

ITS TEST REPORT # J97011860-231
TEST OF A WOOD BURNING STOVE
FOR
EMISSIONS AND EFFICIENCY
PER
EPA METHODS 28 AND 5G-3

MODEL: INTREPID II

VERMONT CASTINGS, INC
ROUTE 107
P.O. BOX 501
BETHEL, VERMONT

TESTED BY:

INTERTEK TESTING SERVICES
8431 MURPHY DRIVE
MIDDLETON, WISCONSIN 53562

TEST DATES: JUNE 2-4, 1997
REPORT DATE: JUNE 9, 1997

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I.

INTRODUCTION

A. GENERAL

From June 2 through June 4, 1997 Intertek Testing Services (ITS) conducted tests on Vermont Castings model Intrepid II catalyst equipped wood burning stove to determine compliance with U.S. EPA emissions regulations.

Tests were conducted by Rick Armstrong. Roger Purinton of Vermont Castings was present to witness the tests. The tests were conducted at the Intertek Testing Services Laboratory located at 8431 Murphy Drive, Middleton, Wisconsin. The laboratory elevation is 860 feet above sea level. Tests were conducted to EPA Method 28 and 5G-3 criteria.

B. TEST UNIT DESCRIPTION

The Vermont Castings Intrepid II catalyst woodburning stove is rectangular in shape constructed primarily of cast iron. It has two gasketed glass front doors and a gasketed hinged cook plate top which is used for fuel loading. The unit has an ash lip below the two front doors. The doors are latched at the center by a single lever at the top left corner of the right door. Air is controlled by a single lever at the top rear right corner of the stove. The lever is attached to a chain which connects to a door covering the primary air opening at the bottom right rear of the stove. A six inch diameter flue opening is at the top center rear. The bypass lever is located at the top right corner of the right side.

C. RESULTS

The unit as tested produced a weighted average emissions rate of 2.0915 grams/hour and did not exceed any of the emissions rate caps specified in the EPA regulations. The unit thus meets EPA certification requirements for 1990.

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D. PRETEST INFORMATION

The test unit was received at Intertek Testing Services in Middleton, Wisconsin on May 30, 1997 via Emory/Tax Air. The unit was inspected upon receipt and found to be in good condition. The unit was set up following the manufacturer's instructions without difficulty.

Following assembly, the unit was placed on the test stand and instrumented with thermocouples in the specified locations. Prior to beginning the emissions tests the unit was operated for a minimum of 50 hours at high-to-medium burn rates, to break in the catalyst. The unit was found to be operating satisfactory during this break-in. The 68.25 hours of break-in were conducted from May 30 through June 2, 1997. The fuel used for the break-in process is all hardwood cordwood or Douglas Fir scrap with a moisture content of 16-20% wet basis.

Following the pre-test break-in process the unit was allowed to cool. The unit's chimney system and laboratory dilution tunnel were cleaned using standard wire brush chimney cleaning equipment.

On June 2, 1997 the unit was set-up for testing.

E. REPORT ORGANIZATION

This report includes summaries of all data necessary to determine compliance with the regulations. Raw data, calibration records, intermediate calculations, drawings and specifications and other supporting information are contained in appendices to this report.

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II. SUMMARY OF TEST RESULTS

A. EMISSIONS

Run Number	Test Date	Burn Rate (kg/hr)	Emission Rate (g/hr)	Adjusted Emission Rate (g/hr)	Heating Efficiency** (% Overall)
1	6-2-97	0.599	0.583	1.164	83.05
2	6-3-97	0.892	0.893	1.657	83.92
3	6-4-97	1.941	0.780	1.480	73.52
4	6-4-97	1.595	1.999	3.233	79.55

**Calculated as specified in CSA B-415

B. WEIGHTED AVERAGE CALCULATION

Run Number	Burn Rate	(E)		Output (OHE)*(BTU/HR)	Prob	(K)		Weighting Factor (KxE) (KxOHE)
		Adjusted Emission Rate g/hr	(OHE)*(BTU/HR)			Factor	(KxE) (KxOHE)	
1	0.599	1.164	83.05	8254.70	.0997	.2926	0.3406	24.30
2	0.892	1.657	83.92	12292.47	.2926	.6982	1.1569	58.59
4	1.595	3.233	79.55	21980.38	.7979	.6114	1.9766	48.64
3	1.941	1.482	73.52	26748.53	.9040	.2021	0.2995	14.86

Sums: 1.8043 3.7736 146.39

Weighted Average Emissions Rate: $3.7736 \div 1.8043 = 2.0915$

Weighted Average Overall Heating Efficiency: $146.39 \div 1.8043 = 81.13\%$

* Calculated as specified in CSA B-415

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C. TEST FACILITY CONDITIONS

Run Number	Room Temperature		Barometric Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
1	76	83	29.05	29.05	49	35	0	0
2	74	81	29.14	29.14	47	44	0	0
3	76	80	29.18	29.18	57	46	0	0
4	81	84	29.18	29.11	46	33	0	0

D. FUEL QUALITIES

Run Number	Pre-Test Load				Test Load			
	Loading		Moisture		Weight		Moisture	
	Weight	Content	Coal Bed	Weight	Density	Content	Piece	
1	Wet	Dry	Weight	Wet	Wet	Dry	Length	Number of
	(lb.)	(%)	(lb.)	(lb.)	(lb./ft ³)	(%)	(in.)	2x4s 4x4s
1	8.70	20.52	2.1	8.46	6.523	19.77	15.75	4 0
2	9.84	20.96	1.8	8.71	6.708	20.64	15.75	4 0
3	9.29	21.21	1.8	8.77	6.762	20.58	15.75	4 0
4	9.87	20.03	1.9	8.66	6.677	20.14	15.75	4 0

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E. DILUTION TUNNEL FLOW RATE MEASUREMENTS
AND SAMPLING DATA (5G-3)

Run Number	Burn Time (min)	Velocity (ft/sec)	Volumetric Flow Rate (dscf/min)	Total Temp. (°R)	Sample Data		Particulate Catch (mg)	Particulate Catch (mg)
					1	2		
1	321	13.14	141.51	549.03	74.74	75.16	5.2	5.1
2	220	13.37	141.24	550.26	51.56	51.87	5.4	5.5
3	102	13.53	138.34	569.33	23.90	23.98	2.1	2.4
4	123	13.59	139.03	568.29	28.68	28.91	6.6	7.2

F. DILUTION TUNNEL DUAL TRAIN PRECISION

Run Number	Sample Ratios		Total Emissions (grams)		% Deviation
	Train 1	Train 2	Train 1	Train 2	
1	607.78	604.35	3.16	3.08	2.08
2	602.64	599.10	3.25	3.30	1.03
3	590.29	588.42	1.24	1.41	3.90
4	596.21	591.55	3.93	4.26	6.57

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G. GENERAL SUMMARY OF RESULTS

Run Number	Burn Rate (kg/hr)	Average Catalyst Surface	Change		Initial Draft (in. H ₂ O)	Primary Air Setting	Run Time (min)	Average Draft (in. H ₂ O)
			Average Temperature (F)	In Surface Temperature (F)				
1	0.599	728.24	327.07	-5.8	.028	closed	321	.029
2	0.892	817.78	380.08	-9.00	.040	1/4"open	220	.044
3	1.941	1013.83	517.30	+7.40	.071	full open	102	.067
4	1.595	967.71	486.14	-45.40	.069	mid range	123	.063

III.

PROCESS DESCRIPTION

A. DISCUSSION

RUN #1 (02 June, 1997) The test was loaded in 50 seconds. The bypass and door were closed immediately after loading. The air control setting (full closed) was not adjusted during loading. At 291 minutes into the test (16:29) there were two readings where the weight remained the same. The fire was stirred in accordance with Sec. 6.4.3 the door was open 15 Seconds. Burn time was 321 minutes for a category 1 burn rate of .599 kg/hour.

RUN #2 (03 June, 1997) The test was loaded in 50 seconds. The door and the bypass were closed after loading. The air control setting (1/4" open) was not adjusted during loading. Burn time was 220 minutes for category 2 burn rate of .892 kg/hr.

RUN #3 (04 June, 1997) The test was loaded in 50 seconds. The door and bypass were closed after loading. The air control setting (full open) was not adjusted during loading. Burn time was 102 minutes for a category 4 burn rate of 1.941 kg/hour.

RUN #4 (04 June, 1997) The test was loaded in 40 seconds. The bypass and door were closed after loading. The air control setting (mid range) was not adjusted during loading. Burn time was 123 minutes for a category 3 burn rate of 1.595 kg/hour.

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B. UNIT DIMENSIONS

23.5" high, 21.25" wide and 21" deep

C. AIR SUPPLY SYSTEM

Primary combustion air enters the unit through the manually and thermostatically controlled openings in the rear of the unit and through two unregulated openings in the lower front bottom of the unit. The thermostatically controlled source is routed forward to the front, then up the manifolds located on either side of the doors and across the top of the doors where it exits down across the glass as air wash. The thermostat can be manually set by a lever located in an assembly on the top rear of the stove. The unregulated air enters directly into the firebox through openings in the bottom grate. Secondary air enters the unit through a factory set, thermostatically controlled opening in the lower rear of the combustion chamber.

D. OPERATION DURING TEST

For all test runs the stove operated with no problems. During test 1 the fuel was adjusted once with the door being open for 15 seconds.

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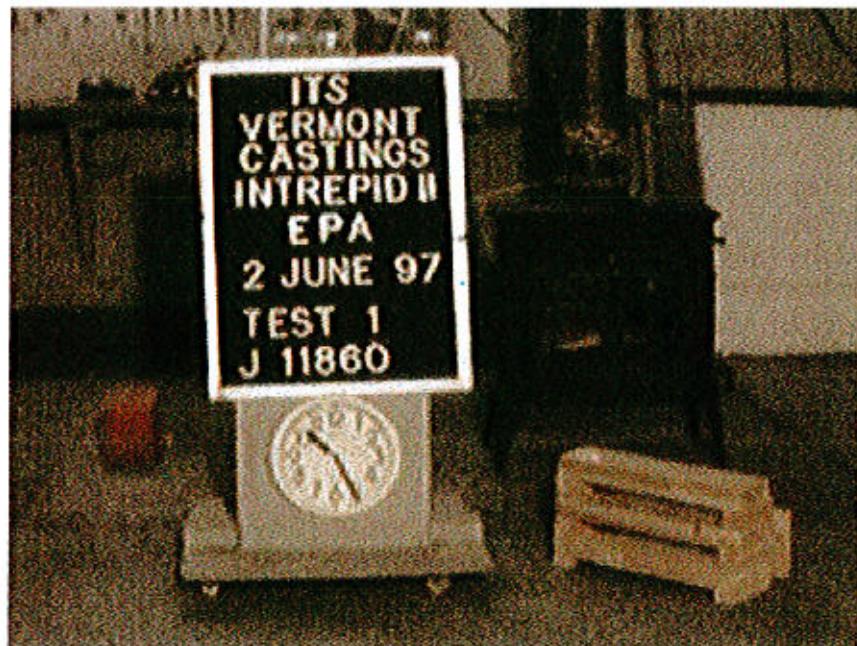
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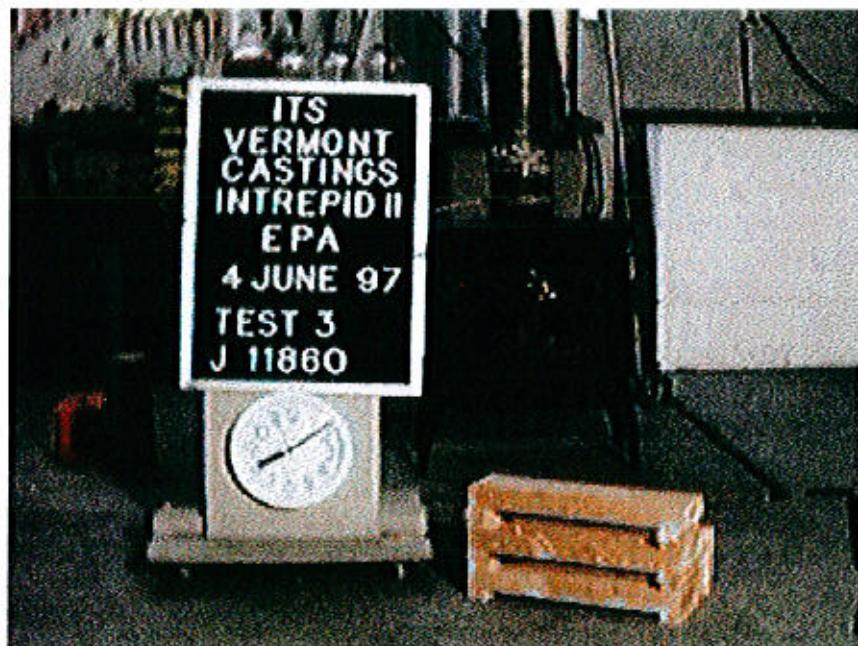
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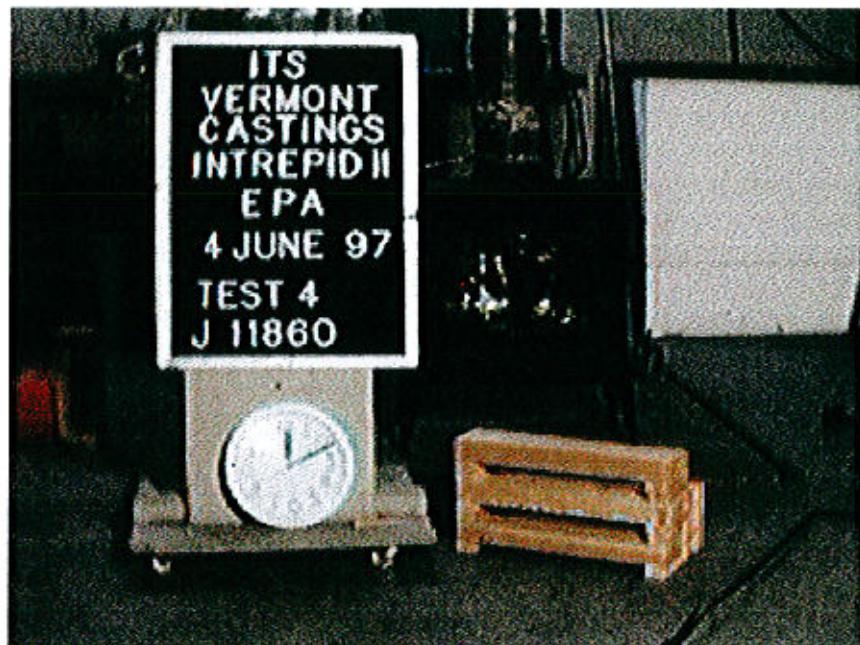
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Intertek testing Services

