TEST REPORT

SCOPE: EMISSIONS AND OUTPUT

FUEL: EPA TEST FUEL (CRIBS)

TEST STANDARD: EPA

MODEL: EASTWOOD 1800 WOOD STOVE

Notice to reader: Our Eastwood 1800 wood stove was tested as part of our Century firebox. Therefore, the Century is referenced throughout the attached test report.

Certification Test Report

CFM – Vermont Castings

Freestanding Wood Stove
Model: Century

Report Number 259-S-12-3

OMNI-Test Laboratories, Inc.
Product Testing & Certification

Mailing: Post Office Box 743
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Certification Test Report

CFM – Vermont Castings

Freestanding Wood Stove

Model: Century

Prepared for:	CFM – Vermont Castings 62 Vermont Castings Road Bethel, VT 05032
Prepared by:	OMNI-Test Laboratories Inc. 5465 SW Western Avenue, Suite G Beaverton, OR 97005 (503) 643-3788
Test Period:	July 31, 2006 through August 3, 2006
Report Date:	August 2006
Project Number:	259-S-12-3

AUTHORIZED SIGNATORIES

This report has been reviewed and approved by the following authorized signatories:

Richard Sparwasser, Vice President
OMNI-Test Laboratories Inc.

John Voorhees, Technical Services Director
OMNI-Test Laboratories Inc.

Ken Morgan, Emissions Test Technician
OMNI-Test Laboratories Inc.

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Section 1

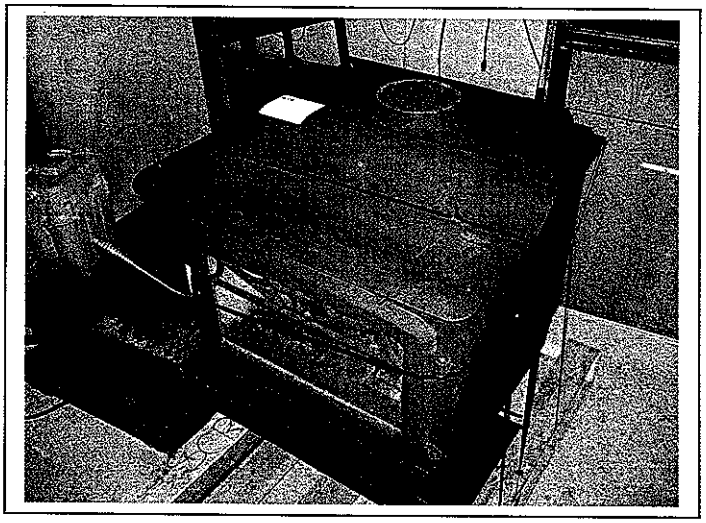
Fuel Photographs/Appliance Description/Drawings

CFM – Vermont Castings

Century

Test Dates: July 31, 2006 through August 3, 2006

Front ¾ View

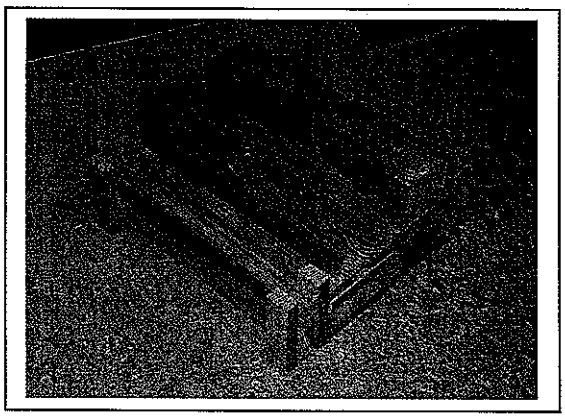


Rear ¾ View

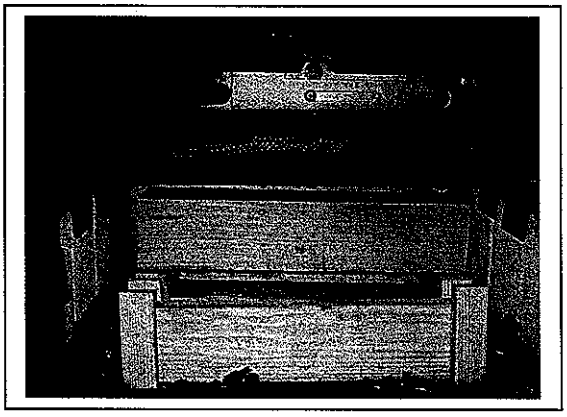
Model: Century
CFM – Vermont Castings
62 Vermont Castings Road
Bethel, VT 05032

CFM – Vermont Castings
Century

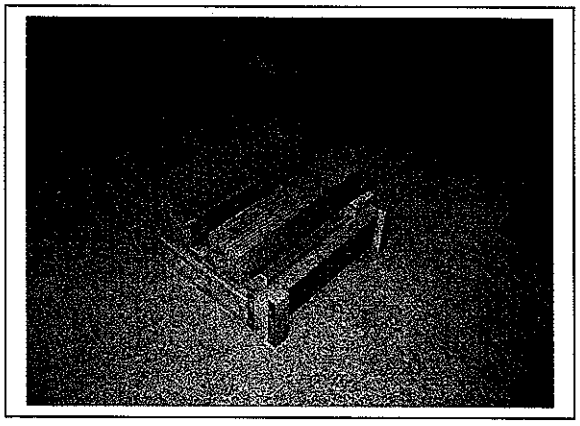
Run 1 – Fuel



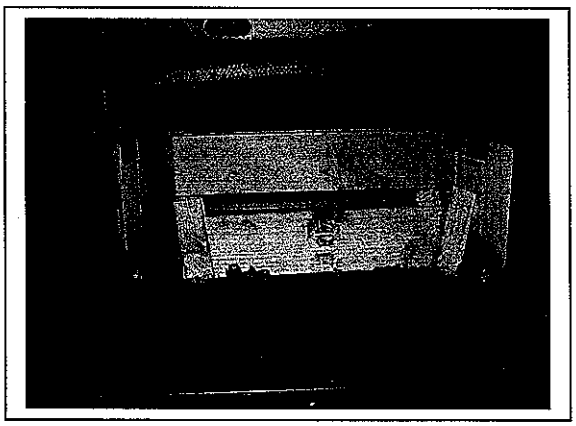
Run 1 - Newly Loaded Stove



Run 2 – Fuel



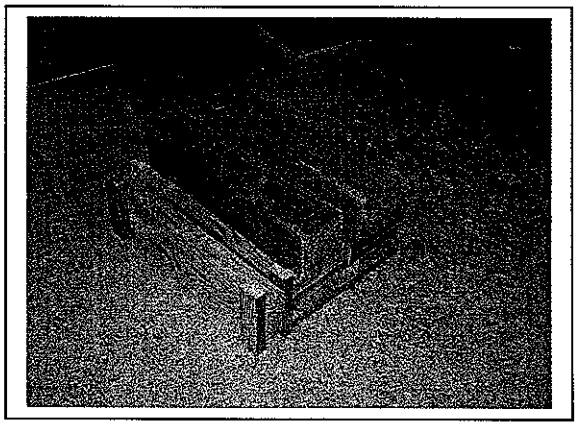
Run 2 - Newly Loaded Stove



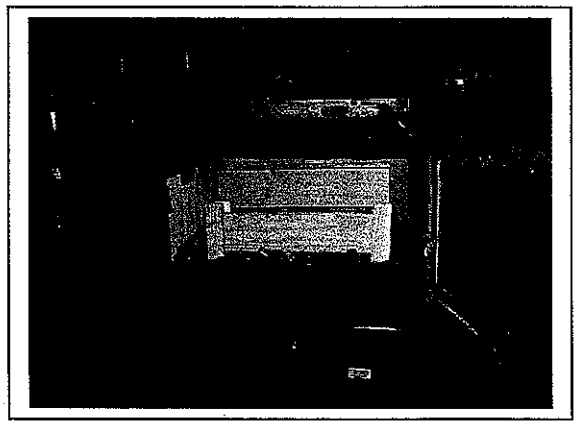
Model: Century
CFM – Vermont Castings
62 Vermont Castings Road
Bethel, VT 05032

CFM – Vermont Castings
Century

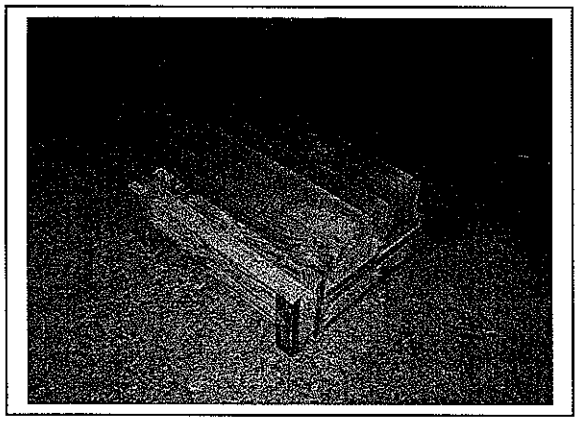
Run 3 – Fuel



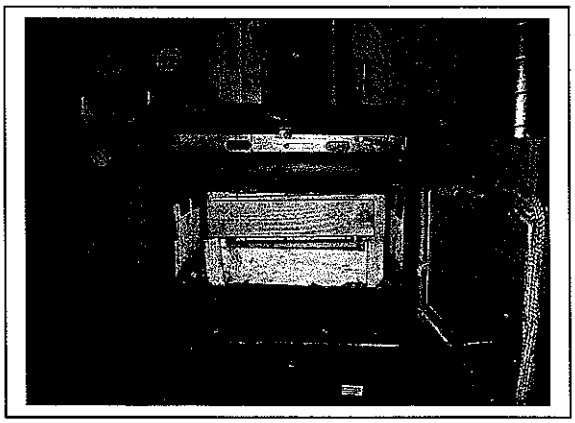
Run 3 - Newly Loaded Stove



Run 4 – Fuel

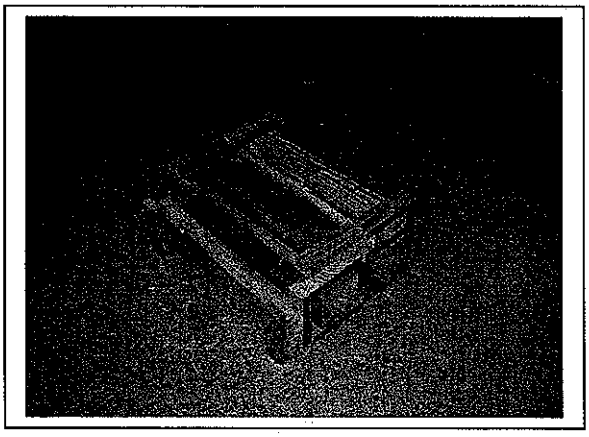


Run 4 - Newly Loaded Stove

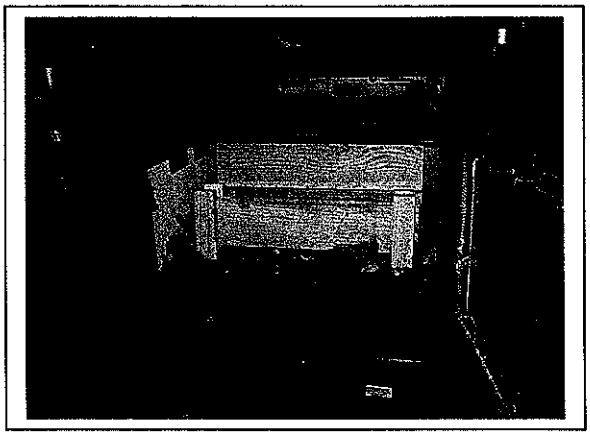


CFM – Vermont Castings
Century

Run 5 – Fuel



Run 5 - Newly Loaded Stove



WOOD HEATER DESCRIPTION

Manufacturer: CFM – Vermont Castings

Model: Century

Type: Freestanding, radiant-type room heater

WOOD HEATER INFORMATION

Materials of Construction: The unit is constructed primarily of mild steel. The firebox is lined with firebrick that measures 21" by 9" by 16-7/8".

Air Introduction System: Air enters the firebox through an opening located at the front of the appliance above the fuel-loading door and below the door via an adjustable intake. Secondary air enters the appliance through the back and is channeled internally to both sides of the firebox supplying four 3/4" diameter tubes.

Combustion Control Mechanisms: The combustion air inlet is controlled by a handle located below the fuel-loading door in the center of the appliance.

Combustor: N/A.

Internal Baffles: A flame deflector baffle is mounted in the upper portion of the firebox. The flame path is forced to the front of the firebox where it travels up through the opening between the baffle and primary air inlet.

Other Features: Optional blower accessory.

Flue Outlet: The 6" diameter flue outlet is located at the top of the unit.

WOOD HEATER OPERATING INSTRUCTIONS

Specific written instructions: See Section 1 of this report. All markings and instruction materials were reviewed for content prior to printing.

Stove Centfiber 3

Vol= 2.14 cu. ft.
Load Weight 6.36 kg
Wood Length 16 in

7/31/06

	Low	Med. Low	Med. High	High
Control Setting	Closed	3/8" open	3/4" open	wide open
Kindling	9. lb 4.08 kg	9. lb 4.08 kg	9. lb 4.08 kg	9. lb 4.08 kg
Pre-burn Load Size 8 in (2x4)	17.6 lb 7.71 kg	16.60 lb 7.53 kg	16.40 lb 7.44 kg	18.10 lb 8.21 kg
Pre-Shutdown instructions	Burn on High Intill Shut down	"	"	START 1 hr pre-burn as soon as LOADED
Shutdown Weight	10. lb 4.54 kg	10.5 lb 4.76 kg	13.0 lb 5.90 kg	ASAP lb kg
Post-Shutdown Instructions	NO-STIR Intill Coal bed is Packed	"	"	"
Loading Temp deg F	FAN-on-Low 340° —	Fan on Low 340° — Fan-off 370° —	FAN-on-High 370°-400°	FAN-on-High 520° —
Results	BR.-.89 EPA.-2.84	BR.-.99 EPA.-3.26 FAN-on BR.-1.14 EPA.-3.24 Fan-off	BR.-1.46 EPA.-3.02	BR.-3.25 EPA.-3.86

(On all burns, Except fan confirmation test, fan is turned on after first 30 min's into test.)

Written Instructions Received from Manufacturer

7-36-06

Section 2

Quality Assurance/Quality Control

QUALITY ASSURANCE/QUALITY CONTROL

OMNI follows the guidelines of ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories," and the quality assurance/quality control (QA/QC) procedures found in *OMNI*'s Quality Assurance Manual.

OMNI's scope of accreditation includes, but is not limited to, the following:

- ANSI (American National Standards Institute) for certification of product to safety standards.
- To perform product safety testing by the International Approval Service (formerly ICBO ES) under accreditation as a testing laboratory designated TL-130.
- To perform product safety testing as a "Certification Organization" by the Standards Council of Canada (SCC).
- Serving as a testing laboratory for the certification of wood heaters by the U.S. Environmental Protection Agency.

This report is issued within the scope of *OMNI*'s accreditation. Accreditation certificates are available upon request.

Sample Analysis

Analysis Worksheets
Tared Filter and Beaker Data
Solvent Blank Data

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 7-31-06 Test Crew: K. Morgan Run #: 1
Sample Train #: TRAIN-1 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI - 291
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	8-02-06	07:00	.1416	1.0003 0.0999	2.5	74	IK
Lab ID # D 368 ID # TRAIN-1 Tare wt. .1277	8-02-06	17:30	.1416	99.9992 1.0002	10	84	IK
D/T in desiccator 7-31-06 19:40							
Preliminary wt.: .1434							
Rear Filter	8-02-06	07:00	.1227	1.0003 0.0999	2.5	74	IK
Lab ID # D 366 ID # TRAIN-1 Tare wt. .1221	8-2-06	17:30	.1226	99.9992 1.0002	10	84	IK
D/T in desiccator: 7-31-06 19:40							
Preliminary wt.: .1229							
Probe	8-02-06	07:00	83.3566	1.0003 .0999	2.5	74	IK
Lab ID # Probe # 2 Tare wt. 83.3562 Cleaned by: IK D/T in desiccator: 7-31-06 19:40 Preliminary wt.: 83.3586	8-02-06	17:30	83.3564	99.9992 1.0002	10	84	IK

Technician signature: K. J. Morgan Date: 8-02-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 7-31-06 Test Crew: K. Morgan Run #: 1
Sample Train #: TRAIN-2 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	8-02-06	07:00	.1238	1.0003 0.0799	2.5	74	IK
Lab ID # D367 ID # TRAIN-2 Tare wt. .1135	8-02-06	17:30	.1237	99.9992 1.0002	10	84	IK
D/T in desiccator 7-31-06 19:40							
Preliminary wt.: .1242							
Rear Filter	8-02-06	07:00	.1197	1.0003 0.0009	2.5	74	IK
Lab ID # D365 ID # TRAIN-2 Tare wt. .1191	8-02-06	17:30	.1197	99.9992 1.0002	10	84	IK
D/T in desiccator: 7-31-06 19:40							
Preliminary wt.: .1202							
Probe	8-02-06	07:00	86.7882	1.0003 0.0009	2.5	74	IK
Lab ID # TRAIN-2 Probe # B Tare wt. 86.7878 Cleaned by: IK	8-02-06	17:30	86.7879	99.9992 1.0002	10	84	IK
D/T in desiccator: 7-31-06 19:40							
Preliminary wt.: 86.7891							

Technician signature: K. Morgan Date: 8-02-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-01-06 Test Crew: K. MORGAN Run #: 2
Sample Train #: TRAIN-1 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # TRAIN-1 ID # D364 Tare wt. .1259 D/T in desiccator 8-01-06 15:00 Preliminary wt.: .1412	8-02-06	17:30	.1405	99.9992 1.0002	10	84	IK
	8-03-06	08:15	.1404	99.9994 1.0002	4	74	IK
Rear Filter Lab ID # TRAIN-1 ID # D362 Tare wt. .1240 D/T in desiccator: 8-01-06 15:00 Preliminary wt.: .1249	8-02-06	17:30	.1242	99.9992 1.0002	10	84	IK
	8-03-06	08:15	.1242	99.9994 1.0002	4	74	IK
Probe Lab ID # TRAIN-1 Probe # 4 Tare wt. 79.0673 Cleaned by: IK D/T in desiccator: 8-01-06 15:00 Preliminary wt.: 79.0700	8-02-06	17:30	79.0682	99.9992 1.0002	10	84	IK
	8-03-06	08:15	79.0684	99.9994 1.0002	4	74	IK

Technician signature: K. Morgan Date: 8-03-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 08-01-06 Test Crew: K. MORGAN Run #: 2
Sample Train #: TRAIN-2 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	8-02-06	17:30	.1264	99.9992 1.0002	10	84	K
Lab ID # TRAIN-2 ID # D 363 Tare wt. .1163	8-03-06	08:15	.1264	99.9994 1.0002	4	74	K
D/T in desiccator 8-01-06 15:00							
Preliminary wt.: .1272							
Rear Filter	8-02-06	17:30	.1182	99.9992 1.0002	10	84	K
Lab ID # TRAIN-2 ID # D 361 Tare wt. .1178	8-03-06	08:15	.1181	99.9994 1.0002	4	74	K
D/T in desiccator: 8-01-06 15:00							
Preliminary wt.: .1187							
Probe	8-02-06	17:30	76.8075	99.9992 1.0002	10	84	K
Lab ID # TRAIN-2 Probe # 6 Tare wt. 76.8065 Cleaned by: K D/T in desiccator: 8-01-06 15:00	8-03-06	08:15	76.8074	99.9994 1.0002	4	74	K
Preliminary wt.: 76.8099							

Technician signature: K. J. Morgan Date: 8-03-06

Control No. L-SFZ-0003(Dual Train - Dilution Tunnel Method 5G Analysis Worksheet).doc, Effective date: 4272005

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 08-02-06 Test Crew: K. Morgan Run #: 3
Sample Train #: TRAIN-1 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # TRAIN-1 ID # D 360 Tare wt. .1299 D/T in desiccator 8-02-06 17:00 Preliminary wt.: .1350	8-03-06	19:25	.1344	99.9996 .1001	4	83	IL
	8-04-06	09:55	.1345	99.9995 .2000	8	75	IL
Rear Filter Lab ID # TRAIN-1 ID # D 359 Tare wt. .1288 D/T in desiccator: 8-02-06 17:00 Preliminary wt.: .4139	8-03-06	19:25	.1296	99.9996 .1001	4	83	IL
	8-04-06	09:55	.1296	99.9995 .2000	8	75	IL
Probe Lab ID # TRAIN-1 Probe # 10 Tare wt. 76.0138 Cleaned by: D/T in desiccator: 8-02-06 17:00 Preliminary wt.: 76.0159	8-03-06	19:25	76.0144	99.9996 .1001	4	83	IL
	8-04-06	09:55	76.0147	99.9995 .2000	8	75	IL

Technician signature: IL J. Morgan Date: 8-04-03

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 08-02-06 Test Crew: K. Morgan Run #: 3
Sample Train #: TRAIN-2 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	~~8-02-06~~ IK 8-03-06	19:25	.1211	99.9996 .1001	4	83	IK
Lab ID # TRAIN-2 ID # D358 Tare wt. .1166	8-04-06	09:55	.1212	99.9995 .2000	8	75	IK
D/T in desiccator 8-02-06 17:00							
Preliminary wt.: .1214							
Rear Filter	~~8-02-06~~ IK 8-03-06	19:25	.1280	99.9996 .1001	4	83	IK
Lab ID # TRAIN-2 ID # D357 Tare wt. .1271	8-04-06	09:55	.1281	99.9995 .2000	8	75	IK
D/T in desiccator: 8-02-06 17:00							
Preliminary wt.: .2276							
Probe	~~8-02-06~~ IK 8-03-06	19:25	76.2572	99.9996 .1001	4	83	IK
Lab ID # TRAIN-2 Probe # E Tare wt. 76.2570 Cleaned by:	8-04-06	09:55	76.2574	99.9995 .2000	8	75	IK
D/T in desiccator: 8-02-06 17:00							
Preliminary wt.: 76.2593							

4.5 (4.6)
0.9 (1.0)
0.2 (0.4)
5.6 (6.0)

Technician signature: K. Morgan Date: 8-04-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-03-06 Test Crew: K. Morgan Run #: 4
Sample Train #: TRAIN-1 Train assembled by: K Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # TRAIN-1 ID # D 356 Tare wt. .1111 D/T in desiccator 8-03-06 15:10 Preliminary wt.: .1188	8-04-06	19:55	.1184	99.9997 .2001	4	85	IL
	8-05-06	07:00	.1184	99.9996 .2000	5	80	IL
Rear Filter Lab ID # TRAIN-1 ID # D 354 Tare wt. .1173 D/T in desiccator: 8-03-06 15:10 Preliminary wt.: .1180	8-04-06	19:55	.1178	99.9997 .2001	4	85	IL
	8-05-06	07:00	.1177	99.9996 .2000	5	80	IL
Probe Lab ID # TRAIN-1 Probe # 5 Tare wt. 80.6627 Cleaned by: IL D/T in desiccator: 8-03-06 15:10 Preliminary wt.: 80.6671	8-04-06	19:55	80.6633	99.9997 .2001	4	85	IL
	8-05-06	07:00	80.6630	99.9996 .2000	5	80	IL

Technician signature: K. L. Morgan Date: 8-05-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-03-06 Test Crew: K. Morgan Run #: 4
Sample Train #: TRAIN-2 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	8-04-06	19:55	.1320	99.9997 .2001	4	85	IL
Lab ID # TRAIN-2 ID # D 355 Tare wt. .1240	8-05-06	07:00	.1320	99.9996 .2000	5	80	IL
D/T in desiccator 8-3-06 15:10							
Preliminary wt.: .1325							
Rear Filter	08-04-06	19:55	.1138	99.9997 .2001	4	85	IL
Lab ID # TRAIN-2 ID # D 317 Tare wt. .1133	08-05-06	07:00	.1138	99.9996 .2000	5	80	IL
D/T in desiccator: 8-03-06 15:10							
Preliminary wt.: .1140							
Probe	08-04-06	19:55	76.9134	99.9997 .2001	4	85	IL
Lab ID # TRAIN-2 Probe # 8 Tare wt. 76.9125 Cleaned by: IL	8-05-06	07:00	76.9131	99.9996 .2000	5	80	IL
D/T in desiccator: 8-03-06 15:10							
Preliminary wt.: 76.9141							

Technician signature: IL J. Morgan Date: 8-03-06

OMNI-Test Laboratories, IL
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-03-06 Test Crew: K. Morgan Run #: 5
Sample Train #: TRAIN-1 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # TRAIN-1 ID # D 318 Tare wt. .1237 D/T in desiccator IK 8-03-06 ~~20:50~~ 19:50 Preliminary wt.: .1270	8-04-06	19:55	.1260	99.9997 .2001	4	85	IK
	8-05-06	07:00	.1260	99.9996 .2000	5	80	IK
Rear Filter Lab ID # TRAIN-1 ID # D325 Tare wt. .1115 D/T in desiccator: IK 8-03-06 ~~20:50~~ 19:50 Preliminary wt.: .2095	8-04-06	19:55	.1118	99.9997 .2001	4	85	IK
	8-05-06	07:00	.1118	99.9996 .2000	5	80	IK
Probe Lab ID # TRAIN-1 Probe # H Tare wt. 91.5343 Cleaned by: IK D/T in desiccator: IK 8-03-06 ~~20:50~~ 19:50 Preliminary wt.: 91.5348	8-04-06	19:55	91.5345	99.9997 .2001	4	85	IK
	8-05-06	07:00	91.5342	99.9996 .2000	5	80	IK

Technician signature: K. J. Morgan Date: 8-05-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-03-06 Test Crew: K. Morgan Run #: 5
Sample Train #: TRAIN-2 Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	8-04-06	19:55	.1238	99.9997 .2001	4	85	IK
Lab ID # TRAIN-2	8-05-06	07:00	.1236	99.9996 .2000	5	80	IK
ID # D 319							
Tare wt. .1212							
D/T in desiccator 8-03-06 19:50							
Preliminary wt.: .1246							
Rear Filter	8-04-06	19:55	.1304	99.9997 .2001	4	85	IK
Lab ID # TRAIN-2	8-5-06	07:00	.1285	99.9996 .2000	5	80	IK
ID # D 326			Transported back to omni + placed in desiccator 8-07-06 @ 07:00 "Preliminary" Weight = .1284 IK			.1284	
Tare wt. .1272	8-8-06	07:15	.1282	.5001	8	74	IK
D/T in desiccator: 8-03-06 19:50	08-08-06	14:10	.1284	.5001	12	75	IK
Preliminary wt.: .6895							
Probe	8-04-06	19:55	92.5716	99.9997 .2001	4	85	IK
Lab ID # TRAIN-2	8-05-06	07:00	92.5712	99.9996 .2000	5	80	IK
Probe # K							
Tare wt. 92.5718							
Cleaned by: IK							
D/T in desiccator: 8-03-06 19:50							
Preliminary wt.: 92.5724							

