Arada Stoves LTD

Project # 035-S-075-1
Model: Farringdon 16
Type: Free Standing Residential Catalytic Wood Fired Heater
February 24, 2017 (Dirigo)
Revised: July 11, 2022, August 30, 2022

EPA Test Method 28R for Certification and Auditing of Wood Heaters

Contact:
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Revision:

July 11, 2022

- Changed CO from g/hr to g/min
- Updated Summary Table for clarity.
- Added 1st hour emissions in g/hr for all runs.
- Added train precision criteria table.
- Added fuel load density to summary table.
- Added firebox volume drawing to main body of report.
- Added statement that no negative catch weights recorded.

August 30, 2022

- Added additional description of dilution tunnel per EPA request dated August 24, 2022 . See Notes page and Page 28.
- Updated conditioning data to state that it was operated at a medium burn rate.
- All fuel used for conditioning was between 18% and 25% wet basis per ASTM E2780-10. Because Conditioning data is not part of the overall results of the unit as tested, Individual piece moisture was checked but not recorded.-Please note that the items that are required to be recorded for conditioning purposes are:
    - Time and Weight for all fuel (ASTM E2780-10 section 9.1.4)
    - Flue gas temperature a minimum of once per hour (ASTM E2780-10 Section 9.1.5)
- Added comment to notes section that no written instructions were provided to the lab from the manufacturer regarding the operation of the catalyst bypass. Operation of the bypass was consistent with those in the Users Manual provided.

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Affidavit:

Dirigo Laboratories, Inc. was contracted by Arada Stoves Ltd. to provide testing services for the Farringdon 16 catalytic wood fired heater per EPA Method 28R for Certification and Auditing of Wood Heaters. All testing and associated procedures were conducted at Dirigo Laboratories, Inc. beginning on 2/14/2017 and ending on 2/17/2017. Dirigo Laboratories is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed EPA Method 28R and ASTM E2780-10. Particulate sampling was performed per ASTM E2515-11 *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel.*

Dirigo Laboratories is accredited by the U.S. Environmental Protection Agency for the certification and auditing of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards for Residential Wood Heaters and subpart QQQQ of 40 CFR Part 60, Standards of Performance for New Hydronic Heaters and Forced Air Furnaces, Methods 28R, 28WHH, 28 WHH-PTS, and all methods listed in Sections 60.534 and 60.5476. Dirigo holds EPA Accreditation Certificate Numbers 4 and 4M (mobile). Dirigo Laboratories, Inc. is accredited by A2LA to ISO 17020:2012 “Criteria for Bodies Performing Inspections, ISO 17025:2005 “Requirements for Testing Laboratories”, and ISO 17065:2012 “Requirements for Bodies Operating Product Certification Systems”. Dirigo holds A2LA Certificate Numbers 3726.01, 3726.02, and 3726.03. See Appendix E for Accreditations.

The following people were associated with the testing, analysis and report writing associated with this project.

John Steinert, President

Ben Nelke, Test Technician

Doug Towne, QA Manager

Introduction:

Arada Stoves Ltd. of Axminster, United Kingdom, contracted with Dirigo Laboratories, Inc. to perform EPA certification testing for their Model Farringdon 16 catalytic wood heater. All testing was performed at Dirigo Laboratories, Inc. Testing was performed by Mr. Ben Nelke.

Notes:

- A 50 hour break-in was performed on the appliance at Dirigo Laboratories, Inc. from 12/02/16 through 12/14/16.
- Prior to testing, the dilution tunnel was cleaned with a steel brush.
- The heater has no blower so no fan confirmation test was performed.
- Front filters were changed on sample train A at one hour for all runs.
- There were no negative filter or probe weights for any of the test runs. All runs were appropriate and valid.
- Leak checks were performed for all test runs and were verified in the run data.
- Sample ports are located 16.5 feet downstream from any disturbances and 1 foot upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 5.5 feet upstream from any disturbances. (See page 28)
- There were no written instructions provided by the manufacturer to the Laboratory. The catalyst bypass was operated per the Owners Manual.

Wood Heater Identification and Testing:

- Appliance Tested: ***Farringdon 16 Free Standing***
- Serial Number: ***DEV6764B***
- Manufacturer*:* ***Arada Stoves Ltd.***
- Catalyst: ***Yes***
- Heat exchange blower: ***None***
- Type: ***Wood Stove***
- Style: ***Free Standing***
- Date Received: ***Tuesday, November 29, 2016***
- Wood Heater Aging: ***December 2 - December 14, 2016***
- Testing Period – Start: ***Tuesday, February 14, 2017*** Finish: ***Friday, February 17, 2017***
- Test Location: ***Dirigo Laboratories, Inc. 11785 SE HWY 212 - Suite 305, Clackamas, OR 97015***
- Elevation: **≈131** ***Feet above sea level***
- Test Technician(s): **Ben Nelke**
- Observers: ***None***

Test Procedures and Equipment:

All Sampling and analytical procedures were performed by Ben Nelke. All procedures used are directly from EPA Method 28R, ASTM E2780-10 and ASTM E2515-11. See the list below for equipment used. See Appendix D for calibration data.

Equipment List:

1. Analyzer -California Analytical ZRE CO2/CO/O2 IR ANALYZER
2. Delmhorst J-2000 Wood Moisture Meter
3. Dayton 4c121 Blower for dilution tunnel -Emissions Booth #1
4. ScienTech Balance Scale
5. 10 lb Calibration Weight
6. DigiWeigh Bench Shipping Scale
7. APEX XC-60 Digital Emissions Sampling Box A
8. APEX XC-60 Digital Emissions Sampling Box B
9. APEX Ambient sampling box
10. Gast MOA-P122-AA Vacuum Pump
11. Rice Lake 3'x3' floor scale w/digital weight indicator

Results:

For the Farringdon 16 wood heater, the weighted average emission rate is **1.5 g/hr** with a weighted average efficiency of **77.2%** and a weighted average CO of **0.91 g/min.** The Arada Stoves Ltd. Model Farringdon 16 catalytic free standing wood heater meets the 2020 PM emission standard of ≤ 2.0 g/hr per CFR 40 part 60, §60.532 (b).

Detailed individual run data can be found in separate digital folders supplied with this report.

Emissions:

DIRIGO LABORATORIES INC.

EPA Method 28 - Weighted Average

Weighted Average: 1.5 (g/hr)

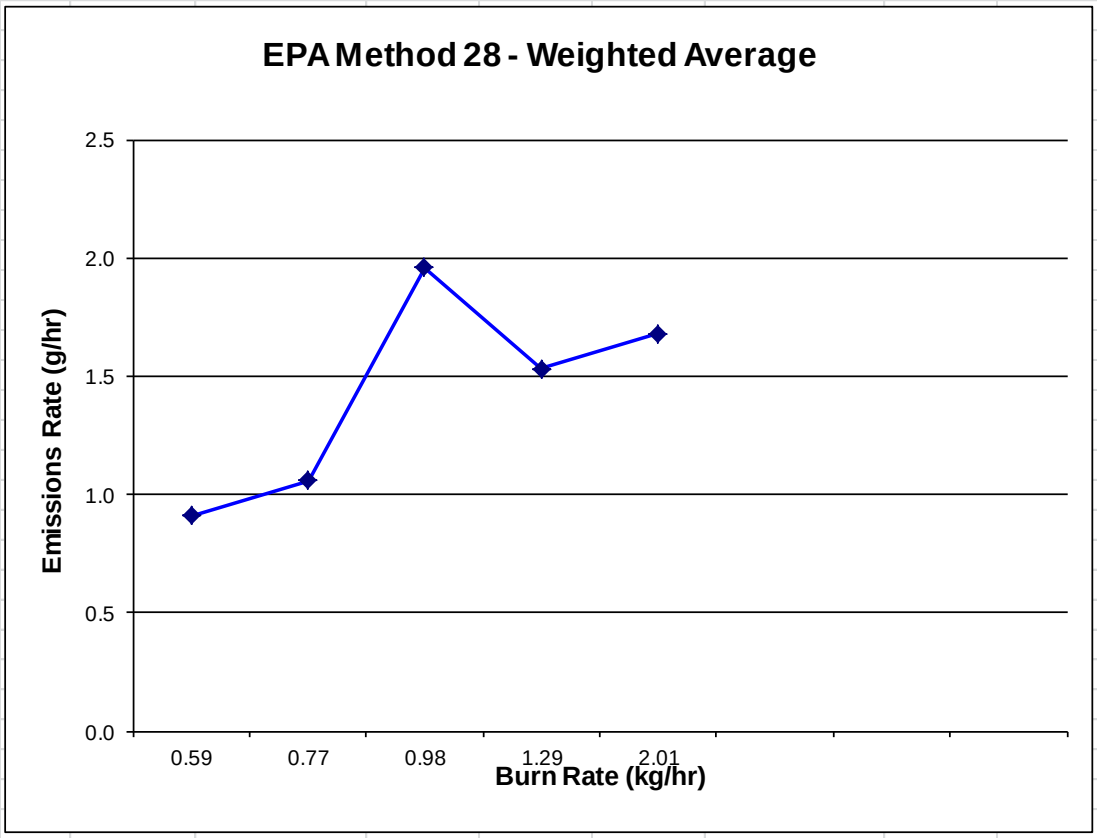
Client:	Arada
Model:	Farringdon 16
Tracking No.:	75
Project No.:	035-S-075-1
Test Dates:	2/14/17 - 2/17/17

Burn Rate Category	1		Burn Rate Category	1
Burn Rate (kg/hr-dry)	0.59		Burn Rate (kg/hr-dry)	0.77
Emissions Rate (g/hr)	0.9		Emissions Rate (g/hr)	1.1
Emissions Rate Cap (g/hr)	15		Emissions Rate Cap (g/hr)	15
Weighting Factor	10.96%		Weighting Factor	14.42%
Run Number	1		Run Number	2
Burn Rate Category	2		Burn Rate Category	3
Burn Rate (kg/hr-dry)	0.98		Burn Rate (kg/hr-dry)	1.29
Emissions Rate (g/hr)	2.0		Emissions Rate (g/hr)	1.5
Emissions Rate Cap (g/hr)	15		Emissions Rate Cap (g/hr)	15
Weighting Factor	22.65%		Weighting Factor	30.52%
Run Number	3		Run Number	4
Burn Rate Category	4			
Burn Rate (kg/hr-dry)	2.01			
Emissions Rate (g/hr)	1.7			
Emissions Rate Cap (g/hr)	18			
Weighting Factor	21.45%			
Run Number	5			

EPA Method 28 - Weighted Average

DIRIGO LABORATORIES INC.

Client:	Arada
Model:	Farringdon 16
Tracking No.:	75
Project No.:	035-S-075-1
Test Dates:	2/14/17 - 2/17/17



Efficiency:

All efficiency values use the HHV.

CSA B415.1-10 Weighted Average

Weighted Average: 77.2 %

Client:	Arada
Model:	Farringdon 16
Tracking No.:	75
Project No.:	035-S-075-1
Test Dates:	2/14/17 - 2/17/17

Burn Rate Category	1	Burn Rate Category	1
Burn Rate (kg/hr-dry)	0.59	Burn Rate (kg/hr-dry)	0.77
OA Efficiency %	81.1	OA Efficiency %	83.4
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	10.96%	Weighting Factor	14.42%
Run Number	1	Run Number	2

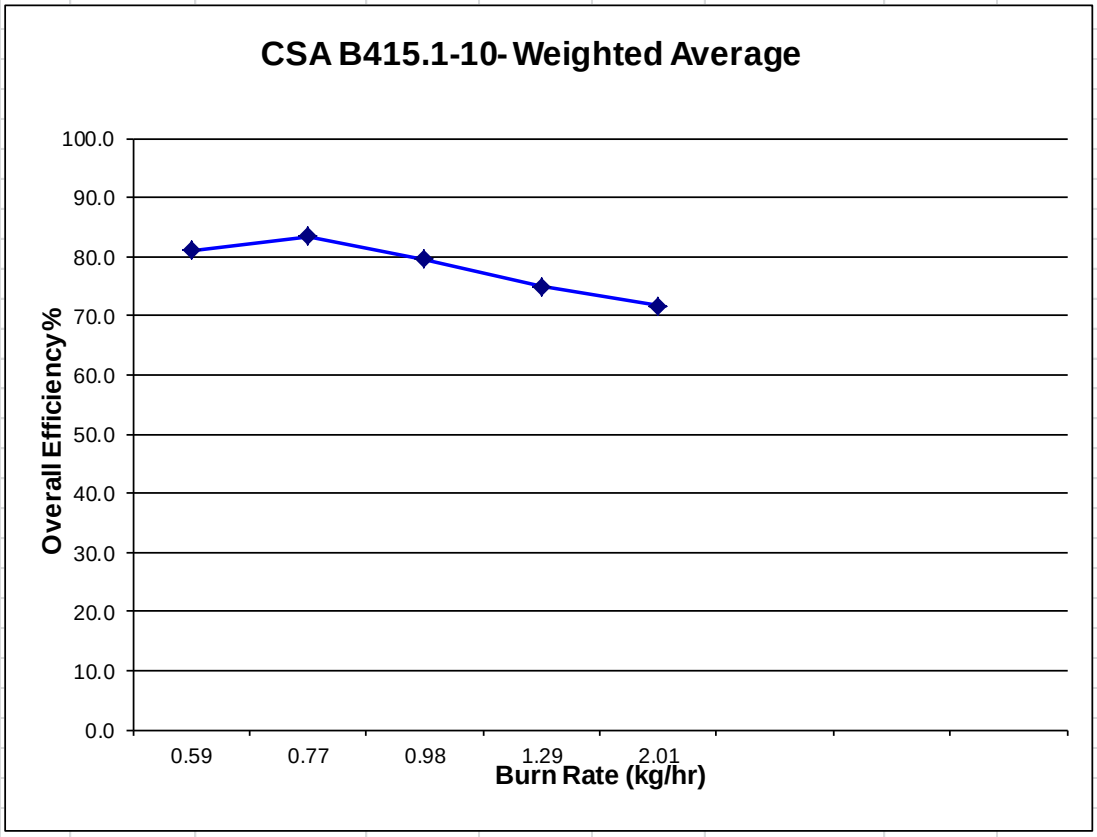
Burn Rate Category	2	Burn Rate Category	3
Burn Rate (kg/hr-dry)	0.98	Burn Rate (kg/hr-dry)	1.29
OA Efficiency %	79.5	OA Efficiency %	75.0
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	22.65%	Weighting Factor	30.52%
Run Number	3	Run Number	4

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.01
Emissions Rate (g/hr)	71.7
Emissions Rate Cap (g/hr)	18
Weighting Factor	21.45%
Run Number	5

CSA B415.1-10 - Weighted Average

DIRIGO LABORATORIES INC.

Client:	Arada
Model:	Farringdon 16
Tracking No.:	75
Project No.:	035-S-075-1
Test Dates:	2/14/17 - 2/17/17



Summary Table:

	Run 1	Run 2	Run 3	Run 4	Run 5
Date	2/14/17	2/15/17	2/16/17	2/17/17	2/17/17
Run Number	1	2	3	4	5
Emission Rate (g/hr)	0.91	1.06	1.99	1.53	1.68
Burn Rate (kg/hr)	0.59	0.77	0.98	1.29	2.01
Heat Output (Btu/hr)	8,298	12,124	14,589	18,210	27,025
Overall Efficiency (% HHV)	81.1	83.4	49.5	75.0	71.7
CO Emissions (g/MJ Output)	4.33	0.74	3.61	4.03	3.21
CO Emissions (g/kg Dry Fuel)	69.62	12.27	56.79	59.79	45.64
CO Emissions (g/min)	0.68	0.16	0.92	1.29	1.53
Emissions Rate – First Hour (g/hr)	3.23	3.48	5.85	4.54	3.18
Particulate emission average of 5 test runs: 1.5 grams per hour.					
Weighted average HHV efficiency of 5 test runs: 77.2%.					
Average CO emissions of 4 test runs: 0.91 g/min.					

