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RESULTS OF THE MARCH 29, 1994 OXIDES OF NITROGEN EMISSION COMPLIANCE TEST ON THE DRYER STACK AT THE LOUISIANA PACIFIC PLANT IN DUNGANNON, VIRGINIA

Submitted to:

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

Attention:

Sue Somers

Reviewed by:

Daniel J. Despen

Daniel J. Despen
Manager
Stationary Source Testing Department

Report Number 4-2557
April 20, 1994
SP/slp

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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^{6}BTU	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 conditions are defined as 68°F (20°C) and 29.92 IN. of mercury pressure.

1 INTRODUCTION

On March 29, 1994, Interpoll Laboratories personnel conducted an oxides of nitrogen emission compliance test on the dryer at the Louisiana Pacific Plant located in Dungannon, Virginia. On-site testing was performed by Bob Aschenbach and Ken Nuessmeier. Coordination between testing activites and plant operation was provided by Mike Mulling and Mark Becker of Louisiana Pacific. The tests were witnessed by Stanley Faggert of the Commonwealth of Virginia Department of Air Pollution Control.

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.

Oxides of nitrogen, oxygen, and carbon dioxide concentrations were determined in accordance with Methods 7E and 3A (Ibid). A slip stream of sample gas was withdrawn from the exhaust gas stream using a heated stainless steel probe equipped with a filter to remove interfering particulate material. The particulate-free gas was transported to the analyzers by means of a heat-traced probe and filter assembly. After passing through the filter, the gas passed through two chilled condenser-type moisture removal systems operating in series. The particulate-free dry gas was then transported to the analyzers with the excess exhausted to the atmosphere through a calibrated orifice which was used to ensure that the flow from the stack exceeds the requirements of the analyzers. A three-way valve on the probe was used to introduce standard gas for the "system bias check".

The analog response of each analyzer was recorded with a computer data logger and backed up with a strip chart recorder. The NO_x analyzer was calibrated with National Specialty Gases (EPA Protocol 1) and Certified Master standard gases. The instrument was calibrated before and after each run as per EPA 3A and 7E. The sample probe was moved through a three-point traverse (1/6, 3/6, 5/6 of the stack diameter) to measure oxides of nitrogen concentrations.

Volumetric flow rate determinations were performed in accordance with EPA Method

2, CFR Title 40, Part 60, Appendix A (revised July 1, 1992). These flows were used to calculate an emission rate of oxides of nitrogen.

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 results of the oxides of nitrogen emission test are summarized in Table 1. As will be noted, the oxides of nitrogen concentration averaged 25 ppm,d and the emission rate averaged 6.12 LB/HR.

During run 1, the NO_x analyzer did not meet the bias specifications outlined in EPA Method 7E (reference EPA Method 6C). During run 4, the plant lost a fan, therefore run 4 was aborted. No other difficulties were encountered in the field or in the laboratory evaluation of the samples. On the basis of these facts and a complete review of the data and results, it is our opinion that the results reported herein are accurate and closely reflect the actual values which existed at the time the tests were performed.

Table 1. Summary of the Results of the March 29, 1994, **Oxides of Nitrogen** Emission Compliance Test on the Dryer Stack at the Louisiana Pacific Plant in Dungannon, Virginia.

Test/Run	Date	**Time** (HRS)	**Concentration** (ppm,d)	**Emission Rate** (LB/HR)
1/1	03-29-94	1020-1120	21.8	5.19
1/2	03-29-94	1140-1240	20.2	4.79
1/3	03-29-94	1905-2005	33.0	8.38
Avg			25.0	6.12

3 AIR EMISSION 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 printouts of the oxides of nitrogen 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 were calculated using the product of the concentration times flow method. The particulate emission factor has been calculated by the dry Carbon Dioxide F-Factor Method using the latest EPA published dry F-Factor for the stated fuel.

3.1 Results of Orsat and Moisture Analyses

Test No. 1
Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	03-29-94	03-29-94	03-29-94
Dry basis (orsat)			
carbon dioxide............	1.31	1.21	3.06
oxygen....................	19.05	19.13	17.07
nitrogen..................	79.64	79.66	79.87
Wet basis (orsat)			
carbon dioxide............	1.07	0.96	2.42
oxygen....................	15.63	15.21	13.51
nitrogen..................	65.35	63.32	63.20
water vapor...............	17.94	20.51	20.87
Dry molecular weight........	28.97	28.96	29.17
Wet molecular weight........	27.00	26.71	26.84
Specific gravity...........	0.933	0.923	0.927
FO	1.412	1.463	1.252

3.2 Results of Oxides of Nitrogen Determinations

Test No. 1
Dryer Stack

Results of **Oxides of Nitrogen Determinations** - EPA Method 7E

	RUN 1	RUN 2	RUN 3
Date of Run	03-29-94	03-29-94	03-29-94
Time run start/end (HRS)	1020-1120	1140-1240	1905-2005
Oxygen content (%v/v)	19.05	19.13	17.07
Moisture content (%v/v)	17.94	20.51	20.87
Oxides of Nitrogen			
concentration (ppm,d)	21.8	20.2	33.0
emission rate (LB/HR)	5.19	4.79	8.38

4 FUEL ANALYSIS RESULTS

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana Pacific/Dungannon, Virginia
Laboratory Log No. 2557

3/94
L-2557

Results of Gross Heating Value Analysis

Sample Type: Wood

Sample Log No.	Sample Description	Gross Heating Value[1] BTU/LB
2557-01	Sample 1	8187
2557-02	Sample 2	8167

Respectfully submitted,

Jeannie F. O

Jeannie F. O'Neil, Manager
Inorganic Chemistry Group

JFO/cg

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[1] Analysis performed by ASTM Method D240

APPENDIX A

VOLUMETRIC FLOW RATE DETERMINATIONS

Interpoll Labs Report No. 4-2557
Louisiana Pacific - Dungannon
Dungannon, VA

Test No. 1
Dryer Stack

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

Date of Determination	03-29-94
Time of Determination (HRS)	1020
Barometric pressure (IN.HG)	28.79
Pitot tube coefficient	.84
Number of sampling ports	2
Total number of points	12
Shape of duct	Round
Stack diameter (IN)	48
Duct area (SQ.FT)	12.57
Direction of flow	UP
Static pressure (IN.WC)	.22
Avg. gas temp (DEG-F)	195
Moisture content (% V/V)	17.94
Avg. linear velocity (FT/SEC)	69.2
Gas density (LB/ACF)	.05442
Molecular weight (LB/LBMOLE)	28.97
Mass flow of gas (LB/HR)	170293
Volumetric flow rate	
actual (ACFM)	52151
dry standard (DSCFM)	33213

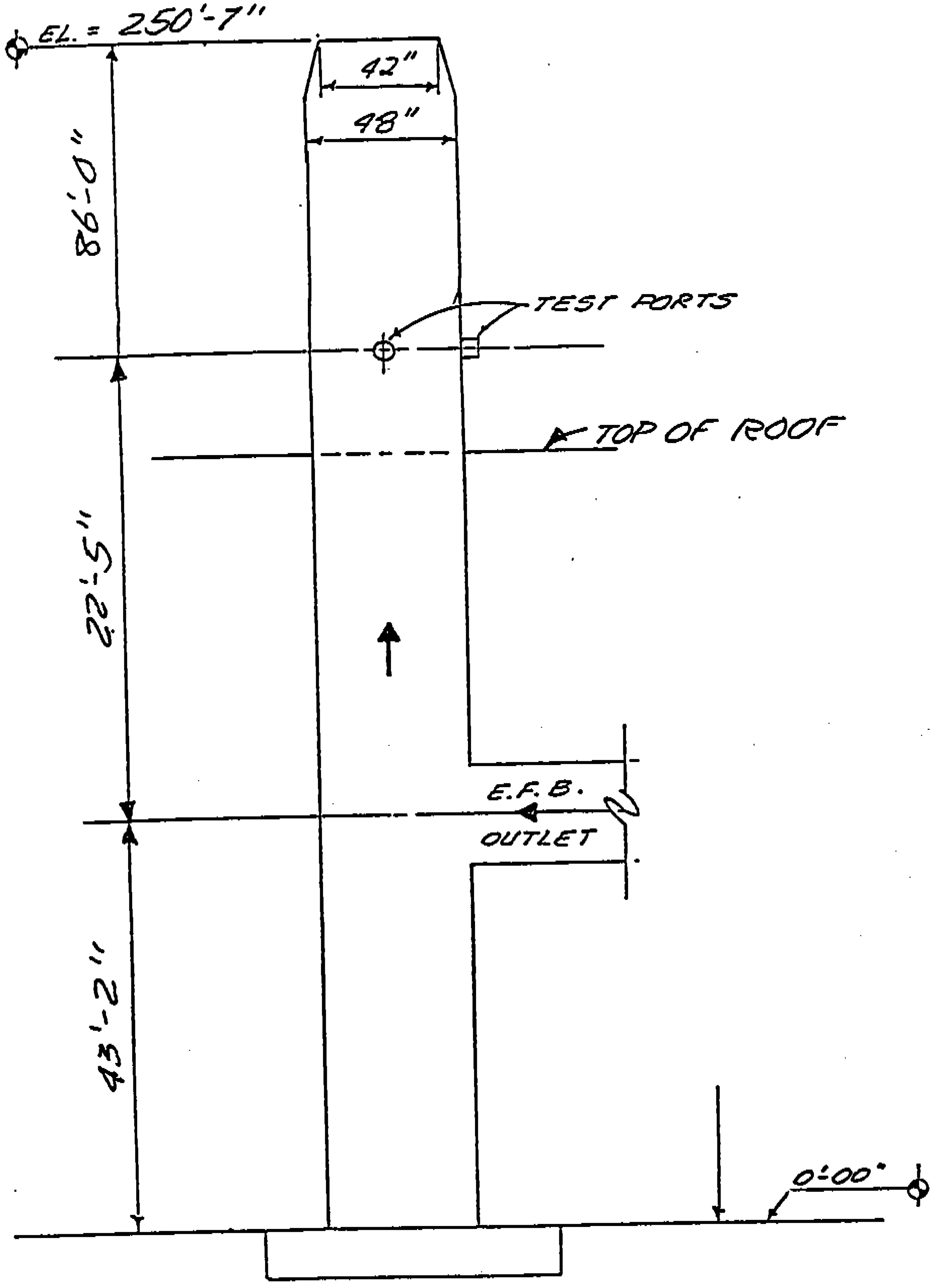
Test No. 1
Dryer Stack

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

Date of Determination............	03-29-94
Time of Determination.......(HRS)	1905
Barometric pressure.......(IN.HG)	28.78
Pitot tube coefficient...........	.84
Number of sampling ports.........	2
Total number of points...........	12
Shape of duct....................	Round
Stack diameter...............(IN)	48
Duct area................(SQ.FT)	12.57
Direction of flow................	UP
Static pressure...........(IN.WC)	.18
Avg. gas temp.............(DEG-F)	196
Moisture content..........(% V/V)	20.87
Avg. linear velocity.....(FT/SEC)	76.7
Gas density..............(LB/ACF)	.05399
Molecular weight......(LB/LBMOLE)	29.17
Mass flow of gas..........(LB/HR)	187237
Volumetric flow rate.............	
actual...................(ACFM)	57801
dry standard............(DSCFM)	35427

APPENDIX B

LOCATION OF TEST PORTS



DUNGANNON
DRYER STACK
DESIGN AIRFLOW 50,000 ACFM
210° - 270° F

N.T.S.

APPENDIX C

FIELD DATA SHEETS

INTERPOLL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job LP/ Dungannon
urce Dryer Stack
ate 3-29-94 Test 1 Run 1

Operator(s) BA KN
Meter Box No. CEM2 Gasmeter coef. .9954
^H@ —— in.WC Bar. press 28.79 in.Hg

Sample Train Leak Check:
Pretest: < 0.02 cfm at 15 in. Hg. ☒
Posttest: 0.0 cfm at 15 in. Hg. ☒

Moisture Pg 1 OF 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
▨	(0845)	(125.010)	▨	▨	▨	▨	▨	▨	▨	▨
1	5	125.222	1000 cc	3	250	—	—	68	—	—
1	10	125.410	1000 cc	3	250	—	—	68	—	—
1	15	125.560	1000 cc	3	250	—	—	68	—	—
1	20	125.730	1000 cc	3	250	—	—	68	—	—
2	25	125.800	1000 cc	3	250	—	—	68	—	—
2	30	126.020	1000 cc	3	250	—	—	68	—	—
				Continued						
▨	θ=60	V_m=2.125	(^H)avg= 1000		▨	▨	▨	$(t_m)_{avg.}$=68		▨

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers			
Condenser	—		
Desiccant	74.3400	83.8044	9.4644
Desiccant	70.8325	70.8350	.0025
▨	Total	9.4669	

Preliminary results of SO_2 concentration determination
V_{std} = 2.034 DSCF
Moisture = 12.97 %v/v
SO_2, dry = ppm
SO_2, wet = ppm
LB/MMBtu =

S-287 as

INTERPOLL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job CP / Dungannon
Source Dryer Stack
Date 3-29-94 Test 1 Run 1A

Operator(s) BA
Meter Box No. CEM1 Gasmeter coef. .9954
^H@ — in.WC Bar. press 28.79 in.H

Sample Train Leak Check:
Pretest: < 0.02 cfm at 15 in. Hg. ☒
Posttest: 0.0 cfm at 15 in. Hg. ☑

Moisture Pg 2 of 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
▨			▨	▨	▨	▨	▨	▨	▨	▨
2	35	126.240	1000	3	250	—	—	68	—	—
2	40	126.410	1000	3	250	—	—	68	—	—
3	45	126.600	1000	3	250	—	—	68	—	—
3	50	126.761	1000	3	250	—	—	68	—	—
3	55	126.935	1000	3	250	—	—	68	—	—
3	60	127.135	1000	3	250	—	—	68	—	—
	(0945)									
▨	θ=60	V_m=2.125	$(^H)_{avg}$=1000 ..		▨	▨	▨	$(t_m)_{avg.}$=68		▨

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impingers			
Condenser			
	SEE Pg 1		
Desiccant			
▨	Total		

Preliminary results of SO_2 concentration determination	
V_{std} =	DSCF
Moisture =	%v/v
SO_2, dry =	ppm
SO_2, wet =	ppm
LB/MMBtu =	

INTERPOLL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job LP / Dungannon
urce Dryer Stack
ate 3-29-94 Test 1 Run 2

Operator(s) BA KN
Meter Box No. CEM1 Gasmeter coef. .9854
^H@ ——— in.WC Bar. press 28.79 in.Hg

Sample Train Leak Check:
Pretest: < 0.02 cfm at 15 in. Hg. ☒
Posttest: 0.0 cfm at 15 in. Hg. ☒

MOISTURE Pg 1 of 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F) Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
▨	(1020)	(127.185)	▨	▨	▨	▨	▨	▨	▨	▨
1	5	127.325	1000	3	250	—	—	68	—	—
1	10	127.532	1000	3	250	—	—	68	—	—
1	15	127.721	1000	3	250	—	—	68	—	—
1	20	127.886	1000	3	250	—	—	68	—	—
2	25	128.051	1000	3	250	—	—	68	—	—
2	30	128.265	1000	3	250	—	—	68	—	—
					CONTINUED					
▨	θ=	V_m=	$(^H)_{avg}$=		▨	▨	▨	$(t_m)_{avg.}$=		▨

Condensate Data:

Item	Weight (g) Final	Tare	Difference
Impingers			
Condenser	SEE Pg 2		
Desiccant			
Desiccant			
▨	▨	Total	

Preliminary results of SO_2 concentration determination
V_{std} = DSCF
Moisture = %v/v
SO_2, dry = ppm
SO_2, wet = ppm
LB/MMBtu =

S-287 as

INTERPOLL LABORATORIES

EPA Method 4 and 6 Field Data Sheet

Job CP / Dungannon
Source Dryer Stack
Date 3-29-94 Test 1 Run 2A

Operator(s) BA KN
Meter Box No. CE12 Gasmeter coef. .9754
^H@ — in.WC Bar. press 28.79 in.Hg

Sample Train Leak Check:
Pretest: < 0.02 cfm at 15 in. Hg. ☒
Posttest: 0.0 cfm at 15 in. Hg. ☒

MOISTURE Pg 2 of 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F) Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
▨			▨	▨	▨	▨	▨	▨	▨	▨
2	35	128.426	1000	3	250	—	—	68	—	—
2	40	128.572	1000	3	250	—	—	68	—	—
3	45	128.763	1000	3	250	—	—	68	—	—
3	50	128.937	1000	3	250	—	—	68	—	—
3	55	129.126	1000	3	250	—	—	68	—	—
3	60	129.295	1000	3	250	—	—	68	—	—
	(1120)									
▨	θ=60	V_m=2.110	(^H)avg=1000		▨	▨	▨	$(t_m)_{avg}$.=68		▨

Condensate Data:

Item	Weight (g) Final	Tare	Difference
Impingers			
Condenser			
Desiccant	74.0050	83.3797	9.3747
Desiccant	63.3292	63.3292	0
▨	▨	Total	9.3747

Preliminary results of SO_2 concentration determination
V_{std} =2.020 DSCF
Moisture = 17.94 %v/v
SO_2, dry = ppm
SO_2, wet = ppm
LB/MMBtu =

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INTERPOLL LABORATORIES

EPA Method 4 and 6 Field Data Sheet

Job LP /Duncannon

urce Dryer Stack

ate 3-29-94 Test 1 Run 3

Operator(s) BA KN

Meter Box No. Com 2 Gasmeter coef. .9954

^H@ — in.WC Bar. press 28.79 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg.

Posttest: 0.0 cfm at 15 in. Hg.

