AP-42 Section Number: 9.10.1.2

Reference Number: 20

Title: Results of the November 14 and 15, 1990, State Particulate Emission Compliance test on the Sugar Cooler and Sugar Granulator at the ACS Moorehead Plant

Interpoll Laboratories, Inc.

Interpoll Laboratories, Inc.

December 1990

AP-42 Section 9.10.1.2
Reference 20
Report Sect. ____
Reference ____

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4500 Ball Road N.E.
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RESULTS OF THE NOVEMBER 14 AND 15, 1990 STATE PARTICULATE EMISSION COMPLIANCE TEST ON THE SUGAR COOLER AND SUGAR GRANULATOR AT THE ACS MOORHEAD PLANT

Submitted to:

AMERICAN CRYSTAL SUGAR COMPANY
2500 North Eleventh Street
P.O. Box 1037
Moorhead, Minnesota 56560

Attention:

Dave Waldon

Approved by:

Perry Lonnes, Ph.D.
Director
Field Testing Division

Report Number 0-3202
December 11, 1990
KE/kce

interpoll

INTERPOLL LABORATORIES, INC.
4500 BALL ROAD N.E.
CIRCLE PINES, MINNESOTA 55014-1819
TEL: 612/786-6020
FAX: 612/786-7854

December 11, 1990

American Crystal Sugar Company
101 North Third Street
Moorhead, Minnesota 56560

Attention: Mr. Tony Heinbaugh

Dear Tony:

Enclosed are your three (3) copies of Interpoll Laboratories Report No. 0-3202 entitled "Results of the November 14 and 15, 1990 State Particulate Emission Compliance Test on the Sugar Cooler and Sugar Granulator at the ACS Moorhead Plant". Two copies of the report have been forwarded directly to Dave Walden.

If you have any questions, please call.

Sincerely,

INTERPOLL LABORATORIES, INC.

Daniel Despen
Senior Data Analyst

DD:kce

TABLE OF CONTENTS

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (^{0}F)	degrees Fahrenheit
DIA.	diameter
FP	finished product for plant
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard cubic meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10^6BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
LTPD	long tons per day
MW	megawatt
mg/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
<	$\leq$ (when following a number)

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

1 INTRODUCTION

On November 14 and 15, 1990, Interpoll Laboratories personnel conducted a particulate emission compliance test on the Sugar Cooler and Sugar Granulator at the American Crystal Sugar (ACS) Plant located in Moorhead, Minnesota. On-site testing was performed by D. Van Hoever and M. Kaehler. Coordination between testing activities and plant operation was provided by Dan Gust of ACS. The tests were not witnessed by a member of the Minnesota Pollution Control Agency.

The granulator and sugar cooler dry and cool the sugar in the later part of the overall process. After the juice is boiled down to the point where the crystal size and concentration in the mother liquor is appropriate; the entire mass is mixed; the crystal separated from the mother liquor and washed with high purity water in centrifugals; then scrolled off and conveyed by elevator to the granulator. The granulator is a horizontal rotary drum dryer. Heated air flows counter current to the sugar crystals passage through the drum and removes the excess moisture. Louvers in the drum cause the sugar to be carried up the side of the rotating drum, much like a cement mixer. This causes the sugar to fall through the heated air stream and increases the speed and efficiency of drying. The dried sugar is then conveyed by elevator to the sugar cooler which is also a horizontal rotary drum. The counter current flow of ambient air through the drum cools the sugar. Finally, the cooled sugar is screened for crystal size control. Particulate emissions from the granulator and cooler are controlled by Rotoclones.

Evaluations were performed in accordance with EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1989). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to extract particulate samples by means of a heated glass-lined probe. Wet catch samples were collected in the back half of the Method 5 sampling train and analyzed as per Minnesota Rules, Part 7005.0500. Gas samples were not collected since ambient air is used in the cooling and granulating processes.

Testing on the Sugar Cooler was performed using two test ports oriented at 90 degrees on the stack. These test ports are located 14 stack diameters downstream of the nearest flow disturbance and 2.6 stack diameters upstream of the stack exit. A 12-point traverse was used to collect representative particulate samples. Each traverse point was sampled 5 minutes to give a total sampling time of 60 minutes per run.

Testing on the Sugar Granulator was also performed using two test ports oriented at 90 degrees on the stack. These test ports are located 9.4 stack diameters downstream of the nearest flow disturbance and 2.4 stack diameters upstream of the stack exit. A 12-point traverse was used to collect representative particulate samples. Each traverse point was sampled 5 minutes to give a total sampling time of 60 minutes per run.

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

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test on the Sugar Cooler and Sugar Granulator are summarized in Tables 1 and 2. As will be noted, the particulate emission rate averaged 4.98 LB/HR for the Sugar Cooler and 2.54 LB/HR for the Sugar Granulator. The average particulate concentrations for the Sugar Cooler and Sugar Granulator were 0.049 and 0.029 GR/DSCF, respectively.

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

Table 1. Summary of the Results of the November 14, 1990 Particulate Emission Compliance Test on the Sugar Cooler at the American Crystal Sugar Company in Moorhead, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-14-90	11-14-90	11-14-90
Time runs were done	(HRS)	938/1040	1102/1204	1226/1329
Process rate	(TPH)	39.7	34.1	36.6
Volumetric flow				
actual	(ACFM)	14075	14382	12971
standard	(DSCFM)	12162	12397	11167
Gas temperature	(DEG-F)	97	97	98
Moisture content	(%V/V)	4.65	4.87	4.79
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	102.0	103.3	98.8
Particulate concentration				
actual	(GR/ACF)	.0412	.0424	.0426
standard	(GR/DSCF)	.0477	.0492	.0496
Part. emission rate	(LB/HR)	4.97	5.23	4.74

Note: Dry + Organic Wet Catch

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test on the Sugar Cooler and Sugar Granulator are summarized in Tables 1 and 2. As will be noted, the particulate emission rate averaged 4.98 LB/HR for the Sugar Cooler and 2.54 LB/HR for the Sugar Granulator. The average particulate concentrations for the Sugar Cooler and Sugar Granulator were 0.049 and 0.029 GR/DSCF, respectively.

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

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition are presented first followed by the computer printout of the particulate results. An Orsat analysis was not performed on the exhaust gas, since only ambient air is exhausted from the process. The reported gas composition is the average geophysical composition of air. The moisture contents reported were measured as per EPA Method 4. 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 particulate emission rate has been calculated using the product of the concentration times flow method.

3.1 Results of Orsat and Moisture Analyses

Test No. 1
Sugar Cooler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-14-90	11-14-90	11-14-90
Dry basis (orsat)			
carbon dioxide............	0.03	0.03	0.03
oxygen....................	20.90	20.90	20.90
carbon monoxide...........	0.00	0.00	0.00
nitrogen..................	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide............	0.03	0.03	0.03
oxygen....................	19.93	19.88	19.90
carbon monoxide...........	0.00	0.00	0.00
nitrogen..................	75.40	75.22	75.29
water vapor...............	4.65	4.87	4.79
Dry molecular weight........	28.84	28.84	28.84
Wet molecular weight........	28.34	28.31	28.32
Specific gravity............	0.979	0.978	0.978
Water mass flow......(LB/HR)	1663	1780	1575
FO	0.000	0.000	0.000

Interpoll Labs Report No. 0-3202
American Crystal Sugar Company
Moorhead, Minnesota

Test No. 2
Sugar Granulator Stack

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

	Run 1	Run 2	Run 3
Date of run	11-15-90	11-15-90	11-15-90
Dry basis (orsat)			
carbon dioxide............	0.03	0.03	0.03
oxygen....................	20.90	20.90	20.90
carbon monoxide...........	0.00	0.00	0.00
nitrogen..................	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide............	0.03	0.03	0.03
oxygen....................	19.27	19.41	19.46
carbon monoxide...........	0.00	0.00	0.00
nitrogen..................	72.88	73.43	73.62
water vapor...............	7.82	7.14	6.89
Dry molecular weight........	28.84	28.84	28.84
Wet molecular weight........	27.99	28.07	28.09
Specific gravity............	0.967	0.969	0.970
Water mass flow......(LB/HR)	2461	2166	2073
FO	0.000	0.000	0.000

3.2 Results of Particulate Loading Determinations

Test No. 1
Sugar Cooler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-14-90	11-14-90	11-14-90
Time run start/end.....(HRS)	938/1040	1102/1204	1226/1329
Static pressure......(IN.WC)	-0.58	-0.58	-0.58
Cross sectional area (SQ.FT)	3.90	3.90	3.90
Pitot tube coefficient......	.840	.840	.840
Water in sample gas			
condenser.............(ML)	0.0	0.0	0.0
impingers..........(GRAMS)	24.0	20.0	26.0
desiccant.........(GRAMS)	12.0	19.0	7.0
total.............(GRAMS)	36.0	39.0	33.0
Total particulate material.. ....collected(grams)	0.1077	0.1145	0.0994
Gas meter coefficient.......	1.0016	1.0016	1.0016
Barometric pressure..(IN.HG)	28.62	28.62	28.62
Avg. orif.pres.drop..(IN.WC)	1.20	1.29	0.97
Avg. gas meter temp..(DEF-F)	88.5	96.3	99.0
Volume through gas meter....			
at meter conditions...(CF)	37.66	39.39	34.13
standard conditions.(DSCF)	34.83	35.92	30.95
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.........(IN)	.183	.183	.183
Avg.stack gas temp ..(DEG-F)	97	97	98
Volumetric flow rate........			
actual..............(ACFM)	14075	14382	12971
dry standard.......(DSCFM)	12162	12397	11167
Isokinetic variation.....(%)	102.0	103.3	98.8
Particulate concentration...			
actual...........(GR/ACF)	0.04122	0.04237	0.04264
dry standard.....(GR/DSCF)	0.04772	0.04918	0.04955
Particle mass rate...(LB/HR)	4.975	5.226	4.743

Test No. 2
Sugar Granulator Stack

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

	Run 1	Run 2	Run 3
Date of run	11-15-90	11-15-90	11-15-90
Time run start/end.....(HRS)	804/ 911	933/1034	1103/1205
Static pressure......(IN.WC)	-0.64	-0.64	-0.64
Cross sectional area (SQ.FT)	3.90	3.90	3.90
Pitot tube coefficient......	.840	.840	.840
Water in sample gas			
condenser.............(ML)	0.0	0.0	0.0
impingers..........(GRAMS)	42.0	63.0	60.0
desiccant..........(GRAMS)	12.0	18.0	18.0
total..............(GRAMS)	54.0	81.0	78.0
Total particulate material.. ....collected(grams)	0.0629	0.0485	0.1300
Gas meter coefficient.......	1.0016	1.0016	1.0016
Barometric pressure..(IN.HG)	28.75	28.75	28.75
Avg. orif.pres.drop..(IN.WC)	0.87	2.42	2.43
Avg. gas meter temp..(DEF-F)	84.2	88.8	90.7
Volume through gas meter....			
at meter conditions...(CF)	32.07	53.34	53.53
standard conditions.(DSCF)	30.00	49.68	49.68
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.........(IN)	.183	.244	.244
Avg.stack gas temp ..(DEG-F)	108	104	105
Volumetric flow rate........			
actual..............(ACFM)	12572	12039	11958
dry standard.......(DSCFM)	10338	10046	9986
Isokinetic variation.....(%)	103.4	99.1	99.7
Particulate concentration...			
actual...........(GR/ACF)	0.02659	0.01257	0.03370
dry standard.....(GR/DSCF)	0.03235	0.01506	0.04037
Particle mass rate...(LB/HR)	2.867	1.297	3.456

APPENDIX A

VOLUMETRIC FLOW RATE DETERMINATIONS

Test No. 1
Sugar Cooler Stack

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

Date of Determination............	11-14-90
Time of Determination.......(HRS)	910
Barometric pressure.......(IN.HG)	28.62
Pitot tube coefficient...........	.84
Number of sampling ports.........	2
Total number of points...........	12
Shape of duct....................	Round
Stack diameter...............(IN)	26.75
Duct area.................(SQ.FT)	3.90
Direction of flow................	UP
Static pressure...........(IN.WC)	-.58
Avg. gas temp.............(DEG-F)	85
Moisture content..........(% V/V)	4.65
Avg. linear velocity.....(FT/SEC)	56.8
Gas density..............(LB/ACF)	.06809
Molecular weight......(LB/LBMOLE)	28.84
Mass flow of gas..........(LB/HR)	54371
Volumetric flow rate.............	
actual...................(ACFM)	13308
dry standard............(DSCFM)	11742

