Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020
FAX: (612) 786-7854

RESULTS OF THE JUNE 8 - 10, 1993 EPA-REQUIRED AIR EMISSION COMPLIANCE TESTS AT THE LOUISIANA PACIFIC WAFERBOARD PLANT IN DUNGANNON, VIRGINIA

Submitted to:

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

Attention:

Sue Somers

Approved by:



Daniel J. Despen
Manager
Field Testing Division

Report Number 3-9053
July 22, 1993
KE/kce

TABLE OF CONTENTS

ABBREVIATIONS iii

1 INTRODUCTION 1

2 SUMMARY AND DISCUSSION 6

3 RESULTS 17

3.1 Results of Orsat and Moisture Determinations 18

3.2 Results of Particulate Determinations 26

3.3 Results of PM-10 Determinations 29

3.4 Results of Oxides of Nitrogen Determinations 31

3.5 Results of Carbon Monoxide Determinations 35

3.6 Results of Formaldehyde Determinations 37

3.7 Results of Phenol Determinations 40

3.8 Results of MDI Determinations 42

4 RESULTS OF FUEL ANALYSES 45

APPENDICES:

A - Results of Volumetric Flow Rate Determinations

B - Location of Test Ports

C - Konus Field Data Sheets

D - Press Vent Field Data Sheets

E - Dryer Field Data Sheets

F - Interpoll Laboratories Analytical Results

G - Total Hydrocarbons Stripchart

H - THC Analyzer Specifications

I - Measurement Systems Performance Specifications

J - Calibration Gas Certification Sheets

K - Process Rate Information

L - Procedures

M - Calculation Equations

N - Sampling Train Calibration Data

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°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/Nm^3	milligrams per dry standard cubic meter
ug/Nm^3	micrograms 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
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight
<	≤ (when following a number)

Standard contitions are defined as 68°F (20°C) and 29.92 IN. of mercury pressure.

1 INTRODUCTION

During the Period June 8 - 10, 1993 Interpoll Laboratories personnel conducted EPA-required air emission compliance tests on the Konus, Dryer and Press Vent at the Louisiana Pacific Corporation (LP) Waferboard Plant located in Dungannon, Virginia. On-site testing was performed by D. Van Hoever, M. Kaehler and J. Bergstrom. Coordination between testing activities and plant operation was provided by Sue Somers of LP. The test was witnessed by C. Musick, S. Faggert, T. Derling, G. Diehl of the Virginia Department of Environmental Quality.

The Konus Oil Heater tested was manufactured by Konus Kessel in 1985. It is equipped with two screw auger-type stokers and is fired with a mixture of bark and wood. The unit is equipped with an economizer and has a design heat input capacity of 31 10^6BTU/HR. Particulate emissions from the Konus are controlled by a large diameter cyclone manufactured by Konus in series with a fabric filter dust collector manufactured by C.E. Preheater. The baghouse has a pulsed air cleaning system. Cleaned flue gas is emitted to the atmosphere by a 75-foot high radial steel stack which has a diameter of 41 inches.

The Wafer Dryer tested is a Model 1260 TNW/L dryer manufactured by MEC Company. 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 electrified filter bed unit manufactured by EFB, Inc. Cleaned flue gas is emitted to the atmosphere by a 150-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.

The oxides of nitrogen samples were collected at the Dryer test site during the particulate determinations using an all-glass Method 7 sampling train. A heated stainless steel probe was used to extract the samples from the exhaust stream. A plug of glass-wool was used in the end of the probe to remove particulate material.

The NO_x samples were collected in volume-calibrated two-liter all-glass flasks. An aliquot of 25 cc of absorbing solution was added to each flask on-site; the flask was closed; inserted into the sampling train; and evacuated. The probe was then purged and the sample collected over a 15 second interval. The flask was then closed; the flask removed from the sampling train; shook for two minutes and then secured for transport to the laboratory.

Upon arrival at the laboratory, the NO_x samples are logged in, placed in a designated area and maintained at 72 ^0F for 24 hours to allow completion of the conversion of NO to NO_2 and absorption in the acidified peroxide reagent. The flasks are then shook to complete absorption; attached to a mercury manometer and the static pressure and temperature recorded. The samples are then recovered and analyzed by ion chromatography.

PM-10 determinations were performed on the Konus Oil Heater in accordance with EPA Method 201A (Ibid, Part 51, Appendix M). An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to extract PM-10 samples by means of an Anderson PM-10 cyclone and a stainless steel probe. The cyclone used in this work meets or exceeds the specifications of Method 201A. Velocity pressure measurements were made prior to and during each run to determine the proper dwell times at each traverse point.

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.

Phenol concentrations were determined from the Press Vent using a Method 5 sampling train with neutral buffered absorbing reagent followed by extraction with methylene chloride and direct analysis by GC/MS with no concentration (EPA Method 8270). The samples were field spiked with 5.33 mg of phenol d5.

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 urea reaction product by normal phase 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 from the dryer and thermal oil heater exhaust gas streams 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 collected at the dryer test site 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 5.5 stack diameters downstream of the nearest flow disturbance and 21.5 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 2.5 minutes for the particulate and formaldehyde sampling to give a total sampling time of sixty minutes per run.

Testing on the Konus was also conducted from two test ports oriented at 90 degrees on the stack. These test ports are located 6.0 stack diameters from the nearest flow disturbance and 2.87 diameters from the stack exit. A 16-point traverse was used to collect representative particulate samples. Each traverse point was sampled for 4 minutes for a total sampling time of 64 minutes per run. A 12-point traverse was used to collect the PM-10 samples. The PM-10 run times varied from 79 to 84 minutes.

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 2.0 stack diameters downstream of the nearest flow disturbance and 6.9

diameters upstream of the stack exit. A 24-point traverse was used to collect the particulate, formaldehyde, phenol 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 tests are summarized in Tables 1-3. The particulate results have been calculated using the dry plus wet catch ("a" Tables) and again with the dry catch only ("b" Tables). The following emission rates are based on the dry catch only. As will be noted, the particulate emission rate for the Dryer averaged 8.9 LB/HR. The particulate emission rate for the Konus averaged 0.89 LB/HR. The PM-10 results are summarized in Table 3. The PM-10 emission rate averaged 0.30 for the Konus.

The oxides of nitrogen results for the Dryer are summarized in Table 4. The oxides of nitrogen emission rate averaged 5.2 LB/HR.

The carbon monoxide results are summarized in Table 5. The carbon monoxide emission rate averaged 23 LB/HR for the Dryer.

A summary of the formaldehyde results are presented in Table 6. The formaldehyde emission rate averaged 1.23 LB/HR for the Dryer and 0.97 LB/HR for the Press Vent.

The results of the Total Hydrocarbons tests are summarized in Table 7. The total hydrocarbon emission rate averaged 8.5 LB/HR for the Dryer 1.1 LB/HR for the Press Vent.

Summaries of the phenol and MDI results for the Press Vent are presented in Tables 8 and 9. The phenol emission rate averaged 0.37 LB/HR and the MDI emission rate averaged 0.086 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 this fact and a complete review of the entire 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 June 8, 1993 Particulate Emission Compliance Test on the Dryer at the Louisiana Pacific OSB Plant in Dungannon, Virginia.

ITEM		Run 1	Run 2	Run 3
Date of test		06-08-93	06-08-93	06-08-93
Time runs were done	(HRS)	1220/1321	1400/1512	1536/1641
Process rate	(TON FP/HR)	9.5	9.5	9.5
Volumetric flow				
actual	(ACFM)	53613	55029	55626
standard	(DSCFM)	33343	33306	34740
Gas temperature	(DEG-F)	201	202	200
Moisture content	(%V/V)	19.15	21.17	18.85
Gas composition	(%V/V,dry)			
carbon dioxide		2.80	3.10	2.60
oxygen		18.20	17.90	18.40
nitrogen		79.00	79.00	79.00
Isokinetic variation	(%)	102.3	104.1	99.5
Particulate concentration				
actual	(GR/ACF)	.0710	.0812	.0426
standard	(GR/DSCF)	0.114	0.134	.0683
Part. emission rate	(LB/HR)	32.65	38.34	20.33

Note: Dry + Method 202 Condensible Particulate Material

Table 1b Summary of the Results of the June 8, 1993 Particulate Emission Compliance Test on the Dryer at the Louisiana Pacific OSB Plant in Dungannon, Virginia.

ITEM		Run 1	Run 2	Run 3
Date of test		06-08-93	06-08-93	06-08-93
Time runs were done	(HRS)	1220/1321	1400/1512	1536/1641
Process rate	(TON FP/HR)	9.5	9.5	9.5
Volumetric flow				
actual	(ACFM)	53613	55029	55626
standard	(DSCFM)	33343	33306	34740
Gas temperature	(DEG-F)	201	202	200
Moisture content	(%V/V)	19.15	21.17	18.85
Gas composition	(%V/V,dry)			
carbon dioxide		2.80	3.10	2.60
oxygen		18.20	17.90	18.40
nitrogen		79.00	79.00	79.00
Isokinetic variation	(%)	102.3	104.1	99.5
Particulate concentration				
actual	(GR/ACF)	.0188	.0242	.0140
standard	(GR/DSCF)	.0302	.0400	.0225
Part. emission rate	(LB/HR)	8.64	11.40	6.69

Note: Dry Catch Only

Table 2a Summary of the Results of the June 9, 1993 Particulate Emission Compliance Test on the Konus at the Louisiana Pacific Plant in Dungannon, Virginia.

ITEM	Run 1	Run 2	Run 3
Date of test	06-09-93	06-09-93	06-09-93
Time runs were done (HRS)	1533/1643	1725/1833	1917/2024
Process rate (TON FP/HR)	9.5	9.5	9.5
Volumetric flow			
actual (ACFM)	21058	20974	21037
standard (DSCFM)	13543	13621	13598
Gas temperature (DEG-F)	284	284	286
Moisture content (%V/V)	5.85	4.96	5.11
Gas composition (%V/V,dry)			
carbon dioxide	2.40	2.40	2.60
oxygen	18.40	18.40	18.10
nitrogen	79.20	79.20	79.30
Isokinetic variation (%)	99.3	99.3	100.2
Particulate concentration			
actual (GR/ACF)	.0656	.0311	.0186
standard (GR/DSCF)	0.102	.0479	.0288
Part. emission rate (LB/HR)	11.85	5.59	3.35

Note: Dry + Method 202 Condensible Particulate Material

Table 2b Summary of the Results of the June 9, 1993 Particulate Emission Compliance Test on the Konus at the Louisiana Pacific Plant in Dungannon, Virginia.

ITEM		Run 1	Run 2	Run 3
Date of test		06-09-93	06-09-93	06-09-93
Time runs were done	(HRS)	1533/1643	1725/1833	1917/2024
Process rate	(TON FP/HR)	9.52	9.52	9.52
Volumetric flow				
actual	(ACFM)	21058	20974	21037
standard	(DSCFM)	13543	13621	13598
Gas temperature	(DEG-F)	284	284	286
Moisture content	(%V/V)	5.85	4.96	5.11
Gas composition	(%V/V,dry)			
carbon dioxide		2.40	2.40	2.60
oxygen		18.40	18.40	18.10
nitrogen		79.20	79.20	79.30
Isokinetic variation	(%)	99.3	99.3	100.2
Particulate concentration				
actual	(GR/ACF)	.00574	.00532	.00371
standard	(GR/DSCF)	.00894	.00819	.00574
Part. emission rate	(LB/HR)	1.04	0.956	0.669

Note: Dry Catch Only

Table 3. Summary of the Results of the June 9, 1993 PM-10 Determinations on the Konus at the Louisiana Pacific OSB Plant located in Dungannon, Virginia.

ITEM		Run 1	Run 2	Run 3
Date of test		06-09-93	06-09-93	06-09-93
Time runs were done	(HRS)	1530/1649	1723/1838	1915/2029
Process rate	(TON FP/HR)	9.52	9.52	9.52
Volumetric flow				
actual	(ACFM)	20576	20521	20766
standard	(DSCFM)	13294	13154	13206
Gas temperature	(DEG-F)	284	284	286
Moisture content	(%V/V)	5.50	6.15	6.68
Gas composition	(%V/V,dry)			
carbon dioxide		2.35	2.50	2.50
oxygen		18.50	18.20	18.30
nitrogen		79.15	79.30	79.20
Isokinetic variation	(%)	102.3	104.3	103.4
PM-10 Concentration				
actual	(GR/ACF)	.00204	.00144	.00161
standard	(GR/DSCF)	.00316	.00224	.00254
PM-10 Emission Rate	(LB/HR)	0.360	0.253	0.287

Note: Dry Catch Only

Table 4. Summary of the June 8, 1993 Oxides of Nitrogen Emission Compliance Test on the Dryer at the Louisiana Pacific Waferboard Plant in Dungannon, Virginia.

Time	Concentration (ppm,d)	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
0857-1027	24	5.9	0.62
1057-1227	22	5.4	0.57
1310-1436	18	4.3	0.45
Avg.	21	5.2	0.55

Table 5. Summary of the June 8, 1993 Carbon Monoxide Emission Compliance Test on the Dryer at the Louisiana Pacific Waferboard Plant in Dungannon, Virginia.

Time	Concentration (ppm,d)	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
1220-1321	168	25	2.63
1400-1512	212	31	3.27
1536-1641	90	14	1.48
Avg.	157	23	2.46

TFP = Ton Finished Product (9.5 TON/HR 6/8/93)

Table 6. Summary of the June 8 and 10, 1993 Formaldehyde Emission Compliance Tests at the Louisiana Pacific Waferboard Plant in Dungannon, Virginia.

Test/Run	Concentration (ppm,d)	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
(Dryer 6/8/93)			
2/1	4.6	0.76	0.08
2/2	7.8	1.29	0.14
2/3	10.1	1.63	0.17
Avg.	7.5	1.23	0.13
(Press 6/10/93)			
8/1	2.4	.89	NA
8/2	2.7	.95	NA
8/3	3.0	1.06	NA
Avg.	2.7	.97	

TFP = Ton Finished Product (9.5 TON/HR 6/8/93)

NA = Not Applicable

Table 7. Summary of the Results of the June 8 and 9, 1993 Total Hydrocarbon Determinations on the Dryer and Press Vent at the Louisiana Pacific Waferboard Plant Located in Dungannon, Virginia.

Test/Run	Time (HRS)	Concentration (ppmC,w)	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
(Dryer 6/8/93)				
3/1	1215-1330	122	9.39	0.99
3/2	1400-1515	137	10.8	1.14
3/3	1536-1641	65	5.19	0.55
Average		108	8.47	0.89
(Press Vent 6/9/93)				
5/1	1120-1220	7.5	1.01	NA
5/2	1233-1333	3.8	0.51	NA
5/3	1350-1450	10.7	1.84	NA
Average		7.0	1.12	

TFP = Ton Finished Product (9.5 TON/HR 6/8/93)

NA = Not Applicable

Table 8. Summary of the June 9, 1993 Phenol Emission Compliance Test on the Press Vent at the Louisiana Pacific Waferboard Plant in Dungannon, Virginia.

Test/Run	Concentration (ppm,d)	Emission Rate (LB/HR)
4/1	.31	.31
4/2	.35	.36
4/3	.31	.40
Avg.	.32	.37

Table 9. Summary of the June 10, 1993 MDI Emission Compliance Test on the Press Vent at the Louisiana Pacific Waferboard Plant in Dungannon, Virginia.

Test/Run	Concentration (ppm,d)	Emission Rate (LB/HR)
9/1	.034	.095
9/2	.035	.098
9/3	.024	.066
9/4	.030	.082
Avg.*	.031	.086

* Average calculated using first three runs only.

Note: The phenol samples were field spiked with 5.33 mg of phenol d5. The average spike recovery was 52%.

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, PM-10, oxides of nitrogen, carbon monoxide, formaldehyde, phenol 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)

	Run 1	Run 2	Run 3
Date of run	06-08-93	06-08-93	06-08-93
Dry basis (orsat)			
carbon dioxide.....	2.80	3.10	2.60
oxygen.....	18.20	17.90	18.40
nitrogen.....	79.00	79.00	79.00
Wet basis (orsat)			
carbon dioxide.....	2.26	2.44	2.11
oxygen.....	14.72	14.11	14.93
nitrogen.....	63.87	62.28	64.11
water vapor.....	19.15	21.17	18.85
Dry molecular weight.....	29.18	29.21	29.15
Wet molecular weight.....	27.04	26.84	27.05
Specific gravity.....	0.934	0.927	0.934
Water mass flow.....(LB/HR)	22147	25088	22637
FO	0.964	0.968	0.962

Test No. 2
Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	06-08-93	06-08-93	06-08-93
Dry basis (orsat)			
carbon dioxide.....	2.35	2.60	3.00
oxygen.....	18.35	18.20	17.90
nitrogen.....	79.30	79.20	79.10
Wet basis (orsat)			
carbon dioxide.....	1.96	2.12	2.36
oxygen.....	15.29	14.83	14.07
nitrogen.....	66.06	64.52	62.19
water vapor.....	16.70	18.53	21.38
Dry molecular weight.....	29.11	29.14	29.20
Wet molecular weight.....	27.25	27.08	26.80
Specific gravity.....	0.941	0.935	0.926
Water mass flow.....(LB/HR)	0.00	0.00	0.00
FO	1.085	1.038	1.000

Test No. 6
Konus Stack

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

	Run 1	Run 2	Run 3
Date of run	06-09-93	06-09-93	06-09-93
Dry basis (orsat)			
carbon dioxide.....	2.35	2.50	2.50
oxygen.....	18.50	18.20	18.30
nitrogen.....	79.15	79.30	79.20
Wet basis (orsat)			
carbon dioxide.....	2.22	2.35	2.33
oxygen.....	17.48	17.08	17.08
nitrogen.....	74.80	74.42	73.91
water vapor.....	5.50	6.15	6.68
Dry molecular weight.....	29.12	29.13	29.13
Wet molecular weight.....	28.50	28.44	28.39
Specific gravity.....	0.985	0.982	0.981
Water mass flow.....(LB/HR)	2171	2419	2651
FO	1.021	1.080	1.040

Test No. 7
Konus Stack

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

	Run 1	Run 2	Run 3
Date of run	06-09-93	06-09-93	06-09-93
Dry basis (orsat)			
carbon dioxide.....	2.40	2.40	2.60
oxygen.....	18.40	18.40	18.10
nitrogen.....	79.20	79.20	79.30
Wet basis (orsat)			
carbon dioxide.....	2.26	2.28	2.47
oxygen.....	17.32	17.49	17.17
nitrogen.....	74.57	75.27	75.25
water vapor.....	5.85	4.96	5.11
Dry molecular weight.....	29.12	29.12	29.14
Wet molecular weight.....	28.47	28.57	28.57
Specific gravity.....	0.983	0.987	0.987
Water mass flow.....(LB/HR)	2359	1994	2056
FO	1.042	1.042	1.077

Test No. 8
Press Vent Stack

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

	Run 1	Run 2	Run 3
Date of run	06-10-93	06-10-93	06-10-93
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.....	20.44	20.30	20.35
nitrogen.....	77.33	76.81	77.00
water vapor.....	2.20	2.86	2.62
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.60	28.53	28.56
Specific gravity.....	0.988	0.986	0.986
Water mass flow.....(LB/HR)	0.00	0.00	0.00

Test No. 9
Press Vent Stack

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

	Run 1	Run 2	Run 3
Date of run	06-10-93	06-10-93	06-10-93
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.....	20.44	20.30	20.14
nitrogen.....	77.33	76.79	76.19
water vapor.....	2.20	2.88	3.64
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.60	28.53	28.45
Specific gravity.....	0.988	0.985	0.983

Test No. 9
Press Vent Stack

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

	Run 4
Date of run	06-10-93
Dry basis (orsat)	
carbon dioxide.....	0.03
oxygen.....	20.90
carbon monoxide.....	0.00
nitrogen.....	79.07
Wet basis (orsat)	
carbon dioxide.....	0.03
oxygen.....	19.95
carbon monoxide.....	0.00
nitrogen.....	75.47
water vapor.....	4.56
Dry molecular weight.....	28.84
Wet molecular weight.....	28.35
Specific gravity.....	0.979

3.2 Results of Particulate Determinations

Test No. 1
Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	06-08-93	06-08-93	06-08-93
Time run start/end.....(HRS)	1220/1321	1400/1512	1536/1641
Static pressure.....(IN.WC)	-0.05	-0.05	-0.05
Cross sectional area (SQ.FT)	12.57	12.57	12.57
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	144.0	167.0	139.0
desiccant.....(GRAMS)	7.0	7.0	11.0
total.....(GRAMS)	151.0	174.0	150.0
Total particulate material..			
.....collected(grams)	0.2226	0.2659	0.1347
Gas meter coefficient.....	0.9997	0.9997	0.9997
Barometric pressure..(IN.HG)	28.80	28.80	28.80
Avg. orif.pres.drop..(IN.WC)	0.88	0.91	0.92
Avg. gas meter temp..(DEF-F)	88.7	96.7	103.0
Volume through gas meter....			
at meter conditions...(CF)	32.41	33.41	33.67
standard conditions.(DSCF)	30.07	30.55	30.44
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.184	.184	.184
Avg.stack gas temp ..(DEG-F)	201	202	200
Volumetric flow rate.....			
actual.....(ACFM)	53613	55029	55626
dry standard.....(DSCFM)	33343	33306	34740
Isokinetic variation.....(%)	102.3	104.1	99.5
Particulate concentration...			
actual.....(GR/ACF)	0.07102	0.08125	0.04262
dry standard.....(GR/DSCF)	0.11424	0.13430	0.06827
Particle mass rate...(LB/HR)	32.648	38.338	20.328

Test No. 7
Konus Stack

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

	Run 1	Run 2	Run 3
Date of run	06-09-93	06-09-93	06-09-93
Time run start/end.....(HRS)	1533/1643	1725/1833	1917/2024
Static pressure.....(IN.WC)	-0.20	-0.20	-0.20
Cross sectional area (SQ.FT)	9.17	9.17	9.17
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	39.0	42.0	45.0
desiccant.....(GRAMS)	19.0	7.0	6.0
total.....(GRAMS)	58.0	49.0	51.0
Total particulate material..			
.....collected(grams)	0.2913	0.1374	0.0832
Gas meter coefficient.....	0.9997	0.9997	0.9997
Barometric pressure..(IN.HG)	28.82	28.82	28.82
Avg. orif.pres.drop..(IN.WC)	1.93	1.92	1.94
Avg. gas meter temp..(DEF-F)	100.8	97.0	94.0
Volume through gas meter....			
at meter conditions...(CF)	48.35	48.29	48.40
standard conditions.(DSCF)	44.03	44.28	44.62
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.303	.303	.303
Avg.stack gas temp ..(DEG-F)	284	284	286
Volumetric flow rate.....			
actual.....(ACFM)	21058	20974	21037
dry standard.....(DSCFM)	13543	13621	13598
Isokinetic variation.....(%)	99.3	99.3	100.2
Particulate concentration...			
actual.....(GR/ACF)	0.06562	0.03108	0.01859
dry standard.....(GR/DSCF)	0.10208	0.04788	0.02877
Particle mass rate...(LB/HR)	11.849	5.590	3.353

3.3 Results of PM-10 Determinations

Test No. 6
Konus Stack

Results of PM-10 Determinations

	Run 1	Run 2	Run 3
Date of run	06-09-93	06-09-93	06-09-93
Time run start/end.....(HRS)	1530/1649	1723/1838	1915/2029
Static pressure.....(IN.WC)	-0.20	-0.20	-0.20
Cross sectional area (SQ.FT)	9.17	9.17	9.17
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	27.0	37.0	36.0
desiccant.....(GRAMS)	14.0	7.0	12.0
total.....(GRAMS)	41.0	44.0	48.0
Total PM-10 material.....			
.....collected(grams)	0.0068	0.0046	0.0052
Gas meter coefficient.....	0.9933	0.9933	0.9933
Barometric pressure..(IN.HG)	28.82	28.82	28.82
Avg. orif.pres.drop..(IN.WC)	0.62	0.61	0.61
Avg. gas meter temp..(DEF-F)	100.2	97.5	94.0
Volume through gas meter....			
at meter conditions...(CF)	36.78	34.88	34.64
standard conditions.(DSCF)	33.21	31.64	31.62
Total sampling time....(MIN)	76.32	72.09	72.37
Nozzle diameter.....(IN)	.232	.232	.232
Avg.stack gas temp ..(DEG-F)	284	284	286
Volumetric flow rate.....			
actual.....(ACFM)	20576	20521	20766
dry standard.....(DSCFM)	13294	13154	13206
Isokinetic variation.....(%)	102.3	104.3	103.4
PM-10 cutpoint.....(um)	9.73	9.60	9.63
PM-10 concentration.....			
actual.....(GR/ACF)	0.00204	0.00144	0.00161
dry standard.....(GR/DSCF)	0.00316	0.00224	0.00254
PM-10 mass rate.....(LB/HR)	0.360	0.253	0.287

3.4 Results of Oxides of Nitrogen Determinations

Test No. 2
Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	06-08-93	06-08-93	06-08-93	06-08-93
Time of run.....(HRS)	920	935	950	1005
Flask number.....	8	9	10	26
Volume of flask.....(ML)	2088	2080	2063	2035
Data: time of sampling				
flask temperature..(DEG-F)	70.00	71.00	71.00	71.00
bar. press.....(IN.HG)	28.80	28.80	28.80	28.80
flask vacuum.....(IN.HG)	26.70	26.90	26.95	26.85
flask abs. press...(IN.HG)	2.10	1.90	1.85	1.95
Data: Time of Flask Opening				
flask temperature..(DEG-F)	78.00	78.00	78.00	78.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	-1.70	-1.30	-0.60	-2.10
flask abs. press...(IN.HG)	27.40	27.80	28.50	27.00
Volume gas sampled....(DSML)	1709	1743	1779	1649
Moisture content.....(%V/V)	16.70	16.70	16.70	16.70
Nitrate in gas sample...(JG)	142.0	80.5	112.0	83.0
NO2 in gas sample.....(JG)	105.4	59.7	83.1	61.6
NOx Concentration				
(GR/DSCF).....	0.0269	0.0150	0.0204	0.0163
(MG/DSCM).....	62	34	47	37
(PPM-DRY).....	32	18	24	20
(PPM-WET).....	27	15	20	16
NOX Emission rate....(LB/HR)	8.10	4.50	6.14	4.91

Test No. 2
Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	06-08-93	06-08-93	06-08-93	06-08-93
Time of run.....(HRS)	1100	1120	1145	1205
Flask number.....	11	12	55	56
Volume of flask.....(ML)	2062	2111	2086	2069
Data: time of sampling				
flask temperature..(DEG-F)	81.00	83.00	88.00	92.00
bar. press.....(IN.HG)	28.80	28.80	28.80	28.80
flask vacuum.....(IN.HG)	26.75	26.85	26.85	26.85
flask abs. press...(IN.HG)	2.05	1.95	1.95	1.95
Data: Time of Flask Opening				
flask temperature..(DEG-F)	78.00	78.00	78.00	78.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	-2.70	-1.50	-2.50	-0.50
flask abs. press...(IN.HG)	26.40	27.60	26.60	28.60
Volume gas sampled....(DSML)	1627	1756	1668	1789
Moisture content.....(%V/V)	18.53	18.53	18.53	18.53
Nitrate in gas sample...(JG)	102.0	102.0	80.0	90.0
NO2 in gas sample.....(JG)	75.7	75.7	59.4	66.8
NOx Concentration				
(GR/DSCF).....	0.0203	0.0188	0.0156	0.0163
(MG/DSCM).....	47	43	36	37
(PPM-DRY).....	24	23	19	20
(PPM-WET).....	20	18	15	16
NOX Emission rate....(LB/HR)	6.18	5.72	4.72	4.96

Test No. 2
Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	06-08-93	06-08-93	06-08-93	06-08-93
Time of run.....(HRS)	1320	1335	1355	1415
Flask number.....	57	58	59	60
Volume of flask.....(ML)	2062	2085	2077	2066
Data: time of sampling				
flask temperature..(DEG-F)	92.00	92.00	92.00	93.00
bar. press.....(IN.HG)	28.80	28.80	28.80	28.80
flask vacuum.....(IN.HG)	26.90	26.90	26.85	26.90
flask abs. press...(IN.HG)	1.90	1.90	1.95	1.90
Data: Time of Flask Opening				
flask temperature..(DEG-F)	78.00	78.00	78.00	78.00
lab. bar. press....(IN.HG)	29.10	29.10	29.10	29.10
flask static press.(IN.HG)	-2.90	-2.00	-0.50	0.00
flask abs. press...(IN.HG)	26.20	27.10	28.60	29.10
Volume gas sampled....(DSML)	1626	1705	1796	1824
Moisture content.....(%V/V)	21.38	21.38	21.38	21.38
Nitrate in gas sample...(JG)	75.5	64.0	92.0	78.0
NO2 in gas sample.....(JG)	56.0	47.5	68.3	57.9
NOx Concentration				
(GR/DSCF).....	0.0151	0.0122	0.0166	0.0139
(MG/DSCM).....	34	28	38	32
(PPM-DRY).....	18	15	20	17
(PPM-WET).....	14	11	16	13
NOX Emission rate....(LB/HR)	4.44	3.59	4.90	4.09

3.5 Results of Carbon Monoxide Determinations

Test No. 1
Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	06-08-93	06-08-93	06-08-93
Time run start/end.....(HRS)	1220-1321	1400-1512	1536-1641
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	19.15	21.17	18.85
O2 Concentration.....(%V/V)	18.20	17.90	18.40
Volumetric flow rate (DSCFM)	33343	33306	34740
CO concentration.....			
(GR/DSCF).....	0.0857	0.1079	0.0460
(MG/DSCM).....	196.19	246.98	105.32
(PPM-WET).....	136.15	167.12	73.36
(PPM-DRY).....	168.40	212.00	90.40
(PPM-DRY @ 7% O2).....	842.00	957.42	486.77
CO emission rate.....(LB/HR)	24.489	30.795	13.697

CO = Carbon monoxide

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

3.6 Results of Formaldehyde Determinations

Test No. 2
Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	06-08-93	06-08-93	06-08-93
Time run start/end.....(HRS)	857/1027	1057/1227	1310/1436
Static pressure.....(IN.WC)	0.08	0.08	0.08
Cross sectional area (SQ.FT)	12.57	12.57	12.57
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	181.0	221.0	260.0
desiccant.....(GRAMS)	11.0	8.0	15.0
total.....(GRAMS)	192.0	229.0	275.0
Formaldehyde in sample..(uG)	7354	13000	17000
Gas meter coefficient.....	0.9933	0.9933	0.9933
Barometric pressure..(IN.HG)	28.80	28.80	28.80
Avg. orif.pres.drop..(IN.WC)	1.02	1.14	1.16
Avg. gas meter temp..(DEF-F)	79.9	87.8	94.0
Volume through gas meter....			
at meter conditions...(CF)	48.20	51.37	52.18
standard conditions.(DSCF)	45.16	47.46	47.67
Total sampling time....(MIN)	84.00	84.00	84.00
Nozzle diameter.....(IN)	.193	.193	.193
Avg.stack gas temp ..(DEG-F)	199	200	203
Volumetric flow rate.....			
actual.....(ACFM)	54620	56534	57100
dry standard.....(DSCFM)	35080	35448	34444
Isokinetic variation.....(%)	94.9	98.6	102.0
CH2O concentration.....			
(GR/DSCF).....	0.0025	0.0042	0.0055
(MG/DSCM).....	5.77	9.70	12.64
(PPM-DRY).....	4.62	7.77	10.12
(PPM-WET).....	3.85	6.33	7.96
CH2O emission rate...(LB/HR)	0.75705	1.28743	1.62871

Test No. 8
Press Vent Stack

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

	Run 1	Run 2	Run 3
Date of run	06-10-93	06-10-93	06-10-93
Time run start/end.....(HRS)	842/ 946	1010/1120	1142/1252
Static pressure.....(IN.WC)	-0.99	-0.99	-0.99
Cross sectional area (SQ.FT)	19.31	19.31	19.31
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	7.0	15.0	15.0
desiccant.....(GRAMS)	15.0	13.0	11.0
total.....(GRAMS)	22.0	28.0	26.0
Formaldehyde in sample..(uG)	3954	4254	4754
Gas meter coefficient.....	0.9933	0.9933	0.9933
Barometric pressure..(IN.HG)	28.89	28.89	28.89
Avg. orif.pres.drop..(IN.WC)	2.07	1.99	2.04
Avg. gas meter temp..(DEF-F)	77.2	85.0	90.6
Volume through gas meter....			
at meter conditions...(CF)	48.73	48.11	49.06
standard conditions.(DSCF)	46.16	44.91	45.61
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.187	.187	.187
Avg.stack gas temp ..(DEG-F)	90	95	99
Volumetric flow rate.....			
actual.....(ACFM)	86102	84617	85800
dry standard.....(DSCFM)	77874	75303	76040
Isokinetic variation.....(%)	100.1	100.7	101.3
CH2O concentration.....			
(GR/DSCF).....	0.0013	0.0015	0.0016
(MG/DSCM).....	3.04	3.36	3.72
(PPM-DRY).....	2.44	2.69	2.98
(PPM-WET).....	2.38	2.62	2.90
CH2O emission rate...(LB/HR)	0.88652	0.94774	1.05957

3.7 Results of Phenol Determinations

Test No. 4
Press Vent Stack

Results of Phenol Determinations ----------

	Run 1	Run 2	Run 3
Date of run	06-09-93	06-09-93	06-09-93
Time run start/end.....(HRS)	1030-1130	1138-1238	1248-1348
Barometric pressure..(IN.HG)	28.82	28.82	28.82
Meter temperature....(DEG-F)	80.62	92.16	97.70
Meter correction coefficient	0.9933	0.9933	0.9933
Volume through gas meter....			
at meter conditions...(CF)	47.300	47.960	48.540
standard conditions (DSCF)	44.402	44.081	44.171
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	3.99	4.21	4.21
Volumetric flow rate (DSCFM)	69000	70000	88000
Phenol in sample.....(uG)	1500.00	1700.00	1500.00
Phenol concentration.....			
(GR/10^{3}DSCF).....	0.5213	0.5951	0.5240
(uG/DSCM).....	1194	1363	1200
(PPB-DRY).....	305	348	307
(PPB-WET).....	293	334	294
Phenol emis. rate(10^{-3}LB/HR)	308.272	357.022	395.218

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

Analysis performed according to NIOSH Method 3502

3.8 Results of MDI Determinations

Test No. 9
Press Vent Stack

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

	Run 1	Run 2	Run 3
Date of run	06-10-93	06-10-93	06-10-93
Time run start/end.....(HRS)	938/1043	1105/1208	1230/1333
Static pressure.....(IN.WC)	-0.99	-0.99	-0.99
Cross sectional area (SQ.FT)	19.31	19.31	19.31
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	5.0	11.0	7.0
desiccant.....(GRAMS)	15.0	15.0	26.0
total.....(GRAMS)	20.0	26.0	33.0
MDI in sample.....(UG)	420	430	290
Gas meter coefficient.....	0.9997	0.9997	0.9997
Barometric pressure..(IN.HG)	28.89	28.89	28.89
Avg. orif.pres.drop..(IN.WC)	1.68	1.66	1.67
Avg. gas meter temp..(DEF-F)	81.7	91.0	97.2
Volume through gas meter....			
at meter conditions...(CF)	44.32	44.53	44.90
standard conditions.(DSCF)	41.86	41.35	41.23
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.185	.185	.185
Avg.stack gas temp ..(DEG-F)	95	98	99
Volumetric flow rate.....			
actual.....(ACFM)	79831	80579	80922
dry standard.....(DSCFM)	71601	71263	70924
Isokinetic variation.....(%)	100.9	100.1	100.3
MDI Concentration.....(PPM DRY)	0.034	0.035	0.024
MDI Emission Rate.....(LB/HR)	0.095	0.098	0.066

Test No. 9
Press Vent Stack

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

	Run 4
Date of run	06-10-93
Time run start/end.....(HRS)	1405/1506
Static pressure.....(IN.WC)	0.00
Cross sectional area (SQ.FT)	19.31
Pitot tube coefficient.....	.840
Water in sample gas	
condenser.....(ML)	0.0
impingers.....(GRAMS)	7.0
desiccant.....(GRAMS)	35.0
total.....(GRAMS)	42.0
MDI in sample.....(UG)	360
Gas meter coefficient.....	0.9997
Barometric pressure..(IN.HG)	28.89
Avg. orif.pres.drop..(IN.WC)	1.70
Avg. gas meter temp..(DEF-F)	100.3
Volume through gas meter....	
at meter conditions...(CF)	45.41
standard conditions.(DSCF)	41.47
Total sampling time....(MIN)	60.00
Nozzle diameter.....(IN)	.185
Avg.stack gas temp ..(DEG-F)	100
Volumetric flow rate.....	
actual.....(ACFM)	82064
dry standard.....(DSCFM)	71105
Isokinetic variation.....(%)	100.6
MDI concentration.....(PPM DRY)	0.030
MDI emission rate.....(LB/HR)	0.082

4 RESULTS OF FUEL ANALYSES

INTERPOLL LABORATORIES, INC.
Fuel Laboratory
(612) 786-6020

6/30/93

Client : LOUISIANNA PACIFIC/DUNGANNON

Laboratory Log Number : 9053-88-4725

Sample Identification : SAWDUST

Short Proximate Analysis WT %

Parameter	Moisture & Ash Free	Moisture Free	As Received
Moisture, Total			3.99
Ash		1.73	1.66
Sulfur	0.34	0.34	0.32
Heating Value, BTU/LB.	4869	4785	4594

Respectfully submitted,

Jeannie F. O'Neil, Manager
Inorganic Chemistry Group

INTERPOLL LABORATORIES, INC.
Fuel Laboratory
(612) 786-6020

6/30/93

Client : LOUISIANNA PACIFIC/DUNGANNON

Laboratory Log Number : 9053-89-4726

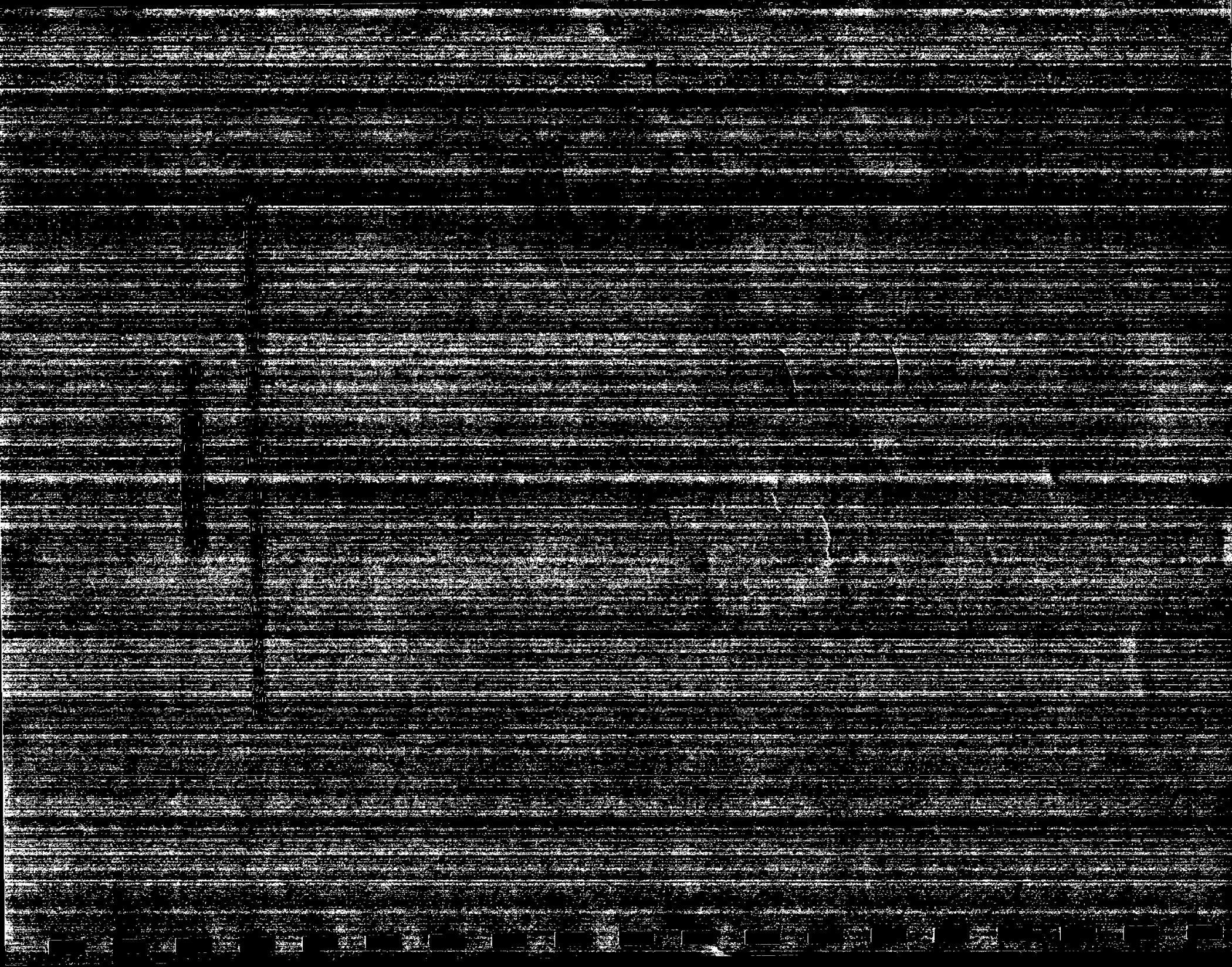
Sample Identification : BARK

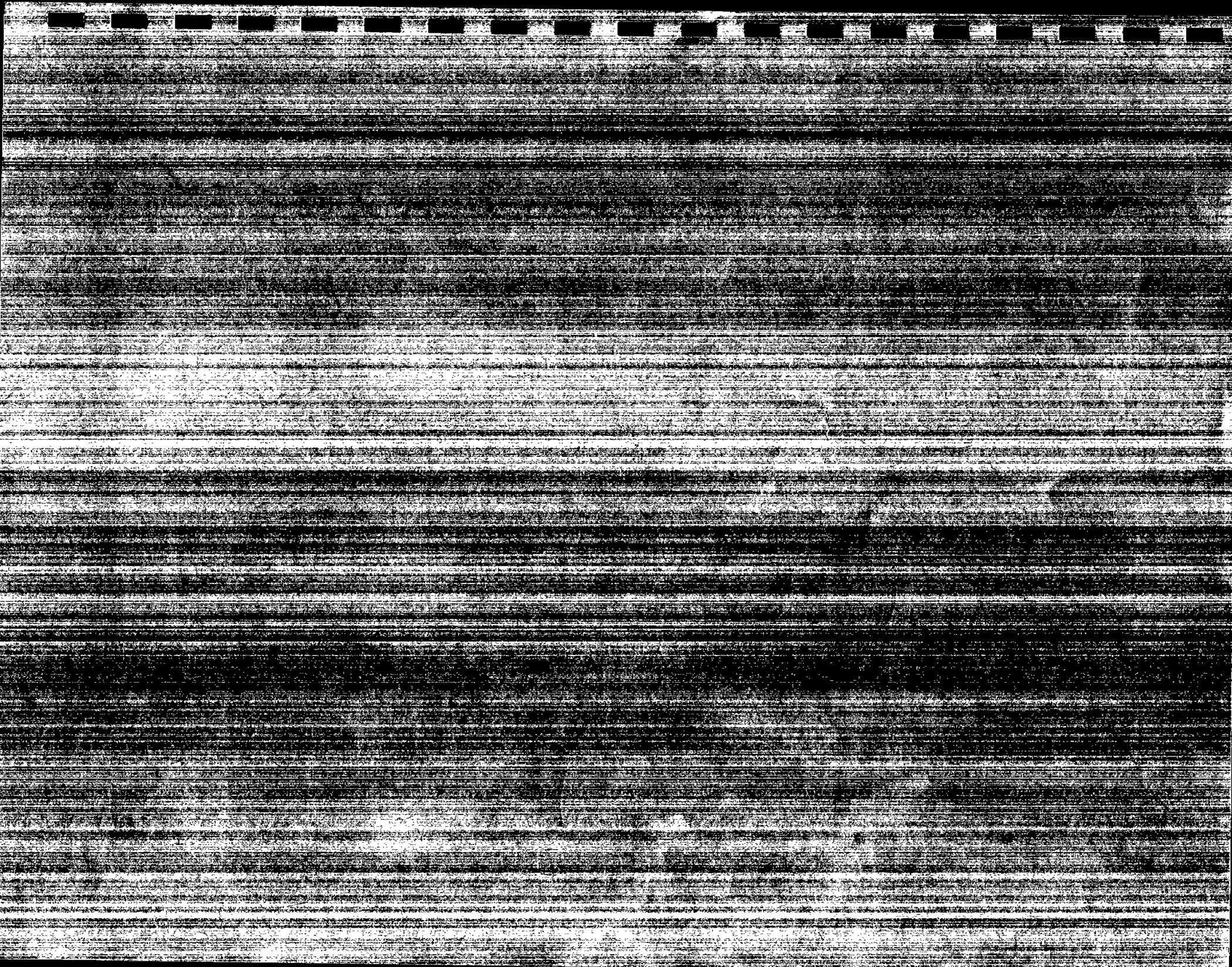
Short Proximate Analysis WT %

Parameter	Moisture & Ash Free	Moisture Free	As Received
Moisture, Total			44.38
Ash		9.27	5.16
Sulfur	0.35	0.31	0.17
Heating Value, BTU/LB.	8536	7744	4307

Respectfully submitted,

Jeannie F. O'Neil, Manager
Inorganic Chemistry Group





Test No. 1
Dryer Stack

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

Date of Determination.....	06-08-93
Time of Determination.....(HRS)	800
Barometric pressure.....(IN.HG)	28.8
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	48
Duct area.....(SQ.FT)	12.57
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.05
Avg. gas temp.....(DEG-F)	201
Moisture content.....(% V/V)	19.15
Avg. linear velocity.....(FT/SEC)	70.5
Gas density.....(LB/ACF)	.05398
Molecular weight.....(LB/LBMOLE)	29.18
Mass flow of gas.....(LB/HR)	172185
Volumetric flow rate.....	
actual.....(ACFM)	53166
dry standard.....(DSCFM)	33048

Test No. 5
Press Vent Stack

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

Date of Determination.....	06-09-93
Time of Determination.....(HRS)	1140
Barometric pressure.....(IN.HG)	28.82
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	59.5
Duct area.....(SQ.FT)	19.31
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.95
Avg. gas temp.....(DEG-F)	101
Moisture content.....(% V/V)	3.99
Avg. linear velocity.....(FT/SEC)	69.0
Gas density.....(LB/ACF)	.06672
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	320131
Volumetric flow rate.....	
actual.....(ACFM)	79970
dry standard.....(DSCFM)	69438

Test No. 5
Press Vent Stack

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

Date of Determination.....	06-09-93
Time of Determination.....(HRS)	1250
Barometric pressure.....(IN.HG)	28.82
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	59.5
Duct area.....(SQ.FT)	19.31
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.95
Avg. gas temp.....(DEG-F)	100
Moisture content.....(% V/V)	4.21
Avg. linear velocity.....(FT/SEC)	69.2
Gas density.....(LB/ACF)	.06678
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	321461
Volumetric flow rate.....	
actual.....(ACFM)	80226
dry standard.....(DSCFM)	69626

Test No. 5
Press Vent Stack

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

Date of Determination.....	06-09-93
Time of Determination.....(HRS)	1415
Barometric pressure.....(IN.HG)	28.82
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	59.5
Duct area.....(SQ.FT)	19.31
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.95
Avg. gas temp.....(DEG-F)	100
Moisture content.....(% V/V)	4.21
Avg. linear velocity.....(FT/SEC)	87.2
Gas density.....(LB/ACF)	.06678
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	405017
Volumetric flow rate.....	
actual.....(ACFM)	101079
dry standard.....(DSCFM)	87724

Test No. 6
Konus Stack

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

Date of Determination.....	06-09-93
Time of Determination.....(HRS)	1437
Barometric pressure.....(IN.HG)	28.82
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	41
Duct area.....(SQ.FT)	9.17
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.2
Avg. gas temp.....(DEG-F)	280
Moisture content.....(% V/V)	5.50
Avg. linear velocity.....(FT/SEC)	37.4
Gas density.....(LB/ACF)	.05085
Molecular weight.....(LB/LBMOLE)	29.12
Mass flow of gas.....(LB/HR)	62844
Volumetric flow rate.....	
actual.....(ACFM)	20599
dry standard.....(DSCFM)	13371

Test No. 7
Konus Stack

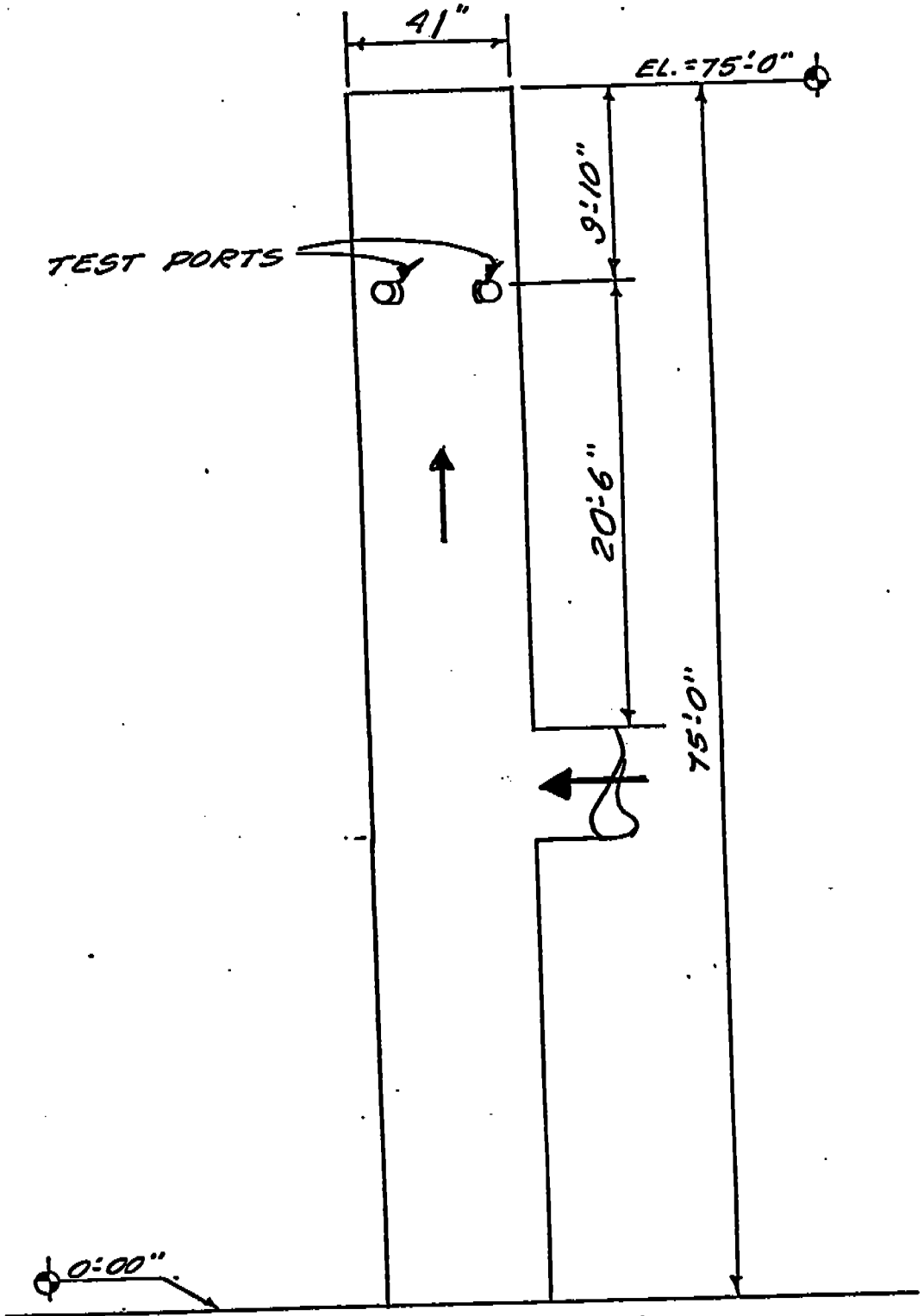
Results of Volumetric Flow Rate Determination--------Method 2

Date of Determination.....	06-09-93
Time of Determination.....(HRS)	1507
Barometric pressure.....(IN.HG)	28.82
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	41
Duct area.....(SQ.FT)	9.17
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.2
Avg. gas temp.....(DEG-F)	282
Moisture content.....(% V/V)	5.85
Avg. linear velocity.....(FT/SEC)	39.0
Gas density.....(LB/ACF)	.05065
Molecular weight.....(LB/LBMOLE)	29.12
Mass flow of gas.....(LB/HR)	65191
Volumetric flow rate.....	
actual.....(ACFM)	21452
dry standard.....(DSCFM)	13837

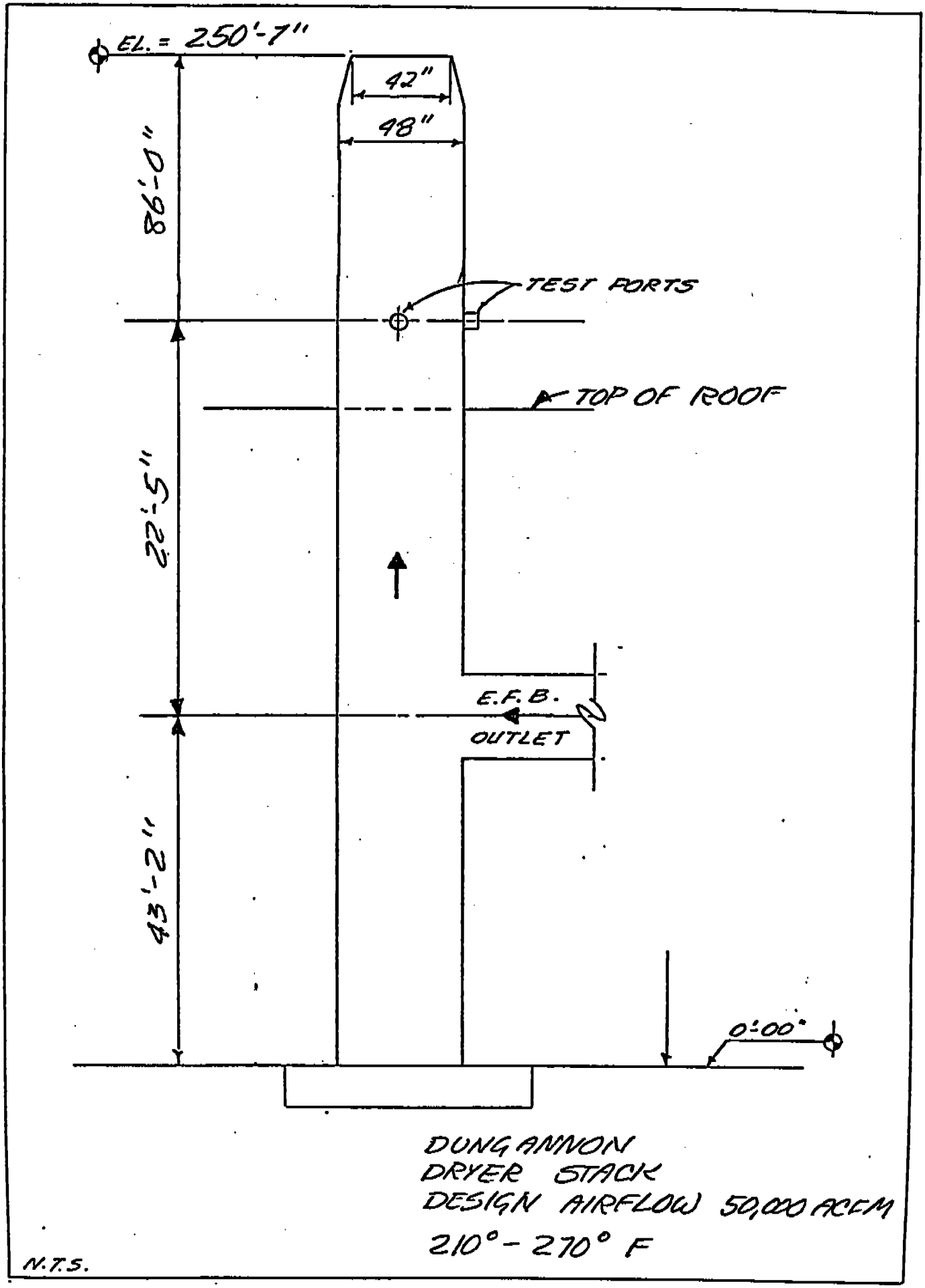
Test No. 9
Press Vent Stack

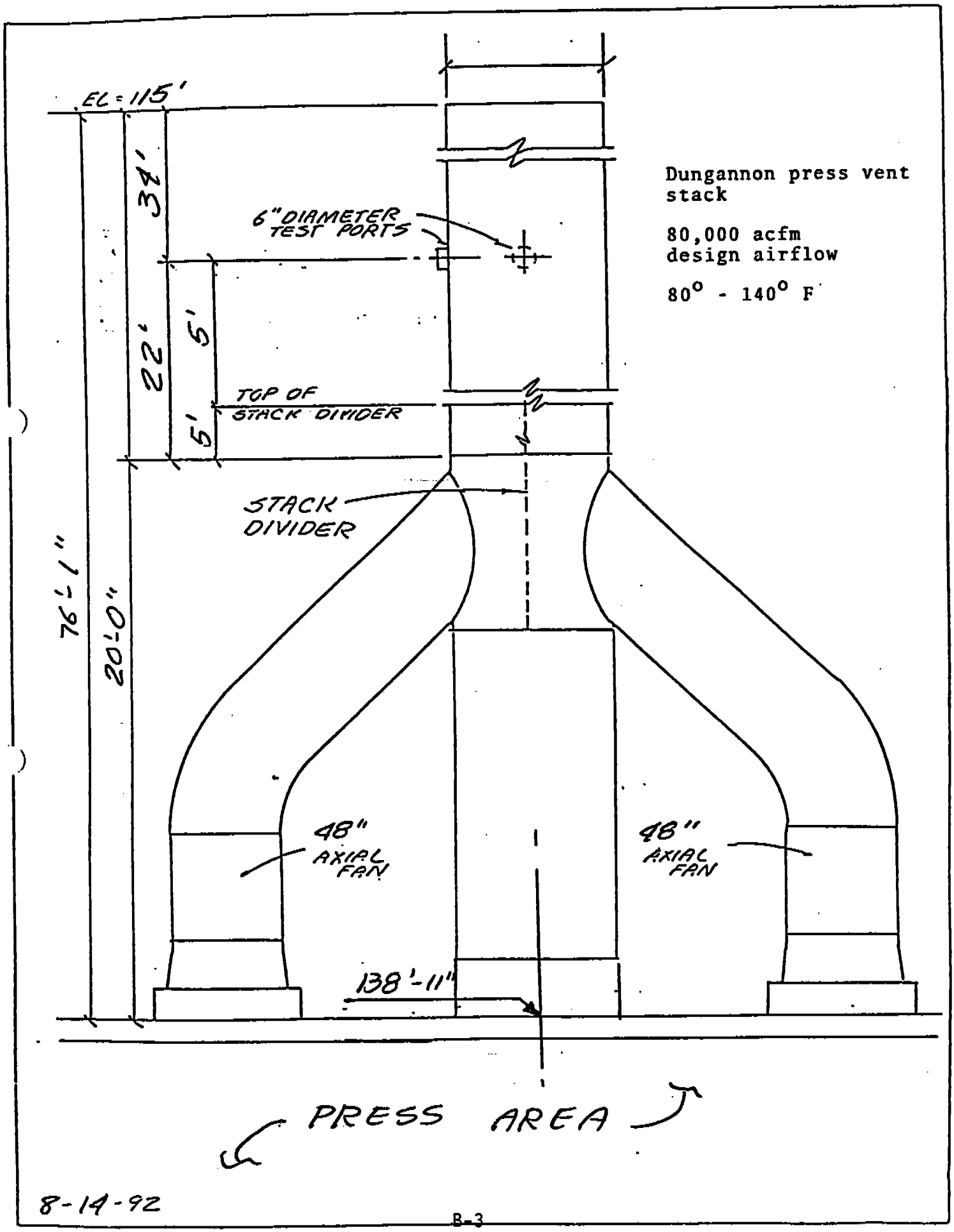
Results of Volumetric Flow Rate Determination-------Method 2

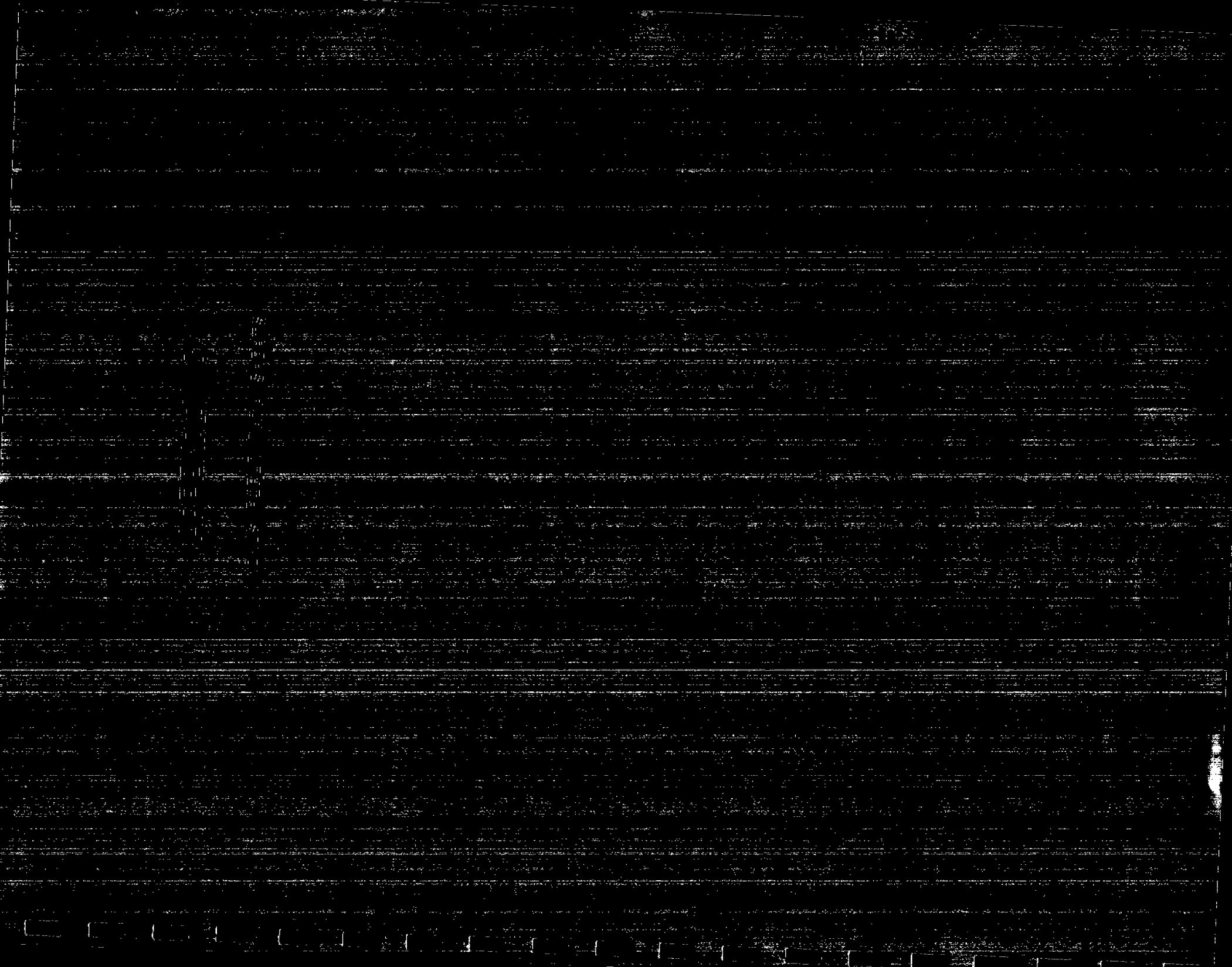
Date of Determination.....	06-10-93
Time of Determination.....(HRS)	900
Barometric pressure.....(IN.HG)	28.89
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	59.5
Duct area.....(SQ.FT)	19.31
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.99
Avg. gas temp.....(DEG-F)	89
Moisture content.....(% V/V)	2.20
Avg. linear velocity.....(FT/SEC)	68.6
Gas density.....(LB/ACF)	.06880
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	328048
Volumetric flow rate.....	
actual.....(ACFM)	79467
dry standard.....(DSCFM)	71988

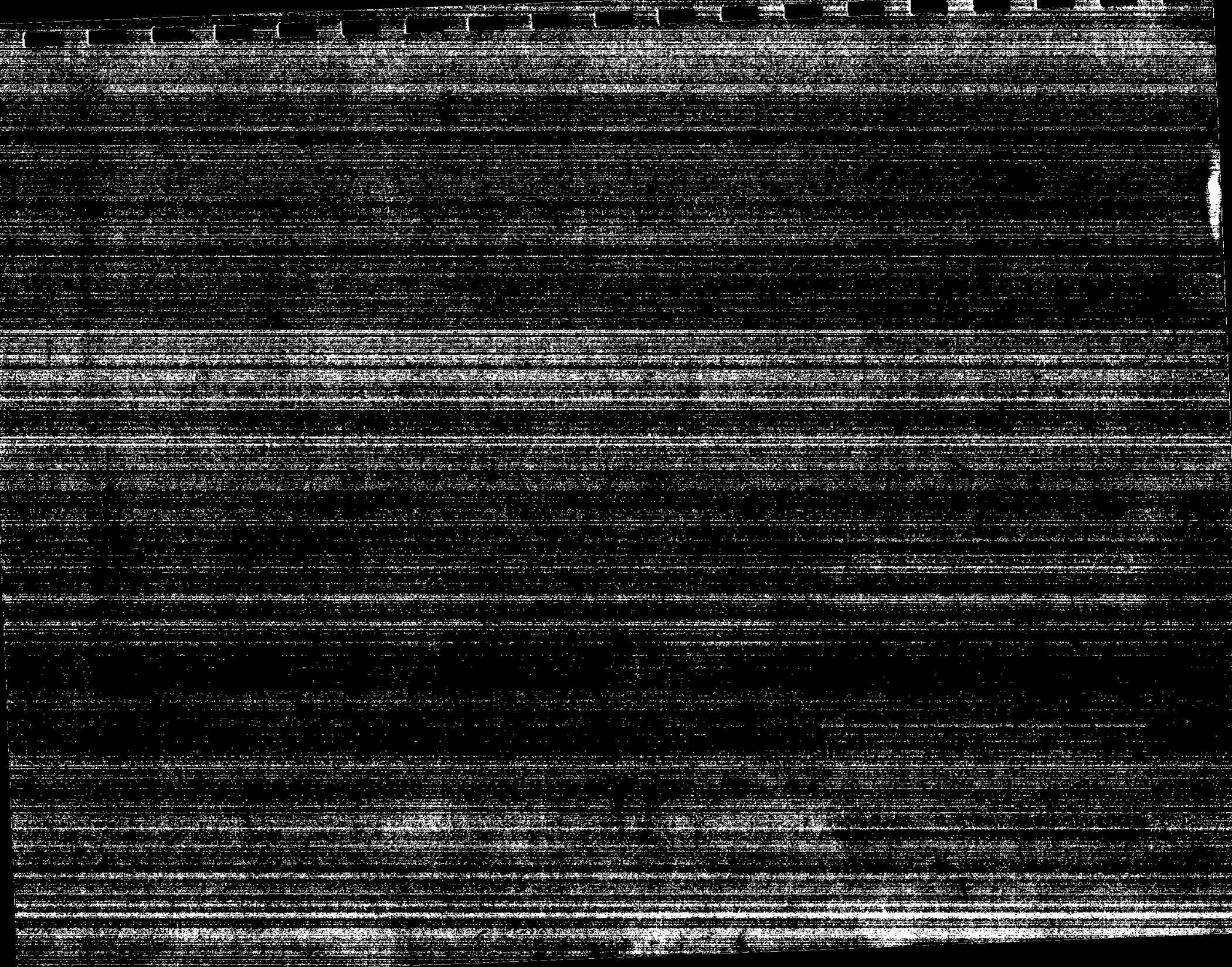


DUNGANNON
THERMAL OIL HEATER STACK
32,600 ACFM
250° - 350° f


EL. = 250'-7"
42"
48"
86'-0"
TEST PORTS
TOP OF ROOF
22'-5"
E.F.B.
OUTLET
43'-2"
0'-00"
DUNGANNON
DRYER STACK
DESIGN AIRFLOW 50,000 ACFM
210° - 270° F
N.T.S.