MOISTURE Pg 1 OF 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
	(1140)	(129.325)								
1	5	129.510	1000	3	250	—	—	68	—	—
1	10	129.722	1000	3	250	—	—	68	—	—
1	15	129.883	1000	3	250	—	—	68	—	—
1	20	130.044	1000	3	250	—	—	68	—	—
2	25	130.205	1000	3	250	—	—	68	—	—
2	30	130.380	1000	3	250	—	—	68	—	—
				CONTINUED						
	θ=	V_m=	$(\Delta H)_{avg}$=					$(t_m)_{avg.}$=		

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impingers			
Condenser	SEE Pg 2		
Desiccant			
		Total	

Preliminary results of SO_2 concentration determination
V_{std} = DSCF
Moisture = %v/v
SO_2, dry = ppm
SO_2, wet = ppm
LB/MMBtu =

INTERPOLL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job CP / Dungannon
Source Dryer Stack
Date 3-29-94 Test 1 Run 3A

Operator(s) BA KN
Meter Box No. CEM 2 Gasmeter coef. .9954
^H@ — in.WC Bar. press 28.79 in.H

Sample Train Leak Check:
Pretest: < 0.02 cfm at 15 in. Hg. ☒
Posttest: 00 cfm at 15 in. Hg. ☒

MOISTURE Pg 2 of 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
2	35	130.530	1000	3	250	—	—	68	—	—
2	40	130.715	1000	3	250	—	—	68	—	—
3	45	130.891	1000	3	250	—	—	68	—	—
3	50	131.119	1000	3	250	—	—	68	—	—
3	55	131.259	1000	3	250	—	—	68	—	—
3	60	131.430	100	3	250	—	—	68	—	—
	(1240)									
	θ=60	Vm=2.105	(^H)ave=1000					(tm)ave.=68		

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers			
Condenser			
Desiccant	66.6070	77.6584	11.0514
Desiccant	72.1576	72.1681	.0105
		Total	11.0619

Preliminary results of SO_2 concentration determination
V_{std} = 2.015 DSCF
Moisture = 20.51 %v/v
SO_2, dry = ppm
SO_2, wet = ppm
LB/MMBtu =

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INTERPOLL LABORATORIES

EPA Method 4 and 6 Field Data Sheet

Job LP / Dungannon
Source Dryer Stack
Date 3-29-94 Test 1 Run 4

Operator(s) BP KN
Meter Box No. CEM 2 Gasmeter coef. .9954
^H@ — in.WC Bar. press 28.79 in.Hg

~~Plant~~ Lost Fan
Lost Moisture

~~No Good~~ ABORT
Pg 1 of 2

Sample Train Leak Check:
Pretest: < 0.02 cfm at 15 in. Hg. ☒
Posttest: ______ cfm at ____ in. Hg. ☐

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
▨	(1415)	(131.463)	▨	▨	▨	▨	▨	▨	▨	▨
1	5	131.640	1000cc	3	250	—	—	68	—	—
1	10	131.818	1000cc	3	250	—	—	68	—	—
1	15	131.996	1000	3	250	—	—	68	—	—
1	20	132.174	1000	3	250	—	—	68	—	—
2	25	132.349	1000	3	250	—	—	68	—	—
2	30		1000	3	250	—	—	68	—	—
					CONTINUED					
▨	θ=	V_m=	$(\Delta H)_{avg}$=		▨	▨	▨	$(t_m)_{avg.}$=		▨

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers			
Condenser	SEE	Pg 2	
Desiccant			
▨	Total		

Preliminary results of SO_2 concentration determination
V_{std} = DSCF
Moisture = %v/v
SO_2, dry = ppm
SO_2, wet = ppm
LB/MMBtu =

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INTERPOLL LABORATORIES

EPA Method 4 and 6 Field Data Sheet

Job LP / Dungannon
Source Dryer Stack
Date 3-29-94 Test 1 Run 4A

Operator(s) RA KN
Meter Box No. Ex12 Gasmeter coef. .9954
^H@ — in.WC Bar. press 28.75 in.H

Sample Train Leak Check:
Pretest: < 0.02 cfm at 15 in. Hg. ☒
Posttest: ______ cfm at ____ in. Hg. ☐

Moisture Pg 2 of 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
▨			▨	▨	▨	▨	▨	▨	▨	▨
2	35		1000	cc	250	—	—	68	—	—
2	40									
3	45									
3	50									
3	55									
3	60									
	( )									
▨	θ=	V_m=	$(^H)_{avg}$=		▨	▨	▨	$(t_m)_{avg.}$=		▨

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impingers			
Condenser			
Dessicant	76.		
Desiccant	70.83		
▨		Total	

Preliminary results of SO_2 concentration determination
V_{std} = DSCF
Moisture = %v/v
SO_2, dry = ppm
SO_2, wet = ppm
LB/MMBtu =

S-287 as

INTERPOLL LABORATORIES

EPA Method 4 and 6 Field Data Sheet

Job LP / Dungannon

urce Dryer Stack

ate 3-29-94 Test 1 Run 5

Operator(s) BA KN

Meter Box No. Cen 2 Gasmeter coef. .9954

^H@ — in.WC Bar. press 28.79 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. ☒

Posttest: 0.0 cfm at 15 in. Hg. ☒

MOISTURE Pg 1 OF 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F) Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
▨	(1905)	(132.682)	▨	▨	▨	▨	▨	▨	▨	▨
1	5	132.861	1000cc	3	250	—	—	68	—	—
1	10	133.035	1000cc	3	250	—	—	68	—	—
1	15	133.215	1000cc	3	250	—	—	68	—	—
1	20	133.360	1000	3	250	—	—	68	—	—
2	25	133.525	1000	3	250	—	—	68	—	—
2	30	133.765	1000	3	250	—	—	68	—	—
				Continued						
▨	θ=	V_m=	$(\Delta H)_{avg}$=		▨	▨	▨	$(t_m)_{avg.}$=		▨

Condensate Data:

Item	Weight(g) Final	Tare	Difference
Impingers			
Condenser			
	SEE	Pg 2	
Desiccant			
▨	▨	Total	

Preliminary results of SO_2 concentration determination

V_{std} = DSCF

Moisture = %v/v

SO_2, dry = ppm

SO_2, wet = ppm

LB/MMBtu =

S-287 as

INTERPOLL LABORATORIES

EPA Method 4 and 6 Field Data Sheet

Job LP / Dungannon

Source Dryer STACK

Date 3-29-94 Test 1 Run 5A

Operator(s) BA

Meter Box No. CCM12 Gasmeter coef. .9954

^H@ — in.WC Bar. press 28.75 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. ☒

Posttest: 0.0 cfm at 15 in. Hg. ☒

MOISTURE Pg 2 of 2

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
▨			▨	▨	▨	▨	▨	▨	▨	▨
2	35	133.914	1000	3	250	—	—	68	—	—
2	40	134.095	1000	4	250	—	—	68	—	—
3	45	134.270	1000	4	250	—	—	68	—	—
3	50	134.427	1000	4	250	—	—	68	—	—
3	55	134.581	1000	4	250	—	—	68	—	—
3	60	134.755	1000	4	250	—	—	68	—	—
	(2005)									
▨	θ= 60	Vm= 2.073	(^H) 1000		▨	▨	▨	(tm)avg.= 68		▨

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers			
Condenser			
DesiccANT	76.6307	87.6477	11.0170
Desiccant	70.8348	70.9000	.0652
▨	Total		11.0822

Preliminary results of SO_2 concentration determination

V_{std} = 1.984 DSCF

Moisture = 20.87 %v/v

SO_2, dry = ppm

SO_2, wet = ppm

LB/MMBtu =

S-297 aS

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job LP / Dunganon

Source Dryer Stack

Test 1 Run 2 Date 3-29-94

Stack dimen. 48.0 IN.

Dry bulb ______ °F Wet bulb ______ °F

Manometer: ☐ Reg. ☐ Exp. ☒ Elec.

Barometric pressure 28.79 in Hg

Static pressure +22 in WC

Operators BASCHENBACH K. NUESSMEIER

Pitot No. 316- Cp .84

Schematic of Cross Section

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: 6.0 in.		Time start: 1020 hrs	
A	1				1.02	
	2				1.27	195
	3				1.51	
	4				1.47	195
	5				1.29	
	6				1.35	195
B	1				.48	
	2				.51	195
	3				1.20	
	4				1.36	195
	5				1.15	
	6				1.13	195
				FT/SEC	69.06	
				ACFM	52076	
				DSCFM	33165	
Temp. meas. tool & S/N: PDT 7					Time end: 1120 hrs	

R or nothing= reg. manometer; S= expanded; E = electronic S-392.1

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job CP/Dungannon

Source Dryer Stack

Test 1 Run 3 Date 3-29-94

Stack dimen. 48 IN.

Dry bulb ____ °F wet bulb ____ °F

Manometer: ☐ Reg. ☐ Exp. ☒ Elec.

Barometric pressure 28.79 in Hg

Static pressure +.14 in WC

Operators GA KN

Pitot No. 31U- Cp .84

Schematic of Cross Section

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: 6.0 in.		Time start: 1140 hrs	
A	1				.87	
	2				.98	196
	3				1.12	
	4				1.36	195
	5				1.34	
	6				1.46	196
B	1				.83	
	2				1.26	194
	3				1.38	
	4				1.12	195
	5				1.05	
	6				1.16	196
						195.33
					FT/SE	71.02
					ACFM	53554
					DSCFM	33032
Temp. meas. tool & S/N: PDT 7					Time end: 1240 hrs	

R or nothing= reg. manometer; S= expanded; E = electronic S-392.1

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job 4P / Dungannon

Source Dryer Stack

Test 1 Run 4 Date 3-29-94

Stack dimen. 48.0 IN.

Dry bulb ____ °F Wet bulb ____ °F

Manometer: ☐ Reg. ☐ Exp. ☒ Elec.

Barometric pressure 28.78 in Hg

Static pressure + .18 in WC

Operators BA KN

Pitot No. 310- Cp .84

Schematic of Cross Section

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.C in.		Time start: 1800 hrs	
A 1		.17	1.08	1.06	196
2			1.12	1.39	197
3			1.28	1.60	195
4			1.40	1.93	197
5			1.38	1.40	196
6			1.40	1.38	196
B 1			1.19	1.42	197
2			1.20	1.40	197
3			1.12	1.42	197
4			1.19	1.46	196
5			1.15	1.12	196
6			1.26	1.09	196
-					
			FT/SEC	73.26	
			ACFM	55237	
			DSCFM	33919	
Temp. meas. tool & S/N:				Time end: [illegible] hrs	

R or nothing= reg. manometer; S= expanded; E = electro[illegible] S-392.1

APPENDIX D

OXIDES OF NITROGEN COMPUTER PRINTOUTS

Interpoll Laboratories, Inc.
(612) 786-6020

Printout of ESC Model 80 DAS
for CEM Trailer No. 2
- 1994 -

File Name: LPD12
Job Number: 4-2557
Client: Louisiana Pacific - Dungannon
Location: Dungannon, Virginia

Dryer Stack -- Run 1

Julian	Time	Conc. (dry basis unless noted)		
Date	(Hrs)	NOx (ppmv)	CO2 (%v/v)	O2 (%v/v)
088	10:21:00	23.9	1.29	19.20
088	10:22:00	23.2	1.27	19.21
088	10:23:00	22.6	1.27	19.21
088	10:24:00	22.1	1.25	19.22
088	10:25:00	21.7	1.25	19.21
088	10:26:00	21.8	1.19	19.27
088	10:27:00	22.0	1.12	19.32
088	10:28:00	22.3	1.09	19.36
088	10:29:00	21.7	1.07	19.37
088	10:30:00	22.3	1.05	19.38
088	10:31:00	21.5	1.07	19.36
088	10:32:00	21.8	1.11	19.32
088	10:33:00	21.1	1.12	19.29
088	10:34:00	20.5	1.17	19.24
088	10:35:00	20.3	1.13	19.26
088	10:36:00	20.7	1.13	19.27
088	10:37:00	21.0	1.10	19.29
088	10:38:00	21.1	1.07	19.31
088	10:39:00	21.2	1.08	19.30
088	10:40:00	21.1	1.10	19.28
088	10:41:00	21.0	1.09	19.28
088	10:42:00	21.3	1.11	19.27
088	10:43:00	21.8	1.14	19.24
088	10:44:00	21.0	1.20	19.18
088	10:45:00	20.9	1.22	19.13
088	10:46:00	20.6	1.24	19.11
088	10:47:00	20.8	1.22	19.12
088	10:48:00	21.0	1.24	19.12
088	10:49:00	21.5	1.26	19.08
088	10:50:00	21.3	1.28	19.05
088	10:51:00	20.9	1.32	19.02
088	10:52:00	20.8	1.33	19.01
088	10:53:00	20.6	1.32	19.02
088	10:54:00	20.7	1.36	18.98

Interpoll Laboratories, Inc.
(612) 786-6020

Printout of ESC Model 80 DAS
for CEM Trailer No. 2
- 1994 -

File Name: LPD12
Job Number: 4-2557
Client: Louisiana Pacific - Dungannon
Location: Dungannon, Virginia

Dryer Stack -- Run 1

Julian Date	Time (Hrs)	Conc. (dry basis unless noted)		
		NOx (ppmv)	CO2 (%v/v)	O2 (%v/v)
088	10:55:00	20.7	1.39	18.94
088	10:56:00	21.1	1.40	18.92
088	10:57:00	22.3	1.37	18.96
088	10:58:00	23.1	1.34	18.99
088	10:59:00	23.8	1.32	19.01
088	11:00:00	24.4	1.35	18.99
088	11:01:00	23.8	1.39	18.95
088	11:02:00	23.5	1.39	18.94
088	11:03:00	23.7	1.43	18.90
088	11:04:00	23.3	1.46	18.87
088	11:05:00	23.1	1.45	18.88
088	11:06:00	22.8	1.46	18.86
088	11:07:00	22.7	1.48	18.84
088	11:08:00	22.6	1.53	18.79
088	11:09:00	22.2	1.53	18.78
088	11:10:00	22.2	1.50	18.80
088	11:11:00	22.1	1.50	18.80
088	11:12:00	20.5	1.58	18.71
088	11:13:00	20.9	1.61	18.68
088	11:14:00	20.4	1.61	18.68
088	11:15:00	20.9	1.59	18.69
088	11:16:00	21.3	1.55	18.74
088	11:17:00	22.1	1.54	18.75
088	11:18:00	22.6	1.53	18.77
088	11:19:00	23.1	1.52	18.78
088	11:20:00	23.1	1.51	18.80
	Run Average	21.8	1.31	19.05

Interpoll Laboratories, Inc.
(612) 786-6020

Printout of ESC Model 80 DAS
for CEM Trailer No. 2
- 1994 -

File Name: LPD13
Job Number: 4-2557
Client: Louisiana Pacific - Dungannon
Location: Dungannon, Virginia

Dryer Stack -- Run 2

Julian Date	Time (Hrs)	Conc. (dry basis unless noted) NOx (ppmv)	CO2 (%v/v)	O2 (%v/v)
088	11:41:00	24.8	1.78	18.54
088	11:42:00	25.5	1.72	18.60
088	11:43:00	25.5	1.64	18.68
088	11:44:00	25.6	1.60	18.76
088	11:45:00	24.3	1.56	18.78
088	11:46:00	24.6	1.55	18.81
088	11:47:00	23.4	1.51	18.83
088	11:48:00	23.8	1.49	18.86
088	11:49:00	22.7	1.45	18.91
088	11:50:00	22.3	1.43	18.91
088	11:51:00	21.4	1.41	18.94
088	11:52:00	21.3	1.39	18.95
088	11:53:00	20.4	1.37	18.97
088	11:54:00	19.5	1.36	18.98
088	11:55:00	19.1	1.36	19.00
088	11:56:00	20.0	1.30	19.04
088	11:57:00	20.4	1.26	19.08
088	11:58:00	20.0	1.22	19.12
088	11:59:00	19.8	1.33	19.02
088	12:00:00	20.4	1.33	19.01
088	12:01:00	19.2	1.30	19.03
088	12:02:00	19.6	1.26	19.07
088	12:03:00	19.8	1.22	19.12
088	12:04:00	20.4	1.22	19.13
088	12:05:00	19.6	1.19	19.14
088	12:06:00	19.3	1.16	19.19
088	12:07:00	19.7	1.11	19.23
088	12:08:00	20.5	1.08	19.27
088	12:09:00	20.1	1.06	19.28
088	12:10:00	20.1	1.04	19.31
088	12:11:00	19.7	1.06	19.29
088	12:12:00	19.3	1.07	19.29
088	12:13:00	18.4	1.07	19.27
088	12:14:00	19.2	1.07	19.28

Interpoll Laboratories, Inc.
(612) 786-6020

Printout of ESC Model 80 DAS
for CEM Trailer No. 2
- 1994 -

File Name: LPD13
Job Number: 4-2557
Client: Louisiana Pacific - Dungannon
Location: Dungannon, Virginia

Dryer Stack -- Run 2

Julian Date	Time (Hrs)	Conc. (dry basis unless noted)		
		NOx (ppmv)	CO2 (%v/v)	O2 (%v/v)
088	12:15:00	18.5	1.08	19.27
088	12:16:00	18.0	1.10	19.24
088	12:17:00	17.6	1.09	19.26
088	12:18:00	18.2	1.07	19.27
088	12:19:00	18.7	1.04	19.30
088	12:20:00	18.5	1.05	19.30
088	12:21:00	18.4	1.07	19.28
088	12:22:00	18.8	1.07	19.28
088	12:23:00	20.6	1.04	19.29
088	12:24:00	19.3	1.07	19.28
088	12:25:00	19.0	1.07	19.28
088	12:26:00	19.3	1.05	19.29
088	12:27:00	18.3	1.05	19.29
088	12:28:00	18.8	1.06	19.29
088	12:29:00	18.7	1.07	19.28
088	12:30:00	18.9	1.07	19.27
088	12:31:00	18.7	1.05	19.29
088	12:32:00	19.4	1.06	19.29
088	12:33:00	19.6	1.07	19.28
088	12:34:00	19.3	1.07	19.27
088	12:35:00	19.5	1.05	19.29
088	12:36:00	19.1	1.04	19.30
088	12:37:00	19.7	1.05	19.30
088	12:38:00	19.3	1.04	19.31
088	12:39:00	19.3	1.05	19.29
088	12:40:00	19.0	1.05	19.29
	Run Average	20.2	1.21	19.13

Interpoll Laboratories, Inc.
(612) 786-6020

Printout of ESC Model 80 DAS
for CEM Trailer No. 2
- 1994 -

File Name: LPD14
Job Number: 4-2557
Client: Louisiana Pacific - Dungannon
Location: Dungannon, Virginia

Dryer Stack -- Run 3

Julian Date	Time (Hrs)	Conc. (dry basis unless noted)		
		NOx (ppmv)	CO2 (%v/v)	O2 (%v/v)
088	19:06:00	31.9	3.29	17.00
088	19:07:00	32.5	3.29	16.97
088	19:08:00	32.4	3.31	16.97
088	19:09:00	32.8	3.32	16.93
088	19:10:00	33.1	3.32	16.92
088	19:11:00	32.7	3.29	16.94
088	19:12:00	33.4	3.31	16.92
088	19:13:00	33.2	3.31	16.92
088	19:14:00	34.2	3.26	16.95
088	19:15:00	34.3	3.28	16.94
088	19:16:00	33.8	3.25	16.94
088	19:17:00	34.1	3.27	16.92
088	19:18:00	34.1	3.30	16.93
088	19:19:00	32.8	3.34	16.85
088	19:20:00	33.0	3.31	16.90
088	19:21:00	34.2	3.27	16.92
088	19:22:00	34.0	3.31	16.88
088	19:23:00	34.2	3.18	16.98
088	19:24:00	35.2	3.08	17.11
088	19:25:00	35.3	3.12	17.08
088	19:26:00	33.6	3.11	17.05
088	19:27:00	33.3	3.15	17.02
088	19:28:00	32.2	3.21	16.95
088	19:29:00	32.9	3.23	16.91
088	19:30:00	33.6	3.15	17.00
088	19:31:00	32.9	3.07	17.03
088	19:32:00	35.0	2.90	17.24
088	19:33:00	34.7	2.85	17.25
088	19:34:00	35.4	2.79	17.33
088	19:35:00	35.8	2.70	17.43
088	19:36:00	35.1	2.80	17.35
088	19:37:00	32.3	2.91	17.21
088	19:38:00	31.8	3.06	17.06
088	19:39:00	30.5	3.12	16.98

Interpoll Laboratories, Inc.
(612) 786-6020

Printout of ESC Model 80 DAS
for CEM Trailer No. 2
- 1994 -

File Name: LPD14
Job Number: 4-2557
Client: Louisiana Pacific - Dungannon
Location: Dungannon, Virginia

Dryer Stack -- Run 3

Julian Date	Time (Hrs)	Conc. (dry basis unless noted) NOx (ppmv)	CO2 (%v/v)	O2 (%v/v)
088	19:40:00	31.1	3.19	16.90
088	19:41:00	31.4	3.13	16.97
088	19:42:00	32.5	3.00	17.07
088	19:43:00	32.3	2.93	17.16
088	19:44:00	32.8	2.87	17.22
088	19:45:00	34.0	2.74	17.35
088	19:46:00	35.3	2.67	17.42
088	19:47:00	34.3	2.73	17.37
088	19:48:00	33.3	2.75	17.35
088	19:49:00	32.9	2.89	17.21
088	19:50:00	30.7	2.95	17.13
088	19:51:00	30.3	3.07	17.00
088	19:52:00	29.8	3.15	16.92
088	19:53:00	30.2	3.29	16.77
088	19:54:00	31.5	3.06	16.96
088	19:55:00	32.9	2.86	17.18
088	19:56:00	32.7	2.90	17.18
088	19:57:00	32.4	2.85	17.18
088	19:58:00	32.8	2.82	17.24
088	19:59:00	33.3	2.76	17.29
088	20:00:00	34.0	2.81	17.28
088	20:01:00	32.7	2.88	17.18
088	20:02:00	31.9	2.98	17.09
088	20:03:00	30.9	2.98	17.07
088	20:04:00	31.8	3.03	17.02
088	20:05:00	34.1	2.86	17.17
	Run Average	33.0	3.06	17.07

APPENDIX E

MEASUREMENT SYSTEM PERFORMANCE SPECIFICATIONS

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job LP/ Dungannon

Source Dryer Stack

Test 1 Run 0 Date 3-28-29-94

Stack dimen. 48 IN.