Test No. 2
Sugar Granulator Stack

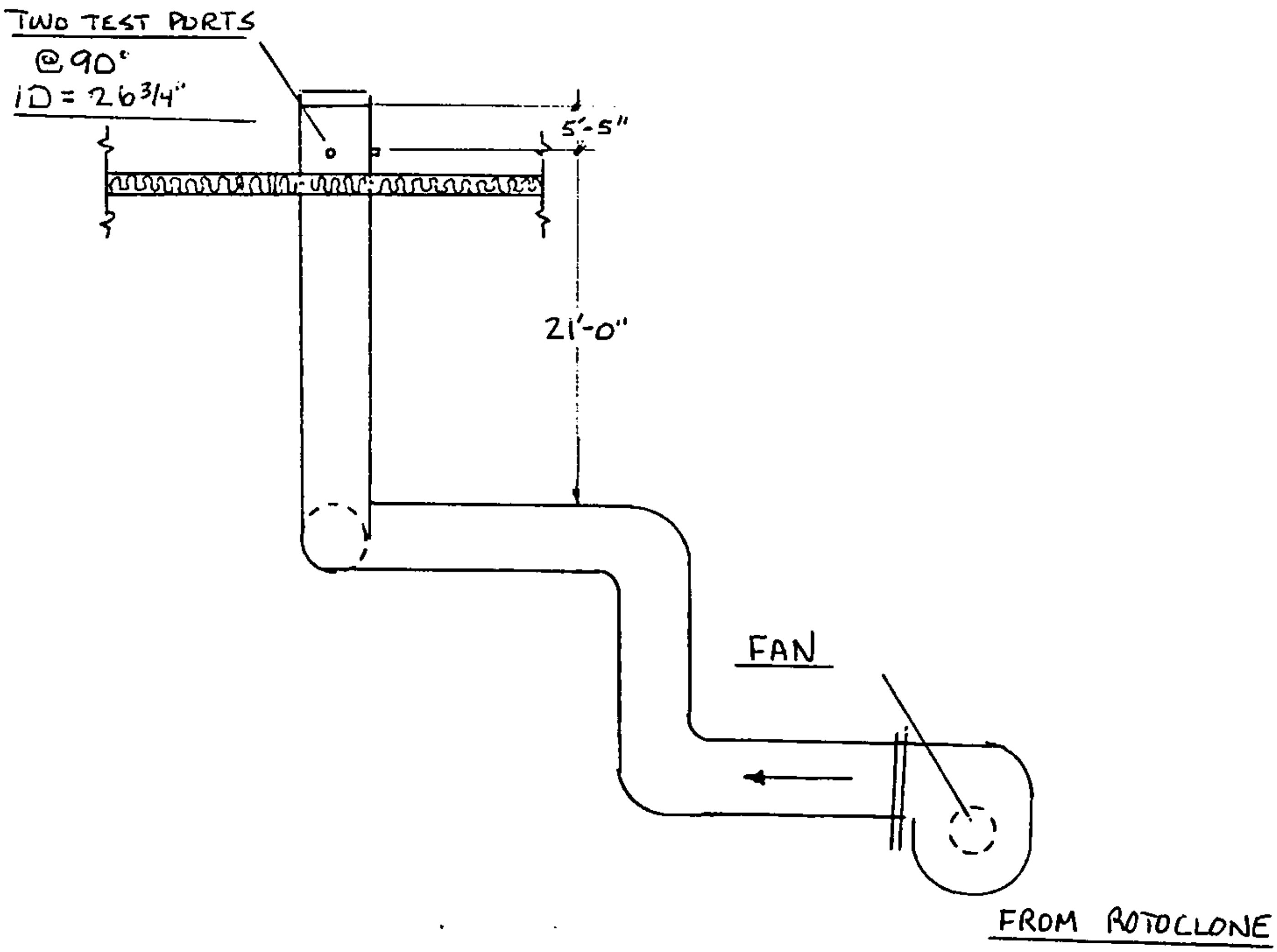
Results of Volumetric Flow Rate Determination-------Method 2

Date of Determination............	11-15-90
Time of Determination.......(HRS)	740
Barometric pressure.......(IN.HG)	28.75
Pitot tube coefficient...........	.84
Number of sampling ports.........	2
Total number of points...........	12
Shape of duct....................	Round
Stack diameter..............(IN)	26.75
Duct area.................(SQ.FT)	3.90
Direction of flow...............	UP
Static pressure...........(IN.WC)	-.64
Avg. gas temp.............(DEG-F)	122
Moisture content..........(% V/V)	7.82
Avg. linear velocity.....(FT/SEC)	54.3
Gas density..............(LB/ACF)	.06327
Molecular weight......(LB/LBMOLE)	28.84
Mass flow of gas..........(LB/HR)	48226
Volumetric flow rate.............	
actual....................(ACFM)	12705
dry standard............(DSCFM)	10192

APPENDIX B

LOCATION OF TEST PORTS

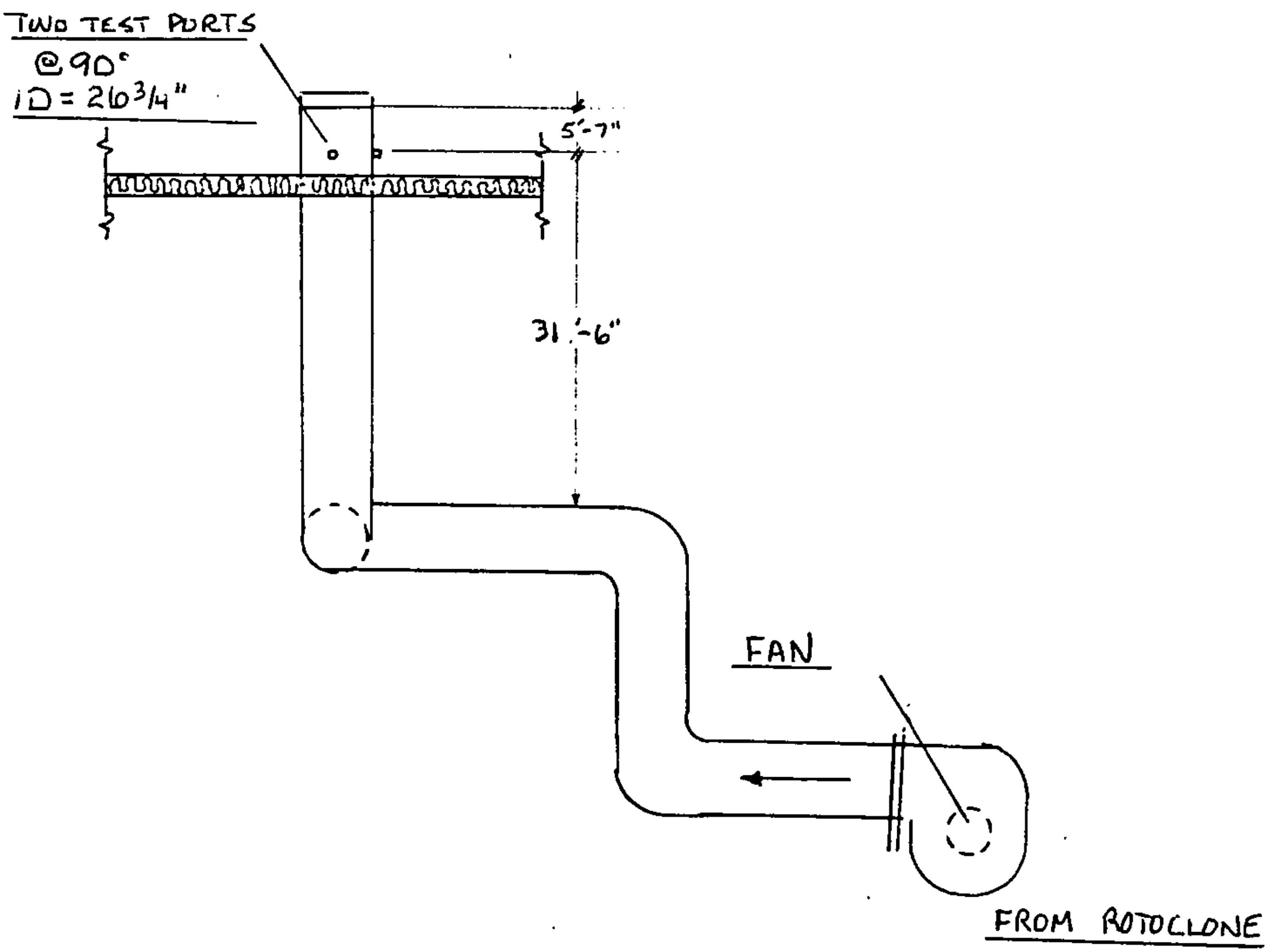
AMERICAN CRYSTAL SUGAR
MOORHEAD PLANT
SUGAR GRANULATOR



DHD 12/90

NOT TO SCALE

AMERICAN CRYSTAL SUGAR
MOORHEAD PLANT
SUGAR COOLER



DHD 12/90

NOT TO SCALE

APPENDIX C

FIELD DATA SHEETS

(Methods 2 - 5)

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job A.C.S. / Moorhead, MN

Source Sugar Cooler / Stack

Test 1 Run 1,2,3 Date 11-14-90

Stack dimen. 26.75 IN.

Dry bulb ____ °F Wet bulb ____ °F

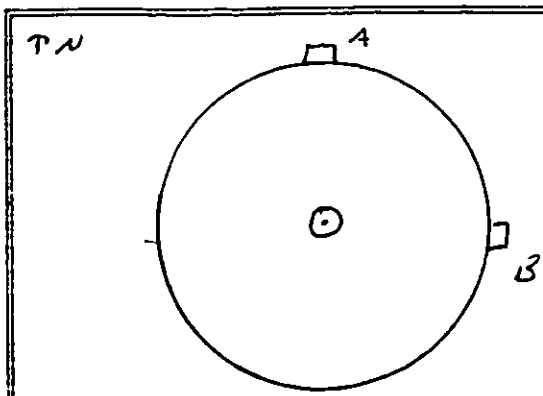
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 28.62 in Hg

Static pressure -.58 in WC

Operators M. Kaehler, D. VanHoever

Pitot No. 25V-2.5 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: 3 in.		Time start: 0910 hrs	
A-1	.044	1.17	4.13	.55	85
2	.146	3.90	6.90	.52	
3	.296	7.92	10.92	1.04	
4	.704	18.83	21.83	1.01	
5	.854	22.84	25.84	1.03	
6	.956	25.57	28.57	.98	
B-1				.55	
2				1.08	
3				1.20	
4				1.18	
5				1.15	
6				1.10	
Temp. meas. tool & S/N: PDT-9/TC				Time end: 0918 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job A.C.S. / Moorhead, MN Date 11-14-90 Test 1 Run 1
Source Sugar Cooler / Stack No. of traverse points 12
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☑
Postest: 0 cfm at 6 in. Hg. (vac) ☑

Particulate Catch Data:

No.s of filters used: 2814

Recovery solvent(s)
☐ acetone
☑ other(s) D.I. H_2O

No. of probe wash bottles: 1
Sample recovered by: M. Koehler, D. VanHoever

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	522	498	24
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1303	1291	12
Total			36

Integrated Gas Sampling Data: NA / Ambient

Bag Pump No. ______ Box No. ______ Bag No. ______
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: ______ cc/min at ______ in. Hg.
Time start: ______ (HRS) Time end: ______ (HRS)
Sampling rate: ______ cc/min Operator: ______
S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

S-0046RR

CF-011

INTERPOLL LABORATORIES PA METHOD 5 FIELD DATA SHEET

Job A.C.S. / Moorhead, M.N Operators M. Kachler D. VanHoover Pitot No. 22V-2.5 Cp .84
Source Sugar Cooler / Stack Meter Box No. 6 ^H@ 1.84 IN WC Bar. Press. 28.62 inHg H2O 2 %
Date 11-14-90 Test 1 Run 1 Gasmeter coeff. 1.0016 Nozzle No. 4-3 Nozzle Dia .183 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgs. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	(0938)	1.66											
A - 6	5	4.89	1.10	1.28	4.88	3.5	94	241	253	38	78	77	20.9
5	10	8.08	1.11	1.28	8.10	3.5	96				83	79	20.9
4	15	11.45	1.19	1.38	1.45	4	97				88	81	20.9
3	20	14.77	1.12	1.30	4.72	4	97	246	257	39	90	83	20.9
2	25	17.54	.82	.96	7.53	3	97				92	84	20.9
1	30	20.80	1.09	1.28	0.78	4	98				94	86	20.9
B - 6	35	24.18	1.16	1.36	4.13	4	98	248	254	41	93	86	20.9
5	40	27.46	1.12	1.32	7.44	4	97				95	88	20.9
4	45	30.81	1.15	1.36	0.79	4	97				97	89	20.9
3	50	33.91	.99	1.[illegible]	3.92	3.5	97	245	260	43	97	89	20.9
2	55	36.88	.88	1.04	6.87	3	95				98	90	20.9
1	60	39.32	.60	.71	9.31	2.5	95				98	91	20.9
	(1040)												
	θ = 60	Vm = 37.66		^H 1.20							Avg. = 88.5		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job A.C.S. / Moorhead, MN Date 11-14-90 Test 1 Run 2
Source Sugar Cooler / Stack No. of traverse points 12
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) OK
Postest: 0 cfm at 7 in. Hg. (vac) OK