Technician signature: IK J. Morgan Date: 8-08-06

Date Placed in Desiccator	26-Jul-06		Balance ID Number	OMNI-00023
Time Placed in Desiccator	6:00 AM		Audit Weight ID Number	OMNI-00131
Technician	Morgan		Thermometer/Hygrometer ID Number	

AE Glass 47 mm Filter Tares

OMNI-Test Laboratories, Inc

47 mm Filters												
	Date:	7/27/2006	7/28/2006									
	Time:	8:00 AM	9:15 AM									
	RH %:	20	20	0	0							
	T (F):	73	74	0	0							
	Tech.:	Morgan	Morgan									
ID Number	Audit:	0.5001	0.5001	0	0		Manufacturer		Appliance		Project No.	Run	Train
D354		0.1176	0.1173	X	0		0		CFM Majestic		Century	259-S-12-3	4	1
D355		0.1242	0.124	X	0		0		CFM Majestic		Century	259-S-12-3	4	2
D356		0.1111	0.1111	X	0		0		CFM Majestic		Century	259-S-12-3	4	1
D357		0.1272	0.1271	X	0		0		CFM Majestic		Century	259-S-12-3	3	2
D358		0.1166	0.1166	X	0		0		CFM Majestic		Century	259-S-12-3	3	2
D359		0.1288	0.1288	X	0		0		CFM Majestic		Century	259-S-12-3	3	1
D360		0.13	0.1299	X	0		0		CFM Majestic		Century	259-S-12-3	3	1
D361		0.1178	0.1178	X	0		0		CFM Majestic		Century	259-S-12-3	2	2
D362		0.124	0.124	X	0		0		CFM Majestic		Century	259-S-12-3	2	1
D363		0.1165	0.1163	X	0		0		CFM Majestic		Century	259-S-12-3	2	2
D364		0.126	0.1259	X	0		0		CFM Majestic		Century	259-S-12-3	2	1
D365		0.1192	0.1191	X	0		0		CFM Majestic		Century	259-S-12-3	1	2
D366		0.1222	0.1221	X	0		0		CFM Majestic		Century	259-S-12-3	1	1
D367		0.1136	0.1135	X	0		0		CFM Majestic		Century	259-S-12-3	1	2
D368		0.1279	0.1277	X	0		0		CFM Majestic		Century	259-S-12-3	1	1

Date Placed in Desiccator	06-Apr-06	Balance ID Number	OMNI-00023	
Time Placed in Desiccator	9:02 AM	Audit Weight ID Number	OMNI-00131	
Technician	Morgan	Thermometer/Hygrometer ID Number		

AE Glass 47 mm Filter Tares

OMNI-Test Laboratories, Inc

47 mm Filters ID Number														
	Date:	4/7/2006	4/8/2006											
	Time:	12:02 PM	7:02 PM											
	RH %:	12	15		0		0							
	T (F):	72	75		0		0							
	Tech.:	Morgan	Morgan											
	Audit:	0.5001	0.5001		0		0							
D317		0.1134	0.1133	X	0		0		CFM Majestic		Century		259-S-12-3	4	2
D318		0.124	0.1237	X	0		0		CFM Majestic		Century		259-S-12-3	5	1
D319		0.1214	0.1212	X	0		0		CFM Majestic		Century		259-S-12-3	5	2
D325		0.1117	0.1115	X	0		0		CFM Majestic		Century		259-S-12-3	5	1
D326		0.1273	0.1272	X	0		0		CFM Majestic		Century		259-S-12-3	5	2

Probe Tare Weights											
Probe #	Into Desiccator Date/Time	7/28/06	7/29	7/30	7/31	8-01-06	* IN 8-01-06 07:00	8-02-06 07:00	8-3-06 07:45	8-3-06 13:00	
1	7:00AM		9:30AM	12:25PM	07:30	08:00					
2	"	83.3564	83.3551	83.3566	83.3562	—	Run 1, T1				
3											
4	"	79.0683	79.0670	79.0683	79.0674	79.0673	—	Run 2, T1			
5							*	80.6625	80.6622	—	Run 4, T1
6	"	76.8072	76.8066	76.8076	76.8069	76.8065	—	Run 2, T2			
7											
8	"	76.9126	76.9120	76.9124	76.9122	—	~~*Run 1, T1~~	~~76.9125~~ R&D 1	76.9125	—	Run 4, T2
9											
10	"	76.0141	76.0136	76.0139	76.0138	—		Run 3, T1			
B	"	86.7881	86.7873	86.7879	86.7878	—	Run 1, T2		86.[illegible]		
C											
D											
E	"	76.2642	76.2569	76.2574	76.2566	76.2570	—	Run 3, T2			
F							*	72.3748	72.3749		
G											
H	Long Probe	91.5343	91.5337	91.5340						91.5343	— Run 5, T1
I	"	84.5672	84.5666	84.5668	84.5666	—					
J			78.2702	78.2638	78.2628	78.2626	—				
K	Long Probe	92.5718	92.5710	92.5715						92.5718	— Run 5, T2
L											
M								~~76.8574~~			
Y	"	76.8649	76.8574	76.8579	76.8576	—	~~*Run 1, T2~~	R&D 1	76.8576		

Calibrations

Method 28 and 5G

Method 28 and 5G:

ID #	Lab Name/Purpose	Log Name	Attachment Type
1	Calibrator Dry Gas Meter	Standard Test Meter – Rockwell Int'l	Calibration Log
33	Manometer	Microtector – Dwyer	Manual
120	TC Simulator	Thermocouple Calibrator	Calibration Log
132	10 lb Weight	Weight Standard, 10 lb	Calibration Log
265	Vaneometer	Vaneometer, Air Velocity Meter – Dwyer	Calibration Log
283	F-Class Audit Weights	Metric Calibrated Weight Set	Calibration Log
306	Stopwatch	Stopwatch – Sportline	Calibration Log
CFM 010	Dry Gas Meter	Dry Gas Meter – American Meter Co.	Post-Test Calibration Log
CFM 020	Dry Gas Meter	Dry Gas Meter – American Meter Co.	Post-Test Calibration Log
CFM 030	Platform Scale	Pre-Post 10.0 Audit	Test Data Sheet
CFM 040	Analytical Balance	Analytical Balance – Mettler Instrument	Calibration Log
CFM 050	Barometer	Mercury Barometer – Princo	Manual Cover
CFM 060	Moisture Meter	Moisture Meter – Delmhorst	Manual
CFM 070	Draft Gauge	Magnehelic Draft Gauge – Dwyer	Calibration Log
CFM 080	Thermometer	Temperature Monitor – Omega	Calibration Log
TM-19	Tape Measure	Tape Measure – 12' Stanley Powerlock	Calibration Log

Standard Gas Test Meter Calibration vs. Bubble Flowmeter

Date: 4/26/06
Calibrated by: K. Morgan
Standard Test Meter S/N: OMNI 00001
Bubble Flow Meter S/N: OMNI 00134 (Volume: 1.000 liters = 0.035336 ft3, NIST traceable)
Barometric Pressure: 30.04 "Hg

Average Y Factor: 0.9828

Signature/Date: K. L. Morgan 4-26-06

Flow Rate #1 dH(pressure across meter, "H2O): 0.35	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	20.35	23.306	23.964
Final Volume (ft3):	21.223	23.964	24.645
Initial Temperature (oF):	64	66	66
Final Temperature (oF):	64	67	67
Elapsed Time (minutes):	4	3	3
(seconds):	0	0	10
Flow rate, Q (cfm):	0.2182	0.2193	0.2151
Bubble Flowmeter			
Time 1:	9.9	9.78	9.78
Time 2:	9.9	9.75	9.78
Time 3:	9.84	9.81	9.9
Time 4:	9.87	9.75	9.71
Time 5:	9.9	9.81	9.9
Initial Temperature (oF):	64	66	66
Final Temperature (oF):	64	67	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.2145	0.2168	0.2160
Y factor:	**0.9822**	**0.9875**	**1.0037**

Deviation of Y factor is acceptable

Flow Rate #2 dH(pressure across meter, "H2O): 0.4	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	26.071	26.071	26.753
Final Volume (ft3):	26.753	26.753	27.686
Initial Temperature (oF):	67	67	68
Final Temperature (oF):	67	67	68
Elapsed Time (minutes):	3	3	4
(seconds):	0	0	0
Flow rate, Q (cfm):	0.2273	0.2273	0.2333
Bubble Flowmeter			
Time 1:	9.35	9.34	9.35
Time 2:	9.31	9.34	9.34
Time 3:	9.3	9.31	9.4
Time 4:	9.31	9.25	9.21
Time 5:	9.35	9.35	9.28
Initial Temperature (oF):	67	67	67
Final Temperature (oF):	67	67	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.2274	0.2275	0.2276
Y factor:	**0.9994**	**1.0000**	**0.9767**

Deviation of Y factor is acceptable

Flow Rate #3 dH(pressure across meter, "H2O): 0.55	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	28.7	29.837	30.967
Final Volume (ft3):	29.837	30.967	32.095
Initial Temperature (oF):	67	68	68
Final Temperature (oF):	68	68	68
Elapsed Time (minutes):	4	4	4
(seconds):	0	0	0
Flow rate, Q (cfm):	0.2843	0.2825	0.2820
Bubble Flowmeter			
Time 1:	7.71	7.78	7.59
Time 2:	7.68	7.62	7.68
Time 3:	7.65	7.65	7.65
Time 4:	7.65	7.62	7.68
Time 5:	7.71	7.68	7.59
Initial Temperature (oF):	67	68	68
Final Temperature (oF):	68	68	68
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.2761	0.2764	0.2776
Y factor:	**0.9704**	**0.9776**	**0.9835**

Deviation of Y factor is acceptable

Flow Rate #4 dH(pressure across meter, "H2O): 0.75	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	32.502	33.512	35.521
Final Volume (ft3):	33.512	35.521	36.529
Initial Temperature (oF):	68	67	68
Final Temperature (oF):	68	67	68
Elapsed Time (minutes):	3	6	3
(seconds):	0	0	0
Flow rate, Q (cfm):	0.3367	0.3348	0.3360
Bubble Flowmeter			
Time 1:	6.46	6.46	6.5
Time 2:	6.4	6.5	6.5
Time 3:	6.46	6.59	6.55
Time 4:	6.44	6.5	6.43
Time 5:	6.46	6.5	6.53
Initial Temperature (oF):	68	67	67
Final Temperature (oF):	68	67	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.3290	0.3257	0.3261
Y factor:	**0.9764**	**0.9718**	**0.9715**

Deviation of Y factor is acceptable

Standard Gas Test Meter Calibration vs. Bubble Flowmeter

Date: 4/26/06

Calibrated by: K. Morgan

Standard Test Meter S/N: OMNI 00001

Bubble Flow Meter S/N: OMNI 00134

Barometric Pressure: 30.04 "Hg

Average Y Factor: 0.9828

(Volume: 1.000 liters = 0.035336 ft3, NIST traceable)

Signature/Date: K. Morgan 4-26-06

Flow Rate #5 dH(pressure across meter, "H2O): 1			
	Run #1	**Run #2**	**Run #3**
Standard Test Meter			
Initial Volume (ft3):	37.003	38.262	39.95
Final Volume (ft3):	38.262	39.95	41.207
Initial Temperature (oF):	67	66	67
Final Temperature (oF):	67	66	67
Elapsed Time (minutes):	3	4	3
(seconds):	0	0	0
Flow rate, Q (cfm):	0.4197	0.4220	0.4190
Bubble Flowmeter			
Time 1:	5.24	5.08	5.08
Time 2:	5.18	5.14	5.08
Time 3:	5.06	5.3	5.2
Time 4:	5.18	5.12	5.1
Time 5:	5.12	5.14	5.12
Initial Temperature (oF):	67	66	67
Final Temperature (oF):	66	66	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.4112	0.4112	0.4144
Y factor:	**0.9799**	**0.9736**	**0.9882**

Deviation of Y factor is acceptable

Acceptance criteria, Method 5 section 16.1.1.5
- The difference between the maximum and minimum values at each flow rate should be no greater than 0.030.
- The meter coefficients (Y) should be between 0.95 and 1.05.

Negative Pressure or Vacuum Measurement

Zero the gage. Connect the source of vacuum or negative pressure to the right side gage connection (5) and proceed as described under Positive Pressure Measurement Section above. Remember that the pressure measured in this way is negative.

Differential Pressure Measurement

Differential pressures may be measured by connecting the higher (more positive) pressure to the left connection (2) and the lower pressure to the right connection (5).

Storage

Turn meter circuit switch to "off" position and withdraw the point well clear of fluid (by turning Micrometer counter-clockwise) when gage is not in use. This will conserve the batteries and minimize build-up of oxides, etc., on the point. Keep the unit covered and in an area free of strong solvent fumes.

Maintenance

When the meter reading becomes reduced or the pointer movement gets sluggish (with the circuit on and point in fluid), the following should be done:

1. Remove the point (by unscrewing) and clean the tip lightly using fine crocus cloth. Wipe off all grit and dirt with a clean rag, reassemble and recheck meter operation.
2. If the meter operation continues to be sluggish, replace the size AA, 1½ volt battery. (Replace the battery at least once a year to avoid deterioration of battery and damage to gage. Leakproof alkaline battery is recommended.)

To replace the battery, remove center screw (10) located in the back of the electronic enclosure. Cover (9) will come off exposing the battery. Pull the old battery out and push a new battery into the battery holder with the positive (center) terminal to the right (to the end marked with a + on the holder).

If the fluid becomes contaminated and requires replacement; empty old fluid from gage; flush out with clear water and replace with distilled water and Dwyer A126 Fluorescein Green Color Concentrate mixed 3/4 oz. concentrate to each quart of water. (CAUTION: Do not substitute other gage fluids as proper gage operation depends on use of the specified gage fluid to provide proper surface tension, wetting ability and electrolyte capability with unity specific gravity.)

If the gage bore is very dirty, a mild soap solution may be used to aid in cleaning prior to flushing with clear water. (CAUTION: Do not clean with liquid soaps, special solvent, degreasers, aromatic hydro-carbons, etc. Such cleaners and solvents frequently contain chlorine, fluorine, acetone and related compounds which will permanently damage the gage, and prevent proper operation.

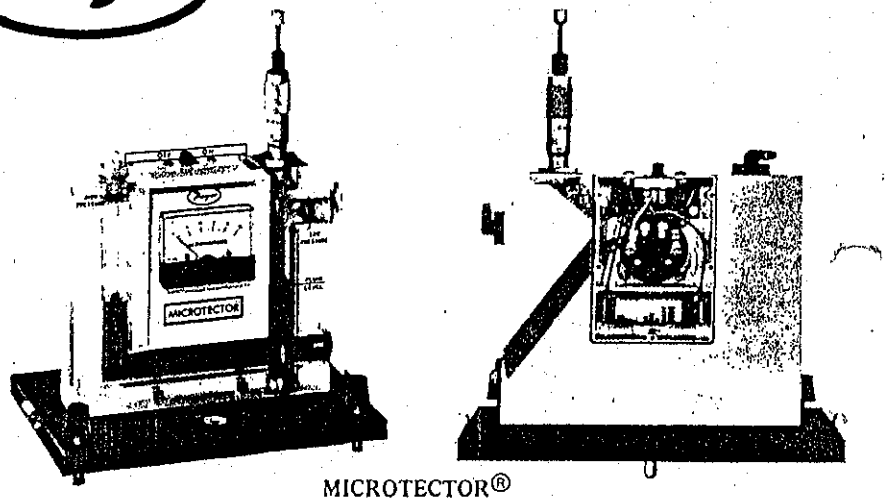
If meter becomes inoperative and cannot be made to operate properly by cleaning point tip or replacing battery, return the entire gage to Dwyer Instruments, Inc., for service.

"Microtector"
A Product From
Dwyer Instruments, Inc
"The Low Pressure People"

Form No. 38-440190-00
Litho in U.S.A. 1/85

DWYER INSTRUMENTS, INC.
P.O. Box 373, Michigan City, Indiana 46360, U.S.A.
Phone: 219/872-9141

MICROTECTOR®
Operating and Maintenance Instructions



MICROTECTOR®
Specifications and Features*

Time Proven Hook Gage Manometer Combined with Modern Electronics For Easier, Faster, More Accurate Precision Measurements.

Accurate and Repeatable to ± .00025 inches water column.

Pressure Range 0-2" w.c. Positive, Negative or Differential Pressures.

Non Toxic and Inexpensive Gage Fluid Consists of Distilled Water Mixed with a Small amount of Fluorescein Green Color Concentrate.

Convenient, Portable, Light Weight, and Self-Contained, the Unit Requires No External Power Connections and is Operated by a 1½ Volt Penlight Cell.

A.C. Detector Current Eliminates Point Plating, Fouling and Erosion.

Micrometer Complies with Federal Specification GGG-C-105A and is Traceable to a Master at the National Bureau of Standards.

Three Point Mounting with Dual Leveling Adjustment and Circular Level Vial Assure Rapid Set Up.

Durablock® Precision Machined Acrylic Plastic Gage Body.

Sensitive 0-50 Microamp D.C. Meter Acts as Detector and Also Indicates Battery and Probe Condition.

Heavy One Half Inch Thick Steel Base Plate Provides Steady Mounting.

Top Quality Glass Epoxy Circuit Board and Solid State-Integrated Circuit Electronics.

Electronic Enclosure of Tough Molded Styrene Acrylonitrile Provides Maximum Protection to Components Yet Allows Easy Access to Battery Compartment.

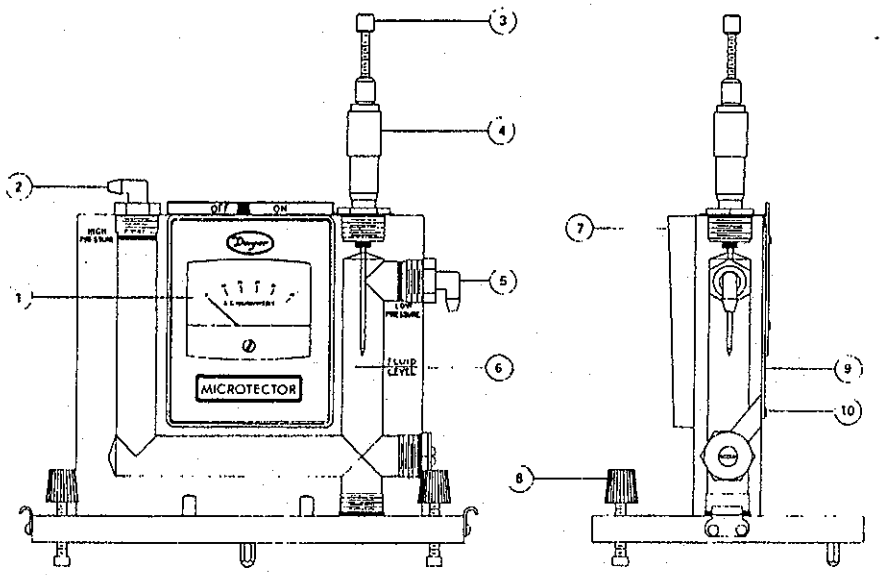
Rugged Sheet Steel Cover and Carrying Case Protects the Entire Unit When Not In Use.

Accessories Included are (2) 3 Foot Lengths Tygon Tubing, (2) 1/8" Pipe Thread Adapters and 3/4 oz. bottle of Fluorscein Green Color Concentrate with Wetting Agent.

Maximum Pressure 100 PSIG (With optional Pipe Thread Connections).

**Patent No. 3,726,142*

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Telephone 219/872-9141



MICROTECTOR® GAGE

Precision Pressure Measurement

The Dwyer Microtector® combines the time proven principles of the Hook Gage type manometer and modern solid state integrated circuit electronics. It provides an inexpensive means of achieving accuracy and repeatability within ± .00025 inches water column throughout its 0 to 2 inches w.c. range. It is truly a new standard in precision pressure measuring devices.

Principles of Operation

A pressure to be measured is applied to the manometer fluid which is displaced in each leg of the manometer by an amount equal to ½ the applied pressure. A micrometer mounted point is then lowered until contacts the manometer gage fluid. The instant of contact is detected by completion of a low power A.C. circuit. Current for this circuit is supplied by a 1½ volt penlight cell feeding two semiconductor amplifiers which act as a free-running multivibrator operating at a frequency of approximately two kilohertz. Completion of the A.C. circuit activates a bridge rectifier which provides the signal for indication on a sensitive (0 to 50 microamps) D.C. microammeter.

On indication of contact the operator stops lowering the point and reads the micrometer which indicates one half the applied pressure. By interpolating eight divisions, (each being .000125" w.c.) between .001 micrometer graduations, a total accuracy of .00025 can easily be achieved. The micrometer complies with Federal Specification GGG-C-105A and is traceable to a master at the National Bureau of Standards.

Locating and Opening

Stand the Microtector® and case on a firm flat level surface. Remove the cover by releasing the latches and lifting straight up. If it is necessary to move the gage without case, handle only the base plate or clear acrylic block. (CAUTION: Do not handle gage by grasping meter-electronic package housing Item 7 on drawing.)

Fluid Level

Level the gage by adjusting the two front leveling screws (Item 8 on drawing) until the bubble in the spirit level is centered in the small circle. After leveling the gage, open both rapid shut off valve tube connectors (2 and 5). Back off the Micrometer (4), if necessary, to make sure that the point is not immersed in the gage fluid. The fluid level in the gage should now coincide with the mark on the right hand bore plus or minus approximately 1/32 inch (6). If the level of fluid is too high, fluid can be removed with an eye dropper pipette or carefully poured out of the right connection (5). If the level is too low, remove the top left rapid shut off valve tube connector (2), and add distilled water pre-mixed with the proper amount of Dwyer green concentrate. (See maintenance instruction for proportions.) After correcting the fluid level, reinstall the rapid shut off connectors and with them in the open position, relevel the Microtector.® The gage is now ready to be zeroed.

Zeroing

Turn the Micrometer barrel (4) until its lower end just coincides with the zero mark on the internal vertical scale *and* the zero on the barrel scale coincides with the vertical line on the internal scale. Note that the internal scale is graduated every .025" from 0 to 1.00 inch and the barrel scale is graduated in one thousandths from 0 to .025." Turn the meter circuit switch at the top of gage to the "on" position. While holding the barrel at the zero position (and with the gage level), raise or lower the point by turning the top knurled knob (3) until the point is above, but near the fluid.

Check to be sure that the meter (1) registers zero. Watch the meter, hold the barrel (4) and lower the point slowly by turning the top knurled knob (3). As the knob is turned, the point will contact the fluid and the meter pointer will move from zero to some upscale position. After making contact, turn the point out of the fluid by turning the Micrometer barrel counter-clockwise to a reading of .010 or more. Again watch the meter and, this time, lower the point by turning the Micrometer barrel. The point position where the meter pointer begins to move up scale is the zero position. This position should correspond to zero reading on the Micrometer. Adjust the point in relation to the Micrometer barrel by turning the top knob while holding the barrel steady. Repeat lowering the point, watching the meter for contact, and adjusting the point until the zero position and zero reading exactly coincide. The gage is now zeroed and should not be moved.

An alternate method of zeroing and reading can be used wherein, instead of zeroing the gage completely, a zero correction reading is taken and recorded then subtracted from the final reading. Comparable results can be obtained with either method.

Positive Pressure Measurement

With the fluid at its proper level, a pressure of 2.0" water column maximum can be measured. Positive pressure should be applied to the top left connection (2) with the Micrometer zeroed as described above. This will permit simple direct reading to be taken.

After an unknown pressure has been applied at the top left connection, the fluid level will drop in the left bore and rise over the point in the right bore. Note the indicating meter point has moved upscale because the point is immersed in the fluid. Turn the Micrometer counter-clockwise until the point leaves the fluid as indicated by the meter pointer dropping to zero on scale. Then slowly turn the Micrometer down until its point just touches the fluid surface causing movement of the meter pointer. Withdraw the point and repeat several times noting each time the Micrometer reading where the meter pointer movement begins. The average of these readings multiplied by two is the pressure applied to the gage. (Avg. reading x 2 = pressure applied in inches w.c. The degree of uncertainty for the operator and instrument is indicated by the difference in these readings.)

When the readings are complete the pressure should be removed and the zero-setting of the Microtector® rechecked. Any change in the zero position will indicate inaccurate readings. Should this happen the zero-set and pressure measurement procedure should be repeated.

Negative Pressure or Vacuum Measurement

Zero the gage. Connect the source of vacuum or negative pressure to the right side gage connection (5) and proceed as described under Positive Pressure Measurement Section above. Remember that the pressure measured in this way is negative.

Differential Pressure Measurement

Differential pressures may be measured by connecting the higher (more positive) pressure to the left connection (2) and the lower pressure to the right connection (5).

Storage

Turn meter circuit switch to "off" position and withdraw "hook" point well clear of fluid (by turning Micrometer counter-clockwise) when gage is not in use. This will conserve the batteries and minimize build-up of oxides, etc., on the "hook." Keep the unit covered and in an area free of strong solvent fumes.

Maintenance

When the meter reading becomes reduced or the pointer movement gets sluggish (with circuit on and "hook" point in fluid), the following should be done:

1. Remove the hook point (by unscrewing) and clean the tip lightly using fine crocus cloth. Wipe off all grit and dirt with a clean rag, reassemble and recheck meter operation.
2. If the meter operation continues to be sluggish, replace the size AA, 1½ volt battery. (Replace the battery at least once a year to avoid deterioration of battery and damage to gage. Leakproof alkaline battery is recommended.)

To replace the battery, remove center screw (10) located in the back of the electronic enclosure. Cover (9) will come off exposing the battery. Pull the old battery out and push a new battery into the battery holder with the positive (center) terminal to the right (to the end marked with a + on the holder).

If the fluid becomes contaminated and requires replacement; empty old fluid from gage; flush out with clear water and replace with distilled water and Dwyer A126 Fluorescein Green Color Concentrate mixed 3/4 oz. concentrate to each quart of water. (CAUTION: Do not substitute other gage fluids as proper gage operation depends on use of the specified gage fluid to provide proper surface tension, wetting ability and electrolyte capability with unity specific gravity.)

If the gage bore is very dirty, a mild soap solution may be used to aid in cleaning prior to flushing with clear water. (CAUTION; Do not clean with liquid soaps, special solvents, degreasers, aromatic hydro-carbons, etc. Such cleaners and solvents frequently contain chlorine, fluorine, acetone and related compounds which will permanently damage the gage, and prevent proper operation.)

If meter becomes inoperative and cannot be made to operate properly by cleaning "hook" tip or replacing battery, return the entire gage to Dwyer Instruments, Inc., for service.