Run 1:

An attempt at a category I burn rate was performed on 2/14/17, resulting in a 0.59 kg/hr category I burn rate. The test duration was 7 hours. The fuel weight was 10.9 lbs. There was an average particulate emissions rate of 0.91 g/hr. The run had an overall efficiency of 81.1%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.23 g/hr. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all criteria were met.

Run 2:

An attempt at a category II burn rate was performed on 2/15/17. However, 25 minutes into the test run, the 4 x 4 on the front stack of the fuel load fell forward against the glass slowing the burn witch resulted in an additional category I burn rate of 0.77 kg/hr. The test duration was 5 hours 10 minutes. The fuel weight was 10.6 lbs. There was an average particulate emissions rate of 1.06 g/hr. The run had an overall efficiency of 83.4%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.48 g/hr. All test results were appropriate and valid. The attempted burn rate category was missed. There were no anomalies and all criteria were met.

Run 3:

Run 3 was an attempt at a category II burn rate performed on 2/16/17, resulting in a 0.98 kg/hr burn rate. The test duration was 4 hours 10 minutes. The fuel weight was 10.7 lbs. There was an average particulate emissions rate of 1.99 g/hr. The run had an overall efficiency of 79.5%. The A filter was changed at 1 hr. The 1-hour filter catch was 5.85 g/hr. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all criteria were met.

Run 4:

Run 4 was an attempt at a category III burn rate performed on 2/17/17, resulting in a 1.29 kg/hr burn rate. The test duration was 3 hours 10 minutes. The fuel weight was 10.8 lbs. There was an average particulate emissions rate of 1.53 g/hr. The run had an overall efficiency of 75.0%. The A filter was changed at 1 hr. The 1-hour filter catch was 4.54 g/hr. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all criteria were met.

Run 5:

Run 5 was a high burn performed on 2/17/17 resulting in a 2.01 kg/hr burn rate. The test duration was 2 hours. The fuel weight was 10.6 lbs. There was an average particulate emissions rate of 1.68 g/hr. The run had an overall efficiency of 71.7%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.18g/hr. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all criteria were met.

Precision:

Dual Train Comparison (ASTM E2515 11.7 - If either criterion (7.5% of average or 0.5 g/kg difference) is met, the run is valid.									
Run #	Train A % of avg.	Train B % of avg.	Max difference (%)	<7.5% of average?		Train A g/kg	Train B g/kg	Difference	<0.5 g/kg from each other?
1	105.7	94.3	5.7	✓		1.638	1.463	0.175	✓
2	100.9	99.1	0.9	✓	Or	1.387	1.362	0.025	✓
3	98.9	101.1	1.1	✓		2.021	2.064	0.043	✓
4	96.8	103.2	3.2	✓		1.144	1.221	0.077	✓
5	97.4	102.6	2.6	✓		0.817	0.859	0.042	✓

Filter Catch:

Run 1:

	Project #	035-S-075-1				MFG	Arada										
	Run #	1				Model	Farringdon 16										
	Date	2/21/17															
	Train A	Front	Rear	Filter #	Tare	Final	Net		**Train B**	Front	Rear	Filter #	Tare	Final	Net		
	First Hour	☑		3028	0.1175	0.1206	0.0031			☑	☐	3030					
		☐	☑	3029						☐	☑	3031	0.2341	0.2392			
		☑	☐	3033	0.2348	0.2372				☑	☐	O ring					
		☑	☐	O Ring						☐	☑	O ring	3.5446	3.5452	0.0057		
		☐	☑	O Ring	3.5909	3.5917	0.0032										
							6.3	mg							5.7	mg	
	Nozzle								Nozzle								
	#	TARE		FINAL		Net			#	TARE		FINAL		Net			
	1A	115.6254		115.6257		0.0003	0.3		1B	115.9004		115.9005		0.0001	0.1		
	Train A Total Catch						6.6	mg	Train B Total Catch						5.8	mg	
	Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)										
		3032		0.1169	0.1170	0.0001	2305.638										
		O ring		1.6727	1.6730	0.0003											
					Total	0.4	mg										
Notes:	Train A Total: 6.6mg		Train B Total: 5.8mg		Ambient Total: 0.4mg		1 Hour Catch: 3.1mg										

Run 2:

	Project #	035-S-075-1				MFG	Arada										
	Run #	2				Model	Farringdon 16										
	Date	2/21/17															
	Train A	Front	Rear	Filter #	Tare	Final	Net		**Train B**	Front	Rear	Filter #	Tare	Final	Net		
	First Hour	☑		3034	0.1179	0.1212	0.0033			☑	☐	3036					
		☐	☑	3035						☐	☑	3037	0.2354	0.2395			
		☑	☐	3039	0.2360	0.2366				☑	☐	O ring					
		☑	☐	O Ring						☐	☑	O ring	3.5554	3.5562	0.0049		
		☐	☑	O Ring	3.5158	3.5168	0.0016										
							4.9	mg							4.9	mg	
	Nozzle								Nozzle								
	#	TARE		FINAL		Net			#	TARE		FINAL		Net			
	6A	116.5641		116.5645		0.0004	0.4		6B	116.1165		116.1167		0.0002	0.2		
	Train A Total Catch						5.3	mg	Train B Total Catch						5.1	mg	
	Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)										
		3038		0.1174	0.1174	0.0000	1736.481										
		O ring		1.6482	1.6484	0.0002											
					Total	0.2	mg										
Notes:	Train A Total: 5.3mg		Train B Total: 5.1mg		Ambient Total: 0.2mg		1 Hour Catch: 3.3mg										

Run 3:

	Project #	035-S-075-1				MFG	Arada										
	Run #	3				Model	Farringdon 16										
	Date	2/21/17															
	Train A	Front	Rear	Filter #	Tare	Final	Net		**Train B**	Front	Rear	Filter #	Tare	Final	Net		
	First Hour	☑		3040	0.1181	0.1234	0.0053			☑	☐	3042					
		☐	☑	3041						☐	☑	3043	0.2361	0.2435			
		☑	☐	3045	0.2358	0.2380				☑	☐	O ring					
		☑	☐	O Ring						☐	☑	O ring	3.5593	3.5593	0.0074		
		☐	☑	O Ring	3.5420	3.5420	0.0022										
							7.5	mg							7.4	mg	
	Nozzle								Nozzle								
	#	TARE		FINAL		Net			#	TARE		FINAL		Net			
	10A	116.8265		116.8265		0.0000	0.0		10B	117.1676		117.1677		0.0001	0.1		
	Train A Total Catch						7.5	mg	Train B Total Catch						7.5	mg	
	Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)										
		3044		0.1177	0.1179	0.0002	1403.742										
		O ring		1.6416	1.6416	0.0000											
					Total	0.0002	mg										
Notes:	Train A Total: 7.5mg Train B Tota: 7.5mg Ambient Total: 0.2mg 1 Hour Catch: 5.3mg																

Run 4:

	Project #	035-S-075-1				MFG	Arada										
	Run #	4				Model	Farringdon 16										
	Date	2-21-2-17															
	Train A	Front	Rear	Filter #	Tare	Final	Net		**Train B**	Front	Rear	Filter #	Tare	Final	Net		
	First Hour	☑		3046	0.1174	0.1216	0.0042			☑	☐	3048					
		☐	☑	3047						☐	☑	3049	0.2357	0.2402			
		☑	☐	3051	0.2346	0.2347				☑	☐	O ring					
		☑	☐	O Ring						☐	☑	O ring	3.5379	3.5379	0.0045		
		☐	☑	O Ring	3.5734	3.5734	0.0001										
							0.1	mg							4.5	mg	
	Nozzle								Nozzle								
	#	TARE		FINAL		Net			#	TARE		FINAL		Net			
	12A	116.8890		116.8890		0.0000	0.0		12B	117.0523		117.0523		0.0000	0.0		
	Train A Total Catch						0.1	mg	Train B Total Catch						4.5	mg	
	Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)										
		3050		0.1175	0.1175	0.0000	1003.027										
		O ring		1.6823	1.6823	0.0000											
					Total	0.0	mg										
Notes:	Train A Total: 4.3mg Train B Total: 4.5mg Ambient Total: 0.0mg 1 Hour Catch: 4.2mg																

Run 5:

	Project #	035-S-075-1				MFG	Arada										
	Run #	5				Model	Farringdon 16										
	Date	2/21/17															
	Train A	Front	Rear	Filter #	Tare	Final	Net		**Train B**	Front	Rear	Filter #	Tare	Final	Net		
	First Hour	☑		3052	0.1172	0.1202	0.0030			☑	☐	3054					
		☐	☑	3053						☐	☑	3055	0.2354	0.2385			
		☑	☐	3057	0.2345	0.2346				☑	☐	O ring					
		☑	☐	O Ring						☐	☑	O ring	3.5135	3.5135	0.0031		
		☐	☑	O Ring	3.5771	3.5771	0.0001										
							3.1	mg							3.1	mg	
	Nozzle								Nozzle								
	#	TARE		FINAL		Net			#	TARE		FINAL		Net			
	13A	117.4532		117.4532		0.0000	0.0		13B	117.0625		117.0626		0.0001	0.1		
	Train A Total Catch						3.1	mg	Train B Total Catch						3.2	mg	
	Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)										
		3056		0.1180	0.1180	0.0000	633.178										
		O ring		1.6545	1.6546	0.0001											
					Total	0.1	mg										
Notes:	Train A Total: 3.1mg Train B Total: 3.2mg Ambient Total: 0.1mg 1 Hour Catch: 3.0mg																

Test Condition Summary:

All testing conditions for all runs fell within allowable specifications of EPA Method 28R, ASTM E2780-10 and ASTM E2515-11. A summary of facility conditions, temperature averages, fuel burned and run times is listed below.

Runs	Ambient (Deg. F)		Barometric Pressure (In. Hg.)	Test Fuel Burned (Lbs.)	Fuel Loading Density (lbs/ft3)	Test Fuel Moisture (Dry Basis)	Run Time (Min.)
	Pre	Post					
1	69	69	30.06	10.9	6.94	20.6	420
2	70	70	29.72	10.6	6.75	20.3	310
3	72	70	29.56	10.7	6.82	19.3	250
4	67	69	29.60	10.8	6.88	19.7	190
5	70	73	29.60	10.6	6.75	19.9	120

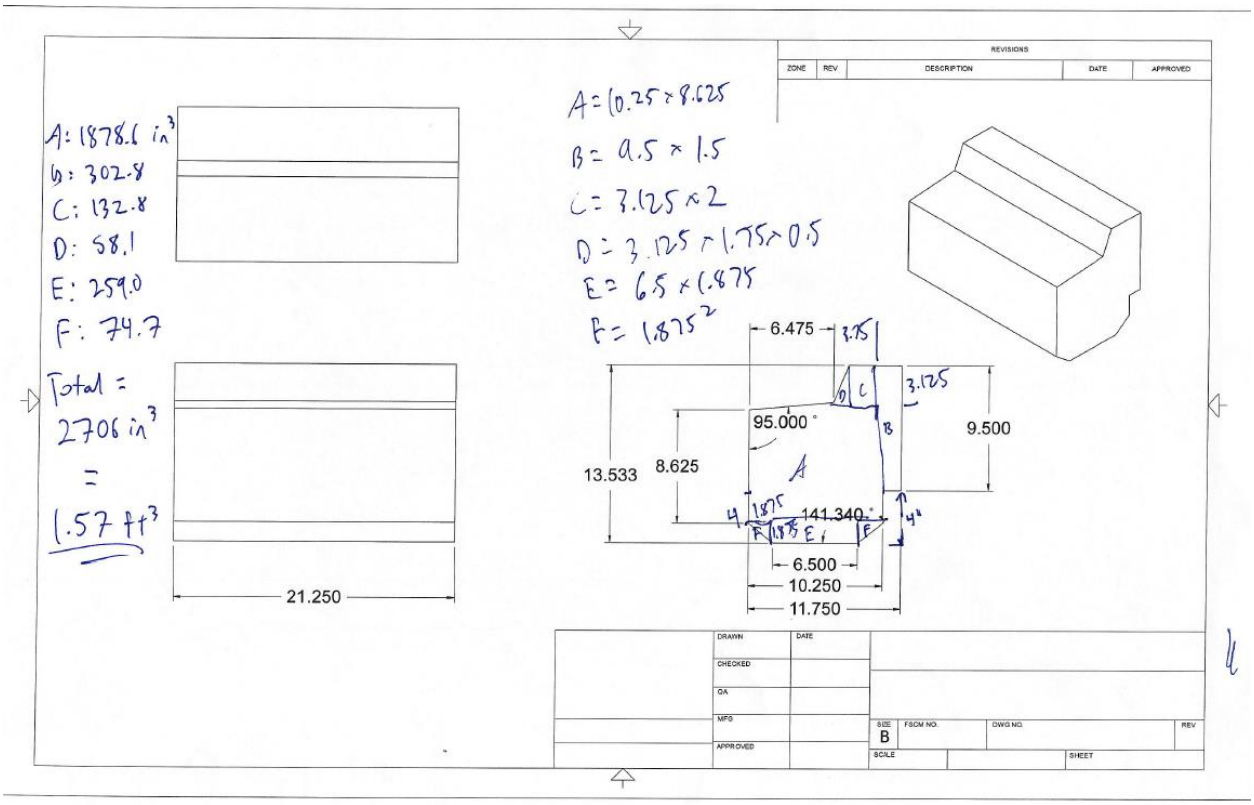
Heater Specifications:

Dimensions, firebox configuration, air supply locations, air introduction locations, and baffle locations of the wood heater are referenced below and on the following page.