Particulate Catch Data:

No.s of filters used: 2832

Recovery solvent(s)
- [ ] acetone
- [x] other(s) D.I. H_2O

No. of probe wash bottles: 1
Sample recovered by: M. Kuehler, D. VanHoever

Condensate Data:

Item	Weight (g) Final	Tare	Difference
Impinger No. 1	520	500	20
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1459	1440	19
Total			39

Integrated Gas Sampling Data: NA/Ambient

Bag Pump No. ______ Box No. ______ Bag No. ______

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

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

Time start: ______ (HRS) Time end: ______ (HRS)

Sampling rate: ______ cc/min Operator: ______

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

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job A.C.S. / Moorhead, MN
Source Sugar Cooler / Stack
Date 11-14-90 Test 1 Run 2

Operators M. Kuehler, D. VanHoever
Meter Box No. 6 ^H@ 1.84 IN WC
Gasmeter coeff. 1.0016

Pitot No. 22V-2.5 Cp .84
Bar. Press. 28.62 inHg H2O 1 %
Nozzle No. 4-3 Nozzle Dia .183 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	(1102)	39.60											
B - 6	5	42.92	1.09	1.30	2.87	4	97	246	262	42	90	88	20.9
5	10	46.12	1.08	1.29	6.14	4	96				95	90	20.9
4	15	49.49	1.13	1.36	9.51	4	96				98	91	20.9
3	20	52.89	1.11	1.34	2.96	4	95	243	259	40	100	92	20.9
2	25	56.38	1.21	1.47	6.36	4.5	95				100	93	20.9
1	30	59.47	.95	1.15	9.47	3.5	97				101	94	20.9
A - 6	35	62.74	1.04	1.26	2.72	4	97	249	255	41	99	94	20.9
5	40	65.99	1.05	1.27	5.98	4	98				101	94	20.9
4	45	69.34	1.10	1.33	9.33	4	97				102	95	20.9
3	50	72.72	1.11	1.35	2.70	4	97	249	252	43	103	95	20.9
2	55	75.93	1.03	1.25	5.95	4	97				103	96	20.9
1	60	78.99	.88	1.07	8.95	3.5	97				103	96	20.9
	(1204)												
	θ = 60	Vm = 39.39		^H 1.29							Avg. = 96.3		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job A.C.S. / Moorhead MN Date 11-14-90 Test 1 Run 3
Source Sugar Cooler / Stack No. of traverse points 12
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac)
Postest: < cfm at 6 in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: 2833

Recovery solvent(s)
- [ ] acetone
- [x] other(s) D.I. H_2O

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler, D. VanHoever

Condensate Data:

Item	Weight (g) Final	Tare	Difference
Impinger No. 1	526	500	26
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1310	1303	7
Total			33

Integrated Gas Sampling Data: NA / Ambient

Bag Pump No. ______ Box No. ______ Bag No. ______

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

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

Time start: ______ (HRS) Time end: ______ (HRS)

Sampling rate: ______ cc/min Operator: ______

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

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job A.C.S. / Moorhead, MN
Source Sugar cooler / stack
Date 11-14-90 Test 1 Run 3

Operators N. Koehler, D. VanHoover
Meter Box No. 6 ^H@ 1.84 IN WC
Gasmeter coeff. 1.0076

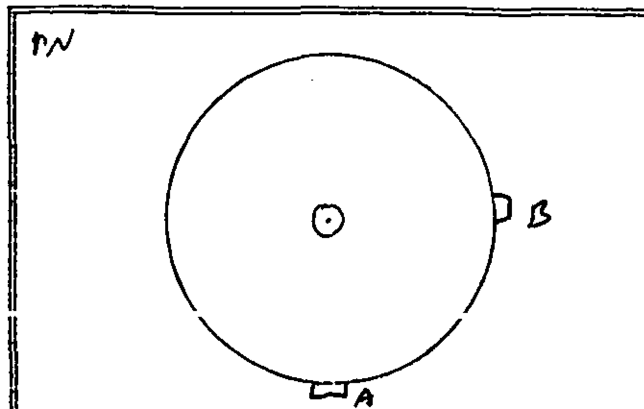
Pitot No. 22V-2.5 Cp .84
Bar. Press. 28.62 inHg H2O 5 x
Nozzle No. 4-3 Nozzle Dia .183 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	(1226)	79.24											
A - 6	5	82.12	.86	.97	2.09	3	97	244	253	38	93	92	20.9
5	10	84.80	.76	.86	4.77	2.5	95				97	94	20.9
4	15	87.34	.20	.79	7.34	2	98				99	94	20.9
3	20	90.54	1.10	1.24	0.52	3.5	99	247	258	39	101	95	20.9
2	25	93.26	.73	.82	3.20	2	99				103	96	20.9
1	30	96.26	.96	1.09	6.24	3	98				103	97	20.9
B - 6	35	98.89	.72	.82	8.87	2.5	98	251	255	41	101	96	20.9
5	40	101.47	.72	.82	1.49	2.5	98				103	97	20.9
4	45	104.52	.96	1.09	4.53	3	97				104	98	20.9
3	50	107.65	.99	1.13	7.62	3	98	249	258	42	105	98	20.9
2	55	110.67	.96	1.09	0.66	3	98				106	99	20.9
1	60	113.37	.96	.87	3.38	2.5	98				106	99	20.9
	(1329)												
	θ = 60	Vm = 34.13		^H = .97							Avg. = 99.0		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job A.C.S. / Moorhead, MN
Source Granulator / Stack
Test 2 Run 1,2,3 Date 11-15-90
Stack dimen. 26.75 IN.
Dry bulb ____ °F Wet bulb ____ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 28.75 in Hg
Static pressure - .64 in WC
Operators M. Kuehler, D. VanHoeven
Pitot No. 22V-2.5 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: 3.25 in.		Time start: 0740 hrs	
A-1	.044	1.17	4.42	* .57	122
2	.146	3.90	7.15	.73	
3	.296	7.92	11.17	.75	
4	.704	18.83	21.08	.82	
5	.854	22.84	26.09	.81	
6	.956	25.57	28.82	.76	
B-1				.69	
2				.87	
3				.88	
4				.88	
5				.87	
6				.86	
Temp. meas. tool & S/N: PDT-9 / TC				Time end: 0749 hrs	

* Washing During Flows Causing Low Flows

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job A.C.S. / Moorhead, MN Date 11-15-90 Test 2 Run 1
Source Granulator / Stack No. of traverse points 12
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 2815

Recovery solvent(s)
☐ acetone
☒ other(s) D.I. H_2O

No. of probe wash bottles: 1
Sample recovered by: M. Kuehler, D. VanHoever

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	534	492	42
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1471	1459	12
Total			54

Integrated Gas Sampling Data: NA/ Ambient

Bag Pump No. ______ Box No. ______ Bag No. ______

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

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

Time start: ______ (HRS) Time end: ______ (HRS)

Sampling rate: ______ cc/min Operator: ______

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

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job A.C.S. / Moorhead, MN
Source Granulator / Stack
Date 11-15-90 Test 2 Run 1

Operators M. Kuehler, D. VanHoever
Meter Box No. 6 ^H@ 1.84 IN WC
Gasmeter coeff. 1.0016

Pitot No. 22U-2.1 Cp .84
Bar. Press. 28.25 inHg H2O 4 %
Nozzle No. 4-3 Nozzle Dia .183 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xv/v)
	(0804)	122.15											
A - 6	5	124.86	.86	.90	4.84	2.5	122	240	255	37	78	78	20.9
5	10	127.57	.84	.89	2.53	2.5	122				82	79	20.9
4	15	130.16	.76	.83	0.13	2.5	110				85	80	20.9
3	20	132.86	.82	.90	2.84	2.5	110	243	252	39	86	81	20.9
2	25	135.71	.88	.98	5.67	3	102				88	82	20.9
1	30	138.55	.92	1.03	8.57	3	102				89	82	20.9
B - 6	35	141.09	.70 ~~1.28~~	.78 ~~1.43~~	1.10	2.5	104	248	257	39	85	81	20.9
5	40	143.68	.72	.80	3.65	2.5	104				88	82	20.9
4	45	146.23	.69	.77	6.16	2.5	104				89	83	20.9
3	50	148.88	.79	.88	8.84	3	107	250	261	40	90	83	20.9
2	55	151.57	.78	.87	1.52	2.5	103				91	84	20.9
1	60	154.22	.75	.84	4.15	2.5	103				91	84	20.9
	(0911)												
	θ = 60	Vm = 32.07		^H = .87							Avg. = 84		

S-0037

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job A.C.S. / Moorhead, MN Date 11-15-90 Test 2 Run 2
Source Granulator / Stack No. of traverse points 12
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 2816

Recovery solvent(s)
☐ acetone
☒ other(s) D.I. H_2O

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler, D. VanHoever

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	565	502	63
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1328	1310	18
Total			81

Integrated Gas Sampling Data: NA / Ambient

Bag Pump No. ______ Box No. ______ Bag No. ______

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

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

Time start: ______ (HRS) Time end: ______ (HRS)

Sampling rate: ______ cc/min Operator: ______

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

CF-023

CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job A.C.S. / Moorhead, MN
Source Granulator / Stack
Date 11-15-90 Test 2 Run 2

Operators M. Kaehler, D. VanHoover
Meter Box No. 6 ^H@ 1.84 IN WC
Gasmeter coeff. 1.0016

Pitot No. 22V-2.5 Cp .84
Bar. Press. 28.75 inHg H2O 8 %
Nozzle No. 4-3 Nozzle Dia .249 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	(0933)	154.40											
B - 6	5	158.58	.66	2.14	8.55	5.5	105	246	258	43	82	80	20.9
5	10	162.69	.65	2.13	2.70	5.5	101				87	82	20.9
4	15	167.17	.75	2.48	7.19	6.5	99				90	83	20.9
3	20	171.78	.79	2.60	1.79	7	103	245	253	43	92	84	20.9
2	25	176.29	.75	2.47	6.29	7	104				94	85	20.9
1	30	180.33	.59	1.95	0.29	5	104				95	86	20.9
A - 6	35	184.78	.73	2.42	4.75	6.5	103	248	256	42	92	86	20.9
5	40	189.16	.72	2.38	9.16	6.5	104				94	86	20.9
4	45	193.55	.70	2.32	3.53	6.5	104				95	87	20.9
3	50	198.42	.89	2.94	8.44	8	106	247	260	40	96	88	20.9
2	55	203.34	.89	2.94	3.36	8	106				96	88	20.9
1	60	207.74	.70	2.32	7.73	9	105				96	88	20.9
	(1034)												
	θ = 60	Vm = 53.34		^H 2.42							Avg. = 88.1		

S-00370

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job A.C.S. / Moorhead, MN   Date 11-15-90 Test 2 Run 3
Source Granulator / Stack   No. of traverse points 12
Method 5 Filter holder: 4" Glass   Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 2807

Recovery solvent(s)
☐ acetone
☒ other(s) D.I. H_2O

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler, D. Van Hoever

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	558	498	60
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1489	1471	18
Total			78

Integrated Gas Sampling Data: NA/ Ambient

Bag Pump No. ______ Box No. ______ Bag No. ______

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

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

Time start: ______ (HRS) Time end: ______ (HRS)

Sampling rate: ______ cc/min Operator: ______

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

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job A.C.S. / Moorhead, MN
Source Granulator / Stack
Date 11-15-90 Test 2 Run 3

Operators M. Koehler D. VanHoever
Meter Box No. 6 ^H@ 1.84 IN WC
Gasmeter coeff. 1.0016