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	VCI	RESULTS	
Model:	Intrepid II		
Date:	6-2-97		
Run:	1	AVERAGE ADJUSTED EMISSION RATE:	1.164
Project #:	11860		
Test Duration:	321	Burn Rate (Dry kg/hr):	0.509
(minutes)			
PRESSURE FACTOR:	0.97092	BAROMETRIC PRESSURE	
TEMPERATURE FACTORS			
DGM #1:	0.97923	Average:	29.05
DGM #2:	0.97918	Start:	29.05
		End:	29.05
DRY GAS METER VALUES			
VOLUMES SAMPLED		DGM #1	
DGM #1:	74.74017	Final:	732.973
DGM #2:	75.18480	Initial:	655.994
TOTAL TUNNEL VOLUME (scf):		DGM #2	
45425.727		Final:	99.037
		Initial:	22.091
SAMPLE RATIOS			
Sample Train 1:	607.782	TEMPERATURES (DEG. RANKIN)	
Sample Train 2:	604.348	DGM #1:	539.197
		DGM #2:	539.227
TOTAL EMISSIONS			
Sample Train 1 (g):	3.1605	CALIBRATION FACTORS	
Sample Train 2 (g):	3.0822	DGM #1:	1.0212
		DGM #2:	1.0275
EMISSION RATES			
Sample Train 1 (g/hr):	0.5907	TUNNEL FLOW RATE:	141.513
Sample Train 2 (g/hr):	0.5761	PARTICULATE CATCH (mg)	
		Sample Train 1:	5.2
		Sample Train 2:	5.1
ADJUSTED EMISSION RATES			
Sample Train 1 (g/hr):	1.1758		
Sample Train 2 (g/hr):	1.1518		
DEVIATION:		2.08%	

Wamock Hersey Inc.

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	Vermont Castings	RESULTS
Model:	Intrepid II	
Date:	6-3-97	AVERAGE ADJUSTED EMISSION RATE: 1.657
Run:	2	
Project #:	11860	Burn Rate (Dry kg/hr): 0.892
Test Duration: (minutes)	220	
PRESSURE FACTOR:	0.97393	BAROMETRIC PRESSURE
TEMPERATURE FACTORS		Average: 29.14
DGM #1:	0.98003	Start: 29.14
DGM #2:	0.98110	End: 29.14
VOLUMES SAMPLED		DRY GAS METER VALUES
DGM #1:	51.56035	DGM #1 Final: 785.910
DGM #2:	51.86531	DGM #1 Initial: 733.012
TOTAL TUNNEL VOLUME (scf):	31072.324	DGM #2 Final: 151.879
		DGM #2 Initial: 99.052
SAMPLE RATIOS		TEMPERATURES (DEG. RANKIN)
Sample Train 1:	602.640	DGM #1: 538.761
Sample Train 2:	599.096	DGM #2: 538.174
TOTAL EMISSIONS		CALIBRATION FACTORS
Sample Train 1 (g):	3.2543	DGM #1: 1.0212
Sample Train 2 (g):	3.2950	DGM #2: 1.0275
EMISSION RATES		TUNNEL FLOW RATE: 141.238
Sample Train 1 (g/hr):	0.8875	
Sample Train 2 (g/hr):	0.8986	PARTICULATE CATCH (mg)
ADJUSTED EMISSION RATES		Sample Train 1: 5.4
Sample Train 1 (g/hr):	1.6484	Sample Train 2: 5.5
Sample Train 2 (g/hr):	1.6655	
DEVIATION:	1.03%	

Wamock Hersey Inc.

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	Vermont Castings	RESULTS
Model:	Intrepid II	
Date:	6-4-97	AVERAGE ADJUSTED EMISSION RATE: 1.480
Run:	3	
Project #:	11860	Burn Rate (Dry kg/hr): 1.941
Test Duration: (minutes)	102	

PRESSURE FACTOR:	0.97527	BAROMETRIC PRESSURE	Average: 29.18
TEMPERATURE FACTORS			
DGM #1:	0.97929	Start: 29.18	
DGM #2:	0.97974	End: 29.18	
DRY GAS METER VALUES			
VOLUMES SAMPLED		DGM #1	Final: 810.451
DGM #1:	23.90402	Initial: 785.942	
DGM #2:	23.98018		
TOTAL TUNNEL VOLUME (scf):	14110.407	DGM #2	Final: 176.315
		Initial: 151.890	
SAMPLE RATIOS			
Sample Train 1:	590.294	TEMPERATURES (DEG. RANKIN)	DGM #1: 539.167
Sample Train 2:	588.420		DGM #2: 538.917
TOTAL EMISSIONS			
Sample Train 1 (g):	1.2398	CALIBRATION FACTORS	DGM #1: 1.0212
Sample Train 2 (g):	1.4122		DGM #2: 1.0275
EMISSION RATES			
Sample Train 1 (g/hr):	0.7292	TUNNEL FLOW RATE:	138.337
Sample Train 2 (g/hr):	0.8307	PARTICULATE CATCH (mg)	
ADJUSTED EMISSION RATES			
Sample Train 1 (g/hr):	1.4003	Sample Train 1: 2.1	
Sample Train 2 (g/hr):	1.5603	Sample Train 2: 2.4	
DEVIATION:	10.81%		

If deviation is greater than 7.5% due to low particulate catch
The two emission rates shall not differ by 7.5%
of the weighted average emission rate limit (4.1 or 7.5) (5g-3)

Use the following:

Catalytic units	3.90%
7.5% of 4.1 g/hr	

Wamock Hersey Inc.

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	Vermont Castings	RESULTS
Model:	Intrepid II	
Date:	6-4-97	AVERAGE ADJUSTED EMISSION RATE: 3.233
Run:	4	
Project #:	11860	Burn Rate (Dry kg/hr): 1.595
Test Duration: (minutes)	123	
PRESSURE FACTOR:	0.97410	BAROMETRIC PRESSURE
TEMPERATURE FACTORS		Average: 29.145 Start: 29.18 End: 29.11
DGM #1:	0.97257	
DGM #2:	0.97513	
VOLUMES SAMPLED		DRY GAS METER VALUES
DGM #1:	28.68132	DGM #1 Final: 840.110 Initial: 810.464
DGM #2:	28.90707	DGM #2 Final: 205.940 Initial: 176.322
TOTAL TUNNEL VOLUME (scf):	17100.082	
SAMPLE RATIOS		TEMPERATURES (DEG. RANKIN)
Sample Train 1:	596.210	DGM #1: 542.893
Sample Train 2:	591.554	DGM #2: 541.464
TOTAL EMISSIONS		CALIBRATION FACTORS
Sample Train 1 (g):	3.9350	DGM #1: 1.0212
Sample Train 2 (g):	4.2592	DGM #2: 1.0275
EMISSION RATES		TUNNEL FLOW RATE: 139.025
Sample Train 1 (g/hr):	1.9195	
Sample Train 2 (g/hr):	2.0777	PARTICULATE CATCH (mg)
ADJUSTED EMISSION RATES		Sample Train 1: 6.6 Sample Train 2: 7.2
Sample Train 1 (g/hr):	3.1269	
Sample Train 2 (g/hr):	3.3393	
DEVIATION:	6.57%	



Inchcape Testing Services NA Inc.

Date: 5-30-97Manufacturer: VCIModel: INTREPID IIWHI LTO #: 11860-231

Run:

Tech: RW

Emissions Testing Initial Stove Check Out

Date received: 5-30-97Carrier: EMORY AIR/airShipping damage? X No Yes

Describe damage _____

If damaged, repairable? No Yes

Repairs affected by: _____ Date: _____

Client notified about
irreparable damage by: _____ Date: _____

Disposition: _____

Safety Certified by: _____ Safety Control#: _____

Overall Unit Dimensions: 23 1/2 High 2 1/4 Wide 21 DeepComments:

Initialed: _____



Inchcape Testing Services NA Inc.

Warnock Hersey

Date: 5-30-97Manufacturer: ICIModel: INTREPID IIWHL TO #: 11860 -231Run: 8Tech: RA

EMISSIONS TESTING UNIT PREPARATION

Unit description (check all that apply)

- | | | |
|-----------------------------------------------|-----------------------------------------------|----------------------------------------------------|
| <input checked="" type="checkbox"/> Stove | <input checked="" type="checkbox"/> Top Vent | Manual Draft |
| <input type="checkbox"/> Insert | <input checked="" type="checkbox"/> Rear Vent | <input checked="" type="checkbox"/> Bimetal Spring |
| <input checked="" type="checkbox"/> Catalytic | <input checked="" type="checkbox"/> Grate | <input type="checkbox"/> Remote Thermostat |
| <input type="checkbox"/> Non-catalytic | <input checked="" type="checkbox"/> Ashpan | <input type="checkbox"/> Blower or Fans |
| <input type="checkbox"/> Other: _____ | | |

Unit received with all parts: Yes NoManual: Yes NoDrawings: Yes NoSpecifications: Yes NoMaterials of construction: CAST IRON

Air introduction: _____

Control mechanism: _____

Unit net weight with all components: 228.0 lbs. 103.42 kg.Unit fire box volume: 1.697 Ft³ (attach fire box volume calculations and drawings)Ideal Load Weight: 9.08 lbs. (Volume x 7)Load Weight Range: ($\pm 10\%$ of ideal weight) 8.17 lbs. to 9.99 lbs.Ideal piece length specification: 15.78 inches. (5/6 of longest fire box dimension)Thermocouples attached: 6 Attached by: RA (attach T/C map)

Unit conditioned prior to test

10 hours at medium
burn rate (non-catalytic)
(attach burn log)

50 hours at medium
burn rate (attach burn log)

Date started: 5-30-97Date completed: 6-2-97

Catalyst manufacturer: _____

Serial number: _____ Dimensions: _____ Cell size: _____ cells/in.²Unit ready for testing (date): 6-2-97 Initialed: RA



Inchcape Testing Services NA Inc.

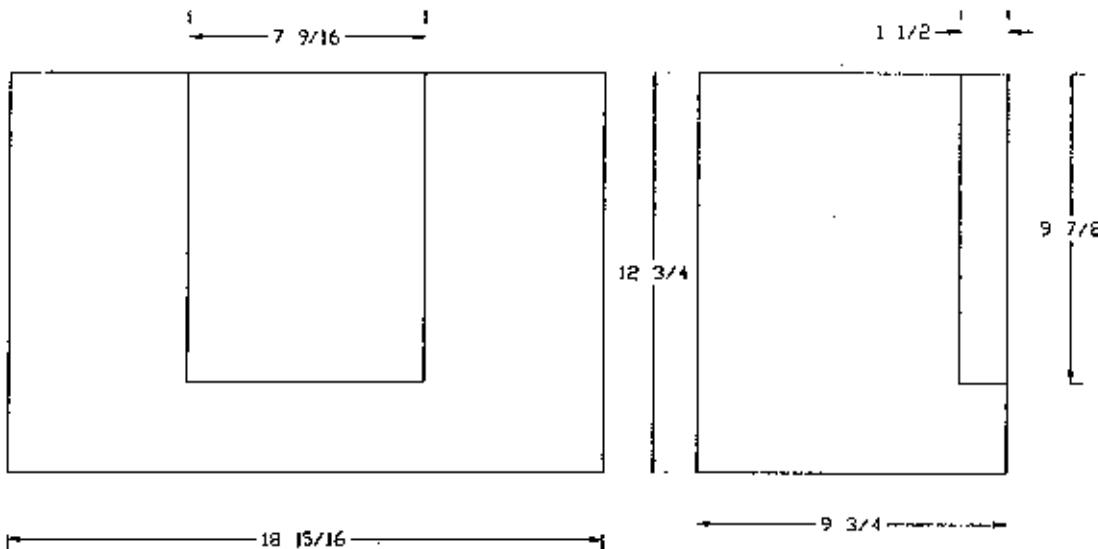
Date: 6-5-97Manufacturer: VCIModel: INTEC PIN IIWHILTO #: 11860-231