"Microtector" ®
A Product From
Dwyer Instruments, Inc.
"The Low Pressure People"

38-440190-00

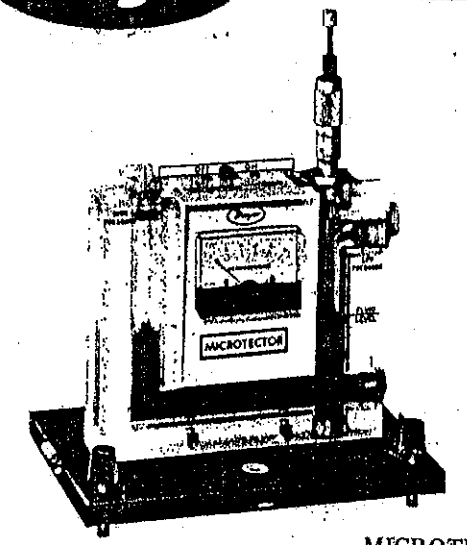
DWYER INSTRUMENTS, INC.
P.O. Box 373, Michigan City, Indiana 46360 U.S.A.
Phone: Area 219/872-9141
Direct Chicago Line: Area 312/733-7883

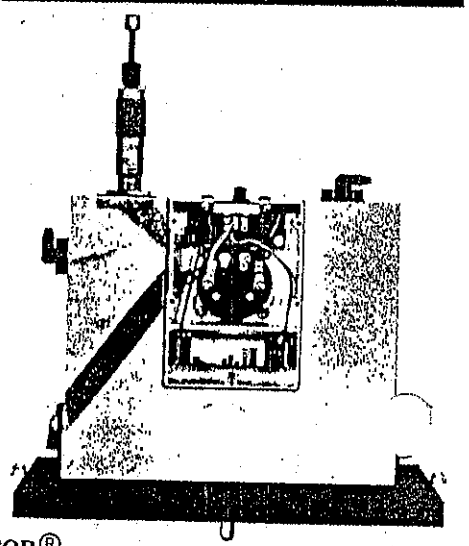
2 - 22 OF 2 - 63

Dwyer

MICROTECTOR®

Operating and Maintenance Instructions





MICROTECTOR®
Specifications and Features*

Time Proven Hook Gage Manometer Combined with Modern Electronics For Easier, Faster, more Accurate Precision Pressure Measurements.

Accurate and Repeatable to ±.00025 inches water column (.000009 P.S.I.).

Pressure Range 0-2" w.c. Positive, Negative or Differential Pressures.

Non Toxic and Inexpensive Gage Fluid Consists of Distilled Water Mixed with a Small Amount of Dwyer Color and Wetting Agent Concentrate.

Convenient, Portable, Light Weight, and Self-Contained, the Unit Requires No External Power Connections and is Operated by a 1½ Volt Penlight Cell.

A.C. Detector Current Eliminates Hook Plating, Fouling and Erosion.

Micrometer Complies with Federal Specification GGG-C-105A and is Traceable to a Master at the National Bureau of Standards.

Three Point Mounting with Dual Leveling Adjustment and Circular Level Assure Rapid Set Up.

Durablock® Precision Machined Acrylic Plastic Gage Body.

Sensitive 0-50 Microamp D.C. Meter Acts as Detector and Also Indicates Battery and Hook Probe Condition.

Heavy One Half Inch Thick Steel Base Plate Provides Steady Mounting.

Top Quality Glass Epoxy Circuit Board and Solid State-Integrated Circuit Electronics.

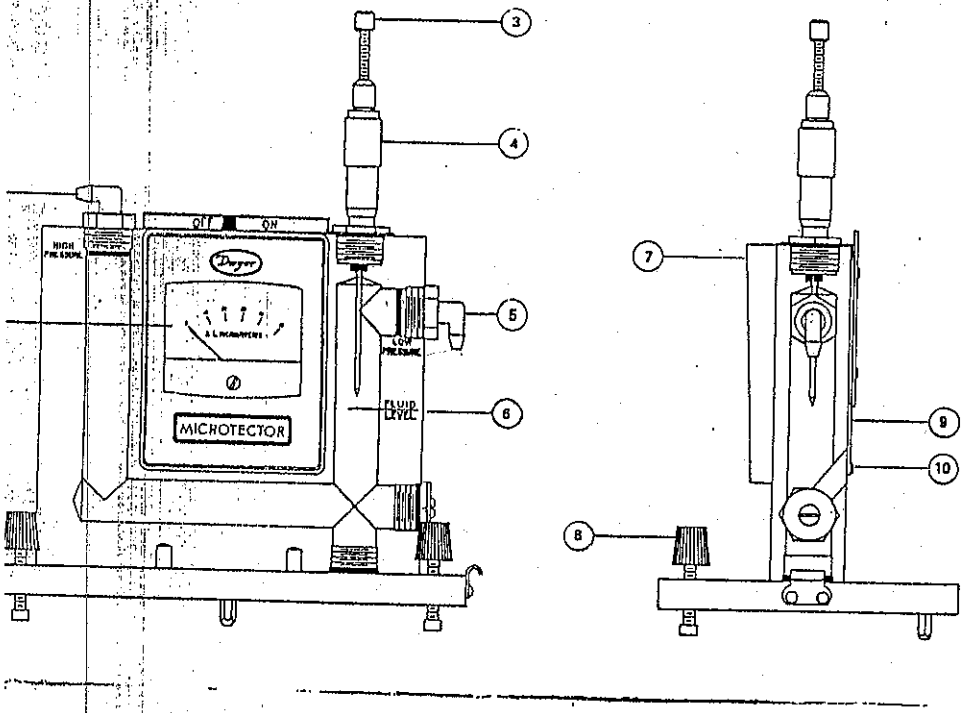
Electronic Enclosure of Tough Molded Styrene Acrylonitrile Provides Maximum Protection to Components Yet Allows Easy Access to Battery Compartment.

Rugged Sheet Steel Cover and Carrying Case Protects the Entire Unit When Not in Use.

Accessories Included are (2) 3 Foot Lengths Tygon Tubing, (2) 1/8" Pipe Thread Adapters and 3/4 oz. bottle of Fluorscein Green Color Concentrate with Wetting Agent.

**Patent Applied For*

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360 U.S.A.
Telephone 219/872-9141 or
Chicago 312/733-7883



MICROTECTOR® GAGE

Precision Pressure Measurement

The Dwyer Microtector® combines the time proven principles of the Hook Gage type manometer and modern solid state integrated circuit electronics. It provides an inexpensive means of achieving accuracy and repeatability within ± .00025 inches water column throughout its 0 to 2 inches w.c. range. It is truly a new standard in precision pressure measuring devices.

Principles of Operation

A pressure to be measured is applied to the manometer fluid which is displaced in each leg of the manometer by an amount equal to ½ the applied pressure. A micrometer mounted hook is then lowered until it contacts the manometer gage fluid. The instant of contact is detected by completion of a low power A.C. circuit. Current for this circuit is supplied by a 1½ volt penlight cell feeding two semi-conductor amplifiers which act as a free-running multivibrator operating at a frequency of approximately two kilohertz. Completion of the A.C. circuit activates a bridge rectifier which provides the signal for indication on a sensitive (0 to 50 microamps) D.C. microammeter.

On indication of contact the operator stops lowering the hook and reads the micrometer which indicates one half the applied pressure. By reading the micrometer to the closest .000125 inches a total accuracy of .00025 inches w.c. is easily achieved. The micrometer complies with Federal Specification GGG-C-105A and is traceable to a master at the National Bureau of Standards.

Locating and Opening

Stand the Microtector and case on a firm flat level surface. Remove the cover by releasing the latches and lifting straight up. If it is necessary to move the gage without case, handle only the base plate or clear acrylic block. (CAUTION: Do not handle gage by grasping meter-electronic package housing Item 7 on drawing.)

Fluid Level

Level the gage by adjusting the two front leveling screws (Item 8 on drawing) until the bubble in the spirit level is centered in the small circle. After leveling the gage, open both rapid shut off valve tube connectors (2 and 5). Back off the Micrometer (4), if necessary, to make sure that the point or "Hook" is not immersed in the gage fluid. The fluid level in the gage should now coincide with the mark on the right hand bore plus or minus approximately 1/32 inch (6). If the level of fluid is too high, fluid can be removed with an eye dropper, pipette or carefully poured out of the right connection (5). If the level is too low, remove the top left rapid shut off valve tube connector (2), and add distilled water pre-mixed with the proper amount of Dwyer green concentrate. (See maintenance instruction for proportions.) After correcting the fluid level, reinstall the rapid shut off connectors and with them in the open position, relevel the Microtector. The gage is now ready to be zeroed.

Zeroing

Turn the Micrometer barrel (4) until its lower end just coincides with the zero mark on the internal vertical scale *and* the zero on the barrel scale coincides with the vertical line on the internal scale. Note that the internal scale is graduated every .025" from 0 to 1.00 inch and the barrel scale is graduated in one thousandths from 0 to .025." Turn the meter circuit switch at the top of gage to the "on" position. While holding the barrel at the zero position (and with the gage level), raise or lower the "hook" by turning the top knurled knob (3) until the "hook" or point is above, but near the fluid.

Check to be sure that the meter (1) registers zero. Watch the meter, hold the barrel (4) and lower the hook slowly by turning the top knurled knob (3). As the knob is turned, the point of the "hook" will contact the fluid and the meter pointer will move from zero to some upscale position. After making contact, turn the hook out of the fluid by turning the Micrometer barrel counter-clockwise to a reading of .010 or more. Again watch the meter and, this time, lower the hook by turning the Micrometer barrel. The "hook" position where the meter pointer begins to move up scale is the zero position. This position should correspond to the zero reading on the Micrometer. Adjust the hook in relation to the Micrometer barrel by turning the top knob while holding the barrel steady. Repeat lowering the hook, watching the meter for contact, and adjusting the hook until the zero position and zero reading exactly coincide. The gage is now zeroed and should not be moved.

An alternate method of zeroing and reading can be used wherein, instead of zeroing the gage completely, a zero correction reading is taken and recorded then subtracted from the final read[illegible] Comparable results can be obtained [illegible] either method.

Positive Pressure Measurement

With the fluid at its proper level, a pressure of 2.0" water column maximum can be measured. Positive pressure should be applied to the top left connection (2) with the Micrometer zeroed as described above. This will permit simple direct readings to be taken.

After an unknown pressure has been applied at the top left connection, the fluid level will drop in the left bore and rise over the "hook" point in the right bore. Note the indicating meter pointer has moved upscale because the "hook" is immersed in the fluid. Turn the Micrometer counter-clockwise until the "hook" point leaves the fluid as indicated by meter pointer dropping to zero on scale. Then slowly turn the Micrometer down until its point or "hook" just touches the fluid surface causing movement of the meter pointer. Withdraw the hook and repeat several times noting each time the Micrometer reading where the meter pointer movement begins. The average of these readings multiplied by two is the pressure applied to the gage. (Avg. reading x 2 = pressure applied in inches w.c.)

When the readings are complete the pressure should be removed and the zero-setting of the Microtector® rechecked. Any change in the zero position will indicate inaccurate readings. Should this happen the zero-set and pressure measurement procedure should be repeated.

BULLETIN NO. H-11

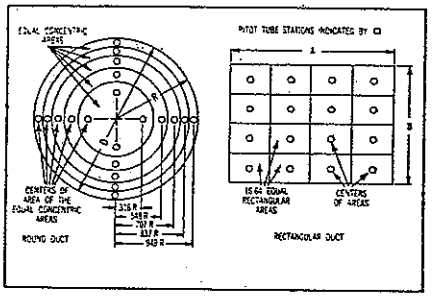
AIR VELOCITIES WITH THE DWYER PITOT TUBE

AIR VELOCITY

The total pressure of an air stream flowing in a duct is the sum of the static or bursting pressure exerted upon the sidewalls of the duct and the impact or velocity pressure of the moving air. Through the use of a pitot tube connected differentially to a manometer, the velocity pressure alone is indicated and the corresponding air velocity determined.

For accuracy of plus or minus 2%, as in laboratory applications, extreme care is required and the following precautions should be observed:

1. Duct diameter 4" or greater.
2. Make an accurate traverse per sketch at right, calculate the velocities and average the readings.
3. Provide smooth, straight duct sections a minimum of 8½ diameters in length upstream and 1½ diameters downstream from the pitot tube.
4. Provide an egg crate type straightener upstream from the pitot tube.



In making an air velocity check select a location as suggested above, connect tubing leads from both pitot tube connections to the manometer and insert in the duct with the tip directed into the air stream. If the manometer shows a minus indication reverse the tubes. With a direct reading manometer, air velocities will now be shown in feet per minute. In other types, the manometer will read velocity pressure in inches of water and the corresponding velocity will be found from the curves in this bulletin. If circumstances do not permit an accurate traverse, center the pitot tube in the duct, determine the center velocity and multiply by a factor of .9 for the approximate average velocity. Field tests run in this manner should be accurate within plus or minus 5%.

The velocity indicated is for dry air at 70°F., 29.9" Barometric Pressure and a resulting density of .075#/cu. ft. For air at a temperature other than 70°F. refer to the curves in this bulletin. For other variations from these conditions, corrections may be based upon the following data:

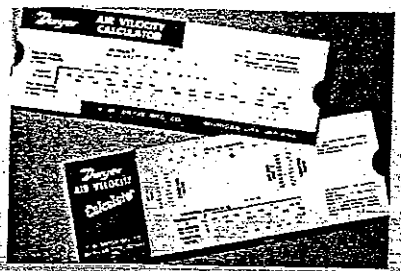
$$\text{Air Velocity} = 1096.2 \sqrt{\frac{P_V}{D}}$$

where P_V = velocity pressure in inches of water
D = Air density in #/cu. ft.

$$\text{Air Density} = 1.325 \times \frac{P_B}{T}$$

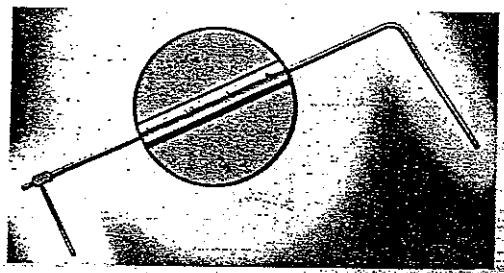
where P_B = Barometric Pressure in inches of mercury
T = Absolute Temperature (indicated temperature °F plus 460)

Flow in cu. ft. per min. = Duct area in square feet x air velocity in ft. per min.



AIR VELOCITY CALCULATOR

Computes velocity based on air density corrected for conditions of temperature and pressure. Eliminates tedious calculations. Ranges from .01 to 10" water corresponding to 400 to 20,000 FPM. Furnished with each pitot tube.

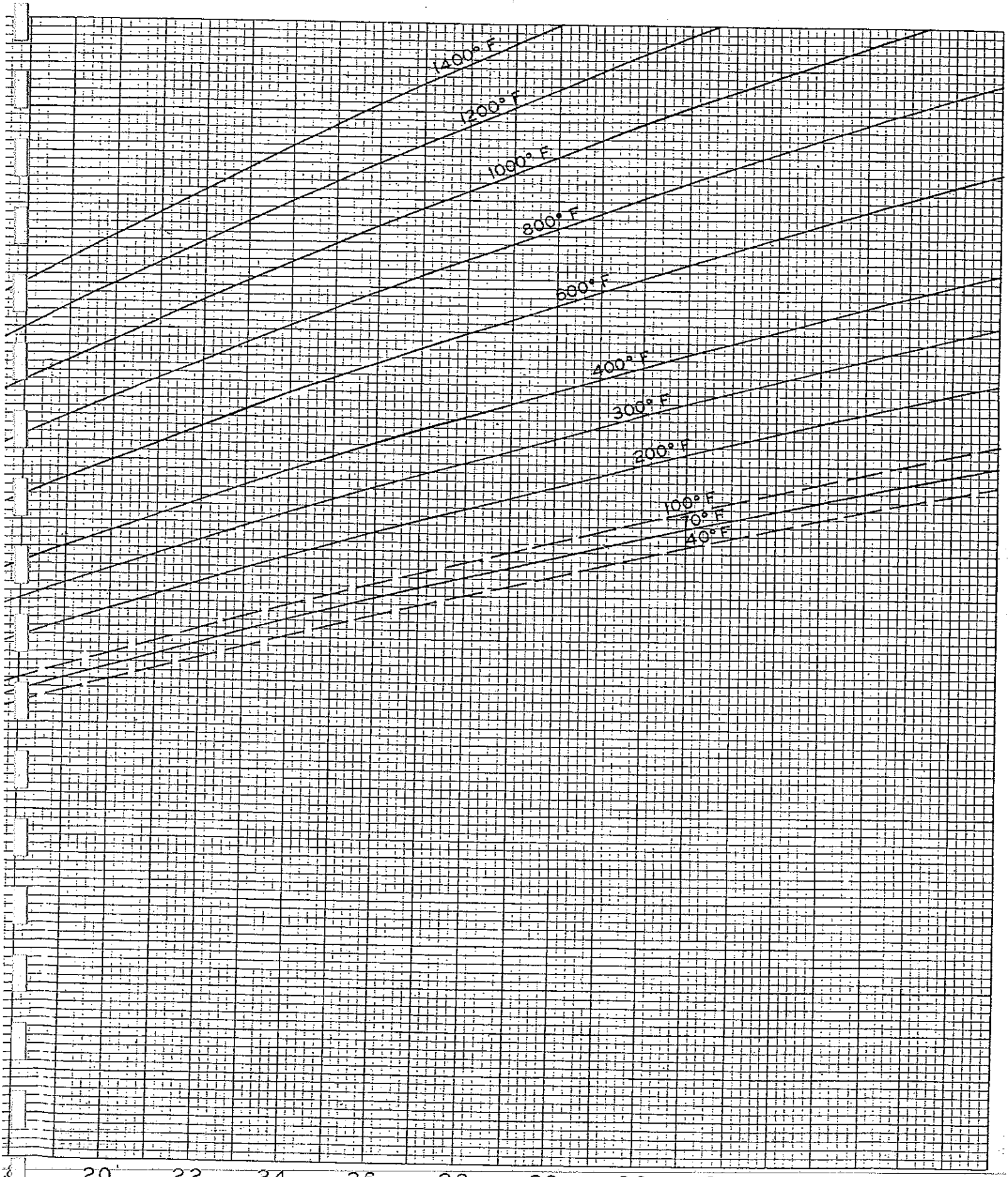


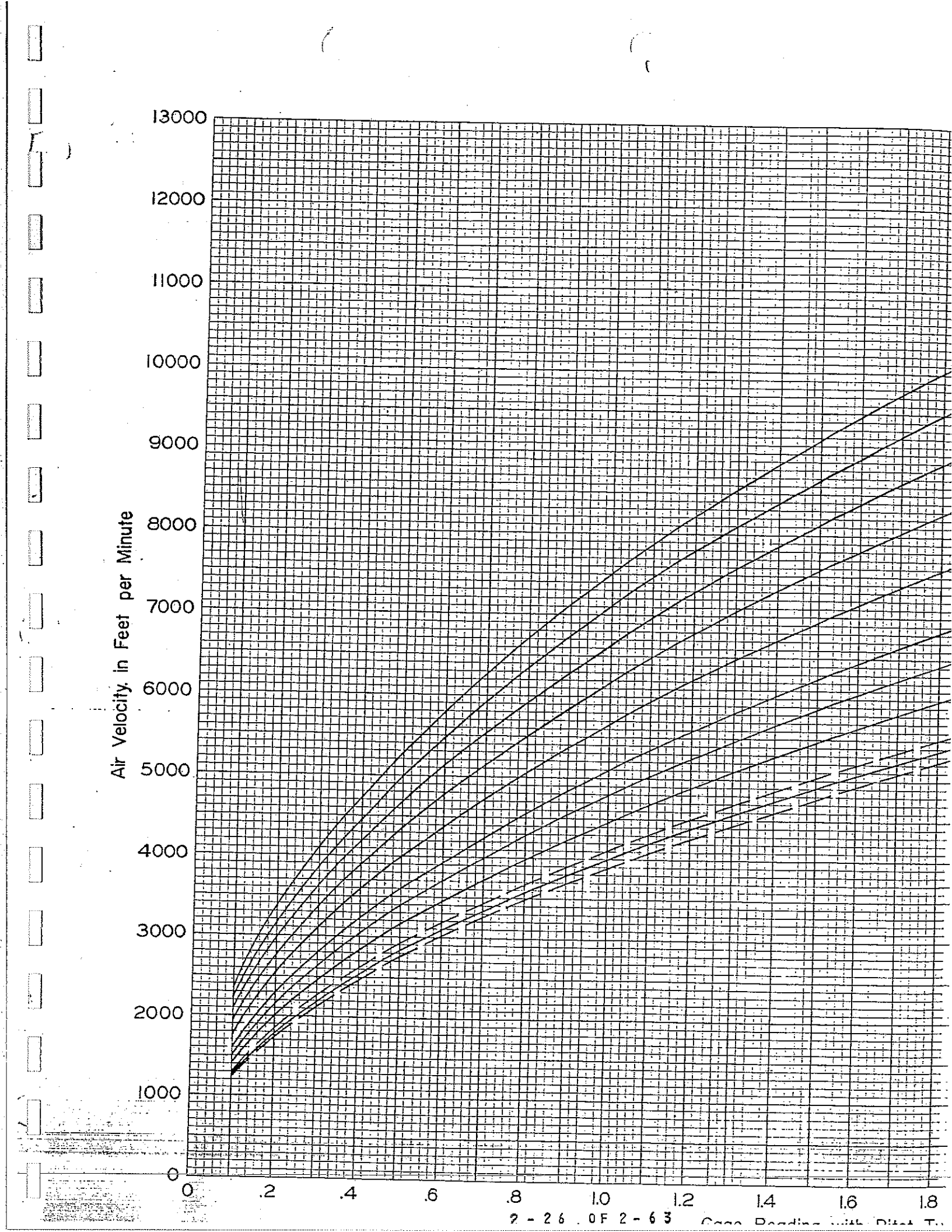
STAINLESS STEEL PITOT TUBES

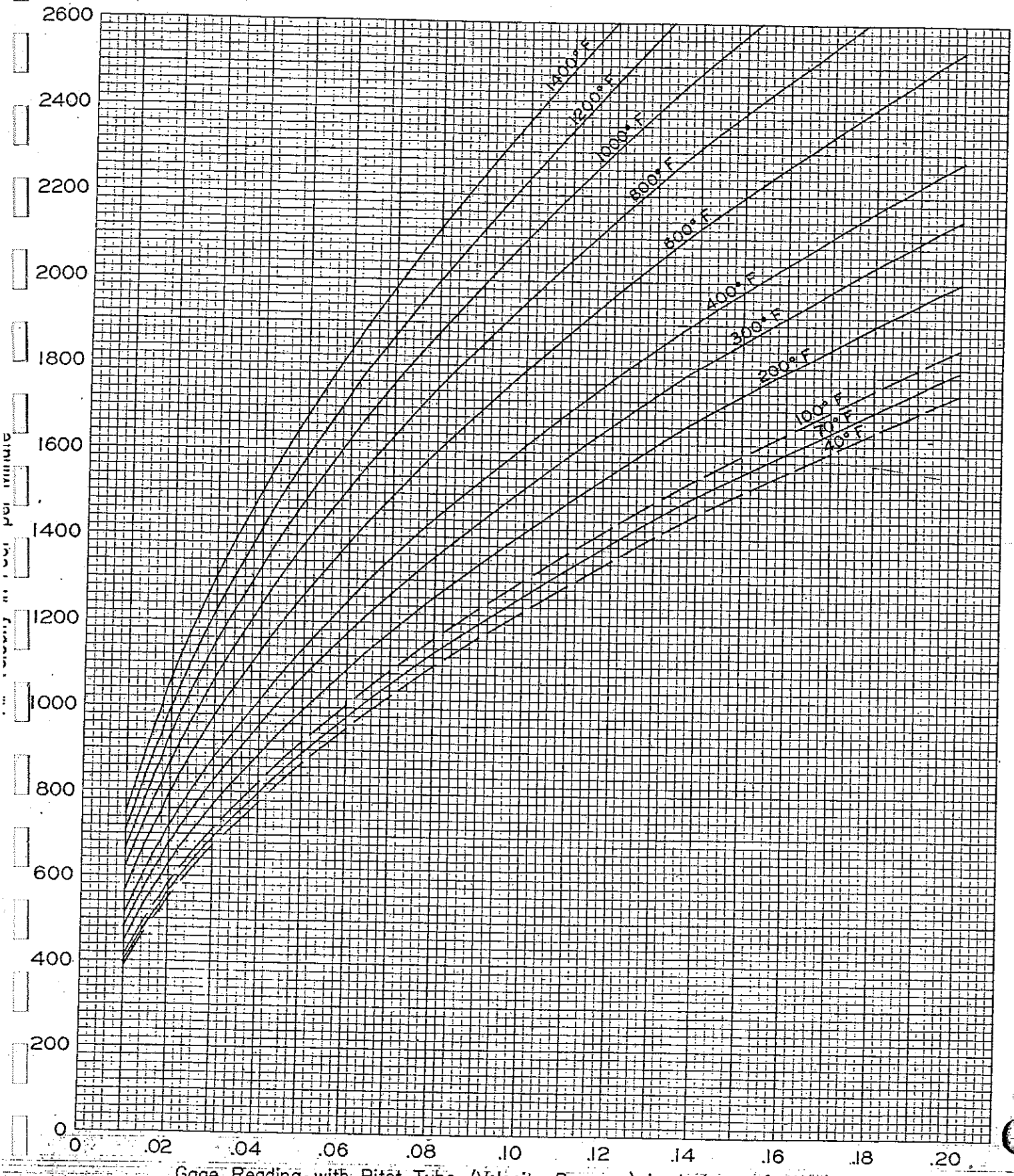
Test confirmed unity coefficient and lifetime construction of No. 304 stainless steel. Inch graduations show depth of insertion for traversing. Complies with AMCA and ASHRAE specifications. Sizes 12" to 60" long. Hand or fixed mounting types.