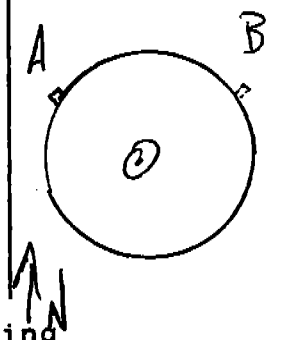

EL = 115'
34'
22'
5'
5'
6" DIAMETER TEST PORTS
TOP OF STACK DIVIDER
STACK DIVIDER
76'-1"
20'-0"
48" AXIAL FAN
48" AXIAL FAN
138'-11"
PRESS AREA
Dungannon press vent stack
80,000 acfm design airflow
80° - 140° F
8-14-92





INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P / DUNGANNON
Source KONUS STACK
Test 6 Run 1 Date 6/9/93
Stack dimen. 41 IN.
Dry bulb ____ °F Wet bulb ____ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.82 in Hg
Static pressure -.20 in WC
Operators D. VAN Hoever + J. Bergstrom
Pitot No. PM-10-4 Cp .84
PM-10

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: 8 in.		Time start: 1437 hrs	
A	1	.044	1.804	9.804	.24
	2	.146	5.986	13.986	.27
	3	.296	12.136	20.136	30
	4	.704	28.864	36.864	.31
	5	.854	35.014	43.014	.34
	6	.956	39.196	47.196	.32
B	1				.30
	2				35
	3				.34
	4				.30
	5				.29
	6				.27
Temp. meas. device & S/N: PDT #18 & #1				Time end: 1447 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / DUNGANNON Date 6/9/93 Test 6 Run 1
Source KONUS STACK No. of traverse points 12
Method 201A Filter holder: ERC Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 5 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: DVH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	227	200	27
Impinger No. 3			
Condenser			
Desiccant	1414	1400	14
Total			41

Integrated Gas Sampling Data:

Bag Pump No. B6 Box No. 15 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1535 (HRS) Time end: 1649 (HRS)
Sampling rate: 300 cc/min Operator: DVH
S/N of O_2 Analyzer used to monitor train outlet: 3

CF-023

[redacted]

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / DUNGANNON
Source KONUS STACK
Date 6/9/93 Test 6 Run 1

Operators DVH & J.B
Meter Box No. 9 ΔH 1.86 IN WC
Coeff. .9933

Pitot No. PM-10-5' Cp .84
Bar. Press. 28.82 inHg H2O 6 %
Nozzle No. PM-10-7 Nozzle Dia .232 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.	Cyc/In	Cyc/Out	Oxygen (v/v)
	1520	260.90											
A 6	6.57	264.04	.32	.61	6.57	2	280	253	257	46	95	95	18.5
5	13.14	267.15	.32	.61	6.57	2	281				97	96	19.1
4	19.51	270.24	.30	.61	6.36	2	281				99	96	19.3
3	25.76	273.15	.29	.62	6.25	2	287	236	263	46	101	97	18.2
2	32.02	276.10	.29	.62	6.25	2	286				102	98	19.4
1	38.06	279.10	.27	.62	6.03	2	284				103	98	19.0
B 6	43.99	282.00	.26	.62	5.92	2	284				102	99	18.9
5	50.24	284.97	.29	.62	6.25	2	283	251	264	46	104	100	18.5
4	56.61	288.01	.30	.62	6.36	2	281				105	100	19.0
3	63.39	291.39	.34	.62	6.77	2	281				105	101	19.1
2	69.96	294.57	.32	.62	6.57	2	287	254	260	47	106	101	18.4
1	76.32	297.68	.30	.62	6.36	2	287				106	101	18.4
	(1649)												
	θ = 76.32	Vm =		ΔH = .62							Avg. =	100.2	

C-3

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / DUNGANNON Date 6/9/93 Test 6 Run 2
Source KONUS STACK No. of traverse points 12
Method 201 A Filter holder: ERC Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☐
Postest: 0 cfm at 5 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: DHH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		200	
Impinger No. 2	237		37
Impinger No. 3			
Condenser			
Desiccant	1455	1448	7
Total			44

Integrated Gas Sampling Data: B6

Bag Pump No. B6 Box No. 15 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1726 (HRS) Time end: 1838 (HRS)
Sampling rate: 300 cc/min Operator: DHH
S/N of O_2 Analyzer used to monitor train outlet: 3

CF-023

[redacted] CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P/Dungannon
Source KoNus Stack
Date 6/9/93 Test 6 Run 2

Operators DVH + J.B
Meter Box No. 9 ΔH 1.86 IN WC
Coumpter coeff. .9933

Pitot No. PM-10-5' Cp .84
Bar. Press. 28.82 inHg H2O 6 X
Nozzle No. PM-10-7 Nozzle Dia .232 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dry. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xv/v)
	1723	297.81											
A 6	5.62	300.52	.26	.61	5.62	2	281	254	263	46	97	96	18.5
5	11.45	303.32	.28	.61	5.83	2	280				99	97	18.6
4	17.39	306.17	.29	.61	5.93	2	281	255	261	46	99	96	19.4
3	23.62	309.23	.32	.61	6.23	2	285				99	96	20.3
2	30.05	312.37	.34	.62	6.42	2	287				100	96	20.0
1	36.09	315.29	.30	.61	6.03	2	287	260	264	46	100	96	18.3
B 6	42.32	318.29	.32	.61	6.23	2	287				98	96	18.1
5	48.46	321.26	.31	.61	6.13	2	281				99	96	18.0
4	54.50	324.19	.30	.61	6.03	2	286				99	96	18.3
3	60.54	327.10	.30	.61	6.03	2	286	263	264	46	99	96	18.6
2	66.47	330.00	.29	.61	5.93	2	285				100	96	18.5
1	72.09	332.69	.26	.61	5.62	2	285				100	96	18.3
	(1838)												
	θ = 72.09	Vm = 34.88		ΔH = .61							Avg. = 97.5		

C-5

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P / DUNGANNON Date 6/9/93 Test 6 Run 3
Source KONUS STACK No. of traverse points 12
Method 201A 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: Recovery solvent(s)

☒ acetone
☐ other(s)

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		200	
Impinger No. 2	236		36
Impinger No. 3			
Condenser			
Desiccant	MRO	1408	12
Total			48

Integrated Gas Sampling Data:

Bag Pump No. B6 Box No. 15 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 14 in. Hg.
Time start: 1920 (HRS) Time end: 2029 (HRS)
Sampling rate: 300 cc/min Operator: DVH
S/N of O_2 Analyzer used to monitor train outlet: 3

CF-023

[redacted] CF-[redacted]

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. DUNGANNON
Source KONUS STACK
Date 6/9/93 Test 6 Run 3

Operators DVA & J.B
Meter Box No. 9 ΔH 1.86 IN WC
Coeffic. .993

Pitot No. Pm-10-5 Cp .84
Bar. Press. 28.52 inHg H2O @ °F
Nozzle No Pm-10-7 Nozzle Dia .232 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 (v/v)
	1915	332.90			6.20	2	282	253	254	45	92	91	18.3
A 6	6.20	335.85	.32	.60	6.2	2	282				93	92	19.7
5	12.40	338.77	.32	.61	6.1	2	282				94	92	18.7
4	18.51	341.65	.32	.61	6.1	2	289				95	92	17.7
3	24.62	344.53	.31	.61	5.80	2	288	254	257	46	96	92	18.9
2	30.42	347.36	.28	.61	5.69	2	285				96	92	17.9
1	36.12	350.12	.27	.61	6.10	2	285				96	92	19.3
B 6	42.22	353.04	.31	.61	6.30	2	288	256	259	49	97	93	18.8
5	48.52	356.05	.33	.61	6.20	2	286				97	93	19.0
4	54.73	359.04	.32	.61	6.10	2	285				97	93	19.6
3	60.83	361.90	.31	.61	5.90	2	288				97	93	18.0
2	66.74	364.80	.29	.61	5.59	2	288				98	93	19.5
1	72.33	367.54	.26	.61									
	(2029)												
	θ = 72.37	Vm = 34.64		ΔH = .61							Avg. = 94		

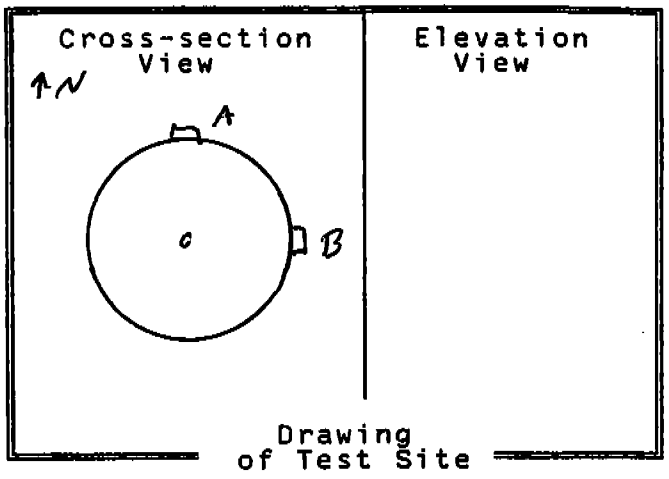
C-7

S-0037R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job 9053
Source Konus / Stack
Test 2 Run 0 Date 6-9-93
Stack dimen. 41 IN.
Dry bulb 102 °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.82 in Hg
Static pressure -.20 in WC
Operators M. Kuehler + J. Bergstrom
Pitot No. 24V-4 C_p .84

Particulate



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: 8 in.		Time start: 1507 hrs	
A-1	.044	1.80	9.80	.27	
2	.146	5.99	13.99	.28	
3	.296	12.14	20.14	.31	
4	.704	28.86	36.86	.33	282
5	.854	35.01	43.01	.33	
6	.956	39.20	47.20	.34	
B-1				.36	
2				.38	
3				.35	282
4				.35	
5				.32	
6				.30	
Temp. meas. device & S/N: PDT-19 / TC				Time end: 1515 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-9-93 Test 2 Run 1
Source Kenus / Stack No. of traverse points 12
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: ≥ 0.02 cfm at 14 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5330

Recovery solvent(s)
☒ acetone D.W.
☒ other(s) MeCl₂ Impinger Rinse

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler + J. Bergstrom

Condensate Data:

pH ~5

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	546	507	39
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1472	1453	19
Total			58

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 18 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 15 in. Hg.
Time start: 1533 (HRS) Time end: 1643 (HRS)
Sampling rate: 400 cc/min Operator: M. Kaehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job 9053
Source Roaus / Stack
Date 6-9-93 Test 2 Run 1

Operators M. Kaehler / J. Bergstrom
Meter Box No. 8 ΔH 1.82 ΔH WC
Coeffic. coeff. .9997

Pitot No. 296-4 Cp .84
Bar. Press. 28.62 inHg HZD 6 x
Nozzle No. B-5 Nozzle Dia .303 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)
	1533	264.50			8.53	10	280	249	263	47	94	94	18.0
B-1	5	268.47	.33	1.98	2.83	11	281	250	265	47	96	95	18.9
2	10	272.75	.36	2.20	7.01	11.5	281	250	261	46	98	95	18.1
3	15	276.92	.34	2.09	1.45	13	281	255	257	44	100	97	18.7
4	20	281.39	.38	2.33	5.32	10	286	252	256	44	101	97	18.6
5	25	285.29	.29	1.78	9.07	9	285	256	255	44	104	98	18.3
6	30	289.13	.27	1.66	2.69	7.5	285	253	257	45	101	99	18.8
A-1	35	292.70	.25	1.54	6.51	8	289	255	253	45	105	100	18.5
2	40	296.45	.28	1.71	0.56	9.5	281	251	255	47	107	101	18.4
3	45	300.51	.31	1.93	4.68	10	283	249	255	47	109	102	19.0
4	50	304.62	.32	1.99	8.86	10.5	286	249	256	48	110	103	18.7
5	55	308.80	.33	2.05	2.93	10	287	253	255	48	110	104	17.9
6	60	312.85	.31	1.92									
	(1643)												
	θ = 60	Vm = 48.35		ΔH 1.93							Avg. = 100.8		

C-10

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-9-93 Test 1 Run 2
Source Kanus / Stack No. of traverse points 12
Method 5 Filter holder: 4"Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: ≥0.02 cfm at 14 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5337

Recovery solvent(s)
☒ acetone D.I.W.
☒ other(s) MeCl₂ / Impinger Rinse

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler & J. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	542	500	42
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1410	1403	7
Total			49

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 18 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 15 in. Hg.
Time start: 1725 (HRS) Time end: 1933 (HRS)
Sampling rate: 400 cc/min Operator: M. Kaehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job 9053
Source Kaneb 1 Stack
Date 6-9-93 Test 2 Run 2

Operators M. Kaehler & S. Bergstrom
Meter Box No. 4 ΔH 1.92 TA WC
Cacaster coeff. .9997

Pitot No. 290-4 Cp .84
Bar. Press. 28.82 inHg H2O 5.8 %
Nozzle No. B-5 Nozzle Dia .303 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 (x v/v)
	1725	313.20											
B-1	5	316.93	.27	1.68	6.97	8	281	258	253	45	94	94	18.8
2	10	320.76	.29	1.78	0.84	9	280	257	255	45	98	95	18.0
3	15	324.87	.33	2.04	4.98	11	281	253	258	45	100	96	18.2
4	20	329.07	.33	2.03	9.12	11	285	249	258	46	101	96	19.1
5	25	333.25	.34	2.09	3.33	11.5	286	252	261	46	101	96	20.0
6	30	337.40	.33	2.03	7.46	11.5	287	250	263	46	102	96	18.9
A-1	35	341.53	.33	2.03	1.61	12	287	247	260	46	95	94	18.6
2	40	345.73	.34	2.09	5.79	12	281	247	262	48	97	94	18.1
3	45	350.01	.35	2.15	0.04	12	282	249	263	48	99	95	17.7
4	50	353.90	.28	1.72	3.85	9.5	286	245	260	49	100	94	18.6
5	55	357.75	.29	1.78	2.73	9.5	286	248	258	49	100	95	18.6
6	60	361.49	.27	1.66	1.47	9	285	248	255	51	101	95	18.5
	(1833)												
	θ = 60	Vm = 48.29		ΔH 1.92							Avg. = 97.0		

C-12

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-9-93 Test 7 Run 3
Source Kraus No. of traverse points 12
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: <0.02 cfm at 14 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5338

Recovery solvent(s)
☒ acetone R.W.
☒ other(s) MeCl₂ / Impinger Rinse

No. of probe wash bottles: 1
Sample recovered by: M. Koehler + J. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	545	500	45
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1420	1414	6
Total			51

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 18 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 15 in. Hg.
Time start: 1917 (HRS) Time end: 2024 (HRS)
Sampling rate: 400 cc/min Operator: M. Koehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job 9053
Source Kanus / stack
Date 6-9-93 Test 2 Run 3

Operators M. Kaehler & S. Bergstrom
Meter Box No. 6 ΔH 1.82 IN WC
Barometer coeff. .9997

Pitot No. 290-4 Cp .84
Bar. Press. 28.82 inHg H2O 5 %
Nozzle No. B-5 Nozzle Dia .303 IN.

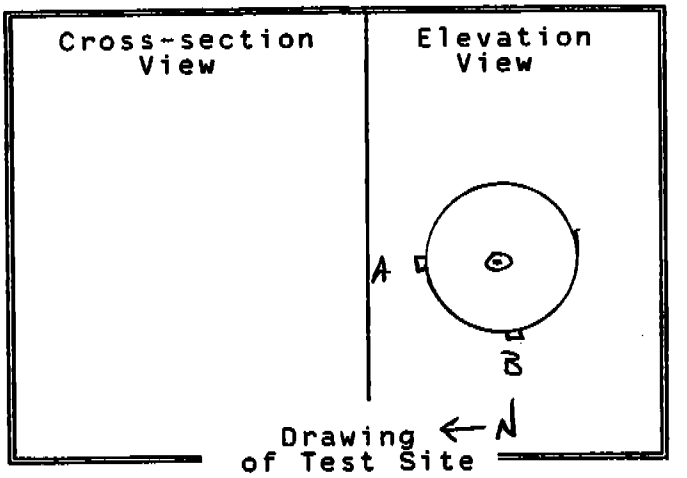
Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (xx/y)
	(1917)	361.80											
B-1	5	365.72	.30	1.89	5.80	8.5	282	247	260	48	90	89	18.5
2	10	369.87	.34	2.09	8.97	11	284	251	262	46	93	90	19.3
3	15	374.02	.34	2.08	4.14	11	289	252	258	46	94	91	19.0
4	20	378.14	.33	2.03	8.26	11	289	255	255	47	96	91	17.9
5	25	382.10	.29	1.81	2.15	10.5	280	251	257	47	96	92	17.0
6	30	385.94	.27	1.67	5.89	9	287	248	253	47	97	92	18.9
A-1	35	389.86	.29	1.80	9.78	9.5	285	245	250	49	98	92	17.9
2	40	393.76	.30	1.86	3.73	9.5	285	249	255	49	97	92	18.9
3	45	397.90	.34	2.10	7.92	11	289	252	260	51	99	93	18.5
4	50	402.17	.35	2.17	2.20	12	287	249	263	52	99	93	18.5
5	55	406.27	.33	2.04	6.34	12	287	248	257	52	99	93	19.0
6	60	410.20	.28	1.73	0.16	11	290	245	253	52	99	93	18.6
	(2024)												
	θ = 60	Vm = 48.40		^H 1.94							Avg. =	94.0	

C-14



INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Donganno2
Source Press Vent Stack
Test 4 Run ___ Date 6/9/98
Stack dimen. 59.5 IN.
Dry bulb ___ °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.82 in Hg
Static pressure ___ in WC
Operators D. Van Hoeven & J. Bergstrom
Pitot No. V23-6 Cp .84
Phenols



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: 6.25 in.		Time start:	hrs
A #1	.021	1.25	7.5		
2	.067	3.99	10.24		
3	.118	7.02	13.27		
4	.177	10.53	16.78		
5	.250	14.88	21.13		
6	.356	21.18	27.43		
7	.644	38.31	44.56		
8	.750	44.62	50.87		
9	.823	48.96	55.22		
10	.882	52.47	58.73		
11	.933	55.51	61.76		
12	.979	58.25	64.50		
1					
2					
3					
4					
5					
6	1/6	9.92	16.17		
7	3/6	29.75	36.00		
8	5/6	49.58	56.08		
9					
10					
11					
12					
Temp. meas. device & S/N: PDT #18				Time end:	hrs

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P./DUNGANNON Date 6/9/93 Test 4 Run 1
Source PRESS VENT STACK No. of traverse points 3
Method _____ 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: _____ _____

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		200	
Impinger No. 2	203		3
Impinger No. 3			
Condenser			
Desiccant	1401	1384	17
Total			20

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

Phenol Field Data Sheet

Job L.P. / DUNGANNON
Source PRESS VENT STACK
Date 6/9/93 Test 4 Run 1

Operator(s) D. VAN Hoever & J. BERGSTROM
Meter Box No. 9 Meter coef. 1.9933
Barometric Pressure 28.82 in.Hg

Sample Train Leak Check:
Pretest: 0 cfm/min at 14 in.Hg
Posttest: 0 cfm/min at 11 in.Hg

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Sample Rate (AH	VAC. (inHg)	Temperature (oF)		
					Stack	Gasmeter IN	Gasmeter OUT
	1030	116.00					
A 3	5	119.85	1.80	10	94	74	74
3	10	123.78	1.80	10		75	74
3	15	127.68	1.80	10		78	75
3	20	131.65	1.80	10		80	76
2	25	135.54	1.80	10	92	82	77
2	30	139.44	1.80	10		83	78
2	35	143.41	1.80	10		85	80
2	40	147.30	1.80	10	94	86	81
1	45	151.35	1.80	10		87	81
1	50	155.33	1.80	10		87	81
1	55	159.34	1.80	10		88	82
1	60	163.30	1.80	10	98	88	83
	θ=60	Vm=47.30					tm=80.62

(1130)

MC = 2.08

S-476

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. Dungannon Date 6/9/93 Test 4 Run 2
Source Press Vent Stack No. of traverse points 3
Method _____ Filter holder: glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 13 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: _____ _____

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	174	172	2
Impinger No. 2	174	169	5
Impinger No. 3			
Condenser			
Desiccant	1469	1457	12
Total			19

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

Phenol Field Data Sheet

Job L.P. / Dungannon
Source Press Vent Stack
Date 6/9/93 Test 4 Run 2

Operator(s) D. VanHoover & J. Bergstrom
Meter Box No. 9 Meter coef. 1.9933
Barometric Pressure 28.82 in.Hg

Sample Train Leak Check:
Pretest: 0 cf/min at 15 in.Hg
Posttest: 0 cf/min at 12 in.Hg

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Sample Rate ("ΔH)	VAC. (inHg)	Temperature (oF)		
					Stack	GASMETER IN	Gasmeter OUT
	1138	163.60					
3	5	167.43	1.80	10	90	87	85
3	10	171.37	1.80	10		90	86
2	15	175.32	1.80	10		92	86
3	20	179.33	1.80	10		93	87
2	25	183.31	1.80	10	94	95	88
2	30	187.31	1.80	10		96	88
2	35	191.31	1.80	10		97	89
2	40	195.37	1.80	10		98	91
1	45	199.46	1.80	10	102	98	91
1	50	203.50	1.80	10		99	91
1	55	207.51	1.80	10		99	93
1	60	211.56	1.80	10		100	93
	θ= 60	Vm= 47.96					tm= 92.16

(1238)

MC = 1.99

S-476

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dungannon Date 6/9/93 Test 4 Run 3
Source Press Vent Stack No. of traverse points - 3
Method _____ Filter holder: glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 14 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: _____ _____

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. A	173	173	-
Impinger No. B	167	200 164	3
Impinger No. 3			
Condenser			
Desiccant	1418	1401	17
Total			20

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

Phenol Field Data Sheet

Job L.P. Dungannon
Source Pitts Vent Stack
Date 6/9/93 Test 4 Run 3

Operator(s) D. Van Hoever
Meter Box No. 9 Meter coef. .9933
Barometric Pressure 28.82 in.Hg

Sample Train Leak Check:
Pretest: <0.02 cf/min at 15 in.Hg
Posttest: <0.02 cf/min at 17 in.Hg

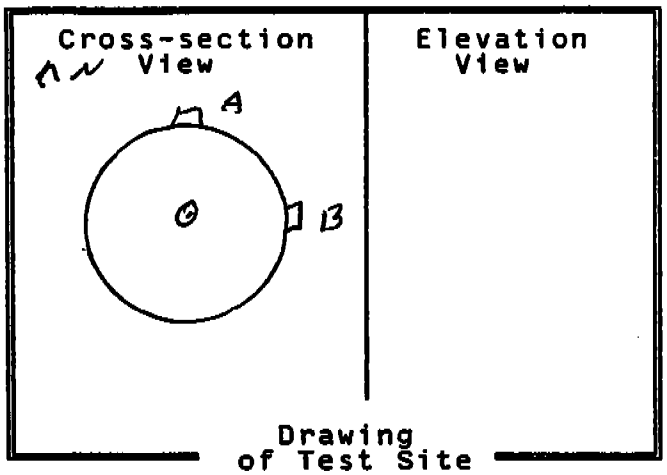
Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Sample Rate ($\frac{1}{\Delta H}$)	VAC. (inHg)	Temperature (oF)		
					Stack	GASMETER IN	Gasmeter OUT
	1248	212.00					
A 3	5	216.00	1.80	10	100	95	92
3	10	220.00	1.80	10	100	98	93
3	5	224.00	1.80	10	101	100	94
3	20	228.05	1.80	10	101	100	95
2	25	232.09	1.80	10	100	101	95
2	30	236.12	1.80	10	100	101	95
2	35	240.18	1.80	10	100	101	96
2	40	244.23	1.80	10	100	101	96
1	45	248.29	1.80	10	100	102	96
1	50	252.40	1.80	10	100	102	97
1	55	256.46	1.80	10	100	102	97
1	60	260.54	1.80	10	100	101	97
	θ=1351	Vm=48.54					tm=97.70

MC = 2.09

S-476

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job 9053
Source Press Vent / Stack
Test 5 Run 1 Date 6-9-93
Stack dimen. 59.5 IN.
Dry bulb 101 °F Wet bulb 87 °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.02 in Hg
Static pressure -.95 in WC
Operators M. Kuehler & J. Bergstrom
Pitot No. 29V-5 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: 6.25 in.		Time start: 1140 hrs	
A-1	.021	1.25	7.5	1.23	
2	.067	3.99	10.24	1.43	
3	.118	7.02	13.27	1.35	
4	.177	10.53	16.78	1.30	
5	.250	14.88	21.13	1.09	
6	.356	21.18	27.43	1.10	
7	.644	38.31	49.56	1.15	
8	.750	44.62	50.87	1.30	
9	.823	48.96	55.22	1.35	
10	.882	52.47	58.73	1.35	↑
11	.933	55.51	61.76	1.45	
12	.979	58.25	64.50	1.40	101
B-1				1.15	↓
2				1.58	
3				1.63	
4				1.68	
5				1.53	
6				1.50	
7				1.50	
8				1.47	
9				1.40	
10				1.43	
11				1.33	
12				1.30	

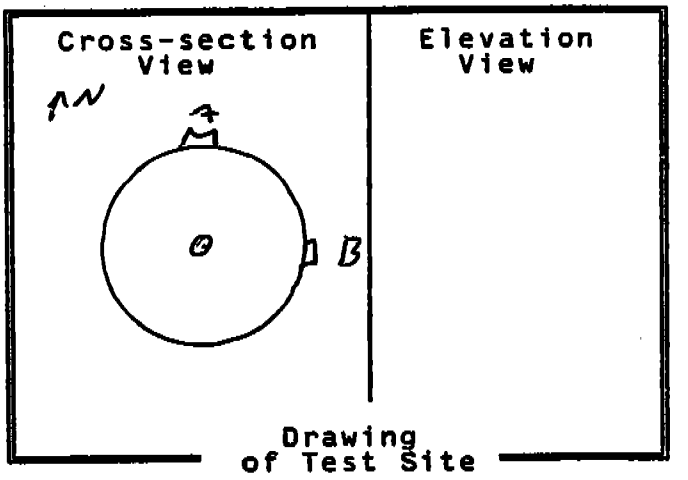
Temp. meas. device & S/N: PDT-14/TC
Time end: 1144 hrs

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

S-3921

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job 9053
Source Press Vent / Stack
Test 5 Run 2 Date 6-9-93
Stack dimen. 59.5 IN.
Dry bulb 100 °F Wet bulb 88 °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.82 in Hg
Static pressure _____ in WC
Operators M. Kaehler & J. Bergstrom
Pitot No. 29V-5 C_p .84

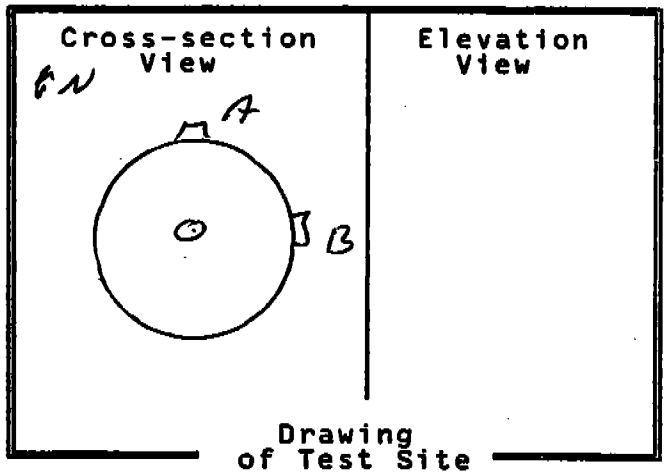


Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 6.25 in.		Time start: 1250 hrs	
A-1				1.27	
2				1.38	
3	Refer	to 5/1		1.38	
4				1.33	
5				1.10	
6				1.05	
7				1.11	
8				1.27	
9				1.33	↑
10				1.35	
11				1.38	100
12				1.41	
B-1				1.42	↓
2				1.11	
3				1.50	
4				1.60	
5				1.65	
6				1.50	
7				1.53	
8				1.52	
9				1.48	
10				1.37	
11				1.40	
12				1.27	
Temp. meas. device & S/N: PDT-19/TC				Time end: 1256 hrs	

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

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job 9053
Source Press Vent / Stack
Test 5 Run 3 Date 6-9-93
Stack dimen. 59.5 IN.
Dry bulb 100 °F Wet bulb 88 °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.82 in Hg
Static pressure _____ in WC
Operators M. Kaehler & J. Bergstrom
Pitot No. 29U-5 C_p .84



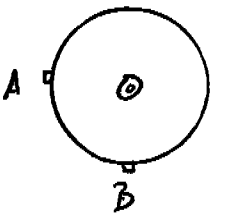
Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 6.25 in.		Time start: 1415 hrs	
A-1				1.20	
2				1.35	
3				1.35	
4	Meter	to 5/1		1.27	
5				1.13	
6				1.05	
7				1.11	
8				1.33	
9				1.37	↑
10				1.35	100
11				1.48	
12				1.42	↓
B-1				1.20	
2				1.55	
3				1.65	
4				1.71	
5				1.50	
6				1.52	
7				1.55	
8				1.44	
9				1.37	
10				1.27	
11				1.30	
12				1.28	
Temp. meas. device & S/N: PDT-19 / TC				Time end: 1419 hrs	

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

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P / Dungannon
Source Press Vent Stack
Test 8 Run ___ Date 6/10/93
Stack dimen. 59.5 IN.
Dry bulb ___ °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.89 in Hg
Static pressure -.99 in WC
Operators D. VanHoever & J. Bergstrom
Pitot No. V29-6 C_p .84

Cross-section View | Elevation View



Drawing of Test Site

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: 6.25 in.		Time start:	hrs
A 1	.021	1.25	7.5		
2	.067	3.99	10.24		
3	.118	7.02	13.27		
4	.177	10.53	16.78		
5	.250	14.88	21.13		
6	.356	21.18	27.43		
7	.644	38.31	44.56		
8	.750	44.62	50.87		
9	.823	48.96	55.22		
10	.882	52.47	58.73		
11	.933	55.51	61.76		
12	.979	58.25	64.50		
B 1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Temp. meas. device & S/N: PDT #18				Time end:	hrs

D-11 R or nothing (reg.) manometer; S= expanded; E=electronic S-3921

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. DUNGANNON Date 6/10/93 Test 8 Run 1
Source PRESS 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 8.5 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		200	
Impinger No. 2	207		7
Impinger No. 3			
Condenser			
Desiccant	1459	1444	15
Total			22

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-011

INTERPOLE LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / Dungannon
Source Press Vent Stack
Date 6/10/93 Test 8 Run 1

Operators DWK / J.B
Meter Box No. 9 ΔH 1.86 IN WC
Coeff. .9933

Pitot No. V29-6 Cp .84
Bar. Press. 28.89 inHg H2O ± X
Nozzle No. Glass Nozzle Dia .187 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 (xx/x)
	0842	377.72			0.00	8	87	253	260	40	70	70	AMBIENT
A 12	2.5	380.00	2.10	2.67	0.01	8	87				70	70	AIR
11	5	382.33	2.05	2.60	2.28	8	87				73	71	↓
10	7.5	384.60	1.85	2.35	4.44	8	87				74	71	
9	10	386.60	1.70	2.16	6.51	7	89	260	262	43	76	72	
8	12.5	388.53	1.55	1.97	8.49	7	89				77	72	
7	15	390.43	1.45	1.84	0.41	6	91				78	73	
6	17.5	392.54	1.50	1.91	2.37	7	90	258	260	43	79	73	
5	20	394.53	1.65	2.11	4.42	7	90				80	74	
4	22.5	396.61	1.70	2.17	6.51	7	90				80	74	
3	25	398.67	1.60	2.06	8.54	7	88				80	74	
2	27.5	400.36	1.20	1.54	0.30	6	90	260	256	43	81	74	
1	30	402.30	1.10	1.41	1.99	6	89				78	74	
B 12	32.5	404.00	1.40	1.80	3.89	6	89				80	75	
11	35	405.99	1.70	2.19	5.98	7	86	262	254	46	81	75	
10	37.5	408.16	1.80	2.31	8.14	7	88				82	76	
9	40	410.25	1.85	2.38	0.33	7	88				83	76	
8	42.5	412.53	1.85	2.37	2.51	7	88				84	77	
7	45	414.60	1.70	2.18	4.66	7	91	260	257	46	85	77	
6	47.5	416.60	1.50	1.93	6.58	7	91				85	78	
5	50	418.60	1.50	1.93	8.56	7	91				85	78	
4	52.5	420.69	1.60	2.06	0.60	7	92				86	79	
3	55	422.66	1.60	2.05	2.64	7	93	264	256	47	86	79	
2	57.5	424.66	1.60	2.05	4.68	7	94				86	79	
1	60	426.45	1.20	1.54	6.45	7	96						
	(0946)												
	θ = 60	Vm = 48.73		ΔH = 2.07							Avg. = 77.2		

D-13

S-0037R

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dungannon Date 6/10/93 Test 8 Run 2
Source Press 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 6 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: DVH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	215	200	15
Impinger No. 3			
Condenser			
Desiccant	1470	1457	13
Total			28

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 / DUNGANNON
Source PRESS VENT STACK
Date 6/10/93 Test 8 Run 2

Operators DWH & JB
Meter Box No 9 ΔH 1.86 TN WC
Cannister coeff. .9935

Pitot No. V29-6 Cp .84
Bar. Press. 28.87 inHg H2O 2 x
Nozzle No. C1655 Nozzle Dia .187 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.	Out/In	Out/Out	Oxygen (x v/v)
	1010	426.75					93	253	249	46	78	78	AMBIENT
A 12	2.5	429.05	2.10	2.67	9.06	7					81	80	AIR
11	5	431.40	2.10	2.68	1.38	7	93				83	79	
10	7.5	433.60	1.90	2.42	3.59	7	96				84	80	
9	10	435.78	1.6	2.05	5.62	7	93	257	260	47	85	80	
8	12.5	437.71	1.50	1.92	7.60	7	95				86	80	
7	15	439.70	1.45	1.87	9.55	7	92				87	81	
6	17.5	441.50	1.45	1.86	1.49	7	94	256	261	48	88	81	
5	20	443.49	1.45	1.87	3.44	7	94				88	82	
4	22.5	445.47	1.55	2.0	5.46	7	93				89	82	
3	25	447.56	1.60	2.07	7.51	7	93	260	263	49	87	82	
2	27.5	449.50	1.60	2.07	9.57	7	94				88	82	
1	30	451.25	1.0	1.28	1.19	7	97				88	83	
B 12	32.5	453.16	1.45	1.86	3.14	7	97	262	263	50	89	83	
11	35	455.15	1.40	1.80	5.05	7	97				90	84	
10	37.5	457.25	1.75	2.24	7.20	7	94				86	83	
9	40	459.20	1.70	2.20	9.32	7	94	264	259	51	88	84	
8	42.5	461.17	1.60	2.06	1.37	7	94				89	84	
7	45	463.28	1.50	1.94	3.36	7	94				90	85	
6	47.5	465.40	1.45	1.87	5.32	7	95	263	261	50	91	85	
5	50	467.23	1.40	1.80	7.24	7	100				91	85	
4	52.5	469.27	1.50	1.94	9.23	7	97				92	86	
3	55	471.39	1.60	2.06	1.28	7	98				92	86	
2	57.5	473.30	1.55	2.0	3.31	7	98				92	86	
1	60	474.8	86	1.11	4.82	5	99						
	1120												
	θ = 60	Vm = 48.11		ΔH = 1.99							Avg. = 85.0		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. Dungannon Date 6/10/93 Test 8 Run 3
Source Press 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: DVH

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	215	200	15
Impinger No. 3			
Condenser			
Desiccant	1353	1341	11
Total			26

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. / DUNGANNON
Source Press Vent Stack
Date 6/10/93 Test 8 Run 3

Operators D.V.H & J.B
Meter Box No. 9 ΔH 1.86 IN WC
Counter coeff. .9933

Pitot No. V29-6 Cp .84
Bar. Press. 28.87 inHg H2O = X
Nozzle No. 6/55 Nozzle Dia .187 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 (v/v)
	1142	475.10											
A-12	2.5	477.50	2.10	2.69	7.43	9	98	261	257	49	84	84	Ambient
11	5	479.81	2.10	2.69	9.77	2	97				87	85	AIR
10	7.5	482.10	1.90	2.43	2.00	7	99				89	85	↓
9	10	484.15	1.70	2.18	4.10	7	100	256	260	51	90	86	
8	12.5	486.17	1.55	2.0	6.13	7	98				91	86	
7	15	488.20	1.45	1.86	8.08	7	98				92	87	
6	17.5	490.18	1.45	1.88	0.05	7	96	260	261	52	93	87	
5	20	492.20	1.50	1.94	2.05	7	98				93	88	
4	22.5	494.16	1.60	2.07	4.11	7	98				94	88	
3	25	496.17	1.60	2.07	6.18	7	98	262	260	53	94	88	
2	27.5	498.16	1.45	1.87	8.14	7	100				95	89	
1	30	499.90	1.0	1.29	9.78	5	100				95	89	
B-12	32.5	501.81	1.35	1.75	1.65	7	100				90	88	
11	35	503.90	1.65	2.14	3.78	7	96	263	260	50	91	88	
10	37.5	505.90	1.75	2.26	5.93	7	97				93	89	
9	40	508.10	1.70	2.20	8.06	7	97				94	89	
8	42.5	510.20	1.75	2.27	0.22	7	98	264	261	51	94	89	
7	45	512.36	1.60	2.08	2.30	7	96				95	90	
6	47.5	514.40	1.45	1.88	4.27	7	99				96	90	
5	50	516.48	1.5	1.95	6.27	7	99	260	257	50	96	90	
4	52.5	518.41	1.50	1.94	8.28	7	101				97	91	
3	55	520.43	1.65	2.12	0.37	7	105				97	91	
2	57.5	522.42	1.60	2.07	2.42	7	102				97	91	
1	60	524.16	.96	1.24	4.05	5	103				97	91	
	1252												
	θ = 60	Vs = 49.06		ΔH = 2.09							Avg. = 90.6		

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job 9053

Source Press Vent / Stack

Test 9 Run 0 Date 6-10-93

Stack dimen. 59.5 IN.

Dry bulb 89 °F Wet bulb ___ °F

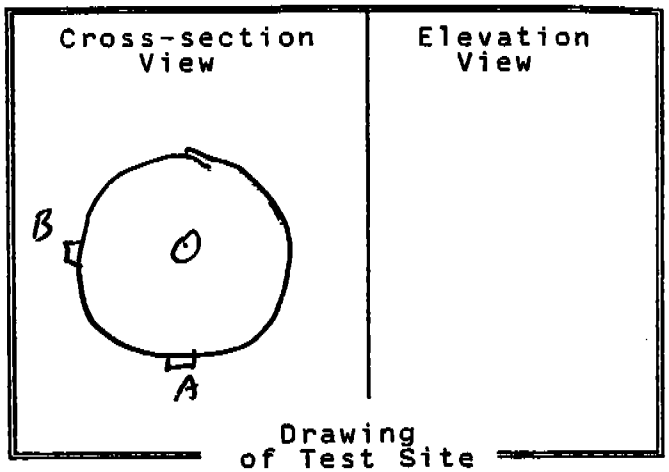
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 28.89 in Hg

Static pressure -.99 in WC

Operators M. Koehler & J. Bergstrom

Pitot No. MDI 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: 6.25 in.		Time start: 0900 hrs	
A-1	.021	1.25	7.50	1.25	
2	.067	3.99	10.24	1.30	
3	.118	7.02	13.27	1.36	
4	.177	10.53	16.78	1.44	
5	.250	14.88	21.13	1.12	
6	.356	21.18	27.43	1.15	
7	.644	38.31	49.56	1.30	
8	.750	44.62	50.87	1.33	
9	.823	48.96	55.22	1.47	↑
10	.882	52.47	58.73	1.45	
11	.933	55.51	61.76	1.44	89
12	.979	58.25	64.50	1.43	↓
B-1				1.10	
2				1.55	
3				1.50	
4				1.48	
5				1.52	
6				1.47	
7				1.45	
8				1.43	
9				1.40	
10				1.33	
11				1.30	
12				1.37	
Temp. meas. device & S/N: PDT-19/TC				Time end: 0907 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-10-93 Test 9 Run 1
Source Press Vent / Stack No. of traverse points 24
Method MD1 Filter holder: ERC Filter type: Treated G.F.

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: ≤0.02 cfm at 4 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: M. Kuebler + J. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	5	0	5
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1385	1370	15
$MeCl_2$ Rinse	253	191	62
Total			20

Integrated Gas Sampling Data: NA / Ambient

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 9053
Source Press Vent / Stack
Date 6-10-93 Test 4 Run 1

Operators M. Koehler & S. Bergstrom
Meter Box No. B (X) RH 1.82 TN DC
Barometer coeff. .9997

Pitot No. M01 Cp .84
Bar. Press. 28.89 inHg H2O 1 X
Nozzle No. B-3 Nozzle Dia .185 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 (xx/v)
	0938	418.60											
A-12	2.5	420.31	1.20	1.45	0.30	2	88	Ambient		48	71	70	20.9
11	5	422.15	1.45	1.74	2.17	2.5	93				74	71	20.9
10	7.5	423.91	1.34	1.61	3.97	2.5	95			48	76	72	20.9
9	10	425.66	1.29	1.55	5.74	2	96				79	73	20.9
8	12.5	427.37	1.14	1.37	7.40	2	96			47	80	74	20.9
7	15	429.01	1.12	1.35	9.06	2	96				81	75	20.9
6	17.5	430.71	1.18	1.43	0.77	2	96			47	83	75	20.9
5	20	432.53	1.32	1.61	2.58	2.5	94				84	76	20.9
4	22.5	434.42	1.39	1.69	4.43	2.5	95			47	85	76	20.9
3	25	436.22	1.39	1.69	6.29	2.5	97				86	77	20.9
2	27.5	438.13	1.43	1.74	8.18	2.5	97			49	86	78	20.9
1	30	440.03	1.45	1.77	0.08	2.5	96				87	78	20.9
B-1	32.5	441.76	1.10	1.34	1.74	2	96			49	86	78	20.9
2	35	443.68	1.54	1.89	3.70	3	93				88	80	20.9
3	37.5	445.68	1.65	2.02	5.74	3	94			46	89	80	20.9
4	40	447.72	1.60	1.97	7.75	3	94				90	81	20.9
5	42.5	449.64	1.48	1.82	9.69	3	93			46	90	81	20.9
6	45	451.61	1.50	1.84	1.64	3	95				91	82	20.9
7	47.5	453.53	1.47	1.82	3.58	3	92			46	91	82	20.9
8	50	455.46	1.45	1.79	5.50	3	92				91	82	20.9
9	52.5	457.35	1.42	1.75	7.40	2.5	94			47	92	83	20.9
10	55	459.22	1.30	1.61	9.23	2.5	94				92	83	20.9
11	57.5	461.02	1.30	1.60	1.05	2.5	96			47	89	83	20.9
12	60	462.92	1.45	1.78	2.96	2.5	96	↓	↓		90	83	209
	(1043)												
	θ = 60	Vm = 44.32		ΔH 1.68							Avg. = 91.7		

Down 1039
Up 1039

D-20

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-10-93 Test 9 Run 2
Source Press Vent / Stack No. of traverse points 24
Method MDI Filter holder: ERC Filter type: Treated C.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0.02 cfm at 5 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: M. Kaehler & J. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	11	0	11
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1487	1472	15
$MeCl_2$ Rinse	239	186	53
Total			26

Integrated Gas Sampling Data: NA / Ambient

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 9053
Source Press Vent / Stack
Date 6-10-93 Test 4 Run 2

Operators M. Kuehler + S. Barnstorm
Meter Box No. 8 ΔH 1.82 TN WC
Counter coeff. .9991

Pitot No. M01 Cp .84
Bar. Press. 28.85 inHg H2O 2 x
Nozzle No. B-3 Nozzle Dia .185 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)
	(1105)	463.14											
A- 1	2.5	464.80	1.18	1.42	4.84	2	95	Ambient		48	83	81	20.9
2	5	466.71	1.51	1.80	6.76	2.5	100				86	82	20.9
3	7.5	468.62	1.48	1.77	8.66	2.5	100			49	90	83	20.9
4	10	470.54	1.44	1.73	0.56	2.5	98				90	84	20.9
5	12.5	472.33	1.35	1.63	2.39	2	98			49	92	84	20.9
6	15	474.12	1.30	1.57	4.19	2	98				92	85	20.9
7	17.5	475.98	1.30	1.57	6.00	2	98			50	94	85	20.9
8	20	477.75	1.28	1.55	7.79	2	99				94	86	20.9
9	22.5	479.60	1.28	1.55	9.59	2	99			50	95	86	20.9
10	25	481.32	1.25	1.51	1.36	2	99				95	87	20.9
11	27.5	483.15	1.30	1.58	3.18	2	98			50	96	87	20.9
12	30	485.10	1.49	1.81	5.12	2.5	99				96	87	20.9
B- 1	32.5	486.87	1.30	1.58	6.93	2	99			51	94	87	20.9
2	35	488.85	1.61	1.95	8.94	3	100				96	88	20.9
3	37.5	490.89	1.61	1.96	0.96	3	98			50	97	88	20.9
4	40	492.87	1.48	1.80	2.90	2.5	98				98	89	20.9
5	42.5	494.68	1.33	1.62	4.74	2.5	100			47	99	91	20.9
6	45	496.57	1.34	1.63	6.59	2.5	100				98	89	20.9
7	47.5	498.35	1.25	1.52	8.38	2	99			47	98	90	20.9
8	50	500.16	1.30	1.59	0.20	2	97				99	90	20.9
9	52.5	502.00	1.31	1.60	2.03	2	97			48	99	90	20.9
10	55	503.83	1.35	1.65	3.89	2	98				99	91	20.9
11	57.5	505.70	1.40	1.71	5.79	2.5	98			48	99	91	20.9
12	60	507.67	1.45	1.77	7.72	2.5	98	↓	↓		100	91	20.9
	(62.08)												
	θ = 60	Vs = 44.53		ΔH 1.66							Avg. =	91.0	

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-10-93 Test 9 Run 3
Source Press Vent / Stack No. of traverse points 24
Method MDI Filter holder: ERC Filter type: Treated C.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: < 0.02 cfm at 4 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: M. Kahler + T. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	7	0	7
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1500	1474	26
Total			33

Integrated Gas Sampling Data: NA / Ambient

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 9053
Source Press Vent / Stack
Date 6-10-93 Test 4 Run 3

Operators M. Gaehler + J. Bergstrom
Meter Box No. 8 ΔH 1.82 IN WC
Coeficient coeff. .9993

Pitot No. MD1 Cp .84
Bar. Press. 28.89 inHg H2O 3 %
Nozzle No. B-3 Nozzle Dia .185 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)
	(1230)	507.90											
A-1	2.5	509.53	1.05	1.25	9.51	2	98	Ambient		47	89	87	20.9
2	5	511.40	1.49	1.77	1.43	2	98				93	89	20.9
3	7.5	513.42	1.57	1.88	3.41	2.5	96			46	96	89	20.9
4	10	515.26	1.49	1.78	5.33	2	99				97	90	20.9
5	12.5	517.18	1.50	1.80	7.27	2	99			46	98	91	20.9
6	15	519.12	1.40	1.67	9.14	2.5	101				99	91	20.9
7	17.5	521.00	1.38	1.64	1.00	2.5	105			46	100	91	20.9
8	20	522.81	1.30	1.55	2.81	2	102				100	92	20.9
9	22.5	524.63	1.33	1.59	4.63	2	103			47	100	92	20.9
10	25	526.47	1.40	1.69	6.52	2	98				102	93	20.9
11	27.5	528.43	1.40	1.68	8.40	2	101			47	101	93	20.9
12	30	530.30	1.61	1.94	0.42	2.5	100				102	94	20.9
B-1	32.5	532.09	1.21	1.46	2.17	2	100			49	100	93	20.9
2	35	534.13	1.59	1.93	4.18	2.5	94				102	94	20.9
3	37.5	536.18	1.62	1.97	6.22	3	96			49	103	95	20.9
4	40	538.10	1.50	1.82	8.18	2.5	97				104	95	20.9
5	42.5	540.04	1.43	1.73	0.09	2.5	99			49	104	95	20.9
6	45	541.89	1.27	1.54	1.90	2	97				104	96	20.9
7	47.5	543.70	1.34	1.63	3.76	2	97			50	105	96	20.9
8	50	545.53	1.30	1.58	5.59	2	97				105	96	20.9
9	52.5	547.37	1.30	1.58	7.42	2	99			52	105	97	20.9
10	55	549.24	1.32	1.60	9.26	2	100				105	97	20.9
11	57.5	551.00	1.25	1.51	1.05	2	100			52	106	97	20.9
12	60	552.80	1.32	1.59	2.89	2	103	↓	↓		106	97	20.9
	(1333												
	θ = 60	Vm = 44.90		ΔH Avg							Avg. = 97.2		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-10-93 Test 9 Run 4
Source Press Vent / Stack No. of traverse points 12
Method MD1 Filter holder: ERL Filter type: Treated G-F

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: <0.02 cfm at 4 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: McKaehler & J. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	2	0	2
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1489	1454	35
MeCl2 Rinse	239	187	52
Total			42

Integrated Gas Sampling Data: NA / Ambient

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

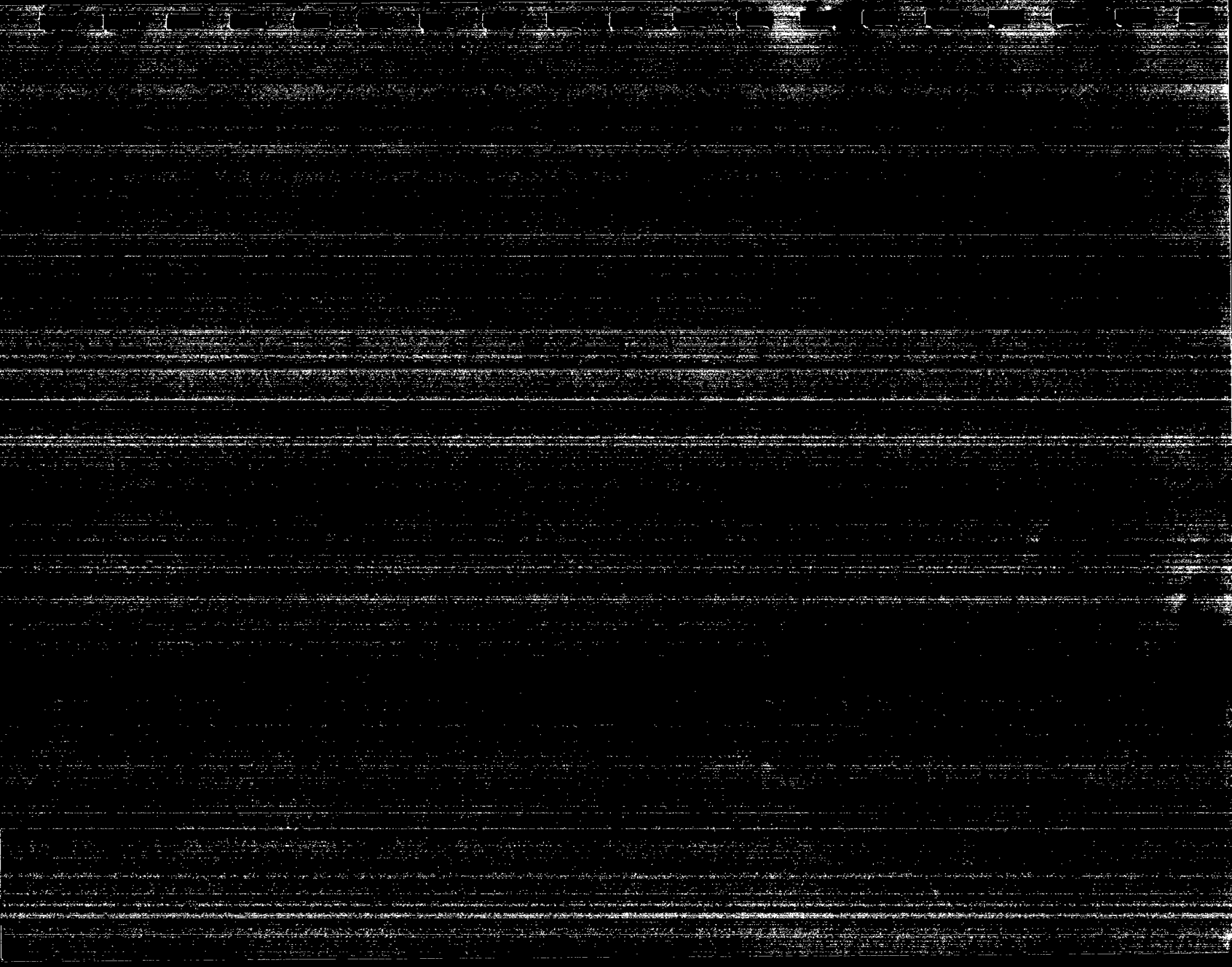
INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job 9053
Source Press Vent / Stack
Date 6-10-93 Test 4 Run 4

Operators McKeehler + S. Bergstrom
Meter Box No. 8 ΔH 1.82 IN WC
Coumeter coeff. .9997

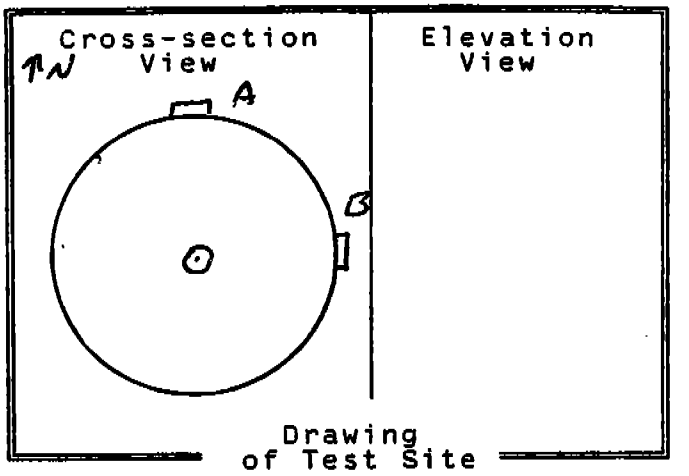
Pitot No. NDI Cp .84
Bar. Press. 28.85 inHg H2O 3.6 x
Nozzle No. B-3 Nozzle Dia .1865 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgm. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Dgm.	Impg.	Gas In	Gas Out	Oxygen (x v/v)
	(1405)	553.00											
A - 1	2.5	554.78	1.28	1.52	4.79	2	100	Ambient		48	94	93	20.9
2	5	556.75	1.57	1.87	6.77	2.5	96				95	93	20.9
3	7.5	558.72	1.58	1.88	8.75	2.5	98			48	97	93	20.9
4	10	560.64	1.43	1.70	0.63	2.5	100				99	94	20.9
5	12.5	562.56	1.49	1.77	2.56	2.5	100			49	100	94	20.9
6	15	564.42	1.40	1.66	4.44	2.5	101				101	95	20.9
7	17.5	566.33	1.38	1.65	6.30	2.5	99			50	104	96	20.9
8	20	568.14	1.38	1.65	8.17	2.5	102				102	96	20.9
9	22.5	570.06	1.53	1.83	0.13	2.5	100			51	102	96	20.9
10	25	572.07	1.60	1.91	2.14	2.5	101				104	96	20.9
11	27.5	574.10	1.58	1.88	4.13	2.5	103			51	104	97	20.9
12	30	576.09	1.67	1.99	6.19	3	102				105	97	20.9
B - 1	32.5	577.75	.98	1.18	7.77	2	99			48	104	98	20.9
2	35	579.55	1.40	1.68	9.50	2.5	99				106	98	20.9
3	37.5	581.69	1.68	2.02	1.73	3	100			47	106	98	20.9
4	40	583.60	1.53	1.84	3.70	2.5	99				106	99	20.9
5	42.5	585.48	1.29	1.56	5.52	2.5	98			48	107	99	20.9
6	45	587.24	1.24	1.49	7.30	2	101				107	99	20.9
7	47.5	589.11	1.30	1.57	9.13	2	99			48	107	99	20.9
8 -	50	590.97	1.32	1.58	0.97	2	102				107	99	20.9
9	52.5	592.77	1.32	1.59	2.81	2	99			48	108	100	20.9
10	55	594.60	1.30	1.57	4.64	2	99				108	100	20.9
11	57.5	596.48	1.41	1.68	6.53	2.5	105			49	109	100	20.9
12	60	598.41	1.50	1.80	8.49	3	102	↓	↓		108	100	20.9
	(1506)												
	θ = 60	Vm = 45.41		ΔH 1.70							Avg. = 100.3		



INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job 9053
Source Dryer / Stack
Test 1 Run 0 Date 6-8-93
Stack dimen. 48 IN.
Dry bulb 201 °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.80 in Hg
Static pressure -.05 in WC
Operators M. Raehler + J. Burgstrom
Pitot No. 29V-5 C_p .84
Particulate



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: 0800 hrs	
A-1	.021	1.01	7.01	.98	
2	.067	3.22	9.22	1.20	
3	.118	5.66	11.66	1.23	
4	.177	8.50	14.50	1.28	
5	.250	12.00	18.00	1.30	
6	.356	17.09	23.09	1.29	
7	.644	30.91	36.91	1.37	
8	.750	36.00	42.00	1.20	
9	.823	39.50	45.50	1.10	
10	.882	42.34	48.34	1.04	
11	.933	44.78	50.78	.82	
12	.979	46.99	52.99	.53	201
B-1				.90	
2				1.04	
3				1.10	
4				1.15	
5				1.15	
6				1.22	
7				1.40	
8				1.43	
9				1.47	
10				1.30	
11				1.10	
12				.92	

