissions were as follows:

Test No.	Compliance Limit	Measured Concentration
1	0.03 gr/dscf	0.0147 gr/dscf
2	0.03 gr/dscf	0.0139 gr/dscf
3	0.03 gr/dscf	0.0151 gr/dscf

2.0 SCOPE AND OBJECTIVES

The scope of this proposal was outlined in BCM Proposal No. 10-8000-06-47 which is contained in Appendix A. The following parameters were determined for each test:

- Gas Flow DSCFM
- Gas Temperature ^{o}F
- Gas Moisture % by Volume
- Particuate Concentration gr/dscf
- Opacity %

3.0 PROCEDURES

The field sampling program was performed on December 11, and 12, 1984. The BCM test personnel consisted of Messrs. Richard G. Beer, P.E., Paul Jadlowiec, and Ms. Maria Buss. Messrs. James Schlaegle and George Manown served as plant coordinators. The tests were witnessed by Messrs. John Logan and Shanker Banninthaya, of the Allegheny County Health Department.

TJM → JDG

Shenango
INCORPORATED

PLANTS
NEVILLE ISLAND, PA
SHARPSVILLE, PA
COKE WORKS
NEVILLE ISLAND, PA

January 4, 1985

Allegheny County Health Department
Bureau of Air Pollution Control
301 - 39th Street
Pittsburgh, PA 15201-1891

Attention: Mr. Ronald J. Chleboski
Deputy Director

Dear Mr. Chleboski:

Enclosed is one (1) copy of the BCM Eastern Inc. final report on the "Particulate Evaluation of Coke Oven Battery #4 Combustion Stack".

Should you have any questions regarding this report, please call me at (412) 777-6654.

Very truly yours,

James R. Zwikl
Director of Environmental Control

JRZ/bsl
Enclosure

Copy to: S. Copeland, EPA

3.1 FIELD WORK

All test and analytical procedures and field data sheets, including visual emissions data, are contained in Appendix B.

3.2 ANALYSIS

All analytical data sheets and calculations are contained in Appendix C.

3.3 CALIBRATIONS

Field equipment calibrations are contained in Appendix D.

3.4 PROCESS DATA

All process data are contained in Appendix E.

4.0 SUMMARY OF RESULTS

Table 1 presents a summary of the results of the particulate testing. The opacity observations are contained in Appendix B. The particulate grain loading ranged from 0.0137 gr/dscf to 0.0151 gr/dscf. The average of the three test runs was 0.0146 gr/dscf. The compliance limit was 0.03 gr/dscf.

TABLE 1

SUMMARY OF RESULTS

COKE OVEN BATTERY NO. 4 COMBUSTION STACK

Parameter	Test #1	Test #2	Test #3
Gas Flow (DSCFM)	22,338	23,624	26,420
Gas Temp. (^{o}F)	429	421	445
Gas Moisture (%)	12.5	11.7	13.5
Isokinetic (%)	98	94	98
Part. Emission (gr/dscf)	0.0147	0.0139	0.0151

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APPENDIX A

BCM PROPOSAL

PROPOSAL

TO

SHENANGO INCORPORATED

FOR

BATTERY NO. 4
COMBUSTION STACK

BCM PROPOSAL NO. 10-8000-06-47

NOVEMBER 8, 1984

PREPARED BY

RICHARD G. BEER
SECTION MANAGER

BCM EASTERN INC.
5777 BAUM BOULEVARD
PITTSBURGH, PENNSYLVANIA 15206

TECHNICAL PROPOSAL

Shenango Incorporated requires testing on their coke oven battery at their Neville Island plant. The data collected will be used for compliance with County regulations. BCM Eastern Inc. (BCM) will evaluate the particulate loading and opacity during the sampling program. The following proposal presents BCM's approach to fulfilling Shenango's needs.

1.0 PROJECT PLANNING

BCM will contact Shenango's personnel upon bid approval to:

- Establish lines of communication
- Finalize the project objectives
- Ensure that requirements for sampling will be completed by the scheduled testing

2.0 FIELD TESTING PROGRAM

BCM will supply three (3) men for up to two (2) days to conduct the sampling program. A total of three (3) particulate samples will be collected. Opacities will be determined simultaneously during each particulate test run.

This program will yield the following data:

- Gas flow rates - ACFM & SCFM
- Gas temperature - ^{o}F
- Gas moisture content - % by volume
- Gas analysis - % by volume CO_2, O_2, CO, and N_2
- Particulate emissions - grains/dscf and lbs/hr
- Opacities - %

3.0 DATA EVALUATION AND REPORT PREPARATION

BCM personnel will review and will incorporate into their written report all pertinent operating data. This report will include, but will not be limited to, the following:

- Description of work undertaken
- Discussion of the sampling and analytical techniques employed
- Tabulation of field and laboratory data
- All calibration sheets for each apparatus used in the program

Shenango will receive five (5) copies of the final report.

4.0 SAFETY

BCM personnel always endeavor to conduct field activities in such a manner as to protect themselves and others from accidents and injury. When special safety equipment is required, the client should so specify. BCM personnel use their own safety equipment (hard hats, goggles, etc.) unless otherwise instructed.

BUSINESS PROPOSAL

5.0 COMPENSATION

We propose that the outlined project scope be performed on a lump sum basis. This fee is firm and cannot be changed unless it is mutually agreed that the scope of work has changed from that outlined in this proposal.

LUMP SUM COST

Coke Oven Battery Sampling Program . . . .

Each additional hour (as per delays/overtime paragraph) will be billed at . for a three-man crew.

6.0 INVOICES

Invoices will be submitted on a monthly basis for work completed. Terms are net thirty (30) days with past-due balances subject to interest at the rate of one-and-one-half percent (1-1/2%) interest charge per month, effective forty-five (45) days after date of invoice. This represents an annual interest charge of eighteen percent (18%).

7.0 WORK SCHEDULE

Upon receipt of your notification that BCM has been selected, we will meet with personnel from your company to finalize the project scope (if necessary) and determine a performance schedule and a target completion date which meet your needs.

8.0 DELAYS/OVERTIME

Delays caused by conditions beyond BCM's control, such as partial or complete process shutdowns or irregularities, strikes, floods or fires which delay the project's completion, constitute a Change-of-Scope. Also, unfavorable weather conditions which BCM's Field Project Engineer considers a threat to crew safety and/or sample quality constitute a Change-of-Scope and will be charged at the delay/overtime rate. In addition, the field work is based on a 10-hour day (excluding travel). Any hours necessary for the successful completion of the project in excess of 10 per day will be charged at the delay/overtime rate described in the compensation section. Any expenses incurred as a result of project delays/overtime will be billed at cost plus 10%. The BCM Field Project Engineer will notify you of such Changes of Scope. At your request, BCM will outline the type of shelter, as required, to minimize weather delays. If the project is postponed within 72 hours of the scheduled start date, you may be subject to a change not to exceed the mobilization fee.

9.0 VALIDITY

This proposal is valid for 60 days. Subsequent to that date, BCM may review the basis of payment to allow for changing costs and adjust starting and completion dates to conform to our workload.

10.0 INSURANCE

BCM will maintain insurance coverage in the following amounts and, upon request of the client, will provide a Certificate of Insurance so indicating:

Type of Policy	Limits of Liability
(a) Standard Workers' Compensation	Statutory
Employer's Liability	$100,000
(b) General Liability	
Bodily Injury	$500,000 Each Occurrence and Aggregate
Property Damage	$500,000 Each Occurrence and Aggregate
(c) Automobile Liability	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000 Each Occurrence

PROJECT MANAGEMENT

BCM will assign key personnel to the project who are experienced in conducting similar studies. Their duties are briefly described below.

PROJECT MANAGER

Mr. Richard Beer, Section Manager, is responsible for all field testing activities involving the Air Quality Section. Mr. Beer will be the primary plant contact.

CLIENT RESPONSIBILITY

To ensure that the proposed project is completed successfully, it will be the responsibility of Shenango Incorporated to provide the following:

1. Plant liaison for the BCM field team for the duration of the program
2. Safe access to the sampling locations and electric power (110V, 20-amp service) to within 50 feet of the sampling location

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APPENDIX B

FIELD DATA

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1.0 SAMPLING PROCEDURES

1.1 Testing Station and Traverse Locations

The following is an explanation of the sampling points to be utilized during the project.

The test location is situated on the Number 8 stack of the Number 4 coke oven battery. The internal diameter as obtained from Shenango is 9.19'. The test station is 7 diameters downstream and approximately 20 diameters upstream from the nearest flow disturbance, which yields a requirement of 20 traverse points. We choose to use 28 points, 7 traverse points per each of 4 test ports.

1.2 Gas Flow and Gas Temperature Measurements

The flow rate and temperature profiles for the gas streams is measured by conducting simultaneous velocity and temperature traverses. Gas velocity head is measured with a calibrated "S"-type Pitot tube which is connected to an inclined manometer. The static pressure is measured using the same Pitot tube and manometer. The static pressure is measured using the same Pitot tube and manometer. A Chrome-Alumel thermocouple attached to a THERMO-ELECTRIC CORPORATION digital potentiometer is used to measure the gas temperature at each of the traverse points. The gas flow and gas temperature measurements follow Method Two of the Federal Register*.

1.3 Molecular Weight Determination

A Fisher-type B, No. 10-605 Orsat analyzer is used to determine the molecular weight of the flue gas. The following parameters are measured in order to calculate molecular weight: volume percent carbon dioxide (CO_2), volume percent oxygen (O_2), and volume percent carbon monoxide (CO); the volume percentage of nitrogen (N_2) is determined by difference. These parameters are measured using the principle of gas absorption in specific absorbing solutions. A 100 ml flue gas sample is drawn through the glass manifold to the sample chamber by the use of the leveling bottle following aspiration of the sampling line. The system is then closed by adjusting the stopcock at the inlet of the manifold.

The sample is bubbled through three absorbing solutions which selectively collect different gaseous components of the stack gas in the following manner: carbon dioxide is collected in a potassium hydroxide solution in the first absorber, oxygen is collected in a potassium pyrogallate solution in the second absorber, and carbon monoxide is collected in a saturated cupric chloride solution in the third absorber. The volume of a specific gaseous component collected

*Federal Register, Vol. 42, No. 160, August 18, 1977

in an individual absorbing solution is determined by the change in volume of sample gas in the sample chamber after the bubbling process is complete. Since the original sample volume was 100 ml, any change in volume is also the percentage of the specific gaseous component found in the stack gas stream. Temperature effects in the sample chamber are minimized by a water jacket which surrounds it, maintaining the temperature at a constant level throughout the duration of the Orsat analysis.

1.4 Moisture Content Sampling

Moisture sampling is conducted employing the principles presented in EPA Method Four and concurrently with particulate sampling. Parameters evaluated in order to determine the gas stream moisture content are: sample gas volume, sample gas temperature, sample gas pressure, impinger moisture gain, and silica gel moisture gain. Some minor modifications are made to the Method Four train to allow concurrent particulate and moisture content sampling; these modifications involve no deviations from sampling principles. Modifications such as the substitution of a glass fiber filter for Pyrex wool as a filtering medium and the substitution of a calibrated orifice for a rotameter as a flow metering device are incorporated.

1.5 Determination of Particulate Emission

The following method will be used in this test program. Sampling procedures follow those described in Method Five of the Federal Register*. Due to space constraints, one exception to the method will exist. A heated teflon flex line will be used to connect the rigid stainless steel-lined probe with the heated filter box.

Approximately 200 grams of silica gel are weighed in a sealed impinger prior to each test. Glass fiber filters** (3-inch diameter) are desiccated for at least 24 hours and weighed to the nearest 0.1 mg on an analytical balance. One hundred ml of distilled water is placed in each of the first two impingers; the third impinger is initially empty; and the impinger containing the silica gel is placed next in series. The train is set up with the probe as shown in Figure A-1. The sampling train is leak checked at the sampling site prior to each test run by plugging the inlet to the nozzle and pulling a 15-inch Hg vacuum, and at the conclusion of the test by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run.

The Pitot tube and lines are leak checked at the test site prior to and following the initial velocity traverse. The check is made by blowing into the impact opening of the Pitot tube until 3 or more inches of water are recorded on the manometer and then capping the impact opening and holding it for 15 seconds to assure it is leak

* Federal Register, Vol. 42, No. 160, August 18, 1977
** Whatman Type 934 AH

free. The static pressure side of the Pitot tube is leak checked using the same procedure, except suction is used to obtain the 3-inch H_2O manometer reading. Crushed ice is placed around the impingers to keep the temperature of the gases leaving the last impinger at 68°F or less.

During sampling, stack gas and sampling train data are recorded at each sampling point and when significant changes in stack flow conditions occur. Isokinetic sampling rates are set throughout the sampling period with the aid of a nomograph or calculator. All sampling data are recorded on the Particulate Field Data Sheet.

1.5.1 Sample Recovery Procedure

The sampling train is moved carefully from the test site to the cleanup area. Samples of the acetone and distilled water used in the sample recovery are taken for use as blanks. The volume of water from the first three impingers is measured. Sample fractions are recovered as follows:

Container No. 1 - The filter is removed from its holder and placed in a petri dish and sealed.

Container No. 2 - Loose particulate and acetone washings from all sample-exposed surfaces prior to the filter are placed in a glass jar, and sealed and labeled. Particulate is removed from the probe with the aid of a brush and acetone rinsing. The liquid level is marked after the container is sealed.

Container No. 3 - A minimum of 200 ml of acetone is taken for the blank analysis. The blank is obtained and treated in a similar manner as the acetone washing.

The silica gel from the fourth impinger is weighed and recorded on the Sample Recovery and Integrity Data Sheet with other pertinent data.

1.5.2 Analytical Procedures

Container No. 1 - The filter and any loose particulate matter from this sample container are placed into a tared glass weighing dish, desiccated for 24 hours to a constant weight, and weighed to the nearest 0.1 mg.

Container No. 2 - The acetone washings are transferred to a tared beaker and evaporated to dryness at ambient temperature and pressures, desiccated for 24 hours to a constant weight, and weighed to the nearest 0.1 mg.

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Container No. 3 - The acetone blank is transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure. The blank is then desiccated for 24 hours to a constant weight and weighed to the nearest 0.1 mg.

The term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive readings, with no less than 6 hours of desiccation between weighings. All analytical data are recorded on the Analytical Particulate Data Sheet. Acetone blank data are recorded on the Acetone Blank Data Sheet.

1.6 Visible Emissions

During compliance testing, visible emission observations will be made simultaneously by a certified observer using EPA Method 9.

1.7 Process Data

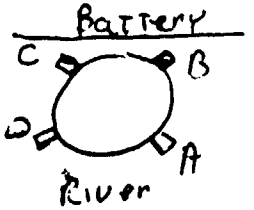
The following operational data will be gathered and inserted into the final report.