LITHOGRAPHED IN U.S.A. 3/84

DWYER INSTRUMENTS, INC. | Phone: 219/872-9141


1400° F
1200° F
1000° F
800° F
600° F
400° F
300° F
200° F
100° F
70° F
40° F
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
Tube (Velocity Pressure) in Inches of Water


13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Air Velocity, in Feet per Minute
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
2 - 26 . OF 2 - 63


2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1400°F
1200°F
1000°F
800°F
600°F
400°F
300°F
200°F
100°F
70°F
40°F
0
.02
.04
.06
.08
.10
.12
.14
.16
.18
.20
Gage Reading with Pitot Tube (Velocity Pressure) in Inches of Water

OMNI Environmental Servi Inc.
OMNI-Test Laboratories, Inc.
Beaverton, OR Phone (503) 643-3788

Thermometer Calibrator Calibration

Model No. CL300 - 2100F Calibration Date 8-24-05 Calibrated By BG Davis

Serial No. 612 OMNI Tracking No. 120

Standard Calibrator
Model No. ~~117~~ CL 300
Serial No. 506
OMNI Tracking No. 117
Calibration Date oct 22 04

Acceptability Criteria ± 5%
Maximum Deviation 2.0%
Acceptance OK
Readout Tracking No. 112

Scale Value °F	Standard Reading °F	Calibrator Reading °F	Reading Deviation °F
Right Scale	Column A	Column B	Column C
100	101	104	3
300	304	307	3
500	502	506	4
700	701	704	3
900	902	904	2
1100	1104	1105	1
1300	1303	1304	1
1500	1500	1500	Ø
1700	1695	1695	Ø
1900	1892	1892	Ø
2100	—	—	
Left Scale	Column A	Column B	Column C
0	001	000	1
200	203	202	1
400	401	400	1
600	603	602	1
800	803	801	2
1000	1003	1002	1
1200	1202	1201	1
1400	1399	1398	1
1600	1597	1596	1
1800	1794	1793	1
2000	1987	1987	Ø

Next Calibration Due 8-24-06

Technician signature: [signature] Date: 8-24-05

Certificate of Calibration

Certificate # 232180 Page # 1 of 1 Order Date: 28Sep2001

For: OMNI-TEST LABORATORIES 56

Department: NO PO#: OTL-01-137

JJ Calibrations, Inc.

Instrument Identification

Property #: 27502 Serial #: 27502

Make: UNKNOWN User:

Model: 10lb

Noun: 10lb WEIGHT

Accuracy: ASTM E617

Certification Information

As Found: Within Tolerance Cal Date: 03Oct2001

As Left: Within Tolerance *Due Date: 03Oct2002

Adjustments: None Repairs: None Seals: N/A

Procedure: CP 16

Environment: 21°C 44% RH

Technician: 49

Remarks

*Any number of factors may cause this item to drift out of calibration before the recommended due date has expired.

Standards Used

ID#	Manufacturer	Model#	Nomenclature	Due Date	Trace ID
550	AND	HP-30K	30k GRAM BALANCE	06Feb2002	210998

JJ Calibrations, Inc., certifies that this instrument has been compared in accordance with the above referenced procedure using standards with accuracies traceable to the National Institute of Standards and Technology, derived from accepted values of physical constants, derived from ratio measurements, or compared to consensus standards. The results contained herein relate only to the item calibrated. This certificate is in compliance with the applicable requirements of; MIL-STD-45662A and ISO-9002.
A Test Accuracy Ratio (TAR) of at least 4:1, if achievable, is maintained unless otherwise stated.

Tom Moody
Manager

Quality Assurance

Issued 04Oct2001
Rev # 11

7007 SE Lake Rd. • Portland, OR 97267-2105 • Telephone (503) 786-3005 • Fax (503) 786-2994 • www.jjcalibrations.com

CALIBRATION RECORD

Vaneometer Air Velocity Meter – OMNI-00~~032~~ 265 ak

CALIBRATION/SERVICE RECORD			
DATE	BY	RESULTS	DATE OF NEXT CALIBRATION
10-18-02	Jared S	Installed new vane from factory	4-18-03
4-15-03	K	Installed new vane from factory	10-15-03
10-26-03	BQ	Installed new vane from factory	4-26-04
4-26-04	BQ	Installed new vane from factory	10-26-04
11-4-04	BD	Installed new vane from factory	5-4-05
5-3-05	BD	Installed new vane from factory	11-3-05
11-3-05	BR	Installed new vane from factory	5-3-06
6-1-06	JTS	Installed new vane from factory ✓	12-1-06
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	

TROEMNER
Henry Troemner LLC

Traceable Certificate

201 Wolf Drive• P.O. Box 87• Thorofare, NJ 08086-0087• Phone: 856-686-1600• Fax: 856-686-1601• www.troemner.com• e-mail: troemner@troemner.com

Weight

Serial Number	47883
Order Number	VERBAL
Certificate #	251432
Date of Calibration	15-MAY-2003

OMNI-TEST
5465 S.W. Western Ave
Suite G
Beaverton, OR 97005

Description of Weights: TW-2000-01T, Metric Set

Material	Assumed Density at 20°C	Range
Aluminum	2.7 g/cm3	1mg-100mg
Stainless Steel	7.95 g/cm3	200mg-500mg
Stainless Steel	7.85g/cm3	1g-2kg

Tested with Reference Standards Traceable to the National Institute of Standards & Technology through NIST Test Number 822/265036-01.

We certify that the weights listed are calibrated to NIST 105-1 Class F tolerances.

The calibration of these weights is based on apparent mass vs material of density 8.0g/cm3.

Nominal Mass Value	Serial Number	Correction *	Tolerance (+ or -)	Uncertainty (+ or -)
2 kg		+30.0015 mg	200.000 mg	1.6515 mg
1 kg		+29.9907 mg	100.000 mg	0.6760 mg
500 g		+17.7906 mg	70.000 mg	0.3713 mg
200 g		+20.1298 mg	40.000 mg	0.1777 mg
200 g *		+15.6792 mg	40.000 mg	0.1776 mg
100 g		-2.0865 mg	20.000 mg	0.0706 mg
50 g		-1.1076 mg	10.000 mg	0.0381 mg
20 g		+0.8379 mg	4.000 mg	0.0244 mg
20 g *		+0.9829 mg	4.000 mg	0.0244 mg
10 g		-0.3028 mg	2.000 mg	0.0157 mg
5 g		-0.0103 mg	1.500 mg	0.0105 mg
2 g		-0.1317 mg	1.100 mg	0.0102 mg
2 g *		+0.3444 mg	1.100 mg	0.0102 mg
1 g		+0.3348 mg	0.900 mg	0.0102 mg
500 mg		+0.3975 mg	0.720 mg	0.0024 mg
200 mg		-0.0286 mg	0.540 mg	0.0024 mg
200 mg *		+0.0494 mg	0.540 mg	0.0024 mg
100 mg		+0.0245 mg	0.430 mg	0.0024 mg
50 mg		+0.0284 mg	0.350 mg	0.0024 mg
20 mg		+0.0713 mg	0.260 mg	0.0024 mg
20 mg *		-0.0317 mg	0.260 mg	0.0024 mg
10 mg		+0.0516 mg	0.210 mg	0.0024 mg
5 mg		+0.0310 mg	0.170 mg	0.0024 mg

* Denotes weight is marked with a dot

TROEMNER
Henry Troemner LLC

Traceable Certificate

201 Wolf Drive• P.O. Box 87• Thorofare, NJ 08086-0087• Phone: 856-686-1600• Fax: 856-686-1601• www.troemner.com• e-mail: troemner@troemner.com

Weight

OMNI-TEST
5465 S.W. Western Ave
Suite G
Beaverton, OR 97005

Order Number	VERBAL
Certificate #	251432
Date of Calibration	15-MAY-2003

Nominal Mass Value	Serial Number	Correction *	Tolerance (+ or -)	Uncertainty (+ or -)
2 mg *		-0.0292 mg	0.120 mg	0.0024 mg
1 mg		+0.0260 mg	0.100 mg	0.0003 mg

* Correction is defined as the difference between the mass value of a weight and its nominal value. A positive correction indicates that the mass value is greater than the nominal value by the amount of the correction.

Robert Thompson, Approved Signatory

* Denotes weight is marked with a dot

OMNI Environmental, Inc.
OMNI-Test Laboratories, Inc.
Beaverton, OR (503) 643-3788

NIST Stopwatch Calibration, Time Proficiency Testing Procedure and Data Sheet

Date: 1/27/06 User/Technician: Jared Sorenson ☑ Pass ☐ Fail

NIST traceable stop watch OMNI Tracking Number: 00292 Last Cal: 31-Jan 2005

Stopwatch to be tested for time proficiency OMNI Tracking Number: 00306

1. Start the NIST traceable stopwatch; at a predetermined time (i.e., 1.00 minutes), the technician shall start the watch being tested. When 15.00 seconds have passed (i.e., the NIST traceable stopwatch reads 1 minute, 15 seconds), the technician shall stop the watch being tested. Record the target time interval (i.e., 15.00 seconds). Repeat this step twice and record the data.

2. Repeat step #1 for each of the following target time intervals: 30.00 seconds, 10.00 minutes, and 30 minutes.

3. If the delta between the target time and measured time is less than 5% of the target time interval or 2.00 seconds (whichever is less), then the technician has demonstrated proficiency with the specific instrument utilized in the proficiency test. The proficiency is valid for a period of twelve months.

4. Archive the proficiency test data and information, including the effective date and expiration date of the proficiency, in the equipment record for the instrument involved.

Target time: 15.00 seconds #1 Measured time: 15.09 #2 Measured time: 15.00 #3 Measured time: 15.02

Target time: 30.00 seconds #1 Measured time: 30.02 #2 Measured time: 30.05 #3 Measured time: 29.96

Target time: 10.00 minutes #1 Measured time: 10:00.03 #2 Measured time: 10:00.06 #3 Measured time: 9:59.97

Target time: 30.00 minutes #1 Measured time: 30:00.01 #2 Measured time: 30:00.00 #3 Measured time: 30:00.09

Technician Signature: _____ Date: 1-27-06

Thermal Metering System Calibration
Y and dH@

Manufacturer:	American Meter Company
Model:	DTM-200A
Serial Number:	40893722
OMNI Tracking No.:	CFM 010

Average Orifice Meter dH@	Average Gas Meter y Factor
0.000	0.987

Calibration Date:	08/11/06
Calibrated by:	Ken Morgan
Calibration Frequency:	Six Month
Next Calibration Due:	02/09/07
Instrument Range:	1.000 cfm
Standard Temp.:	68 oF
Standard Press.:	29.92 "Hg
Barometric Press.:	30 "Hg
Signature/Date:	K. Morg 8-11-06

Previous Calibration Comparision

Date	10/2/05	Acceptable	
dH@ Value	N/A	Deviation (5%)	Deviation
y Factor	0.997	0.04985	0.010
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.006
Acceptable dH@ Deviation	0.200
Maximum dH@ Deviation	0.000
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	141	
	Calib. Date	19-Jun-06	
	Calib. Value	0.9980	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Vacuum ("Hg)	1.00	1.00	1.00
dH ("H2O)	0.00	0.00	0.00
Initial Reference Meter	36.392	41.537	48.303
Final Reference Meter	41.85	48.013	54.502
Initial DGM	852.824	859.055	865.903
Final DGM	858.358	865.62	872.13
Temp. Ref. Meter (°F), Tr	69.0	71.0	72.0
Temperature DGM (°F), Td	69.0	71.0	72.0
Time (Minutes)	50.0	46.5	18.0
Net Volume Ref. Meter, Vr	5.458	6.476	6.199
Net Volume DGM, Vd	5.534	6.565	6.227
Gas Meter y Factor =	0.984	0.984	0.994
Gas Meter y Factor Deviation (from avg.)	0.003	0.003	0.006
Orifice dH@	0.00	0.00	0.00
Orifice dH@ Deviation (from avg.)	0.000	0.000	0.000

where:

1. Deviation = |Average value for all runs - current run value|
2. y = [Vr x (y factor (ref)) x (Pb) x (Td + 460) / [Vd x (Pb + (dH / 13.6)) x (Tr + 460]
3. dH@ = 0.0317 x dH / (Pb (Td + 460)) x [(Tr + 460) x time) / Vr]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272

Thermal Metering System Calibration
Y and dH@

Manufacturer:	American Meter Company
Model:	DTM-200A
Serial Number:	04D893722
OMNI Tracking No.:	CFM 010

Average Orifice Meter dH@	Average Gas Meter y Factor
0.000	0.961

Calibration Date:	08/04/06
Calibrated by:	Ken Morgan
Calibration Frequency:	Post-Series
Next Calibration Due:	02/02/07
Instrument Range:	1.000 cfm
Standard Temp.:	68 oF
Standard Press.:	29.92 "Hg
Barometric Press.:	29.47 "Hg
Signature/Date:	K. Morgan 8-7-06

Previous Calibration Comparision

Date	10/2/2005	Acceptable	
dH@ Value	0	Deviation (5%)	Deviation
y Factor	0.997	0.04985	0.036
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.003
Acceptable dH@ Deviation	0.200
Maximum dH@ Deviation	0.000
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	1	
	Calib. Date	26-Apr-06	
	Calib. Value	0.9828	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Vacuum ("Hg)	1.00	1.00	1.00
dH ("H2O)	0.00	0.00	0.00
Initial Reference Meter	154.682	159.61	164.807
Final Reference Meter	159.61	164.807	170.266
Initial DGM	789.832	794.87	800.183
Final DGM	794.87	800.183	805.792
Temp. Ref. Meter (°F), Tr	77.0	78.0	78.0
Temperature DGM (°F), Td	77.0	79.0	79.0
Time (Minutes)	33.0	35.0	36.0
Net Volume Ref. Meter, Vr	4.928	5.197	5.459
Net Volume DGM, Vd	5.038	5.313	5.609
Gas Meter y Factor =	0.961	0.963	0.958
Gas Meter y Factor Deviation (from avg.)	0.000	0.002	0.003
Orifice dH@	0.00	0.00	0.00
Orifice dH@ Deviation (from avg.)	0.000	0.000	0.000

where:

1. Deviation = |Average value for all runs - current run value|
2. y = [Vr x (y factor (ref)) x (Pb) x (Td + 460) / [Vd x (Pb + (dH / 13.6)) x (Tr + 460]
3. dH@ = 0.0317 x dH / (Pb (Td + 460)) x [(Tr + 460) x time) / Vr]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272

Thermal Metering System Calibration
Y and dH@

Manufacturer:	American Meter Company
Model:	DTM-200A
Serial Number:	04D893721
OMNI Tracking No.:	CFM 020

Average Orifice Meter dH@	Average Gas Meter y Factor
0.000	0.992

Calibration Date:	08/11/06
Calibrated by:	Ken Morgan
Calibration Frequency:	Six Month
Next Calibration Due:	02/09/07
Instrument Range:	1.000 cfm
Standard Temp.:	68 oF
Standard Press.:	29.92 "Hg
Barometric Press.:	30 "Hg
Signature/Date:	K. J. Morgan 8-11-06

Previous Calibration Comparision

Date	10/2/05	Acceptable	
dH@ Value	N/A	Deviation (5%)	Deviation
y Factor	1.005	0.05025	0.013
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.010
Acceptable dH@ Deviation	0.200
Maximum dH@ Deviation	0.000
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	141	
	Calib. Date	19-Jun-06	
	Calib. Value	0.9980	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Vacuum ("Hg)	1.00	1.00	1.00
dH ("H2O)	0.00	0.00	0.00
Initial Reference Meter	55.514	61.005	66.834
Final Reference Meter	60.74	66.314	72.326
Initial DGM	573.007	578.478	584.372
Final DGM	578.21	583.852	589.949
Temp. Ref. Meter (°F), Tr	73.0	74.0	74.0
Temperature DGM (°F), Td	73.0	75.0	76.0
Time (Minutes)	15.0	52.0	42.0
Net Volume Ref. Meter, Vr	5.226	5.309	5.492
Net Volume DGM, Vd	5.203	5.374	5.577
Gas Meter y Factor =	**1.002**	**0.988**	**0.986**
Gas Meter y Factor Deviation (from avg.)	0.010	0.004	0.006
Orifice dH@	**0.00**	**0.00**	**0.00**
Orifice dH@ Deviation (from avg.)	0.000	0.000	0.000

where:

1. Deviation = |Average value for all runs - current run value|
2. y = [Vr x (y factor (ref)) x (Pb) x (Td + 460) / [Vd x (Pb + (dH / 13.6)) x (Tr + 460]
3. dH@ = 0.0317 x dH / (Pb (Td + 460)) x [(Tr + 460) x time) / Vr]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272

Thermal Metering System Calibration
Y and dH@

Manufacturer:	American Meter Company
Model:	DTM-200A
Serial Number:	04D893722
OMNI Tracking No.:	CFM 020

Average Orifice Meter dH@	Average Gas Meter y Factor
0.000	0.976

Calibration Date:	08/04/06
Calibrated by:	Ken Morgan
Calibration Frequency:	Post-Series
Next Calibration Due:	02/02/07
Instrument Range:	1.000 cfm
Standard Temp.:	68 oF
Standard Press.:	29.92 "Hg
Barometric Press.:	29.47 "Hg
Signature/Date:	K. J. Morgan 8-7-06

Previous Calibration Comparision

Date	10/2/2005	Acceptable	
dH@ Value	0	Deviation (5%)	Deviation
y Factor	1.005	0.05025	0.029
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.002
Acceptable dH@ Deviation	0.200
Maximum dH@ Deviation	0.000
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	1	
	Calib. Date	26-Apr-06	
	Calib. Value	0.9828	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Vacuum ("Hg)	1.00	1.00	1.00
dH ("H2O)	0.00	0.00	0.00
Initial Reference Meter	170.366	176.238	181.896
Final Reference Meter	176.238	181.896	187.24
Initial DGM	509.5	515.4	521.128
Final DGM	515.4	521.128	526.55
Temp. Ref. Meter (°F), Tr	81.0	80.0	80.0
Temperature DGM (°F), Td	81.0	83.0	83.0
Time (Minutes)	34.0	37.0	35.0
Net Volume Ref. Meter, Vr	5.872	5.658	5.344
Net Volume DGM, Vd	5.9	5.728	5.422
Gas Meter y Factor =	**0.978**	**0.976**	**0.974**
Gas Meter y Factor Deviation (from avg.)	0.002	0.000	0.002
Orifice dH@	**0.00**	**0.00**	**0.00**
Orifice dH@ Deviation (from avg.)	0.000	0.000	0.000

where:

1. Deviation = |Average value for all runs - current run value|
2. y = [Vr x (y factor (ref)) x (Pb) x (Td + 460) / [Vd x (Pb + (dH / 13.6)) x (Tr + 460]
3. dH@ = 0.0317 x dH / (Pb (Td + 460)) x [(Tr + 460) x time) / Vr]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272

Vermont Castings, Inc.

Analytical Balance Calibration

Mettler AE 100 serial # 11665
Mettler Instrument Corporation
Princetown-Hightstown Road
Box 71
Hightstown, NJ 08520 mettler AE 100

Filter + Probe Scale

Date: 07/29/06
Time: 10:45 AM
Calibrated By: Dan C.
Next Calibration Due: 02/29/07

Barometric Pressure: 29.246 in. Hg
Weigh Room Temperature: 76 °F
Weigh Room Rel. Humidity: 75 %

Calibration Weight *	Measured Weight	Difference
.0200	.0200	.00
.0500	.0500	.00
1.000	1.000	.00
.2000	.2000	.00
.5000	.5000	.00
10.0000	10.0000	.00
50.0000	50.0000	.00

* Calibration Weights:
NBS Class S
Troemner Inc.
6825 Greenway Ave.
Philadelphia, PA 19142

OMNI 00209

Instruction Booklet

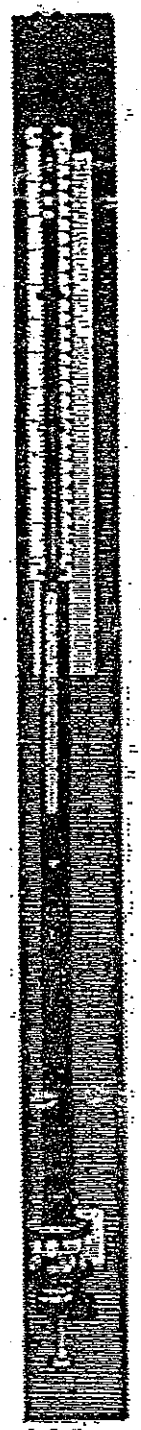
for use with

PRINCO

Fortin type mercurial

Barometers

453
National
Weather
Service
Type



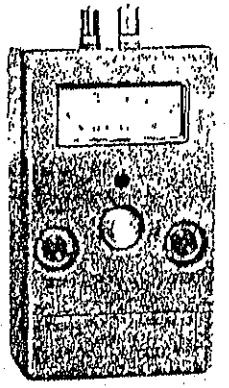
469
NOVA™
Economy
Model

Manufactured by

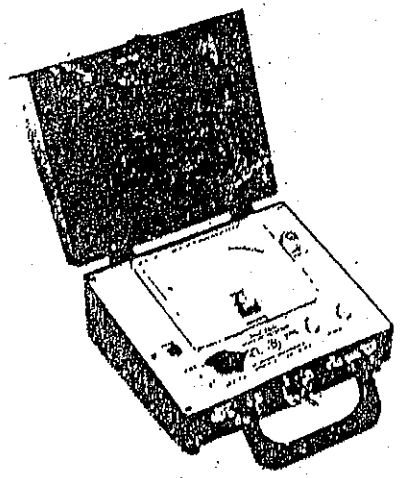
PRINCO INSTRUMENTS, INC.
1020 Industrial Blvd.
Southampton, Pa. 18966-4095
U.S.A.

Phone: 215 355-1500
Fax: 215 355-7766

OWNER'S MANUAL



MOISTURE DETECTORS FOR WOOD



DELMHORST INSTRUMENT COMPANY

DELMHORST INSTRUMENT COMPANY
BOONTON, N.J. 07005

5074-578

INDEX

MOISTURE DETECTORS

HOW TO MAKE THE BEST USE OF THEM

The Moisture Detector models of the RC, G-2 and J Series (Pocket Tester) are portable, battery powered instruments designed to measure the moisture content in wood. Meters are calibrated so that wood moisture content is read directly on the meter dial. The standard calibration is made on Douglas Fir at a temperature of 70°F.

Contact between meter and wood is made by means of an Electrode.

Electrode(s) should be selected primarily on the basis of wood thickness to be tested.

ACCURACY OF MOISTURE DETECTORS

Moisture Detectors will give most satisfactory service if properly kept, and used in accordance with operating instructions.

The Delmhorst Moisture Meters utilize the principle that a definite relation exists between moisture content and electric resistance in wood. A "resistance" moisture meter actually measures the electric resistance in wood as a function of the moisture content. In order to measure the electric resistance of a board we drive two pins into the wood (or 2 sets of pins in the case of multiple-pins electrode), and have a current flow between them. The higher the moisture content, the lower the resistance. The meter "reads" moisture in that area of the board which is in contact with the electrode pins, and it tends to read the highest moisture content in that area.

Significant differences in moisture content may exist in the same board, especially during drying. Such differences largely depend on the species of the wood and on the range of moisture present in it.

Generally, the lower the moisture content the more uniform is the moisture distribution; the higher the moisture content, greater are the variations in moisture from one point to the other. When the oven test is used for determining the moisture content of a board, the result is the average moisture content of the sample tested, which may or may not be equal to the average moisture content of the rest of the board, because of the differences that frequently occur, especially during the drying process.

On the other hand, if measurements are made with a moisture meter on the same sample, various tests may yield different readings and

even an average of these readings may not agree with the average obtained in the oven test.

Moisture meter readings and oven tests are in closest agreement if moisture content in a board has a very uniform distribution. Since it is well known that distribution of moisture content becomes more uniform at lower moisture range, meter readings may be expected to fall within the following tolerances:

0.5%	on range of	5 – 12%
1.0%	"	12 – 20%
2.0%	"	20 – Saturation point.

AVERAGE MOISTURE CONTENT

When wood is in the process of drying and all of it has been dried below the fibre saturation point, the fibres located at 1/5th of the thickness from the surface have the same moisture content as the average of the section. Therefore, driving the contact pins of the electrode to a depth of 1/5th of the thickness of the wood will indicate a moisture content close to the average of the section.

Tests should be made at least one-foot from the end and 1 inch from the edge and at three diagonal points across the width of the board. The average of the various readings should be the correct answer.

As it has been stated before, the average moisture content as determined by an oven test and the average moisture content as measured by the moisture meter may not agree, unless the wood is well seasoned and has a uniform moisture distribution.

The question often asked is "which one of the two is the more reliable method for accurate measurements"? The two methods are not actually exclusive of each other. Oven tests, properly run by expert personnel with efficient and accurate equipment, are very accurate, but their results can be safely applied only to the specific sample(s) tested. Furthermore, the oven method is not practical if a considerable number of tests are to be made – it is time consuming and is a "destructive" test (in order to obtain a sample, a board has to be cut).

Electric meters' tests are also very accurate, if we consider the moisture content in the area which is in contact with the electrode pins. In addition many "non-destructive" tests can be made in a very short time so that not only an "average" moisture content can be determined, but also variations of moisture are detected.

When measuring moisture content it is not only important to measure the average but also the range of moisture content. A few high moisture content pieces may have only a small effect on the average moisture content but will result in rejections when associated with wood having a lower average moisture content. Both determinations and their accuracy, must be considered in relation to the ultimate use of the wood. For example, wood to be used indoors will generally attain its equilibium moisture content between 4 and 10% with a usual average of 6 to 7% in most parts of the U.S.A. The amount of variation that can be tolerated depends on the product to be manufactured from it.

Lumber used in the production of fine furniture must not only be dried to an average of 6 to 7% but there must be little difference (usually less than 2%) among the pieces, and between the shell and core.

The meter is calibrated for use with a 4-pin electrode. When using an electrode with two insulated pins slightly lower readings are obtained. A correction of .5% to 1.5% should be added, according to the range of moisture content (See pg. 12).

EFFECT OF WOOD SPECIES ON METER READINGS

Different species of wood have different electrical properties and, as a result read differently for the same moisture content. The Moisture Detector is calibrated so as to read the moisture content of Douglas fir directly. See species corrections table, for other species of wood. The correction below 10% for many species, is so small that it can be disregarded and the meter read directly.

EFFECTS OF TEMPERATURE

As the temperature of wood increases, the electrical resistance decreases and vice-versa. The rate of change is not constant and, for accurate correction factor the temperature correction tables must be consulted. In the range 7 to 12%, the correction is approximately 1% for every 20°, which is subtracted from the meter reading if the temperature of the wood is higher than 70°F. and added if it is lower than 70°F. Most accurate tests are made when the temperature of the wood is approximately the same as the surroundings as it is difficult to measure the temperature of wood whose temperature is changing; as for example, wood just removed from a dry kiln and tested outside.

NUMBER OF MEASUREMENTS

Whatever the method used in measuring moisture content of lumber they are all intended to provide the most accurate information regarding the moisture condition of an entire board. Such accuracy does not only depend on the accuracy of the procedure or of the equipment used, but also on how "representative" the samples are in relation to the load. Theoretically, if one can be certain that all the boards, of a load have the same moisture content, and that the moisture distribution is quite uniform in each board, one meter reading only, or 1 only oven test should be sufficient.

Such "ideal" condition does not occur very frequently. On the contrary, variations do occur in almost every board. If the lumber is properly seasoned the variations are contained within "safe" limits. However, it should be clear that the greater the number of tests the more accurate the final determination.

