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COMPLIANCE TEST REPORT

DETERMINATION OF PARTICULATE, VISIBLE AND VOLATILE ORGANIC COMPOUND EMISSIONS

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DULUTH, MINNESOTA

Prepared for

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1.0 INTRODUCTION

Air emission source testing was conducted at the ME International facility located in Duluth, Minnesota during the week of April 19, 1993. The testing consisted of particulate and visible emissions determination from the shaker baghouse servicing the electric arc furnaces, volatile organic compound (VOC) emissions from the impingement scrubber servicing the oil quench tank and particulate emissions from the shotblast and multi-purpose booth. The stack gas volumetric flow rate, stack gas temperature, and the concentrations of moisture oxygen and carbon dioxide in the stack gas was also determined for each test performed.

2.0 PROCESS DESCRIPTION

The shaker baghouse, manufactured by Carborundum Corporation, controls emissions from a venting system consisting of a fan rated at 180,000 acfm and associated duct work. The system pulls emissions from two Whiting arc furnaces which melts alloy iron and steel at a capacity of 13 tons per 3-hour batch.

The impingement scrubber, manufactured by Contamination Control Corporation is serviced by a fan rated at 22,000 acfm. The scrubber system pulls emissions from the Johnston Manufacturing Co. oil quench tank where castings are heated and quenched with oil to achieve a specific slower cooling rate for the castings.

The shotblast and multi-purpose booth which is manufactured by Wheelabrator is used to clean the recently made casting. The cooled casting is blasted with steel shot to remove scaling and sand. The shaker type baghouse controlling the emissions from the shotblast operation is manufactured by Carborundum Corporation. The system is serviced by a fan rated at 35,000 acfm.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 SAMPLING POINT LOCATION

The sampling location and number of traverse points were selected according to U.S. EPA Reference Method 1, "Sample and Velocity Traverses for Stationary Sources." A drawing of the sources tested is presented in Figure 4.1 through 4.3. The stack associated with the arc furnace is circular measuring 96 inches in diameter. The sampling ports are located 48 inches upstream from the exit of the stack and approximately 25-feet downstream from the nearest disturbance. The stack associated with the oil quench tank is a 32-inch diameter

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circular stack. The sampling port location for the oil quench tank stack is located 32 inches upstream from the exit of the stack and approximately 18-feet downstream from the nearest disturbance. The shotblast and multi-purpose booth stack is 44 inches in diameter. The sampling port location for the shot blast and multi-purpose booth stack is located 29 inches upstream from exit of the stack and approximately 25-feet downstream from the nearest disturbance.

3.2 VELOCITY AND TEMPERATURE

The stack gas velocity and temperature was determined using U.S. EPA Reference Method 2, "Determination of Stack Gas Temperature and Velocity (Type S Pitot Tube)." The stack temperature was measured using a K type thermocouple.

3.3 MOLECULAR WEIGHT

The stack gas molecular weight was determined using U.S. EPA Reference Method 3, "Gas Analysis for Determination of Molecular Weight." Grab samples were collected and directly analyzed with Fyrite combustion gas analyzers.

3.4 MOISTURE

The stack gas moisture content was determined using U.S. EPA Reference Method 4, "Determination of Moisture in Stack Gases", for the arc furnace stack and the shotblast and multi-purpose booth stack. The sample was collected as part of the particulate sampling train. The sample was passed through a series of four impingers. The first two impingers contain 100 grams of distilled water. The third impinger was empty and used as a drop out impinger. The fourth impinger was filled with silica gel. All the impingers were weighed before and after each test to determine the moisture gain.

The stack gas moisture content of the oil quench tank stack was determined by U.S. EPA Reference Method 4, "Determination of Moisture in Stack Gases." The sample was passed through a stainless steel condenser and a silica gel drier. The condensate was collected in a flask and measured volumetrically. The silica gel drier was weighed before and after the test to determine moisture gain.

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3.5 PARTICULATE

Particulate emission samples were collected using U.S. EPA Reference Method 5, "Determination of Particulate Emissions from Stationary Sources." The emission samples were collected on glass fiber filters. Particulate from the front half of the sample train was recovered with distilled water and acetone rinses. The distilled water and acetone rinses were evaporated in the lab and the residue weighed to determine the amount of particulate collected. The filters were desiccated to remove the uncombined water and then weighed to determine the weight of collected particulate. In addition to the samples, distilled water, acetone and filter blanks were analyzed for quality control. A schematic of the sampling train is presented in Figure 4.4.

3.6 CONDENSIBLE PARTICULATE

Condensible particulate emission samples were collected using U.S. EPA Reference Method 5 along with modifications specified in Minnesota rules part 7005.0500.

3.7 OPACITY

The opacity will be determined using U.S. EPA Reference Method 9, "Visual Determination of the Opacity of Emission from Stationary Sources." Opacity was determined by recording three 1-hour readings.

3.8 VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds were measured using U.S. EPA Reference Method 25A, "Determination of Total Gaseous Organic Concentrations Using a Flame Ionization Analyzer." The total hydrocarbon analyzer was calibrated using U.S. EPA Protocol propane standards. A schematic of the total hydrocarbon sampling system is presented in Figure 4.5.

3.9 DIFFERENTIAL PRESSURE

The differential pressure across the systems being tested was measured in 15 minute intervals. The differential pressure was measured in inches of water.

4.0 TEST RESULTS

4.1 PROCESS CONDITIONS

During the three emission tests of the oil quench operation 6,560 lbs., 1,725 lbs., and 4,230

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lbs. of casting were quenched, respectively. The holding time for the three oil quench batches was 30 minutes, 20 minutes, and 30 minutes, respectively. A 2,200 lb tray rack is used to support the castings while they were being quenched. The magnahelic reading while the emission testing was performed was 2 inches of water.

While the emission testing was being performed on the shotblast and multi-purpose booth stack, the average shotblast cycle lasted for 3 minutes with 5 minutes between cycles. The average casting weighed 2,060 lbs. The magnahelic reading while the emission testing was performed was 5 inches of water.

During the three emission tests of the common exhaust servicing the arc furnaces, Furnace No. 1 Heat No. 8577 had a melting rate of 4.81 tons/hr. Furnace No. 2 Heat No. 5508 had a melting rate of 3.93 tons/hr. Furnace No. 1 Heat No. 8578 had a melting rate of 6.26 tons/hr. Furnace No. 2 Heat No. 5509 had a melting rate of 4.41 tons/hr.

More information regarding process conditions during the emission testing can be found in Appendix D.

4.2 STACK GAS CONDITIONS

The stack gas conditions are summarized in Table 5.1. The stack gas velocity is reported in feet per minute (fpm). The volumetric flow rate is reported in actual cubic feet per minute (acfm) and dry standard cubic feet per minute (dscfm). The stack gas temperature and moisture is reported in degrees Fahrenheit (°F) and percent moisture (%), respectively. The oxygen and carbon dioxide is also reported in percent oxygen (% O_2) and percent carbon dioxide (% CO_2).

The average stack gas velocity for the arc furnace stack was 3,068 fpm. The average volumetric flow rate was 154,233 acfm or 146,448 dscfm. The average stack temperature was 84.8°F with a moisture content of 1.76%. The stack gas % O_2 and % CO_2 average was 20.9 and 0.0, respectively.

The average stack gas velocity for the shotblast and multi-purpose booth stack was 2,730 fpm. The average volumetric flow rate was 30,823 acfm or 30,203 dscfm. The average stack temperature was 70.7°F with a moisture content of 1.80%. The stack gas % O_2 and % CO_2 average was 0.0 and 20.9, respectively.

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4.3 FILTERABLE AND CONDENSIBLE PARTICULATE EMISSIONS

The filterable and condensible particulate emissions from the shotblast operation and the arc furnace stack are reported in Tables 5.2 and 5.3. The particulate concentration is reported in grains per cubic feet (gr/dscf) and pounds per 1000 pounds of dry stack gas (lbs/1000 lbs gas dry). The particulate emission rate is reported in pounds per hour (lbs/hr).

The average filterable particulate concentration for the shotblast and multi-purpose booth stack was 0.0088 gr/dscf or 0.0167 lbs/1000 lbs gas dry. The average filterable particulate emission rate was 2.27 lbs/hr. The average condensible particulate concentration was <0.0002 gr/dscf or 0.0003 lbs/1000 lbs gas dry. The average condensible particulate emission rate was <0.0389 lbs/hr.

The average filterable particulate concentration for the arc furnace stack was 0.0020 gr/dscf or 0.0037 lbs/1000 lbs gas dry. The average filterable particulate emission rate was 2.46 lbs/hr. The average condensible particulate concentration was <0.0001 gr/dscf or <0.0003 lbs/1000 lbs gas dry. The average condensible particulate emission rate was <0.1804 lbs/hr.

4.4 VOLATILE ORGANIC COMPOUND EMISSIONS

The volatile organic compound (VOC) emissions for the oil quench tank stack are reported in Table 5.4. The VOC emissions concentrations are reported in parts per million as propane (ppm C_3H_8). The emission rate is reported in pounds per hour (lbs/hr) and pounds per ton metal processed (lbs/ton metal processed).

The average VOC concentration was 10.8 ppm C_3H_8. The average emission rate was 0.75 lbs/hr or 0.432 lbs/ton metal processed.

4.5 VISUAL OPACITY MEASUREMENTS

The visual opacity measurements form the arc furnace stack are in Table 5.5. The visual opacity is measured in percent visual opacity. The table includes three 1-hour readings.

The visual opacity during the three 1-hour readings was zero.

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TABLES

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Table 5.1

Summary of Stack Gas Conditions

TABLE 5.1

SUMMARY OF STACK GAS CONDITIONS

ME International
Duluth, Minnesota

Source	Run No.	Date 1993	Volumetric Flow Rate (acfm)[c]	Volumetric Flow Rate (dscfm)[b]	Velocity (fpm)[a]	Temperature (°F)	Moisture (%)	CO_2 (%)	O_2 (%)
Arc Furnace Stack	1	5/19	155,599	146,215	3,096	84.5	2.83	0.0	20.9
	2	5/19	150,037	142,180	2,985	85.0	1.92	0.0	20.9
	3	5/19	157,065	150,950	3,125	85.0	0.53	0.0	20.9
	Average		**154,233**	**146,448**	**3,068**	**84.8**	**1.76**	**0.0**	**20.9**
Oil Quench Tank Stack	1	5/18	10,226	10,350	1,831	58.0	1.16	0.0	20.9
	2	5/18	9,931	10,044	1,778	58.0	1.16	0.0	20.9
	3	5/18	10,157	10,273	1,819	58.0	1.16	0.0	20.9
	Average		**10,105**	**10,222**	**1,809**	**58.0**	**1.16**	**0.0**	**20.9**
Shotblast and Multi-purpose Booth Stack	1	5/18	29,401	28,901	2,604	70.5	1.55	0.0	20.9
	2	5/18	32,478	31,478	2,876	70.5	3.13	0.0	20.9
	3	5/18	30,590	30,294	2,709	71.0	0.72	0.0	20.9
	Average		**30,823**	**30,203**	**2,730**	**70.7**	**1.80**	**0.0**	**20.9**

[a] feet per minute
[b] actual cubic feet per minute
[c] dry standard cubic feet per minute

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Table 5.2

Summary of Filterable and Condensible Particulate Emissions
(Shotblast and Multi-Purpose Booth Stack)

TABLE 5.2

SUMMARY OF FILTERABLE AND CONDENSIBLE PARTICULATE EMISSIONS
SHOTBLAST AND MULTI-PURPOSE BOOTH STACK
ME Internationl
Duluth, Minnesota

FILTERABLE PARTICULATE					
Source	Run No.	Date 1993	Concentration (gr/dscf)[a]	Concentration (lbs/1000 lbs gas. dry)[b]	Mass Emissions (lbs/hr)[c]
Shotblast and Multi-purpose Booth Stack	1	5/18	0.0094	0.0179	2.33
	2	5/18	0.0078	0.0146	2.10
	3	5/18	0.0092	0.0175	2.38
	Average		**0.0088**	**0.0167**	**2.27**

CONDENSIBLE PARTICULATE					
Source	Run No.	Date 1993	Concentration (gr/dscf)[a]	Concentration (lbs/1000 lbs gas. dry)[b]	Mass Emissions (lbs/hr)[c]
Shotblast and Multi-purpose Booth Stack	1	5/18	< 0.0002	< 0.0003	< 0.0389
	2	5/18	< 0.0001	< 0.0003	< 0.0384
	3	5/18	< 0.0002	< 0.0003	< 0.0394
	Average		**< 0.0002**	**< 0.0003**	**< 0.0389**

[a]grains per dry standard cubic foot
[b]pounds per thousand pounds stack gas dry
[c]pounds per hour

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Table 5.3

Summary of Filterable and Condensible Particulate Emissions
(ARC Furnace Baghouse Stack)

TABLE 5.3

SUMMARY OF FILTERABLE AND CONDENSIBLE PARTICULATE EMISSIONS
ARC FURNACE BAGHOUSE STACK
ME International
Duluth, Minnesota

FILTERABLE PARTICULATE					
Source	Run No.	Date 1993	Concentration (gr/dscf)[a]	Concentration (lbs/1000 lbs gas. dry)[b]	Mass Emissions (lbs/hr)[c]
Arc Furnace Baghouse Stack	1	5/19	0.0021	0.0040	2.64
	2	5/19	0.0019	0.0036	2.29
	3	5/19	0.0019	0.0036	2.45
	Average		**0.0020**	**0.0037**	**2.46**

CONDENSIBLE PARTICULATE					
Source	Run No.	Date 1993	Concentration (gr/dscf)[a]	Concentration (lbs/1000 lbs gas. dry)[b]	Mass Emissions (lbs/hr)[c]
Arc Furnace Baghouse Stack	1	5/19	< 0.0001	< 0.0003	< 0.1740
	2	5/19	< 0.0002	< 0.0003	< 0.1845
	3	5/19	< 0.0001	< 0.0003	< 0.1828
	Average		**< 0.0001**	**< 0.0003**	**< 0.1804**

[a]grains per dry standard cubic foot
[b]pounds per thousand pounds stack gas dry
[c]pounds per hour

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Table 5.4

Summary of Volatile Organic Compound Emissions
(Oil Quench Tank Stack)

TABLE 5.4

SUMMARY OF VOLATILE ORGANIC COMPOUND EMISSIONS
OIL QUENCH TANK STACK
ME Internationl
Duluth, Minnesota

Source	Run No.	Date 1993	Concentration ($ppmC_3H_8$)[a]	Emission Rate (lbs/hr)[b]	Emission Rate (lbs/ton Metal Processed)[c]
Oil Quench Tank Stack	1	5/18	10.7	0.75	0.229
	2	5/18	7.8	0.53	0.614
	3	5/18	13.9	0.96	0.454
	Average		**10.8**	**0.75**	**0.432**

[a] ponds per million as propane
[b] pounds per hour
[c] pounds per ton of metal processed

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Table 5.5

Summary of Visual Opacity
(ARC Furnace Baghouse Stack)

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ME International Duluth Minnesota

Source 14 Observation Run No. 1

Min/Sec	(0)	(15)	(30)	(45)	Min/Sec	(0)	(15)	(30)	(45)
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

ME International Company
200 East Carterett Street
Duluth, MN 55801
(218) 626-2761

Source I.D. 14
Arc Furnace at 100 % operation
Baghouse at Continuous operation
08/11/93 09.44.00 to 10:43:45

Rolling Six Minute Averages
(24 consecutive readings)

1	0.0	16	0.0	31	0.0	46	0.0
2	0.0	17	0.0	32	0.0	47	0.0
3	0.0	18	0.0	33	0.0	48	0.0
4	0.0	19	0.0	34	0.0	49	0.0
5	0.0	20	0.0	35	0.0	50	0.0
6	0.0	21	0.0	36	0.0	51	0.0
7	0.0	22	0.0	37	0.0	52	0.0
8	0.0	23	0.0	38	0.0	53	0.0
9	0.0	24	0.0	39	0.0	54	0.0
10	0.0	25	0.0	40	0.0	55	0.0
11	0.0	26	0.0	41	0.0		
12	0.0	27	0.0	42	0.0		
13	0.0	28	0.0	43	0.0		
14	0.0	29	0.0	44	0.0		
15	0.0	30	0.0	45	0.0		

Range of Averages

(max)	(min)
0.0	0.0

Range of Values

(max)	(min)
0	0

Weather Observations

Visibility	15 miles
Temp.	72 F
Wet bulb	56 F
W/D	270 degrees
W/S	6 knots

Observation limit is 3 %

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ME International Duluth Minnesota

Source 14 Observation Run No. 2

Min/Sec	(0)	(15)	(30)	(45)	Min/Sec	(0)	(15)	(30)	(45)
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

ME International Company
200 East Carlton Street
Duluth, MN 55801
(218) 626-2761

Source I.D. 14
Arc Furnace at 100 % operation
Baghouse at Continuous operation
06/11/93 11:04:00 to 12:03:45

Rolling Six Minute Averages

(24 consecutive readings)

1	0.0	16	0.0	31	0.0	46	0.0
2	0.0	17	0.0	32	0.0	47	0.0
3	0.0	18	0.0	33	0.0	48	0.0
4	0.0	19	0.0	34	0.0	49	0.0
5	0.0	20	0.0	35	0.0	50	0.0
6	0.0	21	0.0	36	0.0	51	0.0
7	0.0	22	0.0	37	0.0	52	0.0
8	0.0	23	0.0	38	0.0	53	0.0
9	0.0	24	0.0	39	0.0	54	0.0
10	0.0	25	0.0	40	0.0	55	0.0
11	0.0	26	0.0	41	0.0		
12	0.0	27	0.0	42	0.0		
13	0.0	28	0.0	43	0.0		
14	0.0	29	0.0	44	0.0		
15	0.0	30	0.0	45	0.0		

Range of Averages

(max)	(min)
0.0	0.0

Range of Values

(max)	(min)
0	0

Weather Observations

Visibility	15 miles
Temp.	74 F
Wet bulb	57 F
W/D	260 degrees
W/S	7 knots

Observation limit is 3 %

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ME International Duluth Minnesota

Source 14 Observation Run No. 3

Min/Sec	(0)	(15)	(30)	(45)	Min/Sec	(0)	(15)	(30)	(45)
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

ME International Company
200 East Carterett Street
Duluth, MN 55801
(218) 626-2761

Source I.D. 14
Arc Furnace at 100 % operation
Baghouse at Continuous operation
06/11/93 12:18:00 to 13:17:45

Rolling Six Minute Averages

(24 consecutive readings)

1	0.0	16	0.0	31	0.0	46	0
2	0.0	17	0.0	32	0.0	47	0
3	0.0	18	0.0	33	0.0	48	0
4	0.0	19	0.0	34	0.0	49	0
5	0.0	20	0.0	35	0.0	50	0
6	0.0	21	0.0	36	0.0	51	0
7	0.0	22	0.0	37	0.0	52	0
8	0.0	23	0.0	38	0.0	53	0
9	0.0	24	0.0	39	0.0	54	0
10	0.0	25	0.0	40	0.0	55	0
11	0.0	26	0.0	41	0.0	56	0
12	0.0	27	0.0	42	0.0	57	0
13	0.0	28	0.0	43	0.0		
14	0.0	29	0.0	44	0		
15	0.0	30	0.0	45	0		

Range of Averages

(max)	(min)
0.0	0.0

Range of Values

(max)	(min)
0	0

Weather Observations

Visibility	15 miles
Temp.	73 F
Wet bulb	56 F
W/D	280 degrees
W/S	4 knots

Observation limit is 5 %

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APPENDICES

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FIGURES

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Figure 4.1

Sampling Site Location (ARC Furnace Stack)

