#36
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Louisiana-Pacific Corporation

Route 8, Box 8263
Hayward, Wisconsin 54843
715/634-3454

FILE COPY

March 18, 1993

ATTN: Robert Jorgenson
Air Pollution Control Spec.
Air Pollution Control Div.
CO Dept. of Health
4300 Cherry Creek Drive South
Denver, CO 80222

Dear Mr. Jorgenson,

Enclosed please find one copy of Interpoll Laboratories Report No. 3-8023 "Results of the January 25 - 29, 1993 Air Emission Compliance Tests at the Louisiana Pacific Waferboard Plant in Montrose, Colorado.

A review of these results indicates the the E-Tube wet electrostatic precipitator performed well within permit limits.

We were however greatly disappointed with the CO results which were higher than anticipated.

We would like to have the opportunity to discuss these results with the Division at your earliest convenience in order to establish a course of action to resolve the CO issue.

Sincerely,

S. M. Somers

Susan Somers
Environmental Coordinator

cc: Andy Loewi
Bert Krages
Jeff Schultz

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RESULTS OF THE JANUARY 25 - 29, 1993 AIR EMISSION COMPLIANCE TESTS AT THE LOUISIANA PACIFIC WAFERBOARD PLANT IN MONTROSE, COLORADO

Submitted to:

LOUISIANA PACIFIC CORPORATION
Route 8, Box 8263
Hayward, Wisconsin 54843

Attention:

Sue Somers

Approved by:

Kathleen Eckstadt (for)
Daniel J. Despen
Manager
Field Testing Division

Report Number 3-8023
March 31, 1993
KE/kce

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APPENDICES:

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (^{0}F)	degrees Fahrenheit
DIA.	diameter
FP	finished product for plant
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard cubic meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10^6BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
LTPD	long tons per day
MW	megawatt
mg/DSCM	milligrams per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
ohm-cm	ohm-centimeter
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
ug	micrograms
v/v	percent by volume
w/w	percent by weight
<	$\leq$ (when following a number)

Standard conditions are defined as 68 ^{0}F (20 ^{0}C) and 29.92 IN. of mercury pressure.

1 INTRODUCTION

During the Period January 25 - 29, 1993 Interpoll Laboratories personnel conducted air emission compliance tests on the Dryer and Press and Unloader Vents at the Louisiana Pacific Corporation (LP) Waferboard Plant located in Montrose, Colorado. On-site testing was performed by D. Van Hoever, E. Trowbridge, J. Bergstrom and R. Madison. Coordination between testing activities and plant operation was provided by Sue Somers of LP. The test was witnessed by Robert Jorgenson of the Colorado Department of Health, Air Pollution Control Division.

The Wafer Dryer tested is a Model 1260 TNW/L dryer manufactured by MEC Company. It is equipped with a pneumatic injection system for firing wood fines and has a design heat input capacity of 40 10^6BTU/HR. Particulate emissions from the Wafer Dryer are controlled by a primary cyclone followed by a secondary multicyclone also manufactured by MEC Company in series with an E-Tube wet electrostatic precipitator manufactured by Geoenergy, Inc. Cleaned flue gas is emitted to the atmosphere by a 103-foot high radial steel stack which has a diameter of 48 inches.

The press vents tested are the exhaust from general ventilators positioned over the board press and unloader. The press and unloader vent exhausts are emitted to the atmosphere via a common stack which has a diameter of 4'-11.5".

Particulate evaluations were performed in accordance with EPA Methods 2-5, CFR Title 40, Part 60, Appendix A (revised July 1, 1992). A preliminary determination of the gas linear velocity profile was made at each test location before the first particulate determination to allow selection of the appropriate nozzle diameter for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to isokinetically extract particulate samples by means of a heated glass-lined probe. Wet

catch samples were collected in the back half of the Method 5 sampling train and analyzed in accordance with EPA Method 202.

Formaldehyde samples were collected using EPA Method 0011 (SW 846 3rd Ed.). The samples were collected isokinetically using a Method 5 sampling train with an aqueous acidic 2,4-dinitrophenylhydrazine absorbing solution and analyzed by high performance liquid chromatography.

Total gaseous hydrocarbon concentrations were determined instrumentally using a Ratfisch Model RS55 heated flame ionization detector (HFID) calibrated against propane in air standards. The THC concentration was continuously monitored by extracting a slipstream of exhaust gas by means of a heated probe and filter holder. A heat-traced teflon line was used to transport the sample gas from the filter holder outlet to the analyzer inlet.

MDI concentrations were determined in accordance with Interpoll Laboratories Method II-8791 (ver 1.1), which is based on NIOSH Method P&CAM 347 (N-p-nitrobenzyl-N-propylamine impregnated filters with analysis of the reaction product by HPLC). Exhaust gas samples were collected in such a manner as to collect both gaseous and aerosol phase MDI. An Interpoll Labs sampling train was used to extract MDI samples by means of a non-heated stainless steel probe and an out-stack filter assembly.

Integrated flue gas samples were extracted simultaneously with each of the above-referenced sampling trains at the dryer test site using a specially designed gas sampling system. Integrated flue gas samples were collected in 44-liter Tedlar bags housed in a protective aluminum container. After sampling was complete, the bags were sealed and returned to the laboratory for Orsat analysis. Prior to sampling, the Tedlar bags are leak checked at 15 IN.HG. vacuum with an in-line rotameter. Bags with any detectable inleakage are discarded. The integrated flue gas samples were analyzed for carbon monoxide in accordance with EPA Method 10 (NDIR).

Testing on the Dryer was conducted from two test ports oriented at 90 degrees on the stack. These test ports are located 3.4 stack diameters downstream of the nearest flow disturbance and 10.5 stack diameters upstream of the stack exit. A 24-point traverse was used to collect the particulate and formaldehyde samples. Each traverse point was sampled three minutes for the particulate sampling for a total of 72 minutes per run and 2.5 minutes per point for the formaldehyde sampling to give a total sampling time of 60 minutes per run.

All of the testing on the Press Vent was conducted from two test ports oriented at 90 degrees on the stack. These test ports are located 3.2 diameters downstream of the nearest flow disturbance and 2.3 diameters upstream of the stack exit. A 24-point traverse was used to collect the particulate, formaldehyde and MDI samples. Each traverse point was sampled 2.5 minutes for a total sampling time of 60 minutes per run.

The important results of the test are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test are summarized in Tables 1 and 2. The particulate results have been calculated using the dry catch only ("a" Table) and again with the dry plus wet catch ("b" Table). As will be noted, the particulate emission rate averaged 2.69 LB/HR for the Dryer (dry catch only) and 1.95 LB/HR for the Press and Unloader Vent (dry catch only).

The carbon monoxide results are summarized in Table 3. The emission rate averaged 94 LB/HR for the Dryer. A summary of the formaldehyde results are presented in Table 4. The formaldehyde emission rate averaged 0.76 LB/HR for the Dryer and 0.94 LB/HR for the Press and Unloader Vent.

The results of the Total Hydrocarbons tests are summarized in Table 5. The total hydrocarbon emission rate averaged 38 LB/HR for the Dryer 4.3 LB/HR for the Press Vent and Unloader Vent.

A summary of the MDI results for the Press and Unloader Vent are presented in Table 6. The MDI emission rate averaged 0.028 LB/HR.

No difficulties were encountered in the field by Interpoll Labs or in the laboratory evaluation of the samples which were conducted by Interpoll Labs. On the basis of these facts and a complete review of the data and results, it is our opinion that the results reported herein are accurate and closely reflect the actual values which existed at the time the test was performed.

Table 1a. Summary of the Results of the January 27, 1993 Particulate Emission Test on the Dryer Stack at the Louisiana Pacific Plant in Montrose, Colorado.

ITEM		Run 1	Run 2	Run 3
Date of test		01-27-93	01-27-93	01-27-93
Time runs were done	(HRS)	840/ 955	1035/1149	1225/1338
Process rate	(TON /HR)	10.79	10.79	10.79
Volumetric flow				
actual	(ACFM)	54812	54978	54321
standard	(DSCFM)	32022	32314	31723
Gas temperature	(DEG-F)	136	135	136
Moisture content	(%V/V)	21.09	20.70	21.11
Gas composition	(%V/V,dry)			
carbon dioxide		3.10	3.10	3.00
oxygen		17.60	17.60	17.70
nitrogen		79.30	79.30	79.30
Isokinetic variation	(%)	98.6	99.4	99.8
Particulate concentration				
actual	(GR/ACF)	.00596	.00534	.00589
standard	(GR/DSCF)	.0102	.00908	.0101
Part. emission rate	(LB/HR)	2.80	2.52	2.74
Part. emission factor	(LB/TON FP)	.26	.23	.25

Note: Dry Catch Only

Table 1b. Summary of the Results of the January 27, 1993 Particulate Emission Test on the Dryer Stack at the Louisiana Pacific Plant in Montrose, Colorado.

ITEM		Run 1	Run 2	Run 3
Date of test		01-27-93	01-27-93	01-27-93
Time runs were done	(HRS)	840/ 955	1035/1149	1225/1338
Process rate	(TON/HR)	10.79	10.79	10.79
Volumetric flow				
actual	(ACFM)	54812	54978	54321
standard	(DSCFM)	32022	32314	31723
Gas temperature	(DEG-F)	136	135	136
Moisture content	(%V/V)	21.09	20.70	21.11
Gas composition	(%V/V,dry)			
carbon dioxide		3.10	3.10	3.00
oxygen		17.60	17.60	17.70
nitrogen		79.30	79.30	79.30
Isokinetic variation	(%)	98.6	99.4	99.8
Particulate concentration				
actual	(GR/ACF)	.0136	.0136	.0131
standard	(GR/DSCF)	.0233	.0231	.0225
Part. emission rate	(LB/HR)	6.39	6.39	6.11
Part emission factor	(LB/TON FP)	.59	.59	.57

Note: Dry + Organic Wet Catch

Table 2a. Summary of the Results of the January 28, 1993 Particulate Emission Test on the Press & Unloading Vent Stack at the Louisiana Pacific Plant in Montrose, Colorado.

ITEM	Run 1	Run 2	Run 3
Date of test	01-28-93	01-28-93	01-28-93
Time runs were done (HRS)	940/1041	1128/1231	1305/1415
Process rate (TON/HR)	11.64	11.64	11.64
Volumetric flow			
actual (ACFM)	100360	100162	100061
standard (DSCFM)	81713	80637	79764
Gas temperature (DEG-F)	72	78	82
Moisture content (%V/V)	0.97	0.99	1.19
Gas composition (%V/V,dry)			
carbon dioxide	0.03	0.03	0.03
oxygen	20.90	20.90	20.90
nitrogen	79.07	79.07	79.07
Isokinetic variation (%)	99.9	99.7	100.4
Particulate concentration			
actual (GR/ACF)	.00235	.00223	.00224
standard (GR/DSCF)	.00289	.00277	.00282
Part. emission rate (LB/HR)	2.02	1.92	1.92
Part. emission factor (LB/TON FP)	.17	.16	.16

Note: Dry Catch Only

Table 2b. Summary of the Results of the January 28, 1993 Particulate Emission Test on the Press & Unloading Vent Stack at the Louisiana Pacific Plant in Montrose, Colorado.

ITEM		Run 1	Run 2	Run 3
Date of test		01-28-93	01-28-93	01-28-93
Time runs were done	(HRS)	940/1041	1128/1231	1305/1415
Process rate	(TON/HR)	11.64	11.64	11.64
Volumetric flow				
actual	(ACFM)	100360	100162	100061
standard	(DSCFM)	81713	80637	79764
Gas temperature	(DEG-F)	72	78	82
Moisture content	(%V/V)	0.97	0.99	1.19
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	99.9	99.7	100.4
Particulate concentration				
actual	(GR/ACF)	.00358	.00341	.00347
standard	(GR/DSCF)	.00440	.00424	.00435
Part. emission rate	(LB/HR)	3.08	2.93	2.98
Part. emission factor	(LB/TON FP)	.26	.25	.26

Note: Dry + Organic Wet Catch

Table 3. Summary of the January 27, 1993 **Carbon Monoxide** Emission Compliance Test on the Dryer at the Louisiana Pacific Waferboard Plant in Montrose, Colorado.

Test/Run	Concentration (ppm,d)	Emission Rate (LB/HR)	(LB/TFP)
2/1	666	93	8.61
2/2	641	90	8.34
2/3	713	99	9.18
Avg.	673	94	8.71

TFP = Ton Finished Product (10.79/HR 1/27/93)

Table 4. Summary of the Formaldehyde Emission Compliance Tests at the Louisiana Pacific Waferboard Plant in Montrose, Colorado.

Test/Run	Concentration (ppm,d)	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
(Dryer 1/26/93)			
1/1	4.4	0.66	0.064
1/2	4.6	0.69	0.067
1/3	6.1	0.92	0.089
Avg.	5.0	0.76	0.073
(Press & Unloader Vent 1/29/93)			
7/1	2.4	0.93	0.084
7/2	2.6	0.98	0.088
7/3	2.4	0.91	0.082
Avg.	2.5	0.94	0.085

TFP = Ton Finished Product (10.31/HR 1/26/93, 11.08/HR 1/29/93)

Table 5. Summary of the Results of the **Total Hydrocarbon** Determinations on the Dryer and Press & Unloader Vent at the Louisiana Pacific Waferboard Plant Located in Montrose, Colorado.

Test/Run	Time (HRS)	Concentration (ppmC,w)	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
(Dryer 1/27/93)				
3/1	1500-1600	600	45.5	4.21
3/2	1825-1924	396	30.2	2.79
3/3	2000-2100	377	28.3	2.62
Average		458	38.2	3.21
(Press & Unloader 1/28/93)				
6/1	1632-1732	35.1	5.41	0.46
6/2	1743-1844	24.9	3.79	0.32
6/3	1852-1957	24.2	3.65	0.31
Average		28.1	4.28	0.36

TFP = Ton Finished Product (10.79/HR 1/27/93, 11.64/HR 1/28/93)

Table 6. Summary of the January 28, 1993 MDI Emission Compliance Test on the Press & Unloader Vent at the Louisiana Pacific Waferboard Plant in Montrose, Colorado.

Test/Run	Concentration (ppm,d)	Emission Rate (LB/HR)	(LB/TFP)
5/1	.0087	.027	0.0023
5/2	.0086	.027	0.0023
5/3	.0091	.029	0.0025
Avg.	.0088	.028	0.0024

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition (orsat and moisture) are presented first followed by the computer printout of the particulate, carbon monoxide, formaldehyde and MDI results. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on a personal computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs. The emission rates have been calculated using the product of the concentration times flow method.

3.1 Results of Orsat and Moisture Determinations

Test No. 1
Dryer Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 01-25-93	Run 2 01-25-93	Run 3 01-25-93
Dry basis (orsat)			
carbon dioxide.....	3.20	3.10	3.00
oxygen.....	17.50	17.60	17.70
nitrogen.....	79.30	79.30	79.30
Wet basis (orsat)			
carbon dioxide.....	2.51	2.43	2.38
oxygen.....	13.71	13.82	14.05
nitrogen.....	62.13	62.27	62.95
water vapor.....	21.66*	21.47*	20.62*
Dry molecular weight.....	29.21	29.20	29.19
Wet molecular weight.....	26.78	26.80	26.88
Specific gravity.....	0.925	0.926	0.929

* Free or condensed water in the gas stream.

FO	1.062	1.065	1.067

Test No. 2
Dryer Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

	Run 1	Run 2	Run 3
Date of run	01-27-93	01-27-93	01-27-93
Dry basis (orsat)			
carbon dioxide.....	3.10	3.10	3.00
oxygen.....	17.60	17.60	17.70
nitrogen.....	79.30	79.30	79.30
Wet basis (orsat)			
carbon dioxide.....	2.45	2.46	2.37
oxygen.....	13.89	13.96	13.96
nitrogen.....	62.58	62.88	62.56
water vapor.....	21.09*	20.70*	21.11*
Dry molecular weight.....	29.20	29.20	29.19
Wet molecular weight.....	26.84	26.88	26.83
Specific gravity.....	0.927	0.929	0.927
Water mass flow.....(LB/HR)	27070	25994	25662

* Free or condensed water in the gas stream.

FO	1.065	1.065	1.067

Test No. 4
Press & Unloading Vent Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

	Run 1	Run 2	Run 3
Date of run	01-28-93	01-28-93	01-28-93
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.70	20.69	20.65
nitrogen.....	78.30	78.29	78.13
water vapor.....	0.97	0.99	1.19
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.74	28.73	28.71
Specific gravity.....	0.993	0.993	0.992
Water mass flow.....(LB/HR)	2249	2253	2686

Test No. 5
Press & Unloading Vent Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

	Run 1	Run 2	Run 3
Date of run	01-28-93	01-28-93	01-28-93
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.80	20.76	20.78
nitrogen.....	78.68	78.53	78.62
water vapor.....	0.49	0.68	0.57
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.79	28.77	28.78
Specific gravity.....	0.994	0.994	0.994

Test No. 7
Press & Unloading Vent Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

	Run 1	Run 2	Run 3
Date of run	01-29-93	01-29-93	01-29-93
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.72	20.72	20.74
nitrogen.....	78.38	78.37	78.45
water vapor.....	0.87	0.89	0.79
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.75	28.74	28.76
Specific gravity.....	0.993	0.993	0.993

3.2 Results of Particulate Determinations

Test No. 2
Dryer Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	01-27-93	01-27-93	01-27-93
Time run start/end.....(HRS)	840/ 955	1035/1149	1225/1338
Static pressure.....(IN.WC)	0.31	0.31	0.31
Cross sectional area (SQ.FT)	12.44	12.44	12.44
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	213.0	207.0	205.0
desiccant.....(GRAMS)	12.0	11.0	11.0
total.....(GRAMS)	225.0	218.0	216.0
Total particulate material..			
.....collected(grams)	0.0531	0.0536	0.0514
Gas meter coefficient.....	1.0073	1.0073	1.0073
Barometric pressure..(IN.HG)	24.97	24.97	24.97
Avg. orif.pres.drop..(IN.WC)	0.97	1.02	1.00
Avg. gas meter temp..(DEF-F)	56.6	62.6	69.6
Volume through gas meter....			
at meter conditions...(CF)	40.87	42.09	42.03
standard conditions.(DSCF)	35.20	35.84	35.32
Total sampling time....(MIN)	72.00	72.00	72.00
Nozzle diameter.....(IN)	.188	.188	.188
Avg.stack gas temp ..(DEG-F)	136	135	136
Volumetric flow rate.....			
actual.....(ACFM)	54812	54978	54321
dry standard.....(DSCFM)	32022	32314	31723
Isokinetic variation.....(%)	98.6	99.4	99.8
Particulate concentration...			
actual.....(GR/ACF)	0.01359	0.01356	0.01311
dry standard.....(GR/DSCF)	0.02328	0.02308	0.02246
Particle mass rate...(LB/HR)	6.388	6.391	6.107

Test No. 4
Press & Unloading Vent Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	01-28-93	01-28-93	01-28-93
Time run start/end.....(HRS)	940/1041	1128/1231	1305/1415
Static pressure.....(IN.WC)	-0.98	-0.98	-0.98
Cross sectional area (SQ.FT)	19.63	19.63	19.63
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	3.0	2.0	4.0
desiccant.....(GRAMS)	7.0	8.0	8.0
total.....(GRAMS)	10.0	10.0	12.0
Total particulate material..			
.....collected(grams)	0.0137	0.0130	0.0133
Gas meter coefficient.....	1.0051	1.0051	1.0051
Barometric pressure..(IN.HG)	24.87	24.87	24.87
Avg. orif.pres.drop..(IN.WC)	2.55	2.51	2.49
Avg. gas meter temp..(DEF-F)	77.2	85.7	87.8
Volume through gas meter....			
at meter conditions...(CF)	58.11	58.15	58.13
standard conditions.(DSCF)	48.06	47.34	47.14
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.188	.188	.188
Avg.stack gas temp ..(DEG-F)	72	78	82
Volumetric flow rate.....			
actual.....(ACFM)	100360	100162	100061
dry standard.....(DSCFM)	81713	80637	79764
Isokinetic variation.....(%)	99.9	99.7	100.4
Particulate concentration...			
actual.....(GR/ACF)	0.00358	0.00341	0.00347
dry standard.....(GR/DSCF)	0.00440	0.00424	0.00435
Particle mass rate...(LB/HR)	3.081	2.929	2.977

3.3 Results of Carbon Monoxide Determinations

Test No. 2
Dryer Stack

Results of CO Determinations ----------Method 10

	Run 1	Run 2	Run 3
Date of run	01-27-93	01-27-93	01-27-93
Time run start/end.....(HRS)	0840-0955	1035-1149	1225-1338
Total sampling time....(MIN)	72.0	72.0	72.0
Moisture content.....(%V/V)	21.09	20.70	21.11
O2 Concentration.....(%V/V)	17.60	17.60	17.70
Volumetric flow rate (DSCFM)	32022	32314	31723
CO concentration.....			
(GR/DSCF).....	0.3389	0.3262	0.3628
(MG/DSCM).....	775.89	746.76	830.64
(PPM-WET).....	525.54	508.31	562.49
(PPM-DRY).....	666.00	641.00	713.00
(PPM-DRY @ 7% O2).....	2742.	2639.	3024.
CO emission rate.....(LB/HR)	93.013	90.338	98.647

CO = Carbon monoxide

A trailing '<' symbol indicates that the true value is less than or equal to the reported value

3.4 Results of Formaldehyde Determinations

Test No. 1
Dryer Stack

Results of Formaldehyde Tests ---------- EPA Method 0011

	Run 1	Run 2	Run 3
Date of run	01-25-93	01-25-93	01-25-93
Time run start/end.....(HRS)	1040/1142	1300/1402	1505/1609
Static pressure.....(IN.WC)	0.31	0.31	0.31
Cross sectional area (SQ.FT)	12.44	12.44	12.44
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	284.0	280.0	282.0
desiccant.....(GRAMS)	22.0	20.0	19.0
total.....(GRAMS)	306.0	300.0	301.0
Formaldehyde in sample..(uG)	7900	8100	11000
Gas meter coefficient.....	1.0073	1.0073	1.0096
Barometric pressure..(IN.HG)	25.12	25.12	25.12
Avg. orif.pres.drop..(IN.WC)	2.83	2.82	3.02
Avg. gas meter temp..(DEF-F)	44.3	63.6	70.0
Volume through gas meter....			
at meter conditions...(CF)	57.17	57.89	60.44
standard conditions.(DSCF)	51.02	49.76	51.47
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.247	.247	.247
Avg.stack gas temp ..(DEG-F)	137	137	135
Volumetric flow rate.....			
actual.....(ACFM)	54786	54265	54518
dry standard.....(DSCFM)	31900	31689	32264
Isokinetic variation.....(%)	99.7	97.9	99.4
CH2O concentration.....			
(GR/DSCF).....	0.0024	0.0025	0.0033
(MG/DSCM).....	5.52	5.80	7.62
(PPM-DRY).....	4.42	4.64	6.10
(PPM-WET).....	3.46	3.65	4.84
CH2O emission rate...(LB/HR)	0.65843	0.68764	0.91969

CH2O = Formaldehyde

A trailing '<' symbol indicates that the true value is less than or equal to the reported value

Test No. 7
Press & Unloading Vent Stack

Results of Formaldehyde Tests ---------- EPA Method 0011

	Run 1	Run 2	Run 3
Date of run	01-29-93	01-29-93	01-29-93
Time run start/end.....(HRS)	822/ 923	1004/1106	1143/1248
Static pressure.....(IN.WC)	-1.00	-1.00	-1.00
Cross sectional area (SQ.FT)	19.63	19.63	19.63
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	1.0	0.0	3.0
desiccant.....(GRAMS)	8.0	9.0	5.0
total.....(GRAMS)	9.0	9.0	8.0
Formaldehyde in sample..(uG)	4100	4400	4000
Gas meter coefficient.....	1.0051	1.0051	1.0051
Barometric pressure..(IN.HG)	24.86	24.86	24.86
Avg. orif.pres.drop..(IN.WC)	2.54	2.45	2.52
Avg. gas meter temp..(DEF-F)	76.1	81.9	85.1
Volume through gas meter....			
at meter conditions...(CF)	58.10	58.00	58.25
standard conditions.(DSCF)	48.13	47.52	47.45
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.188	.188	.188
Avg.stack gas temp ..(DEG-F)	69	77	78
Volumetric flow rate.....			
actual.....(ACFM)	99953	98720	100163
dry standard.....(DSCFM)	81867	79768	80761
Isokinetic variation.....(%)	99.9	101.2	99.8
CH2O concentration.....			
(GR/DSCF).....	0.0013	0.0014	0.0013
(MG/DSCM).....	3.03	3.29	3.00
(PPM-DRY).....	2.43	2.64	2.40
(PPM-WET).....	2.41	2.62	2.38
CH2O emission rate...(LB/HR)	0.92897	0.98358	0.90673

CH2O = Formaldehyde

A trailing '<' symbol indicates that the true value is less than or equal to the reported value

3.5 Results of MDI Determinations

Test No. 5
Press & Unloading Vent Stack

Results of MDI Determinations----------

	Run 1	Run 2	Run 3
Date of run	01-28-93	01-28-93	01-28-93
Time run start/end.....(HRS)	1600/1709	1741/1844	735/2038
Static pressure.....(IN.WC)	-0.98	-0.98	-0.98
Cross sectional area (SQ.FT)	19.63	19.63	19.63
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	0.0	0.0	0.0
desiccant.....(GRAMS)	5.0	7.0	6.0
total.....(GRAMS)	5.0	7.0	6.0
MDI in sample..... (UG)	120	120	130
Gas meter coefficient.....	1.0051	1.0051	1.0051
Barometric pressure..(IN.HG)	24.87	24.87	24.87
Avg. orif.pres.drop..(IN.WC)	2.59	2.62	2.73
Avg. gas meter temp..(DEF-F)	90.6	92.8	86.9
Volume through gas meter....			
at meter conditions...(CF)	59.32	59.80	60.88
standard conditions.(DSCF)	47.87	48.07	49.48
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.188	.188	.188
Avg.stack gas temp ..(DEG-F)	83	78	73
Volumetric flow rate.....			
actual.....(ACFM)	101731	101402	103015
dry standard.....(DSCFM)	81659	81886	84078
Isokinetic variation.....(%)	99.6	99.7	100.0
MDI Concentration..... (PPM DRY)	8.66	8.63	9.08
MDI Emission Rate.....(LB/HR)	.027	.027	.029

APPENDIX A

RESULTS OF VOLUMETRIC FLOW RATE DETERMINATIONS

Test No. 1
Dryer Stack

Results of Volumetric Flow Rate Determination--------Method 2

Date of Determination.....	01-25-93
Time of Determination.....(HRS)	935
Barometric pressure.....(IN.HG)	25.17
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	47.75
Duct area.....(SQ.FT)	12.44
Direction of flow.....	UP
Static pressure.....(IN.WC)	.31
Avg. gas temp.....(DEG-F)	138
Moisture content.....(% V/V)	21.66
Avg. linear velocity.....(FT/SEC)	73.2
Gas density.....(LB/ACF)	.05171
Molecular weight.....(LB/LBMOLE)	29.21
Mass flow of gas.....(LB/HR)	169494
Volumetric flow rate.....	
actual.....(ACFM)	54630
dry standard.....(DSCFM)	31819

APPENDIX B

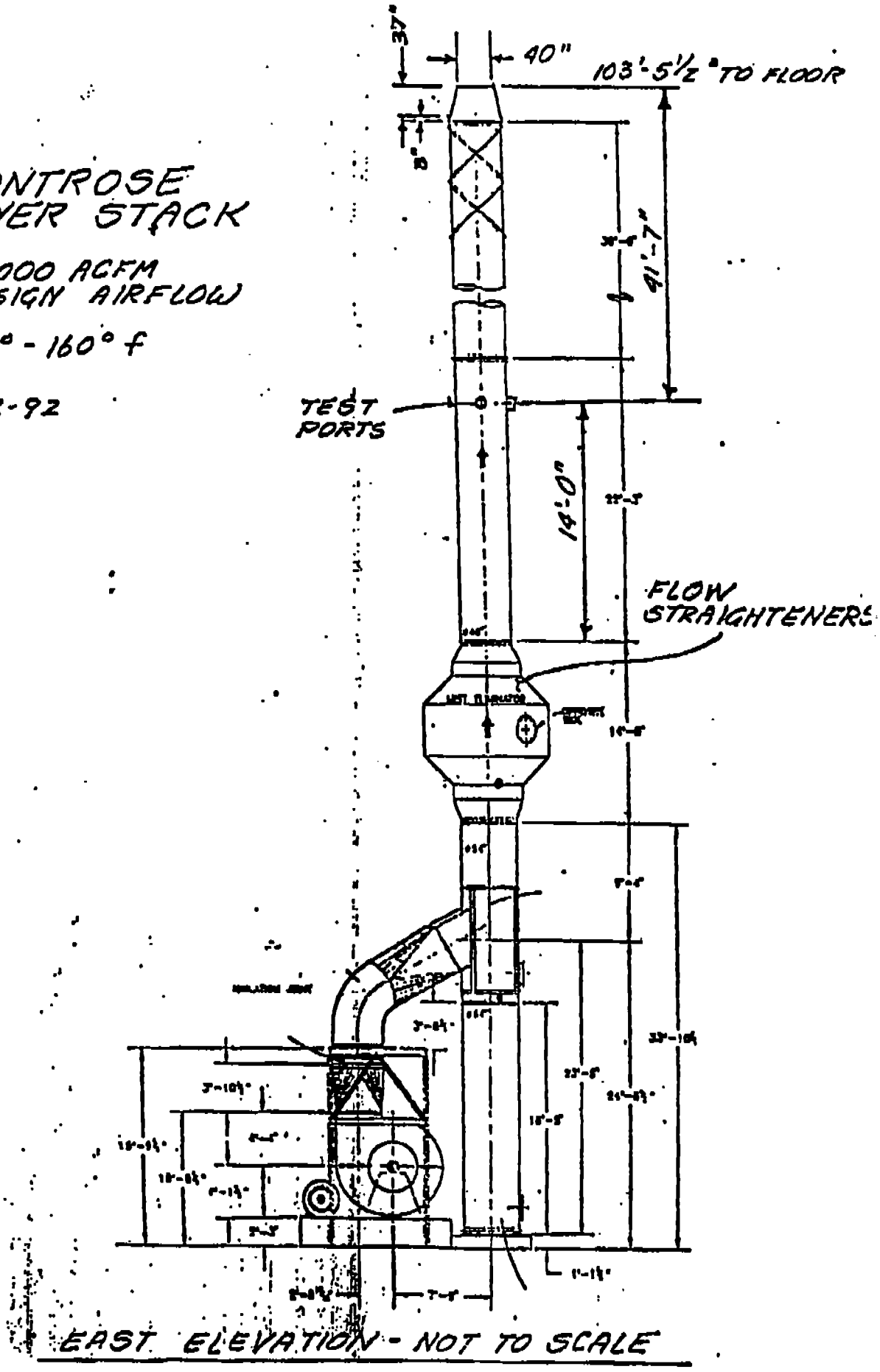
LOCATION OF TEST PORTS

MONTROSE DRYER STACK

60,000 ACFM
DESIGN AIRFLOW

140° - 160° f

12-2-92



EAST ELEVATION - NOT TO SCALE

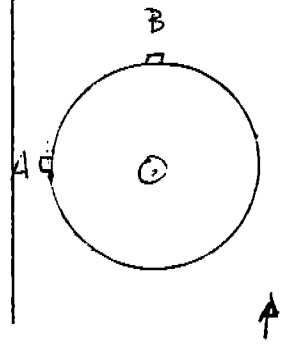
APPENDIX C

DRYER FIELD DATA SHEETS

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.F. / MONTROSE
Source DRYER STACK
Test 2 Run 0 Date 1/27/93
Stack dimen. 47.75 IN.
Dry bulb ____ °F Wet bulb ____ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 24.97 in Hg
Static pressure 31 in WC
Operators (1) VAN Hoover + T. Bergstrom
Pitot No. V23-6 C_p .84
Particulate

Cross-section View | Elevation View



Drawing of Test Site

Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 6 in.		Time start:	hrs
A 1	.021	1.0	7.		
2	.067	3.20	9.20		
3	.118	5.63	11.63		
4	.177	8.45	14.45		
5	.25	11.93	17.93		
6	.356	16.99	23		
7	.644	30.75	36.75		
8	.750	35.81	41.81		
9	.823	39.3	45.3		
10	.882	42.12	48.12		
11	.933	44.55	50.55		
12	.979	46.74	52.74		
B 1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Temp. meas. device & S/N:				Time end:	hrs

R or nothing = reg. manometer; S= expanded; E=electronic

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.F. / MONTROSE Date 1/27/93 Test 2 Run 1
Source DRYER STACK No. of traverse points 24
Method 5 Filter holder: GLASS Filter type: glass fiber

Sample Train Leak Check:

Pretest: ☐ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 6.5 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 4984

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: DLH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		3200	
Impinger No. 2	413		213
Impinger No. 3			
Condenser			
Desiccant	1242	1230	12
Total			225

Integrated Gas Sampling Data:

Bag Pump No. 23A Box No. 30 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 0845 (HRS) Time end: 0955 (HRS)
Sampling rate: 400 cc/min Operator: DLH
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: LP / MONTROSE
Source: DRYER STACK
Date: 1/27/93 Test 2 Run 1

Operators: DW + J.B
Meter Box No.: 8 ΔH@ 1.96 IN WC
Gasmeter coeff.: 1.0073

Pitot No.: V23-6 Cp .84
Bar. Press.: 24.97 inHg H2O 12 x
Nozzle No.: 1-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (xv/v)
	0840	792.52											
A 12	3	795.27	1.30	1.06	5.28	2.5	137	254	251	40	51	50	
11	6	797.06	1.40	1.14	7.12	2.5	137				52	50	
10	9	798.92	1.40	1.14	8.95	2.5	138				54	51	
9	12	800.77	1.35	1.10	0.76	2.5	138	257	253	40	56	52	
8	15	802.61	1.30	1.07	2.54	2.5	136				57	52	
7	18	804.37	1.15	.95	4.22	2	136				58	53	
6	21	805.75	1.05	.82	5.79	2	136	254	257	41	58	53	
5	24	807.40	1.10	.91	7.43	2	135				58	53	
4	27	809.11	1.15	.95	9.12	2	135				60	54	
3	30	810.85	1.15	.95	0.80	2	137	256	253	41	60	54	
2	33	812.51	1.15	.95	2.49	2	136				60	54	
1	36	814.04	.96	.80	4.03	2	135				60	54	
B 12	39	815.80	1.15	.95	5.72	2	135	258	254	40	58	55	
11	42	817.59	1.25	1.03	7.48	2	136				60	55	
10	45	819.26	1.25	1.04	9.24	2	134				60	55	
9	48	821.02	1.25	1.04	1.00	2	137	260	251	40	61	55	
8	51	822.80	1.25	1.03	2.76	2	137				61	55	
7	54	824.47	1.10	.91	4.41	2	136				61	56	
6	57	826.17	1.15	.96	6.11	2	135	257	257	40	62	56	
5	60	827.86	1.15	.96	7.80	2	135				61	56	
4	63	829.60	1.10	.91	9.46	2	135				62	56	
3	66	831.11	1.10	.91	1.11	2	136	254	255	40	62	57	
2	69	832.77	1.10	.92	2.77	2	133				63	57	
1	72	834.39	1.03	.86	4.38		136				63	57	
	(0955)												
	θ = 72	Vm = 40.87		ΔH = .97							Avg. = 56.6		

S-0037R

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job I.P./MONTROSE Date 1/27/93 Test 2 Run 2
Source DRYER STACK No. of traverse points 24
Method 5 Filter holder: glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 6 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 4986

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: DCH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	707	3200	207
Impinger No. 3			
Condenser			
Desiccant	1355	1344	11
Total			218

Integrated Gas Sampling Data:

Bag Pump No. 23A Box No. 30 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1040 (HRS) Time end: 1149 (HRS)
Sampling rate: 300 cc/min Operator: DCH
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. /MONTROSE
Source DRYER STACK
Date 1/27/93 Test 2 Run 2

Operators Dun + J.B
Meter Box No. 6 ^H@ 1.90 IN WC
Gasmeter coeff. 1.0073

Pitot No. 123-6 Cp .84
Bar. Press. 24.97 inHg H2O 22 %
Nozzle No. 7-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (xv/v)
	1035	834.79											
B 12	3	836.54	1.20	1.01	6.52	2.5	137	247	253	41	56	56	
11	6	838.37	1.22	1.03	8.27	2.5	137				60	57	
10	9	840.14	1.30	1.11	.08	2.5	134				61	58	
9	12	841.89	1.25	1.07	1.88	2.5	133	256	254	40	63	58	
8	15	843.70	1.25	1.07	3.68	2.5	133				64	59	
7	18	845.52	1.25	1.07	5.47	2.5	133				64	57	
6	21	847.38	1.25	1.07	7.27	2.5	133	257	253	41	65	59	
5	24	848.94	1.10	.94	8.95	2	137				65	60	
4	27	850.65	1.10	.93	0.63	2	137				64	59	
3	30	852.31	1.10	.93	2.31	2	135	255	253	40	65	59	
2	33	853.95	1.10	.94	3.94	2	135				65	60	
1	36	855.60	1.01	.86	5.61	2	136				65	60	
A 12	39	857.40	1.30	1.11	7.44	2.5	136	257	251	40	64	61	
11	42	859.35	1.45	1.25	9.38	3	133				65	59	
10	45	861.27	1.40	1.20	1.28	3	135				65	60	
9	48	863.14	1.35	1.16	3.14	3	134	260	254	41	66	61	
8	51	865.01	1.35	1.16	5.02	3	133				66	60	
7	54	866.77	1.20	1.02	6.78	2.5	137				68	62	
6	57	868.43	1.0	.86	8.40	2.5	133	260	253	40	68	63	
5	60	870.21	1.10	.95	0.10	2.5	133				68	63	
4	63	871.80	1.15	.99	1.83	2.5	135				68	63	
3	66	873.65	1.15	.99	3.56	2.5	135				68	63	
2	69	875.34	1.10	.94	5.26	2.5	136				69	64	
1	72	876.88	.93	.80	6.82		136				69	64	
	1149												
	θ = 72	Vm = 42.09		^H = 1.02							Avg. = 62.6		

S-0037R

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P./MONTROSE Date 1/27/93 Test 2 Run 3
Source DRYER STACK No. of traverse points 24
Method 5 Filter holder: 9/25? Filter type: 9/25? Fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 8 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

☒ acetone
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: DH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	405	200	205
Impinger No. 3			
Condenser			
Desiccant	1253	1242	11
Total			216

Integrated Gas Sampling Data:

Bag Pump No. 23A Box No. 30 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1230 (HRS) Time end: 1338 (HRS)
Sampling rate: 300 cc/min Operator: DH
S/N of O_2 Analyzer used to monitor train outlet: C

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / MONTROSE
Source DRYER STACK
Date 4/27/93 Test 2 Run 3

Operators DVH & T.B
Meter Box No. 8 ΔH 1.96 IN WC
Barometer coeff. 1.0073

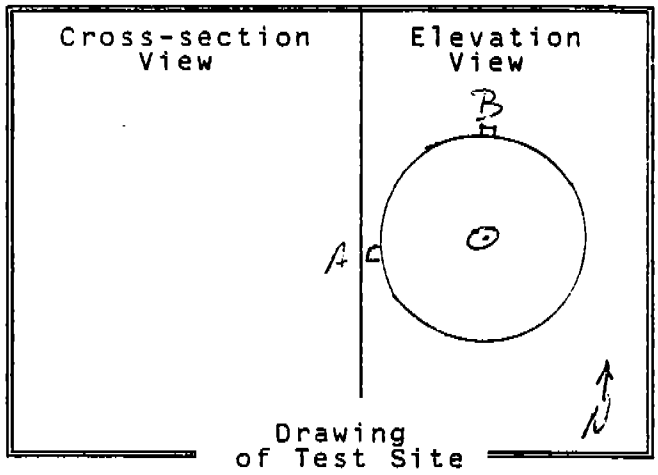
Pitot No. V236 Cp .84
Bar. Press. 24.97 inHg H2O 21 x
Nozzle No. 7-3 Nozzle Dia .157 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (x v/v)
	1225	877.50											
A 12	3	879.33	1.25	1.06	9.28	2.5	140	249	251	44	62	62	
11	6	882.24	1.40	1.19	1.18	3	140				66	63	
10	9	883.15	1.35	1.15	3.04	3	140				68	64	
9	12	884.97	1.35	1.16	4.92	3	138	251	254	45	69	65	
8	15	886.80	1.35	1.17	6.80	3	135				70	65	
7	18	888.56	1.15	1.0	8.54	2.5	134				71	66	
6	21	890.25	1.05	.91	0.21	2.5	135	254	253	44	72	66	
5	24	891.98	1.10	.95	1.92	2.5	134				72	66	
4	27	893.65	1.10	.95	3.62	2.5	135				72	67	
3	30	895.36	1.15	1.0	5.37	2.5	135	256	254	42	73	67	
2	33	897.18	1.15	1.0	7.12	2.5	135				73	67	
1	36	898.76	.96	.83	8.72	2.5	134				73	67	
B 12	39	900.49	1.10	.96	0.43	2.5	134	256	257	43	72	67	
11	42	902.25	1.20	1.04	2.21	2.5	136				73	68	
10	45	904.01	1.20	1.04	4.00	2.5	136				74	68	
9	48	905.85	1.20	1.04	5.79	2.5	135	254	258	45	74	69	
8	51	907.66	1.20	1.04	7.58	2.5	136				74	69	
7	54	909.40	1.08	.94	9.27	2.5	138				74	69	
6	57	910.03	1.10	.95	0.99	2.5	137	257	255	46	74	69	
5	60	912.75	1.10	.96	2.70	2.5	135				74	69	
4	63	914.47	1.10	.96	4.42	2.5	134				75	69	
3	66	916.16	1.10	.96	6.14	2.5	135	256	254	46	75	69	
2	69	917.90	1.05	.92	7.81	2.5	134				75	70	
1	72	919.53	1.03	.90	9.48		134				76	70	
	(1338)												
	θ = 72	Vm = 42.03		ΔH = 1.0							Avg. = 69.6		

C-7

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.F / Montrose
Source Dryer Stack
Test 1 Run 9 Date 1/25/93
Stack dimen. 47.75" IN.
Dry bulb ___ °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 25.17 in Hg
Static pressure +.31 in WC
Operators J. Van Heever & T. Bergstrom
Pitot No. 123-6 C_p .84
Formaldehyde



Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length: 6 in.		Time start: 0935 hrs	
	A 1	.021	1.00	7.00	.93	
	2	.067	3.20	9.20	1.20	
	3	.118	5.63	11.63	1.30	
	4	.177	8.45	14.45	1.15	
	5	.250	11.93	17.93	1.10	
	6	.356	16.99	23.00	1.05	
	7	.644	30.75	36.75	1.15	
	8	.750	35.81	41.81	1.35	
	9	.823	39.30	45.30	1.40	138°
	10	.882	42.12	48.12	1.40	
	11	.933	44.55	50.55	1.40	
	12	.979	46.74	52.74	1.25	
	B 1				1.0	
	2				1.10	
	3				1.05	
	4				1.10	
	5				1.10	
	6				1.10	
	7				1.10	
	8				1.20	
	9				1.25	
	10				1.25	
	11				1.20	
	12				1.10	
Temp. meas. device & S/N: PDT #18					Time end: 0948 hrs	

R or nothing = (reg.) manometer; S= expanded; E=electronic C-8 S-3921

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE Date 1/26/93 Test 1 Run 1
Source DRYER STACK No. of traverse points 24
Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 7 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: NA

Recovery solvent(s)
☐ acetone
☒ other(s) $MECl_2$ & DI H_2O

No. of probe wash bottles: 1
Sample recovered by: DUH & J.B

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		3200	
Impinger No. 2	484		284
Impinger No. 3			
Condenser			
Desiccant	1300	1278	22
Total			306

Integrated Gas Sampling Data:

Bag Pump No. 23A Box No. 1 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1045 (HRS) Time end: 1142 (HRS)
Sampling rate: 400 cc/min Operator: DUH
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / MONTROSE
Source DRYER STACK
Date 1/26/93 Test 1 Run 1

Operators DH & J.B
Meter Box No. 8 ΔH 1.96 IN WC
Counter coeff. 1.0073

Pitot No. 123-6 Cp .84
Bar. Press. 25.12 inHg H2O 29 x
Nozzle No. 1-4 Nozzle Dia .247 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dev. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (x v/v)
	1040	615.60											
B 12	2.5	617.90	1.20	2.77	7.96	4	137	251	261	39	51	51	16.0
11	5	620.29	1.20	2.96	0.41	4.5	136				51	46	15.6
10	7.5	622.73	1.20	2.96	2.85	4.5	136				50	46	15.3
9	10	625.20	1.20	2.94	5.28	5	139				50	45	15.2
8	12.5	627.60	1.20	2.76	7.63	4.5	138				49	41	15.4
7	15	629.88	1.05	2.42	9.83	4.5	136	250	255	40	49	43	16.2
6	17.5	632.23	1.15	2.76	2.18	5	136				49	43	16.3
5	20	634.57	1.10	2.64	4.48	5	136				49	43	16.0
4	22.5	636.80	1.10	2.64	6.78	5	137				49	42	16.1
3	25	639.20	1.10	2.63	9.08	5	137				49	43	16.1
2	27.5	641.50	1.10	2.64	1.37	5	137	251	253	40	49	43	15.6
1	30	643.66	1.05	2.52	3.62	5	137				49	42	15.5
A 12	32.5	646.16	1.30	3.11	6.11	6	137				49	43	16.2
11	35	648.74	1.40	3.35	8.70	6	137				49	43	16.2
10	37.5	651.34	1.40	3.34	1.28	6	139	253	251	39	48	42	16.8
9	40	653.91	1.40	3.33	3.86	6	136				49	42	16.2
8	42.5	656.46	1.40	3.34	6.44	6	138				50	44	16.6
7	45	658.87	1.15	2.75	8.79	5	139	256	260	39	49	43	16.5
6	47.5	661.09	1.05	2.52	1.04	5	136				49	42	15.5
5	50	663.40	1.10	2.65	3.34	5	134				49	42	17.5
4	52.5	665.77	1.20	2.87	5.74	5	138	257	261	43	49	42	17.2
3	55	668.11	1.20	2.87	8.13	5	138				49	42	16.0
2	57.5	670.44	1.10	2.64	0.43	5	136				49	42	16.9
1	60	672.77	1.02	2.45	2.64		136				49	42	17.1
	(1142)												
	θ = 60	Vm = 57.17		ΔH = 2.83							Avg. = 44.3		

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INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE Date 1/26/93 Test 1 Run 2
Source DRYER / STACK No. of traverse points 24
Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 7 in. Hg. (vac) ☐

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

☐ acetone
☒ other(s) $MECl_2$ & DI H_2O

No. of probe wash bottles: 1
Sample recovered by: DWH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	480	3200	280
Impinger No. 3			
Condenser			
Desiccant	1200	1180	20
Total			300

Integrated Gas Sampling Data:

Bag Pump No. 23A Box No. 1 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1304 (HRS) Time end: 1402 (HRS)
Sampling rate: 400 cc/min Operator: DWH
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. MONTROSE — Operators DLM & J.B. — Pitot No. V23-6 — Cp .84
Source DRYER STACK — Meter Box No. 8 ΔH@ 1.96 IN WC — Bar. Press. 25.12 inHg — H2O 22 %
Date 4/26/93 — Test 1 — Run 2 — Counter coeff. 1.0013 — Nozzle No. 7-4 — Nozzle Dia .247 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (xx/x)
	1300	673.10											
A 12	2.5	675.58	1.30	3.10	5.58	5	137	249	263	42	60	60	16.5
11	5	678.13	1.40	3.42	8.23	5	140				60	59	16.5
10	7.5	680.73	1.35	3.16	0.78	5	141				59	57	16.3
9	10	683.31	1.30	3.03	3.27	5	142	254	263	43	58	55	16.0
8	12.5	685.80	1.30	3.03	5.76	5	139				58	54	15.7
7	15	688.18	1.15	2.69	8.10	4.5	138				58	53	15.9
6	17.5	690.38	1.0	2.34	0.28	4.5	137	257	261	43	57	53	16.0
5	20	692.70	1.10	2.57	2.57	4.5	138				57	52	15.7
4	22.5	694.92	1.10	2.56	4.86	4.5	138				57	51	15.7
3	25	697.19	1.15	2.67	7.19	4.5	139	260	263	48	57	51	15.6
2	27.5	699.40	1.10	2.56	9.47	4.5	138				60	55	15.2
1	30	701.60	1.05	2.46	1.72	4.5	138				64	60	15.5
B 12	32.5	704.10	1.15	2.72	4.09	4.5	138	261	263	46	65	61	17.1
11	35	706.53	1.20	2.84	6.51	5	138				70	63	17.3
10	37.5	708.96	1.20	2.87	8.96	5	136				73	67	16.4
9	40	711.40	1.20	2.88	1.41	5	137	260	261	45	74	67	15.8
8	42.5	713.93	1.25	3.00	3.92	5	138				74	68	16.9
7	45	716.39	1.10	2.68	6.29	5	131				75	68	17.8
6	47.5	718.86	1.10	2.91	8.76	5	133	257	260	43	75	68	16.8
5	50	721.36	1.10	2.90	1.23	5	134				75	69	16.7
4	52.5	723.77	1.10	2.91	3.71	5	137				75	69	17.2
3	55	726.24	1.05	2.78	6.13	5	132	259	261	45	75	69	17.6
2	57.5	728.61	1.05	2.78	8.55	5	133				76	69	17.0
1	60	730.99	1.05	2.78	0.97	5	133				76	70	16.6
	1402												
	θ = 60	Vm = 57.89		ΔH = 2.82							Avg. = 63.6		

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE Date 1/26/93 Test 1 Run 3
Source DRYER STACK No. of traverse points 24
Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 7.5 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: NA

Recovery solvent(s)
☐ acetone
☒ other(s) $MECl_2$ & DI H_2O

No. of probe wash bottles: 1
Sample recovered by: DAH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	482	200	282
Impinger No. 3			
Condenser			
Desiccant	1209	1190	19
Total			301

Integrated Gas Sampling Data:

Bag Pump No. 23A Box No. 1 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1510 (HRS) Time end: 1609 (HRS)
Sampling rate: 400 cc/min Operator: DAH
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / MONTROSE
Source DRYER STACK
Date 1/26/93 Test 1 Run 3

Operators DH & TJB
Meter Box No. 8 ΔH .0073 IN WC
Calculated coeff. 196

Pitot No. V23-6 Cp .84
Bar. Press. 25.12 inHg H2O 22 X
Nozzle No. 7-4 Nozzle Dia. .247 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xv/v)
	1505	731.20											
B 12	2.5	733.67	1.10	2.73	3.57	4	137	254	257	41	66	66	16.5
11	5	736.10	1.15	3.12	6.12	4.5	136				68	67	16.2
10	7.5	738.60	1.25	3.12	8.67	4.5	137				70	67	16.4
9	10	741.24	1.30	3.24	1.27	5	138	257	257	41	71	68	16.4
8	12.5	743.84	1.25	3.13	3.83	4.5	138				73	69	16.7
7	15	746.22	1.05	2.65	6.19	4.5	135				73	69	16.9
6	17.5	748.70	1.10	2.78	8.60	4.5	134	260	253	41	74	69	15.8
5	20	751.80	1.10	2.78	1.02	4.5	134				75	70	17.0
4	22.5	753.50	1.10	2.91	3.50	5	133				76	70	17.3
3	25	755.91	1.10	2.91	5.98	5	133	261	252	41	76	71	17.5
2	27.5	758.36	1.10	2.92	8.46	5	132				77	71	17.6
1	30	760.91	1.05	2.79	0.89	5	132				77	71	17.4
A 12	32.5	763.51	1.35	3.58	3.64	6	132	263	257	40	76	71	17.5
11	35	766.31	1.40	3.69	6.42	6	135				77	72	17.4
10	37.5	769.05	1.40	3.68	9.21	6.5	138				77	72	17.2
9	40	771.64	1.30	3.14	1.79	6.5	139				77	72	17.0
8	42.5	774.41	1.30	3.16	4.37	6.5	135	261	258	40	77	72	17.1
7	45	776.88	1.15	2.80	6.80	5	135				78	72	17.0
6	47.5	779.27	1.05	2.72	9.20	5	137				78	73	16.0
5	50	781.69	1.10	2.86	1.66	5	135				79	73	16.6
4	52.5	784.11	1.15	2.99	4.18	5.5	135	260	257	43	79	73	17.0
3	55	786.69	1.15	2.99	6.69	5.5	135				79	75	16.8
2	57.5	789.21	1.15	2.99	9.21	5.5	134				79	74	17.0
1	60	791.64	1.03	2.69	1.60	5	134				79	74	17.1
	1609												
	θ = 60	Vm = 60.44		ΔH = 3.02							Avg. = 70		

C-14

APPENDIX D

PRESS AND UNLOADER VENT FIELD DATA SHEETS

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / MONTROSE

Source PRESS + UNLOADING VENT STACK

Test 4 Run 1 Date 1/28/93

Stack dimen. 60 IN.