Run: _____

Tech: RAMeasurements By: RA

Checked By: _____

FIRE BOX VOLUME CALCULATION



$$18.9375 \times 9.75 \times 12.75 = 2354168$$

$$- 7.5625 \times 1.5 \times 9.875 = 112.0195$$

$$2242.1485 \text{ INCH}^3$$

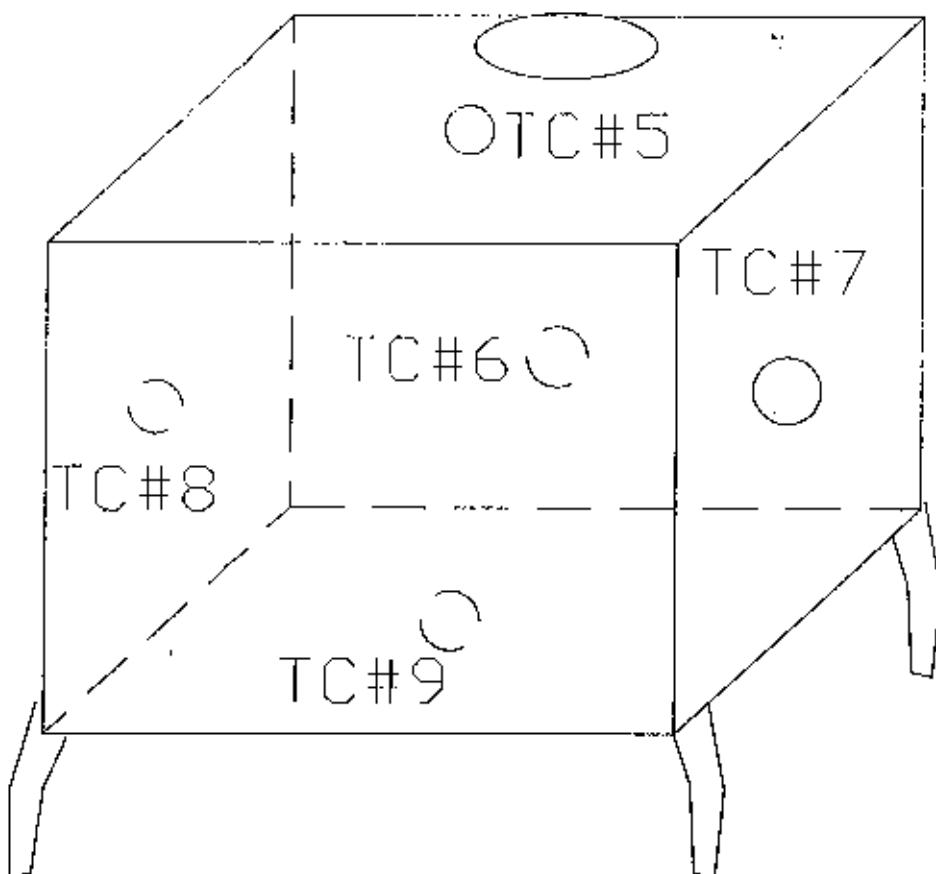
$$\text{OR } 1.297 \text{ FEET}^3$$



Inchcape Testing Services NA Inc.
Warnock Hersey

Date: 6-2-97Manufacturer: VEIModel: INTREP.DIFWHLTO # 11860-231

Run: _____

Tech: RJ**Thermocouple Location**

TC #	LOCATION
TC 5	UNIT TOP
TC 6	UNIT BOTTOM
TC 7	UNIT RIGHT
TC 8	UNIT LEFT
TC 9	UNIT BOTTOM



Inchcape Testing Services NA Inc.

Date: 6-2-97Manufacturer: VCEModel: INTREROD IIWHL TO #: 1860-231 Run: 1Tech: PA

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.05 (inches Hg.) Static pressure (P_s) 120 (inches w.c.)Inside diameter: Port A 6in, Port B 6in, Tunnel cross sectional area: .1963Ft²

Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H ₂ O)	Tunnel Temperature (°F)	$\sqrt{\Delta_p}$
A-Centroid	3.00	.040	95	, 2000
B-Centroid	3.00	.041	95	, 2025
A-1	0.40	.037	94	, 1924
A-2	1.50	.038	95	, 1949
A-3	4.50	.040	95	, 2000
A-4	5.60	.037	95	, 1924
B-1	0.40	.036	94	, 1897
B-2	1.50	.042	94	, 2049
B-3	4.50	.040	94	, 2000
B-4	5.60	.034	94	, 1944
AVERAGE		94.5		, 1961

Adjustment factor application

$$V_t = K_p C_p F_p (\sqrt{\Delta_p}) AVG \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_t = K_p C_p (\sqrt{\Delta_p}) avg. \sqrt{\frac{T_s}{P_s M_s}}$$

9745

Where,

 C_p = pitot tube coefficient = 0.99 for standard pitot Δ_p = manometer reading (inches H₂O) T_s = average absolute dilution tunnel temperature (°F + 460) P_s = absolute dilution tunnel gas pressure or $P_{bar} + P_t$

$inches H_2O$
 P_t = static pressure $\frac{13.6}{M_s}$

$$F_p = \frac{(\sqrt{\Delta_p})avg}{(\sqrt{\Delta_p})centroid}$$

Adjustment factor for alternative pitot tube placement:

 M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured) K_p = 85.49 pitot tube constant, (conversion factor for english units) $(\sqrt{\Delta_p})avg$ = average of the square roots of the velocity heads (Δ_p) measured at each traverse point. $(\sqrt{\Delta_p})centroid$ = average of the square roots of the velocity heads measured at the tunnel centroid (inches of H₂O)



Inchcape Testing Services NA Inc.

Date: 6-2-97Manufacturer: VETModel: INTRACOWHL TO # 11860 -231Run: 1Tech: JL

Moisture Meter Calibration Check:

Pre/Post Checks		X	Y	12	22
Time: <u>8'30</u>		✓			

Facility Conditions:

Air Velocity.....

Pre-Test

Post-Test

<u>0</u>	fpm	<u>0</u>	fpm
✓		✓	

Smoke Capture Check.....

Wood Heater Conditions:

Date Wood Heater Stack Cleaned.....

<u>6-2-97</u>	
<u>6-2-97</u>	
<u>0</u>	
<u>.039</u>	
	<u>141.513</u>

Date Dilution Tunnel Cleaned.....

Induced Draft Check.....

Tunnel Velocity.....

Flow Rate 140 cfm ±10%.

Pitot Leak Check:

Side A.....

✓	✓
✓	✓

Side B.....

Temperature System:

Ambient (65° - 90° F).....

<u>✓</u>	°F
<u>-5.8</u>	°F

Wood Heater Surface (±125° F).....

Proportional Checks:

CO Analyzer Drift Check.....

<u>✓</u>
<u>/</u>
<u>/</u>
<u>/</u>

CO₂ Analyzer Check.....O₂ Analyzer Check.....

Thermocouple check.....

Train 1 Train 2

Sampling Train ID Numbers:

Probe.....

<u>1</u>	<u>2</u>
<u>13</u>	<u>15</u>
<u>14</u>	<u>16</u>
<u>19</u>	<u>22</u>
✓	✓

Filter Front.....

Filter Back.....

Filter Thermocouple.....

Filter 5G-3 (<90°F).....

Thermocouple Identification Number

Flue 1

Room 2

Dilution Tunnel Dry Bulb 3

Dilution Tunnel Wet Bulb 4

Unit Top 5

Unit Back 6

Unit Right Side 7

Unit Left Side 8

Unit Bottom 9

Catalyst/Combustion Chamber 10



Inchcape Testing Services NA Inc.

Date: 6-2-97Manufacturer: VCEModel: INTEGRA IIWHI LTO #: 11860 Run: 1Tech: RL

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	10 lbs, Class F	10.0 lbs
Wood	10 lbs, Class F	10.00 lbs
Analytical	100 mg, Class S	100,00006 mg

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE: 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE 20%-80% of ideal test load weight, ± 0.1 lbs or 1%
WOOD SCALE 20%-80% of ideal test load weight, ± 0.1 lbs or 1%



Inchcape Testing Services NA Inc.

Date: 6-2-97Manufacturer: VERMONT CASTINGS Model: INTREPID IIWHLTO #: 11860 -231 Run: 1 Tech: RA

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test
Vacuum (inches Hg.)	10"	10"	10"	10"
Final 1 minute DGM (ft ³)	655.994	732.980	22.091	99.052
Initial 1 minute DGM (ft ³)	655.994	732.980	22.090	99.052
Change (C) (ft ³)	0	0	.001	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	10"	10"
Rotometer Reading (mm)	0	0
Flow Rate (CFM)	0	0
Allowable (.04 x Sample Rate)		
Check OK	✓	✓



Inchcape Testing Services NA Inc.

Date: 6-2-97Manufacturer: VERMONT CASTINGSModel: INTREPID IIWHL TO # 11860-231Run: 1Tech: RA

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
	Actual	Should Be	Actual	Should Be	Actual	Should Be
CO	0	0	9.99	9.99	.97	.984
CO ₂	0	0	24.50	24.50	9.46	9.98
O ₂	0	0	20.93	20.93	10.23	10.17

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	0	9.95	97	0	.04	0	✓	
CO ₂	0	24.44	9.46	0	.06	0	✓	
O ₂	.01	20.91	10.27	.01	.02	.04	✓	

* Greater than $\pm 5\%$ of the range used.



Inchcape Testing Services NA Inc.

Date: 6-2-97Manufacturer: NETModel: INTREPID IIWHILTO #: 11860 -231 Run: 1Tech: PF

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Samples in Desiccator

Date: 6-2-97Time: 17:11

	SYSTEM 1		SYSTEM 2	
	Probe and Front Half Housing #	Filter Numbers	Probe and Front Half Housing #	Filter Numbers
	1	13414	2	15416
Post Test Weight:	91.4439 grams	.2397 grams	91.6292 grams	.2365 grams
Pre Test Weight:	91.4437 grams	.2348 grams	91.6290 grams	.2315 grams
Gain:	.0002 grams	.0049 grams	.0002 grams	.0050 grams
	a1	b1	a2	b2

Total Gain: a1 + b1 = .0051 grams a2 + b2 = .0052 grams

		SYSTEM 1			SYSTEM 2			TEMP	HUMID
Pre-test Weight Record	Probe & Housing Number	Front Filter Number	Back Filter Number	Probe & Housing Number	Front Filter Number	Back Filter Number			
Date	Time	1	13	14	2	15	16	°F	%
6-2-97	7:30	91.4440	1184	.1164	91.6291	.1152	.1165	70	50
6-2-97	6:50	91.4437	1188	.1160	91.6290	.1154	.1161	71	46
		Total		,2348	Total		,2315		

		SYSTEM 1			SYSTEM 2			TEMP	HUMID
Post-test Weight Record	Probe & Housing Number	Combined Filter Weight Number		Probe & Housing Number	Combined Filter Weight Number				
Date	Time	1	13414	2	15416			°F	%
6-2-97	17:11	91.4441	.2403	91.6295	.2371			77	43
6-2-97	6:45	91.4439	.2398	91.6292	.2366			73	45
6-2-97	6:50	91.4439	.2397	91.6292	.2365			72	48
6-5-97	6:45	91.4439	.2397	91.6292	.2365			73	44



Inchcape Testing Services NA Inc.

Date: Jan 2-97Manufacturer: VCTModel: INTREPID IIWMI LTO #: 1186D -231Run: 1Tech: JCA

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft ³)	132,973	99,037
Initial (ft ³)	656,994	22,091

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.05	29.05
Wet Bulb (°F)	59	64
Dry Bulb (°F)	71	83
Humidity (%)	49	35



Incheape Testing Services NA Inc.

Date: 6-2-97Manufacturer: VEIModel: INTREPID IIWHL TLO #: 11400 -231Run: 1Tech: PA

FUEL DATA PRE-TEST LOAD

FUEL DESCRIPTION:

Kindling weight: 4.8 lbs. Consisting of: Scrap and paper Fire lit Time: 9:05
 Pre-test load weight: 8.71 lbs. Consisting of: 2X4X 16 inches Time loaded: 9:35
 Pre-test moisture content: Uncorrected: 19.10 % Corrected Dry: 18.52 % Wet: 17.23 %

Test Air Control Settings: CLOSEDTime: 10:33Test Unit Fan Settings: NA

Time: _____

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	<u>8.17</u> lbs.	<u>9.08</u> lbs.	<u>9.99</u> lbs.

Fire Box Volume:	<u>1.297</u> ft. ³	Ideal Length:	inches
Load Volume:	<u>1.254</u> ft. ³	Loading Density:	<u>6.523</u> lbs/ft ³
Number of Spacers	<u>COMENTS 3/4x1 1/2x5</u>	Load Density:	<u>37.341</u> lbs/ft ³

Piece Size	Weight	Meter Moisture Content (% dry)*			
<u>3 x 4 x 15.75 in.</u>	<u>2.17</u> lbs.	<u>19.1</u> %	<u>18.4</u> %	<u>19.1</u> %	<u>19.1</u> %
<u>2 x 4 x 15.75 in.</u>	<u>2.18</u> lbs.	<u>18.6</u> %	<u>18.0</u> %	<u>17.9</u> %	<u>18.6</u> %
<u>2 x 4 x 15.75 in.</u>	<u>1.94</u> lbs.	<u>19.1</u> %	<u>17.9</u> %	<u>18.6</u> %	<u>18.6</u> %
<u>2 x 4 x 15.75 in.</u>	<u>2.17</u> lbs.	<u>18.9</u> %	<u>18.4</u> %	<u>18.2</u> %	<u>18.2</u> %
<u>x x in.</u>	<u></u> lbs.	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
<u>x x in.</u>	<u></u> lbs.	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
<u>x x in.</u>	<u></u> lbs.	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>

*uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 8.46 lbsDRY WEIGHT: 3.20 kg.

AVERAGE MOISTURE CONTENT:

(DRY) 18.52 % CORRECTED TO TWO PIN: (DRY) 19.77 % (WET) 16.56 %

COAL BED RANGE:

1.7 lbs. to 2.1 lbs. (20% to 25% of test load)

TEST CHARGE:

Time loaded: 11:38 Coal bed weight: 2.1 lbs. Coal bed weight = 24.8 % of test load weight

CHARCOALIZATION:

good | -- | -- | A | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | poor

Inchcape Testing Services NA Inc.