Pitot No. 22V-2.5 Cp .84
Bar. Press. 28.73 = inHg H2O 7 x
Nozzle No. 4-3 Nozzle Dia .244 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xv/v)
	(1103)	207.90											
A - 6	5	212.22	.71	2.34	2.24	5.5	105	241	253	40	83	82	20.9
5	10	216.59	.70	2.32	6.57	5.5	106				88	84	20.9
4	15	221.01	.73	2.44	1.03	6	104				92	85	20.9
3	20	225.52	.74	2.48	5.54	6	104	243	256	41	94	86	20.9
2	25	230.05	.74	2.49	0.06	6	105				95	87	20.9
1	30	235.22	.96	3.23	5.21	8	105				97	88	20.9
B - 6	35	239.45	.64	2.16	9.43	5	106	247	255	42	93	88	20.9
5	40	243.99	.75	2.53	3.98	6	104				96	88	20.9
4	45	248.61	.78	2.63	8.64	6.5	104				97	89	20.9
3	50	253.12	.72	2.44	3.13	6	104	245	254	42	98	90	20.9
2	55	257.59	.70	2.37	7.56	6	105				98	90	20.9
1	60	261.43	.53	1.80	1.41		105				99	91	20.9
	(1205)												
	θ = 60	Vm = 53.53		^H 2.43							Avg. = 90.1		

S 0037P

APPENDIX D

INTERPOLL LABS ANALYTICAL DATA

TABLE OF CONTENTS

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job A.C.S/Moorhead
Team Leader MK
Date Submitted 11-16-90
Test No. 1
Date of Analysis 11-19-90

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Gilum

0	Test 1 Run 0 Field Blank Log Number 1743.03 Comments	Dish No. 2 Dish Tare Wt. 46.2262 g Dish+Sample Wt. 46.2268 g Sample Wt. 0.0006 g
1	Test 1 Run 1 Log Number -06 Comments	Dish No. 7 Dish Tare Wt. 50.0319 g Dish+Sample Wt. 50.0357 g Sample Wt. 0.0038 g
2	Test 1 Run 2 Log Number -09 Comments	Dish No. 11 Dish Tare Wt. 47.7584 g Dish+Sample Wt. 47.7628 g Sample Wt. 0.0044 g
3	Test 1 Run 3 Log Number -12 Comments	Dish No. 14 Dish Tare Wt. 49.7341 g Dish+Sample Wt. 49.7379 g Sample Wt. 0.0038 g
4	Test Run Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test Run Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0006 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0006	0.0032	0.0038	0.0032	D-1	

LSC-03.GR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90
Transport Leakage [x] None [ ] ______ ml

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Wilson
Solvent DI H_2O

0 Test 1 Run 0
Field Blank
Log Number 1743-01
Vol. of Solvent 100 ml
*Solvent Residue 2.0 ug/ml
Dish No. 72
Dish Tare Wt. 64.1083 g
Dish+Sample Wt. 64.1085 g
Sample Wt. 0.0002 g

1 Test 1 Run 1
Vol. of Solvent 170 ml
Log Number -04
Comments
Dish No. 76
Dish Tare Wt. 70.2561 g
Dish+Sample Wt. 70.3397 g
Sample Wt. 0.0836 g

2 Test 1 Run 2
Vol. of Solvent 170 ml
Log Number -07
Comments
Dish No. 77
Dish Tare Wt. 80.0596 g
Dish+Sample Wt. 80.1473 g
Sample Wt. 0.0877 g

3 Test 1 Run 3
Vol. of Solvent 170 ml
Log Number -10
Comments
Dish No. 79
Dish Tare Wt. 85.9295 g
Dish+Sample Wt. 86.0004 g
Sample Wt. 0.0709 g

4 Test ____ Run ____
Vol. of Solvent ____ ml
Log Number
Comments
Dish No.
Dish Tare Wt. ____ g
Dish+Sample Wt. ____ g
Sample Wt. ____ g

5 Test ____ Run ____
Vol. of Solvent ____ ml
Log Number
Comments
Dish No.
Dish Tare Wt. ____ g
Dish+Sample Wt. ____ g
Sample Wt. ____ g

*Solvent Residue 2.0 ug/ml=[(Sample Wt. 0.0002 g)(10^6)]/Vol. of Sol. 100 ml
EPA-M5 Acetone Residue Blank Spec. ≤7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0002	0.0833	0.0874	0.0706	D-2	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Calvin

0
Test 1 Run 0
Field Blank
Log Number 1793-02
Comments

Filter No. 2811
Filter Type 4"GF
Filter Tare Wt. .9299 g
Filter+Sample Wt. .9300 g
Sample Wt. 0.0001 g

1
Test 1 Run 1
Log Number -05
Comments

Filter No. 2814
Filter Type 4"GF
Filter Tare Wt. .9296 g
Filter+Sample Wt. .9508 g
Sample Wt. 0.0212 g

2
Test 1 Run 2
Log Number -08
Comments

Filter No. 2832
Filter Type 4"GF
Filter Tare Wt. .9442 g
Filter+Sample Wt. .9675 g
Sample Wt. 0.0233 g

3
Test 1 Run 3
Log Number -11
Comments

Filter No. 2833
Filter Type 4"GF
Filter Tare Wt. .9147 g
Filter+Sample Wt. .9403 g
Sample Wt. 0.0256 g

4
Test ____ Run ____
Log Number
Comments

Filter No.
Filter Type
Filter Tare Wt. ____ g
Filter+Sample Wt. ____ g
Sample Wt. ____ g

5
Test ____ Run ____
Log Number
Comments

Filter No.
Filter Type
Filter Tare Wt. ____ g
Filter+Sample Wt. ____ g
Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0001	0.0212	0.0233	0.0256		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1077	0.1145	0.0994		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS/Moorhead
Team Leader MK
Date Submitted 11-16-90
Test No.
Date of Analysis 11-19-90

Source Granulator
Test Site Stack
Date of Test 11-15-90
No. of Runs Completed 3
Technician P. Gdum

0	Test ___ Run 0 Field Blank Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
1	Test 2 Run 1 Log Number 1743-15 Comments ___	Dish No. 16 Dish Tare Wt. 52.8212 g Dish+Sample Wt. 52.8254 g Sample Wt. 0.0042 g
2	Test 2 Run 2 Log Number -18 Comments ___	Dish No. 61 Dish Tare Wt. 44.5893 g Dish+Sample Wt. 44.5948 g Sample Wt. 0.0055 g
3	Test 2 Run 3 Log Number -21 Comments ___	Dish No. 107 Dish Tare Wt. 44.0702 g Dish+Sample Wt. 44.0749 g Sample Wt. 0.0047 g
4	Test ___ Run ___ Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
5	Test ___ Run ___ Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g

Blank Solvent Wt. 0.0006 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0006	0.0036	0.0049	0.0041	D-4	

LSC-03.GR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 2
Date of Analysis 11-16-90
Transport Leakage ☐ None ☐ ____ ml

Source Granulator
Test Site Stack
Date of Test 11-15-90
No. of Runs Completed 3
Technician R. Gulm
Solvent DI H2O

0	Test ____ Run 0 Field Blank Log Number ____ Vol. of Solvent ____ ml *Solvent Residue 2.0 ug/ml	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Vol. of Solvent 160 ml Log Number 1793-13 Comments ____	Dish No. 303 Dish Tare Wt. 49.5732 g Dish+Sample Wt. 49.6228 g Sample Wt. 0.0496 g
2	Test 2 Run 2 Vol. of Solvent 160 ml Log Number -16 Comments ____	Dish No. 304 Dish Tare Wt. 60.5533 g Dish+Sample Wt. 60.5769 g Sample Wt. 0.0236 g
3	Test 2 Run 3 Vol. of Solvent 150 ml Log Number -19 Comments ____	Dish No. 305 Dish Tare Wt. 56.0210 g Dish+Sample Wt. 56.1239 g Sample Wt. 0.1029 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

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

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0002	0.0493	0.0233	0.1026	D-5	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job A.C.S. / Moorhead	Source Granulator
Team Leader MK	Test Site Stack
Date Submitted 11-15-90	Date of Test 11-15-90
Test No. 1	No. of Runs Completed 3
Date of Analysis 11-16-90	Technician R. Cuhn

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Log Number 1793 -14 Comments ____	Filter No. 2815 Filter Type 4" GF Filter Tare Wt. .9335 g Filter+Sample Wt. .9435 g Sample Wt. 0.0100 g
2	Test 2 Run 2 Log Number -17 Comments ____	Filter No. 2816 Filter Type 4" GF Filter Tare Wt. .9138 g Filter+Sample Wt. .9341 g Sample Wt. 0.0203 g
3	Test 2 Run 3 Log Number -20 Comments ____	Filter No. 2807 Filter Type 4" GF Filter Tare Wt. .9404 g Filter+Sample Wt. .9637 g Sample Wt. 0.0233 g
4	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0001	0.0100	0.0203	0.0233		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0629	0.0485	0.1300		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job A.C.S. / Moorhead, MN
Team Leader M. Kaehler
Date Submitted 11-15-90
Test No. 1

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
3+1	Probe Wash: ☐ Acetone ☒ D.I. Water	☒ As per EPA M-5 ☐ Other ____	
3+1	Filter: ☒ 4" G.F. ☐ S.S. Thimble ☐ 2.5" G.F. ☐ 47 mm G.F.	☒ As per EPA M-5 ☐ As per EPA M-17 ☐ Other ____	
3+1	Impinger Catch: ☒ D.I. Water ☐ 3% H_2O_2 ☐ 4M5 Hg Only ☐ 4M5 Metals ☐ 1.0 N NaOH ☐ Other ____	☒ MN Protocol ☐ WI Protocol ☐ EPA M-6 or 8 ☐ Acid Gases ☐ Formaldehyde ☐ Metals ☐ Other ____	
—	Integrated Gas sample	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other ____	
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other ____	Date ____ Time (HRS) ____
—	☐ Fuel Sample ☐ Aggregate	☐ Attached fuel Form #S-0163RRR	
—	Particle Size	☐ X-Ray Sedigraph ☐ Bahco Method ☐ Other ____	
—	Audit Samples ☐ Sulfur Dioxide ☐ Oxides of Nit. ☐ Other ____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other ____	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer
☒ Other Cooler

NA 2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other ____

NA 3) Is sample combustible? ☐ No ☐ Yes

NA 4) Does sample need special handling? ☐ No ☐ Yes If yes, explain ____

S-278RRRR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job A.C.S.
Team Leader M. Koehler
Date Submitted 11-15-90
Test No. 2

Source Granulator
Test Site Stack
Date of Test 11-15-90
No. of Runs Completed 3

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

Source Information

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

S-278RRRR

APPENDIX E

MPCA EXHIBIT C

RECEIVED

Interpoll Laboratories
(612)786-6020

MPCA Exhibit C for Process Emissions INTERPOLL LABORATORIES

JOB AMERICAN CRYSTAL SUGAR CO., MOORHEAD, MN

SOURCE SUGAR DRYER

DATE 12/3/90

C. Equipment & Operating Data

1. Process Equip. No./Ident. CRYSTAL NO. 013220001 STEARNS ROGERS NO. C-27112.
2. Process Equip. Description GRANULATOR (SUGAR DRYER) STEARNS ROGERS.
3. Process equipment operating under normal operating conditions: No ___. Yes X.

D. Instrument Data on Process Equipment

1. Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, lbs. per hour, pressure, air flow, etc.

E. Air Pollution Control Equipment

1. Type/model control equipment AMERICAN AIR FILTER TYPE W ROTOCLONE.
2. Air pressure drop across the control equipment 6.5"-7" WATER
3. Air flow through the control equipment N/A.
4. Was the control equipment operating normally? YES.
5. Date of last major maintenance/cleaning of control equipment SPRAYS WERE CHECKED PRIOR TO TEST. FOUND TO BE CLEAN AND FUNCTIONING. RUNNING AT 900 RPM.

F. Plant Manager's Certification

I certify that the information submitted herein is accurate and correct and that no information requested was withheld from MPCA, Division of Air Quality.

By David Walden, Position Assistant Operation Mgr.

S-349R

Interpoll Laboratories
(612)786-6020

MPCA Exhibit C for Process Emissions

JOB AMERICAN CRYSTAL SUGAR CO., MOORHEAD, MN

SOURCE SUGAR COOLER

DATE 12/3/90

C. Equipment & Operating Data

1. Process Equip. No./Ident. CRYSTAL NO. 013240001 STEARNS ROGERS NO. C-27112.
2. Process Equip. Description SUGAR COOLER (STEARNS ROGERS).
3. Process equipment operating under normal operating conditions:
   No ___. Yes X.