Temp. meas. device & S/N: PDT-19 / TC | Time end: 0911 hrs

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-8-93 Test 1 Run 1
Source Dryer 1 Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 5318

Recovery solvent(s)
☒ acetone D.W.
☒ other(s) MeCl₂ / Impingers

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler + J. Bergstrom

Condensate Data:

pH 5

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	640	496	144
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1384	1377	7
Total			151

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 30 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 1220 (HRS) Time end: 1321 (HRS)
Sampling rate: 400 cc/min Operator: M. Kaehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job 9053 — Operators M. Kuehler & J. Benstrom — Pitot No. 22V-5 — Cp .84
Source Dryer / Stack — Meter Box No. 8 ΔH 1.82 TR WC — Bar. Press. 28.80 inHg H2O 17 %
Date 6-8-93 Test 1 Run 1 — Counter coeff. .9997 — Nozzle No. B-2 Nozzle Dia .184 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)
	(1220)	156.00											
B-12	2.5	157.12	.77	.57	7.07	4	198	239	247	48	81	81	18.6
11	5	158.37	1.05	.78	8.34	5	201				82	82	18.4
10	7.5	159.71	1.08	.80	9.63	5	202	244	253	45	83	82	18.3
9	10	160.89	1.08	.80	0.91	5	204				84	82	18.5
8	12.5	162.27	1.32	.98	2.34	6	201	247	256	44	86	82	19.3
7	15	163.70	1.25	.93	3.73	6	201				87	83	18.6
6	17.5	165.14	1.42	1.06	5.21	6.5	202	246	253	44	88	84	18.0
5	20	166.74	1.53	1.15	6.76	7	201				89	84	18.9
4	22.5	168.24	1.44	1.08	8.26	7	201	242	253	44	90	85	18.7
3	25	169.70	1.35	1.02	9.71	7	200				91	86	17.9
2	27.5	171.19	1.38	1.04	1.18	7	200	243	250	45	91	86	18.4
1	30	172.50	.94	.72	2.41	5	192				92	86	18.5
A-12	32.5	173.76	1.04	.79	3.69	4.5	198	240	252	45	92	87	18.4
11	35	175.08	1.12	.85	5.02	5	200				93	87	18.1
10	37.5	176.51	1.39	1.05	6.51	6	201	243	255	47	94	88	18.1
9	40	177.92	1.28	.97	7.93	6	202				95	88	18.4
8	42.5	179.36	1.30	.98	9.37	6	202	245	256	47	95	89	18.2
7	45	180.81	1.35	1.02	0.83	6.5	202				96	89	18.5
6	47.5	182.27	1.38	1.04	2.31	6.5	203	247	254	45	96	89	18.0
5	50	183.70	1.28	.97	3.74	6.5	202				96	90	18.4
4	52.5	184.99	.95	.72	4.97	5	202	244	255	46	97	90	18.1
3	55	186.28	1.03	.78	6.26	5	200				97	90	18.5
2	57.5	187.41	.73	.55	7.30	4	199	246	253	46	97	90	18.7
1	60	188.41	.60	.46	8.33	3	199				97	91	18.3
	(1321)												
	θ = 60	Vm = 32.41		ΔH = .88							Avg. = 88.7		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-8-93 Test 1 Run 2
Source Dryer 1 Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 5319

Recovery solvent(s)
☒ acetone D.W.
☒ other(s) $MeCl_2$ / Impinger Rinse

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler & J. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	667	500	167
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1445	1438	7
Total			174

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 30 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 1400 (HRS) Time end: 1512 (HRS)
Sampling rate: 400 cc/min Operator: M. Kaehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job 9053 — Operators M. Kaedtler & J. Bergstrom — Pitot No. 29U-5 — Cp .84
Source Dryer / Stack — Meter Box No. B — ΔH 1.82 IN WC — Bar. Press. 28.80 inHg — H2O LB X
Date 6-8-93 — Test 1 — Run 2 — Counter coeff. 9997 — Nozzle No. B-3 — Nozzle Dia .184 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dry. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	1400	188.70											
A-12	2.5	190.07	1.15	.85	0.03	5	203	251	250	43	89	89	18.0
11	5	191.45	1.35	.99	1.47	5	203				94	91	18.1
10	7.5	193.00	1.51	1.12	3.00	6	203	246	254	43	96	91	17.5
9	10	194.57	1.55	1.15	4.56	6.5	203				97	92	17.8
8	12.5	196.13	1.52	1.13	6.10	6.5	203	247	252	43	98	92	17.8
7	15	197.60	1.40	1.04	7.58	7	203				98	93	17.8
6	17.5	199.06	1.28	.95	9.00	6	203	245	255	44	98	93	17.9
5	20	200.42	1.07	.80	0.30	5	203				99	93	17.8
4	22.5	201.67	1.04	.78	1.59	5	202	242	253	44	99	94	17.9
3	25	202.92	.98	.73	2.83	4.5	202				100	94	17.9
2	27.5	204.09	.98	.73	4.08	4.5	202	243	250	46	101	94	17.9
1	30	205.57	.95	.71	5.31	4.5	202				101	94	18.0
B-12	32.5	206.68	.97	.73	6.55	4.5	202	245	247	48	96	94	18.3
11	35	207.99	1.09	.81	7.86	5	202				98	94	18.3
10	37.5	209.41	1.20	.90	9.24	5	202	247	251	47	99	94	18.1
9	40	210.84	1.20	.90	0.02	5	201				100	95	17.9
8	42.5	212.22	1.24	.93	2.03	5	202	249	255	47	101	95	18.2
7	45	213.63	1.37	1.03	3.50	6	202				102	96	18.0
6	47.5	215.12	1.45	1.09	5.02	6.5	202	245	253	47	102	96	18.0
5	50	216.55	1.31	.99	6.47	6	201				103	96	18.0
4	52.5	217.95	1.05	.79	7.77	5	199	246	251	47	103	97	17.8
3	55	219.35	1.17	.88	9.15	5.5	199				104	97	17.9
2	57.5	220.65	1.21	.92	0.54	6	199	243	256	46	104	97	18.1
1	60	222.01	1.07	.81	1.86	5	202				104	97	17.9
	(1512)												
	θ = 60	Vm = 33.41		ΔH = .91							Avg. = 96.7		

E-5

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job 9053 Date 6-8-93 Test 1 Run 3
Source Dryer 1 Stack No. of traverse points 24
Method 5 Filter holder: 4"Glass Filter type: 4"G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 5334

Recovery solvent(s)
☒ acetone D.W.
☒ other(s) MeCl2 / Impinger Rinse

No. of probe wash bottles: 1
Sample recovered by: M. Koehler & S. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	636	497	139
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1457	1446	11
Total			150

Integrated Gas Sampling Data:

Bag Pump No. 294 Box No. 30 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 1536 (HRS) Time end: 1641 (HRS)
Sampling rate: 400 cc/min Operator: M. Koehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

[redacted] LF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job 9053
Source Dryer / Stack
Date 6-8-93 Test 1 Run 3

Operators M. Kuehler & S. Gerstman
Meter Box No. B *HF 1.84 IN NC
Coometer coeff. .9997

Pitot No. 29U-5 Cp .84
Bar. Press. 28.80 inHg H2O 20 %
Nozzle No. B-3 Nozzle Dia .194 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)
[redacted]	1536	222.40	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
B-12	2.5	223.66	1.02	.73	3.64	3.5	199	243	256	45	96	94	18.2
11	5	224.93	.99	.71	4.87	4	201				98	96	18.4
10	7.5	226.28	1.40	1.01	6.33	5	201	244	254	44	100	96	18.2
9	10	227.75	1.43	1.03	7.81	5.5	201				101	97	18.0
8	12.5	229.22	1.38	.99	9.26	5.5	202	242	257	44	102	97	18.4
7	15	230.73	1.48	1.07	0.77	6	201				103	98	18.5
6	17.5	232.26	1.51	1.09	2.30	6	201	247	252	45	104	98	18.1
5	20	233.76	1.41	1.02	3.78	6	201				105	99	18.2
4	22.5	235.18	1.23	.89	5.16	5.5	200	245	255	47	107	100	18.4
3	25	236.48	1.11	.81	6.48	5	200				106	100	18.3
2	27.5	237.86	1.05	.76	7.76	4.5	200	243	255	47	108	101	18.2
1	30	238.99	.89	.65	8.94	4	200				106	101	18.2
A-12	32.5	240.26	.98	.71	0.18	4	201	246	257	46	104	100	18.5
11	35	241.63	1.05	.76	1.46	4	199				106	100	18.5
10	37.5	242.90	1.07	.78	2.75	4.5	200	247	254	46	107	101	18.5
9	40	244.25	1.13	.96	4.18	5	200				108	101	18.4
8	42.5	245.64	1.10	.80	5.50	5	200	247	255	47	109	102	18.3
7	45	246.95	1.22	.89	6.89	5	200				109	102	18.4
6	47.5	248.60	1.55	1.13	8.45	7	200	245	253	48	110	103	18.0
5	50	250.15	1.49	1.09	9.98	7	200				111	103	18.2
4	52.5	251.70	1.53	1.12	1.54	7	200	243	250	48	110	103	18.7
3	55	253.24	1.50	1.10	3.08	6.5	200				111	103	18.5
2	57.5	254.78	1.48	1.09	4.61	6.5	200	243	248	49	111	104	18.1
1	60	256.07	1.10	.81	5.93	5					111	104	18.5
	(1641)												
[redacted]	θ = 60	Vm = 34.67	[redacted]	ΔH = .92	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Avg. = 103.0		[redacted]

E-7

S-0037R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. Dungannon

Source Dryer Stack

Test 2 Run ___ Date 6/8/93

Stack dimen. 48 IN.

Dry bulb ___ °F Wet bulb ___ °F

Manometer: ☐ Reg. ☐ Exp. ☐ Elec.

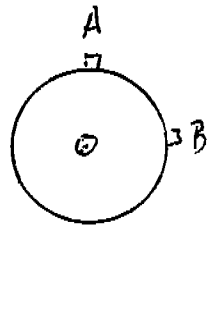
Barometric pressure 28.80 in Hg

Static pressure ___ in WC

Operators D VanHoeven & J. Bergstrom

Pitot No. V Cp ___

Formaldehyde

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	1.008	7.008		
2	.067	3.216	9.216		
3	.118	5.664	11.664		
4	.177	8.496	14.496		
5	.250	12	18		
6	.356	17.088	23.088		
7	.644	30.912	36.912		
8	.750	36	42		
9	.823	39.504	45.504		
10	.882	42.336	48.336		
11	.933	44.784	50.784		
12	.979	46.992	52.992		
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 W.P. / Dungannon
Source Dryer Stack
Method 0011 Filter holder: NA

Date 6/8/93 Test 2 Run 1
No. of traverse points 24
Filter type: NA

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .006 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: Dutt

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	381	200	181
Impinger No. 3			
Condenser			
Desiccant	1470	1459	11
Total			192

Integrated Gas Sampling Data:

Bag Pump No. B6 Box No. 10 Bag No. 1

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

Pretest leak check: 0 cc/min at 14 in. Hg.

Time start: 0900 (HRS) Time end: 1025 (HRS)

Sampling rate: 400 cc/min Operator: Dutt

S/N of O_2 Analyzer used to monitor train outlet: 3

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / Dungannon
Source Dryer Stack
Date 6/8/93 Test 2 Run 1

Operators Dust & J.B
Meter Box No. 9 ΔH@ 1.86 IN WC
Coeffic. coeff. .9933

Pitot No. V29-5 Cp .84
Bar. Press. 28.80 inHg H2O 20 %
Nozzle No. Glass Nozzle Dia .193 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 (xx/x)
	0857	954.805											
A 12	3.5	956.70	1.05	.87	6.66	2	198	238	246	44	71	71	18.4
11	7	958.70	1.20	.99	8.63	2	198				76	72	18.4
10	10.5	960.86	1.30	1.07	0.68	2	200				77	73	18.4
9	14	962.88	1.45	1.20	2.86	2	199	245	250	43	78	73	18.3
8	17.5	965.00	1.35	1.12	4.86	2	200				79	74	18.8
7	21	967.15	1.35	1.12	7.07	2	200				80	74	18.4
6	24.5	969.26	1.45	1.20	9.25	2	200				81	75	18.0
5	28	971.40	1.25	1.04	1.29	2	200	251	256	44	81	75	18.1
4	31.5	973.30	1.20	1.00	3.28	2	200				82	76	18.0
3	35	975.18	1.10	.92	5.19	2	198				82	76	18.1
2	38.5	976.96	.80	.67	6.83	2	197	271	261	38	83	76	18.0
1	42	978.36	.69	.58	8.35	2	197				83	77	18.0
B 12	45.5	980.30	1.0	.84	0.18	2	197				81	77	19.0
11	49	982.11	1.10	.92	2.09	2	200	266	267	39	84	78	18.3
10	52.5	984.15	1.10	.92	4.01	2	200				85	79	18.2
9	56	986.18	1.2	1.0	6.01	2	200				85	79	18.9
8	59.5	988.19	1.25	1.05	8.06	2	200	263	262	40	86	80	18.6
7	63	990.31	1.50	1.26	0.30	2	201				86	80	18.4
6	66.5	992.60	1.50	1.26	2.55	2	200				87	80	18.3
5	70	994.81	1.50	1.26	4.80	2	200	264	263	41	87	81	18.4
4	73.5	997.18	1.50	1.26	7.05	2	199				88	81	17.3
3	77	999.37	1.35	1.14	9.19	2	200				88	82	18.1
2	80.5	1001.34	1.35	1.14	1.33	2	200				88	82	18.1
1	84	1003.30	.82	.69	3.00		200				88	82	18.0
	1027												
	θ = 84	Vm = 48.195		ΔH = 1.02							Avg. =	79	

Stop Test leak check (-.1)

E-10

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dungannon
Source Dryer Stack
Method 0011 Filter holder: NA

Date 6/8/93 Test 2 Run 2
No. of traverse points 24
Filter type: NA

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: _____

Recovery solvent(s)

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	421	200	221
Impinger No. 3			
Condenser			
Desiccant	1446	1438	8
Total			229

Integrated Gas Sampling Data:

Bag Pump No. B6 Box No. 10 Bag No. 2

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

Pretest leak check: 0 cc/min at 14 in. Hg.

Time start: 1100 (HRS) Time end: 1227 (HRS)

Sampling rate: 300 cc/min Operator: DH

S/N of O_2 Analyzer used to monitor train outlet: 3

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. Dungannon
Source Dryer Stack
Date 6/8/93 Test 2 Run 2

Operators D.V.H & J.B
Meter Box No. 9 ΔH 1.86 IN WC
Counter coeff. .9933

Pitot No. V29-5 Cp .84
Bar. Press. 28.80 inHg H2O 18 %
Nozzle No. Glass Nozzle Dia. .53 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)
	1057	1003.20											
B 12	3.5	1005.20	1.0	.87	5.06	2	200	252	258	40	81	81	18.3
11	7	1007.03	1.10	.96	7.02	2	200				84	82	18.6
10	10.5	1009.15	1.20	1.05	9.07	2	200				85	82	18.4
9	14	1011.17	1.30	1.14	1.20	2	200				86	83	18.5
8	17.5	1013.41	1.30	1.14	3.34	2	200	256	259	41	87	83	18.1
7	21	1015.57	1.35	1.18	5.52	2	201				88	83	18.3
6	24.5	1017.89	1.50	1.31	7.82	2	202				89	84	18.3
5	28	1020.13	1.50	1.32	0.13	2	201	260	258	41	89	84	17.7
4	31.5	1022.43	1.50	1.32	2.43	2	201				90	84	18.0
3	35	1024.55	1.30	1.14	4.58	2	201				90	85	17.7
2	38.5	1026.63	1.20	1.06	6.65	2	201	263	260	41	91	85	17.6
1	42	1028.78	1.10	.97	8.63	2	200				91	86	17.3
A 12	45.5	1030.56	.96	.85	0.48	2	200				90	86	17.7
11	49	1032.67	1.3	1.14	2.64	2	201				90	86	18.
10	52.5	1034.50	1.5	1.32	4.95	2	201	263	259	43	91	87	17.5
9	56	1037.30	1.5	1.32	7.26	2	201				92	87	17.6
8	59.5	1039.53	1.5	1.32	9.58	2	201				93	87	17.3
7	63	1041.93	1.5	1.32	1.90	2	202	264	257	42	93	88	18.0
6	66.5	1044.26	1.5	1.33	4.22	2	201				94	88	18.5
5	70	1046.57	1.5	1.33	6.54	2	201				94	88	17.9
4	73.5	1048.93	1.45	1.28	8.83	2	201				94	88	18.6
3	77	1051.10	1.2	1.07	0.91	2	199	263	260	43	94	88	18.6
2	80.5	1053.01	1.2	1.07	3.00	2	198				95	89	18.8
1	84	1054.57	.68	.6	4.57		198				95	89	18.7
	1227												
	θ = 84	Vm = 51.37		ΔH = 1.14							Avg. = 87.5		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dungannon
Source Dryer Stack
Method 0011 Filter holder: NA

Date 6/8/93 Test 2 Run 3
No. of traverse points 24
Filter type: NA

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: _____

Recovery solvent(s)

☐ acetone
☒ other(s) $MeCl_2$ + DI H_2O

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	460	200	260
Impinger No. 3			
Condenser			
Desiccant	1485	1470	15
Total			275

Integrated Gas Sampling Data:

Bag Pump No. B6 Box No. 10 Bag No. 3

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

Pretest leak check: 0 cc/min at 14 in. Hg.

Time start: 1315 (HRS) Time end: 1436 (HRS)

Sampling rate: 300 cc/min Operator: DWT

S/N of O_2 Analyzer used to monitor train outlet: 3

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / Dungannon — Operators DWH & MK & JS — Pitot No. V29-5 — Cp .84
Source Dryer Stack — Meter Box No. 9 — ΔH 1.86 IN WC — Bar. Press. 28.80 inHg — H2O .18 X
Date 6/8/93 — Test 2 — Run 3 — Coefficient .9953 — Nozzle No. 6 Glass — Nozzle Dia .193 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 (xx/x)
	1310	54.90											
A 12	3.5	56.63	.83	.73	6.62	2	202	256	251	43	87	87	18.1
11	7	58.60	1.10	.97	8.59	2	201				88	89	18.0
10	10.5	60.70	1.15	1.01	0.62	2	202				91	88	18.5
9	14	62.60	1.10	.97	2.60	2	202	263	257	44	92	89	17.9
8	17.5	64.75	1.15	1.01	4.63	2	203				93	89	18.0
7	21	66.63	1.10	.97	6.62	2	203				94	90	18.2
6	24.5	68.67	1.15	1.02	8.66	2	203	265	256	43	94	90	18.0
5	28	70.94	1.50	1.32	0.98	2	203				94	90	17.6
4	31.5	73.40	1.50	1.32	3.30	2	205				96	91	17.9
3	35	75.75	1.50	1.33	5.63	2	204	263	257	43	97	91	18.1
2	38.5	77.97	1.50	1.33	7.96	2	204				97	91	18.0
1	42	80.30	1.40	1.25	0.22	2	200				98	92	17.7
B 12	45.5	82.30	1.15	1.03	2.28	2	200	264	260	40	97	92	18.2
11	49	84.80	1.1	.98	4.82	2	203				98	92	18.1
10	52.5	86.36	1.25	1.11	6.41	2	203				98	93	18.1
9	56	88.41	1.25	1.11	8.55	2	203	261	259	43	98	93	17.8
8	59.5	90.70	1.35	1.20	0.77	2	203				98	92	17.8
7	63	93.07	1.40	1.24	3.03	2	203				100	94	17.7
6	66.5	95.25	1.45	1.29	5.33	2	203	263	260	45	100	94	17.8
5	70	97.70	1.55	1.38	7.72	2	203				100	94	17.8
4	73.5	100.08	1.50	1.34	0.04	2	203				100	94	17.8
3	77	102.40	1.50	1.34	2.41	2	202				101	95	17.8
2	80.5	104.60	1.30	1.16	4.60		202				101	95	17.9
1	84	107.08	1.50	1.34	6.96		202				100	95	17.7
	(1436)												
	θ = 84	Vm = 52.18		ΔH = 1.16							Avg. =	91	

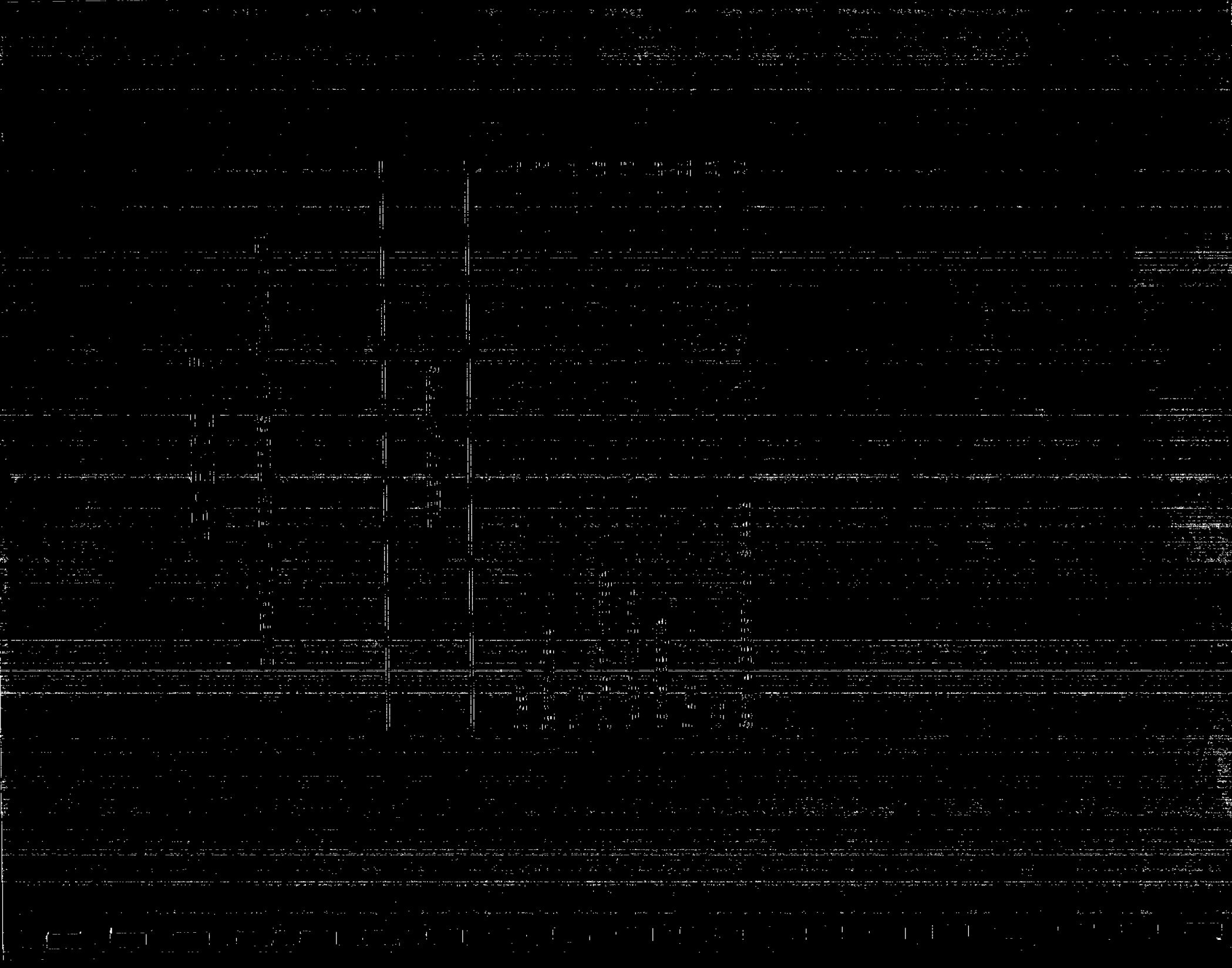
Interpoll Laboratories
(612)786-6020

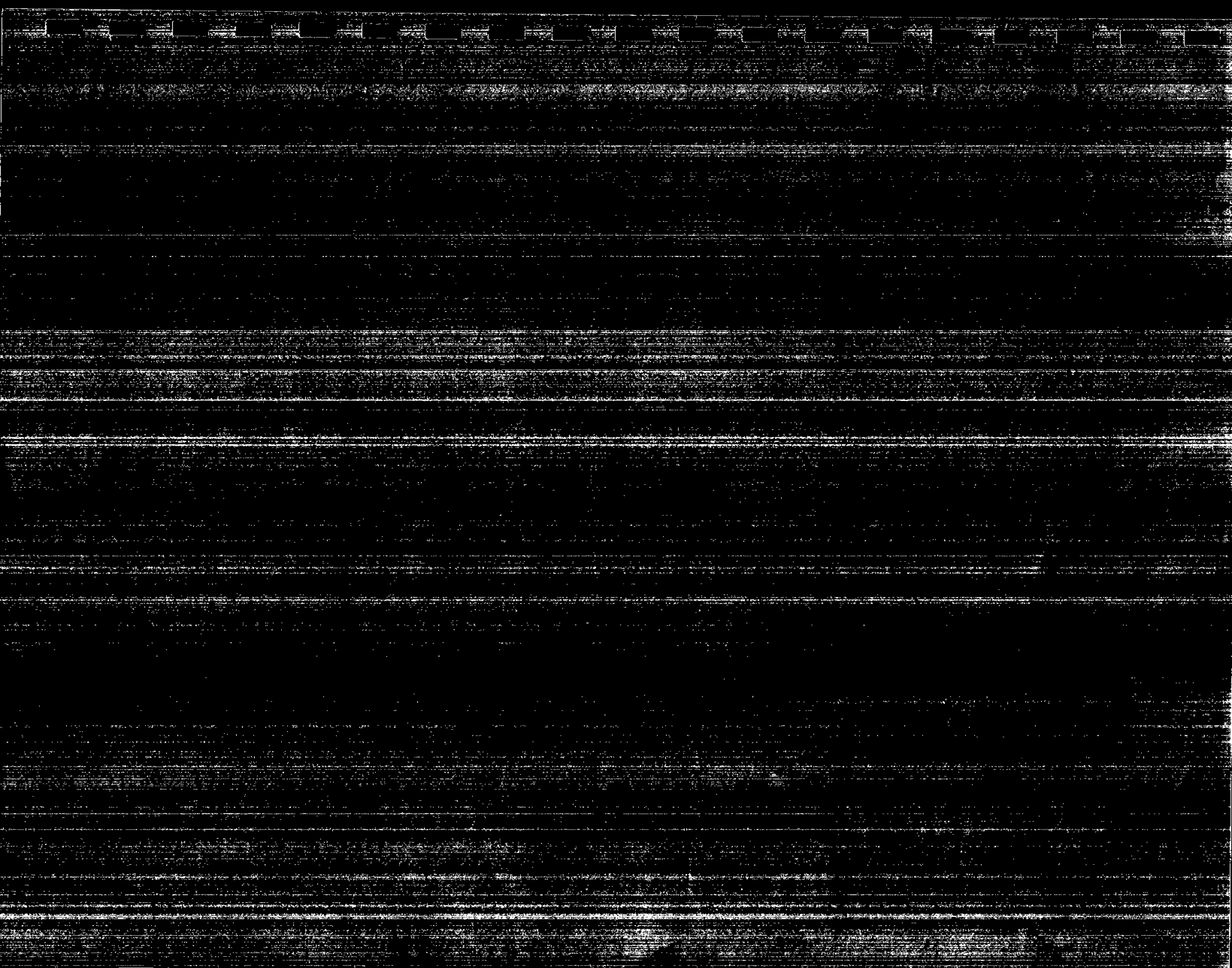
EPA Method 7 Sample Collection
Field Data Sheet

Job L.P.I Date 6-8-93 Bar. Pressure 28.80 IN.HG.
Test Location Dryer Stack Fuel Type wood waste Sample Train No. 1
Technician J.Bergstrom Pump No. 2

No.	Test Run Point	Flask No.	Time (HRS)	Vacuum (IN.HG.)	Flask Temp. (°F)	Leak Rate <0.4 IN.HG./MIN.
1	2-1-1	8	0920	26.70	70	☒ Yes ☐ No
2	2-1-2	09	0935	26.90	71	☒ Yes ☐ No
3	2-1-3	10	0950	26.95	71	☒ Yes ☐ No
4	2-1-1	26	1005	26.85	71	☒ Yes ☐ No
5	2-2-2	11	1100	26.75	81	☒ Yes ☐ No
6	2-2-3	12	1120	26.85	83	☒ Yes ☐ No
7	2-2-1	55	1145	26.85	88	☒ Yes ☐ No
8	2-2-2	56	1205	26.85	92	☒ Yes ☐ No
9	2-3-3	57	1320	26.90	92	☒ Yes ☐ No
10	2-3-1	58	1335	26.90	92	☒ Yes ☐ No
11	2-3-2	59	1355	26.85	92	☒ Yes ☐ No
12	2-3-3	60	1415	26.90	93	☒ Yes ☐ No
13						☐ Yes ☐ No
14						☐ Yes ☐ No
15						☐ Yes ☐ No
16						☐ Yes ☐ No
17						☐ Yes ☐ No
18						☐ Yes ☐ No
19						☐ Yes ☐ No
20						☐ Yes ☐ No
21						☐ Yes ☐ No
22						☐ Yes ☐ No
23						☐ Yes ☐ No
24						☐ Yes ☐ No
25						☐ Yes ☐ No
26						☐ Yes ☐ No
27						☐ Yes ☐ No

S-263R





Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L.P Dungannon
Team Leader MK
Date Submitted 6-21-93
Test No.
Date of Analysis 6-22-93

Source Dryer
Test Site Stack
Date of Test 6-8-93
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	9053-07 ☑B ☐F	1	0.00	2.80	21.00	2.80	18.20	
		2	0.00	2.80	21.00	2.80	18.20	
		Avg				2.80	18.20	
1/2	-11 ☑B ☐F	1	0.00	3.10	21.00	3.10	17.90	
		2	0.00	3.10	21.00	3.10	17.90	
		Avg				3.10	17.90	
1/3	-15 ☑B ☐F	1	0.00	2.60	21.00	2.60	18.40	
		2	0.00	2.60	21.00	2.60	18.40	
		Avg				2.60	18.40	
	☐B ☐F	1						
		2						
		Avg						
	☐B ☐F	1						
		2						
		Avg						
	☐B ☐F	1						
		2						
		Avg						
	☐B ☐F	1						
		2						
		Avg						
	☐B ☐F	1						
		2						
		Avg						
	☐B ☐F	1						
		2						
		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

F-1

LSC-04-BR

Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job A.P. / Dingannon, VA
Team Leader D. VanHoever
Date Submitted 6-8-93
Test No. 1
Date of Analysis 6-9-93

Source Dryer
Test Site stack
Date of Test 6-8-93
No. of Runs Completed 3
Technician Mark Gaither

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	9053-19	1	0.00	2.35	20.70	2.35	18.35	1.035
	☒ B ☐ F	2	0.00	2.35	20.70	2.35	18.35	1.035
		Avg				2.35	18.35	
2/2	9053-22	1	0.00	2.60	20.80	2.60	18.20	1.038
	☒ B ☐ F	2	0.00	2.60	20.80	2.60	18.20	1.038
		Avg				2.60	18.20	
2/3	9053-25	1	0.00	3.00	20.90	3.00	17.90	1.000
	☒ B ☐ F	2	0.00	3.00	20.90	3.00	17.90	1.000
		Avg				3.00	17.90	
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		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

Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L.P. / Dungannon, VA
Team Leader M. Kaehler
Date Submitted 6-9-93
Test No. 6
Date of Analysis 6-10-93

Source Kenus
Test Site Stack
Date of Test 6-9-93
No. of Runs Completed 3
Technician Mark Kaehler

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
6/1	9053-52	1	0.00	2.35	20.85	2.35	18.50	1.021
	☒ B ☐ F	2	0.00	2.35	20.85	2.35	18.50	1.021
		Avg				2.35	18.50	
6/2	9053-56	1	0.00	2.50	20.70	2.50	18.20	1.080
	☒ B ☐ F	2	0.00	2.50	20.70	2.50	18.20	1.080
		Avg				2.50	18.20	
6/3	9053-60	1	0.00	2.50	20.80	2.50	18.30	1.040
	☒ B ☐ F	2	0.00	2.50	20.80	2.50	18.30	1.040
		Avg				2.50	18.30	
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		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 PP

Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L.P./Dungannon VA
Team Leader M. Kuehler
Date Submitted 6-9-93
Test No. 7
Date of Analysis 6-10-93

Source Konus
Test Site stack
Date of Test 6-9-93
No. of Runs Completed 3
Technician Mark Goeddeke

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
7/1	9053-64	1	0.00	2.40	20.80	2.40	18.40	1.042
	☒ B ☐ F	2	0.00	2.40	20.80	2.40	18.40	1.042
		Avg	[redacted]			2.40	18.40	[redacted]
7/2	9053-68	1	0.00	2.60	20.80	2.40	18.40	1.042
	☒ B ☐ F	2	0.00	2.40	20.80	2.40	18.40	1.042
		Avg	[redacted]			2.40	18.40	[redacted]
7/3	9053-72	1	0.00	2.60	20.20	2.60	18.10	1.077
	☒ B ☐ F	2	0.00	2.60	20.20	2.60	18.10	1.077
		Avg	[redacted]			2.60	18.10	[redacted]
	☐ B ☐ F	1						
		2						
		Avg	[redacted]					[redacted]
	☐ B ☐ F	1						
		2						
		Avg	[redacted]					[redacted]
	☐ B ☐ F	1						
		2						
		Avg	[redacted]					[redacted]
	☐ B ☐ F	1						
		2						
		Avg	[redacted]					[redacted]
	☐ B ☐ F	1						
		2						
		Avg	[redacted]					[redacted]
	☐ B ☐ F	1						
		2						
		Avg	[redacted]					[redacted]

☐ 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

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job L.P. Dungannon
Team Leader MK
Date Submitted 6-21-93
Test No. 1
Date of Analysis 6-23-93
Transport Leakage ☒ None ☐ _____ ml

Source Dryer
Test Site Stack
Date of Test 6-8-93
No. of Runs Completed 3
Technician C. Hejesus
Solvent Acetone

0
Test ____ Run 0
Field Blank
Log Number _____
Vol. of Solvent ____ ml
*Solvent Residue 3.8 ug/ml

Dish No. _____
Dish Tare Wt. _____ g
Dish+Sample Wt. _____ g
Sample Wt. _____ g

1
Test 1 Run 1
Vol. of Solvent 140 ml
Log Number 9053-04
Comments _____

Dish No. 61
Dish Tare Wt. 44.5907 g
Dish+Sample Wt. 44.6084 g
Sample Wt. 0.0177 g

2
Test 1 Run 2
Vol. of Solvent 120 ml
Log Number -08
Comments _____

Dish No. 62
Dish Tare Wt. 50.8893 g
Dish+Sample Wt. 50.9267 g
Sample Wt. 0.0374 g

3
Test 1 Run 3
Vol. of Solvent 135 ml
Log Number -12
Comments _____

Dish No. 98
Dish Tare Wt. 47.2123 g
Dish+Sample Wt. 47.2267 g
Sample Wt. 0.0144 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
	0.0172	0.0369	0.0139	F-6	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Wisconsin Protocol

Job L.P Dungannon
Team Leader MK
Date Submitted 6-21-93
Test No. 1
Date of Analysis 6-25-93

Source Dryer
Test Site Stack
Date of Test 6-8-93
No. of Runs Completed 3
Technician C. Helgeson

		Solvent Phase	Aqueous Phase
0	Test 1 Run 0 Field Blank Log Number 9053-03 Comments	Dish No. 41 Dish Tare Wt. 45.3216 g Dish+Sample Wt 45.3218 g Sample Wt. 0.0002 g	Dish No. 66 Dish Tare Wt. 48.3089 g Dish+Sample Wt. 48.3094 g Sample Wt. 0.0005 g
1	Test 1 Run 1 Log Number -06 Comments	Dish No. 44 Dish Tare Wt. 47.6191 g Dish+Sample Wt 47.6399 g Sample Wt. 0.0208 g	Dish No. 69 Dish Tare Wt. 47.8884 g Dish+Sample Wt. 48.1327 g Sample Wt. 0.1443 g
2	Test 1 Run 2 Log Number -10 Comments	Dish No. 46 Dish Tare Wt. 48.8518 g Dish+Sample Wt 48.8678 g Sample Wt. 0.0160 g	Dish No. 93 Dish Tare Wt. 53.9832 g Dish+Sample Wt 54.1554 g Sample Wt. 0.1722 g
3	Test 1 Run 3 Log Number -14 Comments	Dish No. 119 Dish Tare Wt. 47.7656 g Dish+Sample Wt 47.7778 g Sample Wt. 0.0122 g	Dish No. 106 Dish Tare Wt. 43.0161 g Dish+Sample Wt. 43.0957 g Sample Wt. 0.0796 g
4	Test ____ Run ____ Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g	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	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

Blank Solvent Wt. 0.0002 g

Results Solvent Phase:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0206	0.0158	0.0120		

Results Aqueous Phase:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1438	0.1717	0.0791	F-5	

LSC-03WYP

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job L.P. Dunganon Va.
Team Leader MK
Date Submitted 6-21-93
Test No. 1
Date of Analysis 6-23-93

Source Dryer
Test Site Stack
Date of Test 6-8-93
No. of Runs Completed 3
Technician C. Helgeson

0
Test 1 Run 0
Field Blank
Log Number 9053-02
Comments
Filter No. 5336
Filter Type 4"6F
Filter Tare Wt. .9344 g
Filter+Sample Wt. .9447 g
Sample Wt. 0.0003 g

1
Test 1 Run 1
Log Number -05
Comments
Filter No. 5318
Filter Type 4"6F
Filter Tare Wt. .9271 g
Filter+Sample Wt. .9688 g
Sample Wt. 0.0417 g

2
Test 1 Run 2
Log Number -09
Comments
Filter No. 5319
Filter Type 4"6F
Filter Tare Wt. .9350 g
Filter+Sample Wt. .9772 g
Sample Wt. 0.0422 g

3
Test 1 Run 3
Log Number -13
Comments
Filter No. 5334
Filter Type 4"6F
Filter Tare Wt. .9435 g
Filter+Sample Wt. .9739 g
Sample Wt. 0.0304 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
	0.0417	0.0422	0.0304		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2233	0.2666	0.1354		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Wisconsin Protocol

Job L P Dungannon
Team Leader MK
Date Submitted 6-21-93
Test No. 7
Date of Analysis 6-25-93

Source Konus
Test Site Stack
Date of Test 6-9-93
No. of Runs Completed 3
Technician C. Helsson

		Solvent Phase	Aqueous Phase
0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 7 Run 1 Log Number 9053-61 Comments ____	Dish No. 117 Dish Tare Wt. 47.3724 g Dish+Sample Wt 47.3858 g Sample Wt. 0.0134 g	Dish No. 110 Dish Tare Wt. 49.7363 g Dish+Sample Wt: 49.9911 g Sample Wt. 0.2548 g
2	Test 7 Run 2 Log Number -65 Comments ____	Dish No. 60 Dish Tare Wt. 49.6273 g Dish+Sample Wt 49.6458 g Sample Wt. 0.0185 g	Dish No. 111 Dish Tare Wt. 42.7803 g Dish+Sample Wt. 42.8783 g Sample Wt. 0.0980 g
3	Test 7 Run 3 Log Number -69 Comments ____	Dish No. 208 Dish Tare Wt. 52.7966 g Dish+Sample Wt 52.8270 g Sample Wt. 0.0304 g	Dish No. 115 Dish Tare Wt. 45.0680 g Dish+Sample Wt. 45.1068 g Sample Wt. 0.0388 g
4	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g	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	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

Blank Solvent Wt. 0.0002 g

Results Solvent Phase:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0132	0.0183	0.0302		

Results Aqueous Phase:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2543	0.0975	0.0383		

LSC-03WYR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job L.P. Dungannon
Team Leader MK
Date Submitted 6-21-93
Test No. 7
Date of Analysis 6-28-93
Transport Leakage ☒ None ☐ _____ ml

Source Konus
Test Site Stack
Date of Test 6-9-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0
Test _____ Run 0
Field Blank
Log Number _____
Vol. of Solvent _____ ml
*Solvent Residue 3.8 ug/ml
Dish No. _____
Dish Tare Wt. _____ g
Dish+Sample Wt. _____ g
Sample Wt. _____ g

1
Test 7 Run 1
Vol. of Solvent 120 ml
Log Number 9053-61
Comments _____
Dish No. 519
Dish Tare Wt. 49.0522 g
Dish+Sample Wt. 49.0730 g
Sample Wt. 0.0208 g

2
Test 7 Run 2
Vol. of Solvent 95 ml
Log Number -65
Comments _____
Dish No. 522
Dish Tare Wt. 47.0002 g
Dish+Sample Wt. 47.0132 g
Sample Wt. 0.0130 g

3
Test 7 Run 3
Vol. of Solvent 80 ml
Log Number -69
Comments _____
Dish No. 524
Dish Tare Wt. 48.0403 g
Dish+Sample Wt. 48.0504 g
Sample Wt. 0.0101 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
	0.0203	0.0126	0.0098	F-9	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job LP Dungannon
Team Leader MK
Date Submitted 6-21-93
Test No. 7
Date of Analysis 6-25-93

Source Koms
Test Site Stack
Date of Test 6-9-93
No. of Runs Completed 3
Technician C. Hebson

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 7 Run 1
Log Number 9053-62
Comments ____
Filter No. 5330
Filter Type 4"GF
Filter Tare Wt. .9426 g
Filter+Sample Wt. .9478 g
Sample Wt. 0.0052 g

2 Test 7 Run 2
Log Number -66
Comments ____
Filter No. 5337
Filter Type 4"GF
Filter Tare Wt. .9482 g
Filter+Sample Wt. .9591 g
Sample Wt. 0.0109 g

3 Test 7 Run 3
Log Number -70
Comments ____
Filter No. 5338
Filter Type 4"GF
Filter Tare Wt. .9316 g
Filter+Sample Wt. .9984 g
Sample Wt. 0.0068 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
	0.0052	0.0109	0.0068		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2430	0.1393	0.0851		

LSC-02PR

EPA Method 202 Calculations

3-9053.LP

Job: Louisiana Pacific - Dungannon
Date: June 1993

Konus Stack

RUN	Vic (ml)	Sulfate (mg/ml)	Mc (mg)	Mr (mg)	Mi (mg)	Mo (mg)	Mb (mg)	CPM (mg)
1	260	0.0219	1.05	254.3	253.25	13.2	0.7	265.75
2	290	0.0234	1.25	97.5	96.25	18.3	0.7	113.85
3	340	0.019	1.19	38.3	37.11	30.2	0.7	66.61

EPA Method 201A/202 Totals

RUN	Exit Tube (mg)	Filter (mg)	CPM (mg)	Total (mg)
1	20.3	5.2	265.75	291.3
2	12.6	10.9	113.85	137.4
3	9.8	6.8	66.61	83.2

Dryer

RUN	Vic (ml)	Sulfate (mg/ml)	Mc (mg)	Mr (mg)	Mi (mg)	Mo (mg)	Mb (mg)	CPM (mg)
1	390	0.000396	0.03	143.8	143.77	20.6	0.7	163.67
2	410	0.000408	0.03	171.7	171.67	15.8	0.7	186.77
3	390	0.000249	0.02	79.1	79.08	12	0.7	90.38

EPA Method 201A/202 Totals

RUN	Exit Tube (mg)	Filter (mg)	CPM (mg)	Total (mg)
1	17.2	41.7	163.67	222.6
2	36.9	42.2	186.77	265.9
3	13.9	30.4	90.38	134.7

Interpoll Laboratories, Inc.
(612)786-6020

Ion Chromatography Laboratory

DIONEX MODEL 40001 WITH ANION MICRO MEMBRANE SUPRESSION

Analyst: BMS ~~Konus Stack~~ Date of Analysis: 6-29-93

Job: L.P. Dungannon Source: Dryer Stack Site:

Chromatography Conditions

Column		Flow Rate	Eluent	Flow Rate	Suppressor Acid
	AS3	ml/min	2.4 mM Na_2CO_3 & 3.0 mM $NaHCO_3$	10 ml/min	~~12.5~~ 25 mM Sulfuric Acid
X	AS4A	2 ml/min	1.8 mM Na_2CO_3 & 1.7 mM $NaHCO_3$	ml/min	
	AS5	ml/min	100 mM NaOH	X	Isocratic
		ml/min			Gradient(List program below)

Gradient Program	Time (Min.)									
Eluent	0.0									
% A										
% B										

Results of Sulfate Determination

Sample Name	Interpoll Log Number	Tot. Sample Volume (ml)	Dilution	Solution Conc.(ug/ml)	Total ug Sulfate	meq of Sulfate
1/0	9053-03		1	√ 0.0104		
1/1	-06		1	x 0.3916		
1/2	-10		1	√ 0.408		
1/3	-14		1	√ 0.249		
~~?/1~~	-63					
?/2	-67			√		
~~?/3~~	-71			x		

Total ug = (Sample Vol.) x (Dilution) x (Solution Conc.)
meq = Total ug / 48000

LSC-08RR

25ml of sample for IC analysis

Interpoll Laboratories, Inc.
(612)786-6020

Ion Chromatography Laboratory

DIONEX MODEL 40001 WITH ANION MICRO MEMBRANE SUPRESSION

Analyst: BMS Date of Analysis: 10-29-93

Job: L.P. Dungannon Source: Konus Site: Stack

Chromatography Conditions

Column		Flow Rate	Eluent	Flow Rate	Suppressor Acid
	AS3	ml/min	2.4 mM Na_2CO_3 & 3.0 mM $NaHCO_3$	10 ml/min	~~12.5~~ 35 mM Sulfuric Acid
X	AS4A	2 ml/min	1.8 mM Na_2CO_3 & 1.7 mM $NaHCO_3$	ml/min	
	AS5	ml/min	100 mM NaOH	X	Isocratic
		ml/min			Gradient(List program below)

Gradient Program	Time (Min.)									
Eluent	0.0									
% A										
% B										

M-202
Impinger Catch

Results of Sulfate Determination

Sample Name	Interpoll Log Number	Tot. Sample Volume (ml)	Dilution	Solution Conc.(ug/ml)	Total ug/ml Sulfate	meq of Sulfate
T_7R_1	9053-63		10	x ~~2.19~~ 2.19 (BMS 10-30-93)	21.9	
T_7R_2	-67		10	x 2.34	23.4	
T_7R_3	-71		10	x 1.90	19.0	

Total ug = (Sample Vol.) x (Dilution) x (Solution Conc.)
meq = Total ug / 48000

LSC-08RR

Submitted 25ml samples

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash
PM-10

Job C.P. Dungannon
Team Leader DUH
Date Submitted 6-21-93
Test No. 6
Date of Analysis 6-25-93
Transport Leakage [X] None [ ] _____ ml

Source Kenus
Test Site Stack
Date of Test 6-9-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0	Test 6 Run 0 Field Blank Log Number 9053-46 Vol. of Solvent 105 ml *Solvent Residue 3.8 ug/ml	Dish No. 406 Dish Tare Wt. 49.6181 g Dish+Sample Wt. 49.6185 g Sample Wt. 0.0004 g
1	Test 6 Run 1 Vol. of Solvent 35 ml Log Number -49 Comments	Dish No. 408 Dish Tare Wt. 47.6268 g Dish+Sample Wt. 47.6302 g Sample Wt. 0.0034 g
2	Test 6 Run 2 Vol. of Solvent 25 ml Log Number -53 Comments	Dish No. 410 Dish Tare Wt. 50.5569 g Dish+Sample Wt. 50.5583 g Sample Wt. 0.0014 g
3	Test 6 Run 3 Vol. of Solvent 70 ml Log Number -57 Comments	Dish No. 518 Dish Tare Wt. 48.1016 g Dish+Sample Wt. 48.1032 g Sample Wt. 0.0016 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. 0.0004 g)(10^6)]/Vol. of Sol. 105 ml
EPA-M5 Acetone Residue Blank Spec. < 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0033	0.0013	0.0013	F-14	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job L.P. Dungarvan
Team Leader DUH
Date Submitted 6-21-93
Test No. 6
Date of Analysis 6-25-93

Source Kouns
Test Site Stack
Date of Test 6-9-93
No. of Runs Completed 3
Technician C. Hakeson

0
Test 6 Run 0
Field Blank
Log Number 9053-47
Comments
Filter No. 6036
Filter Type 2.5" GF
Filter Tare Wt. .2576 g
Filter+Sample Wt. .2578 g
Sample Wt. 0.0002 g

1
Test 6 Run 1
Log Number -50
Comments
Filter No. 6019
Filter Type 2.5"GF
Filter Tare Wt. .2595 g
Filter+Sample Wt. .2610 g
Sample Wt. 0.0035 g

2
Test 6 Run 2
Log Number -54
Comments
Filter No. 6017
Filter Type 2.5"GF
Filter Tare Wt. .2601 g
Filter+Sample Wt. .2634 g
Sample Wt. 0.0033 g

3
Test 6 Run 3
Log Number -58
Comments
Filter No. 6016
Filter Type 2.5"GF
Filter Tare Wt. .2564 g
Filter+Sample Wt. .2603 g
Sample Wt. 0.0039 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
	0.0035	0.0033	0.0039		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0068	0.0046	0.0052		

LSC-02PR

Interpoll Laboratories
(612)786-6020

EPA Method 7A Recovery and Analysis Data Sheet (1)

**********SOURCE**********	**********RECOVERY**********	**********ANALYTICAL**********
Job L.P Dungannon	Date of Recovery 6-23-93	Date of Analysis 6-24-93
Source Dryer Stack	Recovered by RS	Analyst RMS
Date of Sampling 6-8-93	Recovery volume 500ml ml	Eluent ASHA
Test No(s) 2	Barometric at time 29.10 IN.HG.	Chromatograph: Dionex System 4000i

Samples collected in accordance with EPA Method 7, CFR Title 40, Part 60, Appendix A. Samples analyzed in accordance with EPA Method 7A by ion chromatography. Mercury manometers used to measure flask pressures/vacuums in sampling and in recovery. Thommen Model TX 19 jewel barometer calibrated against laboratory mercury in glass barometer used to measure field barometric pressure. Three field blanks are prepared and the average used to correct measured nitrate concentrations. All samples are analyzed as a batch using a Dionex Model 4270 Chromatograph Data Intergrator. The integrator is programmed to give the actual concentration of the 500 ml recovered sample even if a subsequent dilution was made. The dilution is indicated here as well as on the chromatogram.

$$C_{RS} = DF(C_{DS}) \qquad M_{NO_3} = (C_{RS} - \bar{C}_B)V_R \qquad \bar{C}_B = (C_{B1} + C_{B2} + C_{B3})/3$$

where: C_{RS} = concentration of nitrate in 500 ml recovered sample in ug/ml

DF = dilution factor

C_{DS} = concentration of nitrate of a 500 ml recovered sample which has been diluted by a factor of DF to bring it into the proper range for the ion chromatograph. This value is an intermediate number and is not outputted by the electronic integrator which is programmed to output the concentration of the original undiluted 500 ml recovered sample.

M_{NO_3} = total mass of nitrate in micrograms in the 500 ml recovered sample and/or in the 2L flask.

C_B = average conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

C_{B1}, C_{B2}, C_{B3} = conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

V_R = recovery volume for samples and field blanks in ml

S-340(1)

Interpoll Laboratories
(612)786-6020

EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	ΔP_g (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - C_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	9053-27	8	2-1-1	78°		✓	1.7		1	0.473	0.283	142
2	28	9	2-1-2			✓	1.3		1	0.351	0.161	80.5
3	26	10	2-1-3			✓	0.6		1	0.413	0.223	112
4	30	11	2-2-2			✓	2.1		1	0.3516	0.1016	83.0
5	31	12	2-2-3			✓	2.7		1	0.394	0.204	102
6	29	26	2-1-1			✓	1.5		1	0.393	0.203	102
7	32	55	2-2-1			✓	-2.5		1	0.350	0.160	80.0
8	33	56	2-2-2			✓	0.5		1	0.370	0.180	90.0
9	34	57	2-3-3			✓	2.9		1	0.341	0.151	75.5
10	35	58	2-3-1			✓	2.0		1	0.318	0.128	104.0
11	36	59	2-3-2			✓	0.5		1	0.374	0.184	92.0
12	37	60	2-3-3			✓	0.0		1	0.3416	0.1516	78.0
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
Blank 1	90	a				✓	0.8		1	CB1 0.190	—	
Blank 2									1	CB2		
Blank 3									1	CB3		

$\bar{C}_B$ = 95.0

S-340(2) R-9/85

INTERPOLL LABORATORIES
(612) 786-6020

S-305RR
(9/90)

EPA Method 10 NDIR Analysis

Job Name L. P. Dungannon
Source Dryer Stack
Date of Analysis 6-22-93
Technician C. Helgeson

NDIR Analyzer:
- ☐ Fuji 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	029328
Upscale gas:	40 ppm	40 ppm	Scott	ALM 03029
Upscale gas:	148 ppm	148 ppm	Linde	60832
Upscale gas:	ppm	ppm		

Post-test Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm	Linde	029328
Upscale gas:	40 ppm	40 ppm	Scott	ALM 03029
Upscale gas:	148 ppm	148 ppm	Linde	60832
Upscale gas:	ppm	ppm		

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry) Dilution Factor	Reading	Actual ppm
1/1	9053-07	1	168.4	168.4
1/2	-11	10	21.2	212.0
1/3	-15	1	90.4	90.4

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 Fuji 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, Dungannon
Laboratory Log No. 9053

Results of Formaldehyde Analysis[1]

Test: 2
Source: Dryer Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde Total ug
	Lab Blank (Reagent)	46
9053-16	Run 0 (Field Blank)	46
9053-18	Run 1	7400
9053-21	Run 2	13000
9053-24	Run 3	17000
9053-86	Trip Blank	14
9053-87	Field Spike (75 ug)	93

Sincerely,

INTERPOLL LABORATORIES, INC.

Gregg W. Holman,
Laboratory Director

GWH/cg

[1]Analysis performed by EPA Method 0011.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana-Pacific, Dungannon
Laboratory Log No. 9053

Results of Formaldehyde Analysis[1]

Test: 8
Source: Press Vent Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde Total ug
9053-76	Run 1	4000
9053-78	Run 2	4300
9053-80	Run 3	4800

Sincerely,

INTERPOLL LABORATORIES, INC.

Gregg W. Holman,
Laboratory Director

GWH/cg

[1]Analysis performed by EPA Method 0011.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana-Pacific, Dungannon
Laboratory Log No. 9053

Results of Phenol Analysis[1]

Test: 4
Source: Press Vent Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Phenol Total mg
9053-38	Run 0 (Field Blank)	< 0.84
9053-40	Run 1	1.5
9053-42	Run 2	1.7
9053-44	Run 3	1.5

Sincerely,

INTERPOLL LABORATORIES, INC.

Gregg W. Holman,
Laboratory Director

GWH/cg

[1]Analysis performed by EPA Method SW-846, 8270.

Interpoll Laboratories
(612)786-6020

SOLUTION NUMBER: P67-68

Chromatography Standards Data Sheet

Stock Standard				Intermediates			Working Standard #1
Date: 6/3/93 Solvent: H_2O Analyst: WAO				Date: Solvent:			Date: Solvent:
Compound	mg	vol	Concent.	Aliquot	Solv. vol.	Concentration	Aliquot/Solv.vol:
D6-phenol 98+% P67	5331.6	100mL	53316 mg/mL				Conc. range:
Aldrich 17606-0 Lot 11408DZ							Working Standard #2
							Aliquot/Solv.vol:
2-fluorophenol 98% P68	9962.8	200mL	49.814 mg/mL				Conc. range:
Aldrich F1280-4 Lot 01516 KV AZ							Working Standard #3
							Aliquot/Solv.vol:
							Conc. range:
							Working Standard #4
							Aliquot/Solv.vol:
							Conc. range:
							Working Standard #5
							Aliquot/Solv.vol:
							Conc. range:

22-1

Solution Verification Information:

Date run:

Acceptable variance? yes no (if no, see Organic Lab Manager)

Replaces solution #

Chromatograms for the above comparison are located:

Comments: field spiking solutions for phenol method (impinger catches)

LOA-02RRR

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana-Pacific, Dungannon
Laboratory Log No. 9053

Results of MDI Analysis[1]

Test: 9
Source: Press Vent Stack
Sample Type: MDI Train Catch

Sample Log No.	Sample Description	MDI Total ug
9053-81	Run 0 (Field Blank)	< 13
9053-82	Run 1	420
9053-83	Run 2	430
9053-84	Run 3	290
9053-85	Run 4	360

Sincerely,

INTERPOLL LABORATORIES, INC.

Gregg W. Holman,
Laboratory Director

GWH/cg

[1]Analysis performed by Method II-8791.