Dry bulb ___ °F Wet bulb ___ °F

Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 24.87 in Hg

Static pressure -.98 in WC

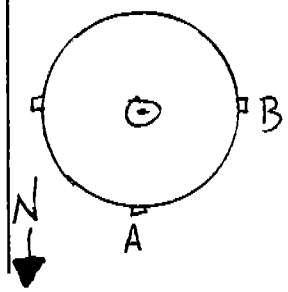
Operators D. VAN HOEVER & R. MALMSON

Pitot No. 1/23-6 Cp .84

Particulate

Cross-section View

Elevation View



Drawing of Test Site

Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 4 in.		Time start: 0857 hrs	
A 1	.021	1.26	5.26	1.80	
2	.067	4.02	8.02	2.15	
3	.118	7.08	11.08	2.15	
4	.177	10.62	14.62	2.0	
5	.250	15	19	1.90	
6	.356	21.36	25.36	1.80	65
7	.644	38.64	42.64	1.90	
8	.750	45	49	2.0	
9	.823	49.38	53.38	2.0	
10	.882	52.92	56.92	1.90	
11	.933	55.98	59.98	1.85	
12	.979	58.74	62.74	1.5	
B 1				1.80	
2				1.90	
3				1.80	
4				1.80	
5				1.80	66
6				1.85	
7				1.80	
8				1.80	
9				1.80	
10				1.80	
11				1.70	
12				1.10	
Temp. meas. device & S/N: PDT #18				Time end: 0906 hrs	

R or nothing = reg. manometer; S= expanded; E=electronic

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE Date 1/28/93 Test 4 Run 1
Source PRESS UNLOADING VENT STACK No. of traverse points 24
Method 5 Filter holder: glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 11 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5017

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: DLH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	203	200	3
Impinger No. 3			
Condenser			
Desiccant	1362	1355	7
Total			10

Integrated Gas Sampling Data: — Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: L.P. / MONTROSE
Source: PRESS & UNLOADING VENT STACK
Date: 1/28/93 Test 4 Run 1

Operators: DLH & R.M
Meter Box No.: 6 ^H@ 1.83 IN WC
Gasmeter coeff.: 1.0051

Pitot No.: V23-6 Cp .84
Bar. Press.: 24.87 inHg H2O / x
Nozzle No.: 7-3 Nozzle Dia. .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgs. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Cos/In	Cos/Out	Oxygen (xv/v)
	0940	256.90											
B 12	2.5	259.34	2.10	2.83	9.43	9	65	253	251	41	65	65	AMBIENT
11	5	261.83	2.05	2.69	1.90	9	76				65	62	AIR
10	7.5	264.28	1.85	2.44	4.24	8	70				73	69	
9	10	266.55	1.80	2.38	6.58	8	77	254	253	42	74	70	
8	12.5	268.86	1.80	2.39	8.92	8	76				76	71	
7	15	271.20	1.90	2.54	1.33	8.5	74				77	71	
6	17.5	273.60	1.80	2.40	3.68	8	76	254	256	40	79	72	
5	20	276.00	1.80	2.43	6.04	8	71				79	73	
4	22.5	278.33	1.85	2.49	8.44	9	72				80	74	
3	25	280.78	1.85	2.48	0.84	9	75	253	257	40	81	74	
2	27.5	283.21	1.70	2.30	3.14	8	71				81	75	
1	30	285.19	1.3	1.76	5.17	6	71				82	76	
A 12	32.5	287.55	1.80	2.44	7.55	8.5	71	251	254	39	81	76	
11	35	290.11	2.20	2.97	0.17	9.5	73				82	76	
10	37.5	292.75	2.2	2.98	2.80	10	71				83	77	
9	40	295.32	2.10	2.86	5.37	9	70	253	255	39	84	77	
8	42.5	297.80	2.0	2.71	7.88	9	73				84	77	
7	45	300.47	1.90	2.58	0.33	9	73				84	78	
6	47.5	302.85	1.95	2.66	2.82	9	70	252	254	39	84	78	
5	50	305.33	2.0	2.72	5.33	9	71				84	79	
4	52.5	307.82	2.0	2.72	7.85	9	73				85	79	
3	55	310.36	2.0	2.73	0.37	9	70	254	255	38	85	79	
2	57.5	312.82	1.90	2.59	2.83	9	71				85	79	
1	60	315.01	1.50	2.04	5.01	7	72				85	80	
	(1041)												
	θ = 60	Vm = 58.11		^H = 2.55							Avg. = 77.2		

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE Date 1/28/93 Test 4 Run 2
Source PRESS 4-UNLOADING VENT STACK No. of traverse points ~24
Method 5 Filter holder: glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 10 in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: 5018

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles:
Sample recovered by: DAH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	202	200	2
Impinger No. 3			
Condenser			
Desiccant	1378	1370	8
Total			10

Integrated Gas Sampling Data: – Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

LF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / MONTROSE
Source PRESS 9 UNLOADING VENT STACK
Date 1/28/93 Test 4 Run 2

Operators DLH & R.M
Meter Box No. 6 ΔH 1.83 IN WC
Gasmeter coeff. 1.0051

Pitot No. V23-6 Cp .84
Bar. Press. 24.87 inHg H2O / X
Nozzle No. T-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	1/28	3,5,40											
A 12	2.5	3,7,79	1.85	2.49	7.80	8	73	231	244	37	82	79	AMBIENT
11	5	320.45	2.20	2.96	0.42	9	76				84	80	AIR
10	7.5	323.60	2.15	2.91	3.02	9	75				86	80	
9	10	325,51	~~300~~	2.72	5.54	8.5	74	249	250	38	86	84	
8	12.5	328,09	2.0	2.74	8.08	8.5	71				87	82	
7	15	330.60	1.95	2.64	0.56	8.5	77				88	82	
6	17.5	333,07	1.95	2.65	3.06	8.5	75	250	251	37	88	82	
5	20	335,60	2.0	2.72	5.58	8.5	76				88	82	
4	22.5	338,10	2.0	2.72	8.10	8.5	76				88	82	
3	25	340,64	1.95	2.65	0.60	8.5	75	251	253	38	88	83	
2	27.5	343,08	1.85	2.51	3.03		75				89	83	
1	30	345,15	1.30	1.77	5.07	6	76				89	83	
B 12	32.5	347,51	1.80	2.45	7.47	8	76				88	83	
11	35	350.01	2.00	2.71	9.99	8.5	78	251	254	40	89	84	
10	37.5	352,39	1.85	2.50	2.42	8	80				89	84	
9	40	354.79	1.80	2.42	4.80	8	84				89	84	
8	42.5	357,19	1.85	2.48	7.22	8	85				89	84	
7	45	359,60	1.90	2.56	9.67	8	82				89	84	
6	47.5	362,03	1.80	2.41	2.05	8	86	256	251	36	90	85	
5	50	364,39	1.80	2.44	4.45	8	80				90	85	
4	52.5	366,77	1.80	2.43	6.84	8	82				90	85	
3	55	369,19	1.80	2.44	9.24	8	81				91	85	
2	57.5	371,65	1.80	2.44	1.64	8	80	254	253	37	91	85	
1	60	373,55	1.10	1.49	3.52	5.5	81				91	85	
	1231												
	Θ = 60	Vm = 58,15		ΔH = 1.51							Avg. = 85.7		

D-5

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE Date 1/23/93 Test 4 Run 3
Source DRYER STACK No. of traverse points 24
Method 5 Filter holder: glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 11 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5019

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles:
Sample recovered by: DHT

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	204	200	4
Impinger No. 3			
Condenser			
Desiccant	1391	1383	8
Total			12

Integrated Gas Sampling Data: Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

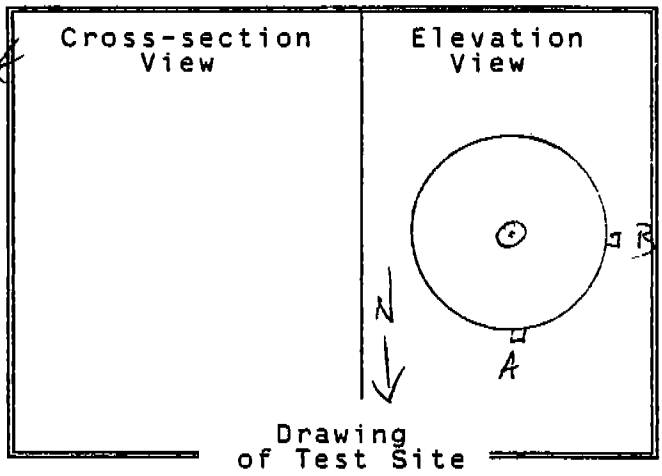
Job: L.P. / MONTROSE
Source: PRESS 4 UNLOADING VENT STACK
Date: 1/28/93 Test 4 Run 3
Operators: D.V.H & R.M
Meter Box No.: 6 ΔH@ 1.83 IN WC
Gasmeter coeff.: 1.0051
Pitot No.: 123-6 Cp .84
Bar. Press.: 24.87 inHg H2O? x
Nozzle No.: 2-3 Nozzle Dia.: .185 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Ors. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (xv/v)
	1305	374.00											
B 12	2.5	376.40	1.75	2.36	6.35	7.5	81	236	246	39	82	82	AMBIENT
11	5	378.82	1.95	2.60	8.81	8	83				83	82	AIR
10	7.5	381.21	1.90	2.53	1.24	8	84				85	83	
9	10	383.61	1.80	2.41	3.62	8	84	244	250	40	87	84	
8	12.5	386.15	1.80	2.40	5.99		86				88	84	
7	15	388.50	1.85	2.48	8.41	8	85				89	84	
6	17.5	390.84	1.75	2.36	0.76	7.5	83	247	251	40	89	85	
5	20	393.16	1.80	2.42	3.15	7.5	84				90	85	
4	22.5	395.57	1.80	2.43	5.54	7.5	83				90	85	
3	25	397.94	1.80	2.43	7.93	7.5	82	250	257	41	91	86	
2	27.5	400.18	1.70	2.29	0.26	7	84				91	86	
1	30	402.41	1.30	1.75	2.30	6	84				92	86	
A 12	32.5	404.88	1.90	2.56	4.76	8	84				91	86	
11	35	407.36	2.15	2.91	7.38	10	81				91	86	
10	37.5	410.64	2.20	2.98	0.03	10	80	253	254	40	92	87	
9	40	412.53	2.0	2.71	2.56	9	81				92	87	
8	42.5	415.10	1.90	2.58	5.03	9	80				92	87	
7	45	417.51	1.85	2.53	7.48	8	78				92	87	
6	47.5	419.97	1.85	2.51	9.92	8	81				93	88	
5	50	422.30	2.0	2.72	2.45	9	81	254	256	43	93	88	
4	52.5	425.05	2.0	2.71	4.99	9	82				89	87	
3	55	427.50	1.95	2.62	7.47	9	85				91	87	
2	57.5	429.97	1.85	2.51	9.91	8.5	82				92	88	
1	60	432.13	1.35	1.84	1.99		81				93	88	
	1415												
	θ = 60	Vm = 58.13		ΔH = 2.49							Avg. = 87.8		

S-0037R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / MONTROSE
Source Press + Unloading Vent Stack
Test 5 Run ___ Date 1/28/93
Stack dimen. 60 IN.
Dry bulb ___ °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.87 in Hg
Static pressure -.98 in WC
Operators D. Van Hoesen + R. Madison
Pitot No. V23-6 C_p .84



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: in.		Time start: hrs	
A	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
B	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
Temp. meas. device & S/N: PDT #18				Time end: hrs	

R or nothing (reg.) manometer; S= expanded; E=electronic

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP / MONTROSE Date 1/28/93 Test 5 Run 1
Source Press + Unloading Vent Stack No. of traverse points 24
Method _____ Filter holder: 5.5 Filter type: MDE impreg.

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 10 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: _____ _____

Recovery solvent(s)
☐ acetone
☒ other(s) $MeCl_2$

No. of probe wash bottles: 1
Sample recovered by: [illegible]

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1490	1485	5
Total			5

Integrated Gas Sampling Data: - Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

CF-01

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / MONTROSE Operators Dust & Rim Pitot No. 1-23-6 Cp .84
Source Press+Hydroloading Vent Stack Meter Box No. 6 ΔH 1.83 IN WC Bar. Press. 24.87 inHg H2O / X
Date 4/28/93 Test 8 Run — Counter coeff. 6 1.0057 Nozzle No. 7-3 Nozzle Dia .255 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	1600	432.40											
A 12	2.5	435.08	2.20	2.96	5.04	5.5	83	—	NA	—	80	80	AMBIENT
11	5	437.68	2.30	3.05	7.70	6	84				86	80	AIR
10	7.5	440.40	2.30	3.07	0.37	6	83				88	84	
9	10	443.01	2.20	2.95	3.00	6	83				90	85	
8	12.5	445.47	2.0	2.69	5.52	5	85				91	85	
7	15	447.91	1.85	2.51	7.95	5	81				92	86	
6	17.5	450.90	2.05	2.77	0.91	5.5	82				93	87	
5	20	453.01	2.05	2.76	3.06	5.5	85				94	87	
4	22.5	455.64	2.05	2.79	5.63	6	81				95	88	
3	25	458.07	2.0	2.72	8.17	6	81				95	88	
2	27.5	460.60	1.90	2.59	0.65	6	80				96	88	
1	30	462.87	1.40	1.91	2.79	4.5	82				96	89	
B 12	32.5	464.99	1.40	1.91	4.92	4.5	82				91	88	
11	35	467.58	1.90	2.56	7.38	6	85				95	87	
10	37.5	469.87	1.80	2.44	9.79	6	85				90	88	
9	40	472.20	1.70	2.29	2.12	5.5	84				95	89	
8	42.5	474.50	1.75	2.38	4.49	6	83				95	90	
7	45	477.01	2.0	2.72	7.03	6	83				97	90	
6	47.5	479.50	1.95	2.66	9.55	6	83				97	90	
5	50	482.10	1.95	2.67	2.07	6	80				97	90	
4	52.5	484.57	1.90	2.60	4.56	6	80				97	91	
3	55	487.05	1.90	2.61	7.05	6	80				98	91	
2	57.5	489.50	1.80	2.47	9.48	6	81				98	91	
1	60	491.72	1.50	2.06	1.70	5	81				98	91	
	(1700)												
	P = 60	Vm = 59.32		ΔH = 2.59							Avg. = 90.6		

D-10

S-00378

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. Montrose
Source Press & Unloading Vent Stack
Method _____ Filter holder: SS

Date 1/28/93 Test 3 Run 2
No. of traverse points 24
Filter type: _____

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac)
Postest: 0 cfm at 10 in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: _____

Recovery solvent(s)

☐ acetone
☑ other(s) MeCl2

No. of probe wash bottles: 1
Sample recovered by: Dick

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1397	1390	7
Total			7

Integrated Gas Sampling Data: Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job K.P. / MONTROSE
Source Press. Unloading Vent Stack
Date 4/28/93 Test 6 Run 2

Operators DUH & R.M.
Meter Box No. 6 ΔH 1.83 IN WC
Coeff. 1.005

Pitot No. V23-6 Cp .84
Bar. Press. 24.87 inHg H2O / X
Nozzle No. 2-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xx/v)
	1741	492.10											
B 12	2.5	494.40	1.60	2.17	4.36	4	83	—	NA	—	90	88	AMBIENT
11	5	496.63	1.70	2.31	6.70	4	80				93	89	AIR
10	7.5	498.96	1.60	2.18	8.97	4	82				94	89	
9	10	501.20	1.60	2.19	1.25	4	80				95	90	
8	12.5	503.58	1.70	2.33	3.61	4	80				95	90	
7	15	506.01	1.90	2.59	6.09	4	82				96	90	
6	17.5	508.45	1.80	2.47	8.51	4	78				96	90	
5	20	510.92	1.90	2.61	1.00	4.5	78				96	90	
4	22.5	513.42	1.85	2.54	3.46	5	78				96	90	
3	25	515.94	1.85	2.55	5.93	5	77				96	90	
2	27.5	518.40	1.85	2.54	8.38	5	78				96	90	
1	30	520.60	1.50	2.07	0.60	4	77				96	90	
A 12	32.5	523.21	2.20	3.03	3.28	5.5	77				95	90	
11	35	525.89	2.20	3.01	5.96	5.5	79				96	91	
10	37.5	528.70	2.30	3.16	8.70	6	77				96	91	
9	40	531.41	2.20	3.02	1.38	5.5	79				96	91	
8	42.5	533.99	2.05	2.82	3.97	5.5	77				96	91	
7	45	536.55	1.90	2.61	6.46	5	79				96	91	
6	47.5	539.10	2.10	2.89	9.08	5.5	77				96	91	
5	50	541.77	2.10	2.90	1.71	5.5	75				96	91	
4	52.5	544.25	2.10	2.90	4.34	5.5	76				96	91	
3	55	546.90	2.10	2.89	6.96	5.5	78				96	91	
2	57.5	549.40	1.90	2.63	9.46	5	75				96	91	
1	60	551.90	1.85	2.56	1.92	5	75				96	91	
	(1844												
	θ = 61	Vm = 59.80		ΔH = 2.62							Avg. = 92.8		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE Date 1/28/93 Test 5 Run 3
Source PRESS + UNLOADING VENT STACK No. of traverse points 24
Method _____ Filter holder: SS Filter type: _____

Sample Train Leak Check:

Pretest: 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 10 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: _____

Recovery solvent(s)

☐ acetone
☒ other(s) $MeCl_2$

No. of probe wash bottles: 1
Sample recovered by: JHH

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1496	1490	6
Total			6

Integrated Gas Sampling Data: – Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P / MONTROSE
Source PRESS & UNLOADING VENT STACK
Date 1/28/93 Test 5 Run 3

Operators DH & R.M
Meter Box No. 6 ΔH 1.83 IN WC
Barometer corr't. .0054

Pitot No. 123-6 Cp .84
Bar. Press. 24.87 inHg H2O / X
Nozzle No. S-3 Nozzle Dia. .188 IN.

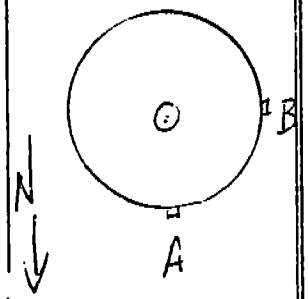
Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dev. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xv/v)
	0735	555.20											
12	2.5	557.90	2.3	3.18	7.94	6	74	—	NA	—	74	74	AMBIENT
11	5	560.55	2.3	3.07	0.59	6	75				77	75	AIR
10	7.5	563.27	2.3	3.08	3.26	6	74				82	78	
9	10	565.88	2.20	2.96	5.88		76				88	85	
8	12.5	568.51	2.10	2.86	8.47	5.5	75				89	84	
7	15	570.99	1.95	2.67	0.97	5	73				91	85	
6	17.5	573.58	2.10	2.87	3.57	5.5	75				91	85	
5	20	576.26	2.20	3.01	6.24	6	74				91	86	
4	22.5	578.87	2.15	2.95	8.88	6	73				92	86	
3	25	581.53	2.15	2.96	1.52	6	73				92	86	
2	27.5	584.05	2.0	2.75	4.07	6	73				92	86	
1	30	586.51	1.70	2.36	6.43	5	70				92	86	
12	32.5	588.91	1.80	2.49	8.85	5	70				90	85	
11	35	591.51	1.85	2.54	1.39	5	74				91	86	
10	37.5	593.79	1.85	2.54	3.74	5	74				91	86	
9	40	596.26	1.80	2.47	6.16	5	74				92	86	
8	42.5	598.63	1.80	2.48	8.58	5	72				91	86	
7	45	601.17	2.05	2.81	1.16	5.5	74				91	86	
6	47.5	603.71	1.95	2.68	3.67	5.5	73				91	86	
5	50	606.15	1.95	2.69	6.19	5.5	71				92	86	
4	52.5	608.73	2.0	2.75	8.74	5.5	73				92	86	
3	55	611.26	1.90	2.62	1.23	5.5	72				92	86	
2	57.5	613.74	1.75	2.41	3.62	5	72				92	86	
1	60	616.08	1.60	2.21	5.90	4.5	71				92	86	
	2038												
	θ = 1.0	Vm = 60.88		ΔH = 2.73							Avg. = 86.9		

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job C.P. / MONTROSE
Source Press & Unloading Vent Stack
Test 1 Run ___ Date 4/29/93
Stack dimen. 60 IN.
Dry bulb ___ °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 24.86 in Hg
Static pressure -1.0 in WC
Operators D. VanHoever & R. Madison
Pitot No. 123-6 C_p .84
Type S

Cross-section View

Elevation View



Drawing of Test Site

Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: in.		Time start: hrs	
A	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
B	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				

Temp. meas. device & S/N: PDT #6 Time end: hrs

R or nothing = reg. manometer; S= expanded; E=electronic

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Montrose Date 1/29/93 Test 7 Run 1
Source Press/a Unloading Vent Stack No. of traverse points 24
Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 8 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: _____ _____

Recovery solvent(s)
☐ acetone
☒ other(s) $MeCl_2$

No. of probe wash bottles: 1
Sample recovered by: DWH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	201	200	1
Impinger No. 3			
Condenser			
Desiccant	1404	1396	8
Total			9

Integrated Gas Sampling Data: -Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: L.P. / MONTROSE
Source: Press & Unloading Vent Stack
Date: 4/29/93 Test 1 Run 1

Operators: Dust & Lem
Meter Box No. 6 ΔH 1.83 IN WC
Barometer coeff.: 1.0051

Pitot No. V236 Cp .84
Bar. Press. 24.86 inHg H2O 1 X
Nozzle No. T3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (xv/v)
	0822	616.40											
A 12	2.5	618.79	1.90	2.53	8.78	5	68	251	250	37	66	66	AMBIENT
11	5	621.31	2.20	2.92	1.35	6	69				70	68	AIR
10	7.5	623.81	2.15	2.87	3.91	6	70				71	68	
9	10	626.40	2.10	2.81	6.44	6	69	254	253	40	73	69	
8	12.5	628.93	2.0	2.69	8.92	5.5	67				75	70	
7	15	631.40	1.95	2.63	1.37	5.5	68				77	71	
6	17.5	633.78	1.90	2.58	3.80	5.5	66	251	256	40	78	71	
5	20	636.31	2.0	2.72	6.30	6	67				78	72	
4	22.5	638.79	2.0	2.72	8.80	6	66				79	72	
3	25	641.24	1.90	2.58	1.24	5	67	254	257	40	79	73	
2	27.5	643.70	1.90	2.59	3.69	5	66				77	72	
1	30	645.93	1.60	2.18	5.73	4.5	66				76	69	
B 12	32.5	648.41	1.90	2.56	8.35	5	69	253	256	40	74	69	
11	35	650.86	2.05	2.74	0.85	6	72				75	70	
10	37.5	653.20	1.90	2.55	3.27	6	71				83	76	
9	40	655.55	1.80	2.44	5.65	6	72	256	256	42	83	76	
8	42.5	658.00	1.80	2.44	8.03	6	72				84	77	
7	45	660.46	1.80	2.45	0.42	6	71				84	77	
6	47.5	662.88	1.85	2.51	2.84	6	72	257	254	43	83	77	
5	50	665.27	1.85	2.51	5.26	6	72				85	78	
4	52.5	667.70	1.80	2.46	7.65	6	70				83	78	
3	55	670.03	1.80	2.45	0.04	6	72				86	79	
2	57.5	672.65	1.75	2.39	2.40	5.5	72				86	79	
1	60	674.50	1.30	1.78	4.44	4	71				86	79	
	(0923)												
	θ = 60	Vm = 58.10		ΔH = 2.54							Avg. = 76.1		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.A. / MONTROSE - Date 1/29/93 Test 7 Run 2
Source Press & Unloading Vent Stack No. of traverse points 24
Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 8 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

☐ acetone
☒ other(s) $MECL_2$ & DI H_2O

No. of probe wash bottles: 1
Sample recovered by: DGH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	200	200	0
Impinger No. 3			
Condenser			
Desiccant	1371	1362	9
Total			9

Integrated Gas Sampling Data: Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

CF-DTT

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: L.P. / Montrose Operators: Dutt & R.M Pitot No. V23-6 Cp .84
Source: Press & Unloading Vent Stack Meter Box No. 6 KAH 1.83 IN WC Bar. Press. 24.86 inHg H2O 6 %
Date: 1/29/93 Test 7 Run 2 Gasmeter coeff. 1.0051 Nozzle No. 7-2 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgs. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (%v/v)
	1004	674.10											
B, 12	2.5	677.20	1.90	2.57	7.23	6	70	247	250	40	75	75	AMBIENT
11	5	679.61	2.0	2.65	9.70	6	79				77	76	AIR
10	7.5	682.11	1.85	2.46	2.08	5.5	80				79	76	
9	10	684.54	1.80	2.40	4.44	5.5	79	256	256	40	77	80	
8	12.5	686.81	1.80	2.40	6.80		81				82	78	
7	15	689.17	1.85	2.47	9.19	5.5	81				83	78	
6	17.5	691.54	1.75	2.35	1.53	5.5	78	255	257	40	83	78	
5	20	693.91	1.75	2.34	3.87	5.5	80				82	77	
4	22.5	696.40	1.75	2.35	6.21	5.5	77				82	77	
3	25	698.60	1.75	2.38	8.56	5	77				83	77	
2	27.5	700.96	1.75	2.34	0.89	5	80	257	256	41	84	78	
1	30	703.14	1.5	2.02	3.06	4.5	77				84	78	
A 12	32.5	705.	1.60	2.16	5.30	4.5	77				85	80	
11	35	707.75	1.90	2.57	7.75	6	76				86	80	
10	37.5	710.34	2.10	2.84	0.33	6	77	253	254	43	86	80	
9	40	712.71	2.05	2.77	2.87	6	76				88	81	
8	42.5	715.30	1.90	2.59	5.32	6	74				88	81	
7	45	717.77	1.80	2.45	7.73	6	75				88	82	
6	47.5	720.20	1.80	2.45	0.13	6	75	256	255	43	88	82	
5	50	722.70	2.0	2.73	2.66	6.5	74				89	82	
4	52.5	725.11	2.0	2.72	5.19	6.5	75				89	83	
3	55	727.75	1.90	2.59	7.65	6	75				89	83	
2	57.5	730.03	1.70	2.33	9.99	5	73				89	83	
1	60	732.10	1.30	1.78	204	4	74				89	83	
	1106												
	θ = 60	Vm = 58.00		ΔH = 2.45							Avg. = 81.9		

S-0037R

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / MONTROSE / Press + Unloading Vent Stack Date 1/29/93 Test 7 Run 3
Source No. of traverse points 24
Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: ~~0.02~~ cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 8 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

☐ acetone
☒ other(s) $MECl_2$ + DI H_2O

No. of probe wash bottles: 1
Sample recovered by: DAH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	203	200	3
Impinger No. 3			
Condenser			
Desiccant	1405	1400	5
Total			8

Integrated Gas Sampling Data: Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / MONTROSE Operators R.D.T. + R.M. Pitot No. 2/23-6 Cp .82
Source Press & Unloading Vent Stack Meter Box No. 6 ^H@ 1.83 IN WC Bar. Press. 24.86 inHg H2O ? %
Date 1/29/93 Test 11 Run 3 Dgsmeter coeff. 1.0037 Nozzle No. 2-3 Nozzle Dia .187 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Obs. Vol. (cf)	VAC. inHg	Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	1143	732.40											
A 12	2.5	734.91	1.90	2.60	4.86	5.5	70	236	249	41	78	78	AMBIENT
11	5	737.45	2.20	2.94	7.46	6	77				79	78	AIR
10	7.5	740.09	2.20	2.96	0.08	6	74				81	79	
9	10	742.60	2.10	2.83	2.64	6	76	251	249	41	83	79	
8	12.5	745.16	2.0	2.69	5.15	5.5	78				84	80	
7	15	747.60	1.85	2.50	7.56	5	76				85	81	
6	17.5	750.11	2.0	2.71	0.08	5.5	76	256	253	40	86	81	
5	20	752.61	2.0	2.70	2.59	5.5	77				87	81	
4	22.5	755.15	2.0	2.71	5.11	5.5	76				88	81	
3	25	757.68	1.95	2.64	7.60	5.5	77	254	254	42	88	82	
2	27.5	760.13	1.85	2.51	0.02	5	77				87	83	
1	30	762.40	1.60	2.18	2.29	4.5	76				87	85	
B 12	32.5	764.82	2.05	2.79	4.85	5.5	76				88	83	
11	35	767.33	1.85	2.50	7.27	5	79				87	83	
10	37.5	769.75	1.85	2.51	9.70	5	79				90	84	
9	40	772.23	1.80	2.44	2.10	5.5	80				90	84	
8	42.5	774.55	1.80	2.43	4.49	5.5	82				91	84	
7	45	776.90	1.80	2.43	6.85	5.5	82				91	84	
6	47.5	779.36	1.75	2.36	9.24	5	82				91	85	
5	50	781.65	1.80	2.42	1.63	5	84				92	83	
4	52.5	784.00	1.75	2.37	4.00	5	81				92	85	
3	55	786.33	1.80	2.44	6.40	5	81				92	83	
2	57.5	788.61	1.60	2.16	8.66	4.5	84				92	85	
1	60	790.65	1.20	1.63	0.62	4	82				92	86	
	(1248)												
	θ = 60	Vm = 58.25		^H = 2.52							Avg. = 85.1		

S-0037R

APPENDIX E

INTERPOLL LABORATORIES ANALYTICAL DATA

TABLE OF CONTENTS

Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job: L.P. Montrose
Team Leader: DVH
Date Submitted: 2-1-93
Test No.: 1
Date of Analysis: 2-1-93

Source: Dryer Stack
Test Site: Stack
Date of Test: 1-26-93
No. of Runs Completed: 3
Technician: C. Helgeson

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml) Zero Pt.	After CO_2	After O_2	Conc. CO_2 %v/v Dry	Conc. O_2 %v/v Dry	F_o
1/1	8023-13	1	0.00	3.20	20.70	3.20	17.50	1.06
		2	0.00	3.20	20.70	3.20	17.50	1.06
	☑ B ☐ F	Avg				3.20	17.50	
1/2	-14	1	0.00	3.10	20.70	3.10	17.60	1.06
		2	0.00	3.10	20.70	3.10	17.60	1.06
	☑ B ☐ F	Avg				3.10	17.60	
1/3	-15	1	0.00	3.00	20.70	3.00	17.70	1.07
		2	0.00	3.00	20.70	3.00	17.70	1.07
	☑ B ☐ F	Avg				3.00	17.70	
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						

☑ Ambient Air QA Check
☑ Orsat Analyzer System Leak Check
☐ F_o Within EPA M-3 Guidelines for fuel type.

Where $F_o = \frac{20.9 - O_2}{CO_2}$

F=Flask (250 cc all glass)
B=Tedlar Bag (5-layer)

EPA Method 3 Guidelines

Fuel Type	F0 Range
Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
Wood/Wood Bark	1.000-1.130

LSC-04-RP

Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L.P. Montrose
Team Leader DCH
Date Submitted 2-1-93
Test No. 2
Date of Analysis 2-1-93

Source Dryer
Test Site Stack
Date of Test 1-27-93
No. of Runs Completed 3
Technician C. Hekeson

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml) Zero Pt.	After CO_2	After O_2	Conc. CO_2 %v/v Dry	Conc. O_2 %v/v Dry	F_o
2/1		1	0.00	3.10	20.70	3.10	17.60	1.06
	8023-37	2	0.00	3.10	20.70	3.10	17.60	1.06
	☑ B ☐ F	Avg				3.10	17.60	
2/2		1	0.00	3.10	20.70	3.10	17.60	1.06
	-41	2	0.00	3.10	20.70	3.10	17.60	1.06
	☑ B ☐ F	Avg				3.10	17.60	
2/3		1	0.00	3.00	20.70	3.00	17.70	1.07
	-45	2	0.00	3.00	20.70	3.00	17.70	1.07
	☑ B ☐ F	Avg				3.00	17.70	
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						

☑ Ambient Air QA Check
☑ Orsat Analyzer System Leak Check
☐ F_o Within EPA M-3 Guidelines for fuel type.

Where $F_o = \frac{20.9 - O_2}{CO_2}$

F=Flask (250 cc all glass)
B=Tedlar Bag (5-layer)

EPA Method 3 Guidelines

Fuel Type	F0 Range
Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
Wood/Wood Bark	1.000-1.130

LSC-04-BR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job: L.P. / Montrose
Team Leader: DVH
Date Submitted: 2-1-93
Test No.: 2
Date of Analysis: 2-8-93

Source: Dryer
Test Site: Stack
Date of Test: 1-27-93
No. of Runs Completed: 3
Technician: C. Helgeson

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Log Number 8023-36 Comments ____	Dish No. 201 Dish Tare Wt. 42.2305 g Dish+Sample Wt. 42.2606 g Sample Wt. 0.0301 g
2	Test 2 Run 2 Log Number -40 Comments ____	Dish No. 203 Dish Tare Wt. 46.8695 g Dish+Sample Wt. 46.9023 g Sample Wt. 0.0328 g
3	Test 2 Run 3 Log Number -44 Comments ____	Dish No. 405 Dish Tare Wt. 48.4905 g Dish+Sample Wt. 48.5191 g Sample Wt. 0.0286 g
4	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

Blank Solvent Wt. 0.0003 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0298	0.0325 E-3	0.0283		

LSC-03.GR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job LP/Montrose
Team Leader DJH
Date Submitted 2-1-93
Test No. 2
Date of Analysis 2-6-93
Transport Leakage [X] None [ ] _____ ml

Source Dryer
Test Site Stack
Date of Test 1-27-93
No. of Runs Completed 3
Technician B. Dale
Solvent Acetone

0	Test ____ Run 0 Field Blank Log Number ____ Vol. of Solvent ____ ml *Solvent Residue 2.4 ug/ml	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Vol. of Solvent 250 ml Log Number 8023-34 Comments ____	Dish No. 33 Dish Tare Wt. 47.9414 g Dish+Sample Wt. 47.9516 g Sample Wt. 0.0102 g
2	Test 2 Run 2 Vol. of Solvent 250 ml Log Number -38 Comments ____	Dish No. 34 Dish Tare Wt. 47.2502 g Dish+Sample Wt. 47.2563 g Sample Wt. 0.0061 g
3	Test 2 Run 3 Vol. of Solvent 210 ml Log Number -42 Comments ____	Dish No. 37 Dish Tare Wt. 49.4978 g Dish+Sample Wt. 49.5063 g Sample Wt. 0.0085 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue ___ ug/ml = [(Sample Wt. ____ g)(10⁶)]/Vol. of Sol. ____ ml
EPA-M5 Acetone Residue Blank Spec. < 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0096	0.0055 E-4	0.0080		

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job L. P. MONTROSE
Team Leader DUH
Date Submitted 2-1-93
Test No. 2
Date of Analysis 2-8-93

Source DRYER
Test Site STACK
Date of Test 1-27-93
No. of Runs Completed 3
Technician JS

0
Test ____ Run 0
Field Blank
Log Number ____
Comments ____
Filter No. ____
Filter Type ____
Filter Tare Wt. ____ g
Filter+Sample Wt. ____ g
Sample Wt. ____ g

1
Test 2 Run 1
Log Number 8023-35
Comments ____
Filter No. 4984
Filter Type 4" GF
Filter Tare Wt. .8929 g
Filter+Sample Wt. .9066 g
Sample Wt. .0137 g

2
Test 2 Run 2
Log Number -34
Comments ____
Filter No. 4986
Filter Type 4" GF
Filter Tare Wt. .8871 g
Filter+Sample Wt. .9027 g
Sample Wt. .0156 g

3
Test 2 Run 3
Log Number -43
Comments ____
Filter No. 4989
Filter Type 4" GF
Filter Tare Wt. .8968 g
Filter+Sample Wt. .9119 g
Sample Wt. .0151 g

4
Test ____ Run ____
Log Number ____
Comments ____
Filter No. ____
Filter Type ____
Filter Tare Wt. ____ g
Filter+Sample Wt. ____ g
Sample Wt. ____ g

5
Test ____ Run ____
Log Number ____
Comments ____
Filter No. ____
Filter Type ____
Filter Tare Wt. ____ g
Filter+Sample Wt. ____ g
Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0137	0.0156	0.0151		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0531	0.0536	0.0514		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job: L.P. Montrose
Team Leader: DuA
Date Submitted: 2-1-93
Test No.: 4
Date of Analysis: 2-5-93

Source: Press + Unloading Vent
Test Site: Stack
Date of Test:
No. of Runs Completed:
Technician:

0	Test 4 Run 0 Field Blank Log Number 8023-48 Comments	Dish No. 55 Dish Tare Wt. 47.7750 g Dish+Sample Wt. 47.7753 g Sample Wt. 0.0003 g
1	Test 4 Run 1 Log Number -51 Comments	Dish No. 62 Dish Tare Wt. 50.8941 g Dish+Sample Wt. 50.8941 g Sample Wt. 0.0050 g
2	Test 4 Run 2 Log Number -53 Comments	Dish No. 69 Dish Tare Wt. 47.9891 g Dish+Sample Wt. 47.9939 g Sample Wt. 0.0048 g
3	Test 4 Run 3 Log Number -57 Comments	Dish No. 100 Dish Tare Wt. 45.9680 g Dish+Sample Wt. 45.9730 g Sample Wt. 0.0050 g
4	Test Run Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test Run Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0003g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0047	0.0045 E-5	0.0047		

LSC-03.GR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job LP / Montrose
Team Leader DVH
Date Submitted 2-1-93
Test No. 4
Date of Analysis 2-6-93
Transport Leakage [X] None [ ] _____ ml

Source Press & Unloading Vent
Test Site Stack
Date of Test 1-28-93
No. of Runs Completed 3
Technician B Anderson
Solvent Acetone

0	Test ____ Run 0 Field Blank Log Number ____ Vol. of Solvent ____ ml *Solvent Residue 2.4 ug/ml	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 4 Run 1 Vol. of Solvent 250 ml Log Number 8023-49 Comments ____	Dish No. 38 Dish Tare Wt. 48.6493 g Dish+Sample Wt. 48.6573 g Sample Wt. 0.0080 g
2	Test 4 Run 2 Vol. of Solvent 250 ml Log Number -52 Comments ____	Dish No. 40 Dish Tare Wt. 47.6429 g Dish+Sample Wt. 47.6513 g Sample Wt. 0.0084 g
3	Test 4 Run 3 Vol. of Solvent 240 ml Log Number -55 Comments ____	Dish No. 41 Dish Tare Wt. 45.3222 g Dish+Sample Wt. 45.3295 g Sample Wt. 0.0073 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue ___ ug/ml = [(Sample Wt. ____ g)(10^6)]/Vol. of Sol. ____ ml
EPA-M5 Acetone Residue Blank Spec. < 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0073	0.0078 E-7	0.0067		

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job: L.P. MONTROSE
Team Leader: DUH
Date Submitted: 2-1-93
Test No.: 4
Date of Analysis: 2-8-93

Source: PRESS & UNLOADING VENT
Test Site: STACK
Date of Test: 1-27-93
No. of Runs Completed: 3
Technician: JS

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
1	Test 4 Run 1 Log Number 8023-50 Comments ____	Filter No. 5017 Filter Type 4" GF Filter Tare Wt. .8912 g Filter+Sample Wt. .8929 g Sample Wt. 0.0017 g
2	Test 4 Run 2 Log Number -53 Comments ____	Filter No. 5018 Filter Type 4" GF Filter Tare Wt. .8833 g Filter+Sample Wt. .8840 g Sample Wt. 0.0007 g
3	Test 4 Run 3 Log Number -56 Comments ____	Filter No. 5019 Filter Type 4" GF Filter Tare Wt. .8868 g Filter+Sample Wt. .8887 g Sample Wt. 0.0019 g
4	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0017	0.0007	0.0019		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0137	0.0130	0.0133		

LSC-02PR

EPA Method 10 NDIR Analysis

Job Name L.P. Montrose
Source Dryer Stack
Date of Analysis 2-1-93
Technician C. Helgeson

NDIR Analyzer:
☐ Fugi ACS Model 3300
☐ Mon. Lab Model 8310
☑ Dasibi Model 3003
Range: 0 - 200 ppm
Flow rate: 1000 cc/min

Pretest Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm	Linde	059245
Upscale gas:	38 ppm	38 ppm	"	HA-7972
Upscale gas:	148 ppm	148 ppm	"	60832
Upscale gas:	ppm	ppm		

Post-test Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm	Linde	0892-15
Upscale gas:	38 ppm	38 ppm	"	HA-7972
Upscale gas:	145 ppm	148 ppm	"	60832
Upscale gas:	ppm	ppm		

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry)		
		Dilution Factor	Reading	Actual ppm
2/1	8023-37	10	66.6	666
2/2	-41	10	64.1	641
2/3	-45	10	71.3	713

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry)		
		Dilution Factor	Reading	Actual ppm

Note 1: If sample dilution is requried the sample is diluted with CO-free gas prior to analysis.
Note 2: The Fugi ACS model 3300 has a rejection ratio for CO to CO_2 greater then 100,000: 1 and the Mon. Labs Model 8310 and Dasibi Model 3003 have rejection ratios greater then 200,000:1 and thus CO_2 removal prior to analysis is not required.
Note 3: The analyzer must be zeroed and spanned immediately before and after sample analysis. Additional checks may be performed between sample analyses if required.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana-Pacific, Montrose
Laboratory Log No. 8023

Results of MDI Analysis[1]

Test: 5

Source: Press & Unloading Vent Stack

Sample Type: Impinger Catch

Sample Log No.	Sample Description	MDI Total ug
8023-58	Run 0 (Field Blank)	< 6.5
8023-59	Run 1	120
8023-60	Run 2	120
8023-61	Run 3	130

Sincerely,

INTERPOLL LABORATORIES, INC.

Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

[1]Analysis performed by Method II-8791.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana-Pacific, Montrose
Laboratory Log No. 8023

Results of Formaldehyde Analysis[1]

Test: 1
Source: Dryer Scrubber Inlet
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde Total ug
8023-01	Run 0 (Field Blank)	10
8023-02	Run 1	9600
8023-03	Run 2	10000
8023-04	Run 3	12000

Sincerely,

INTERPOLL LABORATORIES, INC.

Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

[1]Analysis performed by EPA Method 0011.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana-Pacific, Montrose
Laboratory Log No. 8023

Results of Formaldehyde Analysis[1]

Test: 1
Source: Dryer Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde Total ug
8023-08	Run 0 (Field Blank)	6.8
8023-09	(Field Spike)	5.2
8023-10	Run 1	7900
8023-11	Run 2	8100
8023-12	Run 3	11000

Sincerely,

INTERPOLL LABORATORIES, INC.

Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

[1]Analysis performed by EPA Method 0011.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana-Pacific, Montrose
Laboratory Log No. 8023

Results of Formaldehyde Analysis[1]

Test: 7
Source: Press & Unloading Vent Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde Total ug
8023-62	Run 0 (Field Blank)	5.0
8023-63	Run 1	4100
8023-64	Run 2	4400
8023-65	Run 3	4000

Sincerely,

INTERPOLL LABORATORIES, INC.

Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

[1]Analysis performed by EPA Method 0011.