- Stack smoke density chart
- Waste heat pusher side chart
- Waste heat coke side chart
- Stack draft pusher side chart
- Stack draft coke side chart
- Crossover coke side pressure chart
- Crossover pusher side pressure chart
- Fuel gas pusher side pressure chart
- Fuel gas coke side pressure chart
- Fuel gas flow to battery chart
- Waste heat oxygen level chart
- Offtake main temperature chart
- Pusher's report

EPA METHOD 5
FIELD DATA

PLANT Shenango
DATE Dec 11, 1984
SAMPLING LOCATION No 4 Bot - No 8 Stack
SAMPLE TYPE EPA-5
RUN NUMBER 1
OPERATOR Paul Jadlowiec
AMBIENT TEMPERATURE ~38°F
BAROMETRIC PRESSURE 29.37
STATIC PRESSURE, (P_s) -1.1" H_2O
FILTER NUMBER (s) 347
PITOT TUBE No. & Cp. 7-1, 0.84

1.2 - CO
12.0 - CO_2
7.0 - O_2



PROBE LENGTH AND TYPE 7FT Glass
NOZZLE I.D. 0.520
ASSUMED MOISTURE, % 15
SAMPLE BOX NUMBER —
METER BOX NUMBER 532-128 Y = 1.001
METER ΔH@ 2.00
K FACTOR
PRE-TEST LEAK CHECK RATE .010 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE .004 CFM @ 10 "Hg
REFERENCE Δp ~K @ 450°F

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 6 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET, °F	OUTLET, °F				
A5	0	0837	849.234										
4	6	0843	853.11	.04	1.6	1.6	461	51	43	6	257	~32°F	223
3	12	0849	856.80	.035	1.4	1.4	469	65	43	6	261	↓	224
2	18	0855	860.39	.035	1.4	1.4	471	71	45	6	263		223
1	24	0901	863.19	.03	1.2	1.2	449	77	49	6	259		224
	30	0907	866.55	.02	0.8	0.8	311	77	53	5	255		226
	0	0911											
B5	6	0917	869.93	.03	1.2	1.2	451	73	55	5	263		223
4	12	0928	872.76	.02	0.8	0.8	485	79	57	5	263		223
3	18	0929	874.82	.01	0.4	0.4	459	79	59	3	255		223
2	24	0935	876.91	.01	0.4	0.4	417	79	61	3	253		223
1	30	0941	878.97	.01	0.4	0.4	299	83	63	2	251		225

PLANT Shenango — DATE Dec 11, 1984 — RUN NO. 1

No 4 Bat – No 8 Stack

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m, ft^3)	VELOCITY HEAD (Δp_s, in. H_2O)	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H_2O)		STACK TEMPERATURE (T_s, °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$, °F)	OUTLET ($T_{m_{out}}$, °F)				
C 5	0	0950											
4	6	0956	~~881.90~~	.02	0.8	0.8	473	71	61	4	237	↓	223
3	12	1002	884.37	~~.02~~ .015	0.6	0.6	455	85	61	4	247		223
2	24	1014	889.37	~~.015~~ .015	0.6	0.6	455	87	63	4	253		223
1	30	1020	891.48	.01	0.4	0.4	361	89	65	4	254		223
	0	1024						87	67	3	205		231
D 5	6	1030	~~895.88~~ 775	.04	1.5	1.5	443	83	69	6	251		223
4	12	1036	898.88	.03	1.2	1.2	453	93	67	6	253		227
3	18	1042	902.34	.03	1.2	1.2	461	93	69	6	254		235
2	24	1048	905.79	.03	1.2	1.2	447	95	69	6	261		243
1	30	1054	908.69	.02	0.8	0.8	303	91	71	5	263		241

EPA METHOD 5
FIELD DATA

PLANT Shenango
DATE Dec 11, 1984
SAMPLING LOCATION Unit Rat - No 8 Stack
SAMPLE TYPE EPA-5
RUN NUMBER 2
OPERATOR Paul Jadlowiec
AMBIENT TEMPERATURE ~38°F
BAROMETRIC PRESSURE 29.37
STATIC PRESSURE, (P_s) -41
FILTER NUMBER (s) 345
PITOT TUBE No. & Cp. 72 - 0.84

1.1 - CO
12.5 - CO_2
7.0 - O_2

PROBE LENGTH AND TYPE 7Ft Glass
NOZZLE I.D. .525
ASSUMED MOISTURE, % 15
SAMPLE BOX NUMBER
METER BOX NUMBER 552-128
METER ΔH@ 2.00
K FACTOR 0.9
PRE-TEST LEAK CHECK RATE .003 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE .001 CFM @ 10 "Hg
REFERENCE Δp .046 @ 450°F

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 6 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m, ft^3)	VELOCITY HEAD ($\sqrt{\Delta p}$, in. H_2O)	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H_2O)		STACK TEMPERATURE (T_s, °F)	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$, °F)	OUTLET ($T_{m_{out}}$, °F)				
	0	1141	909.000										
D 5	6	1147	912.00	.04	1.6	1.6	435	61	57	6	261	~32°F	255
4	12	1153	917.34	.05	2.0	2.0	473	83	57	8	269	↓	273
3	18	~~1159~~ 1159	920.84	.03	1.2	1.2	451	85	59	5	273		263
2	24	~~1205~~ 1203	924.73	.035	1.4	1.4	430	87	61	6	273		253
1	30	~~1211~~ 1212	928.59	.02	1.2	1.2	403	91	63	6	283		247
	0	1216					~~444~~						
C 5	6	1222	931.63	.03	1.2	1.2	~~443~~	75	65	5	259		245
4	12	1228	935.37	.035	1.4	1.4	459	89	65	5	253		249
3	18	1234	938.87	.03	1.2	1.2	439	93	65	5	249		255
2	24	1240	942.00	.025	1.0	1.0	427	91	67	5	247		259
1	30	1246	943.30	.005	0.2	02	253	79	67	2	251		259

(2)

ANT Shenango DATE Dec 11, 1984 RUN NO. No 4 Out - No 8 Start

TRAVERSE NT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
5	0	1252											
5	6	1258	946.99	.035	1.4	1.4	457	73	67	5	255	↓	223
4	12	1304	950.50	.03	1.2	1.2	459	89	67	5	255		224
3	18	1310	—	.02	0.8	0.8	457	89	67	4	257		217
2	24	1316	956.27	.02	0.8	0.8	441	89	69	4	257		237
1	30	1322	958.73	.015	0.6	0.6	293	89	69	3	259		255
	0	1330											
5	6	1336	962.48	.035	1.4	1.4	449	63	65	5	257		259
4	12	1342	965.97	.03	1.2	1.2	453	91	67	6	249		243
3	18	1348	969.48	.03	1.2	1.2	447	93	67	6	261		243
2	24	1354	973.00	.03	1.2	1.2	427	93	69	6	263		235
1	30	1400	975.882	.02	0.8	0.8	329	93	71	4	265		235

EPA METHOD 5
FIELD DATA

PLANT [illegible]
DATE [illegible]
SAMPLING LOCATION [illegible]
SAMPLE TYPE [illegible]
RUN NUMBER [illegible]
OPERATOR [illegible]
AMBIENT TEMPERATURE [illegible]
BAROMETRIC PRESSURE [illegible]
STATIC PRESSURE, (P_s) -1.1" H_2O
FILTER NUMBER (s) 240
PITOT TUBE No. & Cp. [illegible]

PROBE LENGTH AND TYPE [illegible] S.S.
NOZZLE I.D. .5[illegible]
ASSUMED MOISTURE, % [illegible]
SAMPLE BOX NUMBER [illegible]
METER BOX NUMBER [illegible]
METER ΔH@ 2.00
K FACTOR 0.95
PRE-TEST LEAK CHECK RATE [illegible] CFM @ [illegible] "Hg
POST TEST LEAK CHECK RATE .010 CFM @ 12 "Hg
REFERENCE Δp [illegible]

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY [illegible] MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD ($\sqrt{\Delta p_s}$), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
		1211	976.156										
		1217	980.80	.05	2.2	2.2	469	63	55	10	275	~32	223
		1223	985.10	.045	1.9	1.9	473	77	55	[illegible]	271	"	231
		1229	988.87	.03	1.3	1.3	453	85	59	7	275		237
		1235	992.62	.035	1.5	1.5	447	91	61	8	265		237
		1241	995.66	.02	0.86	0.86	401	93	65	5	261		241
		1245											
		1251	1000.35	.055	2.4	2.4	475	97	67	12	259		223
		1257	1005.25	.05	2.2	2.2	461	105	69	12	255		224
		1303	1008.72	.025	1.1	1.1	457	103	73	6	253		223
		1309	1011.74	.02	0.86	0.86	453	99	75	5	251		233
		1315	1013.24	.005	0.21	0.21	369	93	75	2	251		247

ANT _____ DATE _____ RUN NO. 3

TRAVERSE INT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m, ft³)	VELOCITY HEAD (Δp_s, in. H_2O)	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H_2O)		STACK TEMPERATURE (T_s, °F)	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$, °F)	OUTLET ($T_{m_{out}}$, °F)				
		1321											
		1327	1017.42	.04	1.7	1.7	427	91	77	7	245	↓	223
2		1333	1021.08	.03	1.3	1.3	449	99	77	6	243		237
		1339	1024.80	.03	1.3	1.3	453	107	77	6	245		241
		1345	1028.18	.025	1.1	1.1	453	107	79	5	241		251
		1351	1030.84	.015	.64	.64	387	101	81	4	241		255
		~~1357~~											
		1357											
		1403	1035.12	.045	1.9	1.9	445	97	77	9	245		263
		1409	—	.045	1.9	1.9	457	105	79	9	249		267
		1415	1043.67	.04	1.7	1.7	465	107	79	9	259		273
		1421	1047.63	.035	1.5	1.5	459	109	83	8	257		267
		1427	1051.220	.03	1.3	1.3	439	109	83	6	259		265

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant Shenango Sample date 12/11/84

Sample location Coke Bat No.4 - Stack No.8 Recovery date 12/11/84

Run number 1 Recovered by Paul Jadlowiec & R. Beer

Filter number(s) 341

MOISTURE

Impingers			Silica gel		
Final volume (wt)	360	ml(g)	Final wt	266.9	g
Initial volume (wt)	200	ml(g)	Initial wt	250	g
Net volume (wt)	160	ml(g)	Net wt	16.9	g
Description of impinger water	Clear		75	% spent	

Total moisture 176.9 g

RECOVERED SAMPLE

Filter container number(s) 341 Sealed Yes

Description of particulate on filter Blank

Probe rinse container no.	1	Liquid level marked	Yes
____ blank container no.		Liquid level marked	
Impinger contents container no.		Liquid level marked	
____ blank container no.		Liquid level marked	

Samples stored and locked

Remarks

LABORATORY CUSTODY

Received by Date

Remarks

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant Shenango Sample date 12/11/84

Sample location Coke Bat No.4 - Stack No.8 Recovery date 12/11/84

Run number 2 Recovered by

Filter number(s) 375

MOISTURE

Impingers			Silica gel		
Final volume (wt)	366	ml(g)	Final wt	277.8	g
Initial volume (wt)	200	ml(g)	Initial wt	250	g
Net volume (wt)	166	ml(g)	Net wt	17.8	g
Description of impinger water	Clear			75	% spent

Total moisture 183.8 g

RECOVERED SAMPLE

Filter container number(s) R Sealed Yes

Description of particulate on filter Black

Probe rinse container no. Liquid level marked Yes

_____ blank container no. Liquid level marked

Impinger contents container no. Liquid level marked

_____ blank container no. Liquid level marked

Samples stored and locked

Remarks

LABORATORY CUSTODY

Received by Date

Remarks

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant Cherokee Sample date 12/12/90
Sample location 1&2 Bat. Log Stack Recovery date 12/12/90
Run number 3 Recovered by Saddler, Lear
Filter number(s) 340

MOISTURE

Impingers

Final volume (wt) 407 ml(g)
Initial volume (wt) 200 ml(g)
Net volume (wt) 207 ml(g)
Description of impinger water Clear

Silica gel

Final wt 278 g
Initial wt 250 g
Net wt 28.4 g
40 % spent

Total moisture 235.4 g

RECOVERED SAMPLE

Filter container number(s) 3 Sealed Yes
Description of particulate on filter Black

Probe rinse container no. 3 Liquid level marked Yes
____ blank container no. ____ Liquid level marked ____
Impinger contents container no. ____ Liquid level marked ____
____ blank container no. ____ Liquid level marked ____
Samples stored and locked ____
Remarks ____

LABORATORY CUSTODY

Received by ____ Date ____
Remarks ____

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Shenango

DATE 12/12/84

SAMPLING TIME (24-hr CLOCK) 1245

SAMPLING LOCATION No 8 Coke Bat STACK

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) 2 GRABS

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE 68 °F

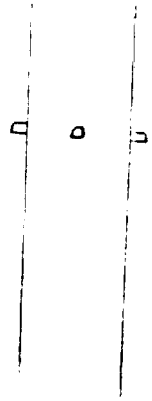
OPERATOR Paul Vadlowiec

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	4.0	4.0						44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	12.0						32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	16.0	0.0						28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Shenango
DATE 10/08/82
SAMPLING LOCATION SH #3 Battery #4
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) _____
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) 40"
STACK I.D., (DISTANCE A - DISTANCE B) 9.2' = 110"
NEAREST UPSTREAM DISTURBANCE _____
NEAREST DOWNSTREAM DISTURBANCE _____
CALCULATOR _____



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
A-1	.026	110"	2.86 → 2 7/8"	40"	42 7/8"
-2	.082	110"	9.02 → 9"	↓	49"
-3	.146	↓	16.06 → 16"		56"
-4	.226		24.86 → 24 7/8"		64 7/8"
-5	.342	↓	37.62 → 37 5/8"	↓	77 5/8"

EA (Dun) 232

VISIBLE EMISSIONS OBSERVATION FORM

1ST TEST

OBSERVER MARIA BUSS

DATE 12/11/84

FACILITY SHENANGO - 4 BATTERY STACK

OBSERVATION PERIOD: START: 0836

FINISH: 0936

OBSERVATION POINT: PARKING LOT NORTH OF PLANT NEAR USS CHEM (1st port →)

SOURCE:

DISTANCE FROM: 350'

DIRECTION FROM: NW

HEIGHT: 100'

WIND:

SPEED: 0-5 MPH

DIRECTION: WEST

TEMPERATURE: 38°F

SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

NO. OF READINGS ≥ 20%: 18

NO. OF READINGS ≥ 60%: 0

MAX OPACITY: 45%

STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	0	0	0	0
1	0	0	0	0
2	10	10	10	10
3	10	10	10	10
4	10	10	10	10
5	10	15	15	15
6	15	15	15	15
7	15	15	15	15
8	15	15	15	15
9	15	10	10	15
10	15	15	15	15
11	15	15	15	15
12	15	10	10	10
13	10	10	10	10
14	10	10	10	10
15	10	10	10	10
16	10	10	10	10
17	5	5	5	5
18	5	5	5	5
19	5	5	5	5
20	0	0	0	5
21	5	5	5	5
22	5	5	5	5
23	5	5	5	5
24	5	5	5	5
25	5	5	5	0
26	0	0	0	0
27	0	0	5	5
28	5	5	5	5
29	5	5	5	5

	0	15	30	45
30	5	5	5	5
31	5	5	5	5
32	5	15	25	45
33	45	45	30	30
34	20	20	15	15
35	15	15	15	15
36	15	15	15	15
37	15	15	15	15
38	15	10	10	10
39	10	10	10	10
40	10	10	5	5
41	5	5	5	5
42	5	5	5	5
43	5	0	0	0
44	0	0	0	0
45	0	0	5	5
46	5	5	5	15
47	15	15	10	10
48	10	5	5	5
49	5	5	5	5
50	5	5	10	10
51	10	10	15	15
52	15	15	15	15
53	20	20	15	15
54	15	15	15	15
55	15	15	15	15
56	15	20	25	25
57	20	20	15	15
58	15	15	20	20
59	20	15	15	15

VISIBLE EMISSIONS OBSERVATION FORM

OBSERVER MARIA BUSS

DATE 12/11/84

FACILITY SHENANGO - 4 BATTERY STACK

OBSERVATION PERIOD: START: 0937

FINISH: 1037

OBSERVATION POINT: PARKING LOT NORTH OF PLANT, WEST OF USS

SOURCE:

DISTANCE FROM: 350'

DIRECTION FROM: NW

HEIGHT: 100'

WIND:

SPEED: 0-5 MPH

DIRECTION: WEST

TEMPERATURE: 43°F

SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

NO. OF READINGS ≥ 20%: 35

NO. OF READINGS ≥ 60%: 1

MAX OPACITY: 75%

STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	15	15	15	15
1	15	15	15	15
2	15	15	15	15
3	15	20	20	15
4	15	15	15	15
5	15	15	15	15
6	20	20	15	15
7	15	15	15	15
8	15	10	10	10
9	10	5	5	5
10	10	10	10	10
11	10	10	10	10
12	10	10	10	10
13	10	15	25	40
14	50	35	35	15
15	15	15	15	15
16	40	75	55	50
17	35	35	30	30
18	20	20	15	15
19	15	10	10	10
20	10	10	10	10
21	5	5	5	5
22	5	5	5	5
23	5	5	5	5
24	5	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0

	0	15	30	45
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	5	10	10
47	10	5	5	5
48	0	0	0	0
49	0	0	0	0
50	0	0	5	5
51	10	10	10	10
52	10	10	10	10
53	10	10	10	15
54	15	15	15	15
55	15	15	15	15
56	20	20	20	20
57	20	20	20	20
58	25	25	20	20
59	20	20	20	20

VISIBLE EMISSIONS OBSERVATION FORM

OBSERVER MARIA BUSS

DATE 12/11/84

FACILITY SHENANGO - 4 BATTERY STACK

OBSERVATION PERIOD: START: 1038

FINISH: 1055

OBSERVATION POINT: PARKING LOT NORTH OF PLANT, WEST OF USS

SOURCE:

DISTANCE FROM: 350'

DIRECTION FROM: NW

HEIGHT: 100'

WIND:

SPEED: 0-5 MPH

DIRECTION: WEST

TEMPERATURE: 43°F

SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

% OF READINGS ≥ 20%:

% OF READINGS ≥ 60%:

MAX OPACITY:

STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	20	20	20	20
1	20	15	15	15
2	15	15	15	20
3	20	20	15	15
4	15	15	15	15
5	20	20	20	20
6	20	20	20	20
7	15	15	15	15
8	20	20	20	20
9	20	15	15	15
10	15	15	15	20
11	20	20	20	20
12	20	20	20	20
13	20	15	15	20
14	15	15	15	15
15	15	15	10	5
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				

	0	15	30	45
30				
31				
32				
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57				
58				
59				

VISIBLE EMISSIONS OBSERVATION FORM

2ND TEST

OBSERVER MARIA BUSS

DATE 12/11/84

FACILITY SHENANGO - 4 BATTERY STACK

OBSERVATION PERIOD: START: 1140

FINISH: 1240

OBSERVATION POINT: PARKING LOT NORTH OF PLANT, WEST OF USS

SOURCE:

DISTANCE FROM: 350'

DIRECTION FROM: NW

HEIGHT: 100'

WIND:

SPEED: 0-5 MPH

DIRECTION: WEST

TEMPERATURE: 45°F

SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

% OF READINGS ≥ 20%: 28

% OF READINGS ≥ 60%: 0

MAX OPACITY: 45%

STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	15	15	15	15
1	15	15	15	15
2	15	15	10	10
3	10	10	10	10
4	10	10	10	10
5	10	15	15	15
6	15	15	15	15
7	15	15	15	15
8	15	15	15	15
9	5	5	5	0
10	0	0	0	0
11	0	5	5	5
12	5	5	5	5
13	5	5	5	5
14	5	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	5
29	10	25	25	25