Dry bulb ____ °F Wet bulb ____ °F

Manometer: ☐ Reg. ☐ Exp. ☐ Elec.

Barometric pressure ________ in Hg

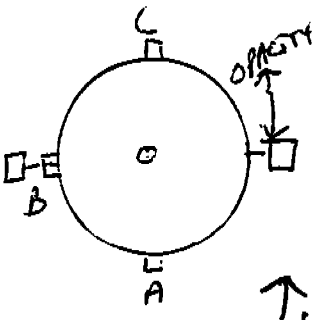
Static pressure ________ in WC

Operators B ASCHENBACH

Pitot No 31 6' Inst Cp ________

3-28-94
28.46
3-29-94
28.79

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: 6.0 in.		Time start: hrs	
1	.16	7.68	13.68		
2	.50	24.00	30.00		
3	.83	39.84	45.84		
Temp. meas. device & S/N:				Time end: hrs	

E-1

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

S-3921

INTERPOLL LABORATORIES, INC
(612) 786-6020

NOx System Bias Check

Job LP / Dungannon
Test 1 Run D-5 Date 3-28-29-94
Operator Bob
Source Dryer
Site STACK

3-28-94

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (ppm)	% of Span
				Cal Err	Sys Bias			
1	0800	Zero Gas	0	0	2	2	250	.80
		Upscale	140.5	139	139	0	250	0
2	1225	Zero Gas	0	0	0	0.	250	0
		Upscale	140.5	139	140	1	250	.40
3	1707	Zero Gas	0	0	2	2	250	.80
		Upscale	140.5	139	143	4	250	1.60
4	0820	Zero Gas	0	0	0	0	250	0
		Upscale	140.5	139	140	1	250	.40
5	0955	Zero Gas	0	0	0	0	250	0
		Upscale	140.5	139	155	16	250	6.4
6	recal	Zero Gas	0	0	0	0	250	0
		Upscale	140.5	139	139	0	250	0
7	1123	Zero Gas	0	0	0	0	250	0
		Upscale	140.5	139	137	2	250	.80
8	1743	Zero Gas	0	0	0	0	250	0
		Upscale	140.5	139	137	2	250	.80
9	1330	Zero Gas	0	0	3	3	250	1.20
		Upscale	140.5	139	139	0	250	0
10	1351	Zero Gas	0	0	3	3	250	1.20
		Upscale	140.5	139	136	3	250	1.20
11	1454	Zero Gas	0	0	2	2	250	.80
		Upscale	140.5	139	136	3	250	1.20
12	1446	Zero Gas	0	0	1	1	250	.40
		Upscale	140.5	139	137	2	250	.80

0815
1215
1235
1705

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

G:\STACK\WP\FORMS\S420-11R

INTERPOLL LABORATORIES, INC
(612) 786-6020

O_2 System Bias Check

Job LP / Dungannon Source Dryer
Test 1 Run 0-5 Date 3-28-29-94 Site Stack
Operator Bob

3-28-94

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (ppm)	% of Span
				Cal Err	Sys Bias			
1	0800	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.6	.1	25	.40
2	1225	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0
3	1207	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0
4	0820	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0
5	0955	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.6	.1	25	.40
6	recal	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0
7	1123	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0
8	1243	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0
9	1330	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.4	.1	25	.40
10	1351	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.4	.1	25	.40
11	1454	Zero Gas	0	0	0.1	0.1	25	.40
		Upscale	13.4	13.5	13.4	.1	25	.40
12	1646	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0

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

G:\STACK\WP\FORMS\S420-11R

INTERPOLL LABORATORIES, INC
(612) 786-6020

CO2 System Bias Check

Job LP / Dungannon
Test 1 Run 0-5 Date 3-28-94
Operator BOB
Source Dryer
Site STACK

3-28-94

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (ppm)	% of Span
				Cal Err	Sys Bias			
1	0850	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	10.9	.1	20	.50
2	1225	Zero Gas	0	0	.1	.1	20	.50
		Upscale	11.0	11.0	10.9	.1	20	.50
3	1707	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	10.8	.2	20	1.00
4	0820	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	11.0	0	20	0
5	0955	Zero Gas	0	0	.1	.1	20	.50
		Upscale	11.0	11.0	10.9	.1	20	.50
6	RECAL	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	10.9	.1	20	.50
7	1123	Zero Gas	0	0	.1	.1	20	.50
		Upscale	11.0	11.0	10.8	.2	20	1.00
8	1243	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	10.9	.1	20	.50
9	1330	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	11.0	0	20	0
10	1357	Zero Gas	0	0	.4	.4	20	2.00
		Upscale	11.0	11.0	11.2	.2	20	1.00
11	1454	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	10.8	.2	20	1.00
12	1646	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	11.0	0	20	0

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

G:\STACK\WP\FORMS\S420-11R

INTERPOLL LABORATORIES, INC
(612) 786-6020

ALL System Bias Check

Job: CP / Dungannon
Test: 1 Run: 1-5 Date: 3-29-94
Operator: GEB
Source: Dryer
Site: STACK

NOx

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm) Cal Err	Analyzer Resp (ppm) Sys Bias	Diff. CE-SB (ppm)	Span Val (ppm)	% of Span
13	1732	Zero Gas	0	0	1	1	250	.40
		Upscale	140.5	139	136	3	250	1.20
14	1844	Zero Gas	0	0	1	1	250	.40
		Upscale	140.5	139	137	2	250	.80
15	2008	Zero Gas	0	0	1	1	250	.40
		Upscale	140.5	139	137	2	250	.80
16		Zero Gas	0					
		Upscale						

O_2

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm) Cal Err	Analyzer Resp (ppm) Sys Bias	Diff. CE-SB (ppm)	Span Val (ppm)	% of Span
13	1732	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.4	.1	25	.40
14	1844	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.5	0	25	0
15	2008	Zero Gas	0	0	.1	.1	25	.40
		Upscale	13.4	13.5	13.4	.1	25	.40
16	–	Zero Gas	0					
		Upscale						

CO_2

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm) Cal Err	Analyzer Resp (ppm) Sys Bias	Diff. CE-SB (ppm)	Span Val (ppm)	% of Span
13	1732	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	11.0	0	20	0
14	1844	Zero Gas	0	0	0	0	20	0
		Upscale	11.0	11.0	10.9	-.1	20	.50
15	2008	Zero Gas	0	0	.2	.2	20	1.00
		Upscale	110	11.0	11.0	0	20	0
16		Zero Gas	0					
		Upscale						

Must be within 3% of the span for the zero or upscale cal. gas.

G:\STACK\WP\FORMS\S420-11R

INTERPOLL LABORATORIES

Calibration Error Check

Job LP / Dungannon

Test 1 Run 6-5 Date 3(28-29) 94
Operator BoB

SO_2 Calibration: Time(HRS)

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

NO_x Calibration: Time(HRS) 0730

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	250	0
Mid level	140.5	139	1.5	250	.60
High level	231.3	232	.7	250	.28

O_2 Calibration: Time(HRS) 0730

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	25	0
Mid level	13.4	13.5	.1	25	.40
High level	21.0	21.0	0	25	0

CO_2 Calibration: Time(HRS) 0730

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	20	0
Mid level	11.0	11.0	0	20	0
High level	17.0	16.9	.1	20	.50

Must be within 2% of the span for each calibration gas

S-420-10

APPENDIX F

CALIBRATION GAS CERTIFICATION SHEETS

Interpoll Laboratories, Inc.
(612) 786-6020

CERTIFICATE OF ANALYSIS FOR
NO STANDARD GASES FOR METHOD 7E

Vendor: Scott Specialty Gases

Cylinder No: AAL4510

Date of Preparation: 11-20-91

Label: 140.5 ppm NOx

Blend Specification:

Results Of Analyses Of Standard Gas (by Method 7A)

Date of Analysis	Run	NO in N_2 (ppm)
8-10-93	1	140.05
"	2	139.975
"	3	139.450
	4	
	5	
	6	
	Avg	139.825

Analyst: Bob Aschenbach

☒ Results are within 10% of the vendor tag value; use tag value.

☐ Results are not within 10% of the vendor tag value; conduct another set of triplicate analyses.

☐ Results of six consecutive analyses within ± 10% of the average; relabel as above.

☐ All results not within ± 10% of the average; perform another set of triplicate analyses.

Approved by,

August 16, 1993
Date

Daniel [illegible] for
Dr. Perry Lonnes

S-431

Interpoll Laboratories, Inc.

(612) 786-6020

Printout of ESC Model 80 DAS
for CEM Trailer No. 1
- 1993 -

File Name: CG1
Job Number: 1-1111
Client: Interpoll Laboratories Inc
Location: Circle Pine, Minnesota

AAL4510 - 140.5 ppm NOx -- Run 1 - 3

Conc. (dry basis unless noted)

Julian Date	Time (Hrs)		NOx (ppmv)
222	09:36:00	RUN 1	140
222	09:36:30		140
222	09:37:00		140
222	09:37:30		140
222	09:38:00		136
222	09:38:30		129
222	09:39:00		174
222	09:39:30		234
222	09:40:00		234
222	09:40:30		165
222	09:41:00		141
222	09:41:30		140
222	09:42:00	RUN 2	140
222	09:42:30		140
222	09:43:00		140
222	09:43:30		140
222	09:44:00		168
222	09:44:30		233
222	09:45:00		234
222	09:45:30		234
222	09:46:00		184
222	09:46:30		140
222	09:47:00	RUN 3	140
222	09:47:30		139
222	09:48:00		139
222	09:48:30		140

ott Specialty Gases Scott Envir ental Technology, Inc.
1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Our Project # : 102
Your P.O. # : 46035A
Expiration Date : 5-20-93
Cylinder Number : AAL-4510
Cylinder Pressure 1909 psig

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 Procedure # G1
Protocol # 1
File # PO-1578
Certified Accuracy 1 % NBS Traceable

ANALYZED CYLINDER

COMPONENT	CERTIFIED CONC.
NITRIC OXIDE	140.5 PPM

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

REFERENCE STD

SRM # (CRM #)	CYLINDER NUMBER	CONC.
1685	ALM-009700	250.3 PPM
GMIS*	AAL-14484	145.3 PPM

INSTRUMENTATION

INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
BECKMAN 951A	10-25-91	CHEMILUMINESCENCE

F-3

FIRST ANALYSIS

DATE : 11-11-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	47.50	140.9	250.3 PPM	84.40	250.3
0.00	47.50	140.9		84.40	250.3
0.00	47.50	140.9		84.40	250.3

CALCULATED RESULTS 140.9
140.9
140.9

AVERAGE : 140.9 PPM

SECOND ANALYSIS

DATE : 11-20-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	47.20	140.0	250.3 PPM	84.40	250.3
0.00	47.20	140.0		84.40	250.3
0.00	47.20	140.0		84.40	250.3
0.00	47.20 NOX	140.0			

CALCULATED RESULTS 140.0
140.0
140.0 140.0 PPM NOX

AVERAGE : 140.0 PPM

CALIBRATION CURVE 1 st DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1685	250.3	100	84.40	250.3	-0.00
	236.0	94	79.80	236.7	0.28
	145.3	58	48.90	145.1	-0.15
	97.30	39	32.80	97.36	0.06
	0.0000	0	0.00	0.0000	0.00
		0		0.0000	0.00
		0		0.00	0.00
1684	97.30	LOW	32.80	97.36	0.06
1685	250.3		84.40	250.3	-0.00

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : L. P. Dora

Approved By :

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

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

Shipped From : Scott Michigan
Our Project # : 547167
Your P.O. # : 3371
Expiration Date : 8-16-94
Cylinder Number : ALM013033
Cylinder Pressure : 1900 psig
Certification Date : 2-16-93
1 of 1 Component(s)

Customer :
EARLS WELDING
C/O HEALTH ONE
305 2ND STREET NW STE 115
NEW BRIGHTON MN 55112

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

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1

Procedure # G1

LAB #0694

Certified Accuracy 1 % NIST Traceable

ANALYZED CYLINDER

COMPONENT	CERTIFIED CONCENTRATION
NITRIC OXIDE	231.3 PPM

BALANCE GAS : NITROGEN

REFERENCE STANDARDS

SRM # (CRM #)	CYLINDER NUMBER	CONCENTRATION
1685	ALM-008716	250.3 PPM
1684	ALM-010464	95,26 PPM

INSTRUMENTATION

INSTRUMENT/ MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
BECKMAN 951A 270-082899B	2-9-93	CHEMILUMINESCENCE

NITROGEN DIOXIDE 3.70 PPM (FROM SECOND ANALYSIS)

4

FIRST ANALYSIS

DATE : 2-9-93

ZERO GAS (mV)	TEST GAS (mV)	CURVE RESULTS PPM	REFERENCE GAS CONCENTR.	REFERENCE GAS (mV)	CURVE RESULTS PPM
0.00	92.40	231.3	250.3 PPM	100.0	250.3
0.00	92.40	231.3		100.0	250.3
0.00	92.40	231.3		100.0	250.3

CALCULATED RESULTS 231.3 231.3 231.3

AVERAGE : 231.3 PPM

SECOND ANALYSIS

DATE : 2-16-93

ZERO GAS (mV)	TEST GAS (mV)	CURVE RESULTS PPM	REFERENCE GAS CONCENTR.	REFERENCE GAS (mV)	CURVE RESULTS PPM
0.00	92.40	231.3	250.3 PPM	100.0	250.3
0.00	92.40	231.3		100.0	250.3
0.00	92.40	231.3		100.0	250.3
0.00	93.90 NOX	235.0			

CALCULATED RESULTS 231.3 231.3 231.3

235.0 PPM NOX

AVERAGE : 231.3 PPM

CALIBRATION CURVE 1 st DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1685	250.3	100	100.0	250.3	0.00
1684	95.26	38	38.05	95.24	-0.02
	0.0000	0	0.0000	0.0000	0.00
		0		0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
		0		0.00	0.00
1684	95.26	LOW	38.05	95.24	-0.02
1685	250.3	HIGH	100.0	250.3	0.00

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst :
DON EICHLER, JR

Approved By : C. C. Shapiro

Revised : 3/31/92 RML

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

NATIONAL SPECIALTY GASES
630 UNITED DRIVE
DURHAM, N.C. 27713
(919) 544-3772

TO: TWIN CITY OXYGEN

CERTIFICATE OF ANALYSIS

DATE REPORTED: 2/14/94 **REFERENCE #:**88-29477

MATERIAL SUBMITTED:OXYGEN AND CARBON DIOXIDE IN NITROGEN, CERTIFIED CYL. #CC111982

INFORMATION REQUESTED:RATIO ANALYSIS

METHOD OF ANALYSIS:INFRARED AND OXYGEN ANALYZERS

RESULT OF INVESTIGATION:

COMPONENT	SPECIFICATION	CONCENTRATION
O2	13.5%	13.4%
CO2	11%	11.0%
N2		BALANCE

AUTHORIZED SIGNATURE

"THIS REPORT STATED ACCURATELY THE RESULTS OF THE INVESTIGATION MADE UPON THE MATERIAL SUBMITTED TO THE ANALYTICAL LABORATORY. EVERY EFFORT HAS BEEN MADE TO DETERMINE OBJECTIVELY, THE INFORMATION REQUESTED; HOWEVER, IN CONNECTION WITH ITS RENDERING OF THIS REPORT, NATIONAL SPECIALTY GASES SHALL HAVE NO LIABILITY IN EXCESS OF ITS ESTABLISHED CHARGE FOR THE SERVICE."

Interpoll Laboratories, Inc.
(612) 786-6020

CERTIFICATE OF ANALYSIS FOR MIDRANGE STANDARD GAS FOR METHOD 3A

Vendor: Linde

Cylinder No: HA4668

Date of Preparation: 4-4-90

Label: 16.99% CO_2 / 20.99% O_2 BAL N_2

Blend Specification: 2%

Results Of Analyses Of Standard Gas (by Orsat)

Date of Analysis	Run	CO_2 (% v/v)	O_2 (% v/v)
8-11-93	1	16.9	21.4
8-11-93	2	16.9	21.4
8-11-93	3	16.9	21.4
	4		
	5		
	6		
	Avg	16.9	21.4

Analyst: Mark Kadler

☑ Results are within 5% of the vendor tag value; use tag value.

☐ Results are not within 5% of the vendor tag value; conduct another set of triplicate analyses.

☐ All results within ± 5% of the average; relabel as above.

☐ All results not within ± 5% of the average; perform another set of triplicate analyses.

Approved by,

August 11, 1993
Date

Dr. Perry Lonnes

S-424

LINDE

Union Carbide Industrial Gases, Inc.
Linde Division
4550 Kennedy Avenue
East Chicago, IN 46312

DATE : APRIL 4, 1990

TO: OXYGEN SERVICE COMPANY
1111 PIERCE BUTLER ROUTE
ST PAUL, MN 55104

LINDE ORDER NUMBER : 093.054.02
CUSTOMER PO NUMBER : 1243SA
CUSTOMER REL NUMBER :

DEAR SIR/MADAM:

THIS IS YOUR CERTIFICATE OF ANALYSIS FOR:

CYLINDER NUMBER	MIXTURE COMPONENTS	REQUESTED COMPOSITION	CERTIFIED COMPOSITION	CERTIFICATION ACCURACY
HA 4668	CARBON DIOXIDE	17%	16.99%	± 0.02% ABS
	OXYGEN	21%	20.99%	± 0.02% ABS
	NITROGEN	BALANCE	BALANCE	

REMARK: The Accuracy of the measuring equipment used to make this Standard is traceable to the National Institute of Standards and Technology (N.I.S.T.) formerly called the National Bureau of Standards (N.B.S.).

APPROVED BY

COA-6MP

APPENDIX G

GAS ANALYZER SPECIFICATIONS

Servomex

1420
Oxygen Analyser
Instruction Manual

Ref : 01420/001A/0

Order as part No. 01420001A

was (7982-2842)

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

1.3 Sampling System

The sampling system of the analyser includes a combination filter/automatic flow control device, designed to keep a constant flow of sample gas through the measuring cell for varying input pressures and to prevent the entrance of particulate matter into the measuring cell. Excess flow is vented to the by-pass.