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job L.P./MONTROSE
Team Leader DH
Date Submitted 1/
Test No. 1

Source DRYER STACK
Test Site "
Date of Test 1/26/93
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
	Probe Wash: ☐Acetone ☐D.I. Water	☐As per EPA M-5 ☐Other _____	
	Filter: ☐4" G.F. ☐S.S. Thimble ☐2.5" G.F. ☐47 mm G.F.	☐As per EPA M-5 ☐As per EPA M-17 ☐Other _____	
5	Impinger Catch: ☐D.I. Water ☐3% H_2O_2 ☐4M5 Hg Only ☐4M5 Metals ☐1.0 N NaOH ☒Other 2-4 DNPH	☐MN Protocol ☐WI Protocol ☐EPA M-6 or 8 ☐Acid Gases ☒Formaldehyde – 0011 ☐Metals ☐Other _____	
3	Integrated Gas sample	☒As per EPA M-3 ☐As per EPA M-10 ☐Other _____	
	Oxides of Nitrogen (NO_x)	☐As per EPA M-7A ☐Other _____	Date _____ Time(HRS) _____
	☐ Fuel Sample ☐ Aggregate	☐Attached fuel Form #S-0163RRR	
	Particle Size	☐X-Ray Sedigraph ☐Bahco Method ☐Other _____	
	Audit Samples ☐Sulfur Dioxide ☐Oxides of Nit. ☐Other _____	☐As per EPA M-6 ☐As per EPA M-7A ☐Other _____	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☒ Dryer ☐ Other _____
2) Fuel: ☐ Coal ☒ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other _____
3) Is sample combustible? ☒ No ☐ Yes
4) Does sample need special handling? ☒ No ☐ Yes If yes, explain _____

S-278RRRR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job: S.P. / MONTROSE
Team Leader: DVH
Date Submitted: 2/1/93
Test No.: 2
Source: DRYER
Test Site: STACK
Date of Test: 1/27/93
No. of Runs Completed: 3

No. of Samples	Type of Sample	Analysis Required	Comments
4	Probe Wash: ☒ Acetone ☐ D.I. Water	☒ As per EPA M-5 ☐ Other	
4	Filter: ☒ 4" G.F. ☐ S.S. Thimble ☐ 2.5" G.F. ☐ 47 mm G.F.	☒ As per EPA M-5 ☐ As per EPA M-17 ☐ Other	
4	Impinger Catch: ☒ D.I. Water ☐ 3% H_2O_2 ☐ 4M5 Hg Only ☐ 4M5 Metals ☐ 1.0 N NaOH ☐ Other	☐ MN Protocol ☐ WI Protocol ☐ EPA M-6 or 8 ☐ Acid Gases ☐ Formaldehyde ☐ Metals ☒ Other Colorado	
3	Integrated Gas sample	☒ As per EPA M-3 ☒ As per EPA M-10 ☐ Other	
	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other	Date Time (HRS)
	☐ Fuel Sample ☐ Aggregate	☐ Attached fuel Form #S-0163RRR	
	Particle Size	☐ X-Ray Sedigraph ☐ Bahco Method ☐ Other	
	Audit Samples ☐ Sulfur Dioxide ☐ Oxides of Nit. ☐ Other	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☒ Dryer ☐ Other
2) Fuel: ☐ Coal ☒ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other
3) Is sample combustible? ☒ No ☐ Yes
4) Does sample need special handling? ☒ No ☐ Yes If yes, explain

S-278RRRR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job K.P./MONTROSE
Team Leader Dutt
Date Submitted 2/1/93
Test No. 4

Source Press & Unloading Vent
Test Site STACK
Date of Test 1/28/93
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
4	Probe Wash: ☒ Acetone ☐ D.I. Water	☒ As per EPA M-5 ☐ Other _____	
4	Filter: ☒ 4" G.F. ☐ S.S. Thimble ☐ 2.5" G.F. ☐ 47 mm G.F.	☐ As per EPA M-5 ☐ As per EPA M-17 ☐ Other _____	
4	Impinger Catch: ☒ D.I. Water ☐ 3% H_2O_2 ☐ 4M5 Hg Only ☐ 4M5 Metals ☐ 1.0 N NaOH ☐ Other _____	☐ MN Protocol ☐ WI Protocol ☐ EPA M-6 or 8 ☐ Acid Gases ☐ Formaldehyde ☐ Metals ☒ Other Colorado	
0	Integrated Gas sample	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	Ambient Air
	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	Date _____ Time (HRS) _____
	☐ Fuel Sample ☐ Aggregate	☐ Attached fuel Form #S-0163RRR	
	Particle Size	☐ X-Ray Sedigraph ☐ Bahco Method ☐ Other _____	
	Audit Samples ☐ Sulfur Dioxide ☐ Oxides of Nit. ☐ Other _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer ☒ Other Vent
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☒ Other none
3) Is sample combustible? ☒ No ☐ Yes
4) Does sample need special handling? ☒ No ☐ Yes If yes, explain

S-278RRRR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job L.P. / MONTROSE
Team Leader DH
Date Submitted 2/1/93
Test No. 5

Source Press + Unloading Vent
Test Site STACK
Date of Test 1/28/93
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
4	Probe Wash: ☐Acetone ☒~~D.I. Water~~ MECL	☐As per EPA M-5 ☒Other MDL	
	Filter: ☐4" G.F. ☐S.S. Thimble ☐2.5" G.F. ☐47 mm G.F.	☐As per EPA M-5 ☐As per EPA M-17 ☐Other	
	Impinger Catch: ☐D.I. Water ☐3% H_2O_2 ☐4M5 Hg Only ☐4M5 Metals ☐1.0 N NaOH ☐Other	☐MN Protocol ☐WI Protocol ☐EPA M-6 or 8 ☐Acid Gases ☐Formaldehyde ☐Metals ☐Other	
	Integrated Gas sample	☐As per EPA M-3 ☐As per EPA M-10 ☐Other	
	Oxides of Nitrogen (NO_x)	☐As per EPA M-7A ☐Other	Date Time(HRS)
	☐ Fuel Sample ☐ Aggregate	☐Attached fuel Form #S-0163RRR	
	Particle Size	☐X-Ray Sedigraph ☐Bahco Method ☐Other	
	Audit Samples ☐Sulfur Dioxide ☐Oxides of Nit. ☐Other	☐As per EPA M-6 ☐As per EPA M-7A ☐Other	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer ☒ Other
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☒ Other
3) Is sample combustible? ☒ No ☐ Yes
4) Does sample need special handling? ☒ No ☐ Yes If yes, explain

S-278RRRR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job L.P. / Montrose
Team Leader Dill
Date Submitted 2/1/93
Test No. 7

Source Press + Unloading Vent
Test Site Stack
Date of Test 1/29/93
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
	Probe Wash: ☐Acetone ☐D.I. Water	☐As per EPA M-5 ☐Other _____	
	Filter: ☐4" G.F. ☐S.S. Thimble ☐2.5" G.F. ☐47 mm G.F.	☐As per EPA M-5 ☐As per EPA M-17 ☐Other _____	
4	Impinger Catch: ☐D.I. Water ☐3% H_2O_2 ☐4M5 Hg Only ☐4M5 Metals ☐1.0 N NaOH ☒Other _____	☐MN Protocol ☐WI Protocol ☐EPA M-6 or 8 ☐Acid Gases ☒Formaldehyde -0011 ☐Metals ☐Other _____	
	Integrated Gas sample	☐As per EPA M-3 ☐As per EPA M-10 ☐Other _____	
	Oxides of Nitrogen (NO_x)	☐As per EPA M-7A ☐Other _____	Date _____ Time(HRS) _____
	☐ Fuel Sample ☐ Aggregate	☐Attached fuel Form #S-0163RRR	
	Particle Size	☐X-Ray Sedigraph ☐Bahco Method ☐Other _____	
	Audit Samples ☐Sulfur Dioxide ☐Oxides of Nit. ☐Other _____	☐As per EPA M-6 ☐As per EPA M-7A ☐Other _____	

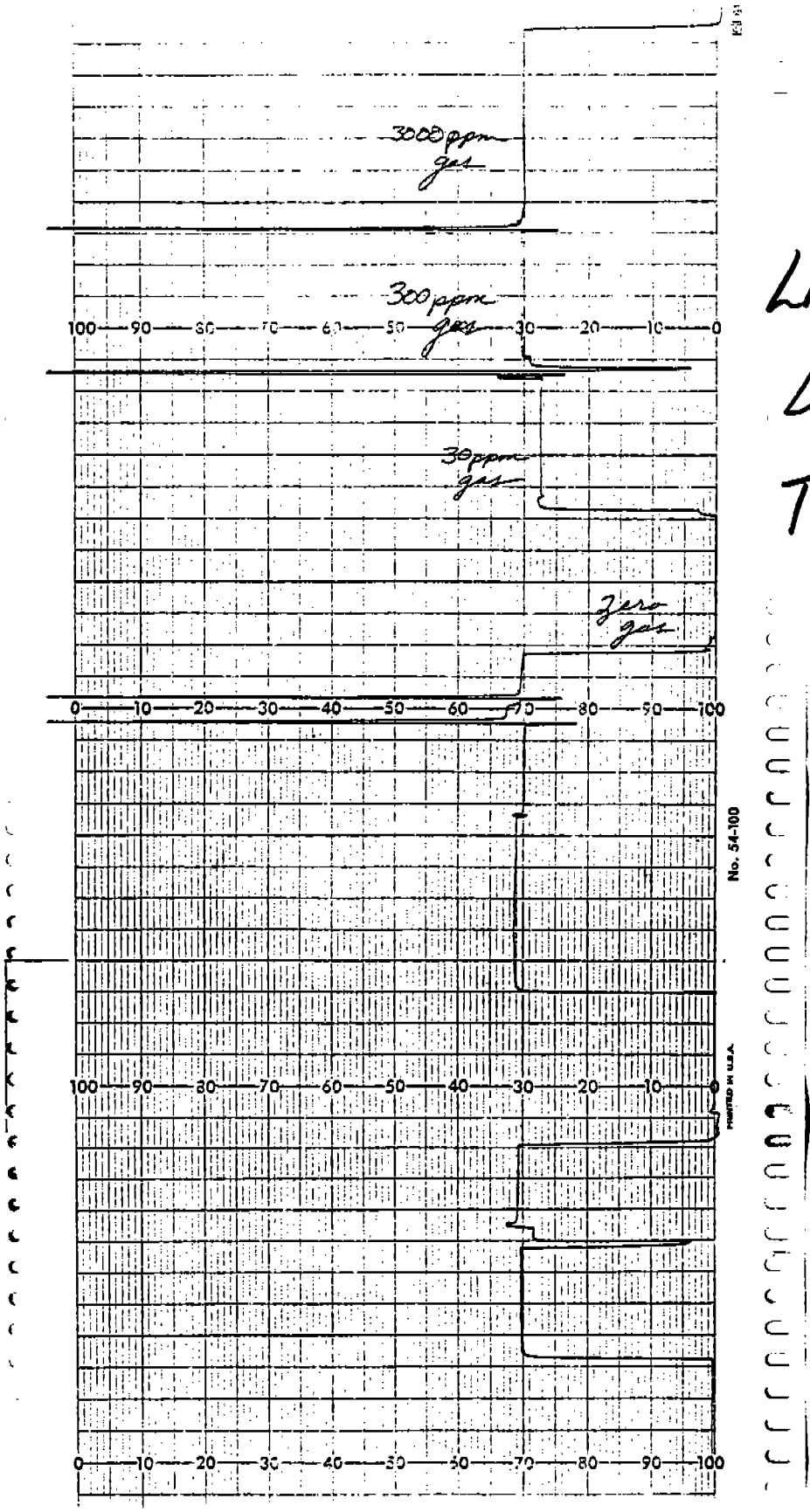
Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer ☐ Other _____
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other _____
3) Is sample combustible? ☒ No ☐ Yes
4) Does sample need special handling? ☒ No ☐ Yes If yes, explain _____

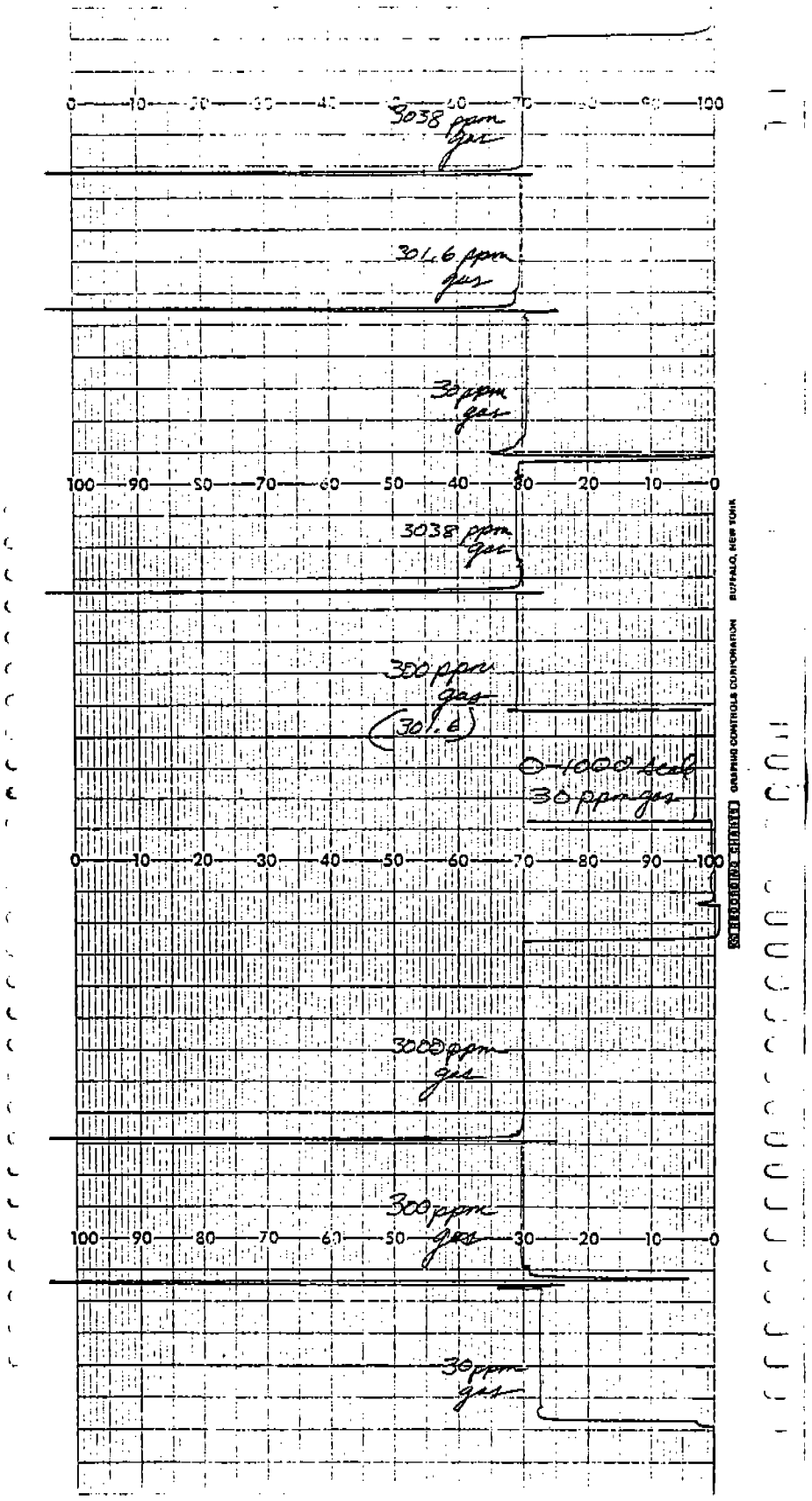
S-278RRRR

APPENDIX F

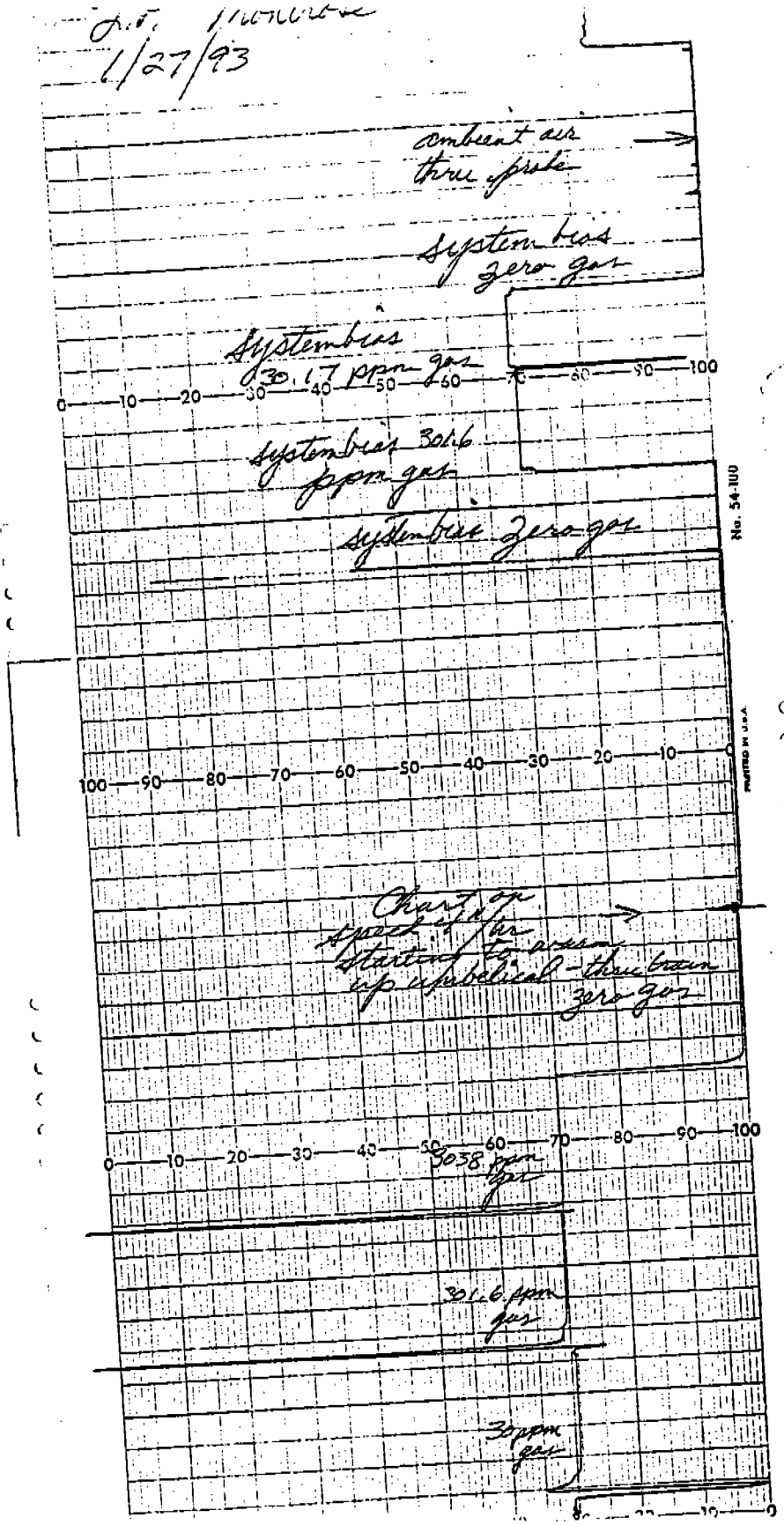
TOTAL HYDROCARBONS STRIPCHART



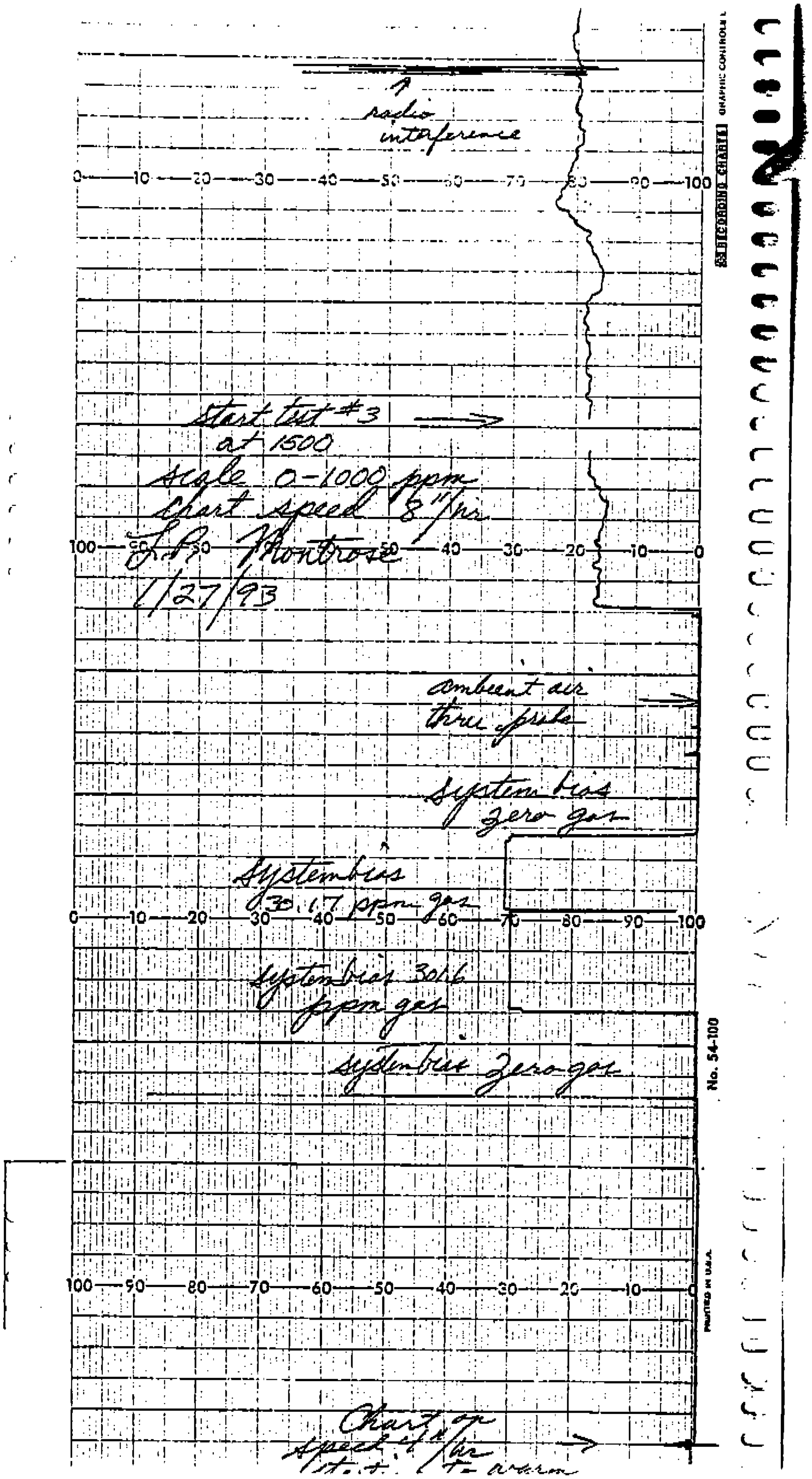
LP/Montreal
Dryer Stack
THC
1/27/93

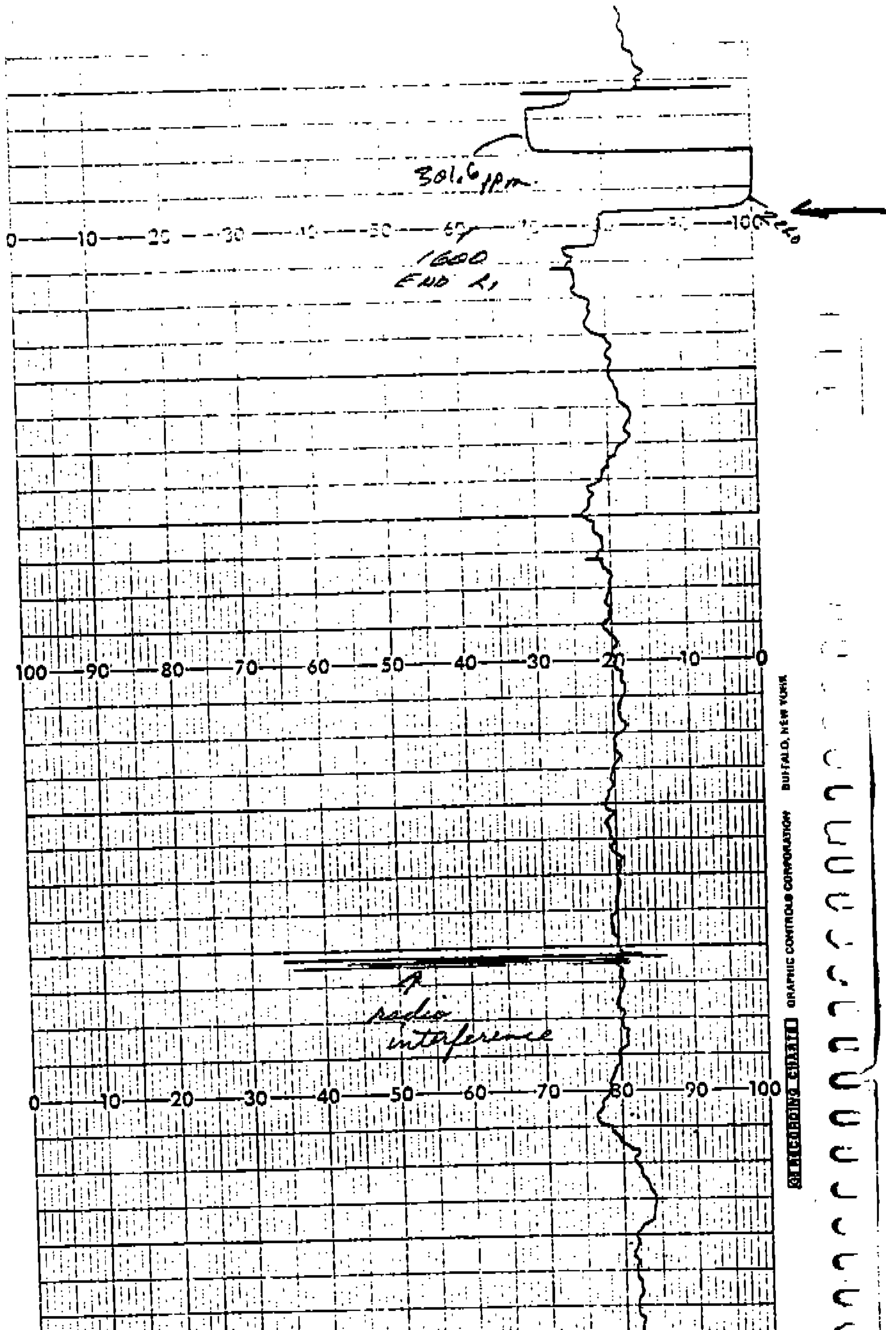


Calibration Data



Calibration data

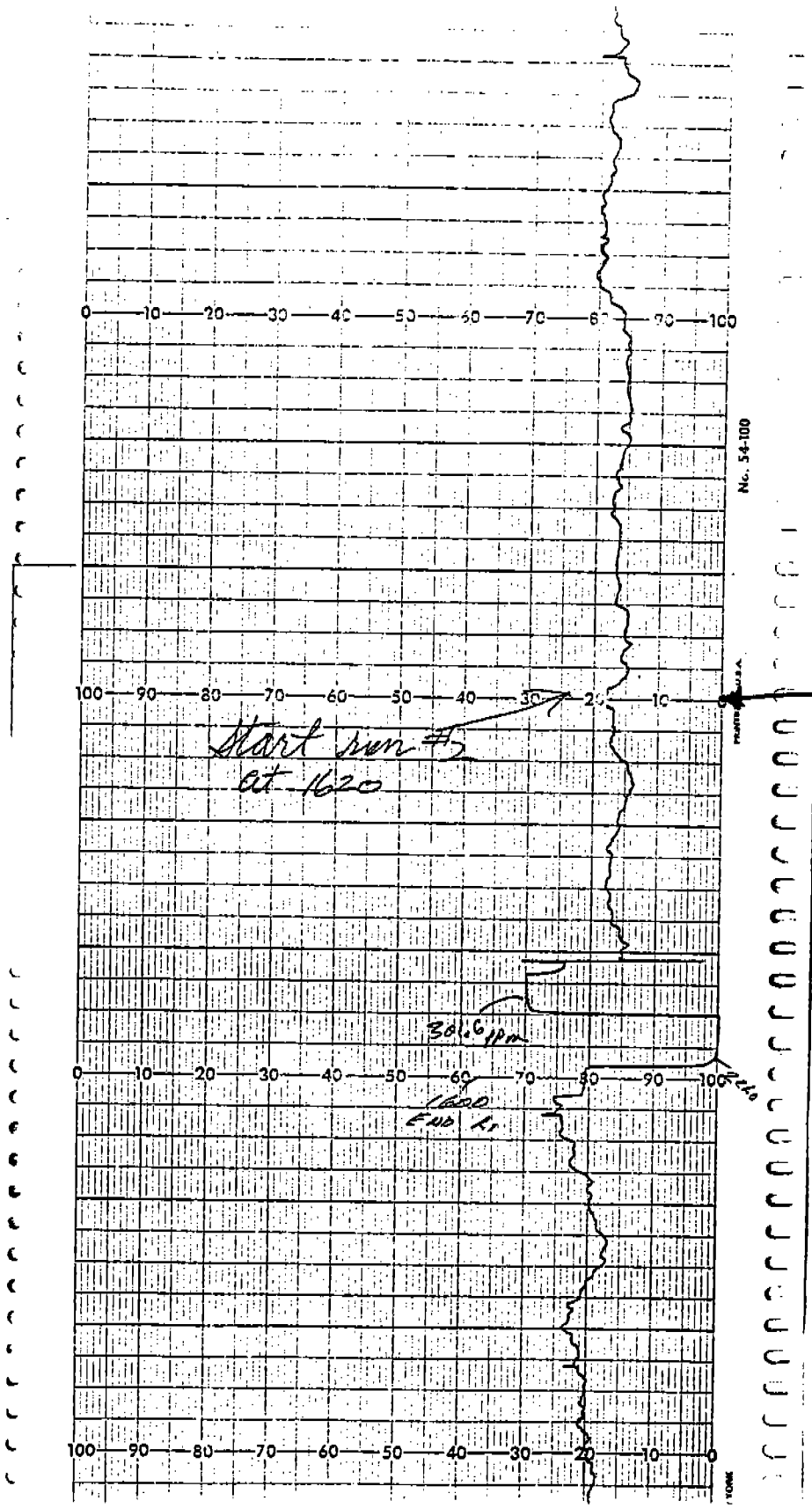

radio interference
Start test #3 at 1500
scale 0-1000 ppm
chart speed 8"/hr
L.P. Montrose
1/27/93
ambient air three probe
system bias zero gas
Systembias 30.17 ppm gas
systembias 30.46 ppm gas
systembias zero gas
Chart on speed 8"/hr
No. 54-100
PRINTED IN U.S.A.

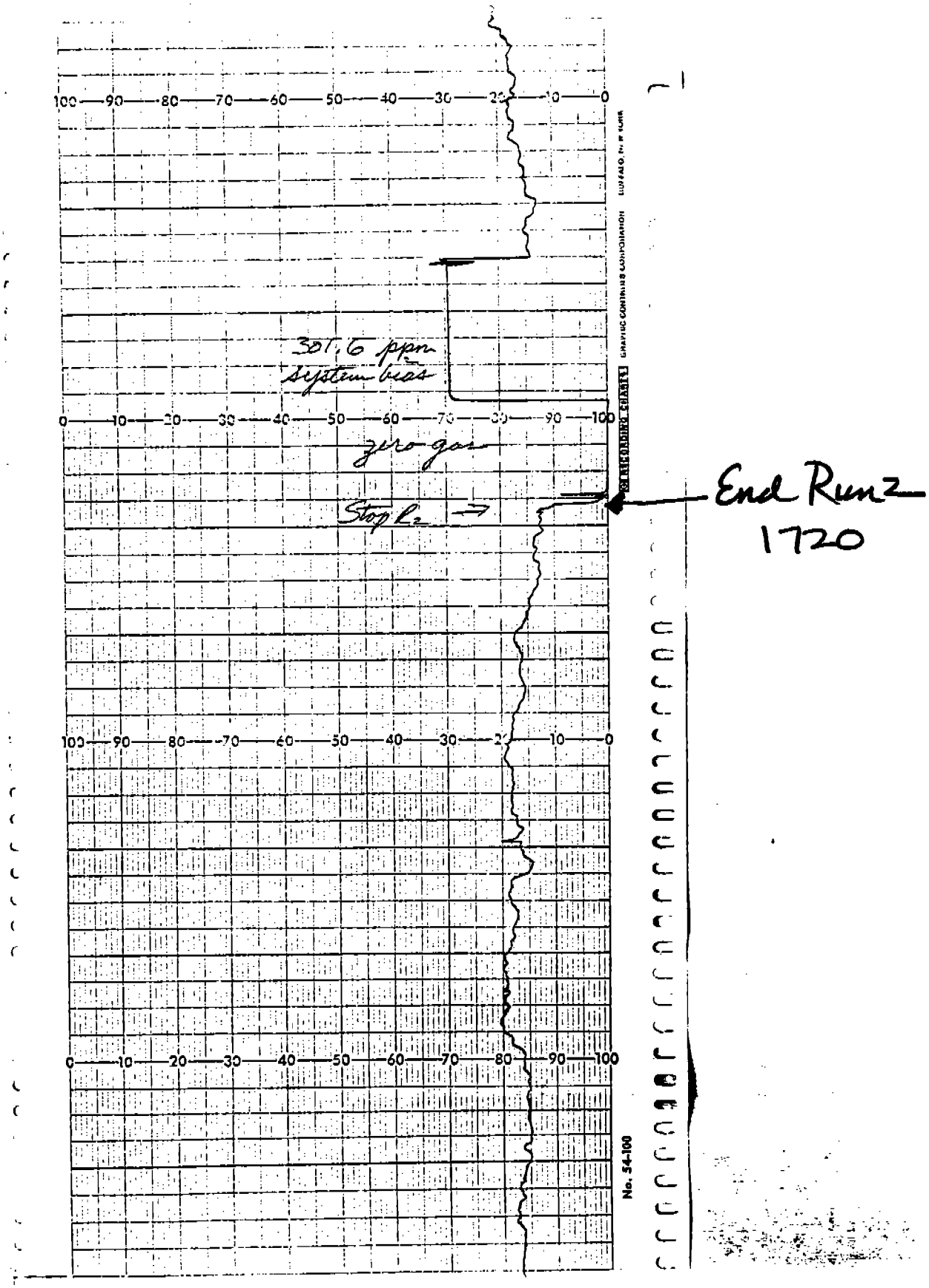


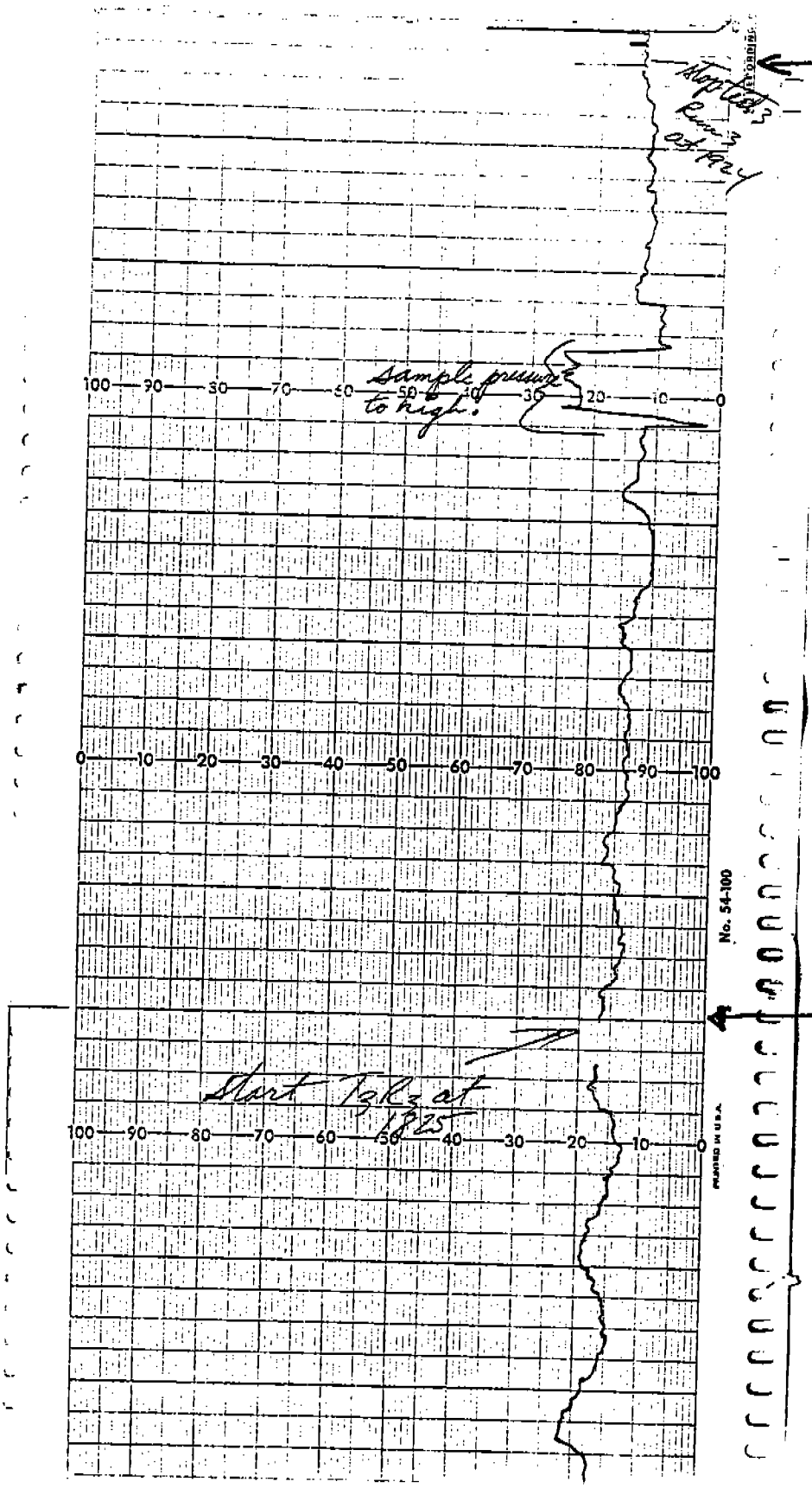
End Run 1
1600 HRS

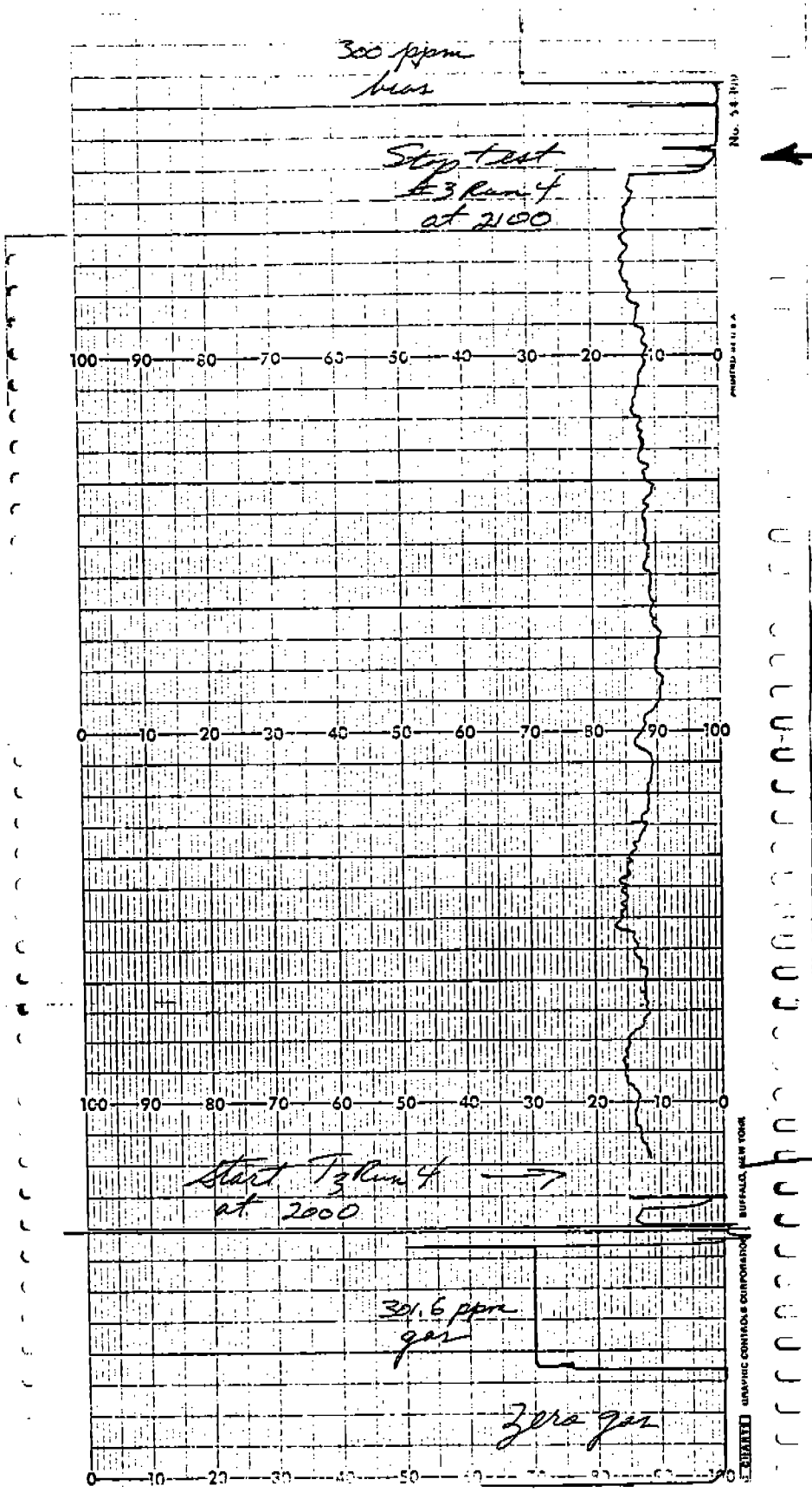
start Run 1
1500 HRS

0-1000 ppm,
as propane


0 10 20 30 40 50 60 70 80 90 100
No. 54-100
Start Run 2
1620 HRS
Start run #2
at 1620
381.6 rpm
1600
End Run
100 90 80 70 60 50 40 30 20 10 0

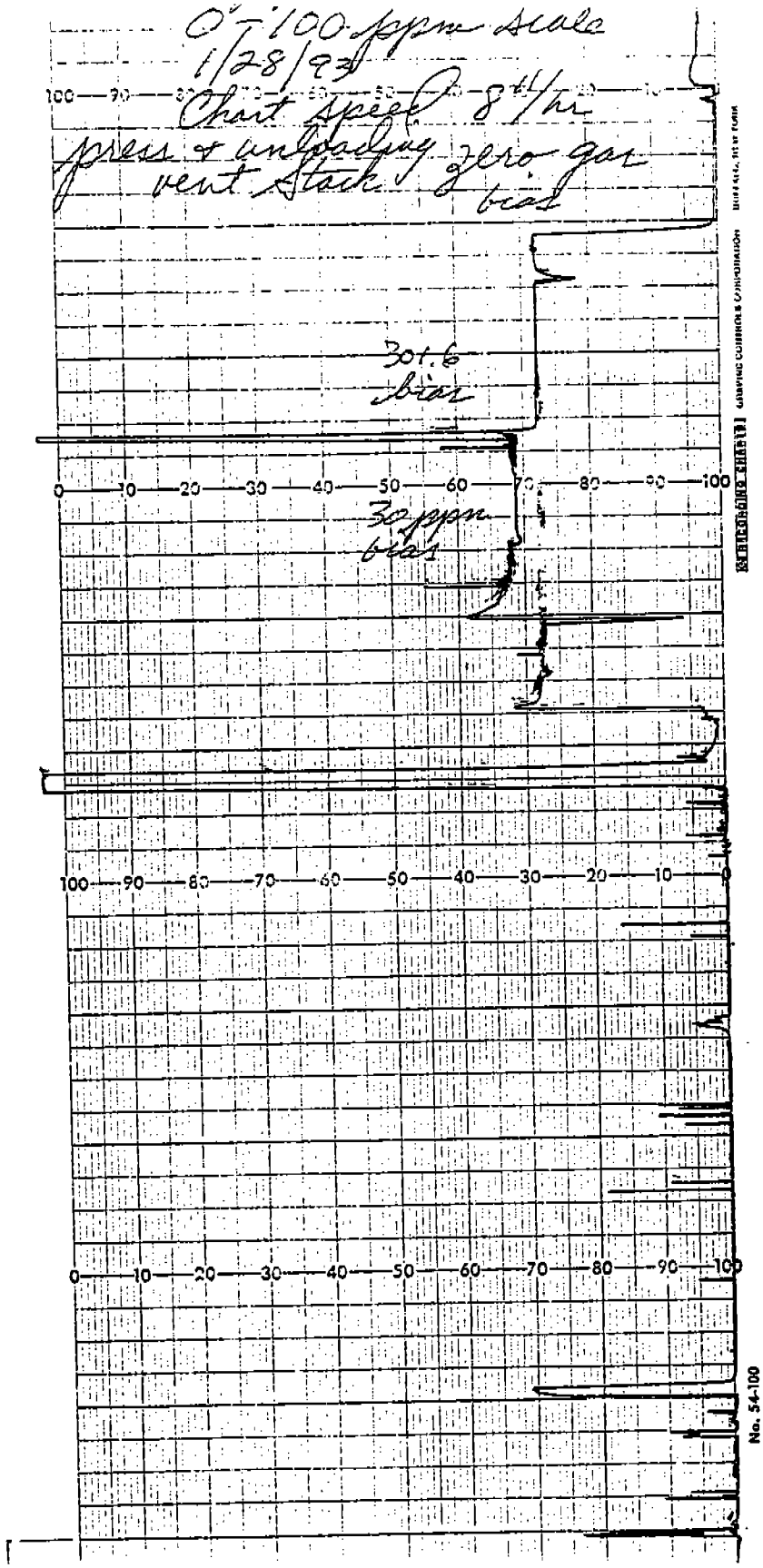

100 90 80 70 60 50 40 30 20 10 0
30T, 6 ppm
System bias
0 10 20 30 40 50 60 70 80 90 100
Zero gas
Stop R2
End Run 2
1720
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
No. 54-100


End Run 3
1924 HRS
Stopped Run 3 at 1924
Sample pressure to high.
Start Run 3
1825 HRS
Start Tk2 at 1825
No. 54-100
PRINTED IN U.S.A.

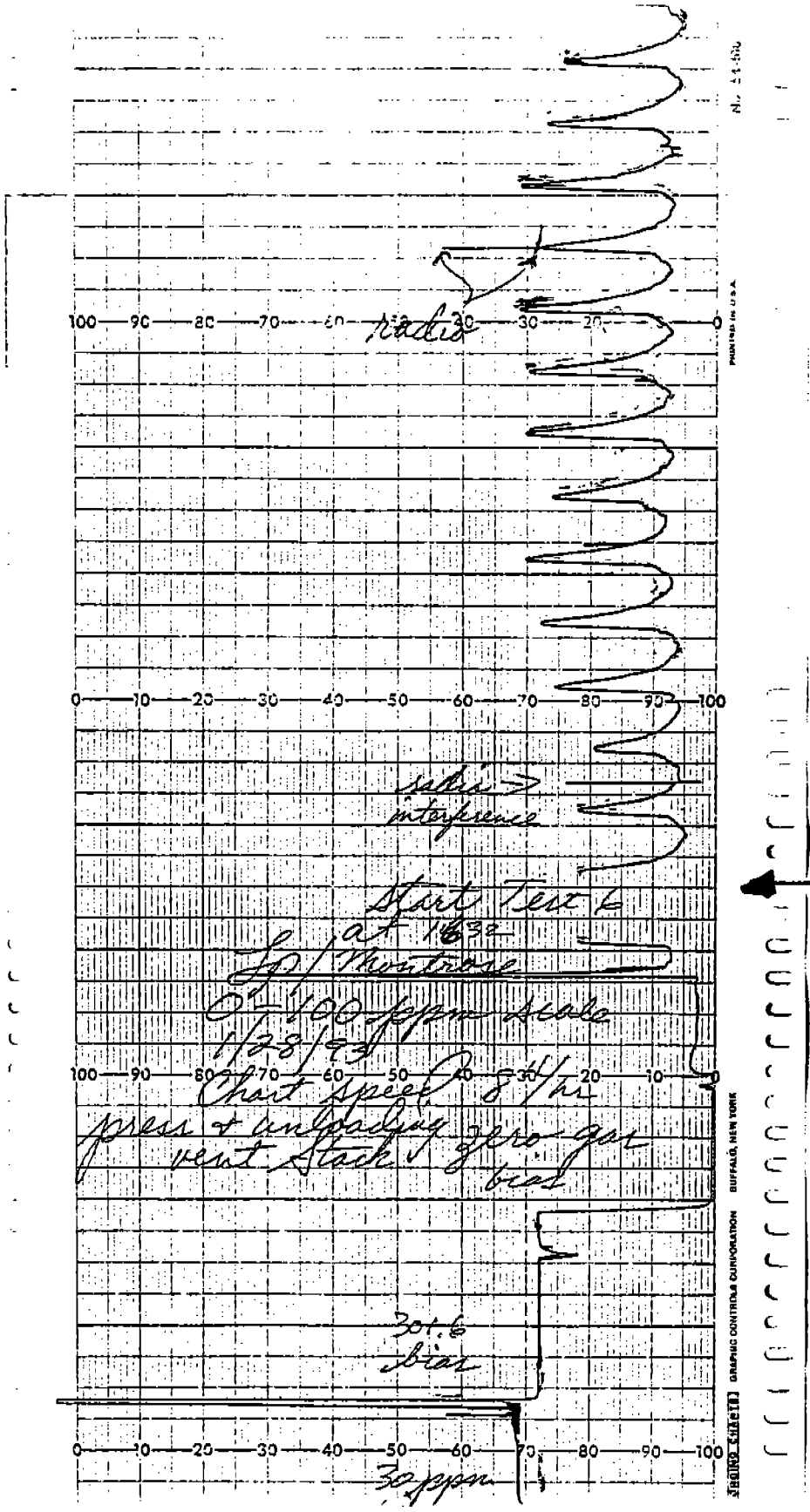


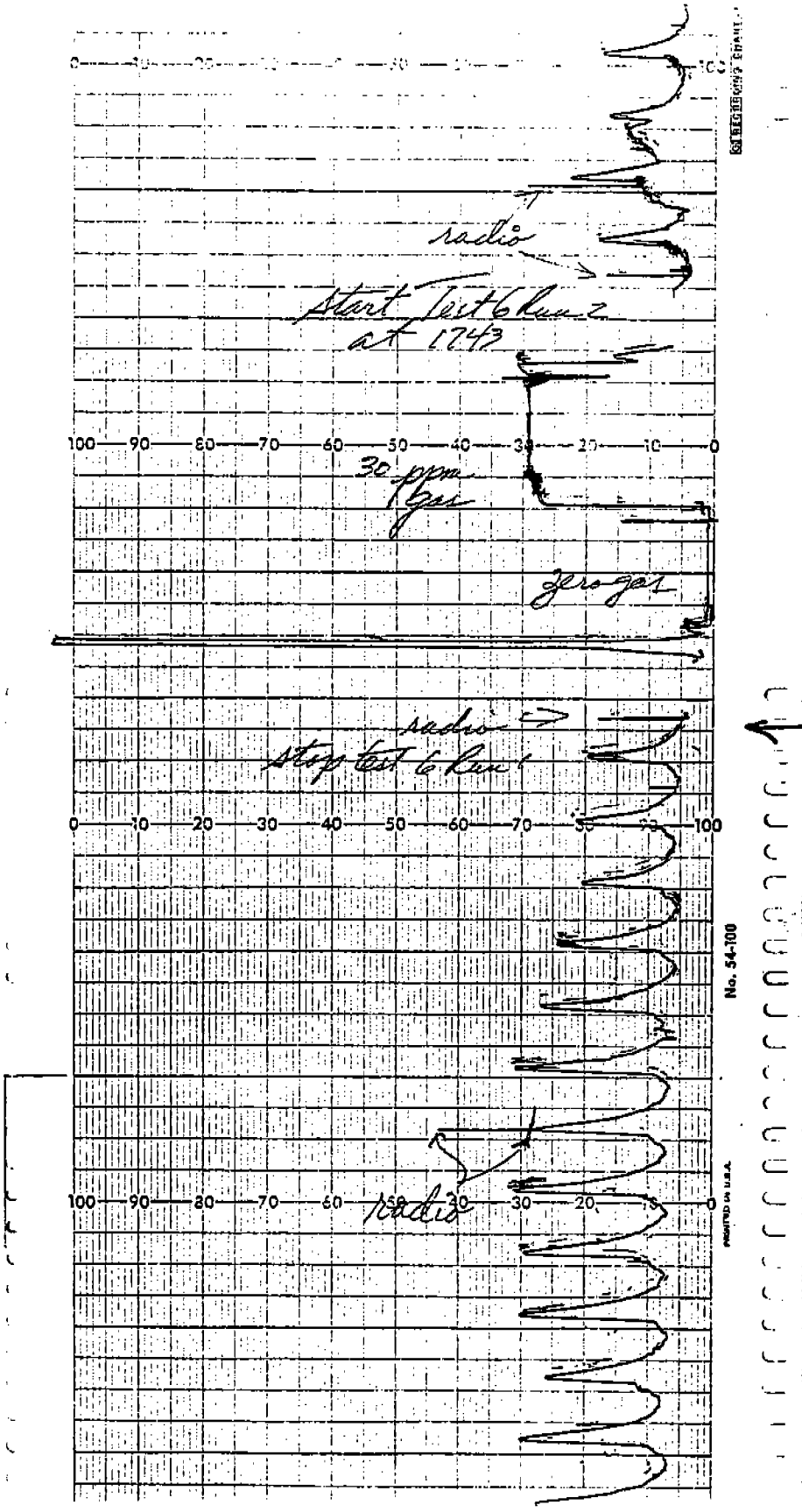
End Run 4
2100 HRS

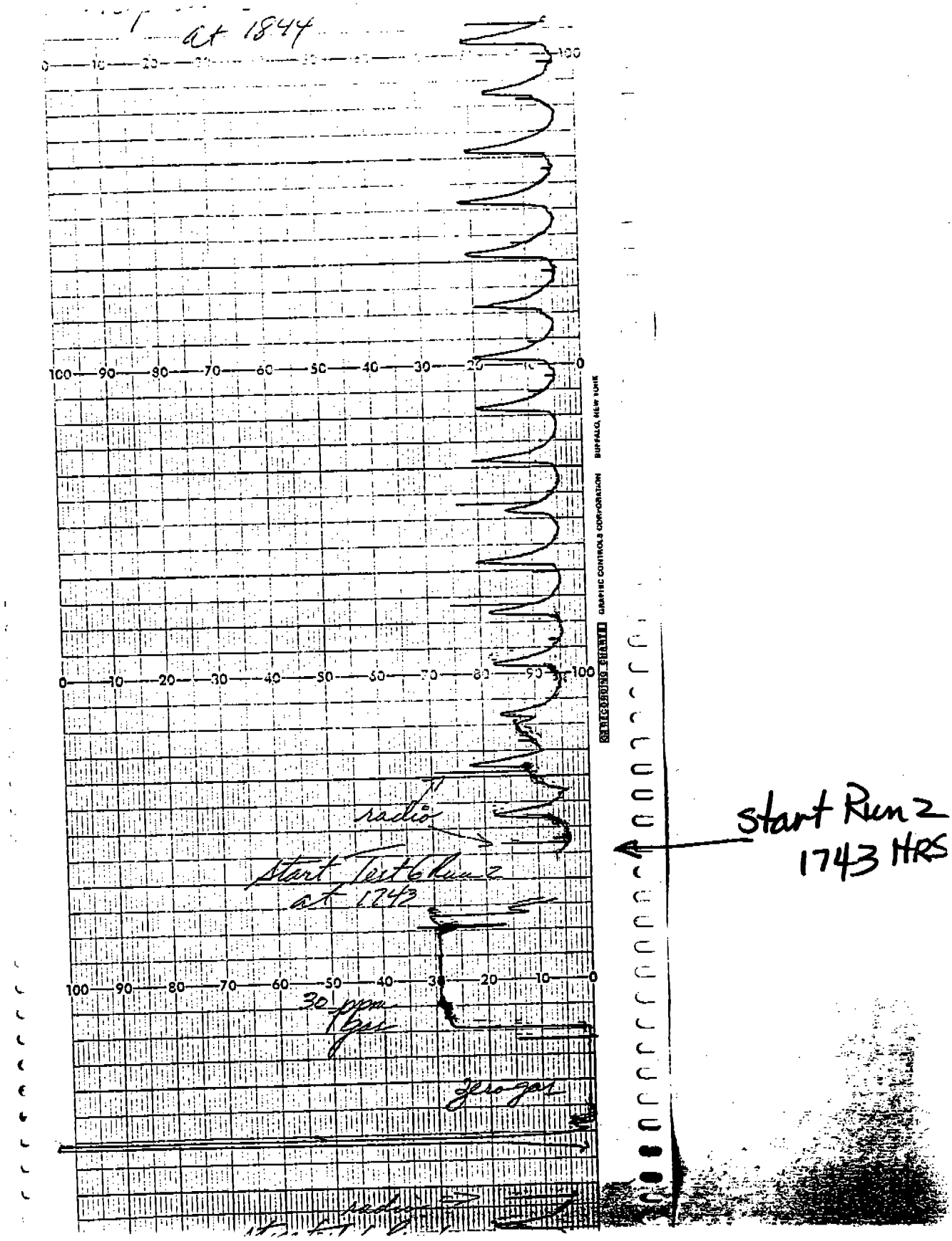
Start Run 4
2000 HRS

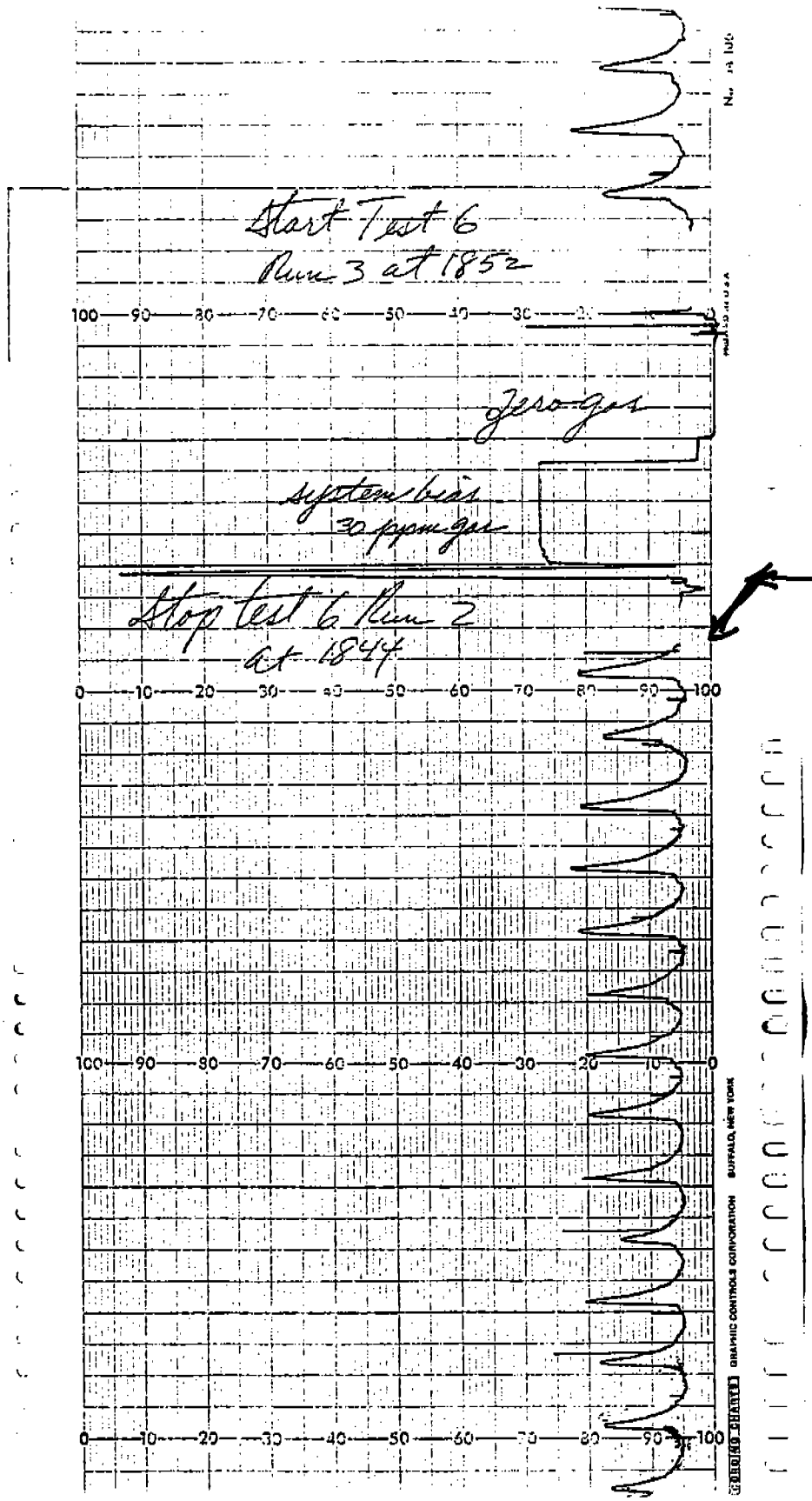


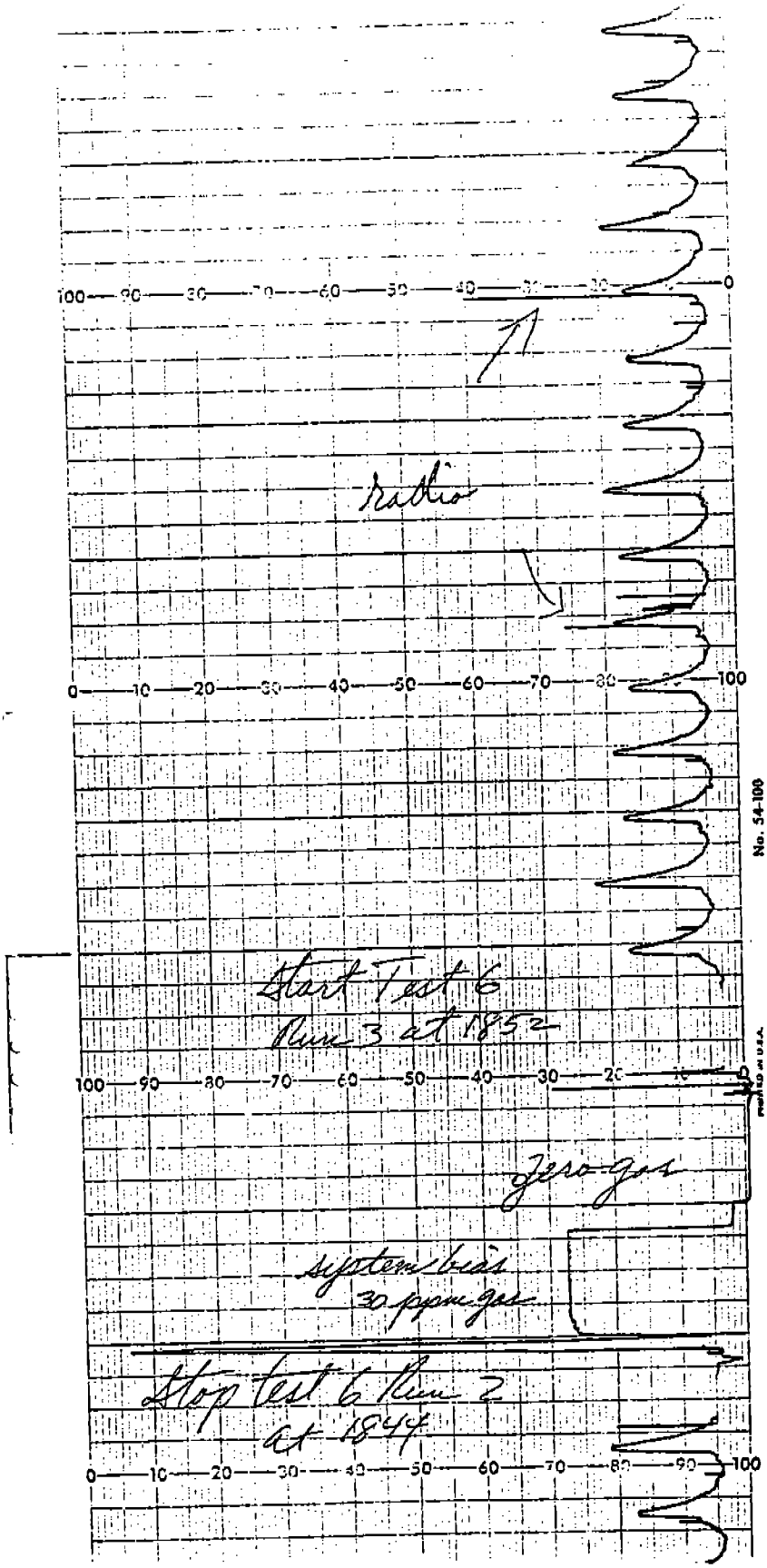
LP/Montrose
Press & Unloads
THC
1/28/93
0-100 ppm,
as propane