D. Instrument Data on Process Equipment

1. Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, lbs. per hour, pressure, air flow, etc.

E. Air Pollution Control Equipment

1. Type/model control equipment AMERICAN AIR FILTER TYPE W ROTOCLONE.
2. Air pressure drop across the control equipment 1.6" → 2.6" WATER
3. Air flow through the control equipment N/A.
4. Was the control equipment operating normally? YES.
5. Data of last major maintenance/cleaning of control equipment SPRAY NOZZLES WERE CHECKED PRIOR TO TEST. FOUND TO BE CLEAN AND OPERATIONAL. OPERATING AT 1080 RPM.

F. Plant Manager's Certification

I certify that the information submitted herein is accurate and correct and that no information requested was withheld from MPCA, Division of Air Quality.

By David Walden. Position Assistant Operations Mgr.

APPENDIX F

PROCESS RATE DATA

	9:40	9:45	9:50	9:55	10:00	10:05	10:10	10:15	10:20	10:25	10:30	10:3[illegible]
Spray Press.	36	36	36	36	36	36	36	36	36	36	36	36
Press. Drop	2	1.9	1.7	1.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Speed	1080											
Parsons Read	557	660	732	789	856	923	1065	1067	1160	1232	1294	1351
Slice Rate	208	217	220	217	215	217	[illegible]	218	218	216	214	213

Rotoclone: Cooler

DAN Guest

Person Taking Readings.

Time of Test: 9:40 / 10:40
Start STOP

Date 11 / 14 / 70

F-1 [illegible]

#1

Time	11:05 A	11:10	11:15	11:20	11:25	11:30	11:35	11:40	11:45	11:50	11:55	12:00 A	12:05
Spray Press.	36	36	36	36	36	36	36	36	36	36	36	36	36
Press. Drop	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.8	1.8
Speed	1080												
Parsons Read	1821	1870	1904	1997	2090	2136	2188	2234	2306	2347	2424	2476	2502
Slice Rate	212	214	212	209	214	208	206	213	214	215	206	204	201

Rotoclone: Cooler

DAN Gust

Person Taking Readings.

Time of Test: 11:05 / 12:05
Start STOP

Date 11 / 14 / 90

F-2

#2

	12:25	12:30	12:35	12:40	12:45	12:50	12:55	1:00	1:05	1:10	1:15	1:20	
Spray Press	36	36	36	36	36	36	36	36	36	36	36	36	
Press. Drop	1.9	2	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.6	2.6	2.6	
Speed	1080												
Parsons Read	2810	2860	2888	2960	3048	3089	3213	3244	3300	3367	3414	3480	3512
Slice Rate	206	207	210	208	212	209	205	208	211	211	211	213	212

Rotoclone: Cooler

DAN Gust[illegible]

Person Taking Readings.

Time of Test: 12:25 /
Start / STOP

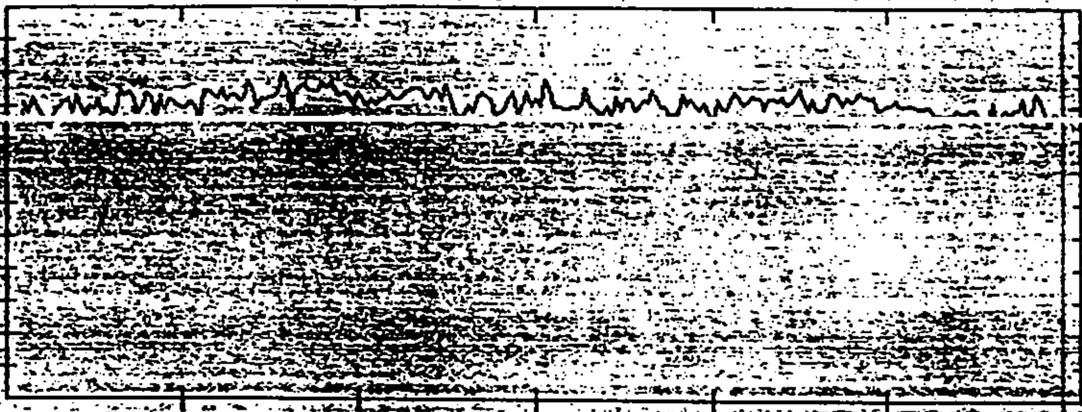
Date 11 / 14 / 90

#3

F-3

Screen Print from Node: 4

Screen Print : 1: BEET END 14-Nov-90 15:41:24



>SLICE

Data Pts >240 Time Scale >8 >Hours >Start Time >15:40:03 >14-Nov-90

	Tag	Descriptor	14-Nov-90	Value at 15:40:03	Units	Eng. Min	Eng. Max
OFF	1A14	SEWER LK		21.4	GPM	.0	714.0
ON	SLICE	BEET SLICE		196.	TONS/HR.	0.	300.
OFF	CRJ-FT	RAW JUICE FLOW		1020.00	GPM	.00	1500.00

CONFIG 2

ccur	Source	Description				
0:38:52.320	PARSON/i	SUGAR	WEIGHT	ON	1367.14	CWT
:43:52.325	PARSON/i	SUGAR	WEIGHT	ON	1434.19	CWT
:48:52.325	PARSON/i	SUGAR	WEIGHT	ON	1501.45	CWT
0:5[illegible]:52.325	PARSON/i	SUGAR	WEIGHT	ON	1568.60	CWT
0:5[illegible]:52.320	PARSON/i	SUGAR	WEIGHT	ON	1641.04	CWT
:03:52.325	PARSON/i	SUGAR	WEIGHT	ON	1713.19	CWT
:08:52.320	PARSON/i	SUGAR	WEIGHT	ON	1780.31	CWT
1:13:52.325	PARSON/i	SUGAR	WEIGHT	ON	1852.63	CWT
[illegible]	PARSON/i	SUGAR	WEIGHT	ON	1919.91	CWT
[illegible]	PARSON/i	SUGAR	WEIGHT	ON	1992.32	CWT
1:28:52.320	PARSON/i	SUGAR	WEIGHT	ON	2059.46	CWT
:33:52.325	PARSON/i	SUGAR	WEIGHT	ON	2121.23	CWT
:38:52.315	PARSON/i	SUGAR	WEIGHT	ON	2188.23	CWT
1:43:52.325	PARSON/i	SUGAR	WEIGHT	ON	2255.28	CWT
1:48:52.315	PARSON/i	SUGAR	WEIGHT	ON	2306.57	CWT
:53:52.325	PARSON/i	SUGAR	WEIGHT	ON	2363.04	CWT
1:58:52.315	PARSON/i	SUGAR	WEIGHT	ON	2424.68	CWT
2:03:52.325	PARSON/i	SUGAR	WEIGHT	ON	2486.49	CWT
:08:52.325	PARSON/i	SUGAR	WEIGHT	ON	2553.55	CWT
:13:52.320	PARSON/i	SUGAR	WEIGHT	ON	2615.31	CWT

ode: 4 EVENT LIST NO. 10 14-Nov-90 10:33:58

Occur	Source	Description				
:32:22.325	PARSON/i	SUGAR	WEIGHT	ON	1274.09	CWT
0:32:27.320	PARSON/i	SUGAR	WEIGHT	ON	1279.28	CWT
:[illegible]32.320	PARSON/i	SUGAR	WEIGHT	ON	1279.28	CWT
:[illegible]37.315	PARSON/i	SUGAR	WEIGHT	ON	1279.28	CWT
0:32:42.320	PARSON/i	SUGAR	WEIGHT	ON	1279.28	CWT
:32:47.320	PARSON/i	SUGAR	WEIGHT	ON	1279.28	CWT
:32:52.320	PARSON/i	SUGAR	WEIGHT	ON	1284.40	CWT
0:32:57.320	PARSON/i	SUGAR	WEIGHT	ON	1284.40	CWT
0:33:02.325	PARSON/i	SUGAR	WEIGHT	ON	1284.40	CWT
:33:07.320	PARSON/i	SUGAR	WEIGHT	ON	1284.40	CWT
:33:12.325	PARSON/i	SUGAR	WEIGHT	ON	1289.58	CWT
0:33:17.325	PARSON/i	SUGAR	WEIGHT	ON	1289.58	CWT
:33:22.325	PARSON/i	SUGAR	WEIGHT	ON	1289.58	CWT
:33:27.325	PARSON/i	SUGAR	WEIGHT	ON	1289.58	CWT
0:33:32.325	PARSON/i	SUGAR	WEIGHT	ON	1289.58	CWT
:33:37.325	PARSON/i	SUGAR	WEIGHT	ON	1294.72	CWT
:33:42.320	PARSON/i	SUGAR	WEIGHT	ON	1294.72	CWT
0:33:47.325	PARSON/i	SUGAR	WEIGHT	ON	1294.72	CWT
0:33:52.315	PARSON/i	SUGAR	WEIGHT	ON	1294.72	CWT
:33:57.325	PARSON/i	SUGAR	WEIGHT	ON	1299.91	CWT

Node: 4		EVENT LIST NO. 10			14-Nov-90 13:53:55
Occur	Source	Description			
12:18:52.325	PARSON/i	SUGAR	WEIGHT	ON	2677.07 CWT
12:23:52.325	PARSON/i	SUGAR	WEIGHT	ON	2738.77 CWT
12:28:52.325	PARSON/i	SUGAR	WEIGHT	ON	2805.76 CWT
12:33:52.320	PARSON/i	SUGAR	WEIGHT	ON	2872.82 CWT
[illegible]	PARSON/i	SUGAR	WEIGHT	ON	2939.79 CWT
[illegible]	PARSON/i	SUGAR	WEIGHT	ON	3006.79 CWT
[illegible]	PARSON/i	SUGAR	WEIGHT	ON	3068.67 CWT
[illegible]	PARSON/i	SUGAR	WEIGHT	ON	[illegible] CWT
12:58:52.330	PARSON/i	SUGAR	WEIGHT	ON	3197.95 CWT
13:03:52.320	PARSON/i	SUGAR	WEIGHT	ON	3259.76 CWT
13:08:52.325	PARSON/i	SUGAR	WEIGHT	ON	3316.30 CWT
13:13:52.320	PARSON/i	SUGAR	WEIGHT	ON	3377.95 CWT
13:18:52.325	PARSON/i	SUGAR	WEIGHT	ON	3439.63 CWT
13:23:52.325	PARSON/i	SUGAR	WEIGHT	ON	3506.64 CWT
13:28:52.320	PARSON/i	SUGAR	WEIGHT	ON	3568.34 CWT
13:33:52.325	PARSON/i	SUGAR	WEIGHT	ON	3630.06 CWT
13:38:52.325	PARSON/i	SUGAR	WEIGHT	ON	3691.89 CWT
13:43:52.325	PARSON/i	SUGAR	WEIGHT	ON	3753.79 CWT
13:48:52.325	PARSON/i	SUGAR	WEIGHT	ON	3815.50 CWT
13:53:52.325	PARSON/i	SUGAR	WEIGHT	ON	3877.28 CWT

Node: 4		EVENT LIST NO. 10			14-Nov-90 15:33:55
Occur	Source	Description			
13:58:52.325	PARSON/i	SUGAR	WEIGHT	ON	3938.92 CWT
14:03:52.320	PARSON/i	SUGAR	WEIGHT	ON	3995.46 CWT
14:08:52.315	PARSON/i	SUGAR	WEIGHT	ON	4052.02 CWT
14:13:52.325	PARSON/i	SUGAR	WEIGHT	ON	4087.73 CWT
14:18:52.320	PARSON/i	SUGAR	WEIGHT	ON	4097.80 CWT
14:23:52.320	PARSON/i	SUGAR	WEIGHT	ON	4107.85 CWT
14:28:52.315	PARSON/i	SUGAR	WEIGHT	ON	4112.87 CWT
14:33:52.320	PARSON/i	SUGAR	WEIGHT	ON	4117.88 CWT
14:38:52.325	PARSON/i	SUGAR	WEIGHT	ON	4122.88 CWT
14:43:52.325	PARSON/i	SUGAR	WEIGHT	ON	4122.88 CWT
14:48:52.315	PARSON/i	SUGAR	WEIGHT	ON	4122.88 CWT
14:53:52.320	PARSON/i	SUGAR	WEIGHT	ON	4127.88 CWT
14:58:52.325	PARSON/i	SUGAR	WEIGHT	ON	4127.88 CWT
15:03:52.325	PARSON/i	SUGAR	WEIGHT	ON	4127.88 CWT
15:08:52.325	PARSON/i	SUGAR	WEIGHT	ON	4148.03 CWT
15:13:52.325	PARSON/i	SUGAR	WEIGHT	ON	4168.21 CWT
15:18:52.320	PARSON/i	SUGAR	WEIGHT	ON	4193.54 CWT
15:23:52.325	PARSON/i	SUGAR	WEIGHT	ON	4208.63 CWT
15:28:52.325	PARSON/i	SUGAR	WEIGHT	ON	4264.99 CWT
15:33:52.325	PARSON/i	SUGAR	WEIGHT	ON	4326.92 CWT

Time	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	9:00	9:05	9:10
Spray Press.	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Press. Drop	7.5	7	7	7.2	7.2	7	5	6.5	7	7	6.8	6.8	7	7
Speed	900													
Parsons Read.	66	154	210	251	308	364	457	493	565	606	668	719	776	843
Slice Rate	223	212	205	211	215	218	213	210	217	217	215	214	213	211

Rotoclone: Granulator

Time of Test: 8:10 / 9:10
Start STOP

Dan Gust
Person Taking Readings.