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job 9053 Source Dryer
Field Engineer M. Kuebler Test Site Stack
Date Submitted _____ Date of Test 6-8-93
Test No. 1 No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
3+1	Probe Wash: ☒ Acetone ☐ $MeCl_2$ ☐ DI Water ☐ _____	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	
3+1	Filter: ☒ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
3+1	Impingers: ☒ DI Water ☐ 3% H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☒ $MeCl_2$ Rinse	☐ MN Protocol ☐ WI Protocol ☒ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
3	Integrated Gas Sample ☒ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☒ As per EPA M-10 ☐ Other _____	M-3 Done by Fetch
–	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
–	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
–	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
–	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Dryer

Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☒Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ☐ Other _____

S-278
G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job L.P. / Dungannon
Field Engineer DH
Date Submitted 6/1/93
Test No. 2

Source Dryer
Test Site Stack
Date of Test 6/8/93
No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
4	Probe Wash: ☐ Acetone ☒ $MeCl_2$ ☒ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☒ Other 0011	
	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
4	Impingers: ☐ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☒ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☒ Formaldehyde – 0011 ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
0	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	done on site
13	Oxides of Nitrogen (NO_x)	☒ As per EPA M-7A ☐ Other _____	
	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Dryer

Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite

Wood: ☒Wood Waste ☐Dust ☐Bark

Oil: ☐Waste Oil ☐No. 2 ☐No. 6

☐ Natural Gas ☐ RDF ☐ Other _____

S-278

G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job 9053 Source Dryer
Field Engineer M. Kuehler Test Site Stack
Date Submitted — Date of Test 6.8.93
Test No. 3 No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
-	Probe Wash: ☐ Acetone ☐ $MeCl_2$ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other_____	
-	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other_____	
-	Impingers: ☐ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other_____	
-	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other_____	
-	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other_____	
-	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
-	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other_____	
3	Misc Samples ☒ THC ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other 25A	strip Chart

Type of Source: Dryer

Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☒Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ☐ Other _____

S-278
G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job L.P. Dungannon
Field Engineer DVH
Date Submitted 6/ /93
Test No. 4

Source Press Vent Stack "
Test Site
Date of Test 6/9/93
No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
	Probe Wash: ☐ Acetone ☐ $MeCl_2$ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other_____	
	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other_____	
4 pairs	Impingers: ☐ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☒ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other Phenol	A + B Bottles
6	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other_____	Ambient Air
	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other_____	
	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other_____	
	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other_____	

Type of Source: Vent

Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☐Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ☒ Other NONE

S-278

G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job 9053 — Source Press Vent
Field Engineer M. Kaehler — Test Site Stack
Date Submitted ____ — Date of Test 6-9-93
Test No. 5 — No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
—	Probe Wash: ☐ Acetone ☐ $MeCl_2$ ☐ DI Water ☐ ____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other ____	
—	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other ____	
—	Impingers: ☐ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ ____ ☐ ____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other ____	
—	Integrated Gas Sample ☐ Tedlar Bag ☐ ____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other ____	
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other ____	
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other ____	
3	Misc Samples ☒ TNC ☐ ____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other 25A	Stamp Chart

Type of Source: Wood Press
Fuel Type: NA

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☐Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ☐ Other ____

S-278
G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job LP / Dungannon
Field Engineer Dutt
Date Submitted 6/ /93
Test No. 6

Source KONUS
Test Site STACK
Date of Test 6/9/93
No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
4	Probe Wash: ☒ Acetone ☐ $MeCl_2$ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☒ As per EPA M-201A ☐ Other _____	
4	Filter: ☐ 4" Glass ☐ SS Thimble ☒ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☒ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
4	Impingers: ☒ DI Water ☐ $3\%H_2O_2$ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other 201A	
3	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	
	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Konus oil heater

Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☒Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ☐ Other _____

S-278
G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job 9053 Source Konus
Field Engineer M. Kuehler Test Site Stack
Date Submitted _____ Date of Test 6-9-93
Test No. 7 No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
3	Probe Wash: ☒ Acetone ☐ $MeCl_2$ ☐ DI Water ☐ _____	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	
3	Filter: ☒ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
3	Impingers: ☒ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☒ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
3	Integrated Gas Sample ☒ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
—	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Konus

Fuel Type:

Coal: ☐ Bituminous ☐ Anthracite ☐ Lignite

Wood: ☒ Wood Waste ☐ Dust ☒ Bark

Oil: ☐ Waste Oil ☐ No. 2 ☐ No. 6

☐ Natural Gas ☐ RDF ☐ Other _____

S-278

G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job L.P. Dungannon
Field Engineer DVH
Date Submitted 6/ /93
Test No. 8

Source Press Vent
Test Site Stack
Date of Test 6/10/93
No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
4	Probe Wash: ☐ Acetone ☒ $MeCl_2$ ☒ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☒ Other OCM	
	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
3	Impingers: ☐ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☒ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☒ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	
	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Vent

Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☐Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ☒ Other none

S-278

G:\STACK\WP\FORMS\S-278.LAS

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job 9053 Source Press Vent
Field Engineer M. Koehler Test Site Stack
Date Submitted _____ Date of Test 6-10-93
Test No. 9 No. of Runs Completed 4

No.	Sample Type	Analysis	Comments
4+1	Probe Wash: ☐ Acetone ☒ $MeCl_2$ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☒ Other MDI	
4+1	Filter: ☐ 4" Glass ☐ SS Thimble ☒ 2.5" Glass Treated ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☒ Other MDI	Added to P.W.
—	Impingers: ☐ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
—	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	Ambient Air
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
—	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

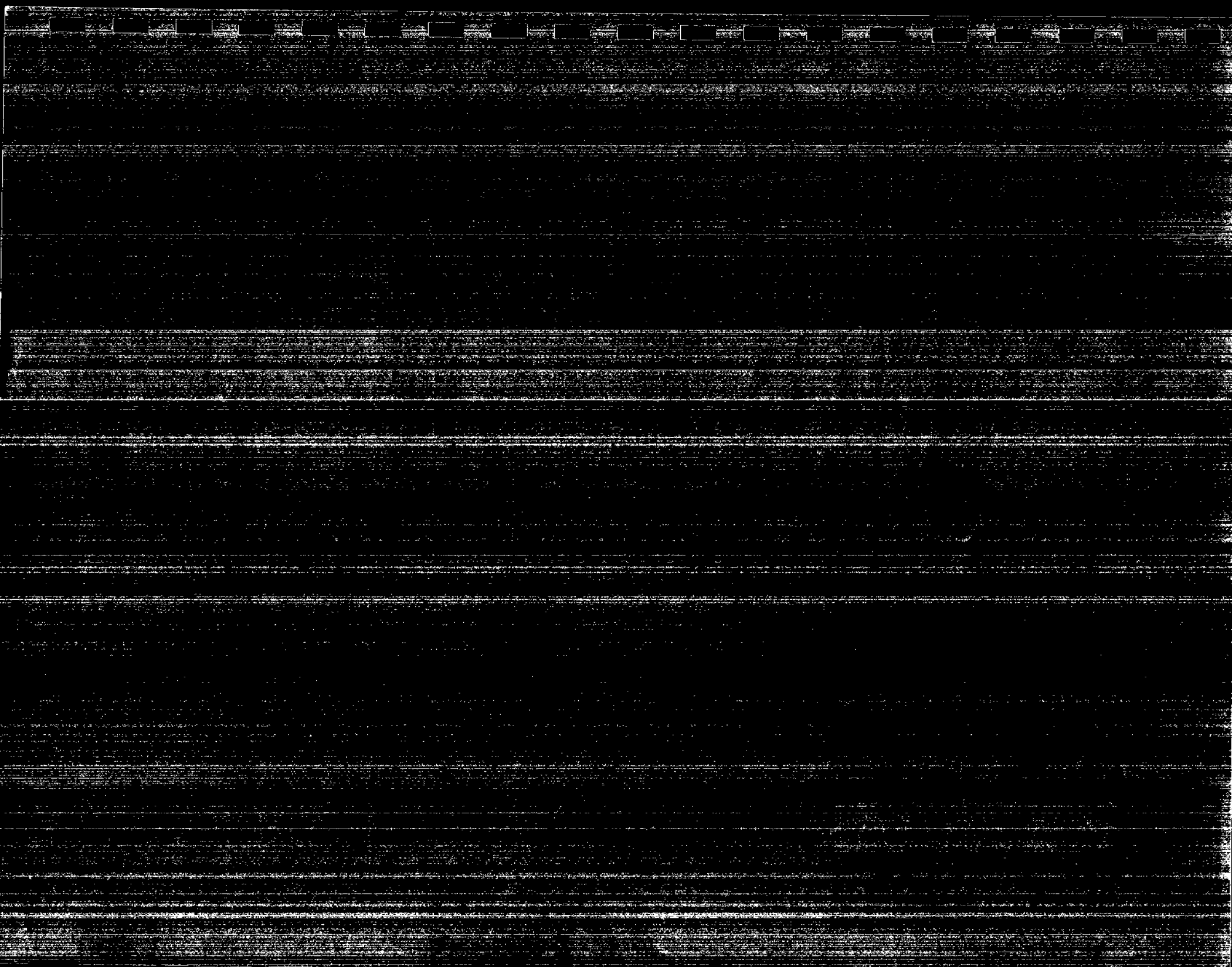
Type of Source: Wood Press

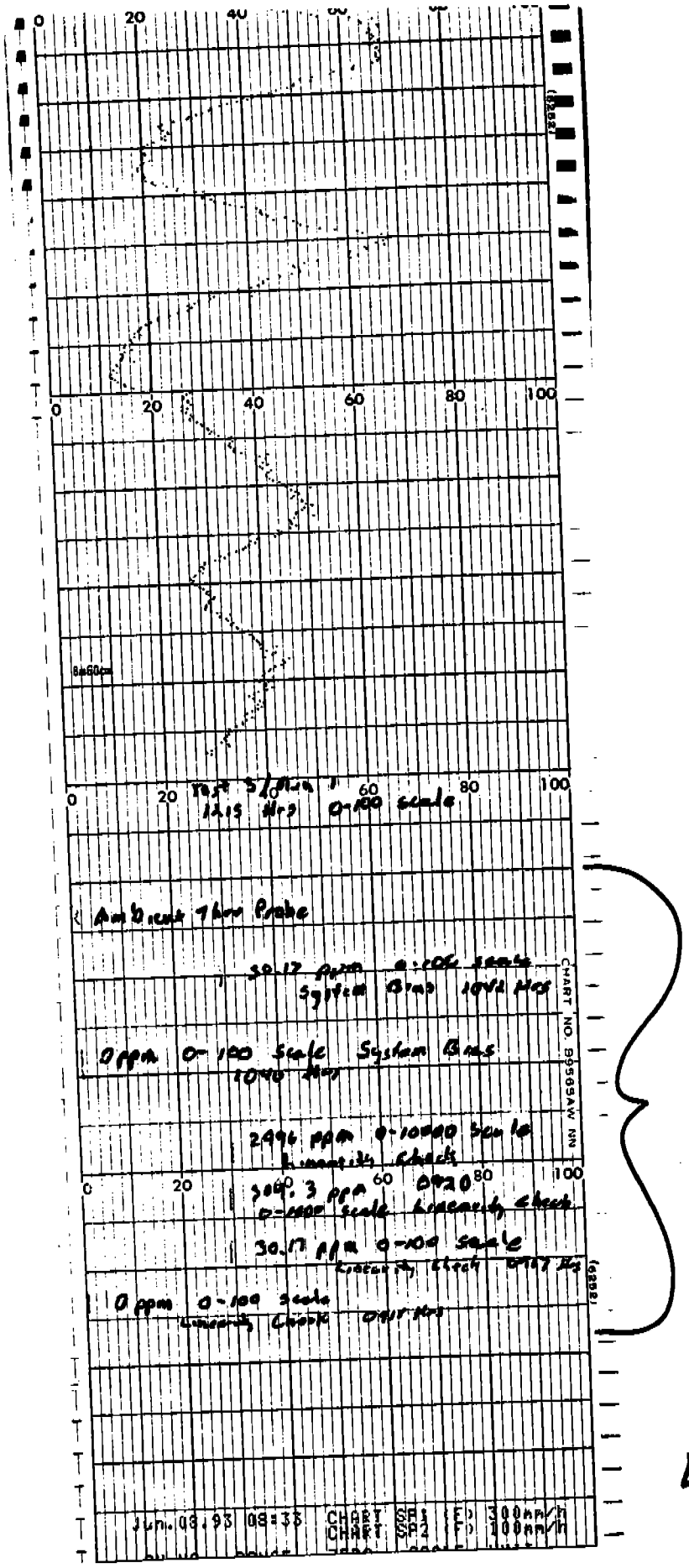
Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☐Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ☐ Other NA

S-278
G:\STACK\WP\FORMS\S-278.LAS

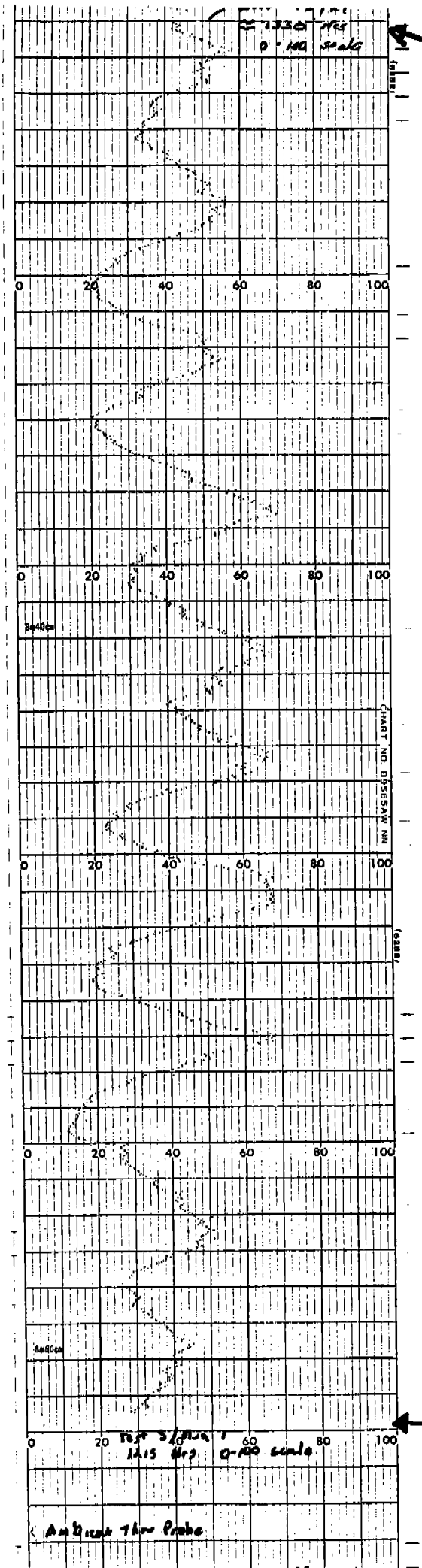


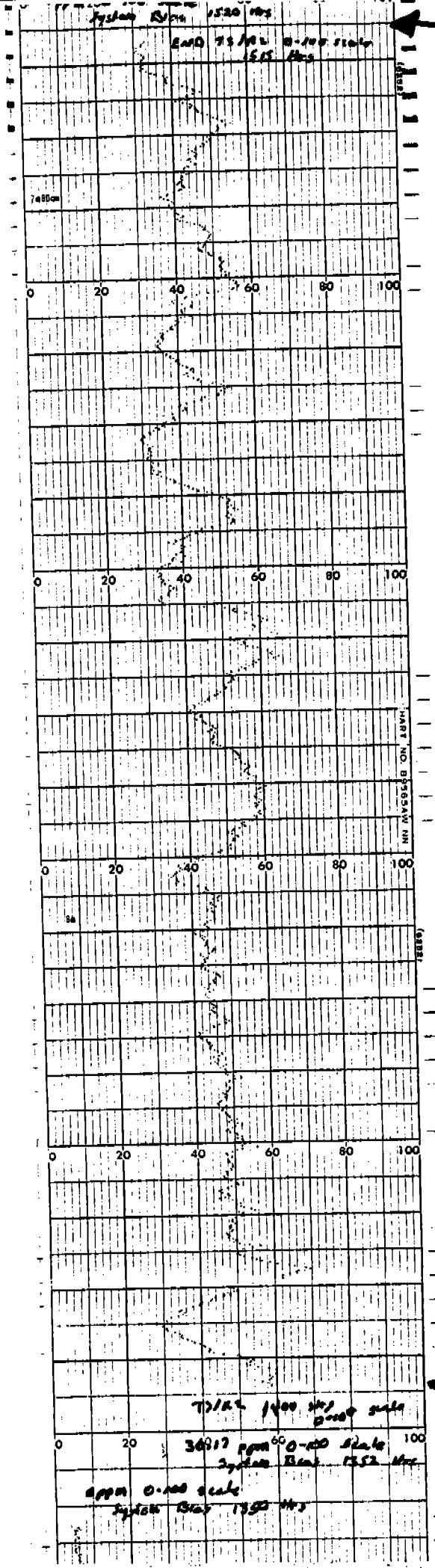




calibration Data

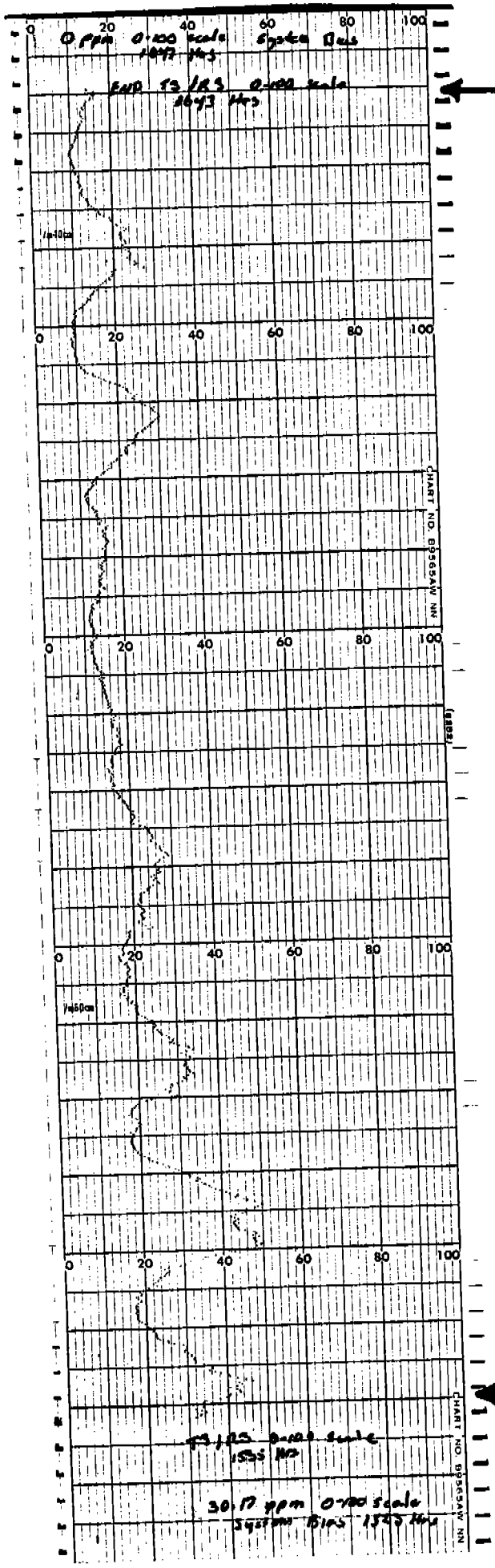
THC
LP/Dungannon
6/8/93


stop run 1
1330 HRS
0-100 ppm range
1215 HRS
start Run 1
DRYER
Ambient Flow Probe



End Run 2
1520 HRS

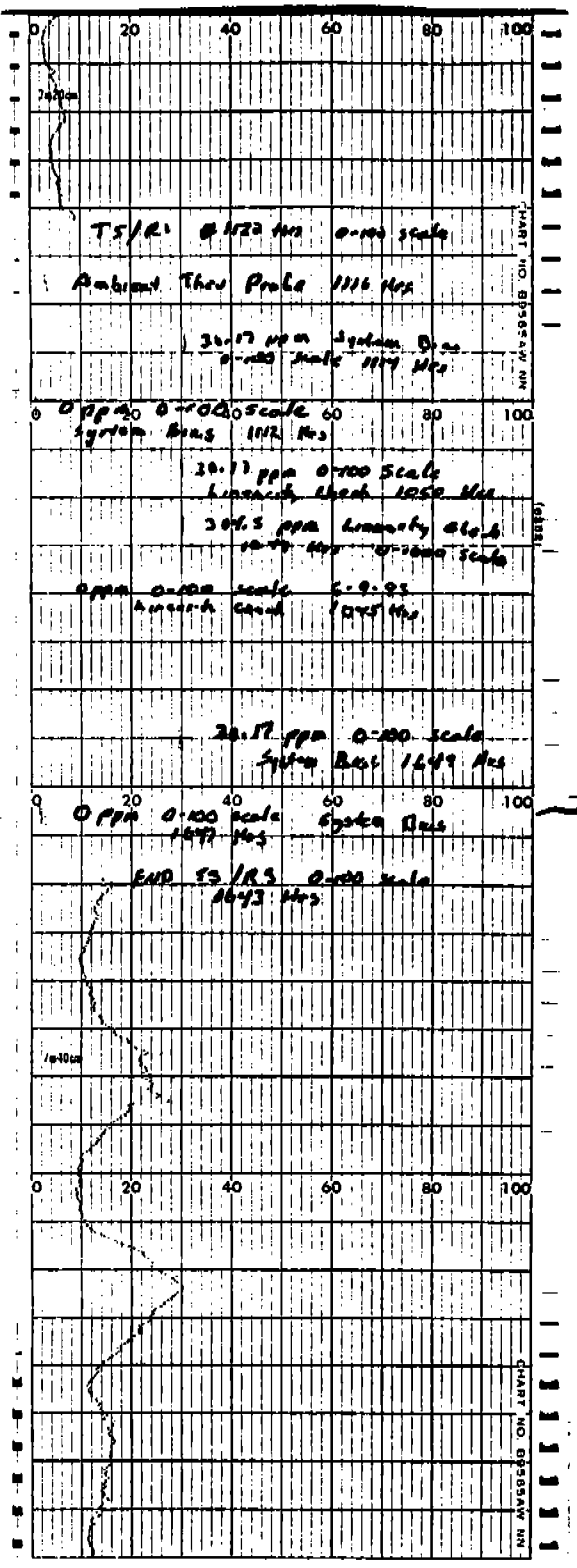
Start Run 2
1400 HRS
DRyer stack



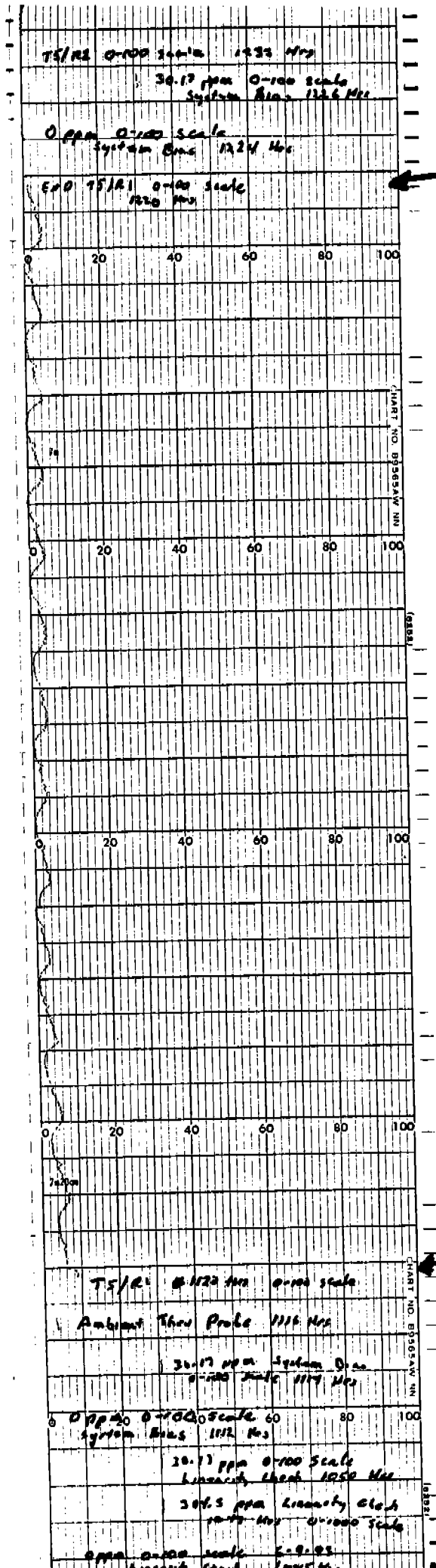
End Run 3
1641 HRS

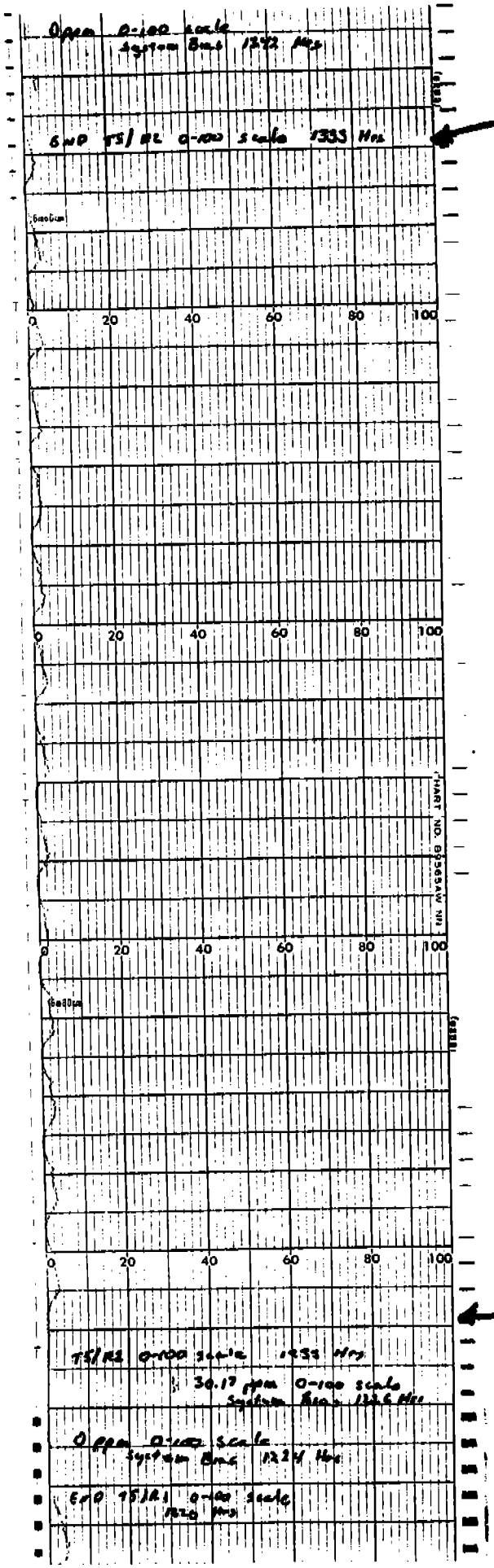
1536 HRS
start Run 3

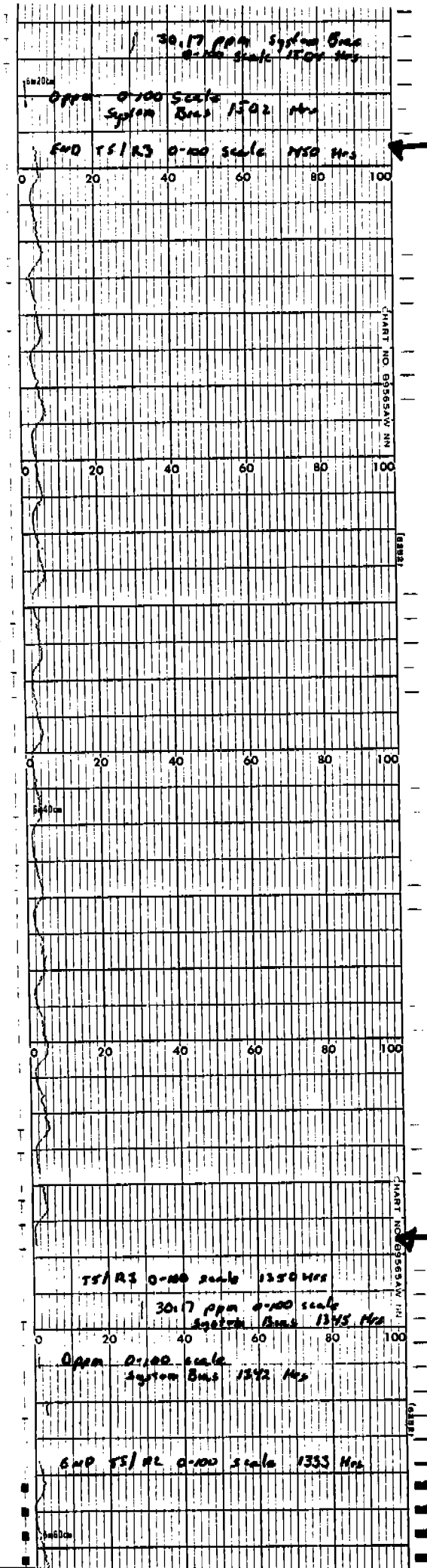
Dryer



calibration DATA


end Run 1
1220 HRS
0-100 ppm Range
start Run 1
1120 HRS
PRESS
6/9/93

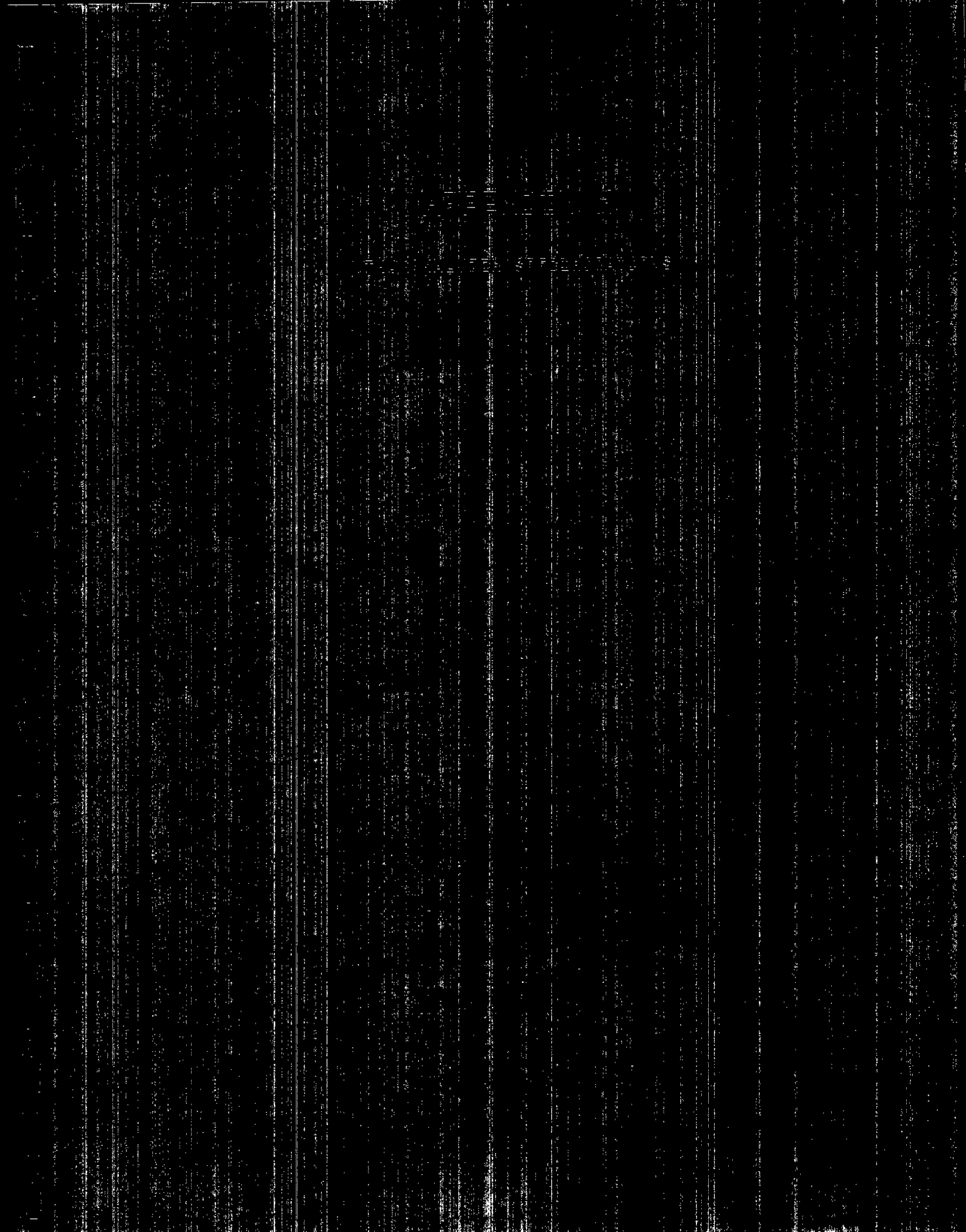

end Run 2
1333 HRS
start Run 2
1233 HRS
PRESS

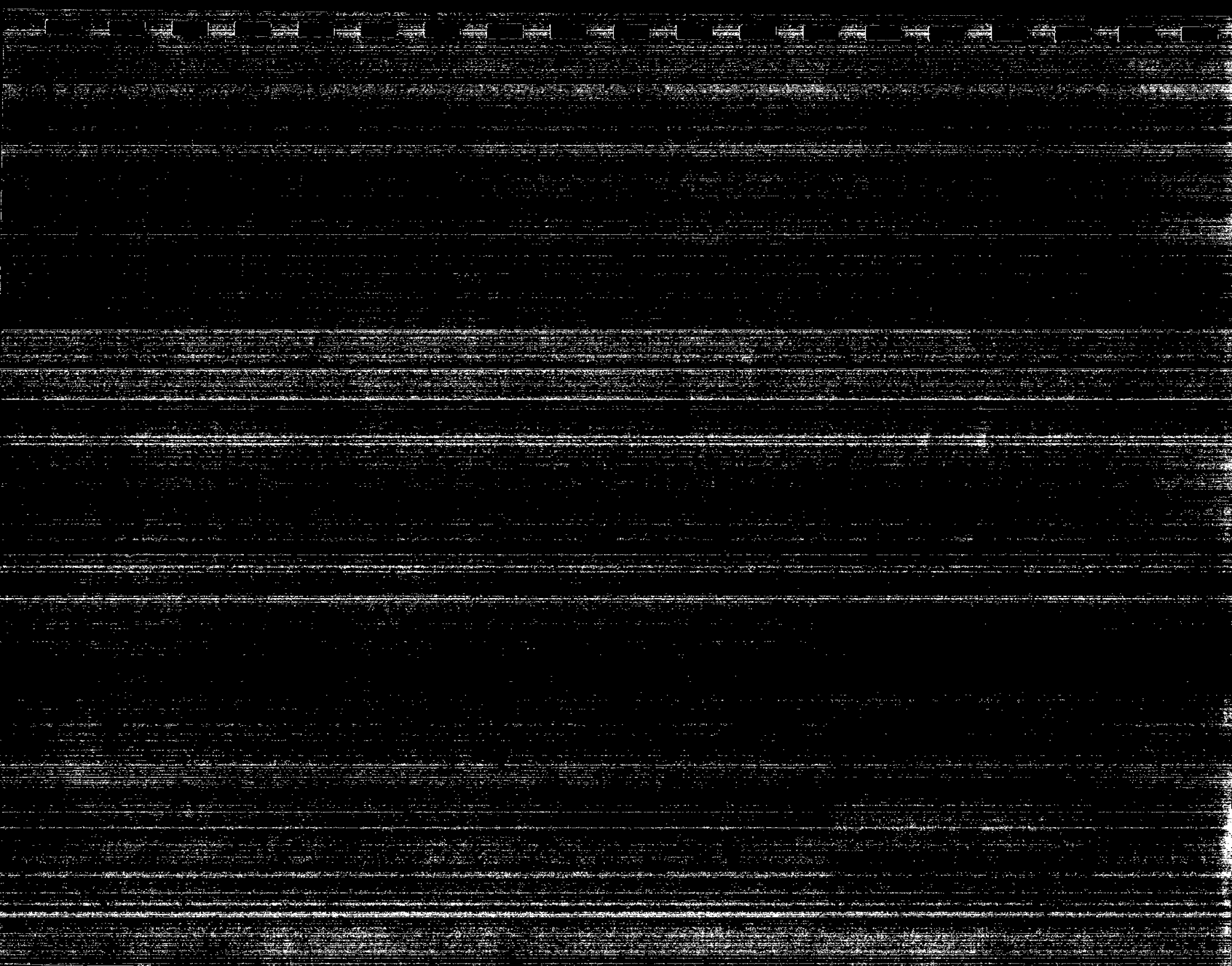


end Run 3
1450 HRS

start Run 3
1350 HRS

PRESS





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:

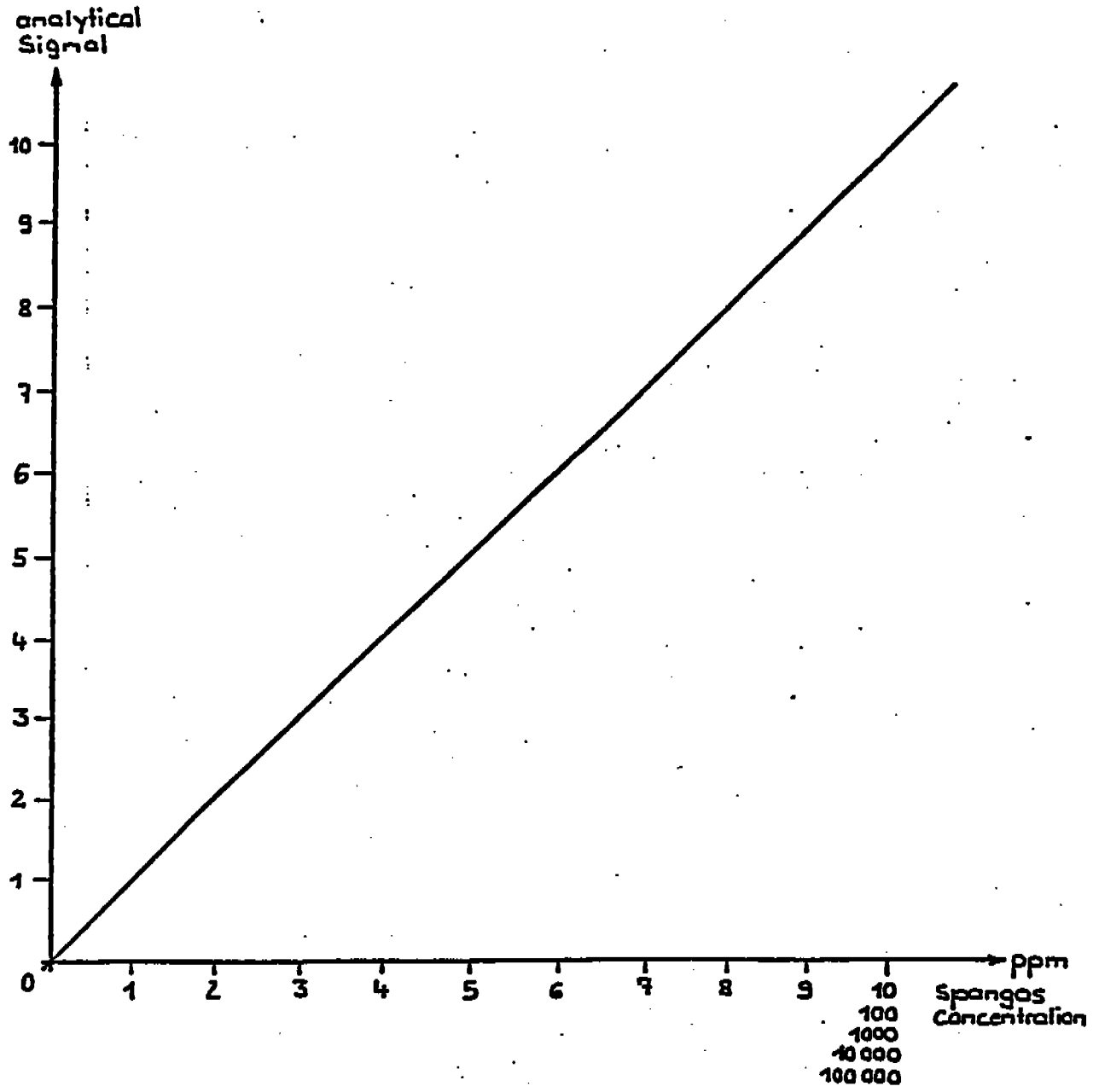
Temperature : 160 °C

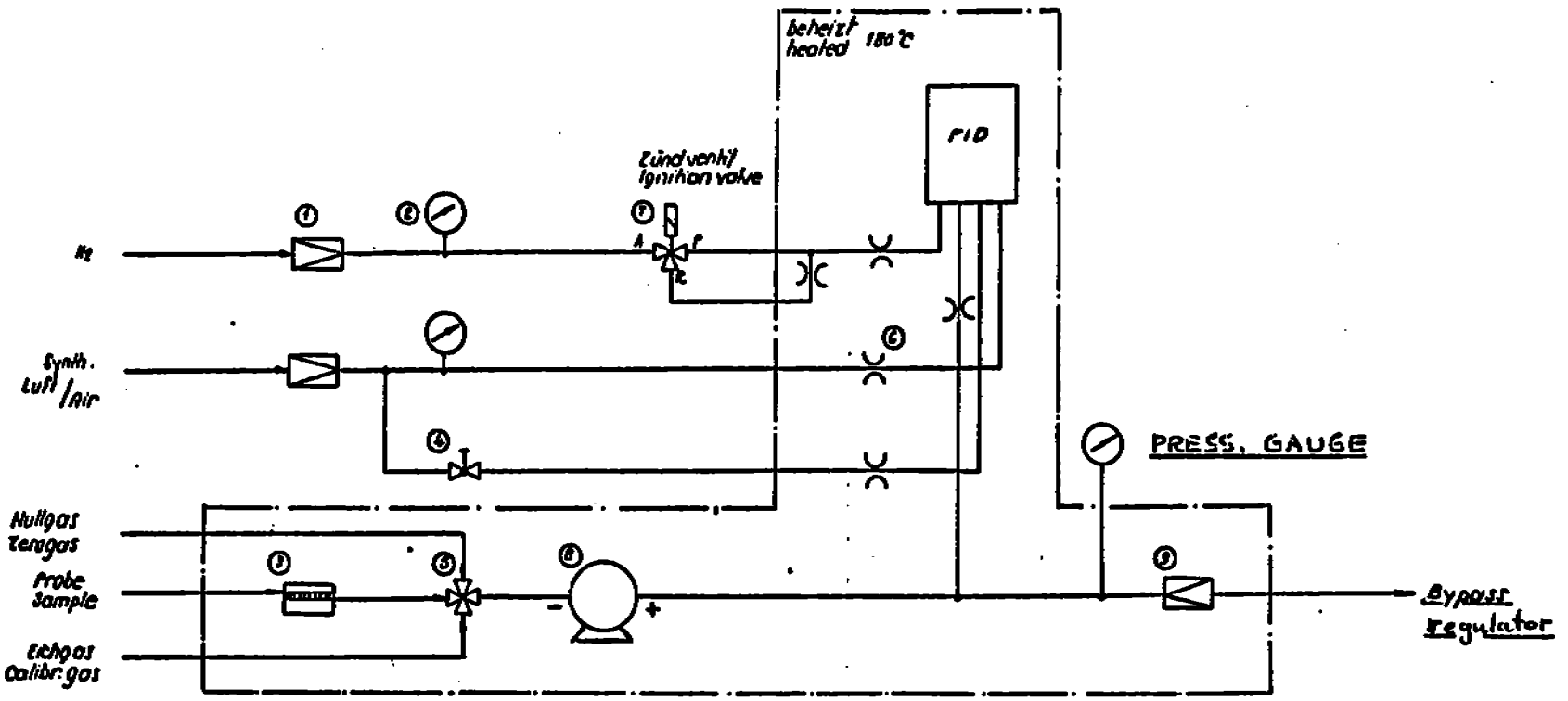
Zero Point : 3,90
Gain : 7,70

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

CALIBRATION DIAGRAMM





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
Boot pressure regulator

Zündventil
Ignition valve

P-A angezogen
energised
R-A stromlos
at rest

Handumschaltung
Manuel switching

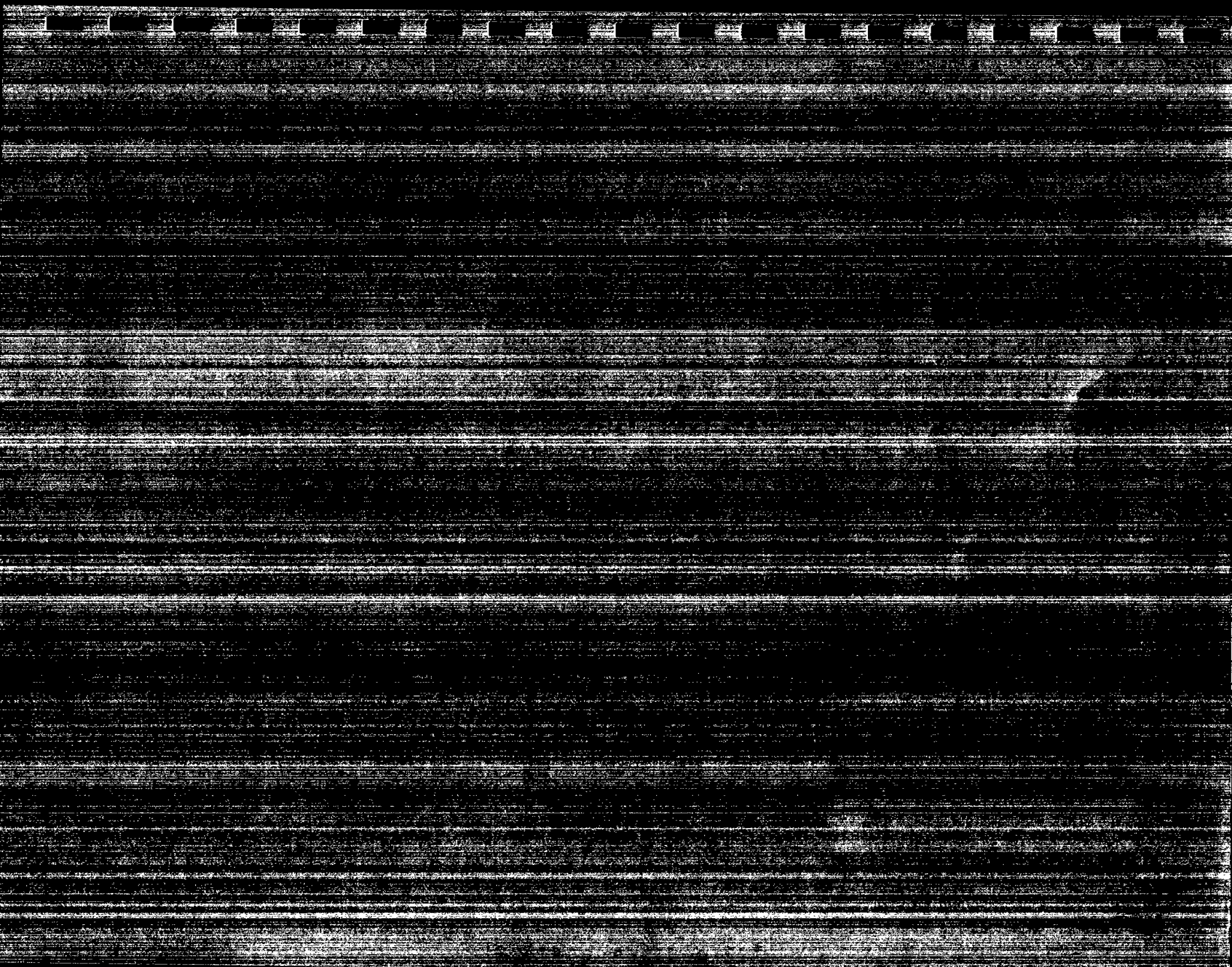
Ratfisch
INSTRUMENTE

FLAMMEN IONISATIONS DETEKTOR
Flame Ionisation Detector

Fließplan
Flowdiagram

RS 55

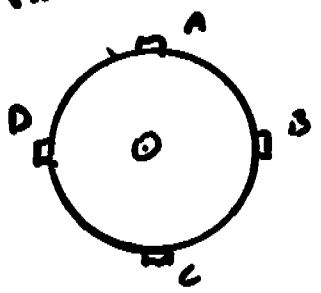
13.04.88 dr



INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job 9053
Source Press Vent / Stack
Test 5 Run 0 Date 6-9-93
Stack dimen. 59.5" IN.
Dry bulb 100 °F Wet bulb ___ °F
Manometer: ☐ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.92 in Hg
Static pressure ~~-.04~~ in WC
Operators M. Loehler & T. Bergstrom
Pitot No. INST. 6 Cp NA

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: 6.25 in.		Time start:	hrs
D-1	1/6	9.92	16.17		
2	3/6	29.75	36.00		
3	5/6	49.58	56.08		
A-1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Temp. meas. device & S/N: NA				Time end:	hrs

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

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

Job 9053

Test 5 Run 0 Date 6-9-93
Operator M. Kuehler

THC Calibration (Low Range): Time(HRS) 1030

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0			
Low level	30.17	30			
Mid level	304.3	305			
High level					

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 9053 Source Press Vent
Test 5 Run 1,2,3 Date 6-9-93 Site Stack
Operator M. Kaebler

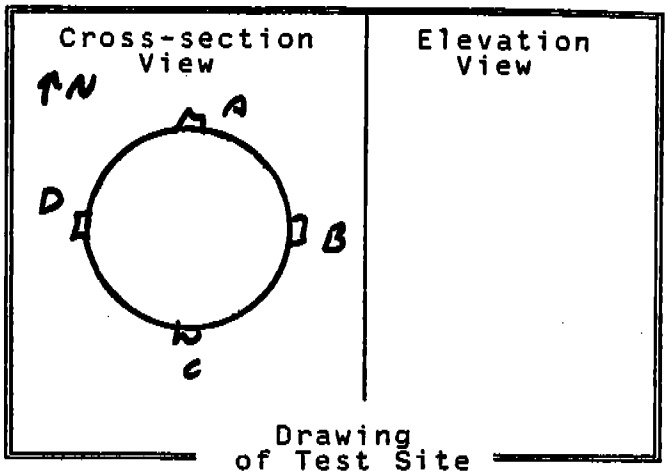
Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1112	Zero gas	0	0	1	1	100	1
		Upscale	30.17	30	31	1	100	1
2	1225	Zero gas	0	0	0	0	100	0
		Upscale	30.17	30	31	1	100	1
3	1340	Zero gas	0	0	1	1	100	1
		Upscale	30.17	30	29	1	100	1
4	1500	Zero gas	0	0	2	2	100	2
		Upscale	30.17	30	31	1	140	1
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 2 FIELD DATA SHEET

Job 9053
Source Dryer 1 stack
Test 3 Run 0 Date 6-9-93
Stack dimen. 48 IN.
Dry bulb 201 °F Wet bulb ___ °F
Manometer: ☐ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 29.80 in Hg
Static pressure ___ in WC
Operators M. Kaehler & J. Bergstrom
Pitot No. INST S Cp .84 NA



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
P-1	1/6	8.00	14.00		
2	3/6	24.00	30.00		
3	5/6	40.00	46.00		
Temp. meas. device & S/N: PDT-19 / TC				Time end:	hrs

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

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

Job 9053

Test 3 Run 0 Date 6-8-93
Operator M. Rankler

THC Calibration (Low Range): Time(HRS) 1000

***	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	29	1.17	100	1.17
Mid level	304.3	297	7.3	1000	.03
High level	2996	3037	41	10000	.41

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

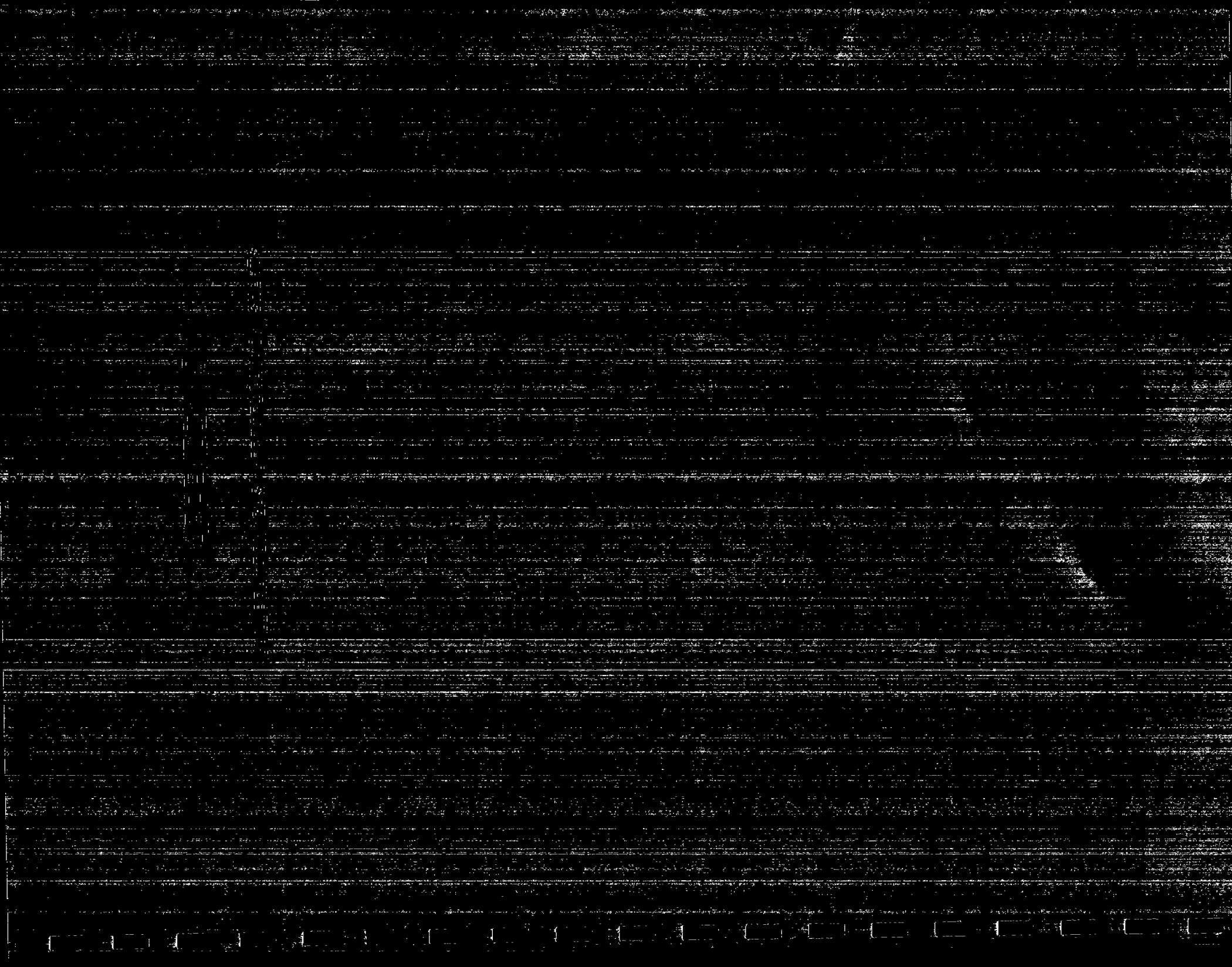
System Bias Check

Job 9053 Source Dryer
Test 3 Run 1,2,3 Date 6-8-93 Site Stack
Operator M. Kaehler

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1135	Zero gas	0	0	1	1	100	1
1218		Upscale	30.17	29	29	0	100	0
1330 2	1350	Zero gas	0	0	1	1	100	1
		Upscale	30.17	29	29	0	100	0
1400 3	1520	Zero gas	0	0	2	2	100	2
1515		Upscale	30.17	29	30	1	100	1
1535 4	1647	Zero gas	0	0	2	2	100	2
1643		Upscale	30.17	29	30	1	100	1
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



[redacted]

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

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

Our Project # : 538033

Your P.O. # : 40142

Expiration Date : 12-11-93

Cylinder Number : ALM018507

Cylinder Pressure 1900 psig

1 of 1 Component(s)

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

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1

Procedure # G1

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-26980	47.80 PPM
GMIS‡	ALM-008846	31.20 PPM

INSTRUMENTATION

INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE
BECKMAN 400	6-12-92

ANALYTICAL PRINCIPLE: 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

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

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

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

Shipped From : Scott Michigan

Our Project # : 533359

Your P.O. # : 6033WW

Expiration Date : 8-6-93

Cylinder Number : BLM-000633

Cylinder Pressure 1900 psig

1 OF 1 COMPONENTS

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

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

Certified Per Traceability Protocol # 1 Procedure # 81

File # PO-2183

Certified Accuracy 1% NBS TRACEABLE

ANALYZED CYLINDER		REFERENCE STD			INSTRUMENTATION		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
PROPANE	304.3 PPM	1669B	CLM-000702	466.0 PPM	BECKMAN	1-23-92	FLAME IONIZATION DETECTOR
		1668B	CLM-000694	95.00 PPM	400		
					1002059		
BALANCE GAS : AIR							

C-2

CERTIFIED EPA PROTOCOL

ANALYSIS DATE : 2-6-92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	65.70	304.3	466.0 PPM	100.00	466.0
0.00	65.70	304.3		100.00	466.0
0.00	65.70	304.3		100.00	466.0
CALCULATED RESULTS		304.3			
		304.3			
		304.3			
AVERAGE :		304.3 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
	315.8	68	68.10	315.6	-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

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : T. C. Dix

Approved By : L Shapiro

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

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

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

Shipped From : Scott Michigan

Our Project # : 528651

Your P.O. # : 4571-BA

Expiration Date : 4-6-93

Cylinder Number ALM-007466

Cylinder Pressure 1900 psig

Customer :
OXYGEN SERVICE
1111 PIERCE BUTLER ROUTE
ST. PAUL, MN. 55104

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1

Procedure # 81

File # PO-1270

Certified Accuracy 1 % NBS Traceable

COMPONENT	CERTIFIED CONC.
PROPANE	2996 PPM

BALANCE GAS : AIR

REFERENCE STD

SRM # (CRM #)	CYLINDER NUMBER	CONC.
2648	FF-26718	4892.00 PPM
2646	AAL-18432	973.20 PPM

GAS ANALYZER

MAKE/MODEL	LAST CALIBRATION DATE
GAS CHROMOTAGRAPHY VARIAN 3400	10-6-91

ANALYTICAL PRINCIPLE

FLAME IONIZATION DETECTOR GAS CHROMATOGRAPHY

ANALYSIS DATE : 10-6-91

ZERO GAS (AREA	TEST GAS (AREA)	RESULTS PPM	REFERENCE GAS CONC.	(AREA)	RESULTS PPM
0.00	642883	0.030	4892.00 PPM	1048770	0.030
0.00	643086	0.030		1050710	0.030
0.00	643342	0.030		1050004	0.030
	CALCULATED RESULTS	2997			
		2993			
		2997			
	AVERAGE :	2996 PPM			

CALIBRATION CURVE 1 ST DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	GC (Area)	FITTED VALUE	PERCENT ERROR
2648	4892.00	100	1049828	4892.00	0.00
	973.20	20	210343	977.50	0.44
	0.00	0	0.00	0.00	0.00
2646	973.20	LOW	210343	977.50	0.44
	4892.00	HIGH	1049828	0.03	0.00

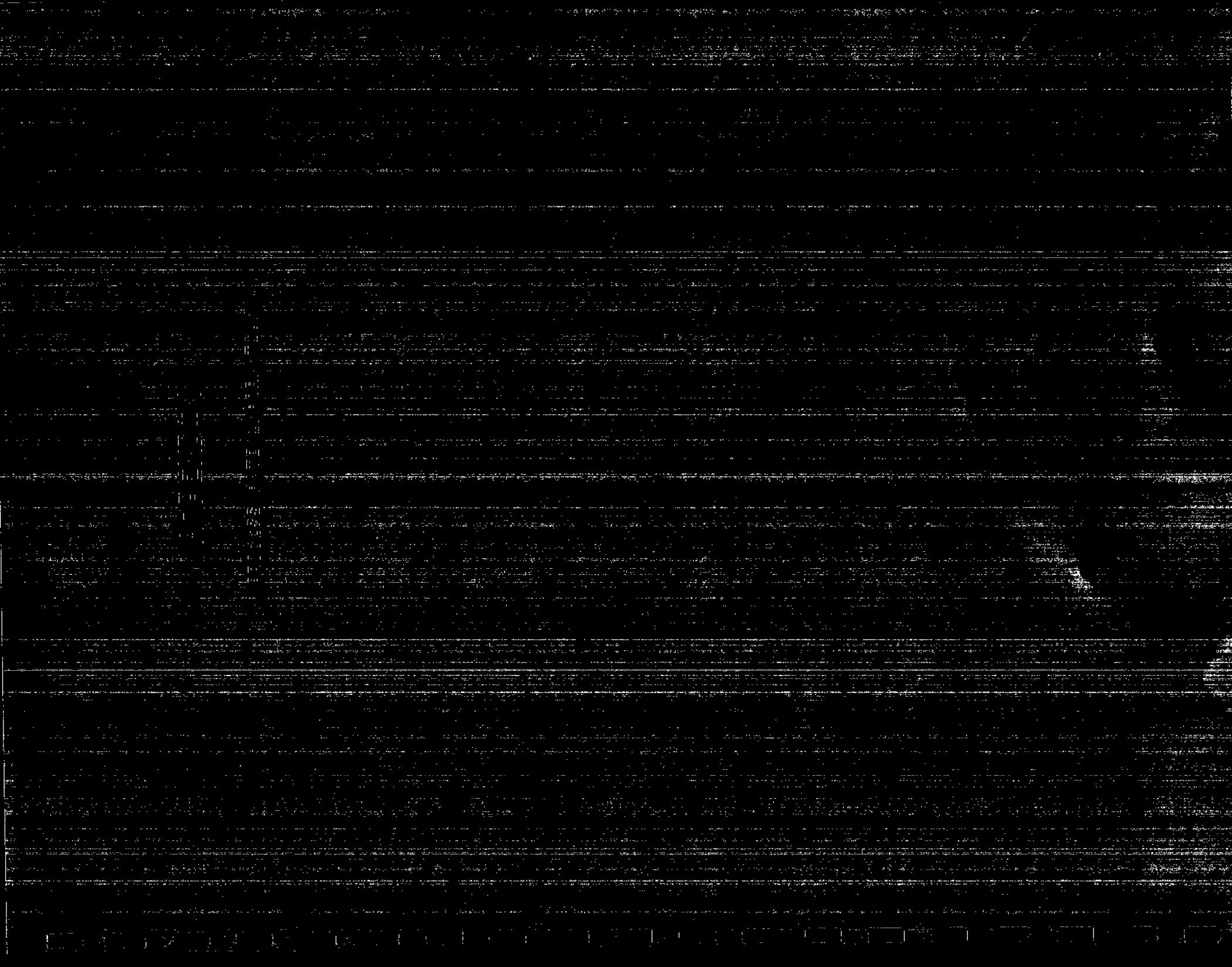
Analyst: L C Dean

Approved By: L Shapiro

: GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

The only warranty of this Company is that which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

J-3



DUNGANNON TESTING 6-8-93 THROUGH 6-10-93
PROCESS DATA

CONTENTS PAGE

TEST SCHEDULE 2

DATA SPECIFIED IN TEST PLAN 3-5

PROCESS DATA SUMMARY 6

DUNGANNON DRYER TESTING 6-8-93

BOARD WEIGHTS / PRODUCTION	7
FUEL BURNING RATE	8
DRYER DATA SHEETS	9-10
DRYER CHARTS	11-12
PRESS CHARTS	13-14
PRESS REPORTS	15-16
EFB READINGS	17-18

DUNGANNON PRESS VENT AND THERMAL OIL HEATER TESTING 6-9-93

BOARD WEIGHTS / PRODUCTION	19
PRESS CHARTS	20-21
PRESS REPORTS	22-23
BTU INPUT	24
THERMAL OIL HEATER LOG	25-26
RESIN AND WAX USAGE	27
RESIN CHARTS	28-43
DAILY INVENTORY SHEET	44

DUNGANNON PRESS VENT TESTING 6-10-93

BOARD WEIGHTS / PRODUCTION	45
PRESS CHARTS	46-47
PRESS REPORTS	48-49
RESIN AND WAX USAGE	50
RESIN CHARTS	51-56
DAILY INVENTORY SHEET	57

TEST SCHEDULE

DRYER TESTING

TEST NO.	DATE	POLLUTANT	RUN #1	RUN #2	RUN #3
1	6-8	TSP,CO	1220-1321	1400-1512	1536-1641
2	6-8	HCHO,NOX	0857-1027	1057-1227	1310-1436
3	6-8	VOC	1215-1330	1400-1515	1536-1641

THERMAL OIL HEATER TESTING

TEST NO.	DATE	POLLUTANT	RUN #1	RUN #2	RUN #3
6	6-9	PM-10	1530-1649	1723-1838	1915-2029
7	6-9	TSP	1533-1643	1725-1833	1917-2024

PRESS VENT TESTING

TEST NO.	DATE	POLLUTANT	RUN #1	RUN #2	RUN #3	RUN #4
4	6-9	PHENOL	1030-1130	1138-1238	1248-1351	
5	6-10	VOC	1120-1220	1233-1333	1350-1450	
8	6-10	HCHO	0842-0946	1010-1120	1142-1252	
9	6-10	MDI	0938-1043	1105-1208	1230-1333	1405-1506

2

1.8 Copies of field data forms are included in attachment.

1.9 The names and titles of personnel are not available at this time. Testing will be performed by Interpoll Laboratories, Inc.

1.10 Procedures for maintaining sample integrity and chain of custody are provided in the attachments. Interpoll Laboratories QA-QC manual will be followed. Due to the size of this document, it has not been included here but can be provided on request.

2. THERMAL OIL HEATER OPERATING DATA:

2.1 Design heat input is 31mm BTU. Operating heat input to be based on f factor. Heat output to be determined by efficiency calculations.

2.2 Type of fuel to be used is 100% green bark and green wood fines.

2.3 Tons of dry fuel burned during testing will be determined by bark infeed counts and moisture content and auger calibration.

2.4 Plant production rate is tons of finished product per hour.

2.5 Thermal Oil Heater operating parameters including:
- Refractory temperature
- Incoming oil temperature
- Outgoing oil temperature
- Fuel feed setting
- Building heat setpoint and thermal oil temperature setpoint.