MN-3
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35310/393/06

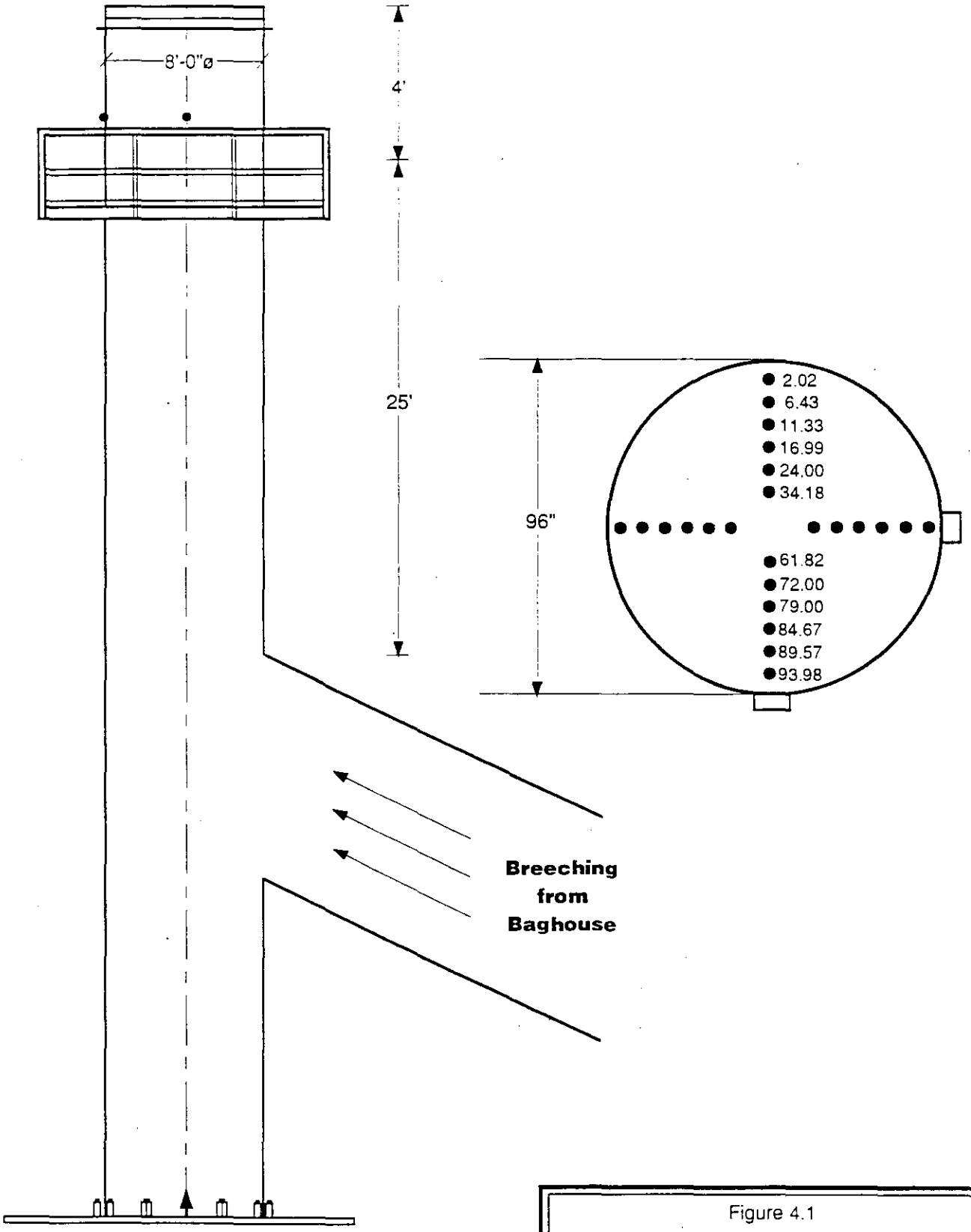

Figure 4.1

Sampling Site Location
Arc Furnace Stack

ME INTERNATIONAL

March 1993

35310

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Figure 4.2

Sampling Site Location (Oil Quench Tank Stack)

mN-3

35310/0393/PK/02

87

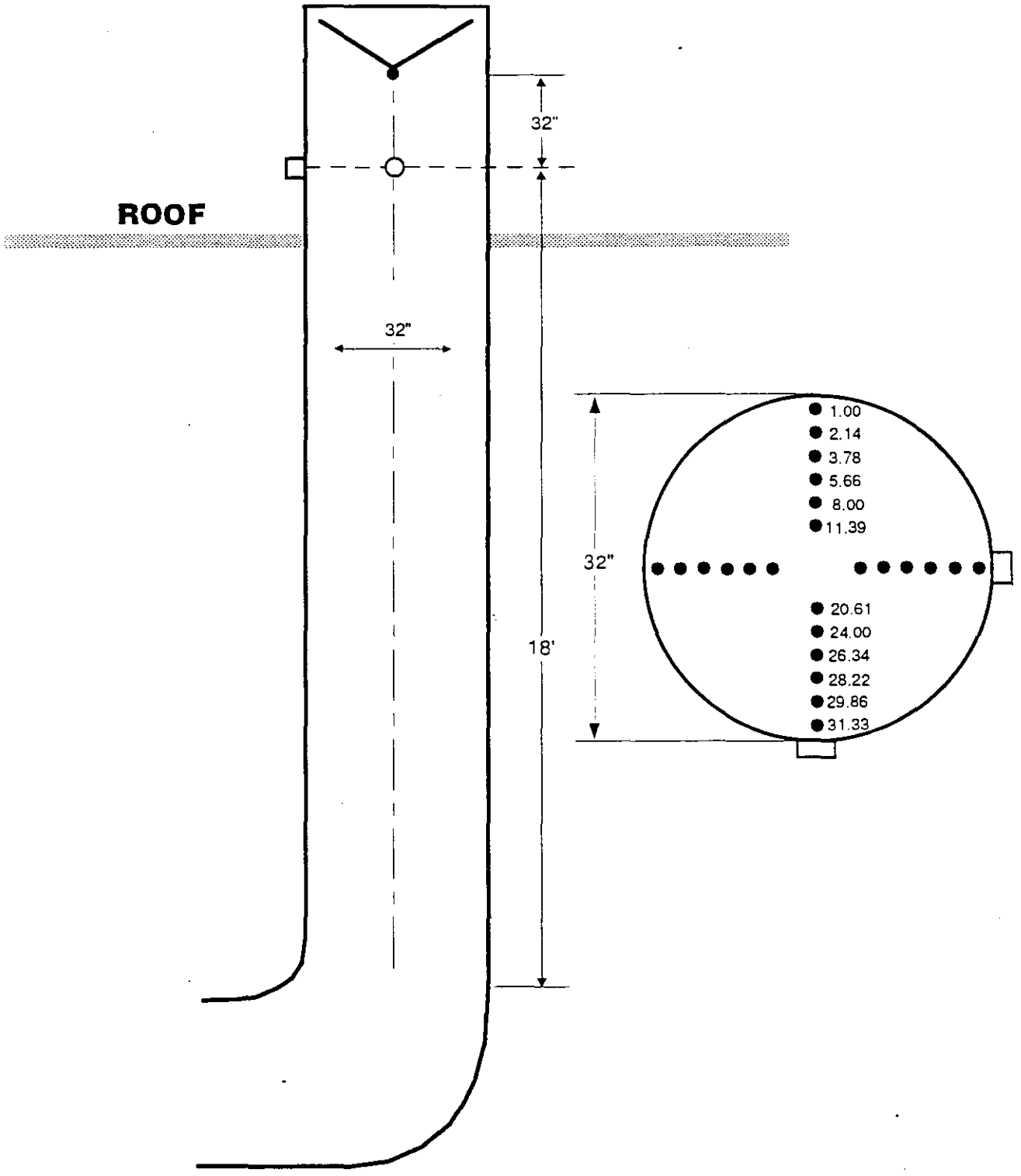

Figure 4.2

Sampling Site Location

Oil Quench Tank Stack

ME INTERNATIONAL

March 1993

35310.00

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Figure 4.3

Sampling Site Location (Shotblast and Multi-purpose Booth Stack)