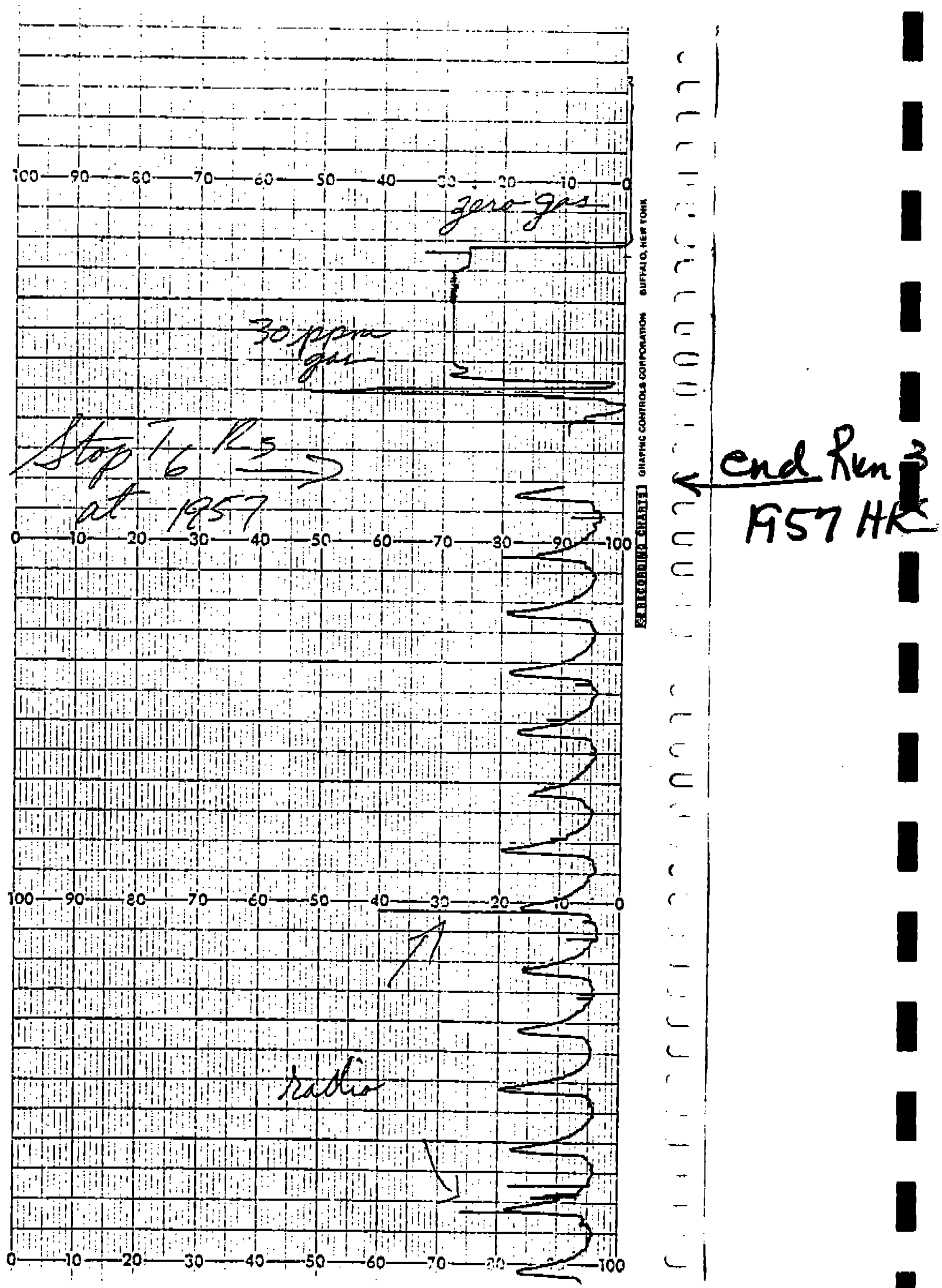

100 90 80 70 60 50 40 30 20 10 0
Radio
0 10 20 30 40 50 60 70 80 90 100
radio interference
Start Test 6 at 1632
Top / Thermocouple
OT 100 degree scale
1/28/93
Chart speed 8"/hr
press & unloading zero gas
vent stack / zero gas
bias
30 t.6
bias
30 ppm
Start Run 1
1632 HRS


radio
Start Test 6 Run 2
at 1743
30 ppm
H2
Zero gas
radio =>
Stop test 6 Run 1
radio
End Run 1
No. 54-100


at 1844
radio
Start Test 6 Run 2
at 1743
30 ppm
Start Run 2
1743 HRS


Start Test 6
Run 3 at 1852
100 90 80 70 60 50 40 30 20 10 0
Jeso gas
system bias
30 ppm gas
Stop test 6 Run 2
at 1844
0 10 20 30 40 50 60 70 80 90 100
End Run 2
1844 HRS
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
GRAPHIC CONTROLS CORPORATION BUFFALO, NEW YORK


100 90 80 70 60 50 40 30 20 10 0
11
Ratio
0 10 20 30 40 50 60 70 80 90 100
No. 54-100
Start Test 6
Run 3 at 1852
100 90 80 70 60 50 40 30 20 10 0
Zero gas
system bias
30 ppm gas
Stop test 6 Run 2
at 1844
0 10 20 30 40 50 60 70 80 90 100
Start Run 3
1852 HRS


100 90 80 70 60 50 40 30 20 10 0
zero gas
30 ppm gas
Stop T6 R5 at 1957
0 10 20 30 40 50 60 70 80 90 100
ratio
GRAPHIC CONTROLS CORPORATION BUFFALO, NEW YORK
end Run 3
1957 HK

APPENDIX G

THC ANALYZER SPECIFICATIONS

Ratfisch INSTRUMENTE

TOTAL HYDROCARBON ANALYZER (FLAME IONIZATION
Model RS 55

TECHNICAL DATES

MAINS : 115V/60H
RECORDER OUTPUT : 0 - 5 V / 4-20mA

MODEL: X Manual switching
__ Solenoid valves

HOUSING: __ Case, __ 19"-Rack

MEASURING RANGES:

1 = 0 –	10	C_1-
2 = 0 –	100	C_1
3 = 0 –	1,000	C_1
4 = 0 –	10,000	C_1

SPECIAL OPTIONS:

Flame out alarm .....
1 Alarm .....
Sample line .....
.....

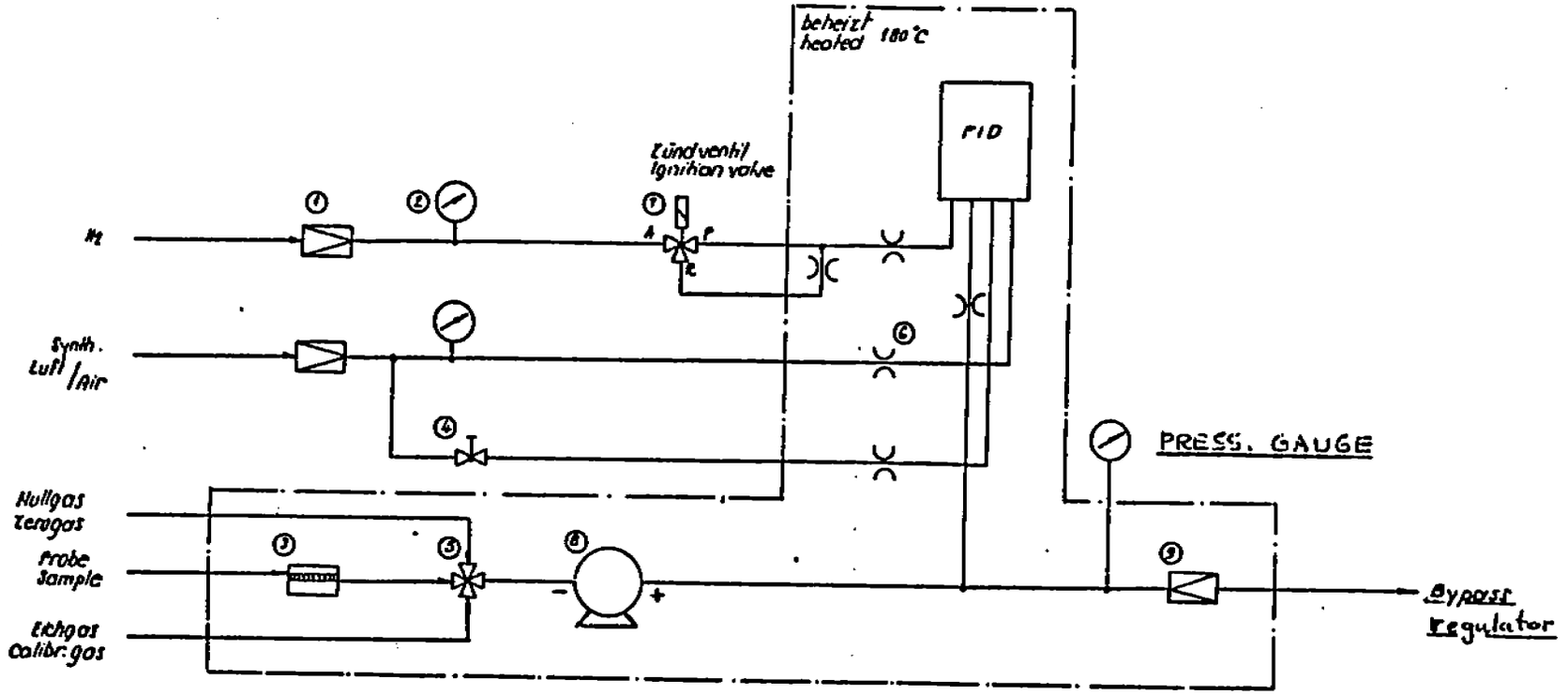
ANALYZER CONDITIONS:

Temperature : 160 °C

Zero Point : 3,90
Gain : 7,70

Pressure Setting: Sample/Spangas/Zerogas: 200 mbar
Fuel: Hydrogen : 0,35 bar
Combustion Air : 0,80 bar

Span Gases : 300 ppm C_1
24 000 ppm C_1



1 Druckregler
Pressure regulator
2 Manometer
Gauge
3 Filter
4 Nadelventil
Needle valve
5 3 Wege Ventil
3 way valve
6 Kapillare
capillary
7 Magnet Ventil
Solenoid valve
8 Pumpe
pump
9 Rückdruckregler
Back pressure regulator

Zündventil
Ignition valve

P-A angezogen
energised

R-A stromlos
at rest

Handumschaltung
Manuel switching

Ratfisch
INSTRUMENTE

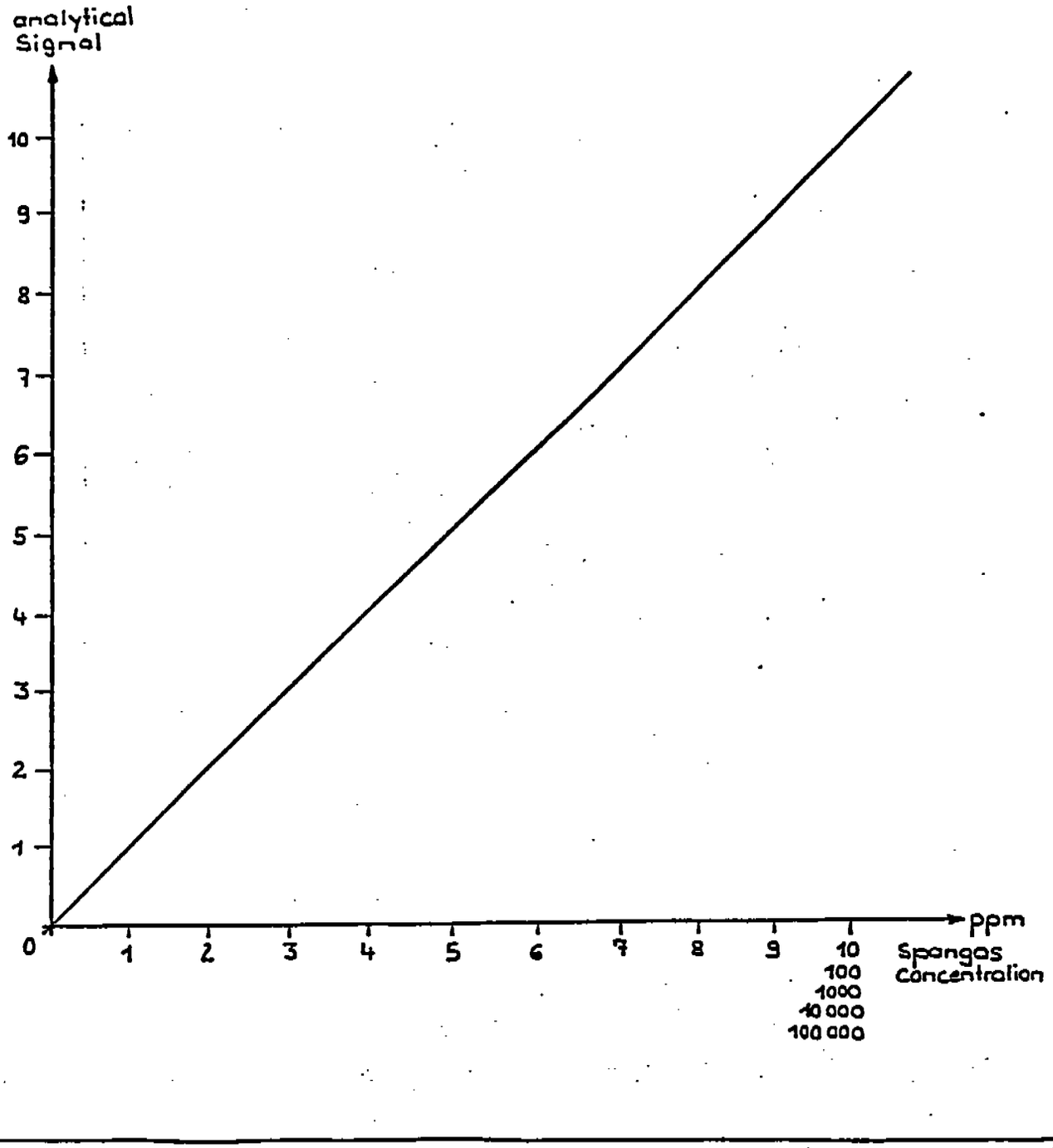
FLAMMEN IONISATIONS DETEKTOR
Flame Ionisation Detector

Fließplan
Flowdiagram

RS 55

13.04.88 dt

CALIBRATION DIAGRAMM



APPENDIX H

MEASUREMENT SYSTEMS PERFORMANCE SPECIFICATIONS

INTERFOLL LABORATORIES
EPA Method 25A
Calibration Error Check & Drift Determination

Job L.P. / MONTROSE

Test 3 Run 0 Date 1/27/93
Operator D. VAN Hoever

THC Calibration (Low Range): Time(HRS) _____

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	1	0	100	1%
Low level	30.17	29	1.17	100	1.17
Mid level	301.6	300	1.6	1000	.16
High level	3038	3000	38	10,000	.38

THC Calibration (High Range): Time(HRS) _____

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0				
Span					

O_2 Calibration: Time(HRS) _____

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

CO_2 Calibration: Time(HRS) _____

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

Must be within 2% of the span for each calibration gas S-420-14

INTERPOLL LABORATORIES
(612) 786-6020

System Bias Check

Job L.P. / MONTROSE Source DRYER STACK
Test 3 Run ___ Date 1/27/93 Site " "
Operator DH

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1600	Zero gas	0	1	0	1	1000	.1
		Upscale	301.6	300	300	0	1000	0
2	1720	Zero gas	0	1	0	1	1000	.1
		Upscale	301.6	300	290	10	1000	1
3	1924	Zero gas	0	1	0	1	1000	.1
		Upscale	301.6	300	300	0	1000	0
4	2100	Zero gas	0	1	0	1	1000	.1
		Upscale	301.6	300	300	0	1000	0
5		Zero gas	0					
		Upscale						
6		Zero gas	0					
		Upscale						
7		Zero gas	0					
		Upscale						
8		Zero gas	0					
		Upscale						
9		Zero gas	0					
		Upscale						
10		Zero gas	0					
		Upscale						
11		Zero gas	0					
		Upscale						
12		Zero gas	0					
		Upscale						

Must be within 5% of the span for the zero or upscale cal. gas.

S420-11R

INTERPOLL LABORATORIES
EPA Method 25A
Calibration Error Check & Drift Determination

Job L.P. / MONTROSE

Test 6 Run 0 Date 1/28/93
Operator DH

THC Calibration (Low Range): Time (HRS) _____

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	100	0
Low level	30.17	30	.17	100	.17
Mid level	301.6	300	1.6	1000	.16
High level	3038	3000	38	10000	.38

THC Calibration (High Range): Time (HRS) _____

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0				
Span					

O_2 Calibration: Time (HRS) _____

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

CO_2 Calibration: Time (HRS) _____

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

Must be within 2% of the span for each calibration gas S-420-14

INTERPOLL LABORATORIES
(612) 786-6020

System Bias Check

Job L.P. / MONTROSE Source Press. & Unloading Vent
Test 6 Run 1 Date 11/28/93 Site STACK
Operator DVH

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1734	Zero gas	0	0	1	1	100	1
		Upscale	30.17	30	29	1	100	1
2	1844	Zero gas	0	0	0	0	100	0
		Upscale	30.17	30	27	3	100	3
3	1957	Zero gas	0	0	0	0	100	0
		Upscale	30.17	30	28	2	100	2
4		Zero gas	0					
		Upscale						
5		Zero gas	0					
		Upscale						
6		Zero gas	0					
		Upscale						
7		Zero gas	0					
		Upscale						
8		Zero gas	0					
		Upscale						
9		Zero gas	0					
		Upscale						
10		Zero gas	0					
		Upscale						
11		Zero gas	0					
		Upscale						
12		Zero gas	0					
		Upscale						

Must be within 5% of the span for the zero or upscale cal. gas.

S420-11R

APPENDIX I

CALIBRATION GAS CERTIFICATION SHEETS

Scott Specialty Gases

a Division of Scott Environmental Technology, Inc.

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

Our Project # : 53[illegible]

Your P.O. # : 40142

Customer : GENEX
C/O AES BARBER POINT COAL
91-086 KAOMI LOOP
EWA BEACH HI 96707

Expiration Date : 12-11-93

Cylinder Number : ALM018597

Cylinder Pressure 1900 psig

1 of 1 Component(s)

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Procedure # G1

Protocol # 1

File # PO-3533

Certified Accuracy 1 % NBS Traceable

ANALYZED CYLINDER

COMPONENT	CERTIFIED CONC.
PROPANE	30.17 PPM

BALANCE GAS : AIR

REFERENCE STD

SRM # (CRM #)	CYLINDER NUMBER	CONC.
1667B	FF-26989	47.80 PPM
GMIS#	ALM-008846	31.20 PPM

INSTRUMENTATION

INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
BECKMAN 400	6-12-92	FLAME IONIZATION DETECTOR

ANALYSIS

DATE : 6-11-92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	30.30	30.17	47.80 PPM	47.80	47.80
0.00	30.30	30.17		47.80	47.80
0.00	30.30	30.17		47.80	47.80

CALCULATED RESULTS 30.17
30.17
30.17

AVERAGE : 30.17 PPM

CALIBRATION CURVE 3 rd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1667B	47.80	100	47.80	47.80	0.00
GMIS	31.20	65	31.40	31.26	0.20
	22.61	47	22.60	22.53	-0.35
NARM	8.17	17	8.20	8.23	0.70
	0.00	0	0.00	0.00	0.00
		0		0.0000	0.00
		0		0.00	0.00
NARM	8.17	LOW	8.20	8.23	0.70
1684B	47.80	HIGH	47.80	47.80	0.00

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Don Eichler Jr

Approved By : J. Shapiro

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

Shipped From : Scott Michigan

Our Project # : 537255

Your P.O. # : 40065

Expiration Date : 12-11-93

Customer :
GENEX
2455 CLEVELAND AVE. N.
ROSEVILLE, MN. 55113

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1

Procedure # G1

File # PO-3417

Certified Accuracy 1% NBS TRACEABLE

Cylinder Number : IL-3399

Cylinder Pressure 1900 psig

1 of 1 Component(s)

ANALYZED CYLINDER		REFERENCE STD			INSTRUMENTATION		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
PROPANE	301.6 PPM	1669B	CLM-000702	466.0 PPM	BECKMAN	4-28-92	FLAME IONIZATION DETECTOR
		1668B	CLM-000694	95.00 PPM	400		
					1002059		
BALANCE GAS : AIR							

EPA PROTOCOL

I-2 ANALYSIS DATE : 6-11-92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	65.10	301.5	466.0 PPM	100.00	466.0
0.00	65.20	302.0		100.00	466.0
0.00	65.10	301.5		100.00	466.0
	CALCULATED RESULTS	301.5			
		302.0			
		301.5			
	AVERAGE :	301.6 PPM			

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1669B	466.0	100	100.00	466.0	0.00
GMIS	315.8	68	68.10	315.6	-0.08
GMIS	199.9	43	43.30	199.7	-0.10
1668B	95.00	20	20.80	95.45	0.47
	0.0000	0	0.00	0.0000	0.00
		0		0.0000	0.00
		0		0.00	0.00
1668B	95.00	LOW	20.80	95.45	0.47
1669B	466.0	HIGH	100.00	466.0	0.00

: GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Jon Eichler

Approved By : L Shapiro

The [illegible] bility of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

15.328 KF

[redacted] Ship[redacted] from [redacted] Co. [redacted] Ga. [redacted]

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

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

Our Project # : 333359

Your P.O. # : 6033NW

Expiration Date : 8-6-93

Cylinder Number : BLM-001645

Cylinder Pressure 1665 psig

1 OF 1 COMPONENTS

Customer :
BENEX
2455 CLEVELAND AVENUE N.
ROSEVILLE, MN. 55113

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES # # #

PERFORMED ACCORDING TO SECTION 2.0.7.

Certified Per Traceability Procedure # G2

Protocol # 2

File # PO-2184

Certified Accuracy 2% ANALYTICAL UNCERTAINTY

ANALYZED CYLINDER		REFERENCE STD			INSTRUMENTATION		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
PROPANE	3038 PPM	1669B	CLM-000702	466.0 PPM	BECKMAN 400 1002059	1-23-92	FLAME IONIZATION DETECTOR
		1668B	CLM-000694	95.00 PPM			

BALANCE GAS : AIR

13 ANALYSIS DATE : 2-6-92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	65.60	303.8	466.0 PPM	100.00	466.0
0.00	65.60	303.8		100.00	466.0
0.00	65.60	303.8		100.00	466.0

CALCULATED RESULTS 303.8
303.8
303.8

AVERAGE : 303.8 PPM

SAMPLE GAS SPLIT @ 10% OF FULL CONC.
303.8 PPM DIVIDED BY 10% = 3038 PPM.

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1669B	466.0	100	100.00	466.0	0.00
	313.8	68	68.10	313.6	-0.08
	199.9	43	43.30	199.7	-0.10
1668B	95.00	20	20.80	95.45	0.47
	0.0000	0	0.00	0.0000	0.00
		0		0.0000	0.00
		0		0.00	0.00
1668B	95.00	LOW	20.80	95.45	0.47
1669B	466.0	HIGH	100.00	466.0	0.00

Analyst : [signature]

Approved By : [signature]

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Warranty limited to exchange of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

APPENDIX J

PROCESS RATE INFORMATION

MONTROSE TESTING 1-26-93 THROUGH 1-29-93
PROCESS DATA

CONTENTS

TEST SCHEDULE

DRYER TESTING

DATE	POLLUTANT	RUN #1	RUN #2	RUN #3
1-26	HCHO	1040-1142	1300-1402	1505-1609
1-27	TSP,CO	0840-0955	1035-1149	1225-1338
1-27	VOC	1500-1600	1620-1720	1825-1924

PRESS VENT TESTING

DATE	POLLUTANT	RUN #1	RUN #2	RUN #3
1-28	TSP	0940-1041	1128-1231	1305-1415
1-28	MDI	1600-1709	1741-1844	1935-2038
1-28	VOC	1632-1733	1743-1844	1852-1957
1-29	HCHO	0822-0923	1004-1006	1143-1248

PROCESS DATA SUMMARY

MONTROSE DRYER TESTING 1-26-93 10:30-16:30
HCHO

10.31 =DRYER PRODUCTION RATE IN TONS PER HOUR
1.64 =DRY FUEL INPUT IN TONS PER HOUR
26595 =LB PER HOUR OF FURNISH PRODUCED BY DRYER
1383 =AVERAGE DRYER INLET TEMPERATURE IN DEGREES F
40.5% = MOISTURE CONTENT OF INCOMING WOOD
4.8% = MOISTURE CONTENT OF WOOD AFTER DRYING

MONTROSE DRYER TESTING 1-27-93 8:00-20:00
PM, CO, VOC

10.79 =DRYER PRODUCTION RATE IN TONS PER HOUR
1.66 =DRY FUEL INPUT IN TONS PER HOUR
25680 =LB PER HOUR OF FURNISH PRODUCED BY DRYER
1407 =AVERAGE DRYER INLET TEMPERATURE IN DEGREES F
41.6% = MOISTURE CONTENT OF INCOMING WOOD
4.5% = MOISTURE CONTENT OF WOOD AFTER DRYING

MONTROSE PRESS VENT TESTING 1-28-93 9:00-21:00
PM, VOC, MDI

11.64 =PLANT PRODUCTION RATE IN TONS PER HOUR
279 =MDI RESIN USAGE IN LBS PER HOUR
1.20% =% MDI RESIN USED
466 =LIQUID PHENOLIC RESIN USAGE IN LBS PER HOUR (100% SOLIDS)
2.00% =% LIQUID PHENOLIC RESIN USED
247 =WAX USAGE IN LBS PER HOUR
1.06% =%WAX USED

MONTROSE PRESS VENT TESTING 1-29-93 8:00-13:00
HCHO

11.08 =PLANT PRODUCTION RATE IN TONS PER HOUR
286 =MDI RESIN USAGE IN LBS PER HOUR
1.29% =% MDI RESIN USED
443 =LIQUID PHENOLIC RESIN USAGE IN LBS PER HOUR (100% SOLIDS)
2.00% =% LIQUID PHENOLIC RESIN USED
239 =WAX USAGE IN LBS PER HOUR
1.08% =%WAX USED

MONTROSE DRYER TESTING 1-26-93

DATA TIME 6 HRS

10:30-16:30

BOARD WEIGHTS - LBS

WEIGHTS OF APPROXIMATELY EVERY 25TH UNTRIMMED BOARD FROM TAPES

194	204	197
189	182	195
195	190	195
185	192	191
196	194	188
191	196	195
189	188	191
183	202	196
184	209	197
190	197	
199	196	

193.23 LB = AVERAGE UNTRIMMED MAT WEIGHT

177.77 LB = AVERAGE FINISHED BOARD WEIGHT (UNTRIMMED MAT WEIGHT - TRIM WEIGHT)

8.0% = TRIM

696 x 8 x 16 / 6 = 14.85 Msf 7/16 / hr

PLANT PRODUCTION RATE

6 =HOURS DURING TESTING

87 =PRESSLOADS

696 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)

123728 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)

20621 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)

10.31 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD PROD/HR / 2000 LB)

DRYER PRODUCTION RATE:

DRY BINS INCREASED FROM 1/2 TO FULL OVER TESTING - ACCOUNTING FOR 1/2 HOUR OF ADDITIONAL PRODUCTION

11.17 =DRYER PRODUCTION RATE (123728 lbs + (20621LB/2)) / 6 HOURS /2000 lb

26595 =LB OF DRYER PRODUCTION / HR (LB OF FINISHED PROD./ (1-(% TRIM + % FINES)

8.0% =%FINES

8.0% =%TRIM

40.5% =AVERAGE INLET MOISTURE CONTENT

4.8% =AVERAGE OUTLET MOISTURE CONTENT

1383 =AVERAGE INLET TEMPERATURE

4

MONTROSE DRYER TESTING 1-26-93
DATA TIME 6 HRS
10:30-16:30

DRYER FUEL BURNING RATE

4.04 =FUEL CALIBRATION IN LB/COUNT
4877 = TOTAL COUNTS DURING TESTING HOURS
6 =HOURS DURING TESTING

19703 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CALIBRATION)
3284 =LB. OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED / TESTING HOURS
1.64 =TONS OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED PER HOUR / 2000 LB)
8600 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)
28.2 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

5

DRYER DATA SHEET

DATE 1-26-93

BY ABBAN

PLANT: MONTROSE

READINGS EVERY 10 MIN.

FUEL CALIBRATION: 4.06 lbs/ct

TIME	OUTLET SET POINT	FEED RATE	DRYER INLET TEMP	DRYER OUTLET TEMP	FUEL COUNT	WET BIN LEVEL	DRY BIN LEVEL		EVERY HOUR FLAKE MOISTURE	
							SUR.	CORE	IN	OUT
700	191	95	1277	190	187764	Full	2/3	1/2	28.3%	4.3%
710	191	95	1263	191	187977	Full	2/3	1/2		
720	191	95	1295	190	187949	Full	1/2+	1/2		
730	191	95	1216	193	188073	Full	1/2	1/2		
740	191	95	1302	189	188216	Full	1/2+	1/2+		
750	191	95	1395	190	188771	2/3 full	3/4	2/3+		
800	191	95	1399	193	188521	1/3	2/3+	2/3+	38.8%	4.4%
810	192	95	1351	190	188654	1/3	Full	3/4+		
820	193	90	1271	192	188802	1/2	Full	Full		
830	193	90	1283	193	188935	2/3	3/4+	3/4		
840	193	92	1364	191	189071	2/3+	2/3+	2/3+		
850	193	92	1421	191	189222	Full	2/3	2/3		
900	195	94	1392	195	189360	Full	2/3	2/3	40.3%	4.2%
910	195	95	1447	192	189513	Full	2/3	2/3		
920	195	95	1437	191	189661	Full	2/3	2/3		
930	195	95	1457	195	189801	Full	1/2+	1/2		
940	195	95	1538	195	189964	Full	1/2-	1/2		
950	195	95	1460	183	190138	Full	1/2	1/2		
1000	195	95	1397	203	190252	Full	1/2-	1/2	40.8%	4.3%
1010	195	95	1399	198	190461	Full	1/2	1/2		
1020	195	95	1513	192	190605	Full	1/2	1/2-		
1030	195	95	1474	190	190733	Full	1/2	1/2		
1040	195	95	1455	198	190899	Full	1/2	1/2		
1050	195	95	1531	193	191037	Full	1/2	1/2		
1100	195	95	1422	196	191171	Full	1/2	1/2-	28.7%	4.5%
1110	195	95	1431	195	191321	Full	1/2	1/2		
1120	195	95	1367	198	191461	1/2	1/3	1/2		
1130	195	95	1314	202	191613	1/3	1/3+	1/3+		
1140	195	95	1312	196	191775	1/3+	1/3+	1/2		
1150	195	95	1281	195	191930	1/3	2/3-	2/3		

6

DRYER DATA SHEET

DATE 1-26-93

BY ALLAN

PLANT: Manhasset

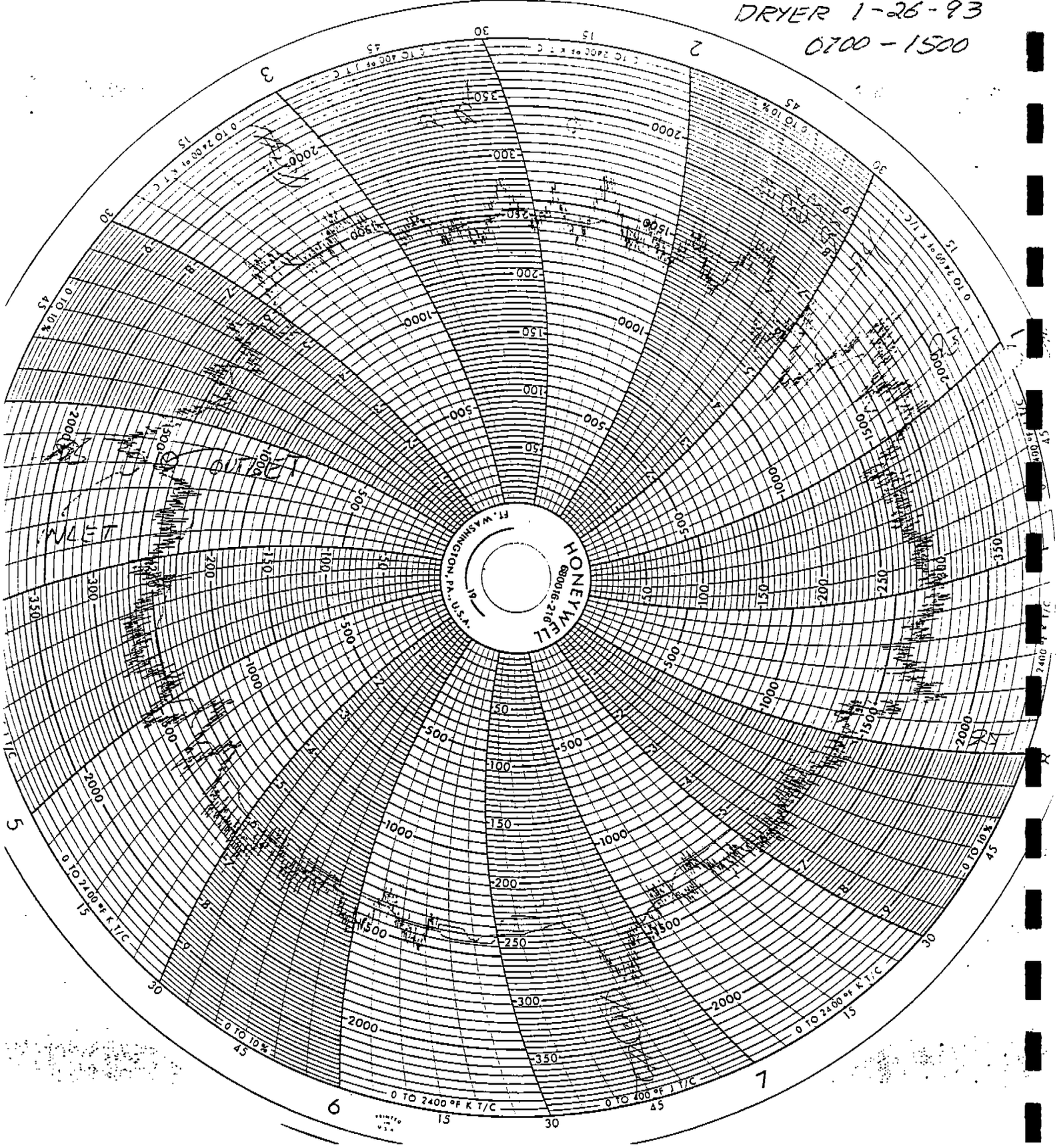
READINGS EVERY 10 MIN.

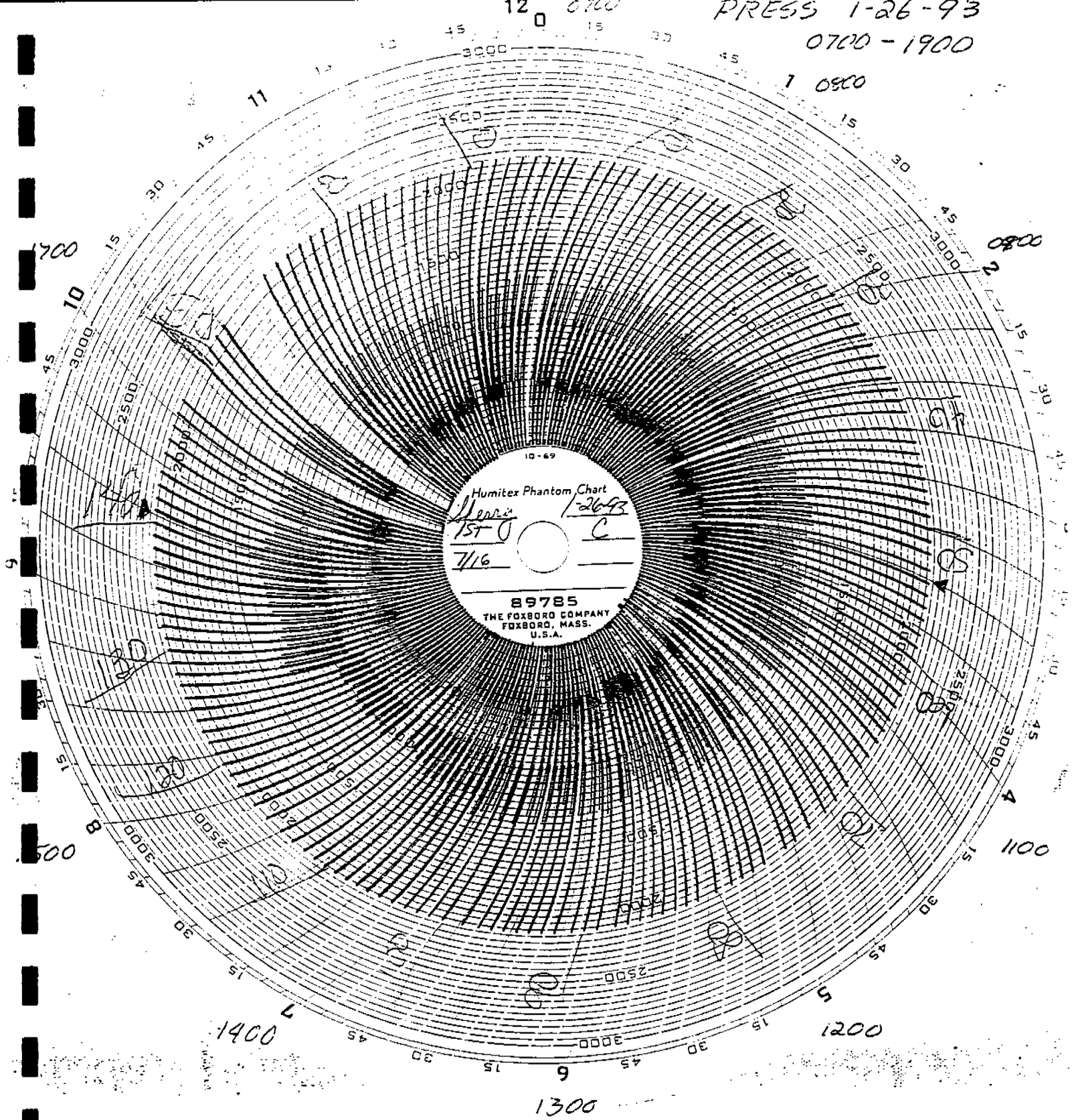
FUEL CALIBRATION: 406 lb/ct.

TIME	OUTLET SET POINT	FEED RATE	DRYER INLET TEMP	DRYER OUTLET TEMP	FUEL COUNT	WET BIN LEVEL	DRY BIN LEVEL		EVERY HOUR FLAKE MOISTURE	
							SUR.	CORE	IN	OUT
1200	195	95	1355	193	192005	2/3	3/4	3/4	38%	5.6%
1210	195	95	1378	195	192232	Full	Full	Full		
1220	195	95	1388	195	192425	Full	Full	3/4+		
1230	195	95	1379	195	192601	Full	Full	Full		
1240	195	95	1375	195	192809	Full	Full	Full		
1250	195	95	1393	195	192673	Full	Full	Full		
1300	195	95	1429	195	192512	Full	Full	Full	42.8%	4.4%
1310	195	95	1477	195	193035	Full	Full	Full		
1320	195	95	1521	191	193131	Full	Full	Full		
1330	195	95	1514	196	193359	Full	Full	Full		
1340	195	95	1416	193	193385	Full	Full	Full		
1350	195	95	1336	195	193574	Full 1/2	Full	Full		
1400	195	95	1322	192	193638	Full	Full	Full	36.8%	4.3%
1410	195	91	1314	194	193762	Full	Full	Full		
1420	196	88	1187	193	193880	Full	Full	Full		
1430	196	88	1298	197	194002	Full	Full	Full		
1440	196	90	1169	195	194115	Full	Full	Full		
1450	196	92	1261	195	194211	Full	Full	Full		
1500	196	94	1320	193	194332	Full	Full	Full	46%	5.1%
1510	196	92	1418	192	194515	Full	Full	Full		
1520	196	90	1311	197	194704	Full	Full	Full		
1530	196	90	1291	198	194754	Full	Full	Full		
1540	196	90	1255	197	194919	Full	Full	Full		
1550	196	91	1413	191	195171	Full	3/4+	3/4+		
1600	196	94	1404	199	195194	3/4+	3/4	3/4	47.4%	4.5%
1610	196	95	1327	199	195318	2/3	Full	3/4		
1620	196	95	1323	197	195411	1/2+	3/4	3/4		
1630	196	95	1375	197	195618	1/2-	3/4	3/4		
1640	196	95	1195	198	195718	1/2-	3/4	3/4		
1650	196	95	1194	195	195829	1/2-	3/4+	3/4+		

DRYER 1-26-93

0700 - 1500





PRESS LOADS
1030 - 1630 =
87

MONTROSE, COLORADO

PRESS REPORT -

OPERATOR Sherry SHIFT 1ST CREW C DATE 1-26-93

Line Speed	From	To
375m	7:00	4:40
34	4:40	7:00

Thickness 7/16

Press Temp 210

Pressloads 170

Footage

Thumbwheel setting

Surface 159 Core 468

Total Footage 203,099

Total Downtime 49

Flow Meters

Surface 1032 lb Core lb

Former Setting

TSL 536 Core 777 BSL 757

Highest Board WT 198

Lowest Board WT 173.

Dry Bin Thumbwheel Setting

Core 80 Surface 58

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	QC	REASONS FOR DOWNTIME
7:29	7:31	2				#6 FLIPPED HB - DUE TO RAILRIDERS CAUSED FROM HIGH SPEED
7:49	7:51	2				#6 " " " " " " "
9:43	9:45	2				DROPPED #1 IN PRESS
10:25	10:26		1			BSLF OUT OF BALANCE - FULL LIGHT STUCK ON
11:23	11:24				1	TOOK OFF CAUL CAUSING BAD BOARDS PUT ON A CAUL
11:29	11:32	3				#8 RETURN - DROPPED HB
11:39	11:41			2		HAD TO JOG Δ - OUT OF SEQ THROWING NUTS ON
11:46	11:47	1				DROPPED MAT #7
11:50	11:52	2				HAD TO JOG Δ
12:06	12:09	3				DROPPED HB #7 RET.
1:00	1:01	1				" " #8 RET
1:42	1:43	1				HAD TO JOG Δ
1:47	1:49	2		1		DROPPED HB #7
2:49	2:51	2				STARTED TO CAGE #3 IN PRESS (STICKER)
4:47	4:48	1				#8 UNLOAD LOADER CAGE DIDN'T MAKE
5:08	5:16	8				BSLF RAKE HITTING DOFFING ROLL
5:33	5:48	15				TAKING OUT BSLF RAKE
		45	1	2	1	

Downtime Codes: M = Mechanical E = Electrical O = Other

26 JAN 1993 LP MONITOR TEST

Flushed @ 9:07 AM

Time	Q outTemp	South TR			North TR		
9:10 AM	138.9	36 KV	250 mA	28 spm	36 KV	240 mA	28.4 spm
9 25	140.1	36 KV	200 mA	28.0 spm	36 KV	260 mA	28.2 spm
9 41	141.5	37 KV	240 mA	27.0 spm	37 KV	260 mA	26.9 spm
9 55	143.3	35 KV	220 mA	27.0 spm	38 KV	400 mA	27.3 spm
10:10	138.1	37 KV	300 mA	27.0	38 KV	320 mA	27.0 spm
10:20	141.2	38 KV	300 mA	27.1	39	400	26.8
1022	Flush	Flush did not come ON					
1040	139.3	37 KV	310	27.1	37	320	27.0
11:10	139.4	36 KV	220 mA	27.4	38 KV	420	26.7
11:25	136.3	36	300	26.9	37	350	26.9
11:40	135.5	37	280	26.7	37	400	26.9
12:00	137.6	37	300	26.5	37	280	26.8
12:15	136.3	35	190	26.9	35	100	27.7
12:30	138.0	36	250	26.8	38	200	27.9
12:45	137.3	36	250	27.1	38	230	27.2
1:00	138.3	36	220	26.8	38	300	27.1
1:15	140.6	36	250	26.9	38	250	27.0
1:40 Flush #121	139.5	40	150	26.6	38	300	27.0
2:00	134.4	40	200	26.9	40	400	26.8
2:15	132.9	40	200	26.2	38	300	27.1
2:30	131.7	40	230	26.9	38	350	26.8
2:45 2:40 Flush	133.1	39	170	27.1	38	140	27.1
3:00	137.2	40	170	27.0	40	220	27.5
3:26	136.6	40	220	27.0	38	180	26.6
3:45 3:58 Flush	136.9	39	200	26.7	39	220	26.9

Time	QTemp	South TR			North TR		
		KV	MA	spm	KV	MA	spm
4:00 pm	134.7	J-11 40	170	27.3	39	220 ~~240~~ 220	

MONTROSE DRYER TESTING 1-27-93

DATA TIME 12 HRS

8:00-20:00

BOARD WEIGHTS - LBS

WEIGHTS OF APPROXIMATELY EVERY 25TH UNTRIMMED BOARD FROM TAPES

186	184	184	189	190	189.68 LB = AVERAGE
192	193	187	187	193	UNTRIMMED
197	189	195	190	197	MAT WEIGHT
192	183	192	194	195	
190	194	193	194	188	
179	193	182	189	187	174.51 LB = AVERAGE
180	194	197	177	185	FINISHED BOARD
190	188	204	188	191	WEIGHT
196	183	199	185	196	(UNTRIMMED MAT
188	186	202	190	195	WEIGHT - TRIM
190	182	183	192		WEIGHT)
189	179	181	193		
193	185	190	191		8.0% = TRIM

=15.19 MSF 7/16 n

PLANT PRODUCTION RATE

12 =HOURS DURING TESTING
178 =PRESSLOADS
1424 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
248502 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
20709 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
10.35 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD PROD/HR / 2000 LB)

DRYER PRODUCTION RATE:

WAFERS WERE "FIRE DUMPED" FROM 18:54-19:24 DUE TO FULL BINS ACCOUNTING FOR 1/2 HOUR OF ADDITIONAL PRODUCTION
10.79 =DRYER PRODUCTION RATE (248502 lbs + (20709LB*.5 HRS))/12 HOURS /2000 lb
25680 =LB OF DRYER PRODUCTION / HR (LB OF FINISHED PROD./ (1-(% TRIM + % FINES)
8.0% =%FINES
8.0% =%TRIM
41.6% =AVERAGE INLET MOISTURE CONTENT
4.5% =AVERAGE OUTLET MOISTURE CONTENT
1407 =AVERAGE INLET TEMPERATURE

12

MONTROSE DRYER TESTING 1-27-93
DATA TIME 12 HRS
8:00-20:00

DRYER FUEL BURNING RATE

4.04 =FUEL CALIBRATION IN LB/COUNT
9878 = TOTAL COUNTS DURING TESTING HOURS
12 =HOURS DURING TESTING

39907 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CALIBRATION)
3326 =LB. OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED / TESTING HOURS
1.66 =TONS OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED PER HOUR / 2000 LB)
8600 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)
28.6 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

12A

DRYER DATA SHEET

DATE 1-22-93
BY ABLAN

PLANT: Manteca

READINGS EVERY 10 MIN.