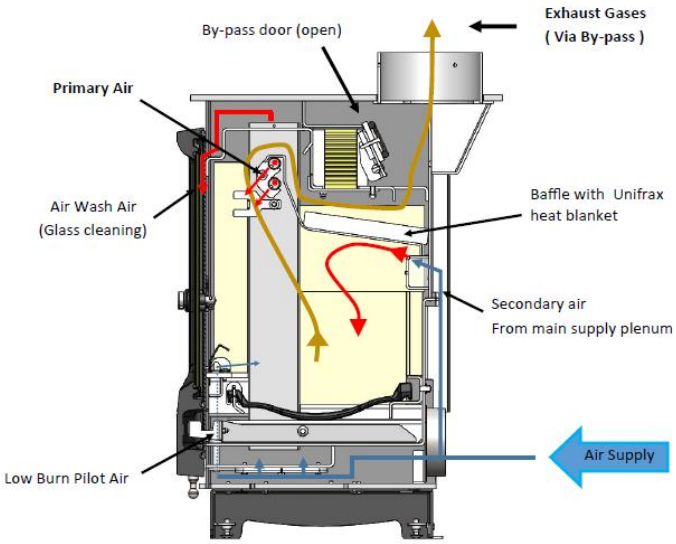
Heater Dimensions

Heater Dimensions				
Height	Width	Depth	Firebox Volume	Weight
13.5”	21.250”	11.75”	1.57 ft^3	340.7 lbs

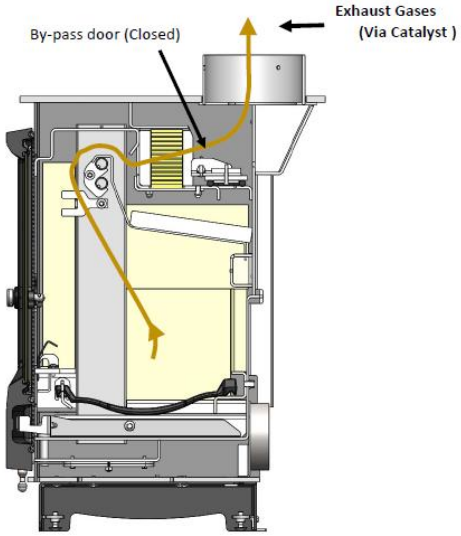
Useable Firebox Volume:



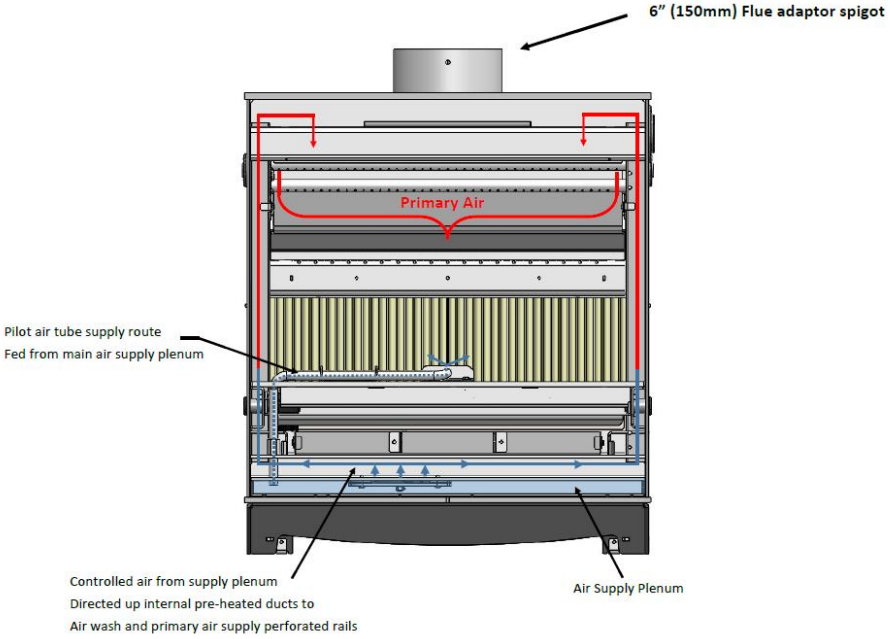
Air Flow Schematic



Right Side Cutaway with By-pass door open



Right Side Cutaway with By-pass door closed



Front

Left

Right

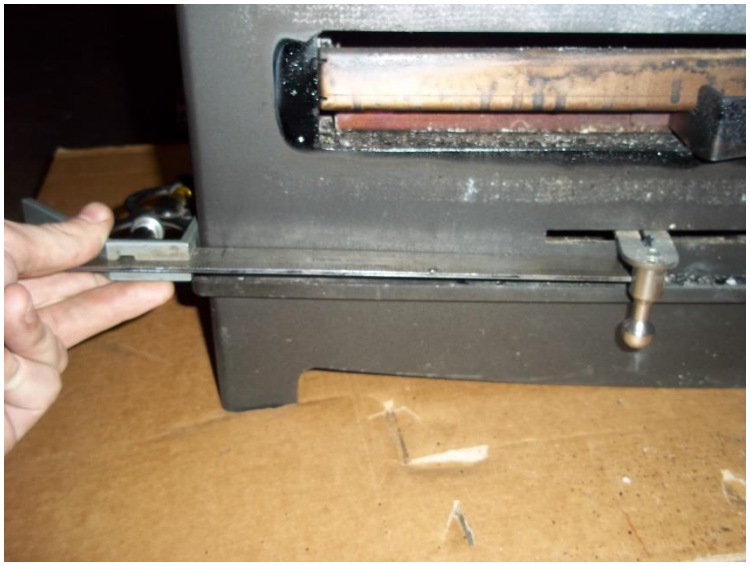
Rear

Process Operations and Description:

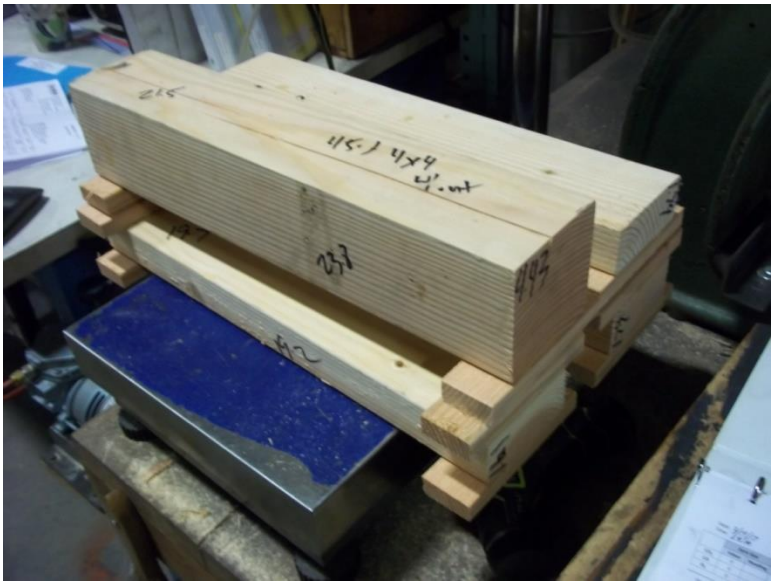
The appliance was operated according to procedures as described in the Operations Manual. Detailed run information can be found in corresponding digital folders submitted with this report.

Settings & Run Notes

	Run Notes	
	Pre-Burn	**Test Run**
Run 1	Primary set to $7^{13}/_{32}$". Start at 1417	Category I: Test start: 1518 – Bypass closed, primary fully open, door open 1 minute. At 5 mins Primary air set to $7^{13}/_{32}$". Front filter A changed at 1618. At 1828 the door was opened and the coals were stirred due to no weight loss in 10 minutes after 60% of fuel load was burned. END test: 2218 – Run time 7 hours.
Run 2	Primary set to $7^{1}/_{2}$". Start at 1238	Category I: Test start: 1339 - Bypass closed, primary fully open, door open 1 minute. At 5 mins Primary air set to $7^{1}/_{2}$". 25 minutes into the test run (at 1404) the front 4x4 fell forward against the glass. Front filter A changed at 1439. At 1759 the door was opened and the coals were stirred due to no weight loss in 10 minutes after 60% of fuel load was burned. END test: 1849 – Run time 5 hours, 10 minutes.
Run 3	Primary set to $7^{9}/_{16}$". Start at 1152	Category II: Test start: 1253 – Bypass closed, primary fully open, door open 1 minute 30 seconds. At 5 mins Primary set to $7^{9}/_{16}$". Front filter A changed at 1353. END Test: 1703 - Run time 4 hours 10 mins.
Run 4	Primary set to $7^{31}/_{32}$". Start at 1153	Category III: Test start: 1254. Bypass closed, primary fully open, door open 1 minute. Front filter A changed at 1354. END test: 1604 - Run Time: 3 hours 10 minutes.
Run 5	Primary fully open. Start at 1624	Category IV: Test start: 1724 - Bypass closed, primary fully open and left open, door open 1 minute. Front filter A changed at 1824. END test: 1924 - Run time 2 hours.



Test Fuel Properties:



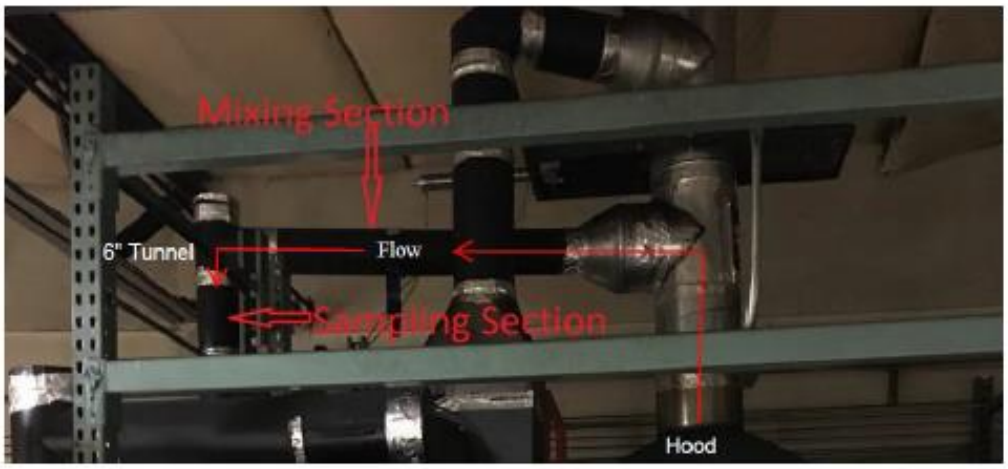
Fuel consisted of 2”x4”x17.5” and 4”x4”x17.5” Green, Douglas fir. Detailed fuel load specifications for each run can be found in the corresponding digital folders submitted with this report.

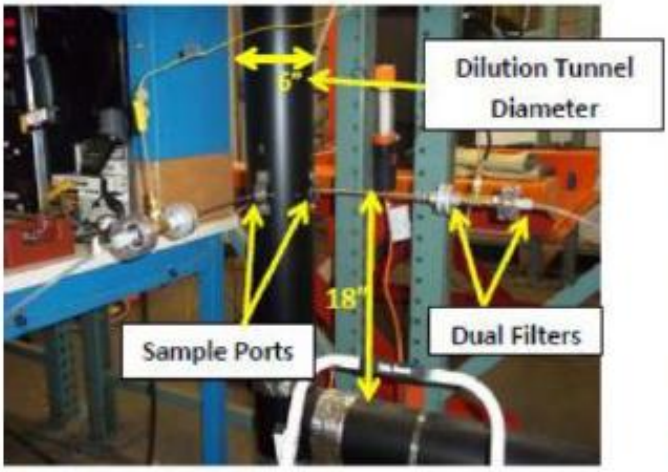
Pre-burn Configuration:

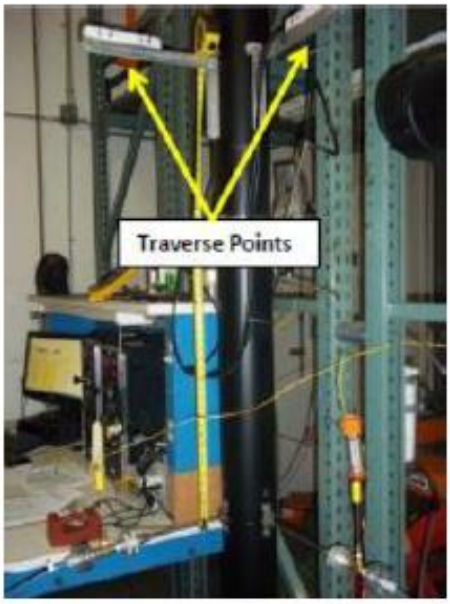
Sampling Locations and Descriptions:

Sample ports are located 16.5 feet downstream from any disturbances and 1 foot upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 5.5 feet upstream from any disturbances. (See below)

Sample Points







Sampling Methods:

EPA ASTM E2515-11 was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per ASTM E2515-11 were followed. No alternate procedures were used.

Analytical Methods Description:

All sample recovery and analysis procedures followed EPA ASTM E2515-11 procedures. At the end of each test run, filters and probes were removed from their housings, dessicated for 24 hours, and then weighed at 6 hour intervals to a constant weight per ASTM E2515-11 section 11.0.

Calibration, Quality Control and Assurances:

Calibration procedures and results were conducted per EPA Method 28R, ASTM E2515-11 and ASTM E2780-10. Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined.

Appliance Sealing and Storage:

Following securing with metal strapping and the seal below, the appliance was placed into storage at client facilities located at: The Fire Works, Weycroft Avenue, Axminster, Devon, United Kingdom EX13 5HU.

Sealing Label

ATTENTION:

THIS SEAL IS NOT TO BE BROKEN WITHOUT PRIOR AUTHORIZATION FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.

THIS APPLIANCE HAS BEEN SEALED IN ACCORDANCE WITH REQUIREMENTS OF 40 CFR PART 60 SUBPART AAA §60.535(g)

REPORT #_____ DATE SEALED_____

MANUFACTURER_____ MODEL #_____

Sealed Unit


ATTENTION:

Sampling and Analytical Procedures

All Sampling and analytical procedures were performed by Ben Nelke. All procedures used were directly from EPA Method 28R, ASTM 2515-11 and ASTM E2780-10. No alternative procedures were used for this test series.

Participants

The following personnel performed all testing:

- Ben Nelke

Analysis and Report Writing

The following people were involved with analysis and report writing:

- Ben Nelke, Doug Towne

Observers:

The following people were observers during testing:

- None

Appliance Updates

No updates to the appliance were made.

Accreditations:

CERTIFICATE OF ACCREDITATION

This certifies that:

Dirigo Laboratories, Inc.

Has satisfied the requirements for laboratory accreditation for the certification of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards For Residential Wood Heaters and subpart QQQQ of 40 CFR Part 60, Standards of Performance for New Hydronic Heaters and Forced Air Furnaces.

October 21, 2015 - October 21, 2020
EFFECTIVE DATE

MEASUREMENT TECHNOLOGY GROUP
GROUP LEADER

Methods 28R, 28 WHH, 28 WHH-PTS,
All Methods listed in Sections 60.534 and 60.5476
METHODS

4
CERTIFICATE NUMBER

American Association for Laboratory Accreditation

Accredited Inspection Body

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clackamas, OR

for technical competence as an

Inspection Body

This inspection body is accredited in accordance with the recognized International Standard ISO/IEC 17020:2012 *Conformity Assessment – Requirements for the operation of various types of bodies performing inspection.* This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 17th day of October 2014.

President & CEO
For the Accreditation Council
Certificate Number 3726.03
Valid to December 31, 2016

For the inspections to which this accreditation applies, please refer to the organization's Inspection Body Scope of Accreditation.

American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clakamas, OR

for technical competence in the field of

Mechanical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 17th day of October 2014.

President & CEO
For the Accreditation Council
Certificate Number 3726.01
Valid to December 31, 2016

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Mechanical Scope of Accreditation.

American Association for Laboratory Accreditation

Accredited Product Certification Body

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clackamas, OR

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services.* This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 17th day of October 2014.