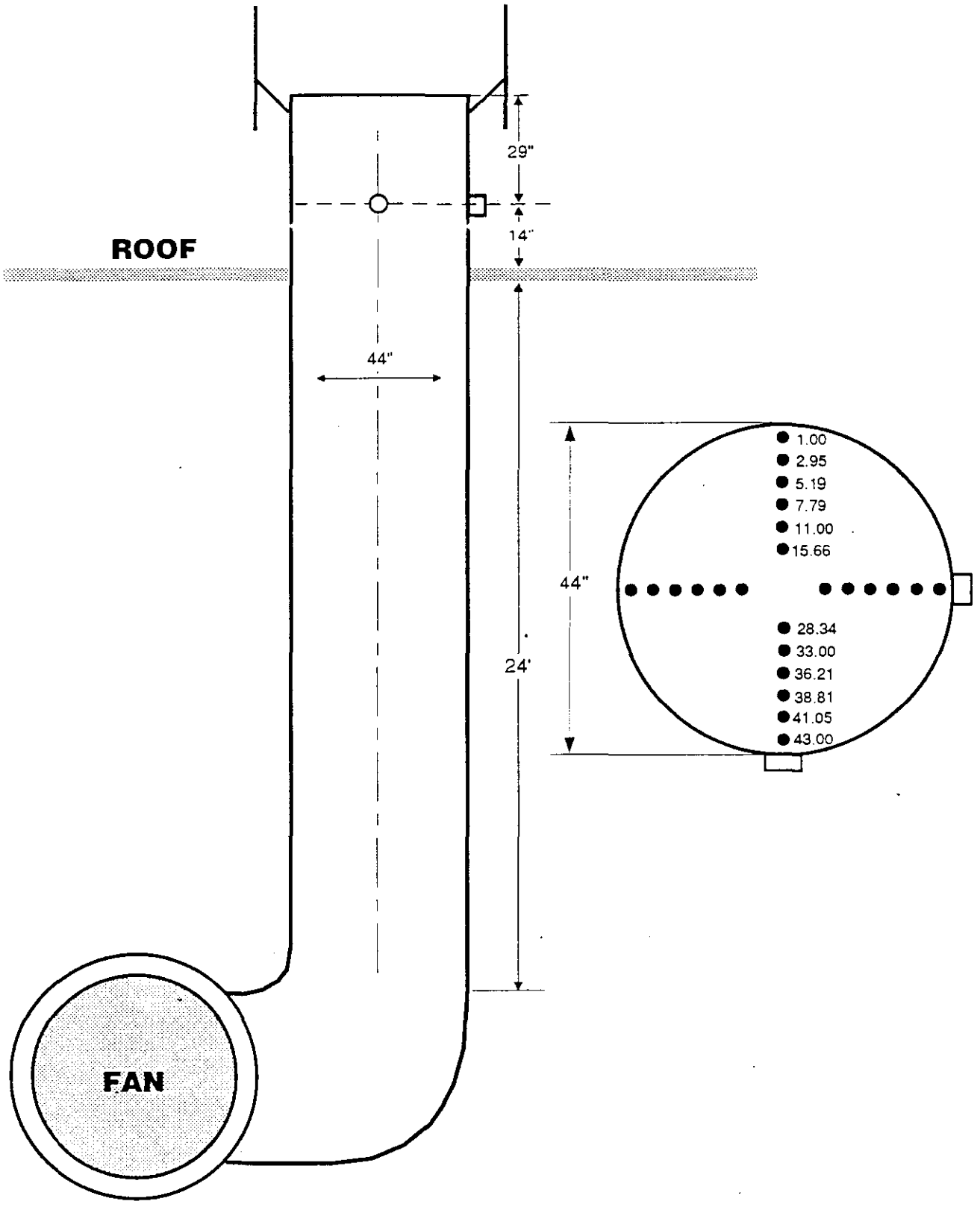

Figure 4.3

Sampling Site Location

Shotblast and Multi-Purpose Blast Stack

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March 1993 35310.00

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Figure 4.4

Particulate Sampling Train

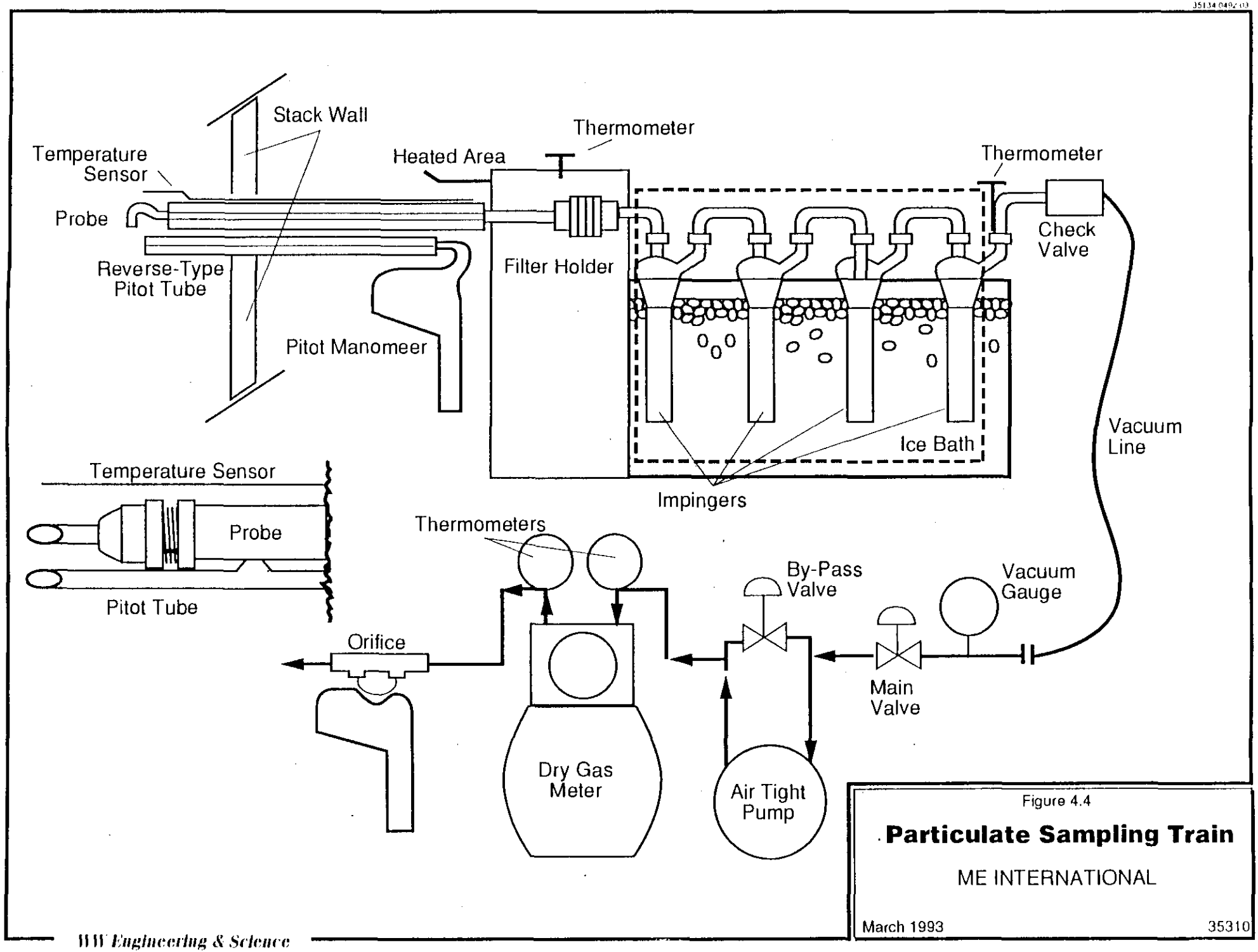

Figure 4.4

Particulate Sampling Train

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March 1993 35310

mr-3 91

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92

Figure 4.5

Total Hydrocarbon Analyzer

MN-3

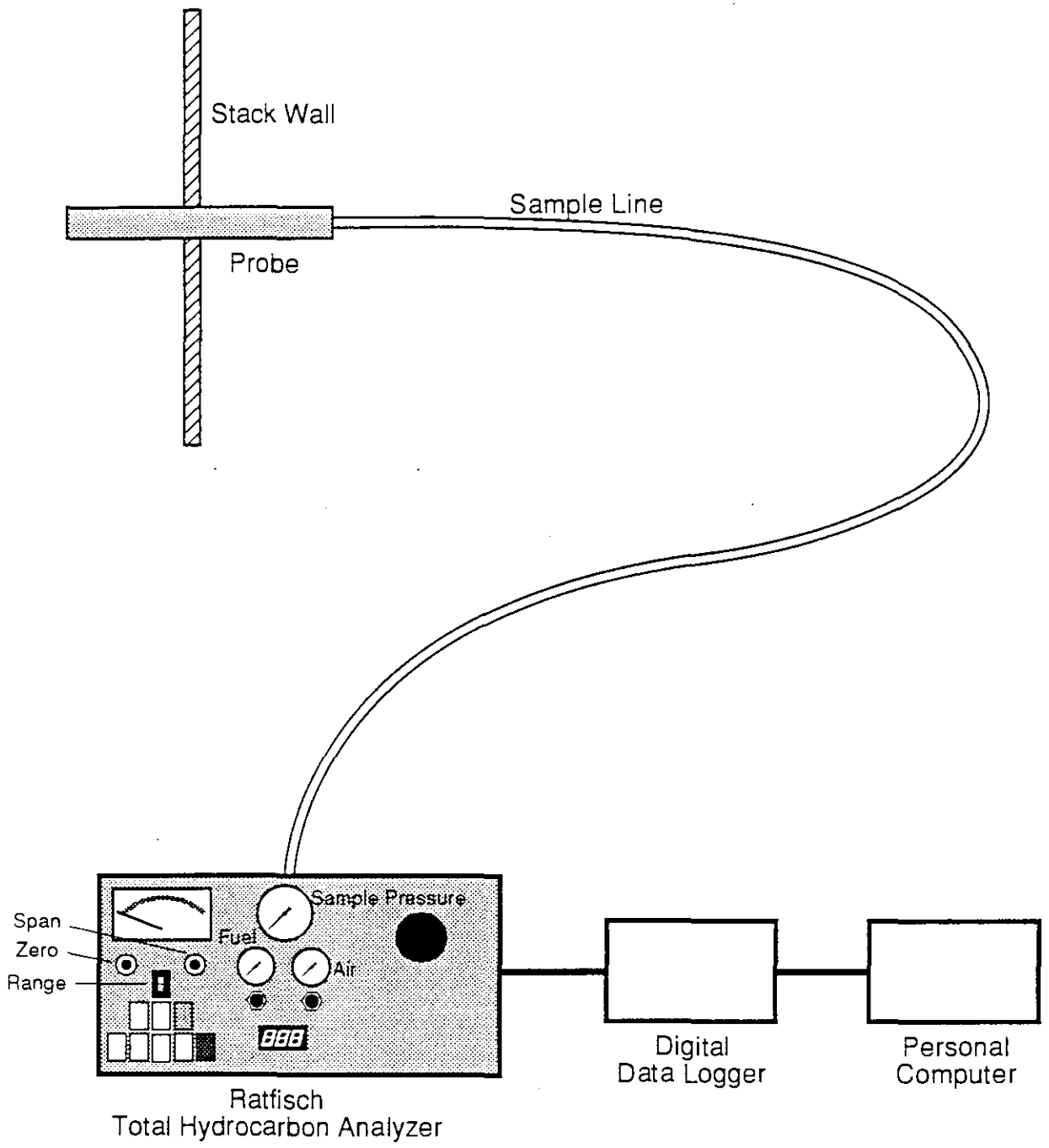

Figure 4.5

Total Hydrocarbon System

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Appendix A

Field Data

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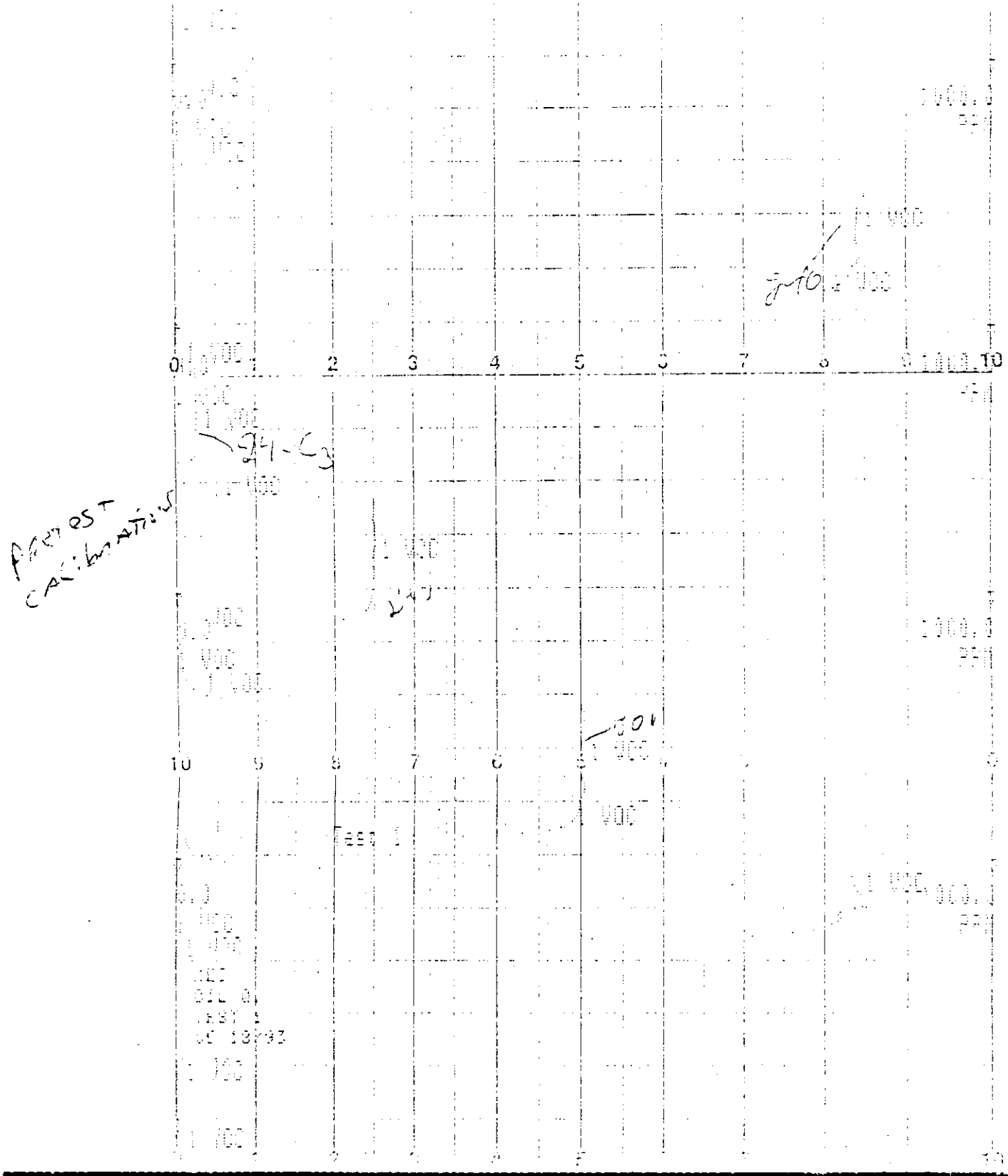
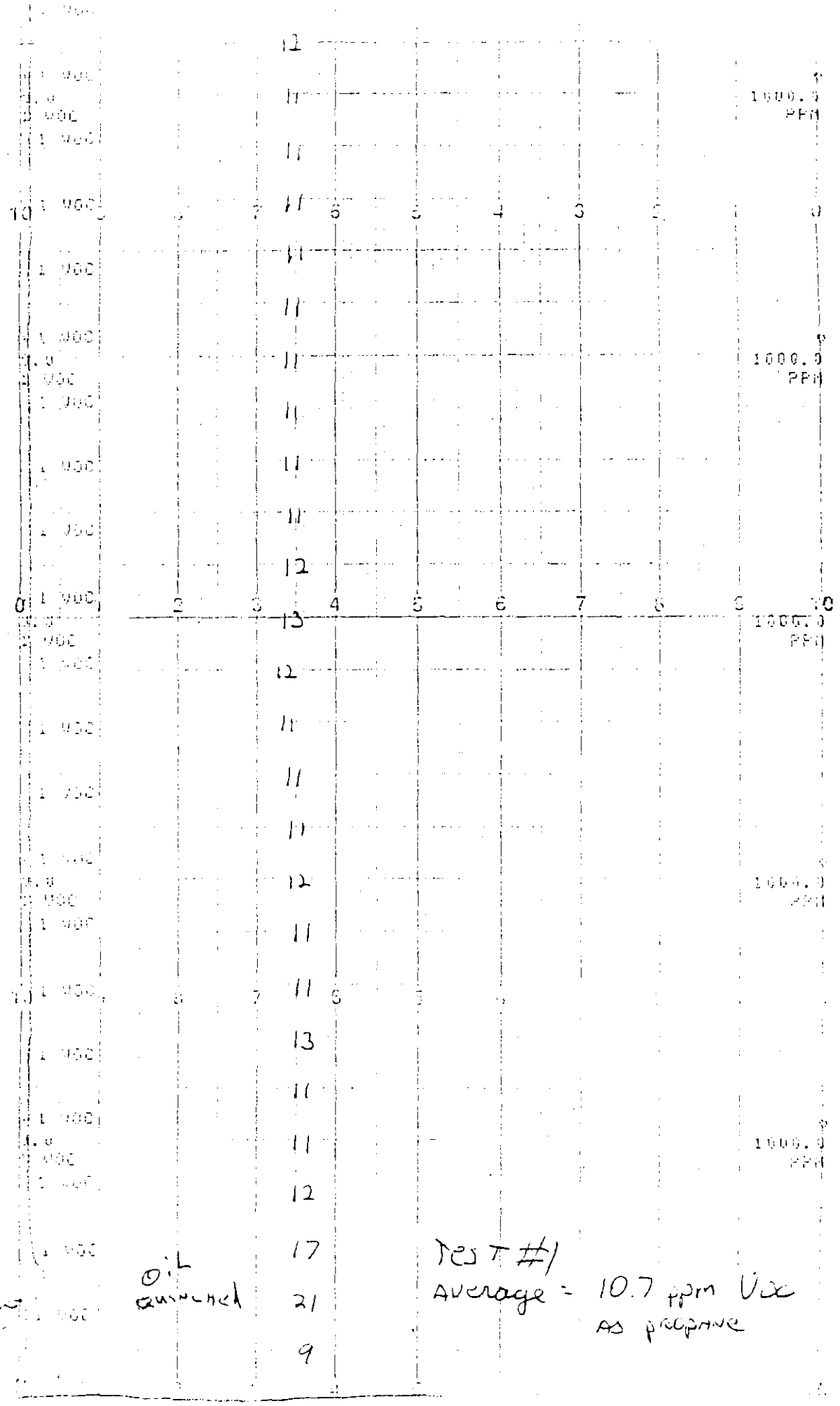


MN-3
90



Oil quenched

Test #1
Average = 10.7 ppm VOC
as propane

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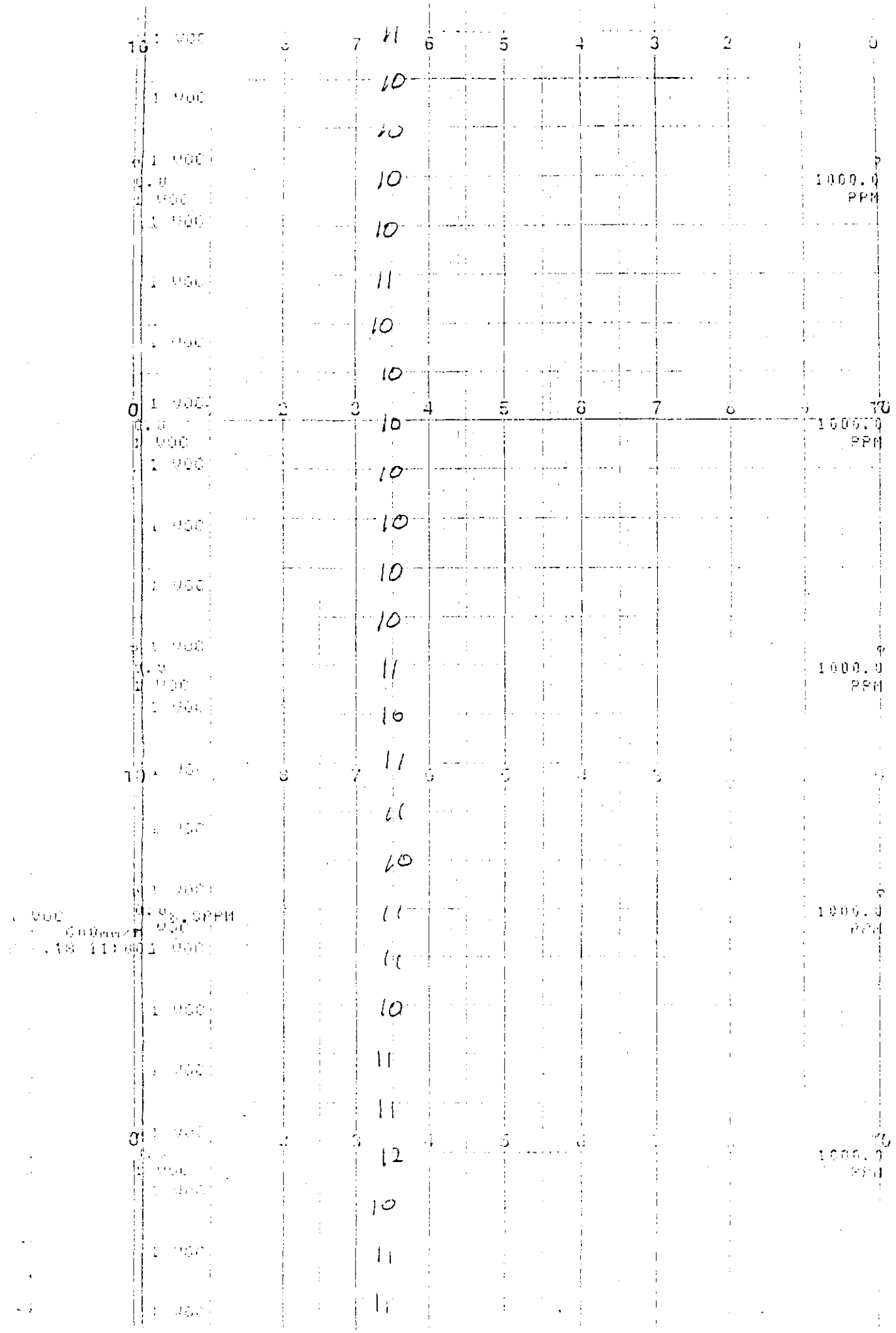
97



MN-3
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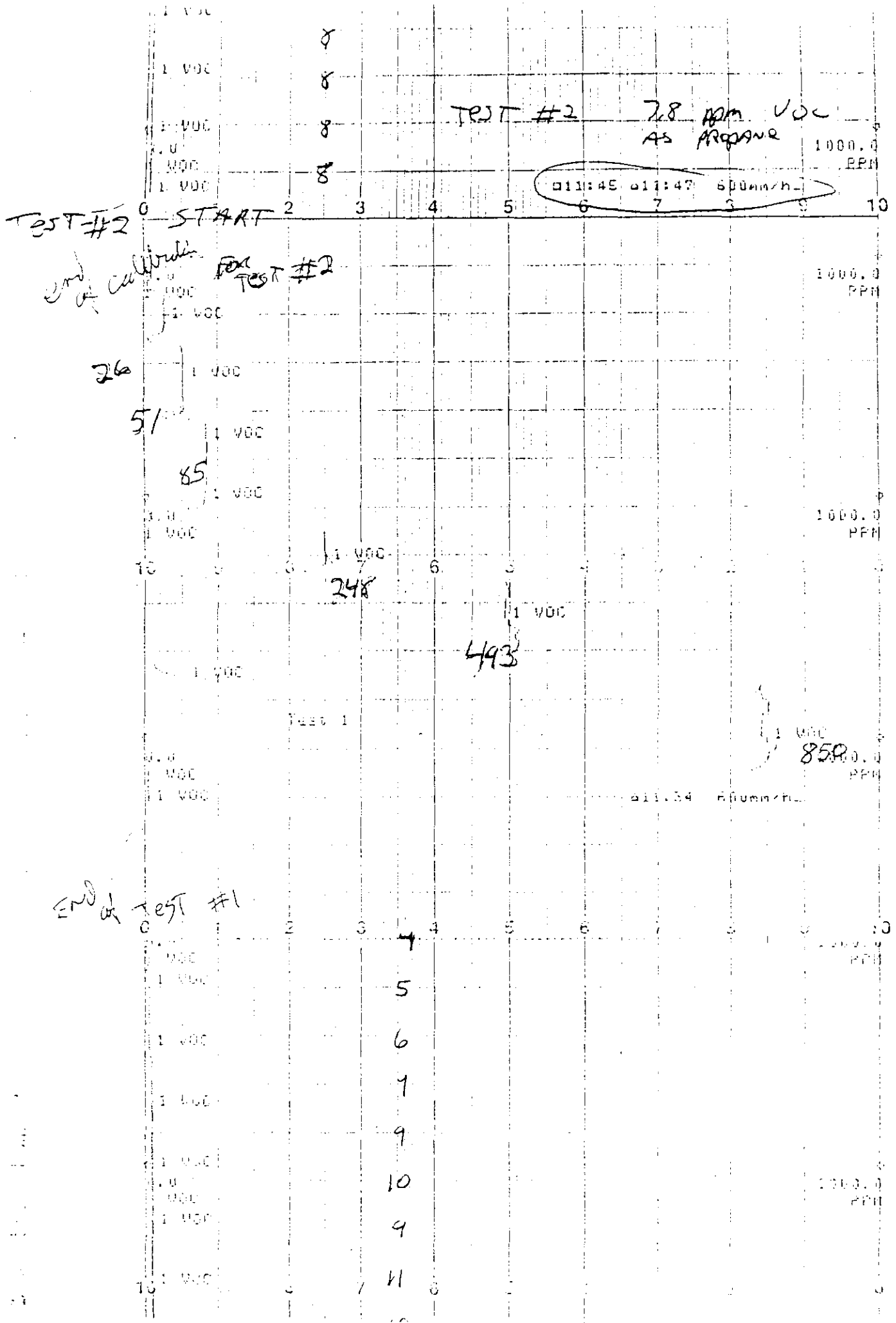
TEST #2 7.8 ppm VOC
AS PROPANE
1000.0 PPM
11:45 11:47 600mm/h
TEST #2 START
End of calibration for TEST #2
26
51
85
248
493
859
Test 1
11:34 600mm/h
End of Test #1

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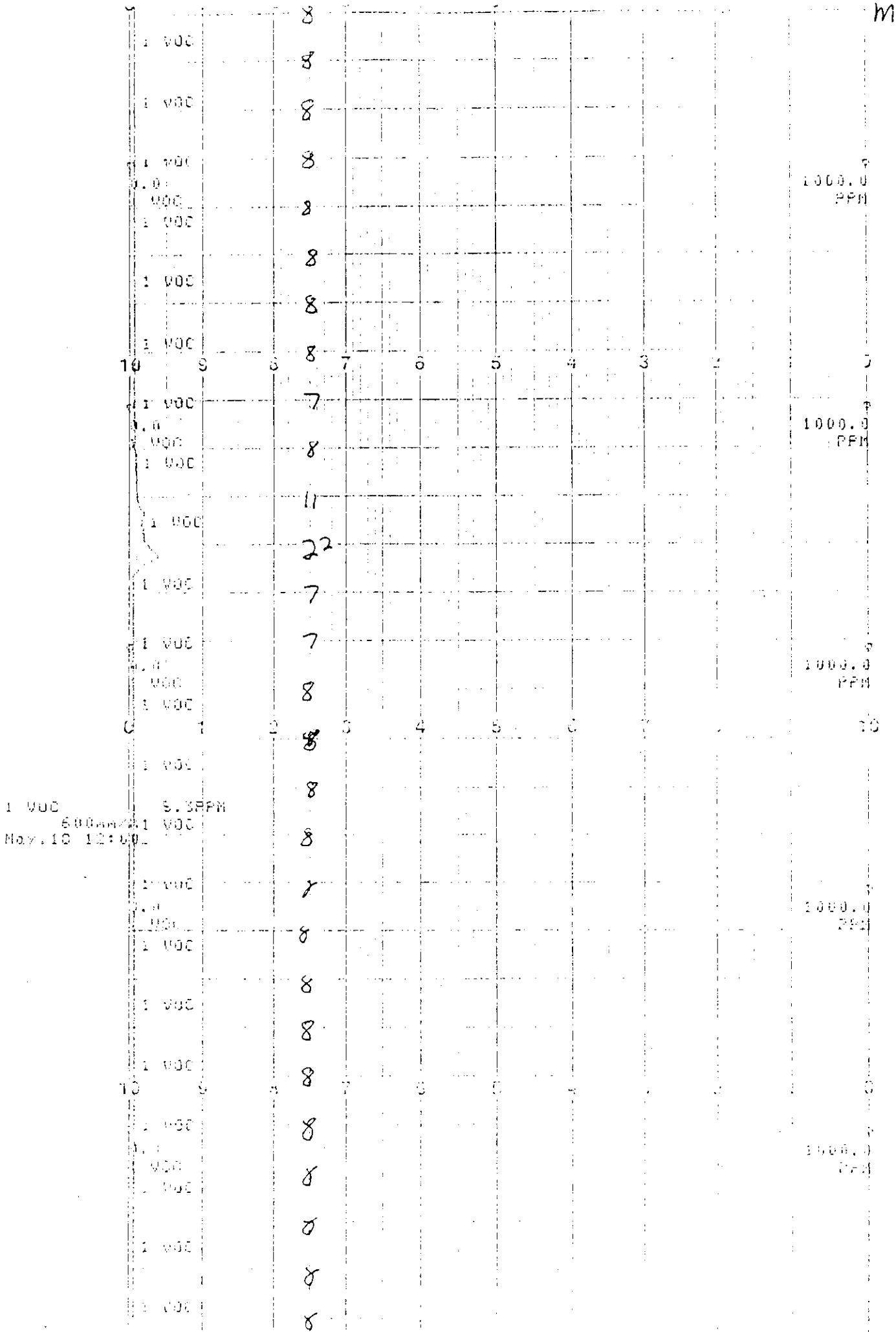
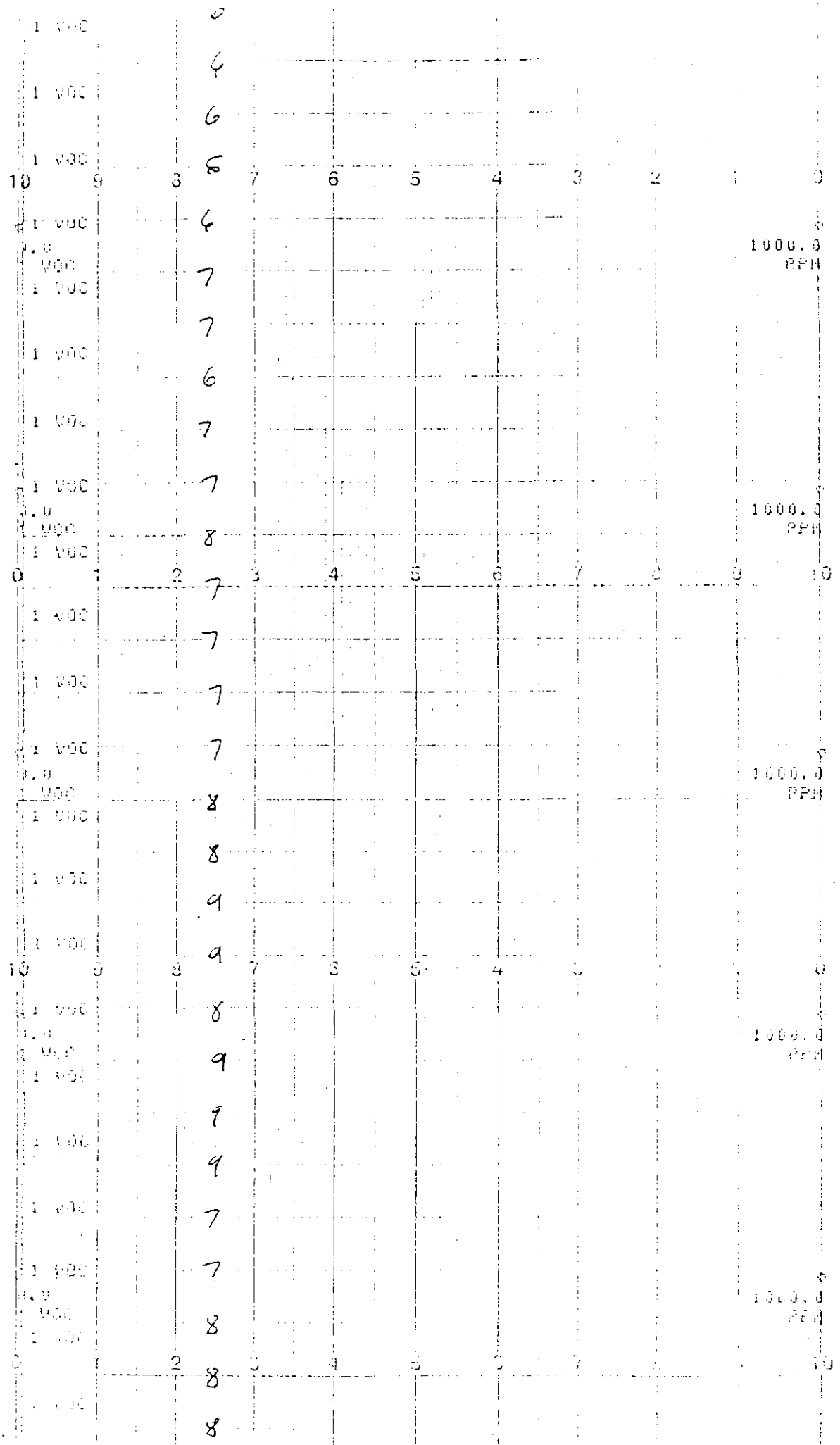
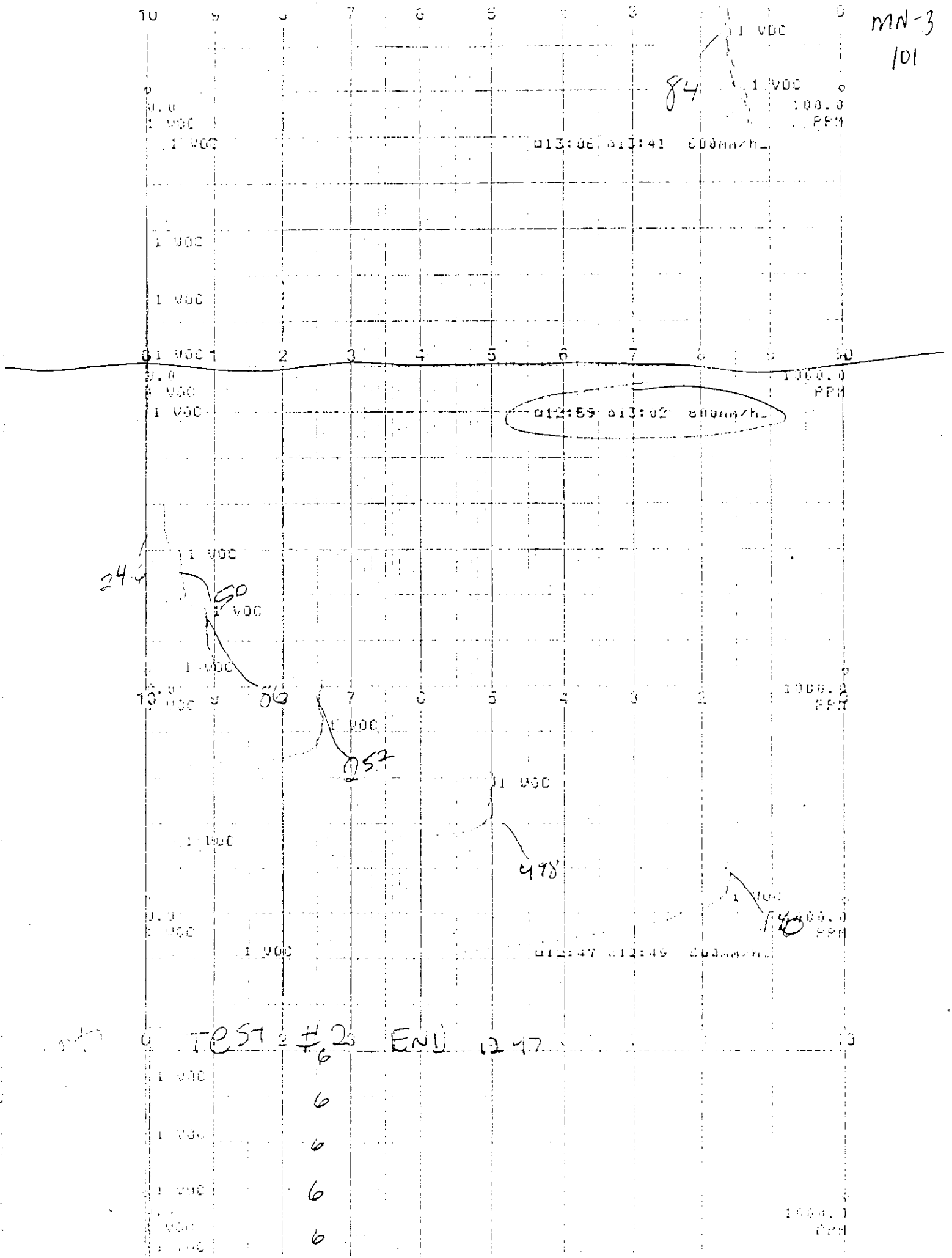
99