FUEL CALIBRATION: 4.06 lb/ct

TIME	OUTLET SET POINT	FEED RATE	DRYER INLET TEMP	DRYER OUTLET TEMP	FUEL COUNT	WET BIN LEVEL	DRY BIN LEVEL SUR.	DRY BIN LEVEL CORE	EVERY HOUR FLAKE MOISTURE IN	EVERY HOUR FLAKE MOISTURE OUT
700	195	95	1495	192	207550	1/2	2/3	2/3	45.5%	5.8%
710	195	95	1523	195	207732	1/2	2/3+	2/3		
720	195	95	1514	193	207976	2/3	2/3+	2/3+		
730	195	95	1504	190	208018	2/3	2/3+	2/3+		
740	195	95	1618	196	208231	Full	2/3+	1/2+		
750	195	95	1529	198	208252	Full	2/3	1/2+		
800	195	95	1615	192	208516	Full	2/3	2/3	33.6%	6.0%
810	195	93	1717	195	208714	Full	2/3	2/3		
820	197	93	1500	199	208859	Full	2/3	2/3		
830	197	95	1513	200	209097	Full	2/3	2/3		
840	197	90	1562	197	209153	Full	1/2+	2/3		
850	197	90	1519	199	209317	Full	3/4	3/4		
900	197	90	1465	198	209510	Full	3/4	3/4	44%	4.4%
910	197	90	1485	195	209524	Full	Full	3/4+		
920	197	91	1465	196	209712	Full	3/4	3/4		
930	197	91	1494	198	209910	1/2-	3/4+	Full		
940	197	93	1385	198	210005	1/2-	Full	3/4+		
950	197	93	1462	195	210126	1/2+	Full	3/4+		
1000	197	93	1495	198	210362	3/4	3/4	3/4	49%	4.8%
1010	197	93	1523	197	210430	2/3	3/4	3/4		
1020	197	93	1592	195	210557	1/2-	3/4+	3/4+		
1030	197	93	1485	198	210687	1/3	3/4+	Full		
1040	197	93	1374	198	210837	1/4	3/4	3/4		
1050	197	93	1322	197	210960	1/4	3/4	3/4		
1100	197	93	1550	195	211192	1/2-	3/4	3/4	44.9%	4.4%
1110	197	94	1314	200	211353	2/3	3/4	3/4		
1120	197	96	1322	197	211405	2/3+	3/4	3/4		
1130	197	95	1315	198	211518	2/3+	2/3	1/2		
1140	197	95	1428	196	211615	3/4+	2/3	2/3		
1150	197	95	1453	199	211783	Full	2/3	2/3		

DRYER DATA SHEET

DATE 1-27-97

BY DILAN

PLANT: Mondovi

READINGS EVERY 10 MIN.

FUEL CALIBRATION: 4.06 15 lb/ft

TIME	OUTLET SET POINT	FEED RATE	DRYER INLET TEMP	DRYER OUTLET TEMP	FUEL COUNT	WET BIN LEVEL	DRY BIN LEVEL SUR.	DRY BIN LEVEL CORE	EVERY HOUR FLAKE MOISTURE IN	EVERY HOUR FLAKE MOISTURE OUT
1200	197	95	1393	198	211919	Full	2/3	3/4	42%	42%
1210	197	95	1366	200	212110	Full	2/3+	3/4+		
1220	197	95	1354	195	212290	Full	2/3+	3/4+		
1230	197	95	1358	197	212471	Full	2/3+	3/4+		
1240	196	95	1375	196	212655	Full	2/3	3/3		
1250	196	95	1378	196	212596	Full	2/3	3/3		
1300	196	95	1359	199	212415	Full	2/3+	3/4+	47%	42%
1310	196	95	1352	197	213911	Full	2/3	3/4+		
1320	197	95	1367	196	213111	Full	3/4	3/4		
1330	197	95	1356	196	213470	Full	3/4	3/4		
1340	197	95	1376	196	213719	Full	3/4	3/4		
1350	197	95	1511	197	213527	Full	Full	Full		
1400	197	88	1425	201	217610	Full	Full+	Full+	37.8%	40%
1410	197	88	1375	198	213815	Full	Full+	Full+		
1420	197	92	1351	197	213941	Full	Full+	Full+		
1430	197	92	1310	196	214003	Full	Full+	Full+		
1440	197	88	1346	198	214176	Full	Full+	Full+		
1450	197	88	1361	199	214371	Full	Full	Full		
1500	196	90	1379	196	214400	Full	Full	Full	41.7%	42%
1510	196	90	1342	196	214579	Full	Full	Full		
1520	196	90	1374	196	214665	Full	Full	Full		
1530	196	90	1355	198	214802	Full	Full	Full		
1540	196	90	1378	198	214947	Full	Full	Full		
1550	196	90	1358	194	215071	Full	Full	Full		
1600	196	90	1425	198	215211	Full	Full	Full	41.5%	42%
1610	196	90	1350	198	215342	Full	Full	Full		
1620	196	91	1366	196	215487	Full	Full	Full		
1630	196	91	1356	195	215626	Full	Full	Full		
1640	196	91	1328	196	215758	Full	Full	Full		
1650	196	91	1347	195	215866	Full	Full	Full		

DRYER DATA SHEET

DATE 1-27-93

BY Edward & Sally

PLANT: Montrose

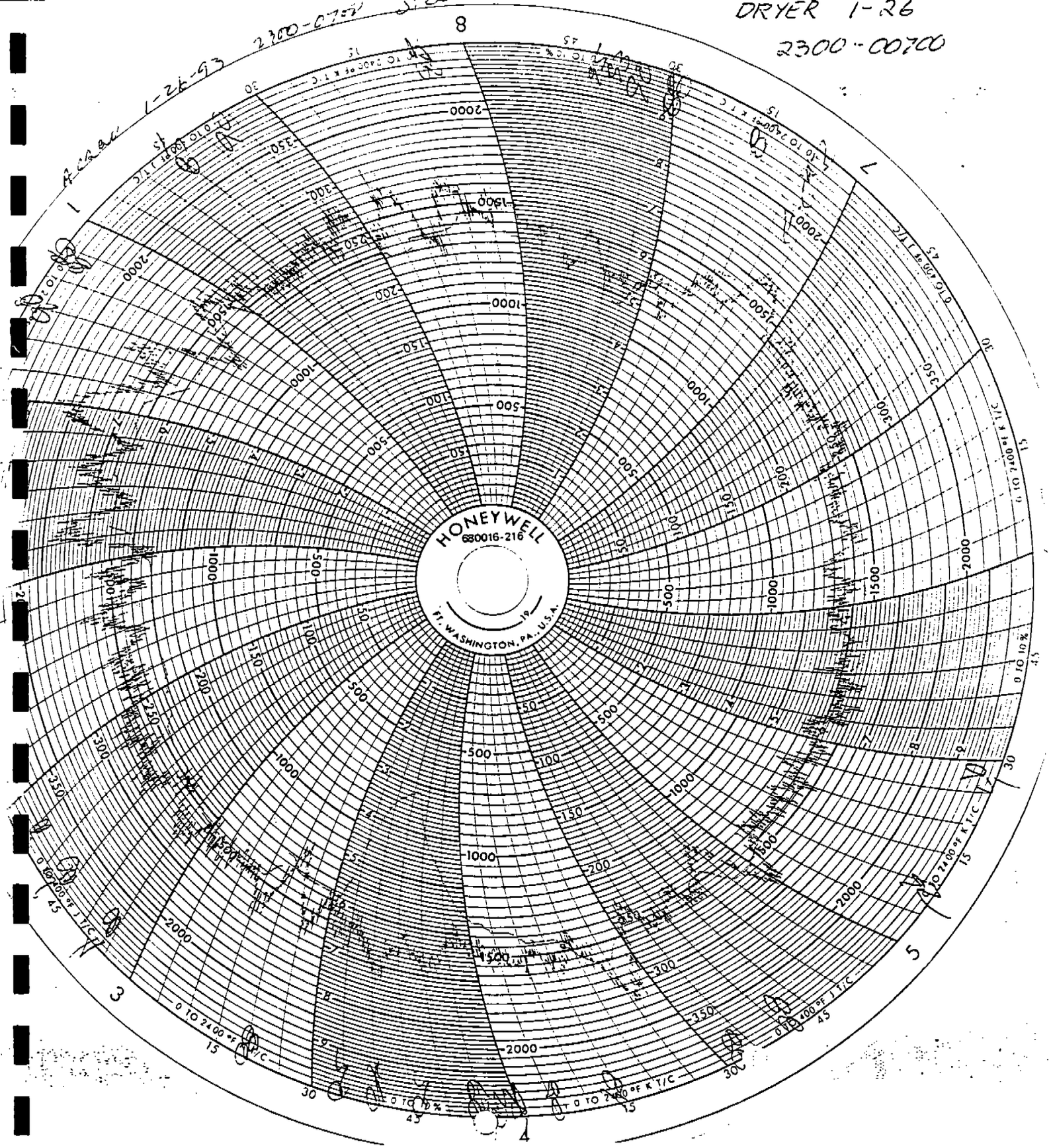
READINGS EVERY 10 MIN.

FUEL CALIBRATION: 406 16/ct

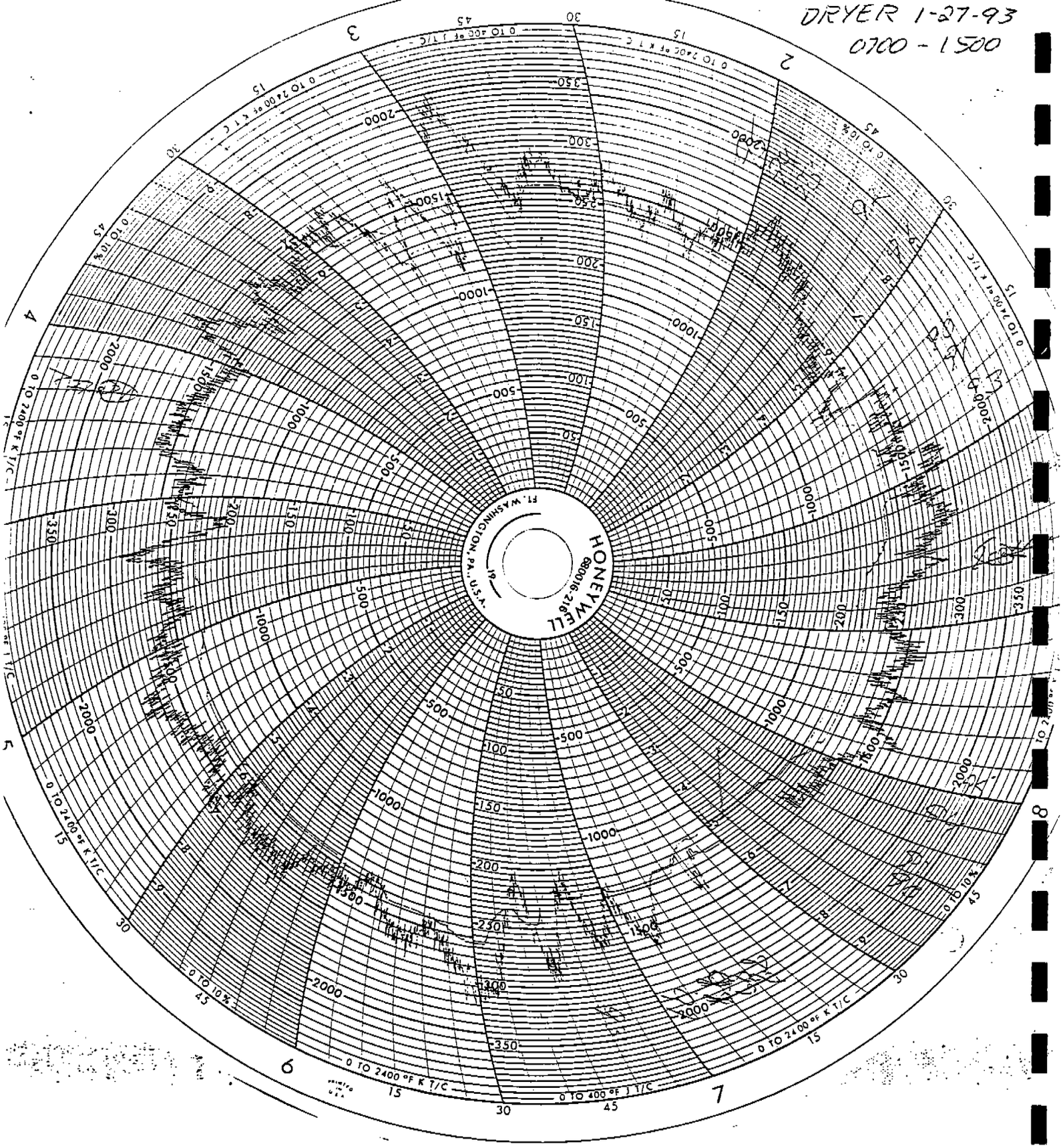
TIME	OUTLET SET POINT	FEED RATE	DRYER INLET TEMP	DRYER OUTLET TEMP	FUEL COUNT	WET BIN LEVEL	DRY BIN LEVEL		EVERY HOUR FLAKE MOISTURE	
							SUR.	CORE	IN	OUT
1700	196	91	1316	192	216007	Full	Full	Full	32%	4.6%
1710	196	89	1341	197	216188	Full	Full	Full		
1720	196	89	1252	197	216274	Full	Full	Full		
1730	196	89	1324	195	216408	Full	Full	Full		
1740	196	89	1385	190	216522	Full	Full	Full		
1750	196	89	1434	193	216684	Full	Full	Full		
1800	196	89	1371	196	216816	Full	Full	Full	45.4%	4.8%
1810	196	89	1338	193	217004	3/4	Full	Full		
1820	196	89	1289	198	217095	1/3	Full	Full		
1830	196	89	1313	198	217255	1/2	Full	Full		
1840	196	89	1314	198	217364	1/2	Full+	Full+		
1850	196	87	1322	196	217502	2/3	Full+	Full+		
1900	196	85	1302	196	217633	1/2	Full	Full	35.6	3.8
1910	196	85	1302	196	217746	1/2	Full	Full		
1920	196	85	1287	197	217871	1/2	Full	Full		
1930	196	87	1285	196	218003	1/2	3/4	3/4		
1940	196	87	1274	196	218118	1/2	3/4	3/4		
2000	196	90	1263	196	218396	1/2	3/4	3/4		
2010	196	91	1336	196	218505	1/2	3/4	3/4	42.8	3.0
2020	196	92	1309	199	218666	1/2	3/4	3/4		
2030	196	92	1229	198	218783	1/2	1/2	3/4		
2040	196	93	1229	197	218896	1/2	1/2	1/2		
2050	196	93	1294	194	219017	1/2	1/2	1/2		
2100	196	93	1287	197	219152	1/2	1/3	2/3	35.0	3.4

DRYER 1-26

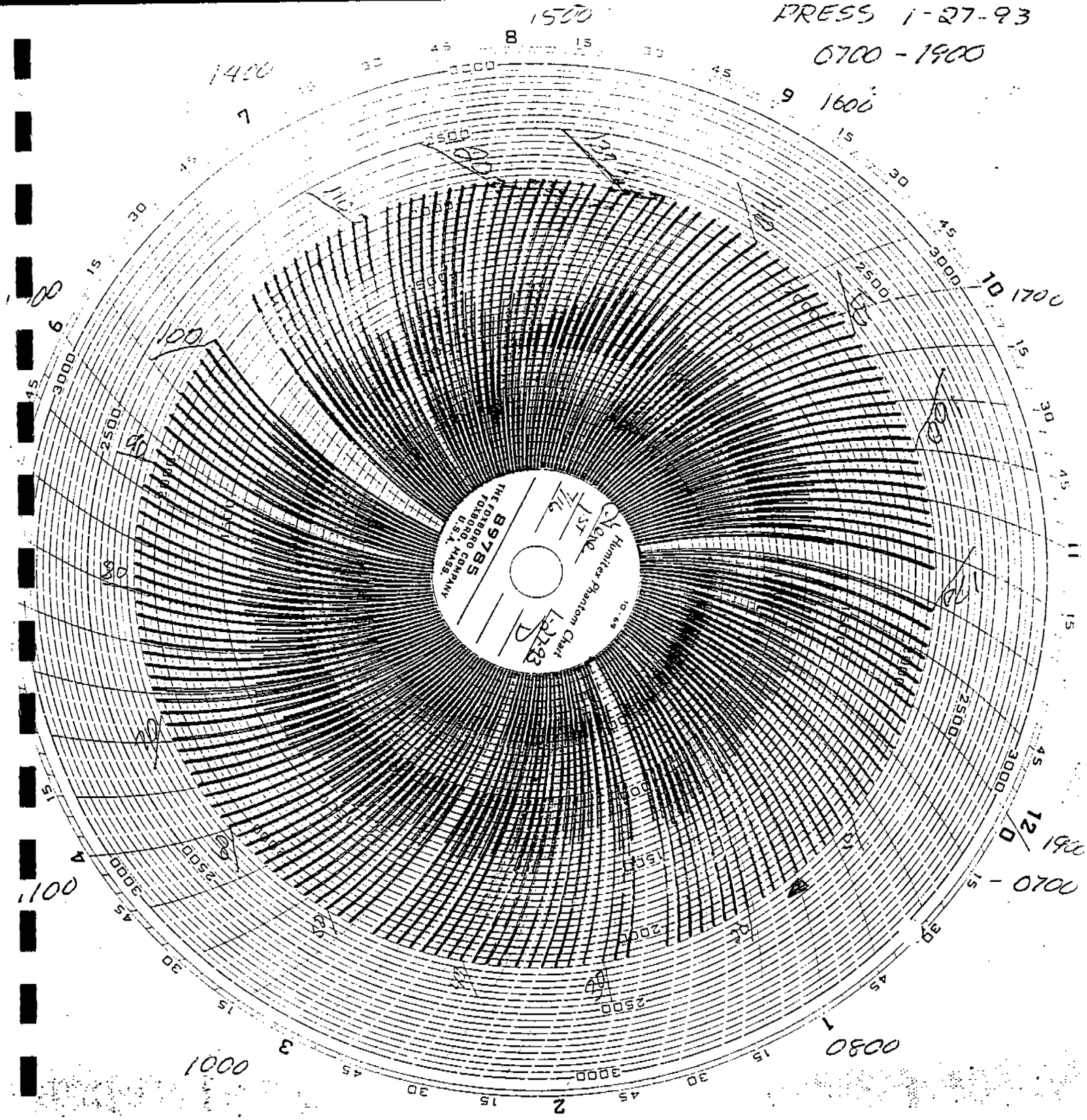
2300-00700



DRYER 1-27-93
0700 - 1500

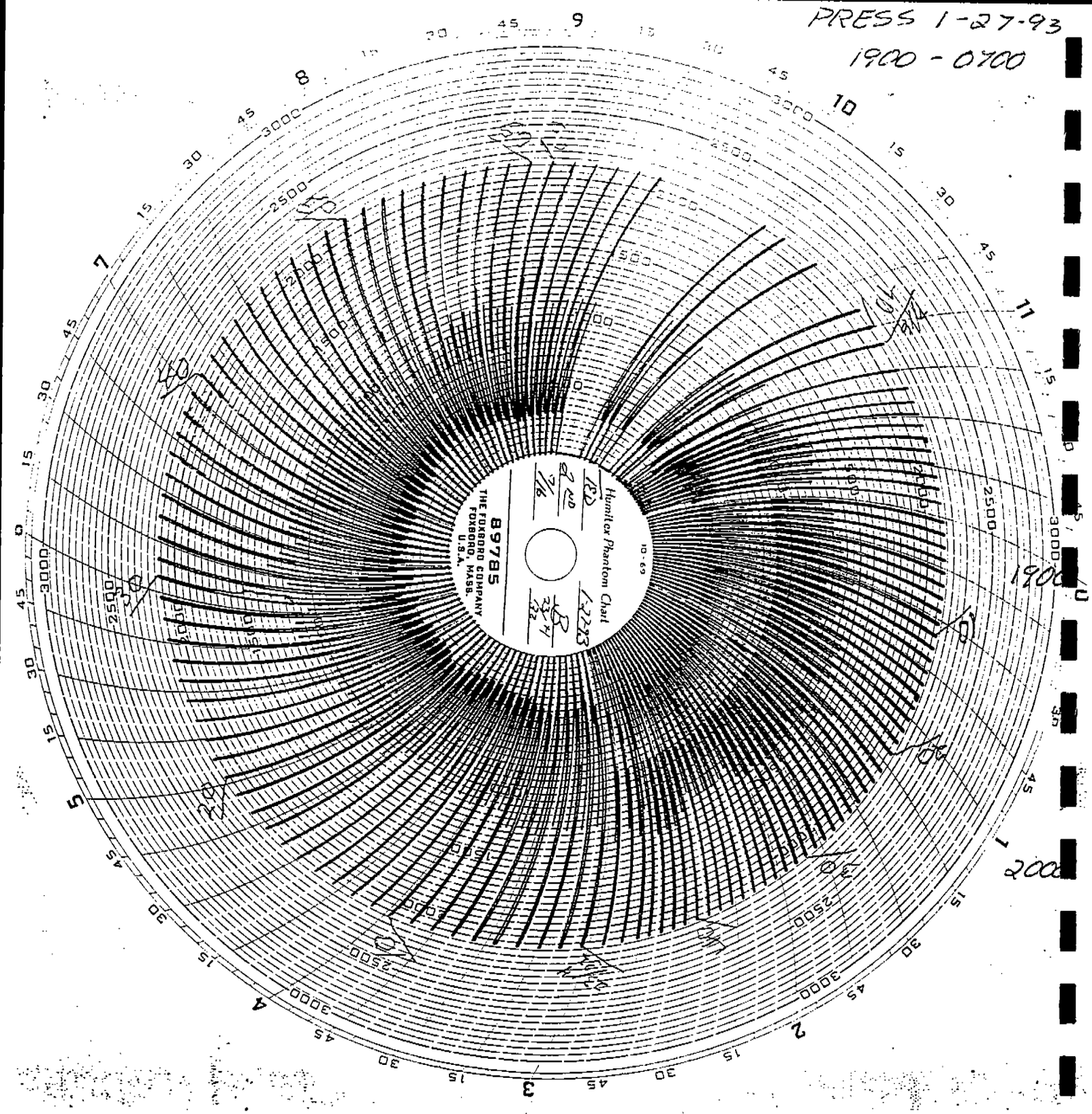


1-27-93



PRESSLOADS

0800 - 1900 = 161



PRESS 1-27-93

1900 - 0700

1900

2000

PRESSLOADS

1900 - 2000 =

17

19

MONTROSE, COLORADO

PRESS REPORT -

OPERATOR Gene SHIFT 1ST CREW D DATE 1-27-93

Line Speed	From	To
37.0 F/M	7:00 A	7:00pm

Thickness 7/16

Press Temp 210

Pressloads 176

Footage 210,267

Thumbwheel setting

Surface 498 Core 176

Total Footage 210,267

Total Downtime 53

Flow Meters

Surface 11.60 lb Core N.A. lb

Former Setting

TSL 582 Core 847 BSL 829

Highest Board WT

Lowest Board WT

Dry Bin Thumbwheel Setting

Core 73 Surface 58

DOWNTIME FROM	DOWNTIME TO	DOWNTIME MIN M	E	O	QC	REASONS FOR DOWNTIME
7:37						
8:03	8:04	1				DROPPED FLIGHT 2 IN PRESS
8:11	8:12	1				CHECKING OUT BAGHOUSE #2
8:45	8:53	8				Working On Baghouse #2 and S.E. pot
9:05	9:08	3				Jam up on A (H.B.#
9:28	9:29	1				No HB @ #6
10:11	10:15	4				TRAMP IRON
12:59	1:03	4				FLASHER @ #7
1:37	1:52	15				TSLE SPREADING ROLLS TRIPPED
1:53	1:54	1				TSLF SPREADING ROLLS TRIPPED
2:25	2:26	1				FLASHER @ #6
2:36	2:37	1				FLASHER @ #6
3:09						
3:43	3:44	1				#8 limit on loader cage not made (H.B.# FX)
4:22	4:24	2				BSLF SPREADING ROLLS TRIPPED
5:04	5:05	1				BSLF DIVIDING ROLLS TRIPPED
6:19	6:20	1				#8 LIMIT ON LOADER CAGE NOT MADE (HB.# FX)
6:20	6:23	3				No HB @ #6

Downtime Codes

20

MONTROSE, COLORADO

PRESS REPORT -

OPERATOR ED SHIFT 2ND CREW B DATE 1-27-93

Line Speed	From	To
37 F/M	7:00 P	9:55
21.5	9:55	6:00
37 F/M	6:00	7:00

Thickness 7/16 23/32 H

Press Temp 210°

Pressloads 59 70

Footage 70,487 137,389

Total Footage = 207,876

Total Downtime 37

Thumbwheel setting

Surface 200 Core 620

Flow Meters

Surface 13.49 lb Core ——— lb

Highest Board WT 321

Lowest Board WT 285

Former Setting

TSL 575 Core 750 BSL 734

Dry Bin Thumbwheel Setting

Core 70 Surface 62

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	QC	REASONS FOR DOWNTIME
8:13	8:15	2				BELT FORMING LINE DOG-EAST-HUNG UP @ #6
4:46	4:51	5				TRIP ON BSLF SPREADER ROLLS-DROPPED MAT
4:52	4:54	2				DROPPED MAT @ #6
4:55	4:58	3				DROPPED MAT @ #8 + TAIL PULLEY
5:09	5:14	5				DROPPED MAT @ #8 + #7
5:27	5:29	2				MAT CRASHED @ #6
5:33	5:37	4				JAM UP ON △ 1
5:40	5:41	1				FLIPPED MAT @ #6
5:42	5:50	8				SHUTTLE JUMPED A HB
6:10	6:13	3				DROPPED MAT @ #8
6:18	6:20				2	ADJUSTING SAWS
				1		

HB #XX

27 JAN 1993 MONTROSE

		SOUTH T/R			NORTH T/R		
7:30	144.7	42 KV	150 mA	28 S/m	41 KV	170 mA	28 S/m
7:50	142.6	42 KV	180 mA	27.3 S/m	41 KV	220 mA	28.1 S/m
8:00	140.9	41 KV	180 mA	27.8 S/m	40 KV	210 mA	27.7 S/m
805	FLUSH				NORTH		
8:15	140.0	42 KV	170 mA	28.1 S/m	43 KV	170 mA	28.2 S/m
8:30	140.3	42 KV	170 mA	28.1	43 KV	180 mA	27.7
8:45	140.5	41 KV	160 mA	28.1	42 KV	160 mA	27.9
9:00	137.6	41 KV	170 mA	27.9	42 KV	180 mA	27.8
9:15	138.8	41 KV	180 mA	27.9	42 KV	180 mA	27.8
9:20	FLUSH	SOUTH					
9:30	138.9	43 KV	150 mA	29.4	42 KV	180 mA	27.9
9:45	138.0	43 KV	150 mA	27.7	42 KV	220 mA	27.8
10:00	141.6	43 KV	160 mA	27.8	41 KV	180 mA	28.2
10:30	138.2	43 KV	190	27.9	41 KV	190 mA	27.4
10:35	FLUSH				NORTH		
10:45	135.1	42 KV	150	28.3	43 KV	170	27.1
11:00	139.5	43 KV	150	27.8	44 KV	180	27.9
11:15	134.7	43	180	27.9	44 KV	210	28.3
11:30	136.2	42	130	27.8	44	200	27.8
11:45	138.6	42	200	27.9	43	200	27.8
12:53	FLUSH	SOUTH					

	27 JAN 1993	SOUTH T/R			NORTH T/R		
12:00	137.8	43 KV	170 mA	27.7 $\frac{S}{M}$	43 KV	200 mA	27.8 $\frac{S}{M}$
12:30	138.1	42 KV	150 mA	27.8	42 KV	190 mA	27.8
12:45	137.6	42 KV	180	27.7	41 KV	200	28.0
1:00	136.9	43 KV	200	27.6	42 KV	240	27.6
1:10	FLUSH				NORTH		
1:15	140.0	42	150	28	43	170	29.3
1:30	141.3	43	160	27.6	43	180	28.0
1:45	141.2	43	180	28	43	180	27.8
2:15	134.5	42	180	27.6	44	230	27.7
2:40	133.7	43	160	27.6	44	250	27.6
305	136.2	43	180	27.7	43	210	27.6
3:32	137.9	42	170	27.8	42	250	27.8
3:45	137.4	40	125	27.9	42	175	29.0
4:10	136.0	42	160	27.8	42	170	27.8
4:30	136.7	40	160	27.9	42	180	27.7
5:00	135.9	42	125	29.1	43	220	27.5
5:30	136.1	42	125	28.0	42	210	27.8
5:51	137.7	42	150	27.8	42	220	27.8
7:03	133.5	40	175	27.6	44	230	28.0
7:30	132.5	42	125	27.3	42	200	27.3
9:00	133.6	42	150	27.8	44	175	27.7

MONTROSE PRESS VENT TESTING 1–28–93

DATA TIME 12 HRS

9:00–21:00

BOARD WEIGHTS – LBS

WEIGHTS OF APPROXIMATELY EVERY 25TH UNTRIMMED BOARD FROM TAPES

179	198	184	180	196	
181	194	193	171	190	
177	184	192	185	193	189.29 LB = AVERAGE
182	188	182	194	199	UNTRIMMED
181	196	183	198	202	MAT WEIGHT
187	200	190	194	199	
195	188	194	200		
193	186	188	188		172.44 LB = AVERAGE
186	190	185	177		FINISHED BOARD
193	190	183	193		WEIGHT
180	188	184	194		(UNTRIMMED MAT
189	190	187	196		WEIGHT – TRIM
195	193	189	188		WEIGHT)
189	191	184	190		
196	188	191	190		8.9% = TRIM

$= \frac{1552 \times 16}{11.5} = 17.27$ MSF/HR 7/16

PLANT PRODUCTION RATE

11.5 =HOURS DURING TESTING
194 =PRESSLOADS
1552 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
267627 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
23272 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
11.64 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD PROD/HR / 2000 LB)

RESIN AND WAX USED

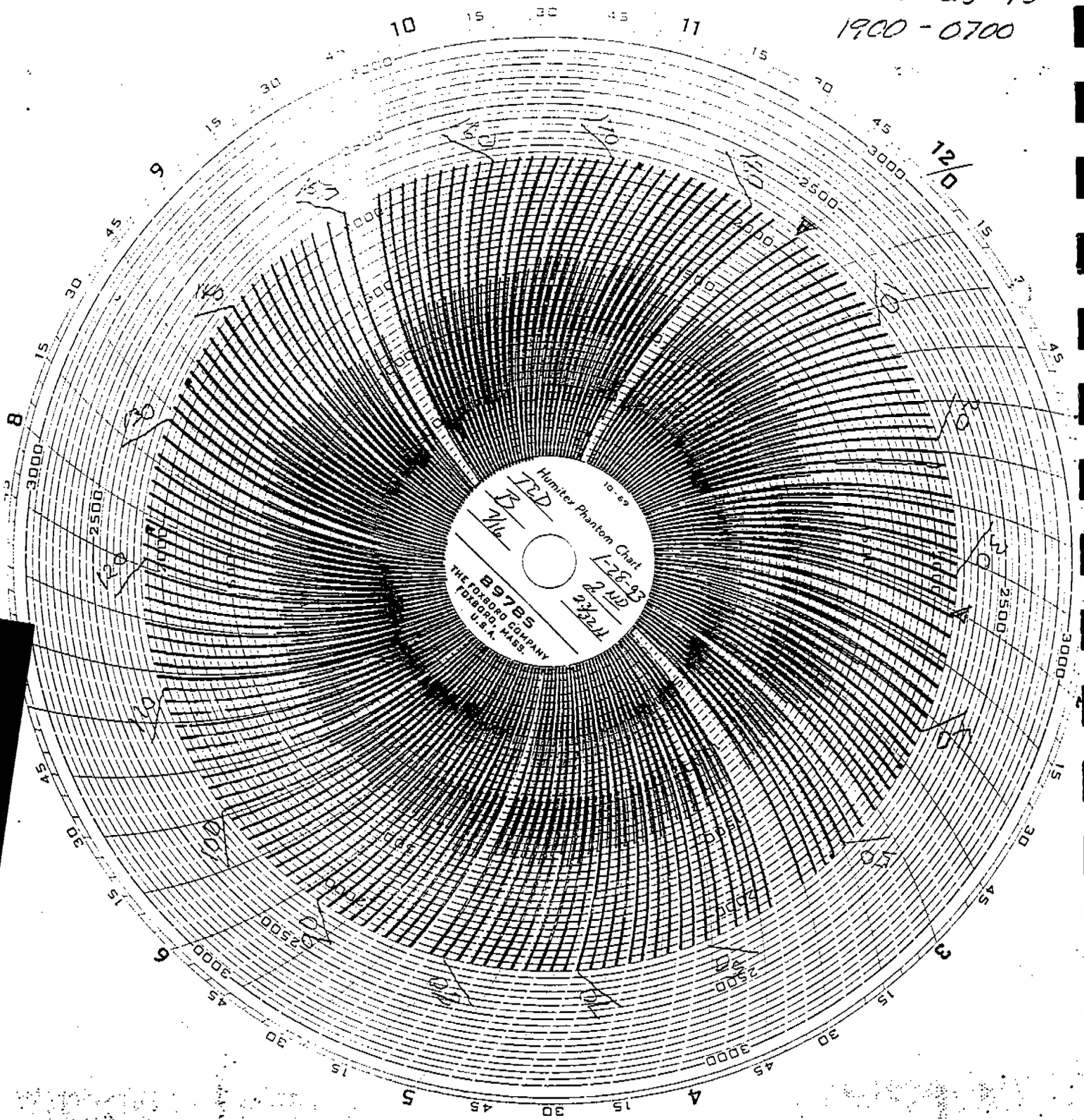
PERCENTAGE INFORMATION FROM DAILY INVENTORY SHEET
PERCENTAGE X WEIGHT OF FINISHED PRODUCT/HR = WEIGHT USED/HR

1.20% =PERCENT MDI USED
279 = LBS OF MDI USED PER HOUR

2.00% =PERCENT LIQUID PHENOLIC RESIN USED (100% SOLIDS)
466 = LBS OF LIQUID PHENOLIC RESIN USED PER HOUR

1.06% =PERCENT WAX USED
247 = LBS OF WAX USED PER HOUR

PRESS 1-28-93
1900 - 0700

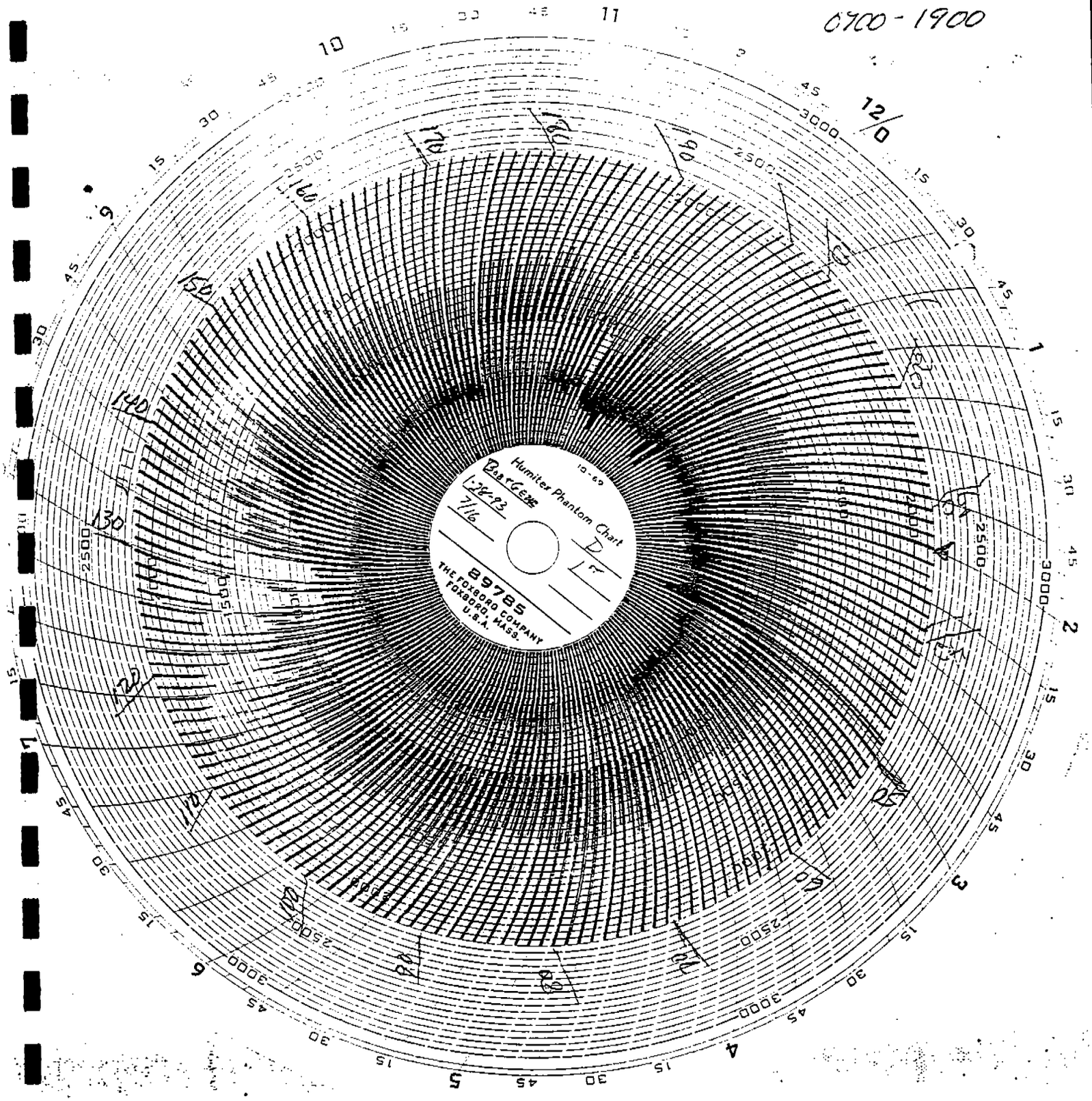


PRESSLOADS

1900 - 2100 = 32

25

PRESS 1-25-93
0700 - 1900



PRESS LOADS
0900 - 1900 = 162

[illegible] CORPORATION

MONTROSE, COLORADO

PRESS REPORT -

OPERATOR Bart Gene SHIFT 1st CREW D DATE 1-28-93

Line Speed	From	To
37 F/M	7:00 A	7:00 P

Thickness 7/16

Press Temp 510°

Pressloads 194

Footage

Thumbwheel setting

Surface Core

Total Footage 231,772

Total Downtime 0

Flow Meters

Surface lb Core lb

Former Setting

TSL Core BSL

Highest Board WT

Lowest Board WT

Dry Bin Thumbwheel Setting

Core Surface

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	Qc	REASONS FOR DOWNTIME

[redacted] CORPORATION

MONTROSE, COLORADO

PRESS REPORT

OPERATOR TED SHIFT 2ND CREW B DATE 1-28-93

Line Speed	From	To
37.0 f/m	7:00 P	7:00

Thickness 7/16

Press Temp 210°

Pressloads 182

Footage 217,436

Thumbwheel setting

Surface 168 Core 482

Total Footage

Total Downtime 30

Flow Meters

Surface 10.76 lb Core lb

Former Setting

TSL 538 Core 777 BSL 762

Highest Board WT 213

Lowest Board WT 176

Dry Bin Thumbwheel Setting

Core 70 Surface 58

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) H	E	O	QC	REASONS FOR DOWNTIME
8:30	8:31	1				DROPPED #6 IN PRESS - HB #55
9:14	9:15				1	BSLF DIVIDING ROLLS TRIPPING
9:19	9:20				1	TSLF DOFFING ROLLS TRIP
10:08	10:09	1				FLIPPED MAT @ #6
10:31	10:32	1				" " "
10:34	10:41	7				DROPPED MAT @ #8 - HB #35
10:58	10:59	1				CC SAW FEED STOPPED
12:27	12:29			2		SAWLINE BEHIND
1:51	1:53	2				BOARD SITTING ON SCALE
3:31	3:33	2				STACKER UNLOADING PROBLEM
4:42	4:44	2				BOARD SITTING ON SCALE
4:47	4:49	2				" " "
4:60	4:57	7			1	DROPPED MAT @ #8 - HB #55

DAILY INVENTORY SHEET

DATE 1-28-93

MTD 8721583

DAILY TOTAL 449208

SHIFT 1 ***			SHIFT 2 ***			
0	3/8	0	38.70	0	3/8	0
194	7/16	231772	37.91	182	7/16	217436
0	15/32	0	38.41	0	15/32	0
0	19/32 SE	0	38.69	0	19/32 SE	0
0	19/32 TG	0	38.63	0	19/32 TG	0
0	23/32 SE	0	38.10	0	23/32 SE	0
0	23/32 TG	0	37.25	0	23/32 TG	0
0	1 SE	0	36.50	0	1 SE	0
0	1 TG	0	36.50	0	1 TG	0
0	1-1/8 TG	0	36.50	0	1-1/8 TG	0
	TOTAL	231772			TOTAL	217436

MDI RESIN

		COST		
DAY B/4	134060		INSIDE	0	0
+INCOMING	0				
TODAY	127683				
USAGE	6377				
DAILY COST					
			OUTSIDE	13.52	118111
MONTH USE	124401				
MONTH COST					

PHENOLIC

		COST			
DAY B/4	163677		SOUTH	6.71	43000
+INCOMING	0				
TODAY	145313		NORTH	17.33	96270
USAGE	18364				
DAILY COST			WEST	0	0
MONTH USE	294332		DAY	2.02	3426
MONTH COST	6.47				

WAX

		COST			
DAY B/4	77940		TANK	12.83	72305
+INCOMING	0				
TODAY	72305				
USAGE	5635				
DAILY COST		1.06%			
MONTH USE	81560				
MONTH COST					

CALENDAR MTD LBS: 11183252

OF BRDS USED FOR TESTS 4 7/16

MDI % TOTAL #'S	1.20	LBS. PROD DAILY	532171
MDI % MTD	1.21	LBS. PROD MTD	10308681
LPH % MTD	1.66	PH % TOTAL #'S	2.00
		DENSITY:	37.9
		TOTAL	907.7
		DAY#	24
		MTD DENSITY	37.8

2

MONTROSE PRESS VENT TESTING 1-29-93
DATA TIME 5 HRS
8:00-13:00

BOARD WEIGHTS - LBS

WEIGHTS OF APPROXIMATELY EVERY 25TH UNTRIMMED BOARD FROM TAPES

186	191	183
173	190	176
183	186	181
185	187	186
185	182	198
181	182	194
183	183	
186	186	
185	188	
184	189	
189	189	

185.39 LB = AVERAGE UNTRIMMED MAT WEIGHT

168.89 LB = AVERAGE FINISHED BOARD WEIGHT (UNTRIMMED MAT WEIGHT - TRIM WEIGHT)

8.9% = TRIM

PLANT PRODUCTION RATE

5 =HOURS DURING TESTING
82 =PRESSLOADS
656 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
110792 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
22158 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
11.08 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD PROD/HR / 2000 LB)

$= \frac{656 \times 8}{5} = 16.8$ mat/hr

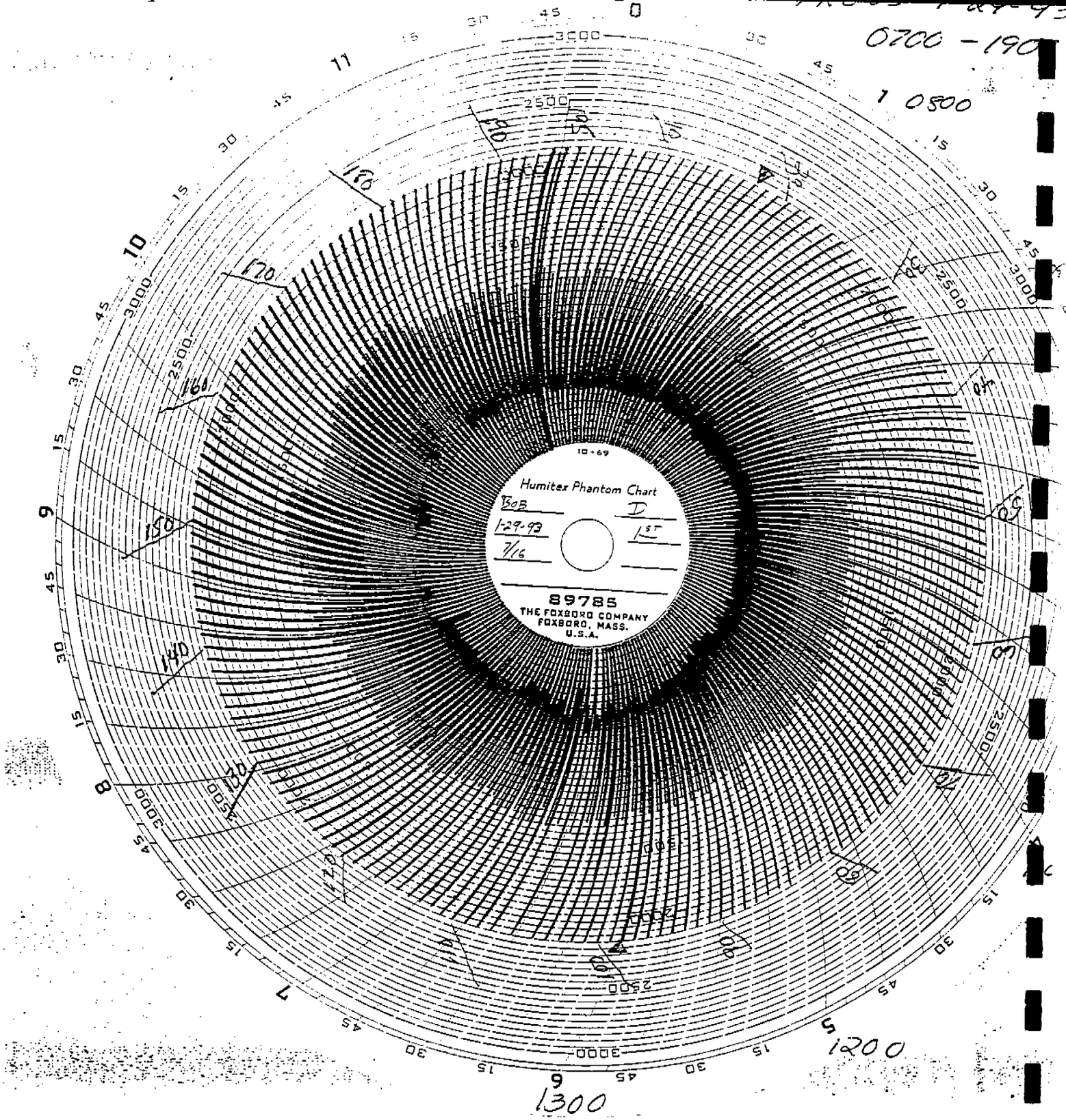
RESIN AND WAX USED

PERCENTAGE INFORMATION FROM DAILY INVENTORY SHEET
PERCENTAGE X WEIGHT OF FINISHED PRODUCT/HR = WEIGHT USED/HR

1.29% =PERCENT MDI USED
286 = LBS OF MDI USED PER HOUR

2.00% =PERCENT LIQUID PHENOLIC RESIN USED (100% SOLIDS)
443 = LBS OF LIQUID PHENOLIC RESIN USED PER HOUR

1.08% =PERCENT WAX USED
239 = LBS OF WAX USED PER HOUR



PRESSLOADS

0800 - 1300 = 82

[illegible] CORPORATION
MONTROSE, COLORADO

PRESS REPORT

OPERATOR Bob SHIFT 1st CREW D DATE 1-29-93

Line Speed	From	To
37 F/m	7:00A	

Thickness 7/16
Press Temp 210°
Pressloads 195
Footage
Total Footage 232,967

Thumbwheel setting
Surface ______ Core ______ Total Downtime 0

Flow Meters
Surface ______ lb Core ______ lb

Former Setting
TSL ______ Core ______ BSL ______

Highest Board WT ______

Dry Bin Thumbwheel Setting
Core ______ Surface ______

Lowest Board WT

DOWNTIME		DOWNTIME (Mins.)				REASONS FOR DOWNTIME
FROM	TO	M	E	O	QC	

(32)

Downtime Codes [illegible] J=33

DAILY INVENTORY SHEET

DATE 1-29-93

MTD 9164217

DAILY TOTAL 442634

SHIFT 1 ***			SHIFT 2 ***			SHIFT 3 ***		
0	3/8	0	38.70	0	3/8	0		
195	7/16	232967	37.91	3	7/16	3584		
0	15/32	0	38.41	0	15/32	0		
0	19/32 SE	0	38.69	0	19/32 SE	0		
0	19/32 TG	0	38.63	0	19/32 TG	0		
0	23/32 SE	0	38.10	0	23/32 SE	0		
0	23/32 TG	0	37.25	105	23/32 TG	206084		
0	1 SE	0	36.50	0	1 SE	0		
0	1 TG	0	36.50	0	1 TG	0		
0	1-1/8 TG	0	36.50	0	1-1/8 TG	0		
	TOTAL	232967			TOTAL	209668		

MDI RESIN

		COST			
DAY B/4	127683		INSIDE	0	0
+INCOMING	0				
TODAY	120956				
USAGE	6727				
DAILY COST			OUTSIDE	12.75	111384
MONTH USE	131128				
MONTH COST					

PHENOLIC

		COST			
DAY B/4	145313		SOUTH	3	24391
+INCOMING	0		NORTH	17.33	96270
TODAY	127418		WEST	0	0
USAGE	17895		DAY	2.58	4140
DAILY COST					
MONTH USE	312227				
MONTH COST					

WAX

		COST			
DAY B/4	72305		TANK	11.83	66669
+INCOMING	0				
TODAY	66669				
USAGE	5636				
DAILY COST		1.08%			
MONTH USE	87196				
MONTH COST		0.81%			

CALENDAR MTD LBS: 11703385

OF BRDS USED FOR TESTS 2 7/16, 2 23/32h

MDI % TOTAL #'S	1.29	LBS. PROD DAILY	520133
MDI % MTD	1.21	LBS. PROD MTD	10828814
LPH % MTD	1.67	PH % TOTAL #'S	2.00
		DENSITY:	37.6
		TOTAL	945.3
		DAY#	25
		MTD DENSITY	37.8

Louisiana-Pacific Corporation

Route 8, Box 8063
Hayward, Wisconsin 54843
715 634-3454

December 2, 1992

BACKUP COPY

Mr. Robert Jorgenson
APCD-SS-B1
Colorado Department of Health
4300 Cherry Creek Drive South
Denver, CO 80222-1530

Dear Mr. Jorgenson,

Louisiana-Pacific Corporation intends to conduct compliance stack testing at its oriented strandboard manufacturing facility located near Montrose, Colorado during late January 1993.