Date: 6-2-97

Manufacturer: VCT

Model: INTREPID II

WHL TO #: 1186D-231 Run: 6

Tech: 24

COMMENTS

NOTE: SPACERS ENDS
WERE REMOVED FROM
FRONT PIECES SO THEY
WOULD FIT.

TEST LOAD CONFIGURATION





Inchcape Testing Services NA Inc.

Date: 6-7-97Manufacturer: VCIModel: INTREPID IIWHLTO #: 11860-231 Run: 1Tech: RAAIR CONTROL CLOSED

SWITCH NUMBER		1	2	3	4	5	6	7	8	9	10	DRAFT	SMOKE
READING #	REAL TIME	ELAPSED TIME	WEIGHT REMAINING	FUEL OAS TEMP	ROOM TEMP	HUM. DRY	TUNNEL WET GULF	UNIT TOP	UNIT BACK	UNIT X SIDE	UNIT BOTTOM	CATALYST DOWNSTREAM	TUNNEL VELOCITY
0	1234	0	470	415	75	98	77	570	630	371	335	291	1125
1		10	3,60	392	76	96	77	469	635	348	329	307	1054
2		20	3,20	335	76	95	78	430	609	333	324	314	946
3		30	270	313	76	95	78	404	561	328	328	317	983
4		40	240	313	76	93	78	391	558	325	324	325	803
5		50	230	185	76	87	78	388	478	320	318	334	625
6		60	220	167	76	86	78	378	413	300	308	310	613
7		70											
8		80											
9		90											
10		100											
11		110											
12		120											
13		130											
14		140											
15		150											
16		160											
17		170											
18		180											
19		190											
20		200											
21		210											
22		220											
23		230											
24		240											
25		250											
26		260											
COMMENTS: 11:36 FIRE STIRRED DOOR OPEN 20 SEC													
FIRE STIRRED 11:06													

WHI LTO#: 11869 AIR CONTROL CLOSED
MANUFACTURED: 1987 MODEL: 1987

MANUFACTURER: *Ve*

MODEL: INTELLIGENT

FIRE SIZE: 104

DATE: 6-2-47

RUNG 1

Page 15 of 48

~~Technician~~ Technician

SWITCH NUMBER:	TEST DATA													TEST CONDITIONS																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	17	18	19	20	21	22												
REAL TIME	ELAPSED TIME	WEIGHT REMAIN.	CO%	O%	TUNNEL TEMP	NET BLDG TEMP	TUNNEL TEMP	UNIT TOP	UNIT BACK	CAT CENTER	FILTER	DGM TEMP	INLET	OUTLET	DGM TEMP	INLET	OUTLET	TUNNEL VELOCITY	MAX DGM TRIPES												
0	11:38	0	8.46	.07	10.07	9.54	16.9	76	87	78	377	413	300	306	314	613	839	135	655.4	120	90	80	76	220	120	27	77	71	1039	.028	C 0
1	10	8.10	1.22	9.89	9.32	19.7	77	89	79	308	382	298	276	330	734	1259	135	658.3	120	81	81	81	24.4	120	79	78	81	1039	.035	C 2	
2	20	7.80	2.27	11.14	8.86	21.4	77	88	80	284	394	312	265	351	737	1234	135	660.7	120	83	82	81	28.7	120	80	79	81	1039	.039	C 2	
3	30	7.30	1.27	11.72	8.23	22.0	76	88	79	288	406	328	260	333	745	1219	135	663.1	120	83	83	80	29.1	120	81	80	81	1041	.040	T 2	
4	40	6.80	1.23	12.19	7.80	21.1	78	88	80	303	410	331	159	336	762	1250	135	665.5	120	83	83	80	31.5	120	82	81	81	1039	.040	C 2	
5	50	6.40	1.23	12.53	7.72	20.3	77	87	79	330	412	326	258	337	776	1268	135	667.9	120	84	83	80	33.9	120	82	81	81	1040	.038	C 2	
6	60	6.00	1.22	12.89	7.25	19.8	78	87	79	356	410	329	258	335	758	1268	135	670.3	120	84	84	80	36.3	120	83	82	81	1039	.038	C 2	
7	70	5.50	1.20	10.40	10.11	20.5	78	87	79	360	414	321	257	331	732	1179	135	672.7	120	84	84	80	38.7	120	83	83	81	1040	.038	C 2	
8	80	5.20	1.20	12.33	8.39	19.5	78	87	79	346	411	323	255	326	771	1337	135	675.1	120	84	85	80	41.1	120	84	83	82	1042	.036	C 2	
9	90	4.90	1.13	11.17	8.94	18.0	78	87	79	338	411	326	252	319	705	1187	135	677.5	120	85	85	80	43.5	120	84	84	80	1041	.031	C 2	
10	100	4.70	1.12	11.86	8.51	16.4	77	86	79	336	396	325	251	310	695	1182	135	679.9	120	86	86	80	45.9	120	85	85	80	1042	.030	C 2	
11	110	4.40	1.12	12.84	7.65	16.1	77	85	79	337	381	324	250	302	699	1226	135	682.3	120	80	83	79	48.3	120	80	83	80	1039	.028	C 2	
12	120	4.20	1.20	13.27	7.12	16.7	78	86	79	340	387	328	253	296	751	1359	135	684.7	120	78	81	79	50.7	120	80	81	79	1041	.027	C 2	
13	130	3.90	1.25	12.77	9.70	19.8	77	87	79	343	400	328	256	289	787	1339	135	687.1	120	77	79	79	53.1	120	79	80	80	1040	.030	C 2	
14	140	3.60	1.22	10.38	10.15	19.7	78	87	79	346	410	321	260	285	787	1321	135	689.5	120	77	78	79	55.5	120	78	79	80	1040	.030	C 2	
15	150	3.30	1.18	9.70	10.81	19.0	79	88	79	347	408	317	265	284	765	1249	135	691.9	120	76	77	79	57.9	120	79	78	80	1040	.030	C 2	
16	160	3.10	1.13	11.11	9.71	16.8	81	89	79	348	398	315	270	281	714	1240	135	694.3	120	76	77	79	60.3	120	77	78	80	1041	.025	C 2	
17	170	2.90	1.14	11.63	8.58	16.6	81	89	79	348	387	313	275	277	717	1214	135	696.7	120	76	77	79	62.7	120	77	78	80	1041	.025	C 2	
18	180	2.70	1.15	12.28	8.05	17.3	81	90	79	347	385	315	285	273	742	1299	135	700.1	AV/20	76	77	79	65.1	120	77	78	80	1039	.025	C 2	
19	190	2.40	1.16	11.24	8.88	17.7	82	90	80	351	391	316	275	268	757	1310	135	702.5	AV/20	76	77	79	67.5	120	77	78	80	1040	.025	C 2	
20	200	2.30	1.11	9.54	10.53	16.9	80	90	80	347	392	313	294	263	722	1211	135	703.9	120	76	76	79	69.9	120	77	77	80	1040	.024	C 2	
21	210	2.10	1.11	9.44	10.57	16.5	82	90	80	341	384	340	303	258	799	1177	135	706.3	AV/20	76	77	79	72.3	120	77	78	80	1040	.023	C 2	
22	220	2.00	0.97	8.76	11.14	16.8	82	90	80	338	375	310	304	254	684	1080	135	708.7	120	76	76	79	74.7	120	77	78	80	1040	.022	C 2	
23	230	1.90	1.20	13.00	6.81	18.0	81	91	80	360	374	342	295	257	773	1343	135	711.1	120	77	77	79	77.1	120	77	77	80	1040	.025	C 2	
24	240	1.60	1.16	10.11	7.65	17.6	82	90	81	368	385	355	288	251	737	1266	135	713.5	120	77	77	79	79.5	120	78	78	81	1038	.025	C 2	
25	250	1.30	1.12	9.45	12.29	16.5	82	91	81	362	384	347	284	249	713	1167	135	715.9	120	76	77	79	81.9	120	77	78	80	1038	.022	C 2	
26	260	1.10	1.11	9.61	10.14	16.4	82	91	81	362	376	338	281	248	682	1145	125	718.3	120	77	77	79	84.3	120	77	77	80	1038	.021	C 2	
27	270	1.10	1.13	10.73	9.06	16.6	82	91	81	371	371	336	287	247	691	1196	135	720.7	120	76	77	79	86.7	120	78	78	80	1040	.022	C 2	
28	280	1.10	1.12	10.01	9.88	17.0	82	91	81	375	371	334	283	246	703	1182	135	723.1	120	77	77	80	89.1	120	78	78	81	1041	.021	C 2	
29	290	1.10	1.10	8.92	11.06	17.0	82	91	81	372	370	330	285	244	696	1131	135	725.5	120	77	77	80	91.5	120	78	78	80	1041	.021	C 2	
30	300	1.10	4.72	13.55	43.6	22.3	81	92	81	427	365	321	330	248	808	1401	135	727.9	120	77	77	80	93.9	120	78	78	81	1041	.035	C 2	
31	310	1.10	1.12	7.90	11.78	21.8	82	94	82	432	412	316	349	254	730	1118	135	730.3	120	77	77	81	9								

COMMENTS: 16:29 NO CHANGE IN WEIGHT FIRE STIRRED AS PER 6.4.3 DOOR OPEN 15 SEC.

TEST LOADED IN 50 SECONDS AIRCONTROL WAS NOT ADJUSTED DURING LOADING B9 PAGE CLOSED AFTER LOADING



Inchcape Testing Services NA Inc.

Date: 6-3-97Manufacturer: VETModel: INTREPID IIWHLTO #: 11860 -231Run: 2Tech: R.A

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.14 (inches Hg.) Static pressure (P_s) .120 (inches w.c.)Inside diameter: Port A 6in. Port B 6in. Tunnel cross sectional area: .1963Ft²

Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H ₂ O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.039	93	.1975
B-Centroid	3.00	.039	94	.1975
A-1	0.40	.034	93	.1844
A-2	1.50	.038	93	.1949
A-3	4.50	.039	93	.1975
A-4	5.60	.035	93	.1871
B-1	0.40	.035	92	.1871
B-2	1.50	.039	94	.1975
B-3	4.50	.040	93	.2000
B-4	5.60	.034	93	.1844
		AVERAGE	93.1	.1928

Adjustment factor application

$$V_i = K_p C_p F_p (\sqrt{\Delta_p}) AVG \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_i = K_p C_p (\sqrt{\Delta_p}) avg. \sqrt{\frac{T_s}{P_s M_s}}, 9762$$

Where,

 C_p = pitot tube coefficient = 0.99 for standard pitot Δ_p = manometer reading (inches H₂O) T_s = average absolute dilution tunnel temperature (°F + 460) P_s = absolute dilution tunnel gas pressure or $P_{bar} + P_s$ inches H₂O P_s = static pressure $\frac{13.6}{13.6}$

$$F_p = \frac{(\sqrt{\Delta_p})avg}{(\sqrt{\Delta_p})centroid}$$

Adjustment factor for alternative pitot tube placement:

 M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured) K_p = 85.49 pitot tube constant, (conversion factor for english units) $(\sqrt{\Delta_p})avg$ = average of the square roots of the velocity heads (Δ_p) measured at each traverse point. $(\sqrt{\Delta_p})centroid$ = average of the square roots of the velocity heads measured at the tunnel centroid (inches of H₂O)



Inchcape Testing Services NA Inc.

Date: 6-3-97Manufacturer: VEEModel: 110 REPID FFWHILTO #: 11860 -231Run: 2Tech: RA

Moisture Meter Calibration Check:

Pre/Post Checks

Time: 7:30 X: Y: 12: 22:

Facility Conditions:

Air Velocity.....

Pre-Test

Post-Test

Smoke Capture Check.....

<u>0</u>	/fpm	<u>0</u>	/fpm
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	

Wood Heater Conditions:

Date Wood Heater Stack Cleaned.....

6-2-97

Date Dilution Tunnel Cleaned.....

6-2-97

Induced Draft Check.....

0

Tunnel Velocity.....

,040

Flow Rate 140 cfm ±10%.

141.238

<u>6-2-97</u>	
<u>6-2-97</u>	
<u>0</u>	
<u>,040</u>	

Pitot Leak Check:

Side A.....

<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Side B.....

Temperature System:

Ambient (65° - 90°F).....

 °F

Wood Heater Surface (±125°F).....

-9 °F

<u>CO Analyzer Drift Check.....</u>	<input checked="" type="checkbox"/>
<u>CO₂ Analyzer Check.....</u>	<input checked="" type="checkbox"/>
<u>O₂ Analyzer Check.....</u>	<input checked="" type="checkbox"/>
<u>Thermocouple check.....</u>	<input checked="" type="checkbox"/>

Sampling Train ID Numbers:

Probe.....
 Filter Front.....
 Filter Back.....
 Filter Thermocouple.....
 Filter 5G-3 (<90°F).....

Train 1	Train 2
<u>3</u>	<u>4</u>
<u>19</u>	<u>19</u>
<u>18</u>	<u>20</u>
<u>19</u>	<u>22</u>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Thermocouple Identification Number

Flue 1
 Dilution Tunnel Wet Bulb 4
 Unit Right Side' 7
 Catalyst/Combustion Chamber 10

Room 2
 Unit Top 5
 Unit Left Side 8

Dilution Tunnel Dry Bulb 3
 Unit Back 6
 Unit Bottom 9



Inchcape Testing Services NA Inc.