	0	15	30	45
30	25	25	40	45
31	40	40	40	45
32	40	30	20	20
33	20	20	20	20
34	20	20	20	20
35	20	20	20	20
36	20	15	15	15
37	15	15	15	15
38	10	10	10	10
39	10	10	5	5
40	5	10	10	10
41	10	10	5	5
42	5	5	10	10
43	5	5	10	10
44	5	5	5	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	5
49	5	10	10	10
50	10	10	15	15
51	15	15	15	15
52	10	10	10	10
53	5	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	5	5	5
57	5	5	5	10
58	10	10	15	15
59	15	15	15	15

VISIBLE EMISSIONS OBSERVATION FORM

OBSERVER MARIA BUSS

DATE 12/11/84

FACILITY SHENANGO 4 BATTERY STACK

OBSERVATION PERIOD: START: 1241

FINISH: 1341

OBSERVATION POINT: PARKING LOT NORTH OF PLANT, WEST OF USS

SOURCE:

DISTANCE FROM: 350'

DIRECTION FROM: NW

HEIGHT: 100'

WIND:

SPEED: 0-5 MPH

DIRECTION: WEST

TEMPERATURE: 45°F

SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

OF READINGS ≥ 20%: 53

OF READINGS ≥ 60%: 4

MAX OPACITY: 65%

STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	15	15	15	15
1	15	15	20	20
2	25	25	20	20
3	20	20	20	25
4	35	45	40	40
5	40	30	45	55
6	65	60	60	45
7	30	25	20	20
8	15	15	15	15
9	10	10	10	10
10	10	15	15	15
11	15	15	15	15
12	15	15	10	10
13	10	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0

	0	15	30	45
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	5	5	5
44	5	5	5	5
45	10	10	10	10
46	10	10	10	10
47	10	10	15	15
48	15	15	30	55
49	60	55	55	55
50	50	35	35	35
51	35	35	25	25
52	25	25	25	25
53	25	25	25	20
54	20	20	15	15
55	15	15	15	20
56	20	15	15	15
57	10	15	15	15
58	15	15	15	15
59	15	15	15	20

VISIBLE EMISSIONS OBSERVATION FORM

OBSERVER MARIA BUSS

DATE 12/11/84

FACILITY SHENANGO - 4 BATTERY STACK

OBSERVATION PERIOD: START: 1342

FINISH: 1403

OBSERVATION POINT: PARKING LOT NORTH OF PLANT, WEST OF USS

SOURCE:

DISTANCE FROM: 350'

DIRECTION FROM: NW

HEIGHT: 100'

WIND:

SPEED: 0 - 5 MPH

DIRECTION: WEST

TEMPERATURE: 43° F

SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

NO. OF READINGS ≥ 20%: 13

NO. OF READINGS ≥ 60%: 0

MAX OPACITY: 20%

STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	20	20	20	20
1	20	20	20	20
2	20	20	20	15
3	5	0	0	0
4	0	0	0	0
5	0	0	0	5
6	0	0	0	0
7	0	0	0	0
8	0	0	10	10
9	15	15	15	15
10	20	20	10	10
11	10	10	10	10
12	5	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
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	0	15	30	4
30				
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59				

3rd Run

BSERVER MARIA BUSS

ATE 12/12/84

ACILITY SHENANGO - 4 BATTERY STACK

BSERVATION PERIOD: START: 1210

FINISH: 1310

BSERVATION POINT: PARKING LOT

RTH OF PLANT, WEST OF USS

OURCE:

DISTANCE FROM: 350'

DIRECTION FROM: NW

HEIGHT: 100'

IND:

SPEED: 0-5 MPH

DIRECTION: WEST

EMPERATURE: 44°F

KY CONDITION: CLOUDY

ACKGROUND: SKY

EADING CONDITIONS: FAIR

OLOR OF EMISSIONS: BLACK

OMMENTS:

. OF READINGS ≥ 20%: 51

. OF READINGS ≥ 60%: 0

MAX OPACITY: 55%

TUS:

GNATURE: Maria Buss

X	0	15	30	45
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	10
13	15	15	15	15
14	15	15	15	15
15	15	15	15	15
16	10	10	15	15
17	15	15	15	15
18	15	15	15	20
19	20	20	15	15
20	15	15	15	15
21	15	15	20	20
22	20	20	20	20
23	20	20	20	20
24	20	20	20	20
25	20	10	10	5
26	5	5	5	0
27	0	0	5	5
28	5	5	10	10
29	10	15	15	15

1241

X	0	15	30	45
30	15	15	15	10
31	10	10	10	15
32	25	40	50	50
33	35	30	20	30
34	40	55	55	50
35	25	20	20	20
36	20	20	20	20
37	20	20	20	20
38	20	20	20	20
39	20	15	15	15
40	15	15	15	15
41	15	20	20	20
42	20	10	10	10
43	10	15	15	10
44	5	5	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0

VISIBLE EMISSIONS OBSERVATION FORM

OBSERVER MARIA BUSS

DATE 12/12/84

FACILITY SHENANGO - 4 BATTERY STACK

OBSERVATION PERIOD: START: 1311

FINISH: 1411

OBSERVATION POINT: PARKING LOT NORTH OF PLANT, WEST OF USS

SOURCE:

DISTANCE FROM: 350'

DIRECTION FROM: N W

HEIGHT: 100'

WIND:

SPEED: 0 - 5 MPH

DIRECTION: WEST

TEMPERATURE: 45°F

SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

NO. OF READINGS ≥ 20%:

NO. OF READINGS ≥ 60%:

MAX OPACITY: 70%

STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	10	20
5	15	15	15	15
6	15	20	40	60
REV → 7	65	70	60	35
8	30	20	20	20
9	20	20	15	15
10	15	10	10	10
11	10	10	10	10
12	10	10	10	5
13	15	25	25	25
14	25	25	20	20
15	25	25	20	20
16	20	20	20	20
17	20	20	20	20
18	20	20	20	25
19	25	25	25	25
20	25	25	25	25
21	25	25	25	25
22	25	25	25	25
23	20	20	20	25
24	25	25	25	25
25	25	25	25	20
26	20	20	20	15
27	5	5	5	5
28	5	5	5	5
29	5	5	10	10

	0	15	30	45
30	15	15	20	20
31	20	20	20	15
32	10	10	10	10
33	10	10	10	10
34	10	10	10	10
35	10	10	10	15
36	15	15	15	15
37	15	20	20	20
38	20	20	25	25
39	25	25	25	30
40	30	30	35	35
41	35	50	65	60
REV → 42	40	40	45	70
43	70	60	40	40
44	30	25	25	25
45	15	10	10	10
46	10	10	5	5
47	5	5	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0

VISIBLE EMISSIONS OBSERVATION FORM

OBSERVER MARIA BUSS
DATE 12/12/84
FACILITY SHENANGO – 4 BATTERY STACK
OBSERVATION PERIOD: START: 1412
FINISH: 1426

OBSERVATION POINT: PARKING LOT NORTH OF PLANT, WEST OF USS
SOURCE:
DISTANCE FROM: 350'
DIRECTION FROM: NW
HEIGHT: 100'
WIND:
SPEED: 0-5 MPH
DIRECTION: WEST
TEMPERATURE: 45°F
SKY CONDITION: CLOUDY

BACKGROUND: SKY

READING CONDITIONS: FAIR

COLOR OF EMISSIONS: BLACK

COMMENTS:

OF READINGS ≥ 20%: 0
OF READINGS ≥ 60%: 0
MAX OPACITY: 10%
STATUS:

SIGNATURE: Maria Buss

	0	15	30	45
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	5	10
13	10	5	0	0
14	0	0	0	0
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	0	15	30	45
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BCM

APPENDIX C

CALCULATIONS

BCM

EPA METHOD 5 CALCULATIONS

$$Vm(std) = 17.64(\gamma)(Vm)\ \frac{Pb + (0.07355)(\Delta H)}{Tm + 460}$$

$$Vw(std) = 0.0471\ Vwc$$

$$Bws = \frac{Vw(std)}{Vw(std) + Vm(std)}$$

$$Md = 0.44(\%CO_2) + 0.32(\%O_2) +) 0.28(\%N_2 + \%CO)$$

$$Ms = Md(1 - Bws) + 18(Bws)$$

$$Vs = 85.49\ Cp\sqrt{\Delta P}\sqrt{\frac{Ts + 460}{Ps\ \ Ms}}$$

$$As = \frac{\pi (Ds)^2}{(4)(144)}$$

$$Qs = 60\ Vs\ As$$

$$Qs(std) = Qs(1 - Bws)17.64\ \frac{Ps}{Ts + 460}$$

$$An = \frac{\pi (Dn)^2}{(4)(144)}$$

$$I = \frac{1.667(Ts + 460)\left[(0.00267\ Vwc) + \left(\left(\frac{Vm}{Tm + 460}\right)(Pb + 0.07355\Delta H)\right)\right]}{\Theta\ Vs\ Ps\ An}$$

$$C's = 0.0154\ \frac{Wt}{Vm(std)}$$

$$E = 0.00857\ C's\ Qs(std)$$

$$lb/mmBTU = \frac{lb/hr}{mmBTU}$$

BCM

Plant Shenango

Location N. 4 Bat., No 8 Stack

Test Date Dec 11, 1984

Run No. 1

Calculator Paul Jadlowiec

Date Dec 11, 1984

SUMMARIZED DATA

Y	= 1.001		Vm (std)	= 58.312	dscf
Vm	= 59.456	cf	Vw (std)	= 8.332	scf
Pb	= 29.37	in. Hg	Bws	= 0.125	
ΔH	= 0.925	in. H_2O	Md	= 2928	wet-lb/lb-mole
Tm	= 70.0	^oF	Ms	= 27.87	dry-lb/lb-mole
Vwc	= 176.9	ml H_2O	Vs	= 11.090	fps
$\%CO_2$	= 4.0		As	= 66.00	ft^2
$\%O_2$	= 16.0		Qs	= 43,916	acfm
%CO	= —		Q_s(std)	= 22,338	dscfm
$\%N_2$	= 80.0		An	= .00[illegible]	ft^2
Cp	= 0.84		I	= 97.6	
$\sqrt{\Delta P}$	= .148	H_2O	C's	= [illegible]	gr/dscf
Ts	= 428.8	^oF	E	=	lbs/hr
Ps	= 29.29	in. Hg	lb/mmBTU	=	lb/mmBTU
Ds	= 110	in.			
Dn	= 0.520	in.			
Θ	= 120	min.			
Wt	= 55.[illegible]	mg.			

BCM

Plant- Shenango
Location- N.4 Bat., No 8 Stack
Test date- Dec 11, 1984
Run No.- 1

Calculator- Paul Jadlowiec
Date- Dec 11, 1984

EPA METHOD 5 CALCULATIONS

$Vm(std) = 17.64(1.001)(59.456)\frac{29.37+(0.07355)(0.925)}{70.0+460} = 58.312$ dscf

$Vw(std) = 0.0471(176.9) = 8.332$ scf

$Bws = \frac{8.332}{8.332+58.312} = .125$

$Md = 0.44(40)+0.32(16.0)+0.28(\text{—}+800) = 29.28$ lb/lb/mole

$Ms = (29.28)(1-.125)+18(.125) = 27.87$ lb/lb-mole

$Vs = 85.49(0.84)(0.148)\sqrt{\frac{428.8+460}{(29.29)(27.87)}} = 11.090$ ft/sec

$As = \frac{(\pi)(110)^2}{(4)(144)} = 66.00$ ft^2

$Qs = 60(11.090)(66.00) = 43,916$ acfm

$Qs(std) = (43,916)(1-0.125)17.64\frac{29.29}{428.8+460} = 22,338$ dscfm

$An = \frac{(\pi)(.520)^2}{(4)(144)} = .00147$ ft^2

$I = \frac{1.667(428.8+460)\left[(0.00267(176.9))+\left(\frac{59.456}{70.0+460}(29.37)+(0.07355(0.925)\right)\right]}{(120)(11.09)(29.29)(.00147)} = 97.6\%$

$C's = 0.0154\frac{\text{[illegible]}}{58.312} = \text{[illegible]}$ gr/dscf

$E = 0.00857(\quad)(\quad) = \quad$ lb/hr

$\text{lb/mmBTU} = \frac{\text{lb/hr}}{\text{mmBTU}} = \quad$ lb/mmBTU

BCM

Plant _____ Calculator _____

Location _____ Date _____

Test Date _____

Run No. _____

SUMMARIZED DATA

Y	=		Vm (std)	=	dscf
Vm	=	cf	Vw (std)	=	scf
Pb	=	in. Hg	Bws	=	
ΔH	= 1.20	in. H_2O	Md	=	wet-lb/lb-mole
Tm	= 75.0	^oF	Ms	=	dry-lb/lb-mole
Vwc	=	mlH_2O	Vs	=	fps
%CO_2	=		As	=	ft^2
%O_2	=		Qs	=	acfm
%CO	= —		Q_s(std)	=	dscfm
%N_2	=		An	=	ft^2
Cp	=		I	=	
$\sqrt{\Delta p}$	=	H_2O	C's	=	gr/dscf
Ts	=	^oF	E	=	lbs/hr
Ps	=	in. Hg	lb/mmBTU	=	lb/mmBTU
Ds	= 1.10	in.			
Dn	=	in.			
Θ	=	min.			
Wt	=	mg.			

BCM

Plant-
Location-
Test date-
Run No.-

Calculator-
Date-

EPA METHOD 5 CALCULATIONS

$$Vm(std) = 17.64(\quad)(\quad)\frac{\quad+(0.07355)(\quad)}{\quad+460} = \quad dscf$$

$$Vw(std) = 0.0471(\quad) = \quad scf$$

$$Bws = \frac{\quad}{\quad+\quad} = \quad$$

$$Md = 0.44(\quad)+0.32(\quad)+0.28(\quad+\quad) = \quad lb/lb/mole$$

$$Ms = (\quad)(1-\quad)+18(\quad) = \quad lb/lb\text{-}mole$$

$$Vs = 85.49(\quad)(\quad)\sqrt{\frac{\quad+460}{(\quad)(\quad)}} = \quad ft/sec$$

$$As = \frac{(\pi)(\quad)^2}{(4)(144)} = \quad ft^2$$

$$Qs = 60(\quad)(\quad) = \quad acfm$$

$$Qs(std) = (\quad)(1-\quad)17.64\frac{\quad}{\quad+460} = \quad dscfm$$

$$An = \frac{(\pi)(\quad)^2}{(4)(144)} = \quad ft^2$$

$$I = \frac{1.667(\quad+460)\left[(0.00267(\quad))+\left(\frac{\quad}{\quad+460}(\quad)+(0.07355(\quad)\right)\right]}{(\quad)(\quad)(\quad)(\quad)} = \quad$$

$$C's = 0.0154\frac{\quad}{\quad} = \quad gr/dscf$$

$$E = 0.00857(\quad)(\quad) = \quad lb/hr$$

$$lb/mmBTU = \frac{\quad lb/hr}{mmBTU} = \quad lb/mmBTU$$

BCM

Plant- [illegible]
Location- [illegible]
Test date- [illegible]
Run No.- 3

Calculator- [illegible]
Date- [illegible]

EPA METHOD 5 CALCULATIONS

Vm(std)= 17.64( )( ) / 84.6 +460 +(0.07355)( ) = dscf

Vw(std)=0.0471( )= scf

Bws= / + = =

Md=0.44( )+0.32( )+0.28(+)= lb/lb/mole

Ms=( )(1-)+18( )= lb/lb-mole

Vs=85.49( )( ) √(+460 / ( )( ) = ft/sec

As= (π)( )^2 / (4)(144) = ft^2

Qs=60( )( )= acfm

Qs(std)= ( )(1-)17.64 / +460 = dscfm

An= (π)( )^2 / (4)(144) = ft^2

I=1.667(+460) [0.00267( ))+(/ +460)+(0.07355( )] / ( )( )( )( ) =

C's=0.0154 / = gr/dscf

E=0.00857( )( )= lb/hr

lb/mmBTU= lb/hr / mmBTU = lb/mmBTU

BLANK ANALYTICAL DATA

Plant Shawnee

Sample location North Bat. N. stack

Relative humidity ≤ 10%

Type of blank .07852

Liquid level at mark and container sealed yes

Density of blank (ρa) .07852 g/ml

Blank volume (Va) 500 ml 11 3

Date and time of wt. 12-17-84 1342 Gross wt. 109575.5 mg

Date and time of wt. 12-20-84 0836 Gross wt. 109575.0 mg

Average gross wt. 109575.25 mg

Tare wt. 109575.7 mg

Weight of blank (ma) − .55 mg

$$Ca = \frac{ma}{Va\ \rho a} = \frac{(\quad)}{(\quad)(\quad)} = \underline{\quad 0 \quad} \text{ mg/g}$$

Note: In no case shall a blank residue greater than (0.01 mg/g) or 0.001% of the weight of blank used be subtracted from the sample weight.