President & CEO
For the Accreditation Council
Certificate Number 3726.02
Valid to December 31, 2016

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation

List of Appendices:

The following appendices have been submitted electronically in conjunction with this report:

Appendix A – Test Run Data, Technician Notes, and Sample Analysis

Appendix B – Labels and Manuals

Appendix C –Equipment Calibration Records

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

Appendix A:

Test Run Data

Client ARADA
Model FARRINGDON 16
Run # BRK2
Project # 00000
Tracking #
Date 12_5_16
Notes:Medium Burn rate setting

Time	FLUE	CAT	CH 3	CH 4	CH 5	CH 6	CH 7	SCALE	CH 9	CH 10	CH 11	CH 12
Ambient	CH 14	CH 15	CH 16	CH 17	CH 18	CH 19	CH 20	CH 21	CH 22	CH 23	CH 24	CH 25	CH 25
CH 27	CH 28	CH 29	CH 30	CH 31	CH 32								
9:38:56 AM	371	565	0	0	0	0	0	5					
9:48:56 AM	416	791	0	0	0	0	0	7					
9:58:56 AM	433	869	0	0	0	0	0	5					
10:08:56 AM	426	861	0	0	0	0	0	4					
10:18:56 AM	399	762	0	0	0	0	0	11					
10:28:56 AM	404	786	0	0	0	0	0	10					
10:38:56 AM	396	793	0	0	0	0	0	9					
10:48:56 AM	385	768	0	0	0	0	0	8					
10:58:56 AM	379	744	0	0	0	0	0	7					
11:08:56 AM	373	724	0	0	0	0	0	6					
11:18:58 AM	394	768	0	0	0	0	0	13					
11:28:58 AM	383	771	0	0	0	0	0	12					
11:38:58 AM	394	765	0	0	0	0	0	11					
11:48:58 AM	400	809	0	0	0	0	0	11					
11:58:58 AM	371	743	0	0	0	0	0	10					
12:08:58 PM	378	760	0	0	0	0	0	9					
12:18:58 PM	358	704	0	0	0	0	0	9					
12:28:58 PM	336	651	0	0	0	0	0	8					
12:38:58 PM	327	632	0	0	0	0	0	8					
12:48:58 PM	320	620	0	0	0	0	0	7					
12:58:58 PM	315	611	0	0	0	0	0	7					
1:08:58 PM	308	608	0	0	0	0	0	6					
1:18:58 PM	301	601	0	0	0	0	0	6					
1:28:58 PM	299	595	0	0	0	0	0	6					
1:38:58 PM	301	606	0	0	0	0	0	5					
1:48:58 PM	277	534	0	0	0	0	0	5					
1:58:58 PM	270	527	0	0	0	0	0	5					
2:08:58 PM	279	509	0	0	0	0	0	12					
2:18:58 PM	372	757	0	0	0	0	0	11					
2:28:58 PM	391	795	0	0	0	0	0	10					
2:38:58 PM	404	811	0	0	0	0	0	9					
2:48:58 PM	395	790	0	0	0	0	0	8					
2:58:58 PM	386	774	0	0	0	0	0	7					
3:08:58 PM	358	719	0	0	0	0	0	6					
3:18:58 PM	341	677	0	0	0	0	0	6					
3:28:58 PM	353	636	0	0	0	0	0	11					
3:38:58 PM	409	838	0	0	0	0	0	10					
3:48:58 PM	440	900	0	0	0	0	0	8					
3:58:58 PM	446	926	0	0	0	0	0	7					
4:08:58 PM	421	909	0	0	0	0	0	6					
4:18:58 PM	368	765	0	0	0	0	0	6					
4:28:58 PM	336	675	0	0	0	0	0	5					
4:38:58 PM	315	623	0	0	0	0	0	5					

4:48:58 PM	299	583	0	0	0	0	0	5
4:58:58 PM	302	553	0	0	0	0	0	13
5:08:58 PM	349	678	0	0	0	0	0	13
5:18:58 PM	361	692	0	0	0	0	0	12
5:28:58 PM	362	712	0	0	0	0	0	11
5:38:58 PM	366	731	0	0	0	0	0	10
5:48:58 PM	373	754	0	0	0	0	0	9
5:58:58 PM	372	757	0	0	0	0	0	9
6:08:58 PM	378	748	0	0	0	0	0	8
6:18:58 PM	362	713	0	0	0	0	0	7
6:28:58 PM	356	707	0	0	0	0	0	7
6:38:58 PM	344	683	0	0	0	0	0	6
6:48:58 PM	327	645	0	0	0	0	0	6
6:58:58 PM	315	620	0	0	0	0	0	6

Client ARADA
Model FARRINGDON 16
Run # BRK3
Project # 00000
Tracking #
Date 12_6_16
Notes:Medium Burn rate setting

Time	FLUE	CAT	SCALE
9:10:59 AM	416	732	10
9:20:59 AM	397	781	8
9:30:59 AM	407	836	10
9:40:59 AM	386	822	9
9:50:59 AM	370	789	8
10:00:59 AM	374	814	7
10:10:59 AM	362	812	6
10:20:59 AM	343	777	5
10:30:59 AM	325	740	5
10:40:59 AM	355	768	12
10:50:59 AM	363	797	10
11:00:59 AM	349	764	9
11:10:59 AM	347	768	8
11:20:59 AM	339	728	9
11:30:59 AM	392	842	13
11:40:59 AM	398	891	12
11:50:59 AM	399	905	11
12:00:59 PM	399	908	10
12:10:59 PM	400	893	9
12:20:59 PM	389	878	7
12:30:59 PM	376	861	7
12:40:59 PM	388	856	12
12:50:59 PM	367	834	11
1:00:59 PM	359	821	10
1:10:59 PM	348	802	9
1:20:59 PM	337	786	9
1:30:59 PM	350	750	11
1:40:59 PM	346	780	10
1:50:59 PM	341	785	9
2:00:59 PM	334	776	9
2:10:59 PM	337	799	8
2:20:59 PM	315	744	8
2:30:59 PM	377	773	10
2:40:59 PM	299	807	9
2:50:59 PM	346	781	8
3:00:59 PM	336	789	8
3:10:59 PM	305	710	8
3:20:59 PM	346	634	13
3:30:59 PM	380	795	12
3:40:59 PM	378	792	12
3:50:59 PM	223	867	11
4:00:59 PM	210	855	11
4:10:59 PM	199	815	11
4:20:59 PM	192	784	10
4:30:59 PM	182	756	10

4:40:59 PM	177	740	10
4:50:59 PM	173	738	10
5:00:59 PM	170	744	9
5:10:59 PM	354	700	9
5:20:59 PM	378	731	8
5:30:59 PM	369	714	8
5:40:59 PM	360	697	7
5:50:59 PM	343	665	7
6:00:59 PM	354	648	10
6:10:59 PM	405	806	9
6:20:59 PM	401	794	9
6:30:59 PM	390	773	8
6:40:59 PM	384	759	7
6:50:59 PM	377	748	7
7:00:59 PM	350	682	6
7:10:59 PM	340	660	6

Client ARADA
Model FARRINGDON 16
Run # BRK4
Project # 00000
Tracking #
Date 12_7_16
Notes:Medium Burn rate setting

Time	FLUE	CAT	SCALE
9:10:27 AM	406	850	9
9:20:27 AM	405	813	20
9:30:27 AM	419	851	19
9:40:27 AM	425	862	17
9:50:27 AM	433	883	16
10:00:27 AM	443	906	14
10:10:27 AM	448	928	13
10:20:27 AM	444	950	12
10:30:27 AM	442	987	10
10:40:27 AM	425	940	9
10:50:27 AM	400	885	8
11:00:27 AM	387	838	8
11:10:27 AM	373	800	7
11:20:27 AM	331	760	7
11:30:27 AM	315	733	6
11:40:27 AM	304	717	6
11:50:27 AM	286	669	6
12:00:27 PM	275	640	6
12:10:27 PM	335	735	10
12:20:27 PM	329	736	9
12:30:27 PM	341	746	8
12:40:27 PM	340	747	8
12:50:27 PM	330	732	7
1:00:27 PM	318	714	6
1:10:27 PM	308	704	6
1:20:27 PM	302	693	5
1:30:27 PM	296	685	5
1:40:27 PM	292	681	5
1:50:27 PM	282	681	4
2:00:27 PM	267	624	4
2:10:27 PM	257	606	4
2:20:27 PM	251	592	4
2:30:27 PM	340	656	18
2:40:27 PM	342	669	17
2:50:27 PM	367	701	16
3:00:27 PM	416	777	15
3:10:27 PM	433	866	14
3:20:27 PM	429	822	13
3:30:27 PM	431	831	11
3:40:27 PM	369	810	10
3:50:27 PM	359	829	10
4:00:27 PM	350	802	9
4:10:27 PM	339	784	8
4:20:27 PM	314	723	8
4:30:27 PM	366	692	7

4:40:27 PM	361	680	7
4:50:27 PM	352	658	6
5:00:27 PM	351	654	6
5:10:27 PM	348	651	5
5:20:27 PM	342	637	5
5:30:27 PM	338	635	4
5:40:27 PM	434	865	12
5:50:27 PM	292	878	11

Client ARADA
Model FARRINGDON 16
Run # BRK5
Project # 00000
Tracking #
Date 12_8_16
Notes:Medium Burn rate setting

Time	FLUE	CAT	SCALE	CH 4	CH 5	CH 6	CH 7	CH 8	CH 9	CH 10	CH 11	CH 12
Ambient	CH 14	CH 15	CH 16	CH 17	CH 18	CH 19	CH 20	CH 21	CH 22	CH 23	CH 24	CH 25	CH 25
CH 27	CH 28	CH 29	CH 30	CH 31	CH 32								
12:49:13 PM	424	653	15										
12:59:13 PM	517	906	13										
1:09:13 PM	407	881	11										
1:19:13 PM	388	878	10										
1:29:13 PM	386	884	9										
1:39:13 PM	352	789	9										
1:49:13 PM	368	788	18										
1:59:13 PM	376	828	17										
2:09:13 PM	377	784	16										
2:19:13 PM	358	774	15										
2:29:13 PM	294	861	14										
2:39:13 PM	311	834	14										
2:49:13 PM	329	810	14										
2:59:13 PM	316	756	13										
3:09:13 PM	305	727	11										
3:19:13 PM	306	736	11										
3:29:13 PM	309	762	11										
3:39:13 PM	300	747	10										
3:49:13 PM	284	711	10										
3:59:13 PM	272	673	10										
4:09:13 PM	362	678	15										
4:19:13 PM	427	804	14										
4:29:13 PM	322	856	13										
4:39:13 PM	314	858	13										
4:49:13 PM	316	844	11										
4:59:13 PM	286	794	10										
5:09:13 PM	268	749	10										
5:19:13 PM	257	734	10										
5:29:13 PM	247	713	10										
5:39:13 PM	238	695	9										
5:49:13 PM	232	697	9										
5:59:13 PM	212	665	9										
6:09:13 PM	202	626	8										
6:19:13 PM	187	581	8										
6:29:13 PM	179	554	8										
6:39:13 PM	200	584	14										
6:49:13 PM	270	897	13										
6:59:13 PM	274	855	13										
7:09:13 PM	287	887	12										
7:19:13 PM	297	879	11										
7:29:13 PM	294	862	11										
7:39:13 PM	281	807	10										
7:49:13 PM	273	826	10										

7:59:13 PM	273	819	9
8:09:13 PM	263	814	9
8:19:13 PM	254	788	8
8:29:13 PM	248	782	8
8:39:13 PM	242	787	8
8:49:13 PM	239	728	8
8:59:13 PM	220	719	7
9:09:13 PM	201	629	7
9:19:13 PM	187	593	7

Client ARADA
Model FARRINGDON 16
Run # BRK7
Project # 00000
Tracking #
Date 12_13_16
Notes:Medium Burn rate setting

Time	FLUE	CAT	SCALE
11:08:01 AM	396	726	9
11:18:01 AM	409	908	7
11:28:01 AM	369	805	7
11:38:01 AM	353	773	6
11:48:01 AM	347	761	5
11:58:01 AM	337	734	5
12:08:01 PM	327	719	4
12:18:01 PM	322	716	4
12:28:01 PM	310	695	4
12:38:01 PM	295	663	4
12:48:01 PM	326	679	9
12:58:01 PM	328	692	8
1:08:01 PM	320	681	7
1:18:01 PM	318	690	7
1:28:01 PM	321	701	6
1:38:01 PM	310	668	6
1:48:01 PM	302	651	5
1:58:01 PM	295	640	5
2:08:01 PM	312	658	13
2:18:01 PM	344	729	12
2:28:01 PM	353	765	11
2:38:01 PM	351	760	10
2:48:01 PM	348	751	10
2:58:01 PM	343	750	9
3:08:01 PM	338	735	8
3:18:01 PM	334	727	8
3:28:01 PM	359	751	11
3:38:01 PM	372	798	9
3:48:01 PM	418	922	8
3:58:01 PM	382	922	8
4:08:01 PM	298	845	7
4:18:01 PM	222	788	7
4:28:01 PM	197	720	7
4:38:01 PM	176	645	6
4:48:01 PM	202	747	15
4:58:01 PM	215	815	14
5:08:01 PM	221	825	14
5:18:01 PM	215	790	14
5:28:01 PM	208	761	14
5:38:01 PM	203	745	13
5:48:01 PM	199	719	13

Client ARADA
Model FARRINGDON 16
Run # BRK8
Project # 00000
Tracking #
Date 12_14_16
Notes:Medium Burn rate setting

Time	FLUE	CAT	SCALE
9:14:31 AM	416	733	15
9:24:31 AM	429	768	14
9:34:31 AM	429	773	13
9:44:31 AM	429	771	12
9:54:31 AM	359	749	10
10:04:31 AM	395	662	14
10:14:31 AM	398	821	13
10:24:31 AM	383	784	12
10:34:31 AM	400	819	11
10:44:31 AM	364	758	10
10:54:31 AM	356	741	9
11:04:31 AM	338	702	9
11:14:31 AM	327	679	8
11:24:31 AM	322	670	8
11:34:31 AM	306	626	9
11:44:31 AM	298	611	8
11:54:31 AM	345	695	15
12:04:31 PM	376	784	14
12:14:31 PM	389	815	14
12:24:31 PM	385	820	13
12:34:31 PM	375	804	12
12:44:31 PM	367	783	10
12:54:31 PM	362	761	10
1:04:31 PM	356	739	9
1:14:31 PM	354	730	8
1:24:31 PM	348	718	8
1:34:31 PM	340	699	7
1:44:31 PM	331	686	7
1:54:31 PM	327	677	6
2:04:31 PM	317	659	8
2:14:31 PM	308	635	7
2:24:31 PM	292	604	7
2:34:31 PM	291	574	13
2:44:31 PM	334	661	12
2:54:31 PM	399	766	18
3:04:31 PM	427	829	16
3:14:31 PM	429	848	14
3:24:31 PM	379	878	13
3:34:31 PM	373	868	12
3:44:31 PM	365	862	11
3:54:31 PM	355	843	11
4:04:31 PM	315	777	10
4:14:31 PM	297	741	9
4:24:31 PM	291	735	9
4:34:31 PM	276	721	8

4:44:31 PM	256	669	8
4:54:31 PM	238	625	8
5:04:31 PM	226	598	7
5:14:31 PM	217	580	7
5:24:31 PM	295	792	17
5:34:31 PM	326	853	17
5:44:31 PM	322	767	15
5:54:31 PM	323	763	15
6:04:31 PM	322	793	14
6:14:31 PM	320	820	13
6:24:31 PM	328	843	13
6:34:31 PM	318	798	12
6:44:31 PM	316	794	11
6:54:31 PM	310	800	11
7:04:31 PM	310	829	10
7:14:31 PM	303	823	10
7:24:31 PM	294	801	9
7:34:31 PM	272	710	9
7:44:31 PM	252	665	9
7:54:31 PM	278	681	14
8:04:31 PM	299	733	14
8:14:31 PM	305	744	13
8:24:31 PM	307	760	12
8:34:31 PM	314	781	12
8:44:31 PM	318	802	11
8:54:31 PM	318	813	10
9:04:31 PM	298	771	10
9:14:31 PM	295	753	9
9:24:31 PM	286	732	9
9:34:31 PM	278	715	8
9:44:31 PM	274	717	8
9:54:31 PM	259	691	8
10:04:31 PM	243	649	8
10:14:31 PM	231	622	7
10:24:31 PM	232	601	13
10:34:31 PM	158	645	13
10:44:31 PM	200	777	13
10:54:31 PM	222	827	12
11:04:31 PM	230	815	12
11:14:31 PM	231	824	11
11:24:31 PM	216	751	11
11:34:31 PM	206	734	11
11:44:31 PM	199	709	10
11:54:31 PM	195	696	10
12:04:31 AM	189	685	10
12:14:31 AM	188	694	10
12:24:31 AM	189	705	10
12:34:31 AM	191	710	9
12:44:31 AM	193	731	9
12:54:31 AM	197	746	9
1:04:31 AM	196	738	9
1:14:31 AM	188	707	8
1:24:31 AM	179	670	8
1:34:31 AM	169	619	8