Date: 6-3-97Manufacturer: VCTModel: INTREPID IIWHI LTO #: 11860 -231Run: 2Tech: RH

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	10 lbs, Class F	10.0 lbs
Wood	10 lbs, Class F	10.00 lbs
Analytical	100 mg, Class S	10,000.06 mg

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE: 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE 20%-80% of ideal test load weight, ± 0.1 lbs or 1%
WOOD SCALE 20%-80% of ideal test load weight, ± 0.1 lbs or 1%



Inchcape Testing Services NA Inc.

Date: 6-3-97Manufacturer: VEIModel: INTREPID IIWHL TO #: 11960 -231Run: 2Tech: PA

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Unplugged Flow Rate = .25cfm				
Vacuum (inches Hg.)	<u>10"</u>	<u>10"</u>	<u>10"</u>	<u>10"</u>
Final 1 minute DGM (ft³)	<u>733,012</u>	<u>785,926</u>	<u>99,052</u>	<u>151,885</u>
Initial 1 minute DGM (ft³)	<u>733,004</u>	<u>785,921</u>	<u>99,052</u>	<u>151,885</u>
Change (C) (ft³)	<u>,008</u>	<u>,005</u>	<u>,8</u>	<u>0</u>
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK				

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	<u>10"</u>	<u>10"</u>
Rotometer Reading (mm)	<u>0</u>	<u>0</u>
Flow Rate (CFM)	<u>0</u>	<u>0</u>
Allowable (.04 x Sample Rate)		
Check OK	<u>✓</u>	<u>✓</u>



Inchcape Testing Services NA Inc.

Date: 6-3-97Manufacturer: VCIModel: INFRAREDWHI LTO #: 1186D -231Run: 2Tech: PT

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	0	0	999	999	.97	.986
CO ₂	0	0	24.50	24.50	9.51	9.98
O ₂	0	0	20.93	20.93	10.29	10.17
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	0	9.98	.97	0	.01	0	/	
CO ₂	.03	24.44	9.41	.03	.06	.10	/	
O ₂	.04	20.86	10.28	.04	.07	.01	/	

* Greater than $\pm 5\%$ of the range used.



Incheape Testing Services NA Inc.

page 21 of 48Date: 6-3-97Manufacturer: VEIModel: INTREPID IIWHILTO #: 11860-231Run: 2Tech: RG

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm AP

Samples in Desiccator

Date: 6-3-97 Time: 15:01

SYSTEM 1		SYSTEM 2	
Probe and Front Half Housing #	Filter Numbers	Probe and Front Half Housing #	Filter Numbers
<u>3</u>	<u>17+18</u>	<u>4</u>	<u>19+20</u>
Post Test Weight:	<u>93.1200</u> grams	<u>.2428</u> grams	<u>.2428</u> grams
Pre Test Weight:	<u>39.1196</u> grams	<u>.2370</u> grams	<u>.2375</u> grams
Gain:	<u>.0004</u> grams	<u>.005</u> grams	<u>.0002</u> grams
	a1	b1	a2
			b2

Total Gain: a1 + b1 = .0054 grams a2 + b2 = .0055 grams

SYSTEM 1				SYSTEM 2				
Pre-test Weight Record	Probe & Housing Number	Front Filter Number	Back Filter Number	Probe & Housing Number	Front Filter Number	Back Filter Number	TEMP	HUMID
Date	Time	<u>3</u>	<u>17</u>	<u>18</u>	<u>4</u>	<u>19</u>	<u>20</u>	<u>°F</u>
<u>6-2-97</u>	<u>7:00</u>	<u>93.1193</u>	<u>.1193</u>	<u>.1188</u>	<u>89.9728</u>	<u>.1192</u>	<u>.1180</u>	<u>71</u>
<u>6-3-97</u>	<u>6:58</u>	<u>93.1196</u>	<u>.1182</u>	<u>.1188</u>	<u>89.9731</u>	<u>.1192</u>	<u>.1183</u>	<u>73</u>
Total		<u>2370</u>		Total		<u>2375</u>		

SYSTEM 1			SYSTEM 2			
Post-test Weight Record	Probe & Housing Number	Combined Filter Weight Number	Probe & Housing Number	Combined Filter Weight Number	TEMP	HUMID
Date	Time	<u>3</u>	<u>17+18</u>	<u>4</u>	<u>19+20</u>	<u>°F</u>
<u>6-3-97</u>	<u>15:51</u>	<u>93.1202</u>	<u>.2435</u>	<u>89.9741</u>	<u>.2433</u>	<u>75</u>
<u>6-4-97</u>	<u>6:45</u>	<u>93.1200</u>	<u>.2420</u>	<u>89.9733</u>	<u>.2428</u>	<u>72</u>
<u>6-5-97</u>	<u>6:45</u>	<u>93.1200</u>	<u>.2420</u>	<u>89.9733</u>	<u>.2428</u>	<u>73</u>



Inchcape Testing Services NA Inc.

Date: 6-3-97Manufacturer: VETModel: INTREPID IIWHI LTO #: 11860-231Run: 2Tech: PA

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft³)	785,910	151,879
Initial (ft³)	733,012	99,052

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.14	29.14
Wet Bulb (°F)	75.60	65
Dry Bulb (°F)	60.73	80
Humidity (%)	47	44



Inchcape Testing Services NA Inc.

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Date: 6-3-97Manufacturer: VCIModel: INTERPID IIWHLTO #: 11860 .231Run: 2Tech: RdFUEL DATA
PRE-TEST LOAD

FUEL DESCRIPTION:

Kindling weight: 6.4 lbs. Consisting of: Scrap and paper Fire lit Time: 8:24
Pre-test load weight: 4.84 lbs. Consisting of: 2X4X 6 inches Time loaded: 8:56
Pre-test moisture content: Uncorrected: 19.6 % Corrected Dry: 20.46 % Wet: 22.33 %

Test Air Control Settings: AIR CONTROL 1/4" OPEN Time: 9:59
Test Unit Fan Settings: _____ Time: _____

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	<u>8.17</u> lbs.	<u>9.08</u> lbs.	<u>9.99</u> lbs.
Fire Box Volume:	<u>1.297</u> ft. ³	Ideal Length:	<u>4.708</u> inches
Load Volume:	<u>.2321</u> ft. ³	Loading Density:	<u>4.708</u> lbs/ft ³
Number of Spacers	<u>COMBINED 1/4x1 1/2x5</u>	Load Density:	<u>37.484</u> lbs/ft ³

Piece Size	Weight	Meter Moisture Content (% dry)*			
<u>2 x 4 x 15 3/4 in.</u>	<u>2.11</u> lbs.	<u>19.6</u> %	<u>19.6</u> %	<u>19.2</u> %	
<u>2 x 4 x 5 3/4 in.</u>	<u>2.22</u> lbs.	<u>19.5</u> %	<u>19.5</u> %	<u>18.7</u> %	
<u>2 x 4 x 5 3/4 in.</u>	<u>2.10</u> lbs.	<u>19</u> %	<u>19</u> %	<u>19.4</u> %	
<u>2 x 4 x 15 3/4 in.</u>	<u>2.27</u> lbs.	<u>19</u> %	<u>19.4</u> %	<u>19.8</u> %	
<u>x x in.</u>	<u>lbs.</u>	<u>%</u>	<u>%</u>	<u>%</u>	
<u>x x in.</u>	<u>lbs.</u>	<u>%</u>	<u>%</u>	<u>%</u>	
<u>x x in.</u>	<u>lbs.</u>	<u>%</u>	<u>%</u>	<u>%</u>	

*uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 8.70 lbs DRY WEIGHT: 3.27 kg

AVERAGE MOISTURE CONTENT:

(DRY) 19.31 % CORRECTED TO TWO PIN: (DRY) 20.64 % (WET) 17.11 %

COAL BED RANGE:

1.8 lbs. to 2.1 lbs. (20% to 25% of test load)

TEST CHARGE:

Time loaded: 11:06 Coal bed weight: 1.8 lbs. Coal bed weight = 20.6 % of test load weightCHARCOALIZATION: good  poor



Inchcape Testing Services NA Inc.

Date: 6-3-97

Manufacturer: VCI

Model: INTREPID II

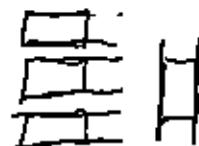
WHI LTO #: 1186D -231 Run: 2

Tech: RH

COMMENTS

NOTE: SPACERS ON FRONT
PIECES SHORTENED TO FIT
TOTAL 4 @ $\frac{3}{4} \times 1\frac{1}{2} \times 5$
10 @ $\frac{3}{4} \times 1\frac{1}{2} \times 4.25$

TEST LOAD CONFIGURATION





Inchcape Testing Services NA Inc.

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Date: 6-3-97

Manufacturer: VCT

Model: INTREPID II

WHILTO #: 11860 -231

Run: 2

Tech: RA

AIR CONTROL 1/4" OPEN BYPASS CLOSED

READING # ON DIAL	REAL TIME	ELAPSED TIME	WEIGHT READING	TEMP FLU GAS	ROOM TEMP	DRAFT DIREC.	TUNNEL		UNIT DOWN	UNIT BACK	UNIT R. SIDE	UNIT L. SIDE	UNIT BOTTOM	CATALYST DOWNSTREAM	TUNNEL VELOCITY	DRAFT	SWITCH NUMBER
							DIA. B	WETT									
0	9:40	0	6.00	440	73	102	75	564	572	522	357	322	1086	1646	.043	.070	C
1		10	5.30	350	75	97	76	453	571	405	332	330	904	1039	.061	C	
2		20	4.80	304	74	93	77	417	529	424	313	324	848	.040	.055	T	
3		30	4.20	328	73	93	76	445	511	486	304	312	853	.040	.055	T	
4		40	3.80	262	74	89	76	451	488	507	302	303	807	.040	.046	C	
5		50	3.20	317	74	91	76	449	494	447	307	311	1086	.040	.054	C	
6		60	2.80	347	73	92	76	467	546	428	311	311	1039	.040	.055	C	
7		70	2.50	261	74	89	77	439	510	422	316	308	758	.040	.056	T	
8		80	2.00	231	74	88	77	488	460	410	342	315	720	.040	.040	C	
9		90															
10		100															
11		110															
12		120															
13		130															
14		140															
15		150															
16		160															
17		170															
18		180															
19		190															
20		200															
21		210															
22		220															
23		230															
24		240															
25		250															
26		260															
COMMENTS: <u>10:21 FIRE STIRRED</u> <u>11:04 FIRE STIRRED</u> <u>Door OPEN</u>																	
<u>DAE</u> <u>10:50, 3.8 lbs REMOVED</u> <u>20sec</u>																	

WHI LTO#: ~~35~~ 11860 AIR CONTROL 1/4" OPEN
MANUFACTURER: VCT MODEL: INTREPID II
SWITCH: N/A (REF)

MANUFACTURER: VCA

MODEL: INTELLIGENT

FIRE SIZE: MEA (PA)

DATE: 6-3-97

PIN#:

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TECHNICIAN: RJ

SWITCH NUMBER:	DATA													RUN # 2													TECHNICIAN: 104	
	1	2	3	4	5	6	7	8	9	10	11	12	13	17	18	19	20	21	22									
REAL TIME	BLASTED TIME	WEIGHT REMAIN.	CO	CO ₂	O ₂	FLUE GAS TEMP	ROOM TEMP	TUNNEL UNIT BACK	UNIT TOP	CAT CENTER	CAT EXIT	DOGM 41 READING	ROTO 1 READING	FILTER TEMP	DOGM 42 READING	DGM TEMP INLET	DGM TEMP OUTLET	FILTER TEMP	TUNNEL VELOCITY	MAX DGM PRESS								
0	11:00	0	870	.06	11.83	7.86	223	74	87	77	440	436	460	350	311	698	958	135	733.0	120	78	78	75	99.0	120	75	75	.040 C-0
1	10:30	.37	10.74	8.81	249	73	88	77	351	421	334	316	330	809	1296	135	735.4	120	79	79	81	101.4	120	77	76	.040 .045 C-2		
2	20:00	.39	12.12	7.73	279	74	89	78	334	438	437	291	337	806	1190	135	737.8	120	80	81	81	103.8	120	78	77	.041 .051 T-2		
3	30:00	.30	12.42	7.62	274	74	89	78	352	448	480	281	342	781	1095	135	740.2	120	81	81	81	106.2	120	77	78	.041 .050 T-2		
4	40:00	.30	12.15	8.06	251	74	89	77	352	448	484	279	347	833	1307	135	742.6	120	80	81	82	108.6	120	79	79	.040 .046 C-2		
5	50:00	.40	11.68	8.36	271	74	90	78	362	457	387	281	351	805	1368	135	745.0	120	81	81	81	111.0	120	79	79	.039 .049 C-2		
6	60:00	.06	12.45	8.68	347	75	93	78	428	496	365	286	348	961	1446	135	747.4	120	81	81	82	113.4	120	79	79	.039 .060 C-2		
7	70:00	.23	8.52	12.04	322	74	92	77	407	575	354	286	341	837	1212	135	749.8	120	80	80	82	115.8	120	79	79	.040 .055 T-2		
8	80:00	.24	8.13	12.31	267	75	90	78	375	494	349	285	335	774	1169	135	752.2	120	81	81	82	118.2	120	80	83	.039 .046 C-2		
9	90:00	.86	14.53	5.29	290	75	91	78	444	475	353	287	325	994	1551	135	756.6	120	81	81	81	120.6	120	80	83	.039 .053 C-2		
10	100:00	.41	9.25	11.32	323	75	93	78	467	508	367	297	315	878	1296	135	757.0	120	81	81	82	123.0	120	80	81	.040 .055 C-2		
11	110:00	.23	9.14	10.98	253	75	91	79	442	480	363	291	304	802	1211	135	759.4	120	82	82	82	125.4	120	80	83	.039 .044 C-2		
12	120:00	.33	14.70	5.43	293	75	92	78	527	471	360	303	297	1017	1683	135	761.8	120	78	80	82	127.8	120	79	79	.041 .052 C-2		
13	130:00	.30	9.97	10.12	316	75	93	78	514	498	353	319	288	929	1446	135	764.2	120	77	79	82	130.2	120	79	79	.039 .052 C-2		
14	140:00	.14	11.63	7.73	241	75	90	78	495	425	345	336	281	787	1212	135	766.6	120	77	78	82	132.6	120	78	79	.040 .040 C-2		
15	150:00	.13	11.79	7.53	229	76	99	78	491	451	352	346	280	778	1180	135	769.0	120	76	77	82	135.0	120	77	78	.040 .085 C-2		
16	160:00	.10	11.58	7.57	219	76	90	79	488	436	366	342	285	734	1085	135	771.4	120	76	77	82	137.4	120	77	78	.039 .085 C-2		
17	170:00	.10	11.01	8.36	214	76	99	79	476	423	374	340	294	715	1080	135	773.8	120	76	77	81	139.8	120	77	77	.040 .031 C-2		
18	180:00	.70	11	10.00	9.41	215	76	88	79	458	415	371	341	298	727	1114	135	776.2	120	76	76	81	142.2	120	77	78	.040 .034 C-2	
19	190:00	.12	9.36	10.26	228	76	88	79	446	413	366	348	298	753	1616	135	778.6	120	77	77	81	144.6	120	77	77	.039 .035 C-2		
20	200:00	.13	9.14	9.43	238	77	91	79	467	415	355	369	302	770	1117	135	781.0	120	76	77	82	147.0	120	77	77	.039 .035 C-2		
21	210:00	.13	9.93	9.61	239	81	92	79	471	419	362	378	308	773	1127	135	783.4	120	76	76	82	149.4	120	77	77	.040 .035 C-2		
22	220:00	0	14	9.51	10.07	238	81	92	79	457	422	370	381	310	776	1146	135	785.8	120	76	76	81	151.079	120	77	77	.039 .035 C-2	
23	230:00																											
24	240:00																											
25	250:00																											
26	260:00																											
27	270:00																											
28	280:00																											
29	290:00																											
30	300:00																											
31	310:00																											
32	320:00																											
33	330:00																											
34	340:00																											
35	350:00																											
36	360:00																											
37	370:00																											
38	380:00																											
39	390:00																											
40	400:00																											
41	410:00																											
42	420:00																											
43	430:00																											
44	440:00				</td																							