2.6 Control equipment parameters to be recorded include:
- Baghouse pressure drop

3. DRYER OPERATING DATA:

3.1 Moisture content of wet wafers.
Moisture content of dry wafers.

3.2 Wood to be processed will be $\geq$ 99% green wood, $\leq$ 1% dried, dead wood.

3.3 Wood to be processed will be $\geq$ 99% hardwood, $\leq$ 1% softwood.

3.4 Dryer operating temperature to be recorded:
- Inlet temperature
- Outlet temperature

3.5 Design airflow rate is 50,000 acfm, actual airflow will be determined during sampling.

3.6 Type of fuel to be burned is dry fines.

3.7 The heat content of the dry fuel will be determined by analysis.

3.8 The dryer is 12' diameter and 60' long.

3.9 Dryer production rate in pounds of dry furnish per hour based on press production plus screened fines and board trim using the following formula:

$$\frac{\text{lb. Dryer Production}}{\text{HR}} = \frac{\text{Tons press prod./hr}}{1 - (0.07 + 0.08)} / 2000$$

Where: Board Trim = 7% of finished product weight
screened fines = 8% of finished product weight
Permit rate is 23,280 lb. dry furnish (19.4/hr at 40% M.C.)
Design rate is 29,105 lb. dry furnish/hr.
Test rate is estimated to be equal to permit rate

3.10 The level of the dry bins will be recorded before and after testing.

3.11 Plant production rate will be at or near 10 tons of finished product per hour based on press production. See 7c10.

3.12 Additional dryer operating parameters to be recorded include:
- Wet bin feed rate

3.13 EFB operating parameters to be recorded include:
- Bed voltage
- Bed amperage
- Ionizer voltage
- Ionizer amperage
- EFB pressure drop

4. PRESS OPERATING DATA:

4.1 Board thickness.

4.2 Number of sheets produced per hour to be determined by press chart.

4.3 Pounds of resin used per hour to be recorded.

4.4 Pounds of wax used per hour to be recorded.

4.5 Type of resin used to be recorded.

4.6 Press temperature to be recorded.

4.7 There are two exhaust fans with a design airflow of 80,000 acfm. Actual acfm will be determined during sampling.

4.8 Tons of finished product produced during test will be determined by board weights and press charts.

DUNGANNON TESTING 6-8-93 THROUGH 6-10-92

PROCESS DATA SUMMARY

DRYER TESTING 6-8-93, 0830-1440

9.5 =PLANT PRODUCTION RATE IN TONS PER HOUR
1.56 =DRY FUEL INPUT IN TONS PER HOUR
22865 =LB PER HOUR OF FURNISH PRODUCED BY DRYER
1148 =AVERAGE DRYER INLET TEMPERATURE IN DEGREES F
44% = MOISTURE CONTENT OF INCOMING WOOD
5% = MOISTURE CONTENT OF WOOD AFTER DRYING

DRYER TESTING 6-8-93, 1220-1640

9.5 =PLANT PRODUCTION RATE IN TONS PER HOUR
1.64 =DRY FUEL INPUT IN TONS PER HOUR
22865 =LB PER HOUR OF FURNISH PRODUCED BY DRYER
1214 =AVERAGE DRYER INLET TEMPERATURE IN DEGREES F
44% = MOISTURE CONTENT OF INCOMING WOOD
5% = MOISTURE CONTENT OF WOOD AFTER DRYING

PRESS VENT TESTING 6-9-93, 1030-1400

9.52 =PLANT PRODUCTION RATE IN TONS PER HOUR
200 =MDI RESIN USAGE IN LBS PER HOUR
435 =LIQUID PHENOLIC RESIN USAGE IN LBS PER HOUR (100% SOLIDS)

PRESS VENT TESTING 6-10-93, 0830-1510

9.4 =PLANT PRODUCTION RATE IN TONS PER HOUR
200 =MDI RESIN USAGE IN LBS PER HOUR
434.5 =LIQUID PHENOLIC RESIN USAGE IN LBS PER HOUR (100% SOLIDS)

THERMAL OIL HEATER TESTING 6-9-93, 1530-2030

9.52 =PLANT PRODUCTION RATE IN TONS PER HOUR
0.58 = ESTIMATED TONS OF DRY FUEL INPUT BASED ON TEMP. DIFFERENTIAL

DUNGANNON DRYER TESTING 6-8-93
0830-1640

BOARD WEIGHTS - LBS
WEIGHTS OF APPROXIMATELY EVERY 25TH
UNTRIMMED BOARD FROM TAPES

196	189	193
184	198	193
185	171	182
194	188	184
195	189	183
190	180	187
185	199	202
184	192	197
192	190	196
190	203	
185	210	
186	212	
185	192	
192	198	
204	201	
190	192	

191.66 LB = AVERAGE UNTRIMMED MAT WEIGHT

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

8.9% = TRIM

PLANT PRODUCTION RATE

8.16 =HOURS DURING TESTING
111 =PRESSLOADS
888 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
155045 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
19001 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
9.5 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PRODUCT PER HR / 2000 LB)

DRYER PRODUCTION RATE:

22865 =LB OF DRYER PRODUCTION / HR (LB OF FINISHED PROD./ (1-(% TRIM + % FINES)

8.0% =%FINES
8.9% =%TRIM

43.8% = MOISTURE CONTENT OF INCOMING WOOD
5.1% = MOISTURE CONTENT OF WOOD AFTER DRYING

DUNGANNON DRYER TESTING 6-8-93
0830-1640

DRYER FUEL BURNING RATE HCHO,NOX TESTING
0830-1440

6.75 =FUEL CALIBRATION IN LB/COUNT
2844 = TOTAL COUNTS DURING TESTING HOURS
6.16 =HOURS DURING TESTING

19197 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CALIBRATION)
3116 =LB. OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED / TESTING HOURS
1.56 =TONS OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED PER HOUR / 2000 LB)
8600 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)
26.8 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

DRYER FUEL BURNING RATE TSP,CO,VOC TESTING
1220-1640

6.75 =FUEL CALIBRATION IN LB/COUNT
2107 = TOTAL COUNTS DURING TESTING HOURS
4.33 =HOURS DURING TESTING

14222 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CALIBRATION)
3285 =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)
28.25 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

DRYER DATA SHEET

DATE 6-8-93
BY Louis Castle

PLANT: DUNGANNON
REVOLUTIONS per MINUTE: 8.33
FUEL CALIBRATION: 6.75

(NOTE ANY CHANGES IN SETPOINTS)

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
7:30	206	62	1105	203	199	Full	1/2	1/2	31.9	8.0
7:40	206	63	1100	205	256	Full	1/2	1/2		
7:50	206	63	1141	205	329	3/4	1/2	1/2		
8:00	206	63	1117	204	402	3/4	1/2	1/2	~~31.9~~ ?	~~8.0~~ ?
8:10	206	63	1103	206	480	3/4	1/2	1/2	47.3	4.6
8:20	206	63	1097	206	543	3/4	1/2	1/2		
8:30	206	63	1061	206	612	Full	1/2	1/2	41.0	4.0
8:40	206	63	1099	203	682	3/4	1/2	1/2		
8:50	206	63	1048	207	749	Full	1/2	1/2		
9:00	206	63	1114	205	824	3/4	1/2	1/2	43.0	5.0
9:10	206	64	1251	203	900	3/4	1/2	1/2		
9:20	206	64	1145	208	978	3/4	1/2	1/2		
9:30	206	64	1084	208	1058	3/4	3/4	3/4	43.0	5.0
9:40	206	64	1011	209	1128	3/4	3/4	3/4		
9:50	206	64	1014	206	1191	3/4	3/4	3/4		
10:00	206	64	1023	205	1259	3/4	3/4	3/4	44.3	4.3
10:10	206	64	1098	204	1347	3/4	3/4	3/4		
10:20	206	64	1075	206	1408	3/4	3/4	3/4		
10:30	206	64	948	207	1473	3/4	3/4	3/4	46.0	5.0
10:40	206	64	854	207	1536	3/4	3/4	3/4		
10:50	206	64	834	204	1596	3/4	3/4	3/4		
11:00	205	64	956	202	1655	3/4	3/4	3/4	47.8	4.0
11:10	205	64	1034	202	1721	3/4	3/4	3/4	[illegible]	[illegible]
11:20	205	64	1189	206	1807	3/4	3/4	3/4		
11:30	205	65	1243	202	1877	3/4	1/2	1/2	44.0	5.0
11:40	205	65	1265	203	1960	3/4	1/2	1/2		
11:50	205	65	1223	206	2040	3/4	3/4	3/4		
12:00	205	65	1184	205	2124	3/4	3/4	3/4	42.0	5.0
12:10	205	65	1181	206	2201	3/4	3/4	3/4		
12:20	205	65	1162	205	2281	3/4	3/4	3/4		

range ? →

9

DRYER DATA SHEET

DATE 10-8-93
BY Lewis Castle

PLANT: DUNGANNON
REVOLUTIONS per MINUTE: 8.33
FUEL CALIBRATION: 6.75

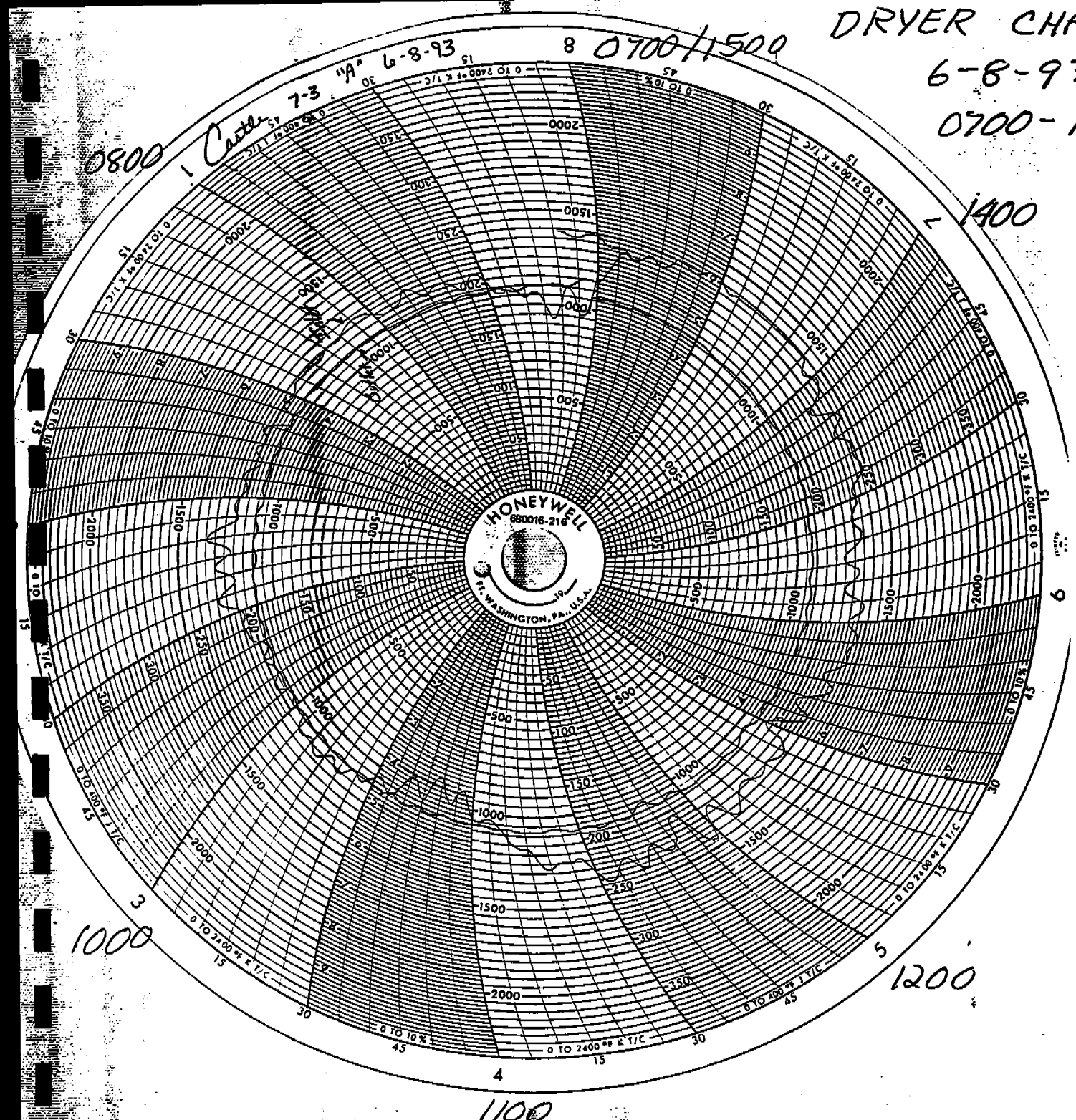
(NOTE ANY CHANGES IN SETPOINTS)

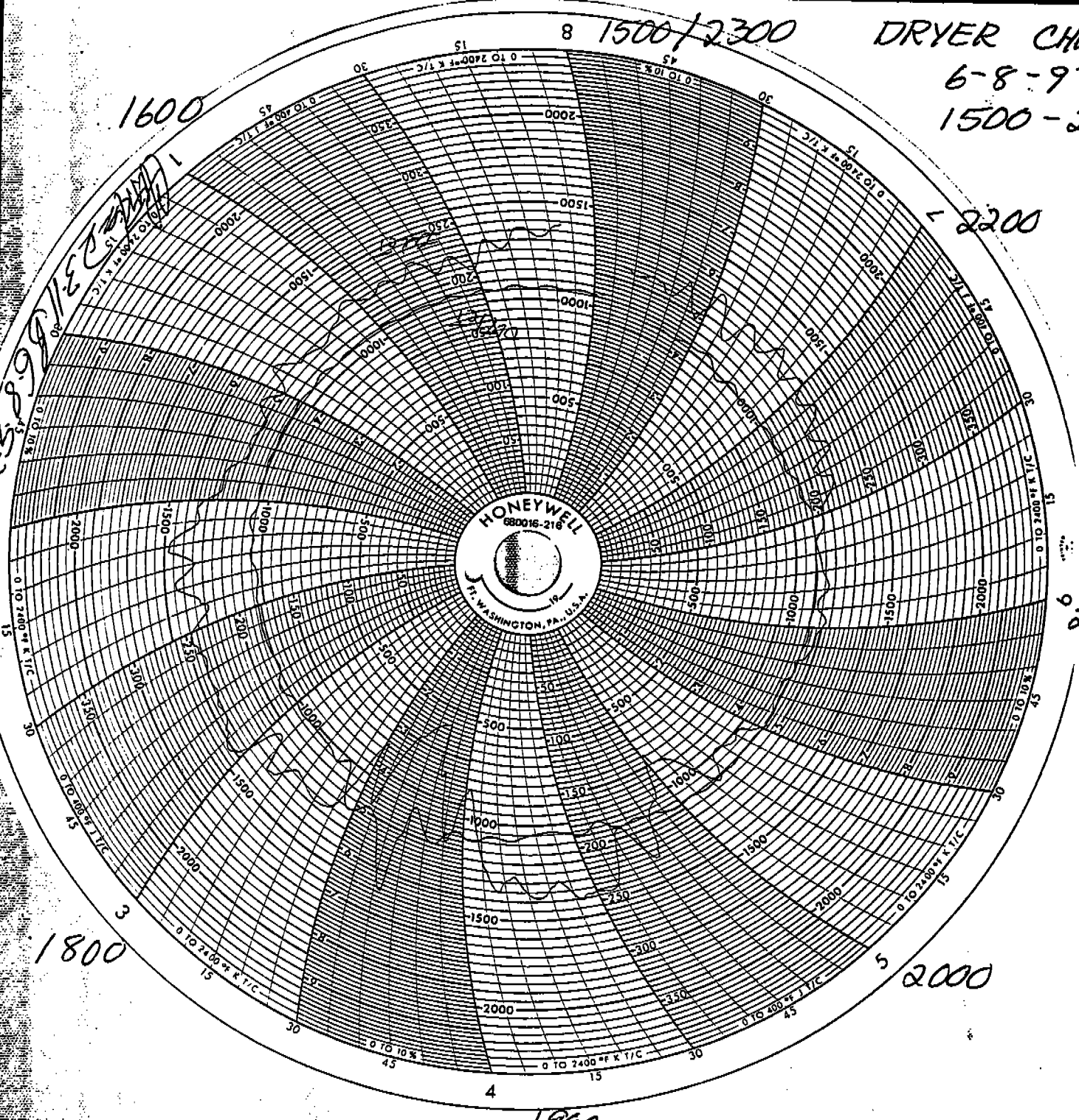
TIME	OUTLET SET POINT	FEED RATE	DRYER INLET TEMP	DRYER OUTLET TEMP	FUEL COUNT	WET BIN LEVEL	DRY BIN LEVEL		EVERY HOUR FLAKE MOISTURE	
							SUR.	CORE	IN	OUT
12:30	205	65	1084	198	2364	3/4	1/2	1/2	45.0	5.0
12:40	205	66	1194	201	2438	3/4	1/2	1/2		
12:50	205	66	1267	204	2517	3/4	1/2	1/2		
1:00	205	66	1217	206	2594	3/4	1/2	1/2	48.0	7.0
1:10	205	66	1211	204	2681	3/4	1/2	1/2		
1:20	205	67	1257	205	2775	3/4	1/2	1/2		
1:30	205	67	1244	205	2845	3/4	1/2	1/2	44.0	4.0
1:40	205	67	1301	204	2927	3/4	1/2	1/2		
1:50	205	67	1292	205	3014	3/4	1/2	1/2		
2:00	205	67	1290	206	3099	3/4	1/2	1/2	47.0	5.0
2:10	205	67	1307	202	3183	3/4	1/2	1/2		
2:20	205	67	1305	202	3269	3/4	1/2	1/2		
2:30	204	67	1335	201	3360	3/4	1/2	1/2	43.0	5.0
2:40	204	67	1315	204	3456	3/4	1/2	1/2		
2:50	203	67	1239	204	3527	3/4	1/2	1/2		
3:00	202	67	1309	201	3626	3/4	1/2	1/2	39.0	6.0
3:10	202	67	1243	204	95	1/4	1/2	1/2		
3:20	201	67	1184	204	174	1/2	1/2	1/2		
3:30	201	67	1105	201	254	1/2	1/2	1/2	42.0	6.0
3:40	201	67	1143	200	328	1/2	1/2	1/2		
3:50	201	67	1134	201	388	1/2	1/2	1/2		
4:00	201	67	1140	201	456	1/2	1/2	1/2	44	5.0
4:10	201	67	1122	202	547	1/2	1/2	1/2		
4:20	201	67	1106	201	605	3/4	1/2	1/2		
4:30	201	67	1192	199	657	3/4	1/2	1/2	41.0	6.0
4:40	201	67	1068	201	762	3/4	1/2	1/2		
4:50										

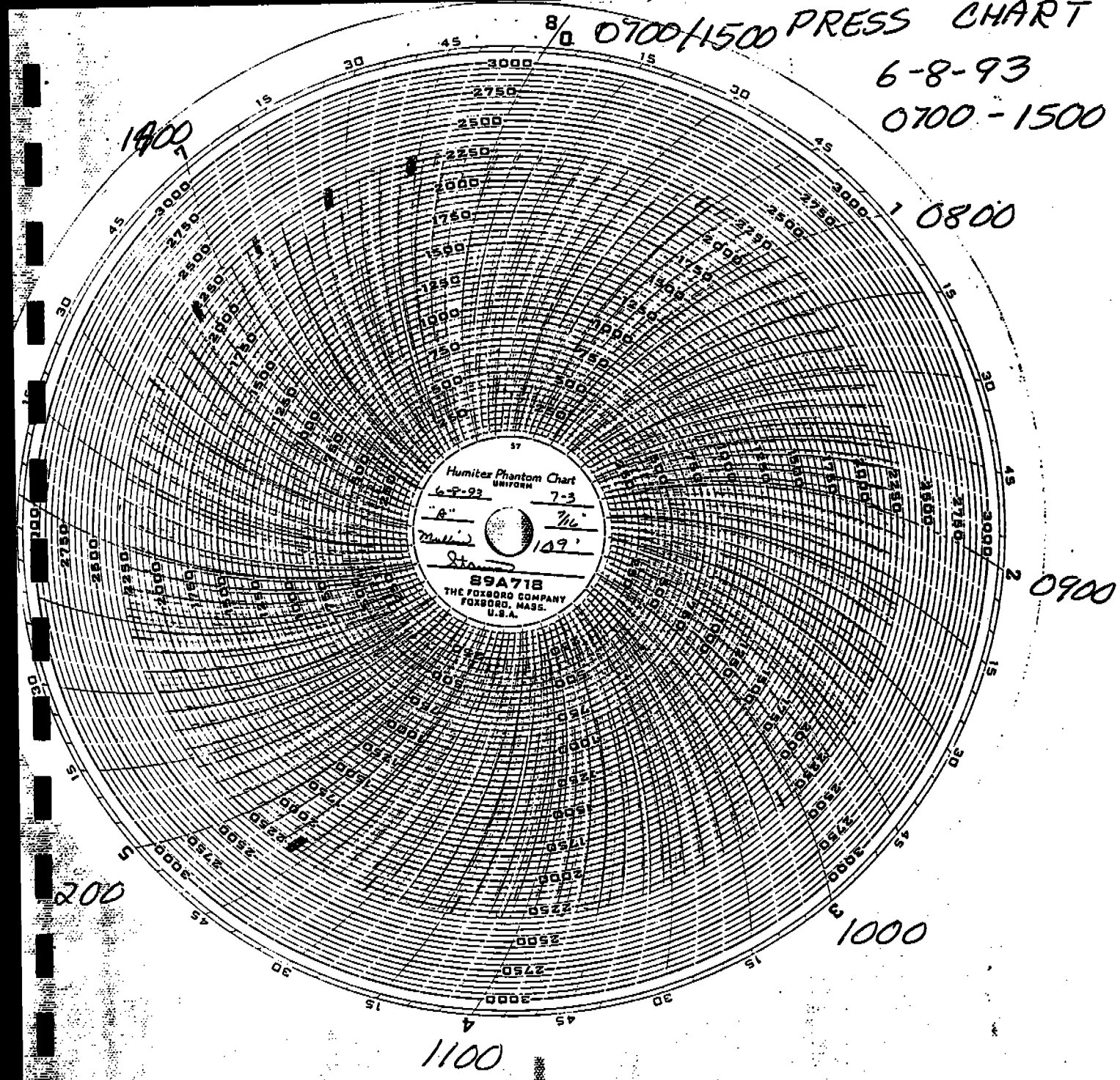
Setpoint change →

Reset fuel counts 3:00 Set P. change 201

10

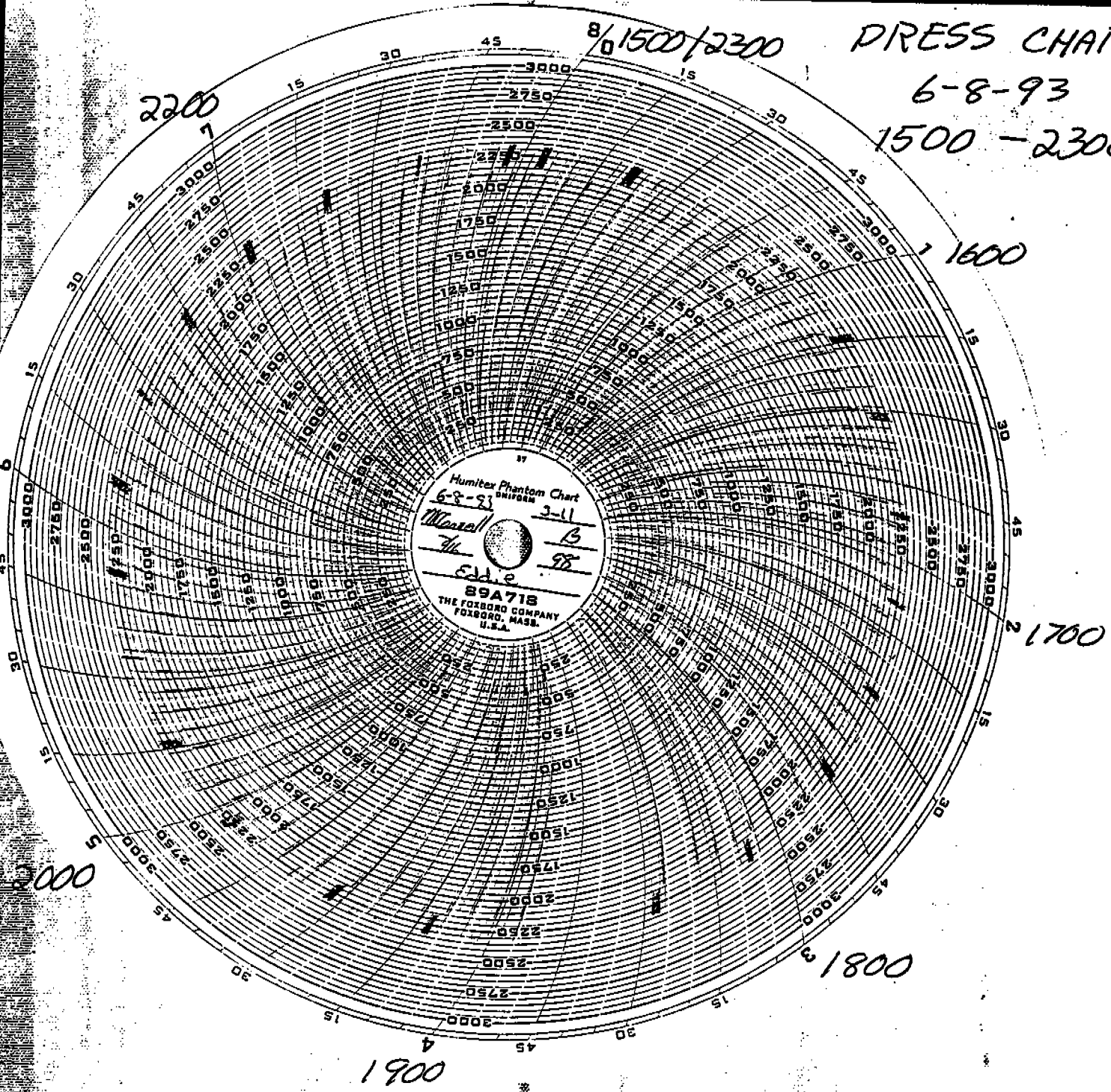

DRYER CHART
6-8-93
0700-1500
0700/1500
8
Carter 7-3 "A" 6-8-93
0800
1400
1300
1200
1100
1000
HONEYWELL
6800016-216
FT. WASHINGTON, PA., U.S.A.
0 TO 10 %
0 TO 2400 °F K T/C
0 TO 400 °F J T/C
0 TO 2400 °F J T/C
0 TO 2400 °F K T/C


DRYER CHART
6-8-93
1500-2300
1600
2200
2100
1800
2000
1900
12
HONEYWELL
680016-216
FT. WASHINGTON, PA., U.S.A.



PRESSLOADS
0830 - 1500 = 88

13



8/0 1500/2300

DRESS CHART

6-8-93

1500 - 2300

2200

1600

1700

1800

1900

2000

PRESS LOADS

1500 - 1640 = 23

14

LOUISIANA-PACIFIC CORPORATION
DUNGANNON, VIRGINIA

PRESS REPORT

OPERATOR James SHIFT 7-3 CREW "A" DATE 6-8-93

THICKNESS: 7/16"

OVERALL TIMER:

PRESS TEMP: 410°

PRESS LOADS 109 - 130,222 BLENDER SHUTDOWNS CORE 23

DECOMPRESSION TIME SURFACE 14

	CORE RESIN	SURFACE RESIN
BEGIN	194327	740111
END	195851	745561

Cleaned Blender Shrouds & Tracks

Former hydraulic and radiater blown out

FCOS hydraulic unit and radiater blown out

Blender outfeed conv. tail pulleys cleaned

LINE SPEED	FROM	TO
30	7:00	7:08
31	7:08	3:00

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

DOWNTIME CODE: M-MECHANICAL E-ELECTRICAL O-OPERATOR

**** MAINTENANCE/LOCK-OUT LOG ****

MOTOR # LOCKED OUT	FROM	TO	BRIEF DESCRIPTION OF WORK BEING DONE	INITIALS OF PERSON LOCKING OUT

(OVER)

LOUISIANA-PACIFIC CORPORATION

DUNGANNON, VIRGINIA

PRESS REPORT

OPERATOR Sid.O SHIFT 3-11 CREW B DATE 6-8-93

THICKNESS: 7/16 PRESS LOADS 98 117.081 BLENDER SHUTDOWNS CORE 33

OVERALL TIMER: DECOMPRESSION TIME SURFACE 35

PRESS TEMP: 410

LINE SPEED	FROM	TO
31	3:00	5:15
30	5:15	11:00

	CORE RESIN	SURFACE RESIN
BEGIN	195851	745561
END	197215	750365

Cleaned Blender Shrouds & Tracks

Former hydraulic and radiater blown out

FCOS hydraulic unit and radiater blown out

Blender outfeed conv. tail pulleys cleaned

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	KEY	REASONS FOR DOWNTIME
4:46	4:48				2	crushed screen at #6
5:55	5:58				3	onloader not go up air pressure
6:22	6:26			√	4	#5 #6 stuck to press
6:30	6:55			√	25	shut line down to clean # 2 bag house
7:28	7:30			√	2	#1 stuck to the press
7:32	7:35			√	3	triangle converay kick out
7:42	7:45			√	3	#1 stuck to the press
7:59	8:00				45 4	onloader would not go up
						245m total Downtime

DOWNTIME CODE: M-MECHANICAL E-ELECTRICAL O-OPERATOR

**** MAINTENANCE/LOCK-OUT LOG ****

MOTOR # LOCKED OUT	FROM	TO	BRIEF DESCRIPTION OF WORK BEING DONE	INITIALS OF PERSON LOCKING OUT

(OVER)

EFB READINGS

EVERY 10 MINUTES

DATE 6-8-93

BY Louis Castle

PLANT:

TIME	"A" SIDE				"B" SIDE					
	BED VOLT	BED CURR.	ION VOLT	ION CURR.	BED VOLT	BED CURR.	ION VOLT	ION CURR.	EFB PRESS.	BAG H. PRESS.
7:30	14.0	0	30	0.6	14.2	0.2	37	1.9	0.1	1.0
7:40	13.5	0	31	0.6	14.0	0.1	36	1.9	0.1	1.0
7:50	14.0	0	31	0.8	14.1	0.1	36	1.9	0.2	1.0
8:00	13.6	0	32	0.8	13.8	0.1	36	1.9	0.1	1.0
8:10	14.5	0	32	0.8	14.0	0.1	36	1.8	0.1	1.0
8:20	14.5	0	32	0.8	14.0	0.1	36	1.8	0.1	1.0
8:30	14.6	0	32	0.8	14.1	0.1	36	1.8	0.1	1.0
8:40	14.7	0	33	0.7	14.2	0.1	36	1.8	0.2	1.0
8:50	14.6	0	32	0.8	14.1	0.1	36	1.8	0.1	1.0
9:00	14.0	0	32	0.8	13.8	0.1	36	1.8	0.1	1.0
9:10	13.5	0	32	0.8	13.2	0.2	35	0.8	0.1	1.1
9:20	14.0	0	32	0.6	13.8	0.2	36	1.8	0.1	1.1
9:30	14.6	0	32	0.6	14.0	0.1	36	1.8	0.1	1.1
9:40	14.9	0	32	0.6	14.2	0.2	36	1.8	0.2	1.1
9:50	14.9	0	31	0.8	14.2	0.1	36	1.7	0.1	1.1
10:00	14.9	0	30	0.4	14.2	0.1	36	1.7	0.1	1.1
10:10	14.5	0	30	1.6	14.0	0.1	36	1.8	0.1	1.1
10:20	15.0	0	30	0.4	13.2	0.1	36	1.6	0.1	1.2
10:30	15.0	0	30	0.4	14.2	0.2	36	1.7	0.2	1.2
10:40	15.0	0	28	0.4	15.0	0.1	36	1.8	0.2	1.2
10:50	15.0	0	28	0.3	15.0	0.1	36	1.8	0.2	1.2
11:00	14.8	0	28	0.3	14.8	0.1	36	1.6	0.2	1.3
11:10	13.4	0	28	0.3	14.0	0.1	36	1.8	0.2	1.4
11:20	13.0	0	28	0.3	13.2	0.2	36	1.7	0.2	1.4
11:30	12.0	0	27	0.4	11.8	0.2	36	1.7	0.2	1.4
11:40	12.0	0	28	0.4	12.1	0.2	36	1.4	0.1	1.3
11:50	13.2	0	28	0.4	13.0	0.1	38	1.6	0.1	1.2
12:00	13.5	0	29	0.4	12.8	0.1	36	1.6	0.1	1.2
12:10	13.4	0	29	0.4	12.5	0.2	36	1.6	0.1	1.3
12:20	13.4	0	29	0.3	13.2	0.2	36	1.4	0.2	1.3

17

EFB READINGS

EVERY 10 MINUTES

DATE 10-8-93

PLANT:

BY Laura Castle

TIME	"A" SIDE				"B" SIDE					
	BED VOLT	BED CURR.	ION VOLT	ION CURR.	BED VOLT	BED CURR.	ION VOLT	ION CURR.	EFB PRESS.	BAG H. PRESS.
12:30	13.5	0	28	0.4	13.5	0.2	36	1.4	0.2	1.3
12:40	13.0	0	30	0.4	13.1	0.2	36	1.4	0.2	1.3
12:50	13.8	0	30	0.4	13.1	0.2	36	1.4	0.2	1.2
1:00	13.5	0	30	0.4	13.2	0.1	36	1.2	0.1	1.3
1:10	13.5	0	30	0.4	13.2	0.2	36	1.2	0.1	1.3
1:20	13.6	0	30	0.4	12.9	0.2	36	1.4	0.2	1.3
1:30	14.0	0	30	0.4	13.9	0.2	36	1.4	0.1	1.3
1:40	13.6	0	30	0.4	13.8	0.2	36	1.2	0.2	1.2
1:50	14.5	0	30	0.4	14.0	0.1	36	1.4	0.2	1.3
2:00	14.0	0	30	0.4	14.0	0.2	36	1.4	0.2	1.3
2:10	13.6	0	30	0.4	13.5	0.2	36	1.4	0.2	1.3
2:20	13.5	0	30	0.4	13.5	0.2	36	1.2	0.2	1.4
2:30	13.6	0	30	0.4	13.8	0.2	36	1.2	0.2	1.4
2:40	14.6	0	30	0.4	14.2	0.2	36	1.4	0.2	1.3
2:50	14.8	0	30	0.4	14.2	0.2	37	1.4	0.1	1.3
3:00	14.8	0	30	0.4	14.2	0.1	37	1.4	0.2	1.3
3:10	14.2	0	30	0.2	14.0	0.2	36	1.4	0.2	1.2
3:20	14.6	0	30	0.4	14.2	0.2	36	1.4	0.2	1.2
3:30	15.0	0	30	0.4	14.8	0.2	36	1.4	0.1	1.0
3:40	14.8	0	30	0.4	14.6	0.2	35	1.4	0.1	1.0
3:50	14.8	0	28	0.3	14.7	0.2	36	1.4	0.2	1.0
4:00	14.6	0	28	0.3	14.6	0.2	35	1.4	0.2	1.0
4:10	15.0	0	28	0.2	15.0	0.2	36	1.4	0.2	1.2
4:20	15.0	0	28	0.3	15.0	0.2	36	1.4	0.2	1.1
4:30	14.8	0	28	0.4	14.6	0.2	37	1.4	0.2	1.1
4:40	15.0	0	28	0.4	15.0	0.2	36	1.4	0.2	1.2
4:50										

18

DUNGANNON PRESS VENT AND THERMAL OIL HEATER TESTING 6-9-93
1030-2030

BOARD WEIGHTS - LBS
WEIGHTS OF APPROXIMATELY EVERY 25TH
UNTRIMMED BOARD FROM TAPES

192	184	197
186	194	198
186	183	197
187	186	198
191	191	206
191	195	199
195	189	195
196	189	195
192	185	198
187	188	187
194	191	189
197	198	191
196	196	199
186	193	190
179	194	
190	196	

192.09 LB = AVERAGE UNTRIMMED MAT WEIGHT

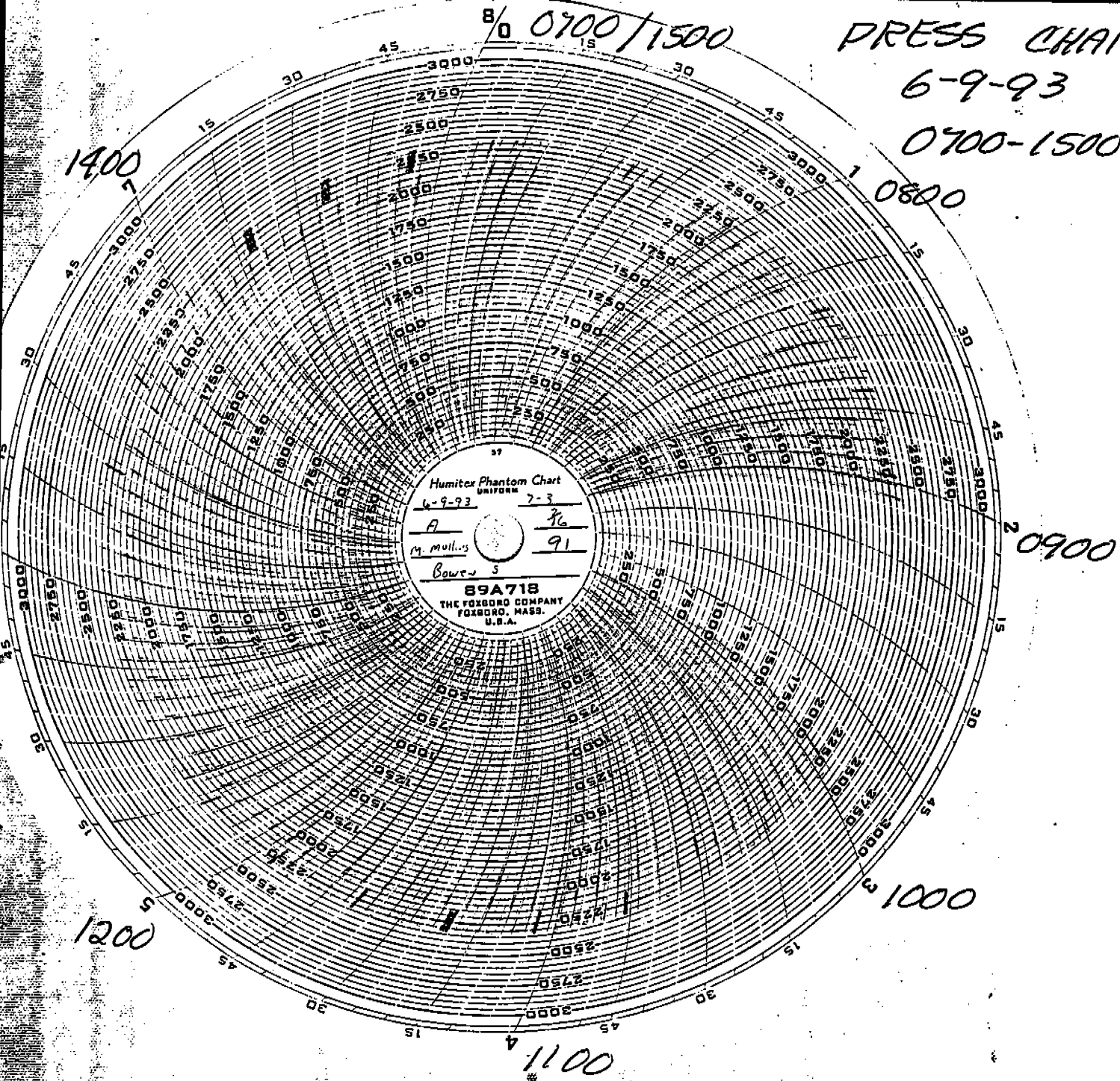
174.99 LB = AVERAGE FINISHED BOARD WEIGHT (UNTRIMMED MAT WEIGHT - TRIM WEIGHT)

8.9% = TRIM

PLANT PRODUCTION RATE

10 =HOURS DURING TESTING
136 =PRESSLOADS
1088 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
190389 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
19039 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
9.52 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PRODUCT PER HR / 2000 LB)

19



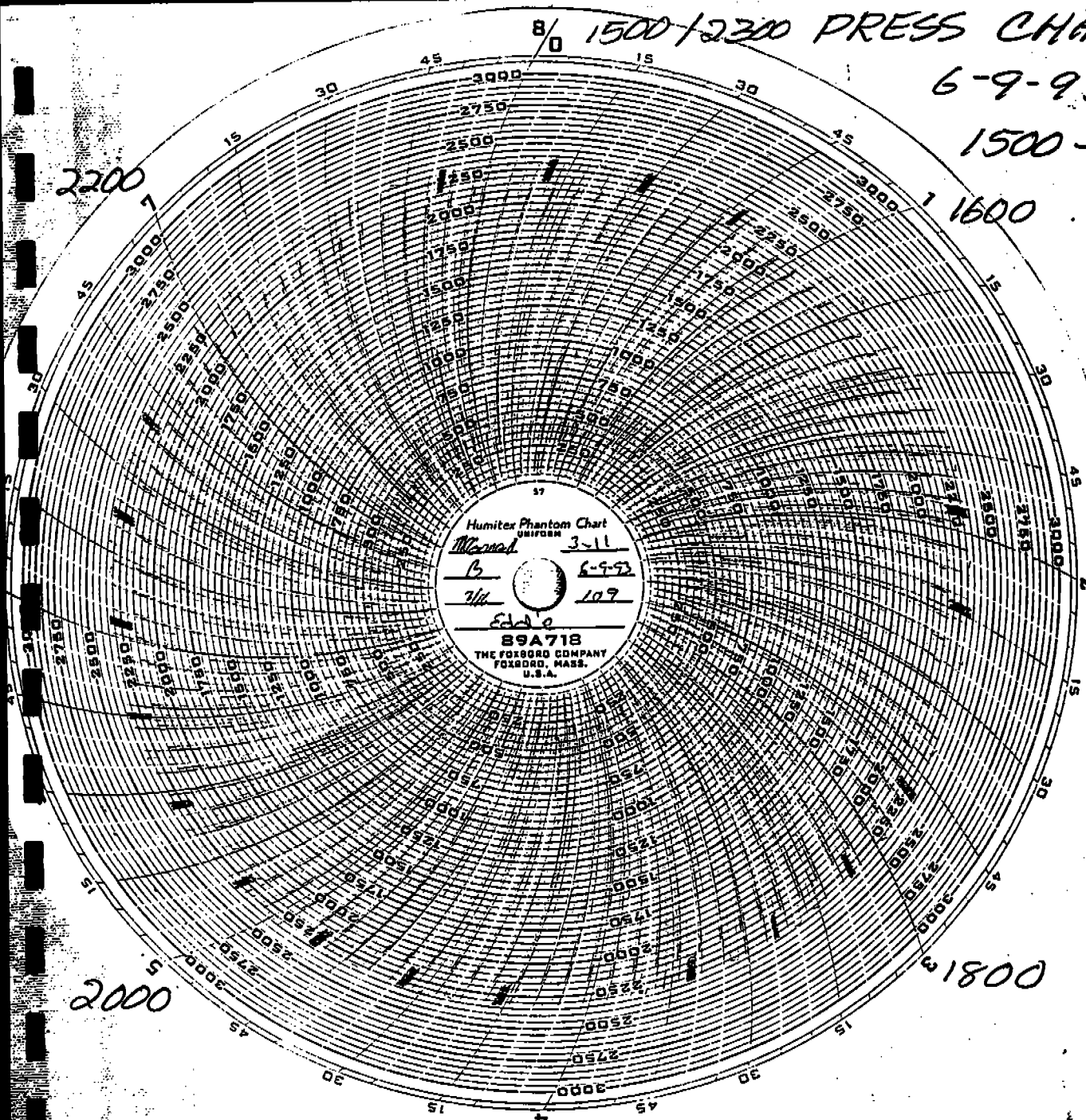
PRESS LOADS

1030 - 1500 = 61

8/0 1500/2300 PRESS CHART

6-9-93

1500-2300



2200 1600 1700 1800 2000 1900

PRESSLOADS

1500 - 2030 =

75

21

LOUISIANA-PACIFIC CORPORATION
DUNGANNON, VIRGINIA

PRESS REPORT

OPERATOR Bowen S. SHIFT 7-3 CREW A DATE 6-9-93

THICKNESS: 7/16 PRESS LOADS 91 108,718 BLENDER SHUTDOWNS CORE 12

OVERALL TIMER: DECOMPRESSION TIME SURFACE 11

PRESS TEMP: 410°

	CORE RESIN	SURFACE RESIN
BEGIN	198741	755769
END	208020	769753

Cleaned Blender Shrouds & Tracks

Former hydraulic and radiater blown out

FCOS hydraulic unit and radiater blown out

Blender outfeed conv. tail pulleys cleaned

LINE SPEED	FROM	TO
31	7:00	3 00

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	KEY	REASONS FOR DOWNTIME
7:22	7:24				2	#7 Limit switch on loader Not made (Loose)
7:27	7:34				7	welding on core slide Trough Track.
7:38	7:49				11	#8 stuck To press. + core Blender Plug.
9:04	9:58				54	Replacing Deckel chain on Back side of F.h.
1:38	1:39				1	Lost inputs.
1:41	1:42				1	Filling Formers.

DOWNTIME CODE: M-MECHANICAL E-ELECTRICAL O-OPERATOR

**** MAINTENANCE/LOCK-OUT LOG ****

MOTOR # LOCKED OUT	FROM	TO	BRIEF DESCRIPTION OF WORK BEING DONE	INITIALS OF PERSON LOCKING OUT

(OVER)

LOUISIANA-PACIFIC CORPORATION

PRESS REPORT

[redacted]GANNON, VIRGINIA

OPERATOR Eddie SHIFT 3-11 CREW B DATE 6-5-93

THICKNESS: 7/16

OVERALL TIMER:

PRESS TEMP: 410

PRESS LOADS 109 130,222 BLENDER SHUTDOWNS CORE 18

DECOMPRESSION TIME SURFACE 17

	CORE RESIN	SURFACE RESIN
BEGIN	200020	760753
END	201542	766175

Cleaned Blender Shrouds & Tracks

Former hydraulic and radiater blown out

FCOS hydraulic unit and radiater blown out

Blender outfeed conv. tail pulleys cleaned

LINE SPEED	FROM	TO
31	3:00	8:30
30	8:30	

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	KEY	REASONS FOR DOWNTIME
8:19	8:20				1	Had to Jog/load out the press
8:18	9:20				2	# 1 stack to the press
						3m total Down time

DOWNTIME CODE: M-MECHANICAL E-ELECTRICAL O-OPERATOR

**** MAINTENANCE/LOCK-OUT LOG ****

MOTOR # LOCKED OUT	FROM	TO	BRIEF DESCRIPTION OF WORK BEING DONE	INITIALS OF PERSON LOCKING OUT

(OVER) K-23

DUNGANNON THERMAL OIL HEATER TESTING 6-9-93
1530-2030
PM-10 AND TSP TESTING

FUEL BURNING RATE ESTIMATED BY BARK INPUT

9.9 =RIGHT SIDE FUEL CALIBRATION IN LB/COUNT
1100 =RIGHT SIDE COUNTS DURING TESTING HOURS
1152-52

10890 =RIGHT SIDE - LB. OF WET FUEL BURNED DURING TESTING
4.29 =LEFT SIDE FUEL CALIBRATION IN LB/COUNT
681 =LEFT SIDE COUNTS DURING TESTING HOURS
716-35
2921 =LEFT SIDE - LB. OF WET FUEL BURNED DURING TESTING
5 =HOURS DURING TESTING
13811 =TOTAL LB. OF WET FUEL BURNED DURING TESTING
43.5% =AVERAGE MOISTURE CONTENT OF FUEL
7803 =TOTAL LB. OF DRY FUEL BURNED DURING TESTING (LB WET FUEL X (1- % MOISTURE)
1561 =LB. OF DRY FUEL BURNED PER HOUR (TOTAL LB OF DRY FUEL BURNED / TESTING HOURS
0.78 =TONS OF DRY FUEL BURNED PER HOUR (TOTAL LB OF DRY FUEL BURNED PER HOUR / 2000 LB)
9000 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)
14.05 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

FUEL BURNING RATE ESTIMATED TEMPERATURE DIFFERENTIAL

499.3 = AVERAGE INCOMING OIL TEMPERATURE IN DEGREES F
521.1 = AVERAGE INCOMING OIL TEMPERATURE IN DEGREES F
65 = TEMPERATURE DIFFERENTIAL AT 100% CAPACITY IN DEG. F
21.8 = ACTUAL TEMPERATURE DIFFERENTIAL
31 = MAXIMUM BTU INPUT IN MM BTU/HR
10.4 = ESTIMATED MMBTU INPUT PER HOUR (ACTUAL TEMP. DIFF./ MAX. TEMP. DIFF. x MAX. HEAT INPUT)

9000 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)
0.58 = ESTIMATED TONS OF DRY FUEL INPUT BASED ON TEMPERATURE DIFFERENTIAL (BTU INPUT/BTU CONTENT OF DRY FUEL / 2000 lb)

input to be verified by f factor

24

KONUS DATA

PLANT:

OIL SETPOINT

BIULDING HEAT SETPOINT

DATE 6-9-93

BY Louis Castle

EVERY 10 MINUTES

(NOTE ANY CHANGES IN SETPOINTS)

TIME	PRIMARY AIR LEFT	I.D. FAN	PRIMARY AIR RIGHT	OIL IN F deg. ¢	OIL OUT deg. F	REFRACTORY TEMP deg c LT	REFRACTORY TEMP deg c RT	FUEL COUNT LT	FUEL COUNT RT	FEED RATE SETTING LT	FEED RATE SETTING RT	EVERY HOUR BAG H. PRESS.	EVERY HOUR BARK MOISTURE
1:00	2300	-.1	2300	511	530	510	—	993	1539	474	290	1.0	41.2
1:10	2300	+.1	2300	507	531	500	—	1019	1571	476	291		
1:20	2300	+.2	2300	511	537	520	—	1058	1621	437	290		
1:30	2300	+.1	2300	526	553	600	—	1082	16162	435	289		
1:40	off	-.1	off	519	537	570	—	1090	1643	off	off		
1:50	2300	+.1	2300	517	542	560	—	1112	1672	off	off		
2:00	2300	0	2300	516	537	560	—	1129	1695	off	off	1.0	39.3
2:15	2300	0	2300	509	529	540	—	1161	1738	437	292		
2:30	2300	0	2200	502	521	540	—	1187	1772	438	292		
2:40	2300	0	2200	500	519	550	—	1217	1818	369	292		
2:50	2300	0	2200	499	521	520	—	1250	1869	400	292		
3:00	2300	0	2200	510	523	530	—	1295	1921	400	293	1.0	43.8
3:10	2300	0	2200	500	521	540	-	1296	1933	400	292		
3:20	2300	0	2200	498	521	530	-	20	28	077	OFF		
3:30	2300	0	2200	496	519	520	-	35	52	077	OFF		
3:40	2300	0	2200	496	519	519	-	46	69	378	292		
3:50	2300	0	2200	499	518	518	-	57	87	374	293		
4:00	2300	0	2200	499	517	525	-	71	109	369	294	1.0	46.2
4:10	2300	0	2200	497	518	520	-	104	160	369	294		
4:20	2300	0	2200	498	521	520	-	127	198	368	292		
4:30	2300	0	2200	499	519	520	-	134	210	368	292		
4:48	2300	0	2200	499	523	520	-	154	241	OFF	OFF		
4:50	2300	0	2200	495	517	510	-	186	272	369	294		
5:00	2300	0	2200	498	523	520	-	214	337	OFF	OFF	1.0	42.5
5:10	2300	0	2200	496	518	518		229	362	OFF	OFF		
5:20	2300	0	2200	497	516	520	-	250	395	365	294		
5:30	2300	0	2200	496	521	520	-	270	428	OFF	OFF		
5:40	2300	0	2200	495	514	520	-	282	447	OFF	OFF		
5:50	2300	0	2200	488	508	510	-	303	482	366	294		
6:00	2300	0	2200	497	522	550	-	351	558	364	293	1.0	41.9

25

KONUS DATA

PLANT:

OIL SETPOINT

BIULDING HEAT SETPOINT

DATE 6·9·93

BY Charles Dotson

EVERY 10 MINUTES

(NOTE ANY CHANGES IN SETPOINTS)

TIME	PRIMARY AIR LEFT	I.D. FAN	PRIMARY AIR RIGHT	OIL IN F deg. ¢	OIL OUT deg. F	REFRACTORY TEMP deg c LT	REFRACTORY TEMP deg c RT	FUEL COUNT LT	FUEL COUNT RT	FEED RATE SETTING LT	FEED RATE SETTING RT	EVERY HOUR BAG H. PRESS.	EVERY HOUR BARK MOISTURE
6:10	2300	0	2200	497	522	550	-	356	567	364	293		
6:20	2300	0	2200	500	523	600	-	388	619	365	293		
6:30	2300	0	2200	500	523	600	-	411	656	364	293		
6:40	2300	0	2200	499	518	550	-	441	704	365	294		
6:50	2300	0	2200	491	511	520	-	472	754	365	294		
7:00	2300	0	2200	497	521	520	-	498	797	364	292	1.2	
7:10	2300	0	2200	503	527	530		532	851	363	292		
7:20	2300	0	2200	502	521	520	-	553	892	361	294		
7:30	2300	0	2200	497	520	510	-	584	937	360	293		
7:40	2300	0	2200	508	529	530	-	600	963	359	292		
7:50	2300	0	2200	508	529	535	-	620	995	359	291	[illegible]	
8:00	2300	0	2200	509	529	530	-	641	1030	358	291	1.2	
8:10	2300	0	2200	510	533	530	-	679	1091	077	077		
8:20	2300	0	2200	509	530	520	-	685	1103	358	291		
8:30	2300	0	2200	505	525	520	-	716	1152	359	292		

26

DUNGANNON PRESS VENT TESTING 12-9-92
13:00 - 21:30

RESIN USAGE FROM FLOW CHARTS

200 = LBS OF MDI RESIN PER HOUR
19039 =LBS FINISHED PRODUCT PRODUCED PER HOUR
1.05% = MDI RESIN USED AS % OF FINAL PRODUCT

790 = LBS OF LIQUID PHENOLIC RESIN PER HOUR ON A 55% SOLIDS BASIS
435 = LBS OF LIQUID PHENOLIC RESIN PER HOUR ON A 100% SOLIDS BASIS
2.28% = LIQUID PHENOLIC RESIN USED AS % OF FINAL PRODUCT

WAX USAGE FROM DAILY INVENTORY SHEET

9676 = LBS OF WAX USED FOR THE DAY @ 48% SOLIDS
5032 = LBS OF WAX USED FOR THE DAY @ 100% SOLIDS
367968 =PRODUCTION FOOTAGE FOR THE DAY - 3/8" BASIS
315401.1 =PRODUCTION FOOTAGE FOR THE DAY - 7/16" BASIS
((3/8" FOOTAGE)/ (7/16" / 3/8"))
2464 =NO OF 8'x16' BOARDS PRODUCED (7/16" FOOTAGE / (8'X16"))
174.99 =WEIGHT OF FINISHED 8'x16'7/16" BOARD
431175.3 = TOTAL LBS OF BOARD PRODUCED (NO. OF BOARDS x BOARD WEIGHT)
1.17% =WAX AS % OF FINAL PRODUCT

19039 =LBS FINISHED PRODUCT PRODUCED PER HOUR
222 = LBS OF WAX USED PER HOUR DURING TESTING (% WAX x LBS FINISHED PRODUCT PER HOUR)

27

Core Resin
6/9/93

I000 B123456 100MM/HR 9 JUN93 A10:13_

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

I000 B123456 100MM/HR 9 JUN93 A 9:13_

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

I000 B123456 100MM/HR 9 JUN93 A 8:13_

CH1 CORE RESIN Pen1 LB/HR
0 500 1000.

I000 B123456 100MM/HR 9 JUN93 A 7:13_

TT1 TOTALIZER SG3351 LBS.
CH1 CORE RESIN 194. LB/HR

MADE IN ENGLAND

CHART No. GD201125

28

I000 B123456 100MM/HR 9 JUN93 P 1:13

CH: CORE RESIN Pen: LB/HR
0. 500. 1000.

I000 B123456 100MM/HR 9 JUN93 P12:13

CH: CORE RESIN Pen: LB/HR
0. 500. 1000.

I000 B123456 100MM/HR 9 JUN93 A11:13

CH: CORE RESIN Pen: LB/HR
0. 500. 1000.

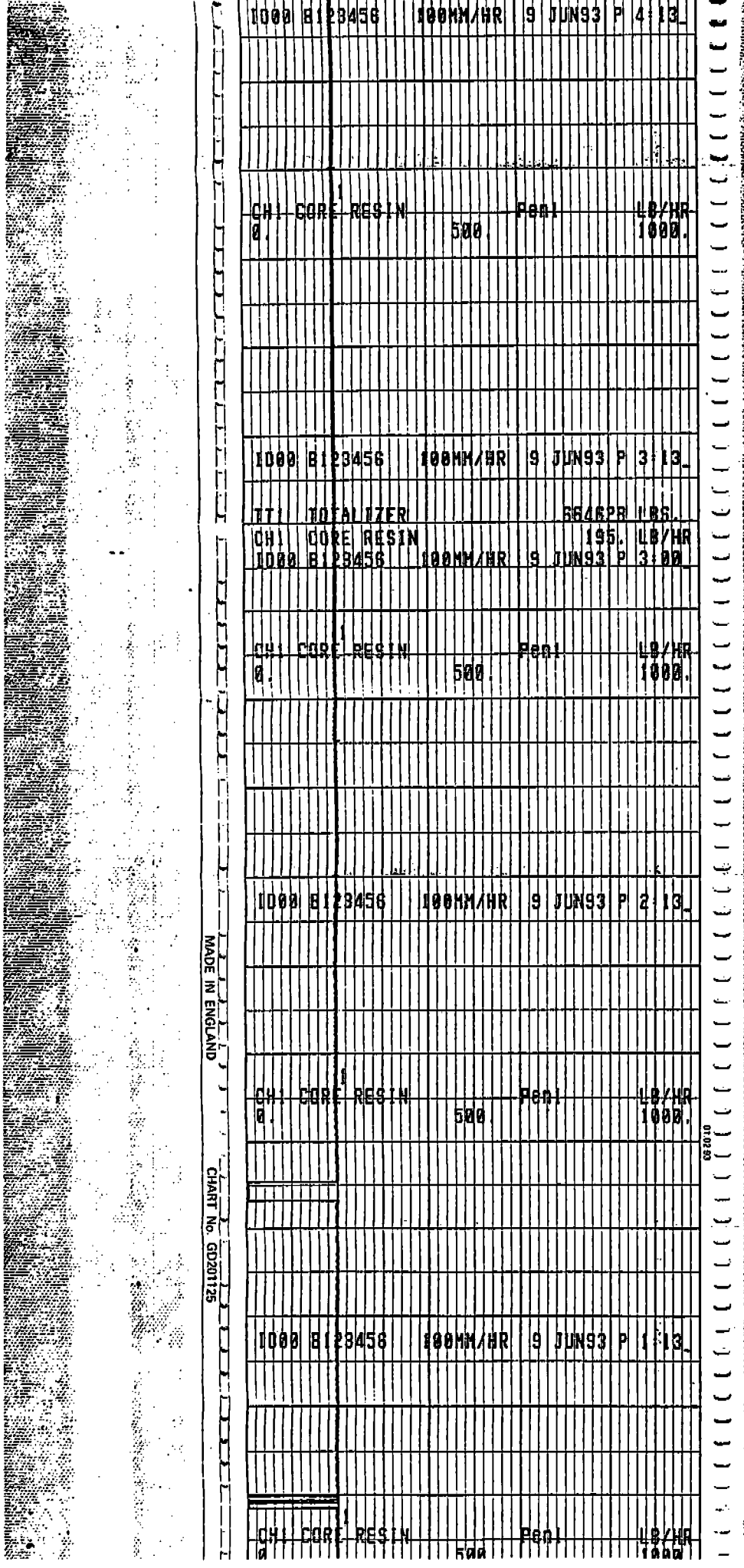
I000 B123456 100MM/HR 9 JUN93 A10:13

CH: CORE RESIN Pen: LB/HR

MADE IN ENGLAND

CHART No. GD20125

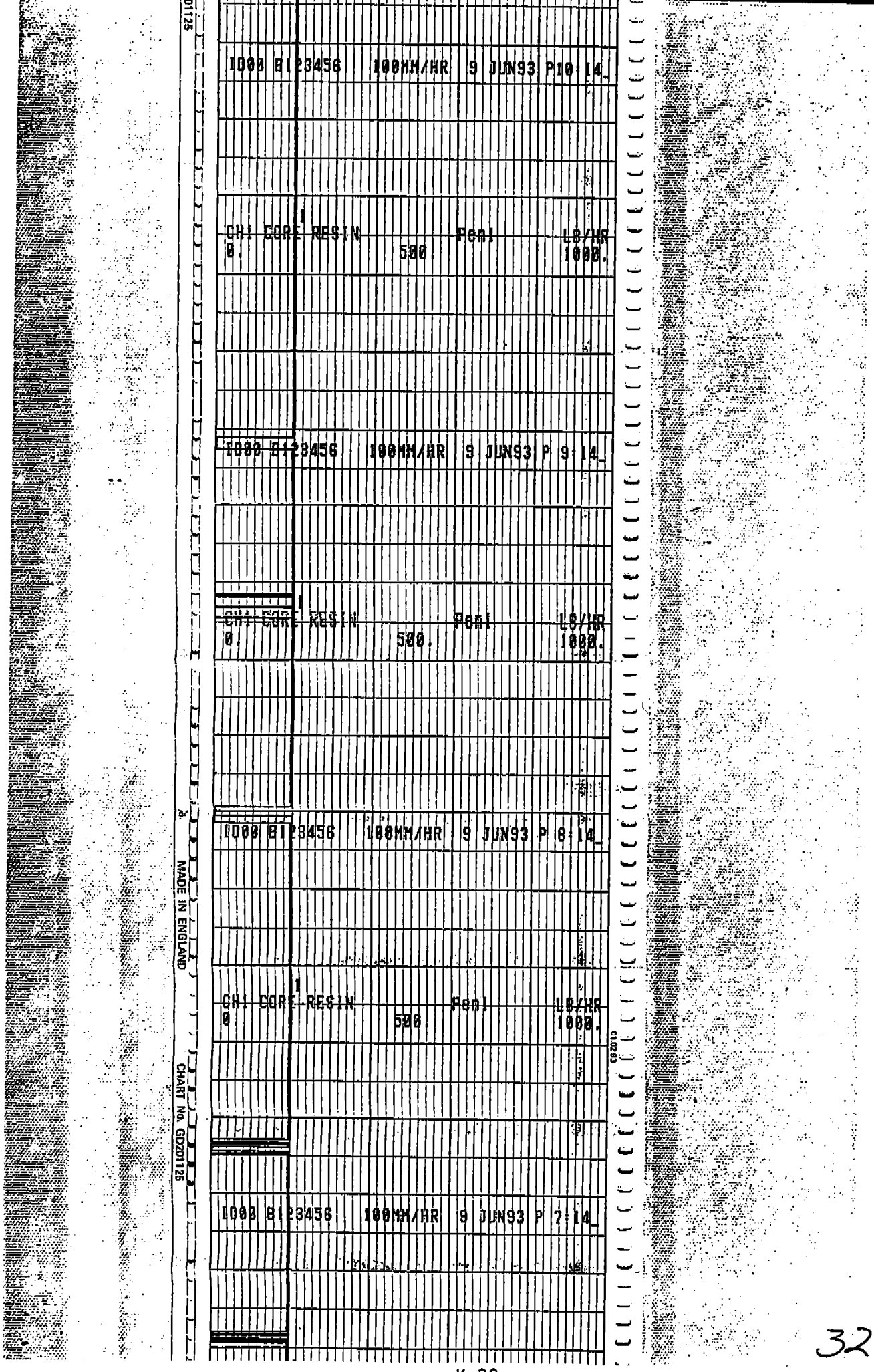
29


ID00 B123456 100MM/HR 9 JUN93 P 4:13
CH1 CORE RESIN Penl LB/HR
0. 500. 1000.
ID00 B123456 100MM/HR 9 JUN93 P 3:13
TT1 TOTALIZER 6646PR LBS
CH1 CORE RESIN 195. LB/HR
ID00 B123456 100MM/HR 9 JUN93 P 3:00
CH1 CORE RESIN Penl LB/HR
0. 500. 1000.
ID00 B123456 100MM/HR 9 JUN93 P 2:13
CH1 CORE RESIN Penl LB/HR
0. 500. 1000.
ID00 B123456 100MM/HR 9 JUN93 P 1:13
CH1 CORE RESIN Penl LB/HR
MADE IN ENGLAND
CHART No. GD201125
GS2010

30

I000 B123456 100MM/HR 9 JUN93 P 7:14
CH1 CORE RESIN
0.
500.
Pedl
LB/HR
1000.
I000 B123456 100MM/HR 9 JUN93 P 6:14
CH1 CORE RESIN
0.
500.
Pedl
LB/HR
1000.
I000 B123456 100MM/HR 9 JUN93 P 5:14
CH1 CORE RESIN
0.
500.
Pedl
LB/HR
1000.
I000 B123456 100MM/HR 9 JUN93 P 4:13
MADE IN ENGLAND
CHART No. GD201125
GD2010

31


1000 B123456 100MM/HR 9 JUN93 P10:14
CH1 CORE RESIN
0. 500. Pen1 LB/HR 1000.
1000 B123456 100MM/HR 9 JUN93 P 9:14
CH1 CORE RESIN
0. 500. Pen1 LB/HR 1000.
1000 B123456 100MM/HR 9 JUN93 P 8:14
CH1 CORE RESIN
0. 500. Pen1 LB/HR 1000.
1000 B123456 100MM/HR 9 JUN93 P 7:14
MADE IN ENGLAND
CHART No. GD201125
GD201125
GB2010

32

1000 B123456 100MM/HR 10 JUN93 A 1:14

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

1000 B123456 100MM/HR 10 JUN93 A12:14

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

1000 B123456 100MM/HR 9 JUN93 P11:14

TT1 TOTALIZER 666150 LBS.M
CH1 CORE RESIN 195. LB/HR
1000 B123456 100MM/HR 9 JUN93 P1:00

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

1000 B123456 100MM/HR 9 JUN93 P10:14

1125

MADE IN ENGLAND

CHART No. GD201125

33

ID00 B123456 100MM/HR 10 JUN93 A 4:14

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

ID00 B123456 100MM/HR 10 JUN93 A 3:14

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

ID00 B123456 100MM/HR 10 JUN93 A 2:14

CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.