1.4 Specification

Performance Specification (typical)

Repeatability:	Better than +/-0.2% O2 under constant conditions.
Drift:	Less than 0.2% O2 per week under constant conditions. (Excluding variation due to barometric pressure changes; reading is proportional to barometric pressure.)

Outputs

Display:	3 1/2 digit LCD reading 0.0 to 100.0% oxygen with overrange capability.
Output:	0 to 1V (non-isolated) for 0 to 100% oxygen available on 'D' type connector located on the back panel of the instrument. Output impedance is less than 10 ohms.
Option:	4 - 20mA isolated, Max impedance 500 ohms.
Flow alarm output:	Change over relay contact rated at 3A/115V ac, 1A/240V ac or 1A/28V dc. 4 sets of single pole changeover contacts. Alarm becomes active when sample gas flow through the analyser fails.

Sample requirements

Condition:	Clean, dry gas with dew point 5 deg C below ambient temperature.
Inlet pressure:	0.5 to 3psig (3.5 to 21kPa). Inlet pressure changes within this range will change the reading by less than 0.1% O2. May be operated up to 10psig (70kPa) with degraded stability.
Flowrate:	1.5 to 6 litres/minute approximately depending on sample pressure.
Filtering:	0.6 micron replaceable filter integral to the automatic flow control device.

Response time:	Less than 15 secs. to 90% at an inlet pressure of 3psig (21kPa).
Inlet/vent connections:	1/4 inch OD tube (stainless steel) suitable for 6mm ID flexible tubing or 1/4 inch OD compression fittings.
Materials exposed to the sample:	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, Viton, polypropylene and glass fibre filter.

Physical Characteristics

Case:	Steel and aluminium finished in epoxy powder paint.
Case classification:	IP 20 (IEC 529) when fitted into the Servomex 1400 series 19 inch case.
Dimensions:	See Figure 2.1.
Weight:	10Kg (22lb) approximately.

Electrical

AC Supply:	110 to 120V AC or 220 to 240V AC, +/-10%, 48 to 62Hz. Voltage selected by a voltage selector integral to the IEC supply plug.
Power required:	15VA maximum.

Environmental Limits

Operating ambient temperature:	0 to +40 deg C (32 to 104 deg F)
Storage temp. range:	-20 to +70 deg C (-4 to 158 deg F)
Relative humidity:	0-85%, non-condensing.

SPECIFICATIONS FOR ACS MODEL 3300 CO_2 NDIR

Measuring principle	NDIR single beam method
Measurable gas components and measuring range	0 - 20%
Reproducibility	±0.5% of full scale
Stability	Zero drift; ±% of full scale/24H Span drift; ±% of full scale/24H
Noise	0.5% of full scale
Ambient temperature	-5 to 45°C
Ambient humidity	Less than 90% RH
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)
Indicator	100 linear division
Output signal	OUTPUT 1; DC 0 - 1 V OUTPUT 2; DC 0 - 10 mV or DC 0 - 100 mV or DC 0 - 1 V or DC 4 - 20 mA (Allowable load resistance 500Ω max.)
Linearity	Better than ±2% of full scale (when linearizer is used)
Power supply	AC 115 V ± 10%, 60 Hz

Power consumption	Approx. 30 VA
Materials of gas-contacting parts	Measuring cell; SUS304 Window; CaF2 Piping; Polyethylene
Sample gas flow rate	1ℓ/min ± 0.5ℓ/min
Sample gas temperature	0 to 55°C
Purging gas flow rate	1ℓ/min (to be flowed as occasion demands)
Warmup time	Approx. 2 hours
External dimensions	200 x 250 x 541 (H x W x D) mm
Weight	Approx. 11 kg
Finish Color	MUNSELL N1.5

Remarks: For combinations of measuring ranges for the dualcomponent analyzer, inquiry should be made to the manufacturer.

SPECIFICATIONS FOR MODEL 10A ROCK MOUNTED CHEMILUMINESCENT NO-NO_x GAS ANALYZER

Sensitivity	Each instrument is equipped with the following ranges: 0 - 2.5 ppm 0 - 10 ppm 0 - 25 ppm 0 - 100 ppm 0 - 250 ppm 0 - 1000 ppm 0 - 2500 ppm 0 - 10000 ppm
Accuracy	Derived from the NO or NO_2 calibration gas, ±1% of fullscale
Response time (0-90%)	1.5 seconds - NO Mode
Typical	1.7 seconds - NO_x Mode
Output	0 - 10mV and 0 - 10V
Zero Drift	Negligible after 1/2-hour warm-up
Linearity	±1% of full scale
Input Power Requirements	115v/50Hz; 115v/60Hz

APPENDIX H

PROCEDURES

9. Entropy Environmentalists, Inc. Traverse Point Study. EPA Contract No. 68-02-3172. June 1977. 19 p.

10. Brown, J. and K. Yu. Test Report: Particulate Sampling Strategy in Circular Ducts. Emission Measurement Branch, Emission Standards and Engineering Division. U.S. Environmental Protection Agency, Research Triangle Park, NC. 27711. July 31, 1980. 12 p.

11. Hawksley, P.G.W., S. Badzioch, and J.H. Blackett. Measurement of Solids in Flue Gases. Leatherhead, England, The British Coal Utilisation Research Association, 1961. p. 129-133.

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METHOD 2—DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

1. *Principle and Applicability*

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. *Apparatus*

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

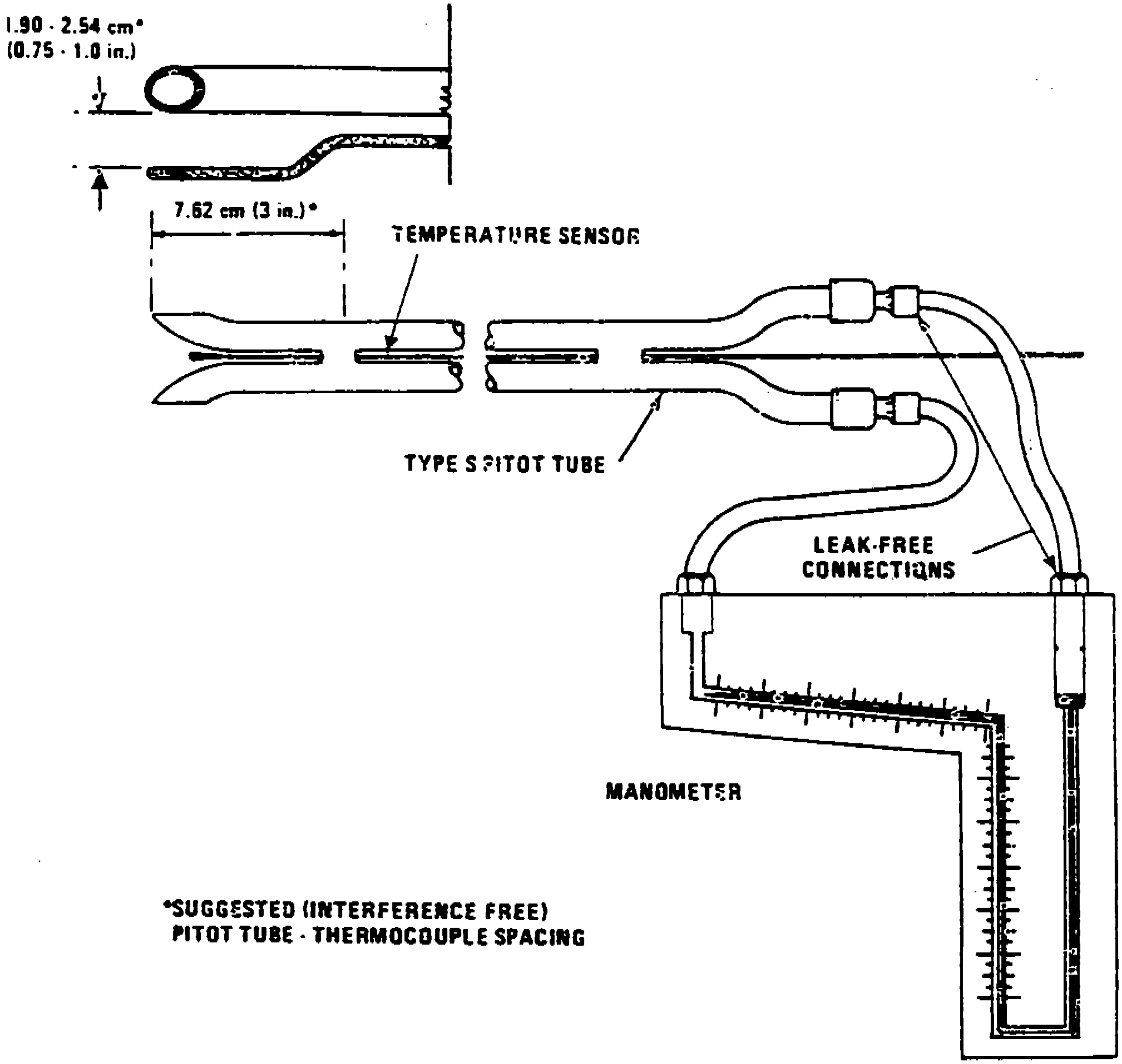


Figure 2-1. Type S pitot tube manometer assembly.

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g., stainless steel). It is recommended that the external tubing diameter (dimension D_t Figure 2-2b) be between 0.48 and 0.95 centimeter (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

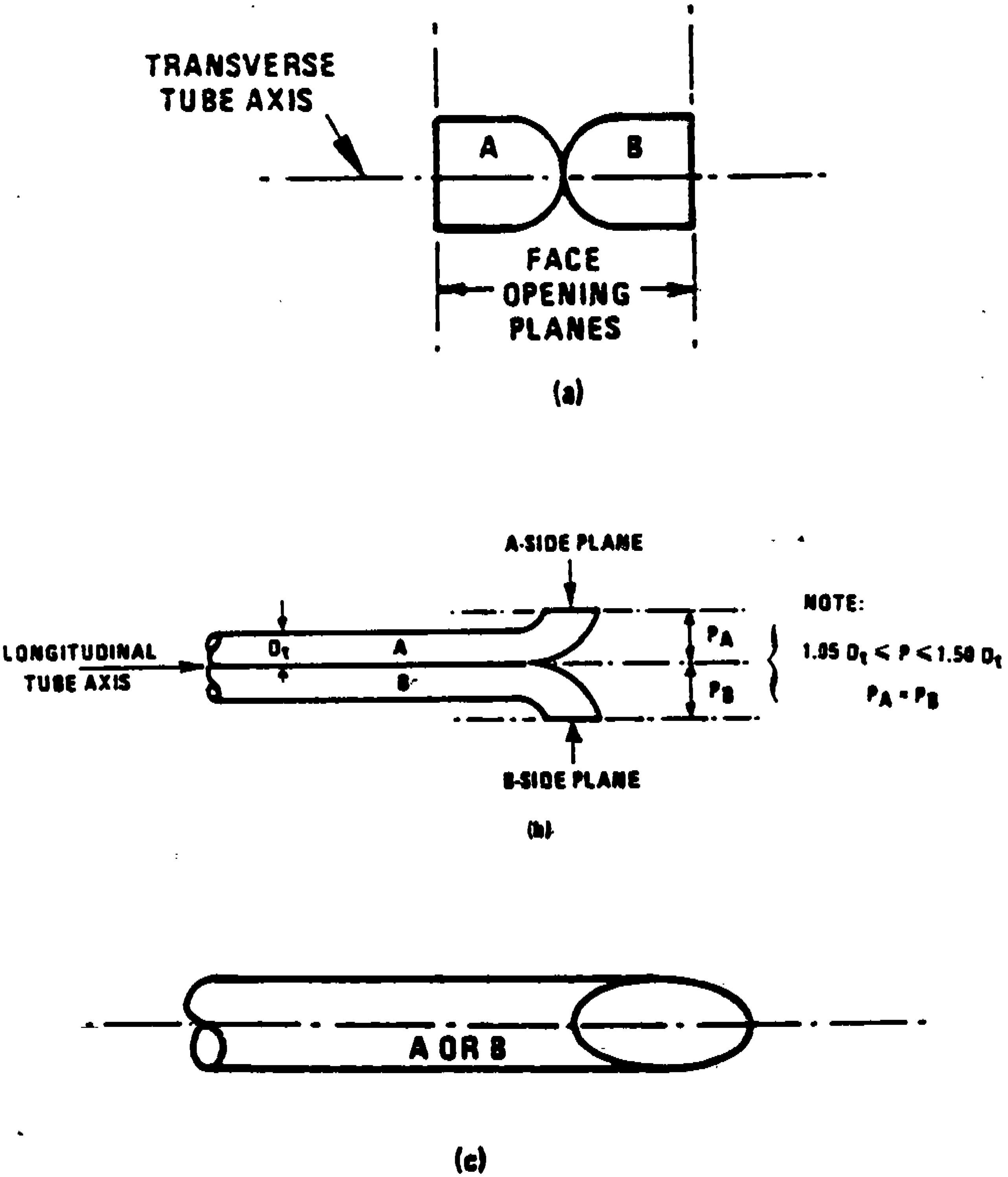


Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

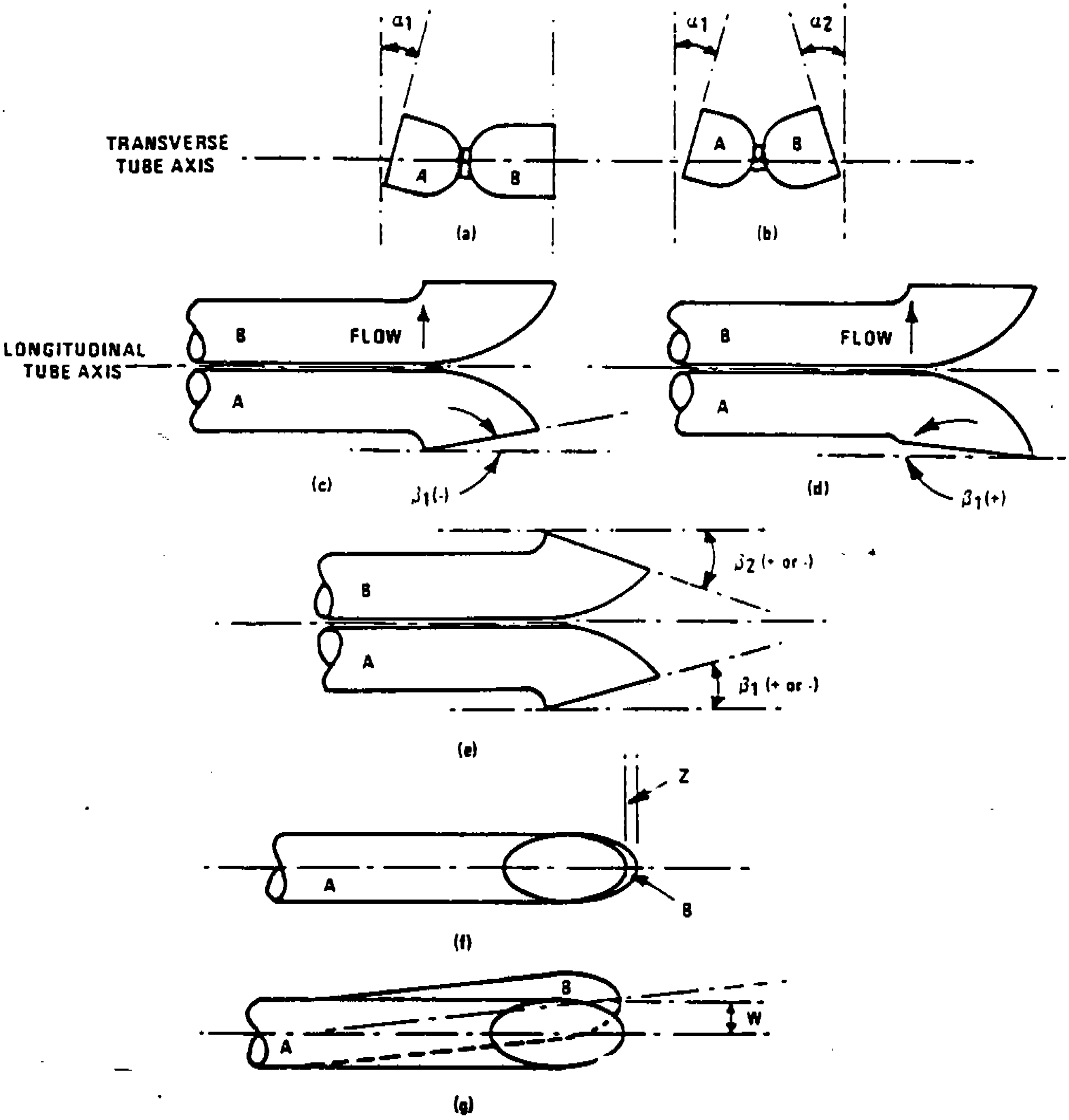


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of Cp(s) so long as $\alpha 1$ and $\alpha 2 < 10°$, $\beta 1$ and $\beta 2 < 5°$, $z < 0.32$ cm (1/8 in.) and $w < 0.08$ cm (1/32 in.) (citation 11 in Section 6).

A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same (±5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0-to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T=\frac{\sum_{i=1}^{n}\sqrt{\Delta p_i+K}}{\sum_{i=1}^{n}\sqrt{\Delta p_i}}$$

Where:

Δp_i=Individual velocity head reading at a traverse point, mm H_2O (in. H_2O).

n=Total number of traverse points.

K=0.13 mm H_2O when metric units are used and 0.005 in. H_2O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

NOTE: If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge, capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. 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) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vice-versa for elevation decrease.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99±0.01.

2.7.1 Hemispherical (shown in Figure 2-4), ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon *D*, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 *D*), equally spaced in a piezometer ring configuration.

2.7.5 Ninety degree bend, with curved or mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O). For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O) for Δp values between 1.3 and 25 mm H_2O (0.05 and 1.0 in. H_2O), and to the nearest 1.3 mm H_2O (0.05 in. H_2O) for Δp values above 25 mm H_2O (1.0 in. H_2O). A special, more sensitive gauge will be required to read Δp values below 1.3 mm H_2O [0.05 in. H_2O] (see Citation 18 in Section 6).