The testing will be conducted on two sources;

Dryer Stack - TSP - Method 5 (Front and back half)
VOC - Method 25A
Formaldehyde - Method 0011
CO - Method 10

Press Vent Stack - TSP - Method 5
(Front and back half)
VOC - Method 25A
Formaldehyde - Method 0011
MDI - Modified Niosh 347

The attached preliminary potocol contains information regarding the plant process and permit requirements.

I am currently reviewing proposals from several contractors for this project. Specific information regarding quality assurance, equations, schedule and personal will be submitted after a contractor is selected.

If you have any questions or comments concerning this information, please contact me.

Sincerely,

S.M. Somers

cc: Andy Loewi
Mark Becker
A.E. Cavadeas
Jeff Schultz

STATE OF COLORADO

COLORADO DEPARTMENT OF HEALTH
Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80222-1530
Phone (303) 692-2000

Laboratory Building
4210 E. 11th Avenue
Denver, Colorado 80220-3716
(303) 691-4700

Roy Romer
Governor

Patricia A. Nolan, MD, MPH
Executive Director

December 15, 1992

Ms. Susan Somers
Louisiana-Pacific Corporation
Route 8 Box 8263
Hayward, Wisconsin 54843

Dear Ms. Somers:

The Colorado Air Pollution Control Division has reviewed the information submitted on December 2, 1992 as a preliminary protocol for the stack testing to be done at the Montrose Plant according to Emission Permit Numbers 89MO373 (1-4). The Division has the following comments:

1. There is no discussion of the resins or binders added to the wafer board prior to pressing. Please notify us as to the composition of the binders used, the percentages of each type of binder used, and any variations in the binder for different products.

2. The process description describes the production of siding, concrete form board, and adding a fine wood particle overlay to the boards. Are these variations to the products produced in the past, and how do these products differ from what was produced in the plant in the past?

3. The protocol does not mention a monitor certification for the CO Monitor on the Konus Heater. This monitor needs to be certified in PPM of CO.

4. Please provide a summary of all the board thicknesses and types produced as well as the maximum capacity of each board type.

5. Please provide the MSDS sheets or ingredient lists for the latex paint used for panel siding, edge sealer, or lap siding finishing processes.

6. What is the current wood species mix used at the plant? Does it vary with the type of wood produced?

36

If you have any questions, please contact me at 303-692-3171.

Sincerely,

Robert Jorgenson

Robert Jorgenson
Air Pollution Control Specialist

cc:
Harry Collier
Scott Miller

Louisiana-Pacific Corporation

Route 8, Box 8263
Hayward, Wisconsin 54843
715-634-3454

January 5, 1993

ATTN: Robert Jorgenson
Air Pollution Control Division
Colorado Department of Health
4300 Cherry Creek Drive South
Denver, CO 80222

Dear Mr. Jorgenson,

This is in response to your comments dated December 15, 1992 regarding testing at the Montrose facility and our phone conversation today.

1. During 1992, this plant has produced board using approximately 1.2% MDI resin in the core layer and 2% liquid phenolic resin in surface layers (measured on 100% solids basis). Approximately 1% wax is also added.

2. The product variations discussed in the plant process description are possible future products at this facility and are not currently being produced.

3. It is Louisiana-Pacific's intention to certify the Konus CO monitor in ppm.

4. A list of board thicknesses produced during 1992 with estimated production rates is attached.

5. MSDS sheets for the edge seal currently used are attached.

6. The plant currently runs a maximum of 20% softwood. 1-1/8" thick board has been produced using 40% softwood and 60% hardwood; however, production of this thickness has been discontinued at this plant for the forseeable future.

38

Pursuant to our conversation, the tested board thickness will be 7/16".

A revised protocol including these responses is attached.

Sincerely,

S. M. Somers

Susan Somers
Environmental Coordinator

cc: Jeff Schultz
Mark Becker
A. E. Cavadeas

APPENDIX K

PROCEDURES

Particulate Loadings and Emission Rates

The particulate emission rates were determined per EPA Methods 1-5, CFR title 40, Part 60, Appendix A (revised July 1, 1987). In this procedure, a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the impinger case and a Drierite drying column. The sampling module is connected by means of an umbilical cord to the control module which houses the dry test gasmeter, the calibrated orifice, a leakless pump, two inclined manometers, and all controls required for operating the sampling train.

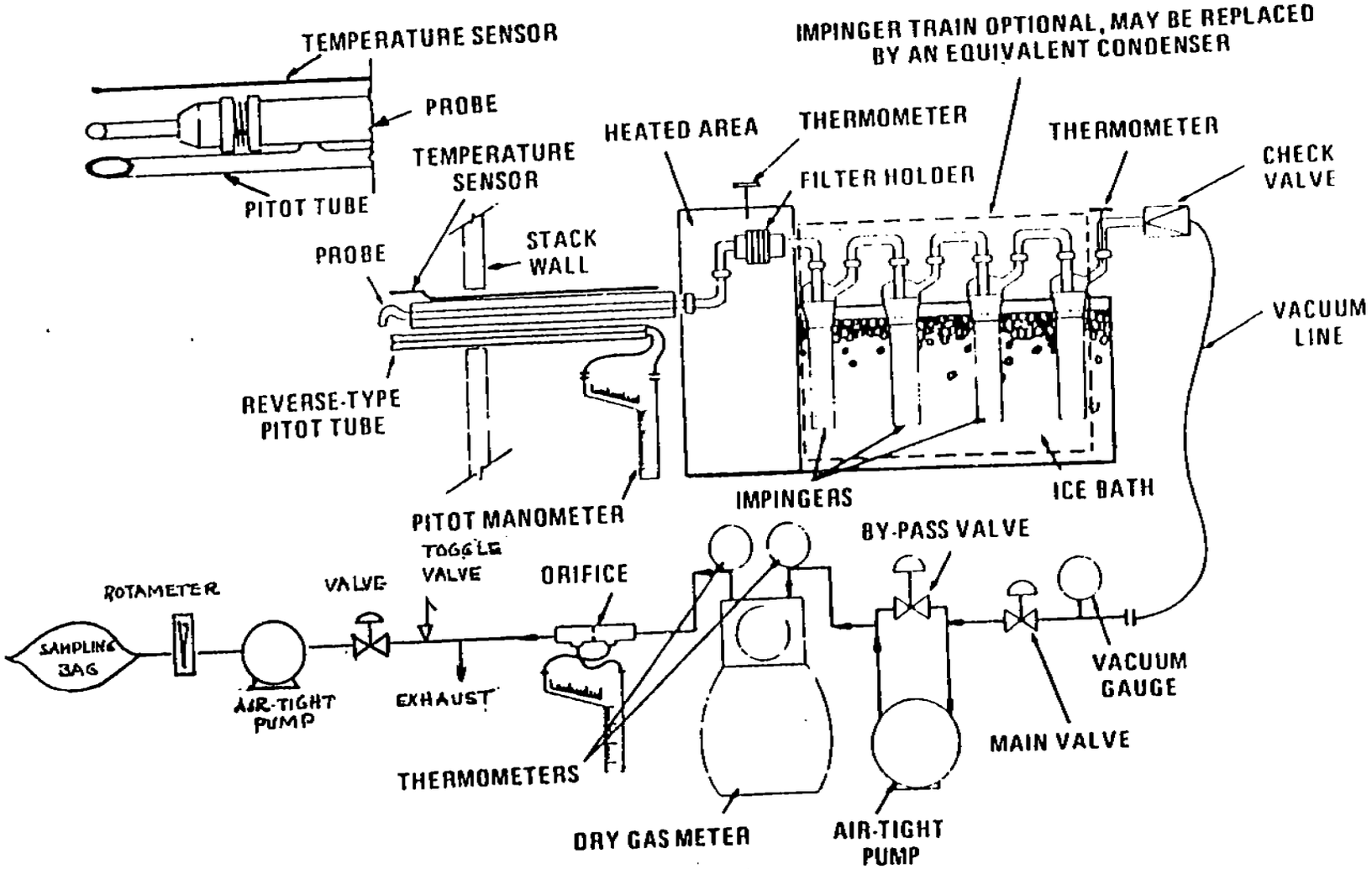
Particulate samples were collected as follows: The sample gas was drawn in through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter. The particulates were removed at this point and collected on the filter. The gases then passed through an ice-cooled impinger train and a desiccant-packed drying column which quantitatively absorb all moisture from the sample gas stream after which the sample gas passes through the pump and the dry test gasmeter which integrates the sample gas flow throughout the course of the test. A calibrated orifice attached to the outlet of the gasmeter provides instantaneous flow rate data.

A representative particulate sample was acquired by sampling for equal periods of time at the centroid of a number of equal area regions in the duct. The sampling rate is adjusted at each site such that an isokinetic sampling condition prevails. Nomographs are used to aid in the rapid determination of the sampling rate.

3a P1(1-5)

After sampling is complete, the filter is removed and placed in a clean container. The nozzle and inlet side of the filter holder are quantitatively washed with acetone and the washings are stored in a second container. A brush is often used in the cleaning step to help dislodge deposits. The samples are returned to the laboratory where they are logged in and analyzed. The volume of the acetone rinse ("probe wash") is noted and then the rinse is quantitatively transferred to a tared 120 cc porcelain evaporating dish and the acetone evaporated off at 97-105 °F. This temperature is used to prevent condensation of atmospheric moisture due to the cooling effect induced by the evaporation of acetone. The acetone-free sample is then transferred to an oven and dried at 105 °C for 30 minutes, cooled in a desiccator over Drierite, and then weighed to the nearest .01 mg. The filter sample is quantitatively transferred to a 6-inch watch glass and dried in an oven at 105 °C for two hours. The filter and watch glass are then cooled in a desiccator and the filter weighed to the nearest .01 mg. All weighings are performed in a balance room where the relative humidity is hydrostatted to less than 50% relative humidity. Microscopic examination of the samples is performed if any unusual characteristics are observed. The weight of the acetone rinse is corrected for the acetone blank. The Drierite column is weighed on-site and the water collected by Drierite is added to the condensate so that the total amount of absorbed water may be ascertained.

Integrated flue gas samples for Orsat analysis were collected simultaneously from the stack and from the breeching at the inlet to the wet scrubber. The samples were collected in 15-liter gas sampling bags at a constant flow rate throughout each particulate run. The bags were then returned to the laboratory and analyzed by Orsat analysis. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen).



Particulate-sampling train.

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 51

[AD-FRL-3977-4]

Preparation, Adoption, and Submittal of State Implementation Plans, Method for Measurement of Condensible Particulate Emissions From Stationary Sources

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: Method 202 for the measurement of condensible particulate matter (CPM) was proposed in the Federal Register on October 12, 1990, at (55 FR 41546). This action promulgates this method. On April 17, 1990 at (55 FR 14246) EPA promulgated two methods for measuring particulate matter (PM) with an aerodynamic diameter of 10 μm or less (PM_{10}). Since CPM emissions form very fine particles in the PM_{10} size range and are considered PM_{10} emissions, the Agency is adding a method for measuring CPM emissions from stationary sources to appendix M in 40 CFR part 51. The purpose of this

rule is to provide the States with a method for measuring CPM.

EFFECTIVE DATE: December 17, 1991.

ADDRESSES: Background Information Document. The Background Information Document for the promulgated test methods may be obtained from Candace Sorrell or Peter Westlin, MD–19, U.S. EPA, Research Triangle Park, North Carolina 27711, telephone number (919) 541–1064. Please refer to "Summary of Comments and Responses for Method 202."

Docket. Docket No. A–90–03, containing materials relevant to this rulemaking, is available for public inspection and copying between 8:30 a.m. to 12 Noon and 1:30 to 3:30 p.m., Monday through Friday, at EPA's Air Docket Section, Waterside Mall, room M1500, 1st Floor, Gallery 1, 401 M Street SW., Washington, DC 20460. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Candace Sorrell or Peter Westlin, Emission Measurement Branch (MD–19), Technical Support Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541–1064.

SUPPLEMENTARY INFORMATION:

I. The Rulemaking

The EPA is proposing to add a method for measuring CPM emissions to appendix M in 40 CFR part 51 to provide a method that States can use in their State implementation plans.

II. Public Participation

The opportunity to hold a public hearing on November 2, 1990 at 10 a.m. was presented in the proposal notice, but no one desired to make an oral presentation. The public comment period was from October 12, 1990 to December 17, 1990.

III. Significant Comments and Changes to the Proposed Rulemaking

Six comment letters were received from the proposal rulemaking. A detailed discussion of these comments is contained in the background document entitled "Summary of Comments and Responses for Method 202" which is referred to in the ADDRESSES section of this preamble. The major comments raised in these letters and the Agency's responses follow.

One commenter suggests that EPA determine the chemical composition of the material collected in the sampling train to verify that it will form ambient condensibles.

The EPA believes that material will collect in the impingers only by condensation or dissolution. Dissolved gases will evaporate during analysis and will not be measured unless the gases react to form a solid or liquid while they are in solution. The EPA has designed Method 202 to prevent the formation of reaction materials from dissolved gases. The EPA believes that any remaining material collected and measured by Method 202 represents the material that would condense in the ambient air. Additional analysis of chemical composition is not necessary.

Another comment raises the concern that the method may collect some portion of the sulfur dioxide (SO_2) as condensible.

The dissolution of SO_2 in water does not lead immediately to the formation of sulfuric acid (H_2SO_4), but tends to lower the solution pH, which further inhibits sulfate or H_2SO_4 formation. The method includes a purging procedure which effectively removes SO_2 before significant oxidation occurs. No additional revisions are necessary.

The commenter feels that if EPA is allowing Method 202 to be used in conjunction with Method 201 or 201A or another dry catch procedure to determine the total PM_{10} measurement, the combined methods should be tested for precision.

The imprecision associated with combining Method 202 with Method 201 or 201A or any other dry catch procedure is not additive because each train provides a separate measurement. Since the total precision associated with the combined methods cannot be larger than the least precise sampling method, a precision evaluation of a combined sampling system is unnecessary.

A commenter suggests that EPA add specific language to the applicability section of the method stating that Method 202 cannot be used on wet sources. He notes that Method 17 is excluded from use on wet sources, and Methods 201 and 201A are not recommended for wet sources.

The EPA agrees that Method 202 with an in-stack filter is not recommended for wet sources, and such a statement has been added to the applicability. However, a heated Method 5 filter could be used in Method 202 instead of the in-stack filter which would allow application to wet sources.

One commenter requests that EPA clearly state that Method 202 should not be used for assessing compliance with emission limits set on the basis of data derived from a different measurement approach.

The EPA agrees that a violation must be shown, in the first instance, by means of measurements made with the applicable test method. Once such a showing is made, however, section 113(e) of the Clean Air Act allows the Agency to rely on any credible evidence, including evidence other than the applicable test method, to establish the duration of the period of noncompliance for the purposes of assessing a penalty.

A commenter believes that the sample collection efficiency and method precision may be affected by the sampling conditions such as impinger temperature and sampling flow rate and the method should address this possibility.

The EPA agrees that the nature of the material in the sample gas may affect collection efficiency. For example, a field demonstration of Method 202 at an oil-fired boiler resulted in about 75 percent impinger collection efficiency. This collection efficiency can be improved with the addition of a second filter place between the second and third impinger. This option has been included in the method with a discussion of applicability.

The commenter feels the 1-hour nitrogen (N_2) purge is too long. He believes the majority of the SO_2 is removed in the first few minutes. He suggests the method be revised to reduce the purge time in conjunction with maintaining the sample under cold conditions and analyzing it within 48 hours.

The EPA does not agree with reducing the purge time. Laboratory tests have shown that a 1-hour purge time is necessary to ensure the adequate removal of SO_2 from the impinger solution.

Another commenter suggests that the method should be revised to give credit for ammonium sulfate ($(NH_4)_2SO_4$) dihydrte and other condensible particulate matter formed in the gas stream due to ammonia (NH_3) injection used to enhance the efficiency of a control device.

The EPA does not agree. The condensible particulate matter formed i the gas stream due to NH_3 injection is emitted to the atmosphere. The EPA believes that condensible particulate matter emitted from the source should be counted as such even if it is a produ of a pollution-control technique.

The commenter suggests that EPA consider an alternative to $MeCl_2$ consistent with the Montreal Protocol.

The EPA investigated the effectiveness of a chloroform-ether extraction during the method development phase. The chloroform-ether was not as effective as the MeCl in removing organic materials; howeve the chloroform-ether procedure was

found to be acceptable for organic extraction. The method has been revised to allow a chloroform-ether extraction.

The commenter supports the exclusion of ammonium chloride as a condensible; however, he expresses concern about $(NH_4)_2SO_4$ forming in the impingers.

The N_2 purge removes SO_2 before significant oxidation occurs. If NH_3 is present in the flue gas, the $(NH_4)_2SO_4$ formed in the impingers would not be counted as a condensible, although the H_2SO_4, which reacted with NH_3, would be counted as a condensible. Method 202 corrects for the NH_3 by measuring the sulfate using an IC analysis and subtracting out the ammonium ion (NH_4^+) mass.

The commenter agrees that the NH_3 added during the titration should be subtracted from the final weight. However, he does not agree with adding back in the water removed by the acid-base reaction.

Because H_2SO_4 is hygroscopic, the H_2SO_4 mass found in the atmosphere would have the water attached to it. The method has been revised to allow the source to correct for only the NH_4^+ or for both NH_4^+ and water as an option depending on the basis for the regulation.

A. Docket

The docket is an organized and complete file of all the information submitted to or otherwise considered by EPA in the development of this proposed rulemaking. The principle purposes of the docket are to: (1) Allow interested parties to identify and locate documents so that they can effectively participate in the rulemaking process, and (2) serve as the record in case of judicial review except for interagency review materials (Section 307(d)(7)(A)).

B. Office of Management and Budget Review

Under Executive Order 12291, EPA must judge whether a regulation is "major" and, therefore, subject to the requirement of a regulatory impact analysis. This rulemaking would not result in any of the adverse economic effects set forth in Section 1 of the Order as grounds for finding a "major rule." It will neither have an annual effect on the economy of $100 million or more, nor will it result in a major increase in costs or prices. There will be no significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of U.S.-based enterprises to compete with foreign-based enterprises in domestic or export markets. This rulemaking was submitted to the Office of Management and Budget (OMB) for review as required by Executive Order 12291.

C. Regulatory Flexibility Act Compliance

Pursuant to the provisions of 5 U.S.C. 605(b), I hereby certify that this attached rule, if promulgated, will not have any economic impact on small entities because no additional costs will be incurred.

This rule does not contain any information collection requirements subject to OMB review under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.*

Dated: December 6, 1991.

F. Henry Habicht II,

Acting Administrator.

List of Subjects in 40 CFR Part 51

Administrative practice and procedure,
Air pollution control,
Carbon Monoxide,
Inter-governmental relations,
Lead,
Nitrogen dioxide,
Ozone,
Particulate matter,
Reporting and recordkeeping requirements,
Sulfur Oxides,
Volatile Organic Compounds.

The EPA amends title 40, chapter I, part 51 of the Code of Federal Regulations as follows:

PART 51—[AMENDED]

1. The authority citation for part 51 continues to read as follows:

Authority: Section 110 of the Clean Air Act as amended (42 U.S.C. 7410).

2. Appendix M, to part 51 Table of Contents is amended by adding an entry to read as follows:

Method 202—Determination of Condensible Particulate Emissions From Stationary Sources

3. By adding Method 202 to Appendix M to part 51 to read as follows:

Method 202—Determination of Condensible Particulate Emissions From Stationary Sources

1. Applicability and Principle

1.1 Applicability. 1.1.1 This method applies to the determination of condensible particulate matter (CPM) emissions from stationary sources. It is intended to represent condensible matter as material that condenses after passing through a filter and as measured by this method (Note: The filter catch can be analyzed according to the appropriate method).

1.1.2 This method may be used in conjunction with Method 201 or 201A if the probes are glass-lined. Using Method 202 in conjunction with Method 201 or 201A only the impinger train configuration and analysis is addressed by this method. The sample train operation and front end recovery and analysis shall be conducted according to Method 201 or 201A.

1.1.3 This method may also be modified to measure material that condenses at other temperatures by specifying the filter and probe temperature. A heated Method 5 out-of-stack filter may be used instead of the in-stack filter to determine condensible emissions at wet sources.

1.2 Principle. 1.2.1 The CPM is collected in the impinger portion of a Method 17 (appendix A, 40 CFR part 60) type sampling train. The impinger contents are immediately purged after the run with nitrogen (N_2) to remove dissolved sulfur dioxide (SO_2) gases from the impinger contents. The impinger solution is then extracted with methylene chloride ($MeCl_2$). The organic and aqueous fractions are then taken to dryness and the residues weighed. The total of both fractions represents the CPM.

1.2.2 The potential for low collection efficiency exist at oil-fired boilers. To improve the collection efficiency at these type of sources, an additional filter placed between the second and third impinger is recommended.

2. Precision and Interference

2.1 Precision. The precision based on method development tests at an oil-fired boiler and a catalytic cracker were 11.7 and 4.8 percent, respectively.

2.2 Interference. Ammonia. In sources that use ammonia injection as a control technique for hydrogen chloride (HCl), the ammonia interferes by reacting with HCl in the gas stream to form ammonium chloride (NH_4Cl) which would be measured as CPM. The sample may be analyzed for chloride and the equivalent amount of NH_4Cl can be subtracted from the CPM weight. However, if NH_4Cl is to be counted as CPM, the inorganic fraction should be taken to near dryness (less than 1 ml liquid) in the oven and then allowed to air dry at ambient temperature to prevent any NH_4Cl from vaporizing.

3. Apparatus

3.1 Sampling Train. Same as in Method 17, section 2.1, with the following exceptions noted below (see Figure 202–1). *Note:* Mention of trade names or specific products does not constitute endorsement by EPA.

3.1.1 The probe extension shall be glass-lined or Teflon.

3.1.2 Both the first and second impingers shall be of the Greenburg-Smith design with the standard tip.

3.1.3 All sampling train glassware shall be cleaned prior to the test with soap and tap water, water, and rinsed using tap water, water, acetone, and finally, $MeCl_2$. It is important to completely remove all silicone grease from areas that will be exposed to the $MeCl_2$ during sample recovery.

3.2 Sample Recovery. Same as in Method 17, section 2.2, with the following additions:

3.2.1 N_2 Purge Line. Inert tubing and fittings capable of delivering 0 to 28 liters/min of N_2 gas to the impinger train from a

standard gas cylinder (see Figure 202-2). Standard 0.95 cm (⅜-inch) plastic tubing and compression fittings in conjunction with an adjustable pressure regulator and needle valve may be used.

3.2.2 Rotameter. Capable of measuring gas flow at 20 liters/min.

3.3 Analysis. The following equipment is necessary in addition to that listed in Method 17, section 2.3:

3.3.1 Separatory Funnel. Glass, 1-liter.

3.3.2 Weighing Tins. 350-ml.

3.3.3 Dry Equipment. Hot plate and oven with temperature control.

3.3.4 Pipets. 5-ml.

3.3.5 Ion Chromatograph. Same as in Method 5F, Section 2.1.6.

4. Reagents

Unless otherwise indicated, all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

4.1 Sampling. Same as in Method 17, section 3.1, with the addition of deionized distilled water to conform to the American Society for Testing and Materials Specification D 1193-74, Type II and the omittance of section 3.1.4.

4.2 Sample Recovery. Same as in Method 17, section 3.2, with the following additions:

4.2.1 N_2 Gas. Zero N_2 gas at delivery pressures high enough to provide a flow of 20 liters/min for 1 hour through the sampling train.

4.2.2 Methylene Chloride. ACS grade. Blanks shall be run prior to use and only methylene chloride with low blank values (0.001 percent) shall be used.

4.2.3 Water. Same as in section 4.1.

4.3 Analysis. Same as in Method 17, section 3.3, with the following additions:

4.3.1 Methylene Chloride. Same as section 4.2.2.

4.3.2 Ammonium Hydroxide. Concentrated (14.8 M) NH_4OH.

4.3.3 Water. Same as in section 4.1.

4.3.4 Phenolphthalein. The pH indicator solution, 0.05 percent in 50 percent alcohol.

5. Procedure

5.1 Sampling. Same as in Method 17, section 4.1, with the following exceptions:

5.1.1 Place 100 ml of water in the first three impingers.

5.1.2 The use of silicone grease in train assembly is not recommended because it is very soluble in $MeCl_2$ which may result in sample contamination. Teflon tape or similar means may be used to provide leak-free connections between glassware.

5.2 Sample Recovery. Same as in Method 17, section 4.2 with the addition of a post-test N_2 purge and specific changes in handling of individual samples as described below.

5.2.1 Post-test N_2 Purge for Sources Emitting SO_2. (Note: This step is recommended, but is optional. With little or no SO_2 is present in the gas stream, i.e., the pH of the impinger solution is greater than 4.5, purging has been found to be unnecessary.) As soon as possible after the post-test leak check, detach the probe and filter from the impinger train. Leave the ice in the impinger box to prevent removal of moisture during the purge. If necessary, add more ice during the purge to maintain the gas temperature below 20 °C. With no flow of gas through the clean purge line and fittings, attach it to the input of the impinger train (see Figure 202-2). To avoid over- or under-pressurizing the impinger array, slowly commence the N_2 gas flow through the line while simultaneously opening the meter box pump valve(s). When using the gas cylinder pressure to push the purge gas through the sample train, adjust the flow rate to 20 liters/min through the rotameter. When pulling the purge gas through the sample train using the meter box vacuum pump, set the orifice pressure differential to ΔH_a and maintain an overflow rate through the rotameter of less than 2 liters/min. This will guarantee that the N_2 delivery system is operating at greater than ambient pressure and prevents the possibility of passing ambient air (rather than N_2) through the impingers. Continue the purge under these conditions for 1 hour, checking the rotameter and ΔH value(s) periodically. After 1 hour, simultaneously turn off the delivery and pumping systems.

5.2.2 Sample Handling.

5.2.2.1 Container Nos. 1, 2, and 3. If filter catch is to be determined, as detailed in Method 17, section 4.2.

5.2.2.2 Container No. 4 (Impinger Contents). Measure the liquid in the first three impingers to within 1 ml using a clean graduated cylinder or by weighing it to within 0.5 g using a balance. Record the volume or weight of liquid present to be used to calculate the moisture content of the effluent gas. Quantitatively transfer this liquid into a clean sample bottle (glass or plastic); rinse each impinger and the connecting glassware, including probe extension, twice with water, recover the rinse water, and add it to the same sample bottle. Mark the liquid level on the bottle.

5.2.2.3 Container No. 5 ($MeCl_2$ Rinse). Follow the water rinses of each impinger and the connecting glassware, including the probe extension with two rinses of $MeCl_2$; save the rinse products in a clean, glass sample jar. Mark the liquid level on the jar.

5.2.2.4 Container No. 6 (Water Blank). Once during each field test, place 500 ml of water in a separate sample container.

5.2.2.5 Container No. 7 ($MeCl_2$ Blank). Once during each field test, place in a separate glass sample jar a volume of $MeCl_2$ approximately equivalent to the volume used to conduct the $MeCl_2$ rinse of the impingers.

5.3 Analysis. Record the data required on a sheet such as the one shown in Figure 202-3. Handle each sample container as follows:

5.3.1 Container Nos. 1, 2, and 3. If filter catch is analyzed, as detailed in Method 17, section 4.3.

5.3.2 Container Nos. 4 and 5. Note the level of liquid in the containers and confirm on the analytical data sheet whether leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in Container No. 4 either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Remove a 5-ml aliquot and set aside for later ion chromatographic (IC) analysis of sulfates. (Note: Do not use this aliquot to determine chlorides since the HCl will be evaporated during the first drying step; Section 8.2 details a procedure for this analysis.)

5.3.2.1 Extraction. Separate the organic fraction of the sample by adding the contents of Container No. 4 ($MeCl_2$) to the contents of Container No. 4 in a 1000-ml separatory funnel. After mixing, allow the aqueous and organic phases to fully separate, and drain off most of the organic/$MeCl_2$ phase. Then add 75 ml of $MeCl_2$ to the funnel, mix well, and drain off the lower organic phase. Repeat with another 75 ml of $MeCl_2$. This extraction should yield about 250 ml of organic extract. Each time, leave a small amount of the organic/$MeCl_2$ phase in the separatory funnel ensuring that no water is collected in the organic phase. Place the organic extract in a tared 350-ml weighing tin.

5.3.2.2 Organic Fraction Weight Determination (Organic Phase from Container Nos. 4 and 5). Evaporate the organic extract at room temperature and pressure in a laboratory hood. Following evaporation, desiccate the organic fraction for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg.

5.3.2.3 Inorganic Fraction Weight Determination. (Note: If NH_4Cl is to be counted as CPM, the inorganic fraction should be taken to near dryness (less than 1 ml liquid) in the oven and then allow to air dry at ambient temperature. If multiple acid emissions are suspected, the ammonia titration procedure in section 8.1 may be preferred.) Using a hot plate, or equivalent, evaporate the aqueous phase to approximately 50 ml; then, evaporate to dryness in a 105 °C oven. Redissovle the residue in 100 ml of water. Add five drops of phenolphthalein to this solution; then, add concentrated (14.8 M) NH_4OH until the sample turns pink. Any excess NH_4OH will be evaporated during the drying step. Evaporate the sample to dryness in a 105 °C oven, desiccate the sample for 24 hours, weigh to a constant weight, and record the results to the nearest 0.1 mg. (Note: The addition of NH_4OH is recommended, but is optional when little or no SO_2 is present in the gas stream, i.e., when the pH of the impinger solution is greater than 4.5, the addition of NH_4OH is not necessary.)

5.3.2.4 Analysis of Sulfate by IC to Determine Ammonium Ion (NH_4^+) Retained in the Sample. (Note: If NH_4OH is not added, omit this step.) Determine the amount of sulfate in the aliquot taken from Container No. 4 earlier as described in Method 5F (appendix A, 40 CFR part 60). Based on the IC SO_4^{-2} analysis of the aliquot, calculate the correction factor to subtract the NH_4^+ retained in the sample and to add the combined water removed by the acid-base reaction (see section 7.2).

5.3.3 Analysis of Water and $MeCl_2$ Blanks (Container Nos. 6 and 7). Analyze these sample blanks as described above in sections 5.3.2.3 and 5.3.2.2, respectively.

5.3.4 Analysis of Acetone Blank (Container No. 8). Same as in Method 17, section 4.3.

6. Calibration

Same as in Method 17, section 5, except for the following:

6.1 IC Calibration. Same as Method 5F, section 5.

6.2 Audit Procedure. Concurrently, analyze the audit sample and a set of compliance samples in the same manner to evaluate the technique of the analyst and the standards preparation. The same analyst, analytical reagents, and analytical system shall be used both for compliance samples and the EPA audit sample. If this condition is met, auditing of subsequent compliance analyses for the same enforcement agency within 30 days is not required. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies, unless prior arrangements are made with both enforcement agencies.

6.3 Audit Samples. Audit Sample Availability. Audit samples will be supplied only to enforcement agencies for compliance tests. The availability of audit samples may be obtained by writing:

Source Test Audit Coordinator (MD–77B), Quality Assurance Division, Atmospheric Research and Exposure Assessment Laboratory, U.S. Environmental Protection Agency, Research Triangle, Park, NC 27711

or by calling the Source Test Audit Coordinator (STAC) at (919) 541–7834. The request for the audit sample must be made at least 30 days prior to the scheduled compliance sample analysis.

6.4 Audit Results. Calculate the audit sample concentration according to the calculation procedure described in the audit instructions included with the audit sample. Fill in the audit sample concentration and the analyst's name on the audit response form included with the audit instructions. Send one copy to the EPA Regional Office or the appropriate enforcement agency and a second copy to the STAC. The EPA Regional Office or the appropriate enforcement agency will report the results of the audit to the laboratory being audited. Include this response with the results of the compliance samples in relevant reports to the EPA Regional Office or the appropriate enforcement agency.

7. Calculations

Same as in Method 17, section 6, with the following additions:

7.1 Nomenclature. Same as in Method 17, section 6.1 with the following additions.

C_{cpm} = Concentration of the CPM in the stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

C_{SO_4} = Concentration of SO_4^{-2} in the sample, mg/ml.

m_w = Sum of the mass of the water and $MeCl_2$ blanks, mg.

m_a = Mass of the NH_4^+ added to sample to form ammonium sulfate, mg.

m_i = Mass of inorganic CPM matter, mg.

m_o = Mass of organic CPM, mg.

m_r = Mass of dried sample from inorganic fraction, mg.

V_a = Volume of aliquot taken for IC analysis, ml.

V_{ic} = Volume of impinger contents sample, ml.

7.2 Correction for NH_4^+ and H_2O. Calculate the correction factor to subtract the NH_4^+ retained in the sample based on the IC SO_4^{-2} and if desired, add the combined water removed by the acid-base reaction.

$$m_c = K\ C_{so_4}\ V_{ic} \qquad \text{Eq. 202–1}$$

where:

K = 0.0205, when correcting for NH_4^+ and H_2O.

= 0.1840, when only correcting for NH_4^+.

7.3 Mass of Inorganic CPM.

$$m_i = m_r + \frac{V_{ic}}{V_{ic} - V_a} - m_c \qquad \text{Eq. 202–2}$$

7.4 Concentration of CPM.

$$C_{cpm} = \frac{m_o + m_i - m_w}{V m_{std}} \qquad \text{Eq. 202–3}$$

8. Alternative Procedures

8.1 Determination of NH_4^+ Retained in Sample by Titration.

8.1.1 An alternative procedure to determine the amount of NH_4^+ added to the inorganic fraction by titration may be used. After dissolving the inorganic residue in 100 ml of water, titrate the solution with 0.1 N NH_4OH to a pH of 7.0, as indicated by a pH meter. The 0.1 N NH_4OH is made as follows: Add 7 ml of concentrated (14.8 M) NH_4OH to 1 liter of water. Standardize against standardized 0.1 N H_2SO_4 and calculate the exact normality using a procedure parallel to that described in section 5.5 of Method 6 (appendix A, 40 CFR part 60). Alternatively, purchase 0.1 N NH_4OH that has been standardized against a National Institute of Standards and Technology reference material.

8.1.2 Calculate the concentration of SO_4^{-2} in the sample using the following equation.

$$CSO_4 = \frac{48.03\ V_t\ N}{100} \qquad \text{Eq. 202–4}$$

where

N = Normality of the NH_4OH, mg/ml.

V_t = Volume of NH_4OH titrant, ml.

48.03 = mg/meq.

100 = Volume of solution, ml.

8.3.1 Calculate the CPM as described in section 7.

8.2 Analysis of Chlorides by IC. At the conclusion of the final weighing as described in section 5.3.2.3, redissolve the inorganic fraction in 100 ml of water. Analyze an aliquot of the redissolved sample for chlorides by IC using techniques similar to those described in Method 5F for sulfates. Previous drying of the sample should have removed all HCl. Therefore, the remaining chlorides measured by IC can be assumed to be NH_4Cl, and this weight can be subtracted from the weight determined for CPM.

8.3 Air Purge to Remove SO_2 from Impinger Contents. As an alternative to the post-test N_2 purge described in section 5.2.1, the tester may opt to conduct the post-test purge with air at 20 liter/min. Note: The use of an air purge is not as effective as a N_2 purge.

8.4 Chloroform-ether Extraction. As an alternative to the methylene chloride extraction described in section 5.3.2.1, the tester may opt to conduct a chloroform-ether extraction. Note: The Chloroform-ether was not as effective as the $MeCl_2$ in removing the organics, but it was found to be an acceptable organic extractant. Chloroform and diethylether of ACS grade, with low blank values (0.001 percent), shall be used. Analysis of the chloroform and diethylether blanks shall be conducted according to Section 5.3.3 for $MeCl_2$.

8.4.1 Add the contents of Container No. 4 to a 1000-ml separatory funnel. Then add 75 ml of chloroform to the funnel, mix well, and drain off the lower organic phase. Repeat two more times with 75 ml of chloroform. Then perform three extractions with 75 ml of diethylether. This extraction should yield approximately 450 ml of organic extraction. Each time, leave a small amount of the organic/$MeCl_2$ phase in the separatory funnel ensuring that no water is collected in the organic phase.

8.4.2 Add the contents of Container No. 5 to the organic extraction. Place approximately 300 ml of the organic extract in a tared 350-ml weighing tin while storing the remaining organic extract in a sample container. As the organic extract evaporates, add the remaining extract to the weighing tin.

8.4.3 Determine the weight of the organic phase as described in Section 5.3.2.2.

8.5 Improving Collection Efficiency. If low impinger collection efficiency is suspected, the following procedure may be used.

8.5.1 Place an out-of-stock filter as described in Method 8 between the second and third impingers.

8.5.2 Recover and analyze the filter according to Method 17, Section 4.2. Include the filter holder as part of the connecting glassware and handle as described in sections 5.2.2.2 and 5.2.2.3.

8.5.3 Calculate the Concentration of CPM as follows:

$$C_{cpm} = \frac{m_o + m_i + m_f - m_w}{V m_{std}} \qquad \text{Eq. 202–5}$$

where:

m_f = amount of CPM collected on out-of-stack filter, mg.

8.6 Wet Source Testing. When testing at a wet source, use a heated out-of-stack filter as described in Method 5.

9. Bibliography

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Shigehara. "Laboratory and Field Evaluation of the EPA Method 5 Impinger Catch for Measuring Condensible Matter from Stationary Sources." Paper presented at the 1989 EPA/AWMA International Symposium on Measurement of Toxic and Related Air Pollutants. Raleigh, North Carolina. May 1–5, 1989.

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3. Texas Air Control Board, Laboratory Division. "Determination of Particulate in Stack Gases Containing Sulfuric Acid and/or Sulfur Dioxide." *Laboratory Methods for Determination of Air Pollutants*. Modified December 3, 1978.

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5. "Particulate Source Test Procedures Adopted by Puget Sound Air Pollution Control Agency Board of Directors." Puget Sound Air Pollution Control Agency, Engineering Division. Seattle, Washington. August 11, 1983.

6. Commonwealth of Pennsylvania, Department of Environmental Resources. Chapter 139, Sampling and Testing (Title 25, Rules and Regulations, Part I, Department of Environmental Resources, Subpart C, Protection of Natural Resources, Article III, Air Resources). January 8, 1960.

7. Wisconsin Department of Natural Resources. *Air Management Operations Handbook, Revision 3*. January 11, 1988.

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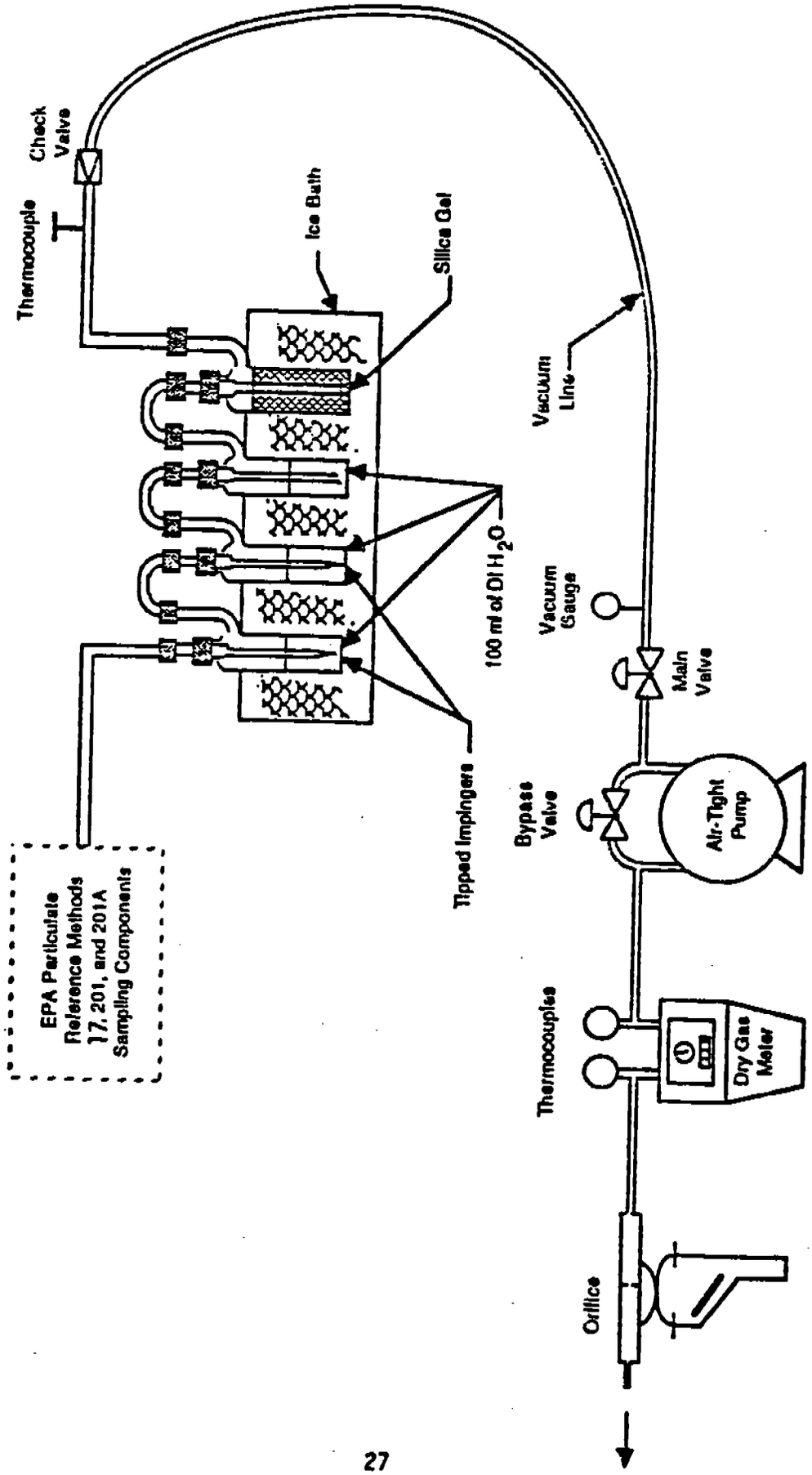

Figure 202-1. . Schematic of condensible particulate sampling train.

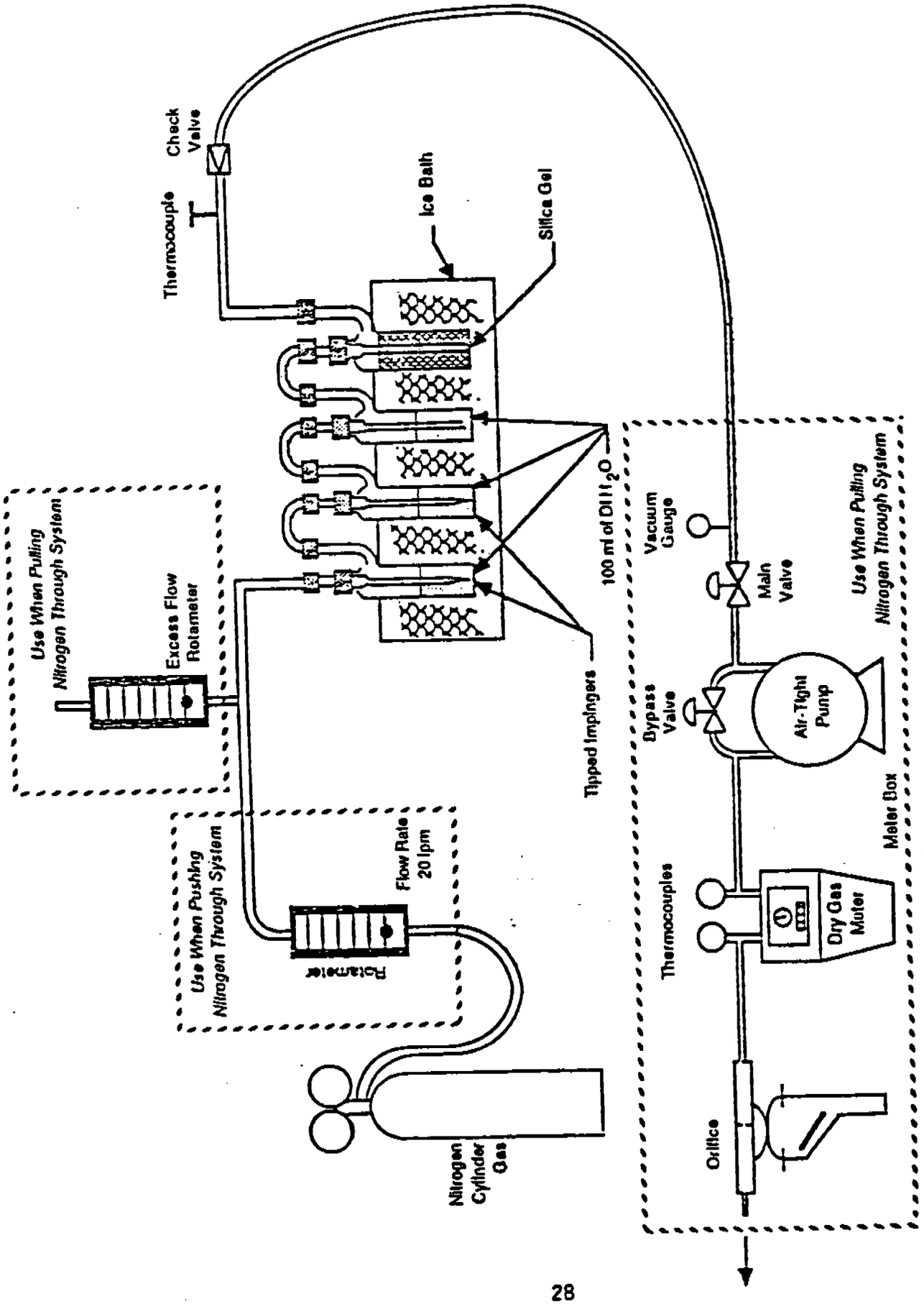

Figure 202-2. Schematic of post-test nitrogen purge system.

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Moisture Determination

Volume or weight of liquid in impingers: _____ ml or g

Weight of moisture in silica gel: _____ g

Sample Preparation (Container No. 4)

Amount of liquid lost during transport: _____ ml

Final volume: _____ ml

pH of sample prior to analysis: _____

Addition of NH_4OH required: _____

Sample extracted 2X with 75 ml $MeCl_2$?: _____

For Titration of Sulfate

Normality of NH_4OH: _____ N

Volume of sample titrated: _____ ml

Volume of titrant: _____ ml

Sample Analysis

Container number	Weight of condensible particulate, mg		
	Final weight	Tare weight	Weight gain
4 (Inorganic)			
4 & 5 (Organic)			

Total: _____

Less Blank: _____

Weight of Consensible Particulate: _____

Figure 202-3. Analytical data sheet.

[FR Doc. 91-29957 Filed 12-16-91; 8:45 am]

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DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

Carbon monoxide concentrations were determined in accordance with CFR Title 40, Part 60, Appendix A (revised July 1, 1990), EPA Method 10 using the integrated sampling technique. An integrated gas sample is extracted from a three-point sampling traverse and analyzed for carbon monoxide content using a ACS Model 3300 nondispersive infrared analyzer (NDIR). This analyzer has a measuring range of 0-500 and 0-1000 ppm. The measuring method is single beam. Linearity is better than ± 2% full scale and the noise is less than 0.5 fs. The minimum detectable concentration is 5 ppm. Zero drift is rated at ± 1% fs per 24 hours and the span drift is less than 1% in a 24-hour period. Response time is less than 15 seconds to 90% of final reading. Precision is rated at better than ± 0.5% fs on low range and ± 1% fs on high range. The flow rate through the analyzer is 1.0 ± 0.5 LPM..

Integrated flue gas samples are collected over a 21-minute period using a three or more point traverse. The flue gas samples are collected at a flow rate of 400-1000 cc per minute. The flue gas is dried using a desiccant column filled with silica gelor Drierite. Integrated gas samples are collected in 44-liter Tedlar bags. The bags are leak-checked immediately before initiation of sampling. The integrated bags are housed in aluminum housings to eliminate any contact with sharp objects which might cause puncture and leakage.

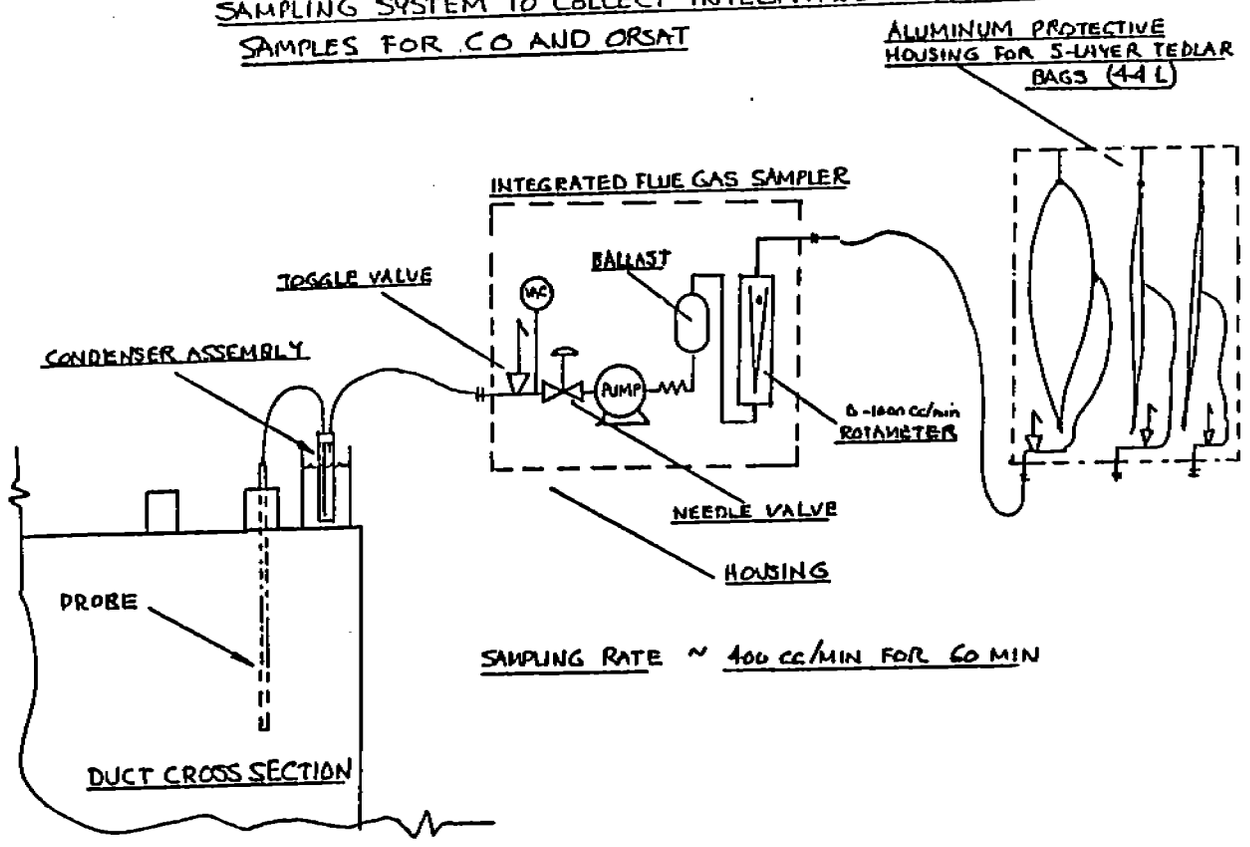
After sampling is complete, the bags are transported to the laboratory for analysis. The bags are analyzed using a flow system whereby any residual moisture and carbon dioxide are quantitatively removed prior to introduction into the NDIR. This is accomplished using two cartridges in series immersed in an ice bath. The first cartridge contains silica gel or Drierite and the second cartridge Ascarite as prescribed in EPA Method 10. The analyzer is then zeroed and calibrated

using NBS traceable standard gases (Scott Specialty Gases). These gases are introduced directly into the system and passed through the two adsorbent cartridges. A high purity nitrogen zero gas is used to zero the analyzer. Several concentrations of carbon monoxide in air standards are used to calibrate the analyzer and to quality assure intermittently the analysis of the individual flue gas samples.