Remarks: −.55 acceptable error

Signature of analyst Paul Faltbrooks

Signature of reviewer _____

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

ACETONE RINSE

Plant Sherburne Run No. 1

Sample location Unit 1 Bot No 8 Stack

Relative humidity 40 %

Density of acetone (ρa) .7852 g/ml

Sample type	Sample identifiable	Liquid level at mark and/or container sealed
Acetone rinse	Yes	Yes
filter(s)	Yes	Yes

Acetone rinse container no. 11 M

Acetone rinse volume (Vaw) 218 ml

Acetone blank residue concentration (Ca) _____ mg/g

Wa = Ca Vaw ρa = ( )( )( ) = 0 mg

Date and time of wt 12-20-84 0815 Gross wt [illegible] mg

Date and time of wt 12-21-84 1830 Gross wt [illegible] mg

Average gross wt [illegible] mg

Tare wt [illegible] mg

Less acetone blank wt (Wa) 0 mg

Weight of particulate in acetone rinse 33.35 mg

Filter(s) container no. 391

Date and time of wt 12-20-84 0833 Gross wt 425.5 mg

Date and time of wt 12-21-84 1831 Gross wt 425.3 mg

Average gross wt 425.55 mg

Tare wt 403.75 mg

Weight of particulate on filter(s) 22.80 mg

Weight of particulate in acetone rinse 33.05 mg

Total weight of particulate 55.85 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks: _____

Signature of analyst Paul Faltinson

Signature of reviewer _____

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

ACETONE RINSE

Plant Shawnee Run No. 2

Sample location A + B Ext Duct Stack

Relative humidity ~ 10%

Density of acetone (ρa) 0.7852 g/ml

Sample type	Sample identifiable	Liquid level at mark and/or container sealed
Acetone rinse	Yes	Yes
filter(s)	Yes	Yes

Acetone rinse container no. 11 N

Acetone rinse volume (Vaw) 182 ml

Acetone blank residue concentration (Ca) _____ mg/g

Wa = Ca Vaw ρa = ( )( )( ) = 0 mg

Date and time of wt 12-17-84 0814 Gross wt 112406.1 mg

Date and time of wt 12-17-84 1645 Gross wt 112406.7 mg

Average gross wt 112406.35 mg

Tare wt 112382.35 mg

Less acetone blank wt (Wa) 0 mg

Weight of particulate in acetone rinse 24 mg

Filter(s) container no. 345

Date and time of wt 12-14-84 0827 Gross wt 438.3 mg

Date and time of wt 12-17-84 1532 Gross wt 438.3 mg

Average gross wt 438.3 mg

Tare wt 403.85 mg

Weight of particulate on filter(s) 34.45 mg

Weight of particulate in acetone rinse 24 mg

Total weight of particulate 58.75 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks: _____

Signature of analyst Paul Goldman

Signature of reviewer _____

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

ACETONE RINSE

Plant Sherrago Run No. 3

Sample location N. 4 Bot [illegible] STACK

Relative humidity [illegible]

Density of acetone (ρa) [illegible] g/ml

Sample type	Sample identifiable	Liquid level at mark and/or container sealed
Acetone rinse	Yes	Yes
filter(s)	Yes	Yes

Acetone rinse container no. 113

Acetone rinse volume (Vaw) 350 ml

Acetone blank residue concentration (Ca) _____ mg/g

Wa = Ca Vaw ρa = ( )( )( ) = _____ mg

Date and time of wt 12-20-84 0817 Gross wt 105556.1 mg

Date and time of wt 12-20-84 1531 Gross wt 105556.8 mg

Average gross wt 105556.45 mg

Tare wt 105515.55 mg

Less acetone blank wt (Wa) 0 mg

Weight of particulate in acetone rinse 41.3 mg

Filter(s) container no. 340

Date and time of wt 12-17-84 0735 Gross wt 433.2 mg

Date and time of wt 12-17-84 1511 Gross wt 433.4 mg

Average gross wt 433.3 mg

Tare wt 405.05 mg

Weight of particulate on filter(s) 28.25 mg

Weight of particulate in acetone rinse 41.3 mg

Total weight of particulate 69.55 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks: _____

Signature of analyst [signature]

Signature of reviewer _____

DRY GAS METER AND ORIFICE SYSTEM CALIBRATION

DATE Sept 18, 1984 OPERATOR Paul Judkowitz CONSOLE NUMBER 582-128

* Orifice Manometer Setting In. H_2O ΔH	Minimum Volume of Gas ft^3	WET TEST METER GAS VOLUMES AND TEMPERATURES						DRY TEST METER GAS VOLUMES AND TEMPERATURES						Total Test Time Minutes θ	Barometer Reading, Inches Hg P_b
		Initial		Final		Net Volume	Avg. Temp.	Initial	Final			Net Volume	Avg. Temp.		
		ft^3 V_{w_i}	Temp. °F T_{w_i}	ft^3 V_{w_f}	Temp. °F T_{w_f}	ft^3 V_w	°F T_w	ft^3 V_{d_i}	ft^3 V_{d_o}	Temp. °F T_{d_i}	Temp. °F T_{d_o}	ft^3 V_d	°F T_d		
0.5	5	4.251	68.0	9.502	68.0	5.251	68.0	[illegible]	405.984	107	77	5.849	78	14.283	29.56
0.75	5	3.200	68.5	8.254	68.0	5.254	68.25	370.137	375.442	85	67	5.313	76	11.552	29.56
1.00	5	8.749	68.0	13.253	68.0	4.154	68.0	375.488	380.211	101	73	4.853	87	9.175	29.56
1.50	10	3.749	68.0	13.752	68.0	10.003	68.0	381.134	391.736	113	83	10.702	95	15.582	29.56
2.00	10	4.001	68.0	14.009	68.0	10.008	68.0	371.850	403.471	119	87	10.694	103	13.543	29.56
2.50	10														

* Check at least every 2 minutes and adjust if needed.

(1) Adjusted dry gas meter
(2) Increased orifice size

CALCULATIONS

$$\gamma = \frac{(V_w)(P_b)(T_d + 460)}{(V_d)(P_b + \frac{\Delta H}{13.6})(T_w + 460)} \qquad \Delta H@ = \frac{0.0317\ (\Delta H)}{(P_b)(T_{d_o} + 460)} \left[\frac{(T_w + 460)\ \theta}{(V_w)} \right]^2$$

Calc. By:
Checked By:
Date:

ΔH	GAMMA CALCULATIONS	γ	$\Delta H@$ CALCULATIONS	$\Delta H@$
0.5	[illegible]	.7719	[illegible]	1.96
0.75	[illegible]	.9916	[illegible]	2.02
1.00	[illegible]	1.008	[illegible]	2.04
1.50	[illegible]	1.007	[illegible]	1.95
2.00	[illegible]	.9919	[illegible]	2.03
2.50	( )( )(+ 460) / ( )(+ 460)		0.0317 ( ) / ( )(+ 460) [(+ 460)( ) / ( )]^2	
	AVERAGE	1.021	AVERAGE	2.00

(γ) Gamma = ratio W_t to D_t
Tol. = ±.01

$\Delta H@$ = orifice pressure differential that gives 0.75 cfm of air at 68°F and 29.92" Hg.
Average $\Delta H@$ value between 1.59-2.09 is acceptable. In addition, the $\Delta H@$ must not vary by more than ±0.15 over the ΔH range of calibration of 0.5-2.50" H_2O.

THERMOCOUPLE CALIBRATION DATA SHEET

Date: 9/26/84 Thermocouple No.: T-1

Ambient Temperature: 77.5 °F Barometric pressure: 29.48 " Hg

Calibrator: Paul Jadlowiec Reference: Mercury-in-glass: Yes

Other: _____

Reference point No.	Source*, (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Difference, %
1	②	77.6	79.1	2.1
2	③	212	221	4.2
3	④	352	351	0.3
			Average % difference	2.2

* Source: 1) Ice bath 3) Boiling water bath
2) Ambient 4) Heated oil bath

Percent difference

$$\frac{\text{Ref. temp. °F} - \text{thermocouple temp. °F}}{\text{Ref. temp. °F}} \times 100$$

THERMOCOUPLE CALIBRATION DATA SHEET

Date: 9/26/84 Thermocouple No.: 7-2

Ambient Temperature: 77.5 °F Barometric pressure: 29.48 " Hg

Calibrator: Paul Jadlowiec Reference: Mercury-in-glass: Yes

Other: _____

Reference point No.	Source*, (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Difference, %
1	②	77.5	78.8	1.7
2	③	212	219	3.3
3	④	365	367	0.5
			Average % difference	1.8

* Source: 1) Ice bath 2) Ambient 3) Boiling water bath 4) Heated oil bath

Percent difference

$$\frac{\text{Ref. temp. °F} - \text{thermocouple temp. °F}}{\text{Ref. temp. °F}} \times 100$$

TYPE S ... PE INSPECTION DATA FORM

DATE: 9/7/87

TECH.: P. SPRINGER

Pitot tube assembly level? ✓ yes ___ no

Pitot tube openings damaged? ___ yes (explain below) ✓ no

α_1 = 0.0° (<10°), α_2 = 0.0° (<10°), β_1 = 0.0° (<5°),

β_2 = 0.0° (<5°)

γ = 10°, θ = 10°, A = 9.5 cm (in.)

z = A sin γ = .017 cm (in.); <0.32 cm (<1/8 in.),

w = A sin θ = .017 cm (in.); <.08 cm (<1/32 in.)

P_A 1.73 cm (in.) P_b 1.53 cm (in.)

D_t = 3.01 cm (in.)

Comments: _____

_____

_____

Calibration required? ___ yes ✓ no

...E S... ...E INSPECTION DATA FORM

No. [illegible]
DATE: 9/7/94
TECH.: P Jacobs

Pitot tube assembly level? ✓ yes ____ no

Pitot tube openings damaged? ____ yes (explain below) ✓ no

α_1 = 0.0° (<10°), α_2 = 0.0° (<10°), β_1 = 0.5° (<5°),
β_2 = 1.0° (<5°)

γ = 0.0°, θ = 0.0°, A = .95 cm (in.)

z = A sin γ = 0 cm (in.); <0.32 cm (<1/8 in.),
w = A sin θ = 0 cm (in.); <.08 cm (<1/32 in.)

P_A 1.20 cm (in.) P_b 1.21 cm (in.)

D_t = 2.41 cm (in.)

Comments: _____

_____

_____

Calibration required? ____ yes ✓ no

BALANCE CALIBRATION CHECK LOG

Standard Weights (mg)

Date	10	50	100	200	500	1,000	10,000	50,000
9/24/84	9.7	49.7	99.5	199.6	499.4	1,000.5	10,000.0	50,000.0
11/5/84	9.9	49.9	99.5	199.7	499.4	1,000.4	10,000.2	50,000.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BAROMETER CALIBRATION LOG

DATE	MERCURY BAROMETER	TEST BAROMETER	ADJUSTED (YES/NO)
8/16/84	29.70	29.68	YES
9/7/84	29.55	29.66	YES
9/19/84	29.64	29.64	No
9/25/84	29.26	29.25	YES

NOZZLE CALIBRATION

Date 12/11/84 Calibrated by Paul Jedlowiec

Nozzle identification number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	D_{avg}
	Shenango Coke Oven Battery No. 4, Stack No. 8 - Test of 12/84				
Probe 7-1	.518	.520	.522	.004	.520
Probe 7-2	.524	.525	.526	.002	.525

where:

$D_{1,2,3}$ = nozzle diameter measured on a different diameter, in. Tolerance = measure within 0.001 in.

ΔD = maximum difference in any two measurements, in. Tolerance = 0.004 in.

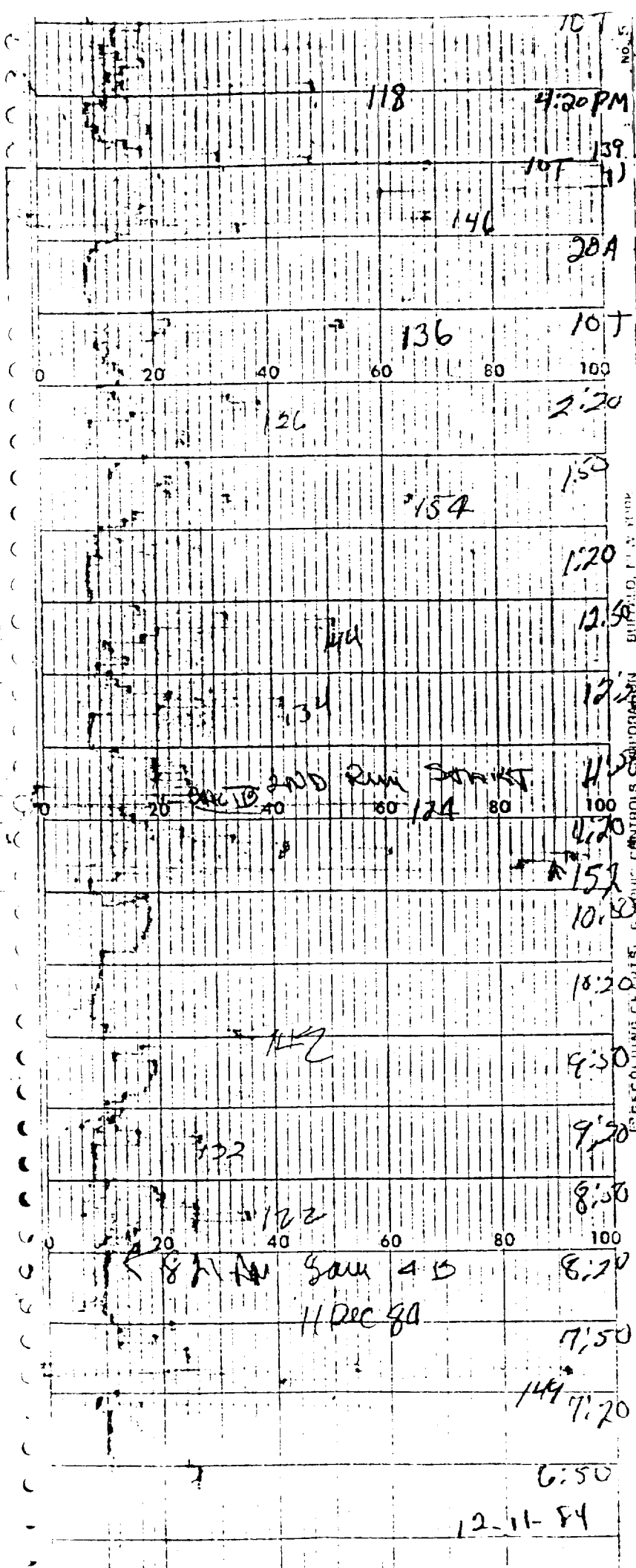
D_{avg} = average of D_1, D_2, and D_3.

Nozzle calibration data.

BCM

APPENDIX E

PROCESS DATA


10T
118
4:20 PM
139
10T
146
20A
136
10T
0 20 40 60 80 100
2:20
126
1:50
154
1:20
144
12:50
134
0 20 PACIFIC 40 60 124 80 100
4:20
151
10:50
10:20
142
9:50
9:20
172
122
8:50
0 20 40 60 80 100
8:20
11 Dec 84
7:50
144
7:20
6:50
12-11-84

SHENANGO INCORPORATED

322

BA[illegible] 4

12 – 11 – [illegible]

	OVEN NO.	TIME PUSHED	TIME CHARGED	TO PUSH
1	149	7:35	7:[illegible]	5[illegible]
2	13[illegible]	:40		5[illegible]
3	122	8:[illegible]	8:36	[illegible]
4	12[illegible]	9:[illegible]	:02	[illegible]
5	14[illegible]	:38	:49	[illegible]
6	152	10:[illegible]	11:[illegible]	[illegible]
7	124	11:[illegible]	[illegible]	[illegible]
8	134	12:0[illegible]	12:04	
9	144	[illegible]	12:38	[illegible]
10	154	1:[illegible]	1:[illegible]	4[illegible]
11	126	2:00	2:15	300
12	136	:35	:50	305
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S Mascellano

COAL
CHARGE
SPILLAGE
FOREMAN [illegible]
REMARKS:

	OVEN NO.	TIME PUSHED	TIME CHARGED	TO PUSH
1	146	3:10	3:25	300
2	118	4:05	4:20	310
3	12[illegible]	4:55	5:10	350
4	135	5:30	5:45	310
5	14[illegible]	6:05	6:25	450 +
6	121	6:45	7:05	400
7	131	7:15	7:30	190
8	141	8:15	8:30	300
9	151	8:55	9:10	310
10	[illegible]	9:50	10:05	240
11	12[illegible]	10:20	10:35	200
12	143	:46	:57	260
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14			12	
15	139	—	8:35	—
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M [illegible]

COAL
CHARGE
SPILLAGE
FOREMAN
REMARKS:

	OVEN NO.	TIME PUSHED	TIME CHARGED	TO PUSH
1	153	11:16	11:27	360
2	125	:42	12:04	240
3	13[illegible]	12:16	:40	340
4	145	1:02	1:13	2[illegible]
5	15[illegible]	:33	:51	2[illegible]
6	117	2:[illegible]	2:22	2[illegible]
7	127	:35	:46	27[illegible]
8	137	3:46	4:10	280
9	147	4:18	:33	200
10	119	:48	5:08	280
11	129	5:25	:58	290
12	149	6:13	:35	390
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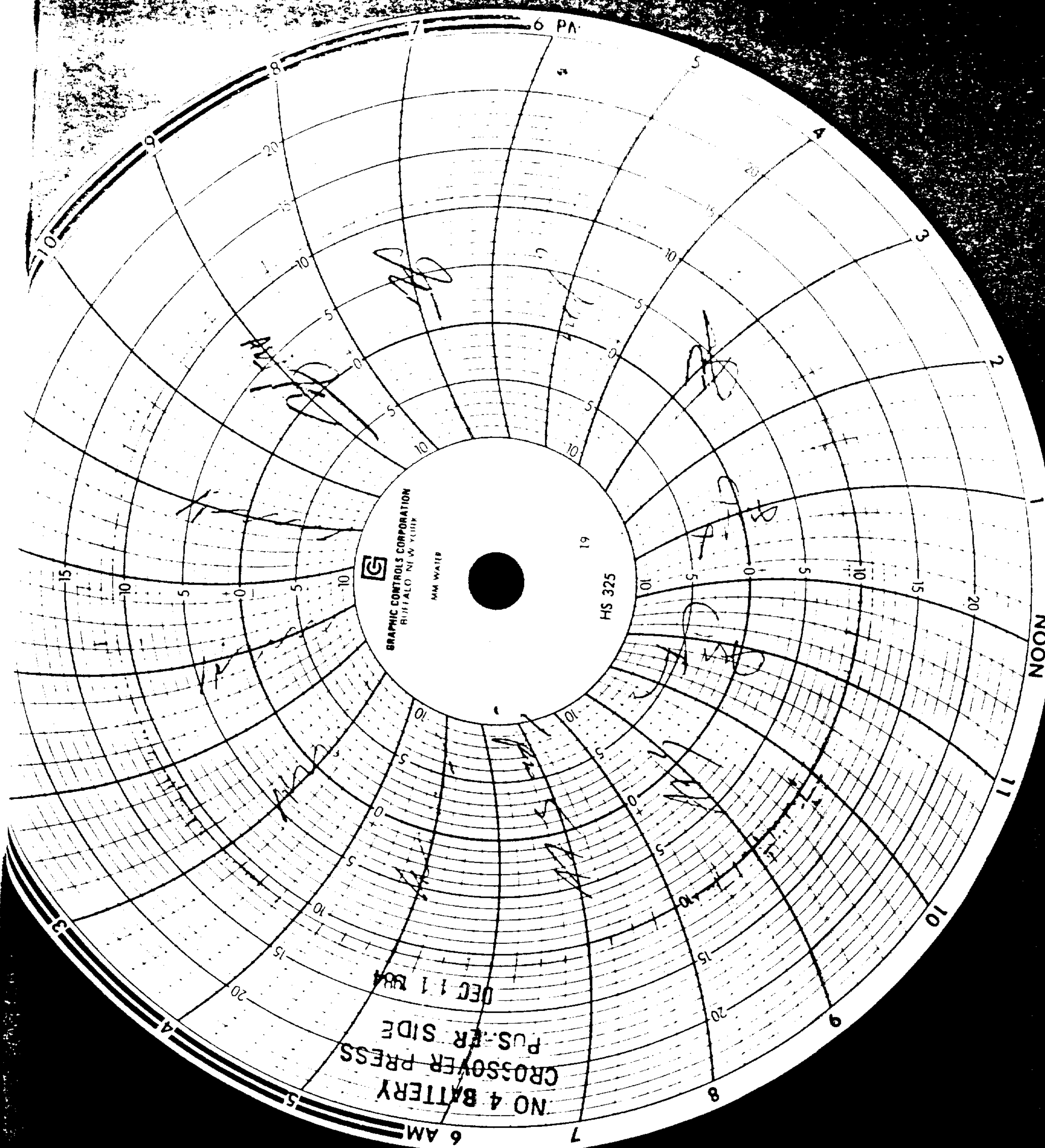
M [illegible]

COAL
CHARGE
SPILLAGE
FOREMAN [illegible]
REMARKS: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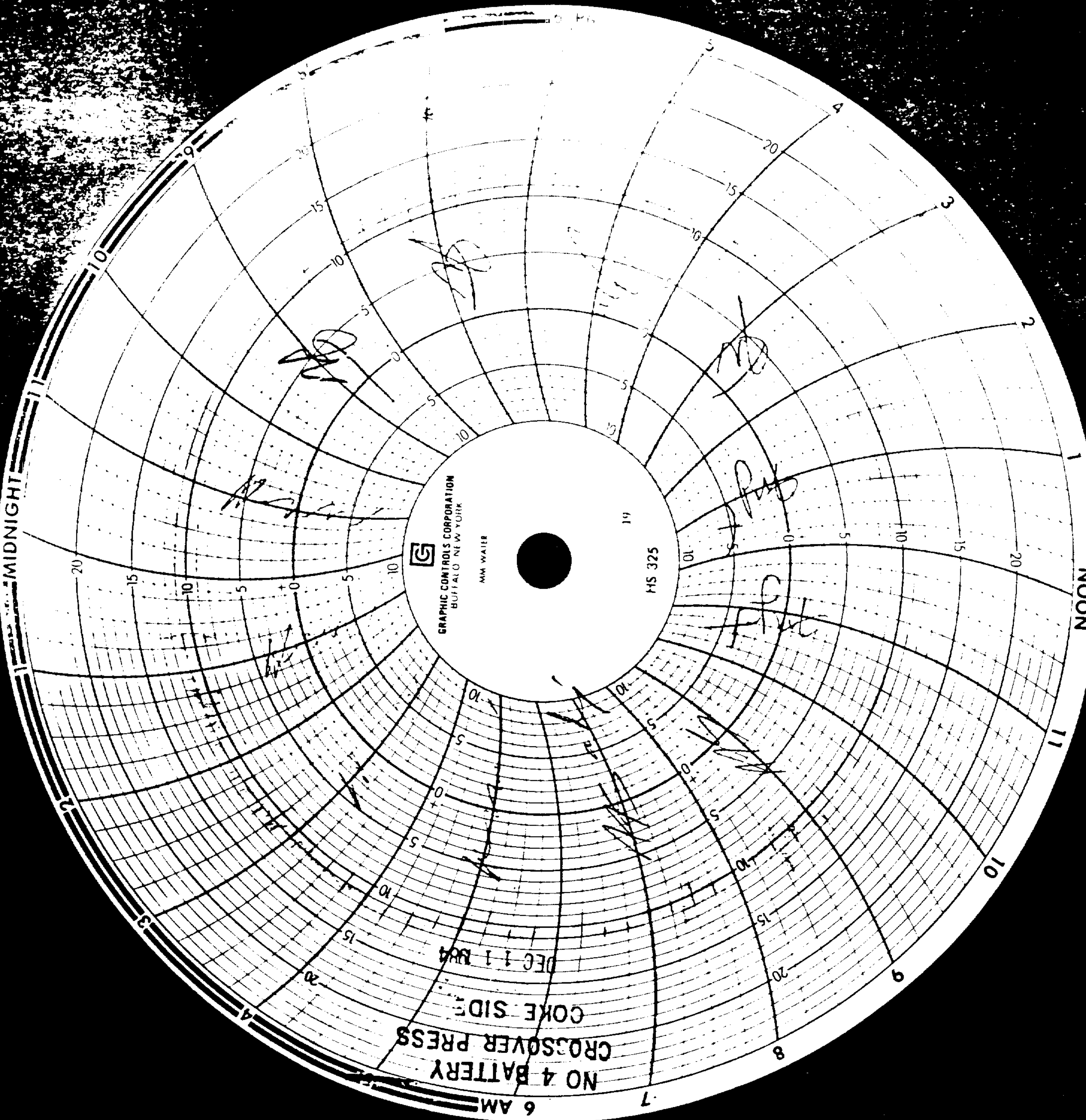
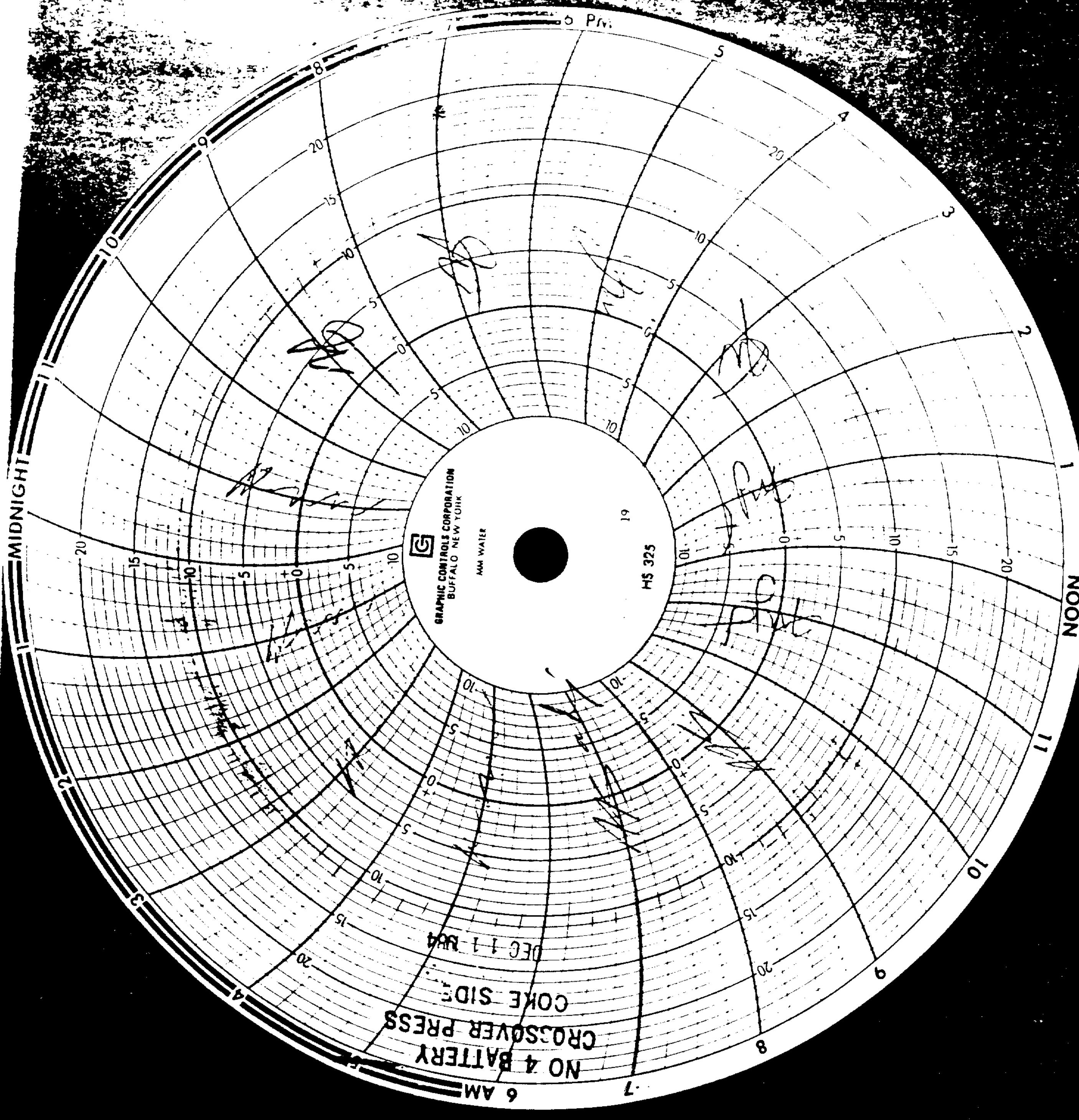
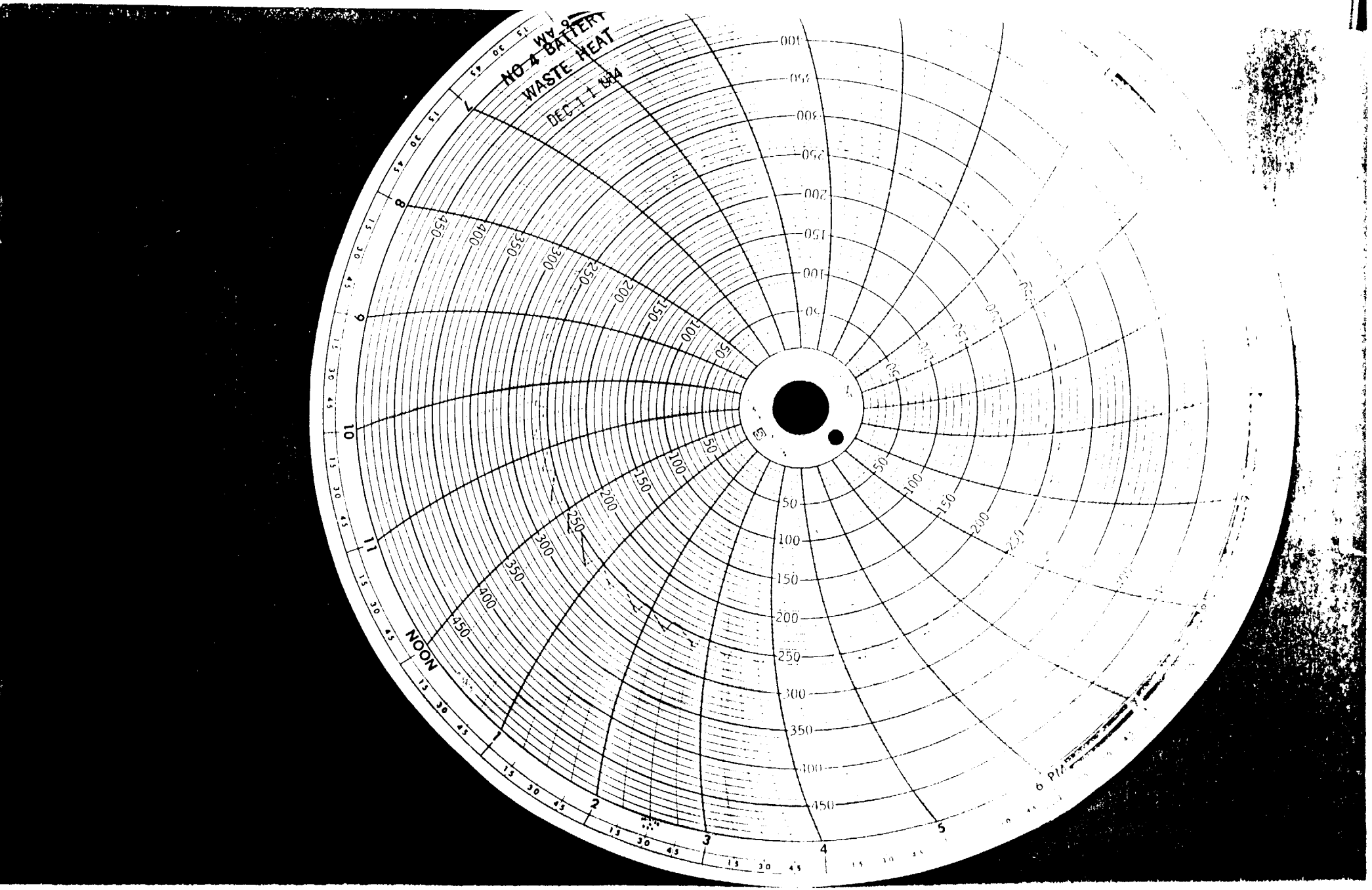
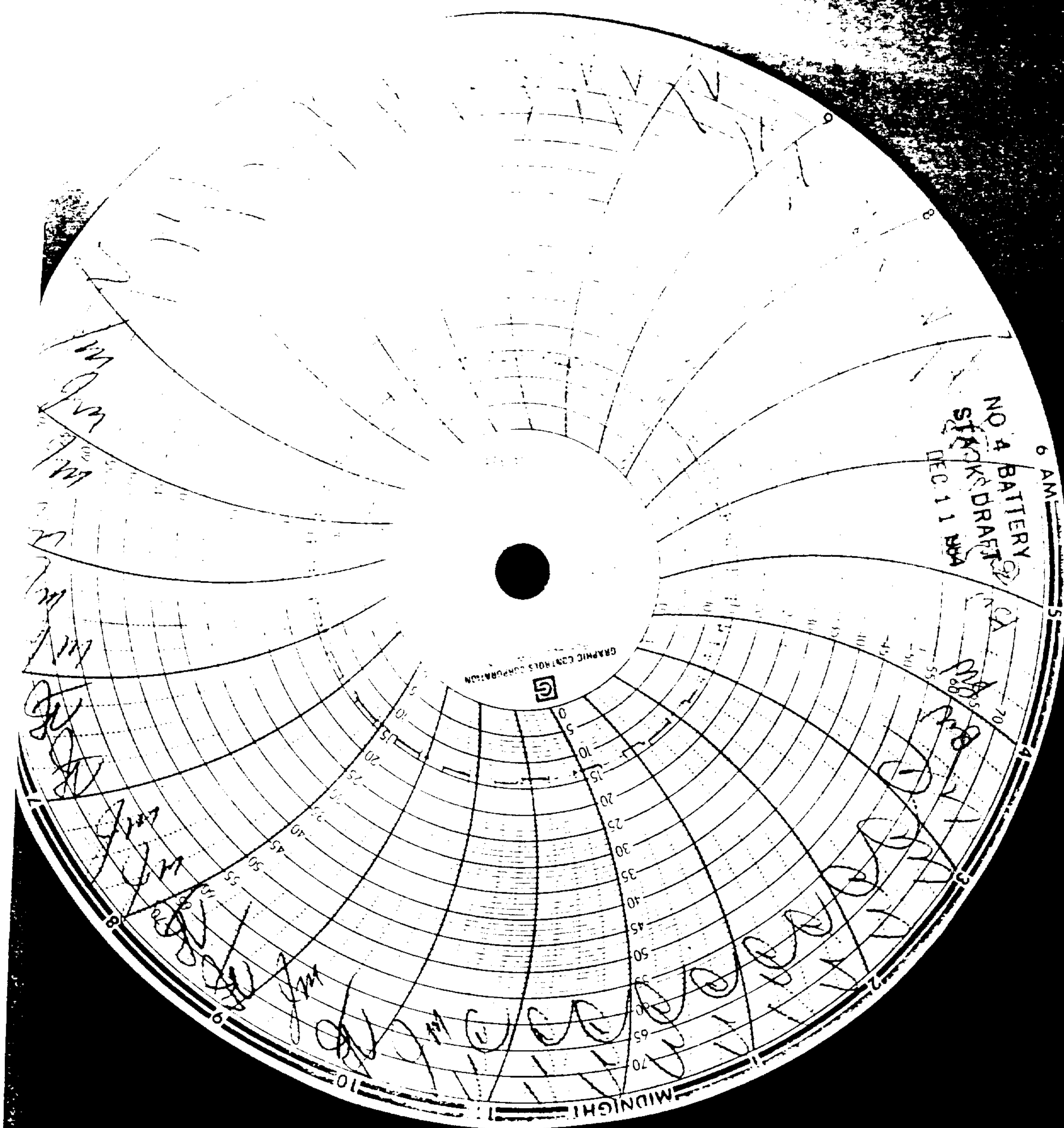
CROSSOVER PRESS
PUSHER SIDE
DEC 1 1 1984
GRAPHIC CONTROLS CORPORATION
BUFFALO NEW YORK
HS 325
6 PM
NOON
6 AM