The end use of the lumber should indicate how accurate an evaluation of the moisture content is required. For critical use, 5% or even 10% of the load should be tested. It is advisable that a large percentage of pieces be tested when starting to test for moisture. If it is apparent that the lumber is well dried, because of the small difference between readings, the number of tests can be reduced. However, it is important that some tests be made on boards that come from all parts of a load.

SELECTION OF THE ELECTRODE

A standard 4 pin Electrode (Delmhorst Type 4-E) having a 5/16" penetration can be used on most lumber up to 1½" thick. Satisfactory tests can be made with the 4-E Electrode even on wood 2" thick provided the lumber has a low moisture content, normally associated with uniform moisture distribution. Thicker lumber should be tested with electrodes having deeper penetration, such as the Delmhorst Type 26-E and 18-E.

The 26-E has a penetration of 1", the 18-E a penetration of 3". The contact pins of these electrodes are insulated except for approximately 1/8" at their points so that they measure only the moisture of the wood in contact with the uncoated points. These electrodes are generally used for making shell and core tests without cutting the sample.

Thin wood, such as veneer, is tested by using contact pins with very shallow penetration, such as Delmhorst Type 16-E.

When making tests, contact pins should be driven into sound wood. If poor contact is made the moisture content will be underestimated. Uncoated pins should be driven into the wood to their full length, coated pins to the desired depth.

GRAIN DIRECTION

As the resistance of wood is greater across the grain than with the grain, the electrode should be applied so that current flows parallel to the grain. The effect due to the current flowing across the grain is very small when the moisture content is less than 10% and can be disregarded. At 20% the meter will read about 2% lower when the electrode is placed so that the current flows across the grain.

EFFECTS OF PRESERVATIVES

Organic treatments, such as creosote and pentachlorophenol, have little effect on the accuracy of moisture meter readings. On the other hand, inorganic salts such as zinc chloride and fire retardant compounds electrolize rapidly and affect the readings by indicating a higher moisture content than is actually present.

TESTING PLYWOOD

Most of the animal and vegetable glues have no effect on moisture meter readings. Therefore, when the contact pins penetrate a glue line, if it is dry the moisture content of the wood is accurately measured. In fact, the moisture meter is frequently used to determine when a glue joint is dry.

Many of the resin glues do affect the meter readings because they have a lower electrical resistance than the wood. The effect will be greater at a high moisture content than at a low moisture content.

The moisture meter can be used to show whether or not the glue affects the accuracy of the meter. Drive the contact pins through not more than one half the thickness of the first ply and read the meter.

Then, drive the pins so that they just pass through the first flue line. If there is no appreciable increase in moisture meter reading as the pins make contact with the glue line, the glue may be considered to have no effect and the readings will be correct. The pins should then be driven to their full length and the moisture content read on the meter.

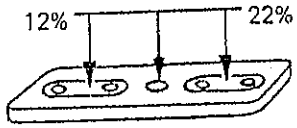
CALIBRATION MOISTURE STANDARDS

Moisture Detectors are accurately calibrated at the factory and they generally hold the calibration indefinitely. If there is doubt as to the accuracy of the Moisture Detector, the calibration is easily checked by use of the Moisture Content Standards which are available for 12% and 22% moisture content.

HOW TO USE MOISTURE STANDARDS

The Moisture Meter (with the electrode not connected to it) should be adjusted in accordance with the operating instructions. After the electrode is connected to the Detector, there should be no appreciable change in the meter reading.

The electrode pins are then applied against the plates on the face of the standard: one pin to the center point, the other pin to one of the plates. The meter is considered to be in calibration if the reading is within one half of 1 percent of the standard (12% or 22%).



TESTS ON LUMBER THAT IS WET ON THE SURFACE

Lumber exposed to rain, fog or high relative humidity, is likely to have a higher surface moisture than the core. When the surface moisture is only a very thin film, it will dissipate quickly, without affecting the soundness of the lumber.

However, if it must be tested when surface moisture is present, insulated pins should be used (Electrode 26E with #496 pins).

DECAY OF WOOD

When wood has a moisture content in excess of 20% and is exposed to air it will support fungus growth, cause of decay and rot. The Delmhorst Moisture Detector is very useful in determining whether or not a wood structure or part thereof is subject to decay while it is still in good condition. For instance, a joint between two wood members may collect storm water and hold it there for considerable periods of time, thus causing decay. The Delmhorst Moisture Detector will reveal this condition and show that treated wood should be used or some metal protection or waterproofing be provided to prevent the retention of water in joints of this nature.

READINGS ABOVE FIBER SATURATION POINT

The meter scale features readings above 30%, (fiber saturation point). They are marked in green to indicate that the lumber still has free water, and should not be taken as an accurate, quantitative measurement of the moisture content. They lag far behind the actual moisture content and should only be used for the following purposes:

1. to indicate that the wood still has free water,
2. to allow dry kiln operators to make "Hot" board readings as the boards are removed from the kiln, when the temperature effect causes the meter readings to rise.

A reading of 40% on a board with a temperature of 160°F. indicates that, after the appropriate temperature correction is applied, the actual moisture content is 24%, which is a reliable indication, since the moisture content is below fiber saturation point.

TESTING WOOD FLOORING AND SUB-FLOORING

Moisture detectors are indispensable for the proper installation of wood flooring. For best results wood should have, at the time of installation, a moisture content close to the average between the high and low moisture content value it will attain in use. If wood is too wet when it is put in place, it will eventually dry to a moisture content in equilibrium with the environment conditions of prevailing relative humidity. The drying will obviously result in shrinkage, and cracks will develop.

On the other hand, if flooring with a very low moisture content were laid in an area when high relative humidity prevails, it will pick up

moisture and swell. The recommended moisture content for wood flooring as follows (based on information shown in Forest Products Laboratory Bulletin No. 1055 entitled "Moisture Content of Wood in Use"):

	Average	Indiv. Pieces
Dry Southwestern States	6%	5-8%
Damp Southern Coastal States	10%	8-12%
Remainder of the United States	7%	6-9%

When flooring is installed on concrete slabs, it is important that the concrete be thoroughly dry at the time of installation. If it is not, the floor will pick up moisture from the slab and, even though it had the recommended moisture content at the time of installation, will absorb the moisture which will result in "compression set" which will be followed by shrinkage when the wood finally dries to the normal moisture content.

MAINTENANCE OF MOISTURE DETECTOR

Your Delmhorst Moisture Detector is a fine quality precision instrument. Given reasonably good care it will last indefinitely with only an occasional replacement of batteries.

When it is necessary to replace the batteries, the screws holding the panel in the case must be removed in order to remove the panel. In more recent models, the battery compartment is easily accessible through its own door or cover, thus eliminating the need to remove the panel.

THE EFFECT OF HIGH RELATIVE HUMIDITY

If a moisture detector is used in areas of high relative humidity, moisture may set on some of the components or on parts of the electrode, creating an electrical leakage. This will cause the meter to "read" as soon as it is turned on. In such areas, the instrument should be stored in a dry office or warehouse, when not in use. If a dry office is not available, it may be stored in a small closed cabinet, heated with a 40-watt bulb. This will raise the temperature sufficiently to lower the level of humidity in the cabinet. Normally, moisture by condensation will collect on the meter or on the electrode and it will affect the meter readings when the instrument is brought from a cool storage area into a warm, humid environment. For this reason, operating a moisture meter inside a kiln is a practice to be discouraged.

Following are some comments concerning the possible malfunctions:

1. The meter cannot be adjusted.
   In such case, the batteries are usually weak or they are not making good contacts with battery terminals in the holders.
2. The meter pointer moves to the right as soon as the meter is turned on, even though the electrode is not in contact with any material.
   This is due to a current leakage, generally caused by dirt or moisture between the two poles of the electrode. The electrode insulation should be cleaned.
3. The meter gives no readings after the pins are driven into the wood and the meter is turned on.
   This is normally due to a broken wire in the electrode cable. The Moisture Detector and its electrode are in good working order if, upon placing the fingers across the contact pins, the meter reads between 20 and 30. If it had been possible to adjust the meter according to instructions, a failure to obtain a reading when touching the contact pins would indicate that the trouble is in the electrode and not in the instrument.
4. Whenever it appears necessary that a panel meter or a vacuum tube is to be replaced, the instrument should be returned to the factory for repair.
5. Such Models as the J-1, J-2, and RC-1C and RC-2, feature printed circuits on boards which can be easily unplugged and returned to the factory for repair, replacement or recalibration.

USING THE MOISTURE METER ON MATERIAL OTHER THAN WOOD

It is possible that the moisture detectors may find a useful application to indicate the moisture content of material other than wood. In such cases, after an initial evaluation, a calibration should be developed for the material in question. Ask for Bulletin "Procedure for Moisture Meter Calibration", PIB #87.

TYPE 26E ELECTRODE

The 26E electrode is an original Delmhorst design for
- non-destructive shell and core tests,
- detection of moisture gradient,
- testing lumber with wet surface.

The contact pins of this electrode are insulated except for the tip so that the depth at which measurements are taken is clearly identified.

Readings taken with the 26E electrode are slightly lower than those taken with the 4-pin (4E) electrode which is used in the basic calibration of the instrument.

When using the 26E Electrode with insulated pins, the meter readings should be corrected according to the following table:

26E

Meter Reading

7	8	10	12	14	16	18	20	22	24
			Correct Reading						
7.3	8.4	10.6	12.8	14.9	17.0	19.2	21.4	23.7	26.0

The above correction should be disregarded when the insulation of the pins has worn off, or the uninsulated pins (A-111) are used.

4E

TYPE 4E – To test boards, ¼" to 1½" thick. Pins penetration is 5/16". A hammer extractor for driving and extracting pins from lumber is available as optional equipment. Weight 2½ lbs.

4E-H

TYPE 4E-H – Hammer style version of the 4E. To be used on softwoods only. Excellent for measuring moisture content on "dry chain". Weight 1½ lbs.

TYPE 18E – Similar to the 26E electrode. Pins penetration up to 3¼". Weight 2½ lbs.

15E

TYPE 15E – Eight-pin electrode for veneer. Pins penetration is 1/8". Electrode can be used for checking veneer m.c. at end of dryer, at time of gluing and for incoming inspection. Weight ½ lb.

BATTERIES USED IN VARIOUS DELMHORST MOISTURE DETECTORS

INSTRUMENT MODEL	NO. BATTERIES	BATTERY TYPES	
RC-1	3	1.5V "D" Flashlight Eveready	#950
	4	22.5V Burgess K-15 or Eveready	#420
RC-1B with Serial Nos. up to #6444			
	1	1.5V "D" Flashlight Eveready	#950
	4	22.5V Burgess Y-15 or Eveready	#505
RC-1B with Serial Nos. 6445 to #6699			
	1	1.5V Alkaline Energizer Ever.	#E-91
	4	22.5V Burgess Y-15 or Eveready	#505
RC-1B with Serial Nos. 6700 & up			
	1	1.5V Alk. Energizer Eveready	#E-91
	3	22.5V Burgess Y-15 or Eveready	#505
RC-1C	3	9V Eveready	#216
RC-2	2	9V Eveready	#216
G-2	1	45V Eveready	#455
	1	1.5V "D" Flashlight Eveready	#950
G-2B	1	1.5V "D" Flashlight Eveready	#950
	2	22.5V Burgess Y-15 or Eveready	#505
G-2C & G-2D	1	1.5V Alk. Energizer Eveready	#E-91
	1	22.5V Burgess Y-15 or Eveready	#505
G-2E/G-22	2	9V Eveready	#216
J & J (A)	1	1.5V Alk. Energizer Eveready	#E-91
	1	22.5V Burgess Y-15 or Eveready	#505
J-1 & J-2	2	9V Eveready	#216

OTHER INSTRUMENTS AVAILABLE

Electronic
THERMOMETER
Model TM-2

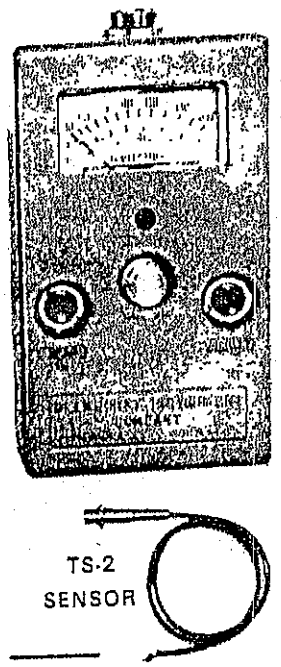
The TM-2 is a solid-state, portable battery operated instrument.

Remote sensing is possible up to 1000' or more. Probe extensions available in 3' rigid sections.

RANGES

TM-2 (30°-150°F / 0-65°C.)
TM-3 (−20°-110°F)
TM-4 (100°-250°F)
TM-5 (−20°-200°F)

The TS-2 Sensor is used to measure the temperature of liquids, gases or solids.



THE DELMHORST KIL-MO-TROL

The kiln keeps operating — you stay outside and measure moisture content of lumber while it is drying. There is no need to enter a hot kiln or to shut it down.

Saves Lumber — No need for sample boards. Tests are made on the lumber in the charge.

Saves Time — Shows exactly when lumber is dry.

Saves Labor — Twenty moisture tests, shell and core, in all parts of the charge can be made in less than two minutes.

Send sketch showing your kilns and control panel for a free Kil-Mo-Trol layout and cost of installation.

Appendix 2

MOISTURE CONTENT SCALES

There are two common ways of reporting moisture content in wood. In this book, and in most technical writings, moisture content is always based upon the ovendry weight of the wood:

$$\text{Moisture content (ovendry wood basis)} = \frac{\text{weight of moisture removed in oven drying}}{\text{weight of ovendry wood}}$$

Using this scale, wood which is half water by weight has a moisture content of 100 percent.

A second way to report moisture contents is based on the weight of the moist wood:

$$\text{Moisture content (moist wood basis)} = \frac{\text{weight of moisture removed in oven drying}}{\text{initial weight of wood, including its moisture}}$$

Using this scale, wood which is half water by weight has a moisture content of 50 percent.

These different scales for reporting moisture contents are another possible cause for discrepancies among lists of energy contents. 20 percent moisture content on an ovendry wood basis is the same as 25 percent moisture content on a moist wood basis. To facilitate comparisons between writings using the two conventions, Table A2-1 gives conversions.

MOISTURE CONTENT ON AN OVENDRY-WOOD BASIS PERCENT	MOISTURE CONTENT IN EITHER SCALE PERCENT	MOISTURE CONTENT ON A MOIST-WOOD BASIS PERCENT
0%	0%	0%
5.3	5	4.8
11.1	10	9.1
17.6	15	13.0
25.0	20	16.7
33.3	25	20.0
42.9	30	23.1
53.8	35	25.9
66.7	40	28.6
100.0	50	33.3
150.0	60	37.5
233.0	70	41.2
Infinite	100	50.0
--	150	60.0
--	200	66.7
--	250	71.4

TABLE A2-1. Conversions between moisture contents as expressed in the moist wood and oven-dry wood scales. To use the table for either conversion, find the value to be converted in the center column. Then to convert from dry to moist basis read to adjacent number in the right column. To convert from moist to dry, read the adjacent number in the left column. If m and d represent the moisture contents on the moist-wood and dry-wood bases respectively, then $m = d/1+d$), and $d = m/(1-m)$.

OMNI Environmental Services, I
OMNI-Test Laboratories, Inc.
Beaverton, OR Phone (503) 643-3788

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET
Magnehelic Gauge

Instrument to be calibrated: Dwyer MAGNAHELIC DRAFT GAUGE

Range: 0 - 0.25" ID Number: CFM 070

Calibration Instrument: Liquid Manometer ID Number: 33

Date: 4-10-06 By: K. Morgan

Liquid Manometer (A) (inches of H_20)	Magnehelic Gauge (B) (inches of H_20)	Difference (A - B)	% Error of Full Span*
- 0.012	- 0.013	.001	.004
- 0.036	- 0.038	.002	.008
- 0.074	- 0.075	.001	.004
- 0.154	- 0.150		1.6

*Acceptable tolerance is 4%.

This calibration is traceable to NIST through the Dwyer Liquid Manometer, NIST Test #MAS 822/254143-94.

Technician signature: K. Morgan Date: 4-10-06

Vermont Castings

Temperature Device Calibration

Temperature Device: Make: Omega Model: DP 2000 Serial #: _____

Calibrator: Make: Omega Model: CL521 Serial #: VCI 079

Date: 7/29/06

Time: _____

Calibrated By: Dan. W.

Next Calibration Due: 2/29/07

Barometric Pressure: 29.246 in. Hg

Scale 2B

Type	Channel	Ice Bath or Cal. Value		Boil. Water or Cal. Value		Upscale Value	
		Meas'd Temp °F	Ref * Temp °F	Meas'd Temp °F	Ref * Temp °F	Meas'd Temp °F	Calibrator Value °F
K	1	74°	75°	90°	90°	120°	120°
K	2	799°	800°	1201°	1200°	250°	250°
K	3	799°	800°	1201°	1200°	250°	250°
K	4	799°	800°	1200°	1200°	250°	250°
K	5	799°	800°	1201°	1200°	250°	250°
K	6	799°	800°	1201°	1200°	250°	250°
K	7	800°	800°	1201°	1200°	250°	250°
K	8	800°	800°	1201°	1200°	250°	250°
K	9	800°	800°	1201°	1200°	250°	250°
K	10	799°	800°	1201°	1200°	250°	250°
K	11	799°	800°	1201°	1200°	250°	250°

* Reference Temp.: ASTM Mercury-in-Glass Thermometer or Omega Temperature Calibrator / Thermometer Serial Number _____ or Ice Bath-32 °F;
Boiling Water- see attached chart for temperature corrected for barometeric pressure

Printed Name	Signature	Date
Dan Whitcomb	Dan Whitcomb	07/29/06

Vermont Castings

Temperature Device Calibration

Temperature Device: Make: Omega Model: DP2000 Serial #: _____

Calibrator: Make: Omega Model: CL521 Serial #: UCI 079

Date: 7/29/06

Time: 11:50A

Calibrated By: Dan.W

Next Calibration Due: 1/29/07

Barometric Pressure: 29.24C in. Hg

Type	Channel	Ice Bath or Cal. Value		Boil. Water or Cal. Value		Upscale Value	
		Meas'd Temp °F	Ref * Temp °F	Meas'd Temp °F	Ref * Temp °F	Meas'd Temp °F	Calibrator Value °F
K	12	799°	800°	1200°	1200°	250°	250°
K	13	49°	50°	99°	100°	251°	250°
K	14	49°	50°	89°	90°	98°	100°
K	15						
K	16	50°	50°	89°	90°	99°	100°

* Reference Temp.: ASTM Mercury-in-Glass Thermometer or Omega Temperature Calibrator / Thermometer Serial Number _____ or Ice Bath-32 °F;
Boiling Water- see attached chart for temperature corrected for barometeric pressure

Printed Name	Signature	Date
Dan Whitcomb	Dan Whitcomb	07/29/06

OMEGA ENGINEERING, INC.
An OMEGA Technologies Company

Certificate of Calibration
for
CFM DEVELOPMENTS LTD

Customer PO: 917689 **Model #:** CL521

Report #: 602978474 **Serial #:** 1385

Cal-3

OMEGA Engineering, Inc. certifies the above instrumentation has been calibrated to meet or exceed the published specifications. This calibration was performed using instrumentation and Standards that are traceable to the United States National Institute of Standards and Technology and is in compliance with ISO-10012-1 and ANSI/NCSL Z540-1-1994. This Certificate/Report shall not be reproduced, except in full, without the written consent of OMEGA Engineering, Inc.

Accuracy of UUT: SEE MANUAL

* Indicates Out Of Tolerance Condition

Range	Standard	As Found Input	As Left Input	As Found Output	As Left Output
mV	0	0.000	0.000	0.003	0.003
	25	25.004	25.004	25.000	25.000
	50	50.006	50.006	49.999	49.999
	75	75.008	75.008	74.997	74.997
	100	100.010	100.010	99.997	99.997
Ohm	100	99.98	99.9	N/A	N/A
	200	199.95	199.95	N/A	N/A
	400	399.89	399.89	N/A	N/A
KF	32	31.7	31.7	32.2	32.2
	2500	2499.8	2499.8	2499.8	2499.8

Max calibration System Uncertainty : 8 ppm (DC), ± 0.01%(ohms), ± 0.19°F

NIST Traceable Test No: 775585-5985303:1073509367

			Cal Due:
Calibration Standards	Fluke 5700A Calibrator	STD-098-04	4/7/06
	Ice Point Reference	CL-098-19	7/25/06

Test Conditions : Temp 24°C, ± 3°C RH 35%, ± 20 %

Accepted By: _____ **Certified by:** _____ **Date:** 2/23/06

Lab Representative Technician **Due Date:** 2/23/07

OMEGA Engineering, Inc., One Omega Circle, P.O. Box 336, Bridgeport, NJ 08014-0336 Telephone: **(856) 467-4200** • FAX: **(856) 467-1212**

www.omega.com e-mail: info@omega.com

OMNI Environmental Services, Inc.
OMNI-Test Laboratories, Inc.
Beaverton, OR

Tape Measure Calibration Log

Place the calibrated 12" ruler under the tape measure and verify that each ½" (i.e. 1.5", 2", 2.5") between 0 and 36" is within 1/8".

Tape Measure Number	Description	Cal Dates	Technician Initials
TM-1	Bruce- lime green - 12' Leverlock Stanley	4/1/04 Out of service 6/1/05	AS
TM-2	Alana - Orange — 8' WorkForce	4/1/04	AS
TM-3	Jared - Yellow - 25' Leverlock Stanley	4/1/04 Out of Service 10/10/05	AS
TM-4	Richard - White Austroflamm	4/1/04	AS
TM-5	Richard - Metal @ red 12' Craftsman	4/1/04	AS
TM-6	Richard - Metal Red & White - Security Chimneys Weldenco	4/1/04	AS
TM-7	16' Workforce Auto-stop. - Silver	4/1/04	AS
TM-8	" " - Silver	4/1/04	AS
TM-9	26' Lufkin - orange	4/1/04	AS
TM-10	Stanley Powerlock 16' - Silver	4/1/04	AS
TM-11	Brown 2m Stanley intermetric cal. using ruler & converting 25.4 mm = 1"	4/1/04	AS
TM-12	25' Stanley Powerlock Silver & yellow	4/7/04	AS
TM-13	Fabrian Stone Age Masonry Blue	4/7/04	AS
TM-14	Stanley Powerlock 16' - Silver	3/25/05	AS
TM-15	Yellow 25' Stanley	3/25/05	AS
TM-16	Yellow 12' Stanley	3/25/05	AS
TM-17	Yellow 12' Stanley	3/25/05	AS
TM-18	Yellow 27' Stanley PowerStop - Jared	10/10/05	AS
TM-19	Stanley Powerlock 12' - Silver	3/24/06	AS
TM-20	Stanley PowerLock 12' - Silver	3/24/06	AS
TM-21	Instimet - Interm. (MTS)	3/24/06	AS
TM-22	Grey Starrett 25' CS1-25-1 64183	7/18/06	AS
TM-23	Stanley Powerlock 25' Blade Armor - JS	7/18/06	AS

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Example Calculations

Note: OMNI uses the Lotus 1-2-3 computer program for all Method 5G and 5H calculations. The program automatically carries 14 decimal points in all calculations. The numbers on the printouts have been rounded for display only.

Equations and Sample Calculations - Method 5G

Equations used to calculate the parameters listed below are described in this appendix. Sample calculations are provided for each equation. The raw data and printout results from a sample run are also provided for comparison to the sample calculations.