1 VOC
1000.0 PPM
1000.0 PPM
1000.0 PPM
1 VOC 5.3PPM
600am
May.10 12:00
1000.0 PPM
1000.0 PPM

MN-3
100



MN-3
101


1 VDC
84
100.0 PPM
013:06 013:41 600mm/h
1000.0 PPM
012:59 013:02 600mm/h
24.4
50
66
052
478
012:47 013:49 600mm/h
TEST #23 END 12 47
6

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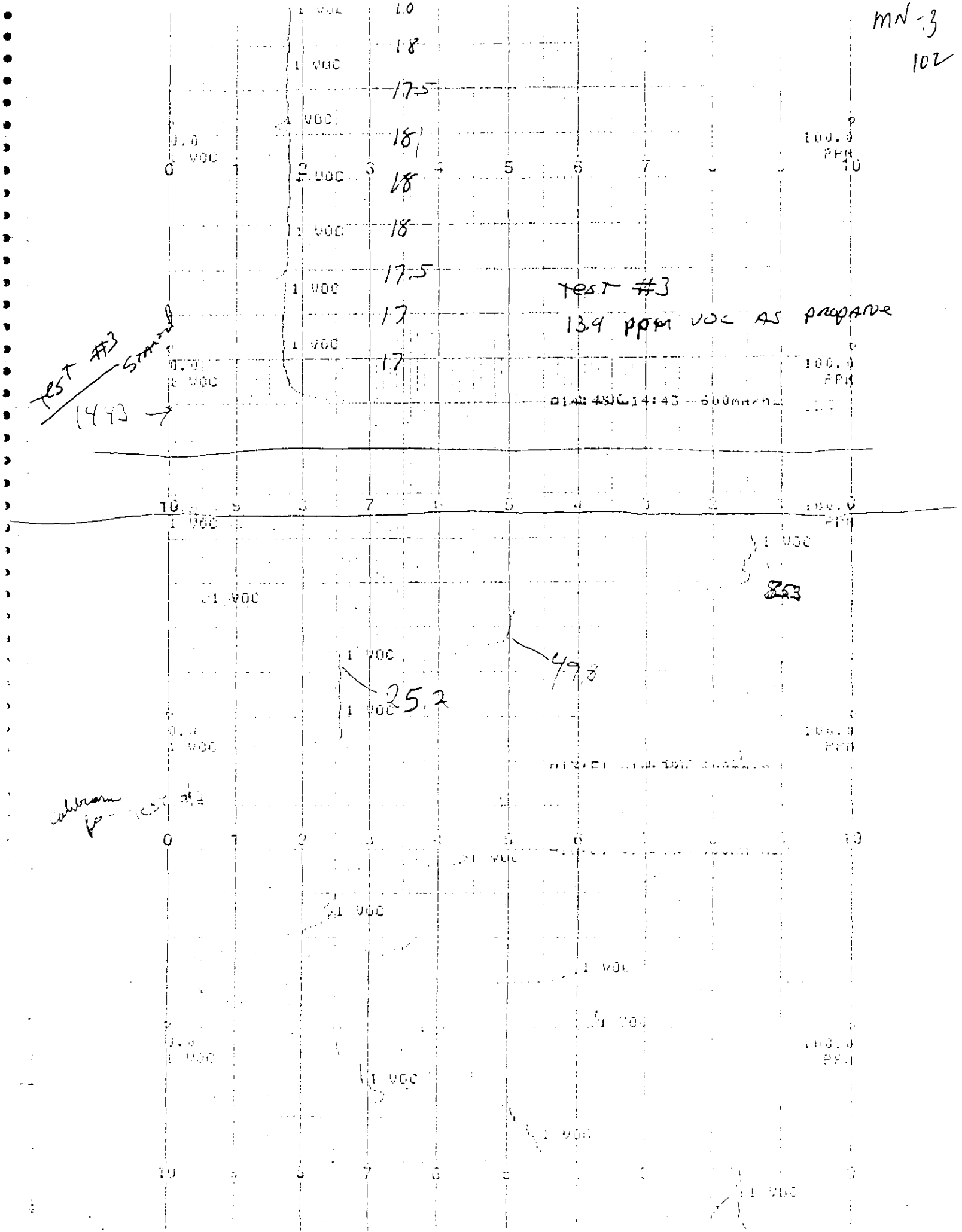
102


1 VOC
1.0
18
17.5
18
18
18
17.5
17
17
0.0
100.0
PPM
0
1
2
3
4
5
6
7
8
9
10
14:43 600mm/h
test #3
13.4 ppm VOC as propane
test #3 start
1443
25.2
49.8
353
calibration
test #3

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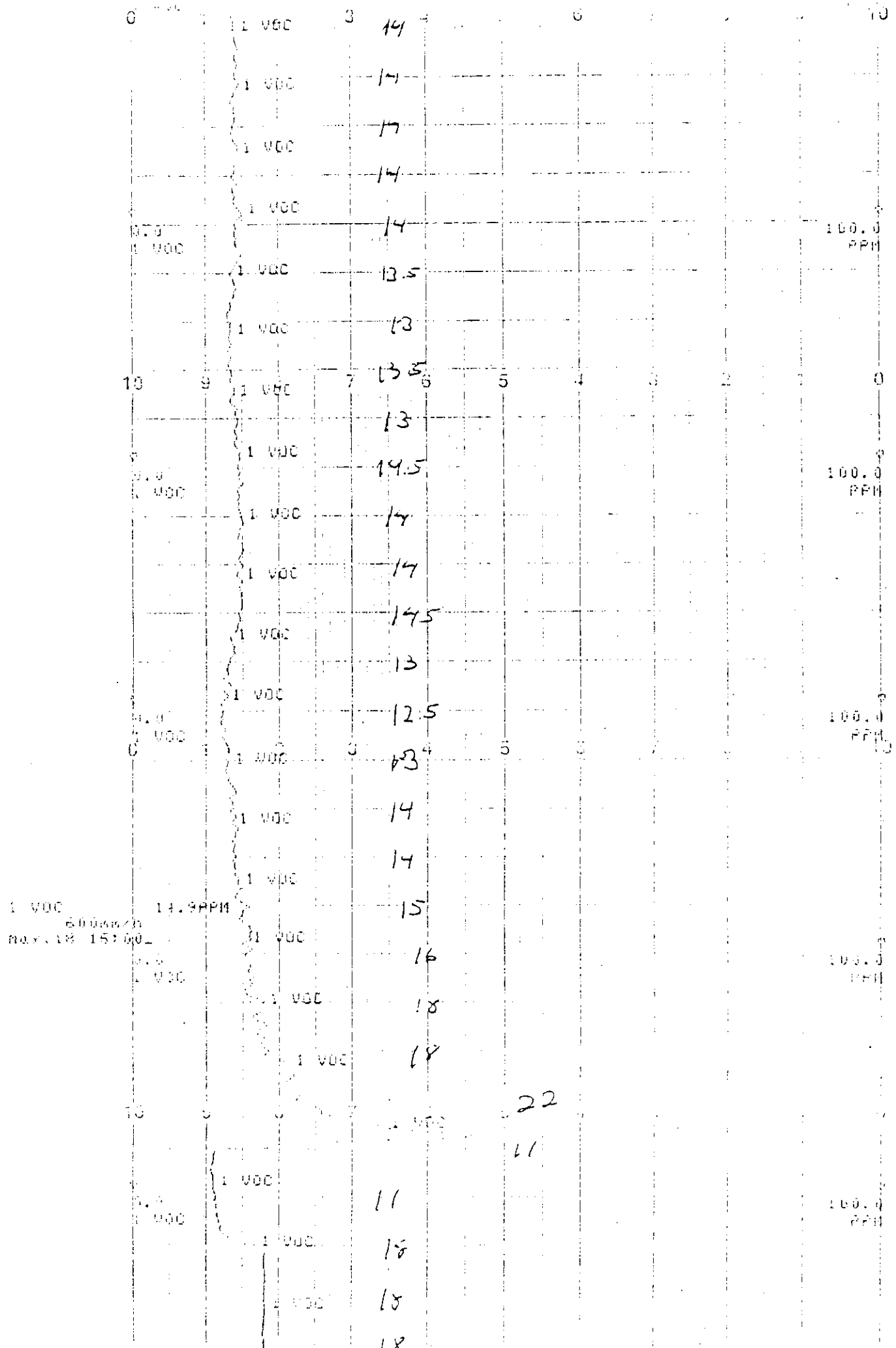
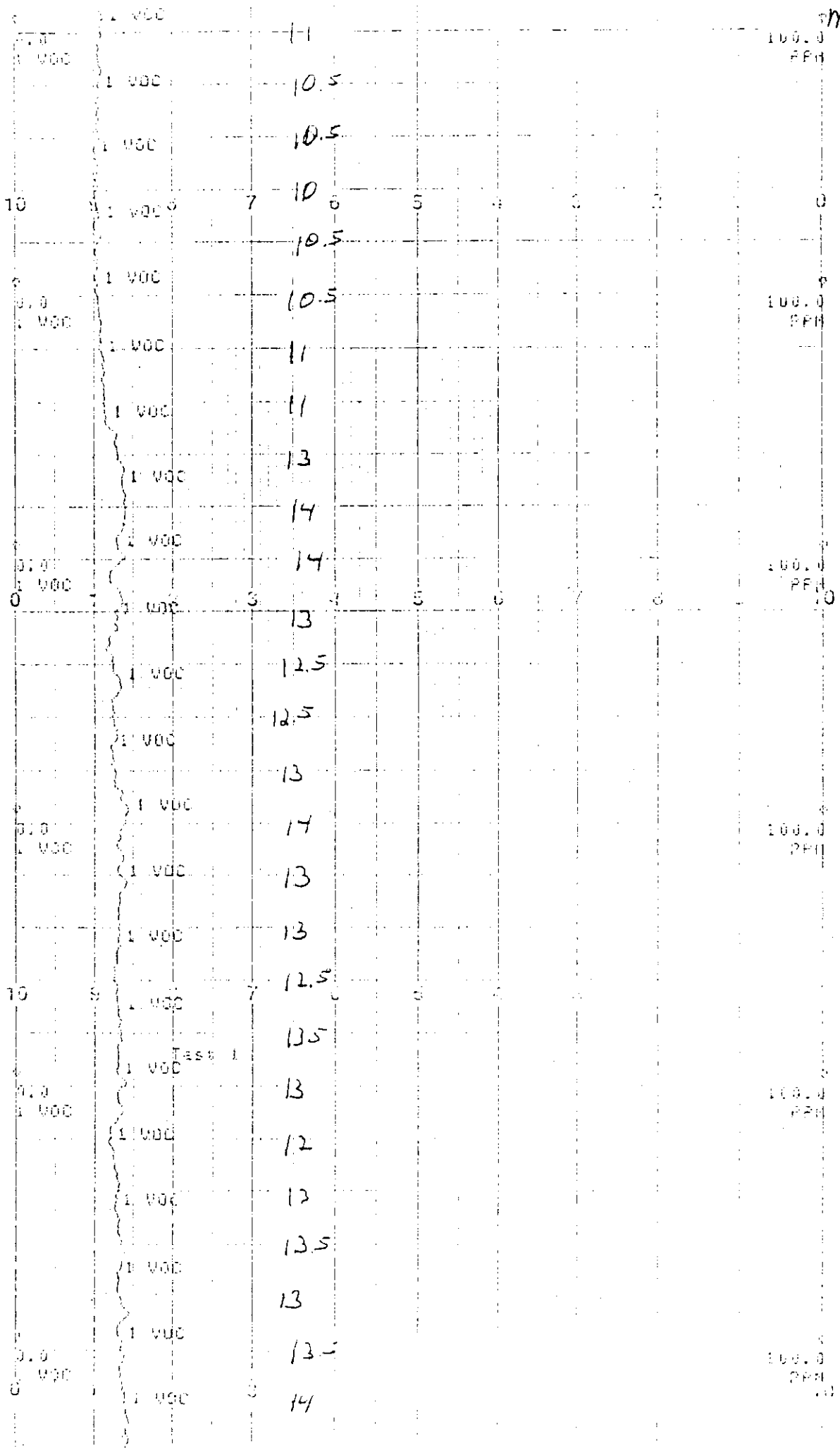
103



MN-3

104


1 VOC
100.0 PPM
11
10.5
10.5
10
10.5
10.5
11
11
13
14
14
13
12.5
12.5
13
14
13
13
12.5
13.5
13
12
13
13.5
13
13
14
Test 1

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105

zero

1 VOC

1 VOC

1 VOC

0.0

1 VOC

1 VOC

100.0 PPM

11 VOC

256

1 VOC

10 9 8 7 6 5

50.6

1 VOC

0.0

1 VOC

1 VOC

100.0 PPM

85.3

0 1 2 3 4 5 6 7 8 10

1 VOC

1547 END

1 VOC

10.5

11

1 VOC

0.0

1 VOC

11

100.0 PPM

1 VOC

10.5

1 VOC

10.5

10

10 9 8 7 6 5

1 VOC

10.5

1 VOC

0.0

1 VOC

10.5

100.0 PPM

1 VOC

11

1 VOC

11

13

1 VOC

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MEF
Project Number: 35310
Source: outlet O.L Quench
Sampling Site:
Test Number: #1, 2, 3
Sample Type: Moisture

Pitot Tube I.D.: Standard C_p: .99
Probe Length.: —
Meter Box Number: 1
Meter Y Factor: 1.00513
Meter K_{iso}: —
Meter Factor: —

Barometric Pressure: 29.91
Static Pressure: —
Estimated Moisture: —
Nozzle Diameter: 5
Initial Leak Check: 0.000 Pitot Leak Check Pre: — Post: —
Final Leak Check: 0.000 Filter Number(s):

Date: 5-18-93 Page 1 of 1
Staff: AK
Stack Size: 32"
Orsat Leak Check Pre: — Post: —

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
	0		777.7									
1	10		781.99		1.77	0	68	66	58			
2	15		788.20		1.77	0	72	64	65			
	20		792.32		1.77	0	64	76	[illegible]			
	25		795.94		1.77	0	68	82	64			
	30		797.84		1.77	0	69	85	66			

Averages: Volume 22.13 √ΔP: ΔH: 1.77 T_m: 71.4 T_s: ~~62.6~~

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WW Engineering & Science, Inc.
Environmental Services Division

Velocity Data Sheet

Client:
Project Number: 35310
Source:
Pitot Tube I.D.: Coefficient
Staff:
Wet Bulb Temp.:

Date:
Barometric Pressure:
Location:
Pitot Leak Check Pre:
Pitot Leak Check Post:
Static Pressure: "H_2O

TEST #1

Port/Point	Pitot Tube ΔP	Stack Temperature (°F)	Point/Port	Pitot Tube ΔP	Stack Temperature (°F)
1	.30	58°F		.27	58°F
2	.25			.29	
3	.29			.31	
4	.29			.32	
5	.29			.32	
6	.29			.32	
7	.30			.31	
8	.30			.31	
9	.31			.31	
10	.31			.29	
11	.31			.29	
12	.32	58°F		.29	58°F

$\%O_2$: 20.9 $\%CO_2$: 0 Average $\sqrt{\Delta P}$ .5483 Average Stack Temp.:

Ave. ΔP = .3008

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WW Engineering & Science, Inc.
Environmental Services Division

Velocity Data Sheet

Client: NEI
Project Number: 33310
Source: [illegible]
Pitot Tube I.D.: standard Coefficient .99
Staff: PK
Wet Bulb Temp.:

Date: 5/[illegible]
Barometric Pressure: 29.91
Location: [illegible]
Pitot Leak Check Pre: —
Pitot Leak Check Post: —
Static Pressure: [illegible] "H_2O

Port/Point	Pitot Tube ΔP	Stack Temperature (°F)	Point/Port	Pitot Tube ΔP	Stack Temperature (°F)
1	.15	55	1	.25	[illegible]
2	.21		2	.25	
3	.23		3	.29	
4	.25		4	.29	
5	.27		5	.30	
6	.29		6	.30	
7	.30		7	.31	
8	.31		8	.31	
9	.31		9	.31	
10	.31		10	.31	
11	.31		11	.30	
12	.31		12	.30	

$\%O_2$: 20.9 $\%CO_2$: 0 Average $\sqrt{\Delta P}$ ~~.5323~~ .5323 Average Stack Temp.: 55

AVE. ΔP = ~~.2850~~ .2846 SJH

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WW Engineering & Science, Inc.
Environmental Services Division

Velocity Data Sheet

Client: MEI
Project Number: 35310
Source: Oil Quench
Pitot Tube I.D.: Standard Coefficient .99
Staff: PK
Wet Bulb Temp.:

Date: 5/18/93
Barometric Pressure: 29.91
Location: outlet
Pitot Leak Check Pre: —
Pitot Leak Check Post: —
Static Pressure: +0.16 "H_2O

TEST #3

Port/Point	Pitot Tube ΔP	Stack Temperature (°F)	Point/Port	Pitot Tube ΔP	Stack Temperature (°F)
1	.23	58°F	1	.26	58°F
2	.29		2	.28	
3	.30		3	.29	
4	.29		4	.30	
5	.30		5	.31	
6	.29		6	.30	
7	.30		7	.30	
8	.31		8	.29	
9	.31		9	.31	
10	.30		10	.32	
11	.30		11	.32	
12	.30	58°F	12	.32	58°F

$\%O_2$: 20.9 $\%CO_2$: 0 Average $\overline{\sqrt{\Delta P}}$ .5444 Average Stack Temp.: 58°F

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Extra Set of Impingers

Run 1

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MEI
Project Number:
Source: Shot Blast
Sampling Site: 0.74
Test Number: 1
Sample Type: M5 202

Pitot Tube I.D.: 6's C_p: .84
Probe Length.: 6' Dual
Meter Box Number: ABEN
Meter Y Factor: 6.48
Meter K_{iso}:
Meter Factor: 1.8

Barometric Pressure: 29.91
Static Pressure:
Estimated Moisture:
Nozzle Diameter:
Initial Leak Check: —
Final Leak Check: —

Date: 5/18 Page 2 of 2
Staff:
Stack Size:
Orsat Leak Check Pre: Post:
Pitot Leak Check Pre: Post:
Filter Number(s): 0056

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
	30	1148	298.006									
	3[illegible]		299.152	0.56	2.15	3	56	55	70	260	248	40
	3[illegible]		302.152	0.56	2.15	3	56	55	70	254	250	40
	37.5		3[illegible]	0.56	2.15	3	60	55	71	250	250	41
	40	[illegible]	306.255	0.56	2.15	3	62	55	71	250	250	41
			308.152	0.57	2.15	3	62	55	71	249	253	41
			310.515	0.57	2.15	3	62	56	70	250	251	41
	[illegible]	[illegible]	312.405	0.57	2.15	3	62	56	70	250	251	41
52	0.0	1208	314.015	0.56	2.15	3	62	56	71	260	251	41
52.5			316.150	0.59	2.2	3	62	56	71	248	261	40
55			318.350	0.59	2.2	3	63	56	70	258	260	40
57.5	5		320.450	0.59	2.2	3	63	56	70	260	260	40
60		1218	322.15	0.59	2.2	3	63	56	70	263	260	40