COMMENTS: AIR CONTROL WAS NOT ADJUSTED DURING LOADING

TEST LOADED IN 50 SECONDS DOOR AND BY PASS CLOSED AFTER LOADING



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INTREPID IIWHLTO #: 1186D 231Run: 3Tech: RH

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.18 (inches Hg.) Static pressure (P_s) .124 (inches w.c.)Inside diameter: Port A 6in Port B 6in Tunnel cross sectional area: .1963Ft²

Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H ₂ O)	Tunnel Temperature (°F)	$\sqrt{\Delta_p}$
A-Centroid	3.00	.040	106	, 2000
B-Centroid	3.00	.039	105	, 1975
A-1	0.40	.036	106	, 1897
A-2	1.50	.040	106	, 2000
A-3	4.50	.040	106	, 2000
A-4	5.60	.036	106	, 1897
B-1	0.40	.036	106	, 1897
B-2	1.50	.039	106	, 1975
B-3	4.50	.040	106	, 2000
B-4	5.60	.034	106	, 1844
		AVERAGE	105.9	, 1944

Adjustment factor application

$$V_t = K_p C_p F_p (\sqrt{\Delta_p}) AVG \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_t = K_p C_p (\sqrt{\Delta_p}) avg. \sqrt{\frac{T_s}{P_m}} , 9805$$

Where,

 C_p = pitot tube coefficient = 0.99 for standard pitot Δ_p = manometer reading (inches H₂O) T_s = average absolute dilution tunnel temperature (°F + 460) P_m = absolute dilution tunnel gas pressure or $P_{bar} + P_s$ inches H₂O P_s = static pressure 13.6

$$F_p = \frac{(\sqrt{\Delta_p})avg}{(\sqrt{\Delta_p})centroid}$$

Adjustment factor for alternative pitot tube placement:

 M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured) K_p = 85.49 pitot tube constant, (conversion factor for English units) $(\sqrt{\Delta_p})avg$. = average of the square roots of the velocity heads (Δ_p) measured at each traverse point. $(\sqrt{\Delta_p})centroid$ = average of the square roots of the velocity heads measured at the tunnel centroid (inches of H₂O)



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INTREPID IIWHI LTO #: 118LD -231Run: 3Tech: RA

Moisture Meter Calibration Check:

Pre/Post Checks

Time: <u>7:15</u>	X: <input checked="" type="checkbox"/>	Y: <input type="checkbox"/>	12: <input type="checkbox"/>	22: <input checked="" type="checkbox"/>
-------------------	----------------------------------------	-----------------------------	------------------------------	-----------------------------------------

Facility Conditions:

Air Velocity.....

Pre-Test

Post-Test

<u>0</u>	fpm	<u>0</u>	fpm
----------	-----	----------	-----

Smoke Capture Check.....

<u>6-2-97</u>	
<u>6-2-97</u>	

Wood Heater Conditions:

Date Wood Heater Stack Cleaned.....

<u>0</u>	
<u>,039</u>	

Date Dilution Tunnel Cleaned.....

138,337

Induced Draft Check.....

Tunnel Velocity.....

Flow Rate 140 cfm $\pm 10\%$.

<u>0</u>	
----------	--

Pitot Leak Check:

Side A.....

<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-------------------------------------	-------------------------------------

Side B.....

Temperature System:

Ambient (65° - 90°F).....

<input checked="" type="checkbox"/>	°F
-------------------------------------	----

Wood Heater Surface ($\pm 125^\circ F$).....+174 °F

Proportional Checks:

CO Analyzer Drift Check.....

<input checked="" type="checkbox"/>

CO₂ Analyzer Check.....

<input checked="" type="checkbox"/>

O₂ Analyzer Check.....

<input checked="" type="checkbox"/>

Thermocouple check.....

<input checked="" type="checkbox"/>

Sampling Train ID Numbers:

Probe.....

<u>5</u>	<u>6</u>
----------	----------

Filter Front.....

<u>21</u>	<u>23</u>
-----------	-----------

Filter Back.....

<u>22</u>	<u>24</u>
-----------	-----------

Filter Thermocouple.....

<u>19</u>	<u>22</u>
-----------	-----------

Filter 5G-3 (<90°F).....

<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
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Termocouple Identification Number

Flue 1

Room 2

Dilution Tunnel Dry Bulb 3

Dilution Tunnel Wet Bulb 4

Unit Top 5

Unit Back 6

Unit Right Side 7

Unit Left Side 8

Unit Bottom 9

Catalyst/Combustion Chamber 10



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VEIModel: INTREPID IIWHI LTO #: 1186D -231Run: 3Tech: RH

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	<u>10</u> lbs, Class F	<u>10.0</u> lbs
Wood	<u>10</u> lbs, Class F	<u>10.00</u> lbs
Analytical	<u>100G</u>	<u>100,000G</u>
	<u>100 mg</u> , Class S	<u>100 mg</u>

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE: 50%–150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE 20%–80% of ideal test load weight, ± 0.1 lbs or 1%
WOOD SCALE 20%–80% of ideal test load weight, ± 0.1 lbs or 1%



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INTREPID IIWHI LTO #: 1860Run: 3Tech: RA

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Unplugged Flow Rate = .25cfm				
Vacuum (inches Hg.)	<u>10"</u>	<u>10"</u>	<u>10"</u>	<u>10"</u>
Final 1 minute DGM (ft ³)	<u>785,942</u>	<u>810,463</u>	<u>151,890</u>	<u>176,321</u>
Initial 1 minute DGM (ft ³)	<u>785,937</u>	<u>810,461</u>	<u>151,890</u>	<u>176,321</u>
Change (C) (ft ³)	<u>.005</u>	<u>.002</u>	<u>0</u>	<u>0</u>
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK	/	/	/	/

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	<u>10"</u>	<u>10"</u>
Rotometer Reading (mm)	<u>0</u>	<u>0</u>
Flow Rate (CFM)	<u>0</u>	<u>0</u>
Allowable (.04 x Sample Rate)	/	/
Check OK	/	/



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VETModel: INTREPID IIWHI LTO #: 11860-231Run: 3Tech: PA

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
	Actual	Should Be	Actual	Should Be	Actual	Should Be
CO	0	0	9.99	9.99	.97	.986
CO ₂	0	0	24.30	24.30	9.47	9.98
O ₂	0	0	20.93	20.93	10.28	10.17

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	0	9.96	.98	0	.03	.01	/	
CO ₂	0	24.36	9.44	0	.14	.03	/	
O ₂	.04	20.82	10.29	.04	.11	.01	/	

* Greater than $\pm 5\%$ of the range used.



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VETModel: INTREPID IIWHLTO #: 11860 -231Run: 3Tech: R4

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Samples in Desiccator Date: 6-4-97 Time: 11:51

SYSTEM 1		SYSTEM 2	
Probe and Front Half Housing #	Filter Numbers	Probe and Front Half Housing #	Filter Numbers
5	21+22	6	23+24
Post Test Weight:	91.0643 grams	.2384 grams	91.5731 grams
Pre Test Weight:	91.0649 grams	.2363 grams	91.5731 grams
Gain:	0 grams	.0021 grams	.0024 grams
	a1	b1	a2
			b2

Total Gain: a1 + b1 = .0021 grams a2 + b2 = .0024 grams

SYSTEM 1				SYSTEM 2				TEMP	HUMID
Pre-test Weight Record	Probe & Housing Number	Front Filter Number	Back Filter Number	Probe & Housing Number	Front Filter Number	Back Filter Number			
Date	Time	5	21	22	6	23	24	°F	%
6-2-97	7:00	91.0639	,1175	,1194	91.5737	,1176	,1181	71	46
6-3-97	6:55	91.0641	,1173	,1189	91.5731	,1177	,1179	73	45
6-4-97	6:50	91.0643	,1173	,1190	91.5731	,1177	,1181	72	48
		Total		,2363	Total		,2358		

SYSTEM 1			SYSTEM 2			TEMP	HUMID
Post-test Weight Record	Probe & Housing Number	Combined Filter Weight Number	Probe & Housing Number	Combined Filter Weight Number			
Date	Time	5	21+22	6	23+24	°F	%
6-4-97	11:51	91.0648	,2385	91.5731	,2384	75	46
6-5-97	6:45	91.0644	,2384	91.5734	,2382	73	44
6-9-97	7:00	91.0643	,2384	91.5731	,2382	71	49
6-9-97	10:12	91.0643	,2384	91.5731	,2382	76	44



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INTREPID IIWHILTO #: 11860 -231Run: 3Tech: RA

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft ³)	810,451	176,315
Initial (ft ³)	785,942	151,890

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.18	29.18
Wet Bulb (°F)	61	63
Dry Bulb (°F)	71	77
Humidity (%)	57	46



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INTREPID IIWHI LTO #: 118LD-231Run: 3Tech: PA

FUEL DATA PRE-TEST LOAD

FUEL DESCRIPTION:Kindling weight: 3.7 lbs.Consisting of: Scrap and paperFire lit Time: 7:59Pre-test load weight: 9.29 lbs.Consisting of: 2X4X 6 inchesTime loaded: 8:25

Pre-test moisture content:

Uncorrected: 19.825 %Corrected Dry: 21.21 %Wet: 17.50 %Test Air Control Settings: 1/2 OPENTime: 7:59Test Unit Fan Settings: full open

Time: _____

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	<u>8.17</u> lbs.	<u>9.08</u> lbs.	<u>9.99</u> lbs.
Fire Box Volume:	<u>1,297</u> ft. ³	Ideal Length:	inches
Load Volume:	<u>.2321</u> ft. ³	Loading Density:	<u>6.762</u> lbs./ft. ³
Number of Spacers	<u>14</u> $\frac{3}{4} \times 1\frac{1}{2} \times 5$	Load Density:	<u>37.786</u> lbs./ft. ³

Piece Size	Weight	Meter Moisture Content (% dry)*		
<u>2 x 4 x 17 1/4 in.</u>	<u>2.14</u> lbs.	<u>19.3</u> %	<u>19.5</u> %	<u>19.7</u> %
<u>2 x 4 x 17 3/4 in.</u>	<u>2.07</u> lbs.	<u>19.3</u> %	<u>19.0</u> %	<u>19.5</u> %
<u>2 x 4 x 17 1/2 in.</u>	<u>2.35</u> lbs.	<u>19.5</u> %	<u>18.5</u> %	<u>19.2</u> %
<u>2 x 4 x 17 3/4 in.</u>	<u>2.21</u> lbs.	<u>19.0</u> %	<u>19.1</u> %	<u>19.4</u> %
<u>x x in.</u>	lbs.	%	%	%
<u>x x in.</u>	lbs.	%	%	%
<u>x x in.</u>	lbs.	%	%	%

*uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 8.77 lbsDRY WEIGHT: 3.30 kg.