BR	Dry burn rate, kg/hr
m_n	Total particulate matter collected, mg
$V_{m(std)}$	Volume of gas sampled corrected to standard conditions, dscf
v_s	Average dilution tunnel gas velocity, ft/sec
C_s	Particulate concentration, g/dscf
Q_{sd}	Average dilution tunnel gas flow rate, dscf/min
E	Particulate emission rate, lbs/hr
PR	Proportional rate variation, %

Dry Burn Rate

Using equation 28-3:

$$BR = \frac{60 \times W_{wd}}{\theta} \times \frac{100 - \%M_w}{100}$$

Where,

BR	=	Dry burn rate, lb/hr
W_{wd}	=	Mass of wood burned (wet basis) during test run, lb
θ	=	Total time of test run, minutes
$\%M_w$	=	Average moisture content of test fuel charge, wet basis percent

Sample Calculation:

Dry basis moisture of fuel = 20.03%

Using the equation 28-2 for converting dry basis moisture to wet basis moisture,

$$\%M_w = \frac{20.03 \times 100}{20.03 + 100}$$

$$\%M_w = 16.69\%$$

The wet weight of the fuel charge was 7.8 pounds. Converting pounds to kilograms yields a weight of 3.538 kg. The run time for this run was 180 minutes. Therefore, the burn rate equation appears thus:

$$BR = \frac{60 \times 3.538 \times (100 - 16.69)}{180 \times 100}$$

$$BR = 0.98\ kg/hr = 2.17\ lb/hr$$

Total Particulate Matter Collected

$$m_n = F_1 + F_2 + R - (V_a \times B_a)$$

Where:

m_n	=	Total particulate matter collected, mg
F_1	=	Particulate matter collected on front filter, mg
F_2	=	Particulate matter collected on rear filter, mg
R	=	Residue from evaporated probe and filter holder acetone rinse, mg
V_a	=	Volume of acetone evaporated probe and filter holder actone rinse, ml
B_a	=	Acetone blank value, mg/ml

Sample Calculation:

$m_n = 12.6 - 0.4 + 4.7 - (180 \times 0.0040)$

$m_n = 16.2$ mg

Volume of Gas Sampled Corrected to Dry Standard Conditions

Using equation 5-1:

$$V_{m(std)} = V_m \times Y \times \left(\frac{T_{std}}{P_{std}}\right) \times \frac{\left(P_b + \frac{\Delta H}{13.6}\right)}{T_m}$$

Where:

K	=	17.64 °R/in. Hg
T_{std}	=	528 °R
P_{std}	=	29.92 in. Hg
V_m	=	Volume of gas sample measured at the dry gas meter, dcf
Y	=	Dry gas meter calibration factor, dimensionless
P_b	=	Barometric pressure at the testing site, in. Hg
ΔH	=	Average pressure differential across the orifice meter, in. H_2O
T_m	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

$$V_{m(std)} = 98.434 \times 1.01 \times \left(\frac{528}{29.92}\right) \times \frac{30.03 + \frac{0.7}{13.6}}{532.5}$$

$$V_{m(std)} = 99.116\ ft^3$$

Dilution Tunnel Gas Velocity

Using equations 2-7 and 2-6, calculated at each recorded interval:

$$v_s = k_p \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{T_{s(avg)}}{P_s \times M_s}}$$

$$M_s = M_d \times (1 - B_{ws}) + 18.0 \times B_{ws}$$

Where:

v_s	=	Average dilution tunnel gas velocity, ft/sec
k_p	=	Pitot tube constant: $85.49 \frac{ft}{\text{sec}} \left[\frac{(lb/lb\text{-}mole) \times (inches\ Hg)}{(^\circ R) \times (inches\ H_2O)}\right]^{\frac{1}{2}}$
C_p	=	Pitot tube coefficient (0.99 for standard pitot tube; 0.84 may be used for S-type pitot tubes constructed according to Method 2 procedures), unitless
ΔP	=	ΔP measured during the pre-test flow traverse of the dilution tunnel; the square root of the ΔP values are averaged for this calculation, in. H_2O
P_b	=	Barometric pressure at test site, in. Hg
P_g	=	Static Pressure of tunnel, in. Hg
P_s	=	Absolute tunnel pressure, $= P_b + P_g$
M_s	=	Molecular weight of tunnel gas; assume M_d =29 lb/lb-mole (per method 5G)
B_{ws}	=	Moisture content of dilution tunnel gas, ratio; assume 4% (per method 5G)
T_s	=	Dilution tunnel temperature, °R; (°R = °F + 460)

Sample calculation:

$$M_s = 29 \times (1 - 0.04) + 18.0 \times 0.04 = 28.56$$

$$v_s = 85.49 \times 0.99 \times \sqrt{0.0351} \times \sqrt{\frac{(548)}{(30.03 + \frac{-0.45}{13.6}) \times (28.56)}}$$

$$v_s = 12.69 \frac{ft}{sec}$$

Particulate Concentration

Using equation 5G-2:

$$C_s = 0.001 \frac{g}{mg} \times \frac{m_n}{V_{m(std)}}$$

Where:

C_s	=	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscf
m_n	=	Total mass of particulate matter collected in the sampling train, mg
$V_{m(std)}$	=	Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

$$C_s = \frac{0.001 \times 16.2}{99.116}$$

$$C_s = 0.000163 \ g/dscf$$

Average Dilution Tunnel Gas Flow Rate

Using equation 2-8, calculated at each recorded interval:

$$Q_{sd} = 3600 \times (1 - B_{ws}) \times v_s \times A \times \frac{T_{std}}{T_{s(avg)}} \times \frac{P_s}{P_{std}}$$

Where:

Q_{sd}	=	Gas flow rate corrected to dry, standard conditions, dscf/hr
3600	=	Conversion from seconds to hours
B_{ws}	=	Moisture content of dilution tunnel gas, ratio; assume 4% (per method 5G)
v_s	=	Average dilution tunnel gas velocity, ft/sec
A	=	Cross sectional area of dilution tunnel, ft^2
T_{std}	=	Standard absolute temperature, 538°R
$T_{s(avg)}$	=	Average absolute dilution tunnel temperature, °R, (°R = °F + 460)
P_b	=	Barometric pressure at test site, in. Hg
P_g	=	Dilution tunnel static pressure, in. Hg
P_s	=	Absolute dilution tunnel gas pressure, in Hg, (Hg = $P_b + P_g$)
P_{std}	=	Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.04) \times 12.69 \times \frac{(\pi \times 3^2)}{144} \times \frac{528}{548} \times \frac{30.03 + \frac{-0.45}{13.6}}{29.92}$$

$$Q_{sd} = 8313.36 \ dscf/hr = 138.56 \ dscf/min$$

Particulate Emission Rate

Using equation 5G-3 and 5G-4:

$$E = C_s \times Q_{sd}$$

$$E_{adj} = K_3 \times E^{0.83}$$

Where:

E = Particulate emission rate, g/hr

E_{adj} = Particulate emission rate, adjusted, g/hr

C_s = Concentration of particulate matter in the stack, corrected to dry, standard conditions, g/dscf

Q_{sd} = Average dilution tunnel gas flow rate, dscf/hr

K_3 = Constant, 1.82 for metric units, 0.643 for English units

Sample calculation:

$$E = 0.000163 \times 8313.36 \times 60$$

$$E = 1.36\ g/hr$$

$$E_{adj} = 1.82 \times 1.36^{0.83}$$

$$E = 2.35\ g/hr$$

Proportional Rate Variation

Using equation 5H-9, calculated at each recorded interval:

$$PR = \frac{\theta \times (V_{mi} \times V_s \times T_m \times T_{si})}{10 \times (V_m \times V_{si} \times T_s \times T_{mi})} \times 100$$

Where:

PR	=	Percent proportional rate
θ	=	Time of test, min
S_i	=	Measured tracer gas concentration for the "i^{th}" interval, in this case, the inverse of the calculated flow in the stack based on CO_2 concentrations in the stack and in the dilution tunnel
$V_{mi(std)}$	=	Volume of gas sample measured by the dry gas meter during the "i^{th}" 10 minute interval, dscf
V_m	=	Volume of gas sample as measured by dry gas meter, dscf
V_{si}	=	Average gas velocity in the dilution tunnel during each 10 minute interval, i, of the test run, m/sec
V_s	=	Average gas velocity in the dilution tunnel, m/sec
T_{mi}	=	Absolute average dry gas meter temperature during each 10 minute interval, i, of the test run, °R
T_m	=	Absolute average dry gas meter temperature, °R
T_{si}	=	Absolute average gas temperature in the dilution tunnel during each 10 minute interval, i, of the test run, °R
T_s	=	Absolute average gas temperature in the dilution tunnel, °R

Sample calculation (for the reading at 50 minutes into test run 1):

$$PR = \frac{180 \times 5.6 \times 12.69 \times 533 \times 552}{10 \times 98.434 \times 12.63 \times 548 \times 532} \times 100$$

$$PR = 103.8\%$$

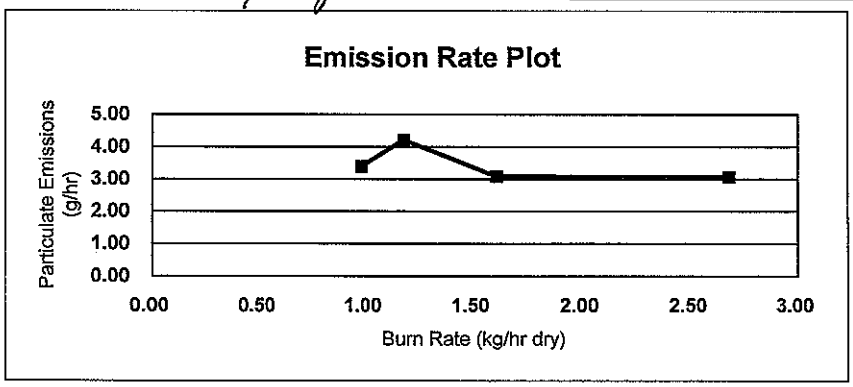
Section 4

Test Data by Run

EPA Weighted Average Emissions
EPA Method 28

Client:	CFM Majestic	Status:	FINAL
Stove Model:	Century/Dutch West	Stove Type:	Non-Catalytic Stove
Test Dates:	7/31/06 - 8/03/06		
Project Number:	259-S-12-3		
Tracking Number:	861		
Signature/Date:	8-17-06		

Weighted Average (g/hr)
3.5



Run #	1	
Burn Rate (dry kg/hr)	0.98	
Catagory	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	3.38	
Cap (g/hr)	15	
Weighting Factor	0.526	32.53%
Heat Output (BTU/hr)	11842	

Run #	2	
Burn Rate (dry kg/hr)	1.18	
Catagory	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	4.21	
Cap (g/hr)	15	
Weighting Factor	0.446	27.57%
Heat Output (BTU/hr)	14259	

Run #	3	
Burn Rate (dry kg/hr)	1.61	
Catagory	3	
Overall Efficiency (%)	63%	
Emissions (g/hr)	3.08	
Cap (g/hr)	18	
Weighting Factor	0.450	27.84%
Heat Output (BTU/hr)	19454	

Run #	5	
Burn Rate (dry kg/hr)	2.68	
Catagory	4	
Overall Efficiency (%)	63%	
Emissions (g/hr)	3.06	
Cap (g/hr)	18	
Weighting Factor	0.195	12.06%
Heat Output (BTU/hr)	32384	

Run 1

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: CFM Majestic
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861
Run: 1
Test Date: 7/31/006

Burn Rate	**0.98 kg/hr dry**
Average Tunnel Temperature	90 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	14.5 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8926.4 dscf/hour
Average Delta p	0.045 inches H20
Average Delta H	0.00 inches H20
Total Time of Test	340 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	46.06 cubic feet	45.59 cubic feet	46.53 cubic feet
Average Gas Meter Temperature	77 degrees Fahrenheit	77 degrees Fahrenheit	78 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	54.2 dscf	63.2 dscf	45.2 dscf
Train-2 corrected for 6.42 PSI meter pressure			
Total Particulates - mn		14.6 mg	10.9 mg
Particulate Concentration (dry-standard)	0.00024 grams/dscf	0.00023 grams/dscf	0.00024 grams/dscf
Particulate Emission Rate	2.11 grams/hour	2.06 grams/hour	2.15 grams/hour
Adjusted Emissions	**3.38 grams/hour**	3.32 grams/hour	3.44 grams/hour
Difference from Average		0.06 grams/hour	0.06 grams/hour
7.5% of the average emission rate	0.25		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		

Results Are Acceptable

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 1

Manufacturer: CFM Majestic
Model: Century
Tracking No.: 861
Project No.: 259-S-12-3
Test Date: 7/31/006
Beginning Clock Time: 13:50
Recording Interval: 10 min.
Total Sampling Time: 340 min.

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.038	0.048	0.050	0.044	0.040	0.050	0.050	0.040	"H2O
Initial Temp.	92	92	92	92	92	92	92	92	oF

OMNI Equipment Numbers:

Signature/Date: K. J. Murg 8-29-06

PM Control Module: 10,20
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.56 lb/lb-mole
Dilution Tunnel H2O: 4.00 percent
Dilution Tunnel Static: -0.148 "H2O
Pitot Tube Cp: 0.99
Meter Box Y Factor: 0.997 (1) 1.005 (2)
Barometric Pressure: Begin 29.47, Middle 29.43, End 29.39, Average 29.43 "Hg

Tunnel Velocity: 14.52 ft/sec.
Intial Tunnel Flow: 148.2 scfm
Average Tunnel Flow: 148.8 scfm
Tunnel Area: 0.1883 ft2
Post-Test Leak Check (1): 0 @ 15 cfm@"Hg
Post-Test Leak Check (2): 0 @ 13 cfm@"Hg
Fuel Moisture (dry basis %): 19.61
Total Particulate (1): 14.6
Total Particulate (2): 10.9

Elapsed Time	Particulate Sampling Data														Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack
	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Orifice dH (1)	Orifice dH (2)	Meter oF (1)	Meter oF (2)	Meter Vac. In. Hg. (1)	Meter Vac. In. Hg. (2)	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%) (1)	Pro. Rate (10%) (2)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Exit	Average Surface	Stack	Filter (1)	Filter (2)	Impinger exit (1)	Impinger exit (2)	Ambient	Draft In. H2O
0	592.600	321.800			0.00	0.00	77	78	0	0	92	0.045			14.6		291	416	308	319	339		334.6	277	75	75			74	-0.040
10	593.970	323.215	0.14	0.14	0.00	0.00	77	77	0	-0	92	0.045	103	105	14.2	-0.4	291	427	297	293	304		322.4	230	79	79			76	-0.035
20	595.310	324.620	0.13	0.14	0.00	0.00	77	77	0	0	88	0.045	101	103	13.8	-0.4	267	413	265	248	251		288.8	233	77	77			75	-0.035
30	596.645	326.000	0.13	0.14	0.00	0.00	76	77	0	0	88	0.045	100	102	13.2	-0.6	243	393	237	230	231		266.8	243	76	73			75	-0.035
40	597.985	327.385	0.13	0.14	0.00	0.00	77	77	0	0	86	0.045	100	102	12.6	-0.6	296	373	200	224	226		263.8	231	75	73			74	-0.035
50	599.315	328.760	0.13	0.14	0.00	0.00	76	77	0	0	93	0.045	100	102	11.6	-1	354	354	187	222	226		268.6	337	76	73			75	-0.048
60	600.660	330.125	0.13	0.14	0.00	0.00	76	77	0	0	96	0.045	102	101	10.8	-0.8	463	342	281	246	254		317.2	374	77	74			73	-0.055
70	602.000	331.500	0.13	0.14	0.00	0.00	79	77	0	0	98	0.045	101	102	9.6	-1.2	488	327	313	281	292		340.2	378	80	74			75	-0.055
80	603.330	332.855	0.13	0.14	0.00	0.00	76	77	0	0	100	0.045	101	101	8.5	-1.1	529	317	362	302	322		366.4	399	79	74			73	-0.058
90	604.670	334.225	0.13	0.14	0.00	0.00	77	77	0	0	101	0.045	102	102	7.4	-1.1	541	308	386	317	351		380.6	397	80	75			75	-0.058
100	606.010	335.590	0.13	0.14	0.00	0.00	77	78	0	0	98	0.045	101	101	6.6	-0.8	499	302	379	321	356		371.4	358	80	75			74	-0.053
110	607.350	336.960	0.13	0.14	0.00	0.00	77	78	0	0	97	0.045	101	101	5.8	-0.8	481	297	377	321	349		365.0	352	80	76			74	-0.053
120	608.685	338.320	0.13	0.14	0.00	0.00	77	78	0	0	98	0.045	101	101	5.0	-0.8	475	295	380	321	352		364.6	361	80	75			75	-0.053
130	610.030	339.680	0.13	0.14	0.00	0.00	77	78	0	0	99	0.045	102	101	4.2	-0.8	514	293	407	331	369		382.8	383	80	76			74	-0.055
140	611.360	341.050	0.13	0.14	0.00	0.00	77	78	0	0	95	0.045	100	101	3.6	-0.6	475	292	401	343	376		377.4	334	80	76			74	-0.048
150	612.695	342.420	0.13	0.14	0.00	0.00	77	78	0	0	93	0.045	101	101	3.3	-0.3	427	292	387	327	360		358.6	305	79	75			74	-0.045
160	614.050	343.760	0.14	0.13	0.00	0.00	77	78	0	0	93	0.045	102	99	2.9	-0.4	408	293	390	322	347		352.0	303	78	75			75	-0.043
170	615.385	345.145	0.13	0.14	0.00	0.00	77	78	0	0	90	0.045	100	102	2.7	-0.2	379	294	363	314	338		337.6	274	78	75			74	-0.040
180	616.730	346.515	0.13	0.14	0.00	0.00	77	78	0	0	89	0.045	101	101	2.5	-0.2	360	295	339	307	331		326.4	264	77	74			74	-0.038
190	618.070	347.880	0.13	0.14	0.00	0.00	77	78	0	0	88	0.045	101	100	2.3	-0.2	346	296	330	304	326		320.4	255	77	74			74	-0.035
200	619.410	349.240	0.13	0.14	0.00	0.00	77	78	0	0	86	0.045	100	100	2.0	-0.3	333	297	324	299	320		314.6	246	76	74			74	-0.035
210	620.750	350.610	0.13	0.14	0.00	0.00	77	78	0	0	87	0.045	100	101	1.9	-0.1	323	298	319	293	315		309.6	240	76	73			75	-0.033
220	622.090	351.975	0.13	0.14	0.00	0.00	77	78	0	0	85	0.045	100	100	1.7	-0.2	315	299	313	288	310		305.0	237	76	73			73	-0.033
230	623.430	353.335	0.13	0.14	0.00	0.00	77	78	0	0	86	0.045	100	100	1.6	-0.1	309	299	310	283	306		301.4	234	76	73			74	-0.033
240	624.770	354.700	0.13	0.14	0.00	0.00	77	78	0	0	85	0.045	100	100	1.4	-0.2	303	299	306	279	301		297.6	230	76	73			73	-0.030
250	626.115	356.070	0.13	0.14	0.00	0.00	77	78	0	0	84	0.045	101	100	1.3	-0.1	301	299	305	276	298		295.8	228	75	73			74	-0.030
260	627.455	357.430	0.13	0.14	0.00	0.00	77	77	0	0	85	0.045	100	100	1.1	-0.2	298	298	297	273	296		292.4	225	75	73			75	-0.030
270	628.800	358.790	0.13	0.14	0.00	0.00	77	78	0	0	84	0.045	101	100	1.0	-0.1	296	297	289	271	295		289.6	224	75	73			74	-0.030
280	630.140	360.135	0.13	0.13	0.00	0.00	76	77	0	0	83	0.045	100	99	0.8	-0.2	293	297	285	269	293		287.4	222	75	72			74	-0.030
290	631.480	361.520	0.13	0.14	0.00	0.00	76	77	0	0	84	0.045	100	102	0.6	-0.2	289	294	277	268	288		283.2	219	75	72			74	-0.028
300	632.800	362.850	0.13	0.13	0.00	0.00	76	77	0	0	83	0.045	99	97	0.5	-0.1	281	290	273	265	278		277.4	215	74	72			73	-0.028
310	634.165	364.240	0.14	0.14	0.00	0.00	76	77	0	0	82	0.045	102	102	0.4	-0.1	279	288	277	264	274		276.4	214	74	72			73	-0.028
320	635.510	365.610	0.13	0.14	0.00	0.00	76	77	0	0	83	0.045	101	100	0.3	-0.1	275	286	273	264	270		273.6	210	74	72			74	-0.028
330	636.850	366.975	0.13	0.14	0.00	0.00	76	77	0	0	82	0.045	100	100	0.1	-0.2	267	284	264	258	262		267.0	204	74	72			74	-0.028
340	638.191	368.330	0.13	0.14	0.00	0.00	76	77	0	0	82	0.045	100	99	0.0	-0.1	261	282	255	252	257		261.4	199	74	72			74	-0.025
Avg/Total	45.591	46.530	0.13	0.14	0.00	0.00	76.74	77.51			89.57	0.045	100.76	100.76									73		76.80	73.91	#DIV/0!	#DIV/0!		-0.039

OMNI Test Laboratories
Beaverton, OR Phone (503) 643-3788

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: CFM Vermont Castings____ Project #: 259-S-12-3_____ Tracking #: 861_____

Date: 7-31-06 Test Crew: K. Morgan Run #: 1

OMNI Equipment ID #: _____

Preburn [X] Test [ ] Coal Bed: Data: 0 = 1 Range: 3.0 - 3.6 Actual: Coal Bed: 3.3

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top 4	Bottom 8	Back 7	Left 6	Right 5	Flue 3	Catalyst (Not Used)
0	10.1		-.090	75	802	353	580	434	472	781	
10	8.6	1.5	-.070	75	664	380	519	431	474	464	
20	7.4	1.2	-.070	73	640	388	494	409	454	467	
30	6.0	1.4	-.068	75	655	384	484	407	446	463	
40	5.1	0.9	-.063	73	613	380	465	405	437	425	
50	4.6	0.5	-.053	74	523	378	457	390	415	346	
60	4.3	0.3	-.045	74	415	383	405	349	364	294	
* 70	3.6	* 0.4	-.040	74	395	397	348	329	346	275	
80	3.4	0.2	-.040	73	355	410	315	321	340	269	
83 90	3.3	0.1	-.040	74	347	416	308	319	339	277	
00											
10											
20											
30											
40											
50											
60											
70		Removed	0.31 in at	69 min							
80											
90											
AVG											

Technician signature: K. L. Morgan Date: 7-31-06

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 1
Train #: 1
Date: 07/31/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D368	141.6	127.7	13.9
B. Rear filter catch	Filter	D366	122.6	122.1	0.5
C. Probe catch	Probe	2	83356.4	83356.2	0.2

Total Particulate, mg :	14.6

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: K. J. Morgan Date: 8-7-06

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 1
Train #: 2
Date: 07/31/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D367	123.7	113.5	10.2
B. Rear filter catch	Filter	D365	119.7	119.1	0.6
C. Probe catch	Probe	B	86787.9	86787.8	0.1

Total Particulate, mg :	10.9

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: M. Mayo Date: 8-7-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3
Tracking Number: 861
Run #: 1 Date: 7-31-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

Fully Closed

SECONDARY: Fixed

TERTIARY: N/A - None

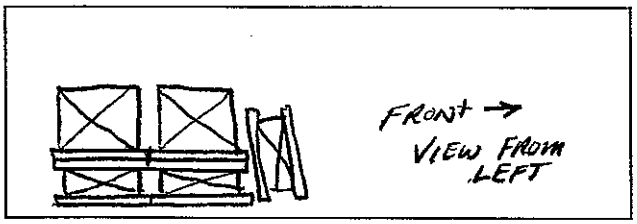
FAN: ON - Low

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	Test setting					
67				0.3	Removed coals	
83					K	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 104 sec.
DOOR: Closed at 3 min
PRIMARY AIR: Fully Open until 5:0 min
OTHER: None

DESCRIBE OR SKETCH TEST SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

Fully Closed

SECONDARY: Fixed

TERTIARY: None

FAN: OFF For First 30 min, ON-Low Remainder of test

Technician signature: K. J. Morgan Date: 7-31-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 7-31-06 Test Crew: K. Morgan Run #: 1
OMNI Equipment ID #: _____
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length		Readings		Type
1	8 ft	19.0	18.8	20.2	2x4
2	8 ft	19.9	18.8	19.8	2x4
3	____ ft				

Length of cut pieces: 21 @ 8.25 inches Pre-Burn Fuel Average Moisture: 19.42 %

Time (clock): 11:30 Room Temperature (F): 73 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 2
CALCULATED LOAD WEIGHT: 15.4 ACTUAL LOAD WEIGHT: 6.1 (2 × 4)
8.5 (4 × 4)
FUEL PIECE LENGTH: 16.0 14.6 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	19.0	18.9	19.3	2x4
2	19.0	19.4	18.9	2x4
3	20.2	19.5	18.9	2x4
4	20.6	19.4	18.9	4x4
5	21.3	21.3	19.6	4x4
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.61 %

Time (clock): 11:35 Room Temperature (F): 73 Initials: K

Technician signature: K J. Morgan Date: 7-31-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: CFM Vermont Castings

Model: Century

Project No.: 259-S-12-3 Tracking No.: 861

Date: 7-31-06 Run No.: 1 Booth: 2B

Test Crew: K. Morgan Start Time: 13:50 Stop Time: 19:30

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: _____ Initial: _____

Final: N/A Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2							
CO_2			N/A				
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: < 50 Final: < 50

Scale Audit (lbs.): Pretest: 10.0 Post Test: 10.0

Induced Draft: 0 %Smoke Capture: 100

Pitot Tube Leak Test: Pre: ϕ @ 3.1" w.c. Post: ϕ @ 3.2" w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-29-06 Initials: JC

	Initial	Middle	Ending
Pb (in. Hg)	29.47	29.43	29.39
Room Temp (°F)	74	74	74

Technician signature: K. J. Morgan Date: 7-31-06

Run 2

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861
Run: 2
Test Date: 08/01/06

Burn Rate	**1.18 kg/hr dry**
Average Tunnel Temperature	97 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	14.3 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8664.3 dscf/hour
Average Delta p	0.043 inches H20
Average Delta H	0.00 inches H20
Total Time of Test	270 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	36.36 cubic feet	36.05 cubic feet	36.67 cubic feet
Average Gas Meter Temperature	77 degrees Fahrenheit	76 degrees Fahrenheit	77 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	42.8 dscf	50.0 dscf	35.6 dscf
Train-1 corrected for 6.42 PSI meter pressure			
Total Particulates - mn		15.8 mg	11.3 mg
Particulate Concentration (dry-standard)	0.00032 grams/dscf	0.00032 grams/dscf	0.00032 grams/dscf
Particulate Emission Rate	2.75 grams/hour	2.74 grams/hour	2.75 grams/hour
Adjusted Emissions	**4.21 grams/hour**	4.20 grams/hour	4.21 grams/hour
Difference from Average		0.01 grams/hour	0.01 grams/hour
7.5% of the average emission rate	0.32		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		

Results Are Acceptable

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 2

Manufacturer: CFM Vermont Castings
Model: Century
Tracking No.: 861
Project No.: 259-S-12-3
Test Date: 01-Aug-06
Beginning Clock Time: 10:15
Recording Interval: 10 min.
Total Sampling Time: 270 min.