Averages: Volume = 48.22 √ΔP: .7699 ΔH: 2.25 T_m: 58 T_s: 70.5

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HIH

HVE ΔP = 5975

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WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MEI
Project Number: [illegible]
Source: [illegible]
Sampling Site: [illegible]
Test Number: 1
Sample Type: [illegible]

Pitot Tube I.D.: [illegible] C_p: .84
Probe Length.: [illegible]
Meter Box Number: [illegible] 1
Meter Y Factor: 0.987
Meter K_{iso}:
Meter Factor: 1.51

Barometric Pressure: 29.31
Static Pressure: [illegible]
Estimated Moisture: 4%
Nozzle Diameter: [illegible] .243
Initial Leak Check: 0.00 @ 10"
Final Leak Check: 0.008 @ 10

Date: 5/18 Page 1 of 2
Staff: [illegible]
Stack Size: 48"
Orsat Leak Check Pre: — Post: —
Pitot Leak Check Pre: ✓ Post:
Filter Number(s): [illegible]

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
	0	1112	275.223									
1	5	1114.5	275.182	0.59	2.2	2	54	54	70	250	246	48
2	5	1117	278.25	0.56	2.1	2	57	55	70	248	260	47
3	7.5	1119.5	280.155	0.56	2.1	2	58	55	71	252	265	45
4	[illegible]	1122	281.375	0.60	2.1	2	59	55	71	251	248	47
5	12.5	1124.5	284.255	0.60	2.3	3	60	55	71	250	252	47
6	15.0	1127	285.555	0.62	2.4	3	61	55	71	251	252	47
7	17.5	1129.5	287.375	0.67	2.7	3	61	55	71	251	266	46
8	20.0	1132	289.415	0.6	2.55	3	61	55	71	254	260	45
9	22.5	1134.5	291.75	0.65	2.5	3	62	55	71	250	261	44
10	25.0	1137	293.550	0.60	2.5	3	62	55	71	250	260	43
11	27.5	1139.5	295.365	0.61	2.3	3	62	55	71	247	261	44
12	30.0	1142	298.661	0.59	2.3	3	62	55	70	251	261	45

Averages: Volume = 48.22 $\sqrt{\Delta P}$: .7694 ΔH: 2.25 T_m: 58 T_s: 70.5

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MH

Ave. ΔP = .5925

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WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: IIET
Project Number: 35310
Source: Shot Blast
Sampling Site: Outlet
Test Number: 2
Sample Type: IM5 - 202

Pitot Tube I.D.: "S" 6" C_p: .84
Probe Length.:
Meter Box Number: APEX 1
Meter Y Factor: .989
Meter K_{iso}:
Meter Factor: 1.81

Barometric Pressure: 29.91
Static Pressure: -0.1
Estimated Moisture: 4%
Nozzle Diameter: .243
Initial Leak Check: 0.01 @ 6
Final Leak Check: 0.01 @ 17"

Date: 5-18-93 Page 2 of 2
Staff: PK, GH, BH
Stack Size: 45.5
Orsat Leak Check Pre: Post:
Pitot Leak Check Pre: Post:
Filter Number(s): 0087

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
	0	1304 ~~1250~~	322.543									
L 1	2.5	1305	325.04		3.0	7.0	59	59	71	243	257	48
2	5.0		327.15	.75	2.9	7.0	61	57	71	243	257	48
3	7.5		329.95	.75	3.0	7.0	63	58	69	245	255	50
4			331.86	.76	2.95	7	63	58	70	250	250	50
5	10		334.06	.76	2.95	7	63	57	71	250	252	50
6	15		337.45	.76	2.95	7	63	55	71	250	250	50
7	17.5		339.10	.76	2.95	7	63	56	71	251	252	50
8	20		340.60	.76	2.95	7	63	55	71	251	249	50
9	22.5		343.75	.71	2.7	7	63	59	71	250	251	50
10	[illegible]		345.15	.71	2.7	6	64	59	71	248	252	50
11	[illegible]		347.515	.71	2.7	6	64	59	71	252	251	50
12	[illegible]		350.120	.71	2.7	6	64	59	70	252	251	50

Averages: Volume = 53.44 √ΔP: .8374 ✓ ΔH: 2.71 T_m: 61 ✓ T_s: 70.5 ✓

Ave. ΔP = .7021 ✓

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WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: [illegible]
Project Number: [illegible]
Source: [illegible]
Sampling Site: [illegible]
Test Number: 3
Sample Type: [illegible]

Pitot Tube I.D.: S-6.0" C_p: .84
Probe Length.: [illegible]
Meter Box Number: [illegible]
Meter Y Factor: [illegible]
Meter K_{iso}: —
Meter Factor: 1.81

Barometric Pressure: 29.91
Static Pressure: -0.0
Estimated Moisture: [illegible]
Nozzle Diameter: .243
Initial Leak Check: [illegible] @ 8"
Final Leak Check: 0.001 @ 4"

Date: [illegible] Page 1 of 2
Staff: [illegible]
Stack Size: [illegible]
Orsat Leak Check Pre: [illegible] Post: —
Pitot Leak Check Pre: — Post: —
Filter Number(s): [illegible]

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
	0	1530	376.343									
	2.5		379.150	.66	2.3	2	55	54	70	260	248	38
	5.0	1535	381.600	.66	2.3	2	57	55	72	258	256	38
	7.5		383.175	.66	2.3	2	58	55	71	260	260	39
	10.0	1540	385.620	.66	2.3	2	58	55	71	260	260	41
	12.5		388.150	.64	2.5	2	65	58	72	258	262	42
	15.0		390.450	.64	2.5	2	65	58	71	260	258	42
	17.5		392.515	.64	2.5	2	64	58	72	260	258	42
	20.0	1550	393.85	.64	2.5	3	64	58	71	260	252	42
	22.5		394.515	.64	2.5	3	64	58	71	260	255	42
	25.0	1555	395.750	.64	2.5	3	64	58	71	260	255	42
	27.5	1557	398.710	.64	2.0	3	64	58	71	258	255	42
	30.0	1600	401.624	.64	2.0	3	64	58	71	255	255	42

Averages: Volume = 50.35 √ΔP: ~~.7127~~ 0.79195 ✓ ΔH: 2.40 T_m: 67 T_s: 71

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ΔH AVE ΔP = ~~.6287~~

Mod 3
119

Run 3

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Slot Blast

Client: HCT
Project Number: 33316
Source: Slot Blast
Sampling Site: Cell 8
Test Number: 3
Sample Type: M5 (2002)

Pitot Tube I.D.: _____ C_p: _____
Probe Length.: _____
Meter Box Number: _____
Meter Y Factor: _____
Meter K_{iso}: _____
Meter Factor: _____

Barometric Pressure: _____
Static Pressure: _____
Estimated Moisture: _____
Nozzle Diameter: _____
Initial Leak Check: _____
Final Leak Check: 0.001 @ 6"

Date: 5/18 Page 2 of 2
Staff: JBL, CA, JK
Stack Size: 4.5
Orsat Leak Check Pre: — Post: —
Pitot Leak Check Pre: — Post: —
Filter Number(s): 6031

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
	30	1601	401.620									
1	325		403.545	0.69	2.6	3	65	63	71	260	250	50
2	350		405.915	0.69	2.6	3	66	63	71	260	250	50
3	375		407.550	0.64	2.45	3	68	62	71	260	251	50
4	400		409.105	0.65	2.5	3	68	63	70	255	248	48
5	425		412.550	0.65	2.5	3	65	63	70	257	250	48
6	450		414.225	0.6	2.25	3	66	62	71	255	252	48
7	475		416.150	0.6	2.25	3	66	62	71	255	252	50
8	500		418.510	0.6	2.25	3	66	63	71	260	250	52
9	525		420.150	0.6	2.25	3	66	63	72	262	250	54
10	550		422.315	0.6	2.25	3	66	63	71	262	252	54
11	575		424.150	0.6	2.25	3	66	63	70	262	250	54
12	600	1631	426.673	0.6	2.25	3	66	63	71	260	250	54

Averages: Vol/comp = 50.35 √ΔP: ~~.7927~~ 0.79195 ΔH: 2.40 T_m: 62 T_s: 71

AVG ΔP = ~~0.287~~

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MN-3
120

MINNEAPOLIS ELECTRIC
DULUTH FACILITY

SCH. 3M

A. Real Estate

1. Main Plant Property — 91.097 acres
2. Employee Parking — 3.173

94.270 acres

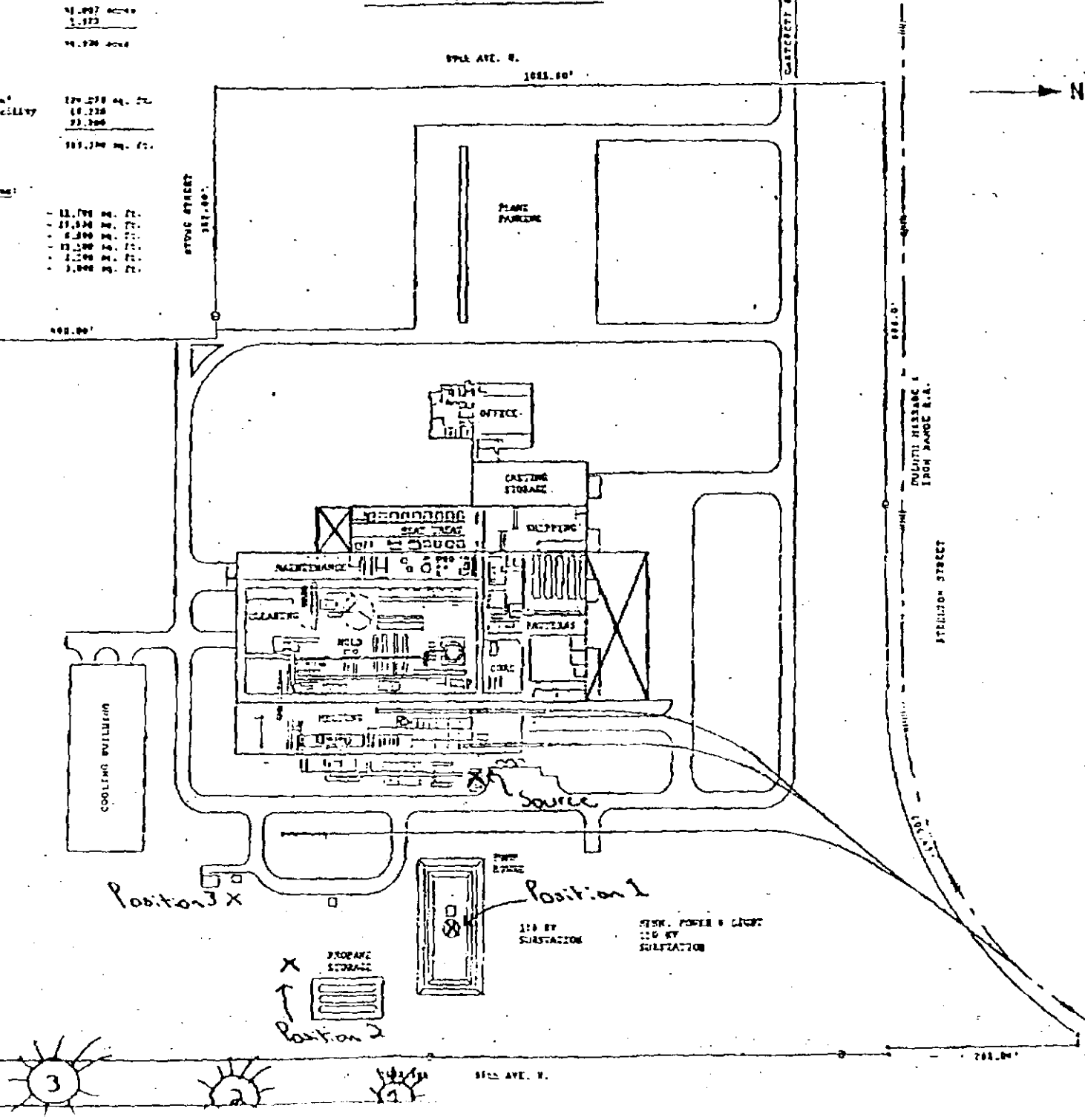
B. Buildings

1. Main Plant Production Area* — 170,278 sq. ft.
2. Main Office & Employee Facility — 18,238
3. Casting Cooling Building — 23,000

211,340 sq. ft.

*Note - Included in Main Plant Area:

a) Casting Storage — 11,791 sq. ft.
b) Plant Offices & Lunch Room — 27,530 sq. ft.
c) Service Storage — 4,200 sq. ft.
d) Restrooms — 13,200 sq. ft.
e) Air Lock Enclosure — 2,200 sq. ft.
f) Lab Office & ATS Areas — 3,000 sq. ft.



MINNEAPOLIS ELECTRIC STEEL CASTINGS CO.

2-1185 01

Plant | Bldg Contents

WW ENGINEERING & SCIENCE

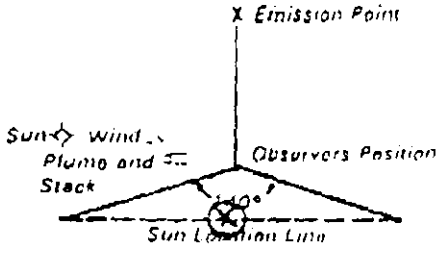
A Summit Company

06/11/93 12:18:00 13:17:45

Source Name	ME International
Address	200 E. Cutler Street
City	Duluth
State	MN
Zip	55808
Phone	(218) 626-2761
Source ID	14
Process Equipment	Arc Furnace
Operating Mode	Normal
Control Equipment	Bag House
Operating Mode	Cont.
Affected Emission Point	Arc Furnace Exhaust Stack
Height Above Ground	52'
Relative Height	≈ 40'
Distance From Observer	≈ 300'
Direction From Observer	NNW
Detective Emissions	None Present
Emission Color	Grayish White / Black
Plume Type	None Present
Water Droplets Present	No
Droplets Attached	No
Point In The Plume Was Opacity Determined	Center 2' above
Detective Background	Clear Sky
Background Color	Blue
Sky Conditions	Clear
Wind Speed	See Table 1
Wind Direction	Table 1
Ambient Temperature	See Table 1
Relative Humidity	Table 1

Source Layout Sketch — Draw North Arrow

See Picture 3
See Attached Map (Question 3)



	0	15	30	45		0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

Comments: No Observed Emissions

Average Opacity For (min/min): 0 max 0 min

Range Of Opacity Readings (min/min): 0 max 0 min

Observers Name (print): Brian Hooks

Observers Signature: Brian Hooks — Date: 06/11/93

Organization: WW Engineering & Science

Certified By: WDWR — Date: 06/06/93

Verified: Joe Reiss — Date: 06/16/93

I Have Received A Copy Of These Opacity Observations

Signature

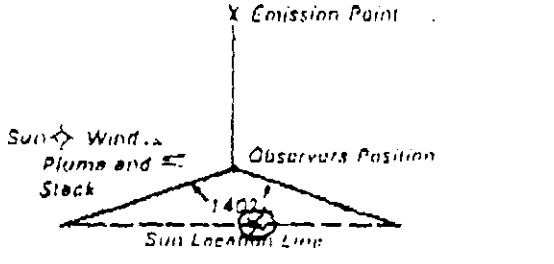
Title — Date

mn-12

WW ENGINEERING & SCIENCE

A Sunpak Company

Source Name: ME International				Observation Date: 06/11/93			Start Time: 11:04:00			Stop Time: 12:05:45		
Address: 2006 E. Superior Street				0	15	30	45		0	15	30	45
				1	0	0	0	0	31	0	0	0	0
Duluth	State: MN	Zip: 55808		2	0	0	0	0	32	0	0	0	0
Phone: (218) 626-2761	Source ID: 14			3	0	0	0	0	33	0	0	0	0
Process Equipment: Arc Furnace		Operating Mode: 100%		4	0	0	0	0	34	0	0	0	0
Control Equipment: Bag House		Operating Mode: Cont.		5	0	0	0	0	35	0	0	0	0
Describe Emission Point: Arc Furnace Exhaust Stack				6	0	0	0	0	36	0	0	0	0
Height Above Ground: 52'	Stack Height: 245'			7	0	0	0	0	37	0	0	0	0
Distance From Observer: ≈ 300'	Direction From Observer: NW			8	0	0	0	0	38	0	0	0	0
Describe Emissions: None Present				9	0	0	0	0	39	0	0	0	0
Emission Color: Light White	Plume Type: None Present			10	0	0	0	0	40	0	0	0	0
Water Droplets Present: No	Droplets Attached: No			11	0	0	0	0	41	0	0	0	0
What Point In The Plume Was Opacity Determined: Center 2' above				12	0	0	0	0	42	0	0	0	0
Describe Background: Clear Sky				13	0	0	0	0	43	0	0	0	0
Background Color: Blue	Sky Conditions: Clear			14	0	0	0	0	44	0	0	0	0
Wind Speed: See Table 1	Wind Direction: See Table 1			15	0	0	0	0	45	0	0	0	0
Ambient Temperature: See Table 1	Relative Humidity: See Table 1			16	0	0	0	0	46	0	0	0	0
Source Layout Sketch:			Draw North Arrow	17	0	0	0	0	47	0	0	0	0
See Picture 2				18	0	0	0	0	48	0	0	0	0
See Attached Map (Question 23)				19	0	0	0	0	49	0	0	0	0
				20	0	0	0	0	50	0	0	0	0
				21	0	0	0	0	51	0	0	0	0
				22	0	0	0	0	52	0	0	0	0
				23	0	0	0	0	53	0	0	0	0
				24	0	0	0	0	54	0	0	0	0
				25	0	0	0	0	55	0	0	0	0
				26	0	0	0	0	56	0	0	0	0
				27	0	0	0	0	57	0	0	0	0
				28	0	0	0	0	58	0	0	0	0
				29	0	0	0	0	59	0	0	0	0
				30	0	0	0	0	60	0	0	0	0



Comments: No Observed Emissions

Average Opacity For (min/min): 0 min 0 min

Range Of Opacity Readings (min/min): 0 min 0 min

Observer's Name (print): Brian Hooker

Observer's Signature: Brian Hooker Date: 06/11/93

Organization: WW Engineering & Science

I Have Received A Copy Of These Opacity Observations

Signature

Title Date

Certified By: WDNR Date: 04/06/95

Verified: Jon Reed Date: 04/06/95

Appendix B

Laboratory Data

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WW Engineering & Science, Inc.
Environmental Laboratory Division

ANALYTICAL REPORT

ME International
Proj: Condensible Particulate Water Analysis
Subm: May 18th Samples

Submittal Number: 30561- 1
Location:
CCS Number 35310
CCS Manager: Paul Kantola

	ARC FURNACE-1	ARC FURNACE-2	ARC FURNACE-3	DETECTION LIMIT	UNITS
WWES Sample No.					
Condensible-Particulate Matter	<0.5mg	<0.5mg	<0.5mg	<0.5mg	
Sampled by:	P. Kantola	P. Kantola	P. Kantola		
Date Sampled:	05/18/93	05/18/93	05/18/93		
Time Sampled:	14:00	14:00	14:00		
Date Received:	05/22/93	05/22/93	05/22/93		
Time Received:	08:35	08:35	08:35		

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WW Engineering & Science, Inc.
Environmental Laboratory Division

ANALYTICAL REPORT

ME International
Proj: Condensible Particulate Water Analysis
Subm: May 18th Samples

Submittal Number: 30561- 1
Location:
CCS Number 35310
CCS Manager: Paul Kantola

	SHOT BLAST-1	SHOT BLAST-2	SHOT BLAST-3	DETECTION LIMIT	UNITS
WWES Sample No.					
Condensible-Particulate Matter	<0.5mg	<0.5mg	<0.5mg	<0.5mg	
Sampled by:	P. Kantola	P. Kantola	P. Kantola		
Date Sampled:	05/18/93	05/18/93	05/18/93		
Time Sampled:	14:00	14:00	14:00		
Date Received:	05/22/93	05/22/93	05/22/93		
Time Received:	08:35	08:35	08:35		

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WW Engineering & Science, Inc.
Environmental Laboratory Division

ANALYTICAL REPORT

ME International Submittal Number: 30561- 1
Proj: Condensible Particulate Water Analysis CCS Number 35310
Location:
Subm: May 18th Samples
CCS Manager: Paul Kantola

	1 BLANK	1 BLANK	1 BLANK	DETECTION LIMIT	UNITS
WWES Sample No.					
Condensible-Particulate Matter	<0.5mg				
Sampled by:	P. Kantola	P. Kantola	P. Kantola		
Date Sampled:	05/18/93	05/18/93	05/18/93		
Time Sampled:	14:00	14:00	14:00		
Date Received:	05/22/93	05/22/93	05/22/93		
Time Received:	08:35	08:35	08:35		

MN-3
128

Furnace Bag House

WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 35310

Date Received: 5-19-93
Run No.: 1

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
3" Filter # 0101				Acetone
150ml Beaker	# 249	✓		Acetone 25ml 213

Filter Analysis

Filter Number: 0101
Date and Time Desiccated: 5-25-93, 10:30

Date	Time	Weight
5-26-93	0825	2.0322
6-20-93	1228	2.0312
6-20-93	1930	2.0311

Average: 2.03115
Tare Weight: 2.03105
Weight Gain: 0.0001 g

Filter Number: Beaker # 249
Date and Time Desiccated: 5-26-93 0730

Date	Time	Weight
5-26-93	1050	70.8480
6-20-93	1240	70.8485
~~6-20-93~~	~~1935~~	~~70.~~