GRAPHIC CONTROLS CORPORATION
BUFFALO NEW YORK
MM WATER
HS 325
MIDNIGHT
NOON
6 AM
NO 4 BATTERY
CROSSOVER PRESS
COKE SIDE



MIDNIGHT
NOON
6 AM
6 PM
GRAPHIC CONTROLS CORPORATION
BUFFALO NEW YORK
MM WATER
MS 325
NO 4 BATTERY
CROSSOVER PRESS
COKE SIDE


NO 4 BATTERY
WASTE HEAT
DEC 1 + 1934
NOON
6 PM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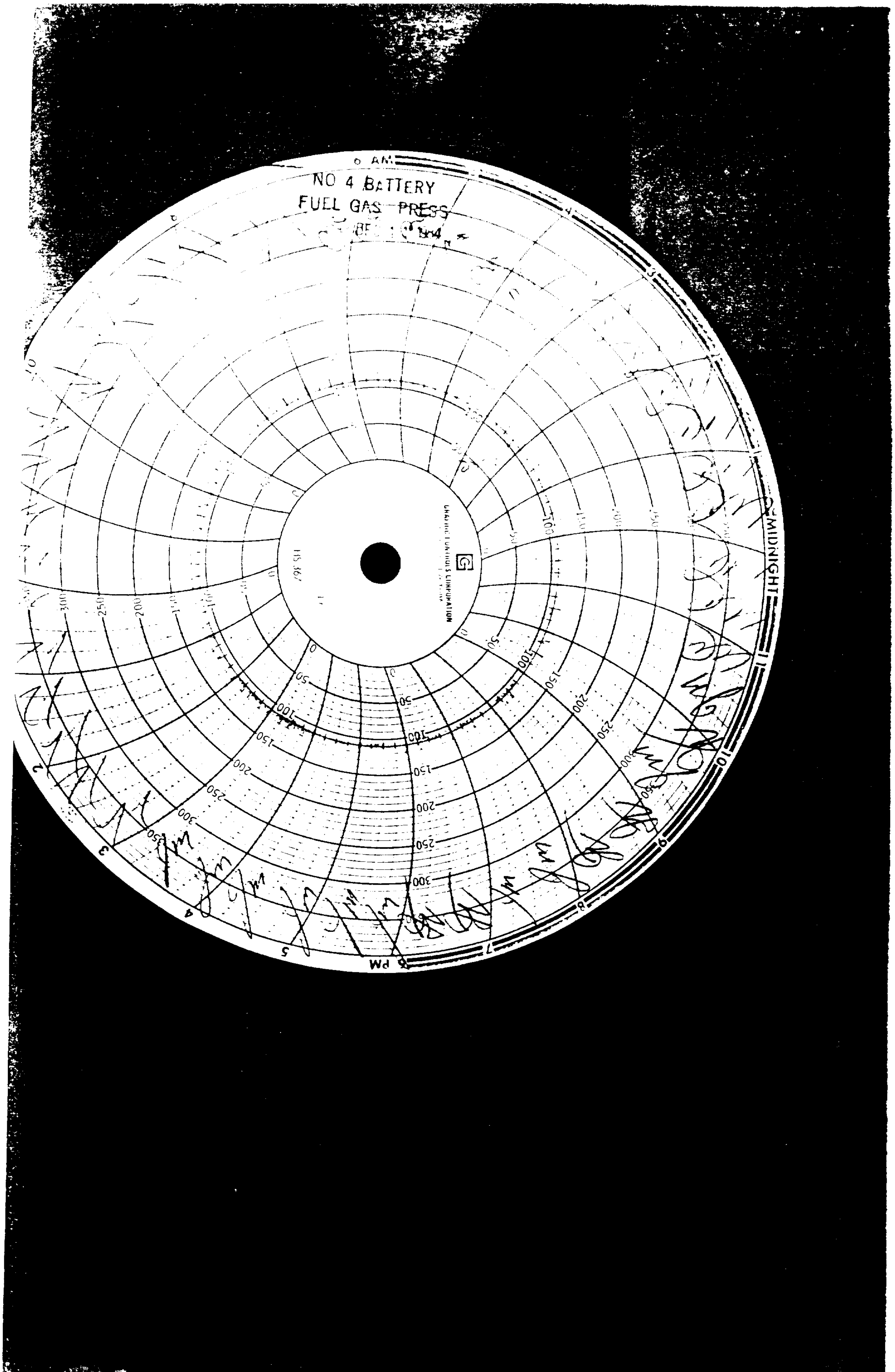
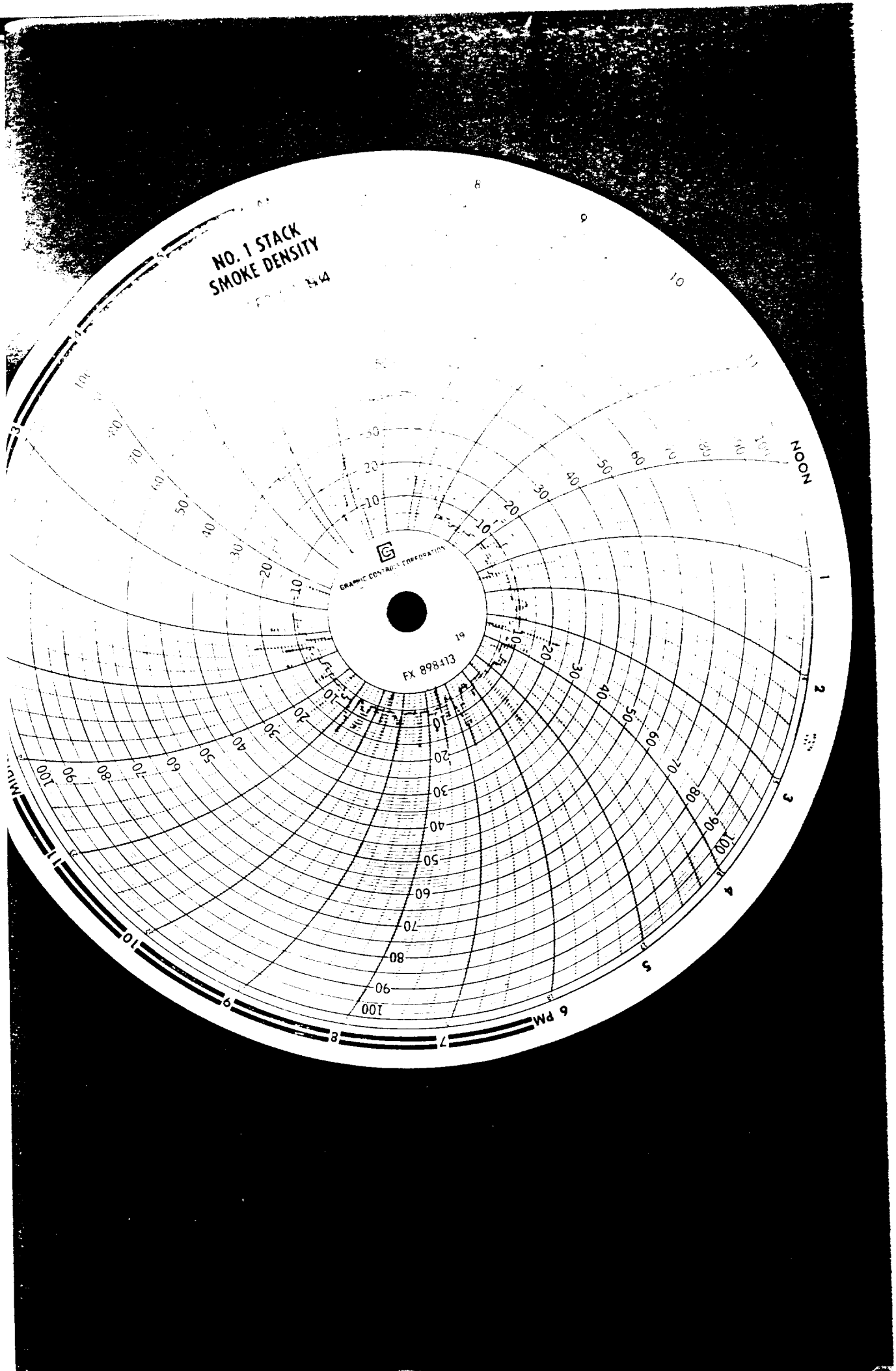
STACK DRAFT
DEC 11
6 AM
MIDNIGHT
GRAPHIC CONTROLS CORPORATION


6 AM
NO 4 BATTERY
FUEL GAS PRESS
MIDNIGHT
6 PM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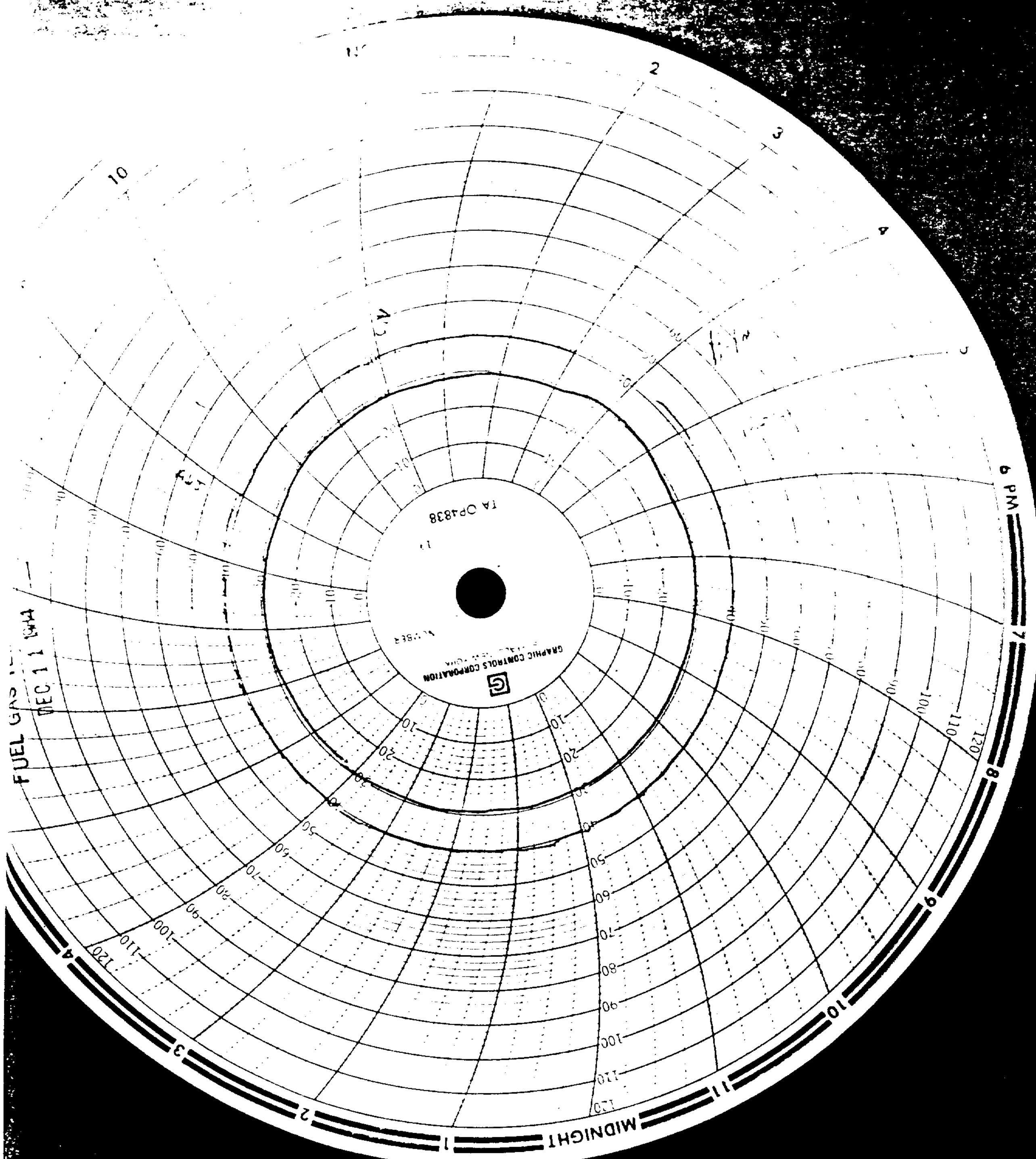
SMOKE DENSITY
NOON
6 PM
GRAPHIC CONTROLS CORPORATION
FX 898413


FUEL GAS
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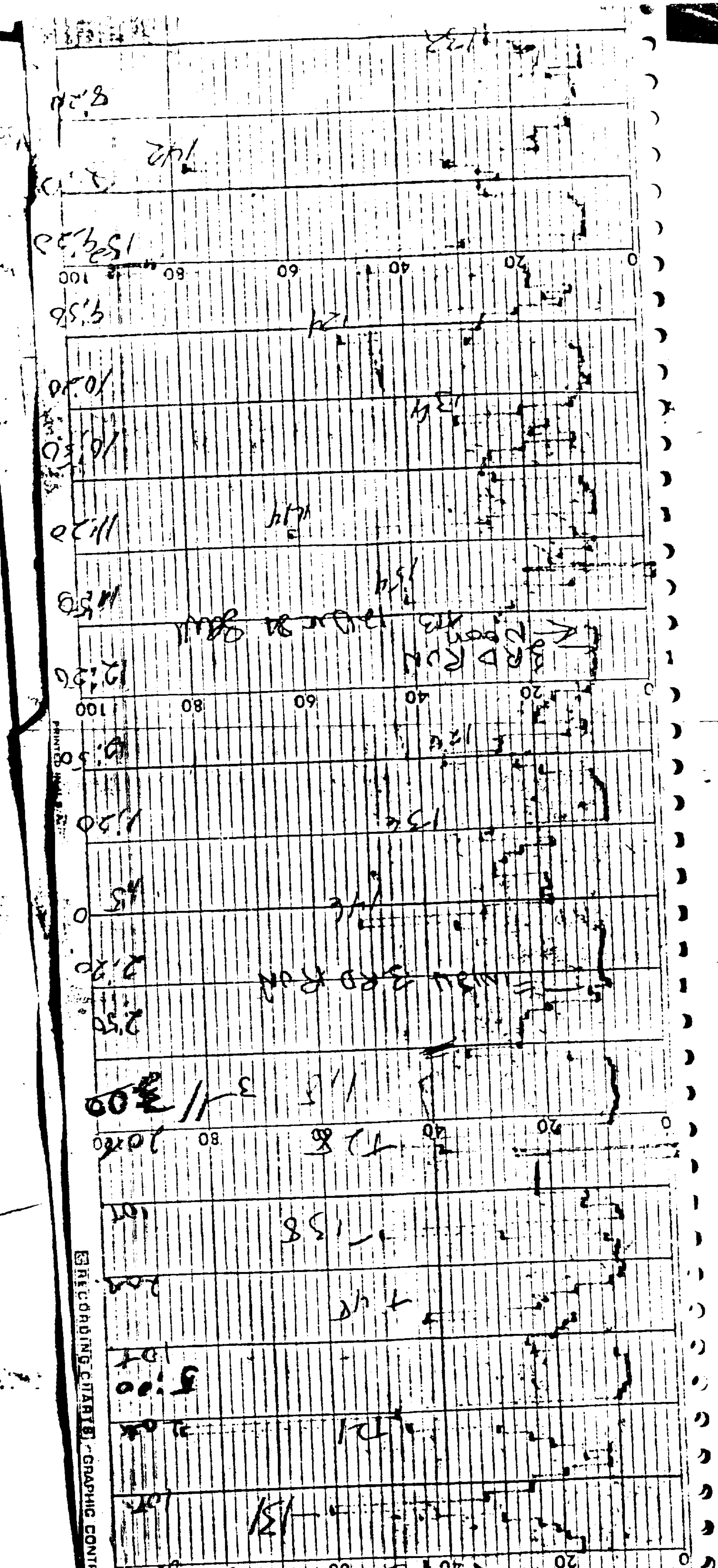
GRAPHIC CONTROLS CORPORATION