The integrated bag samples are also analyzed for carbon dioxide and oxygen by means of a standard Orsat analyzer equipped with a 100 cc buret using standard commercially available absorption reagents in accordance with EPA Method 3. The moisture content of the flue gas is determined independently in accordance with EPA Method 4 (large impinger version) to allow mathematical conversion of the dry, CO_2-free concentrations to actual flue gas conditions.

The reported carbon monoxide concentrations, unless otherwise noted, have been mathematically corrected for both carbon dioxide and moisture content in accordance with the equations given in EPA Method 10.

SAMPLING SYSTEM TO COLLECT INTEGRATED FLUE GAS SAMPLES FOR CO AND ORSAT



SAMPLING RATE ~ 400 cc/MIN FOR 60 MIN

REVISIONS			EPA METHOD 3 & 10 SAMPLING TRAIN		
NO.	DATE	BY			
1					
2					
3			DRAWN BY LP	SCALE N/A	MATERIAL
4			CHK'D	DATE 10/85	DRAWING NO. S-310
5			TRACED	APP'D	

Interpoll Inc.
(612)786-6020

ACS Model 3300 (Fugi) NDIR Carbon Monoxide Analyzer

SPECIFICATIONS

1)	Measuring Principle:	NDIR single beam method
2)	Range:	CO: 0 - 500 ppm and 0 -1000 ppm
3)	Repeatability:	L-range; ± 0.5% of full scale H-range; ± 1% of full scale
4)	Stability:	Zero drift; ± 1% of full scale/24H Span drift; ± 1% of full scale/24H
5)	Noise:	0.5% of full scale
6)	Ambient temp:	-5 to 45 °C
7)	Ambient humid:	Less than 90% RH
8)	Response time: (90% of final reading)	Electrical system; 2 sec, 3 sec, 5 sec, (selectable with connector). Response of actual gas; within 15 sec (depending on cell length)
9)	Indicator:	100 linear divisions
10)	Output signal:	OUTPUT 1; DC 0 - 1V OUTPUT 2; DC 4- 20 mA (Allowable load resistance 550 max.)
11)	Interferences:	The rejection ratio of CO_2 is greater than 100,000:1 (thus a 10% change in CO_2 would cause a change in carbon monoxide concentration of 1 ppm or less)
12)	Linearity:	Better than ± 2% of full scale (when linearizer is used)
13)	Power supply:	AC 115 V ± 10%, 60 Hz
14)	Power consmp:	Approx. 30 VA
15)	Materials of gas contacting parts:	Measuring cell; SUS304 Window; CaF_2 Piping; Polyethylene
16)	Sample gas	1 L/min ± 0.5 L/min
17	Sample gas temp:	0 to 50 °C

EPA
METHOD 0011

SAMPLING FOR FORMALDEHYDE EMISSIONS FROM STATIONARY SOURCES

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to the determination of Destruction and Removal Efficiency (DRE) of formaldehyde, CAS Registry number 50-00-0, and possibly other aldehydes and ketones from stationary sources as specified in the regulations. The methodology has been applied specifically to formaldehyde; however, many laboratories have extended the application to other aldehydes and ketones. Compounds derivatized with 2,4-dinitrophenylhydrazine can be detected as low as 6.4×10^{-8} lbs/cu ft (1.8 ppbv) in stack gas over a 1 h sampling period, sampling approximately 45 cu ft.

2.0 SUMMARY OF METHOD

2.1 Gaseous and particulate pollutants are withdrawn isokinetically from an emission source and are collected in aqueous acidic 2,4-dinitrophenylhydrazine. Formaldehyde present in the emissions reacts with the 2,4-dinitrophenylhydrazine to form the formaldehyde dinitrophenylhydrazone derivative. The dinitrophenylhydrazone derivative is extracted, solvent-exchanged, concentrated, and then analyzed by high performance liquid chromatography.

3.0 INTERFERENCES

3.1 A decomposition product of 2,4-dinitrophenylhydrazine, 2,4-dinitroaniline, can be an analytical interferent if concentrations are high. 2,4-dinitroaniline can coelute with the 2,4-dinitrophenylhydrazone of formaldehyde under high performance liquid chromatography conditions which may be used for the analysis. High concentrations of highly oxygenated compounds, especially acetone, that have the same retention time or nearly the same retention time as the dinitrophenylhydrazone of formaldehyde and that also absorb at 360 nm will interfere with the analysis.

Formaldehyde, acetone, and 2,4-dinitroaniline contamination of the aqueous acidic 2,4-dinitrophenylhydrazine (DNPH) reagent is frequently encountered. The reagent must be prepared within five days of use in the field and must be stored in an uncontaminated environment both before and after sampling in order to minimize blank problems. Some level of acetone contamination is unavoidable, because acetone is ubiquitous in laboratory and field operations. However, the acetone contamination must be minimized.

4.0 APPARATUS AND MATERIALS

4.1 A schematic of the sampling train is shown in Figure 1. This sampling train configuration is adapted from EPA Method 5 procedures. The sampling train consists of the following components: Probe Nozzle, Pitot Tube, Differential Pressure Gauge, Metering System, Barometer, and Gas Density Determination Equipment.

4.1.1 Probe Nozzle: Quartz or glass with sharp, tapered (30° angle) leading edge. The taper shall be on the outside to preserve a constant inner diameter. The nozzle shall be buttonhook or elbow design. A range of nozzle sizes suitable

for isokinetic sampling should be available in increments of 0.16 cm (1/16 in), e.g., 0.32 to 1.27 cm (1/8 to 1/2 in), or larger if higher volume sampling trains are used. Each nozzle shall be calibrated according to the procedures outlined in Section 8.1.

4.1.2 Probe Liner: Borosilicate glass or quartz shall be used for the probe liner. The tester should not allow the temperature in the probe to exceed 120 ± 14°C (248 ± 25°F).

4.1.3 Pitot Tube: The Pitot tube shall be Type S, as described in Section 2.1 of EPA Method 2, or any other appropriate device. The pitot tube shall be attached to the probe to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see EPA Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of EPA Method 2.

4.1.4 Differential Pressure Gauge: The differential pressure gauge shall be an inclined manometer or equivalent device as described in Section 2.2 of EPA Method 2. One manometer shall be used for velocity-head readings and the other for orifice differential pressure readings.

4.1.5 Impingers: The sampling train requires a minimum of four impingers, connected as shown in Figure 1, with ground glass (or equivalent) vacuum-tight fittings. For the first, third, and fourth impingers, use the Greenburg-Smith design, modified by replacing the tip with a 1.3-cm inside diameter (1/2 in) glass tube extending to 1.3 cm (1/2 in) from the bottom of the flask. For the second impinger, use a Greenburg-Smith impinger with the standard tip. Place a thermometer capable of measuring temperature to within 1°C (2°F) at the outlet of the fourth impinger for monitoring purposes.

4.1.6 Metering System: The necessary components are a vacuum gauge, leak-free pump, thermometers capable of measuring temperature within 3°C (5.4°F), dry-gas meter capable of measuring volume to within 1%, and related equipment as shown in Figure 1. At a minimum, the pump should be capable of 4 cfm free flow, and the dry gas meter should have a recording capacity of 0-999.9 cu ft with a resolution of 0.005 cu ft. Other metering systems may be used which are capable of maintaining sampling rates within 10% of isokinetic collection and of determining sample volumes to within 2%. The metering system may be used in conjunction with a pitot tube to enable checks of isokinetic sampling rates.

4.1.7 Barometer: The barometer may be mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in Hg). In many cases, the barometric reading may be obtained from a nearby National Weather Service Station, in which case the station value (which is the absolute barometric pressure) is requested and an adjustment for elevation differences between the weather station and sampling point is applied at a rate of minus 2.5 mm Hg (0.1 in Hg) per 30 m (100 ft) elevation increase (vice versa for elevation decrease).

4.1.8 Gas Density Determination Equipment: Temperature sensor and pressure gauge (as described in Sections 2.3 and 2.4 of EPA Method 2), and gas analyzer, if necessary (as described in EPA Method 3). The temperature sensor ideally should be permanently attached to the pitot tube or sampling probe in a fixed

configuration such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see EPA Method 2, Figure 2-7). As a second alternative, if a difference of no more than 1% in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube.

4.2 Sample Recovery

4.2.1 Probe Liner: Probe nozzle and brushes; Teflon® bristle brushes with stainless steel wire handles are required. The probe brush shall have extensions of stainless steel, Teflon®, or inert material at least as long as the probe. The brushes shall be properly sized and shaped to brush out the probe liner, the probe nozzle, and the impingers.

4.2.2 Wash Bottles: Three wash bottles are required. Teflon® or glass wash bottles are recommended; polyethylene wash bottles should not be used because organic contaminants may be extracted by exposure to organic solvents used for sample recovery.

4.2.3 Graduated Cylinder and/or Balance: A graduated cylinder or balance is required to measure condensed water to the nearest 1 mL or 1 g. Graduated cylinders shall have divisions not >2 mL. Laboratory balances capable of weighing to ±0.5 g are required.

4.2.4 Amber Glass Storage Containers: One-liter wide-mouth amber flint glass bottles with Teflon®-lined caps are required to store impinger water samples. The bottles must be sealed with Teflon® tape.

4.2.5 Rubber Policeman and Funnel: A rubber policeman and funnel are required to aid in the transfer of materials into and out of containers in the field.

5.0 REAGENTS

Reagent grade chemicals or better grades shall be used in all tests. Unless otherwise indicated, all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.

5.1 Water: HPLC-grade water is used in preparation of DNPH reagent and in all other applications in the sampling train.

5.2 Silica Gel: Silica gel shall be indicating type, 6-16 mesh. If the silica gel has been used previously, dry at 175°C (350°F) for 2 h before using. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used.

5.3 Crushed Ice: Quantities ranging from 10-50 lb may be necessary during a sampling run, depending upon ambient temperature. Samples which have been taken must be stored and shipped cold; sufficient ice for this purpose must be allowed.

5.4 2,4-Dinitrophenylhydrazine Reagent: The 2,4-dinitrophenylhydrazine reagent must be prepared in the laboratory within five days of sampling use in the field. Preparation of DNPH can also be done in the field, with consideration of appropriate procedures required for safe handling of solvent in the field. When a container of prepared DNPH reagent is opened in the field, the contents of the opened container should be used within 48 hours. All laboratory glassware must be washed with detergent and water and rinsed with water, methanol, and methylene chloride prior to use.

NOTE: The glassware must not be rinsed with acetone or unacceptable levels of acetone contamination will be introduced. If field preparation of DNPH is performed, caution must be exercised in avoiding acetone contamination.

Reagent bottles for storage of cleaned DNPH derivatizing solution must be rinsed with acetonitrile and dried before use. Baked glassware is not essential for preparation of DNPH reagent.

NOTE: DNPH crystals or DNPH solution should be handled with plastic gloves at all times, with prompt and extensive use of running water in case of skin exposure.

5.4.1 Preparation of Aqueous Acidic DNPH: The following materials and reagents are required for preparation of the reagent.

5.4.1.1 Bottles/Caps: amber 1- or 4 L bottles with Teflon®-lined caps are required for storing cleaned DNPH solution. Additional 4-L bottles are required to collect waste organic solvents.

5.4.1.2 Large Glass Container: at least one large glass container (8 to 16 L) is required for mixing the aqueous acidic DNPH solution.

5.4.1.3 Stir Plate/Large Stir Bars/Stir Bar Retriever: a magnetic stir plate and large stir bar are required for the mixing of the aqueous acidic DNPH solution. A stir bar retriever is needed for removing the stir bar from the large container holding the DNPH solution.

5.4.1.4 Buchner Filter/Filter Flask/Filter Paper: a large filter flask (2-4 L) with a buchner filter, appropriate rubber stopper, filter paper, and connecting tubing are required for filtering the aqueous acidic DNPH solution prior to cleaning.

5.4.1.5 Separatory Funnels: at least one large separatory funnel (2 L) is required for cleaning the DNPH prior to use.

5.4.1.6 Beakers: beakers (150 mL, 250 mL, and 400 mL) are useful for holding/measuring organic liquids when cleaning the aqueous acidic DNPH solution and for weighing DNPH crystals.

5.4.1.7 Funnels: at least one large funnel is needed for pouring the aqueous acidic DNPH into the separatory funnel.

5.4.1.8 Graduated Cylinders: at least one large graduated cylinder (1 to 2 L) is required for measuring HPLC-grade water and acid when preparing the DNPH solution.

5.4.1.9 Top-Loading Balance: a one-place top loading balance is needed for weighing out the DNPH crystals used to prepare the aqueous acidic DNPH solution.

5.4.1.10 Spatulas: spatulas are needed for weighing out DNPH when preparing the aqueous DNPH solution.

5.4.1.11 HPLC-Grade Water: water (HPLC-grade) is required to mix the aqueous DNPH solution.

5.4.1.12 Hydrochloric Acid: reagent grade hydrochloric acid (approximately 12N) is required for acidifying the aqueous DNPH solution.

5.4.1.13 2,4-Dinitrophenylhydrazine: a supply of moist solid 2,4-dinitrophenylhydrazine (DNPH) is required for preparation of aqueous acidic DNPH solution. The quantity of water may vary from 10 to 30%. Reagent grade or equivalent is required.

5.4.1.14 Methylene Chloride: methylene chloride (suitable for residue and pesticide analysis, GC/MS, HPLC, GC, Spectrophotometry or equivalent) is required for cleaning the aqueous acidic DNPH solution, rinsing glassware, and recovery of sample trains.

5.4.1.15 Cyclohexane: cyclohexane (HPLC grade) is required for cleaning the aqueous acidic DNPH solution.

NOTE: Do not use spectroanalyzed grades of cyclohexane if this sampling methodology is extended to aldehydes and ketones with four or more carbon atoms.

5.4.1.16 Methanol: methanol (HPLC grade or equivalent) is required for rinsing glassware.

5.4.1.17 Acetonitrile: acetonitrile (HPLC grade or equivalent) is required for rinsing glassware.

5.4.1.18 Formaldehyde: Analytical grade or equivalent formaldehyde is required for preparation of standards. If other aldehydes or ketones are used, analytical grade or equivalent is required.

5.4.2 Preparation of Aqueous Acidic DNPH Derivatizing Reagent: Each batch of DNPH reagent should be prepared and purified within five days of sampling, according to the procedure described below.

5.4.2.1 Place an 8-L container under a fume hood on a magnetic stirrer. Add a large stir bar and fill the container half full of HPLC-grade water. Save the empty bottle from HPLC-grade water. Start the stirring bar and adjust the stir rate to be as fast as possible. Using a graduated cylinder, measure 1.4 mL of concentrated hydrochloric acid. Slowly pour the acid into the stirring water. Fumes may be generated and the water may become warm. Weigh the DNPH crystals on a one-place balance (see Table 1 for approximate amounts) and add to the stirring acid solution. Fill the 8 L container to the 8 L mark with HPLC water and stir overnight. If all of the DNPH crystals have dissolved overnight, add additional DNPH and stir for two more hours. Continue the process of adding DNPH with additional stirring until a saturated solution has been formed. Filter the DNPH solution using vacuum filtration. Gravity filtration may be used, but a

much longer time is required. Store the filtered solution in an amber bottle at room temperature.

TABLE 1. APPROXIMATE AMOUNT OF CRYSTALLINE DNPH USED TO PREPARE A SATURATED SOLUTION

Amount of Moisture in DNPH	Weight Required per 8 L of Solution
10 weight percent	31 g
15 weight percent	33 g
30 weight percent	40 g

Within five days of proposed use, place about 1.6 L of the DNPH reagent in a 2 L separatory funnel. Add approximately 200 mL of methylene chloride and stopper the funnel. Wrap the stopper of the funnel with paper towels to absorb any leakage. Invert and vent the funnel. Then shake vigorously for 3 minutes. Initially, the funnel should be vented frequently (every 10 - 15 sec). After the layers have separated, discard the lower (organic) layer.

Extract the DNPH a second time with methylene chloride and finally with cyclohexane. When the cyclohexane layer has separated from the DNPH reagent, the cyclohexane layer will be the top layer in the separatory funnel. Drain the lower layer (the cleaned extracted DNPH reagent solution) into an amber bottle that has been rinsed with acetonitrile and allowed to dry.

5.4.3 Quality Control: Take two aliquots of the extracted DNPH reagent. The size of the aliquots is dependent upon the exact sampling procedure used, but 100 mL is reasonably representative. To ensure that the background in the reagent is acceptable for field use, analyze one aliquot of the reagent according to the procedure of EPA Draft Method 8315. Save the other aliquot of aqueous acidic DNPH for use as a method blank when the analysis is performed.

5.4.4 Shipment to the Field: Tightly cap the bottle containing extracted DNPH reagent using a Teflon®-lined cap. Seal the bottle with Teflon® tape. After the bottle is labeled, the bottle may be placed in a friction-top can (paint can or equivalent) containing a 1 -2 inch layer of granulated charcoal and stored at ambient temperature until use.

If the DNPH reagent has passed the Quality Control criteria, the reagent may be packaged to meet necessary shipping requirements and sent to the sampling area. If the Quality Control criteria are not met, the reagent solution may be re-extracted or the solution may be re-prepared and the extraction sequence repeated.

If the DNPH reagent is not used in the field within five days of extraction, an aliquot may be taken and analyzed as described Draft Method 8315. If the reagent meets the Quality Control requirements, the reagent may be used. If the reagent does not meet Quality Control requirements, the reagent must be discarded and new reagent must be prepared and tested.

5.4.5 Calculation of Acceptable Levels of Impurities in DNPH Reagent: The acceptable impurity level (AIL, µg/mL) is calculated from the expected analyte level in the sampled gas (EAL, ppbv), the volume of air that will be sampled at standard conditions (SVOL, L), the formula weight of the analyte (FW, g/mol), and the volume of DNPH reagent that will be used in the impingers (RVOL, mL):

$$AIL = 0.1 \times [EAL \times SVOL \times FW/22.4 \times (FW + 180)/FW]/(RVOL \times 1000).$$

where 0.1 is the acceptable contaminant level, 22.4 is a factor relating ppbv to g/L, 180 is a factor relating the underivatized analyte to the derivatized analyte, and 1000 is a unit conversion factor.

5.4.6 Disposal of Excess DNPH Reagent: Excess DNPH reagent may be returned to the laboratory and recycled or treated as aqueous waste for disposal purposes. 2,4-Dinitrophenylhydrazine is a flammable solid when dry so water should not be evaporated from the solution of the reagent.

5.5 Field Spike Standard Preparation: To prepare a formaldehyde field spiking standard at 4.01 mg/mL, use a 500µL syringe to transfer 0.5 mL of 37% by weight of formaldehyde (401 mg/mL) to a 50 mL volumetric flask containing approximately 40 mL of methanol. Dilute to 50 mL with methanol.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 Because of the complexity of this method, field personnel should be trained in and experienced with the test procedures in order to obtain reliable results.

6.2 Laboratory Preparation:

6.2.1 All the components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified.

6.2.2 Weigh several 200- to 300-g portions of silica gel in airtight containers to the nearest 0.5 g. Record on each container the total weight of the silica gel plus containers. As an alternative to preweighing the silica gel, it may instead be weighed directly in the impinger or sampling holder just prior to train assembly.

6.3 Preliminary Field Determinations:

6.3.1 Select the sampling site and the minimum number of sampling points according to EPA Method 1 or other relevant criteria. Determine the stack pressure, temperature, and range of velocity heads using EPA Method 2. A leak-check of the pitot lines according to EPA Method 2, Section 3.1, must be performed. Determine the stack gas moisture content using EPA Approximation Method 4 or its alternatives to establish estimates of isokinetic sampling-rate settings. Determine the stack gas dry molecular weight, as described in EPA Method 2, Section 3.6. If integrated EPA Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the sample run.

6.3.2 Select a nozzle size based on the range of velocity heads so that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates below 28 L/min (1.0 cfm). During the run, do not change the nozzle.

Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of EPA Method 2).

6.3.3 Select a suitable probe liner and probe length so that all traverse points can be sampled. For large stacks, to reduce the length of the probe, consider sampling from opposite sides of the stack.

6.3.4 A minimum of 45 ft^3 of sample volume is required for the determination of the Destruction and Removal Efficiency (DRE) of formaldehyde from incineration systems (45ft^3 is equivalent to one hour of sampling at 0.75 dscf). Additional sample volume shall be collected as ecessitated by the capacity of the DNPH reagent and analytical detection limit constraints. To determine the minimum sample volume required, refer to sample calculations in Section 10.

6.3.5 Determine the total length of sampling time needed to obtain the identified minimum volume by comparing the anticipated average sampling rate with the volume requirement. Allocate the same time to all traverse points defined by EPA Method 1. To avoid timekeeping errors, the length of time sampled at each traverse point should be an integer or an integer plus 0.5 min.

6.3.6 In some circumstances (e.g., batch cycles) it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas-volume samples. In these cases, careful documentation must be maintained in order to allow accurate calculation of concentrations.

6.4 Preparation of Collection Train:

6.4.1 During preparation and assembly of the sampling train, keep all openings where contamination can occur covered with Teflon® film or aluminum foil until just prior to assembly or until sampling is about to begin.

6.4.2 Place 100 mL of cleaned DNPH solution in each of the first two impingers, and leave the third impinger empty. If additional capacity is required for high expected concentrations of formaldehyde in the stack gas, 200 mL of DNPH per impinger may be used or additional impingers may be used for sampling. Transfer approximately 200 to 300 g of pre-weighed silica gel from its container to the fourth impinger. Care should be taken to ensure that the silica gel is not entrained and carried out from the impinger during sampling. Place the silica gel container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

6.4.3 With a glass or quartz liner, install the selected nozzle using a Viton-A O-ring when stack temperatures are <260°C (500°F) and a woven glass-fiber gasket when temperatures are higher. See APTD-0576 (Rom, 1972) for details. Other connecting systems utilizing either 316 stainless steel or Teflon® ferrules may be used. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

6.4.4 Assemble the train as shown in Figure 1. During assembly, do not use any silicone grease on ground-glass joints upstream of the impingers. Use Teflon® tape, if required. A very light coating of silicone grease may be used on ground-glass joints downstream of the impingers, but the silicone grease should be limited to the outer portion (see APTD-0576) of the ground-glass joints to

minimize silicone grease contamination. If necessary, Teflon® tape may be used to seal leaks. Connect all temperature sensors to an appropriate potentiometer/display unit. Check all temperature sensors at ambient temperature.

6.4.5 Place crushed ice all around the impingers.

6.4.6 Turn on and set the probe heating system at the desired operating temperature. Allow time for the temperature to stabilize.

6.5 Leak-Check Procedures:

6.5.1 Pre-test Leak Check:

6.5.1.1 After the sampling train has been assembled, turn on and set the probe heating system at the desired operating temperature. Allow time for the temperature to stabilize. If a Viton-A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 381-mm Hg (15 in Hg) vacuum.

NOTE: A lower vacuum may be used, provided that the lower vacuum is not exceeded during the test.

6.5.1.2 If an asbestos string is used, do not connect the probe to the train during the leak check. Instead, leak-check the train by first attaching a carbon-filled leak check impinger to the inlet and then plugging the inlet and pulling a 381-mm Hg (15 in Hg) vacuum. (A lower vacuum may be used if this lower vacuum is not exceeded during the test.) Then connect the probe to the train and leak-check at about 25 mm Hg (1 in Hg) vacuum. Alternatively, leak-check the probe with the rest of the sampling train in one step at 381 mm Hg (15 in Hg) vacuum. Leakage rates in excess of 4% of the average sampling rate or >0.00057 m^3/min (0.02 cfm), whichever is less, are acceptable.

6.5.1.3 The following leak check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with the fine-adjust valve fully open and coarse-adjust valve completely closed. Partially open the coarse-adjust valve and slowly close the fine-adjust valve until the desired vacuum is reached. Do not reverse direction of the fine-adjust valve, as liquid will back up into the train. If the desired vacuum is exceeded, either perform the leak check at this higher vacuum or end the leak check, as shown below, and start over.

6.5.1.4 When the leak check is completed, first slowly remove the plug from the inlet to the probe. When the vacuum drops to 127 mm (5 in) Hg or less, immediately close the coarse-adjust valve. Switch off the pumping system and reopen the fine-adjust valve. Do not reopen the fine-adjust valve until the coarse-adjust valve has been closed to prevent the liquid in the impingers from being forced backward into the sampling line and silica gel from being entrained backward into the third impinger.

6.5.2 Leak Checks During Sampling Runs:

6.5.2.1 If, during the sampling run, a component change (i.e., impinger) becomes

necessary, a leak check shall be conducted immediately after the interruption of sampling and before the change is made. The leak check shall be done according to the procedure described in Section 6.5.1, except that it shall be done at a vacuum greater than or equal to the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable. If a higher leakage rate is obtained, the tester must void the sampling run.

NOTE: Any correction of the sample volume by calculation reduces the integrity of the pollutant concentration data generated and must be avoided.

6.5.2.2 Immediately after a component change and before sampling is re-initiated, a leak check similar to a pre-test leak check must also be conducted.

6.5.3 Post-test Leak Check:

6.5.3.1 A leak check is mandatory at the conclusion of each sampling run. The leak check shall be done with the same procedures as the pre-test leak check, except that the post-test leak check shall be conducted at a vacuum greater than or equal to the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable. If, however, a higher leakage rate is obtained, the tester shall record the leakage rate and void the sampling run.

6.6 Sampling Train Operation:

6.6.1 During the sampling run, maintain an isokinetic sampling rate to within 10% of true isokinetic, below 28 L/min (1.0 cfm). Maintain a temperature around the probe of 120° ± 14°C (248° ± 25°F).

6.6.2 For each run, record the data on a data sheet such as the one shown in Figure 2. Be sure to record the initial dry-gas meter reading. Record the dry-gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak check, and when sampling is halted. Take other readings required by Figure 2 at least once at each sample point during each time increment and additional readings when significant adjustments (20% variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

6.6.3 Clean the stack access ports prior to the test run to eliminate the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are at the specified temperature, and verify that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point, with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations, are available. These nomographs are designed for use when the Type S pitot tube coefficient is 0.84 ± 0.02 and the stack gas equivalent density (dry molecular weight) is equal to 29 ± 4. APTD-0576 details the procedure for using the nomographs. If the stack gas molecular weight and

the pitot tube coefficient are outside the above ranges, do not use the nomographs unless appropriate steps are taken to compensate for the deviations.

6.6.4 When the stack is under significant negative pressure (equivalent to the height of the impinger stem), take care to close the coarse-adjust valve before inserting the probe into the stack in order to prevent liquid from backing up through the train. If necessary, the pump may be turned on with the coarse-adjust valve closed.

6.6.5 When the probe is in position, block off the openings around the probe and stack access port to prevent unrepresentative dilution of the gas stream.

6.6.6 Traverse the stack cross section, as required by EPA Method 1, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the access port, in order to minimize the chance of extracting deposited material.

6.6.7 During the test run, make periodic adjustments to keep the temperature around the probe at the proper levels. Add more ice and, if necessary, salt, to maintain a temperature of <20°C (68°F) at the silica gel outlet. Also, periodically check the level and zero of the manometer.

6.6.8 A single train shall be used for the entire sampling run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates a change of trains. An additional train or additional trains may also be used for sampling when the capacity of a single train is exceeded.

6.6.9 When two or more trains are used, separate analyses of components from each train shall be performed. If multiple trains have been used because the capacity of a single train would be exceeded, first impingers from each train may be combined, and second impingers from each train may be combined.

6.6.10 At the end of the sampling run, turn off the coarse-adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak check. Also, leak check the pitot lines as described in EPA Method 2. The lines must pass this leak check in order to validate the velocity-head data.

6.6.11 Calculate percent isokineticity (see Method 2) to determine whether the run was valid or another test should be made.

7.0 SAMPLE RECOVERY

7.1 Preparation:

7.1.1 Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. When the probe can be handled safely, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over the tip to prevent losing or gaining particulate matter. Do not cap the probe tip tightly while the sampling train is cooling because a vacuum will be created, drawing liquid from the impingers back through the sampling train.

7.1.2 Before moving the sampling train to the cleanup site, remove the probe from the sampling train and cap the open outlet, being careful not to lose any condensate that might be present. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used, let any condensed water or liquid drain into the impingers. Cap off any open impinger inlets and outlets. Ground glass stoppers, Teflon® caps, or caps of other inert materials may be used to seal all openings.

7.1.3 Transfer the probe and impinger assembly to an area that is clean and protected from wind so that the chances of contaminating or losing the sample are minimized.

7.1.4 Inspect the train before and during disassembly, and note any abnormal conditions.

7.1.5 Save a portion of all washing solutions (methylene chloride, water) used for cleanup as a blank. Transfer 200 mL of each solution directly from the wash bottle being used and place each in a separate, pre-labeled sample container.

7.2 Sample Containers:

7.2.1 Container 1: Probe and Impinger Catches. Using a graduated cylinder, measure to the nearest mL, and record the volume of the solution in the first three impingers. Alternatively, the solution may be weighed to the nearest 0.5 g. Include any condensate in the probe in this determination. Transfer the impinger solution from the graduated cylinder into the amber flint glass bottle. Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, clean all surfaces to which the sample is exposed (including the probe nozzle, probe fitting, probe liner, first impinger, and impinger connector) with methylene chloride. Use less than 500 mL for the entire wash (250 mL would be better, if possible). Add the washings to the sample container.

7.2.1.1 Carefully remove the probe nozzle and rinse the inside surface with methylene chloride from a wash bottle. Brush with a Teflon® bristle brush, and rinse until the rinse shows no visible particles or yellow color, after which make a final rinse of the inside surface. Brush and rinse the inside parts of the Swagelok® fitting with methylene chloride in a similar way.

7.2.1.2 Rinse the probe liner with methylene chloride. While squirting the methylene chloride into the upper end of the probe, tilt and rotate the probe so that all inside surfaces will be wetted with methylene chloride. Let the methylene chloride drain from the lower end into the sample container. The tester may use a funnel (glass or polyethylene) to aid in transferring the liquid washes to the container. Follow the rinse with a Teflon® brush. Hold the probe in an inclined position, and squirt methylene chloride into the upper end as the probe brush is being pushed with a twisting action through the probe. Hold the sample container underneath the lower end of the probe, and catch any methylene chloride, water, and particulate matter that is brushed from the probe. Run the brush through the probe three times or more. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since there may be small crevices in which particulate matter can be entrapped. Rinse the brush with methylene chloride or water, and quantitatively collect these washings in the sample container. After the brushings, make a final rinse

of the probe as described above.

NOTE: Two people should clean the probe in order to minimize sample losses. Between sampling runs, brushes must be kept clean and free from contamination.

7.2.1.3 Rinse the inside surface of each of the first three impingers (and connecting tubing) three separate times. Use a small portion of methylene chloride for each rinse, and brush each surface to which sample is exposed with a Teflon® bristle brush to ensure recovery of fine particulate matter. Water will be required for the recovery of the impingers in addition to the specified quantity of methylene chloride. There will be at least two phases in the impingers. This two-phase mixture does not pour well, and a significant amount of the impinger catch will be left on the walls. The use of water as a rinse makes the recovery quantitative. Make a final rinse of each surface and of the brush, using both methylene chloride and water.

7.2.1.4 After all methylene chloride and water washings and particulate matter have been collected in the sample container, tighten the lid so that solvent, water, and DNPH reagent will not leak out when the container is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Seal the container with Teflon® tape. Label the container clearly to identify its contents.

7.2.1.5 If the first two impingers are to be analyzed separately to check for breakthrough, separate the contents and rinses of the two impingers into individual containers. Care must be taken to avoid physical carryover from the first impinger to the second. The formaldehyde hydrazone is a solid which floats and froths on top of the impinger solution. Any physical carryover of collected moisture into the second impinger will invalidate a breakthrough assessment.

7.2.2 Container 2: Sample Blank. Prepare a blank by using an amber flint glass container and adding a volume of DNPH reagent and methylene chloride equal to the total volume in Container 1. Process the blank in the same manner as Container 1.

7.2.3 Container 3: Silica Gel. Note the color of the indicating silica gel to determine whether it has been completely spent and make a notation of its condition. The impinger containing the silica gel may be used as a sample transport container with both ends sealed with tightly fitting caps or plugs. Ground-glass stoppers or Teflon® caps may be used. The silica gel impinger should then be labeled, covered with aluminum foil, and packaged on ice for transport to the laboratory. If the silica gel is removed from the impinger, the tester may use a funnel to pour the silica gel and a rubber policeman to remove the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use water or other liquids to transfer the silica gel. If a balance is available in the field, the spent silica gel (or silica gel plus impinger) may be weighed to the nearest 0.5 g.

7.2.4 Sample containers should be placed in a cooler, cooled by although not in contact with ice. Sample containers must be placed vertically and, since they are glass, protected from breakage curing shipment. Samples should be cooled during shipment so they will be received cold at the laboratory.

8.0 CALIBRATION

8.1 Probe Nozzle: Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in). Make measurements at three separate places across the diameter and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in). When the nozzles become nicked or corroded, they shall be replaced and calibrated before use. Each nozzle must be permanently and uniquely identified.

8.2 Pitot tube: The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of EPA Method 2, or assigned a nominal coefficient of 0.84 if it is not visibly nicked or corroded and if it meets design and intercomponent spacing specifications.

8.3 Metering system:

8.3.1 Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry-gas meter dial readings to correspond to the wet-test meter readings, calibration factors may be used to correct the gas meter dial readings mathematically to the proper values. Before calibrating the metering system, it is suggested that a leak check be conducted. For metering systems having diaphragm pumps, the normal leak check procedure will not detect leakages within the pump. For these cases, the following leak check procedure will apply: make a ten-minute calibration run at 0.00057 m^3/min (0.02 cfm). At the end of the run, take the difference of the measured wet-test and dry-gas meter volumes and divide the difference by 10 to get the leak rate. The leak rate should not exceed 0.00057 m^3/min (0.02 cfm).

8.3.2 After each field use, check the calibration of the metering system by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). Set the vacuum at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet-test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5%, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

8.3.3 Leak check of metering system: The portion of the sampling train from the pump to the orifice meter (see Figure 1) should be leak-checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. Use the following procedure: Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 - 18 cm (5 - 7 in) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for 1 min. A loss of pressure on the manometer indicates a leak in the meter box. Leaks must be corrected.

NOTE: If the dry-gas-meter coefficient values obtained before and after a test series differ by >5%, either the test series must be voided or calculations for test series must be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

8.4 Probe heater: The probe heating system must be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

8.5 Temperature gauges: Each thermocouple must be permanently and uniquely marked on the casting. All mercury-in-glass reference thermometers must conform to ASTM E-1 63C or 63F specifications. Thermocouples should be calibrated in the laboratory with and without the use of extension leads. If extension leads are used in the field, the thermocouple readings at ambient air temperatures, with and without the extension lead, must be noted and recorded. Correction is necessary if the use of an extension lead produces a change >1.5%.

8.5.1 Impinger and dry-gas meter thermocouples: For the thermocouples used to measure the temperature of the gas leaving the impinger train, three-point calibration at ice water, room air, and boiling water temperatures is necessary. Accept the thermocouples only if the readings at all three temperatures agree to ±2°C (3.6°F) with those of the absolute value of the reference thermometer.

8.5.2 Probe and stack thermocouple: For the thermocouples used to indicate the probe and stack temperatures, a three-point calibration at ice water, boiling water, and hot oil bath temperatures must be performed. Use of a point at room air temperature is recommended. The thermometer and thermocouple must agree to within 1.5% at each of the calibration points. A calibration curve (equation) may be constructed (calculated) and the data extrapolated to cover the entire temperature range suggested by the manufacturer.

8.6 Barometer: Adjust the barometer initially and before each test series to agree to within ±2.5 mm Hg (0.1 in Hg) of the mercury barometer or the corrected barometric pressure value reported by a nearby National Weather Service Station (same altitude above sea level).

8.7 Triple-beam balance: Calibrate the triple-beam balance before each test series, using Class S standard weights. The weights must be within ±0.5% of the standards, or the balance must be adjusted to meet these limits.

9.0 CALCULATIONS

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

9.1 Calculation of Total Formaldehyde:

To determine the total formaldehyde in mg, use the following equation:

Total mg formaldehyde = $C_d \times V \times DF \times$

([g/mole aldehyde]/[g/mole DNPH derivative]) x

10^{-3} mg/μg

where:

C_d = measured concentration of DNPH-formaldehyde derivative, μg/mL

V = organic extract volume, mL

DF = dilution factor

9.2 Formaldehyde concentration in stack gas:

Determine the formaldehyde concentration in the stack gas using the following equation:

C_f = K [total formaldehyde, mg] / $V_{m(std)}$

where:

K = 35.31 ft^3/m^3 if $V_{m(std)}$ is expressed in English units

= 1.00 m^3/m^3 if $V_{m(std)}$ is expressed in metric units

$V_{m(std)}$ = volume of gas sample as measured by dry gas meter, corrected to standard conditions, dscm (dscf)

9.3 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop are obtained from the data sheet.

9.4 Dry Gas Volume: Calculate $V_{m(std)}$ and adjust for leakage, if necessary, using the equation in Section 6.3 of EPA Method 5.

9.5 Volume of Water Vapor and Moisture Content: Calculate the volume of water vapor and moisture content from equations 5-2 and 5-3 of EPA Method 5.

10.0 DETERMINATION OF VOLUME TO BE SAMPLED

To determine the minimum sample volume to be collected, use the following sequence of equations.

10.1 From prior analysis of the waste feed, the concentration of formaldehyde (FORM) introduced into the combustion system can be calculated. The degree of destruction and removal efficiency that is required is used to determine the maximum amount of FORM allowed to be present in the effluent. This amount may be expressed as:

Max $FORM_i$ Mass =

[(WF) ($FORM_i$ conc) (100 - %DRE)] / 100

where:

WF = mass flow rate of waste feed per h, g/h (lb/h)

$FORM_i$ = concentration of FORM (wt %) introduced into the combustion process

DRE = percent Destruction and Removal Efficiency required

Max FORM = mass flow rate (g/h [lb/h]) of FORM emitted from the combustion source

10.2 The average discharge concentration of the FORM in the effluent gas is determined by comparing the Max FORM with the volumetric flow rate being exhausted from the source. Volumetric flow rate data are available as a result of preliminary EPA Method 1 - 4 determinations:

Max $FORM_i$ conc = [Max $FORM_i$ Mass] / $DV_{eff(std)}$

where:

$DV_{eff(std)}$ = volumetric flow rate of exhaust gas, dscm (dscf)

$FORM_i$ conc = anticipated concentration of the FORM in the exhaust gas stream, g/dscm (lb/dscf)

10.3 In making this calculation, it is recommended that a safety margin of at least ten be included.

$[LDL_{FORM} \times 10] / [FORM_{i\ conc}] = V_{tbc}$

where:

LDL_{FORM} = detectable amount of FORM in entire sampling train

V_{tbc} = minimum dry standard volume to be collected at dry-gas meter

10.4 The following analytical detection limits and DNPH Reagent Capacity (based on a total volume of 200 mL in two impingers) must also be considered in determining a volume to be sampled.

Table 2. Instrument Detection Limits and Reagent Capacity for Formaldehyde Analysis[1]

Analyte	Detection Limit, ppbv[2]	Reagent Capacity, ppmv
formaldehyde	1.8	66
acetaldehyde	1.7	70
acrolein	1.5	75
acetone/propionaldehyde	1.5	75
butyraldehyde	1.5	79
methyl ethyl ketone	1.5	79
valeraldehyde	1.5	84
isovaleraldehyde	1.4	84
hexaldehyde	1.3	88
benzaldehyde	1.4	84
o-/m-/p-tolualdehyde	1.3	89
dimethylbenzaldehyde	1.2	93

[1] Oxygenated compounds in addition to formaldehyde are included for comparison with formaldehyde; extension of the methodology to other compounds is possible.

[2] Detection limits are determined in solvent. These values therefore represent the optimum capability of the methodology.

11.0 QUALITY CONTROL

11.1 Sampling: See EPA Manual 600/4-77-027b for Method 5 quality control.

11.2 Analysis: The quality assurance program required for this method includes the analysis of field and method blanks, procedure validations, and analysis of field spikes. The assessment of combustion data and positive identification and quantitation of formaldehyde are dependent on the integrity of the samples received and the precision and accuracy of the analytical methodology. Quality Assurance procedures for this method are designed to monitor the performance of the analytical methodology and to provide the required information to take corrective action if problems are observed in laboratory operations or in field sampling activities.

11.2.1 Field Blanks: Field blanks must be submitted with the samples collected at each sampling site. The field blanks include the sample bottles containing aliquots of sample recovery solvents, methylene chloride and water, and unused DNPH reagent. At a minimum, one complete sampling train will be assembled in the field staging area, taken to the sampling area, and leak-checked at the beginning and end of the testing (or for the same total number of times as the actual sampling train). The probe of the blank train must be heated during the sample test. The train will be recovered as if it were an actual test sample. No gaseous sample will be passed through the Blank sampling train.

11.2.2 Method Blanks: A method blank must be prepared for each set of analytical operations, to evaluate contamination and artifacts that can be derived from glassware, reagents, and sample handling in the laboratory.

11.2.3 Field Spike: A field spike is performed by introducing 200 µL of the Field Spike Standard into an impinger containing 200 mL of DNPH solution. Standard impinger recovery procedures are followed and the field spike sample is returned to the laboratory for analysis. The field spike is used as a check on field handling and recovery procedures. An aliquot of the field spike standard is retained in the laboratory for derivatization and comparative analysis.

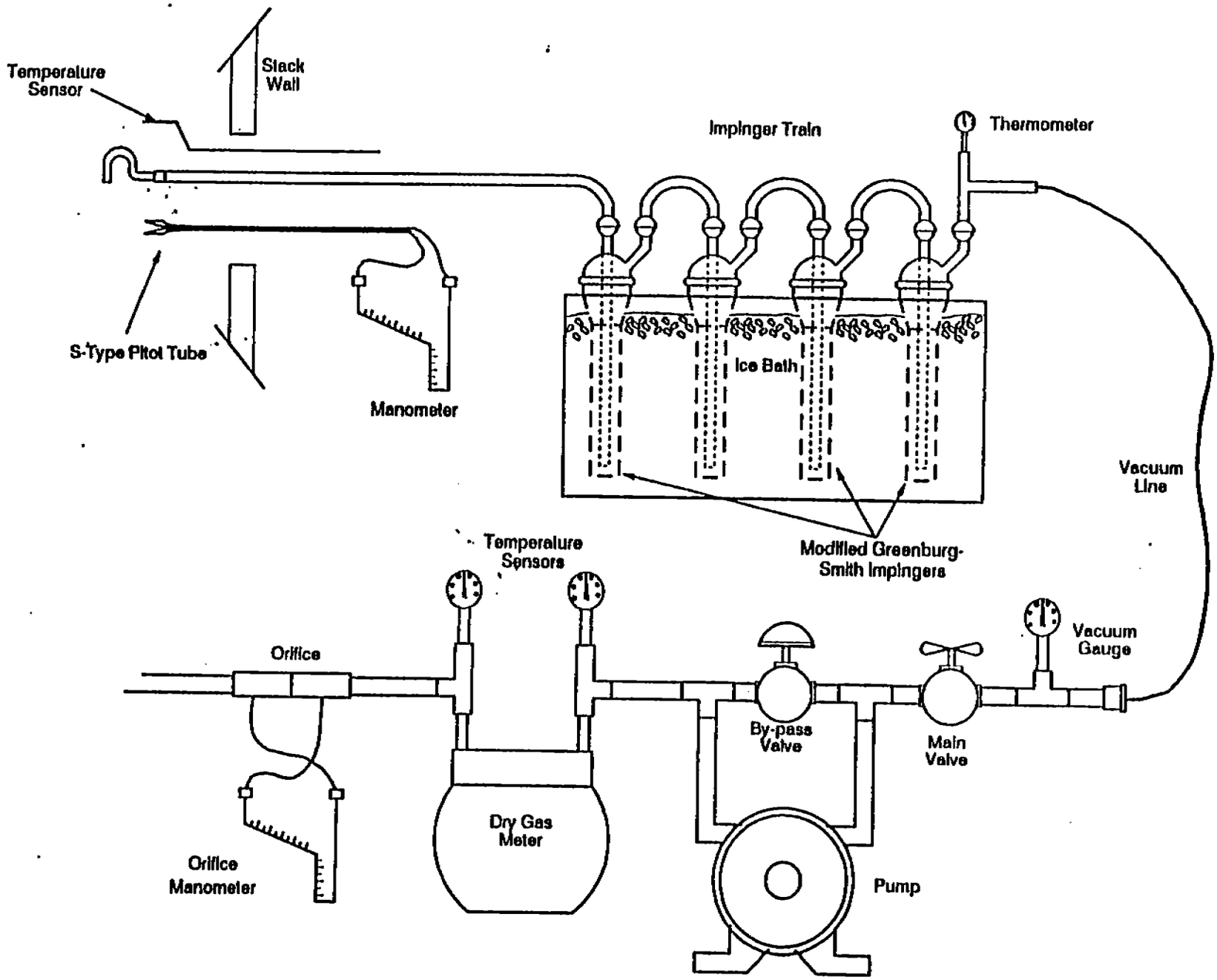
12.0 METHOD PERFORMANCE

12.1 Method performance evaluation: The following expected method performance parameters for precision, accuracy, and detection limits are provided in Table 3.

Table 3. Expected Method Performance for Formaldehyde

Parameter	Precision	[1]Accuracy[2]	Detection Limit[3]
Matrix: Dual trains	±15% RPD	±20%	1.5×10^{-7} lb/ft^3 (1.8 ppbv)

1 Relative percent difference limit for dual trains.
2 Limit for field spike recoveries.
3 The lower reporting limit having less than 1% probability of false positive detection.



Formaldehyde Sampling Train

Plant _____

Location _____

Operator _____

Date _____

Run No. _____

Sample Box No. _____

Meter Box No. _____

Meter H@ _____

C Factor _____

Pilot Tube Coefficient C_p _____

Schematic of Stack Cross Section

Ambient Temperature _____

Barometric Pressure _____

Assumed Moisture % _____

Probe Length, m(ft) _____

Nozzle Identification No. _____

Average Calibrated Nozzle Diameter, cm (in) _____

Probe Heating Setting _____

Leak Rate, m^3/min. (cfm) _____

Probe Liner Material _____

Static Pressure, mm Hg (in. Hg) _____

Filter No. _____

Traverse Point Number	Sampling Time (θ) Min.	Vacuum mm Hg (in. Hg)	Stack Temperature (T_s) °C (°F)	Velocity Head (P_s) mm (in) H_2O	Pressure Differential Across Orifice Meter mm (H_2O) (in H_2O)	Gas Sample Volume m^3 (ft^3)	Gas Sample Temp. at Dry Gas Meter		Filter Holder Temperature °C(°F)	Temperature of Gas Leaving Last Impinger °C(°F)
							Inlet °C(°F)	Outlet °C(°F)		
							Avg.	Avg.		
Total										
Average										

3404.346R

Figure 2. Field Data Sheet

7/90

C O N F I D E N T I A L Version 1.1

Interpoll Laboratories
Method II-8791

Determination of 4,4'-Methylenebis (phenyl isocyanate)(MDI) in Wood Board Press Vent Exhausts

This method is a modification of NIOSH Method 347 in which a known volume of stack gas is drawn out of the stack through a glass-fiber filter impregnated with N-p-nitrobenzyl-N-propylamine to collect MDI. MDI reacts with this reagent to form a stable urea. The urea derivative is analyzed by HPLC. The modifications and the rationale therefor are enumerated below. The modifications used in this work were chosen expressly to accomodate the conditions normally encountered in board press exhaust gas stacks and may not be appropriate for other sources.

The method was modified by Interpoll Laboratories to 1) protect the urea derivative from exposure to high temperature; 2) to provide for isokinetic collection of samples, since some MDI will be associated with particles larger than 3 microns in diameter; 3) to make possible field recovery of samples, since stack testing requires repetitive determinations with large sophisticated sampling trains; 4) to increase the sensitivity of the determination; 5) and to more rigorously protect the collected samples since stack sampling normally requires transport of the samples by truck for extended periods of time.

The NIOSH was modified to meet the requirement of isokinetic collection by using a larger filter so that the same or a lower face velocity than that specified in the NIOSH Method is maintained, since the

superficial face velocity is the controlling parameter in analyte breakthrough.

A non-heated probe liner and out-stack filter holder assembly will be used to sample the vents since the gas is essentially ambient air (100-110 ^{0}F) with very low moisture content. The filter holder will be of the "out-stack" type to minimize the effect of increased temperature on breakthrough. Sampling will be isokinetic to ensure representative collection of particles which may have MDI adsorbed on their surfaces.

Sample recovery will be quantitative using methylene chloride as the recovery solvent. Samples will be recovered into amber jars with Teflon lids and stored on ice or in a refrigerator until analysis. The filter and probe rinse will be recovered into the same container to initiate extraction immediately upon recovery in the field.

Criteria used in developing stack procedure:

1. The method as conceived for OSHA work uses a filter with an effective filtering area diameter of 1 cm. A flow rate of 1 LPM is recommended. At this superficial velocity, the collection efficiency for MDI was found to be >99.3%.

$$\text{If } t_{amb} \leq 18\ ^{0}\text{C then } \phi \leq 10 \text{ HRS}$$

$$18 \leq t_{amb} \leq 29\ ^{0}\text{C then } \phi \leq 5.5 \text{ HRS}$$

$$29 \leq t_{amb} \leq 40\ ^{0}\text{C then } \phi \leq 3 \text{ HRS}$$

where ϕ = total sampling time

2. Since some of the MDI or other diisocyanates (DIs) could and will be associated with particulate material, samples will be collected isokinetically.

3. Since breakthrough is temperature dependent, it is necessary to use an out-stack filter holder. The probe and filter holder should not be heated.

4. Since interferences form on long standing especially in the presence of light, samples are to be recovered into amber bottles and stored at 4 °C.

5. Methylene chloride should be used as the recovery solvent. The filter and the probe wash should be placed in the same container. The filter must be preweighed as well as the sample container. After the sample is recovered, the container is weighed again. The total volume of methylene chloride may then be calculated from the above weights and the density of methylene chloride.

Note: This method of recovery initiates extraction of the urea derivative immediately and probably increases the stability of the samples.

The total volume of CH_2Cl_2 should be about 35-50 ml. The aliquot for HPLC analysis may then be drawn directly from the sample container (after sonication).