1:44:31 AM	159	578	8
1:54:31 AM	152	543	8
2:04:31 AM	378	764	11
2:14:31 AM	413	833	10
2:24:31 AM	399	818	9
2:34:31 AM	388	804	9
2:44:31 AM	301	779	8
2:54:31 AM	256	715	8
3:04:31 AM	239	666	8
3:14:31 AM	226	634	8
3:24:31 AM	216	609	7
3:34:31 AM	233	592	14
3:44:31 AM	294	811	13
3:54:31 AM	314	858	13
4:04:31 AM	301	783	12
4:14:31 AM	290	766	11
4:24:31 AM	282	759	11
4:34:31 AM	275	744	10
4:44:31 AM	269	722	10
4:54:31 AM	265	722	9
5:04:31 AM	258	704	9
5:14:31 AM	301	815	12
5:24:31 AM	309	828	11
5:34:31 AM	296	784	10
5:44:31 AM	291	795	10
5:54:31 AM	282	782	9
6:04:31 AM	284	794	9
6:14:31 AM	277	773	9

Client ARADA
Model FRRINGDON16
Run # BRK1
Project # 0000
Tracking #
Date 12_2_16
Notes:Medium Burn rate setting

Time	FLUE	CAT	CH 3	CH 4	CH 5	CH 6	CH 7	SCALE	CH 9	CH 10	CH 11	CH 12
Ambient	CH 14	CH 15	CH 16	CH 17	CH 18	CH 19	CH 20	CH 21	CH 22	CH 23	CH 24	CH 25	CH 25
CH 27	CH 28	CH 29	CH 30	CH 31	CH 32								
11:41:19 AM	386	754	0	0	0	0	0	10					
11:51:19 AM	417	829	0	0	0	0	0	8					
12:01:19 PM	428	825	0	0	0	0	0	7					
12:11:19 PM	413	840	0	0	0	0	0	5					
12:21:19 PM	407	841	0	0	0	0	0	3					
12:31:19 PM	410	846	0	0	0	0	0	2					
12:41:19 PM	399	969	0	0	0	0	0	11					
12:51:19 PM	365	971	0	0	0	0	0	10					
1:01:19 PM	441	974	0	0	0	0	0	9					
1:11:19 PM	401	971	0	0	0	0	0	7					
1:21:19 PM	373	964	0	0	0	0	0	6					
1:31:19 PM	361	927	0	0	0	0	0	6					
1:41:19 PM	347	888	0	0	0	0	0	5					
1:51:19 PM	334	859	0	0	0	0	0	3					
2:01:19 PM	310	813	0	0	0	0	0	4					
2:11:19 PM	350	902	0	0	0	0	0	12					
2:21:19 PM	349	897	0	0	0	0	0	11					
2:31:19 PM	355	948	0	0	0	0	0	10					
2:41:19 PM	358	944	0	0	0	0	0	10					
2:51:19 PM	336	884	0	0	0	0	0	9					
3:01:19 PM	318	863	0	0	0	0	0	8					
3:11:19 PM	308	852	0	0	0	0	0	8					
3:21:19 PM	295	814	0	0	0	0	0	7					
3:31:19 PM	287	791	0	0	0	0	0	7					
3:41:19 PM	279	779	0	0	0	0	0	6					
3:51:19 PM	271	739	0	0	0	0	0	6					
4:01:19 PM	270	724	0	0	0	0	0	4					
4:11:19 PM	262	698	0	0	0	0	0	5					
4:21:19 PM	257	672	0	0	0	0	0	4					
4:31:19 PM	296	846	0	0	0	0	0	14					
4:41:19 PM	317	934	0	0	0	0	0	13					
4:51:19 PM	309	874	0	0	0	0	0	13					
5:01:19 PM	301	808	0	0	0	0	0	12					
5:11:19 PM	295	786	0	0	0	0	0	12					
5:21:19 PM	289	834	0	0	0	0	0	11					
5:31:19 PM	291	819	0	0	0	0	0	11					
5:41:19 PM	284	771	0	0	0	0	0	10					
5:51:19 PM	295	825	0	0	0	0	0	10					
6:01:19 PM	303	845	0	0	0	0	0	9					
6:11:19 PM	337	889	0	0	0	0	0	9					
6:21:19 PM	364	838	0	0	0	0	0	8					
6:31:19 PM	363	830	0	0	0	0	0	7					
6:41:19 PM	361	822	0	0	0	0	0	7					

6:51:19 PM	349	809	0	0	0	0	0	7
7:01:19 PM	339	795	0	0	0	0	0	6
7:11:19 PM	334	797	0	0	0	0	0	6
7:21:19 PM	331	792	0	0	0	0	0	5
7:31:19 PM	328	787	0	0	0	0	0	4
7:41:19 PM	321	767	0	0	0	0	0	4

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_17_17
RUN #: EPA5
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.045	0.042	0.040	0.045	0.050	0.040	0.036	0.042
Temperature	135	135	135	135	135	135	135	135	135.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	11.5	-0.05	306	297	371	314	150	287.6
10	9.5	-0.074	307	300	368	407	149	306.2
20	7	-0.076	367	376	405	552	149	369.8
30	4.6	-0.074	450	455	458	646	149	431.6
40	3.2	-0.065	477	495	499	658	150	455.8
50	2.4	-0.064	473	483	522	591	154	444.6
60	2.1	-0.058	443	450	502	512	157	412.8

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	14.42095	ft/sec.
Intial Tunnel Flow:	145.7073	scfm
Average Tunnel Flow:	147.4251	scfm

Run #	EPA5
Date:	2/17/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.045	0.042	0.040	0.045	0.050	0.040	0.036	0.042
Temperature	135	135	135	135	135	135	135	135	135.000

Tunnel Velocity:	14.421	ft/sec.
Intial Tunnel Flow:	145.71	scfm
Average Tunnel Flow	147.43	scfm

JOB #	035-S-075-1															
TECHNICIAN	BTN							ROOM TEMP (F)		71.4			BEG	MID	END	AVG
DATE:	2_17_17							BAROMETRIC P					29.60	29.60	29.60	29.60
RUN #:	EPA5															
READING INTERVAL:	10															
SAMPLE BOX :	A	METER Y FACTOR:	1.01							PROBE MATERIAL:			SS			
FRONT FILTER #:	3052&3057				REAR FILTER #	REAR FILTER #:	3053									
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)	<0.01	@	19	IN-HG						
Run Time:	60	AMBIENT FILTER #:				3056	VOLUME	633.178	LITERS	FUEL MOISTURE DB				19.9	%	
		FINAL LEAK RATE (CFM):				<0.01	@	19	IN-HG							
TEST START TIME:	17:24								1	2	3	4	5	6		
									TEMPERATURES							
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP
0	0.000	0.000	0.042	0	-0.08		NA	10.6	0	118	451	73	500	829.67	84	70
10	1.394	0.139	0.042	2.02	-0.73	14.436	100	8.4	2.2	134	588	82	446	1295.63	83	70
20	2.805	0.141	0.042	2.01	-1.44	14.484	102	5.9	2.5	138	610	84	446	1333.6	84	70
30	4.215	0.141	0.042	2.01	-1.6	14.411	101	4.4	1.5	132	553	83	465	1145.09	86	70
40	5.636	0.142	0.042	2.02	-1.68	14.387	101	3.1	1.3	130	543	84	471	1149.54	88	71
50	7.056	0.142	0.042	2.02	-0.69	14.326	100	2.3	0.8	125	505	84	480	988.93	91	70
60	8.482	0.143	0.042	2.01	-0.84	14.277	100	1.8	0.5	121	473	83	479	901.51	92	71

TEST START TIME:		17:24								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP

TEST START TIME:		17:24								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP
	8.482		0.042	2.02		14.387	100.4			128	532				87	70

JOB NUMBER 035-S-075-1

RUN # EPA5

DATE: 2_17_17

BURN RATE 4.01 KG/HR DRY

FILTER A PARTICULATE 3 mg

FILTER B PARTICULATE mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	8.48		0.00	
Average Gas Velocity in Dilution Tunnel - vs	14.42	feet/second	14.42	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8845.50	dscf/hour	8845.50	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	8.22	dscf	#DIV/0!	dscf
Average Tunnel Temperature	128.3	F	128.3	F
Average Delta p	0.042		0.042	
Average Gas Meter Temperature	87	F	#DIV/0!	F
Average Delta H	2.02	in-h20	#DIV/0!	in-h20
Total Time of Test	60	min	0	min
Total Particulates	3	mg	0	mg
Particulate Concentration (dry-standard)	0.00036	grams/dscf	#DIV/0!	grams/dscf
Ambient Train (dry-standard)	0.000004753	grams/dscf	0.000004753	grams/dscf
Net (dry-standard)	0.000360037	grams/dscf	#DIV/0!	grams/dscf
Particulate Emission Rate	3.18	grams/hour	#DIV/0!	grams/hour
Total PM Emissions	3.18	grams	#DIV/0!	grams
Average Total PM Emissions		#DIV/0!	grams	
AVERAGE PARTICLATE EMISSIONS RATE		#DIV/0!	grams/hour	
% OF AVERAGE	#DIV/0!		#DIV/0!	
Emissions Factor	0.794	g/Kg -Dry	#DIV/0!	g/Kg -Dry

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_17_17
RUN #: EPA4
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.037	0.045	0.040	0.041	0.042	0.046	0.042	0.035	0.041
Temperature	120	120	120	120	120	120	120	120	120.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	8.9	-0.067	392	420	479	546	155	398.4
10	7	-0.063	408	424	507	589	161	417.8
20	5.2	-0.062	436	430	537	598	165	433.2
30	3.7	-0.057	471	465	532	609	168	449
40	3.2	-0.049	465	461	514	574	169	436.6
50	2.4	-0.046	422	417	473	491	169	394.4
60	2.3	-0.043	385	378	429	428	168	357.6

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.9422	ft/sec.
Intial Tunnel Flow:	146.5631	scfm
Average Tunnel Flow:	148.8567	scfm

Notes:

Run #	EPA4
Date:	2/17/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.037	0.045	0.040	0.041	0.042	0.046	0.042	0.035	0.041
Temperature	120	120	120	120	120	120	120	120	120.000

Tunnel Velocity:	13.942	ft/sec.
Intial Tunnel Flow:	146.56	scfm
Average Tunnel Flow	148.86	scfm

JOB #	035-S-075-1															
TECHNICIAN	BTN							ROOM TEMP (F)	68.0				BEG	MID	END	AVG
DATE:	2_17_17							BAROMETRIC P					29.60	29.60	29.60	29.60
RUN #:	EPA4															
READING INTERVAL:	10															
SAMPLE BOX :	A	METER Y FACTOR:	1.01						PROBE MATERIAL:				SS			
FRONT FILTER #:	3046&3051				REAR FILTER #	REAR FILTER #:	3047									
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)	<0.01	@	19	IN-HG						
Run Time:	60	AMBIENT FILTER #:				3050	VOLUME	1003.027	LITERS	FUEL MOISTURE DB				19.7	%	
		FINAL LEAK RATE (CFM):				<0.01	@	19	IN-HG							
TEST START TIME:	12:54								1	2	3	4	5	6		
									TEMPERATURES							
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
0	0.000	0.000	0.041	0	-0.06		NA	10.8	0	96	318	70	426	707.33	74	67
10	1.382	0.138	0.041	2.02	-0.72	13.836	100	9.8	1	99	367	75	383	949.24	74	68
20	2.778	0.140	0.041	2.02	-0.93	13.898	101	8.4	1.4	104	441	76	368	1070.56	77	68
30	4.182	0.140	0.041	1.99	-1.53	13.959	101	6.7	1.7	109	467	77	388	1139.04	80	68
40	5.585	0.140	0.041	2.02	-0.65	13.923	100	5.5	1.2	106	428	77	418	1050.08	83	69
50	6.999	0.141	0.041	2	-0.88	13.923	100	4.4	1.1	106	421	78	435	1014.88	86	69
60	8.416	0.142	0.041	2.04	-0.84	13.886	100	3.6	0.8	103	402	77	448	975.45	88	69

TEST START TIME:		12:54								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP

TEST START TIME:		12:54								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	8.416		0.041	2.02		13.904	100.3			103	406				80	68

JOB NUMBER 035-S-075-1

RUN # EPA4

DATE: 2_17_17

BURN RATE 4.09 KG/HR DRY

FILTER A PARTICULATE 4.2 mg

FILTER B PARTICULATE mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	8.42		0.00	
Average Gas Velocity in Dilution Tunnel - vs	13.94	feet/second	13.94	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8931.40	dscf/hour	8931.40	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	8.26	dscf	#DIV/0!	dscf
Average Tunnel Temperature	103.3	F	103.3	F
Average Delta p	0.041		0.041	
Average Gas Meter Temperature	80	F	#DIV/0!	F
Average Delta H	2.02	in-h20	#DIV/0!	in-h20
Total Time of Test	60	min	0	min
Total Particulates	4.2	mg	0	mg
Particulate Concentration (dry-standard)	0.00051	grams/dscf	#DIV/0!	grams/dscf
Ambient Train (dry-standard)	0.000000000	grams/dscf	0.000000000	grams/dscf
Net (dry-standard)	0.000508526	grams/dscf	#DIV/0!	grams/dscf
Particulate Emission Rate	4.54	grams/hour	#DIV/0!	grams/hour
Total PM Emissions	4.54	grams	#DIV/0!	grams

Average Total PM Emissions	#DIV/0!	grams	
AVERAGE PARTICLATE EMISSIONS RATE	#DIV/0!	grams/hour	
% OF AVERAGE	#DIV/0!		#DIV/0!
Emissions Factor	1.110	g/Kg -Dry	#DIV/0! g/Kg -Dry

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_16_17
RUN #: EPA3
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.041	0.043	0.041	0.044	0.043	0.046	0.040	0.035	0.042
Temperature	105	105	105	105	105	105	105	105	105.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	6.4	-0.067	380	411	446	580	153	394
10	5.3	-0.047	406	428	459	605	160	411.6
20	4.2	-0.046	399	418	448	598	164	405.4
30	3.6	-0.039	395	409	440	591	166	400.2
40	3.4	-0.031	397	392	440	526	167	384.4
50	2.7	-0.024	380	371	426	462	169	361.6
60	2.5	-0.025	356	349	411	411	173	340

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.93148	ft/sec.
Intial Tunnel Flow:	149.5518	scfm
Average Tunnel Flow:	152.6048	scfm

Run #	EPA3
Date:	2/16/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.041	0.043	0.041	0.044	0.043	0.046	0.040	0.035	0.042
Temperature	105	105	105	105	105	105	105	105	105.000

Tunnel Velocity:	13.931	ft/sec.
Intial Tunnel Flow:	149.55	scfm
Average Tunnel Flow	152.6	scfm