RECORDING CHARTS GRAPHIC CONT

SHENANGO INCORPORATED

NEVILLE PLANT
PUSHERS REPORT

BATTERY NO. 4 DATE 12-12 19 84

	7-3				3-11				11-7			
	OVEN NO.	TIME PUSHED	TIME CHARGED	AMPS TO PUSH	OVEN NO.	TIME PUSHED	TIME CHARGED	AMPS TO PUSH	OVEN NO.	TIME PUSHED	TIME CHARGED	AMPS TO PUSH
1	122	7:05	7:26	240	139	3:05	3:20	360+	125	11:06	11:21	240
2	130	37	8:06	220	128	3:45	4:00	320+	135	:35	:45	240
3	142	8:23	38	260	138	4:20	4:35	360	145	12:03	12:22	210
4	150	9:00	9:17	220	148	5:00	5:15	350	155	:42	:54	180
5	124	40	54	260	121	5:30	5:45	280	117	1:15	1:39	220
6	134	10:10	10:25	260	131	6:05	6:20	800	127	:54	2:10	270
7	144	55	11:20	200	141	6:40	6:55	280	137	2:36	:55	230
8	152	11:25	40	320+	151	7:40	7:55	210	147	3:54	4:10	200
9	126	12:30	12:48	230	129	8:10	8:25	800	119	4:24	:39	220
10	136	1:57	2:01	290	139	8:50	9:05	800	129	5:00	5:09	300
11	146	1:41	1:43	190	149	9:20	9:35	880	149	:27	:45	365
12	118	2:35	2:49	200+	159	10:00	10:15	290	122	6:02	:15	210
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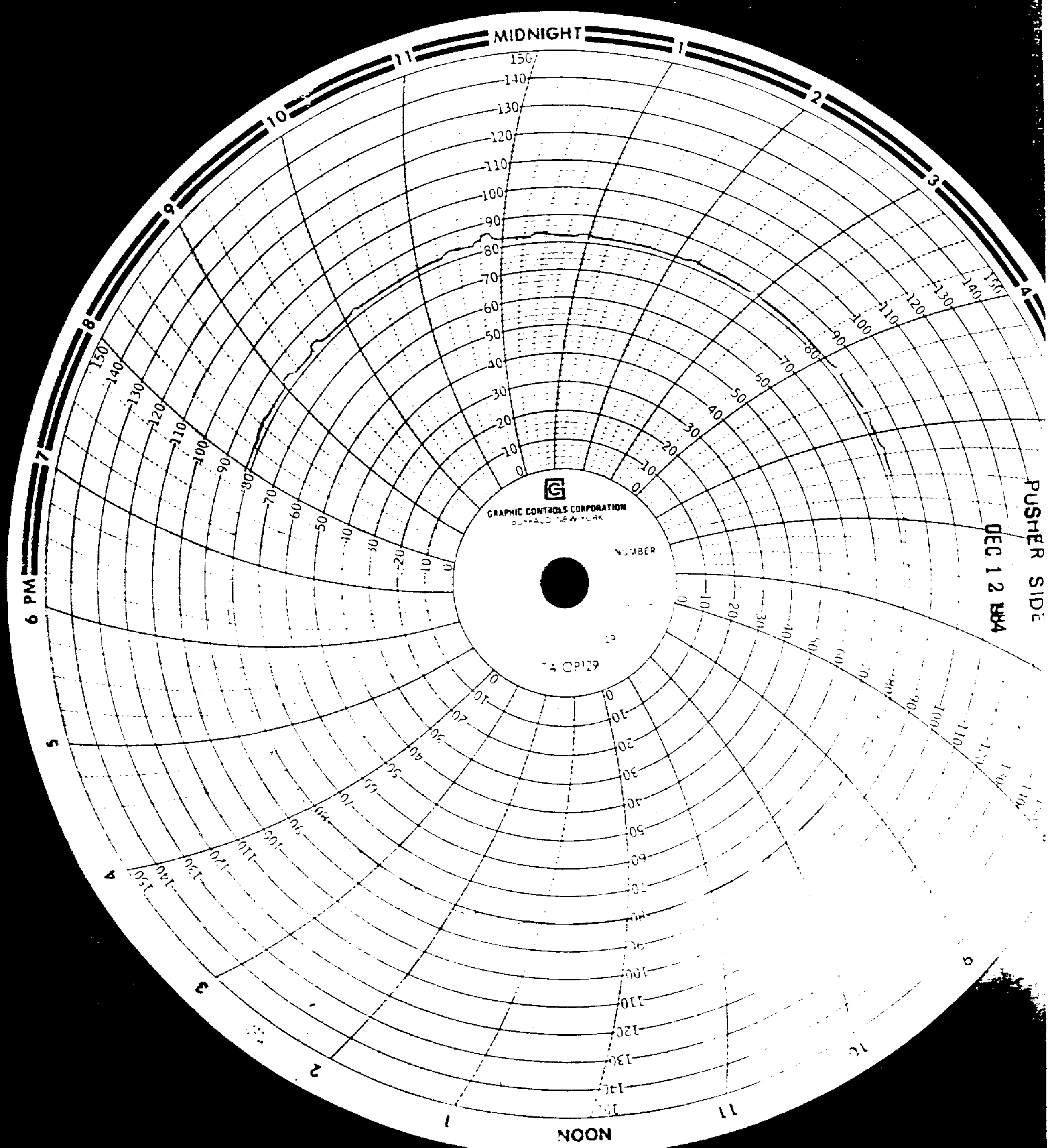
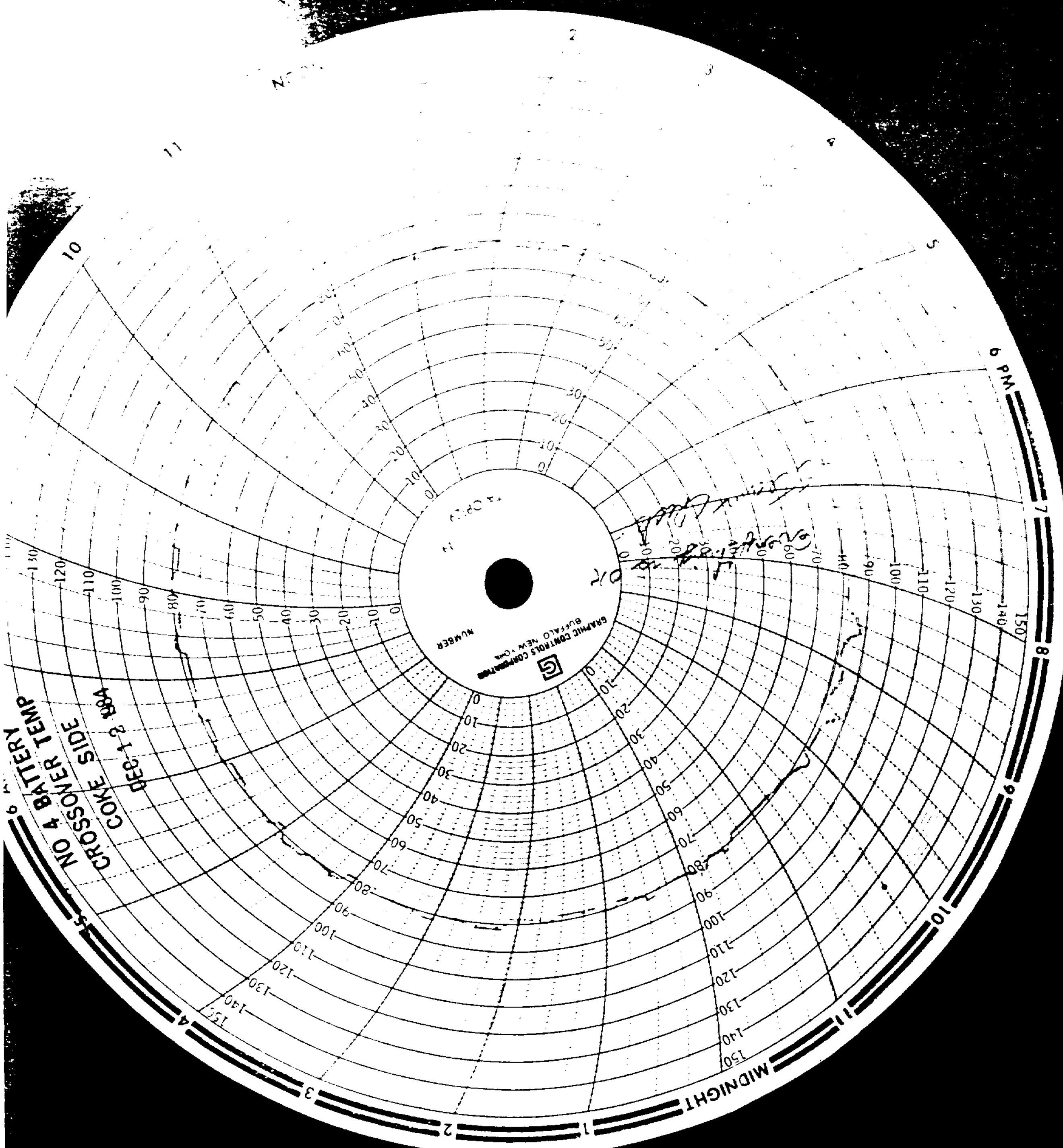
COAL	COAL	COAL
CHARGE	CHARGE	CHARGE
SPILLAGE	SPILLAGE	SPILLAGE
FOREMAN Singleton	FOREMAN Simons	FOREMAN
REMARKS:	REMARKS:	REMARKS:

36 pc


MIDNIGHT
NOON
6 PM
GRAPHIC CONTROLS CORPORATION
BUFFALO NEW YORK
NUMBER
PUSHER SIDE
DEC 12 1984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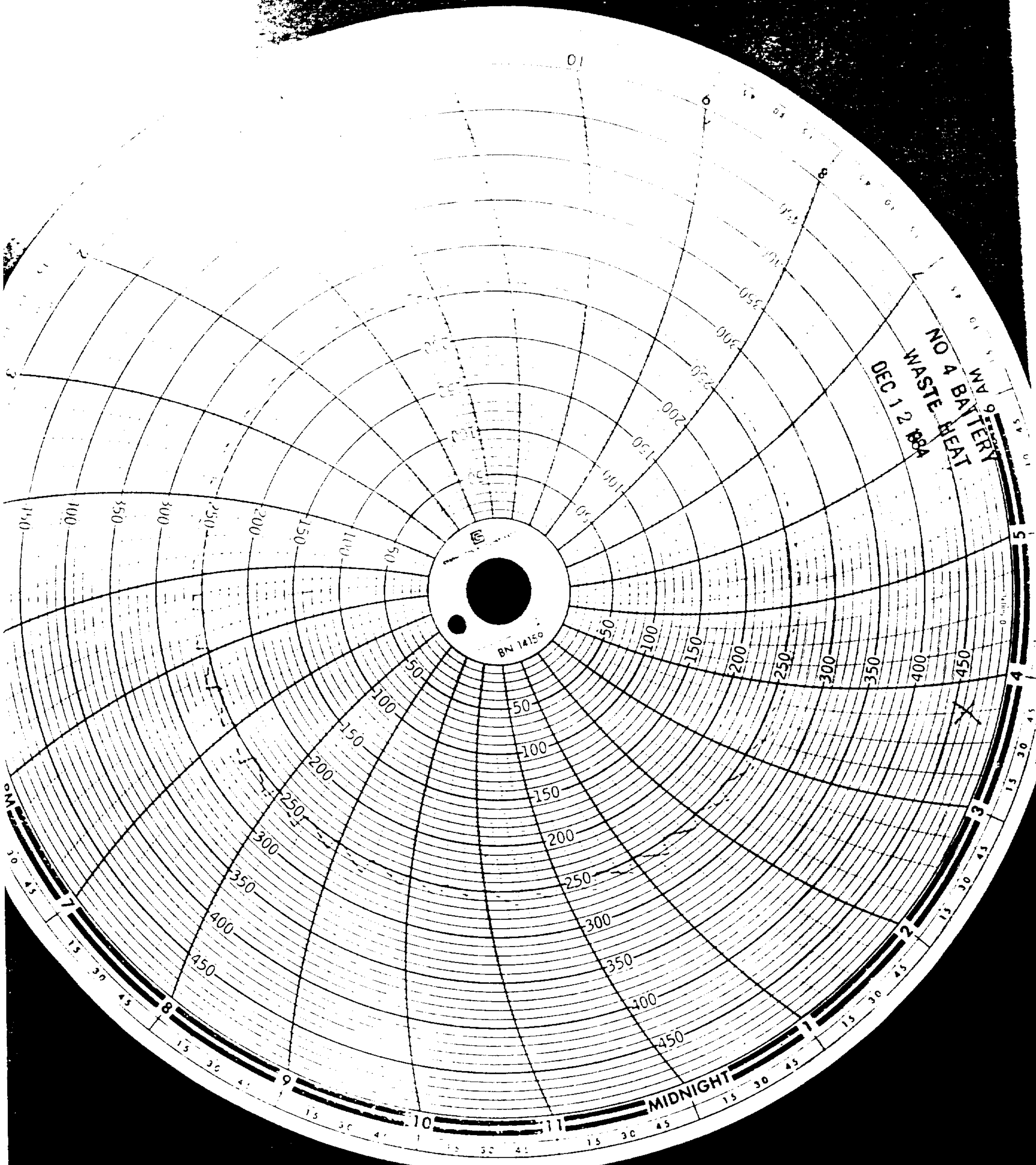
CROSSOVER TEMP
COKE SIDE
DEC 1-2 1984
6 PM
MIDNIGHT
GRAPHIC CONTROLS CORPORATION
BUFFALO NEW YORK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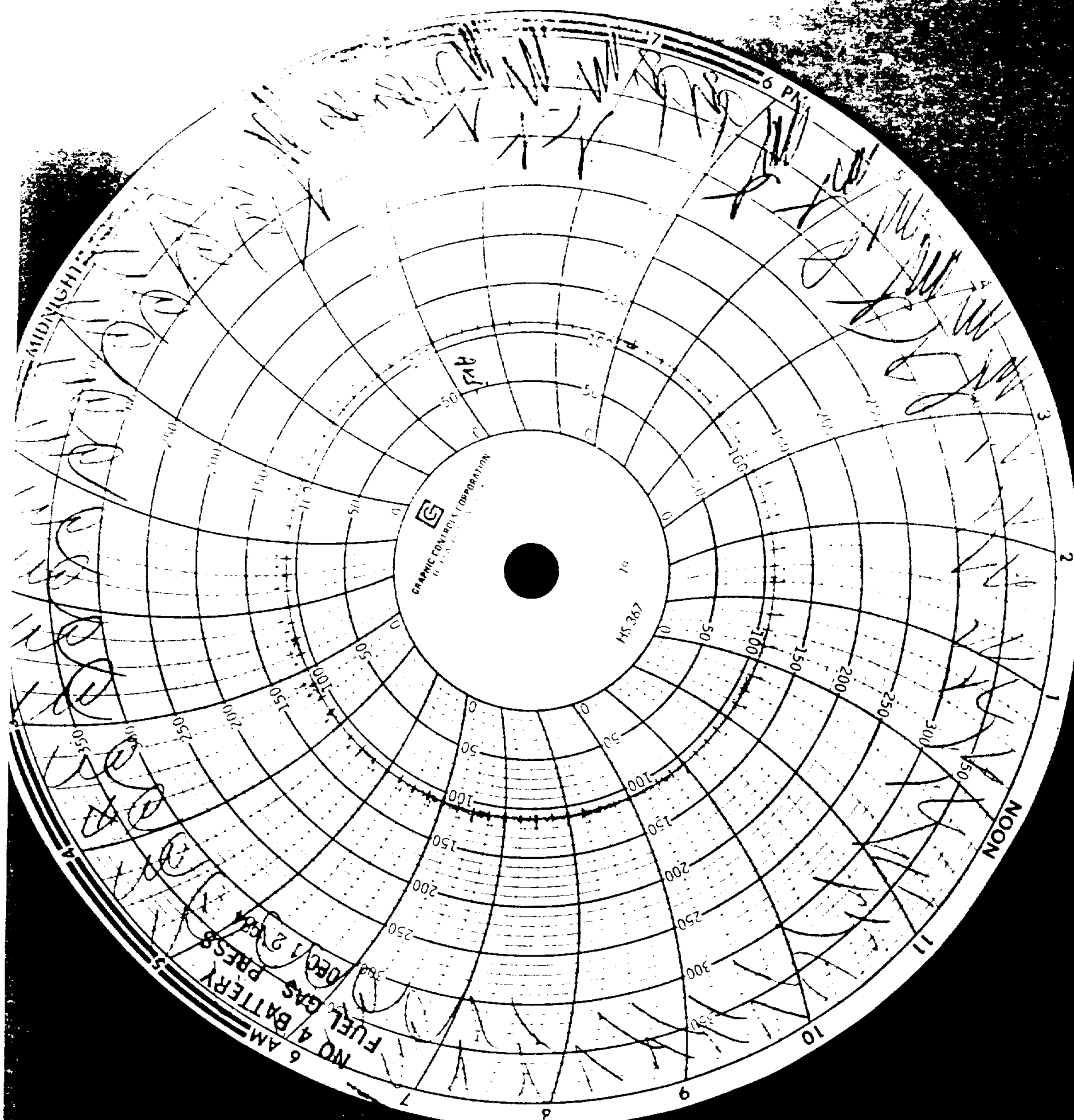
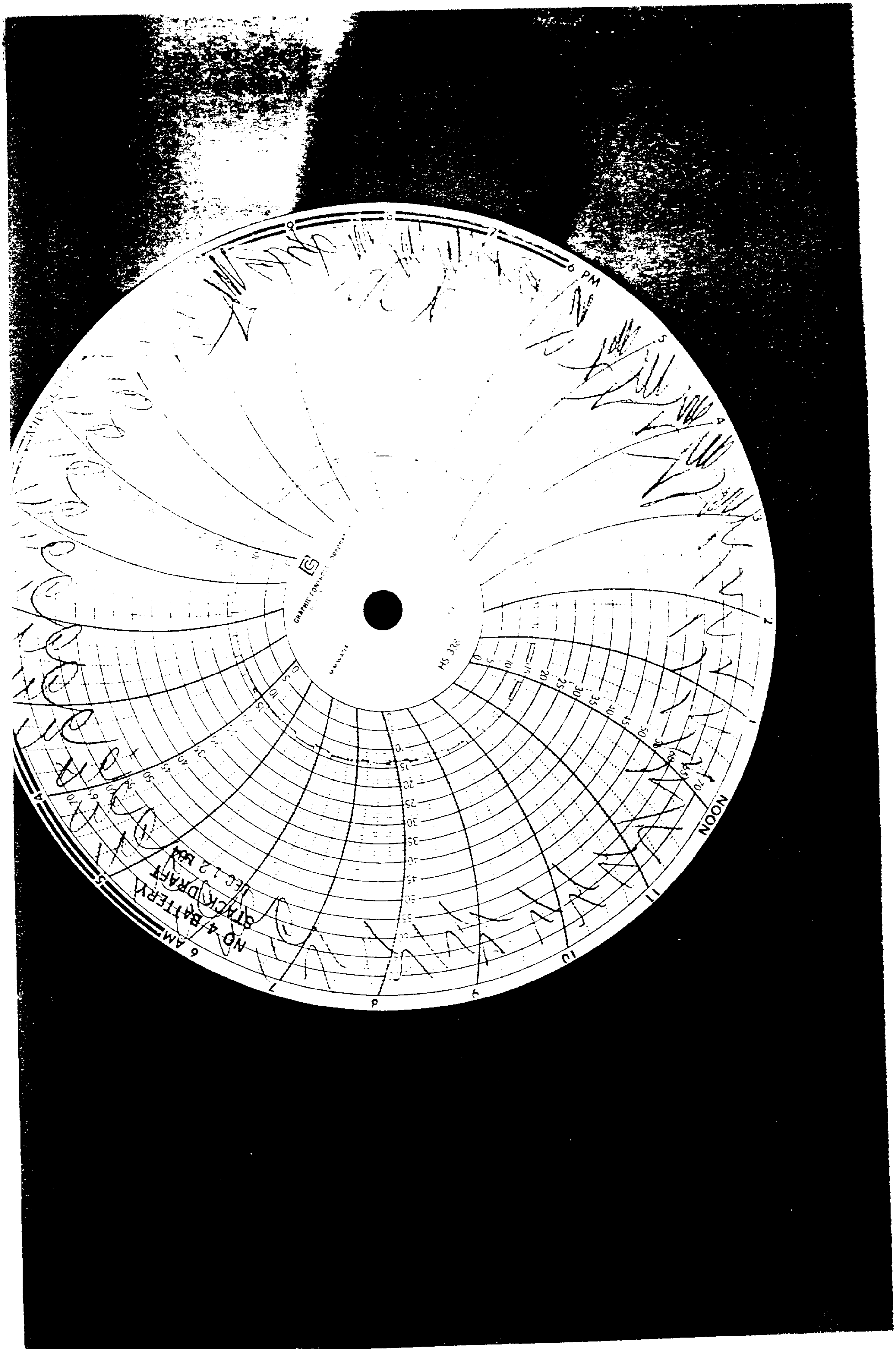
WASTE HEAT
DEC 1 2 1984
AM
PM
MIDNIGHT
BN 14159