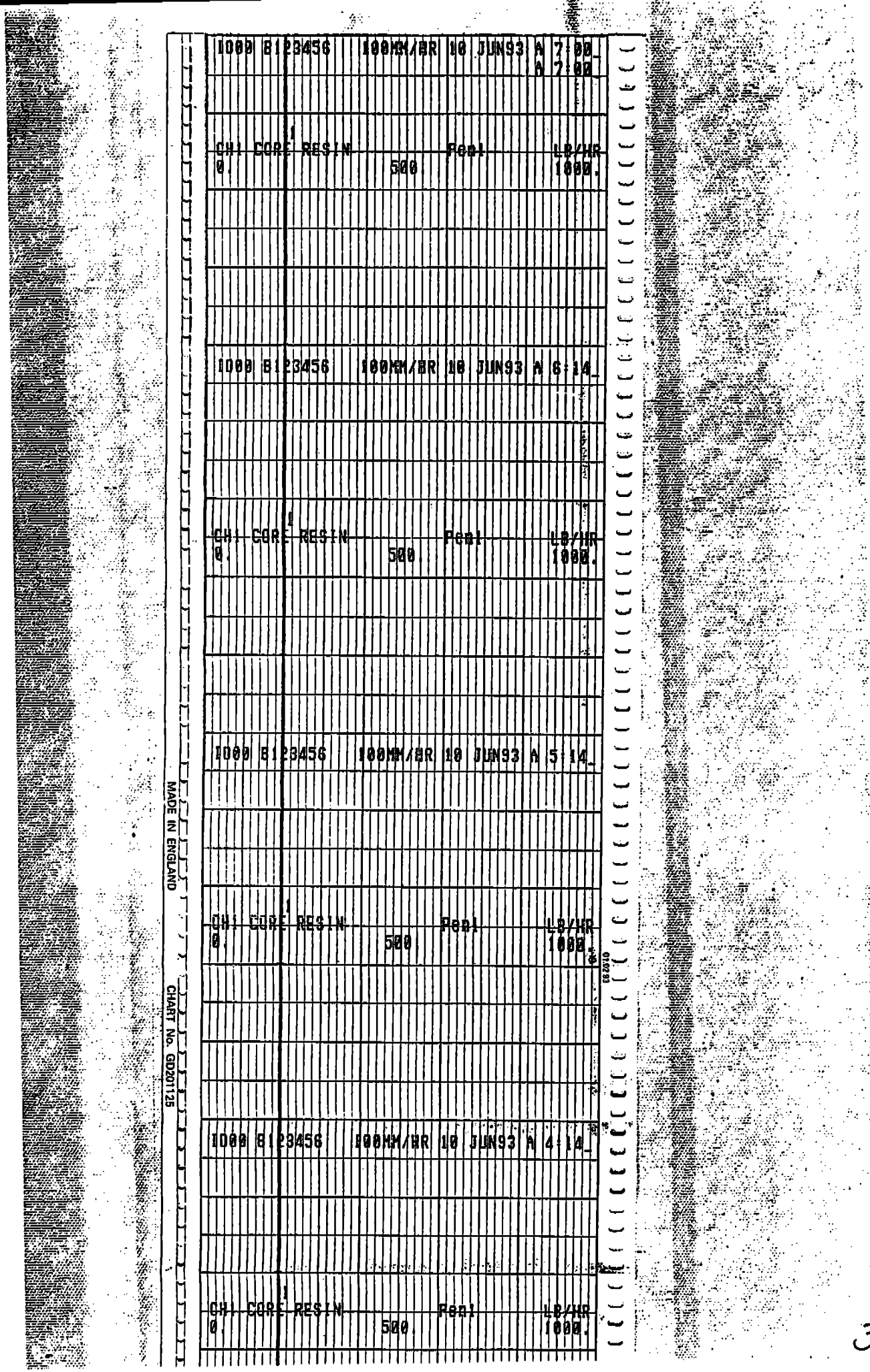
ID00 B123456 100MM/HR 10 JUN93 A 1:14

CH1 CORE RESIN Pen1 LB/HR

MADE IN ENGLAND

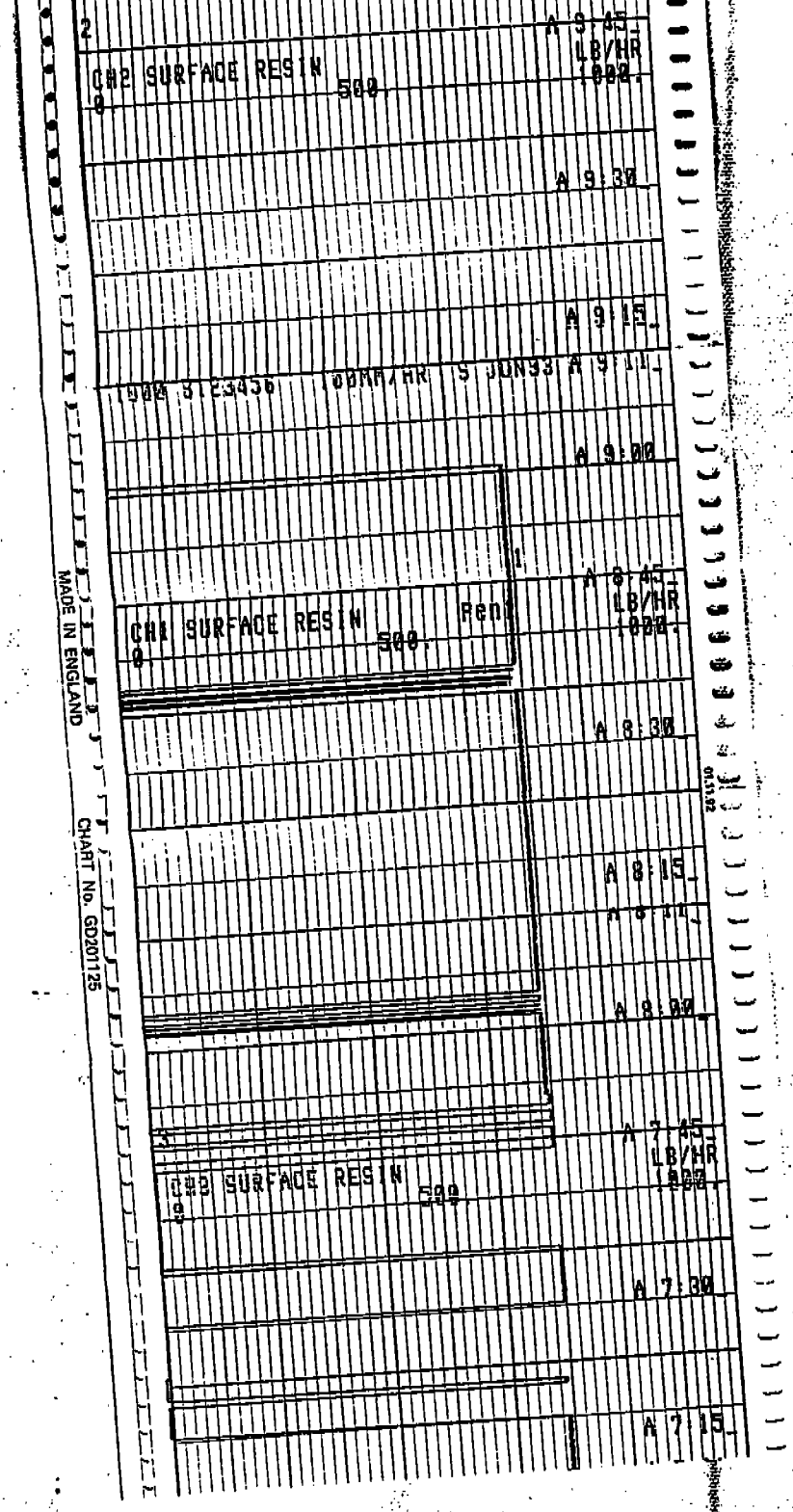
CHART No. GD201125

34


I000 B123456 100MM/HR 10 JUN93 A 7:00
A 7:00
CH1 CORE RESIN
0. 500. Real LB/HR
1000.
I000 B123456 100MM/HR 10 JUN93 A 6:14
CH1 CORE RESIN
0. 500. Real LB/HR
1000.
I000 B123456 100MM/HR 10 JUN93 A 5:14
CH1 CORE RESIN
0. 500. Real LB/HR
1000.
I000 B123456 100MM/HR 10 JUN93 A 4:14
CH1 CORE RESIN
0. 500. Real LB/HR
1000.
MADE IN ENGLAND
CHART No. GD201125
0102B3

35

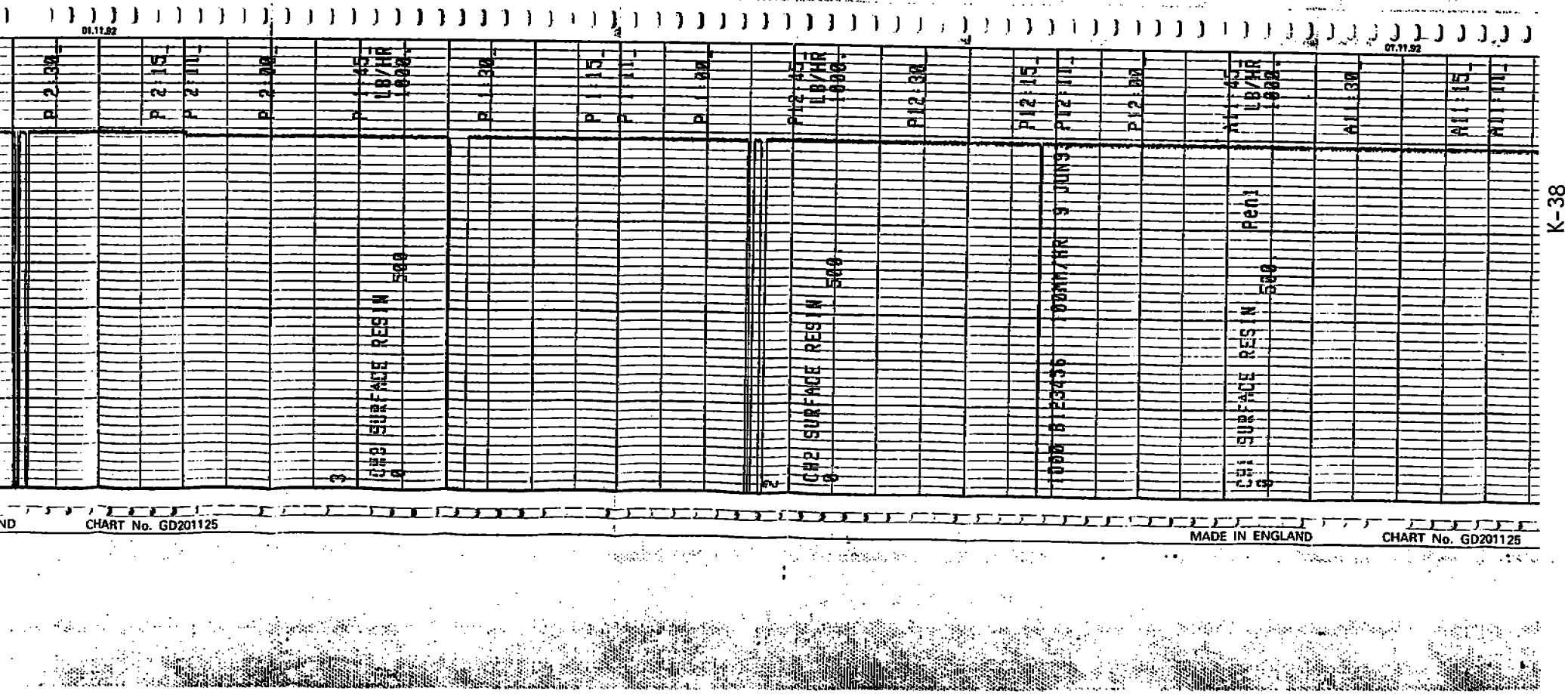
Surface Resin
6/9/93



36

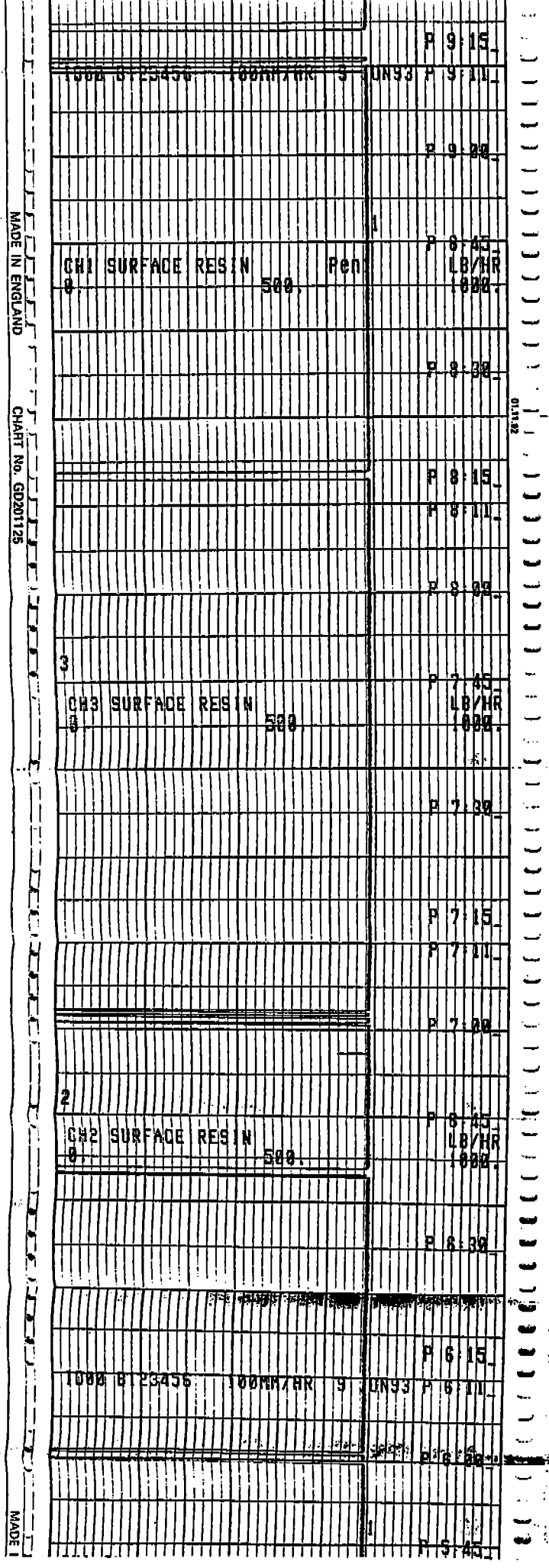
No. GD201125
3
CH3 SURFACE RESIN
0
500
A10:45
LB/HR
1000
A10:30
A10:15
A10:11
A10:00
2
CH2 SURFACE RESIN
0
500
A 9:45
LB/HR
1000
A 9:30
A 9:15
1000 8:23456 100MM/HR 9 JUN93 A 9:11
A 9:00
1
CH1 SURFACE RESIN
0
500
Pen
A 8:45
LB/HR
1000
A 8:30
A 8:15
A 8:00
MADE IN ENGLAND
CHART No. GD201125

37


01.11.92
P2:30
P2:15
P2:00
P1:45
P1:30
P1:15
P1:00
P12:45
P12:30
P12:15
P12:00
P11:45
P11:30
P11:15
P11:00
07.11.92
CHP2 SURFACE RESIN 500
CHP2 SURFACE RESIN 500
1000 BF3436 100N/HR 9 JUN93
CHP1 SURFACE RESIN 500
Pen1
CHART No. GD201125
MADE IN ENGLAND
CHART No. GD201125

MADE IN ENGLAND
CHART No. GD201125
CH4 SURFACE RESIN
0
500
Pen
P 5:45
LB/HR
1000
P 5:30
01.11.92
P 5:15
P 5:00
CH3 SURFACE RESIN
0
500
P 4:45
LB/HR
1000
P 4:30
P 4:15
P 4:00
CH2 SURFACE RESIN
0
500
P 3:45
LB/HR
1000
P 3:30
P 3:15
1000 B123456 100MM/HR 9-JUN93 P 3:00
P 2:45
CH1 SURFACE RESIN
0
500
Pen1
LB/HR
1000
P 2:30
01.11.92
MADE IN ENGLAND
CHART

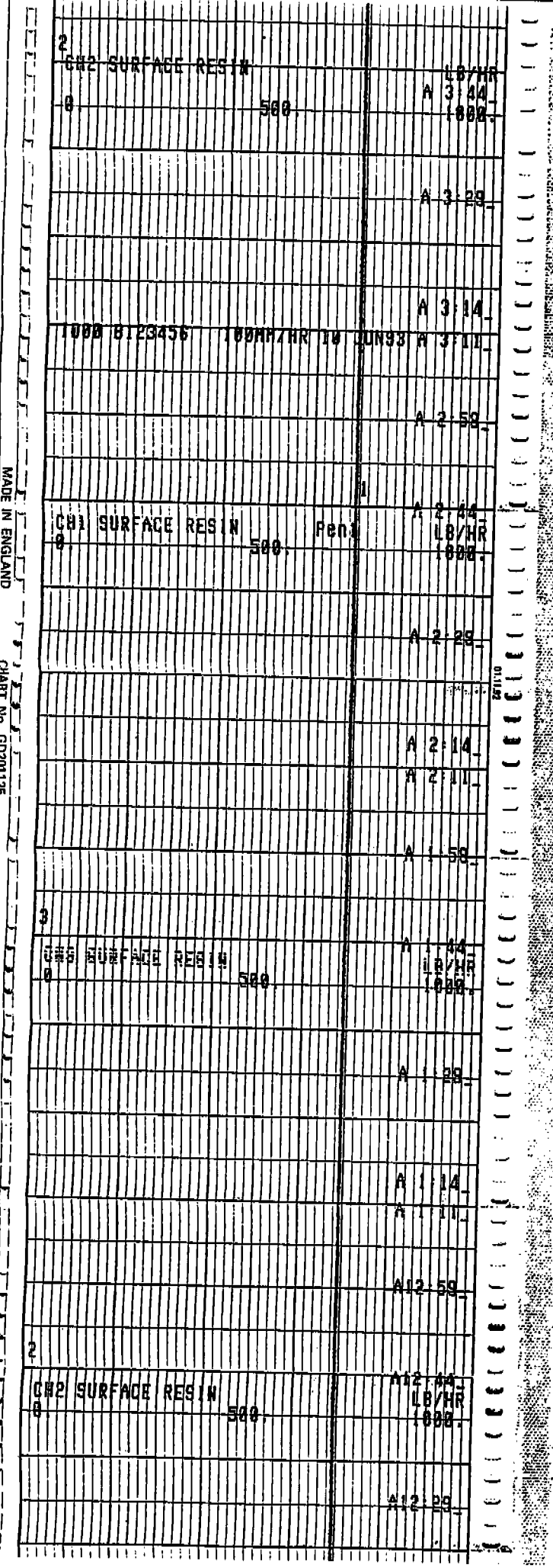
39


P 9:15
P 9:11
P 9:00
P 8:45
LB/HR
1000
P 8:30
P 8:15
P 8:11
P 8:00
P 7:45
LB/HR
1000
P 7:30
P 7:15
P 7:11
P 7:00
P 6:45
LB/HR
1000
P 6:30
P 6:15
P 6:11
P 6:00
P 5:45
CH1 SURFACE RESIN
0
500
CH3 SURFACE RESIN
0
500
CH2 SURFACE RESIN
0
500
1000 B123456 100MM/HR 9 UN93
MADE IN ENGLAND
CHART No. GD201125
MADE

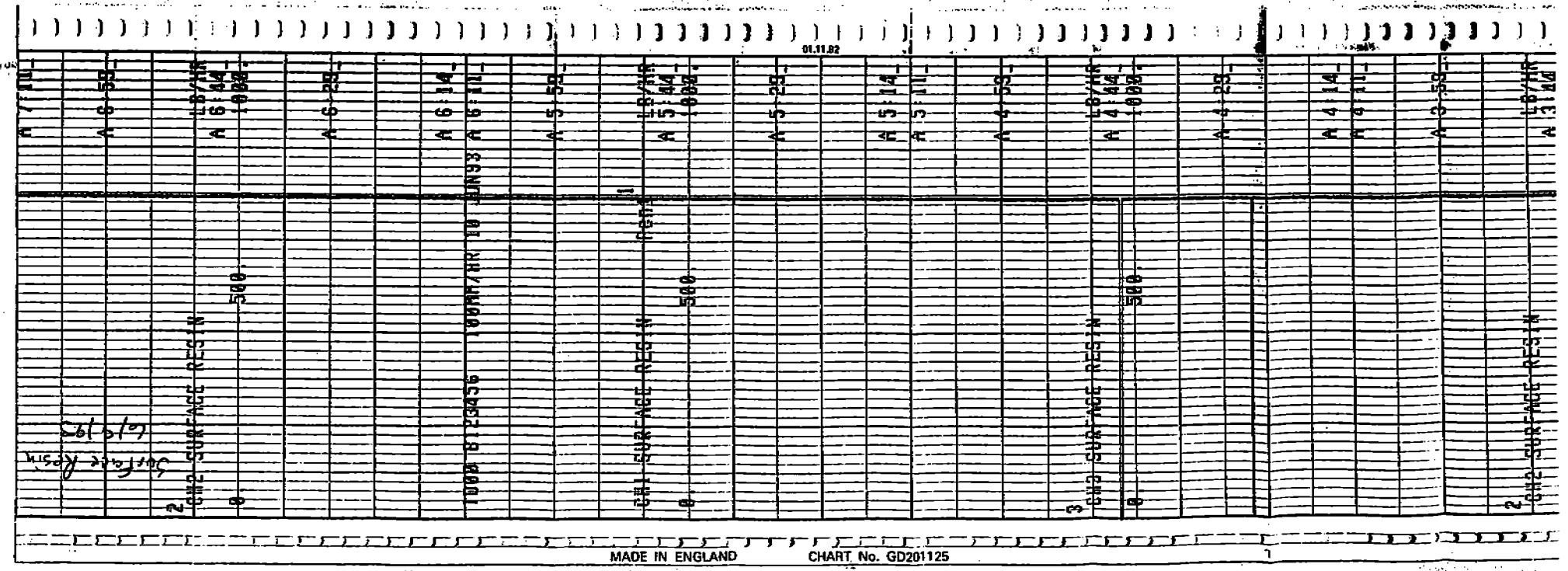
40

A12:29
A12:14
1000 G123456 100MM/HR 10 JUN93 A12:14
P11:59
P11:44
LB/HR
1000
CH1 SURFACE RESIN
0
500
Pen1
P11:29
01.11.92
P11:14
P11:10
P10:59
P10:44
LB/HR
1000
CH3 SURFACE RESIN
0
500
P10:29
P10:15
P10:11
P10:00
P 9:45
LB/HR
1000
CH2 SURFACE RESIN
0
500
P 9:30
P 9:15
1000 G123456 100MM/HR 3 JUN93 P 9:11
P 9:00
MADE IN ENGLAND
CHART No. GD201125

41


2
CH2 SURFACE RESIN
0
500.
LB/HR
A 3:44
1000.
A 3:29
A 3:14
1000 B123456 100MM/HR 10 JUN93 A 3:11
A 2:59
1
CH1 SURFACE RESIN Pen1
0
500.
A 2:44
LB/HR
1000.
A 2:29
A 2:14
A 2:11
A 1:59
3
A 1:44
LB/HR
1000.
A 1:29
A 1:14
A 1:11
A12:59
2
CH2 SURFACE RESIN
0
500.
A12:44
LB/HR
1000.
A12:29
MADE IN ENGLAND
CHART No. GD20125

42


01.11.82
A 7.00
A 6.58
A 6.44
.002
A 6.28
A 6.14
A 5.59
A 5.44
.002
A 5.28
A 5.14
A 3.11
A 4.59
A 4.44
.002
A 4.28
A 4.14
A 4.11
A 3.58
A 3.44
L8/HR
500
0
2 GM2 SURFACE RESIN
TD08 81.23456 1000M/HR 10 JUN93 A 6.11
CH1 SURFACE RESIN
3 GM3 SURFACE RESIN
MADE IN ENGLAND
CHART No. GD201125

K-43

A1...H46 A47...W85

INVENTORY DATE: 6-9-93

PF:

		Start	End
OUTSIDE PF TANK HEIGHT INCHES	71.00		
INSIDE PF TANK HEIGHT INCHES	110.00	Start	End
DAY TANK HEIGHT INCHES	45.00	of day	of day
PF FLOWMETER	15934	755769	771703
INCOMING PF POUNDS	44140		
PF INVENTORY IN LBS	108131		

MDI:

		Start	End
OUTSIDE MDI TANK HEIGHT INCHES	172.00	Start	End
INSIDE TANK HEIGHT INCHES	118.00	of day	of day
MDI STORAGE FLOWMETER	4369	198727	203096
INCOMING MDI POUNDS	0		
MDI INVENTORY IN LBS	177602		

WAX:

WAX TANK HEIGHT INCHES	135.00	
INCOMING WAX POUNDS	0	57638 - 47962 =
WAX INVENTORY IN LBS	47962	9676

PRESSLOADS:

THICKNESS	0.025	0.375	0.4375	0.469	0.594	0.719
SHIFT 1	0		91			
SHIFT 2	0		109			
SHIFT 3	0		108			
TOTAL	0	0	308	0	0	0
MSF	0.000	0.000	367.968	0.000	0.000	0.000

DAILY MSF 367.968

	A-GRADE: PERCENT	U&E MSF
SHIFT 1	99.8	0.191
SHIFT 2	99.8	0.186
SHIFT 3	99.8	0.187
TOTAL:		0.564

PRIMARY DOWNGRADE: [redacted] TSF Plug

A47...W85

44

DUNGANNON PRESS VENT TESTING 6–10–93
0830–1510

BOARD WEIGHTS – LBS
WEIGHTS OF APPROXIMATELY EVERY 25TH
UNTRIMMED BOARD FROM TAPES

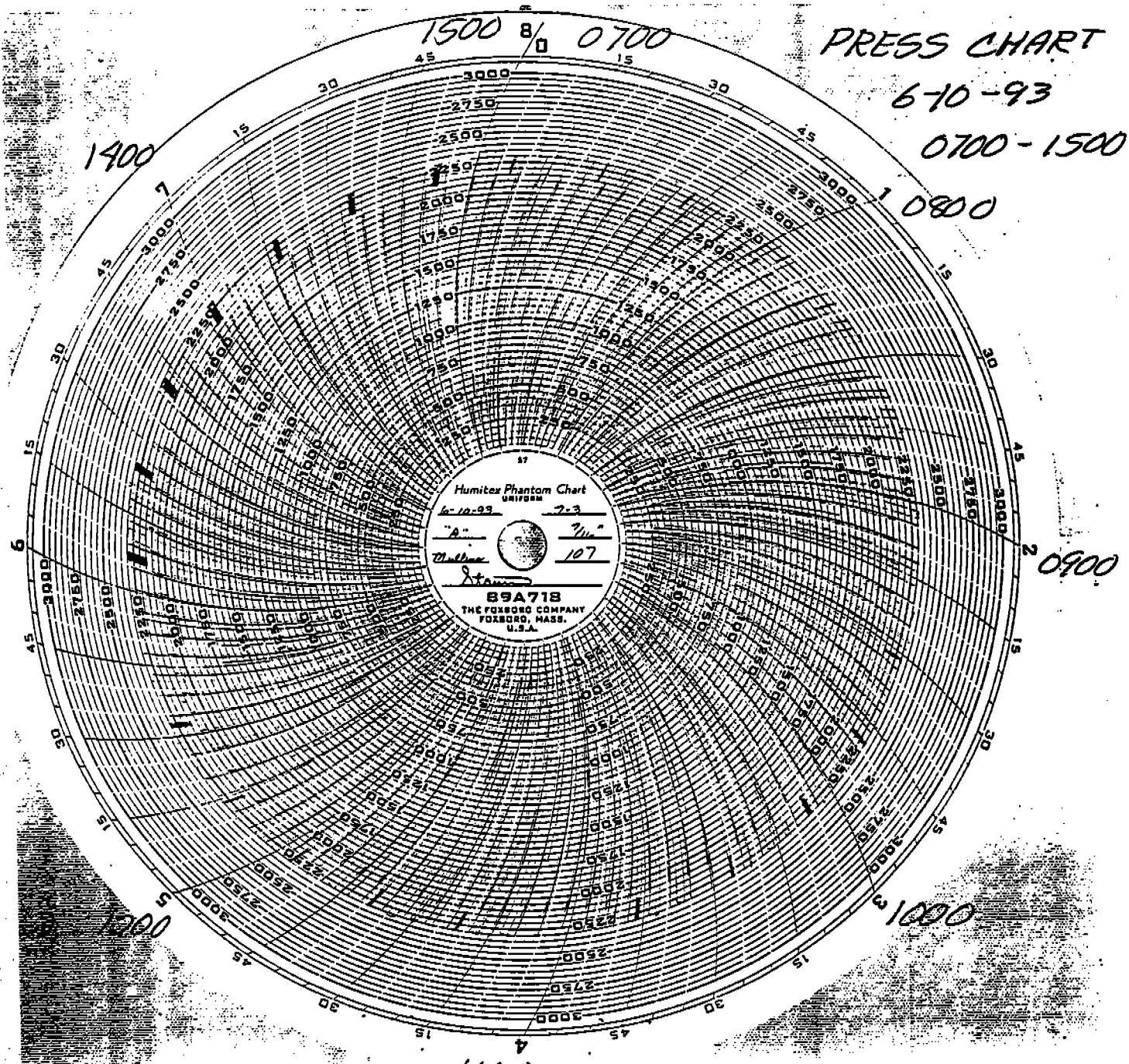
188	186
193	194
201	198
193	194
197	188
190	198
187	199
183	198
187	184
182	195
183	198
201	206
191	202
184	200
193	
196	

192.97 LB = AVERAGE UNTRIMMED MAT WEIGHT

175.8 LB = AVERAGE FINISHED BOARD WEIGHT (UNTRIMMED MAT WEIGHT – TRIM WEIGHT)

8.9% = TRIM

6.66 =HOURS DURING TESTING
89 =PRESSLOADS
712 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
125170 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
18794 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
9.4 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PRODUCT PER HR / 2000 LB)



PRESS CHART

6-10-93

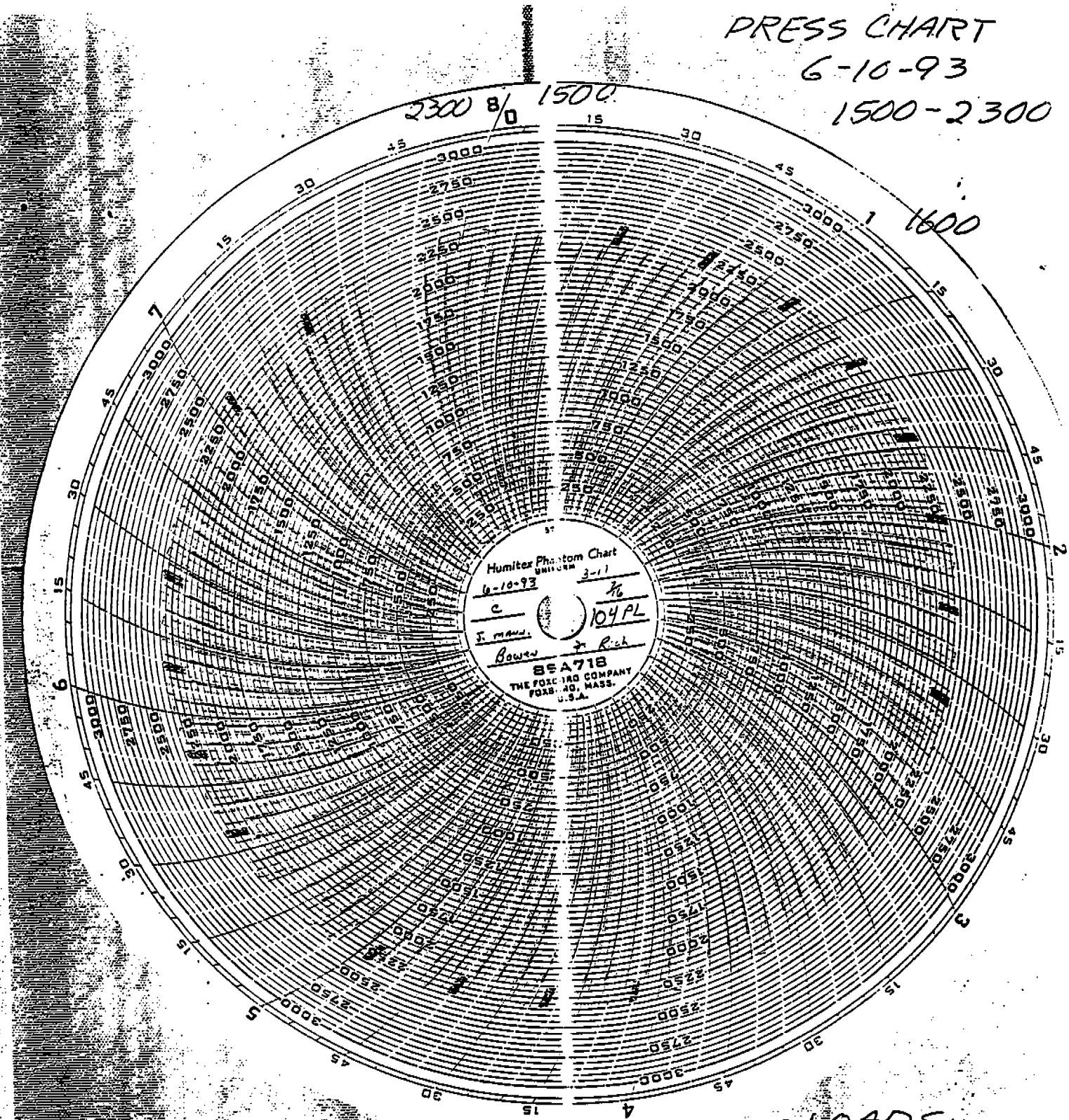
0700 - 1500

PRESSLOADS

0830 - 1500 = 87

46

PRESS CHART
6-10-93
1500-2300



PRESS LOADS
1500-1510=
2

47

LOUISIANA-PACIFIC CORPORATION

DUNGANNON, VIRGINIA

PRESS REPORT

OPERATOR Spinner SHIFT 7-3 CREW "A" DATE 6-10-93

THICKNESS: 7/16" PRESS LOADS 107 - 127,833 BLENDER SHUTDOWNS CORE 24

OVERALL TIMER: _____ DECOMPRESSION TIME _____ SURFACE 22

PRESS TEMP: 410°

	CORE RESIN	SURFACE RESIN
BEGIN	203096	771703
END	204605	777771

LINE SPEED	FROM	TO
31	7:00	3:00

Cleaned Blender Shrouds & Tracks _____

Former hydraulic and radiater blown out _____

FCOS hydraulic unit and radiater blown out _____

Blender outfeed conv. tail pulleys cleaned _____

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	KEY	REASONS FOR DOWNTIME
8:29	8:31				2	Lost inputs
9:17	9:19				2	" "
10:12	10:13				1	#1 stack to press
10:31	10:33				2	#8 stack to press.
12:26	12:27				1	#1 Didn't make an loaded case.

DOWNTIME CODE: M-MECHANICAL E-ELECTRICAL O-OPERATOR

**** MAINTENANCE/LOCK-OUT LOG ****

MOTOR # LOCKED OUT	FROM	TO	BRIEF DESCRIPTION OF WORK BEING DONE	INITIALS OF PERSON LOCKING OUT

(OVER)

98

LOUISIANA-PACIFIC CORPORATION

DUNGANNON, VIRGINIA

PRESS REPORT

OPERATOR Bowen S./Rich V. SHIFT 3-11 CREW C DATE 6-10-93

THICKNESS: 7/16

OVERALL TIMER:

PRESS TEMP: 410°

PRESS LOADS 104

DECOMPRESSION TIME

BLENDER SHUTDOWNS
CORE 21
SURFACE 23

	CORE RESIN	SURFACE RESIN
BEGIN	204605	777721
END	206085	783060

Cleaned Blender Shrouds & Tracks

Former hydraulic and radiater blown out

FCOS hydraulic unit and radiater blown out

Blender outfeed conv. tail pulleys cleaned

LINE SPEED	FROM	TO
30	3:00	

DOWNTIME FROM	DOWNTIME TO	DOWNTIME (Mins.) M	E	O	KEY	REASONS FOR DOWNTIME
10:11	10:44			✓	3	#2 stuck in press (long wafers)
10:23	10:24			✓	1	#7 stuck to press " "
10:37	10:45			✓	8	splitter gate plugged (long wafers)
10:47	10:49			✓	2	low formers due to above problem

DOWNTIME CODE: M-MECHANICAL E-ELECTRICAL O-OPERATOR

**** MAINTENANCE/LOCK-OUT LOG ****

MOTOR # LOCKED OUT	FROM	TO	BRIEF DESCRIPTION OF WORK BEING DONE	INITIALS OF PERSON LOCKING OUT

(OVER)

49

DUNGANNON PRESS VENT TESTING 6-10-93
0830-1500

RESIN USAGE FROM FLOW CHARTS

200 = LBS OF MDI RESIN PER HOUR
18824 =LBS FINISHED PRODUCT PRODUCED PER HOUR
1.06% = MDI RESIN USED AS % OF FINAL PRODUCT

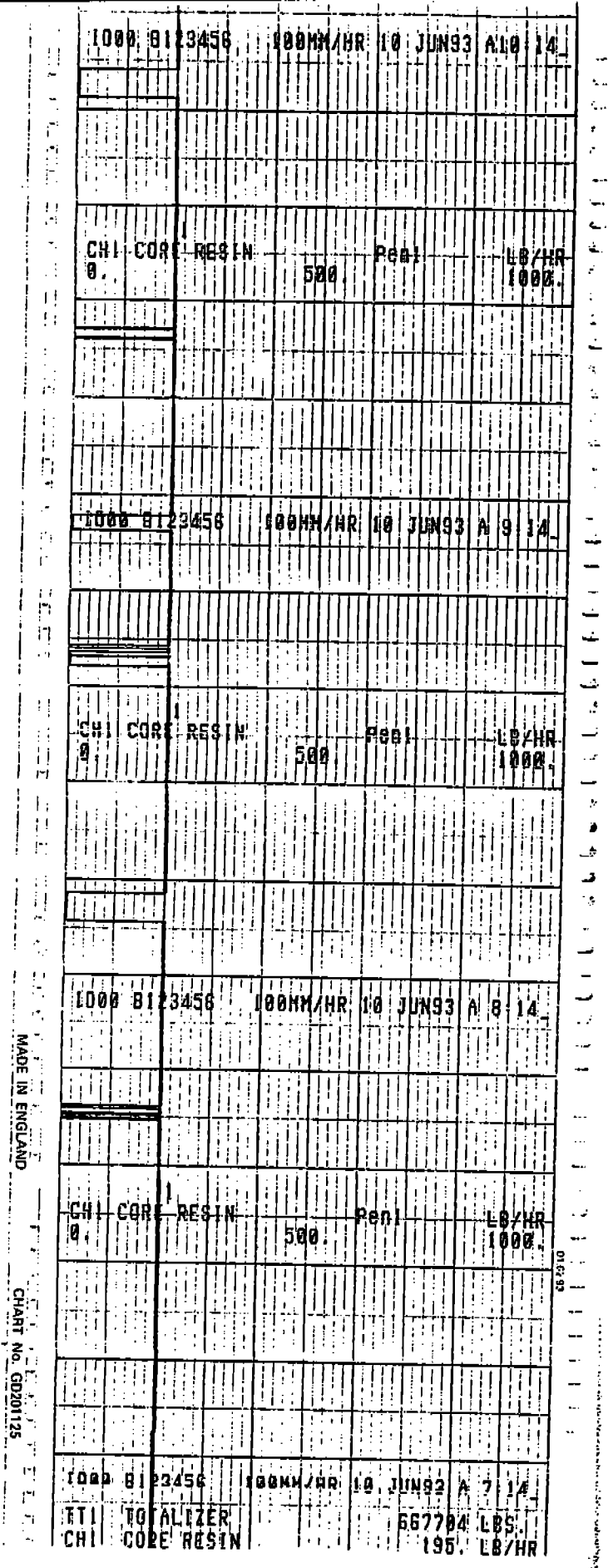
790 = LBS OF LIQUID PHENOLIC RESIN PER HOUR ON A 55% SOLIDS BASIS
435 = LBS OF LIQUID PHENOLIC RESIN PER HOUR ON A 100% SOLIDS BASIS
2.31% = LIQUID PHENOLIC RESIN USED AS % OF FINAL PRODUCT

WAX USAGE FROM DAILY INVENTORY SHEET

8395 = LBS OF WAX USED FOR THE DAY @ 48% SOLIDS
4365 = LBS OF WAX USED FOR THE DAY @ 100% SOLIDS
379915 =PRODUCTION FOOTAGE FOR THE DAY -- 3/8" BASIS
325641.4 =PRODUCTION FOOTAGE FOR THE DAY -- 7/16" BASIS
((3/8" FOOTAGE)/ (7/16" / 3/8"))
2544 =NO OF 8'x16' BOARDS PRODUCED (7/16" FOOTAGE / (8'X16"))
175.8 =WEIGHT OF FINISHED 8'x16'7/16" BOARD
447235.2 = TOTAL LBS OF BOARD PRODUCED (NO. OF BOARDS x BOARD WEIGHT)
0.98% =WAX AS % OF FINAL PRODUCT

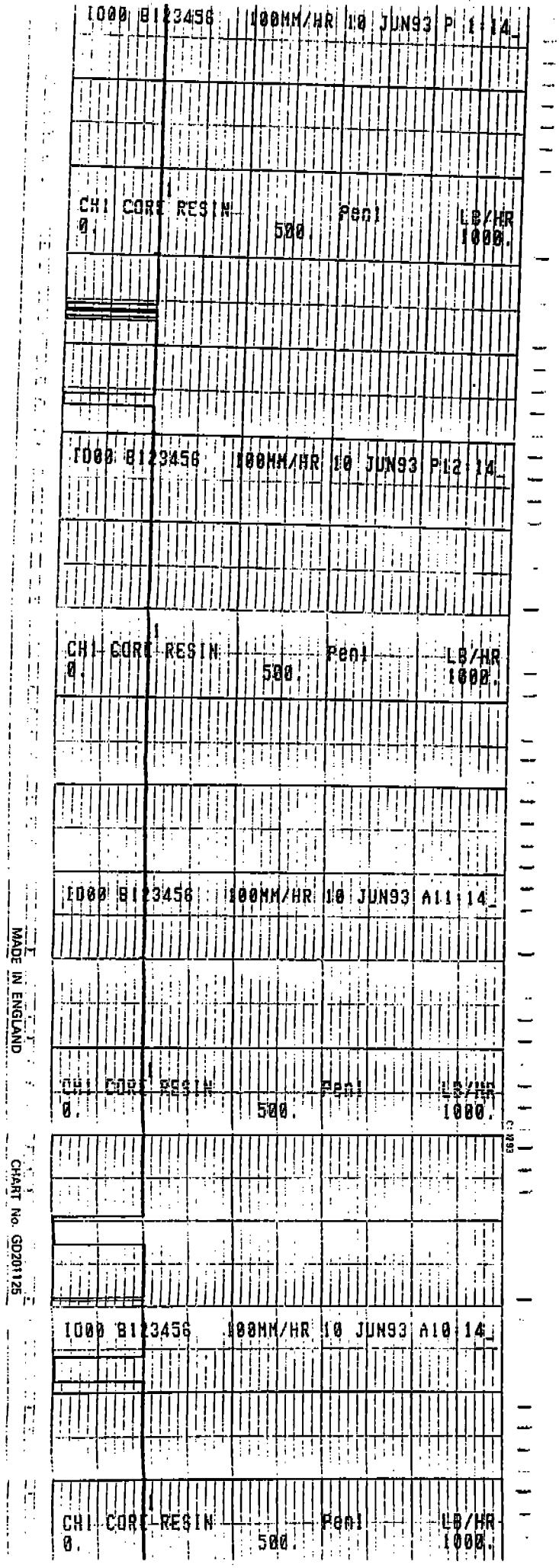
18824 =LBS FINISHED PRODUCT PRODUCED PER HOUR
184 = LBS OF WAX USED PER HOUR DURING TESTING (% WAX x LBS FINISHED PRODUCT PER HOUR)

50

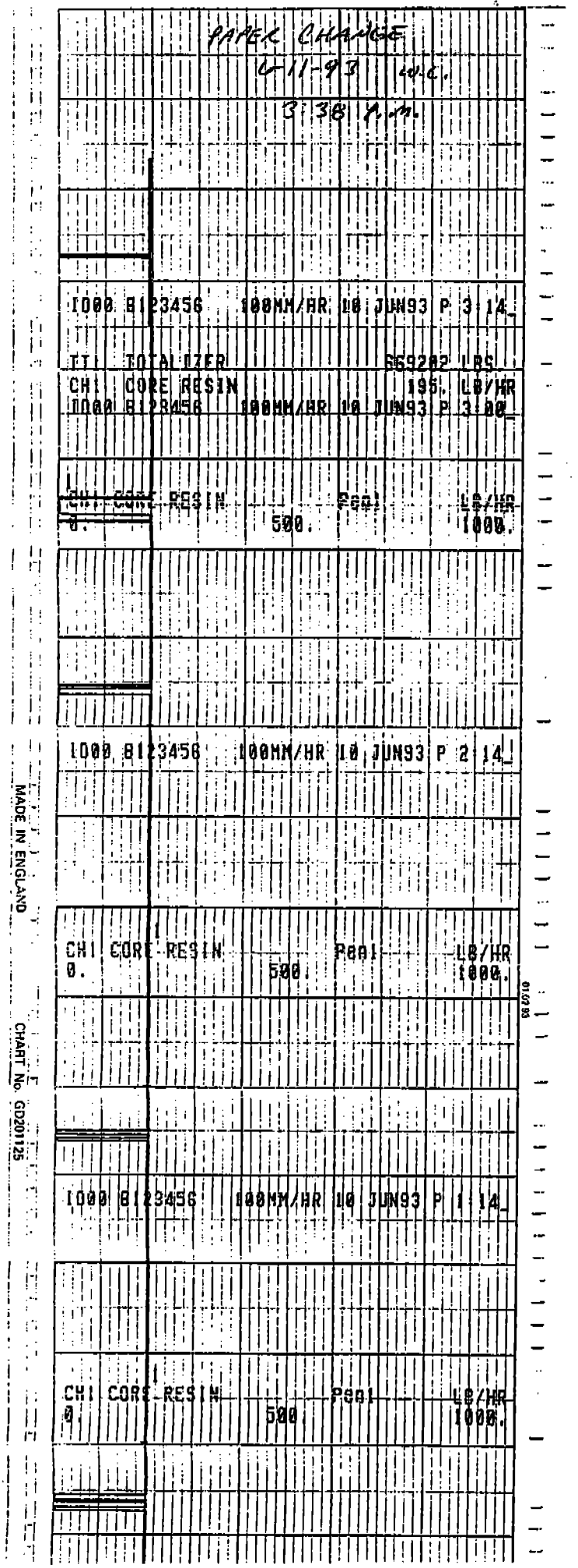


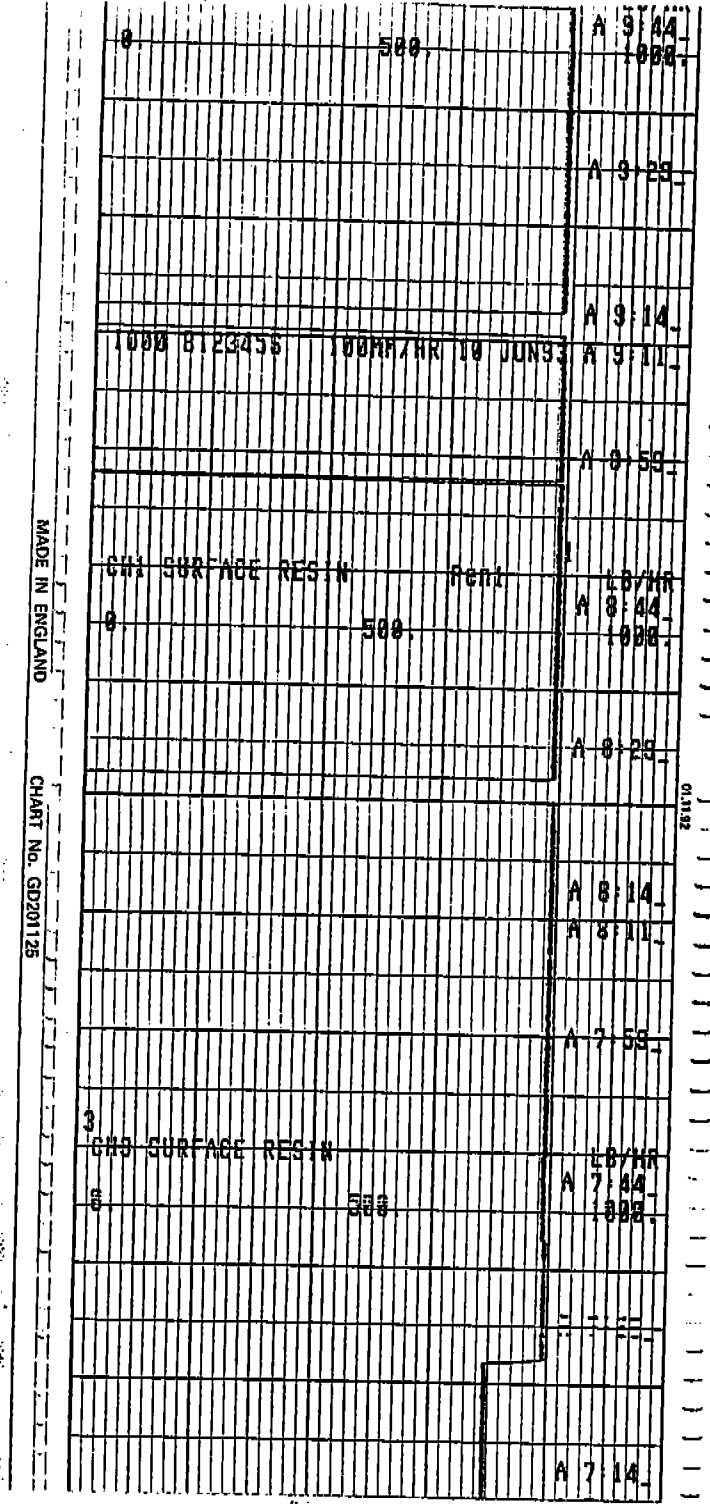
Core Resin
6/10/93
7:14am - 3:14pm

51


I000 B123456 100MM/HR 10 JUN93 P L 14
CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.
I000 B123456 100MM/HR 10 JUN93 PL2 14
CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.
I000 B123456 100MM/HR 10 JUN93 A11 14
CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.
I000 B123456 100MM/HR 10 JUN93 A10 14
CH1 CORE RESIN Pen1 LB/HR
0. 500. 1000.
MADE IN ENGLAND
CHART No. GD201125

52


PAPER CHANGE
6-11-93 W.C.
3:38 P.M.
I000 B123456 100MM/HR 10 JUN93 P 3 14
TT1 TOTALIZER 659282 LBS
CH1 CORE RESIN 195. LB/HR
I000 B123456 100MM/HR 10 JUN93 P 3 00
CH1 CORE RESIN Peal LB/HR
0. 500. 1000.
I000 B123456 100MM/HR 10 JUN93 P 2 14
CH1 CORE RESIN Peal LB/HR
0. 500. 1000.
I000 B123456 100MM/HR 10 JUN93 P 1 14
CH1 CORE RESIN Peal LB/HR
0. 500. 1000.
MADE IN ENGLAND
CHART No. GD201125

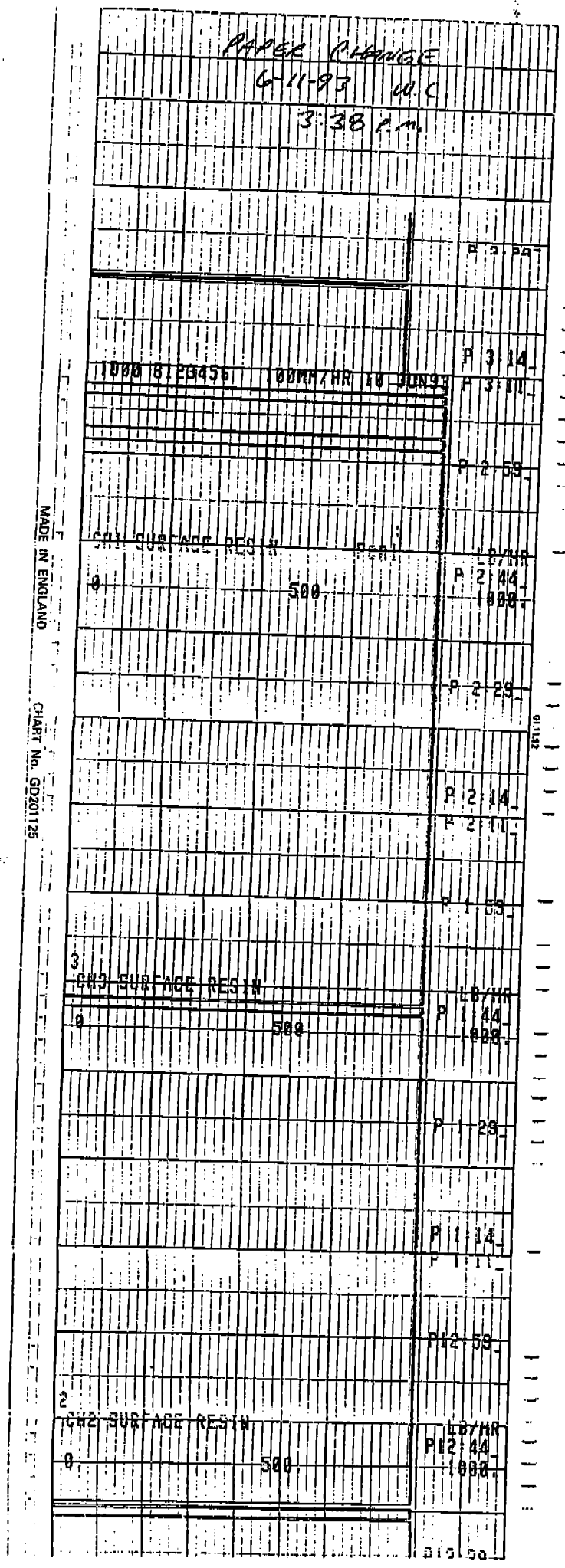


Surface Resin
6/10/93
7:11am - 3:38pm

54

CH2 SURFACE RESIN
0
500
LB/HR
P12:44
1000.
P12:29
P12:14
1000 81:23456 100MM/HR 10 JUN93 P12:10
A11:58
CH1 SURFACE RESIN
Rch1
LB/HR
A11:44
1000.
0
500
A11:25
A11:14
A11:11
A10:58
3
CH3 SURFACE RESIN
LB/HR
A10:44
1000.
0
500
A10:29
A10:14
A10:11
A 9:58
2
CH2 SURFACE RESIN
LB/HR
A 9:44
1000.
0
500
A 9:29
MADE IN ENGLAND
CHART No. GD201125

55


PAPER CHANGE
6-11-97 W.C.
3:38 P.m.
1000 B:29456 100MM/HR 10 JUN97
CH1 SURFACE RESIN
0
500
LB/HR
1000
CH2 SURFACE RESIN
0
500
LB/HR
1000
CH2 SURFACE RESIN
0
500
LB/HR
1000
MADE IN ENGLAND
CHART No. GD201125

A1...H46 A47...W85

INVENTORY DATE: 6-10-93

PF:

		Start of day	End of day
OUTSIDE PF TANK HEIGHT INCHES	71.00		
INSIDE PF TANK HEIGHT INCHES	70.00		
DAY TANK HEIGHT INCHES	39.00		
PF FLOWMETER	16812	771703	788515
INCOMING PF POUNDS	0		
PF INVENTORY IN LBS	91032		

MDI:

		Start of day	End of day
OUTSIDE MDI TANK HEIGHT INCHES	168.00		
INSIDE TANK HEIGHT INCHES	115.00		
MDI STORAGE FLOWMETER	4520	203096	207616
INCOMING MDI POUNDS	0		
MDI INVENTORY IN LBS	173497		

WAX:

WAX TANK HEIGHT INCHES	109.00	
INCOMING WAX POUNDS	0	47962 - 39576 =
WAX INVENTORY IN LBS	39576	8386

PRESSLOADS:

THICKNESS	0.025	0.375	0.4375	0.469	0.594	0.719
SHIFT 1	0		107			
SHIFT 2	0		104			
SHIFT 3	0		107			
TOTAL	0	0	318	0	0	0
MSF	0.000	0.000	379.915	0.000	0.000	0.000

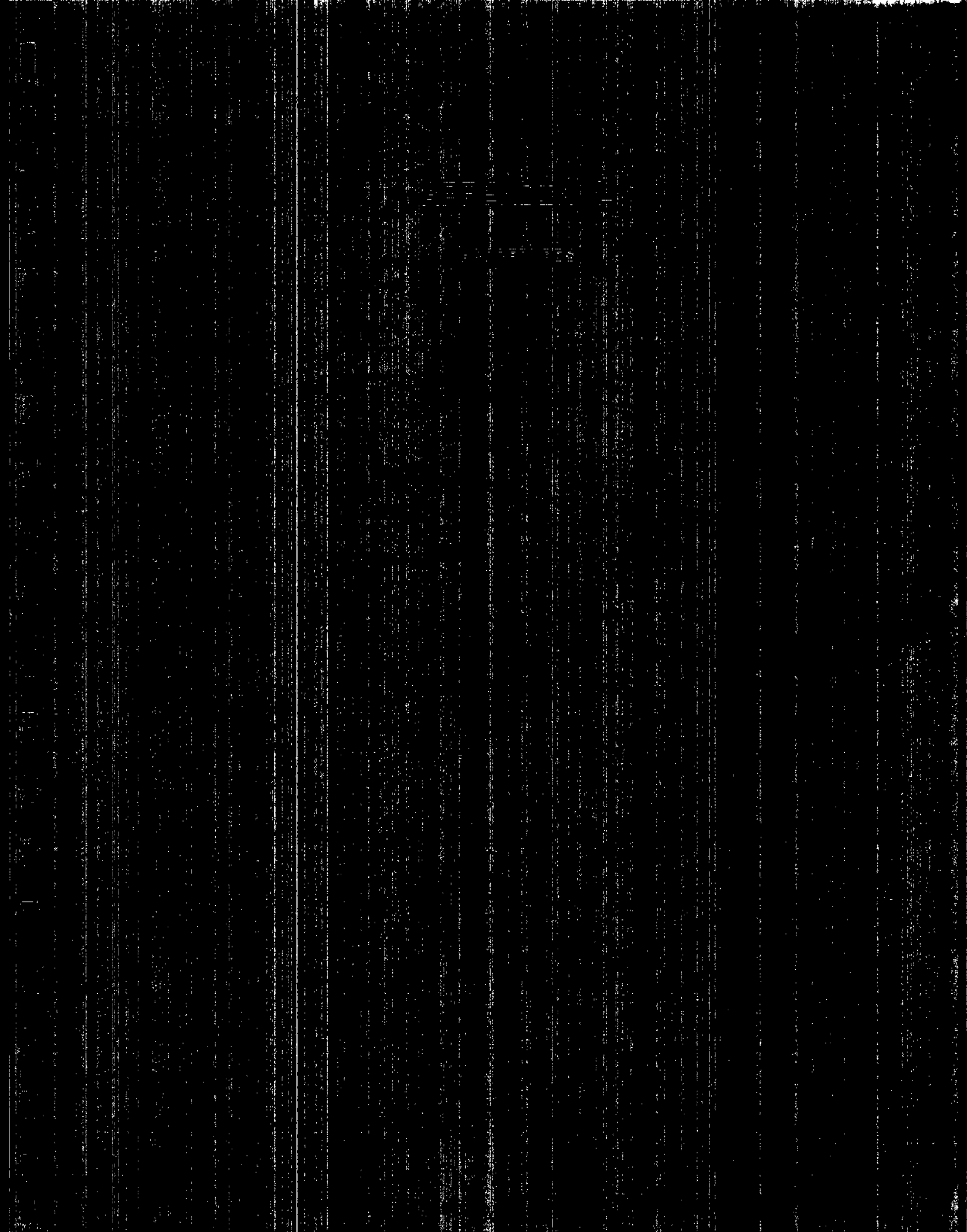
DAILY MSF 379.915

	A-GRADE: PERCENT	U&E MSF
SHIFT 1	99.1	1.07
SHIFT 2	98.8	1.456
SHIFT 3	99.9	0.75
TOTAL:		3.276

PRIMARY DOWNGRADE:RESIN SPOTS
A47...W85



57



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.