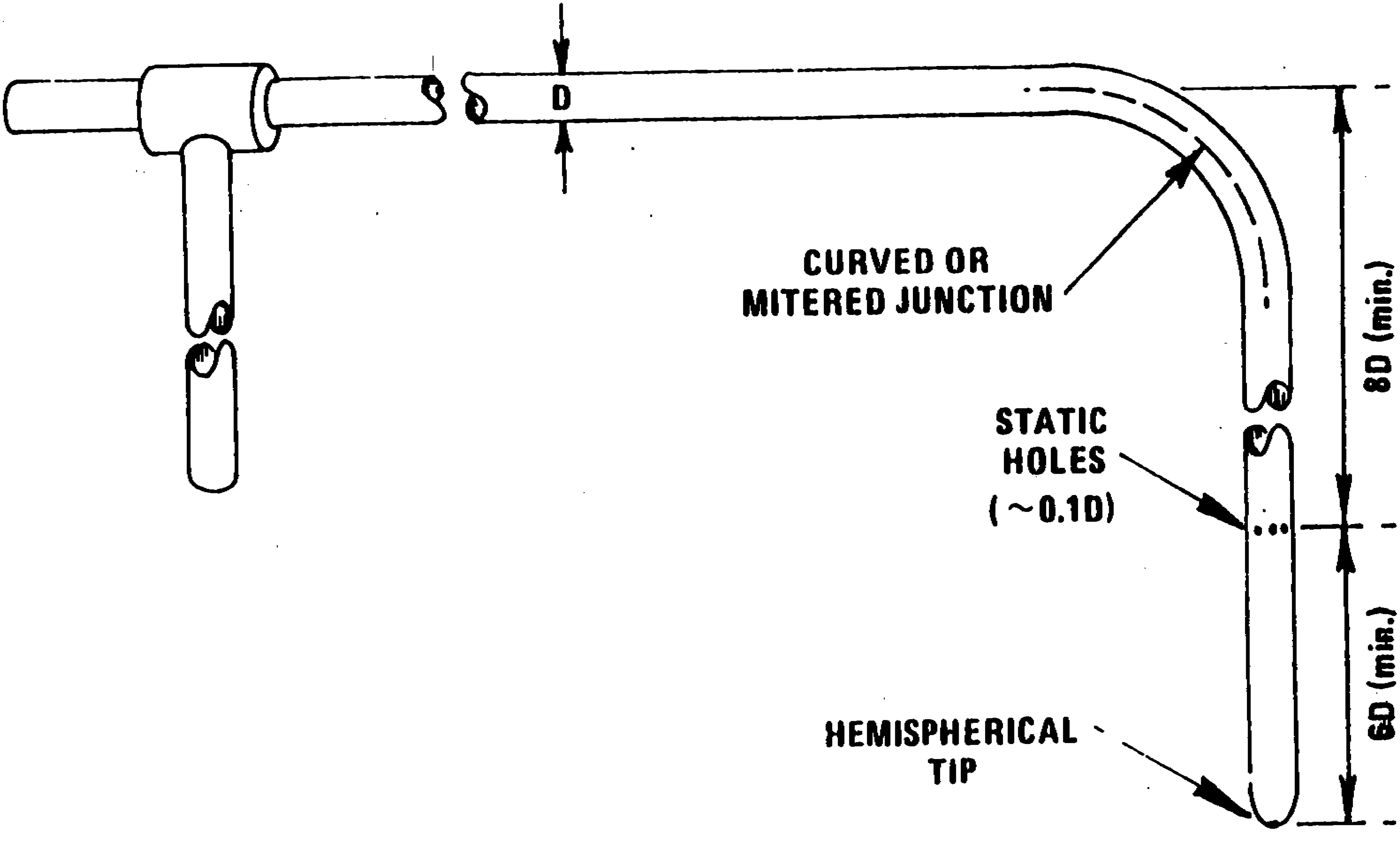


Figure 2-4. Standard pitot tube design specifications.

3. *Procedure*

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak-check procedures, subject to the approval of the Administrator, may be used.

3.2 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. Record all necessary data as shown in the example data sheet (Figure 2-5).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

PLANT ______________________________

DATE ____________ RUN NO. ____________

STACK DIAMETER OR DIMENSIONS, m(in.) ____________

BAROMETRIC PRESSURE, mm Hg (in. Hg) ____________

CROSS SECTIONAL AREA, $m^2 (ft^2)$ ____________

OPERATORS ______________________________

PITOT TUBE I.D. NO. ____________________

AVG. COEFFICIENT, C_p = ____________

LAST DATE CALIBRATED ____________

SCHEMATIC OF STACK CROSS SECTION

Traverse Pt. No.	Vel. Hd., Δp mm (in.) H_2O	Stack Temperature		P_g mm Hg (in.Hg)	$\sqrt{\Delta p}$
		t_s, °C (°F)	T_s, °K (°R)		
		Average			

Figure 2-5. Velocity traverse data.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. *Calibration*

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

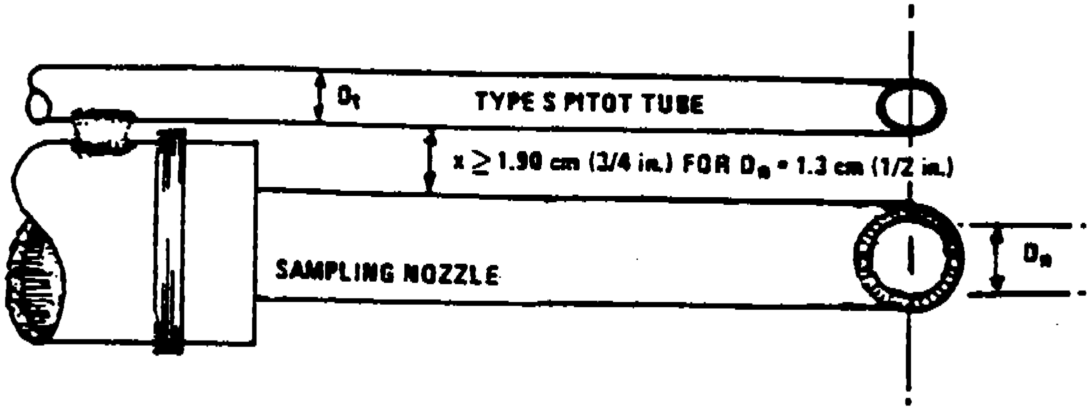
After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm ($\frac{3}{16}$ and $\frac{3}{8}$ in.) and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.4).

If D_t, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in 4.1.2 through 4.1.5 below.

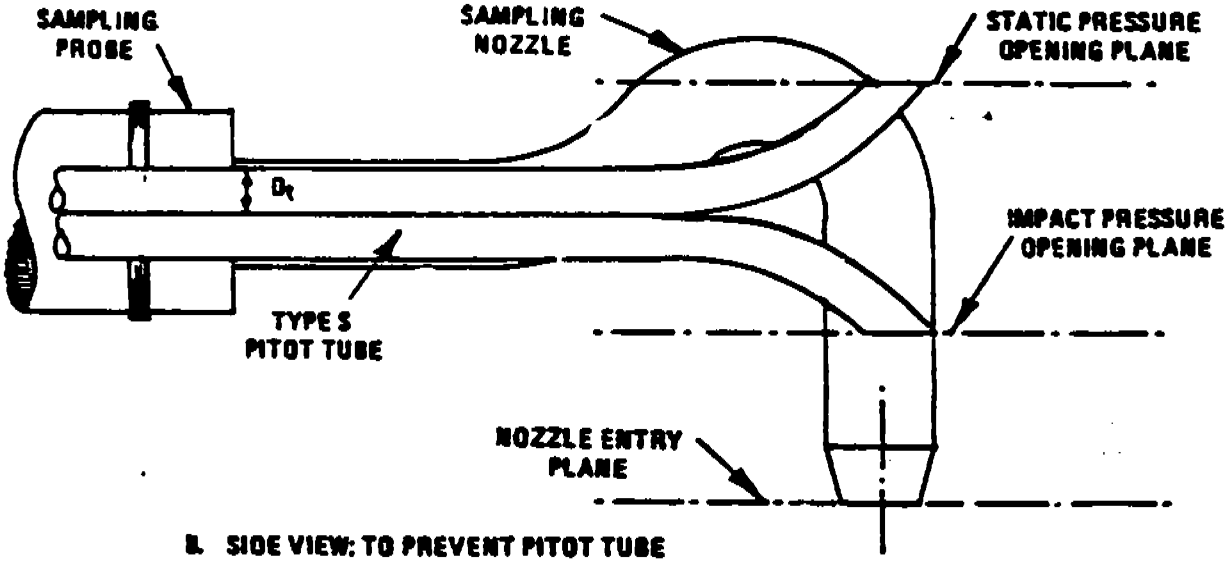
4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm ($\frac{3}{16}$ and $\frac{3}{8}$ in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:



A. BOTTOM VIEW; SHOWING MINIMUM PITOT-NOZZLE SEPARATION.



B. SIDE VIEW; TO PREVENT PITOT TUBE FROM INTERFERING WITH GAS FLOW STREAMLINES APPROACHING THE NOZZLE, THE IMPACT PRESSURE OPENING PLANE OF THE PITOT TUBE SHALL BE EVEN WITH OR ABOVE THE NOZZLE ENTRY PLANE.

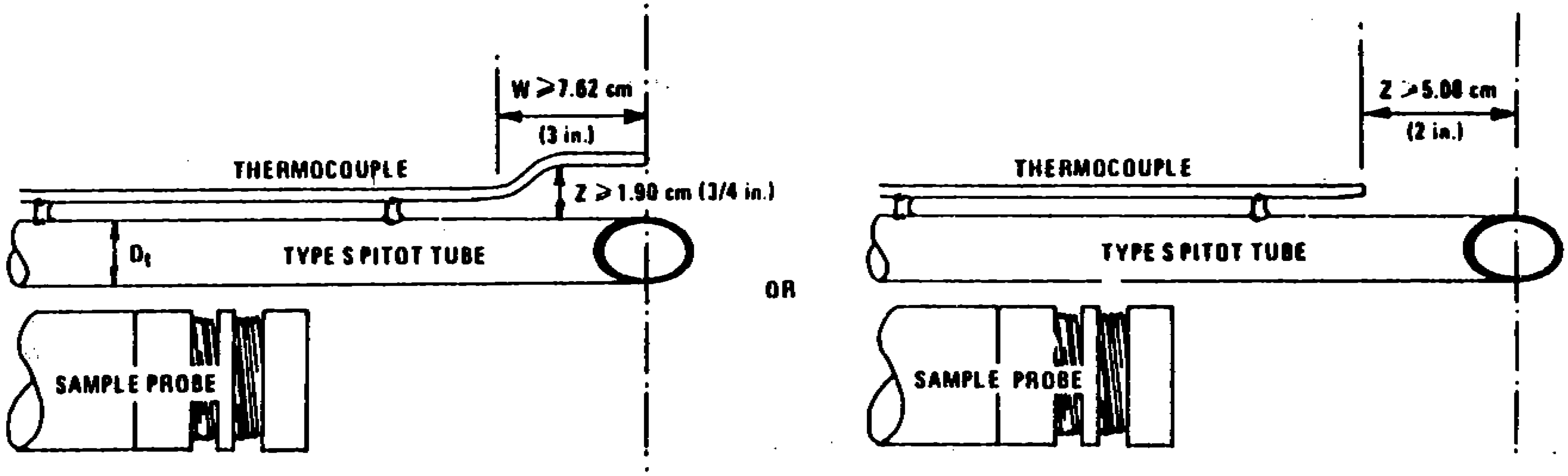


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

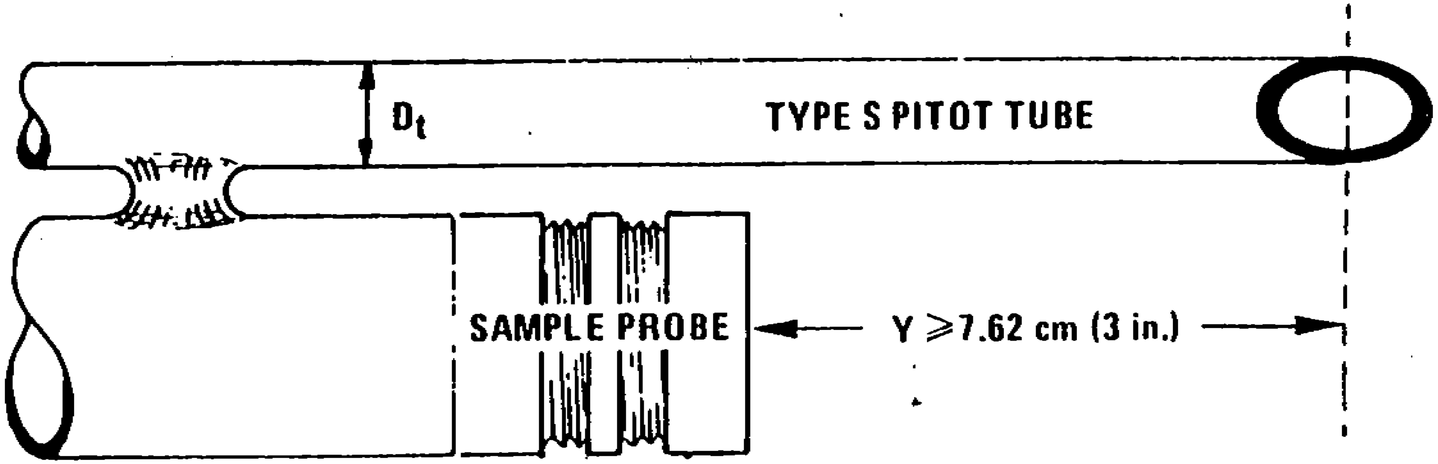


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D_e = \frac{2LW}{(L+W)} \qquad \text{Eq. 2-1}$$

Where:
D_e = Equivalent diameter
L = Length
W = Width

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ±3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ±5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read Δp_{std} and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read Δp_s and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer.

4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of Δp readings have been obtained.

4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of Δp readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

PITOT TUBE IDENTIFICATION NUMBER: ______________ DATE: ______________

CALIBRATED BY: ______________________________

	"A" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1				
2				
3				
		$\bar{C}_p$ (SIDE A)		

	"B" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p\,(\text{SIDE A}) - \bar{C}_p\,(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2-9. Pitot tube calibration data.

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$

Equation 2-2

Where:

$C_{p(s)}$=Type S pitot tube coefficient

$C_{p(std)}$=Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

Δp_{std}=Velocity head measured by the standard pitot tube, cm H_2O (in. H_2O)

Δp_s=Velocity head measured by the Type S pitot tube, cm H_2O (in. H_2O)

4.1.4.2 Calculate $\overline{C}_p$ (side A), the mean A-side coefficient, and $\overline{C}_p$ (side B), the mean B-side coefficient; calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of $C_{p(s)}$ from $\overline{C}_p$ (side A), and the deviation of each B-side value of $C_{p(s)}$ from $\overline{C}_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p(s)} - \overline{C}_p(\text{A or B})$$

Equation 2-3

4.1.4.4 Calculate δ, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma\ (\text{side A or B}) = \frac{\sum_{1}^{3} |C_{p(s)} - \overline{C}_p(A \text{ or } B)|}{3}$$

Equation 2-4

4.1.4.5 Use the Type S pitot tube only if the values of δ (side A) and δ (side B) are less than or equal to 0.01 and if the absolute value of the difference between $\overline{C}_p$ (A) and $\overline{C}_p$ (B) is 0.01 or less.

4.1.5 Special considerations.

4.1.5.1 Selection of calibration point.

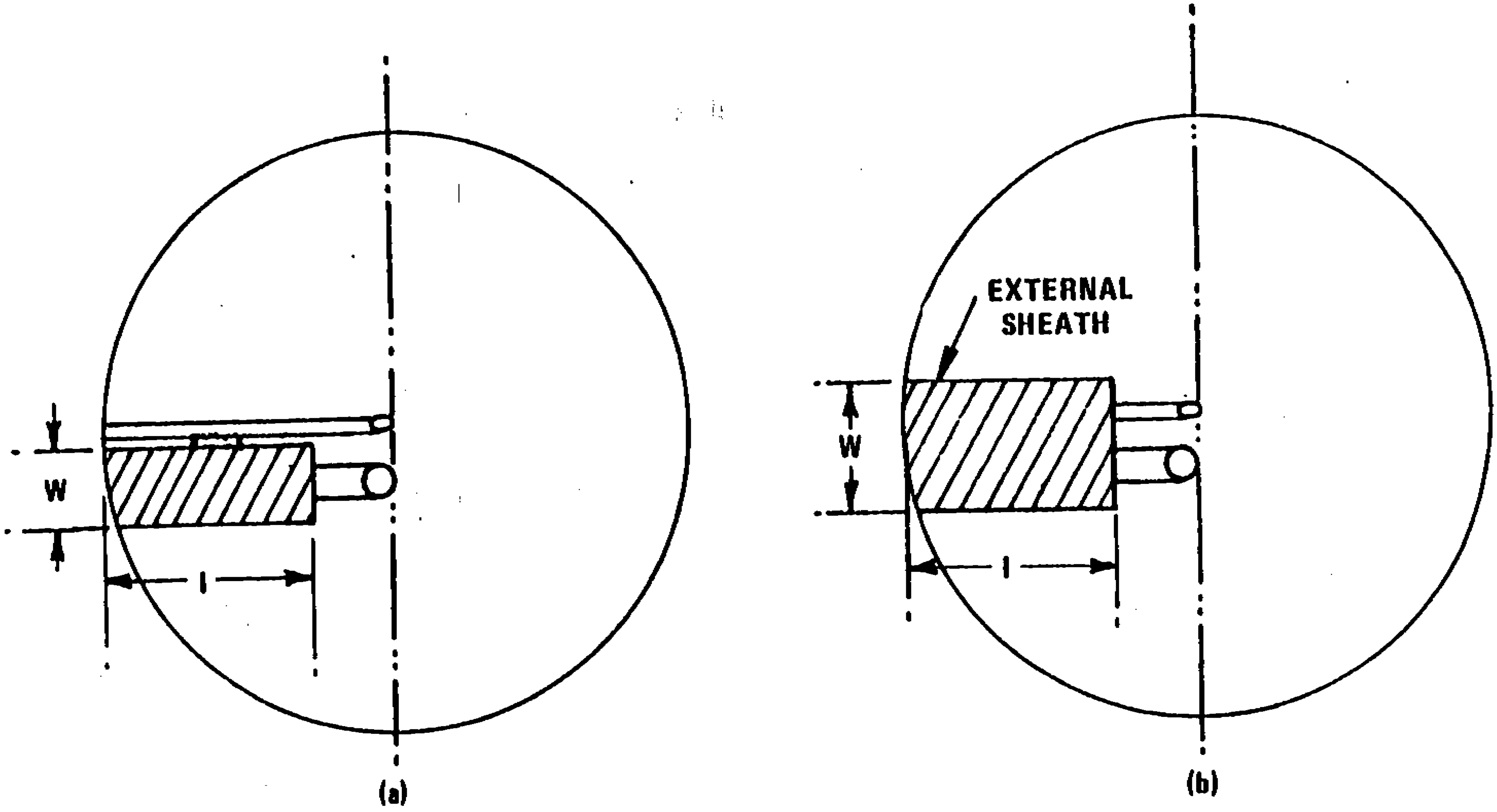
4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., $\overline{C}_p$ (side A) and $\overline{C}_p$ (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6 and 2-8).

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_{p(s)}$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or ¼ in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (δ) value of 0.01 or less (see Section 4.1.4.4).



$$\text{ESTIMATED SHEATH BLOCKAGE (\%)} = \left[\frac{l \times W}{\text{DUCT AREA}}\right] \times 100$$

Figure 2-10. Projected-area models for typical pitot tube assemblies.

4.1.6 Field Use and Recalibration.

4.1.6.1 Field Use.

4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.

4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $C_{p(s)}$. Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 12 inches (Citation 16 in Section 6).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.

4.2 Standard pitot tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of an assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).

4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405° C (761° F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator.

If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

A = Cross-sectional area of stack, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant,

$$34.97 \frac{\text{m}}{\text{sec}} \left[\frac{(g/g\text{-mole})(\text{mm Hg})}{(^\circ\text{K})(\text{mm H}_2\text{O})} \right]^{1/2}$$

for the metric system and

$$85.49 \frac{\text{ft}}{\text{sec}} \left[\frac{(\text{lb/lb-mole})(\text{in. Hg})}{(^\circ\text{R})(\text{in. H}_2\text{O})} \right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$$= M_d\ (1 - B_{ws}) + 18.0\ B_{ws} \qquad \text{Eq. 2-5}$$

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

P_g = Stack static pressure, mm Hg (in. Hg).