NO 4 BATTERY
FUEL GAS PRESS
GRAPHIC CONTROLS CORPORATION
HS 367
MIDNIGHT
6 PM
NOON
6 AM


NO 4 BATTERY
STACK DRAFT
NOON
PM
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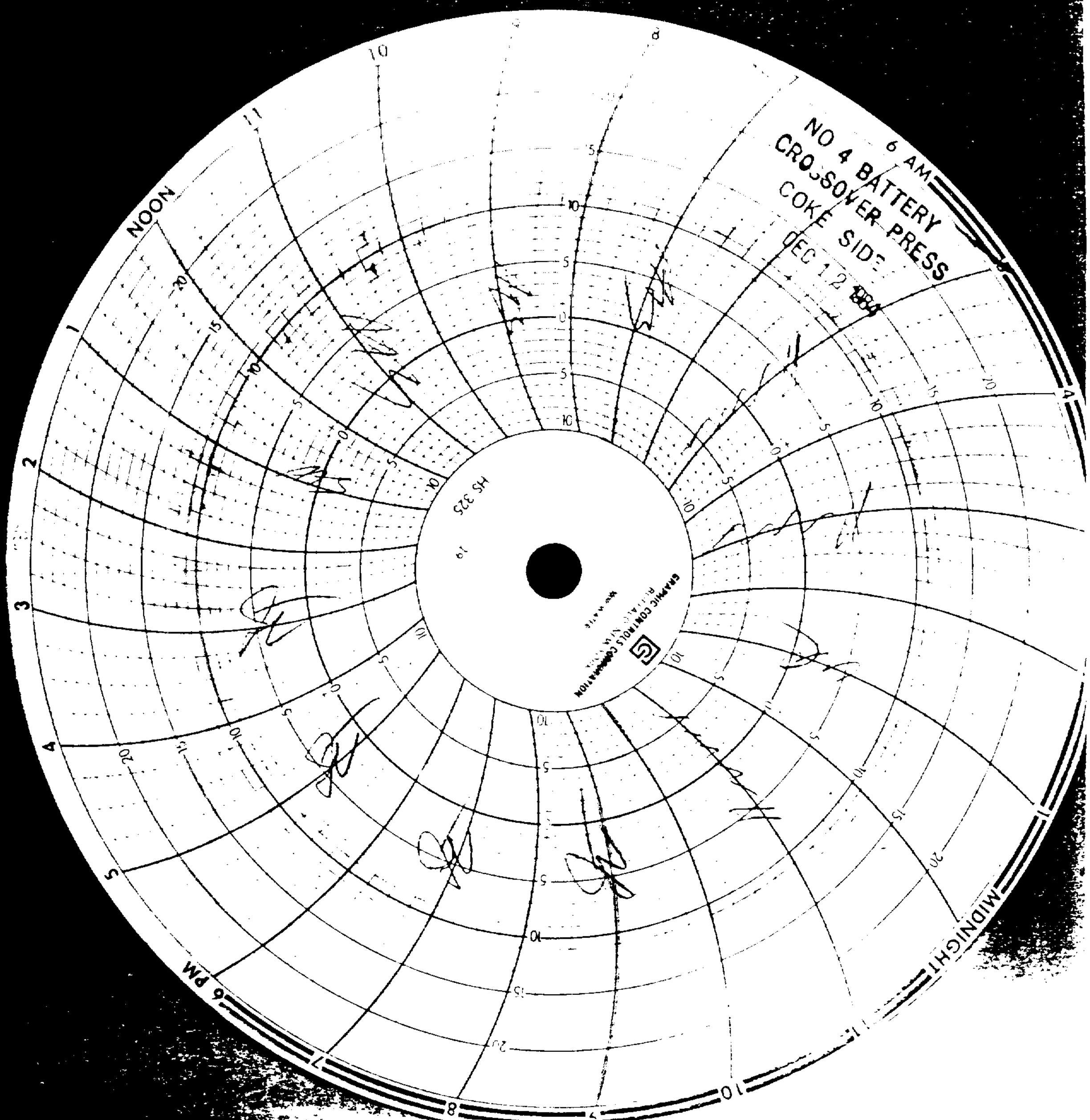
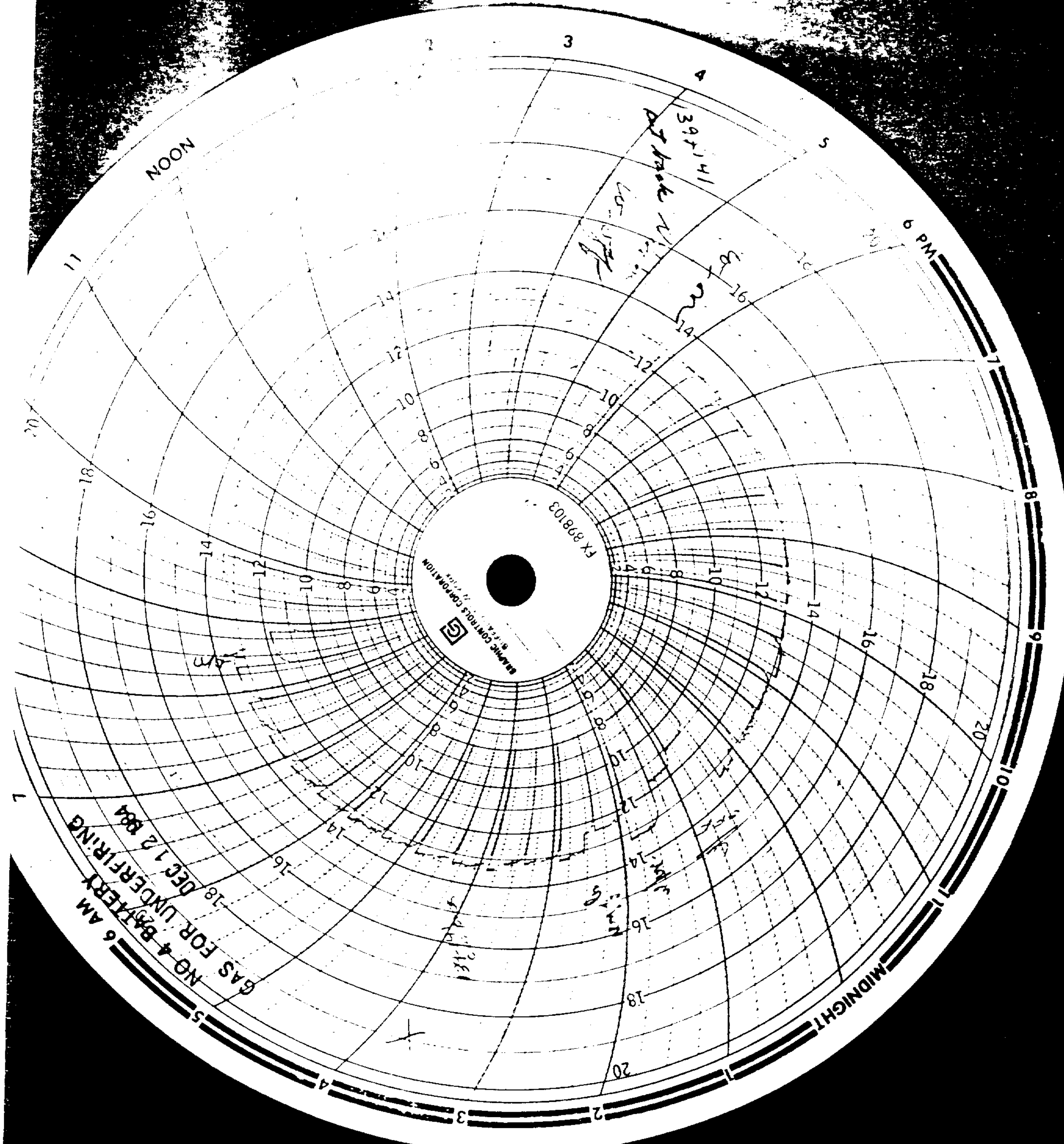
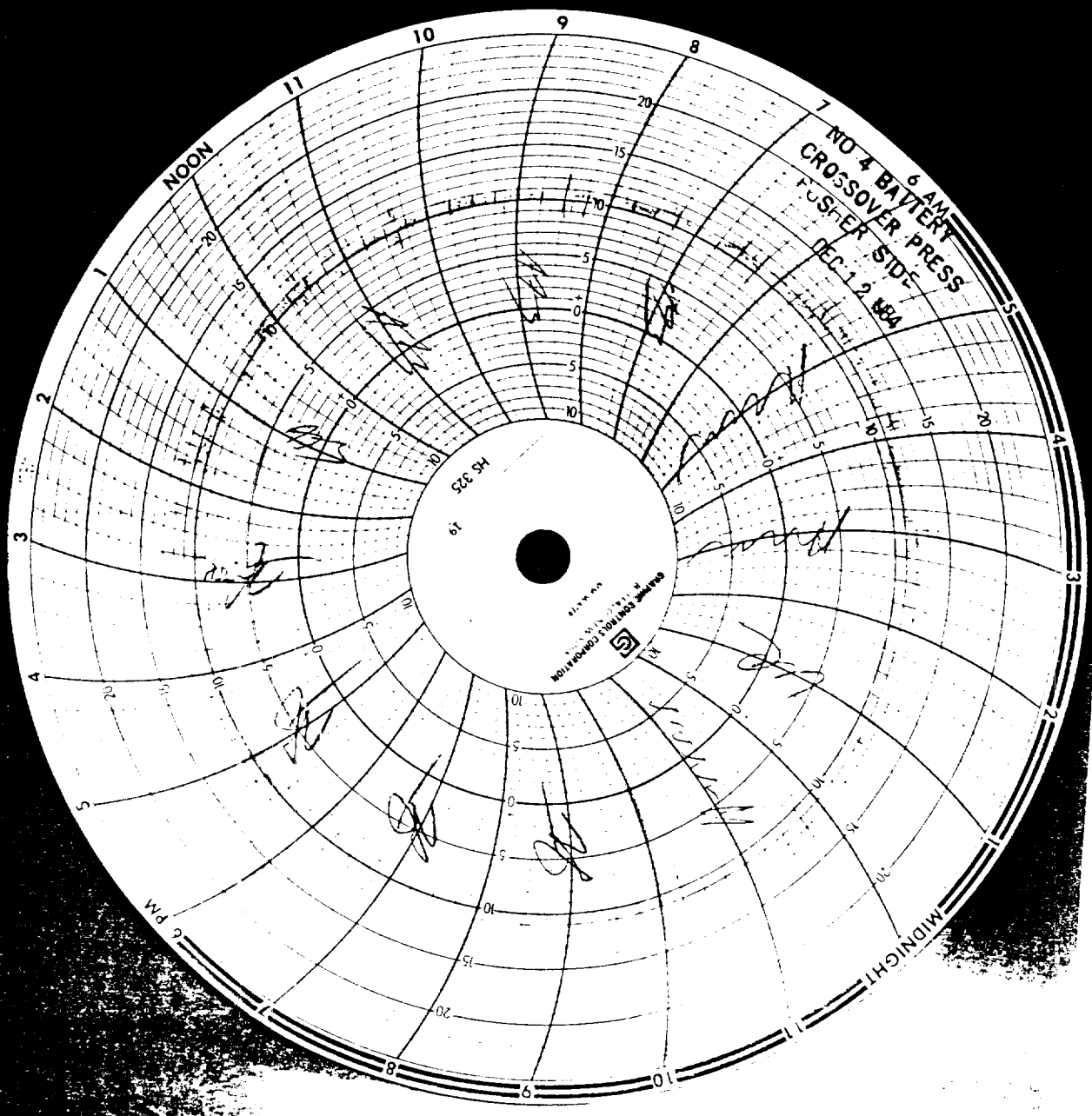

NO 4 BATTERY
CROSSOVER PRESS
COKE SIDE
6 AM
NOON
6 PM
MIDNIGHT
HS 325
GRAPHIC CONTROLS CORPORATION


NOON
6 PM
MIDNIGHT
6 AM
GAS FOR UNDERFIRING
NO 4 BATTERY
GRAPHIC CONTROLS CORPORATION


NO 4 BAT/ERT
CROSSOVER PRESS
PUSHER SIDE
DEC 1 2 1984
6 AM
NOON
MIDNIGHT
6 PM
HS 325