JOB #	035-S-075-1															
TECHNICIAN	BTN							ROOM TEMP (F)		69.9			BEG	MID	END	AVG
DATE:	2_16_17								BAROMETRIC P				29.56	29.56	29.56	29.56
RUN #:	EPA3															
READING INTERVAL:		10														
SAMPLE BOX :		A	METER Y FACTOR:		1.01					PROBE MATERIAL:			SS			
FRONT FILTER #:		3040&3045				REAR FILTER #	REAR FILTER #:		3041							
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG				
Run Time:		60		AMBIENT FILTER #:			3044	VOLUME	1403.742	LITERS		FUEL MOISTURE DB		19.3	%	
				FINAL LEAK RATE (CFM):			<0.01	@	19	IN-HG						
TEST START TIME:		12:53								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
0	0.000	0.000	0.042	0	-0.04		NA	10.7	0	90	229	72	410	672.61	75	72
10	1.386	0.139	0.042	2.01	-0.84	13.900	100	10.1	0.6	90	245	75	371	761.22	76	70
20	2.785	0.140	0.042	2.01	-1.08	13.862	100	9.4	0.7	87	239	75	345	863.72	78	70
30	4.190	0.141	0.042	2	-1.45	13.862	100	9	0.4	87	246	74	336	916.06	82	69
40	5.601	0.141	0.042	2.01	-1.51	13.850	100	8.5	0.5	86	253	74	334	993.19	85	69
50	7.014	0.141	0.042	2.02	-0.73	13.875	100	7.9	0.6	88	290	74	339	1246.55	87	69
60	8.434	0.142	0.042	2	-1.02	13.900	100	6.8	1.1	90	330	74	356	1281.97	89	69

TEST START TIME:		12:53								1	2	3	4	5	6	
										TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	TUNNEL DELTA P	ORIFICE DELTA H	FILTER VAC	TUNNEL VEL FT/SEC	Proportional Rate (%)	Scale Weight	Weight Chg	TUNNEL TEMP	FLUE TEMP	FILTER TEMP	FB REAR TEMP	CAT TEMP	METER TEMP	AMBIENT TEMP

TEST START TIME:		12:53								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	8.434		0.042	2.01		13.875	100.1			88	262				82	70

JOB NUMBER 035-S-075-1

RUN # EPA3

DATE: 2_16_17

BURN RATE 4.07 KG/HR DRY

FILTER A PARTICULATE 5.3 mg

FILTER B PARTICULATE mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	8.43		0.00	
Average Gas Velocity in Dilution Tunnel - vs	13.93	feet/second	13.93	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9156.29	dscf/hour	9156.29	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	8.24	dscf	#DIV/0!	dscf
Average Tunnel Temperature	88.3	F	88.3	F
Average Delta p	0.042		0.042	
Average Gas Meter Temperature	82	F	#DIV/0!	F
Average Delta H	2.01	in-h20	#DIV/0!	in-h20
Total Time of Test	60	min	0	min
Total Particulates	5.3	mg	0	mg
Particulate Concentration (dry-standard)	0.00064	grams/dscf	#DIV/0!	grams/dscf
Ambient Train (dry-standard)	0.000004251	grams/dscf	0.000004251	grams/dscf
Net (dry-standard)	0.000638659	grams/dscf	#DIV/0!	grams/dscf
Particulate Emission Rate	5.85	grams/hour	#DIV/0!	grams/hour
Total PM Emissions	5.85	grams	#DIV/0!	grams
Average Total PM Emissions		#DIV/0!	grams	
AVERAGE PARTICLATE EMISSIONS RATE		#DIV/0!	grams/hour	
% OF AVERAGE	#DIV/0!		#DIV/0!	
Emissions Factor	1.437	g/Kg -Dry	#DIV/0!	g/Kg -Dry

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_15_17
RUN #: EPA2
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

Tunnel Traverse Information									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.036	0.043	0.040	0.040	0.042	0.041	0.040	0.033	0.039
Temperature	105	105	105	105	105	105	105	105	105.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	6.5	-0.063	387	417	465	578	170	403.4
10	5.4	-0.047	410	428	471	601	179	417.8
20	4.5	-0.04	397	410	451	596	180	406.8
30	3.8	-0.033	387	395	435	593	179	397.8
40	3.5	-0.026	376	380	432	557	175	384
50	2.7	-0.025	373	379	441	488	174	371
60	2.6	-0.024	356	360	417	429	174	347.2

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.39546	ft/sec.
Intial Tunnel Flow:	145.8342	scfm
Average Tunnel Flow:	147.3747	scfm

Run #	EPA2
Date:	2/15/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.036	0.043	0.040	0.040	0.042	0.041	0.040	0.033	0.039
Temperature	105	105	105	105	105	105	105	105	105.000

Tunnel Velocity:	13.395	ft/sec.
Intial Tunnel Flow:	145.83	scfm
Average Tunnel Flow	147.37	scfm

JOB #	035-S-075-1															
TECHNICIAN	BTN							ROOM TEMP (F)	70.0				BEG	MID	END	AVG
DATE:	2_15_17							BAROMETRIC P					29.72	29.72	29.72	29.72
RUN #:	EPA2															
READING INTERVAL:		10														
SAMPLE BOX :		A	METER Y FACTOR:		1.01				PROBE MATERIAL:				SS			
FRONT FILTER #:		3034&3039				REAR FILTER #	REAR FILTER #:	3035								
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)	<0.01	@	19	IN-HG					
Run Time:		60		AMBIENT FILTER #:			3038	VOLUME	1736.481	LITERS		FUEL MOISTURE DB			20.3	%
				FINAL LEAK RATE (CFM):			<0.01	@	19	IN-HG						
TEST START TIME:		13:39								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
0	0.000	0.000	0.039	0	-0.04		NA	10.6	0	90	229	72	414	667.55	74	70
10	1.388	0.139	0.039	2.01	-0.82	13.371	100	9.9	0.7	91	244	75	375	768.67	75	70
20	2.782	0.139	0.039	1.98	-1.49	13.346	100	9.3	0.6	89	233	75	346	857.3	78	70
30	4.189	0.141	0.039	2.01	-0.7	13.334	100	8.7	0.6	88	234	75	340	867.06	81	70
40	5.605	0.142	0.039	2.01	-1.49	13.322	100	8.2	0.5	87	230	75	338	880.21	84	70
50	7.021	0.142	0.039	2.03	-0.94	13.334	100	7.5	0.7	88	249	74	338	898.99	87	69
60	8.446	0.143	0.039	2.03	-1.53	13.346	100	6.6	0.9	89	264	75	343	899.71	89	70

TEST START TIME:		13:39								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP

TEST START TIME:		13:39								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	8.446		0.039	2.01		13.342	100.1			89	240				81	70

JOB NUMBER 035-S-075-1

RUN # EPA2

DATE: 2_15_17

BURN RATE 4.00 KG/HR DRY

FILTER A PARTICULATE 3.3 mg

FILTER B PARTICULATE mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	8.45		0.00	
Average Gas Velocity in Dilution Tunnel - vs	13.40	feet/second	13.40	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8842.48	dscf/hour	8842.48	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	8.31	dscf	#DIV/0!	dscf
Average Tunnel Temperature	88.9	F	88.9	F
Average Delta p	0.039		0.039	
Average Gas Meter Temperature	81	F	#DIV/0!	F
Average Delta H	2.01	in-h20	#DIV/0!	in-h20
Total Time of Test	60	min	0	min
Total Particulates	3.3	mg	0	mg
Particulate Concentration (dry-standard)	0.00040	grams/dscf	#DIV/0!	grams/dscf
Ambient Train (dry-standard)	0.000003426	grams/dscf	0.000003426	grams/dscf
Net (dry-standard)	0.000393744	grams/dscf	#DIV/0!	grams/dscf
Particulate Emission Rate	3.48	grams/hour	#DIV/0!	grams/hour
Total PM Emissions	3.48	grams	#DIV/0!	grams
% OF AVERAGE	#DIV/0!		#DIV/0!	
Emissions Factor	0.871	g/Kg -Dry	#DIV/0!	g/Kg -Dry

Average Total PM Emissions	#DIV/0!	grams
AVERAGE PARTICLATE EMISSIONS RATE	#DIV/0!	grams/hour

PREBURN

035-S-075-1
BTN
2_14_17
EPA1
NTERVAL: 10

60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.032	0.036	0.042	0.040	0.035	0.040	0.043	0.036	0.038
Temperature	100	100	100	100	100	100	100	100	100.000

		1	2	3	4	5	
		TEMPERATURES					
SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
5.2	-0.066	429	431	483	609	149	420.2
4.3	-0.042	436	438	484	613	162	426.6
3.6	-0.036	407	409	455	588	171	406
3.2	-0.026	386	387	430	556	175	386.8
3	-0.015	369	366	419	504	178	367.2
2.7	-0.015	357	352	413	449	179	350
2.6	-0.02	341	338	403	406	180	333.6

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.12014	ft/sec.
Intial Tunnel Flow:	144.6789	scfm
Average Tunnel Flow:	146.6092	scfm

Run #	EPA1
Date:	2/14/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.032	0.036	0.042	0.040	0.035	0.040	0.043	0.036	0.038
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	13.12	ft/sec.
Intial Tunnel Flow:	144.68	scfm
Average Tunnel Flow	146.61	scfm

JOB #	035-S-075-1															
TECHNICIAN	BTN							ROOM TEMP (F)		70.0			BEG	MID	END	AVG
DATE:	2_14_17								BAROMETRIC P				30.06	30.06	30.06	30.06
RUN #:	EPA1															
READING INTERVAL:		10														
SAMPLE BOX :		A	METER Y FACTOR:		1.01					PROBE MATERIAL:			SS			
FRONT FILTER #:		3028&3033				REAR FILTER #	REAR FILTER #:		3029							
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG				
Run Time:		60		AMBIENT FILTER #:			3032	VOLUME	2305.638	LITERS		FUEL MOISTURE DB		20.6	%	
				FINAL LEAK RATE (CFM):			<0.01	@	19	IN-HG						
TEST START TIME:		15:18								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
0	0.000	0.000	0.038	0	-0.13		NA	10.9	0	89	206	72	402	609.39	72	69
10	1.371	0.137	0.038	1.98	-0.7	13.099	100	10.4	0.5	89	212	74	365	758.11	74	69
20	2.752	0.138	0.038	1.99	-1.48	13.075	100	9.9	0.5	87	194	74	342	874.81	77	69
30	4.139	0.139	0.038	2.01	-1.46	13.051	100	9.4	0.5	85	200	74	334	951.59	80	69
40	5.537	0.140	0.038	2.02	-0.77	13.051	100	8.8	0.6	85	204	73	334	990.19	83	69
50	6.944	0.141	0.038	2.02	-1.47	13.051	100	8.2	0.6	85	211	74	339	1087.04	86	70
60	8.352	0.141	0.038	2	-1.46	13.063	100	7.6	0.6	86	233	74	350	1125.14	88	70

TEST START TIME:		15:18								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP

TEST START TIME:		15:18								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	8.352		0.038	2.00		13.065	100.1			87	209				80	69

JOB #	035-S-075-1										
TECHNICIAN	BTN										
DATE:	2_14_17										
RUN #:	EPA1										
READING INTERVAL:	10										
SAMPLE BOX :	B	METER Y FACTOR:		1.002		PROBE MATERIAL:			SS		
FRONT FILTER #:	3030				REAR FILTER #:	3031					
FINAL LEAK RATE (CFM):	<0.01	@	18	IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	18	IN-HG		

Run Time: 0 **Firebox Delta T** **#N/A**

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
0	0	0	NA	0										Run No

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
	0	#DIV/0!	#DIV/0!	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#N/A	
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT	

JOB NUMBER 035-S-075-1

RUN # EPA1

DATE: 2_14_17

BURN RATE 4.10 KG/HR DRY

FILTER A PARTICULATE 3.1 mg

FILTER B PARTICULATE mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	8.35		0.00	
Average Gas Velocity in Dilution Tunnel - vs	13.12	feet/second	13.12	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8796.55	dscf/hour	8796.55	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	8.33	dscf	#DIV/0!	dscf
Average Tunnel Temperature	86.6	F	86.6	F
Average Delta p	0.038		0.038	
Average Gas Meter Temperature	80	F	#DIV/0!	F
Average Delta H	2.00	in-h20	#DIV/0!	in-h20
Total Time of Test	60	min	0	min
Total Particulates	3.1	mg	0	mg
Particulate Concentration (dry-standard)	0.00037	grams/dscf	#DIV/0!	grams/dscf
Ambient Train (dry-standard)	0.000005048	grams/dscf	0.000005048	grams/dscf
Net (dry-standard)	0.000367223	grams/dscf	#DIV/0!	grams/dscf
Particulate Emission Rate	3.23	grams/hour	#DIV/0!	grams/hour
Total PM Emissions	3.23	grams	#DIV/0!	grams

Average Total PM Emissions	#DIV/0!	grams	
AVERAGE PARTICLATE EMISSIONS RATE	#DIV/0!	grams/hour	
% OF AVERAGE	#DIV/0!		#DIV/0!
Emissions Factor	0.788	g/Kg -Dry	#DIV/0! g/Kg -Dry

DIRIGO LABORATORIES INC.

Client:	**Arada**
Model:	**Farringdon 16**
Tracking No.:	**75**
Project No.:	**035-S-075-1**
Test Dates:	**2/14/17 - 2/17/17**

Run Number	(kg/hr) Burn Rate	(g/hr) Emmisions Rate
1	**0.59**	**0.9**
2	**0.77**	**1.1**
3	**0.98**	**2.0**
4	**1.29**	**1.5**
5	**2.01**	**1.7**

Total Runs: **5**

EPA Method 28 - Weighted Average

DIRIGO LABORATORIES INC.

Weighted Average: 1.5 (g/hr)

Client: Arada
Model: Farringdon 16
Tracking No.: 75
Project No.: 035-S-075-1
Test Dates: 2/14/17 - 2/17/17

Burn Rate Category	1
Burn Rate (kg/hr-dry)	0.59
Emissions Rate (g/hr)	0.9
Emissions Rate Cap (g/hr)	15
Weighting Factor	10.96%
Run Number	1

Burn Rate Category	1
Burn Rate (kg/hr-dry)	0.77
Emissions Rate (g/hr)	1.1
Emissions Rate Cap (g/hr)	15
Weighting Factor	14.42%
Run Number	2

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.98
Emissions Rate (g/hr)	2.0
Emissions Rate Cap (g/hr)	15
Weighting Factor	22.65%
Run Number	3