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

$$= P_{bar} + P_g$$

Eq. 2-6

P_{std}=Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd}=Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).

t_s=Stack temperature, °C (°F).

T_s=Absolute stack temperature, °K, (°R).

=273+t_s for metric.

Eq. 2-7

=460+t_s for English.

Eq. 2-8

T_{std}=Standard absolute temperature, 293 °K (528° R).

v_s=Average stack gas velocity, m/sec (ft/sec).

Δ_p=Velocity head of stack gas, mm H_2O (in. H_2O).

3,600=Conversion factor, sec/hr.

18.0=Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average Stack Gas Velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

Equation 2-9

5.3 Average Stack Gas Dry Volumetric Flow Rate.

$$Q_{sd} = 3,600(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s\ (avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

Eq. 2-10

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Method 3A—Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. Applicability and Principle

1.1 Applicability. This method is applicable to the determination of oxygen (O_2) and carbon dioxide (CO_2) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A sample is continuously extracted from the effluent stream: a portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). Performance specifications and test procedures are provided to ensure reliable data.

2. Range and Sensitivity

Same as Method 6C, Sections 2.1 and 2.2, except that the span of the monitoring system shall be selected such that the average O_2 or CO_2 concentration is not less than 20 percent of the span.

3. Definitions

3.1 Measurement System. The total equipment required for the determination of the O_2 or CO_2 concentration. The measurement system consists of the same major subsystems as defined in Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, Response Time, and Calibration Curve. Same as Method 6C, Sections 3.2 through 3.8, and 3.10.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. Measurement System Performance Specifications

Same as Method 6C, Sections 4.1 through 4.4.

5. Apparatus and Reagents

5.1 Measurement System. Any measurement system for O_2 or CO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe. A leak-free probe, of sufficient length to traverse the sample points.

5.1.2 Sample Line. Tubing, to transport the sample gas from the probe to the moisture removal system. A heated sample line is not required for systems that measure the O_2 or CO_2 concentration on a dry basis, or transport dry gases.

5.1.3 Sample Transport Line, Calibration Value Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.3 through 5.1.9, and 5.1.11, except that the requirements to use stainless steel, Teflon, and nonreactive glass filters do not apply.

5.1.4 Gas Analyzer. An analyzer to determine continuously the O2 or CO2 concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. The requirements for measuring and controlling the analyzer flow rate are not applicable if data are presented that demonstrate the analyzer is insensitive to flow variations over the range encountered during the test.

5.2 Calibration Gases. The calibration gases for CO_2 analyzers shall be CO_2 in N_2 or CO_2 in air. Alternatively, CO_2/SO_2, O_2/SO_2, or $O_2/CO_2/SO_2$ gas mixtures in N_2 may be used. Three calibration gases, as specified Section 5.3.1 through 5.3.3 of Method 6C, shall be used. For O_2 monitors that cannot analyze zero gas, a calibration gas concentration equivalent to less than 10 percent of the span may be used in place of zero gas.

6. Measurement System Performance Test Procedures

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 3 and change the acceptance criteria for agreement among Method 3 results to 5 percent (or 0.2 percent by volume, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the type of gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sampling System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

7. Emission Test Procedure

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 3.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias check. Maintain constant rate sampling (i.e., ± 10 percent) during the entire run. The sampling time per run shall be the same as for tests conducted using Method 3 plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.

8. Quality Control Procedures

The following quality control procedures are recommended when the results of this method are used for an emission rate correction factor, or excess air determination. The tester should select one of the following options for validating measurement results:

8.1 If both O_2 and CO_2 are measured using Method 3A, the procedures described in Section 4.4 of Method 3 should be followed to validate the O_2 and CO_2 measurement results.

8.2 If only O_2 is measured using Method 3A, measurements of the sample stream CO_2 concentration should be obtained at the sample by-pass vent discharge using an Orsat or Fyrite analyzer, or equivalent. Duplicate samples should be obtained concurrent with at least one run. Average the duplicate Orsat or Fyrite analysis results for each run. Use the average CO_2 values for comparison with the O_2 measurements in accordance with the procedures described in Section 4.4 of Method 3.

8.3 If only CO_2 is measured using Method 3A, concurrent measurements of the sample stream CO_2 concentration should be obtained using an Orsat or Fyrite analyzer as described in Section 8.2. For each run, differences greater than 0.5 percent between the Method 3A results and the average of the duplicate Fyrite analysis should be investigated.

9. Emission Calculation

For all CO_2 analyzers, and for O_2 analyzers that can be calibrated with zero gas, follow Section 8 of Method 6C, except express all concentrations as percent, rather than ppm.

For O_2 analyzers that use a low-level calibration gas in place of a zero gas, calculate the effluent gas concentration using Equation 3A-1.

$$C_{gas} = \frac{C_{MA} - C_{OA}}{C_M - C_O}(\overline{C} - C_M) + C_{MA} \qquad \text{Eq. 3A-1}$$

Where:

C_{gas} = Effluent gas concentration, dry basis, percent.
C_{MA} = Actual concentration of the upscale calibration gas, percent.
C_{OA} = Actual concentration of the low-level calibration gas, percent.
C_M = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent.
C_O = Average of initial and final system calibration bias check responses for the low-level gas, percent.
$\overline{C}$ = Average gas concentration indicated by the gas analyzer, dry basis, percent.

10. Bibliography

Same as bibliography of Method 6C.

METHOD 7E—DETERMINATION OF NITROGEN OXIDES EMISSIONS FROM STATIONARY SOURCES (INSTRUMENTAL ANALYZER PROCEDURE)

1. *Applicability and Principle*

1.1 Applicability. This method is applicable to the determination of nitrogen oxides (NO_x) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A gas simple is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental chemiluminescent analyzer for determination of NO_x concentration. Performance specifications and test procedures are provided to ensure reliable data.

2. *Range and Sensitivity*

Same as Method 6C, Sections 2.1 and 2.2.

3. *Definitions*

3.1 Measurement System. The total equipment required for the determination of NO_x concentration. The measurement system consists of the following major subsystems:

3.1.1 Sample Interface, Gas Analyzer, and Data Recorder. Same as Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.1.2 NO_2 to NO Converter. A device that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO).

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, and Response Time. Same as Method 6C, Sections 3.2 through 3.8.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. *Measurement System Performance Specifications*

Same as Method 6C, Sections 4.1 through 4.4.

5. *Apparatus and Reagents*

5.1 Measurement System. Any measurement system for NO_x that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe, Sample Line, Calibration Valve Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.1 through 5.1.9, and 5.1.11.

5.1.2 NO_2 to NO Converter. That portion of the system that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO). An NO_2 to NO converter is not necessary if data are presented to demonstrate that the NO_2 portion of the exhaust gas is less than 5 percent of the total NO_x concentration.

5.1.3 NO_x Analyzer. An analyzer based on the principles of chemiluminescence, to determine continuously the NO_x concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer.

5.2 NO_x Calibration Gases. The calibration gases for the NO_x analyzer shall be NO in N_2. Three calibration gases, as specified in Sections 5.3.1 through 5.3.3. of Method 6C, shall be used. Ambient air may be used for the zero gas.

6. *Measurement System Performance Test Procedures*

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Gas Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 7, and change all 5 percent performance values to 10 percent (or 10 ppm, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sample System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

6.4 NO_2 to NO Conversion Efficiency. Unless data are presented to demonstrate that the NO_2 concentration within the sample stream is not greater than 5 percent of the NO_x concentration, conduct an NO_2 to NO conversion efficiency test in accordance with Section 5.6 of Method 20.

7. *Emission Test Procedure*

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 7.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the system calibration drift test. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as the total time required to perform a run using Method 7, plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed, to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.

8. *Emission Calculation*

Follow Section 8 of Method 6C.

9. *Bibliography*

Same as bibliography of Method 6C.

APPENDIX I

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 3

$$\%EA = \frac{100(\%O_2 -).5\%\ CO)}{0.264\%\ N_2 - \%O_2 + 0.5\%\ CO}$$

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

$$M_s = M_d\ (I - B_{ws}) + 0.18\ B_{ws}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

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

Y = 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

$\overline{V}_s$ = Average actual stack gas velocity, FT/SEC

vp_{tdb} = Vapor pressure at T_{db}, IN. HG.

vp_{twb} = Vapor pressure at T_{wb}, IN. HG

$\overline{\Delta H}$ = Average pressure differential across the orifice meter, IN. WC.

ΔP = Velocity pressure of stack gas, IN. WC.

Υ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

CALCULATION EQUATIONS

METHOD 7

$$V_{m(std)} = 17.64\ (V_f - 25)\ [\frac{p_f}{T_f} - \frac{P_i}{T_i}]$$

$$C_s = 6.243\ x\ 10^{-5}\ \frac{M}{V_{m(std)}}$$

$$E = \frac{2090\ C_s F}{20.9\ -\ \overline{B}'_{O_2}}$$

$$C_s\ (GR/DSCF) = 7000\ C_s$$

$$C_s\ (MG/DSCM) = 1.60186\ x\ 10^7\ C_s$$

$$C_s\ (ppm\text{-}dry) = 8.37552\ x\ 10^6\ C_s$$

$$C_s\ (ppm\text{-}3\%\ O_2) = 8.37552\ x\ 10^6\ C_s\ \{1 + [\frac{\overline{B}'_{O_2} - 3}{20.9\ -\ B'_{O_2}}]\}$$

$$C_s\ (ppm\text{-}wet) = 8.37552\ x\ 10^6\ C_s\ (1 - \frac{MC}{100})$$

SYMBOLS

$\bar{B}\ O_2$ = 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/10^4BTU

M = Mass of nitrogen oxides as nitrogen dioxide in gas sample, ug

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, °R

T_i = Initial absolute temperature in flask, °R

V_f = Volume of flask and valve, cc

$V_{m(std)}$ = Sample volume at standard conditions, dry basis, cc

		LP - Dungannon			Report No. 4-2557				
		Oxides of Nitrogen							
		LB/HR Calculations							
RUN	NOx ppm	Flow	LB/DSCF	LB/HR					
1	21.8	33213	2.6E-06	5.186871					
2	20.2	33079	2.41E-06	4.786792			M	(MOLECULAR WT)	
3	33	35427	3.94E-06	8.375084		NO2	46.01		
						HCL	36.458		
						SO2	64.06		
						CO	28		
						CO2	44		
						CH4	16		
						Ammonia	17.031		

APPENDIX J

SAMPLING TRAIN CALIBRATION DATA

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: April 1, 1994

Meter Box No. : CEM2 Trailer (Rockwell Dry Test Meter Serial No. 1676425)

Date of Last Calibration: August 11, 1993
Calibration Technician: E. Trowbridge
Wet Test Meter No.: American Meter AL-17

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
August 19, 1993	3-9754	51.232	57.800	6.568	6.568
September 14, 1993	3-1040	57.898	63.785	5.887	12.455
September 29, 1993	3-1180	63.880	70.983	7.103	19.558
November 23, 1993	3-1742	71.165	84.886	13.721	33.279
February 10, 1994	4-2086	84.907	93.383	8.476	41.755
February 15, 1994	4-2281	93.400	118.452	25.052	66.807
March 15, 1994	4-2436	118.522	125.008	6.486	73.293
March 29, 1994	4-2557	125.010	134.755	9.745	83.038

* Total volume through meter since last calibration.

Date 8-11-93

Bar. Press. 29.08 in. Hg

INTERPOLL LABORATORIES
MINIMODULE CALIBRATION SHEET
Flow Rate Range 0-0.13 CFM
(0-4 LPM)

Meter Box No. TR 2

Serial No. DTM 167642 5

Wet Test Meter No. AL-17 (.05 CF/REV)

Technician-

			**		Gas Volume Dry test meter (ft³)		Gas temperatures					
Rota-meter Reading (cc/min)	ΔP_d (IN/WC)	Gas Volume Wet Test Meter (ft³)	Cal. Index ϕ (%)	Diff. Wet Test Meter ΔP_w (in.WC)	V_{di}	V_{df}	Wet Test t_w (°F)	Dry Test t_{di} (°F)		Time θ (min/sec)	Meter Coeff. Y	Rota-meter Coeff. Z
1000	.001	.5	99.55	0.04	49.800	50.286	77	60			.9952	
1000	.001	.3	99.55	0.04	50.350	50.640	77	60			1.0007	
1000	.001	.4	99.55	0.04	50.700	51.090	78	60			.9903	
1	2	3	4	5	6	7	8	9		10/11 Average:	.9954	

Meter was in tolerance ☒

Meter was not in tolerance ☐; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Gas Meter Bimetallic Therm. Calibration/Verification*

☐ ≥ ± 5°F (Out of control) ☐ Recalibrated / /

☐ ≤ ± 5°F (in control) ☐ No action required

Temp Comp at 60°F

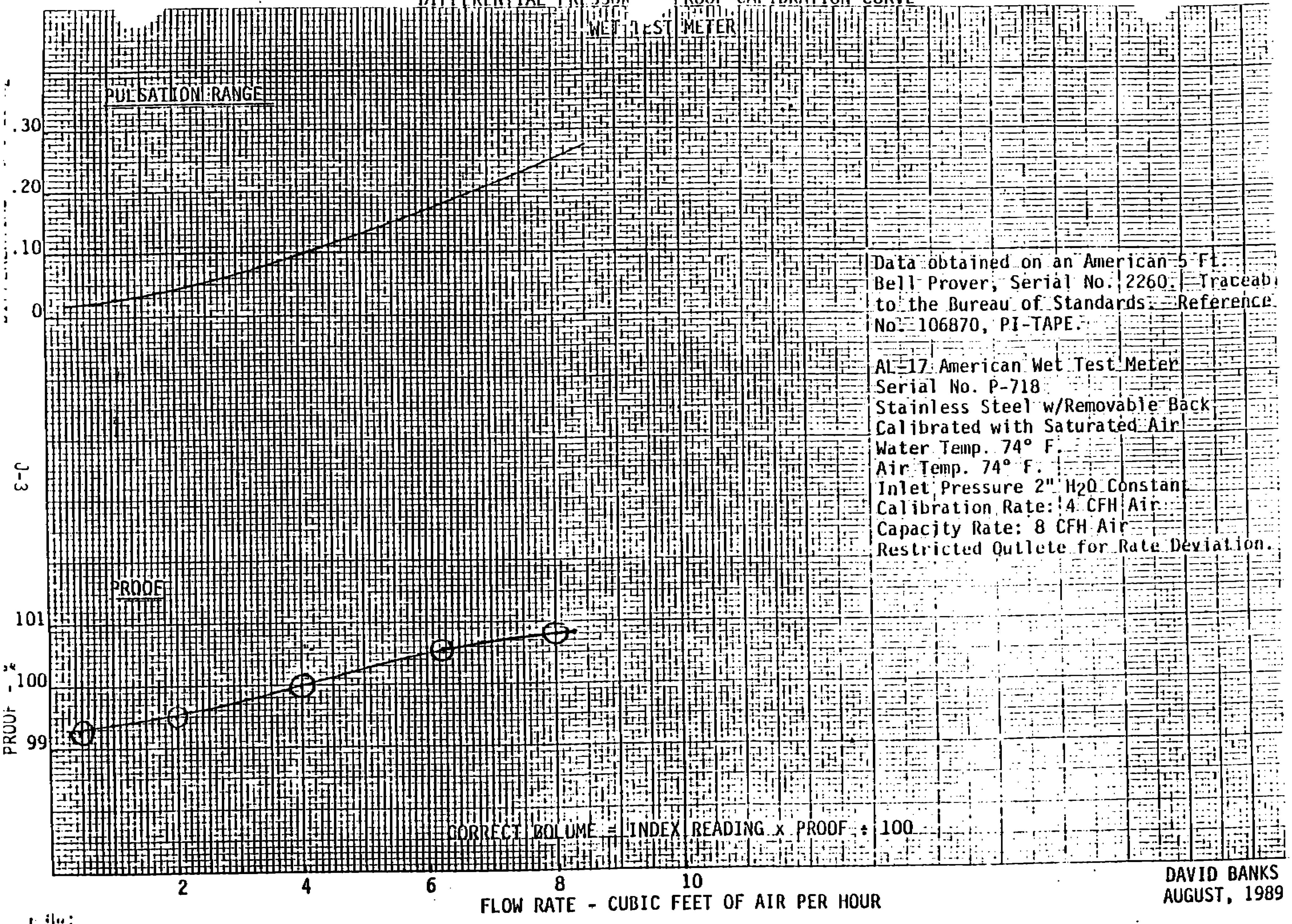
Approved by Date 8/10/93

* Verified against mercury in glass thermometer or calibrated platinum resistance thermometer.

** Based on AL-17 wet test meter calibration in August 1989 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102R 8.

DIFFERENTIAL PRESSURE PROOF CALIBRATION CURVE
WET TEST METER



Data obtained on an American 5 Ft. Bell Prover, Serial No. 2260. Traceab to the Bureau of Standards. Reference No. 106870, PI-TAPE.

AL-17 American Wet Test Meter
Serial No. P-718
Stainless Steel w/Removable Back
Calibrated with Saturated Air
Water Temp. 74° F.
Air Temp. 74° F.
Inlet Pressure 2" H_2O Constant
Calibration Rate: 4 CFH Air
Capacity Rate: 8 CFH Air
Restricted Qutlete for Rate Deviation.

CORRECT VOLUME = INDEX READING x PROOF ÷ 100

DAVID BANKS
AUGUST, 1989

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

PDT # 7

Unit under test:

Vendor GORDON

Model 5310-K

Serial Number 890423276-103

Range 0-2000 °F

Thermocouple Type K

Date of Calibration 7-26-93

Technician SL

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)	(%)
0	0	-1.6	1.6	0.34
100	100	95.0	5.0	0.89
200	200	198	2	0.30
300	300	295	5	0.66
400	400	392	8	0.93
500	500	491	9	0.94
600	600	592	8	0.75
700	700	692	8	0.67
800	800	796	4	0.32
900	900	896	4	0.29
1000	1000	1000	0	0.00
1100	1100	1101	1	0.06
1200	1200	1205	5	0.30
1300	1300	1304	4	0.23
1400	1400	1407	7	0.38
1500	1500	1503	3	0.15
1600	1600	1602	2	0.10
1700	1700	1695	5	0.23
1800	1800	1791	9	0.37
1900	1900	1882	18	0.76
2000				
2100				
		Averages:	5.4	0.43

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.

Interpoll Laboratories, Inc.