Date 11 / 15 / 90

1*

Time	9:35 AM	9:40	9:45	9:50	9:55	10:00	10:05	10:10	10:15	10:20	10:25	10:30	10:35
Spray Press.	45	45	[illegible]	46	46	45	45	[illegible]	45	45	45	45	45
Press. Drop	7	7	7	7	7	7	[illegible]	7	7	7	7	7	7
Speed	900	—	—	—	—	—	—	—	—	—	—	—	—
Parsons Read	1099	1145	1185	1216	1272	1324	1406	1459	1535	1576	[illegible]	1700	1762
Slice Rate	217	215	212	217	208	213	212	210	210	211	210	216	217

Rotoclone: GRANULATOR

DAN Gust

Person Taking Readings.

Time of Test: 9:35 / 10:35
Start STOP

Date 11 / 15 / 90

#8

Time	11:00	11:05	11:10	11:15	11:20	11:[illegible]	11:30	11:35	11:40	11:45	11:50	11:[illegible]	1[illegible]	12:[illegible]
Spray Press.	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Press. Drop	7	7	7	7	7	7.	7.8	7.7	7.7	7.7	7.7	7.7	7.7	7.7
Speed	900													
Parsons Read.	2142	2183	2245	2301	2363	2420	2487	2553	2574	2651	2708	2780	2826	2898
Slice Rate	218	204	208	216	209	210	207	219	210	205	212	217	215	209

Rotoclone GRANULATOR

Time of Test: 11:00 / 12:05
Start STOP

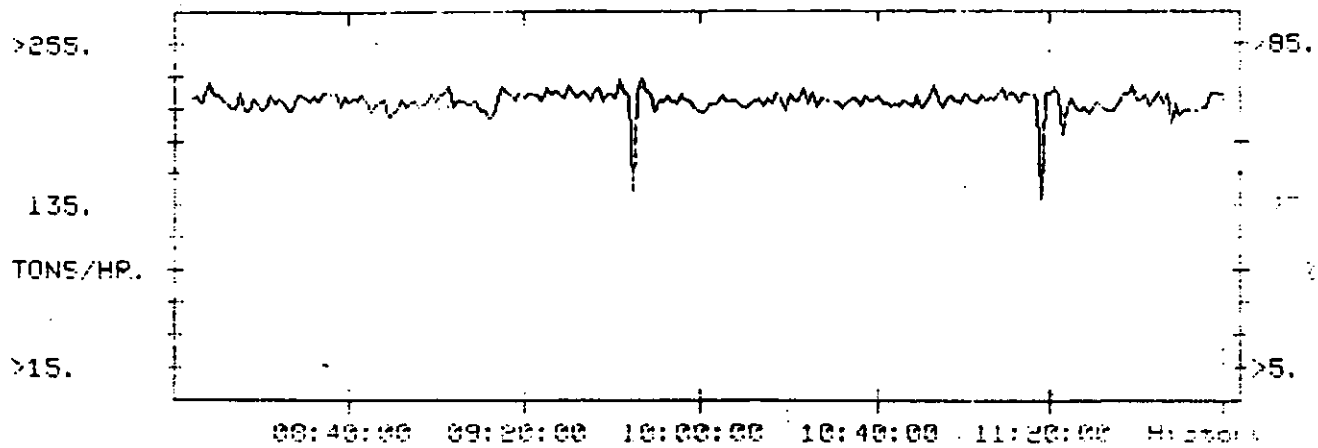
[illegible]

Person Taking Readings.

Date 11 / 15 / 90

11/3

Screen Print :   --BEET END   15-Nov-90 12:48:30



>SLICE

Data Pts >240 Time Scale >240 >Minutes   >Start Time >12:00:00 >15-Nov-90

	Tag	Descriptor	15-Nov-90	Value at 12:00:00	Units	Eng. Min	Eng. Max
OFF	1A14	SEWER LK		17.9	GPM	.0	714.0
ON	SLICE	BEET SLICE		216.	TONS/HR.	0.	300.
OFF	CRJ-FT	RAW JUICE FLOW		1072.50	GPM	.00	1500.00

OPER 3

Node: 4 EVENT LIST NO. 10 15-Nov-90 09:53:55

Occur	Source	Description			
08:18:52.325	PARSON/i	SUGAR	WEIGHT	ON	200.[illegible] CWT
[illegible]23:5[illegible].[illegible]25	[illegible]	SUGAR	WEIGHT	ON	255.[illegible] CWT
[illegible] 52.325	PARSON/i	SUGAR	WEIGHT	ON	[illegible] CWT
08:3[illegible]:52.315	PARSON/i	SUGAR	WEIGHT	ON	374.[illegible]6 CWT
[illegible]:38:52.320	PARSON/i	SUGAR	WEIGHT	ON	436.49 CWT
[illegible]:43:52.325	PARSON/i	SUGAR	WEIGHT	ON	498.[illegible]6 CWT
08:48:52.325	PARSON/i	SUGAR	WEIGHT	ON	565.[illegible] CWT
[illegible]:53:52.325	PARSON/i	SUGAR	WEIGHT	ON	626.89 CWT
[illegible]:58:52.320	PARSON/i	SUGAR	WEIGHT	ON	689.05 CWT
09:03:52.325	PARSON/i	SUGAR	WEIGHT	ON	756.07 CWT
09:08:52.320	PARSON/i	SUGAR	WEIGHT	ON	817.87 CWT
[illegible]:13:52.325	PARSON/i	SUGAR	WEIGHT	ON	884.76 CWT
[illegible]:18:52.320	PARSON/i	SUGAR	WEIGHT	ON	946.59 CWT
09:23:52.325	PARSON/i	SUGAR	WEIGHT	ON	1013.44 CWT
[illegible]:28:52.320	PARSON/i	SUGAR	WEIGHT	ON	1054.2[illegible] CWT
[illegible]:33:52.325	PARSON/i	SUGAR	WEIGHT	ON	1089.74 CWT
9:38:52.325	PARSON/i	SUGAR	WEIGHT	ON	1120.09 CWT
[illegible]:43:52.325	PARSON/i	SUGAR	WEIGHT	ON	1150.44 CWT
[illegible]:48:52.325	PARSON/i	SUGAR	WEIGHT	ON	1185.92 CWT
9:53:52.320	PARSON/i	SUGAR	WEIGHT	ON	1231.87 CWT

Node: 4 EVENT LIST NO. 10 15-Nov-90 11:33:56

Occur	Source	Description			
[illegible]5[illegible]:52.325	PARSON/i	SUGAR	WEIGHT	ON	1288.2[illegible] CWT
[illegible]:03:52.325	PARSON/i	SUGAR	WEIGHT	ON	1350.04 CWT
[illegible]:08:52.325	PARSON/i	SUGAR	WEIGHT	ON	1417.01 CWT
[illegible]:13:52.320	PARSON/i	SUGAR	WEIGHT	ON	1483.97 CWT
[illegible]:18:52.325	PARSON/i	SUGAR	WEIGHT	ON	1545.83 CWT
[illegible]:23:52.320	PARSON/i	SUGAR	WEIGHT	ON	1612.82 CWT
[illegible]:28:52.325	PARSON/i	SUGAR	WEIGHT	ON	1674.64 CWT
[illegible]:33:52.320	PARSON/i	SUGAR	WEIGHT	ON	1741.53 CWT
0:38:52.320	PARSON/i	SUGAR	WEIGHT	ON	1808.39 CWT
0:43:52.320	PARSON/i	SUGAR	WEIGHT	ON	1875.26 CWT
[illegible]:48:52.325	PARSON/i	SUGAR	WEIGHT	ON	1942.13 CWT
[illegible]:53:52.315	PARSON/i	SUGAR	WEIGHT	ON	1998.63 CWT
0:58:52.325	PARSON/i	SUGAR	WEIGHT	ON	2055.18 CWT
1:03:52.315	PARSON/i	SUGAR	WEIGHT	ON	2116.67 CWT
[illegible]:08:52.320	PARSON/i	SUGAR	WEIGHT	ON	2178.40 CWT
1:13:52.325	PARSON/i	SUGAR	WEIGHT	ON	2245.27 CWT
[illegible]:18:52.325	PARSON/i	SUGAR	WEIGHT	ON	2307.21 CWT
[illegible]:23:52.325	PARSON/i	SUGAR	WEIGHT	ON	2368.98 CWT
1:28:52.320	PARSON/i	SUGAR	WEIGHT	ON	2435.91 CWT
1:33:52.325	PARSON/i	SUGAR	WEIGHT	ON	2492.42 CWT

Screen Print from Node: 10

Print : [illegible] 15-Nov 90 12:3[illegible]

Occur	Source	Description				
15-Nov-90						
12:33:52.325	:PARSON/i	SUGAR	WEIGHT	ON	3238.13	CW
12:28:52.325	:PARSON/i	SUGAR	WEIGHT	ON	3176.49	CW
12:23:52.320	:PARSON/i	SUGAR	WEIGHT	ON	3109.54	CW
12:18:52.315	:PARSON/i	SUGAR	WEIGHT	ON	3047.79	CW
12:13:52.325	:PARSON/i	SUGAR	WEIGHT	ON	2980.86	CW
12:08:52.315	:PARSON/i	SUGAR	WEIGHT	ON	2919.01	CW
12:03:52.320	:PARSON/i	SUGAR	WEIGHT	ON	2852.16	CW
11:58:52.320	:PARSON/i	SUGAR	WEIGHT	ON	2790.45	CW
11:53:52.320	:PARSON/i	SUGAR	WEIGHT	ON	2723.58	CW
11:48:52.320	:PARSON/i	SUGAR	WEIGHT	ON	2661.70	CW
11:43:52.325	:PARSON/i	SUGAR	WEIGHT	ON	2594.79	CW
11:38:52.320	:PARSON/i	SUGAR	WEIGHT	ON	2538.41	CW
11:33:52.325	:PARSON/i	SUGAR	WEIGHT	ON	2492.42	CW
11:28:52.320	:PARSON/i	SUGAR	WEIGHT	ON	2435.91	CW
11:23:52.325	:PARSON/i	SUGAR	WEIGHT	ON	2368.98	CW
11:18:52.325	:PARSON/i	SUGAR	WEIGHT	ON	[illegible]	CW
11:13:52.325	:PARSON/i	SUGAR	WEIGHT	ON	[illegible]	CW
11:08:52.320	:PARSON/i	SUGAR	WEIGHT	ON	2178.40	CW

* More *

Unprint 20

OPER 3

APPENDIX G

PROCEDURES

Particulate Loading and Emission Rates

The particulate emission rates were determined per EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1988). In this procedure a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

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

Particulate samples are collected as follows: The sample gas is drawn through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter where particulates are removed. The sample gas is then passed through an ice-cooled impinger train and a desiccant-packed column which absorbs remaining moisture. The sample gas then passes through a vacuum pump followed by a dry test gas meter. The gas meter integrates the sample gas flow throughout the course of the test. A calibrated orifice attached to the outlet of the gasmeter provides real time flow rate data.

A representative particulate sample was acquired by sampling for equal periods of time at the centroid of a number of equal area regions in the duct. The sampling rate is adjusted at each test point maintaining isokinetic sampling conditions. Nomographs are used for rapid determination of the sampling rate.