Average: 70.84825
Tare Weight: 70.8403
Weight Gain: 0.00795 g

Acetone Rinse Analysis

Date in Oven: 5-25-93
Date Removed: 5-26-93
Time in Oven: 11:00
Time Removed: 0730
Oven Temperature: 125°F
Rinse Volume: 238 ml

Date	Time	Weight

Average:
Tare Weight:
Weight Gain:

213
25
238 ml rinse

$C_a \times V_a \times pa$ = Acetone Blank Correction: .4103 mg

Total Weight Gain Minus Acetone Blank: 7.5892 ~~3997~~ mg

Analyzed By: _____ Reviewed By: _____

MN-3
129

Furnace Bag House

WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 35310

Date Received: 5-19-93
Run No.: 2

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
3" Filter	#0100			Acetone
150 ml Beaker	#250	✓		Acetone 25ml+170

Filter Analysis

Filter Number: 0100
Date and Time Desiccated: 5-24-93 10:30

Date	Time	Weight
5-26-93	0822	1.9224
6-20-93	1230	1.9208
6-20-93	1935	1.9209

Average: 1.92085
Tare Weight: 1.92315
Weight Gain: -0.0023 g

Filter Number: Beaker #250
Date and Time Desiccated: 5-26-93 0730

Date	Time	Weight
5-26-93	1052	73.5139
6-20-93	1241	73.5142

Average: 73.51405
Tare Weight: 73.50525
Weight Gain: 0.0088 g

Acetone Rinse Analysis

Date in Oven: 5-25-93
Date Removed: 5-26-93

Time in Oven: 11:00
Time Removed: 0730

Oven Temperature: 125°F
Rinse Volume: 195 ml

Date	Time	Weight

Average:
Tare Weight:
Weight Gain:

170
25
195 ml rinse

$C_a \times V_a \times pa$ = Acetone Blank Correction: .3063 mg

Total Weight Gain Minus Acetone Blank: ~~0.3488~~ 6.1937 mg

Analyzed By:
Reviewed By:

MN-3

130

Furnace Bag House

WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 35310

Date Received: 5-19-93
Run No.: 3

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
3" Filter	# 0102			Acetone
150ml Beaker	# 251	✓		Acetone 35ml+150

Filter Analysis

Filter Number: 0102
Date and Time Desiccated: 5-24-93, 10:30

Date	Time	Weight
5-26-93	0823	2.0596
6-20-93	1229	2.0579
6-20-93	1938	2.0577

Average: 2.0578 g
Tare Weight: 2.0580 g
Weight Gain: -0.0002 g

Filter Number: Beaker #251
Date and Time Desiccated: 5-26-93 0730

Date	Time	Weight
5-26-93	1053	72.7880
6-20-93	1242	72.7885

Average: 72.78825
Tare Weight: 72.78105
Weight Gain: 0.0072 g

Acetone Rinse Analysis

Date in Oven: 5-25-93
Time in Oven: 11:00
Oven Temperature: 125°F
Date Removed: 5-26-93
Time Removed: 0730
Rinse Volume: 185ml

Date	Time	Weight

Average:
Tare Weight:
Weight Gain:

150
35
185 ml rinse

$C_a \times V_a \times pa$ = Acetone Blank Correction: .2906 mg

Total Weight Gain Minus Acetone Blank: ~~0.4095~~ g 6.7094 g

Analyzed By:
Reviewed By:

MN-3

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shot Blast

WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 35310

Date Received: 5-18-93
Run No.: 1

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
3" Filter	#0086			
150ml Beaker	#252	✓		Acetone 55mL+ 162

Filter Analysis

Filter Number: 0086
Date and Time Desiccated: 5-24-93 10:00

Date: 5-26-93	Time: 804	Weight: 2.0114
Date: 6-20-93	Time: 1233	Weight: 2.0109
Date:	Time:	Weight:
Date:	Time:	Weight:
		Average: 2.01115
		Tare Weight: 2.0019
		Weight Gain: 0.00925 g

Filter Number: Beaker #252
Date and Time Desiccated:

Date: 5-26-93	Time: 1054	Weight: 73.0635
Date: 6-20-93	Time: 1243	Weight: 73.0645
Date: 6-20-93	Time: 1944	Weight: 73.0643
Date:	Time:	Weight:
		Average: 73.0644 g
		Tare Weight: 73.04335 g
		Weight Gain: ~~0.01~~ 0.02105 g

Acetone Rinse Analysis

Date in Oven: 5-25-93
Date Removed: 5-26-93

Time in Oven: 11:00
Time Removed: 07:30

Oven Temperature: 125°F
Rinse Volume: 217 ml

Date:	Time:	Weight:
Date:	Time:	Weight:
Date:	Time:	Weight:
Date:	Time:	Weight:
		Average:
		Tare Weight:
		Weight Gain:

162
55
217 ml rinse

$C_a \times V_a \times pa$ = Acetone Blank Correction: .3409 mg
29.9591

Total Weight Gain Minus Acetone Blank: ~~2.6891~~ mg

Analyzed By:
Reviewed By:

shot Blast

MN-3
132

WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 35310

Date Received: 5-18-93
Run No.: 2

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
3" Filter	#0087			
150ml Beaker	#253	✓		Acetone 35+162

Filter Analysis

Filter Number: 0087
Date and Time Desiccated: 5-24-93 10:00

Date	Time	Weight
5-26-93	0811	2.1882
6-20-93	1231	2.1870
6-20-93	1949	2.1872

Average: 2.1871
Tare Weight: 2.1819
Weight Gain: 0.0052 g

Filter Number: Beaker # 253
Date and Time Desiccated: 5-26-93 0730

Date	Time	Weight
5-26-93	1056	75.1460
~~6~~ 6-20-93	1244	75.1471
6-20-93	1753	75.1469

Average: 75.1470
Tare Weight: 75.12455
Weight Gain: 0.02245 g

Acetone Rinse Analysis

Date in Oven: 5-25-93
Time in Oven: 11:00
Oven Temperature: 125°F
Date Removed: 5-26-93
Time Removed: 0730
Rinse Volume: 197 ml

Date	Time	Weight

Average:
Tare Weight:
Weight Gain:

162
35
197 ml rinse

$C_a \times V_a \times pa$ = Acetone Blank Correction: .3094 mg

Total Weight Gain Minus Acetone Blank: ~~2.4556~~ 27.3406 mg.

Analyzed By: _____ Reviewed By: _____

MN-3
133

Shot Blast

WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 35310

Date Received: 5-18-93
Run No.: 3

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
3" Filter	# 0088			
150ml Beaker	#254	✓		Acetone 45ml + 186

Filter Analysis

Filter Number: 0088
Date and Time Desiccated: 5-24-93 10:00

Date	Time	Weight
5-26-93	0818	~~2.31236~~ 2.30836
6-20-93	1230	~~2.3122~~ 2.30834

Average: ~~2.31235~~ 2.30835
Tare Weight: 2.3032 g
Weight Gain: 0.00515 mg

Filter Number: Beaker #254
Date and Time Desiccated: 5-26-93 - 0730

Date	Time	Weight
5-26-93	1057	71.5309
6-20-93	1252	71.5312

Average: 71.53105
Tare Weight: 71.49565
Weight Gain: 0.0354 g

Acetone Rinse Analysis

Date in Oven: 5-25-93
Date Removed: 5-26-93
Time in Oven: 11:00
Time Removed: 0730
Oven Temperature: 125°F
Rinse Volume: 231 ml

Date	Time	Weight

Average:
Tare Weight:
Weight Gain:

186
45
231 ml rinse

$C_a \times V_a \times pa$ = Acetone Blank Correction: .3629 mg

Total Weight Gain Minus Acetone Blank: ~~1.093~~ mg 30.19 mg

Analyzed By:
Reviewed By:

MN-3
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WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 22570

Date Received: 5-24-93
Run No.: BLANK

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
248 BLANK	248			

Filter Analysis

Filter Number: _____ Date and Time Desiccated: _____

Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Average: _____
Tare Weight: _____
Weight Gain: _____

Filter Number: _____ Date and Time Desiccated: _____

Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Average: _____
Tare Weight: _____
Weight Gain: _____

Acetone Rinse Analysis

Date in Oven: 5-25-93 Time in Oven: 11:00 Oven Temperature: 125 °F
Date Removed: 5-26-93 Time Removed: 07:30 Rinse Volume: 58 ml

Date: 5-26-93 Time: 1045 Weight: 73.0481
Date: 6-20-93 Time: 1250 Weight: 73.0475
Date: 6-20-93 Time: 1938 Weight: 73.0475
Date: _____ Time: _____ Weight: _____
Average: 73.0475 g
Tare Weight: 73.0474 g
Weight Gain: .00010 g

$C_a \times V_a \times pa$ = Acetone Blank Correction: .000002

Total Weight Gain Minus Acetone Blank: _____

Analyzed By: _____ Reviewed By: _____

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WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 35310

Date Received: 5-24-93
Run No.: Blank

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)

Filter Analysis

Filter Number: 0089

Date and Time Desiccated: 5-24-93 1000

Date: 5-26-93 Time: 0820 Weight: 2.0224
Date: 6-20-93 Time: 1234 Weight: 2.0214
Date: 6-20-93 Time: 1956 Weight: 2.0212
Date: Time: Weight:
Average: 2.0213
Tare Weight: 2.0212
Weight Gain:

Filter Number:

Date and Time Desiccated:

Date: Time: Weight:
Date: Time: Weight:
Date: Time: Weight:
Date: Time: Weight:
Average:
Tare Weight:
Weight Gain:

Acetone Rinse Analysis

Date in Oven: Time in Oven: Oven Temperature:
Date Removed: Time Removed: Rinse Volume:

Date: Time: Weight:
Date: Time: Weight:
Date: Time: Weight:
Date: Time: Weight:
Average:
Tare Weight:
Weight Gain:

C_a x V_a x pa = Acetone Blank Correction:

Total Weight Gain Minus Acetone Blank:

Analyzed By: Reviewed By:

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WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MEI
Project Number: 22570

Date Received: 5-24-93
Run No.: BLANK

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)
248 BLANK	248			

Filter Analysis

Filter Number: _____ Date and Time Desiccated: _____

Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Average: _____
Tare Weight: _____
Weight Gain: _____

Filter Number: _____ Date and Time Desiccated: _____

Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Date: _____ Time: _____ Weight: _____
Average: _____
Tare Weight: _____
Weight Gain: _____

Acetone Rinse Analysis

Date in Oven: 5-25-93
Date Removed: 5-26-93

Time in Oven: 11:00
Time Removed: 07:30

Oven Temperature: 125 °F
Rinse Volume: 58 ml

Date: 5-26-93 Time: 1045 Weight: 73.0481
Date: 5-20-93 Time: 1250 Weight: 73.0485
Date: 6-20-93 Time: 1938 Weight: 73.0475
Date: _____ Time: _____ Weight: _____
Average: 73.0475 g
Tare Weight: 73.0474 g
Weight Gain: .00010 g

$C_a \times V_a \times pa$ = Acetone Blank Correction: .000002

Total Weight Gain Minus Acetone Blank: _____

Analyzed By: _____ Reviewed By: _____

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WW Engineering & Science, Inc.
Environmental Services Division

Particulate Analysis

Client: MES
Project Number: 35316

Date Received: 5-24-93
Run No.: Blank

Field ID	Lab. ID	Level Marked ?	Container Sealed ?	Comments (include acetone rinse volume)

Filter Analysis

Filter Number: 0084

Date and Time Desiccated: 5-24-93 1000

Date: 5-26-93	Time: 0820	Weight: 2.0224
Date: 6-20-93	Time: 1234	Weight: 2.0214
Date: 6-20-93	Time: 1956	Weight: 2.0212
Date:	Time:	Weight:
		Average: 2.0213
		Tare Weight: 2.0212
		Weight Gain:

Filter Number:

Date and Time Desiccated:

Date:	Time:	Weight:
Date:	Time:	Weight:
Date:	Time:	Weight:
Date:	Time:	Weight:
		Average:
		Tare Weight:
		Weight Gain:

Acetone Rinse Analysis

Date in Oven:
Date Removed:

Time in Oven:
Time Removed:

Oven Temperature:
Rinse Volume:

Date:	Time:	Weight:
Date:	Time:	Weight:
Date:	Time:	Weight:
Date:	Time:	Weight:
		Average:
		Tare Weight:
		Weight Gain:

$C_a \times V_a \times pa$ = Acetone Blank Correction:

Total Weight Gain Minus Acetone Blank:

Analyzed By:

Reviewed By:

Appendix C

Calculations

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MOISTURE TRAIN CALCULATIONS

M1. BAROMETRIC PRESSURE, inches of mercury

M2. DURATION OF SAMPLE, minutes

M3. METER CALIBRATION FACTOR

M4. AVERAGE METER TEMPERATURE, degrees F

M5. AVERAGE METER PRESSURE, inches of water

M6. METER VOLUME, ACTUAL, cubic feet

M7. METER VOLUME, STP, cubic feet

$$M7 = M3 * M6 * \frac{530}{M1+460} * \frac{M1 + 0.07355 * M5}{29.92}$$

M8. LIQUID VOLUME OF WATER COLLECTED, milliliters

M9. VAPOR VOLUME OF WATER CONDENSED, @ STP, cubic feet

$$M9 = M8 * 0.0474$$

M10. TOTAL GAS SAMPLED, @ STP, cubic feet

$$M10 = M7 + M9$$

M11. PERCENT MOISTURE

$$M11 = 100 * \frac{M9}{M10}$$

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G13. DENSITY, WET, @ STACK GAS CONDITIONS, lbs./cu. ft.

$$G13 = G12 * \frac{530}{G5 + 460} * \frac{G3 + 0.07355 * G4}{29.92}$$

G14. MOLECULAR WEIGHT, DRY, lb/lb-mole

$$G14 = G11 * 386.9$$

G15. AVERAGE STACK GAS VELOCITY, feet/minute

$$G15 = P5 * G6 * \frac{1096}{\sqrt{G13}}$$

G16. STACK GAS FLOW RATE, ACFM

$$G16 = G2 * G15$$

G17. STACK GAS FLOW RATE, SCFM

$$G17 = G16 * \frac{530}{G5 + 460} * \frac{G3 + 0.07355 * G4}{29.92}$$

G18. STACK GAS FLOW RATE, DSCFM

$$G18 = G17 * \frac{100 - G7}{100}$$

PARTICULATE CALCULATIONS

P1. NUMBER OF POINTS SAMPLED

P2. DURATION OF SAMPLE, minutes

P3. NOZZLE DIAMETER, inches

P4. NOZZLE AREA, square feet

$$P4 = \frac{3.14159 * \left(\frac{P3}{2}\right)^2}{144}$$

P5. PITOT TUBE CALIBRATION FACTOR

P6. METER CALIBRATION FACTOR

P7. AVERAGE FILTER TEMPERATURE, degrees F

P8. AVERAGE METER TEMPERATURE, degrees F

P9. AVERAGE METER PRESSURE, inches water

P10. METER VOLUME, ACTUAL, cubic feet

P11. METER VOLUME, @ STP, cubic feet

$$P11 = P10 * P6 * \frac{530}{P8 + 460} * \frac{G3 + 0.07355 * P9}{29.92}$$

P12. LIQUID VOLUME OF WATER CONDENSED, milliliters

P13. VAPOR VOLUME OF WATER CONDENSED, @ STP, cubic feet

$$P13 = P12 * 0.0474$$

P14. TOTAL GAS SAMPLED, @ STP, cubic feet

$$P14 = P11 + P13$$

P15. WEIGHT OF GAS SAMPLED, DRY, pounds

$$P15 = P11 * G11$$

P16. WEIGHT OF GAS SAMPLED, WET, pounds

$$P16 = P14 * G12$$

P17. PERCENT ISOKINETICS

$$P17 = \frac{100 * 29.92 * (G5 + 460) * P14}{530 * (G3 + 0.07355 * G4) * P2 * P4 * G15}$$

<u>CONCENTRATION CONVERSION FACTORS:</u>

P18. 50 % EXCESS AIR, AFTER COLLECTOR

$$P18 = \frac{G14 + 18 * \frac{G7}{100 - G7}}{0.1826 * \%N_2 - 2.0592 * \%O_2 + G14 + 18 * \frac{G7}{100-G7}}$$

P19. 50 % EXCESS AIR, BEFORE COLLECTOR

$$P19 = \frac{G14 + 18 * \frac{G7}{100 - G7}}{0.1826 * \%N_2 - 2.0592 * \%O_2 + G14 + 18 * \frac{G8}{100 - G8}}$$

P20. MOISTURE BEFORE COLLECTOR

$$P20 = \frac{G14 + 18 * \frac{G7}{100 - G7}}{G14 + 18 * \frac{G8}{100-G8}}$$

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EMISSIONS CALCULATIONS

E1. CONCENTRATION AS PROPANE, ppm

E2. MOLECULAR WEIGHT OF PROPANE

E3. CONCENTRATION OF COMPOUND, mg/m3

$$E3 = \frac{E2.}{24.45} * E1.$$

E4. TOTAL HYDROCARBON EMISSION RATE, lbs/hr as propane

$$E4. = E3. * G14 * 6.24E\text{-}08 * 60$$

EXHAUST GAS CALCULATIONS

G1. STACK DIMENSIONS, inches

G2. AREA OF STACK, square feet

$$G2(ROUND) = \frac{3.14159 * \left(\frac{DIA}{2}\right)2}{144}$$

$$G2(RECT.) = \frac{WIDTH * LENGTH}{144}$$

G3. BAROMETRIC PRESSURE, inches of mercury

G4. STATIC PRESSURE IN STACK, inches of water

G5. STACK GAS TEMPERATURE, degrees F

G6. AVG. SQRT. VELOCITY PRESSURE OF POINTS SAMPLED

G7. PERCENT MOISTURE AT TEST LOCATION

$$G7 = 100 * \frac{P13}{P14}$$

G8. PERCENT MOISTURE BEFORE COLLECTOR

G9. DRY GAS COMPOSTION, $\%O_2$, $\%CO_2$, $\%CO$, $\%N_2$

G10. PERCENT EXCESS AIR AT TEST LOCATION

$$G10 = 100 * \frac{\%O_2 - 0.5 * \%CO}{0.264 * \%N_2 - \%O_2 + 0.5 * CO}$$

G11. DENSITY, DRY, @ STP, lbs./cu. ft.

$$G11 = \frac{0.827 * \%O_2 + 0.1137 * \%CO_2 + (\%CO + \%N_2) * 0.0724}{100}$$

G12. DENSITY, WET, @ STP, lbs./cu.ft.

$$G12 = G11 * \frac{100 - G7}{100} + 0.0465 * \frac{G7}{100}$$

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Particulate Sampling Train Calculations				
Client:	ME INTERNATIONAL			
Project No:	35310			
Date:	5/18/93			
Source	Shotblast			
Test No:	1	2	3	Averages
Pitot Tube Calibration Factor:	0.84	0.85	0.85	
Meter Calibration Factor:	0.989	0.989	0.989	
Stack Length:	0	0	0	
Stack Width:	0	0	0	
Stack Diameter:	45.5	45.5	45.5	
Nozzle Diameter, inches:	0.243	0.243	0.243	
Barometric Pressure, inches mercury:	29.91	29.91	29.91	
Static Pressure in Stack, Inches Water:	-0.1	-0.1	-0.1	
Duration of Sample, minutes	60	60	60	
Meter Leak Rate:	0.008	0.01	0.001	
Meter Start Volume:	273.923	322.593	376.343	
Meter Final Volume:	322.15	376.037	426.698	
Average Meter Pressure, Inches Water:	2.25	2.71	2.4	
Average Meter Temperature, degrees F:	58	61	62	
Average Sqrt. Velocity Pressure:	0.7694	0.8374	0.79195	0.8
Stack Gas Temperature, degrees F:	70.5	70.5	71	70.7
Percent Carbon Dioxide:	0	0	0	0
Percent Oxygen:	20.9	20.9	20.9	20.9
Percent Carbon Monoxide:	0	0	0	
Liquid Volume Collected, milliliters:	16.3	36.9	7.8	
Total Weight of Particulate, Milligrams:	29.96	27.34	30.19	

Sample Train Calculations				
Meter Volume, Actual:	48.227	53.444	50.355	
Meter Volume, STP:	49.055	54.109	50.846	
Volume of Water Vapor Condensed:	0.773	1.749	0.370	
Total Gas Sampled:	49.828	55.858	51.215	
Percent Moisture:	1.55	3.13	0.72	1.80
Area of Stack, Square Feet:	11.29	11.29	11.29	
Density Dry at STP:	0.0746	0.0746	0.0746	
Density Wet at STP:	0.0741	0.0737	0.0744	
Density Wet at Stack Cond:	0.0740	0.0736	0.0742	
Isokinetic, %	99.18	100.65	98.08	
Molecular Weight, lb/lb-Mole	28.84	28.84	28.84	

Velocity and Flow Calculations				
Average Stack Gas Velocity FPM:	2603.8	2876.3	2709.1	2729.7
Stack Gas Flow Rate, ACFM:	29401.0	32477.7	30589.5	30822.7
Stack Gas Velocity, SCFM:	29356.4	32428.4	30514.3	30766.4
Stack Gas Velocity, DSCFM:	28901.2	31413.0	30294.0	30202.8
Pounds of Gas Sampled, Dry	3.657	4.034	3.791	
Pounds of Gas Sampled, Wet	3.693	4.115	3.808	