Temperature Measurement Device
Calibration Sheet

Unit under test:

Vendor FLUKE

Model 51 Serial Number PDT 16

Range -328 to 2498 °F Thermocouple Type K

Date of Calibration 2-18-94 Technician BOB

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)	(%)
0	0	-6.2	-6.0	-1.30
100	100	94	6	107
200	200	196.0	4	.60
300	300	294	6	.78
400	400	393.0	7	.81
500	500	494	6	.62
600	600	596	4	.37
700	700	694	6	.51
800	800	796	4	.31
900	900	894	6	.44
1000	1000	996	4	.27
1100	1100	1095	5	.32
1200	1200	1198	2	.12
1300	1300	1294	6	.34
1400	1400	1397	3	.16
1500	1500	1495	5	.25
1600	1600	1596	4	.19
1700	1700	1695	5	.23
1800	1800	1797	3	.13
1900	1900	1893	7	.29
2000	2000	1995	5	.20
2100	2100	2092	8	.31
		Averages:	4.54	.32

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.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 3/-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° 0
7. B_2 < 5° 0

8. Z <.125" 0
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) ,755 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:

4-8-93

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. 31-6

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° 0
7. B_2 < 5° 0

8. Z <.125" 0
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) .750 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:

4-8-93

Inspected by:

CFR Title 40 Part 60 Appenidix A Method 2

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 2-18-74

Technician BOB

Mercury Column Barometer No. LAB 1

Aneroid Barometer No. 10723029

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
2901	76	.125	28.885	28.83	.055

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

APPENDIX K

PROCESS DATA

DUNGANNON TESTING 3-29-94
PROCESS DATA

DUNGANNON TESTING 3-29-94

TEST SCHEDULE

DUNGANNON DRYER TESTING 3-29-94, NOx

DATE	POLLUTANT	RUN #2	RUN #3	RUN #5
3-29	NOX	1020-1120	1140-1240	1905-1005

note: run no 1 was voided due to analyzer calibration
run no. 4 was aborted due to dryer shutdown

PROCESS DATA SUMMARY

DUNGANNON DRYER TESTING 3-29-94, NOx

9.59 =PLANT PRODUCTION RATE IN TONS PER HOUR
1.469 =DRY FUEL INPUT IN TONS PER HOUR
23084 =LB PER HOUR OF FURNISH PRODUCED BY DRYER
1098 =AVERAGE DRYER INLET TEMPERATURE IN DEGREES F
43% = MOISTURE CONTENT OF INCOMING WOOD
6% = MOISTURE CONTENT OF WOOD AFTER DRYING

04/12/94

MARPRODA.WK4

2

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. DRYER OPERATING DATA:

2.1 Moisture content of wet wafers.
Moisture content of dry wafers.

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

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

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

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

2.6 Type of fuel to be burned is dry fines.

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

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

2.9 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.

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

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

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

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

3. PRESS OPERATING DATA:

3.1 Board thickness.

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

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

DUNGANNON DRYER TESTING 3-29-94, NOx
DATA FOR TSP, NOX,CO, AND Formaldehyde testing
DATA TIME: START= 10:10 END= 11:20 HOURS= 1.17
START= 11:40 END= 12:50 HOURS= 1.17
START= 19:00 END= 20:10 HOURS= 1.17

BOARD WEIGHTS - LBS

WEIGHTS OF APPROXIMATELY EVERY 25TH
UNTRIMMED BOARD FROM TAPES

190	190	199
188	197	193
194	201	198
195	189	200
191	192	188
190	177	192
190	194	194
190	190	194
200	194	190
197	196	188
189	199	190
185	188	191
189	183	190

191.92 LB = AVERAGE UNTRIMMED MAT WEIGHT

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

8.9% = TRIM

PLANT PRODUCTION RATE

3.50 =HOURS DURING TESTING
48 =PRESSLOADS
384 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
67139 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
19182 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
9.59 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PRODUCT PER HR / 2000 LB)

DRYER PRODUCTION RATE:

23084 =LB OF DRYER PRODUCTION / HR (LB OF FINISHED PROD./ (1-(% TRIM + % FINES)

8.0% =%FINES
8.9% =%TRIM

42.5% = MOISTURE CONTENT OF INCOMING WOOD
5.5% = MOISTURE CONTENT OF WOOD AFTER DRYING

DUNGANNON DRYER TESTING 3-29-94, NOx
DATA FOR TSP, NOX,CO, AND Formaldehyde testing
DATA TIME: START= 10:10 END= 11:20 HOURS= 1.17
DRYER FUEL BURNING RATE

7.08 =FUEL CALIBRATION IN LB/COUNT
1453 = TOTAL COUNTS DURING TESTING HOURS
3.5 =HOURS DURING TESTING

10284 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CALIBRATION)
2938 =LB. OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED / TESTING HOURS
1.47 =TONS OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED PER HOUR / 2000 LB)
8600 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)
25.3 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

DRYER DATA SHEET

DATE 3-29-94
BY Charles Dotson

PLANT: DunGannon VA.
REVOLUTIONS per MINUTE:
FUEL CALIBRATION:
→ Arrow indicates Change in set Point

(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
A.M 7:00	215	60	1054	195	0002	3/4	3/4	3/4	38	30
7:10	215	61	1089	197	0099	3/4	3/4	3/4		
7:20	215	61	1121	194	0213	1/2	3/4	3/4		
7:30	215	60	1155	193	0284	1/2	3/4	3/4		
7:40	215	62	1155	198	0384	1/2	3/4	3/4.		
→ 7:50	204	65	1194	200	0467	1/2	3/4	3/4		
8:00	204	63	1223	196	0550	3/4	3/4	3/4	.35	5.0
8:10	204	65	1212	200	0650	3/4	3/4	3/4		
8:20	204	66	1162	202	0742	3/4	3/4	3/4		
8:30	204	67	1215	198	0901	3/4	3/4	3/4		
8:40	204	67	1215	198	0930	Full	3/4	3/4		
8:50.	204	67	1152	199	1000	Full	3/4	3/4		
9:00	204	67	1039	200	1084	3/4	3/4	3/4	.41	5.0
9:10	204	67	998	197	1150	3/4	3/4	3/4		
9:20	204	67	996	197	1235	1/2	3/4	3/4		
9:30	204	67	984	198	1325	1/2	3/4	3/4		
9:40	204	67	1027	197	1390	1/2	3/4	3/4		
→ 9:50	196	67	1051	196	1468	1/2	3/4	3/4		
10:00	196	67	1012	196	1560	1/2	3/4	3/4	40	5.0
10:10	196	67	888	201	1619	1/2	3/4	3/4		
10:20	196	67	950	195	1698	1/2	3/4	3/4		
10:30	196	67	925	196	1754	1/2	3/4	3/4		
10:40	196	67	991	195	1844	1/2	3/4	3/4		
10:50	196	67	1066	194	1910	1/2	3/4	3/4		
11:00	196	67	1070	197	2002	3/4	3/4	3/4	41	4.0
11:10	196	67	1144	196	2082	3/4	3/4	3/4		
→ 11:20	197	67	1171	197	2172	3/4	3/4	3/4		
11:30	197	67	1208	194	2254	3/4	3/4	3/4		
→ 11:40	197	67	1195	196	2350	3/4	3/4	3/4		
11:50	197	67	1163	196	2428	3/4	3/4	3/4		

DRYER DATA SHEET

DATE 3-29-94
BY Charles D[illegible]

PLANT: DunGannon VA
REVOLUTIONS per MINUTE:
FUEL CALIBRATION:

(NOTE ANY CHANGES IN SETPOINTS)

→ Arrow indicates Change in set Poin

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
→ 12:00	199	65	1167	196	2532	3/4	3/4	3/4	41	60
12:10	199	66	1062	199	2612	3/4	3/4	3/4		
12:20	199	65	1083	199	2709	3/4	3/4	3/4		
12:30	199	65	1078	210	2780	3/4	3/4	3/4		
12:40	199	65	1065	196	2870	3/4	3/4	3/4		
1250	199	60	1028	206	2935	3/4	3/4	3/4		
→ 1:00	215	50	622	216	3000	1/2	3/4	3/4	40	7.0
→ 1:10	220	44	680	207	3056	1/2	3/4	3/4		
→ 1:20	205	66	1088	200	3157	1/2	1/2	1/2		
1:30	205	67	1100	200	3200	1/2	1/2	1/2		
→ 1:40	199	67	1102	200	3296	1/2	1/2	1/2		
1:50	199	67	1025	2.00	3370	1/2	1/2	1/2		
→ 2:00	199	67	1006	200	3474	3/4	1/2	1/2	.46	50
210	200	67	971	199	3530	3/4	1/2	1/2		
→ 2:20	199	67	944	200	3596	3/4	1/2	1/2		
→ 2:30	196	67	947	197	3664	3/4	1/2	1/2		
2:40					3730	3/4	1/2	1/2		
2:50										
3.00									45	
→ 3:10	220	36	440	192	3754	5/4	1/2	1/2		
→ 3:20	205	65	1045	201	3833	3/4	1/2	1/2		
3:30	205	60	1137	190	3915	3/4	1/2	1/2		
→ 3:40	200	66	1169	197	3991	3/4	1/2	1/2		
→ 3:50	205	47	965	206	4109	1/2	1/2	1/2		
→ 4:00	218	38	738	214	4158	1/4	1/2	1/2	45	7.0
4:10										
420										
4:30										
→ 4:40	218	65	913	210	4210	1/2	1/2	1/2		
→ 4:50	218	65	976	210	4320	1/2	1/2	1/2		

Screener Down

Wood conditioning blower Belts broke

Electrical Problem Breakdown

DRYER DATA SHEET

DATE 3-29-94

BY R. L. Johnson

PLANT: Dungannon, Va.

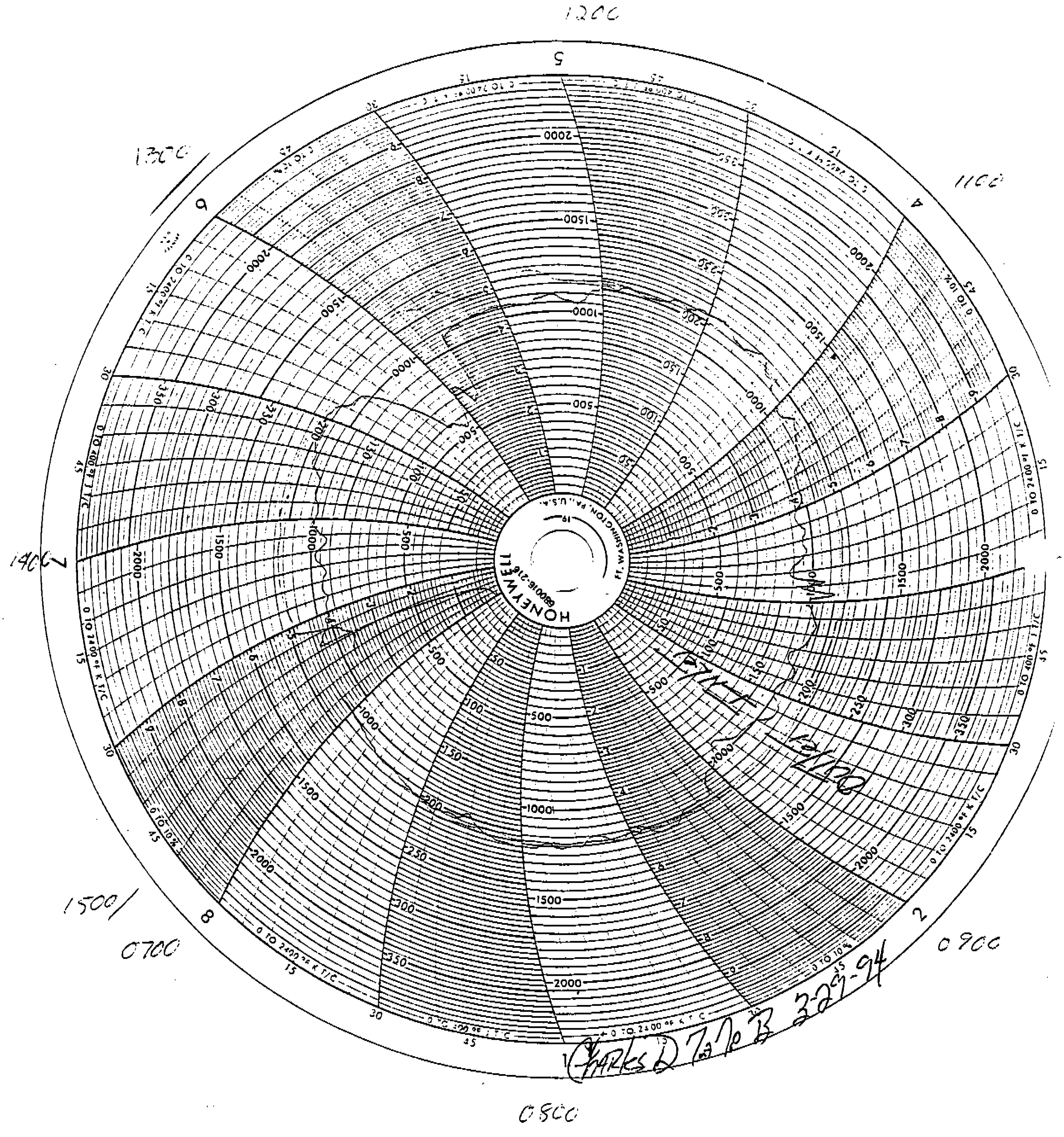
REVOLUTIONS per MINUTE:

FUEL CALIBRATION:

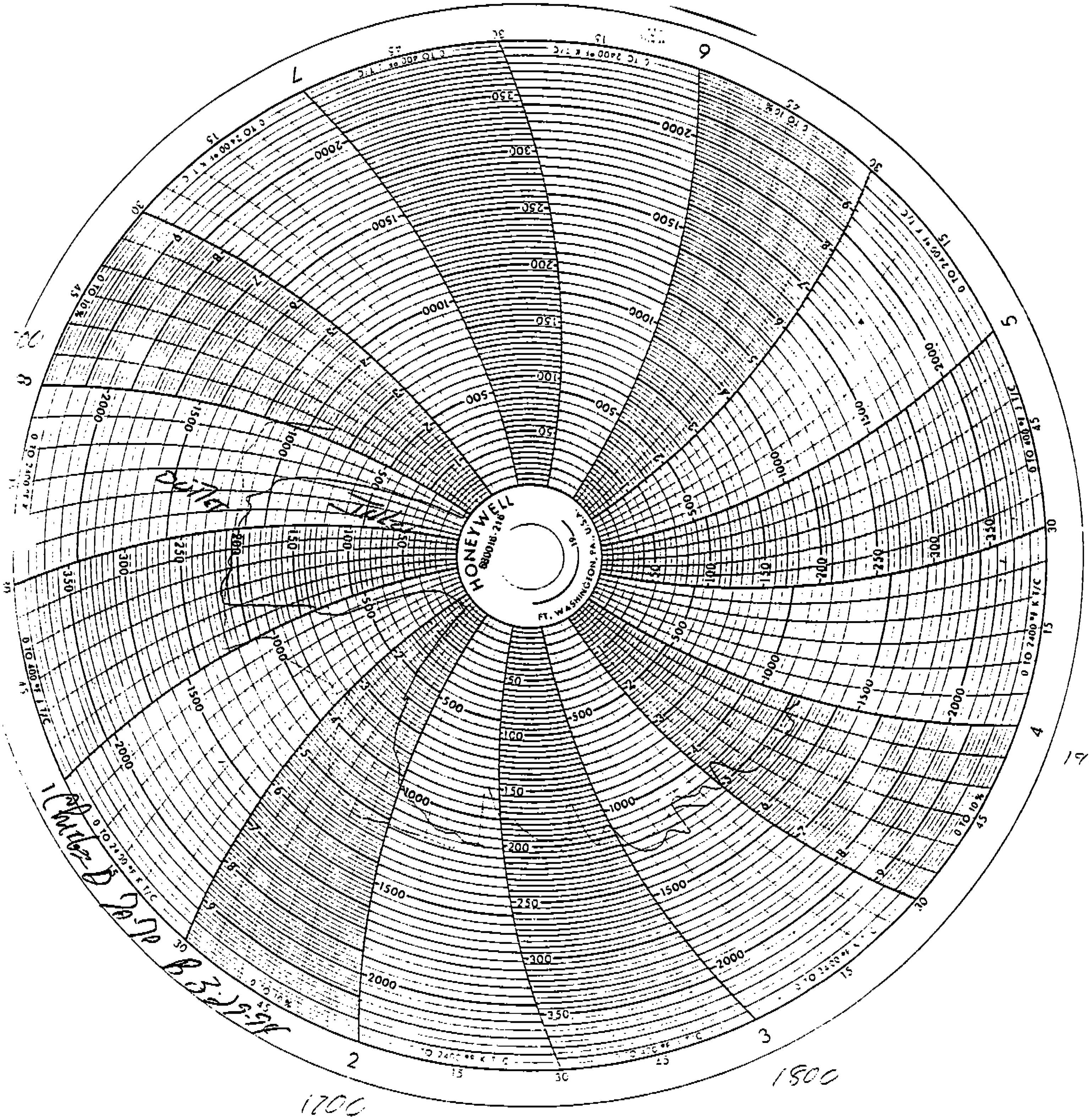
(NOTE ANY CHANGES IN SETPOINTS)

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
am 7:00	197	67	1211	203	0000	3/4	1/2	1/2	42.0	6.0
7:10	197	67	1220	200	106	1/4	1/2	1/2		
7:20	197	67	1179	204	197	1/4	1/2	1/2		
7:30	197	67	1635	205	274	1/4	1/2	1/2		
7:40	197	67	1141	203	365	1/2	1/2	1/2		
7:50	197	67	1148	200	437	1/2	1/2	1/2		
8:00	197	67	1111	201	524	1/2	1/4	1/4	46.0	6.0
8:10	197	67	1161	196	613	Full	1/2	1/2		
8:20	197	67	1150	198	710	Full	1/2	1/2		
8:30	197	67	1188	196	798	Full	1/2	1/4		
8:40	197	67	713	189	872	Full	1/2	1/4		
8:50	DOWN									
9:00	197	67	1243	207	872	1/2	1/4	1/4	43.0	6.0
9:10	220	70	1281	209	872	Full	1/2	1/4		
9:20	220	72	1397	205	"	1/2	1/4	1/4		
9:30	220	72	1234	199	"	1/2	1/4	1/4		
9:40	220	70	1250	192	"	1/2	1/2	1/4		
9:50	220	70	1345	205	"	Full	1/2	1/2		
10:00	220	70	1330	207	"	1/2	1/2	1/2	30.0	4.0
10:10	220	70	1351	215	"	1/2	1/2	1/2		
10:20	220	70	1338	206	"	1/2	1/2	1/2		
10:30	220	70	1411	200	"	1/2	1/2	1/2		
10:40	220	70	1407	197	"	1/2	1/2	1/2		
10:50	220	70	1323	203	874	1/4	1/2	1/2		
11:00	200	76	1174	198	908	1/4	1/2	1/2	40.0	5.0
11:10	200	76	1322	210	1008	1/4	1/2	1/2		
11:20	200	76	1246	198	1108	1/2	1/2	1/2		
11:30	200	76	1254	199	1220	1/2	1/2	1/2		
11:40	200	76	1260	204	1311	1/2	1/2	1/2		
11:50	200	76	1267	211	1404	Full	1/2	1/2		