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.040	0.044	0.048	0.040	0.040	0.044	0.046	0.042	"H2O
Initial Temp.	97	97	97	97	97	97	97	97	oF

OMNI Equipment Numbers:

PM Control Module: 010/020
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.56 lb/lb-mole
Dilution Tunnel H2O: 4.00 percent
Dilution Tunnel Static: -0.180 "H2O
Pitot Tube Cp: 0.99
Meter Box Y Factor: 0.997 (1) 1.005 (2)
Barometric Pressure: Begin 29.40, Middle 29.4, End 29.4, Average 29.40 "Hg

Signature/Date: M. Morey 8-29-06

Tunnel Velocity: 14.29 ft/sec.
Intial Tunnel Flow: 144.3 scfm
Average Tunnel Flow: 144.4 scfm
Tunnel Area: 0.1883 ft2
Post-Test Leak Check (1): 0 @ 12 cfm@"Hg
Post-Test Leak Check (2): 0 @ 10 cfm@"Hg
Fuel Moisture (dry basis %): 19.95
Total Particulate (1): 15.8
Total Particulate (2): 11.3

	Particulate Sampling Data														Fuel Weight, lb		Wood Heater Temperature Data, oF												Stack
Elapsed Time	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Orifice dH (1)	Orifice dH (2)	Meter oF (1)	Meter oF (2)	Meter Vac. In. Hg. (1)	Meter Vac. In. Hg. (2)	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%) (1)	Pro. Rate (10%) (2)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Exit	Average Surface	Stack	Filter (1)	Filter (2)	Impinger exit (1)	Impinger exit (2)	Ambient	Draft In. H2O
0	638.400	368.500			0.00	0.00	75	76	0	0	97	0.043			14.1		317	489	284	313	335		347.6	250	73	72			72	-0.035
10	639.770	369.890	0.14	0.14	0.00	0.00	75	75	1	1	89	0.043	103	103	13.7	-0.4	264	465	285	273	285		314.4	221	75	75			73	-0.033
20	641.110	371.280	0.13	0.14	0.00	0.00	75	75	1	1	87	0.043	100	103	13.4	-0.3	247	436	256	236	247		284.4	217	75	74			73	-0.035
30	642.450	372.650	0.13	0.14	0.00	0.00	75	75	1	1	91	0.043	101	102	12.6	-0.8	312	412	263	231	226		288.8	308	75	74			72	-0.045
40	643.780	374.015	0.13	0.14	0.00	0.00	75	75	1	1	94	0.043	100	101	11.6	-1	364	389	229	252	223		291.4	332	76	75			73	-0.050
50	645.100	375.360	0.13	0.13	0.00	0.00	75	75	1	1	108	0.043	101	101	10.2	-1.4	568	368	322	294	276		365.6	473	78	77			73	-0.063
60	646.440	376.735	0.13	0.14	0.00	0.00	76	76	1	1	110	0.043	102	103	8.8	-1.4	600	361	366	322	326		395.0	474	80	78			72	-0.065
70	647.775	378.095	0.13	0.14	0.00	0.00	76	76	1	1	113	0.043	102	103	7.5	-1.3	618	355	403	348	362		417.2	480	81	79			73	-0.065
80	649.100	379.445	0.13	0.13	0.00	0.00	76	77	1	1	112	0.043	101	102	6.2	-1.3	619	352	434	373	384		432.4	469	81	80			74	-0.065
90	650.430	380.795	0.13	0.14	0.00	0.00	76	77	1	1	111	0.043	102	101	5.1	-1.1	579	351	452	392	400		434.8	451	82	80			74	-0.063
100	651.760	382.150	0.13	0.14	0.00	0.00	76	77	1	1	111	0.043	102	102	4.0	-1.1	568	352	437	401	412		434.0	449	82	80			75	-0.063
110	653.090	383.510	0.13	0.14	0.00	0.00	77	77	1	1	108	0.043	101	102	3.2	-0.8	553	354	433	404	416		432.0	425	82	80			75	-0.060
120	654.425	384.855	0.13	0.13	0.00	0.00	77	78	1	1	104	0.043	101	100	2.7	-0.5	497	355	412	390	405		411.8	381	81	80			75	-0.055
130	655.755	386.210	0.13	0.14	0.00	0.00	77	78	1	1	101	0.043	101	101	2.3	-0.4	469	354	422	382	396		404.6	366	80	79			75	-0.053
140	657.090	387.560	0.13	0.14	0.00	0.00	77	78	1	1	98	0.043	101	100	2.0	-0.3	426	353	421	369	387		391.2	332	80	79			75	-0.048
150	658.425	388.915	0.13	0.14	0.00	0.00	77	78	1	1	95	0.043	100	100	1.8	-0.2	391	351	416	352	370		376.0	314	79	78			74	-0.045
160	659.760	390.280	0.13	0.14	0.00	0.00	77	78	1	1	94	0.043	100	101	1.6	-0.2	372	350	410	340	358		366.0	303	78	77			74	-0.043
170	661.090	391.630	0.13	0.14	0.00	0.00	77	78	1	1	93	0.043	100	100	1.4	-0.2	355	348	397	328	346		354.8	294	78	77			74	-0.043
180	662.425	392.985	0.13	0.14	0.00	0.00	77	78	1	1	93	0.043	100	100	1.2	-0.2	351	348	389	323	343		350.8	292	78	76			75	-0.043
190	663.760	394.335	0.13	0.13	0.00	0.00	77	78	1	1	92	0.043	100	100	1.1	-0.1	340	347	366	313	337		340.6	279	77	76			75	-0.038
200	665.095	395.690	0.13	0.14	0.00	0.00	77	78	1	1	91	0.043	100	100	0.9	-0.2	325	352	341	302	324		328.8	269	77	76			75	-0.038
210	666.435	397.050	0.13	0.14	0.00	0.00	77	78	1	1	90	0.043	100	100	0.8	-0.1	313	359	314	292	313		318.2	260	77	76			75	-0.038
220	667.765	398.400	0.13	0.13	0.00	0.00	77	78	1	1	89	0.043	100	99	0.6	-0.2	299	364	302	281	302		309.6	250	77	76			74	-0.035
230	669.110	399.755	0.13	0.14	0.00	0.00	77	78	1	1	89	0.043	101	100	0.5	-0.1	289	368	284	271	292		300.8	243	77	75			74	-0.033
240	670.450	401.105	0.13	0.14	0.00	0.00	77	78	1	1	88	0.043	100	99	0.4	-0.1	280	369	267	262	283		292.2	236	76	75			75	-0.033
250	671.780	402.460	0.13	0.14	0.00	0.00	77	78	1	1	88	0.043	99	100	0.2	-0.2	272	367	257	253	275		284.8	230	76	75			74	-0.030
260	673.115	403.815	0.13	0.14	0.00	0.00	77	78	1	1	87	0.043	100	99	0.1	-0.1	265	358	252	246	268		277.8	226	76	75			74	-0.030
270	674.454	405.167	0.13	0.14	0.00	0.00	77	78	1	1	87	0.043	100	99	0.0	-0.1	260	347	238	242	261		269.6	221	76	75			74	-0.030
Avg/Total	36.054	36.667	0.13	0.14	0.00	0.00	76.39	77.11			96.79	0.043	100.75	100.76									78		77.96	76.75	#DIV/0!	#DIV/0!		-0.046

OMNI Test Laboratories
Beaverton, OR Phone (503) 643-3788

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: CFM Vermont Castings Project #: 259-S-12-3 Tracking #: 861

Date: 8-01-06 Test Crew: K. Morgan Run #: 2

OMNI Equipment ID #:

Preburn [X] Test [ ] Coal Bed: Data: 0 = Range: 2.9 - 3.5 Actual: Coal Bed: 3.2

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top 4	Bottom 8	Back 7	Left 6	Right 5	Flue	Catalyst N/A
0	10.6		-.090	72	837	407	463	411	455	783	
10	8.8	1.8	-.075	73	~~519~~ 679	445	424	416	~~459~~ 681C	520	
20	7.4	1.4	-.070	72	658	445	429	402	452	504	
30	6.2	1.2	-.068	73	625	435	428	393	449	486	
40	5.2	1.0	-.063	72	592	431	416	387	444	451	
50	4.5	0.7	-.060	72	528	437	408	385	421	413	
60	3.9	0.6	-.055	72	489	454	407	382	411	374	
70	3.6	0.3	-.048	73	428	472	399	365	394	332	
80	3.3	0.3	-.045	72	368	499	344	344	378	294	
90	3.2	0.1	-.038	72	322	491	289	317	340	254	
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: K. J. Morgan Date: 8-01-06

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 2
Train #: 1
Date: 08/01/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D364	140.4*	125.9	14.5
B. Rear filter catch	Filter	D362	124.2	124.0	0.2
C. Probe catch	Probe	4	79068.4	79067.3	1.1

Total Particulate, mg :	15.8

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: M. Morse Date: 8-7-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861-

Equipment Numbers:

Run #: 2
Train #: 2
Date: 08/01/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D363	126.4	116.3	10.1
B. Rear filter catch	Filter	D361	118.1	117.8	0.3
C. Probe catch	Probe	6	76807.4	76806.5	0.9

Total Particulate, mg :	11.3

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: L. J. Morgan Date: 8-7-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3
Tracking Number: 861
Run #: 2 Date: 08-01-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

Open 0.375"

SECONDARY: Fixed

TERTIARY: None

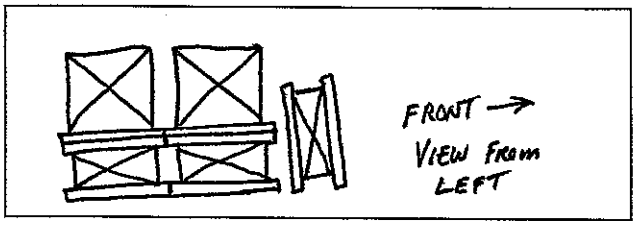
FAN: ON - Low

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	Test Setting					
76					K	Level bed

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 1.5 min.
DOOR: AJAR until 3.0 min.
PRIMARY AIR: ABRUPTLY Closed at 5.0 min
OTHER: None

DESCRIBE OR SKETCH TEST SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SAME AS ABOVE

SECONDARY: Fixed

TERTIARY: None

FAN: OFF 1st 30 min,
ON - Low Remainder

Technician signature: K. J. Morgan Date: 8-01-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-01-06 Test Crew: K. Morgan Run #: 2
OMNI Equipment ID #: _____
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length		Readings		Type
1	8 ft	21.5	18.6	19.8	2x4
2	8 ft	21.7	19.9	20.7	2x4
3	____ ft	____	____	____	____

Length of cut pieces: 19@8.5 inches Pre-Burn Fuel Average Moisture: 20.37%

Time (clock): 07:30 Room Temperature (F): 69 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 2
CALCULATED LOAD WEIGHT: 15.4 ACTUAL LOAD WEIGHT: 5.9 (2 × 4)
8.2 (4 × 4)
FUEL PIECE LENGTH: 16.0 14.1 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	19.2	19.6	21.4	4x4
2	19.6	19.8	20.4	4x4
3	19.9	21.3	19.4	2x4
4	20.4	20.0	20.4	2x4
5	19.5	19.0	19.3	2x4
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.95%

Time (clock): 07:30 Room Temperature (F): 69 Initials: K

Technician signature: K J. Morgan Date: 8-01-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: CFM Vermont Castings

Model: Century

Project No.: 259-S-12-3 Tracking No.: 861

Date: 08-01-06 Run No.: 2 Booth: 2B

Test Crew: K. Morgan Start Time: 10:15 Stop Time: 14:45

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: _____ Initial: _____

Final: N/A Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2							
CO_2			N/A				
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: <50 Final: <50

Scale Audit (lbs.): Pretest: 10.0 Post Test: 10.0

Induced Draft: 0 %Smoke Capture: 100

Pitot Tube Leak Test: Pre: ∅ @ 3.2" w.c. Post: ∅ @ 3.1" w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-29-06 Initials: JC

	Initial	Middle	Ending
Pb (in. Hg)	29.40	29.40	29.40
Room Temp (°F)	72	75	74

Technician signature: K. Morgan Date: 08-01-06

Run 3

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861
Run: 3
Test Date: 08/02/06

Burn Rate	**1.61 kg/hr dry**
Average Tunnel Temperature	117 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	15.6 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9071.5 dscf/hour
Average Delta p	0.049 inches H20
Average Delta H	0.12 inches H20
Total Time of Test	200 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	31.07 cubic feet	31.48 cubic feet	30.67 cubic feet
Average Gas Meter Temperature	84 degrees Fahrenheit	83 degrees Fahrenheit	84 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	29.6 dscf	29.9 dscf	29.3 dscf
Total Particulates - mn		6.3 mg	6 mg
Particulate Concentration (dry-standard)	0.00021 grams/dscf	0.00021 grams/dscf	0.00020 grams/dscf
Particulate Emission Rate	1.88 grams/hour	1.91 grams/hour	1.86 grams/hour
Adjusted Emissions	**3.08 grams/hour**	3.12 grams/hour	3.04 grams/hour
Difference from Average		0.04 grams/hour	0.04 grams/hour
7.5% of the average emission rate	0.23		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		

Results Are Acceptable

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 3

Manufacturer: CFM Vermont Castings
Model: Century
Tracking No.: 861
Project No.: 259-S-12-3
Test Date: 02-Aug-06
Beginning Clock Time: 12:40
Recording Interval: 10 min.
Total Sampling Time: 200 min.

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.046	0.050	0.052	0.048	0.046	0.050	0.052	0.048	"H2O
Initial Temp.	126	126	126	126	126	126	126	126	oF

OMNI Equipment Numbers:

PM Control Module: 010, 020
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.56 lb/lb-mole
Dilution Tunnel H2O: 4.00 percent
Dilution Tunnel Static: -0.200 "H2O
Pitot Tube Cp: 0.99
Meter Box Y Factor: 0.997 (1) 1.005 (2)
Barometric Pressure: Begin 29.39, Middle 29.31, End 29.26, Average 29.32 "Hg

Signature/Date: K. J. Morgan 8-22-06

Tunnel Velocity: 15.56 ft/sec.
Intial Tunnel Flow: 150.0 scfm
Average Tunnel Flow: 151.2 scfm
Tunnel Area: 0.1883 ft2
Post-Test Leak Check (1): 0 @ 4 cfm@"Hg
Post-Test Leak Check (2): 0 @ 3 cfm@"Hg
Fuel Moisture (dry basis %): 19.85
Total Particulate (1): 6.3
Total Particulate (2): 6.0

Elapsed Time	Particulate Sampling Data														Fuel Weight, lb		Wood Heater Temperature Data, oF												Stack
	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Orifice dH (1)	Orifice dH (2)	Meter oF (1)	Meter oF (2)	Meter Vac. In. Hg. (1)	Meter Vac. In. Hg. (2)	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%) (1)	Pro. Rate (10%) (2)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Exit	Average Surface	Stack	Filter (1)	Filter (2)	Impinger exit (1)	Impinger exit (2)	Ambient	Draft In. H2O
0	698.900	420.500			0.00	0.00	85	85	0	0	126	0.049			14.2		390	486	293	363	393		385.0	328	60	62			82	-0.050
10	700.440	422.025	0.15	0.15	0.13	0.11	85	85	1	1	112	0.049	98	100	13.6	-0.6	349	490	323	315	336		362.6	321	72	67			81	-0.053
20	702.010	423.570	0.16	0.15	0.13	0.11	84	84	1	1	125	0.049	101	102	12.4	-1.2	430	469	382	281	317		375.8	474	74	71			81	-0.070
30	703.570	425.105	0.16	0.15	0.13	0.11	84	84	1	1	138	0.049	102	103	10.6	-1.8	601	444	449	297	351		428.4	560	76	73			80	-0.078
40	705.105	426.645	0.15	0.15	0.13	0.11	84	85	1	1	143	0.049	100	103	8.7	-1.9	679	423	359	345	416		444.4	582	78	74			81	-0.078
50	706.630	428.180	0.15	0.15	0.13	0.11	84	85	1	1	141	0.049	99	103	7.0	-1.7	683	405	380	383	458		461.8	565	78	74			81	-0.078
60	708.150	429.720	0.15	0.15	0.13	0.11	84	85	1	1	138	0.049	99	103	5.6	-1.4	659	393	384	411	472		463.8	533	77	73			81	-0.075
70	709.645	431.250	0.15	0.15	0.13	0.11	84	85	1	1	134	0.049	97	102	4.5	-1.1	618	384	399	423	476		460.0	507	76	73			82	-0.073
80	711.170	432.780	0.15	0.15	0.13	0.11	84	85	1	1	130	0.049	99	101	3.5	-1	482	379	397	429	467		430.8	482	75	72			81	-0.070
90	712.730	434.315	0.16	0.15	0.13	0.11	84	85	1	1	124	0.049	100	101	2.8	-0.7	546	376	377	427	452		435.6	446	74	71			81	-0.065
100	714.325	435.845	0.16	0.15	0.13	0.11	84	85	1	1	117	0.049	102	100	2.3	-0.5	473	375	349	406	422		405.0	392	73	71			82	-0.060
110	715.930	437.370	0.16	0.15	0.13	0.11	84	85	1	1	113	0.049	102	100	2.0	-0.3	435	372	352	387	396		388.4	367	73	72			81	-0.055
120	717.535	438.900	0.16	0.15	0.13	0.11	83	84	1	1	109	0.049	102	100	1.7	-0.3	401	370	330	366	377		368.8	346	73	72			80	-0.055
130	719.140	440.435	0.16	0.15	0.13	0.11	83	84	1	1	107	0.049	102	100	1.5	-0.2	381	367	317	350	364		355.8	334	72	72			81	-0.053
140	720.745	441.970	0.16	0.15	0.13	0.11	83	84	1	1	106	0.049	102	100	1.2	-0.3	371	365	304	341	357		347.6	326	72	73			79	-0.050
150	722.360	443.520	0.16	0.15	0.13	0.11	83	83	1	1	103	0.049	102	101	1.0	-0.2	351	363	286	327	344		334.2	314	72	73			79	-0.048
160	723.950	445.030	0.16	0.15	0.13	0.11	82	83	1	1	102	0.049	101	98	0.8	-0.2	342	360	284	319	337		328.4	309	73	73			79	-0.048
170	725.550	446.560	0.16	0.15	0.13	0.11	81	83	1	1	100	0.049	101	99	0.6	-0.2	334	357	281	311	327		322.0	305	74	74			78	-0.048
180	727.160	448.095	0.16	0.15	0.13	0.11	81	82	1	1	99	0.049	102	100	0.4	-0.2	327	355	272	308	323		317.0	298	75	74			78	-0.045
190	728.750	449.650	0.16	0.16	0.13	0.11	81	82	1	1	97	0.049	100	101	0.2	-0.2	315	352	263	301	313		308.8	290	75	75			77	-0.043
200	730.375	451.165	0.16	0.15	0.13	0.11	80	81	1	1	97	0.049	103	98	0.0	-0.2	308	349	257	297	305		303.2	285	75	76			76	-0.043
Avg/Total	31.475	30.665	0.16	0.15	0.12	0.10	83.19	84.00			117.19	0.049	100.71	100.73									82		73.67	72.14	#DIV/0!	#DIV/0!		-0.059

OMNI Test Laboratories, Inc.
Beaverton, OR Phone (503) 643-3788

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: CFM Vermont Castings____ Project #: 259-S-12-3_____ Tracking #: 861_____

Date: 8-02-06 Test Crew: K. MorgAN Run #: 3

OMNI Equipment ID #: _____

Preburn [X]	Coal Bed:			Actual:
Test [ ]	Data: 0 =	Range: 2.9 – 3.5		Coal Bed: 3.5

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top 4	Bottom 8	Back 7	Left 6	Right 5	Flue 3	Not Used Catalyst
0	13.5		-.090	82	554	257	445	426	409	798	
10	12.0	1.5	-.070	82	565	337	306	403	421	472	
20	10.2	1.8	-.075	82	619	370	300 419	370	420	539	
30	8.5	1.7	-.078	82	681	391	337	387	443	567	
40	6.7	5	-.078	82	723	400	373	418	480	578	
50	5.3	1.4	-.073	83	676	405	403	428	491	524	
60	4.5	0.8	-.078	82	577	417	406	426	477	461	
70	4.0	0.5	-.063	82	506	437	372	414	452	414	
80	3.7	0.3	-.058	82	446	462	326	391	424	368	
90	3.5	0.2	-.055	81	406	479	301	367	398	346	
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: K. J. Morgan Date: 8-02-06

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 3
Train #: 1
Date: 08/02/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D360	134.5	129.9	4.6
B. Rear filter catch	Filter	D359	129.6	128.8	0.8
C. Probe catch	Probe	10	76014.7	76013.8	0.9

Total Particulate, mg :	6.3

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: K. J. Morgan Date: 8-7-06

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 3
Train #: 2
Date: 08/02/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D358	121.2	116.6	4.6
B. Rear filter catch	Filter	D357	128.1	127.1	1.0
C. Probe catch	Probe	E	76257.4	76257.0	0.4

Total Particulate, mg :	6.0

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: M. Morgan Date: 8-7-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3
Tracking Number: 861
Run #: 3 Date: 08-02-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

OPEN 0.750"

SECONDARY: FIXED

TERTIARY: NONE

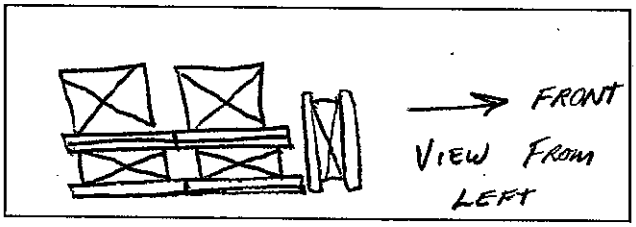
FAN: ON - High

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	TEST Setting					
90					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 1:15
DOOR: AJAR until 3.0 min.
PRIMARY AIR: Fully Open until 5.0 min, Abruptly set to test setting @ 5.0 min.
OTHER: None.

DESCRIBE OR SKETCH TEST SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SAME AS ABOVE

SECONDARY: FIXED.

TERTIARY: NONE

FAN: Off for 1st 30 min, then ON - High Remainder of test.

Technician signature: K. Morgan Date: 8-02-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-02-06 Test Crew: K. Morgan Run #: 3
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length		Readings		Type
1	8 ft	23.0	19.0	20.1	2x4
2	8 ft	18.2	21.5	21.5	2x4
3	ft				

Length of cut pieces: 17@8.5" inches Pre-Burn Fuel Average Moisture: 20.55%

Time (clock): 07:15 Room Temperature (F): 70 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 2
CALCULATED LOAD WEIGHT: 15.4 ACTUAL LOAD WEIGHT: 6.4 (2 × 4)
7.8 (4 × 4)
FUEL PIECE LENGTH: 16.0 14.2 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	19.3	19.0	19.2	2x4
2	19.3	19.6	20.1	2x4
3	20.3	20.3	20.4	2x4
4	19.2	19.6	21.6	4x4
5	20.4	19.2	20.3	4x4
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.85%

Time (clock): 07:15 Room Temperature (F): 70 Initials: K

Technician signature: K. Morgan Date: 08-02-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: CFM Vermont Castings

Model: Century

Project No.: 259-S-12-3 Tracking No.: 861

Date: 08-02-06 Run No.: 3 Booth: 28

Test Crew: K. Morgan Start Time: 12:40 Stop Time: 16:00

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: _____ Initial: _____

Final: N/A Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2			N/A				
CO_2							
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: < 50 Final: < 50

Scale Audit (lbs.): Pretest: 10.0 Post Test: 10.0

Induced Draft: ~~0 @ 3.1" w.c.~~ 0 %Smoke Capture: 100

Pitot Tube Leak Test: Pre: 0 @ 3.1" w.c. Post: 0 @ 3.1" w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-29-06 Initials: IL

	Initial	Middle	Ending
Pb (in. Hg)	29.39	29.31	29.26
Room Temp (°F)	82	82	76

Technician signature: K. Morgan Date: 8-02-06

Run 4

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861
Run: 4
Test Date: 08/03/06

Burn Rate	**1.12 kg/hr dry**
Average Tunnel Temperature	97 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	14.2 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8579.7 dscf/hour
Average Delta p	0.042 inches H20
Average Delta H	0.12 inches H20
Total Time of Test	290 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	43.10 cubic feet	42.71 cubic feet	43.49 cubic feet
Average Gas Meter Temperature	76 degrees Fahrenheit	75 degrees Fahrenheit	76 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	41.7 dscf	41.2 dscf	42.2 dscf
Total Particulates - mn		8.5 mg	9.1 mg
Particulate Concentration (dry-standard)	0.00021 grams/dscf	0.00021 grams/dscf	0.00022 grams/dscf
Particulate Emission Rate	1.81 grams/hour	1.77 grams/hour	1.85 grams/hour
Adjusted Emissions	**2.98 grams/hour**	2.92 grams/hour	3.03 grams/hour
Difference from Average		0.05 grams/hour	0.05 grams/hour
7.5% of the average emission rate	0.22		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		

Results Are Acceptable

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 4

Manufacturer: CFM Vermont Castings
Model: Century
Tracking No.: 861
Project No.: 259-S-12-3
Test Date: 03-Aug-06
Beginning Clock Time: 10:05
Recording Interval: 10 min.
Total Sampling Time: 290 min.

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.042	0.044	0.046	0.042	0.038	0.044	0.042	0.040	"H2O
Initial Temp.	102	102	101	101	100	100	99	99	oF

OMNI Equipment Numbers:

PM Control Module: 010, 020
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.56 lb/lb-mole
Dilution Tunnel H2O: 4.00 percent
Dilution Tunnel Static: -0.196 "H2O
Pitot Tube Cp: 0.99
Meter Box Y Factor: 0.997 (1) 1.005 (2)
Barometric Pressure: Begin 29.30, Middle 29.35, End 29.38, Average 29.34 "Hg

Signature/Date: M. J. Morgan 8-29-06

Tunnel Velocity: 14.18 ft/sec.
Intial Tunnel Flow: 142.5 scfm
Average Tunnel Flow: 143.0 scfm
Tunnel Area: 0.1883 ft2
Post-Test Leak Check (1): 0 @ 5 cfm@"Hg
Post-Test Leak Check (2): 0 @ 5 cfm@"Hg
Fuel Moisture (dry basis %): 19.51
Total Particulate (1): 8.5
Total Particulate (2): 9.1

Elapsed Time	Particulate Sampling Data														Fuel Weight, lb		Wood Heater Temperature Data, oF												Stack
	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Orifice dH (1)	Orifice dH (2)	Meter oF (1)	Meter oF (2)	Meter Vac. In. Hg. (1)	Meter Vac. In. Hg. (2)	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%) (1)	Pro. Rate (10%) (2)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Exit	Average Surface	Stack	Filter (1)	Filter (2)	Impinger exit (1)	Impinger exit (2)	Ambient	Draft In. H2O
0	730.700	451.600			0.00	0.00	75	75	0	0	101	0.042			14.3		314	440	410	316	343		364.6	249	71	71			72	-0.038
10	732.145	453.125	0.14	0.15	0.12	0.12	75	75	1	1	88	0.042	98	102	14.2	-0.1	242	425	321	269	285		308.4	206	74	73			73	-0.030
20	733.650	454.675	0.15	0.16	0.12	0.12	74	75	1	1	86	0.042	102	103	13.9	-0.3	231	405	278	232	245		278.2	228	73	73			73	-0.033
30	735.145	456.210	0.15	0.15	0.12	0.12	74	75	1	1	86	0.042	102	102	13.5	-0.4	253	381	246	208	220		261.6	235	73	73			72	-0.035
40	736.630	457.725	0.15	0.15	0.12	0.12	74	74	1	1	89	0.042	101	102	12.9	-0.6	266	361	239	201	211		255.6	275	73	73			73	-0.045
50	738.100	459.225	0.15	0.15	0.12	0.12	74	75	1	1	97	0.042	101	101	11.9	-1	378	346	266	214	235		287.8	376	73	73			72	-0.055
60	739.570	460.725	0.15	0.15	0.12	0.12	74	75	1	1	109	0.042	102	102	10.4	-1.5	536	335	385	253	289		359.6	463	75	75			73	-0.065
70	741.040	462.220	0.15	0.15	0.12	0.12	74	75	1	1	113	0.042	102	102	8.9	-1.5	599	329	450	300	345		404.6	483	76	77			74	-0.068
80	742.505	463.715	0.15	0.15	0.12	0.12	75	76	1	1	114	0.042	102	102	7.5	-1.4	631	327	520	337	382		439.4	484	77	78			72	-0.068
90	743.970	465.210	0.15	0.15	0.12	0.12	75	76	1	1	114	0.042	102	102	6.3	-1.2	625	326	554	363	404		454.4	482	78	78			73	-0.068
100	745.425	466.700	0.15	0.15	0.12	0.12	75	76	1	1	112	0.042	101	102	5.1	-1.2	595	326	573	380	420		458.8	461	78	79			74	-0.065
110	746.885	468.190	0.15	0.15	0.12	0.12	76	77	1	1	112	0.042	101	101	4.1	-1	585	330	598	392	430		467.0	462	79	79			74	-0.065
120	748.340	469.680	0.15	0.15	0.12	0.12	76	77	1	1	110	0.042	101	101	3.3	-0.8	559	334	599	400	436		465.6	435	78	79			75	-0.063
130	749.805	471.180	0.15	0.15	0.12	0.12	76	77	1	1	105	0.042	101	101	2.8	-0.5	517	340	590	400	429		455.2	394	78	79			73	-0.058
140	751.270	472.670	0.15	0.15	0.12	0.12	76	77	1	1	101	0.042	100	100	2.3	-0.5	474	345	580	393	416		441.6	372	77	78			74	-0.055
150	752.745	474.170	0.15	0.15	0.12	0.12	76	77	1	1	98	0.042	101	101	2.1	-0.2	428	348	543	378	391		417.6	338	76	77			73	-0.050
160	754.220	475.660	0.15	0.15	0.12	0.12	76	77	1	1	96	0.042	101	100	1.9	-0.2	397	350	514	361	372		398.8	322	76	76			73	-0.048
170	755.690	477.155	0.15	0.15	0.12	0.12	76	77	1	1	93	0.042	100	100	1.7	-0.2	376	350	498	347	355		385.2	311	75	76			72	-0.045
180	757.175	478.655	0.15	0.15	0.12	0.12	75	77	1	1	92	0.042	101	100	1.5	-0.2	358	349	484	345	341		375.4	300	75	75			72	-0.043
190	758.650	480.155	0.15	0.15	0.12	0.12	75	76	1	1	91	0.042	100	100	1.3	-0.2	345	347	467	328	331		363.6	290	74	74			74	-0.043
200	760.130	481.650	0.15	0.15	0.12	0.12	75	76	1	1	90	0.042	101	100	1.1	-0.2	335	344	458	322	319		355.6	284	74	74			74	-0.040
210	761.615	483.150	0.15	0.15	0.12	0.12	75	76	1	1	92	0.042	101	100	0.9	-0.2	327	342	456	317	309		350.2	281	74	74			75	-0.040
220	763.090	484.650	0.15	0.15	0.12	0.12	75	76	1	1	94	0.042	101	101	0.8	-0.1	324	340	450	315	305		346.8	276	75	74			75	-0.038
230	764.565	486.145	0.15	0.15	0.12	0.12	76	77	1	1	93	0.042	100	100	0.7	-0.1	313	339	433	306	297		337.6	264	75	75			75	-0.038
240	766.045	487.640	0.15	0.15	0.12	0.12	76	77	1	1	90	0.042	100	100	0.5	-0.2	303	338	425	294	290		330.0	258	75	75			75	-0.038
250	767.525	489.130	0.15	0.15	0.12	0.12	76	77	1	1	90	0.042	100	99	0.4	-0.1	293	336	412	283	282		321.2	251	75	75			77	-0.035
260	768.990	490.625	0.15	0.15	0.12	0.12	76	78	1	1	89	0.042	99	99	0.3	-0.1	285	334	404	274	276		314.6	245	75	75			77	-0.035
270	770.475	492.140	0.15	0.15	0.12	0.12	76	78	1	1	87	0.042	101	101	0.2	-0.1	275	331	392	264	266		305.6	238	75	75			76	-0.033
280	771.935	493.595	0.15	0.15	0.12	0.12	76	78	1	1	87	0.042	99	97	0.1	-0.1	268	327	387	259	259		300.0	232	75	74			75	-0.033
290	773.415	495.092	0.15	0.15	0.12	0.12	76	78	1	1	86	0.042	100	99	0.0	-0.1	259	322	362	252	252		289.4	225	74	74			75	-0.030
Avg/Total	42.715	43.492	0.15	0.15	0.12	0.12	75.27	76.33			96.82	0.042	100.75	100.74									75		75.20	75.37	#DIV/0!	#DIV/0!		-0.047