Particulate Calculations:				
Grains Per DSCF:	0.0094	0.0078	0.0092	0.0088
LBS/1000 LBS GAS, ACTUAL	0.0179	0.0146	0.0175	0.0167
LBS/1000 LBS GAS, DRY	0.0179	0.0146	0.0175	0.0167
LBS/HR:	2.33	2.10	2.38	2.2692

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Condensible Particulate Sampling Train Calculations				
Client:	ME INTERNATIONAL			
Project No:	35310			
Date:	5/18/93			
Source	Shotblast			
Test No:	1	2	3	Averages
Pitot Tube Calibration Factor:	0.84	0.85	0.85	
Meter Calibration Factor:	0.989	0.989	0.989	
Stack Length:	0	0	0	
Stack Width:	0	0	0	
Stack Diameter:	45.5	45.5	45.5	
Nozzle Diameter, inches:	0.243	0.243	0.243	
Barometric Pressure, inches mercury:	29.91	29.91	29.91	
Static Pressure in Stack, Inches Water:	-0.1	-0.1	-0.1	
Duration of Sample, minutes	60	60	60	
Meter Leak Rate:	0.008	0.01	0.001	
Meter Start Volume:	273.923	322.593	376.343	
Meter Final Volume:	322.15	376.037	426.698	
Average Meter Pressure, Inches Water:	2.25	2.71	2.4	
Average Meter Temperature, degrees F:	58	61	62	
Average Sqrt. Velocity Pressure:	0.7694	0.8374	0.79195	0.8
Stack Gas Temperature, degrees F:	70.5	70.5	71	70.7
Percent Carbon Dioxide:	0	0	0	0
Percent Oxygen:	20.9	20.9	20.9	20.9
Percent Carbon Monoxide:	0	0	0	
Liquid Volume Collected, milliliters:	16.3	36.9	7.8	
Total Weight of Particulate, Milligrams:	0.5	0.5	0.5	

Sample Train Calculations				
Meter Volume, Actual:	48.227	53.444	50.355	
Meter Volume, STP:	49.055	54.109	50.846	
Volume of Water Vapor Condensed:	0.773	1.749	0.370	
Total Gas Sampled:	49.828	55.858	51.215	
Percent Moisture:	1.55	3.13	0.72	1.80
Area of Stack, Square Feet:	11.29	11.29	11.29	
Density Dry at STP:	0.0746	0.0746	0.0746	
Density Wet at STP:	0.0741	0.0737	0.0744	
Density Wet at Stack Cond:	0.0740	0.0736	0.0742	
Isokinetic, %	99.18	100.65	98.08	
Molecular Weight, lb/lb-Mole	28.84	28.84	28.84	

Velocity and Flow Calculations				
Average Stack Gas Velocity FPM:	2603.8	2876.3	2709.1	2729.7
Stack Gas Flow Rate, ACFM:	29401.0	32477.7	30589.5	30822.7
Stack Gas Velocity, SCFM:	29356.4	32428.4	30514.3	30766.4
Stack Gas Velocity, DSCFM:	28901.2	31413.0	30294.0	30202.8
Pounds of Gas Sampled, Dry	3.657	4.034	3.791	
Pounds of Gas Sampled, Wet	3.693	4.115	3.808	

Condensible Particulate Calculations: (calculated using the detection limit of <.5 mg, all values are less than values)				
Grains Per DSCF:	**0.0002**	**0.0001**	**0.0002**	**0.0002**
LBS/1000 LBS GAS, ACTUAL	**0.0003**	**0.0003**	**0.0003**	**0.0003**
LBS/1000 LBS GAS, DRY	**0.0003**	**0.0003**	**0.0003**	**0.0003**
LBS/HR:	**0.04**	**0.04**	**0.04**	**0.0389**

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Particulate Sampling Train Calculations				
Client:	ME INTERNATIONAL			
Project No:	35310			
Date:	5/19/93			
Source	Furnace Baghouse			
Test No:	1	2	3	Averages
Pitot Tube Calibration Factor:	0.84	0.84	0.84	
Meter Calibration Factor:	0.989	0.989	0.989	
Stack Length:	0	0	0	
Stack Width:	0	0	0	
Stack Diameter:	96	96	96	
Nozzle Diameter, inches:	0.24	0.24	0.24	
Barometric Pressure, inches mercury:	29.74	29.74	29.74	
Static Pressure in Stack, Inches Water:	-0.2	-0.2	-0.2	
Duration of Sample, minutes	60	60	60	
Meter Leak Rate:	0.003	0.015	0.001	
Meter Start Volume:	427.022	482.319	533.68	
Meter Final Volume:	481.823	533.05	588.01	
Average Meter Pressure, Inches Water:	3	2.75	3.09	
Average Meter Temperature, degrees F:	58	62.6	62.7	
Average Sqrt. Velocity Pressure:	0.898	0.867	0.91	0.9
Stack Gas Temperature, degrees F:	84.5	85	85	84.8
Percent Carbon Dioxide:	0	0	0	0
Percent Oxygen:	20.9	20.9	20.9	20.9
Percent Carbon Monoxide:	0	0	0	
Liquid Volume Collected, milliliters:	34.1	21	6.1	
Total Weight of Particulate, Milligrams:	7.5897	6.1937	6.7094	

Sample Train Calculations				
Meter Volume, Actual:	54.801	50.731	54.33	
Meter Volume, STP:	55.529	50.921	54.569	
Volume of Water Vapor Condensed:	1.616	0.995	0.289	
Total Gas Sampled:	57.145	51.917	54.858	
Percent Moisture:	2.83	1.92	0.53	1.76
Area of Stack, Square Feet:	50.27	50.27	50.27	
Density Dry at STP:	0.0746	0.0746	0.0746	
Density Wet at STP:	0.0738	0.0740	0.0744	
Density Wet at Stack Cond:	0.0713	0.0715	0.0719	
Isokinetic, %	101.27	95.51	96.40	
Molecular Weight, lb/lb-Mole	28.84	28.84	28.84	

Velocity and Flow Calculations				
Average Stack Gas Velocity FPM:	3095.5	2984.9	3124.7	3068.4
Stack Gas Flow Rate, ACFM:	155598.9	150036.7	157064.7	154233.4
Stack Gas Velocity, SCFM:	150471.3	144959.3	151749.4	149060.0
Stack Gas Velocity, DSCFM:	146215.3	142180.0	150949.6	146448.3
Pounds of Gas Sampled, Dry	4.140	3.796	4.068	
Pounds of Gas Sampled, Wet	4.215	3.843	4.082	

Particulate Calculations:				
Grains Per DSCF:	0.0021	0.0019	0.0019	0.0020
LBS/1000 LBS GAS, DRY	0.0040	0.0036	0.0036	0.0037
LBS/HR:	2.64	2.29	2.45	2.4598

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Condensible Particulate Sampling Train Calculations				
Client:	ME INTERNATIONAL			
Project No:	35310			
Date:	5/19/93			
Source	Furnace Baghouse			
Test No:	1	2	3	Averages
Pitot Tube Calibration Factor:	0.84	0.84	0.84	
Meter Calibration Factor:	0.989	0.989	0.989	
Stack Length:	0	0	0	
Stack Width:	0	0	0	
Stack Diameter:	96	96	96	
Nozzle Diameter, inches:	0.24	0.24	0.24	
Barometric Pressure, inches mercury:	29.74	29.74	29.74	
Static Pressure in Stack, Inches Water:	-0.2	-0.2	-0.2	
Duration of Sample, minutes	60	60	60	
Meter Leak Rate:	0.003	0.015	0.001	
Meter Start Volume:	427.022	482.319	533.68	
Meter Final Volume:	481.823	533.05	588.01	
Average Meter Pressure, Inches Water:	3	2.75	3.09	
Average Meter Temperature, degrees F:	58	62.6	62.7	
Average Sqrt. Velocity Pressure:	0.898	0.867	0.91	0.9
Stack Gas Temperature, degrees F:	84.5	85	85	84.8
Percent Carbon Dioxide:	0	0	0	0
Percent Oxygen:	20.9	20.9	20.9	20.9
Percent Carbon Monoxide:	0	0	0	
Liquid Volume Collected, milliliters:	34.1	21	6.1	
Total Weight of Particulate, Milligrams:	0.5	0.5	0.5	

Sample Train Calculations				
Meter Volume, Actual:	54.801	50.731	54.33	
Meter Volume, STP:	55.529	50.921	54.569	
Volume of Water Vapor Condensed:	1.616	0.995	0.289	
Total Gas Sampled:	57.145	51.917	54.858	
Percent Moisture:	2.83	1.92	0.53	1.76
Area of Stack, Square Feet:	50.27	50.27	50.27	
Density Dry at STP:	0.0746	0.0746	0.0746	
Density Wet at STP:	0.0738	0.0740	0.0744	
Density Wet at Stack Cond:	0.0713	0.0715	0.0719	
Isokinetic, %	101.27	95.51	96.40	
Molecular Weight, lb/lb-Mole	28.84	28.84	28.84	

Velocity and Flow Calculations				
Average Stack Gas Velocity FPM:	3095.5	2984.9	3124.7	3068.4
Stack Gas Flow Rate, ACFM:	155598.9	150036.7	157064.7	154233.4
Stack Gas Velocity, SCFM:	150471.3	144959.3	151749.4	149060.0
Stack Gas Velocity, DSCFM:	146215.3	142180.0	150949.6	146448.3
Pounds of Gas Sampled, Dry	4.140	3.796	4.068	
Pounds of Gas Sampled, Wet	4.215	3.843	4.082	

Condensible Particulate Calculations: (calculated using the detection limit of <.5 mg, all values are less than values)				
Grains Per DSCF:	**0.0001**	**0.0002**	**0.0001**	**0.0001**
LBS/1000 LBS GAS, DRY	**0.0003**	**0.0003**	**0.0003**	**0.0003**
LBS/HR:	**0.17**	**0.18**	**0.18**	**0.1804**

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Moisture/VOC Sampling Train Calculations				
Client:	ME INTERNATIONAL			
Project No:	35310			
Date:	5/18/93			
Source	Oil Quench			
Test No:	1	2	3	Averages
Pitot Tube Calibration Factor:	0.84	0.84	0.84	
Meter Calibration Factor:	1.00513	1.00513	1.00513	
Stack Length:	0	0	0	
Stack Width:	0	0	0	
Stack Diameter:	32	32	32	
Nozzle Diameter, inches:	0	0	0	
Barometric Pressure, inches mercury:	29.91	29.91	29.91	
Static Pressure in Stack, Inches Water:	0.43	0.16	0.16	
Duration of Sample, minutes	30	30	30	
Meter Leak Rate:	0	0	0	
Meter Start Volume:	777.71	777.71	777.71	
Meter Final Volume:	799.84	799.84	799.84	
Average Meter Pressure, Inches Water:	1.77	1.77	1.77	
Average Meter Temperature, degrees F:	71.4	71.4	71.4	
Average Sqrt. Velocity Pressure:	0.5483	0.5323	0.5444	0.5
Stack Gas Temperature, degrees F:	58	58	58	58.0
Percent Carbon Dioxide:	0	0	0	0
Percent Oxygen:	20.9	20.9	20.9	20.9
Percent Carbon Monoxide:	0	0	0	
Liquid Volume Collected, milliliters:	5.5	5.5	5.5	

Sample Train Calculations				
Meter Volume, Actual:	22.13	22.13	22.13	
Meter Volume, STP:	22.274	22.274	22.274	
Volume of Water Vapor Condensed:	0.261	0.261	0.261	
Total Gas Sampled:	22.535	22.535	22.535	
Percent Moisture:	1.16	1.16	1.16	1.16
Area of Stack, Square Feet:	5.59	5.59	5.59	
Density Dry at STP:	0.0746	0.0746	0.0746	
Density Wet at STP:	0.0742	0.0742	0.0742	
Density Wet at Stack Cond:	0.0760	0.0760	0.0760	
Molecular Weight, lb/lb-Mole	28.84	28.84	28.84	

Velocity and Flow Calculations				
Average Stack Gas Velocity FPM:	1831.0	1778.2	1818.6	1809.3
Stack Gas Flow Rate, ACFM:	10226.4	9931.2	10157.0	10104.9
Stack Gas Velocity, SCFM:	10470.6	10161.8	10392.8	10341.7
Stack Gas Velocity, DSCFM:	10349.5	10044.3	10272.6	10222.1
Pounds of Gas Sampled, Dry	1.661	1.661	1.661	
Pounds of Gas Sampled, Wet	1.673	1.673	1.673	

VOC Calculations:				
ppm as propane	10.7000	7.8000	13.9000	
LBS/HR:	0.75	0.53	0.96	0.75

Appendix D

Process Data

Production Summary During OPACITY MEASUREMENTS
Melting 6/11/93

Stack Testing Times

Test #1	Start - 9:44 am		Stop - 10:45 am	
" #2	"	11:04 am	"	12:04 pm
" #3	"	12:18 pm	"	1:18 pm

Whiting II, Heat # 5606
Power On - 6:00 am
Power Off - 9:50 am = Tap Time
Charge Wt = 24,666 lbs
Melting Time = 2 Hrs, 20 Min
Melting Rate = 5.29 Tons / Hr

Whiting I, Heat # 8679
Power On - 9:25 am
Power Off - 1:20 pm = Tap Time
Charge Wt = 24,590 lbs
Melting Time = 2 Hrs, 50 Min.
Melting Rate = 4.34 Tons / Hr

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MET
Project Number: 35310
Source: Furnace Bag House
Sampling Site: Outlet
Test Number: 1
Sample Type: M5-202

Pitot Tube I.D.: 9' Cp: .84
Probe Length.: 108" S.S.
Meter Box Number: HPEX-1
Meter Y Factor: 0.989
Meter K_{iso}:
Meter Factor: 1.81

Barometric Pressure: 29.74
Static Pressure: -0.2
Estimated Moisture: 3%
Nozzle Diameter: 0.24
Initial Leak Check: 0.005@11"
Final Leak Check: 0.003@9"

Date: 5-19-93 Page 1 of 2
Staff: BH, PK, GH
Stack Size: 96"
Orsat Leak Check Pre: -- Post: --
Pitot Leak Check Pre: ✓ Post: ✓
Filter Number(s): 0101

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
B	0	1214	427.022									
1	2.5		430.055	1.0	3.7	6	54	54	81		237	53
2	5.0		432.551	1.0	3.7	6	54	54	81		237	53
3	7.5		435.015	0.95	3.5	5	56	54	82		236	60
4	10.0		437.457	0.81	3.15	5	58	55	83		238	62
5	12.5		439.755	0.67	2.4	4	58	54	85		240	62
6	15.0		441.695	0.58	2.1	3	60	55	86		238	62
7	17.5		444.150	0.67	2.4	4	60	55	88		234	62
8	20.0		445.915	0.92	3.3	5	62	56	90		238	62
9	22.5		448.045	1.0	3.7	6	63	56	89		237	61
10	25.0		451.430	1.0	3.1	6	63	56	88		240	61
11	27.5		454.156	1.0	3.1	6	63	56	88		238	61
12	30.0	1244	455.912	0.59	3.2	5	64	57	87		236	64
	32.5											
	35.0											
	37.5											
	40.0											

Averages: volume = 54.8 ft³ √ΔP: .898 ΔH: 3.0 T_m: 58 T_s: 84.5 BH

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AVE ΔP = .82

MN-3
110

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MEI
Project Number: 35310
Source: Furnace Baghouse
Sampling Site: outlet
Test Number: 2 (1)
Sample Type: M5-202

Pitot Tube I.D.: 9' Cp: .84
Probe Length.: 108" S.S.
Meter Box Number: APEX-1
Meter Y Factor: 0.989
Meter K_{iso}:
Meter Factor: 1.81

Barometric Pressure: 29.74
Static Pressure: -0.2
Estimated Moisture: 3%
Nozzle Diameter: 0.24
Initial Leak Check: [illegible]
Final Leak Check: [illegible]

Date: 5-19-93 Page 2 of 2
Staff: BH, PK, GH
Stack Size: 96"
Orsat Leak Check Pre: — Post: —
Pitot Leak Check Pre: ✓ Post: ✓
Filter Number(s): 0101

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
A	20.0	1316	455.992									
1	32.5		457.582	0.58	2.1	3	56	57	81	80%	270	53
2	35.0		459.552	0.6	2.2	3	57	56	81		258	54
3	37.5		461.660	0.58	2.1	3	59	56	81		247	53
4	40.0		463.445	0.56	1.8	3	60	56	83		254	54
5	42.5		465.180	0.52	1.9	3	61	56	83		261	54
6	45.0		467.075	0.51	2.0	3	62	56	84		246	55
7	47.5		469.370	0.62	2.25	3	62	56	85		258	56
8	50.0		471.375	0.95	3.4	5	63	57	85		255	56
9	52.5		473.252	0.10	3.7	6	64	57	85		248	58
10	55.0		476.571	~~1.5~~ 1.1	4.0	6	64	57	85		245	55
11	57.5		479.055	1.1	4.0	7	64	57	84		254	61
12	60	1350	481.823	1.1	4.0	7	64	57	83		251	61

$\frac{\cancel{7}\ 284}{456}$
25

Averages: volume = 54.84 ft³ √ΔP: .848 ΔH: 3.0 T_m: 58 T_s: 84.5 [illegible]

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ave: ΔP = .82

MW-3
11

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MEI
Project Number: 35310
Source: Furnace Bag House
Sampling Site: outlet
Test Number: 2
Sample Type: M5-202

Pitot Tube I.D.: 9 C_p: .84
Probe Length.: 108" S.S.
Meter Box Number: APEX-1
Meter Y Factor: 0.98
Meter K_{iso}:
Meter Factor: 1.81

Barometric Pressure: 29.74
Static Pressure: -0.2
Estimated Moisture: 3%
Nozzle Diameter: 0.290
Initial Leak Check: 0.004@5"
Final Leak Check: 0.005@7"

Date: 5-19-93 Page 1 of 2
Staff: BH, [illegible]
Stack Size: 96"
Orsat Leak Check Pre: ___ Post: ___
Pitot Leak Check Pre: ___ Post: ___
Filter Number(s): 0100

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
	0	0140	482.319									
1	2.5			0.67	2.4	6	57	57	84		235	58
	5.0			0.7	2.65							
	7.5		485.44	.57	2.15	6	61	57	83		233	51
	10.0		490.48	.58	2.16	6	63	58	83		242	53
5	12.5		492.45	.56	2.07	6	64	58	83		244	54
6	15.0		494.43	.58	2.10	6	65	58	83		245	55
7	17.5		496.44	.66	2.47	6	65	58	83		251	55
8	20.0		498.50	.74	3.40	6	65	59	83		250	56
9	22.5		501.44	1.1	3.7	7	66	59	83		251	55
10	25.0		503.51	1.0	3.65	7	66	59	83		251	55
11	27.5		505.30	1.1	3.1	7	65	60	84		249	56
12	30.0	1433	508.40	.88	3.20	7	65	60	84		248	57
	32.5											
	35.0											
	37.5											
	40.0											

Averages: Volume ft^3 = 50.73 $\sqrt{\Delta P}$: .867 ΔH: 2.75 T_m: 62.6 T_s: 85.2 BH

Ave ΔP = .767

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112

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MET
Project Number: 35310
Source: Furnace Bag House
Sampling Site: Outlet
Test Number: # 1
Sample Type: M5-202

Pitot Tube I.D.: 9' Cp: .84
Probe Length.: 108" S.S.
Meter Box Number: APEX-1
Meter Y Factor: 0.989
Meter K_{iso}:
Meter Factor: 1.81

Barometric Pressure: 29.74
Static Pressure: -0.2
Estimated Moisture: 3%
Nozzle Diameter: 0.240
Initial Leak Check: 0.0[illegible] 2"
Final Leak Check: 0.015 @ 10

Date: 5-19-93 Page 2 of 2
Staff: BH, GH, GK
Stack Size: 96"
Orsat Leak Check Pre: ___ Post: ___
Pitot Leak Check Pre: ___ Post: ___
Filter Number(s): 0100

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
A	30.0	1444	508.46									
1	32.5		516.37	.61	2.16	5	64	59	88	86%	254	54
2	35.0		512.31	.59	2.15	5	65	59	88		254	53
3	37.5		514.44	.58	2.10	5	65	59	88		253	51
4	40.0		516.31	.51	1.89	5	67	61	85		252	51
5	42.5		518.01	.53	1.92	5	67	61	85		251	53
6	45.0		520.40	.53	1.92	5	68	62	85		250	52
7	47.5		522.31	.63	2.30	5	68	63	85		250	53
8	50.0		524.69	.89	3.20	6	68	62	86		255	57
9	52.5			1.1	3.85	6	68	62	85		253	57
10	55.0		528.38	1.0	3.70	6	68	63	86		254	56
11	57.5		531.00	1.1	3.85	7	67	61	86		254	56
12	60.0	1515	533.05	1.0	3.7	7	68	62	86		254	56