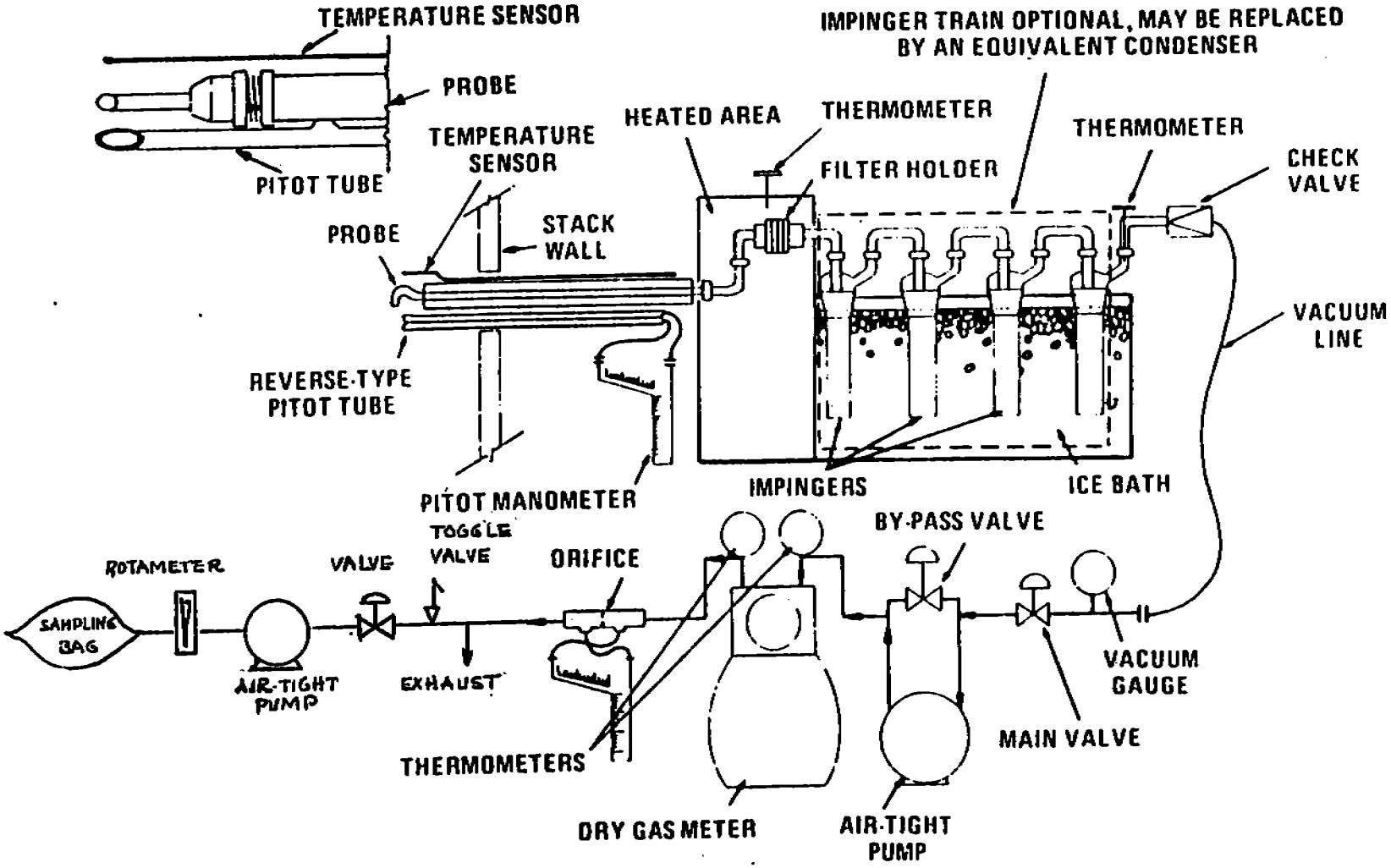
The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the impinger case 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.

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 in 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 $\Delta H_@$ 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_{SO4} = 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_s = 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.

$$m_c = K\, C_{so4}\, V_{ic} \qquad \text{Eq. 202-1}$$

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.

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

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

1. DeWees, W.D., S.C. Steinsberger, G.M. Plummer, L.T. Lay, C.D. McAlister, and R.T.

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.

2. DeWees, W.D. and K.C. Steinsberger. "Method Development and Evaluation of Draft Protocol for Measurement of Condensible Particulate Emissions." Draft Report. November 17, 1988.

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.

4. Nothstein, Greg. Masters Thesis. University of Washington. Department of Environmental Health. Seattle, Washington.

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.

BILLING CODE 6560-50-M

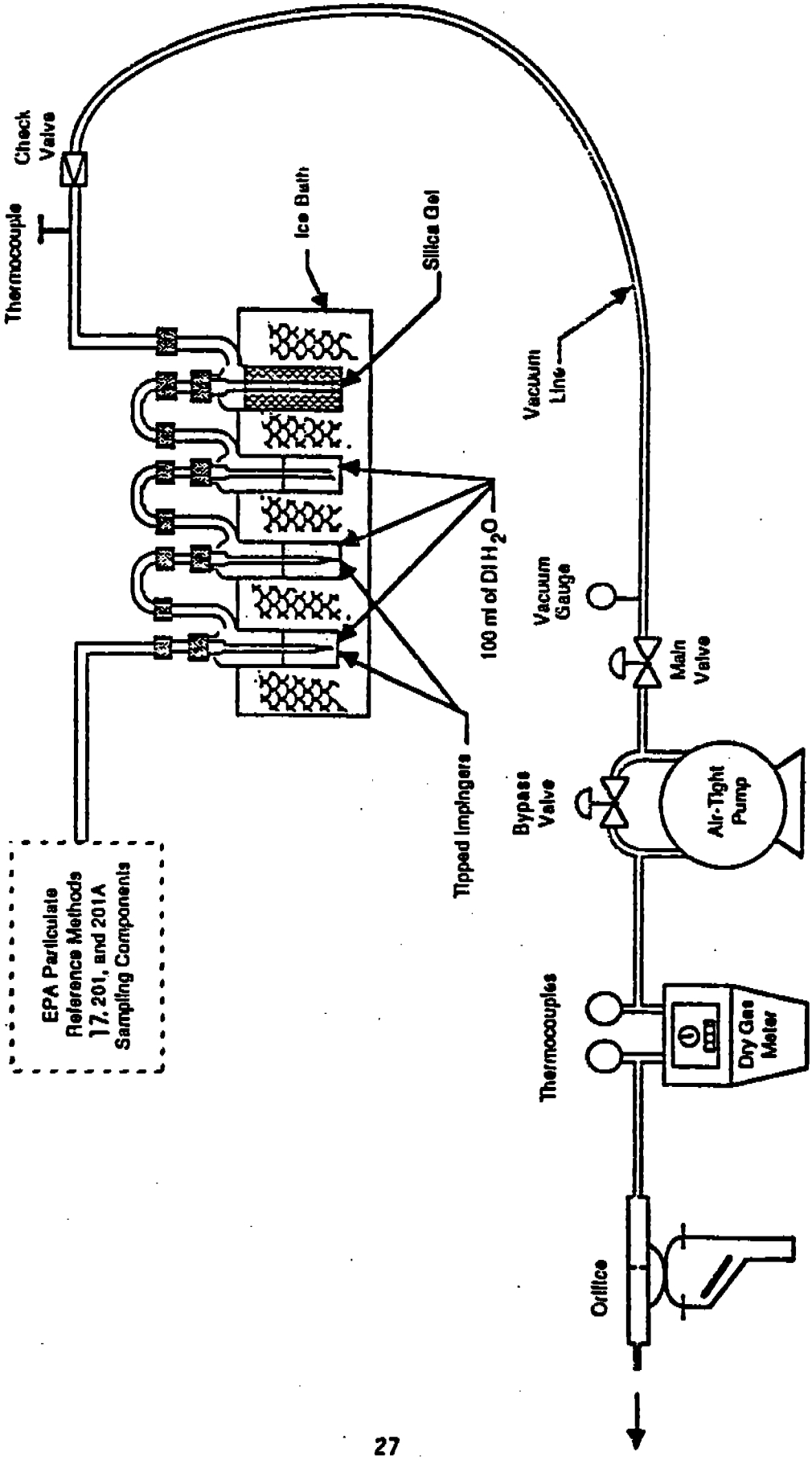


Figure 202-1. , Schematic of condensible particulate sampling train.

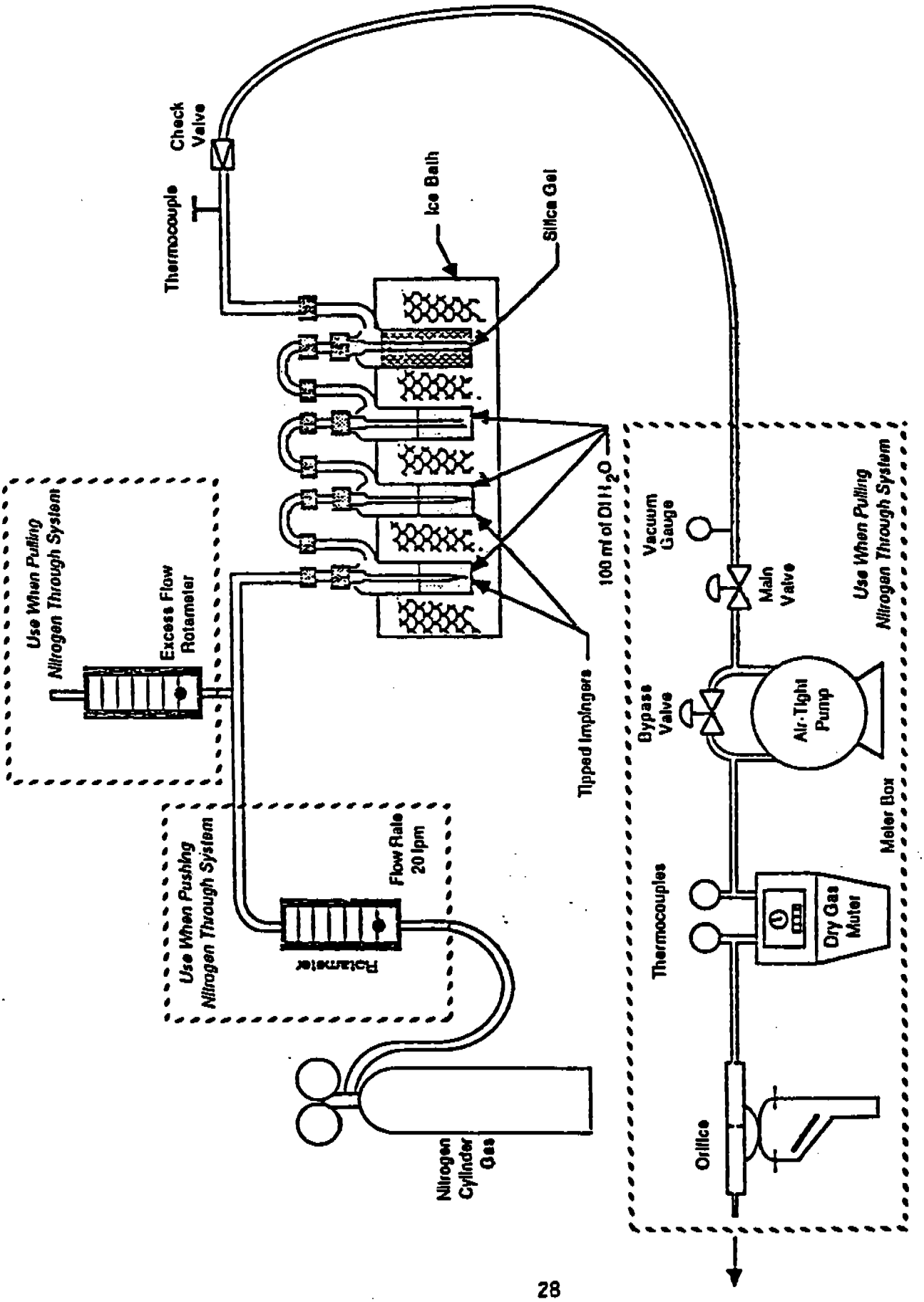


Figure 202-2. Schematic of post-test nitrogen purge system.

28

BILLING CODE 6560-50-M

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 Condensible Particulate: _____

Figure 202-3. Analytical data sheet.

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

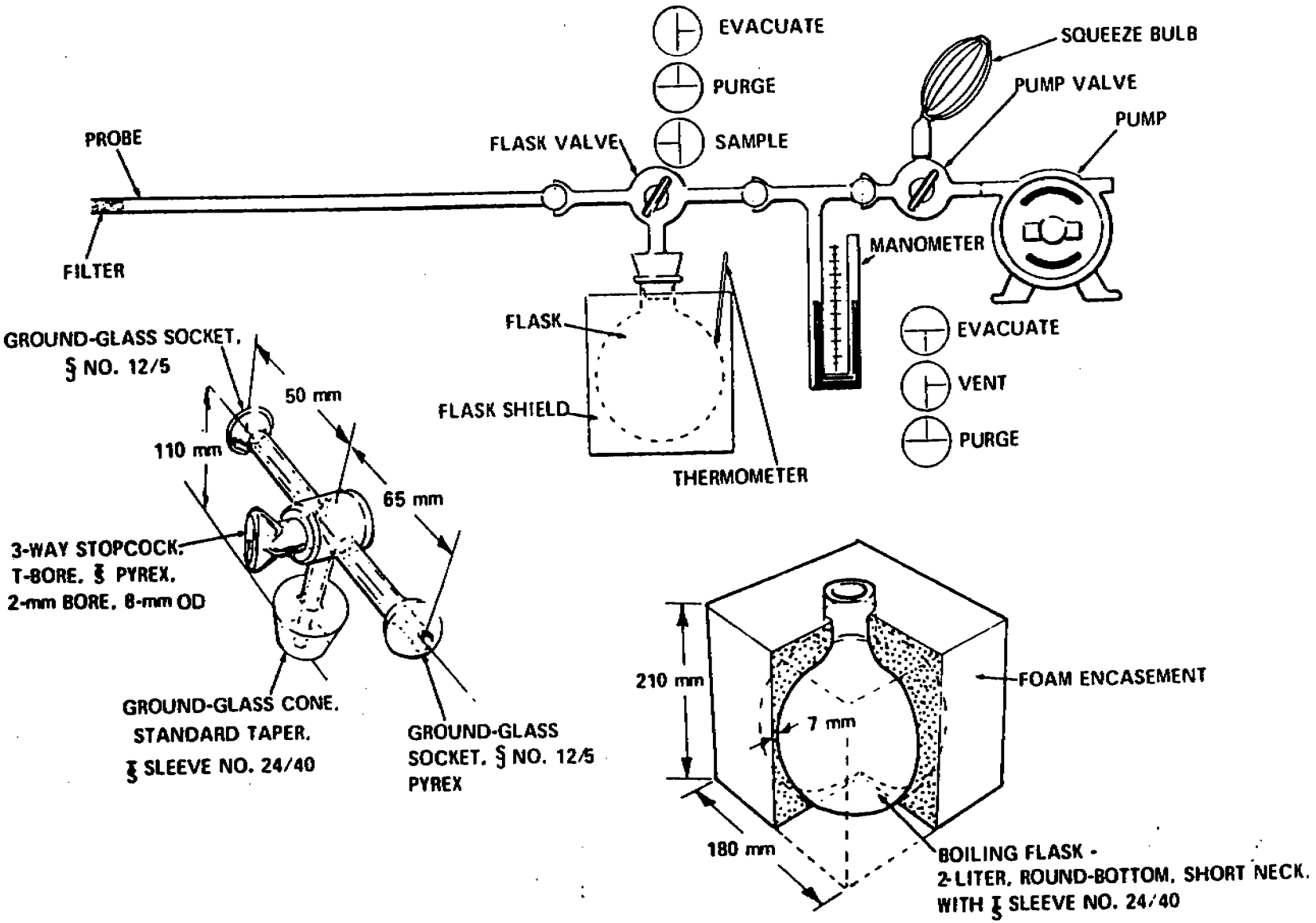
BILLING CODE 6560-50-M

Oxides of Nitrogen

Oxides of nitrogen concentrations were collected in accordance with EPA Method 7 (see above-cited reference) with a specially designed all glass manifold and valving assembly and a heated stainless steel-lined probe. Samples were collected in two-liter evacuated insulated flasks which contained 25 cc of acidified peroxide solution (Method 7 reagent). Nine sets or more of three samples each were collected over a period of 4.5 to 5 hours.

The sampling train was leak checked through the probe at the beginning and end of the test and, in addition, the system leak checked at the time of evacuation of each flask. Before the samples were collected, the probe was purged to eliminate dead volume effects and to raise the temperature of the probe outlet and manifold assembly to minimize condensation of moisture. A plug of microfiber glass wool inserted in the probe inlet was used to prevent particulate material from entering into the flask. The temperature of the flask, vacuum in the flask and barometric pressure at the time of sampling was recorded for each flask. After sampling was complete, as evidenced by the in-line vacuum gauge, the flask valve was closed, the flask assembly disconnected from the manifold/valve assembly and the flask shook for several minutes to promote oxidation and absorption. The recovered oxides of nitrogen samples were returned to the laboratory and analyzed immediately by ion chromatography as per EPA 7A.

The internal volume of each numbered flask assembly has been measured prior to initial use by filling with water, weighing before and after and then converting the weight of water to volume by means of the density of water at room temperature. Flask volumes are stored in the computer and recalled automatically in the computer calculation.



Sampling train, flask valve, and flask.

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 $\pm$ 2% full scale and the noise is less than 0.5 fs. The minimum detectable concentration is 5 ppm. Zero drift is rated at $\pm$ 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 $\pm$ 0.5% fs on low range and $\pm$ 1% fs on high range. The flow rate through the analyzer is 1.0 $\pm$ 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.

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 ^{o}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 ^{o}C

4500 BALL ROAD N.E.
CIRCLE PINES, MN 55014-1819
(612) 786-6020

Current as of 3-26-91

METHOD 201A - DETERMINATION OF PM_{10} EMISSIONS (Constant Sampling Rate Procedure)

(55 FR 14246)

1. Applicability and Principle

1.1 Applicability. This method applies to the in-stack measurement of particulate matter (PM) emissions equal to or less than an aerodynamic diameter of nominally 10 μm (PM_{10}) from stationary sources. The EPA recognizes that condensible emissions not collected by an in-stack method are also PM_{10}, and that emissions that contribute to ambient PM_{10} levels are the sum of condensible emissions and emissions measured by an in-stack PM_{10} method, such as this method or Method 201. Therefore, for establishing source contributions to ambient levels of PM_{10}, such as for emission inventory purposes, EPA suggests that source PM_{10} measurement include both in-stack PM_{10} and condensible emissions. Condensible emissions may be measured by an impinger analysis in combination with this method.

1.2 Principle. A gas sample is extracted at a constant flow rate through an in-stack sizing device, which separates PM greater than PM_{10}. Variations from isokinetic sampling conditions are maintained within well-defined limits. The particulate mass is determined gravimetrically after removal of uncombined water.

2. Apparatus

NOTE: Methods cited in this method are part of 40 CFR Part 60, Appendix A.

2.1 Sampling Train. A schematic of the Method 201A sampling train is shown in Figure 1. With the exception of the PM_{10} sizing device and in-stack filter, this train is the same as an EPA Method 17 train.

2.1.1 Nozzle. Stainless steel (316 or equivalent) with a sharp tapered leading edge. Eleven nozzles that meet the design specifications in Figure 2

This version is a corrected version of (55 FR 14246 Apr 17 1990)

are recommended. A large number of nozzles with small nozzle increments increase the likelihood that a single nozzle can be used for the entire traverse. If the nozzles do not meet the design specifications in Figure 2, then the nozzles must meet the criteria in Section 5.2.

2.1.2 PM_{10} Sizer. Stainless steel (316 or equivalent), capable of determining the PM_{10} fraction. The sizing device shall be either a cyclone that meets the specifications in Section 5.2 or a cascade impactor that has been calibrated using the procedure in Section 5.4.

2.1.3 Filter Holder. 63-mm, stainless steel. An Andersen filter, part number SE274, has been found to be acceptable for the in-stack filter. NOTE: Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.1.4 Pitot Tube. Same as in Method 5, Section 2.1.3. The pitot lines shall be made of heat resistant tubing and attached to the probe with stainless steel fittings.

2.1.5 Probe Liner. Optional, same as in Method 5, Section 2.1.2.

2.1.6 Differential Pressure Gauge, Condenser, Metering System, Barometer, and Gas Density Determination Equipment. Same as in Method 5, Sections 2.1.4, and 2.1.7 through 2.1.10, respectively.

2.2 Sample Recovery.

2.2.1 Nozzle, Sizing Device, Probe, and Filter Holder Brushes. Nylon bristle brushes with stainless steel wire shafts and handles, properly sized and shaped for cleaning the nozzle, sizing device, probe or probe liner, and filter holders.

2.2.2 Wash Bottles, Glass Sample Storage Containers, Petri Dishes, Graduated Cylinder and Balance, Plastic Storage Containers, Funnel and Rubber

Policeman, and Funnel. Same as in Method 5, Sections 2.2.2 through 2.2.8, respectively.

2.3 Analysis. Same as in Method 5, Section 2.3.

3. Reagents

The reagents for sampling, sample recovery, and analysis are the same as that specified in Method 5, Sections 3.1, 3.2, and 3.3, respectively.

4. Procedure

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. Same as in Method 5, Section 4.1.1.

4.1.2 Preliminary Determinations. Same as in Method 5, Section 4.1.2, except use the directions on nozzle size selection and sampling time in this method. Use of any nozzle greater (less than) that 0.16 in. in diameter require a sampling port diameter of 6 inches. Also, the required maximum number of traverse points at any location shall be 12.

? See pg 22

4.1.2.1 The sizing device must be in-stack or maintained at stack temperature during sampling. The blockage effect of the CSR sampling assembly will be minimal if the cross-sectional area of the sampling assemble is 3 percent or less of the cross-sectional area of the duct. (ie $D_s \geq 17.5$ inches) If the cross-sectional area of the assembly is greater than 3 percent of the cross-sectional area of the duct, then either determine the pitot coefficient at sampling conditions or use a standard pitot with a known coefficient in a configuration with the CSR sampling assembly such that flow disturbances are minimized.

* when $D_s \leq 17.5$ inches, blockage exceeds 3%

4.1.2.2 The setup calculations can be performed by using the following procedures.

4.1.2.2.1 In order to maintain a cut size of 10 μm in the sizing device, the flow rate through the sizing device must be maintained at a constant, discrete value during the run. If the sizing device is a cyclone that meets the design specifications in Figure 3, use the equations in Figure 4 to calculate three orifice pressure drops (ΔH): one at the average stack temperature, and the other two at temperatures ±28°C (±50°F) of the average stack temperature. Use the ΔH calculated at the average stack temperature as the orifice pressure head for the sample flow rate as long as the stack temperature during the run is within 28°C (50°F) of the average stack temperature. If the stack temperature varies by more than 28°C (50°F), then use the appropriate ΔH.

4.1.2.2.3 To select a nozzle, use the equations in Figure 5 to calculate Δp_{min} and Δp_{max} for each nozzle at all three temperatures. If the sizing device is a cyclone that does not meet the design specifications in Figure 3, the example worksheets can be used.

4.1.2.2.4 Correct the Method 2 pitot readings to Method 201A pitot readings by multiplying the Method 2 pitot readings by the square of a ratio of the Method 201A pitot coefficient to the Method 2 pitot coefficient. Select the nozzle for which Δp_{min} and Δp_{max} bracket all of the corrected Method 2 pitot readings. If more than one nozzle meets this requirement,

select the nozzle giving the greatest symmetry. Note that if the expected pitot reading for one or more points is near a limit for a chosen nozzle, it may be outside the limits at the time of the run.

4.1.2.2.5 Vary the dwell time, or sampling time, at each traverse point proportionately with the point velocity. Use the equations in Figure 6 to calculate the dwell time at the first point and at each subsequent point. It is recommended that the number of minutes sampled at each point be rounded to the nearest 15 seconds.

4.1.3 Preparation of Collection Train. Same as in Method 5, Section 4.1.3, except omit directions about a glass cyclone.

4.1.4 Leak-Check Procedure. The sizing device is removed before the post-test leak-check to prevent any disturbance of the collected sample prior to analysis.

4.1.4.1 Pretest Leak-Check. A pretest leak-check of the entire sampling train, including the sizing device, is required. Use the leak-check procedure in Method 5, Section 4.1.4.1 to conduct a pretest leak-check.

4.1.4.2 Leak-Checks During Sample Run. Same as in Method 5, Section 4.1.4.1.

4.1.4.3 Post-Test Leak-Check. A leak-check is required at the conclusion of each sampling run. Remove the cyclone before the leak-check to prevent the vacuum created by the cooling of the probe from disturbing the collected sample and use the procedure in Method 5, Section 4.1.4.3 to conduct a post-test leak-check.

4.1.5 Method 201A Train Operation. Same as in Method 5, Section 4.1.5, except use the procedures in this section for isokinetic sampling and flow rate adjustment. Maintain the flow rate calculated in Section 4.1.2.2.1

throughout the run provided the stack temperature is within 28°C (50°F) of the temperature used to calculate ΔH. If stack temperatures vary by more than 28°C (50°F), use the appropriate ΔH value calculated in Section 4.1.2.2.1. Calculate the dwell time at each traverse point as in Figure 6.

4.2 Sample Recovery. If a cascade impactor is used, use the manufacturer's recommended procedures for sample recovery. If a cyclone is used, use the same sample recovery as that in Method 5, Section 4.2, except an increased number of sample recovery containers is required.

4.2.1 Container Number 1 (In-Stack Filter). The recovery shall be the same as that for Container Number 1 in Method 5, Section 4.2.

4.2.3 Container Number 2 (Cyclone or Large PM Catch). This step is optional. The anisokinetic error for the cyclone PM is theoretically larger than the error for the PM_{10} catch. Therefore, adding all the fractions to get a total PM catch is not as accurate as Method 5 or Method 201. Disassemble the cyclone and remove the nozzle to recover the large PM catch. Quantitatively recover the PM from the interior surfaces of the nozzle and cyclone, excluding the "turn around" cup and the interior surfaces of the exit tube. The recovery shall be the same as that for Container Number 2 in Method 5, Section 4.2.

4.2.4 Container Number 3 (PM_{10}). Quantitatively recover the PM from all of the surfaces from the cyclone exit to the front half of the in-stack filter holder, including the "turn around" cup inside the cyclone and the interior surfaces of the exit tube. The recovery shall be the same as that for Container Number 2 in Method 5, Section 4.2.

4.2.6 Container Number 4 (Silica Gel). The recovery shall be the same as that for Container Number 3 in Method 5, Section 4.2.

4.2.7 Impinger Water. Same as in Method 5, Section 4.2, under "Impinger Water."

4.3 Analysis. Same as in Method 5, Section 4.3, except handle Method 201A Container Number 1 like Container Number 1, Method 201A Container Numbers 2 and 3 like Container Number 2, and Method 201A Container Number 4 like Container Number 3. Use Figure 7 to record the weights of PM collected. Use Figure 5-3 in Method 5, Section 4.3, to record the volume of water collected.

4.4 Quality Control Procedures. Same as in Method 5, Section 4.4.

4.5 PM_{10} Emission Calculation and Acceptability of Results. Use the procedures in Section 6 to calculate PM_{10} emissions and the criteria in Section 6.3.5 to determine the acceptability of the results.

5. Calibration

Maintain an accurate laboratory log of all calibrations.

5.1 Probe Nozzle, Pitot Tube, Metering System, Probe Heater Calibration, Temperature Gauges, Leak-check of Metering System, and Barometer. Same as in Method 5, Section 5.1 through 5.7, respectively.

6. Calculations

Calculations are as specified in Method 5, Sections 6.3 through 6.7, and 6.9 through 6.11, with the addition of the following:

6.1 Nomenclature.

B_{ws} = Moisture fraction of stack, by volume, dimensionless.

C_1 = Viscosity constant, 51.12 micropoise for °K (51.05 micropoise for °R).

C_2 = Viscosity constant, 0.372 micropoise/°K (0.207 micropoise/°R).

C_3 = Viscosity constant, 1.05×10^{-4} micropoise/°K^2 (3.24×10^{-5} micropoise/°R^2).

C_4 = Viscosity constant, 53.147 micropoise/fraction O_2.

C_5 = Viscosity constant, 74.143 micropoise/fraction H_2O.

D_{50} = Diameter of particles having a 50 percent probability of penetration, μm.

f_o = Stack gas fraction O_2, by volume, dry basis.

K_1 = 0.3858 °K/mm Hg (17.64 °R/in. Hg).

M_w = Wet molecular weight of the stack gas, g/g-mole (lb/lb-mole).

M_d = Dry molecular weight of stack gas, g/g-mole (lb/lb-mole).

P_{bar} = Barometric pressure at sampling site, mm Hg (in. Hg).

P_s = Absolute stack pressure, mm Hg (in. Hg).

Q_s = Total cyclone flow rate at wet cyclone conditions, m^3/min (ft^3/min). YES!

$Q_{s(std)}$ = Total cyclone flow rate at dry standard conditions, dscm/min (dscf/min). DSCFM YES!

T_m = Average absolute temperature of dry meter, °K (°R).

T_s = Average absolute stack gas temperature, °K (°R).

$V_{m(std)}$ = Volume of gas measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions), scm (scf).

θ = Total sampling time, min.

μ_s = Viscosity of stack gas, micropoise.

6.2 Analysis of Cascade Impactor Data. Use the manufacturer's recommended procedures to analyze data from cascade impactors.

6.3 Analysis of Cyclone Data. Use the following procedures to analyze data from a single stage cyclone.

6.3.1 PM_{10} Weight. Determine the PM catch in the PM_{10} range from the sum of the weights obtained from Container Numbers 1 and 3 less the acetone blank.

6.3.2 Total PM Weight (optional). Determine the PM catch for greater than PM_{10} from the weight obtained from Container Number 2 less the acetone blank, and add it to the PM_{10} weight.

6.3.3 PM_{10} Fraction. Determine the PM_{10} fraction of the total particulate weight by dividing the PM_{10} particulate weight by the total particulate weight.

6.3.4 Aerodynamic Cut Size. Calculate the stack gas viscosity as follows:

$$\mu_s = C_1 + C_2 T_s + C_3 T_s^2 + C_4 f_{O2} - C_5 B_{ws}$$

No! Use equation on page 24

$V_{w(std)} = .04707 (V_f - V_i)$

6.3.4.1 The PM_{10} flow rate, at actual cyclone conditions, is calculated as follows:

$$Q_s = \frac{T_s}{K_1 P_s} \left[Q_{s(std)} + \frac{V_{w(std)}}{\theta} \right]$$

$T_s = \bar{t}_s + 460$

but $Q_{s(std)} = \frac{V_{m(std)}}{\theta}$

$K_1 = 17.64$

Substituting gives:

$$Q_s = \frac{5.669 \times 10^{-2} (\bar{t}_s + 460)}{\theta P_s} \left[V_{m(std)} + .04707 (V_f - V_i) \right]$$

6.3.4.2 Calculate the molecular weight on a wet basis of the stack gas as follows:

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

6.3.4.3 Calculate the actual D_{50} of the cyclone for the given conditions as follows:

$$D_{50} = \beta_1 \left(\frac{T_s}{M_w P_s} \right)^{0.2091} \left(\frac{\mu_s}{Q_s} \right)^{0.7091}$$

actual cutpoint achieved during run

where $\beta_1 = 0.027754$ for metric units (0.15625 for English units).

6.3.5 Acceptable Results. The results are acceptable if two conditions are met. The first is that 9.0 $\mu m \leq D_{50} \leq 11.0$ μm. The second is that no sampling points are outside Δp_{min} and Δp_{max}, or that 80 percent $\leq I \leq 120$ percent and no more than one sampling point is outside Δp_{min} and Δp_{max}. If D_{50} is less than 9.0 μm, reject the results and repeat the test.

7. Bibliography

1. Same as Bibliography in Method 5.

2. McCain, J.D., J.W. Ragland, and A.D. Williamson. Recommended Methodology for the Determination of Particle Size Distributions in Ducted Sources, Final Report. Prepared for the California Air Resources Board by Southern Research Institute. May 1986.

3. Farthing, W.E., S.S. Dawes, A.D. Williamson, J.D. McCain, R.S. Martin, and J.W. Ragland. Development of Sampling Methods for Source PM_{10} Emissions. Southern Research Institute for the Environmental Protection Agency. April 1989. NTIS PB 89 190375, EPA/600/3-88-056.

4. Application Guide for Source PM_{10} Measurement with Constant Sampling Rate, EPA/600/3-88-057.

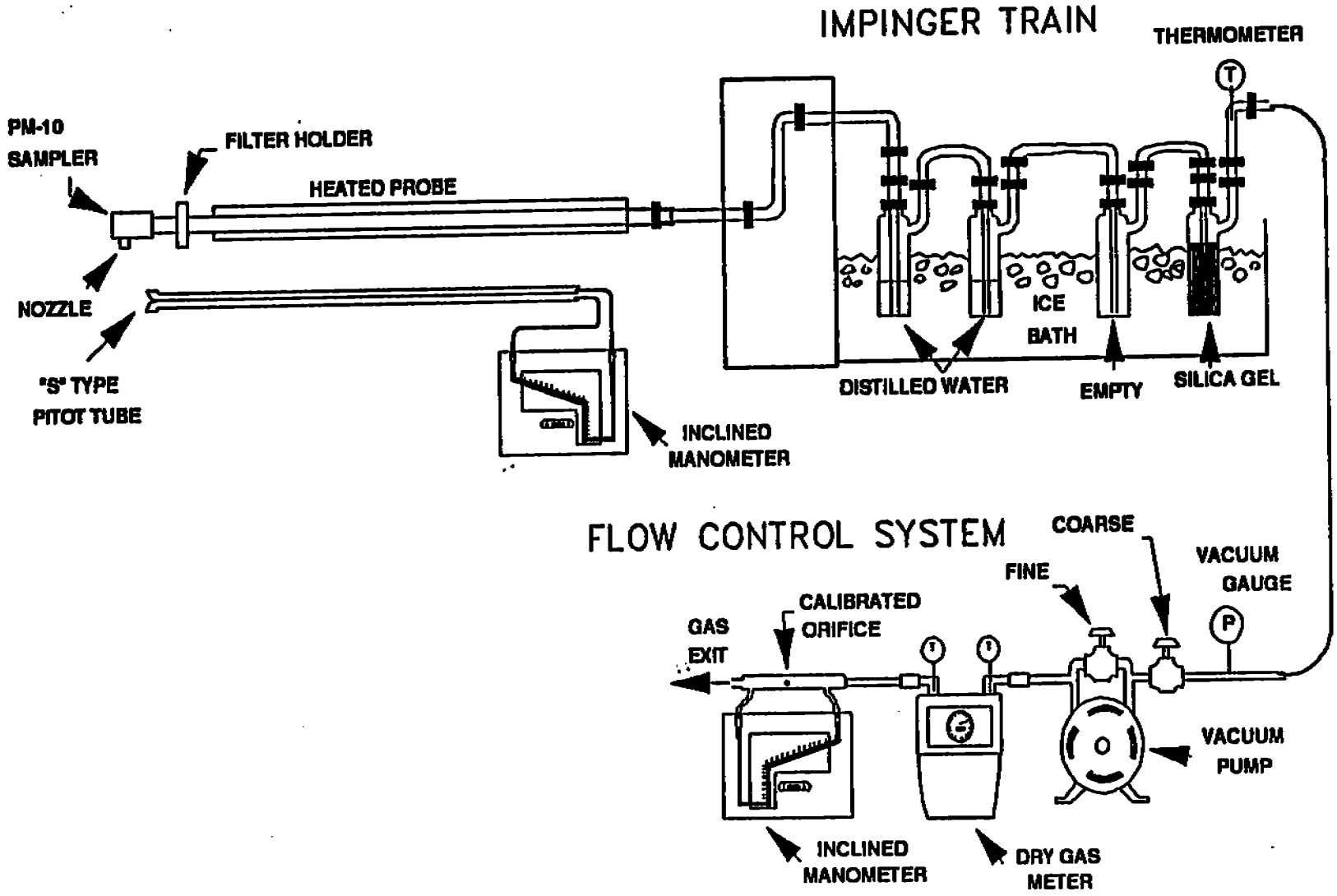
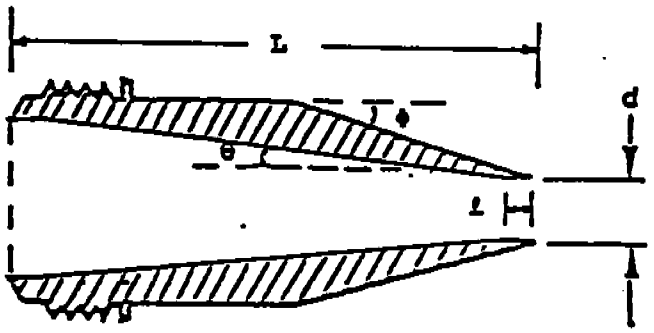


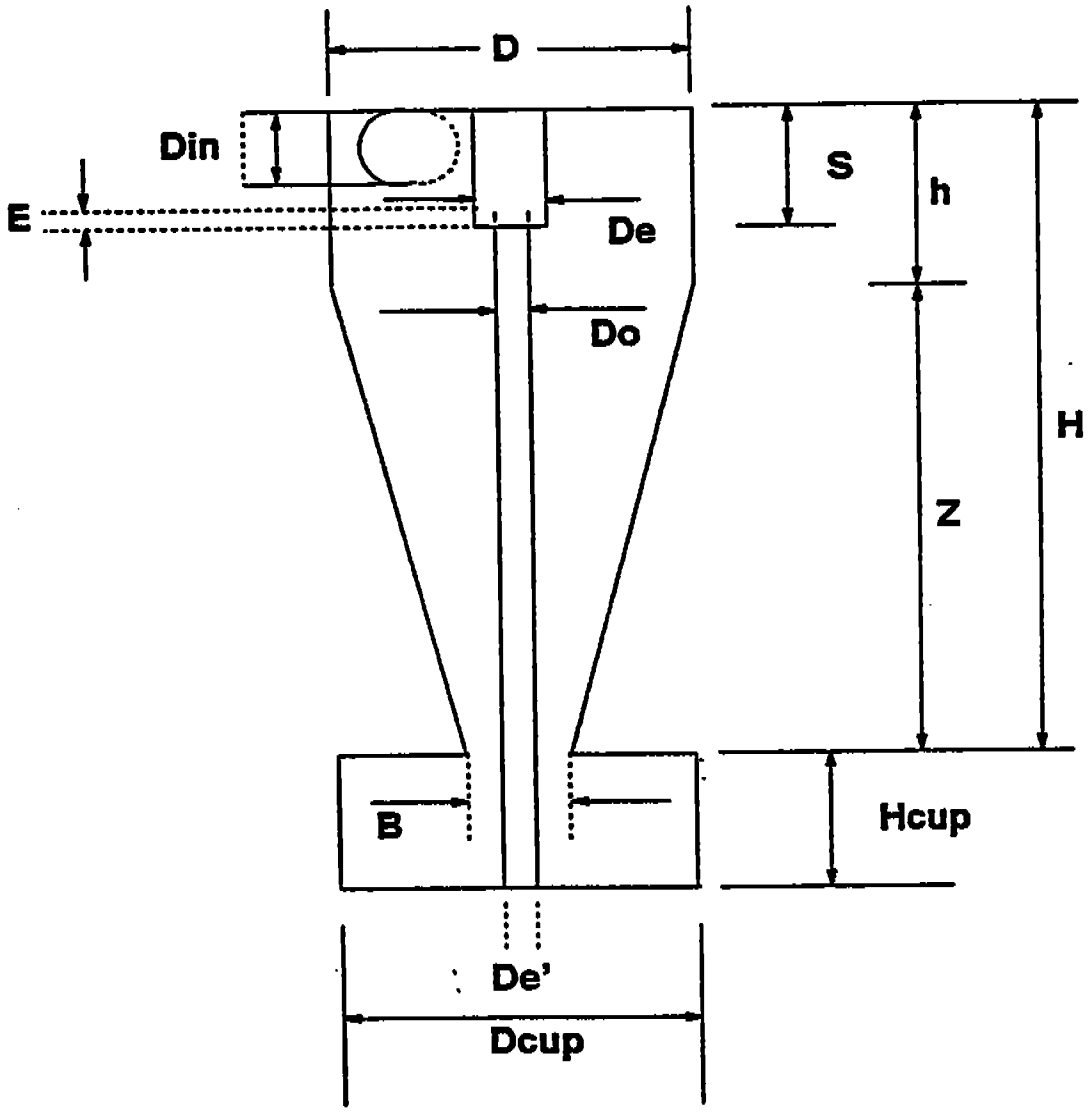
Figure 1. CSR Sampling Train



Nozzle Diameter (inches)	Cone Angle, θ (degrees)	Outside taper, ϕ (degrees)	Straight inlet length, ℓ (inches)	Total Length L (inches)
0.136	4	15	<0.05	2.653±0.05
0.150	4	15	<0.05	2.553±0.05
0.164	5	15	<0.05	1.970±0.05
0.180	6	15	<0.05	1.572±0.05
0.197	6	15	<0.05	1.491±0.05
0.215	6	15	<0.05	1.45 ±0.05
0.233	6	15	<0.05	1.45 ±0.05
0.264	5	15	<0.05	1.45 ±0.05
0.300	4	15	<0.05	1.48 ±0.05
0.342	4	15	<0.05	1.45 ±0.05
0.390	3	15	<0.05	1.45 ±0.05

Figure 2. Nozzle design specifications.

Cyclone Interior Dimensions



	Dimensions (+0.02 cm, +0.01 in.)												
	Din	D	De	B	H	h	Z	S	Hcup	Dcup	De'	Do	E
cm	1.27	4.47	1.50	1.88	6.95	2.24	4.71	1.57	2.25	4.45	1.02	1.24	0.25
in.	0.50	1.76	0.59	0.74	2.74	0.88	1.85	0.62	0.89	1.75	0.40	0.49	0.10

Figure 3. Cyclone design specifications.

Barometric pressure, P_{bar}, in. Hg = _____
Stack static pressure, P_g, in. H_2O = _____
Average stack temperature, t_s, °F = _____
Meter temperature, t_m, °F = _____
Orifice ΔH_a, in. H_2O = _____

Gas analysis:

$\%CO_2$ = _____
$\%O_2$ = _____
$\%N_2 + \%CO$ = _____
Fraction moisture content, B_{ws} = _____

Molecular weight of stack gas, dry basis:

$$M_d = 0.44(\%CO_2) + .32(\%O_2) + 0.28(\%N_2 + \%CO) = _____ \text{lb/lb mole}$$

Molecular weight of stack gas, wet basis:

$$M_w = M_d(1 - B_{ws}) + 18(B_{ws}) = _____ \text{lb/lb mole}$$

Absolute stack pressure:

$$P_s = P_{bar} + \frac{P_s}{13.6} = _____ \text{in. Hg}$$

Viscosity of stack gas:

$$\mu_s = 152.418 + 0.2552\ t_s + 3.2355 \times 10^{-5}\ t_s^2 + 0.53147\ (\%O_2) - 74.143\ B_{ws} = ____ \text{ micropoise}$$

Cyclone flow rate:

$$Q_s = 0.002837\ \mu_s \left[\frac{t_s + 460}{M_w\ P_s}\right]^{0.2949} = ___ \text{ ft}^3/\text{min}$$

Figure 4. Example worksheet 1 (Page 1 of 2), cyclone flow rate and ΔH.

Orifice pressure head (ΔH) needed for cyclone flow rate:

note

$$\Delta H = \left[\frac{Q_s(1-B_{ws})P_s}{t_s+460}\right]^2 \frac{(t_a+460)\ M_d\ (1.083)\ \Delta H_a}{P_{bar}} = _____ \text{ in. } H_2O$$

Calculate ΔH for three temperatures:

t_s, °F			
ΔH, in. H_2O			

Figure 4. Example worksheet 1 (Page 2 of 2), cyclone flow rate and ΔH.

Stack viscosity, μ_s, micropoise = _____
Absolute stack pressure, P_s, in. Hg = _____
Average stack temperature, t_s, °F = _____
Meter temperature, t_m, °F = _____
Method 201A pitot coefficient, C_p = _____
Cyclone flow rate, ft^3/min, Q_s = _____
Method 2 pitot coefficient, C_p = _____
Molecular weight of stack gas, wet basis, M_w = _____
Nozzle diameter, D_n, in. = _____

Nozzle velocity

$$v_n = \frac{3.056\ Q_s}{D_n^2} = _____ \text{ft/sec}$$

Maximum and minimum velocities:

Calculate R_{min}.

$$R_{min} = 0.2457 + \sqrt{0.3072 - \frac{0.2603\ (\sqrt{Q_s})\ \mu_s}{v_n^{1.5}}} = ____$$

If R_{min} is less than 0.5, or if an imaginary number occurs when calculating R_{min}, use Equation 1 to calculate v_{min}. Otherwise, use Equation 2.

Eq. 1 $v_{min} = v_n\ (0.5) = _____$ ft/sec

Eq. 2 $v_{min} = v_n\ R_{min} = _____$ ft/sec

Calculate R_{max}.

$$R_{max} = 0.4457 + \sqrt{0.5690 + \frac{0.2603\ (\sqrt{Q_s})\ \mu_s}{v_n^{1.5}}} = ____$$

Figure 5. Example worksheet 2 (page 1 of 2), nozzle selection.

If R_{max} is greater than 1.5, use Equation 3 to calculate v_{max}. Otherwise, use Equation 4.

Eq. 3 $v_{max} = v_n\ (1.5) =$ _____ ft/sec

Eq. 4 $v_{max} = v_n\ R_{max} =$ _____ ft/sec

Maximum and minimum velocity head values:

$$\Delta p_{min} = 1.3686 \times 10^{-4} \frac{P_s\ M_w\ (v_{min})^2}{(t_s + 460)\ C_p^2} = _____ \text{ in. } H_2O$$

$$\Delta p_{max} = 1.3686 \times 10^{-4} \frac{P_s\ M_w\ (v_{max})^2}{(t_s + 460)\ C_p^2} = _____ \text{ in. } H_2O$$

Nozzle Number				
D_n, in.				
v_n, ft/sec				
v_{min}, ft/sec				
v_{max}, ft/sec				
Δp_{min}, in. H_2O				
Δp_{max}, in. H_2O				

Velocity traverse data:

incorrect

$$\Delta p(\text{Method 201A}) = \Delta p(\text{Method 2}) \left[\frac{C_p}{C_p'}\right]^2 = \Delta p^{M2} \left(\frac{C_p^{M2}}{C_p^{201A}}\right)^2$$

4-11-91 PL

Figure 5. Example worksheet 2 (page 2 of 2), nozzle selection.

Total run time, minutes = _____

Number of traverse points = _____

$$t_1 = \sqrt{\frac{\Delta p'_1}{\Delta p'_{avg}}} \left(\frac{\text{Total run time}}{\text{Number of points}} \right)$$

where:

t_1 = dwell time at first traverse point, minutes.

$\Delta p'_1$ = the velocity head at the first traverse point (from a previous traverse), in. H_2O.

$\Delta p'_{avg}$ = the square of the average square root of the Δp's (from a previous velocity traverse), in. H_2O.

At subsequent traverse points, measure the velocity Δp and calculate the dwell time by using the following equation:

$$t_n = \frac{t_1}{\sqrt{\Delta p_1}} \sqrt{\Delta p_n}, \text{ where } n = 2,3,....\text{total number of sampling points}$$

where:

t_n = dwell time at traverse point n, minutes.

Δp_n = measured velocity head at point n, in. H_2O.

Δp_1 = measured velocity head at point 1, in. H_2O.

Figure 6. Example worksheet 3 (page 1 of 2), dwell time.

	Port No_____		Port No_____		Port No_____		Port No_____	
Point Number	Δp	t	Δp	t	Δp	t	Δp	t
1								
2								
3								
4								
5								
6								

Figure 6. Example worksheet 3 (page 2 of 2), dwell time.

Plant _____

Date _____

Run no. _____

Filter no. _____

Amount of liquid lost during transport _____

Acetone blank volume, ml _____

Acetone wash volume, ml (4) _____ (5) _____

Acetone blank conc., mg/mg (Equation 5-4, Method 5) _____

Acetone wash blank, mg (Equation 5-5, Method 5) _____

Container number	Weight of PM_{10} (mg)		
	Final weight	Tare weight	Weight gain
1			
3			
		Total.....	
		Less acetone blank.....	
		Weight of PM10.....	

Figure 7. Method 201A analysis sheet.

TABLE 1. PERFORMANCE SPECIFICATIONS FOR SOURCE PM_{10} CYCLONES AND NOZZLE COMBINATIONS

Parameter	Units	Specification
1. Collection efficiency	Percent	Such that collection efficiency falls within envelope specified by Section 5.2.6 and Figure 8.
2. Cyclone cut size (D_{50})	μm	10 ± 1 μm aerodynamic diameter

TABLE 2. PARTICLE SIZES AND NOMINAL GAS VELOCITIES FOR EFFICIENCY

Particle size (μm)[a]	Target gas velocities (m/sec)		
	7 ± 1.0	15 ± 1.5	25 ± 2.5
5 ± 0.5			
7 ± 0.5			
10 ± 0.5			
14 ± 1.0			
20 ± 1.0			

(a) Mass median aerodynamic diameter.

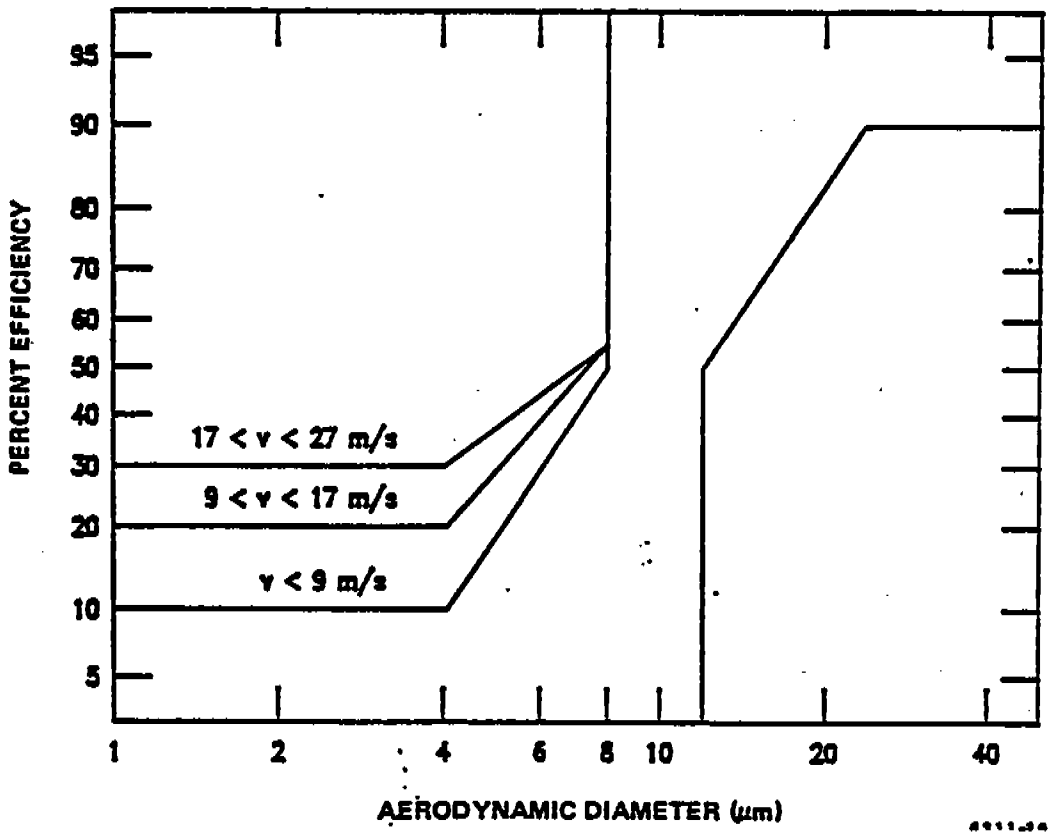


Figure 8. Efficiency envelope for the PM_{10} cyclone.

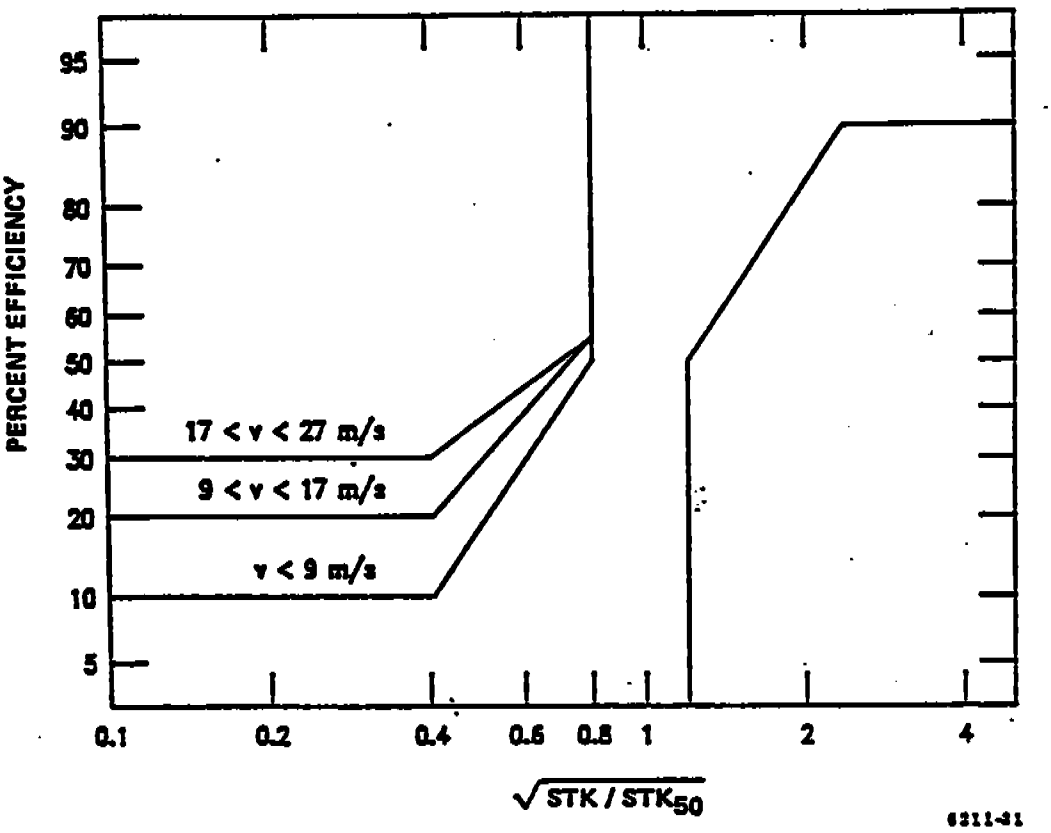


Figure 9. Efficiency envelope for first calibration stage.

METHOD 25A—DETERMINATION OF TOTAL GASEOUS ORGANIC CONCENTRATION USING A FLAME IONIZATION ANALYZER

1. *Applicability and Principle*

1.1 Applicability. This method applies to the measurement of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

1.2 Principle. A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

2. *Definitions*

2.1 Measurement System. The total equipment required for the determination of the gas concentration. The system consists of the following major subsystems:

2.1.1 Sample Interface. That portion of the system that is used for one or more of the following: sample acquisition, sample transportation, sample conditioning, or protection of the analyzer from the effects of the stack effluent.

2.1.2 Organic Analyzer. That portion of the system that senses organic concentration and generates an output proportional to the gas concentration.

2.2 Span Value. The upper limit of a gas concentration measurement range that is specified for affected source categories in the applicable part of the regulations. The span value is established in the applicable regulation and is usually 1.5 to 2.5 times the applicable emission limit. If no span value is provided, use a span value equivalent to 1.5 to 2.5 times the expected concentration. For convenience, the span value should correspond to 100 percent of the recorder scale.

2.3 Calibration Gas. A known concentration of a gas in an appropriate diluent gas.

2.4 Zero Drift. The difference in the measurement system response to a zero level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

2.5 Calibration Drift. The difference in the measurement system response to a mid-level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair or adjustment took place.

2.6 Response Time. The time interval from a step change in pollutant concentration at the inlet to the emission measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the recorder.

2.7 Calibration Error. The difference between the gas concentration indicated by the measurement system and the known concentration of the calibration gas.

3. *Apparatus*

A schematic of an acceptable measurement system is shown in Figure 25A-1. The essential components of the measurement system are described below:

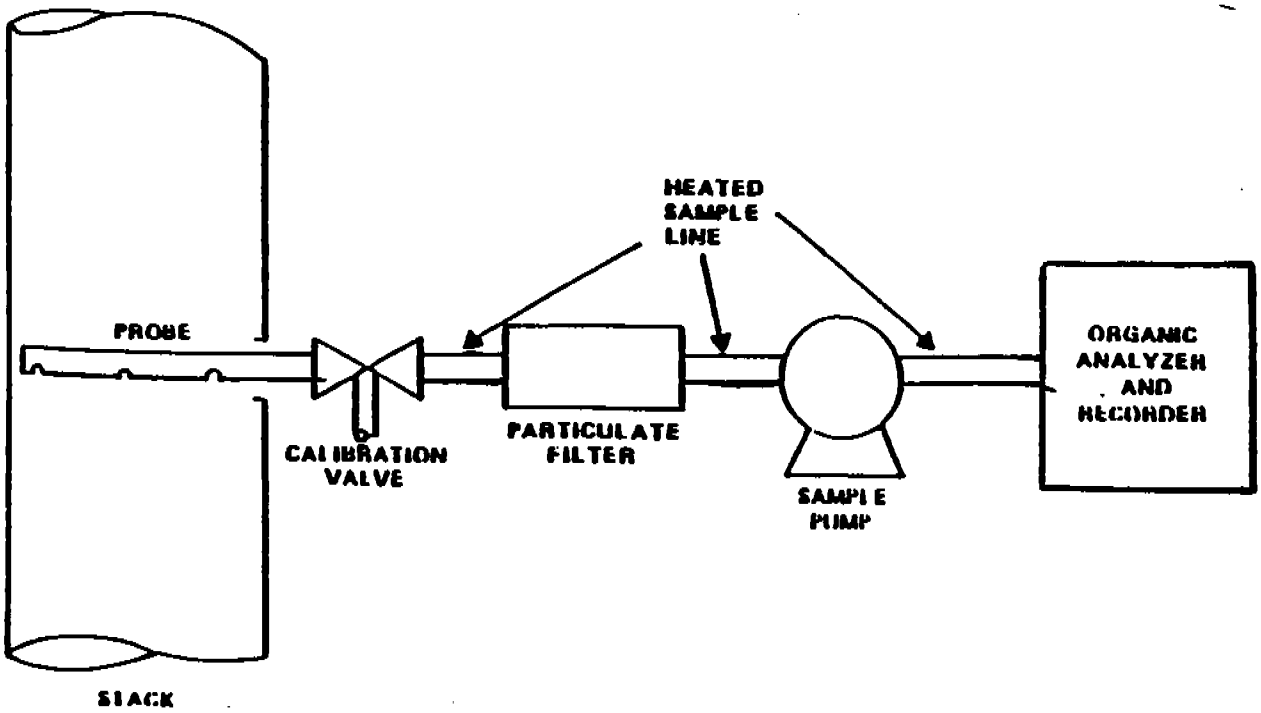


Figure 25A 1. Organic Concentration Measurement System.

3.1 Organic Concentration Analyzer. A flame ionization analyzer (FIA) capable of meeting or exceeding the specifications in this method.

3.2 Sample Probe. Stainless steel, or equivalent, three-hole rake type. Sample holes shall be 4 mm in diameter or smaller and located at 16.7, 50, and 83.3 percent of the equivalent stack diameter. Alternatively, a single opening probe may be used so that a gas sample is collected from the centrally located 10 percent area of the stack cross-section.

3.3 Sample Line. Stainless steel or Teflon* tubing to transport the sample gas to the analyzer. The sample line should be heated, if necessary, to prevent condensation in the line.

3.4 Calibration Valve Assembly. A three-way valve assembly to direct the zero and calibration gases to the analyzers is recommended. Other methods, such as quick-connect lines, to route calibration gas to the analyzers are applicable.

3.5 Particulate Filter. An in-stack or an out-of-stack glass fiber filter is recommended if exhaust gas particulate loading is significant. An out-of-stack filter should be heated to prevent any condensation.

3.6 Recorder. A strip-chart recorder, analog computer, or digital recorder for recording measurement data. The minimum data recording requirement is one measurement value per minute. Note: This method is often applied in highly explosive areas. Caution and care should be exercised in choice of equipment and installation.

4. *Calibration and Other Gases*

Gases used for calibrations, fuel, and combustion air (if required) are contained in compressed gas cylinders. Preparation of calibration gases shall be done according to the procedure in Protocol No. 1, listed in Reference 9.2. Additionally, the manufacturer of the cylinder should provide a recommended shelf life for each calibration gas cylinder over which the concentration does not change more than ±2 percent from the certified value. For calibration gas values not generally available (i.e., organics between 1 and 10 percent by volume), alternative methods for preparing calibration gas mixtures, such as dilution systems, may be used with prior approval of the Administrator.

Calibration gases usually consist of propane in air or nitrogen and are determined in terms of the span value. Organic compounds other than propane can be used following the above guidelines and making the appropriate corrections for response factor.

* Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

4.1 Fuel. A 40 percent H_2/60 percent He or 40 percent H_2/60 percent N_2 gas mixture is recommended to avoid an oxygen synergism effect that reportedly occurs when oxygen concentration varies significantly from a mean value.

4.2 Zero Gas. High purity air with less than 0.1 parts per million by volume (ppmv) of organic material (propane or carbon equivalent) or less than 0.1 percent of the span value, whichever is greater.

4.3 Low-level Calibration Gas. An organic calibration gas with a concentration equivalent to 25 to 35 percent of the applicable span value.

4.4 Mid-level Calibration Gas. An organic calibration gas with a concentration equivalent to 45 to 55 percent of the applicable span value.

4.5 High-level Calibration Gas. An organic calibration gas with a concentration equivalent to 80 to 90 percent of the applicable span value.

5. *Measurement System Performance Specifications*

5.1 Zero Drift. Less than ±3 percent of the span value.

5.2 Calibration Drift. Less than ±3 percent of span value.

5.3 Calibration Error. Less than ±5 percent of the calibration gas value.

6. *Pretest Preparations*

6.1 Selection of Sampling Site. The location of the sampling site is generally specified by the applicable regulation or purpose of the test; i.e., exhaust stack, inlet line, etc. The sample port shall be located at least 1.5 meters or 2 equivalent diameters upstream of the gas discharge to the atmosphere.

6.2 Location of Sample Probe. Install the sample probe so that the probe is centrally located in the stack, pipe, or duct and is sealed tightly at the stack port connection.

6.3 Measurement System Preparation. Prior to the emission test, assemble the measurement system following the manufacturer's written instructions in preparing the sample interface and the organic analyzer. Make the system operable.

FIA equipment can be calibrated for almost any range of total organics concentrations. For high concentrations of organics (>1.0 percent by volume as propane) modifications to most commonly available analyzers are necessary. One accepted method of equipment modification is to decrease the size of the sample to the analyzer through the use of a smaller diameter sample capillary. Direct and continuous measurement of organic concentration is a necessary consideration when determining any modification design.

6.4 Calibration Error Test. Immediately prior to the test series, (within 2 hours of the start of the test) introduce zero gas and

high-level calibration gas at the calibration valve assembly. Adjust the analyzer output to the appropriate levels, if necessary. Calculate the predicted response for the low-level and mid-level gases based on a linear response line between the zero and high-level responses. Then introduce low-level and mid-level calibration gases successively to the measurement system. Record the analyzer responses for low-level and mid-level calibration gases and determine the differences between the measurement system responses and the predicted responses. These differences must be less than 5 percent of the respective calibration gas value. If not, the measurement system is not acceptable and must be replaced or repaired prior to testing. No adjustments to the measurement system shall be conducted after the calibration and before the drift check (Section 7.3). If adjustments are necessary before the completion of the test series, perform the drift checks prior to the required adjustments and repeat the calibration following the adjustments. If multiple electronic ranges are to be used, each additional range must be checked with a mid-level calibration gas to verify the multiplication factor.

6.5 Response Time Test. Introduce zero gas into the measurement system at the calibration valve assembly. When the system output has stabilized, switch quickly to the high-level calibration gas. Record the time from the concentration change to the measurement system response equivalent to 95 percent of the step change. Repeat the test three times and average the results.

7. *Emission Measurement Test Procedure*

7.1 Organic Measurement. Begin sampling at the start of the test period, recording time and any required process information as appropriate. In particular, note on the recording chart periods of process interruption or cyclic operation.