3a P1(1-5)

When sampling is complete the filter is removed with tweezers and placed in a clean container. The nozzle, pitot tube and inlet side of the filter holder are quantitatively washed with acetone and the washings are stored in a second container. A brush is often used in the cleaning step to help dislodge deposits. The samples are returned to the laboratory where they are logged in and analyzed. The volume of the acetone rinse ("probe wash") is noted and the rinse is transferred to a tared 120 cc porcelain evaporating dish. The acetone is then evaporated off at 97 - 105 ^{0}F. At this elevated temperature condensation of atmospheric moisture is prevented. The acetone-free sample is then dried at 105 ^{0}C for 30 minutes, cooled in a desiccator over Drierite, and weighed to the nearest 0.01 mg. The filter sample is transferred to a 6 inch watch glass and dried at 105 ^{0}C for two hours. The filter and watch glass are then cooled in a desiccator and the filter weighed to the nearest 0.01 mg. All weighings are performed in a balance room where the relative humidity is maintained at less than 50%. Microscopic examination of the samples is performed if any unusual characteristics are observed. The weight of the acetone rinse blank is subtracted from the samples. The Drierite column is weighed on-site and the water absorbed by the Drierite is added to the condensate to give the total amount of absorbed water.

3af

Interpoll Laboratories
(612)786-6020

Condensible Organic Compounds Analysis

(State of Minnesota - MPCA Exhibit C)

Method II-8672-MN

Equipment:	Separatory funnel - 500 cc with Teflon stopcock
	Powder funnel - 75 mm ID with a 17 mm stem
	Evaporating dish(es) - 200 cc or 250 cc beaker
Reagents:	Diethyl ether - reagent grade
	Chloroform - reagent grade
	Sodium sulfate - (ACS) granular anhydrous
	Toluene - (if 3% hydrogen peroxide is used to collect the samples)
	Glass wool (Pyrex microfiber)

PREPARATION

1. Place 1 kg of granular anhydrous sodium sulfate in a shallow tray and heat to 200 °C for at least four hours. Store in a tightly sealed glass container.

2. Place a plug of clean glass wool in the stem of the powder funnel. The plug must be of sufficient size so that it is held snuggly in place by its own pressure. Add a one-inch layer of dry sodium sulfate.

SAMPLING

An all-glass impinger assembly is used in the back half of the EPA Method 5 sampling train when an organic wet catch is to be collected. The impinger assembly consists of a modified impinger, a Greenburg Smith impinger followed by another modified impinger. The third impinger should have a temperature measuring device at the outlet upstream of a final impinger or desiccant column to monitor the temperature of the outlet gas stream. Prior to the start of the test, each of the first two impingers should be charged with 100 g of Class I water. The Method 5 train should be operated as provided for in EPA Method 5. Ice should be added to the impinger bath to keep the temperature of the gas at the outlet at or less than 68 ^{o}F. After the post test leak check, the impinger train is removed and impinger contents poured into a tared all-glass sample bottle and closed with a Teflon-lined cap. The sample bottle is then weighed and the total condensate calculated by subtraction of the bottle tare weight and the weight of initial water added to the impingers (200 g). A label is affixed and the sample is returned to the laboratory for analysis. The sample should be stored at 4 ^{o}C if the analysis is not conducted within 48 hours.

ANALYSIS

I. Organics

Caution! Work in vented hood!!!

A. Organic Blank Determination

1. Pour 125 mL of ethyl ether and 125 mL of chloroform into a tared beaker.
2. Evaporate solvent in hood at 70 ^{o}F or less until no solvent remains.
3. Desiccate the sample in dish for two hours.
4. Weigh the sample to nearest 0.1 mg, record and report on Form LSC-036.

B. Organic Sample Determination

1. Test for peroxide in sample ether using KI strips. (If KI strip shows positive, contact your supervisor before proceeding.)
2. Transfer the sample solution quantitatively to a 500 mL separatory funnel. Use the first of three 25 mL chloroform aliquots to rinse the sample container.
3. Extract with three 25 mL portions of chloroform. (Shake and vent to release pressure about 4 to 5 times each.) Allow the phases to separate. (Bottom layer is chloroform.) Draw off the bottom layer, transferring the solvent with a funnel containing a plug of sodium sulfate into a tared beaker. (Do not draw off any of the aqueous layer.)

4. After the three chloroform extractions, use two 25 mL portions of chloroform to rinse the sodium sulfate, collecting the rinses in the same tared beaker as the extracts.

5. Next extract the sample three times with 25 mL aliquots of ethyl ether. (Shake and vent to release pressure about 4 to 5 times each.) Allow the phases to separate. (Top layer is ethyl ether.) Draw off the bottom layer (aqueous) into another separatory funnel taking less than 1 mL of the ethyl ether layer with. Decant the ethyl ether, passing it through sodium sulfate and collecting the ethyl ether in the same tared dish as the chloroform.

6. After the three ethyl ether extractions, take two 25 mL portions of ethyl ether and rinse the sodium sulfate collecting the rinses in the same tared beaker as the extracts.

7. Evaporate the solvents (chloroform and ethyl ether) in the tared beaker in the hood at 70 $^{\circ}F$ or less until no solvent remains. (Use no heat and have no sources of ignition in the hood when doing this procedure.) Do not evaporate so quickly as to allow evaporative cooling to lower the temperature of the container below the dew point of water, otherwise, water will be condensed out in the container.

8. Desiccate to constant weight (two hours). Record and report the final weight to the nearest 0.1 mg on Form LSC-036.

II. Inorganics

If inorganic residue information is required, the following procedure should be conducted:

A. Inorganic Blank Determination

1. Vent the remaining aqueous phase from the organic extraction in the hood to remove residual organic solvents (usually overnight).
2. Decant the impinger catch into a tared evaporating dish.
3. Evaporate all of the water in the sample in an oven at 100 ^{o}C. Take care not to boil to prevent bumping and loss of sample.
4. Cool the dried sample in the desiccator and desiccate until a constant weight is obtained.
5. Report the results to the nearest 0.1 mg on Form LSC-036.

B. Inorganic Sample Determination

Follow steps 1-5 in Section A above.

NOTES

1. For the organics determination, in the rare event that the impinger catch resulted from a Modified Method 6 determination (SO_2), whereby the solution contains dilute hydrogen peroxide ($\geq$ 3%), do <u>not</u> use ether as an extraction solvent. <u>Substitute toluene</u> for ethyl ether in Section I. (Ether in the presence of peroxide forms explosive hydroperoxide.)

2. In the organics determination, more than three extractions may be required to extract all of the organics. Additional extractions should be performed if the aqueous phase is still cloudy.

3. Special state requirements:

   <u>Michigan</u> - Total sample evaporated in tared evaporating dish on steam bath.

   <u>Iowa</u> - Organics and inorganics separately, as required.

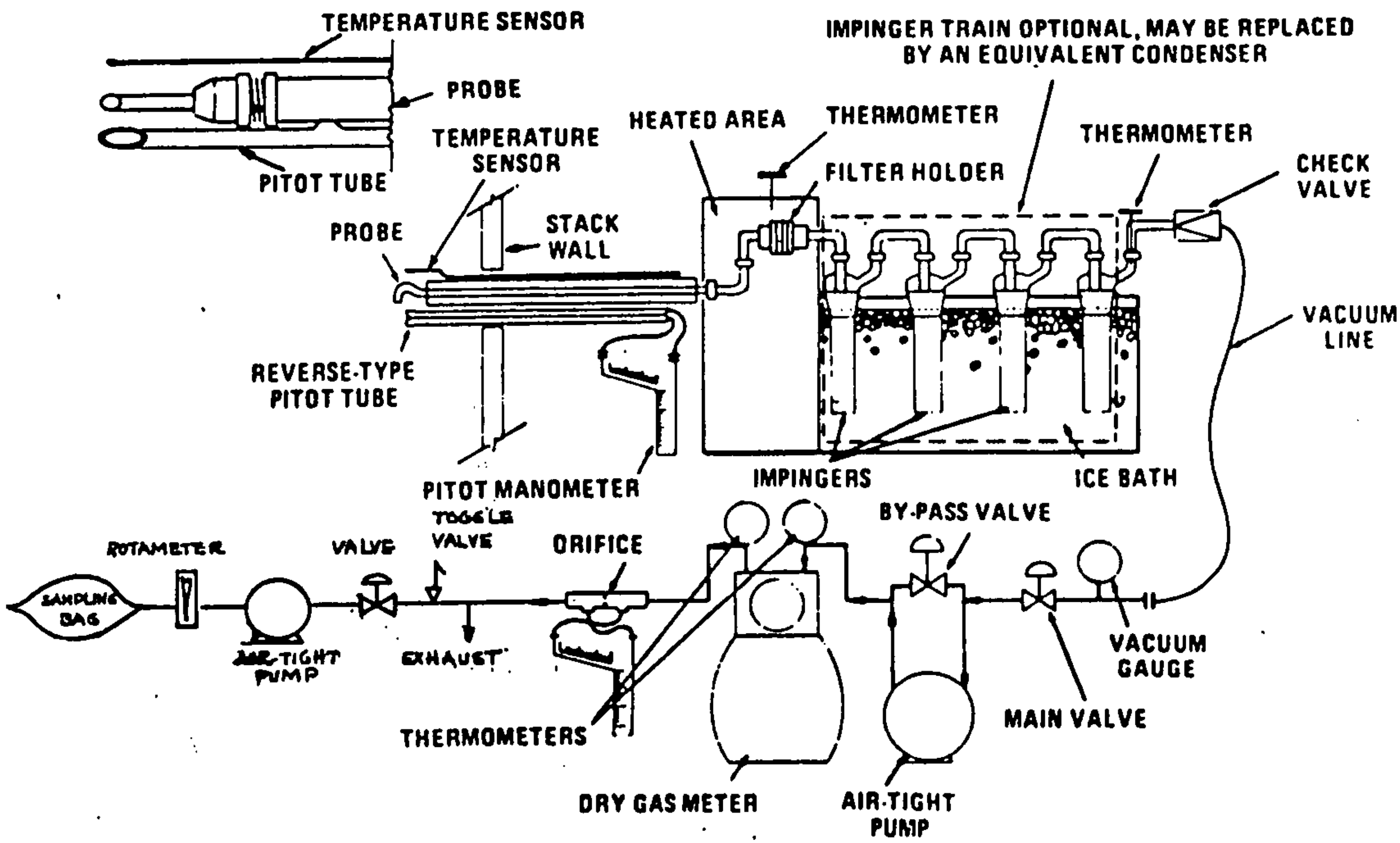
   <u>Wisconsin</u> - Use Method II-8672-WI.

   <u>Rest of states</u> - Organics only.

REFERENCES

Proposed Standards of Performance for New Stationary Sources, Federal Register <u>36</u>(159) Part II, August 1, 1979.

Minnesota Pollution Control Agency, Exhibit C.



Particulate-sampling train.

APPENDIX H

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 2

$$\overline{V}_s = 35.48\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,d} = 60(1 - B_{ws})\ \overline{V}_s\ A\ \left(\frac{528}{T_{s(avg)}}\right)\ \left(\frac{P_s}{29.92}\right)$$

$$Q_a = 60\ \overline{V}_s\ A$$

$$\dot{m}_g = \frac{4.995\ Q_{s,d}\ G_d}{1 - B_{ws}}$$

$$RH^* = 100\ (vp_{twb}\ 0.0003641\ P_s\ (T_{db} - T_{wb}))/vp_{tdb}$$

$$B^*_{ws} = RH(vp_{tdb})/P_s$$

$$= \frac{4.585 \times 10^{-2}\ P_s M_s}{T_s\ (avg)}$$

*Alternate equations for calculating moisture content from wet bulb and dry buld data.

SYMBOLS

A	=	Cross sectional area of stack, SQ. FT.
A_n	=	Cross sectional area of nozzle, SQ. FT.
B_{ws}	=	Water vapor in gas stream, proportion by volume
C_p	=	Pitot tube coefficient, dimensionless
C_a	=	Concentration of particulate matter in stack gas, wet basis, GR/ACF
C_s	=	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF
EA	=	Excess air, percent by volume
γ	=	Dry test meter correction factor, dimensionless
G_d	=	Specific gravity (relative to air), dimensionless
I	=	Isokinetic variation, percent by volume
M_d	=	Molecular weight of stack gas, dry basis, g/g - mole.
$\dot{m}_g$	=	Mass flow of wet flue gas, LB/HR
$\dot{m}_p$	=	Particulate mass flow, LB/HR
M_s	=	Molecular weight of stack gas, wet basis, g/g, mole.
M_p	=	Total amount of particulate matter collected, g
P_{bar}	=	Atmospheric pressure, IN. HG. (uncompensated)
P_g	=	Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN.HG.