AVERAGE MOISTURE CONTENT:

(DRY) 19.25 % CORRECTED TO TWO PIN: (DRY) 20.58 % (WET) 17.06 %

COAL BED RANGE:

1.8 lbs. to 2.1 lbs. (20% to 25% of test load)

TEST CHARGE:

Time loaded: 9.48 Coal bed weight: 1.8 lbs. Coal bed weight = 20.5 % of test load weight

CHARCOALIZATION:

good poor

WHI LTO#: 11860 AIR CONTROL FULL OPEN
MANUFACTURER: VCI MODEL: INTREPID II

MANUFACTURER: VET

AIR CONTROL FULL OPEN

MODEL: INTREPID II

FIRE SIZE: 11/4

DATE: 6-17-63

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TECHNICIAN: /

COMMENTS:

TEST LOADED IN 30 SECONDS

4

TEST LOADED IN 50 SECONDS AIR-CONTROL NOT ACT DURING START BY PASS CLOSED AFTER LOADING



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VEIModel: INTREPID IIWHLTO #: 11860-231Run: 4Tech: RA

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.18 (inches Hg.) Static pressure (P_s) 121 (inches w.c.)Inside diameter: Port A 6in. Port B 6in. Tunnel cross sectional area: .1963Ft²

Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H ₂ O)	Tunnel Temperature (°F)	$\sqrt{\Delta_p}$
A-Centroid	3.00	.038	113	,1949
B-Centroid	3.00	.039	114	,1975
A-1	0.40	.034	113	,1844
A-2	1.50	.037	113	,1924
A-3	4.50	.038	113	,1949
A-4	5.60	.035	113	,1871
B-1	0.40	.035	113	,1871
B-2	1.50	.039	114	,1975
B-3	4.50	.038	113	,1949
B-4	5.60	.034	113	,1844
AVERAGE			113.2	,1915

Adjustment factor application

$$V_t = K_p C_p F_p (\sqrt{\Delta_p}) AVG \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_t = K_p C_p (\sqrt{\Delta_p}) avg. \sqrt{\frac{T_s}{P_s M_s}} , 9760$$

Where,

 C_p = pitot tube coefficient = 0.99 for standard pitot Δ_p = manometer reading (inches H₂O) T_s = average absolute dilution tunnel temperature (°F + 460) P_s = absolute dilution tunnel gas pressure or $P_{bar} + P_i$ P_s = static pressure 13.6 inches H₂O

$$F_p = \frac{(\sqrt{\Delta_p})avg}{(\sqrt{\Delta_p})centroid}$$

Adjustment factor for alternative pitot tube placement:

 M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured) K_p = 85.49 pitot tube constant, (conversion factor for english units) $(\sqrt{\Delta_p})avg$ = average of the square roots of the velocity heads (Δ_p) measured at each traverse point. $(\sqrt{\Delta_p})centroid$ = average of the square roots of the velocity heads measured at the tunnel centroid (inches of H₂O)



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VEIModel: INTEP 10 IIWHLTO #: 11860-231Run: 4Tech: RA

Moisture Meter Calibration Check:

Pre/Post Checks

Time: <u>7:30</u>	X: <input checked="" type="checkbox"/>	Y: <input type="checkbox"/>	12: <input type="checkbox"/>	22: <input type="checkbox"/>
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Facility Conditions:

Air Velocity.....

Pre-Test

fpm

Post-Test

fpm

Smoke Capture Check.....

<u>0</u>	<u>✓</u>
----------	----------

Wood Heater Conditions:

Date Wood Heater Stack Cleaned.....

6-2-97

Date Dilution Tunnel Cleaned.....

6-2-97

Induced Draft Check.....

0

Tunnel Velocity.....

040

Flow Rate 140 cfm ±10%.

139,025

Pitot Leak Check:

Side A.....

✓✓

Side B.....

✓✓

Temperature System:

Ambient (65° - 90°F).....

75 °F

Wood Heater Surface (±125°F).....

-46.4 °F

Proportional Checks:

CO Analyzer Drift Check.....

✓CO₂ Analyzer Check.....✓O₂ Analyzer Check...../

Thermocouple check.....

✓

Sampling Train ID Numbers:

Probe.....

Train 1

Train 2

78252726281922✓✓

Thermocouple Identification Number

Flue 1

Room 2

Dilution Tunnel Dry Bulb 3

Dilution Tunnel Wet Bulb 4

Unit Top 5

Unit Back 6

Unit Right Side 7

Unit Left Side 8

Unit Bottom 9

Catalyst/Combustion Chamber 10



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCEModel: INDEPENDENTWHLTO #: 11860 -231Run: 4Tech: RA

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	<u>10</u> lbs, Class F	<u>10.0</u> lbs
Wood	<u>10</u> lbs, Class F	<u>10.00</u> lbs
Analytical	<u>100G</u> 100 mg, Class S	<u>100,0000G</u> <u>106</u> mg

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE 20%-80% of ideal test load weight, ± 0.1 lbs or 1%
WOOD SCALE 20%-80% of ideal test load weight, ± 0.1 lbs or 1%



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCTModel: INTEPIDIWHI LTO #: 1186D-231Run: 4Tech: R4

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Unplugged Flow Rate = .25cfm				
Vacuum (inches Hg.)	<u>10"</u>	<u>10"</u>	<u>10"</u>	<u>10"</u>
Final 1 minute DGM (ft ³)	<u>810.464</u>	<u>840.120</u>	<u>176.322</u>	<u>205.946</u>
Initial 1 minute DGM (ft ³)	<u>810.464</u>	<u>840.120</u>	<u>176.321</u>	<u>205.945</u>
Change (C) (ft ³)	<u>0</u>	<u>0</u>	<u>.001</u>	<u>.001</u>
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	<u>10'</u>	<u>10"</u>
Rotometer Reading (mm)	<u>0</u>	<u>0</u>
Flow Rate (CFM)	<u>0</u>	<u>0</u>
Allowable (.04 x Sample Rate)	✓	
Check OK		✓



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INDEPILOTWHI LTO #: 11860-231Run: 4Tech: PA

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
	Actual	Should Be	Actual	Should Be	Actual	Should Be
CO	0	0	9.99	9.99	.97	.982
CO ₂	0	0	24.58	24.52	9.50	9.98
O ₂	0	0	20.93	20.93	10.28	10.17

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	0	9.97	.97	0	.02	0	✓	
CO ₂	0	24.52	9.49	0	.02	.01	✓	
O ₂	.02	20.83	10.26	.02	.1	.02	✓	

* Greater than $\pm 5\%$ of the range used.



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VERIModel: INTREPID IIWHILTO # 11860 -231Run: 4Tech: RA

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Samples in Desiccator Date: 6-4-97 Time: 17:40

		SYSTEM 1		SYSTEM 2	
		Probe and Front Half Housing #	Filter Numbers	Probe and Front Half Housing #	Filter Numbers
		7	25+26	8	27+28
Post Test Weight:		90.9551 grams	2444 grams	92.1923 grams	2448 grams
Pre Test Weight:		90.9550 grams	2378 grams	92.1921 grams	2377 grams
Gain:		.0001 grams	0.0061 grams	.0001 grams	0.0071 grams
		a1	b1	a2	b2

Total Gain: a1 + b1 = 0067 grams a2 + b2 = 0072 grams

		SYSTEM 1			SYSTEM 2			TEMP	HUMID
Pre-test Weight Record	Probe & Housing Number	Front Filter Number	Back Filter Number	Probe & Housing Number	Front Filter Number	Back Filter Number			
Date	Time	7	25	26	8	27	28	°F	%
6-4-97	6:55	90.9551	,1187	,1191	92.1923	,1187	,1191	73	46
6-4-97	6:55	90.9550	,1186	,1192	92.1921	,1185	,1192	72	48
		Total	2378	Total	2377				

		SYSTEM 1			SYSTEM 2			TEMP	HUMID
Post-test Weight Record	Probe & Housing Number	Combined Filter Weight Number		Probe & Housing Number	Combined Filter Weight Number				
Date	Time	7	25+26	8	27+28			°F	%
6-4-97	6:40	90.9552	,2448	92.1923	,2448			77	41
6-5-97	6:45	90.9551	,2446	92.1923	,2449			73	44
6-9-97	7:00	90.9551	,2444	92.1922	,2448			71	49
6-9-97	10:15	90.9551	,2444	92.1922	,2448			76	44



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INTREPID IIWHI LTO #: 11860-231Run: 4Tech: RK

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft ³)	840,110	205,940
Initial (ft ³)	810,464	176,322

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.18	29.11
Wet Bulb (°F)	63	62
Dry Bulb (°F)	77	81
Humidity (%)	46	33



Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VCIModel: INTREPID IIWHLTO #: 11960-231Run: 4Tech: R4

FUEL DATA PRE-TEST LOAD

FUEL DESCRIPTION:Kindling weight: 5.5 lbs. Consisting of: Scrap and paperFire lit Time: 5:55 11:52Pre-test load weight: 9.87 lbs. Consisting of: 2X4X 6 inchesTime loaded: 12:08Pre-test moisture content: Uncorrected: 18.75 % Corrected Dry: 16.03 %Wet: 16.68 %Test Air Control Settings: MID RANGETime: 12:24Test Unit Fan Settings: NA

Time: _____

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	<u>8.17</u> lbs.	<u>9.08</u> lbs.	<u>9.99</u> lbs.
Fire Box Volume:	<u>1.297</u> ft. ³	Ideal Length:	inches
Load Volume:	<u>1.321</u> ft. ³	Loading Density:	<u>6.677</u> lbs./ft. ³
Number of Spacers	<u>14</u> <u>3/4x1 1/2x5</u>	Load Density:	<u>37.312</u> lbs./ft. ³

Piece Size	Weight	Meter Moisture Content (% dry)*		
<u>2 x 4 x 15 3/4 in.</u>	<u>2.11</u> lbs.	<u>17.9</u> %	<u>18.5</u> %	<u>18.2</u> %
<u>2 x 4 x 15 1/2 in.</u>	<u>1.94</u> lbs.	<u>19.5</u> %	<u>18.6</u> %	<u>19.0</u> %
<u>2 x 4 x 15 3/4 in.</u>	<u>2.36</u> lbs.	<u>19.0</u> %	<u>19.0</u> %	<u>18.7</u> %
<u>2 x 4 x 15 3/4 in.</u>	<u>2.25</u> lbs.	<u>18.7</u> %	<u>19.3</u> %	<u>19.9</u> %
<u>x x in.</u>	lbs.	%	%	%
<u>x x in.</u>	lbs.	%	%	%
<u>x x in.</u>	lbs.	%	%	%

*Uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 8.66 lbsDRY WEIGHT: 3.27 kg.**AVERAGE MOISTURE CONTENT:**(DRY) 18.86 % CORRECTED TO TWO PIN: (DRY) 20.14 % (WET) 16.77 %**COAL BED RANGE:**1.8 lbs. to 2.1 lbs. (20% to 25% of test load)**TEST CHARGE:**Time loaded: 13:35 Coal bed weight: 1.9 lbs. Coal bed weight = 21.9 % of test load weightCHARCOALIZATION: good | X | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | poor

Inchcape Testing Services NA Inc.

Date: 6-4-97

Manufacturer: VCT

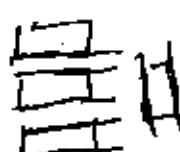
Model: INTREPID II

WHILTO #: 1186D-231 Run: 4

Run: 4

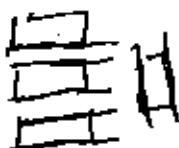
Tech: RH

COMMENTS

<p>3 SPACERS ON FRONT PIECES MEASURE $4\frac{1}{4}$" SO PIECES WOULD FIT</p>	<p>TEST LOAD CONFIGURATION</p> 

SPACERS ON FRONT
PIECES MEASURE
4 1/4" SO PIECES
WOULD FIT

TEST LOAD CONFIGURATION





Inchcape Testing Services NA Inc.