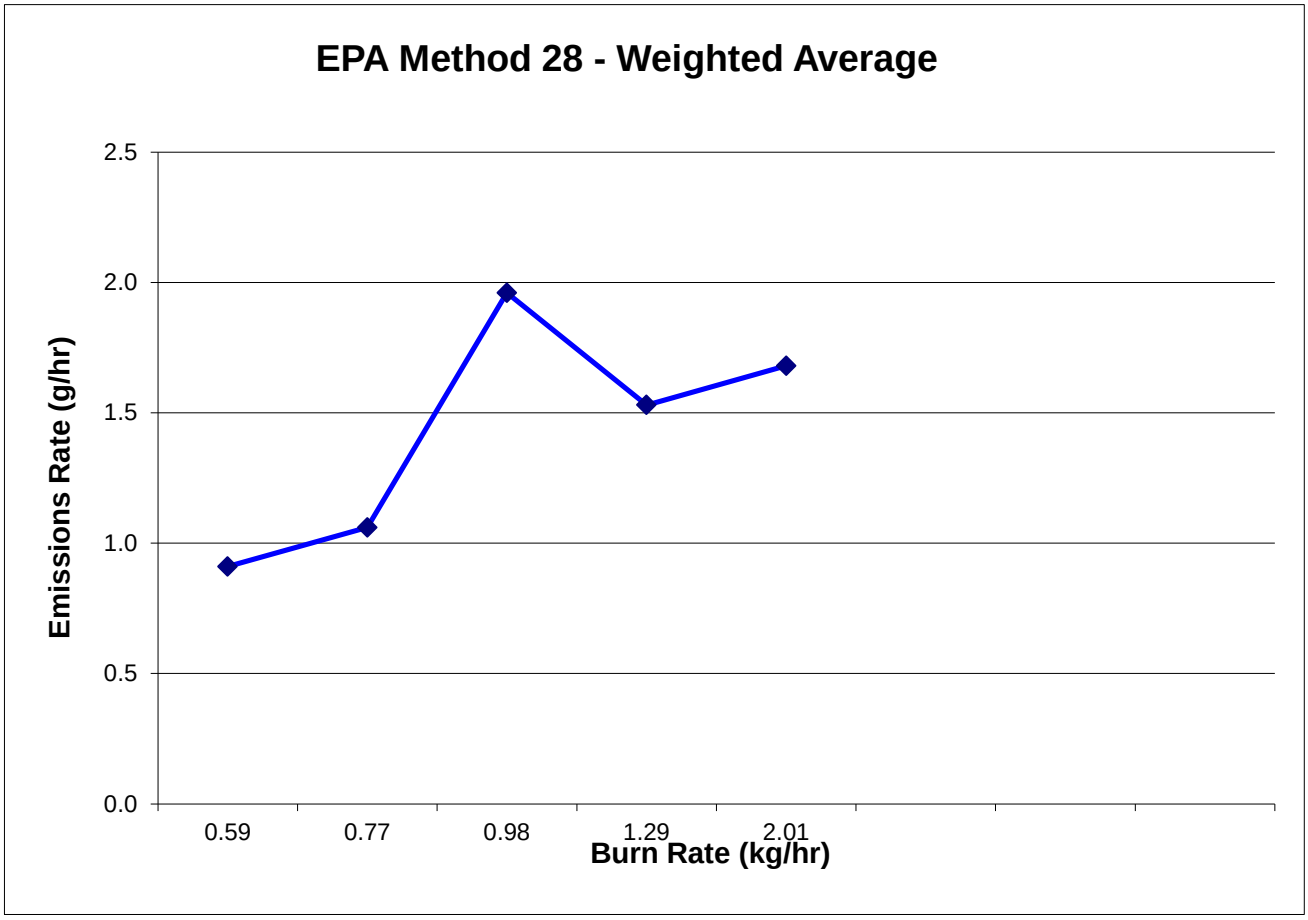
Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.29
Emissions Rate (g/hr)	1.5
Emissions Rate Cap (g/hr)	15
Weighting Factor	30.52%
Run Number	4

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.01
Emissions Rate (g/hr)	1.7
Emissions Rate Cap (g/hr)	18
Weighting Factor	21.45%
Run Number	5

EPA Method 28 - Weighted Average

DIRIGO LABORATORIES INC.

Client:	Arada
Model:	Farringdon 16
Tracking No.:	75
Project No.:	035-S-075-1
Test Dates:	2/14/17 - 2/17/17



DIRIGO LABORATORIES INC.

Test No.	Burn Rate	Pi	Ei	Ki	KiEi
1	0.59	0.097	0.9	0.199	0.18
2	0.77	0.199	1.1	0.262	0.28
3	0.98	0.359	2.0	0.411	0.81
4	1.29	0.610	1.5	0.554	0.85
5	2.01	0.914	1.7	0.390	0.65
0	5.00	1.000	0.0	0.000	0.00
0	5.00	1.000	0.0	0.000	0.00
0	5.00	1.000	0.0	0.000	0.00
		1.000		1.816	2.77

Nomenclature:
Pi = Probability for burn rate during test run
Ei = Emissions Rate for test run
Ki = Test run weighting factor

Burn Rate (kg/hr-dry)	Cum. Probability (P)
0.00	0.0000
0.01	0.0004
0.02	0.0008
0.03	0.0012
0.04	0.0016
0.05	0.0020
0.06	0.0030
0.07	0.0040
0.08	0.0050
0.09	0.0060
0.10	0.0070
0.11	0.0080
0.12	0.0090
0.13	0.0100
0.14	0.0110
0.15	0.0120
0.16	0.0128
0.17	0.0136
0.18	0.0144
0.19	0.0152
0.20	0.0160
0.21	0.0170

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_17_17
RUN #: EPA5
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.045	0.042	0.040	0.045	0.050	0.040	0.036	0.042
Temperature	135	135	135	135	135	135	135	135	135.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	11.5	-0.05	306	297	371	314	150	287.6
10	9.5	-0.074	307	300	368	407	149	306.2
20	7	-0.076	367	376	405	552	149	369.8
30	4.6	-0.074	450	455	458	646	149	431.6
40	3.2	-0.065	477	495	499	658	150	455.8
50	2.4	-0.064	473	483	522	591	154	444.6
60	2.1	-0.058	443	450	502	512	157	412.8

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	14.33707	ft/sec.
Intial Tunnel Flow:	145.7073	scfm
Average Tunnel Flow:	148.2876	scfm

Run #	EPA5
Date:	2/17/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.035	0.045	0.042	0.040	0.045	0.050	0.040	0.036	0.042
Temperature	135	135	135	135	135	135	135	135	135.000

Tunnel Velocity:	14.337	ft/sec.
Intial Tunnel Flow:	145.71	scfm
Average Tunnel Flow	148.29	scfm

JOB #	035-S-075-1															
TECHNICIA	BTN							ROOM TEMP (F)		71.4			BEG	MID	END	AVG
DATE:	2_17_17								BAROMETRIC				29.60	29.60	29.60	29.60
RUN #:	EPA5															
READING INTERVAL:		10														
SAMPLE BOX :		A	METER Y FACTOR:		1.01					PROBE MATERIAL:			SS			
FRONT FILTER #:		3052&3057				REAR FILTER #	REAR FILTER #:		3053							
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG				
Run Time:		120	AMBIENT FILTER #:				3056	VOLUME	633.178	LITERS	FUEL MOISTURE DB			19.9	%	
			FINAL LEAK RATE (CFM):				<0.01	@	19	IN-HG						
TEST START TIME:		17:24								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP
0	0.000	0.000	0.042	0	-0.08		NA	10.6	0	118	451	73	500	829.67	84	70
10	1.394	0.139	0.042	2.02	-0.73	14.436	101	8.4	2.2	134	588	82	446	1295.63	83	70
20	2.805	0.141	0.042	2.01	-1.44	14.484	102	5.9	2.5	138	610	84	446	1333.6	84	70
30	4.215	0.141	0.042	2.01	-1.6	14.411	101	4.4	1.5	132	553	83	465	1145.09	86	70
40	5.636	0.142	0.042	2.02	-1.68	14.387	102	3.1	1.3	130	543	84	471	1149.54	88	71
50	7.056	0.142	0.042	2.02	-0.69	14.326	101	2.3	0.8	125	505	84	480	988.93	91	70
60	8.482	0.143	0.042	2.01	-0.84	14.277	100	1.8	0.5	121	473	83	479	901.51	92	71
70	9.912	0.143	0.042	2.02	-1.39	14.240	100	1.3	0.5	118	454	83	474	887.48	94	72
80	11.337	0.143	0.042	2.04	-0.79	14.215	99	1	0.3	116	441	83	467	867.68	95	73
90	12.772	0.144	0.042	2.03	-1.34	14.191	100	0.6	0.4	114	428	83	458	830.02	96	73
100	14.203	0.143	0.042	2.04	-1.38	14.166	99	0.4	0.2	112	415	83	447	785.94	97	73
110	15.635	0.143	0.042	2.04	-0.93	14.154	99	0.2	0.2	111	407	82	448	773.63	98	73
120	17.075	0.144	0.042	2.04	-1.54	14.141	99	0	0.2	110	402	82	454	758	99	73

TEST START TIME:		17:24								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP

TEST START TIME:	17:24								1	2	3	4	5	6	
									TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	FB	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	INT	TEMP	TEMP
	17.075		0.042	2.03		14.286	100.3			121	482				91	71

JOB #	035-S-075-1						
TECHNICIA	BTN						
DATE:	2_17_17						
RUN #:	EPA5						
READING INTERVAL:	10						
SAMPLE BOX :	*B*	METER Y FACTOR:	1.002		PROBE MATERIAL:	**SS**	
FRONT FILTER #:	3054			REAR FILTER #:	3055		
FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG

Run Time: 120 **Firebox Delta T** **57.8**

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
0	0	0	NA	0	0	1	441	448	74	508	157	83	411	Run No
10	1.373	0.137	101	-0.07	1.98	2.04	386	394	81	522	161	82	382	
20	2.765	0.139	102	-0.08	1.97	1.62	407	421	83	626	161	83	412	
30	4.160	0.140	101	-0.07	1.99	1.66	433	444	83	630	160	85	426	
40	5.555	0.140	101	-0.06	2	1.68	452	458	83	623	157	87	432	
50	6.965	0.141	101	-0.07	1.99	1.4	457	462	83	583	152	89	427	
60	8.373	0.141	100	-0.06	1.98	1.47	443	448	82	522	149	91	408	
70	9.782	0.141	100	-0.06	1.98	1.67	428	436	82	480	145	92	393	
80	11.196	0.141	100	-0.06	1.99	2.13	413	421	82	452	143	93	379	
90	12.608	0.141	99	-0.06	1.99	1.46	404	411	82	424	142	94	368	
100	14.024	0.142	99	-0.05	1.97	1.91	398	402	82	411	142	95	360	
110	15.438	0.141	99	-0.05	1.99	1.39	393	393	82	398	144	96	355	
120	16.857	0.142	99	-0.05	1.98	1.36	390	386	82	389	146	97	353	

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
	16.857	0.140	100.301	-0.057	1.984167	1.599231	419	425	82	505	151	90	58	
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER: 035-S-075-1
TECHNICIAN: BTN
DATE: 2_17_17
RUN NUMBER: EPA5

METER Y FACTOR: **0.997**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	86	0	0
End	633.178	101	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	633.178	Liters
Total Sample Volume - Vm	22.360	ft^3
Average Sample Rate	0.19	ft^3/min
Sample Time	120.00	Minutes
Average Meter Temperature	93.5	°F
Total Sample Volume (Standard Conditions) - Vmstd	21.039	dscf
Total Particulates	0.1	mg
Particulate Concentration (dry-standard)	0.000004753	grams/dscf
Particulate Emission Rate	0.000050000	grams/hour

JOB NUMBER 035-S-075-1

RUN # EPA5

DATE: 2_17_17

BURN RATE 2.01 KG/HR DRY

FILTER A PARTICULATE 3.1 mg

FILTER B PARTICULATE 3.2 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	17.08		16.86	
Average Gas Velocity in Dilution Tunnel - vs	14.34	feet/second	14.34	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8897.26	dscf/hour	8897.26	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	16.42	dscf	16.13	dscf
Average Tunnel Temperature	121.5	F	121.5	F
Average Delta p	0.042		0.042	
Average Gas Meter Temperature	91	F	90	F
Average Delta H	2.03	in-h20	1.98	in-h20
Total Time of Test	120	min	120	min
Total Particulates	3.1	mg	3.2	mg
Particulate Concentration (dry-standard)	0.00019	grams/dscf	0.00020	grams/dscf
Ambient Train (dry-standard)	0.000004753	grams/dscf	0.000004753	grams/dscf
Net (dry-standard)	0.000184016	grams/dscf	0.00019367	grams/dscf
Particulate Emission Rate	1.64	grams/hour	1.72	grams/hour
Total PM Emissions	3.27	grams	3.45	grams
Average Total PM Emissions		3.36		grams
AVERAGE PARTICLATE EMISSIONS RATE		1.68		grams/hour
% OF AVERAGE	97.4		102.6	
Emissions Factor	0.817	g/Kg -Dry	0.859	g/Kg -Dry

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_17_17
RUN #: EPA4
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.037	0.045	0.040	0.041	0.042	0.046	0.042	0.035	0.041
Temperature	120	120	120	120	120	120	120	120	120.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	8.9	-0.067	392	420	479	546	155	398.4
10	7	-0.063	408	424	507	589	161	417.8
20	5.2	-0.062	436	430	537	598	165	433.2
30	3.7	-0.057	471	465	532	609	168	449
40	3.2	-0.049	465	461	514	574	169	436.6
50	2.4	-0.046	422	417	473	491	169	394.4
60	2.3	-0.043	385	378	429	428	168	357.6

Notes:

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.87974	ft/sec.
Intial Tunnel Flow:	146.5631	scfm
Average Tunnel Flow:	149.5266	scfm

Run #	EPA4
Date:	2/17/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.037	0.045	0.040	0.041	0.042	0.046	0.042	0.035	0.041
Temperature	120	120	120	120	120	120	120	120	120.000

Tunnel Velocity:	13.88	ft/sec.
Intial Tunnel Flow:	146.56	scfm
Average Tunnel Flow	149.53	scfm

JOB #	035-S-075-1															
TECHNICIA	BTN							ROOM TEMP (F)		68.0				BEG	MID	END	AVG
DATE:	2_17_17								BAROMETRIC					29.60	29.60	29.60	29.60
RUN #:	EPA4																
READING INTERVAL:		10															
SAMPLE BOX :		A	METER Y FACTOR:		1.01					PROBE MATERIAL:				SS			
FRONT FILTER #:		3046&3051				REAR FILTER #	REAR FILTER #:		3047								
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG					
Run Time:		190		AMBIENT FILTER #:			3050	VOLUME	1003.027	LITERS	FUEL MOISTURE DB				19.7	%	
				FINAL LEAK RATE (CFM):			<0.01	@	19	IN-HG							
TEST START TIME:		12:54								1	2	3	4	5	6		
										TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	TUNNEL DELTA P	ORIFICE DELTA H	FILTER VAC	TUNNEL VEL FT/SEC	Proportional Rate (%)	Scale Weight	Weight Chg	TUNNEL TEMP	FLUE TEMP	FILTER TEMP	FB REAR TEMP	CAT TEMP	METER TEMP	AMBIENT TEMP	
0	0.000	0.000	0.041	0	-0.06		NA	10.8	0	96	318	70	426	707.33	74	67	
10	1.382	0.138	0.041	2.02	-0.72	13.836	100	9.8	1	99	367	75	383	949.24	74	68	
20	2.778	0.140	0.041	2.02	-0.93	13.898	101	8.4	1.4	104	441	76	368	1070.56	77	68	
30	4.182	0.140	0.041	1.99	-1.53	13.959	102	6.7	1.7	109	467	77	388	1139.04	80	68	
40	5.585	0.140	0.041	2.02	-0.65	13.923	101	5.5	1.2	106	428	77	418	1050.08	83	69	
50	6.999	0.141	0.041	2	-0.88	13.923	101	4.4	1.1	106	421	78	435	1014.88	86	69	
60	8.416	0.142	0.041	2.04	-0.84	13.886	101	3.6	0.8	103	402	77	448	975.45	88	69	
70	9.844	0.143	0.041	2.04	-1.53	13.861	101	3.1	0.5	101	375	78	443	913.11	90	68	
80	11.270	0.143	0.041	2.04	-1.5	13.849	100	2.8	0.3	100	369	77	428	889.28	91	69	
90	12.702	0.143	0.041	2.04	-1.53	13.836	100	2.3	0.5	99	354	77	419	864.55	93	68	
100	14.136	0.143	0.041	2.04	-1.34	13.812	100	1.9	0.4	97	349	76	417	851.24	94	68	
110	15.567	0.143	0.041	2.03	-0.85	13.799	100	1.6	0.3	96	342	76	416	823.57	94	68	
120	17.004	0.144	0.041	2.02	-0.61	13.787	100	1.3	0.3	95	334	76	416	822.79	95	68	
130	18.442	0.144	0.041	2.03	-1.43	13.787	100	1.1	0.2	95	335	76	412	840.93	95	68	
140	19.877	0.144	0.041	2.04	-1.36	13.774	100	0.9	0.2	94	326	75	404	799.58	96	67	
150	21.313	0.144	0.041	2.03	-1.54	13.762	100	0.7	0.2	93	318	75	400	790.09	96	68	
160	22.748	0.144	0.041	2.01	-0.7	13.774	100	0.5	0.2	94	310	75	396	770.57	96	68	
170	24.177	0.143	0.041	2.02	-1.22	13.762	99	0.3	0.2	93	300	75	392	739.88	96	68	
180	25.610	0.143	0.041	2.01	-1.26	13.762	99	0.2	0.1	93	295	75	389	733.66	96	69	
190	27.043	0.143	0.041	2.02	-1.43	13.749	99	0	0.2	92	290	75	387	730.31	97	69	