OMNI Test Laboratories
Beaverton, OR Phone (503) 643-3788

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: CFM Vermont Castings____ Project #: 259-S-12-3_____ Tracking #: 861_____

Date: 08-03-06 Test Crew: K. Morgan Run #: 4

OMNI Equipment ID #: _____

Preburn [X] Test [ ] Coal Bed: Data: 0 = Range: 2.9 - 3.5 Actual: Coal Bed: 3.2

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top 4	Bottom 8	Back 7	Left 6	Right 5	Flue 3	Not Used Catalyst
0	10.5		-.090	73	694	407	772	411	463	680	
10	8.9	1.6	-.073	72	640	425	681	403	464	501	
20	7.4	1.5	-.073	73	671	427	632	407	463	520	
30	6.0	1.4	-.070	73	656	422	664	414	460	499	
40	5.0	1.0	-.065	72	589	422	728	420	450	440	
50	4.4	0.6	-.058	72	519	424	734	418	425	397	
60	4.0	0.4	-.053	72	463	421	622	399	406	354	
70	3.7	0.3	-.050	72	419	432	556	374	396	330	
80	3.4	0.3	-.048	72	391	436	516	358	392	317	
90	3.3	0.1	-.043	72	346	443	459	342	376	277	
95 ~~00~~	3.2	0.1	-.038	72	317	441	415	319	347	252	
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: K. J. Morgan Date: 8-03-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 4
Train #: 1
Date: 08/03/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D356	118.4	111.1	7.3'
B. Rear filter catch	Filter	D354	117.7	117.3	0.4
C. Probe catch	Probe	K	80663.0	80662.2	0.8

Total Particulate, mg :	8.5

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: K. J. Morgan Date: 8-7-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 4
Train #: 2
Date: 08/03/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D355	132.0	124.0	8.0
B. Rear filter catch	Filter	D317	113.8	113.3	0.5
C. Probe catch	Probe	8	76913.1	76912.5	0.6

Total Particulate, mg :	9.1

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: M. Morgan Date: 8-7-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3
Tracking Number: 861
Run #: 4 Date: 8-03-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

OPEN 0.375"

SECONDARY: FIXED

TERTIARY: NONE

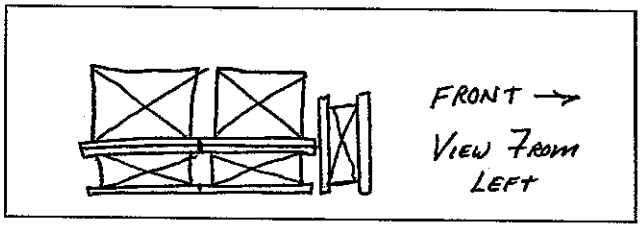
FAN: NONE - FAN CONFIRMATION

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
Ø	test setting					
80					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 65 sec.
DOOR: AJAR 4 min, 50 sec.
PRIMARY AIR: Fully Open 5.0 min
OTHER: None

DESCRIBE OR SKETCH TEST SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)

PRIMARY:

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE - FAN CONFIRMATION

Technician signature: K. J. Morgan Date: 8-03-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-03-06 Test Crew: K. Morgan Run #: 4
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length		Readings			Type
1	8 ft	20.7	21.6	21.7		2x4
2	8 ft	20.5	20.5	20.6		2x4
3	ft					

Length of cut pieces: 20 @ 8 1/2 inches Pre-Burn Fuel Average Moisture: 20.93 %

Time (clock): 07:30 Room Temperature (F): 70 Initials: JC

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 2
CALCULATED LOAD WEIGHT: 15.4 ACTUAL LOAD WEIGHT: 6.5 (2 × 4)
7.8 (4 × 4)
FUEL PIECE LENGTH: ~~20 @ 8.5"~~ 16 16.0" 14.3 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	19.2	19.6	19.5	2x4
2	19.5	19.5	19.6	2x4
3	19.6	19.0	19.5	2x4
4	20.6	19.5	19.2	4x4
5	19.2	19.6	19.5	4x4
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.51 %

Time (clock): 07:35 Room Temperature (F): 70 Initials: JC

Technician signature: K. Morgan Date: 08-03-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: CFM Vermont Castings

Model: Century

Project No.: 259-S-12-3 Tracking No.: 861

Date: 08-03-06 Run No.: 4 Booth: 2B

Test Crew: K. Morgan Start Time: 10:05 Stop Time: 14:55

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack: Initial: _____ Final: N/A

Dilution Tunnel (Method 5G Only): Initial: _____ Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2							
CO_2				N/A			
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: <50 Final: <50

Scale Audit (lbs.): Pretest: 10.0 Post Test: 10.0

Induced Draft: 0 %Smoke Capture: 100

Pitot Tube Leak Test: Pre: ø @ 5.1" w.c. Post: ø @ 3.2" w.c

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-29-06 Initials: JL

	Initial	Middle	Ending
Pb (in. Hg)	29.30	29.35	29.38
Room Temp (°F)	72	73	75

Technician signature: K. Morgan Date: 8-03-06

Run 5

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861
Run: 5
Test Date: 08/03/06

Burn Rate	**2.68 kg/hr dry**
Average Tunnel Temperature	157 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	16.7 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9140.9 dscf/hour
Average Delta p	0.053 inches H20
Average Delta H	0.08 inches H20
Total Time of Test	130 minutes

	AVERAGE	SAMPLE TRAIN 1	SAMPLE TRAIN 2
Total Sample Volume - Vm	13.94 cubic feet	13.80 cubic feet	14.08 cubic feet
Average Gas Meter Temperature	80 degrees Fahrenheit	80 degrees Fahrenheit	80 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	13.4 dscf	13.2 dscf	13.6 dscf
Total Particulates - mn		2.5 mg	3 mg
Particulate Concentration (dry-standard)	0.00020 grams/dscf	0.00019 grams/dscf	0.00022 grams/dscf
Particulate Emission Rate	1.87 grams/hour	1.73 grams/hour	2.02 grams/hour
Adjusted Emissions	**3.06 grams/hour**	2.86 grams/hour	3.26 grams/hour
Difference from Average		0.20 grams/hour	0.20 grams/hour
7.5% of the average emission rate	0.23		
Weighted Average Emission Rate Limit	4.10 grams/hour		
7.5% of the weighted average emission rate limit	0.31		

Results Are Acceptable

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 5

Manufacturer:	CFM Vermont Castings	
Model:	Century	
Tracking No.:	861	
Project No.:	259-S-12-3	
Test Date:	03-Aug-06	
Beginning Clock Time:	17:30	
Recording Interval:	10	min.
Total Sampling Time:	130	min.

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.050	0.054	0.056	0.052	0.052	0.054	0.054	0.052	"H2O
Initial Temp.	162	162	161	161	161	160	160	160	oF

OMNI Equipment Numbers:

PM Control Module:	010, 020				
Dilution Tunnel MW(dry):	29.00	lb/lb-mole			
Dilution Tunnel MW(wet):	28.56	lb/lb-mole			
Dilution Tunnel H2O:	4.00	percent			
Dilution Tunnel Static:	-0.230	"H2O			
Pitot Tube Cp:	0.99				
Meter Box Y Factor:	0.997	(1)	1.005	(2)	
Barometric Pressure:	Begin	Middle	End	Average	
	29.40	29.42	29.42	29.41	"Hg

Signature/Date: M. J. Morgan 8-28-06

Tunnel Velocity:	16.70	ft/sec.
Intial Tunnel Flow:	151.8	scfm
Average Tunnel Flow:	152.3	scfm
Tunnel Area:	0.1883	ft2
Post-Test Leak Check (1):	0 @ 3	cfm@"Hg
Post-Test Leak Check (2):	0 @ 3	cfm@"Hg
Fuel Moisture (dry basis %):	20.26	
Total Particulate (1):	2.5	
Total Particulate (2):	3.0	

Elapsed Time	Particulate Sampling Data														Fuel Weight, lb		Wood Heater Temperature Data, oF												Stack
	Gas Meter Cubic Feet (1)	Gas Meter Cubic Feet (2)	Sample Rate, cfm (1)	Sample Rate, cfm (2)	Orifice dH (1)	Orifice dH (2)	Meter oF (1)	Meter oF (2)	Meter Vac. In. Hg. (1)	Meter Vac. In. Hg. (2)	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%) (1)	Pro. Rate (10%) (2)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Catalyst Exit	Average Surface	Stack	Filter (1)	Filter (2)	Impinger exit (1)	Impinger exit (2)	Ambient	Draft In. H2O
0	774.300	495.500			0.00	0.00	82	83	0	0	161	0.053			15.4		465	560	318	425	461		445.8	425	81	80			78	-0.068
10	775.375	496.625	0.11	0.11	0.09	0.09	81	82	1	1	157	0.053	102	104	13.8	-1.6	498	542	332	353	378		420.6	593	72	72			77	-0.083
20	776.435	497.750	0.11	0.11	0.09	0.09	81	81	1	1	185	0.053	103	107	11.1	-2.7	675	509	391	353	402		466.0	723	71	71			77	-0.088
30	777.480	498.850	0.10	0.11	0.09	0.09	81	81	1	1	200	0.053	102	106	8.3	-2.8	780	482	563	404	459		537.6	782	71	71			75	-0.090
40	778.500	499.930	0.10	0.11	0.09	0.09	81	82	1	1	194	0.053	99	103	6.0	-2.3	776	461	415	461	507		524.0	741	70	70			75	-0.088
50	779.515	500.995	0.10	0.11	0.09	0.09	80	81	1	1	182	0.053	98	101	4.5	-1.5	681	449	411	485	507		506.6	634	69	69			75	-0.083
60	780.555	502.060	0.10	0.11	0.09	0.09	80	81	1	1	165	0.053	99	100	3.2	-1.3	618	439	415	478	486		487.2	595	68	66			75	-0.078
70	781.630	503.130	0.11	0.11	0.09	0.09	79	81	1	1	174	0.053	104	101	2.3	-0.9	592	428	412	460	468		472.0	555	67	65			77	-0.075
80	782.715	504.210	0.11	0.11	0.09	0.09	79	80	1	1	148	0.053	102	100	1.7	-0.6	536	419	418	435	453		452.2	501	65	63			76	-0.070
90	783.795	505.300	0.11	0.11	0.09	0.09	79	80	1	1	138	0.053	101	100	1.1	-0.6	501	412	431	413	434		438.2	473	65	63			75	-0.068
100	784.860	506.350	0.11	0.11	0.09	0.09	78	79	1	1	131	0.053	99	96	0.7	-0.4	457	408	391	398	418		414.4	448	64	61			76	-0.063
110	785.940	507.430	0.11	0.11	0.09	0.09	78	79	1	1	125	0.053	100	98	0.4	-0.3	424	404	357	380	403		393.6	415	64	60			76	-0.060
120	787.015	508.505	0.11	0.11	0.09	0.09	77	78	1	1	121	0.053	100	98	0.2	-0.2	390	407	321	364	379		372.2	393	64	60			76	-0.058
130	788.098	509.578	0.11	0.11	0.09	0.09	77	78	1	1	114	0.053	100	97	0.0	-0.2	360	409	301	346	354		354.0	360	65	60			76	-0.053
Avg/Total	13.798	14.078	0.11	0.11	0.08	0.08	79.50	80.43			156.78	0.053	100.71	100.76									92		68.29	66.50	#DIV/0!	#DIV/0!		-0.073

OMNI Test Laboratories
Beaverton, OR Phone (503) 643-3788

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: CFM Vermont Castings Project #: 259-S-12-3 Tracking #: 861

Date: 08-03-06 Test Crew: K. Morgan Run #: 5

OMNI Equipment ID #:

Preburn [X] Coal Bed: Actual:
Test [ ] Data: 0 = Range: 3.1 - 3.8 Coal Bed: 3.5

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top 4	Bottom 8	Back 7	Left 6	Right 5	Flue 3	Not Used ~~Catalyst~~
0	20.7		-.085	77	630	310	426	403	391	571	
10	18.0	2.7	-.090	76	756	404	283	386	403	767	
20	14.8	3.2	-.095	76	864	437	308	365	431	832	
30	11.4	3.4	-.095	77	921	479	388	379	471	860	
40	8.3	3.1	-.095	78	920	518	465	418	523	838	
50	5.7	2.6	-.095	78	894	544	545	455	553	839	
60	4.1	1.6	-.083	78	743	567	500	509	557	626	
70	3.7	0.4	-.073	77	545	558	366	459	495	493	
74 80	3.5	0.2	-.068	78	482	560	329	435	471	430	
90											
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: K. Morgan Date: 8-03-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name: CFM Vermont Castings
Model: Century
Project No.: 259-S-12-3
Tracking No.: 861

Equipment Numbers:

Run #: 5
Train #: 1
Date: 08/03/06

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D318	126.0	123.7	2.3
B. Rear filter catch	Filter	D325	111.8	111.5	0.3
C. Probe catch	Probe	H	91534.2	91534.3	-0.1

Total Particulate, mg :	2.5

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: M. Morgan Date: 8-7-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G Dual Train
Dilution Tunnel Particulate Calculations

Client Name:	CFM Vermont Castings	Equipment Numbers:		Run #:	5
Model:	Century			Train #:	2
Project No.:	259-S-12-3			Date:	08/03/06
Tracking No.:	861				

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D319	123.6	121.2	2.4
B. Rear filter catch	Filter	D326	128.4	127.2	1.2
C. Probe catch	Probe	K	92571.2	92571.8	-0.6

Total Particulate, mg :	3.0

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Analyst: M. Morgan Date: 8-17-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3
Tracking Number: 861
Run #: 5 Date: 8-03-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

Fully Open

SECONDARY: Fixed

TERTIARY: None

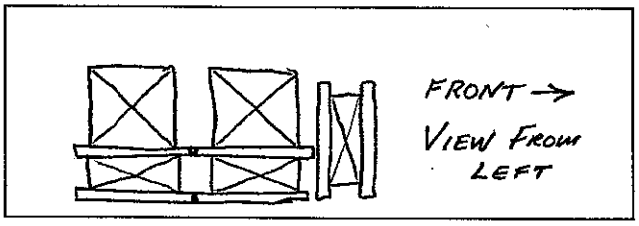
FAN: ON - High

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	test setting					
53					X	STIR
72					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES
BYPASS: N/A
FUEL LOADING: Loaded by 70 sec.
DOOR: AJAR until 3.5 min.
PRIMARY AIR: Fully open Duration of test.
OTHER: None

DESCRIBE OR SKETCH TEST SETTINGS BELOW: (SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)
PRIMARY:

Fully open.

SECONDARY: Fixed

TERTIARY: None

FAN: OFF 1st 30 min, ON-High Remainder of test.

Technician signature: K. L. Morgan Date: 8-03-06

4 = 4.5 OF 4 - 4.7

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: CFM Vermont Castings
Model: Century
Project #: 259-S-12-3 Tracking #: 861
Date: 8-03-06 Test Crew: K. Morgan Run #: 5
OMNI Equipment ID #: _____
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length		Readings		Type
1	8 ft	20.4	20.6	19.0	2 x 4
2	8 ft	19.9	21.0	19.1	2 x 4
3	8 ft	20.0	24.5	23.6	2 x 4

Length of cut pieces: 25@9" inches Pre-Burn Fuel Average Moisture: 20.9 %

Time (clock): 13:40 Room Temperature (F): 75 Initials: JK

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 2
CALCULATED LOAD WEIGHT: 15.4 ACTUAL LOAD WEIGHT: 7.1 (2 × 4)
8.3 (4 × 4)
FUEL PIECE LENGTH: 16.0" 15.4 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	19.7	19.5	19.0	4 x 4
2	20.0	21.3	22.5	4 x 4
3	19.5	20.5	20.7	2 x 4
4	20.6	19.7	19.6	2 x 4
5	21.0	19.6	20.7	2 x 4
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.26 %

Time (clock): 13:45 Room Temperature (F): 75 Initials: JK

Technician signature: K. Morgan Date: 8-03-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: CFM Vermont Castings

Model: Century

Project No.: 259-S-12-3 Tracking No.: 861

Date: 8-03-06 Run No.: 5 Booth: 2B

Test Crew: K. Morgan Start Time: 17:30 Stop Time: 19:40

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack:
Initial: _____
Final: N/A

Dilution Tunnel (Method 5G Only):
Initial: _____
Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2							
CO_2			N/A				
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: <50 Final: <50

Scale Audit (lbs.): Pretest: 10.0 Post Test: 10.0

Induced Draft: 0 %Smoke Capture: 100

Pitot Tube Leak Test: Pre: ø @ 3.1" w.c Post: ø @ 3.3" w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-29-06 Initials: JL

	Initial	Middle	Ending
Pb (in. Hg)	29.40	29.42	29.42
Room Temp (°F)	78	75	76

Technician signature: K. J. Morgan Date: 8-03-06

Section 5

Sampling Procedures and Test Results

INTRODUCTION

CFM – Vermont Castings retained *OMNI* to perform U.S. Environmental Protection Agency (EPA) certification testing on the model Century wood stove. The Century wood stove is a non-catalytic, freestanding, radiant-type room heater. The firebox is constructed of mild steel. The usable firebox volume was measured to be 2.2 cubic feet. The stove is vented through a 6" diameter flue collar located at the top of the unit.

The testing was performed at CFM – Vermont Castings' testing facility in Bethel, Vermont. The altitude of the laboratory is 573 feet above sea level. The unit was in good condition and was assigned and labeled with *OMNI* ID #861. *OMNI* representative Ken Morgan conducted the certification testing and completed all testing by August 3, 2006. The EPA was notified of the testing dates in a letter dated July 14, 2006. A testing contract, including provisions for Random Compliance Audit (RCA) testing, has been signed by Mark Champion of CFM – Vermont Castings and is on file at *OMNI*'s testing facility.

The Century wood stove was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standard of Performance for Residential Wood Heaters (Appendix A, Methods 28 and 5G). Particulate emissions were measured using a Method 5G sampling train consisting of two filters (front and back). The weighted average emissions of the five test runs included in the results indicate a particulate emission level of 3.5 grams per hour. Run #4, a fan confirmation test run, was performed and was not used in the weighted average emission results. Test runs were conducted in each of three burn rate categories (0.80-1.25 kg/hr, 1.25-1.90 kg/hr, and maximum). Emissions for each of their individual test runs did not exceed the cap. The Century results are within the emission limit of 7.5 grams per hour for non-catalytic affected facilities manufactured on or after July 1, 1990, or sold at retail on or after July 1, 1992.

The wood heater was sealed after completion of testing in compliance with the EPA regulation as follows:

- "DO NOT TAMPER" labels were placed on the door and all other openings.
- Plastic material sealed with "DO NOT TAMPER" labels and tape was wrapped around the unit.
- The unit was sealed in a wood box constructed for the unit and secured with steel banding.
- "DO NOT TAMPER" labels were placed on all outer surfaces of the box.

This report is organized in accordance with the EPA-recommended outline and is summarized in the Table of Contents immediately preceding this report.

Table 1.1 – Particulate Emissions

Run	Burn Rate (kg/hr dry)	Method 5G Emissions (g/hr)
1	0.98	3.38
2	1.18	4.21
3	1.61	3.08
5	2.68	3.06
Weighted particulate emission average of four test runs: 3.5 grams per hour.		

Table 1.2 – Test Facility Conditions

Run	Room Temperature (°F)		Barometric Pressure (Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	74	74	29.47	29.39	<50	<50
2	72	74	29.40	29.40	<50	<50
3	82	76	29.39	29.26	<50	<50
5	78	76	29.40	29.42	<50	<50

Table 1.3.1 – Fuel Measurement and Crib Description Summary – PRETEST

Run	Pretest Fuel Weight (Starting weight in lbs)	Pretest Moisture (Dry basis - %)	Coal Bed Weight (lbs)
1	10.1	19.4	3.3
2	10.6	20.4	3.2
3	13.5	20.6	3.5
5	20.7	20.9	3.5

Table 1.3.2 – Fuel Measurement and Crib Description Summary – TEST

Run	Test Fuel – Wet Basis (lbs)	Firebox Volume (ft^3)	Fuel Loading Density – Wet Basis (lbs/ft^3)	Fuel Moisture Content – Dry (%)	Piece Length (in)	2x4s Used	4x4s Used
1	14.6	2.2	6.64	19.6	16.0	3	2
2	14.1	2.2	6.41	20.0	16.0	3	2
3	14.2	2.2	6.45	19.9	16.0	3	2
5	15.4	2.2	7.00	20.3	16.0	3	2

Table 1.4 – Dilution Tunnel Gas Measurements and Sampling Data Summary

Run	Length of Test (min)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
1	340	14.5	148.8	89.6
2	270	14.3	144.4	96.8
3	200	15.6	151.2	117.2
5	130	16.7	152.3	156.8

Table 1.5 - Heater Operation Data (Average Temperature Data)

Run	Beginning Surface Temperature Average[a]	Ending Surface Temperature Average[a]	Surface Delta T[b]
1	334.6	261.4	73
2	347.6	269.6	78
3	385.0	303.2	82
5	445.8	354.0	92
a. All temperatures are in degrees F.			
b. Represents the difference between beginning and ending average surface temperatures.			

Table 1.6 – Pretest Configuration

Run	Combustion Air	Fuel Added	Fuel Removed (lbs)	Time (min)
1	Fully Closed	10.1 lbs at start; no addition; coal bed 3.3 lbs	0.3	83
2	Open 0.375"	10.6 lbs at start; no addition; coal bed 3.2 lbs	0.0	90
3	Open 0.750"	13.5 lbs at start; no addition; coal bed 3.5 lbs	0.0	90
5	Fully Open	20.7 lbs at start; no addition; coal bed 3.5 lbs	0.0	74

Table 1.7 – Run Data

Run	Average Dry Burn Rate (kg/hr)	Initial (Induced) Draft (H_2O)	Primary Air Setting	Run Time (min)	Average Draft (H_2O)
1	0.98	0	Fully Closed	340	-0.039
2	1.18	0	Open 0.375"	270	-0.046
3	1.61	0	Open 0.750"	200	-0.059
5	2.68	0	Fully Open	130	-0.073

Table 1.8 – Test Configurations

Run	Five-Minute Startup	Combustion Air
1	Bypass: N/A. Fuel Loading: Loaded by 104 seconds. Door: Closed at 3.0 minutes. Primary Air: Fully open until 5.0 minutes. Other: None. Secondary: Fixed. Tertiary: None. Fan: Off for first 30.0 minutes; on Low for remainder of test.	Fully Closed
2	Bypass: N/A. Fuel Loading: Loaded by 1.5 minutes. Door: Ajar until 3.0 minutes. Primary Air: Abruptly closed at 5.0 minutes. Other: None. Secondary: Fixed. Tertiary: None. Fan: Off for first 30.0 minutes; on Low for remainder of test.	Open 0.375"
3	Bypass: N/A. Fuel Loading: Loaded by 1.25 minutes. Door: Ajar until 3.0 minutes. Primary Air: Fully open until 5.0 minutes; abruptly set to test setting at 5.0 minutes. Other: None. Secondary: Fixed. Tertiary: None. Fan: Off for first 30.0 minutes; on High for remainder of test.	Open 0.750"
5	Bypass: N/A. Fuel Loading: Loaded by 70 seconds. Door: Ajar until 3.5 minutes. Primary Air: Fully open for duration of test. Other: None. Secondary: Fixed. Tertiary: None. Fan Off for first 30.0 minutes; on High for remainder of test.	Fully Open

TEST RESULTS AND DISCUSSION

A total of five test runs were performed on the Century wood stove. Four test runs were conducted in the following categories and included in the weighted average emission level results: two in the 0.80 to 1.25 kg/hr dry category; one in the 1.26 to 1.90 kg/hr dry category; and one at maximum.

The weighted particulate emission level was measured to be 3.5 g/hr.

The proportionality results for all five test runs were acceptable. Quality check results for each test run are presented in Section 2 of this report.