Averages: Volume ft³ = 50.73 √ΔP: .867 ΔH: 2.75 T_m: 62.6 T_s: 85

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AVE ΔP = .767

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WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MEI
Project Number: 35310
Source: Furnace Bag House
Sampling Site: Outlet
Test Number: 3
Sample Type: M5-202

Pitot Tube I.D.: 9' C_p: .84
Probe Length.: 108" S. S.
Meter Box Number: APEX-1
Meter Y Factor: 0.989
Meter K_{iso}:
Meter Factor: 1.81

Barometric Pressure: 29.74
Static Pressure: -0.2
Estimated Moisture: 3%
Nozzle Diameter: 0.24
Initial Leak Check: 0.001 @ 10"
Final Leak Check: 0.001 @ 4"

Date: 5-19-93 Page 1 of 2
Staff: BH, GH, PK
Stack Size: 96"
Orsat Leak Check Pre: — Post: —
Pitot Leak Check Pre: — Post: —
Filter Number(s): 0102

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filter Temp. (°F)	Impinger Temp. (°F)
A	0	4:30	533.68									
1	2.5		536.15	1.0	3.65	3	59	58	85	80%	242	53
2	5.0		538.25	1.0	3.65	3	63	58	85	80%	243	54
3	7.5		541.10	.98	3.6	3	64	58	85	80%	243	54
4	10.0		543.54	.80	2.40	3	65	58	85	80%	245	54
5	12.5		545.61	.75	2.85	3	65	58	85	80%	247	54
6	15.0		547.31	.69	2.50	3	65	58	85	80%	250	54
7	17.5		549.85	.70	2.65	3	65	58	85	80%	258	54
8	20.0		551.66	.85	3.15	3	65	58	85	80%	256	54
9	22.5		553.52	1.10	4.00	3	66	58	84	80%	253	54
10	25.0		556.38	1.0	3.8	3	67	58	84	80%	255	53
11	27.5		560.31	1.0	3.8	3	67	59	85	80%	256	57
12	30.0	5:00	562.15	1.0	3.8	4	67	60	84	80%	253	54

5
562
533
29

Averages: Volume ft^3 = 54.3 √ΔP: .91 ΔH: 3.69 T_m: 62.7 T_s: ~~84.8~~ 85

Ave: ΔP = .8.39

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MW-3

WW Engineering & Science, Inc.
Environmental Services Division

EMISSION TESTING DATA

Client: MEI
Project Number: 35310
Source: Furnace Baghouse
Sampling Site: outlet
Test Number: 3
Sample Type: M5-202

Pitot Tube I.D.: 9' C_p: .84
Probe Length.: 108" S.S.
Meter Box Number: APEX-1
Meter Y Factor: 0.989
Meter K_{iso}:
Meter Factor: 1.81

Barometric Pressure: 29.74
Static Pressure: -0.2
Estimated Moisture: 3%
Nozzle Diameter: 0.24
Initial Leak Check: 0.00 @ 4"
Final Leak Check: 0.001 @ 4"

Date: 5-19-93 Page 2 of 2
Staff: BH, GH, PK
Stack Size: 96"
Orsat Leak Check Pre: ___ Post: ___
Pitot Leak Check Pre: ___ Post: ___
Filter Number(s): 0102

Sample Point/Port	Test Time (minutes)	Time (24 Hr.)	Meter Volume	Pitot Tube ΔP	Orifice ΔH	Pump Vacuum	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp. (°F)	Probe Temp (°F)	Filler Temp. (°F)	Impinger Temp. (°F)
BM		5:08	562.33									
1	32.5		564.44	.60	2.2	2	64	60	85	80%	253	56
2	35.0		566.18	.63	2.5	2	66	60	85	80%	251	56
3	37.5		568.43	.60	2.18	2	67	60	85	80%	250	56
4	40.0		570.18	.53	1.98	2	68	60	84	80%	248	55
5	42.5		572.17	.56	2.00	2	68	60	85	80%	252	56
6	45.0		574.69	.66	2.40	2	68	61	85	80%	250	55
7	47.5		576.94	.60	2.20	2	67	60	85	80%	252	56
8	50.0		578.01	.88	3.19	2	68	60	85	80%	251	55
9	52.5		580.55	.98	3.5	2	68	61	85	80%	252	56
10	55.0		582.81	1.09	3.8	3	68	61	85	80%	250	56
11	57.5		585.34	1.05	3.8	4	68	61	85	80%	252	56
12	60.0	5:38	588.01	1.1	4.1	4	68	61	86	80%	253	56

Averages: Volume ft^3 = 54.3 $\sqrt{\Delta P}$: .91 ΔH: 3.08 T_m: 62.7 T_s: 85

Ave. ΔP = .839

Dnt.

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115

mN-3
152

EAF Dust Collection Stack Testing

Production Summary - 5/19/93

Whiting #1 Heat No. 8577

Power On - 11:55 AM
Power Off - 3:20 PM = Tap Time
Hold for Molds - 1:30pm - 2:25 pm
Charge Weight = 24,061 lbs
Total Melting Time = 2 hrs, 30 min
Melting Rate = 4.81 Tons / hr

Whiting #1 Heat No. 8578

Power On - 4:20 PM
Power Off - 6:55 PM = Tap Time
Hold for Molds - 5:40 pm - 6:15 pm
Charge Weight = 25,035 lbs
Total Melting Time = 2 hrs
Melting Rate = 6.26 Tons / hr

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EAF Summary Page 2

Whiting #2 Heat No. 5508

Power On - 10:40 AM
Power Off - 1:45 PM = Tap Time
Hold for Molds - None
Charge Weight = 24,214 lbs
Total Melting Time = 3 hrs, 5 min
Melting Rate = 3.93 Tons/hr

Whiting #2 Heat No. 5509

Power On - 1:05 PM
Power Off - 5:45 PM = Tap Time
Hold for Molds - 3:30 pm - 4:20 pm
Hold for W1 Tap - 2:25 pm - 3:30 pm
Charge Wt = 24,245 lbs
Total Melting Time = 2 hrs, 45 min
Melting Rate = 4.41 Tons/hr

MN-3
15

Air Emission Testing

Oil Quench 5/18/93

Batch #1
Quenched @ 10:25 AM
Hold Time 30 min
Part No. 17501918020 01
Qty 4 pcs @ 1,640 lbs ea
Tray - Rack Type @ 2,200 lbs

TOTAL 6560 lbs

Batch #2
Quenched @ 12:00 PM
Hold Time 20 min
Part No. 3500218 (St. Cloud)
Qty 3 pcs @ 575 lbs ea
Tray - Rack Type @ 2,200 lbs

total 1725 lbs

Batch # 3
Quenched @ 3:10 PM
Hold Time 30 min
Part No 17501918020 02
Qty 5 pcs @ 1,410 lbs ea
Tray - Rack Type @ 2,2,00 lbs

total 4,230 lbs

Air Emission Testing

Shotblast 5/18/93

Cycle Time - 3 min in blast cabinet
- 5 min between blasts

Ave. Wt. per Load - 2,060 lbs

~~Need Magnahelic Readings from May 18th~~

Magnahelic Readings for 5/18/93
Shotblast - 5
Oil Quench - 2

ARC FURNACE DUST COL. MAGNETICS

TIME OF	1	2	3	4	5	6	7	8	9	1
2:19	.8	7.0	4.5	5.3	6.1	20	8.8	5.0	5.8	7.5	5
12:30	.8	7.3	4.7	5.6	6.2	5.2	8.9	5.1	.8	7.5	5.2
[illegible]	.7	7.4	20	5.9	6.6	5.6	9	5.2	6.3	8	5.1
1:31	.9	7.4	4.2	5.2	6.6	5.6	3.9	4.5	5.7	8	4.5
[illegible]	.8	6.8	4.2	5.1	6.2	5.3	8.8	4.6	5.4	7.4	20
1:30	.8	6.9	4.5	20	6	5.2	8.8	4.8	5.7	7.4	4.9
1:45	.7	7.5	4.9	5.7	6.6	5.9	8.8	20	6.2	8.1	5.1
2:00	.8	7.3	4.7	5.5	6.7	6	8.8	4.9	6.1	8.2	5
2:16	.7	7.2	4.6	5.4	6.8	0	8.8	5	6	8.4	5
2:31	.7	7.1	4.5	5.3	6.5	5.8	8.8	4.7	5.8	7.5	5.1
2:45	.8	7.3	4.9	.1	7	6.4	8.8	5.1	6.2	8.5	5
3:00	.7	7.5	4.6	5.6	7	6.3	31	5.1	6.1	8.5	5
3:15	.7	7.1	4.4	5.1	6.6	5.8	8.6	4.6	5.6	8.1	5.2
3:30	.8	7.8	4.3	5	.8	5.9	8.8	4.8	5.6	8.0	5.1

(105)	1	2	3	4	5	6	7	8	9	10
3:45 .6	7	4.3	5.2	6.4	5.9	8.6	4.9	5.9	8.3	<0
400 .7	6.9	<0	5.3	6.5	5.9	8.8	4.8	5.8	8.2	4.9
415 .7	6.6	4.2	5.1	6.1	<0	8.6	4.5	5.3	7.8	4.
1:1 .7	68	44	5.1	6	5.4	8.7	4.7	5.6	28	5.1
7 75 .7	7	4.6	.2	5.8	6.5	8.8	4.8	5.7	7.8	5
7:00 .6	7	6.5	5.2	5.8	5.4	8.6	<0	5.7	7.6	5.1
7:15 .8	7	6.5	5.2	5.8	5.3	8.7	4.8	5.6	7.3	5.5
5:30 .8	7.2	4.8	8.6	0	5.8	8.5	5.2	6.0	7.8	5.4

Appendix E

QA/QC Data

WW ENGINEERING & SCIENCE
METER POST TEST CALIBRATION

Date: 12-Jun-93 Calibration Meter I.D.: REF Yds.: 1.0054 Barometric: 30.05

Meter Box Identification: apex 1 Calibrators Initials: BLB Approved By:

	Orifice Reading (H) in H20	Calibration Meter Gas Volume (Vds) ft3	Meter Box Meter Gas Volume (Vd) ft3	Temperature Calibration Mater Average (tds) F	Temperature Meter Bex Meter Average (td) F	Calibration Meter Pressure (p) in H2O	Time (O) min	Orfice Pressure Differential (H@)	Meter Box Meter Coefficient (Yd)	Kd
Stop	0.5	616.452	237.738	74	67.5	-0.2	15	1.66427	0.97899	0.13933
Start	0.5	612.254	231.449	74	69	-0.2				
Average:	0.5	6.198	6.3	74	68.25	-0.2				
Stop	1.0	624.071	243.405	74	69	-0.2	10	1.79837	0.98700	0.13398
Start	1.0	618.452	237.738	74	71	-0.2				
Average:	1.0	5.619	5.67	74	70	-0.2				
Stop	2.0	631.741	251.133	74	74	-0.2	10	1.93159	0.98974	0.12932
Start	2.0	624.071	243.405	74	70.5	-0.2				
Average:	2.0	7.67	7.73	74	72.25	-0.2				
Stop	3.0	641.126	260.58	73	77	-0.2	10	1.93103	0.99431	0.12926
Start	3.0	631.741	251.133	74	73	-0.2				
Average:	3.0	9.385	9.4	73.5	75	-0.2				
Stop	5.0	653.276	272.786	73	79	-0.2	10	1.92630	0.99704	0.12968
Start	5.0	641.126	260.58	73	76	-0.2				
Average:	5.0	12.15	12.21	73	77.5	-0.2				
							Average:	1.85031	0.98942	0.13232
									Kiso=	1565.054

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National Emission Standards for Hazardous Air Pollutants (NESHAP) for Iron and Steel Foundries - Background Information for Proposed Standards

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National Emission Standards for Hazardous Air Pollutants (NESHAP) for Iron and Steel Foundries-- Background Information for Proposed Standards

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APPENDIX F

SOURCE TEST PARTICULATE MATTER DATA FOR ELECTRIC ARC FURNACE BAGHOUSES

F.1 INTRODUCTION

This appendix presents the individual sampling run data for the source tests available to characterize the control performance for baghouses applied to EAF (Chapter 4). Summary test data are given in Table F-1 along with information on furnace melting rates and capacities and a description of the control systems and the processes they serve.

The data in Table F-1 represent a range of furnace sizes and types of baghouses. The design furnace melting rates range from 2.5 to 15 tons per hour, and ventilation rates range from 31,000 to 225,000 acfm. The baghouses include both negative and positive pressure operating modes and employ both shaker and pulse jet cleaning systems. Some were installed about 30 years ago, and some are relatively new (rebuilt). The design air-to-cloth ratios cover a range of 2.3 to 5.7 ft/min. No information is available on the ages of the bags in service when the tests were conducted.

The reported results were checked to ensure the weights of PM from the filter and the probe catch were above detection limits. When the reported catch was less than 3 mg, a detection limit value of 3 mg and the sample volume were used to estimate the detection limit in gr/dscf. Values calculated in this manner are reported as “less than” (<).

TABLE F-1. PM TEST RESULTS FOR BAGHOUSES SERVING EAF

Foundry IN-7 (tested December 1997)								
Run	PM loading (gr/dscf)	PM mass flow rate (lb/hr)	Flow rate (dscfm)	Flow rate (acfm)	Temp, (ºF)	Air-to-cloth ratio (ft/min)	Melt rate (tph)	Baghouse design and service data
1	0.0006	0.15	29,200				3.7	Negative pressure; shaker cleaning. Fabric: Dacron/cotton. Design gas flow rate: 31,200 acfm. Design operating temperature: 100 ºF. Design air-to-cloth ratio: 2.51 ft/min. Rebuilt 1985. Serves one EAF, 3.6 tons/hr design melt rate.
2	0.0004	0.11	32,100				3.7	
3	0.0005	0.13	30,300				3.1	
Average	0.0005	0.13	30,500				3.5	
Foundry IA-09 (tested August 1996)								
Run	PM loading (gr/dscf)	PM mass flow rate (lb/hr)	Flow rate (dscfm)	Flow rate (acfm)	Temp, (ºF)	Air-to-cloth ratio (ft/min)	Melt rate (tph)	Baghouse design and service data
1	0.00083	0.62	85,099	87,520	127	2.4	5.65	Positive pressure; shaker cleaning. Fabric: 10.5 oz. polyester. Design gas flow rate: 85,000 acfm Design operating temperature: 90 ºF. Design air-to-cloth ratio: 2.36 ft/min. Installed 1974. Serves two EAFs, 6.0 tons/hr design melt rate each, one holding furnace with 61 tons capacity, and one holding furnace with 40 tons capacity.
2	0.00063	0.47	85,200	87,030	129	2.4		
3	0.00041	0.29	79,414	81,406	126	2.3		
Average	0.00062	0.46	83,238	85,319	127	2.4		

Foundry IA-09 (tested July 2002)								
Run	PM loading (gr/dscf)	PM mass flow rate (lb/hr)	Flow rate (dscfm)	Flow rate (acfm)	Temp, (ºF)	Air-to-cloth ratio (ft/min)	Melt rate (tph)	Baghouse design and service data
1	0.0007	0.51	85,927	93,624	127	2.6	5.65	Positive pressure; shaker cleaning. Fabric: 10.5 oz. polyester. Design gas flow rate: 85,000 acfm Design operating temperature: 90 ºF. Design air-to-cloth ratio: 2.36 ft/min. Installed 1974. Serves two EAFs, 6.0 tons/hr design melt rate each, one holding furnace with 61 tons capacity, and one holding furnace with 40 tons capacity.
2	0.0007	0.50	83,992	89,854	117	2.5		
3	0.0006	0.42	80,727	86,978	121	2.4		
Average	0.00067	0.48	83,549	90,152	122	2.5		
Foundry IA-09 (tested May 1995)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0013	1.0	87,520				---	Positive pressure; shaker cleaning. Fabric: 10.5 oz. polyester. Design gas flow rate: 85,000 acfm Design operating temperature: 90 ºF. Design air-to-cloth ratio: 2.36 ft/min. Installed 1974. Serves two EAFs, 6.0 tons/hr design melt rate each, one holding furnace with 61 tons capacity, and one holding furnace with 40 tons capacity.
2	0.001	0.63	87,030				---	
3	0.00072	0.50	81,406				---	
Average	0.0010	0.71	85,319				5.65 total	

Foundry TX-19 (January 1995)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0030	1.18	46,100	51,000	114	2.34		Negative pressure; shaker cleaning. Fabric: 10.5 oz. seamless polyester. Design gas flow rate: 50,000 acfm. Design operating temperature: 250 ºF. Design air-to-cloth ratio: 2.30 ft/min. Serves two EAFs, 5 tons/hr design melt rate each.
2	<0.0013	<0.5	47,700	52,500	114	2.41		
3	<0.0013	<0.5	46,700	51,600	118	2.37		
Average	<0.002	<0.7	46,800	51,700	115	2.37		
Foundry AL-11 (tested September 1995)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0019	1.77	109,000	122,000	121	3.05	9.1, 9.4	Negative pressure; pulse jet cleaning. Fabric: 18 oz. polyester dual density felt. Design gas flow rate: 140,000 acfm. Design operating temperature: 200 ºF. Design air-to-cloth ratio: 3.50 ft/min. Rebuilt 1995. Serves two EAFS, 9.25 tons/hr design melt rate each.
2	0.0017	1.58	108,000	123,000	130	3.08	9.4, 9.5	
3	0.0009	0.87	113,000	127,000	126	3.18	9.1, 9.5	
Average	0.0015	1.41	110,000	124,000	126	3.10	9.2, 9.5	

Foundry MN-3 (tested May 1993)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0021	2.64	146,200	155,600	84	2.27	4.8, 3.9	Negative pressure; shaker cleaning. Fabric: polyester. Design gas flow rate: 180,000 acfm Design operating temperature: 100°F Design air-to-cloth ratio: 2.4 ft/min Installed 1980. Serves two EAFs, 4.3 tons/hr design melt rate each.
2	0.0019	2.29	142,200	150,000	85	2.19	4.8, 4.4	
3	0.0019	2.45	151,000	157,100	85	2.30	6.3, 4.4	
Average	0.0020	2.46	146,500	154,200	85	2.25	5.3, 4.2	
Foundry MI-09 (tested October 1996)								
Run	PM loading (gr/dscf)	PM mass flow rate (lb/hr)	Flow rate (dscfm)	Flow rate (acfm)	Temp, (ºF)	Air-to-cloth ratio (ft/min)	Melt rate (tph)	Baghouse design and service data
1	0.0044	1.03	26,702	31,467	144		12	Positive pressure; shaker cleaning. Fabric: Polyester. Design gas flow rate: 200,000 acfm. Design operating temperature: 170 ºF. Design air-to-cloth ratio: 2.33 ft/min. Built 1987. Serves three EAF, 15 tons/hr design melt rate.
2	0.0030	0.69	26,365	31,868	159			
3	0.0017	0.39	26,716	31,447	143			
4	0.0015	0.35	26,544	31,654	151			
Average	0.0027	0.62	26,582	31,609	149			

Foundry OH-1 (tested March 1994)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0025	4.45	208,000	234,000	96			Design gas flow rate: 225,000 acfm. Design operating temperature: 150 ºF. Design air-to-cloth ratio: Serves three EAFs, 13 tons/hr design melt rate each.
2	0.0030	5.26	205,000	230,000	103			
3	0.0025	4.42	206,000	230,000	102			
Average	0.0027	4.71	206,000	231,000	100			
Foundry OH-1 (tested May 1997)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0063							
2	0.0076							
3	0.0059							
Average	0.0066							

Foundry WI-45 (tested September 1990)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0033	1.97	33,550				2.07	Positive pressure; shaker cleaning. Fabric: polyester/cotton. Design gas flow rate: 35,000 Design operating temperature: 125 ºF. Design air-to-cloth ratio: 5.7 ft/min. Installed 1979. Serves one EAF, 2.5 tons/hr design melt rate and sand mulling.
2	0.0025	1.45	33,800				2.16	
3	0.0035	1.77	33,667				2.46	
Average	0.0031	1.73	33,700				2.23	
Foundry IA-17 (tested January 1995)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0069	5.35	82,000				8.3, 11.6	Negative pressure; shaker cleaning. Fabric: woven Dacron. Design gas flow rate: 120,383. Design operating temperature: 182 ºF. Design air-to-cloth ratio: 2.59 ft/min. Installed 1972. Serves two EAFs, 12 tons/hr design melt rate each.
2	0.0029	2.55	92,100				9.6, 14.1	
3	0.0035	2.68	85,200					
Average	0.0044	3.53	86,400					

Foundry PA-11 (tested November 1994)								
Run	PM loading, gr/dscf	PM mass flow rate, lb/hr	Flow rate, dscfm	Flow rate, acfm	Temp, ºF	Air-to-cloth ratio, ft/min	Melt rate (tph)	Baghouse design and service data
1	0.0058	4.9	99,000				15.1	Negative pressure; shaker cleaning. Fabric: polyester. Design gas flow rate: 120,000. Design operating temperature: 130 ºF. Design air-to-cloth ratio: 3.2 ft/min. Installed 1977. Serves one EAF, 15 tons/hr design melt rate.
2	0.0080	6.3	92,000				15.1	
3	0.0103	7.6	86,000				8.2	
Average	0.0080	6.3	92,000				12.8	

APPENDIX G

SOURCE TEST PARTICULATE MATTER DATA FOR POURING, COOLING AND SHAKEOUT