7.2 Drift Determination. Immediately following the completion of the test period and hourly during the test period, reintroduce the zero and mid-level calibration gases, one at a time, to the measurement system at the calibration valve assembly. (Make no adjustments to the measurement system until after both the zero and calibration drift checks are made.) Record the analyzer response. If the drift values exceed the specified limits, invalidate the test results preceding the check and repeat the test following corrections to the measurement system. Alternatively, recalibrate the test measurement system as in Section 6.4 and report the results using both sets of calibration data (i.e., data determined prior to the test period and data determined following the test period).

8. *Organic Concentration Calculations*

Determine the average organic concentration in terms of ppmv as propane or other calibration gas. The average shall be determined by the integration of the output recording over the period specified in the applicable regulation.

If results are required in terms of ppmv as carbon, adjust measured concentrations using Equation 25A-1.

$$C_c = K\,C_{meas} \qquad \text{Eq. 25A-1}$$

Where:

C_c = Organic concentration as carbon, ppmv.

C_{meas} = Organic concentration as measured, ppmv.

K = Carbon equivalent correction factor,

K = 2 for ethane.

K = 3 for propane.

K = 4 for butane.

K = Appropriate response factor for other organic calibration gases.

9. *Bibliography*

9.1 Measurement of Volatile Organic Compounds—Guideline Series. U.S. Environmental Protection Agency. Research Triangle Park, NC. Publication No. EPA-450/2-78-041. June 1978. p. 46-54.

9.2 Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Continuous Source Emission Monitors (Protocol No. 1). U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory. Research Triangle Park, NC. June 1978.

9.3 Gasoline Vapor Emission Laboratory Evaluation—Part 2. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC. EMB Report No. 75-GAS-6. August 1975.

Interpoll Inc.
Method II-8556

PHENOL SAMPLING PROCEDURE FOR STACK TESTING

The phenol concentration in the exhaust gas stream were sampled using an EPA Method 5 sampling train with an ice-cooled impinger assembly. Particulate material is removed by the standard all-glass filter assembly which is maintained at 250 ^{o}F. The phenol passes through the filter assembly and is quantitatively absorbed by the 0.1 N sodium hydroxide solution in the impinger train.

The first two impingers in the impinger train are loaded with 100 cc of 0.1 N NaOH. The 0.1 N NaOH absorbing solution is strongly alkaline and thus serves as an excellent absorbing reagent for phenol which forms the nonvolatile phenolate ion at high pH's. If phenol only is being collected, a sampling rate of 0.75 cfm is used for a period ranging from 20 to 60 minutes. Twenty minutes is adequate for most cases due to the high sensitivity of the analytical technique. Collected samples are adjusted to pH less than 1 in the field with reagent grade concentrated sulfuric acid for preservation.

The amount of phenol collected in the absorbing solution is determined in accordance with EPA Method 604 (FR 44(23) Dec. 3, 1979) by extraction and concentration followed by high resulution GC/FID. The minimum detectable concentration of phenol by this method is about 10 ug/m^3 (3 ppb).

The front half of the above-described EPA Method 5 train may be used to determine the particulate concentration of the exhaust stream. If this is done, the sampling rate is adjusted as required at each traverse point to allow isokinetic aerosol collection.

INTERPOLL INC.
4500 BALL ROAD N. E.
CIRCLE PINES, MN 55014
612-786-6020

ANALYTICAL METHOD for "PHENOL" STACK TEST SAMPLES

Phenols—Method 604.

1. *Scope and Application.*

1.1 This method covers the determination of various phenolic compounds. The following parameters may be determined by this method:

Parameter	Stored No.
4 Chloro 3 methylphenol	34452
2 Chlorophenol	34586
2,4 Dichlorophenol	34601
2,4 Dimethylphenol	34606
2,4 Dinitrophenol	34616
2 Methyl 4,6 dinitrophenol	34657
2 Nitrophenol	34591
4 Nitrophenol	34646
Pentachlorophenol	39064
Phenol	34694
2,4,6 Trichlorophenol	34621

1.2 This method is applicable to the determination of these compounds in municipal and industrial discharges. It is designed to be used to meet the monitoring requirements of the National Pollutant Discharge Elimination System (NPDES). As such, it presupposes a high expectation of finding the specific compounds of interest. If the user is attempting to screen samples for any or all of the compounds above, he must develop independent protocols for the verification of identity.

1.3 The sensitivity of this method is usually dependent upon the level of interferences rather than instrumental limitations. The limits of detection listed in Table I represent sensitivities that can be achieved in wastewaters with a flame ionization detector in the absence of interferences. If the derivatization cleanup is required, the sensitivity of the method is 10 μg/l. This concentration represents the minimum amount proven to date to give reproducible and linear response during derivatization.

1.4 This method is recommended for use only by experienced residue analysts or under the close supervision of such qualified persons.

2. *Summary of Method.*

2.1 A 1-liter sample of wastewater is acidified and extracted with methylene chloride using separatory funnel techniques. The extract is dried and concentrated to a volume of 10 ml or less. Flame ionization gas chromatographic conditions are described which allow for the measurement of the compounds in the extract.

2.2 The method also provides for the preparation of pentafluorobenzylbromide (PFB) derivatives for electron capture gas chromatography with additional cleanup procedures to aid the analyst in the elimination of interferences.

3. *Interferences.*

3.1 Solvents, reagents, glassware, and other sample processing hardware may yield discrete artifacts and/or elevated baselines causing misinterpretation of gas chromatograms. All of these materials must be demonstrated to be free from interferences under the conditions of the analysis by running method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required.

3.2 Interferences coextracted from the samples will vary considerably from source to source, depending upon the diversity of the industrial complex or municipality being sampled. While general cleanup techniques are provided as part of this method, unique samples may require additional cleanup approaches to achieve the sensitivities stated in Table I.

4. *Apparatus and Materials.*

4.1 Sampling equipment, for discrete or composite sampling.

4.1.1 Grab sample bottle—amber glass, 1-liter or 1-quart volume. French or Boston Round design is recommended. The container must be washed and solvent rinsed before use to minimize interferences.

4.1.2 Bottle caps—Threaded to screw on to the sample bottles. Caps must be lined with Teflon.

4.1.3 Compositing equipment—Automatic or manual compositing system. Must incorporate glass sample containers for the collection of a minimum of 250 ml. Sample containers must be kept refrigerated during sampling. No tygon or rubber tubing may be used in this system.

4.2 Separatory funnel—2000 ml, with Teflon stopcock.

4.3 Drying column—20 mm ID Pyrex chromatographic column with coarse frit.

4.4. Kuderna-Danish (K-D) Apparatus

4.4.1 Concentrator tube—10 ml, graduated (Kontes K-570050-1025 or equivalent). Calibration must be checked. Ground glass stopper (size 19/22 joint) is used to prevent evaporation of extracts.

4.4.2 Evaporative flask—500 ml (Kontes K-57001-0500 or equivalent). Attach to concentrator tube with springs. (Kontes K-662750-0012).

4.4.3 Snyder column—three-ball macro (Kontes K-503000-0121 or equivalent).

4.4.4 Snyder column—two-ball micro (Kontes K-569001-0219 or equivalent).

4.4.5 Boiling chips—solvent extracted, approximately 10/40 mesh.

4.5 Water bath—Heated, with concentric ring cover, capable of temperature control (±2°C). The bath should be used in a hood.

4.6 Gas chromatograph—Analytical system complete with gas chromatograph suitable for on-column injection and all required accessories including flame ionization and electron capture detector, column supplies, recorder, gases, syringes. A data system for measuring peak areas is recommended.

4.7 Chromatographic column—10 mm ID by 100 mm length, with Teflon stopcock.

4.8 Reaction vial—20 ml, with Teflon-lined cap.

5. *Reagents.*

5.1 Preservatives:

5.1.1 Sodium hydroxide—(ACS) 10 N in distilled water.

5.1.2 Sulfuric acid—(1 + 1) Mix equal volumes of conc. H_2SO_4 (ACS) with distilled water.

5.1.3 Sodium thiosulfate—(ACS) Granular.

5.2 Methylene chloride, acetone, 2-propanol, hexane, toluene—Pesticide quality or equivalent.

5.3 Sodium sulfate—(ACS) Granular, anhydrous (purified by heating at 400° C for 4 hrs. in a shallow tray).

5.4 Stock standards—Prepare stock standard solutions at a concentration of 1.00 µg/µl by dissolving 0.100 grams of assayed reference material in pesticide quality 2-propanol and diluting to volume in a 100 ml ground glass stoppered volumetric flask. The stock solution is transferred to ground glass stoppered reagent bottles, stored in a refrigerator, and checked frequently for signs of degradation or evaporation, especially just prior to preparing working standards from them.

5.5 Sulfuric acid—(ACS) 1 N in distilled water.

5.6 Potassium carbonate—(ACS) powdered.

5.7 Pentafluorobenzyl bromide (a-Bromopentafluorotoluene)—97% minimum purity.

5.8 1,4,7,10,13,16—Hexaoxacyclooctadecane (18 crown 6)—98% minimum purity.

5.9 Derivatization reagent—Add 1 ml pentafluorobenzyl bromide and 1 gram 18 crown 6 to a 50 ml volumetric flask and dilute to volume with 2-propanol. Prepare fresh weekly.

5.10 Silica gel—(ACS) 100/200 mesh, grade 923; activated at 130°C and stored in a sesiccator.

6. *Calibration.*

6.1 Prepare calibration standards for the flame ionization detector that contain the compounds of interest, either singly or mixed together. The standards should be prepared at concentrations covering two or more orders of magnitude that will completely bracket the working range of the chromatographic system. If the sensitivity of the detection system can be calculated from Table I as 100 µg/l in the final extract, for example, prepare standards at 10 µg/l, 50 µg/l, 100 µg/l, 500 µg/l, etc. so that injections of 1–5 µl of each calibration standard will define the linearity of the detector in the working range.

6.2 Assemble the necessary gas chromatographic apparatus and establish operating parameters equivalent to those indicated in Table I. By injecting calibration standards, establish the sensitivity limit of the detector and the linear range of the analytical system for each compound.

6.3 Before using the derivatization clean up procedure, the analyst must process a series of calibration standards through the procedure to validate the precision of the derivatization and the absence of interferences from the reagents.

7. *Quality Control.*

7.1 Before processing any samples, the analyst should demonstrate through the analysis of a distilled water method blank, that all glassware and reagents are interference-free. Each time a set of samples is extracted or there is a change in reagents, a method blank should be processed as a safeguard against chronic laboratory contamination.

7.2 Standard quality assurance practices should be used with this method. Field replicates should be collected to validate the precision of the sampling technique. Laboratory replicates should be analyzed to validate the precision of the analysis. Fortified samples should be analyzed to validate the accuracy of the analysis. Where doubt exists over the identification of a peak on the chromatogram, confirmatory techniques such as mass spectroscopy should be used.

8. *Sample Collection, Preservation, and Handling.*

8.1 Grab samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prewashed with sample before collection. Composite samples should be collected in refrigerated glass containers in accordance with the requirements of the program. Automatic sampling equipment must be free of tygon and other potential sources of contamination.

8.2 The samples must be iced or refrigerated from the time of collection until extraction. At the sampling location fill the glass container with sample. Add 35 mg of sodium thiosulfate per part per million free chlorine per liter. Adjust the sample pH to approximately 2, as measured by pH paper, using appropriate sulfuric acid

INTERPOLL INC.
4500 BALL ROAD N. E.
CIRCLE PINES, MN 55014
612-786-6020

solution or 10N sodium hydroxide. Record the volume of acid used on the sample identification tag so the sample volume can be corrected later.

8.3 All samples must be extracted within 7 days and completely analyzed within 30 days of collection.

9. *Sample Extraction.*

9.1 Mark the water meniscus on the side of the sample bottle for later determination of sample volume. Pour the entire sample into a two-liter separatory funnel. Adjust the sample pH to 12 with sodium hydroxide.

9.2 Add 60 ml methylene chloride to the sample bottle, seal, and shake 30 seconds to rinse the inner walls. Transfer the solvent into the separatory funnel, and extract the sample by shaking the funnel for one minute with periodic venting to release vapor pressure. Allow the organic layer to separate from the water phase for a minimum of ten minutes. If the emulsion interface between layers is more than one-third the size of the solvent layer, the analyst must employ mechnical techniques to complete the phase separation. The optimum technique depends upon the sample, but may include stirring, filtration of the emulsion through glass wool, or centrifugation. Discard the methylene chloride layer, and wash the sample with an additional two 60 ml portions of methylene chloride in similar fashion.

9.3 Adjust the aqueous layer to a pH of 1–2 with sulfuric acid.

9.4 Add 60 ml of methylene chloride to the sample and shake for two minutes. Allow the solvent to separate from the sample and collect the methylene chloride in a 250 ml Erlenmeyer flask.

9.5 Add a second 60 ml volume of methylene chloride to the sample bottle and complete the extraction procedure a second time, combining the extracts in the Erlenmeyer flask.

9.6 Perform a third extraction in the same manner. Pour the combined extract the through a drying column containing 3–4 inches of anhydrous sodium sulfate, and collect it in a 500-ml Kuderna-Danish (K-D) flask equipped with a 10 ml concentrator tube. Rinse the Erlenmeyer flask and column with 20–30 ml methylene chloride to complete the quantitative transfer.

9.7 Add 1–2 clean boiling chips to the flask and attach a three-ball Snyder column. Prewet the Snyder column by adding about 1 ml methylene chloride to the top. Place the K-D apparatus on a hot water bath (60–65°C) so that the concentrator tube is partially immersed in the hot water, and the entire lower rounded surface of the flask is bathed in vapor. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 15–20 minutes. At the proper rate of distillation the balls of the column will actively chatter but the chambers will not flood. When the apparent volume of liquid reaches 1 ml, remove the K-D apparatus and allow it to drain for at least 10 minutes while cooling.

9.8 Increase the temperature of the hot water bath to 95–100°C. Remove the Snyder column and rinse the flask and its lower joint into the concentrator tube with 1–2 ml of 2-propanol. A 5-ml syringe is recommended for this operation. Attach a micro-Snyder column to the concentrator tube and prewet the column by adding about 0.5 ml 2-propanol to the top. Place the micro-K-D apparatus on the water bath so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature as required to complete concentration in 5–10 minutes. At the proper rate of distillation, the balls of the column will actively chatter but the chambers will not flood. When the apparent volume of the liquid reaches 2.5 ml, remove the K-D apparatus and allow it to drain for at least 10 minutes while cooling. Add an additional 2 ml of 2-propanol through the top of the micro-Snyder column and resume concentrating as before. When the apparent volume of liquid reaches 0.5 ml, remove the K-D apparatus and allow it to drain for at least 10 minutes while cooling. Remove the micro-Snyder column and rinse its lower joint into the concentrator tube with a minimum amount of 2-propanol. Adjust the extract volume to 1.0 ml. Stopper the concentrator tube and store in refrigerator, if further processing will not be performed immediately. If the sample extract requires no further cleanup, proceed with flame ionization gas chromatographic analysis. If the sample requires cleanup, proceed to section 11.

9.9 Determine the original sample volume by refilling the sample bottle to the mark and transferring the liquid to a 1000 ml graduated cylinder. After correction for sulfuric acid preservative, record the sample volume to the nearest 5 ml.

10. *Gas Chromatography-Flame Ionization Detector.*

10.1 Table I summarizes some recommended gas chromatographic column materials and operating conditions for the instrument. Included in this table are estimated retention times and sensitivities that should be achieved by this method. An example of the separation achieved by one of these columns is shown in Figure 1. Calibrate the gas chromatographic system daily with a minimum of three injections of calibration standards.

10.2 Inject 2–5 µl of the sample extract using the solvent-flush technique. Smaller (1.0 µl) volumes can be injected if automatic devices are employed. Record the volume injected to the nearest 0.05 µl, and the resulting peak size, in area units.

10.3 If the peak area exceeds the linear range of the system, dilute the extract and reanalyze.

10.4 If the peak area measurement is prevented by the presence of interferences, the phenols must be derivatized and analyzed by electron capture gas chromatography.

11. *Derivatization and Electron Capture Gas Chromatography.*

11.1 Pipet a 1.0 ml aliquot of the 2-propanol solution of standard or sample extract into a glass reaction vial. Add 1.0 ml derivatization reagent. This is a sufficient amount of reagent to derivatize a solution whose total phenolic content does not exceed 0.3 mg/ml.

11.2 Add about 3 mg of potassium carbonate to the solution and shake gently.

11.3 Cap the mixture and heat it for 4 hours at 80°C in a hot water bath.

11.4 Remove the solution from the hot water bath and allow it to cool.

11.5 Add 10 ml hexane to the reaction vial and shake vigorously for one minute. Add 3.0 ml of distilled, deionized water to the reaction vial and shake for two minutes.

11.6 Decant organic layer into a concentrator tube and cap with a glass stopper.

11.7 Pack a 10 mm ID chromatographic column with 4.0 grams of activated silica gel. After settling the silica gel by tapping the column, add about two grams of anhydrous sodium sulfate to the top.

11.8 Pre-elute the column with 6 ml hexane. Discard the eluate and just prior to exposure of the sulfate layer to air, pipet onto the column 2.0 ml of the hexane solution (11.6) that contains the derivatized sample or standard. Elute the column with 10.0 ml of hexane (Fraction 1) and discard this fraction. Elute the column, in order, with: 10.0 ml 15% toluene in hexane (Fraction 2); 10.0 ml 40% toluene in hexane (Fraction 3); 10.0 ml 75% toluene in hexane (Fraction 4); and 10.0 ml 15% 2-propanol in toluene (Fraction 5). Elution patterns for the phenolic derivatives are shown in Table II. Fractions may be combined as desired, depending upon the specific phenols of interest or level of interferences.

11.9 Analyze the fractions by electron capture gas chromatography.

INTERPOLL INC.
4500 BALL ROAD N. E.
CIRCLE PINES, MN 55014
612-786-6020

Table II summarizes some recommended gas chromatographic column materials and operating conditions for the instrument. Included in this table are estimated retention times that should be achieved by this method. Examples of the separation achieved by this column is shown in Figure 2. Calibrate the system daily with a minimum of three aliquots of calibration standards, containing each of the phenols of interest that are derivatized according to the procedure.

11.10 Inject 2-5 µl of the column fractions using the solvent-flush technique. Smaller (1.0 µl) volumes can be injected if automatic devices are employed. Record the volume injected to the nearest 0.05 µl, and the resulting peak size, in area units. If the peak area exceeds the linear range of the system, dilute the extract and reanalyze.

12. *Calculations*

12.1 Determine the concentration of individual compounds measured by the flame ionization procedure (without derivatization) according to the formula:

$$\text{Concentration, } \mu g/l = \frac{(A)\ (B)\ (V_t)}{(V_s)\ (V_i)}$$

Where:

A = Calibration factor for chromatographic system, in nanograms material per area unit.

B = Peak size in injection of sample extract, in area units

V_t = Volume of extract injected (µl)

V_t = Volume of total extract (µl)

V_s = Volume of water extracted (µl)

12.2 Determine the concentration of individual compounds measured by the derivatization and electron capture procedure according to the following procedure:

12.2.1 From the concentration of the calibration standards that were derivatized with the samples, calculate the amounts, in nanograms, of underivatized phenols that were added as 2-propanol solution (11.1). From the size of the injection into the electron capture gas chromatograph, determine the nanograms of material (calculated as the underivatized phenol) injected onto the column. Compare the detector responses obtained to develop a calibration factor for the chromatographic system, in nanograms of material per area unit.

12.2.2 Determine the concentration of individual compounds according to the formula:

$$\text{Concentration, } \mu g/l = \frac{(A)(B)(V_t)(10)(D)}{(V_s)(V_i)(C)(E)}$$

Where:

A = Calibration factor for chromatographic system, in nanograms material per area unit, calculated as underivatized phenol.

B = Peak size in injection of sample extract, in area units.

V_t = Volume of eluate injected (µl)

V_t = Total volume of column eluate (µl)

V_s = Volume of water extracted (ml)

C = Volume of hexane sample solution added to cleanup column, in ml.

D = Total volume of 2-propanol extract after concentration.

E = Volume of 2-propanol extract used for derivatization.

12.3 Report results in micrograms per liter without correction for recovery data. When duplicate and spiked samples are analyzed, all data obtained should be reported.

13. *Accuracy and Precision*

13.1 The U.S. EPA Environmental Monitoring and Support Laboratory in Cincinnati is in the process of conducting an interlaboratory method study to determine the accuracy and precision of this test procedure.

Bibliography

"Development and Application of Test Procedures for Specific Organic Toxic Substances in Wastewaters. Category 3—Chlorinated Hydrocarbons and Category 8—Phenols." Report for EPA Contract 68-03-2625 (In preparation).

Table I.— *Flame Ionization Gas Chromatography of Phenols*

Compound [1]	Retention time	Detection limit (µg/L) [2]
2-Chlorophenol	1.70	2.0
2-Nitrophenol	2.90	2.6
Phenol	3.01	1.4
2,4-Dimethylphenol	4.03	1.7
2,4-Dichlorophenol	4.30	2.1
2,4,6-Trichlorophenol	6.05	6.0
4-Chloro-3-methylphenol	7.50	8.3
2,4-Dinitrophenol	10.00	7.0
2-Methyl-4,6-dinitrophenol	10.24	10.0
Pentachlorophenol	12.42	10.0
4-Nitrophenol	24.25	10.0

[1] Column conditions: Supelcoport 80/100 mesh coated with 1% SP-1240 DA in 6 ft long × 2 mm ID glass column with nitrogen carrier gas at 30 ml/min flow rate. Column temperature is 80°C at injection, programmed immediately at 8°C/min to 150°C final temperature.

[2] Detection limit is calculated from the minimum detectable GC response being equal to five times the GC background noise, assuming a 10 ml final extract volume of the 1 liter sample extract, and assuming a GC injection of 5 microliters.

Table II.—*Electron Capture Gas Chromatography of PFB Derivatives*

Parent compound [1]	Retention time (minutes)	Recovery percent by fraction [2]				
		1	2	3	4	5
2-chlorophenol	3.3			80	>1	
2-nitrophenol	8.1				9	88
Phenol	1.8			89	10	
2,4-Dimethylphenol	2.8			86	7	
2,4-Dichlorophenol	5.8			85	>1	
2,4,6-Trichlorophenol	7.0		80	80		
4-Chloro-2-methylphenol	4.8			84	14	
Pentach lorophenol	28.8		75	20		
4-Nitrophenol	14.8				>1	80
(2,4-Dinitrophenol)	[3]46.9					
(2-Methyl-4,6-dinitrophenol	[3]36.8					

[1] Column conditions: Chromosorb W-AW-DMCS 80/100 mesh coated with 5% OV-17 packed in a 1.8 m long × 2.8 mm ID glass column with 5% methane/95% argon carrier gas at 30 ml/min flow rate. Column temperature is 200°C.

[2] From, "Development and Application of Test Procedures for Specific Organic Toxic Substances in Wastewaters. Categories 3-Chlorinated Hydrocarbons and Category 8-Phenols."

[3] Retention times included for qualitative information only. The lack of accuracy and precision of the derivatization reaction precludes the use of the approach for quantitative purposes.

BILLING CODE 6560-01-M

INTERPOLL INC.
4500 BALL ROAD N. E.
CIRCLE PINES, MN 55014
612-786-6020

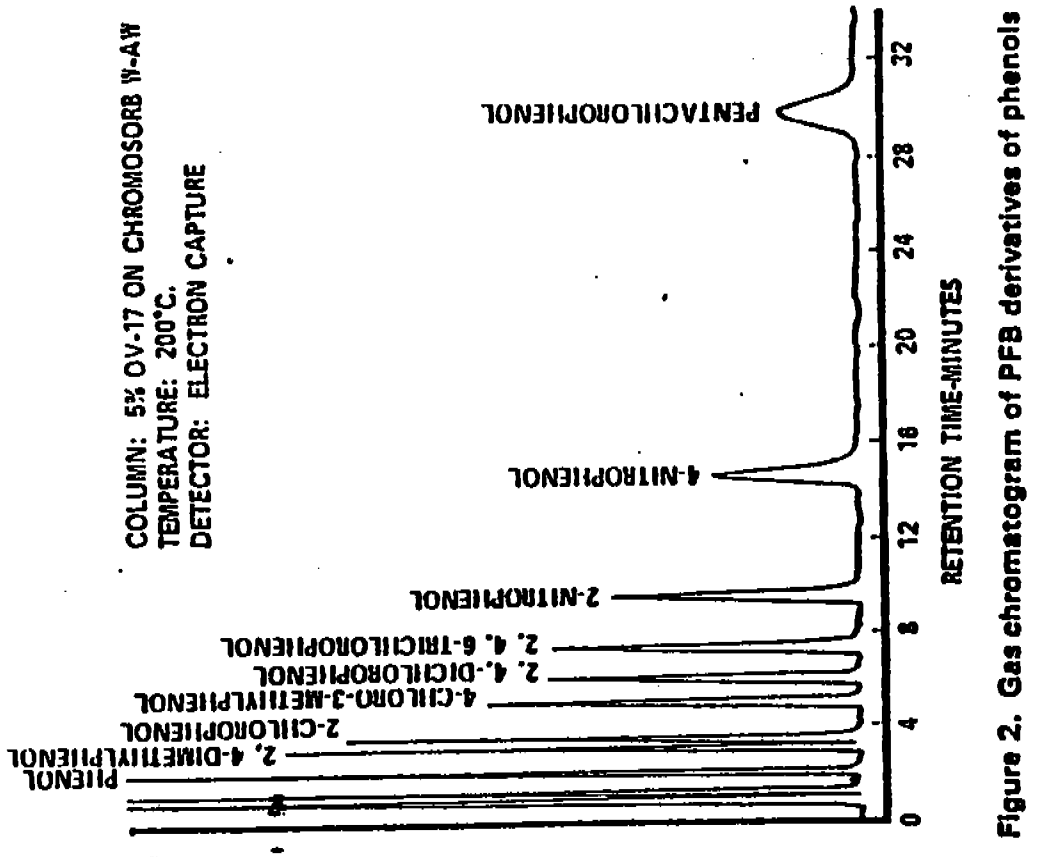


Figure 2. Gas chromatogram of PFB derivatives of phenols

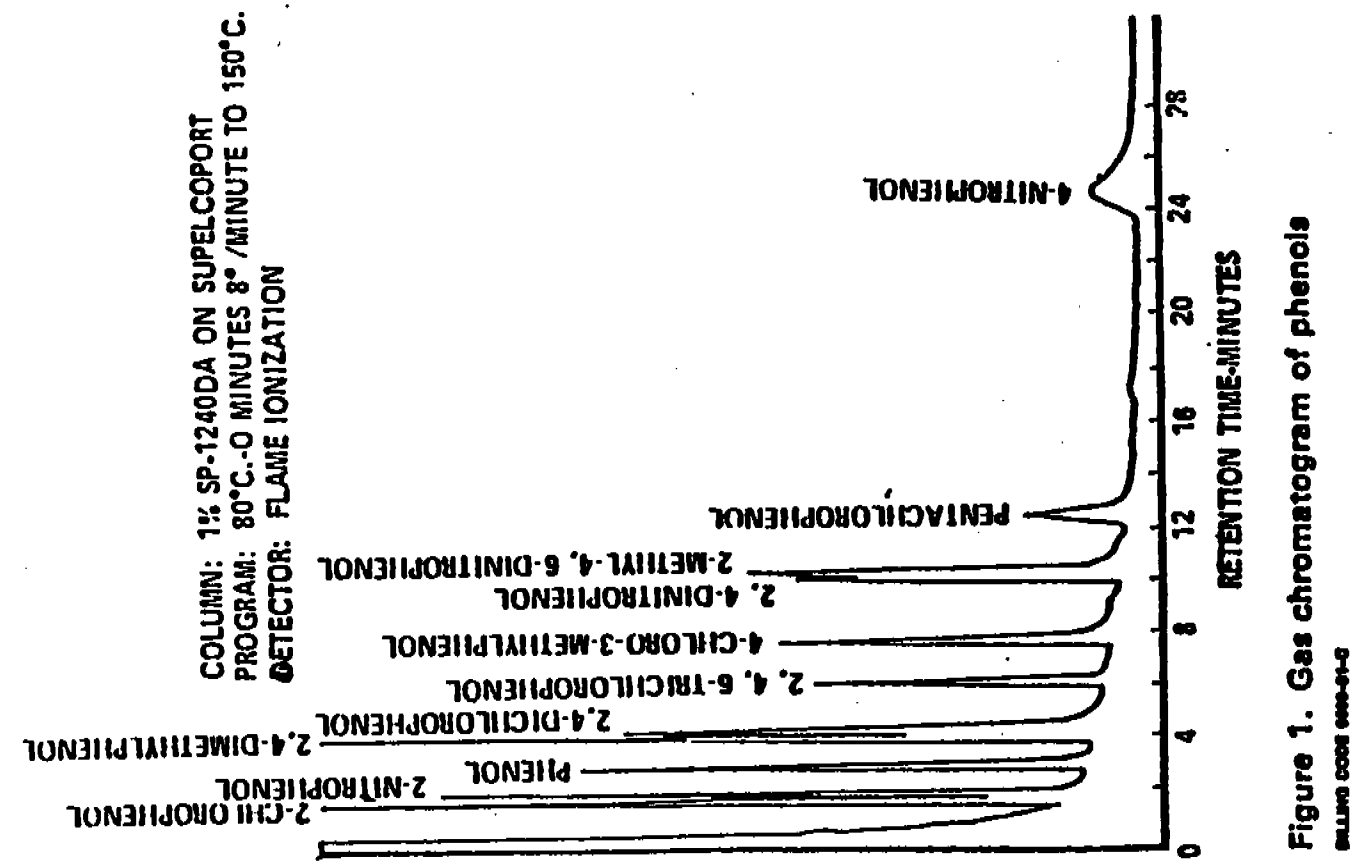


Figure 1. Gas chromatogram of phenols

INTERPOLL INC
4500 BALL ROAD N. E.
CIRCLE PINES, MN 55014
612-786-6020

EPA
METHOD 0011

RECEIVED
JUL 16 1990
INTERPOLL LABORATORIES

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

INTERPOLL LABORATORIES
4500 BALL ROAD N.E.
CIRCLE PINES, MN 55014-1819
(612) 786-6020

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 x V x DF x

([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:

$$\text{Max } FORM_i \text{ conc} = [\text{Max } FORM_i \text{ Mass }] / DV_{eff(std)}$$

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.

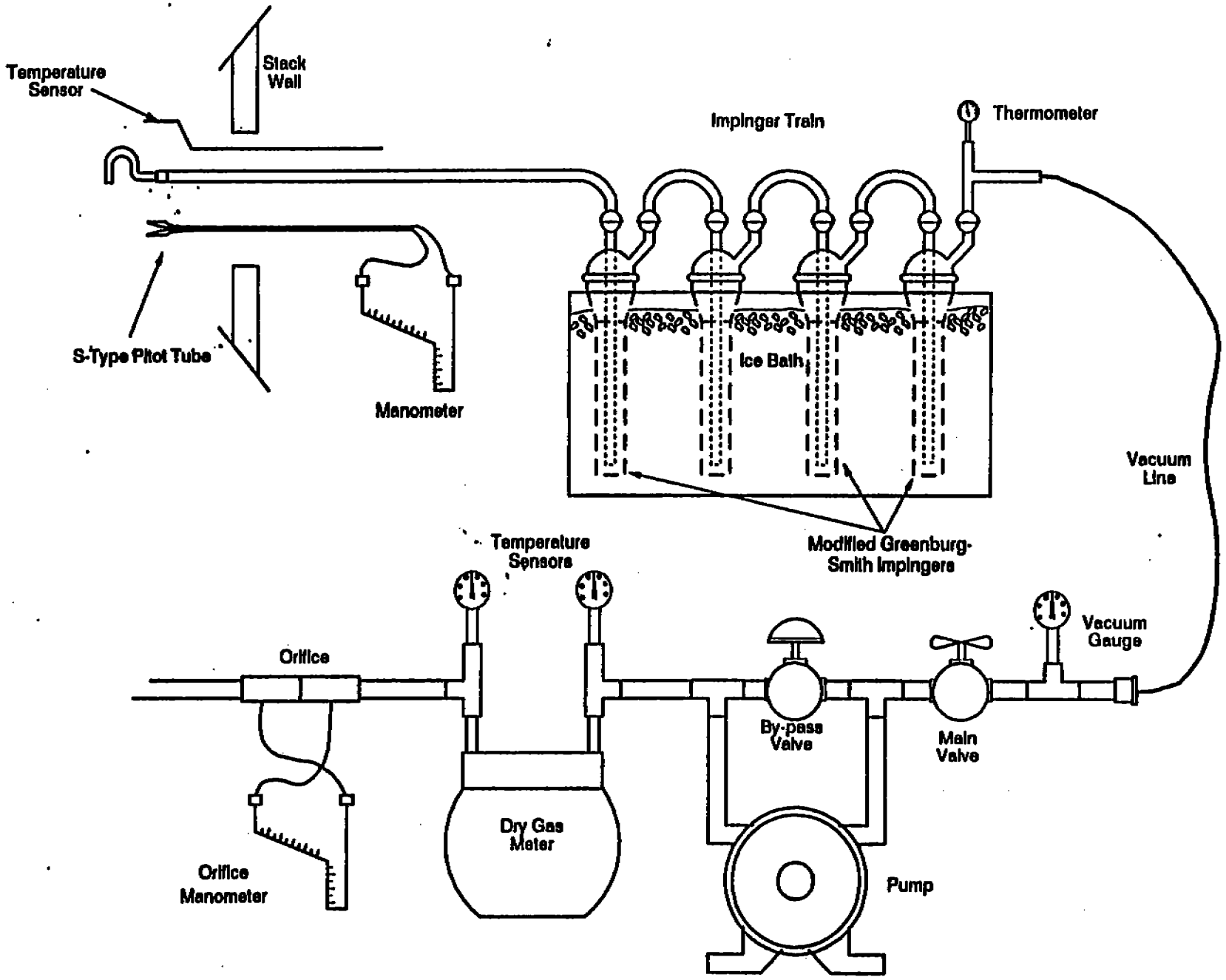
12.0 METHOD PERFORMANCE

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 _____

Pitot 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)		
Total							Avg.	Avg.		
Average										

3404346R

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 ^{0}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
		Range:	4.4 to 800 µg/m^3
Matrix:	Air		
		Precision:	0.078
Procedure:	Collection and derivatization on impregnated filter, HPLC	$PPB = 0.0978(\mu g/m^3)$	
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 the 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.

Samuel P. Tucker, Ph.D.
James E. Arnold
Alexander W. Teass, Ph.D.
Organic Methods Development Section

CALCULATION EQUATIONS

METHOD 2

$$\bar{V}_s = 85.48\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,d} = 60(1 - B_{ws})\ \bar{V}_s\ A\ (\frac{528}{T_{s(avg)}})\ (\frac{P_s}{29.92})$$

$$Q_a = 60\ \bar{V}_s\ A$$

$$\dot{m}_g = \frac{4.995\ Q_{s,d}\ G_d}{1 - B_{ws}}$$

$$RH^* = 100\ (vp_{twb}\ 0.0003641\ P_s\ (T_{db} - T_{wb}))/vp_{tdb}$$

$$B^*_{ws} = RH(vp_{tdb})/P_s$$

$$= \frac{4.585 \times 10^{-2}\ P_s M_s}{T_s\ (avg)}$$

*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

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 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

$$V_{m(std)} = 17.65\ V_m\ \gamma\ \left(\frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}}\right)$$

$$V_{w(std)} = 0.0472\ V_{Is}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$I = 0.0944\ \left(\frac{T_{s(avg)}\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (1 - B_{ws})}\right)$$

$$C_s = \frac{15.43\ M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3\ M_p\ P_s}{T_{s(avg)}\ (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714 \times 10^{-3}\ C_s\ Q_{s,d}$$

$$(\dot{m}_p)_2 = \frac{1.3228 \times 10^{-1}\ M_p\ A}{0\ A_n}$$

$$\dot{m}_p = \frac{(\dot{m}_p)_1 + (\dot{m}_p)_2}{2}$$

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, ^{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

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

Interpoll Laboratories
PM-10 Equations

Preliminary Run Calculations:

$$M_d = 0.44\,B_{CO_2} + 0.32\,B_{O_2} + 0.28\,(B_{N_2} + B_{CO})$$

$$M_s = M_d\left(1 - \frac{MC}{100}\right) + 0.18\,(MC)$$

$$P_s = P_b + \frac{P_g}{13.6}$$

$$\mu = 152.418 + 0.2552\,t_s + 3.2355x10^{-5}\,t_s^2 + 0.53147\,(B_{O_2}) - 0.74143\,MC$$

$$Q_s = 2.837x10^{-3}\,\mu\left[\frac{(t_s + 460)}{(M_s\,P_s)}\right]^{0.2949}$$

$$\Delta H = \frac{1.083\,(t_m + 460)\,M_d\,\Delta H_@}{P_b}\left[\frac{Q_s\left(1 - \frac{MC}{100}\right)P_s}{t_s + 460}\right]^2$$

$$\Delta_p^{M201A} = \Delta_p^{M2}\left(\frac{C_p^{M2}}{C_p^{M201A}}\right)^2$$

Dwell Times:

Firstpoint $\quad \Delta t_1 = \left[\frac{\sqrt{\Delta P_1}}{(\sqrt{\Delta P})_{AVG}}\right]$

OtherPoints $\quad \Delta t_n = \left(\frac{\Delta t_1}{\sqrt{\Delta P_1}}\right)\sqrt{\Delta P_n}$ *where* $n = 2, 3, \ldots, 12$

9-5-91/PL

Post Test Calculations:

$$V_{m(std)} = 17.64\,\gamma\,V_m\left(\frac{P_b + \frac{\Delta\bar{H}}{13.6}}{(\bar{t}_m + 460)}\right)$$

$$Q_s = \frac{5.669 \times 10^{-2}\,(\bar{t}_s + 460)}{\Theta\,P_s}\left[V_{m(std)} + 0.04707\,(V_f - V_i)\right]$$

$$\mu = 152.418 + 0.2552\,\bar{t}_s + 3.2355 \times 10^{-5}\,\bar{t}_s^2 + 0.53147\,B_{O_2} - 0.74143\,MC$$

$$M_s = M_d\left(1 - \frac{MC}{100}\right) + 0.18\,MC$$

$$D_{50} = 0.15625\left(\frac{\bar{t}_s + 460}{M_s\,P_s}\right)^{0.2091}\left(\frac{\mu}{Q_s}\right)^{0.7091}$$

where

M_d = dry molecular weight of exhaust gas

B_{CO2} = percent volume of CO_2 in exhaust gas on a dry basis

B_{O2} = percent by volume of O_2 in exhaust gas on a dry basis

B_{N2} = percent by volume of N_2 in exhaust gas on a dry basis

B_{CO} = percent by volume of CO in exhaust gas on a dry basis

MC = percent by volume of water vapor in exhaust gas

M_s = actual molecular weight of exhaust gas

P_s = absolute pressure of exhaust gas, IN.HG

P_g = static pressure of exhaust gas, IN.WC

P_b = absolute barometric pressure, IN.HG

t_s = average exhaust gas temperature from preliminary determination or point gas temperature, ^0F

Q_s = cyclone flow rate at actual (or stack) conditions, ACFM

$Q_{s(std)}$ = cyclone flow rate at dry standard conditions, DSCFM

ΔH = pressure drop across calibrated orifice, IN.WC

$\Delta H_@$ = orifice coefficient or pressure drop across calibrated orifice @ 0.75 DSCFM, IN.WC

t_m = temperature of dry test meter, ^0F

Δp^{M201A} = velocity pressure of gas stream as measured with S-type pitot attached to cyclone, IN.WC

Δp^{M2} = velocity pressure of gas stream as measured with S-type pitot tube as per EPA Method 2 (preliminary traverse), IN.WC

C_p^{M201A} = pitot tube coefficient of S-type pitot tube attached to cyclone, dimensionless

C_p^{M2} = pitot tube coefficient of S-type pitot tube used in preliminary traverse, dimensionless

Δt_n = dwell time at traverse point n, where n = 2, 3, ..., 12, minutes

Δt_1 = dwell time at the first sampling point, minutes

$\bar{t}_s$ = average stack gas temperature during test run, ^0F

θ = total run time, minutes

$V_{m(std)}$ = total dry volume of gas sampled, DSCF

V_f = final volume of water in sampling train condenser system, mℓ

V_i = initial volume of water in sampling train condenser system, mℓ

$\bar{t}_m$ = average temperature of dry test meter during run, ^0F

γ = dry test meter coefficient, dimensionless

$\overline{\Delta H}$ = average pressure drop across the calibrated orifice in the sampling train during the run, IN.WC

V_m = volume of dry gas sampled as measured by the dry test meter at meter conditions, CF

D_{50} = actual or achieved 50% cutpoint for a given run of the device or cyclone used to remove or skim off those particles with aerodynamic equivalent diameters greater than or equal to 10 microns, microns

CALCULATION EQUATIONS

METHOD 7

$$V_{m(std)} = 17.64\ (V_f - 25)\ \left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

$$C_s = 6.243 \times 10^{-5}\ \frac{M}{V_{m(std)}}$$

$$E = \frac{2090\ C_s F}{20.9 - B'_{0_2}}$$

$$C_s\ (GR/DSCF) = 7000\ C_s$$

$$C_s\ (MG/DSCM) = 1.60186 \times 10^7\ C_s$$

$$C_s\ (ppm\text{-}dry) = 8.37552 \times 10^6\ C_s$$

$$C_s\ (ppm\text{-}3\%\ O_2) = 8.37552 \times 10^6\ C_s \left\{1 + \left[\frac{B'_{0_2} - 3}{20.9 - B'_{0_2}}\right]\right\}$$

$$C_s\ (ppm\text{-}wet) = 8.37552 \times 10^6\ C_s \cdot \left(1 - \frac{MC}{100}\right)$$

CE6-1

SYMBOLS

B'_{O_2} = Average oxygen content in flue gas, % v/v

C_s = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, LB/DSCF

C_s (GR/DSCF) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, GR/DSCF

C_s (MG/DSCM) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, MG/DSCM

E = Emission factor, LB/10^6BTU

F = F-Factor for given fuel type, DSCF/10^6BTU

M = Mass of nitrogen oxides as nitrogen dioxide in gas sample, µg

MC = Moisture content of flue gas, %

P_f = Final absolute pressure in flask, IN. HG

P_i = Initial absolute pressure in flask, IN. HG

C_s (ppm-dry) = Concentration of nitrogen oxides in flue gas, dry basis, (v/v), ppm

C_s (ppm-3% O_2) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to 3% O_2 , (v/v) ppm

C_s (ppm-wet) = Concentration of nitrogen oxides in flue gas, wet basis, (v/v), ppm

T_f = Final absolute temperature in flask, ^{o}R

T_i = Initial absolute temperature in flask, ^{o}R

V_f = Volume of flask and valve, cc

$V_{m(std)}$ = Sample volume at standard conditions, dry basis, cc

CALCULATION EQUATIONS

METHOD 10

$$CO\text{-}PPM\text{-}DRY = CO_{CO_2\text{-}free,dry,avg}\ (1 - CO_{2,d}/100)$$

$$CO\text{-}PPM\text{-}WET = CO\text{-}PPM\text{-}DRY\ (1 - MC/100)$$

$$GR/DSCF = 5.0885 \times 10^{-4}\ (CO\text{-}PPM\text{-}DRY)$$

$$mg/dscm = 1.165\ (CO\text{-}PPM\text{-}DRY)$$

$$\dot{m} = 8.5714 \times 10^{-3}\ (GR/DSCF)(Q_{s,d})$$

$$E = \frac{2.9857 \times 10^{-3}\ F_d\ (GR/DSCF)}{20.9 - O_{2,d}}$$

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)

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^{0}F, 29.92 IN.HG.)

$\dot{m}$ = emission or mass rate of formaldehyde in pounds per hour (LB/HR)

... 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

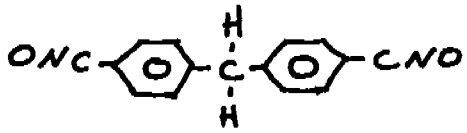
Note 1: The Ratfisch Model RS 55 Heated FID Analyzer as normally operated with a heated filter, sample line and heated detector oven gives ppm,w.

Note 2: ppm,C = ppm as carbon = 3(ppm propane)

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:

$$Cppmv = \frac{\mu g}{Nm^3}\left[\frac{Nm^3}{1000\,L} \times \frac{24.46\,mL}{250.27\,\mu g}\right]$$

$$Cppmv = 0.0978 \times 10^{-3}\ Cug/Nm3$$

5. Notes:

$$C_{ppbv} = 0.0978\ \frac{\mu g}{Nm^3}$$

Derived by: DJD/PL | Date: 1/15/93

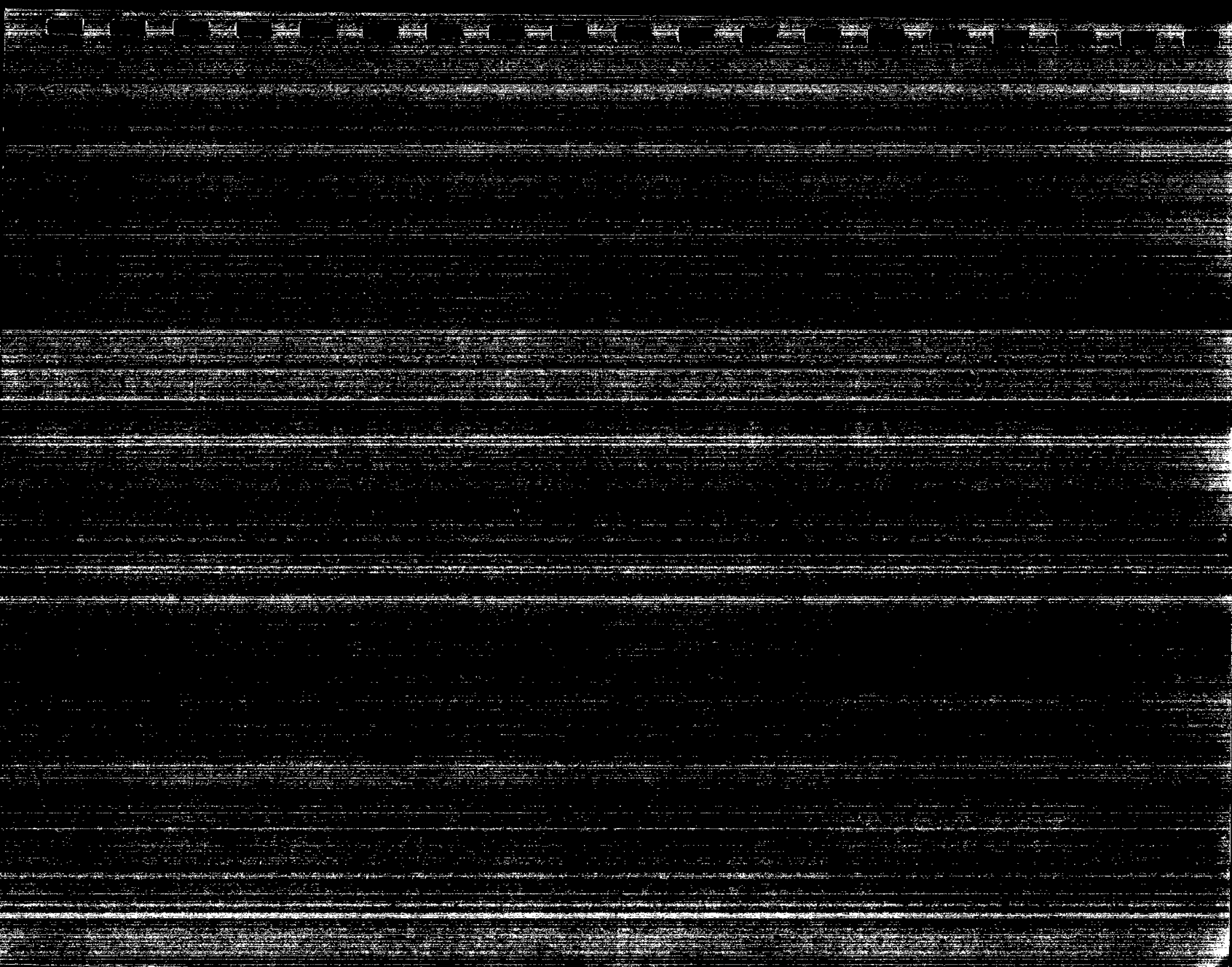
Form S-511

LOUISIANA PACIFIC CORPORATION
DUNGANNON, VIRGINIA

Source: PRESS VENT STACK
Report No. 3-9053

MDI CALCULATIONS

RUN #	TIME (HRS)	Vstd	Mass (ug)	Flow DSCFM	Conc (mg/Nm3)	Conc ppm	Mass Rate (LB/HR)
1	0938-1043	41.86	420	71601	0.354	0.0340	0.095024
2	1105-1208	41.35	430	71263	0.367	0.0353	0.098022
3	1230-1333	41.23	290	70924	0.248	0.0239	0.065985



INTERPOLL LABORATORIES
EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Job 9053 Date 6-8-93

Operator M. Kaehler Module No. B

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 28.80 in. Hg. τ = .9997 ^H@ 1.82 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(148.00)	[redacted]	
2.5	149.94	72	71
5.0	151.89	73	73
7.5	153.84	76	74
10	155.77	77	74
[redacted]	V_m= 7.77	Avg(t_m)= 73.75	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\tau\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(.9997)(7.77)}\left[\frac{(73.75) + 460}{(28.90)}\right]^{0.5}$$

Y_{cn} = .990

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. Dungannon Date 6/8/93

Operator J. VanHoever Module No. 9

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 28.80 in. Hg. $_T$ = .9933 ^H@ 1.86 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(945.80)	[redacted]	
2.5	947.69	72	72
5.0	949.75	73	72
7.5	951.70	74	73
10	953.67	75	73
[redacted]	V_m= 7.87	Avg(t_m)= 73	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{T\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(.9933)(7.87)}\left[\frac{(73) + 460}{(28.80)}\right]^{0.5}$$

$$Y_{cn} = .983$$

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./Dungannon Date 6/9/93

Operator DGH Module No. 9

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 28.82 in. Hg. $_T$ = .9933 ^H@ 1.86 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(108.00)	[redacted]	
2.5	109.96	72	71
5.0	111.92	73	72
7.5	113.88	74	72
10	115.83	75	72
[redacted]	V_m= 7.83	Avg(t_m)= 72.63	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{T\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(.9933)(7.83)}\left[\frac{(72.63) + 460}{(28.82)}\right]^{0.5}$$

Y_{cn} = .99

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 9053 Date 6-9-93

Operator M. Kaehler 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 28.82 in. Hg. $_T$ = .9997 ^H@ 1.82 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(256.50)	[redacted]	
2.5	258.43	71	71
5.0	260.36	72	71
7.5	262.30	74	72
10	264.25	76	72
[redacted]	V_m= 7.75	Avg(t_m)= 72.38	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{T\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(.9997)(7.75)}\left[\frac{(72.38) + 460}{(28.82)}\right]^{0.5}$$

Y_{cn} = .991

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 A.P. / Dungannon, VA Date 6-10-93

Operator D. Van Hoever Module No. 9

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 28.89 in. Hg. Y_T = .9933 ^H@ 1.86 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(369.00)	[redacted]	
2.5	370.93	69	68
5.0	372.93	71	69
7.5	374.90	72	70
10	376.90	74	70
[redacted]	V_m= 7.90	Avg(t_m)= 70.38	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{Y_T V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(.9933)(7.90)}\left[\frac{(70.38) + 460}{(28.89)}\right]^{0.5}$$

Y_{cn} = .975

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 9053 Date 6-10-93

Operator M. Koehler Module No. B

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 ~~28.88~~ 28.99 in. Hg. γ = .9997 ^H@ 1.82 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(410.60)	[redacted]	
2.5	412.52	69	69
5.0	414.44	70	69
7.5	416.40	71	69
10	418.28	71	70
[redacted]	V_m= 7.68	Avg(t_m)= 69.75	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\gamma V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(.9997)(7.68)}\left[\frac{(69.75) + 460}{(28.89)}\right]^{0.5}$$

Y_{cn} = .996

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) 786-620

Meter Box Calibration and Usage Status

Date of Report: June 11, 1993

Meter Box No. : 8 (Rockwell Dry Test Meter Serial No. 964547)

Date of Last Calibration: May 20, 1993
Calibration Technician: E. Trowbridge
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.)
May 26, 1993	3-8921	915.00	1147.57	232.57	232.57
June 8, 1993	3-9053	1148.00	1598.41	450.41	682.98

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: June 11, 1993

Meter Box No. : 9 (Rockwell Dry Test Meter Serial No. 949231)

Date of Last Calibration: May 21, 1993
Calibration Technician: E. Trowbridge
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.)
June 8, 1993	3-9053	945.80	1524.16	578.36	578.36

* Total volume through meter since last calibration.

Date 5-20-93

Bar. Press. 29.00 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 8
Serial No. DTH 964547
Wet Test Meter No. AL-20
Technician E Townsend

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index θ (%)	* 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_{dl}	V_{df}	Wet Test t_w (°F)	Dry Test t_{dl} (°F)	Dry Test t_{do} (°F)				
0.6		2	99.85	0.01	886.500	888.531	67	81	75	4/59	.0024	1.75	
1.2		3	99.91	0.025	879.500	882.544	67	80	75	4/49	1.0011	1.75	
2.0		3	99.93	0.055	883.000	886.048	67	83	75	3/51	1.0007	1.86	
3.3		5	100.00	0.09	889.000	894.090	67	86	76	5/02	.9998	1.87	
4.7		5	100.02	0.12	894.500	899.613	67	88	77	4/13	.9947	1.87	
1.0	1.03	5	100.00	0.09	6	7	68	88	76	11/13	.9997	1.82	

Positive leak check performed by ET

Meter was in tolerance ☒

Meter was not in tolerance ☐; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Approved by Daniel A Deza Date 5/21/93

* Based on AL-20 wet test meter calibration in Nov. 1991 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102RR 11/91

6-N

Date 5-21-93

Bar. Press. 29.03 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 9
Serial No. DTM 949231
Wet Test Meter No. AL-20
Technician [signature]

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index θ (%)	* 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
							Wet Test	Dry Test					
nominal	actual				V_{di}	V_{df}	t_w (°F)	t_{di} (°F)	t_{do} (°F)				
0.5	.5	2	99.85	0.01	928.000	930.041	68	79	74	5/09	.9929	1.88	
1.2	1.2	3	99.91	0.025	924.500	927.547	68	78	72	4/52	.9936	1.80	
2.0	2.0	3	99.93	0.055	930.500	933.570	68	86	75	3/48	.9944	1.81	
3.3	3.3	5	100.00	0.09	934.500	939.648	68	90	79	4/57	.9930	1.81	
4.7	4.7	5	100.02	0.12	940.000	945.157	68	93	81	4/22	.9925	1.99	
8	8	4	8	6	7		8	8	8	11/11	.9933	1.86	

Positive leak check performed by QT
Meter was in tolerance ☒
Meter was not in tolerance ☐; readjusted linkage
Meter was not in tolerance ☐; changed dry test meters

Approved by [signature] Date 5/27/93

* Based on AL-20 wet test meter calibration in Nov. 1991 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102RR 11/91

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 6-8-93 Nozzle Number 8-3
Technician: Mark Kaehler

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	.184
2	.182
3	.186
Average:	.184

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 6-8-93 Nozzle Number G-1
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	.195
2	.192
3	.193
Average:	.193

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 6-9-93 Nozzle : PM10-4

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	.232
2	.232
3	.231
Average:	.232

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 6-9-93 Nozzle Number 8-5
Technician: Mark Kaehler

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	.303
2	.303
3	.304
Average:	.303

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 6-10-93 Nozzle Number G-2
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	.187
2	.187
3	.187
Average:	.187

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

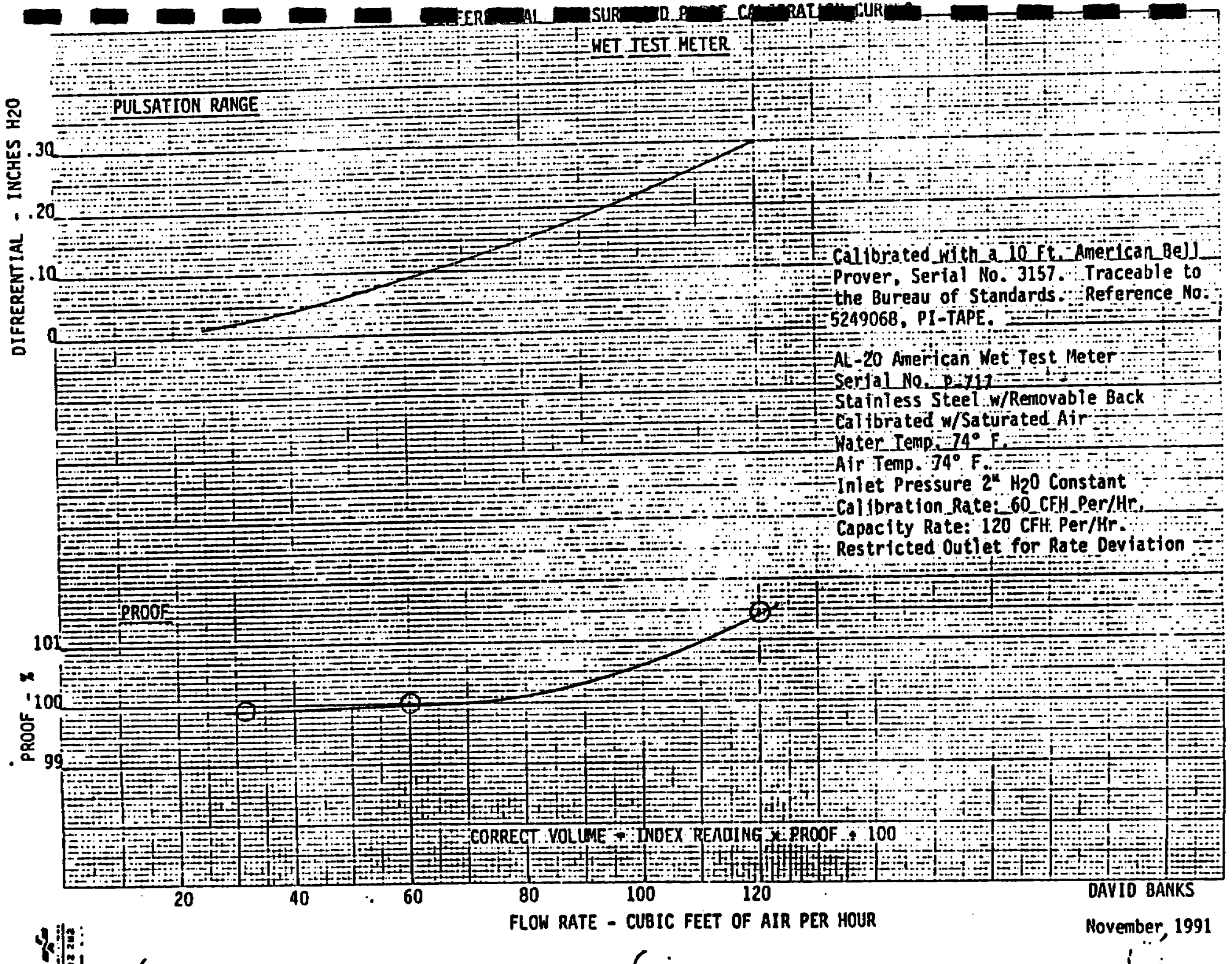
Date of Calibration: 6-10-93 Nozzle Number 8-4
Technician: Mark Kaehler

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	.185
3	.185
Average:	.185

[redacted] CALIBRATION CURVE

WET TEST METER



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" H_2O Constant
Calibration Rate: 60 CFH Per/Hr.
Capacity Rate: 120 CFH Per/Hr.
Restricted Outlet for Rate Deviation

CORRECT VOLUME = INDEX READING x PROOF ÷ 100

DAVID BANKS

November, 1991

N-17

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

Unit under test:

Vendor Beckman

Model HD110T Serial Number 10913005 (PDT-19)

Range 0-2000 °F Thermocouple Type K

Date of Calibration 5-20-93 Technician Mark Baehler

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	-003	3	.65
100	100	93	7	1.52
200	200	196	4	.61
300	300	294	6	.79
400	400	392	8	.93
500	500	491	9	.94
600	600	594	6	.57
700	700	695	5	.43
800	800	800	0	0
900	900	902	2	.15
1000	1000	1007	7	.48
1100	1100	1110	10	.64
1200	1200	1217	17	1.02
1300	1300	1317	17	.97
1400	1400	1422	22	1.18
1500	1500	1520	20	1.02
1600	1600	1621	21	1.02
1700	1700	1716	16	.74
1800	1800	1815	15	.66
1900	1900	1908	8	.34
2000	2000	OL	-	-
2100				
		Averages:	10.15	.73

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
Date of Calibration 4/7/93
Serial Number POT #18
Thermocouple Type K
Technician D. VAN Hoever

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	0
100		96	4	.71
200		199	1	.15
300		298	2	.26
400		395	5	.58
500		495	5	.52
600		597	3	.28
700		698	2	.25
800		803	3	.24
900		906	6	.38
1000		1011	11	.75
1100		1114	14	.89
1200		1220	20	1.20
1300		1321	21	1.19
1400		1426	26	1.39
1500		1524	24	1.22
1600		1625	25	1.27
1700		1721	21	.97
1800		1819	19	.84
1900		1912	12	.51
2000				
2100				
		Averages:		.68

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. 23-6

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .461 IN.

Alignment:

4. α_1 <10° 1
5. α_2 <10° 1

6. B_1 <5° 1
7. B_2 < 5° 2

8. Z <.125" .02
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .750 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: 4-7-93

Inspected by: [signature]

CFR Title 40 Part 60 Appendix A Method 2

Interpoll Laboratories, Inc.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 29-6

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .460 IN.

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0

6. B_1 < 5° 1
7. B_2 < 5° 1

8. Z <.125" .02
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .750 IN.
11. Pitot to probe sheath 3.0 IN.
12. Pitot to thermocouple (parallel to probe) 3.0 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:

4-7-93

Inspected by:

CFR Title 40 Part 60 Appenidix A Method 2

S-348

Interpoll Laboratories, Inc.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 29-5

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .460 IN.

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0

6. B_1 < 5° 0
7. B_2 < 5° 0

8. Z <.125" .03
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .750 IN.
11. Pitot to probe sheath 3.0 IN.
12. Pitot to thermocouple (parallel to probe) 3.0 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: 4-7-93

Inspected by: G. Crawford

CFR Title 40 Part 60 Appenidix A Method 2

Interpoll Laboratories, Inc.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 29-4

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .460 IN.

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0

6. B_1 < 5° 2
7. B_2 < 5° 1

8. Z <.125" .02
9. W <.0625" .01

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .750 IN.
11. Pitot to probe sheath 3.0 IN.
12. Pitot to thermocouple (parallel to probe) 3.0 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: 4-7-93

Inspected by: [signature]

CFR Title 40 Part 60 Appenidix A Method 2

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 4/7/93

Technician D Van Hoever

Mercury Column Barometer No. _____

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})
29.11	72	.110	29.00	28.94	.06

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.

S-312

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 5·20·93
Technician Mark Gaebler
Mercury Column Barometer No. Lab 1
Aneroid Barometer No. 560815

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
29.09	74	.120	28.97	28.97	0

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.

S-312