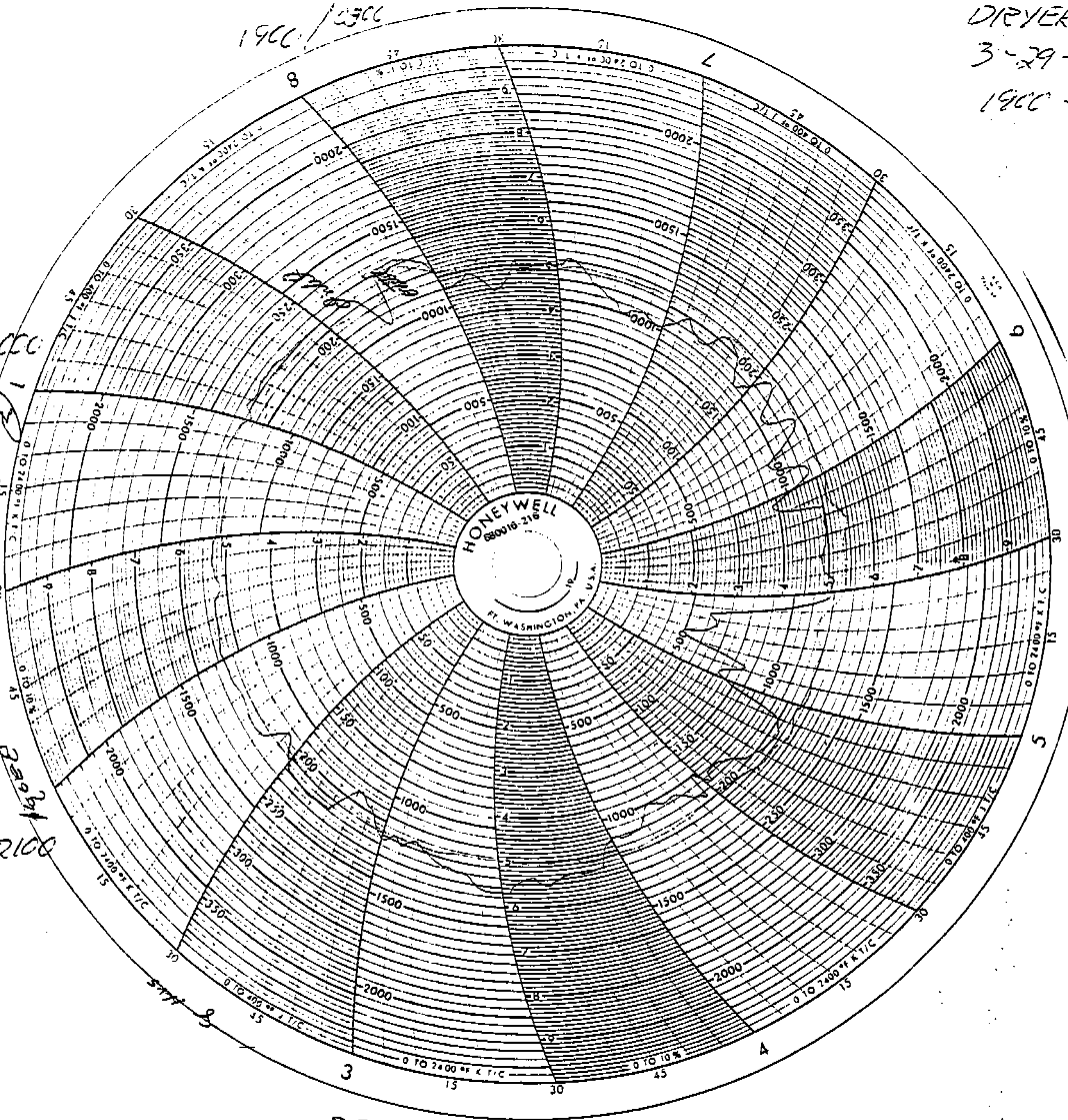
DRYER CHART
3-29-94
0700-1500



DRYER CHART
3-29-94
1500 - 1900



DRYER CHART
3-29-94
1900-0300



1900/0300

2000

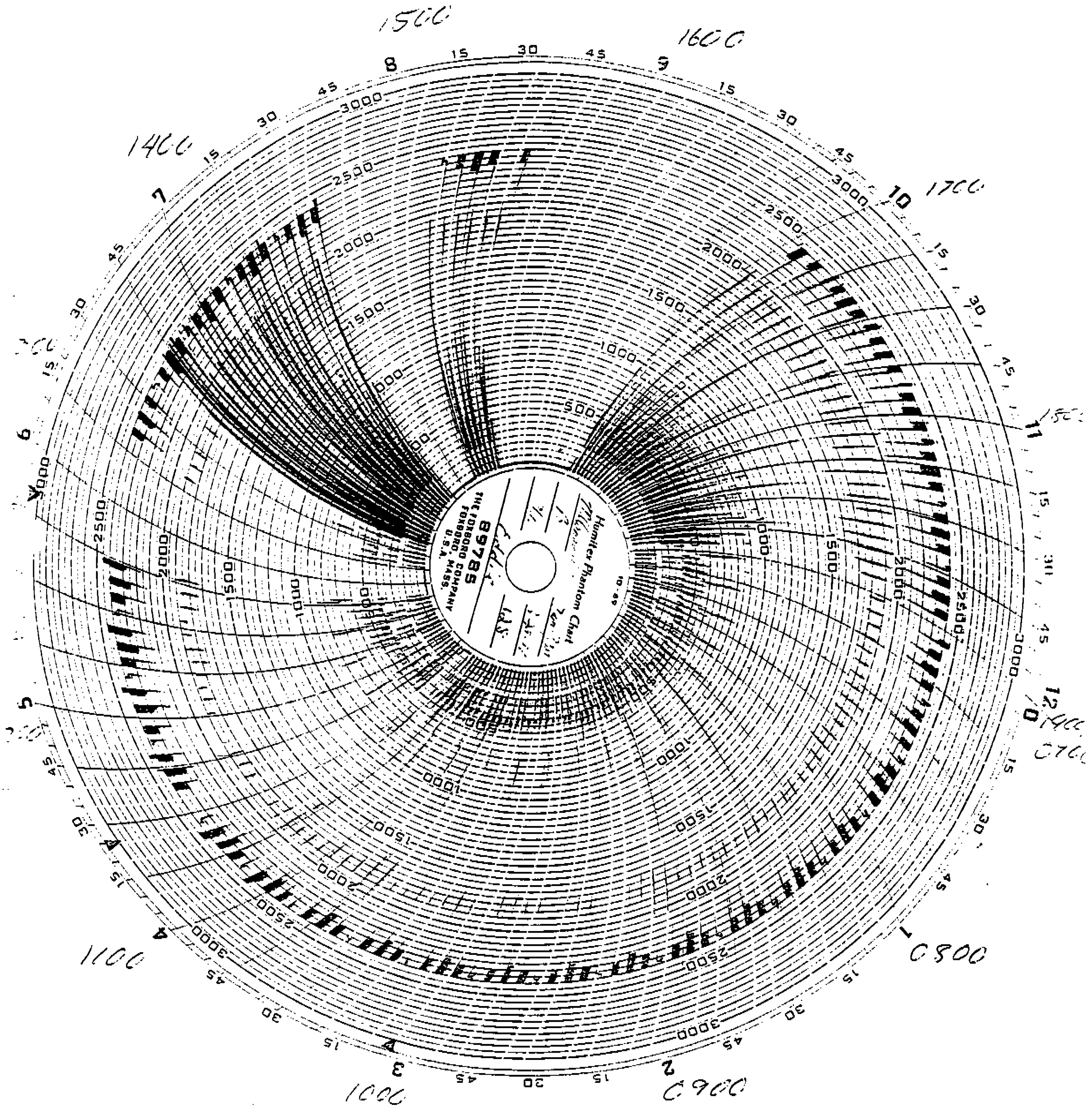
3-29-94

2100

8 Hrs

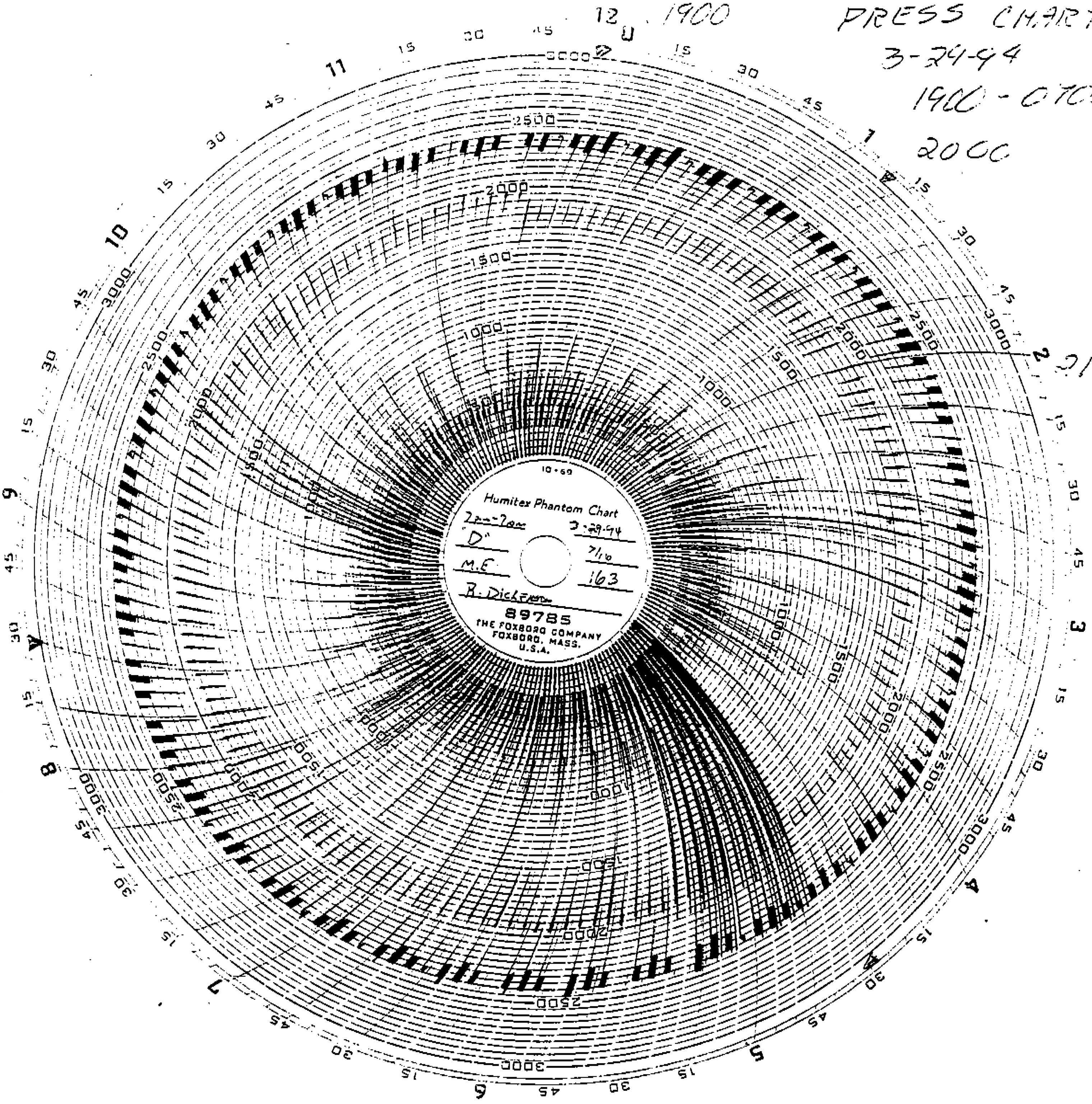
2200

PRESS CHART
3-29-94
0700-1900



PRESS LOADS
1010 - 1120 = 16
1140 - 1250 = 16

PRESS CHART
3-24-94
1900 - 0700



1900

2000

2100

PRESSLOADS
1900 - 2010 = 16

ISIANA-PACIFIC CORPORATION

GANNON, VIRGINIA

PRESS REPORT

RATOR Eddie SHIFT 7am-7pm CREW B DATE 3-29-94

KNESS: 7/16

PRESS LOADS 128 151,922

BLENDER SHUTDOWNS CORE 37

RALL TIMER:

DECOMPRESSION TIME

SURFACE 44

SS TEMP: 400

	CORE RESIN	SURFACE RESIN
BEGIN	1200979	4706583
END	1202514	4915952

LINE SPEED	FROM	TO
31	7:00	7:00

Cleaned Blender Shrouds & Tracks

Former hydraulic and radiater blown out

FCOS hydraulic unit and radiater blown out

Blender outfeed conv. tail pulleys cleaned

WNTIME		DOWNTIME (Mins.)			KEY	REASONS FOR DOWNTIME
M	TO	M	E	O		
1:29	11:34				5	to work on t-oil lines on press
:35	11:36				1	look still on injector
56	11:59				1	dropped back mat at injector
:51	1:20				29	to work on screener in dryer (Dry bins Full)
'44	3:19			-71	35	to replace bolts on wood burner
'46	5:04				-149 78	Lost power at flaker (Dry bins Full)
						149m total Down time

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

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

OTOR # OCKED OUT	FROM	TO	BRIEF DESCRIPTION OF WORK BEING DONE	INITIALS OF PERSON LOCKING OUT

(OVER) 15 K-15

OUISIANA-PACIFIC CORPORATION

UNCANNON, VIRGINIA

PRESS REPORT

OPERATOR ____ SHIFT 7p.m-7a.m CREW "D" DATE 3-29-94

HICKNESS: 7/16"

PRESS LOADS 163 = 190,172

BLENDER SHUTDOWNS
CORE 54

VERALL TIMER: ____

DECOMPRESSION TIME ____ SURFACE 50

RESS TEMP: 400°

	CORE RESIN	SURFACE RESIN
BEGIN	1202514	4913952
END	1204560	4923290

LINE SPEED	FROM	TO
31	7:00	7:00

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	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) 16 K-16

EFB READINGS

DATE 3-29-94

BY Mickey Mullins

PLANT: DUNGANNON VA.

7 AM

(Take readings every 10 minutes)

	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.
	7:00	15.0	.0	11.0	0	15.0	0.2	40	1.2	.0	2.8
	7:10	15.	0	11.0	0	15.0	0.2	40	1.0	0	2.7
	7:20	15.0	0	11.0	0	15.0	0.2	40	1.2	0	2.7
	7:30	15.0	0	11.0	0	15.0	0.2	38	1.4	0	2.8
	7:40	15.0	0	11.0	0	15.0	0.2	40	1.2	0	3.0
	7:50	15.0	0	11.0	0	15.0	0.3	39	1.2	0	3.7
	8:00	14.9	0	11.0	0	15.0	0.3	38	1.3	0	3.7
	8:10	15.0	0	11.0	0	15.0	0.3	40	1.2	0	3.3
	8:20	15.0	0	11.0	0	15.0	0.3	40	1.0	0	3.0
	8:30	15.0	0	11.0	0	15.0	0.4	40	1.0	0	3.2
T-1	8:40	15.0	0	12.0	0	15.0	0.3	39	1.1	0	3.2
	8:50	15.0	0	12.0	0	15.0	0.3	40	1.0	0	3.1
	8:00	15.0	0	11.0	0	15.0	0.2	41	1.0	0	3.1
	9:10	15.0	.0	11.0	.0	15.0	0.2	41	1.0	.0	34
	9:20	4	.3	11.0	0	15.0	0.2	41	1.0	0	3.6
	9:30	3.0	1.0	11.0	0	15.0	0.2	40	1.0	.0	.0
	9:40	2.9	0.62	11.0	0	15.0	0.2	40	1.0	.0	.0
	9:50	2.8	1.0	11.0	0	15.0	0.4	40	1.2	.0	.0
	10:00	.0	.0	11.6	0	14.4	0.2	38	1.6	.0	.0
T-1	10:10	-6	.0	11.0	0	15.0	0.2	38	1.4	.0	2.1
	10:20	70	.0	11.0	.0	15.0	0.2	38	1.6	.0	1.8
	10:30	15.0	.0	11.0	0	15.0	0.2	38	1.6	.0	0.2
	10:40	14.4	.0	11.0	.0	14.6	0.4	38	1.6	.0	.0
	10:50	12.4	0.2	11.0	.0	14.0	0.6	36	2.0	.0	.0
	11:00	13.0	0.3	11.0	.0	13.0	0.6	37	2.0	.0	0.5
	11:10	11.0	0.5	11.0	.0	11.2	0.8	37	2.0	.0	1.9
	11:20	10.0	0.5	11.0	.0	11.0	1.0	36	2.0	.0	2.0
	11:30	9.6	0.6	11.0	.0	10.2	1.0	36	2.0	.0	2.0
T-2	11:40	10.0	0.5	11.0	.0	10.6	1.0	37	2.0	.0	2.0
	11:50	9.6	0.6	11.0	.0	10.2	1.2	37	2.0	.0	2.0

EFB READINGS

DATE 3-29-94

BY Mickey Mullins

PLANT: DUNGANNON VA.

(Take readings every 10 minutes)

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.
12:00	10.0	0.7	11.0	0	11.0	1.1	38	1.8	0	2.1
12:10	11.0	0.6	11.6	0	11.3	0.8	38	1.5	0	2.0
12:20	14.0	0.2	11.0	0	13.0	0.6	38	1.4	0	2.4
12:30	15.0	0.2	11.0	0	8.9	0.3	39	1.2	0	2.9
12:40	15·0	0·2	10·0	·0	3·6	1·2	40	1·6	0	3·0
12:50	OFF									
1:00	OFF									
1:10	OFF									
1:20	15.0	0	10	0	15.0	0.3	38	1.2	0	3.3
1:30	15.0	0	10	0	15.0	0.3	39.	1.2	0	3.3
1:40	15·0	·0	10	·0	15·0	0 3	39	12	·0	3·4
1:50	15·0	·0	10	·0	15·0	0.4	40	1.0	·0	3·0
2:00	15.0	0	10	0	150	0.2	40	1.0	0	3.4
2:10	15·0	·0	10	·0	15·0	0·2	40	1·0	·0	3·4
2:20	15·0	·0	10	·0	15·0	0·2	40	1·0	·0	3·4
2:30	15·0	·0	10	·0	15·0	0·2	38	1·1	·0	3·4
2:40	OFF									
2:50	OFF									
3:00	OFF									
3:10	7·0	·0	11	·0	8·0	0·2	5·0	2·0	·0	3·2
3:20	2.0	.1	11	.0	1	.08	28	1.2	0	1.8
3:30	4·0	0·6	10	·0	4·0	0·6	28	1·2	·0	3·0
3:40	9·4	0·6	10	·0	6·6	0·6	30	1·4	·0	2·8
3:50	OFF									
4:00	OFF									
4:10	OFF									
4:20	OFF									
4:30	OFF									
4:40	OFF									
4:50	OFF									

T-3

EFB READINGS

DATE 3-29-94
BY C. L. Johnson

PLANT: Dungannon, Va.

(Take readings every 10 minutes)

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.
p.m. 7:00	10.0	0.8	11.0	.0	11.0	1.0	34	1.0	0	2.6
7:10	10.0	0.8	10.0	0	11.0	1.0	33	1.2	0	3.2
7:20	10.2	0.8	11.0	0	10.2	0.8	33	1.0	0	3.4
7:30	12.0	0.4	11.0	0	12.4	0.8	33	1.0	0	3.4
7:40	12.2	0.4	11.0	0	12.8	0.8	33	1.0	0	3.4
7:50	12.0	0.4	11.0	0	12.2	0.8	33	1.0	0	3.4
8:00	12.4	0.2	10.0	0	13.0	0.8	33	1.0	0	3.2
8:10	12.0	0.2	10.0	0	12.0	0.8	33	1.2	0	3.2
8:20	12.0	0.2	10.0	0	12.0	0.8	33	1.2	0	3.2
8:30	12.0	0.4	10.0	0	12.0	0.8	33	1.2	0	3.2
8:40	15.0	0	10.0	0	15.0	0.2	28	2.6	0	3.2
8:50	9.0	0.4	10.0	0	9.0	0.8	31	1.0	0	3.2
9:00	9.0	0.4	10.0	0	8.0	0.8	31	1.0	0	3.2
9:10										
9:20										
9:30										
9:40										
9:50										
10:00										
10:10										
10:20										
10:30										
10:40										
10:50										
11:00										
11:10										
11:20										
11:30										
11:40										
11:50										