Alternatively, the entire mixture may be filtered through a methylene chloride rinsed glass fiber filter, the filter

rinsed and combined with the filtrate and brought to a known volume. This method, however, results in some dilution and also increases the possibility of contamination.

6. A 2.5 inch glass fiber filter with an effective filtration diameter of 5.69 cm will allow sampling at a flow rate 32.4 times greater than the NIOSH procedure and still maintain the same superficial velocity. Thus a flow rate of up to 1.14 CFM can be used and still give a collection efficiency of ≥99.3%.

7 For an M5 sampling train, this means that an orifice pressure drop as high as 4.3 IN.WC. can be used without concern about reduction in the collection efficiency of MDI. At a temperature up to 104 ^{0}F (40 ^{0}C), sampling can be performed for a period up to three hours without concern of breakthrough.

8. Based on the above consideration, a normal MDI sampling will consist of three one-hour samplings at a flow rate not to exceed 1.14 CFM.

Note: (ppb v/v) = 0.0978 X (ug/Nm^{3})

4,4'-METHYLENEBIS(PHENYL ISOCYANATE) (MDI)

Methods Research Branch

Analytical Method
II-8791

Analyte:	A urea derivative of MDI	Method No:	P&CAM 347
			0.43 to 78 ppb
Matrix:	Air	Range:	4.4 to 800 µg/m^3
		Precision:	0.078
Procedure:	Collection and derivatization on impregnated filter, HPLC	PPB = 0.0978(µg/m^3)	
Date Issued:	8/31/81		
Date Revised:		Classification:	E (Proposed)

1. Synopsis

1.1 A known volume of air is drawn through a glass-fiber filter impregnated with a reagent, N-p-nitrobenzyl-N-propylamine, to collect MDI. MDI reacts with the reagent to form N,N"-(methylenedi-4,1-phenylene)bis[N'-[(4-nitrophenyl)methyl]-N'-propylurea] (MDIU) as a derivative. (Reference 11.1)

1.2 The impregnated filter is treated with dichloromethane to recover the urea derivative.

1.3 The dichloromethane solution is analyzed by high pressure liquid chromatography (HPLC) with an ultraviolet detector set at 254 nm to determine the concentration of MDIU.

1.4 The concentration of MDI in air is calculated from the quantity of MDIU on the filter and the volume of air sampled.

2. Working Range, Sensitivity and Detection Limit

2.1 MDI in air can be quantified at concentrations ranging from 4.4 to 800 µg/m^3 for 180-L air samples and at ceiling concentrations ranging from 80 to 1000 µg/m^3 for 10-L air samples. The range useful for quantitation of the urea derivative (MDIU) in solution is equivalent to 0.8 to more than 150 µg MDI per mL of solution when 50-µL aliquots are injected into the HPLC.

2.2 The impregnated filter can collect more than 298 µg of MDI (greater than 99.3% of the MDI) at a concentration of 500 µg/m^3 during a 10-hour sampling period at 1 L/min when the air temperature is 18 °C.

2.3 It has been estimated that MDI at a concentration of 0.6 µg/m^3 could be detected in a 180-L air sample. The detection limit of MDIU in solution is equivalent to approximately 0.1 µg of MDI per mL if a 50-µL aliquot is injected into the HPLC.

3. Interferences

3.1 When other compounds are known or suspected to be present in the air, such information, including their suspected identities, should be transmitted with the sample.

3.2 N-p-Nitrobenzyl-N-propylamine on glass fiber filters is unstable in the presence of light and is unstable to a smaller degree during storage in the dark at room temperature. Interference during HPLC analysis may result if impregnated filters in filter holders are exposed to light for an excessive period or are stored in the dark at room temperature for an excessive period. Exposure of two impregnated filters inside filter holders to fluorescent lighting for 25 hours gave rise to interferences during HPLC analysis which corresponded to roughly 2 µg of MDI per filter. Storage of three impregnated filters for 41 days in the dark (33 days at room temperature and 8 days at -21 °C) gave rise to interferences which corresponded to an average of roughly 0.4 µg MDI per filter. Storage of six impregnated filters for 42 days in the dark at -21 °C gave rise to no interferences during HPLC analysis.

3.3 The following compounds would not interfere with the analysis of MDI in this method: toluene-2,4-diisocyanate (2,4-TDI), toluene-2,6-diisocyanate (2,6-TDI), and hexamethylene diisocyanate (HDI).

3.4 Any compound which has the same retention time as that of MDIU and is detected under the HPLC conditions indicated in this method is an interference.

4. Precision and Accuracy

4.1 The pooled relative standard deviation for the sampling and analytical method in the approximate range from 170 to 800 µg/m^3 was 0.060 when critical orifices were used to maintain sampling rates near 1 L/min. The relative standard deviation for the sampling and analytical method in the same approximate range of concentrations would be 0.078 if a pump error of 0.05 is assumed for personal-sampling pumps.

4.2 Average recoveries of MDIU from impregnated filters ranged from 0.96 to 0.99 over the range 0.8 to 67 µg of MDI per filter. The pooled relative standard deviation for the average recoveries was 0.030.

4.3 MDIU on impregnated filters is stable during storage at room temperature in the dark for at least 15 days.

5. Advantages and Disadvantages

5.1 Advantages of tne method are: (a) the sampler is small, portable and convenient for personal sampling; (b) the sampler can collect MDI in both vapor and aerosol forms; and (c) the analytical method is specific for MDI.

5.2 Disadvantages of the method are: (a) a time limitation of approximately 21 days for storage of impregnated filters at room temperature in the dark because of the instability of the reagent, N-p-nitrobenzyl-N-propylamine; (b) a need to protect impregnated filters from light; and (c) a need to wash the HPLC column when N-p-nitrobenzyl-N-propylamine causes a large detector response (see Sections 3.2 and 8.3.6).

6. Apparatus

6.1 Sampling Equipment

6.1.1 Samplers. Each sampler contains a glass-fiber filter, 13 mm in diameter, which has been impregnated with N-p-nitrobenzyl-N-propylamine. The impregnated filter is housed in a 13-mm filter holder (Catalogue No. SX00 013 00, Millipore Corporation, Bedford, MA, or equivalent). The internal diameter of the inlet of the filter holder is 4 mm. The filter holders may be wrapped with black tape in order to help protect the impregnated filters from light. Seal the inlets and outlets of the filter holders with plastic tape for storage. The samplers may be stored at -21 °C in the dark for at least 6 weeks. Limit the storage time of the samplers at room temperature in the dark to approximately 21 days (see Section 3.2).

6.1.2 Impregnated Filters. Place 300 mg (0.0013 mole) of N-p-nitrobenzyl-N-propylamine hydrochloride into a 125-mL separatory funnel. Add 25 mL of deionized water and shake the mixture until all of the hydrochloride has dissolved. Cause free amine to separate from the solution by adding 15 mL of 1 N NaOH solution and shaking the mixture. Extract the N-p-nitrobenzyl-N-propylamine with 50 mL of hexane.

Place six glass-fiber filters which are free of binders and 6 mL of the hexane solution into a 50-mL beaker. In dim light, allow hexane to evaporate from the beaker with the aid of a stream of nitrogen. Occasionally swirl the mixture. The filters are sufficiently dry when they no longer cling to the beaker. It has been estimated that there is 4.5 mg of N-p-nitrobenzyl-N-propylamine on each impregnated filter.

6.1.3 Calibrated Personal-Sampling Pump. The personal sampling pump should be calibrated for the recommended flow rate of 1 L/min with a representative sampler in line.

6.1.4 Stopwatch.

6.1.5 Thermometer.

6.2 High pressure liquid chromatograph with an ultraviolet detector set at 254 nm.

6.3 HPLC column, 25-cm x 4.6-mm internal diameter, packed with Partisil 10 (a porous silica packing; diameter, 10 µm; surface area, 400 m^2/g; Whatman, Inc., Clifton, NJ).

6.4 Frits, 0.5-micrometer pore diameter, for use in front of the packing in the HPLC column.

6.5 Partisil 10 or other silica packing for use in replacing packing which may be lost from the HPLC column (see Section 8.3.7).

6.6 Spectrophotometer set at 555 nm.

6.7 Quartz cells for spectrophotometer, 5-cm path length.

6.8 Glass vials, 1-mL, with caps lined with polytetrafluoroethylene.

6.9 Volumetric flasks, 5-mL and other convenient sizes.

6.10 Graduated cylinders, 10-, 25-, 100-, and 1000-mL.

6.11 Tweezers.

7. Reagents

Except where otherwise indicated, each reagent should be of ACS reagent grade or better.

7.1 4,4'-Methylenebis(phenyl isocyanate) (MDI), practical grade or better.

7.2 N-p-Nitrobenzyl-N-propylamine hydrochloride.

7.3 Dichloromethane, distilled in glass.

7.4 Solution of MDI in dichloromethane. Mix 2.0 g of MDI with 200 mL of dichloromethane. Filter the solution with a glass frit of fine porosity. Determine the concentration of MDI according to Section 9.1.

7.5 Water, deionized.

7.6 MDIU. Mix 1.500 g (0.00650 mole) of N-p-nitrobenzyl-N-propylamine hydrochloride with 25 mL of deionized water in a 125-mL separatory funnel. Cause free amine to separate from the solution by adding 15 mL of 1 N NaOH and shaking the mixture. Extract the N-p-nitrobenzyl-N-propylamine with 50 mL of hexane. Determine the volume of the solution prepared according to Section 7.4 which would contain 577 mg (0.00231 mole) of MDI, and add 577 mg of MDI in solution to 40 mL of the hexane solution. Reduce the volume of the mixture to approximately 25 mL with a rotary evaporator. Collect the solid by filtration. Wash the solid with several portions of hexane. Recrystallize the product from benzene by dissolving the product in hot benzene, filtering the solution quickly, and allowing the filtrate to cool. Collect the crystals in a Buchner funnel, and dry the product in vacuo at 80 °C. Melting point = 161-162 °C. (Reference 11.2)

NOTE: Benzene is a carcinogen and should be handled with care in a ventilated fume hood.

7.7 4,4'-Methylenedianiline, high purity.

7.8 Acetic acid, glacial.

7.9 Standard solution of 4,4'-methylenedianiline. Dissolve 238 mg of 4,4'-methylenedianiline in 700 mL of glacial acetic acid. Dilute the solution to 1 liter with deionized water.

7.10 Hydrochloric acid, 12 M.

7.11 Hydrochloric acid-acetic acid solution. Add 35 mL of 12 M hydrochloric acid and 22 mL of glacial acetic acid to 600 mL of deionized water. Dilute the solution to 1 liter with deionized water.

7.12 Sodium nitrite-sodium bromide solution. Dissolve 3.0 g of sodium nitrite and 5.0 g of sodium bromide in deionized water and dilute the solution to 100 mL. Discard the solution after 1 week.

7.13 Sulfamic acid solution. Dissolve 10.0 g of sulfamic acid in 100 mL of deionized water.

7.14 Sodium carbonate solution. Dissolve 16.0 g of anhydrous sodium carbonate in deionized water and dilute the solution to 100 mL. Discard the solution after 1 week.

7.15 N-(1-Naphthyl)ethylenediamine dihydrochloride solution. Dissolve 1.0 g of N-(1-naphthyl)ethylenediamine dihydrochloride in 50 mL of deionized water, add 2 mL of 12 M hydrochloric acid, and dilute the solution to 100 mL. Discard the solution after 1 week.

7.16 N,N-Dimethylformamide-hydrochloric acid solution. Mix 90 mL of N,N-dimethylformamide with 10 mL of 6 M hydrochloric acid. Discard the solution after 1 week.

7.17 2-Propanol, distilled in glass.

8. Procedure

8.1 Cleaning of Equipment. All glassware to be used for laboratory analysis should be washed with detergent and rinsed thoroughly with tap water and deionized water.

8.2 Collection and Shipping of Samples

8.2.1 In each set of samplers consisting of six or fewer samplers, label two samplers as "blank" samplers. The "blank" samplers and the corresponding samplers used in actual air sampling should contain impregnated filters from the same batch (Section 6.1.2).

8.2.2 Handle the "blank" samplers and other samplers under the same conditions of temperature, light exposure and storage time. Do not unseal and do not draw air through the "blank" samplers.

8.2.3 Immediately before sampling, unseal the inlet and outlet of the sampler.

8.2.4 Connect the sampler to a calibrated personal-sampling pump with flexible tubing.

8.2.5 Sample at a flow rate of 1 L/min for 10 hours or less if the maximum air temperature will be 18 °C or less. (Experiments were performed at air temperatures near 18 °C, and 12 hours of sampling was borderline for breakthrough to occur. Breakthrough volumes would be expected to decrease with increases in concentration

of MDI vapor, and the maximum vapor concentration of MDI would increase with temperature. Maximum sampling periods should be decreased with increases in air temperature.) Sample at 1 L/min for 5.5 hours or less if the maximum air temperature will be between 18 °C and 29 °C. Sample at 1 L/min for 3 hours or less if the maximum air temperature will be between 29 °C and 40 °C.

8.2.6 Record pertinent data in regard to sampling including sampling time, air temperatures, and atmospheric pressures. If pressure data are not available, record the elevation.

8.2.7 After sampling, seal the inlets and outlets of the samplers with plastic tape. Store these samplers and the "blank" samplers in the dark and, if practical, at −21 °C until analyses are performed. If the samplers are stored at room temperature, limit the total storage time at room temperature to approximately 21 days. Consider storage time before sampling as part of the total storage time. The samplers may be stored in the dark at −21 °C for at least 6 weeks.

8.2.8 If a bulk sample of material suspected to contain MDI is to be submitted to the laboratory, place the bulk sample into a glass container, and seal it with a cap lined with polytetrafluoroethylene. Secure the cap in place with tape.

8.2.9 Do not transport the bulk sample and the air samples in the same container.

8.3 Analysis of Samples

8.3.1 Preparation of Samples. Remove the impregnated filter from the filter holder with tweezers, and place the filter into a 1-mL glass vial. Place 1 mL of dichloromethane into the vial. Seal the vial with a cap lined with polytetrafluoroethylene. Shake the vial vigorously for approximately 1 minute.

8.3.2 HPLC Conditions. Operating conditions for high pressure liquid chromatography are:

Column temperature:	Room temperature
Mobile phase:	1.4:98.6 2-Propanol-dichloromethane (v/v)
Flow rate:	2.0 mL/min
Detector:	UV (254 nm)

Injection volume: 50 µL
Column efficiency: Approximately 300 theoretical plates for MDIU

Compound*	Adjusted Retention Volume (V_R')	Capacity Factor (k')
MDIU	4.1 mL	1.9
2,4-TDIU	11.1 mL	5.0
2,6-TDIU	>18.4 mL	>8.3
HDIU	>30 mL	>13.6

*2,4-TDIU, 2,6-TDIU, and HDIU are the corresponding urea derivatives of toluene-2,4-diisocyanate (2,4-TDI), toluene-2,6-diisocyanate (2,6-TDI), and hexamethylene diisocyanate (HDI), respectively.

NOTE: If HPLC conditions are employed which are different from those mentioned for this method, "blank" impregnated filters should be analyzed after storage of such filters and after exposure of such filters to light in order to help determine possibilities of interference.

8.3.3 Inject a 50-µL aliquot of sample solution into the high pressure liquid chromatograph, and determine the size of the peak corresponding to MDIU.

8.3.4 If the quantity of MDIU is above the lower quantitation limit, analyze another aliquot of the sample solution with two standards at concentrations above and below that of the MDIU in the sample solution. Precede and follow an injection of sample solution with an injection of standard solution.

8.3.5 Analyze the "blank" samples with the field samples.

8.3.6 After an aliquot of sample solution has been injected into the liquid chromatograph, N-p-nitrobenzyl-N-propylamine will emerge eventually from the HPLC column and cause a large response in the detector. Wash the column periodically to remove excess N-p-nitrobenzyl-N-propylamine by pumping 50:50 2-propanol-dichloromethane (v/v) at 2 mL/min through the column for at least 1 minute. Then pump 1.4:98.6

2-propanol-dichloromethane (v/v) at 2 mL/min through the column for 15 minutes before the next injection.

8.3.7 Replace the frit in front of the column packing when pressure becomes excessive (see Section 6.4). If a small quantity of packing is lost, replace the lost packing with fresh Partisil 10 or other silica packing.

8.3.8 Measure either peak heights or peak areas.

8.3.9 Construct a calibration curve for each sample based on the two adjacent standards (see Section 8.3.4).

8.4 Determination of Analytical-Method Recovery

8.4.1 Significance of Determination. The determination of analytical-method recovery may provide information which would aid in correcting for bias, if any, in the analytical method. Analytical-method recoveries should be determined at three levels of MDI which span the range of interest.

8.4.2 Procedure. Prepare three solutions of MDI in dichloromethane at concentrations appropriate for the application of approximately 10-µL aliquots to filters (a solution at a concentration of 0.08 µg/µL would be appropriate for the application of 0.8 µg of MDI per filter). Determine the concentrations of MDI according to Section 9.2. Place 18 impregnated filters (six filters for each level of MDI) into separate 1-mL glass vials, and add a known quantity of MDI in approximately 10 µL of dichloromethane solution to each filter. Seal each vial with a cap lined with polytetrafluoroethylene, and store each vial at room temperature in the dark for several hours. Analyze the samples and nine "blanks" (three "blanks" for each level) according to Section 8.3.

The analytical-method recovery for a level of MDI equals the average quantity of MDIU found in the samples corrected for the average blank and divided by the quantity of MDIU corresponding to the quantity of MDI applied.

Construct a curve of recovery versus average quantity of MDIU found.

9. Calibration and Standardization

9.1 Determination of Concentration of MDI in Dichloromethane Solution by a Colorimetric Method. (Reference 11.3)

9.1.1 Mix 10 mL of the standard solution of 4,4'-methylenedianiline (Section 7.9) with 35 mL of 12 M hydrochloric acid and 15 mL of glacial acetic acid, and dilute the solution to 1 liter with deionized water.

9.1.2 Prepare a series of standards in the range from 1.2 to 12 µg 4,4'-methylenedianiline per 15 mL of solution by diluting aliquots of the diluted standard solution (Section 9.1.1) with hydrochloric acid-acetic acid solution (Section 7.11).

9.1.3 Take 15 mL of hydrochloric acid-acetic acid solution (Section 7.11) as a blank.

9.1.4 Mix 0.5 mL of sodium nitrite-sodium bromide solution with 15 mL of each standard solution prepared according to Section 9.1.2 and with the blank (Section 9.1.3).

9.1.5 Add 1 mL of sulfamic acid solution to each mixture, stir each mixture for 0.5 minute, and allow each mixture to stand for 2 minutes.

9.1.6 Add 1.5 mL of sodium carbonate solution to each mixture, and stir each mixture.

9.1.7 Add 1 mL of N-(1-naphthyl)ethylenediamine dihydrochloride solution to each mixture, and stir each mixture.

9.1.8 Transfer a portion of each solution to a 5-cm cell 15 minutes after the addition of N-(1-naphthyl)ethylenediamine dihydrochloride solution, and measure the absorbance of each solution within 15 minutes after transfer. Water may be placed into the reference cell.

9.1.9 Construct a calibration curve of absorbance versus quantity of 4,4'-methylenedianiline in µg per 15 mL of solution.

9.1.10 Mix four 0.5-mL samples of the solution of MDI in dichloromethane with quantities of N,N-dimethylformamide-hydrochloric acid solution

(Section 7.16) in 10-mL graduated cylinders sufficient to make 9.5 mL of solution for each sample.

9.1.11 Add 10 µL of each solution prepared according to Section 9.1.10 to a separate 14-mL quantity of hydrochloric acid-acetic acid solution (Section 7.11), and dilute each solution to 15 mL with hydrochloric acid-acetic acid solution.

9.1.12 Analyze each sample solution according to Sections 9.1.3 through 9.1.8.

9.1.13 Determine the quantity of 4,4'-methylenedianiline in each 15-mL quantity of the sample solution (Section 9.1.11) from the calibration curve.

9.1.14 Calculate the concentration, D, of MDI in each sample of dichloromethane solution in mg/mL according to the following equation:

$$D = 2.39 \times B$$

where: 2.39 = a value based on three volumes (9.5 mL, 10 µL and 0.5 mL) specified in Sections 9.1.10 and 9.1.11 and the molecular weights of MDI and 4,4'-methylenedianiline (250.26 and 198.27, respectively)

B = quantity of 4,4'-methylenedianiline in µg in 15 mL of solution according to the calibration curve (see Section 9.1.13).

9.1.15 Calculate the average concentration of MDI.

9.2 Determination of Concentration of MDI in Dichloromethane Solution by an HPLC Method.

9.2.1 Mix four 10-µL aliquots of the solution of MDI in dichloromethane with separate volumes of a solution of N-p-nitrobenzyl-N-propylamine in hexane sufficient to make 1-mL quantities of solution (see Section 6.1.2 for preparation of a solution of N-p-nitrobenzyl-N-propylamine in hexane).

9.2.2 Analyze each solution according to Section 8.3.

9.2.3 Determine each concentration of MDIU from a calibration curve (see Section 8.3.9).

9.2.4 Calculate the concentration of MDI in each sample of dichloromethane solution, D', in µg/µL according to the following equation:

$$D' = 0.0392 \times J$$

where: 0.0392 = a value based on the 10-µL aliquot of solution of MDI and the molecular weights of MDI and MDIU (250.26 and 638.73, respectively)

J = the concentration of MDIU in µg/mL.

9.2.5 Calculate the average concentration of MDI.

9.3 Construction of Calibration Curve. A calibration curve will be an aid in selecting standards to be analyzed with samples. Prepare 5 mL of a dichloromethane solution containing 50 mg of MDIU. Prepare a series of standard solutions at concentrations ranging from 0.3 to 380 µg MDIU per mL of solution. Analyze 50-µL aliquots of the standards according to the HPLC conditions indicated in Section 8.3. Construct a calibration curve of either peak height or peak area versus concentration of MDIU.

10. Calculations

10.1 Determine the quantity of MDIU in µg found on the impregnated filter from the appropriate calibration curve (see Section 8.3.9).

10.2 Correct the quantity of MDIU for the corresponding "blank" value.

10.3 Determine the value of the recovery, R, from the recovery curve (see Section 8.4.2).

10.4 Correct the quantity of MDIU for recovery by dividing the quantity by R.

10.5 Calculate the concentration of MDI, C, in $\mu g/m^3$ in the air sample according to the following equation:

$$C = \frac{392 \times Q}{V}$$

where: 392 = a value based on 1000 liters/m^3 and the molecular weights of MDI and MDIU (250.26 and 638.73, respectively)

Q = the corrected quantity of MDIU in µg

V = the volume of air sampled in liters.

11. References

11.1 Tucker, S. P., and J. E. Arnold, "Sampling and Analytical Methods for Toluene-2,4-diisocyanate and 4,4'-Methylenebis(phenyl isocyanate) in Air" (report in preparation).

11.2 Hastings Vogt, C. R., C. Y. Ko and T. R. Ryan, "Simple Ureas Derived from Diisocyantes and Their Liquid Chromatography on a 5-cm Column," J. Chromatogr., 134, 451-458 (1977).

11.3 Method No. P&CAM 142, "p,p- Diphenylmethane Diisocyanate (MDI) in Air," in NIOSH Manual of Analytical Methods, Vol. 1, Second Ed., D. G. Taylor, Ed., National Institute for Occupational Safety and Health, Cincinnati, Ohio, 1977. DHEW (NIOSH) Publication No. 77-157-A.

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APPENDIX L

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 2

$$\bar{V}_s = 85.48\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,d} = 60(1 - B_{ws})\ \bar{V}_s\ A\ \left(\frac{528}{T_{s(avg)}}\right)\ \left(\frac{P_s}{29.92}\right)$$

$$Q_a = 60\ \bar{V}_s\ A$$

$$\dot{m}_g = \frac{4.995\ Q_{s,d}\ G_d}{1 - B_{ws}}$$

$$RH^* = 100\ (vp_{twb}\ 0.0003641\ P_s\ (T_{db} - T_{wb}))/vp_{tdb}$$

$$B^*_{ws} = RH(vp_{tdb})/P_s$$

$$= \frac{4.585 \times 10^{-2}\ P_s M_s}{T_{s\ (avg)}}$$

*Alternate equations for calculating moisture content from wet bulb and dry buld data.

SYMBOLS

A	=	Cross sectional area of stack, SQ. FT.
A_n	=	Cross sectional area of nozzle, SQ. FT.
B_{ws}	=	Water vapor in gas stream, proportion by volume
C_p	=	Pitot tube coefficient, dimensionless
C_a	=	Concentration of particulate matter in stack gas, wet basis, GR/ACF
C_s	=	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF
EA	=	Excess air, percent by volume
γ	=	Dry test meter correction factor, dimensionless
G_d	=	Specific gravity (relative to air), dimensionless
I	=	Isokinetic variation, percent by volume
M_d	=	Molecular weight of stack gas, dry basis, g/g - mole.
$\dot{m}_g$	=	Mass flow of wet flue gas, LB/HR
$\dot{m}_p$	=	Particulate mass flow, LB/HR
M_s	=	Molecular weight of stack gas, wet basis, g/g, mole.
M_p	=	Total amount of particulate matter collected, g
P_{bar}	=	Atmospheric pressure, IN. HG. (uncompensated)
P_g	=	Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN.HG.

P_{std} = Standard absolute pressure, 29.92 IN. HG.

A_a = Actual volumetric stack gas flow rate, ACFM

$Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM

RH = Relative humidity, %

T_{db} = Dry bulb temperature of stack gas, ^{o}F

T_{wb} = Wet bulb temperature of stack gas, ^{o}F

$T_{m(avg)}$ = Absolute average dry gas meter temperature, ^{o}R

$T_{s(avg)}$ = Absolute average stack temperature, ^{o}F

T_{std} = Standard absolute temperature, 528 ^{o}F (68 ^{o}F)

θ = Total sampling time, min.

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml

V_m = Volume of gas sample as measured by dry gas meter, CF

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF

$V_{w(std)}$ = Volume of water vapor in the gas sample corrected to standard conditions, SCF

$\bar{V}_s$ = Average actual stack gas velocity, FT/SEC

v_{Ptdb} = Vapor pressure at T_{db}, IN. HG.

VP_{twb} = Vapor pressure at T_{wb}, IN. HG

$\overline{\Delta H}$ = Average pressure differential across the orifice meter, IN. WC.

ΔP = Velocity pressure of stack gas, IN. WC.

Y = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

CALCULATION EQUATIONS

METHOD 3

$$\%EA = \frac{100(\%O_2 -).5\%\ CO)}{0.264\%\ N_2 - \%O_2 + 0.5\%\ CO}$$

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

$$M_s = M_d\ (I - B_{ws}) + 0.18\ B_{ws}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

CALCULATION EQUATIONS

METHOD 5

$$V_{m(std)} = 17.65\ V_m\ \gamma\ \left(\frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}}\right)$$

$$V_{w(std)} = 0.0472\ V_{Is}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$I = 0.0944\ \left(\frac{T_{s(avg)}\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (1 - B_{ws})}\right)$$

$$C_s = \frac{15.43\ M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3\ M_p\ P_s}{T_{s(avg)}\ (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714 \times 10^{-3}\ C_s\ Q_{s,d}$$

$$(\dot{m}_p)_2 = \frac{1.3228 \times 10^{-1}\ M_p\ A}{\theta\ A_n}$$

$$\dot{m}_p = \frac{(\dot{m}_p)_1 + (\dot{m}_p)_2}{2}$$

SYMBOLS

A = Cross sectional area of stack, SQ. FT.

A_n = Cross sectional area of nozzle, SQ. FT.

B_{ws} = Water vapor in gas stream, proportion by volume

C_p = Pitot tube coefficient, dimensionless

C_a = Concentration of particulate matter in stack gas, wet basis, GR/ACF

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

M_d = Molecular weight of stack gas, dry basis, g/g - mole.

$\dot{m}_g$ = Mass flow of wet flue gas, LB/HR

$\dot{m}_p$ = Particulate mass flow, LB/HR

M_s = Molecular weight of stack gas, wet basis, g/g, mole.

M_p = Total amount of particulate matter collected, g

P_{bar} = Atmospheric pressure, IN. HG. (uncompensated)

P_g = Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN.HG.

P_{std} = Standard absolute pressure, 29.92 IN. HG.

A_a = Actual volumetric stack gas flow rate, ACFM

$Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM

RH = Relative humidity, %

T_{db} = Dry bulb temperature of stack gas, ^oF

T_{wb} = Wet bulb temperature of stack gas, ^oF

$T_{m(avg)}$ = Absolute average dry gas meter temperature, ^oR

$T_{s(avg)}$ = Absolute average stack temperature, ^oF

T_{std} = Standard absolute temperature, 528 ^oF (68 ^oF)

θ = Total sampling time, min.

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml

V_m = Volume of gas sample as measured by dry gas meter, CF

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF

$V_{w(std)}$ = Volume of water vapor in the gas sample corrected to standard conditions, SCF

$\overline{V}_s$ = Average actual stack gas velocity, FT/SEC

vP_{tdb} = Vapor pressure at T_{db}, IN. HG.

vp_{twb} = Vapor pressure at T_{wb}, IN. HG

$\overline{\Delta H}$ = Average pressure differential across the orifice meter, IN. WC.

ΔP = Velocity pressure of stack gas, IN. WC.

γ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

CALCULATION EQUATIONS

METHOD 10

$$CO\text{-}PPM\text{-}DRY = CO_{CO_2\text{-free,dry,avg}} \left(1 - CO_{2,d}/100\right)$$

$$CO\text{-}PPM\text{-}WET = CO\text{-}PPM\text{-}DRY \left(1 - MC/100\right)$$

$$GR/DSCF = 5.0885 \times 10^{-4} \left(CO\text{-}PPM\text{-}DRY\right)$$

$$mg/dscm = 1.165 \left(CO\text{-}PPM\text{-}DRY\right)$$

$$\dot{m} = 8.5714 \times 10^{-3} \left(GR/DSCF\right)\left(Q_{s,d}\right)$$

$$E = \frac{2.9857 \times 10^{-3} \, F_d \left(GR/DSCF\right)}{20.9 - O_{2,d}}$$

Where

$CO_{CO_2\text{-free,dry,avg}}$ = average of two determinations of carbon monoxide on a dry, CO_2-free integrated flue gas sample reported in ppm by volume

$CO_{2,d}$ = carbon dioxide concentration of flue gas on a dry percent by volume basis

$O_{2,d}$ = oxygen concentration of flue gas on a dry percent by volume basis

MC	= moisture content of flue gas on a percent by volume basis
CO·PPM·DRY	= carbon monoxide concentration in ppm by volume on a dry basis
CO·PPM·WET	= carbon monoxide concentration in ppm by volume on a wet or actual basis
GR/DSCF	= concentration of carbon monoxide in flue gas on a grains per dry standard cubic foot basis (68 ^{o}F, 29.92 IN.HG.)
mg/dscm	= concentration of carbon monoxide in flue gas on a milligrams per dry standard cubic meter basis (60 ^{o}F, 29.92 IN.HG.)
$\dot{m}$	= emission or mass rate of carbon monoxide on a LB/HR basis
$Q_{s,d}$	= volumetric flow rate of flue gas in dry standard cubic feet per minute
E	= emission factor of carbon monoxide in pounds of carbon monoxide emitted per million BTU heat input (LB/MMBTU)
F_d	= F-Factor of respective fuel in dry standard cubic feet of exhaust gas at 0% oxygen per million BTU of heat input (DSCF/MMBTU)

Total Gaseous Organics Calculation Equations

$$GR\ C/SCF = 2.180 \times 10^{-4}\ (ppm,w)$$

$$GR\ C/DSCF = 2.180 \times 10^{-4}\ (ppm,w)/(1-MC/100)$$

$$LB\ C/HR = 8.5714 \times 10^{-3}\ (GR/DSCF)\ (DSCFM)$$

where:

GR C/SCF = grains of total gaseous organics as carbon per actual (wet) standard cubic foot

GR C/DSCF = grains of total gaseous organics as carbon per dry standard cubic foot

LB C/HR = pounds of total gaseous organics as carbon emitted hour

Note 1: The Ratfisch Model RS 55 Heated FID Analyzer as normally operated with a heated filter, sample line and heated detector oven gives ppm,w.

Note 2: ppm,C = ppm as carbon = 3(ppm propane)

CALCULATION EQUATIONS

Chromotropic Acid Method for Formaldehyde

$$m_t = \frac{m_a \times V_{soln}}{V_{aliq}}$$

where m_t = mass of formaldehyde in total sample in ug

m_a = mass of formaldehyde in aliquot in ug

V_{soln} = volume of total sample in cc (500 cc normally)

V_{aliq} = volume of aliquot taken for analysis in cc

$$PPM\text{-}DRY = \frac{.0283\ m_t}{V_{std}}$$

$$PPM\text{-}WET = PPM\ DRY\ (1\text{-}MC/100)$$

$$GR/DSCF = 5.45 \times 10^{-4}\ (PPM\text{-}DRY)$$

$$mg/dscm = 1.249\ (PPM\text{-}DRY)$$

$$\dot{m} = 8.5714 \times 10^{-3}\ (GR/DSCF)\ (Q_{s,d})$$

where PPM-DRY = concentration of formaldehyde in parts per million by volume on a dry basis

PPM-WET = concentration of formaldehyde in parts per million by volume on an actual or wet basis

MC = moisture content of gas on a percent by volume basis

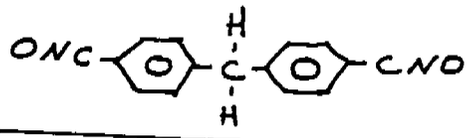
GR/DSCF = concentration of formaldehyde in gas on a grains per dry standard cubic foot basis ($68^{o}F$, 29.92 IN.HG.)

$\dot{m}$ = emission or mass rate of formaldehyde in pounds per hour (LB/HR)

INTERPOLL LABORATORIES, INC

Concentration Calculation Equations for 4,4-Methylenebis (phenyl isocyanate) (MDI)

1. Structure:



2. Molecular weight:

250.27 g/g-mole

3. Mass/volume Concentration:

$$Cug/Nm3 = \frac{35.314\ m}{Vstd}$$

where m = Total mass of MDI in sample in micrograms (ug), and

Vstd = Total volume of exhaust gas or air sampled in dry standard cubic feet (DSCF).

4. Volume/volume Concentration:

$$Cppmv = \frac{\mu g}{Nm^3}\left[\frac{Nm^3}{1000\,L} \times \frac{24.46\,\mu L}{250.27\,\mu g}\right]$$

$$Cppmv = 0.0978 \times 10^{-3}\ Cug/Nm3$$

5. Notes:

$$C_{ppbv} = 0.0978\ \frac{\mu g}{Nm^3}$$

Derived by: DJD/PL | Date: 1/15/93

CALCULATION OF MASS RATES

$$\dot{m}^{x} = \frac{m\text{g}}{Nm^3} \times \left(\frac{\text{g}}{10^3\, m\text{g}}\right) \times \left(\frac{LB}{453.6\,\text{g}}\right) \times \left(\frac{DSCF}{MIN}\right) \times \left(\frac{1\,Nm^3}{35.31\,DSCF}\right) \times \left(\frac{60\,MIN}{1\,HR}\right)$$

(C_s^x → $m\text{g}/Nm^3$; Q_s → $DSCF/MIN$)

$$\dot{m}^{x} = 3.746 \times 10^{-6} C_s Q_s$$

where $\dot{m}$ = mass rate in LB/HR of Compound x

C_s = Concentration of Compound x in mg/Nm^3

Q_s = dry standard volumetric flow rate in DSCFM.

APPENDIX M

SAMPLING TRAIN CALIBRATION DATA

INTERPOLL LABORATORIES
EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Date 1-25-93

Job IP/mautlose

Module No. 6

Operator [illegible signature]

Instructions: Operate the control module at a flow rate equal to ^H@ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 25.20 in. Hg. γ = 1.0051 ^H@ 1.83 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(17.50)		
2.5	19.48	56	50
5.0	21.48	57	53
7.5	23.47	59	55
10	25.47	61	55
	V_m = 7.97	Avg(t_m) = 55.8 °F	

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\gamma\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(1.0051)(\quad)}\left[\frac{(55.8) + 460}{(25.20)}\right]^{0.5} \quad 4.524$$

Y_{cn} = 1.0086

If Y_{cn} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

S-432

INTERPOLL LABORATORIES
EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Job L.P. / Montrose Date 11/26/92

Operator [redacted] Module No. 8

Instructions: Operate the control module at a flow rate equal to ^H@ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 25.12 in. Hg. T = 1.0073 ^H@ 1.96 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	607.30	[redacted]	
2.5	609.30	52	48
5.0	611.26	53	49
7.5	613.23	53	48
10	615.23	54	48
[redacted]	V_m = 7.93	Avg(t_m) = 50.62 °F	

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{T\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(7.93)(1.0073)}\left[\frac{(50.62 + 460}{(25.12)}\right]^{0.5}$$

Y_{cn} = 1.008

If Y_{cn} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

S-432

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: February 3, 1993

Meter Box No. : 6 (Rockwell Dry Test Meter Serial No. 64710)

Date of Last Calibration: December 20, 1992
Calibration Technician: D. Brennan
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
December 22, 1992	2-7784	892.80	1147.05	255.05	255.05
December 29, 1992	2-7822	1158.17	1288.17	129.47	384.52
December 30, 1992	2-7825	1289.22	1424.70	135.48	520.00
January 14, 1993	3-7914	1425.00	1601.41	176.41	696.41
January 19, 1993	3-7981	1602.00	2014.40	412.40	1108.81
January 26, 1993	3-8023	2017.50	2790.65	773.15	1881.96

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-620

Meter Box Calibration and Usage Status

Date of Report: February 3, 1993

Meter Box No. : 8 (Rockwell Dry Test Meter Serial No. 949230)

Date of Last Calibration: December 20, 1992
Calibration Technician: D. Brennan
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
December 29, 1992	2-7822	952.80	1053.30	100.50	100.50
January 6, 1993	3-7873	1055.48	1484.07	428.59	529.09
January 14, 1993	3-7914	1484.30	1597.14	112.84	641.93
January 25, 1993	3-8023	1607.30	1919.53	312.23	954.16

* Total volume through meter since last calibration.

Date 12/20/92

Bar. Press. 29.23 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. C

Serial No. DTN 64710

Wet Test Meter No. AL-20

Technician D. BRENNAN

ΔH (in. WC) nominal	ΔH (in. WC) actual	Gas Volume Wet Test Meter (ft^3)	* Cal. Index Φ (%)	* Diff. Wet Test Meter ΔP_M (in. WC)	Gas Volume Dry test meter (ft^3) V_{df}	Gas Volume Dry test meter (ft^3) V_{df}	Gas temperatures Wet Test t_w (°F)	Gas temperatures Dry Test t_{d1} (°F)	Gas temperatures Dry Test t_{do} (°F)	Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔHθ	C_f
0.6	.50	2	99.85	0.01	886.000	888.010	64.0	74	70	5:02	1.0074	1.78	
1.2	1.2	3	99.91	0.025	888.500	891.528	64.0	75	70	4:56	1.0028	1.82	
2.0	2.0	3	99.93	0.055	865.000	868.023	64.0	76	70	3:49	1.0035	1.81	
3.3	3.3	5	100.00	0.09	~~870.50~~	875.528	64.0	78	71	5:02	1.0058	1.86	
4.7	4.7	5	100.02	0.12	871.000	879.015	64.	79	71	4:14	1.0059	1.87	
										Avg =	1.0051	1.83	

05-10 *

Positive leak check performed by D. BRENNAN

Meter was in tolerance ☒

Meter was not in tolerance ☐; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Approved by [signature] Date 12/22/92

* Based on AL-20 wet test meter calibration in Nov. 1991 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102RR 11/91

M-5

Date 12/20/92

Bar. Press. 29.23 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 8
Serial No. DTH 949 230
Wet Test Meter No. AL-20
Technician D. BRENNAN

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index Y (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔH@	C_f
nominal	actual				V_{di}	V_{df}	Wet Test t_w (°F)	Dry Test t_{di} (°F)	Dry Test t_{do} (°F)				
0.6	.50	2	99.85	0.01	946.500	948.522	63.5	77	70	5:14	1.0052	1.91	
1.2	1.2	3	99.91	0.025	949.000	952.031	63.5	79	71	5:06	1.0075	1.93	
2.0	2.0	3	99.93	0.055	932.000	935.006	63.5	76	66	3:57	1.0064	1.94	
3.3	3.3	5	100.00	0.09	935.500	940.515	63.5	79	68	5:13	1.0075	2.00	
4.7	4.7	5	100.02	0.12	941.000	946.014	63.5	82	71	4:24	1.0099	2.01	
		1	0	4	8	6	7	8	0	11	11/13 Avg.	1.0073	1.96	

Positive leak check performed by D. BRENNAN
Meter was in tolerance ■
Meter was not in tolerance ☐; readjusted linkage
Meter was not in tolerance ☐; changed dry test meters

Approved by Daniel L. Deye Date 12/22/92

* Based on AL-20 wet test meter calibration in Nov. 1991 against Bell Prover (NBS Traceable) - Carl Poe Co.

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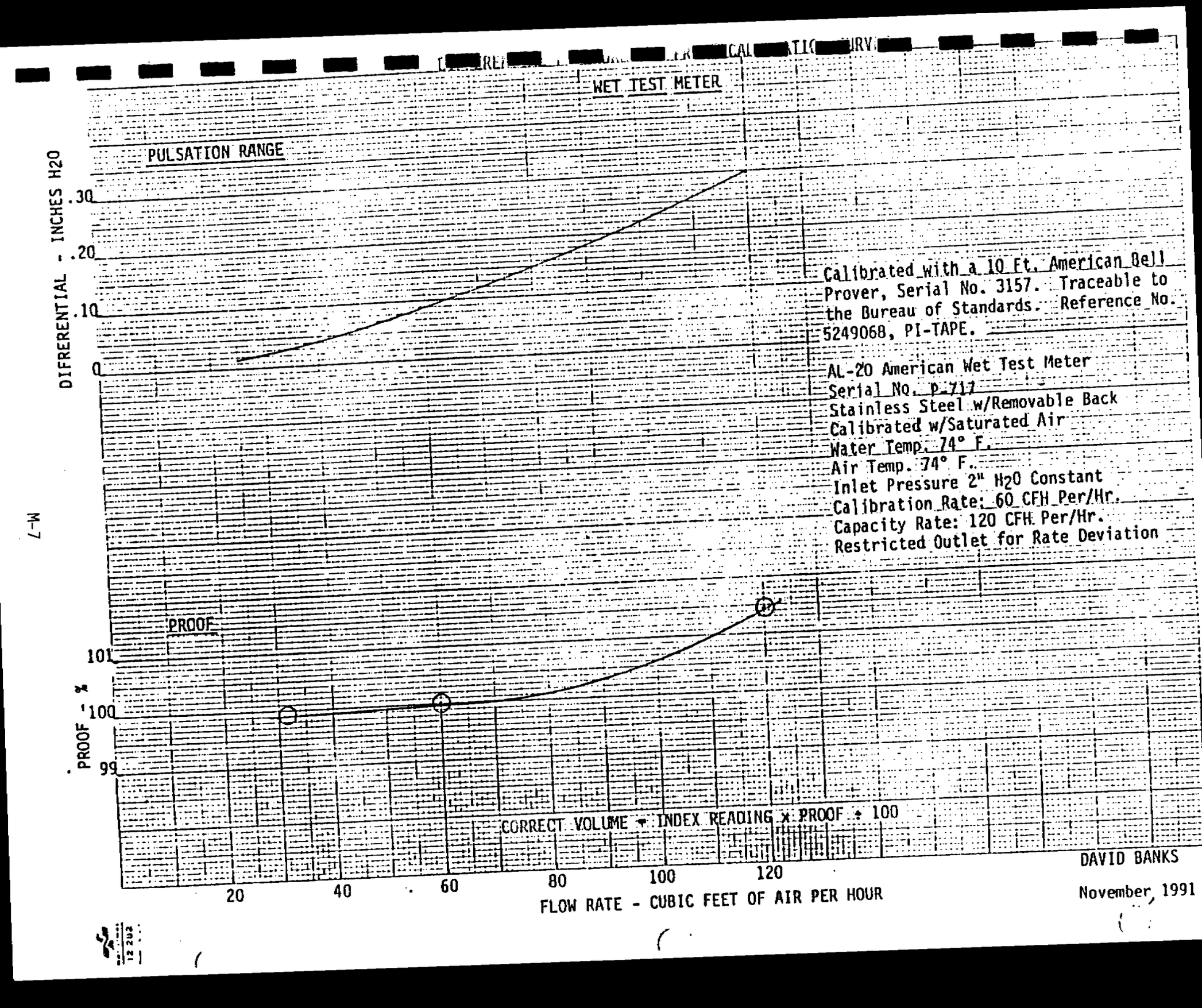
WET TEST METER
PULSATION RANGE
DIFRERENTIAL - INCHES H20
.30
.20
.10
0
PROOF
101
100
99
PROOF - %
20
40
60
80
100
120
FLOW RATE - CUBIC FEET OF AIR PER HOUR
CORRECT VOLUME = INDEX READING x PROOF ÷ 100
Calibrated with a 10 Ft. American Bell Prover, Serial No. 3157. Traceable to the Bureau of Standards. Reference No. 5249068, PI-TAPE.
AL-20 American Wet Test Meter
Serial No. P-717
Stainless Steel w/Removable Back
Calibrated w/Saturated Air
Water Temp. 74° F.
Air Temp. 74° F.
Inlet Pressure 2" H2O Constant
Calibration Rate: 60 CFH Per/Hr.
Capacity Rate: 120 CFH Per/Hr.
Restricted Outlet for Rate Deviation
DAVID BANKS
November, 1991

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Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 1-26-93
Technician: Ed Trowbridge

Nozzle Number 6-3

The nozzle is rotated in 60 degree increments and the diameter at each point is measured to the nearest 0.001 inch. The observed readings and average are shown below.

Position	Diameter (inches)
1	.185
2	.186
3	.185
Average:	.185

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Nozzle Number 7-4

Date of Calibration: 1-26-93
Technician: Duane Van Hoever

The nozzle is rotated in 60 degree increments and the diameter at each point is measured to the nearest 0.001 inch. The observed readings and average are shown below.

Position	Diameter (inches)
1	.247
2	.247
3	.246
Average:	.247

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 1-27-93
Technician: Duane Van Hoever

Nozzle Number 7-3

The nozzle is rotated in 60 degree increments and the diameter at each point is measured to the nearest 0.001 inch. The observed readings and average are shown below.

Position	Diameter (inches)
1	.188
2	.188
3	.188
Average:	.188

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

Unit under test: PDT-12

Vendor Fluke

Model 51

Range 0 - 2100 °F

Date of Calibration 12-17-92

Serial Number 5030375

Thermocouple Type K

Technician E Trawinski

Method of Calibration:

☐ Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.

☒ Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is ± 0.1% of span (2100 °F) ± 1 degree (for negative temperatures add ± 2 degrees. The CL-300 simulates exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation Δt (°F)	Deviation (%)
0	0	.4	-.6	.13
100	100	98.6	-1.4	.25
200	200	201.0	+1.0	.15
300	300	299.6	-.4	.05
400	400	398.0	-2.0	.23
500	500	499.2	-.8	.08
600	600	601.0	+1.0	.09
700	700	698.2	-1.8	.15
800	800	800.0	—	0
900	900	897.4	-2.6	.19
1000	1000	999.2	-.8	.05
1100	1100	1098.8	-1.2	.07
1200	1200	1200.8	+.8	.05
1300	1300	1297.8	-2.2	.13
1400	1400	1400.4	+.4	.02
1500	1500	1497.8	-2.2	.11
1600	1600	1599.0	-1.0	.05
1700	1700	1697.0	-3.0	.14
1800	1800	1798.4	-1.6	.07
1900	1900	1895.8	-4.2	.18
2000	2000	1997.6	-2.4	.09
2100	2100	2094.4	-4.6	.18
		Averages:	1.64	.11

OF = off scale response by unit under test (°F)

% dev = 100 Δt / (460 + t)

☒ Unit in tolerance

☐ Unit was not in tolerance; recalibrated - See new calibration sheet.

S-433

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

Unit under test:

Vendor Beckman Industrial

Model HD 110 T

Range -1999 °F

Serial Number PDT #18

Thermocouple Type K

Date of Calibration 12/31/92

Technician DH

Method of Calibration:

☐ Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.

☒ Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is ± 0.1% of span (2100 °F) ± 1 degree (for negative temperatures add ± 2 degrees. The CL-300 simulates exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation Δt (°F)	Deviation (%)
0		0	—	0
100		96	4	.71
200		200	0	0
300		298	2	.26
400		395	5	.58
500		495	5	.52
600		597	3	.28
700		698	2	.17
800		803	3	.23
900		905	5	.36
1000		1011	11	.75
1100		1114	14	.89
1200		1220	20	1.20
1300		1324	24	1.19
1400		1426	26	1.40
1500		1524	24	1.22
1600		1625	25	1.21
1700		1720	20	.92
1800		1819	19	.84
1900		1912	12	.50
2000				
2100				
		Averages:		.66

OF = off scale response by unit under test (°F)

% dev = 100 Δt / (460 + t)

☒ Unit in tolerance

☐ Unit was not in tolerance; recalibrated - See new calibration sheet.

S-433

(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 22-4

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .462 IN.
3. Base to Side B opening plane (P_B) .461 IN.

Alignment:

4. $\alpha_1 < 10^0$ 0
5. $\alpha_2 < 10^0$ 1

6. $B_1 < 5^0$ 1
7. $B_2 < 5^0$ 1

8. Z <.125" .01
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .760 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 IN.
13. Pitot to thermocouple (perpendicular to probe) .762 IN.

☒ Meets all EPA design criteria thus C_p = 0.84

☐ Does not meet EPA design criteria - thus calibrate in wind tunnel
C_p = _____

Date of Inspection:

3-1-92

Inspected by:

E Trawicki

CFR Title 40 Part 60 Appendix A Method 2

(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 23-4

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .462 IN.
3. Base to Side B opening plane (P_B) .464 IN.

Alignment:

4. α_1 <10° 1
5. α_2 <10° 0

6. B_1 <5° 2
7. B_2 < 5° 2

8. Z <.125" .03
9. W <.0625" .03

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .754 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 IN.
13. Pitot to thermocouple (perpendicular to probe) .760 IN.

☒ Meets all EPA design criteria thus C_p = 0.84

☐ Does not meet EPA design criteria - thus calibrate in wind tunnel
C_p = _____

Date of Inspection: 3-2-92

Inspected by: E Trowbridge

CFR Title 40 Part 60 Appendix A Method 2

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 1-8-93

Technician E Trowbridge

Mercury Column Barometer No. Lab #1

Aneroid Barometer No. Peet Model 72 Ser # 01002008

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
29.560	72	.116	29.444	29.44	.001

Has this barometer shown any consistent problems with calibration? Yes/No. If yes, explain. No

Has problem been alleviated? Yes/No. How?

*Note

Aneroid barometers will be calibrated periodically against a mercury column barometer. The aneroid barometer to be calibrated should be placed in close proximity to the mercury barometer and left to equilibrate for 20-30 minutes before calibrating. Aneriod barometer will be calibrated to the adjusted mercury barometer readings.

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INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 12/31/92
Technician D. VanHoever
Mercury Column Barometer No. 1
Aneroid Barometer No. 861216

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
29.56	67	.105	29.46	29.48	.02

Has this barometer shown any consistent problems with calibration? Yes/(No.) If yes, explain. _____

Has problem been alleviated? Yes/No. How? _____

*Note

Aneroid barometers will be calibrated periodically against a mercury column barometer. The aneroid barometer to be calibrated should be placed in close proximity to the mercury barometer and left to equilibrate for 20-30 minutes before calibrating. Aneriod barometer will be calibrated to the adjusted mercury barometer readings.

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