Date: 6-4-97Manufacturer: VEIModel: INTREPID IIWHL TO #: 11860-231Run: 4Tech: PAAIR CONTROL MIDWAY BETWEEN FULL OPEN + CLOSED

SWITCH NUMBER	1	2	3	4	5	6	7	8	9	10	DRAFT	SOURCE	
READING #	REAL TIME	WEIGHT KGS/MIN/HR	WEIGHT LBS/MIN/HR	ROOM TEMP	DUCT TEMP	TUNNEL TEMP	DUCT WET	UNIT TOP	UNIT BACK	UNIT R. SIDE	UNIT L. SIDE	CATALYST DOWNSTREAM	TUNNEL VELOCITY
0	12:21	0	860	398	80	110	84	633	518	431	505	463	947
1		10	760	408	80	109	84	551	544	403	540	453	1010
2		20	640	427	80	109	85	503	578	385	535	443	1037
3		30	550	448	80	110	85	515	631	374	375	431	1180
4		40	450	454	80	111	85	533	691	376	617	416	1268
5		50	320	451	81	113	85	617	699	390	518	405	1114
6		60	250	430	81	112	85	633	657	402	486	392	976
7		70											
8		80											
9		90											
10		100											
11		110											
12		120											
13		130											
14		140											
15		150											
16		160											
17		170											
18		180											
19		190											
20		200											
21		210											
22		220											
23		230											
24		240											
25		250											
26		260											
COMMENTS: <u>12:47 FIRE STIRRED</u>				<u>13:34 FIRE STIRRED</u> <u>DOOR OPEN 30 SEC</u>									
<u>13:07 , 3 lbs COALS REMOVED</u>													

WHI LTO#: 118D, AIR CONTROL AT CENTER OF RANGE

MANUFACTURER: JL

MODEL: INTREPID

FIRE SIZE: WED HIGH

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SWITCH

MODEL: INTELLIGENT

DATE: 6-4-97

RUN#: 4

TECHNICIAN: *RK*

COMMENTS:

TEST LOADED IN **40** SECONDS

~~DOOR CLOSED AFTER LOADING AIR CONTROL NOT ADJUSTED DURING LOADING~~

Manufacturer: VCI

Model: Intrepid II

Date: 6-2-97

Run: 1

Control #: 11860

Test Duration: 321

Barometer (in.Hg):

Wet Bulb (F):

Dry Bulb (F):

Humidity (%):

Start	End
29.05	29.05
59	64
71	83
49	35

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency: 83.05%
 Combustion Efficiency: 99.00%
 Heat Transfer Efficiency: 83.89%

Heat Output: 9390 BTU/Hr 9898 KJ/Hr
 Heat Input: 11305 BTU/Hr 11918 KJ/Hr

Burn Duration: 5.35 Hours

Burn Rate: 1.32 Lb/Hr 0.589 Kg/Hr

Average Stove Temperature: ERR Stack Temp: 183.3 Deg.F 84.0 Deg.C

Average	0.3	10.92	9.086	183.2727	79.61	0.09526	0.617906	ERR	ERR	7.5285	0.986	
Elapsed Time	Weight Remaining	CO	CO2	O2	Flue Gas	Room Temp	% Comb	Combust	Heat	Net Eff	air Eff	Fuel MN
0	8.46	0.07	10.07	9.54	169	76	-0.51	108.9%	42.0%	45.8%	7	3.84
10	8.10	0.22	9.89	9.32	197	77	-0.68	111.0%	54.6%	61.0%	8	3.68
20	7.80	0.27	11.14	8.86	214	77	1.00	84.1%	52.5%	44.1%	6	3.54
30	7.30	0.27	11.72	8.28	220	76	1.45	79.0%	60.2%	47.6%	6	3.31
40	6.80	0.23	12.19	7.80	211	78	1.03	77.6%	65.7%	51.0%	6	3.13
50	6.40	0.23	12.53	7.72	203	77	2.20	72.1%	69.4%	50.0%	6	2.90
60	6.00	0.22	12.89	7.25	198	78	2.06	74.3%	73.2%	54.4%	6	2.72
70	5.50	0.20	10.40	10.11	205	78	1.88	71.9%	74.5%	53.5%	7	2.50
80	5.20	0.20	12.55	8.39	195	78	2.85	68.4%	76.4%	50.7%	6	2.38
90	4.90	0.13	11.17	8.94	180	78	1.05	84.3%	80.2%	67.6%	8	2.22
100	4.70	0.12	11.86	8.54	164	77	1.47	80.1%	81.4%	65.2%	7	2.13
110	4.40	0.14	12.84	7.65	161	77	1.57	80.5%	82.9%	66.7%	7	2.00
120	4.20	0.20	13.27	7.12	167	78	1.38	83.0%	83.7%	69.5%	7	1.91
130	3.90	0.25	10.77	9.70	198	77	0.94	85.1%	83.1%	70.7%	8	1.77
140	3.60	0.22	10.38	10.15	197	78	0.73	87.7%	84.2%	73.0%	9	1.63
150	3.30	0.18	9.70	10.81	190	79	0.40	92.3%	85.4%	78.9%	10	1.50
160	3.10	0.13	11.11	9.71	168	81	0.77	88.3%	87.4%	77.2%	9	1.41
170	2.90	0.14	11.63	8.58	166	81	-0.14	101.5%	88.3%	89.6%	10	1.32
180	2.70	0.15	12.28	8.05	173	81	-0.06	100.1%	88.8%	89.0%	9	1.23
190	2.40	0.16	11.24	8.68	177	82	-0.53	107.7%	89.4%	96.2%	11	1.09
200	2.30	0.11	9.54	10.50	169	80	-0.77	114.7%	89.3%	102.5%	14	1.04
210	2.10	0.11	9.41	10.57	165	82	-0.91	118.2%	90.0%	108.3%	15	0.95
220	2.00	0.09	8.76	11.19	168	82	-1.01	122.4%	89.9%	110.0%	17	0.91
230	1.80	0.20	13.00	6.81	180	81	-1.04	114.6%	91.2%	104.4%	11	0.82
240	1.60	0.16	10.11	9.65	176	82	-1.23	123.9%	90.9%	112.7%	16	0.73
250	1.50	0.12	9.45	10.29	165	82	-1.31	128.4%	91.2%	117.1%	18	0.68
260	1.40	0.11	9.61	10.14	164	82	-1.31	128.1%	91.5%	117.3%	18	0.64
270	1.20	0.13	10.73	9.08	166	82	-1.23	123.2%	92.4%	113.8%	17	0.54
280	1.10	0.12	10.01	9.68	170	82	-1.12	122.7%	92.3%	113.2%	19	0.50
290	0.40	4.72	13.55	4.36	223	81	0.20	81.8%	94.8%	77.5%	11	0.18
310	0.10	0.12	7.90	11.78	218	82	-1.33	139.1%	90.8%	128.3%	35	0.05
320	0.10	0.09	9.19	10.20	165	82	-1.69	144.4%	93.3%	134.7%	31	0.05
321	0.00	0.10	9.47	10.00	166	83	-1.55	138.7%	93.7%	130.0%	30	0.00

Manufacturer: Vermont Castings

Model: Intrepid II

Date: 6-3-97

Run: 2

Control #: 11880

Test Duration: 220

	Start	End
'Barometer (in.Hg):	29.14	29.14
Wet Bulb (F):	60	65
Dry Bulb (F):	73	80
Humidity (%):	47	44

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency: 83.92%
 Combustion Efficiency: 99.00%
 Heat Transfer Efficiency: 84.76%

Heat Output:	14304	BTU/Hr	15174 KJ/Hr
Heat Input:	17153	BTU/Hr	18063 KJ/Hr

Burn Duration: 3.67 Hours

Burn Rate: 1.97 Lb/Hr 0.882 Kg/Hr

Average Stove Temperature: ERR Stack Temp: 281.7 Deg.F 127.6 Deg.C

Average	0.242	10.98	8.897	261.6957	75.57	-0.0684	0.453067	ERR	5.8476	0.645
Elapsed Time	Weight Remaining	CO	CO2	O2	Flue Gas	Room Temp	% Comb	Combust	Heat	Net
0	8.70	0.08	11.83	7.88	223	74	-0.17	102.2%	36.6%	37.5%
10	8.30	0.37	10.74	8.86	249	73	0.23	94.5%	47.2%	44.6%
20	7.60	0.39	12.12	7.73	279	74	1.38	80.1%	56.5%	45.2%
30	6.90	0.30	12.42	7.62	274	74	1.90	74.9%	64.0%	48.0%
40	6.30	0.30	12.15	8.08	251	74	2.11	72.3%	69.2%	50.0%
50	5.80	0.40	11.68	8.36	271	74	1.72	75.7%	71.9%	54.4%
60	5.10	0.08	12.45	8.68	347	75	2.81	87.1%	71.2%	47.8%
70	4.50	0.23	8.52	12.04	322	74	1.04	80.0%	73.7%	59.0%
80	4.10	0.29	8.13	12.31	267	75	0.64	85.8%	78.1%	67.1%
90	3.60	0.80	14.55	5.29	290	75	0.67	90.0%	82.9%	74.6%
100	3.00	0.41	9.25	11.32	323	75	0.43	90.3%	81.0%	73.1%
110	2.70	0.23	9.14	10.98	253	75	-0.47	107.7%	84.9%	91.5%
120	2.20	0.30	14.70	5.43	293	75	-0.38	103.1%	87.7%	90.5%
130	1.70	0.30	9.97	10.12	316	75	-0.69	111.4%	86.0%	95.7%
140	1.40	0.14	11.83	7.73	241	75	-1.76	131.7%	89.8%	118.0%
150	1.20	0.13	11.79	7.53	229	76	-1.82	133.0%	90.4%	120.3%
160	1.00	0.10	11.58	7.57	219	76	-2.08	140.1%	90.8%	127.2%
170	0.80	0.10	11.01	8.38	214	76	-1.77	135.9%	91.3%	124.0%
180	0.70	0.11	10.00	9.41	215	76	-1.72	139.0%	90.9%	126.3%
190	0.60	0.12	9.36	10.26	228	76	-1.44	134.1%	90.5%	121.4%
200	0.40	0.13	10.14	9.43	238	79	-1.45	131.7%	91.0%	119.9%
210	0.20	0.13	9.93	9.61	239	81	-1.46	133.2%	91.2%	121.5%
220	0.00	0.14	9.51	10.07	238	81	-1.37	132.7%	91.3%	121.2%

Manufacturer: Vermont Casting
 Model: Intrepid II
 Date: 6-4-97
 Run: 3
 Control #: 11860
 Test Duration: 102

Barometer (in.Hg):
 Wet Bulb (F):
 Dry Bulb (F):
 Humidity (%):

Start	End
29.18	29.18
61	63
71	73
57	46

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency: 73.52%
 Combustion Efficiency: 95.39%
 Heat Transfer Efficiency: 77.07%

Heat Output: 27921 BTU/Hr 29433 KJ/Hr
 Heat Input: 37977 BTU/Hr 40034 KJ/Hr

Burn Duration: 1.70 Hours

Burn Rate: 4.28 Lb/Hr 1.941 Kg/Hr

Average Stove Temperature: ERR Stack Temp: 460.9 Deg.F 238.3 Deg.C

*	Average	0.369	13.25	6.596	460.9167	79.08	0.01835	0.231829	ERR	ERR	2.926	0.302
Elapsed Time Remaining	Weight	CO	CO2	O2	Flue Gas	Room Temp	% Comb	% Combust	Heat	Net	*	*
0	8.77	0.18	11.42	8.92	460	76	0.83	87.4%	14.2%	12.4%	6	3.98
10	7.50	1.18	13.93	5.36	461	78	1.92	75.2%	50.2%	37.7%	5	3.40
20	6.00	0.54	15.04	4.66	479	78	2.20	75.7%	65.0%	49.3%	5	2.72
30	4.60	0.68	18.40	1.84	495	79	2.73	76.2%	73.7%	56.2%	4	2.09
40	3.30	1.08	17.99	1.69	794	79	0.67	91.2%	72.8%	66.3%	5	1.50
50	2.20	0.04	16.71	3.50	481	79	-0.44	104.7%	84.0%	88.0%	8	1.00
60	1.40	0.10	12.55	7.76	481	80	-0.57	108.2%	83.7%	90.5%	13	0.64
70	1.00	0.21	8.24	11.84	430	80	-1.09	126.4%	81.3%	102.7%	24	0.45
80	0.70	0.10	9.85	9.56	385	80	-1.73	140.1%	85.3%	119.5%	23	0.32
90	0.40	0.09	11.70	7.80	360	80	-1.53	129.1%	88.2%	113.9%	21	0.18
100	0.10	0.12	11.69	8.12	353	80	-1.04	118.8%	89.2%	108.0%	21	0.05
102	0.00	0.13	11.53	8.31	352	80	-0.97	117.7%	89.4%	105.2%	22	0.00

Manufacturer: Vermont Castings

Model: Intrepid II

Date: 6-4-97

Run: 4

Control #: 11880

Test Duration: 123

'Barometer (in.Hg):

Wet Bulb (F):

Dry Bulb (F):

Humidity (%):

Start	End
29.18	29.11
63	62
77	81
46	33

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency: 79.55%
 Combustion Efficiency: 99.00%
 Heat Transfer Efficiency: 80.35%

Heat Output: 24498 BTU/Hr 25625 KJ/Hr
 Heat Input: 30796 BTU/Hr 32465 KJ/Hr

Burn Duration: 2.05 Hours

Burn Rate: 3.52 Lb/Hr 1.595 Kg/Hr

Average Stove Temperature: ERR Stack Temp: 382.9 Deg.F 195.0 Deg.C

Elapsed Time	Weight Remaining	Average			Flue Gas	Room Temp	Comb %	Combust %	Heat Eff	Transfer Eff	ERR Net	3.8104	0.341 *
		CO	CO2	O2									
0	8.66	0.16	6.79	11.86	440	81	-2.24	182.1%	45.2%	82.4%	15	3.93	*
10	7.70	0.67	11.45	7.58	388	82	0.22	93.6%	53.8%	50.3%	7	3.49	*
20	6.80	1.22	12.83	5.23	418	81	0.01	94.8%	65.7%	62.3%	6	2.09	*
30	5.20	0.21	15.34	4.84	480	82	2.21	77.1%	70.3%	54.2%	5	2.38	*
40	4.00	0.70	18.28	3.84	454	82	1.58	83.1%	77.1%	64.0%	5	1.81	*
50	2.70	3.73	16.00	2.46	455	83	0.67	84.1%	82.2%	69.1%	6	1.23	*
60	1.70	0.30	16.27	3.44	430	84	-1.08	111.3%	88.5%	90.2%	9	0.77	*
70	1.30	0.15	8.22	11.75	401	83	-1.02	124.8%	82.0%	102.3%	22	0.59	*
80	1.00	0.10	9.31	10.28	349	84	-1.53	138.2%	85.7%	116.7%	22	0.45	*
90	0.80	0.11	11.39	8.18	318	83	-1.50	128.2%	88.7%	113.7%	19	0.38	*
100	0.50	0.12	11.54	8.22	311	83	-1.19	121.8%	89.8%	109.3%	19	0.23	*
110	0.30	0.14	10.87	8.93	311	84	-1.10	121.4%	89.7%	109.0%	22	0.14	*
120	0.10	0.17	10.62	9.25	313	84	-0.95	118.5%	89.9%	106.6%	23	0.05	*
123	0.00	0.16	10.38	9.55	313	84	-0.85	116.6%	90.0%	105.0%	25	0.00	*