P_{std} = Standard absolute pressure, 29.92 IN. HG.

A_a = Actual volumetric stack gas flow rate, ACFM

$Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM

RH = Relative humidity, %

T_{db} = Dry bulb temperature of stack gas, ^{o}F

T_{wb} = Wet bulb temperature of stack gas, ^{o}F

$T_{m(avg)}$ = Absolute average dry gas meter temperature, ^{o}R

$T_s(avg)$ = Absolute average stack temperature, ^{o}F

T_{std} = Standard absolute temperature, 528 ^{o}F (68 ^{o}F)

θ = Total sampling time, min.

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml

V_m = Volume of gas sample as measured by dry gas meter, CF

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

$V_{w(std)}$ = Volume of water vapor in the gas sample corrected to standard conditions, SCF

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

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

vp_{twb}	=	Vapor pressure at T_{wb}, IN. HG
$\overline{\Delta H}$	=	Average pressure differential across the orifice meter, IN. WC.
ΔP	=	Velocity pressure of stack gas, IN. WC.
γ	=	Dry test meter correction coefficient, dimensionless
ρ	=	Actual gas density, LB/ACF

CALCULATION EQUATIONS

METHOD 3

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

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

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

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

CALCULATION EQUATIONS

METHOD 5

$$V_{m(std)} = 17.65\ V_m\ \gamma\ \left(\frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}}\right)$$

$$V_{w(std)} = 0.0472\ V_{Is}$$

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

$$I = 0.0944\ \left(\frac{T_{s(avg)}\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (1 - B_{ws})}\right)$$

$$C_s = \frac{15.43\ M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3\ M_p\ P_s}{T_{s(avg)}\ (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714 \times 10^{-3}\ C_s\ Q_{s,d}$$

$$(\dot{m}_p)_2 = \frac{1.3228 \times 10^{-1}\ M_p\ \ A}{0\ A_n}$$

$$\dot{m}_p = \frac{(\dot{m}_p)_1 + (\dot{m}_p)_2}{2}$$

SYMBOLS

A = Cross sectional area of stack, SQ. FT.

A_n = Cross sectional area of nozzle, SQ. FT.

B_{ws} = Water vapor in gas stream, proportion by volume

C_p = Pitot tube coefficient, dimensionless

C_a = Concentration of particulate matter in stack gas, wet basis, GR/ACF

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF

EA = Excess air, percent by volume

Υ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

M_d = Molecular weight of stack gas, dry basis, g/g - mole.

$\dot{m}_g$ = Mass flow of wet flue gas, LB/HR

$\dot{m}_p$ = Particulate mass flow, LB/HR

M_s = Molecular weight of stack gas, wet basis, g/g, mole.

M_p = Total amount of particulate matter collected, g

P_{bar} = Atmospheric pressure, IN. HG. (uncompensated)

P_g = Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN.HG.

P_{std} = Standard absolute pressure, 29.92 IN. HG.

A_a = Actual volumetric stack gas flow rate, ACFM

$Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM

RH = Relative humidity, %

T_{db} = Dry bulb temperature of stack gas, ^oF

T_{wb} = Wet bulb temperature of stack gas, ^oF

$T_{m(avg)}$ = Absolute average dry gas meter temperature, ^oR

$T_s(avg)$ = Absolute average stack temperature, ^oF

T_{std} = Standard absolute temperature, 528 ^oF (68 ^oF)

θ = Total sampling time, min.

V_{1c} = 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.

Y = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: November 16, 1990

Meter Box No. : 6 (Rockwell Dry Test Meter Serial No. 64711)

Date of Last Calibration: October 29, 1990
Calibration Technician: E. Trowbridge
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
November 5, 1990	0-3192	354.80	993.19	638.39	638.39
November 14-15, 1990	0-3202	993.90	1261.43	267.53	905.92

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: November 14, 1990 Nozzle Number 4-3
Technician: M. Kaehler

Nozzle rotated by 60 degree increments and diameter measured to nearest 0.001 inch. Observed readings and average:

Position	Diameter (inches)
1	0.183
2	0.184
3	0.183
Average:	0.183

Interpoll Laboratories, Inc.
(612) 786-6060

EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Job A.C.S. / Moorhead, MN Date 11-14-90

Operator M. Kaehler Module No. 6

Instructions: Operate the control module at a flow rate equal to ^H@ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 28.62 in. Hg. τ = 1.0016 ^H@ 1.84 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(993.90)		
2.5	995.85	71	68
5.0	997.79	74	70
7.5	999.71	76	71
10	1001.66	78	72
	V_m = 7.76	$Avg(t_m)$ = 72.5 °F	

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\tau\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(1.0016)(7.76)}\left[\frac{(72.5) + 460}{(28.62)}\right]^{0.5}$$

Y_{cn} = .991

If Y_{cn} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

Interpoll Laboratories, Inc.
(612) 786-6060

EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Job A.C.S. / Moorhead, MN   Date 11-15-90

Operator M. Kaehler   Module No. 6

Instructions: Operate the control module at a flow rate equal to ^H@ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 28.75 in. Hg. γ = 1.0016 ^H@ 1.84 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F) Inlet	Meter Temp. (°F) Outlet
	(114.20)		
2.5	116.15	79	77
5.0	118.10	80	78
7.5	120.05	82	79
10	121.98	84	79
	V_m= 7.78	Avg (t_m) = 79.75 °F	

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\gamma\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(1.0016)(7.78)}\left[\frac{(79.75) + 460}{(28.75)}\right]^{0.5}$$

Y_{cn} = .993

If Y_{cn} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

Date 10-29-90

Bar. Press. 28.99 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET

EPA METHOD 5

Control Module No. 6

Serial No. DTM 64710

Wet Test Meter No. AL-20

Technician E Trewhella

ΔH (in. WC)		Gas Volume Wet Test Meter (ft³)	* Cal. Index φ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft³)		Gas temperatures			Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔH@	C_f
nominal	actual				V_{di}	V_{df}	Wet Test t_w (°F)	Dry Test t_{di} (°F)	Dry Test t_{do} (°F)				
0.5	.5	2	99.70	0.01	337.500	339.533	65	78	72	5/04.35	.9982	1.82	
1.2	1.2	3	99.77	0.03	334.000	337.037	65	78	71	4/55.36	1.0024	1.83	
2.0	2.0	3	99.87	0.05	340.000	343.053	65	83	75	3/50.74	1.0023	1.84	
3.3	3.3	5	100.00	0.08	343.500	348.599	65	86	76	5/01.84	1.0018	1.86	
4.7	4.7	5	100.20	0.11	349.000	354.096	65	89	76	4/14.86	1.0036	1.87	
	2	3	4	5	6	7	8	9	10	11/12	1.0016	1.84	

Positive leak check performed by ET
Meter was in tolerance ☒
Meter was not in tolerance ☐; readjusted linkage
Meter was not in tolerance ☐; changed dry test meters

Approved by Daniel J. Dyer Date 10/29/90

* Based on AL-20 wet test meter calibration in August 1989 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102RR 5/90

Interpoll Laboratories
(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 2½ - 22

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .462 IN.
3. Base to Side B opening plane (P_B) .464 IN.

Alignment:

4. $\alpha_1 < 10^o$ 0
5. $\alpha_2 < 10^o$ 0

6. $B_1 < 5^o$ 1
7. $B_2 < 5^o$ 1

8. Z <.125" .02
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .760 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 IN.
13. Pitot to thermocouple (perpendicular to probe) .762 IN.

Date of Inspection: 12-8-89

Inspected by: [signature]

S-348(1)

Interpoll Laboratories, Inc.

Temperature Measurement Device
Calibration Sheet

Unit under test:

Vendor Gordon

Model 5310-K   Serial Number PDT-9

Range -112°F to +1999°F °F   Thermocouple Type K

Date of Calibration 9-13-90   Technician Mark Kaehler

Method of Calibration:

☐ Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.

☑ Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is ± 0.1% of span (2100 °F) ± 1 degree (for negative temperatures add ± 2 degrees. The CL-300 simulates exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation Δt (°F)	Deviation (%)
0		-1.8	1.8	.39
100		95.4	4.6	.82
200		198	2	.30
300		296	4	.53
400		392	8	.93
500		491	9	.94
600		593	7	.66
700		692	8	.69
800		796	4	.32
900		897	3	.22
1000		1000	0	0
1100		1102	2	.13
1200		1206	6	.36
1300		1305	5	.28
1400		1408	8	.43
1500		1504	4	.20
1600		1603	3	.15
1700		1697	3	.14
1800		1793	7	.31
1900		1883	17	.72
2000		1976	24	.98
2100		** OF	OF	OF
		Averages:	6.21	0.45

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.

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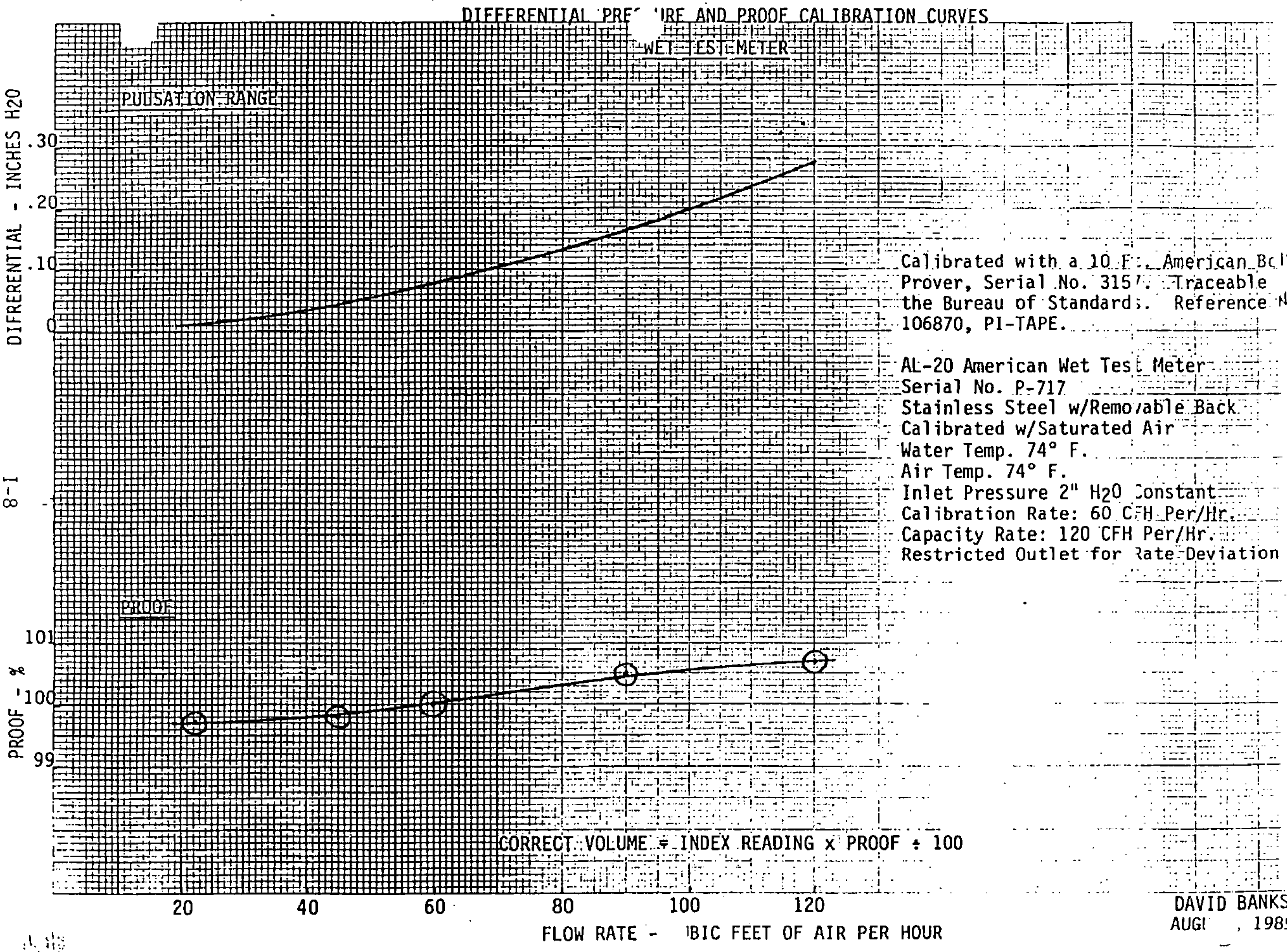

DAVID BANKS
AUG[illegible], 1989