TEST START TIME:		12:54								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP

TEST START TIME:	12:54								1	2	3	4	5	6	
									TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	27.043		0.041	2.02		13.828	100.2			98	357				90	68

JOB #	035-S-075-1						
TECHNICIA	BTN						
DATE:	2_17_17						
RUN #:	EPA4						
READING INTERVAL:	10						
SAMPLE BOX :	*B*	METER Y FACTOR:	1.002		PROBE MATERIAL:	**SS**	
FRONT FILTER #:	3048			REAR FILTER #:	3049		
FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG

Run Time: 190 **Firebox Delta T** **42.8**

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
0	0	0	NA	0	0	1	382	375	70	421	167	73	354	Run No
10	1.364	0.136	100	-0.05	1.98	1.61	326	317	74	380	163	73	314	
20	2.738	0.137	101	-0.07	1.98	2	309	295	76	443	159	76	315	
30	4.116	0.138	101	-0.06	1.98	1.77	325	325	77	523	154	79	343	
40	5.497	0.138	101	-0.06	1.96	2.02	365	370	77	559	151	82	373	
50	6.882	0.139	101	-0.05	1.97	1.42	381	394	77	562	147	84	384	
60	8.282	0.140	101	-0.05	1.99	1.77	397	413	77	557	144	87	392	
70	9.688	0.141	101	-0.05	1.99	1.56	400	411	77	519	141	88	383	
80	11.098	0.141	101	-0.05	1.99	1.64	388	395	76	472	138	90	364	
90	12.508	0.141	100	-0.04	1.99	1.72	383	390	76	453	137	91	356	
100	13.920	0.141	100	-0.04	2	1.3	386	391	76	451	136	92	356	
110	15.336	0.142	100	-0.04	2.01	1.5	387	387	75	435	136	93	352	
120	16.749	0.141	100	-0.04	2.01	1.33	384	385	75	415	136	93	347	
130	18.166	0.142	100	-0.04	2	2.02	380	384	75	406	136	94	344	
140	19.580	0.141	100	-0.04	2	2.04	372	375	75	394	137	94	336	
150	20.998	0.142	100	-0.04	2	1.65	363	366	74	382	139	94	330	
160	22.413	0.142	100	-0.04	1.99	1.97	354	357	75	372	141	94	324	
170	23.832	0.142	100	-0.03	2	1.62	345	347	75	361	143	95	318	
180	25.246	0.141	99	-0.04	1.99	2.05	340	339	75	354	145	95	313	
190	26.665	0.142	100	-0.03	1.99	1.72	339	333	75	350	148	95	311	

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
	26.665	0.140	100.246	-0.043	1.990526	1.6855	365	367	75	440	145	88	43	
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER: 035-S-075-1
TECHNICIAN: BTN
DATE: 2_17_17
RUN NUMBER: EPA4

METER Y FACTOR: **0.997**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	80.5	0	0
End	1003.027	97	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1003.027	Liters
Total Sample Volume - Vm	35.422	ft^3
Average Sample Rate	0.19	ft^3/min
Sample Time	190.00	Minutes
Average Meter Temperature	88.75	°F
Total Sample Volume (Standard Conditions) - Vmstd	33.616	dscf
Total Particulates	0.0	mg
Particulate Concentration (dry-standard)	0.000000000	grams/dscf
Particulate Emission Rate	0.000000000	grams/hour

JOB NUMBER 035-S-075-1

RUN # EPA4

DATE: 2_17_17

BURN RATE 1.29 KG/HR DRY

FILTER A PARTICULATE 4.3 mg

FILTER B PARTICULATE 4.5 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	27.04		26.67	
Average Gas Velocity in Dilution Tunnel - vs	13.88	feet/second	13.88	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8971.59	dscf/hour	8971.59	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	26.09	dscf	25.59	dscf
Average Tunnel Temperature	98.3	F	98.3	F
Average Delta p	0.041		0.041	
Average Gas Meter Temperature	90	F	88	F
Average Delta H	2.02	in-h20	1.99	in-h20
Total Time of Test	190	min	190	min
Total Particulates	4.3	mg	4.5	mg
Particulate Concentration (dry-standard)	0.00016	grams/dscf	0.00018	grams/dscf
Ambient Train (dry-standard)	0.000000000	grams/dscf	0.000000000	grams/dscf
Net (dry-standard)	0.000164800	grams/dscf	0.00017586	grams/dscf
Particulate Emission Rate	1.48	grams/hour	1.58	grams/hour
Total PM Emissions	4.68	grams	5.00	grams
Average Total PM Emissions	4.84	grams		
AVERAGE PARTICLATE EMISSIONS RATE	1.53	grams/hour		
% OF AVERAGE	96.8		103.2	
Emissions Factor	1.144	g/Kg -Dry	1.221	g/Kg -Dry

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_16_17
RUN #: EPA3
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.041	0.043	0.041	0.044	0.043	0.046	0.040	0.035	0.042
Temperature	105	105	105	105	105	105	105	105	105.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	6.4	-0.067	380	411	446	580	153	394
10	5.3	-0.047	406	428	459	605	160	411.6
20	4.2	-0.046	399	418	448	598	164	405.4
30	3.6	-0.039	395	409	440	591	166	400.2
40	3.4	-0.031	397	392	440	526	167	384.4
50	2.7	-0.024	380	371	426	462	169	361.6
60	2.5	-0.025	356	349	411	411	173	340

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.91758	ft/sec.
Intial Tunnel Flow:	149.5518	scfm
Average Tunnel Flow:	152.7572	scfm

Run #	EPA3
Date:	2/16/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.041	0.043	0.041	0.044	0.043	0.046	0.040	0.035	0.042
Temperature	105	105	105	105	105	105	105	105	105.000

Tunnel Velocity:	13.918	ft/sec.
Intial Tunnel Flow:	149.55	scfm
Average Tunnel Flow	152.76	scfm

JOB #	035-S-075-1															
TECHNICIA	BTN							ROOM TEMP (F)		69.9				BEG	MID	END	AVG
DATE:	2_16_17								BAROMETRIC					29.56	29.56	29.56	29.56
RUN #:	EPA3																
READING INTERVAL:		10															
SAMPLE BOX :		A	METER Y FACTOR:		1.01					PROBE MATERIAL:				SS			
FRONT FILTER #:		3040&3045				REAR FILTER #	REAR FILTER #:		3041								
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG					
Run Time:		250		AMBIENT FILTER #:			3044	VOLUME	1403.742	LITERS	FUEL MOISTURE DB				19.3	%	
				FINAL LEAK RATE (CFM):			<0.01	@	19	IN-HG							
TEST START TIME:		12:53								1	2	3	4	5	6		
										TEMPERATURES							
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT	
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	
0	0.000	0.000	0.042	0	-0.04		NA	10.7	0	90	229	72	410	672.61	75	72	
10	1.386	0.139	0.042	2.01	-0.84	13.900	101	10.1	0.6	90	245	75	371	761.22	76	70	
20	2.785	0.140	0.042	2.01	-1.08	13.862	101	9.4	0.7	87	239	75	345	863.72	78	70	
30	4.190	0.141	0.042	2	-1.45	13.862	101	9	0.4	87	246	74	336	916.06	82	69	
40	5.601	0.141	0.042	2.01	-1.51	13.850	101	8.5	0.5	86	253	74	334	993.19	85	69	
50	7.014	0.141	0.042	2.02	-0.73	13.875	101	7.9	0.6	88	290	74	339	1246.55	87	69	
60	8.434	0.142	0.042	2	-1.02	13.900	101	6.8	1.1	90	330	74	356	1281.97	89	69	
70	9.854	0.142	0.042	2.02	-1.4	13.925	101	5.7	1.1	92	320	76	386	996.75	91	69	
80	11.279	0.143	0.042	2.03	-1.58	13.938	101	4.6	1.1	93	320	76	415	985.38	92	70	
90	12.706	0.143	0.042	2.02	-1.01	13.925	101	3.7	0.9	92	304	76	431	1040.25	94	70	
100	14.130	0.142	0.042	2.01	-1.06	13.900	100	3.2	0.5	90	268	76	425	940.21	95	70	
110	15.564	0.143	0.042	2.02	-1.48	13.900	101	2.9	0.3	90	255	75	409	958.74	95	70	
120	16.993	0.143	0.042	2.01	-0.86	13.875	100	2.6	0.3	88	247	75	396	947.01	96	70	
130	18.424	0.143	0.042	2.03	-0.98	13.862	100	2.3	0.3	87	240	75	389	944.75	96	70	
140	19.860	0.144	0.042	2.03	-1.45	13.862	100	1.9	0.4	87	245	75	384	1045.24	97	70	
150	21.292	0.143	0.042	2	-0.99	13.862	100	1.6	0.3	87	241	75	381	867.04	97	70	
160	22.724	0.143	0.042	2.03	-1.05	13.862	100	1.4	0.2	87	229	74	379	927.06	97	70	
170	24.163	0.144	0.042	2.02	-0.67	13.850	100	1.2	0.2	86	220	74	377	878.07	98	70	
180	25.596	0.143	0.042	2.03	-1.05	13.837	100	1	0.2	85	208	74	377	808.37	98	70	
190	27.029	0.143	0.042	2.04	-0.7	13.824	100	0.9	0.1	84	201	74	376	808.27	98	70	
200	28.468	0.144	0.042	2.02	-1.6	13.824	100	0.7	0.2	84	198	74	375	808.93	98	70	
210	29.906	0.144	0.042	2.04	-0.76	13.824	100	0.6	0.1	84	195	74	375	791.46	98	70	
220	31.340	0.143	0.042	2.03	-1.32	13.824	100	0.5	0.1	84	191	74	373	764.68	98	70	
230	32.777	0.144	0.042	2.03	-1.44	13.811	100	0.3	0.2	83	189	74	372	764.73	98	70	
240	34.214	0.144	0.042	2.04	-0.63	13.811	100	0.2	0.1	83	187	73	371	770.54	98	70	
250	35.648	0.143	0.042	2.04	-1.49	13.811	100	0	0.2	83	186	73	366	760.1	98	70	

TEST START TIME:		12:53								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP

TEST START TIME:	12:53								1	2	3	4	5	6	
									TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	35.648		0.042	2.02		13.863	100.2			87	241				92	70

JOB #	035-S-075-1						
TECHNICIA	BTN						
DATE:	2_16_17						
RUN #:	EPA3						
READING INTERVAL:	10						
SAMPLE BOX :	*B*	METER Y FACTOR:	1.002		PROBE MATERIAL:	**SS**	
FRONT FILTER #:	3042			REAR FILTER #:	3043		
FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG

Run Time: 250 **Firebox Delta T** **33.8**

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
0	0	0	NA	0	0	1	355	349	73	408	173	74	339	Run No
10	1.367	0.137	101	-0.03	1.99	1.67	317	305	75	356	173	75	304	
20	2.750	0.138	101	-0.03	1.98	1.82	288	274	75	341	173	78	284	
30	4.132	0.138	101	-0.03	1.98	1.32	272	256	74	336	171	81	274	
40	5.522	0.139	101	-0.03	1.98	1.51	265	248	74	342	168	84	271	
50	6.914	0.139	101	-0.04	1.99	1.83	266	248	74	365	166	86	277	
60	8.308	0.139	100	-0.04	1.99	1.92	273	256	74	431	163	88	296	
70	9.711	0.140	101	-0.04	1.98	1.24	294	281	75	480	159	90	320	
80	11.115	0.140	101	-0.04	1.99	1.59	325	321	75	507	157	91	345	
90	12.518	0.140	101	-0.04	1.97	1.62	351	350	75	528	154	92	363	
100	13.927	0.141	101	-0.03	1.98	1.57	367	365	75	515	151	93	365	
110	15.334	0.141	100	-0.03	1.98	1.47	365	362	75	485	150	94	354	
120	16.742	0.141	100	-0.03	1.98	1.49	355	354	75	454	149	94	342	
130	18.154	0.141	100	-0.02	1.98	1.77	348	346	75	431	148	95	332	
140	19.564	0.141	100	-0.03	2	1.74	343	341	74	424	148	95	328	
150	20.977	0.141	100	-0.03	1.99	1.83	340	339	74	451	148	95	332	
160	22.386	0.141	100	-0.02	1.99	1.98	339	340	74	437	147	96	328	
170	23.801	0.142	100	-0.02	2	1.99	338	338	74	420	147	96	324	
180	25.212	0.141	100	-0.02	1.99	1.38	336	339	74	405	148	96	321	
190	26.627	0.142	100	-0.02	1.98	2.04	333	337	74	392	148	96	317	
200	28.040	0.141	100	-0.02	1.99	1.91	331	336	74	389	149	96	316	
210	29.453	0.141	100	-0.02	1.99	1.93	329	334	74	381	149	96	314	
220	30.866	0.141	100	-0.01	1.98	1.24	326	331	73	374	150	97	311	

							1	2	3	4	5	6	
							TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T
230	32.280	0.141	100	-0.01	1.99	1.54	324	326	73	367	151	97	308
240	33.695	0.142	100	-0.02	2	1.99	324	323	73	364	151	97	307
250	35.108	0.141	100	-0.02	1.99	1.56	323	322	73	363	152	97	305

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
	35.108	0.140	100.249	-0.026	1.9864	1.651923	324	320	74	413	156	91	34	
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER: 035-S-075-1
TECHNICIAN: BTN
DATE: 2_16_17
RUN NUMBER: EPA3

METER Y FACTOR: **0.997**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	79	0	0
End	1403.742	97	0	0

Total Sample Volume - Vm
Total Sample Volume - Vm
Average Sample Rate
Sample Time
Average Meter Temperature
Total Sample Volume (Standard Conditions) - Vmstd

Total Particulates

Particulate Concentration (dry-standard)
Particulate Emission Rate

SAMPLE INFORMATION	
1403.742	Liters
49.573	ft^3
0.20	ft^3/min
250.00	Minutes
88	°F
47.047	dscf

0.2	mg

0.000004251	grams/dscf
0.000048000	grams/hour

JOB NUMBER 035-S-075-1

RUN # EPA3

DATE: 2_16_17

BURN RATE 0.98 KG/HR DRY

FILTER A PARTICULATE 7.5 mg

FILTER B PARTICULATE 7.5 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	35.65		35.11	
Average Gas Velocity in Dilution Tunnel - vs	13.92	feet/second	13.92	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9165.43	dscf/hour	9165.43	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	34.17	dscf	33.46	dscf
Average Tunnel Temperature	87.2	F	87.2	F
Average Delta p	0.042		0.042	
Average Gas Meter Temperature	92	F	91	F
Average Delta H	2.02	in-h20	1.99	in-h20
Total Time of Test	250	min	250	min
Total Particulates	7.5	mg	7.5	mg
Particulate Concentration (dry-standard)	0.00022	grams/dscf	0.00022	grams/dscf
Ambient Train (dry-standard)	0.000004251	grams/dscf	0.000004251	grams/dscf
Net (dry-standard)	0.000215258	grams/dscf	0.00021989	grams/dscf
Particulate Emission Rate	1.97	grams/hour	2.02	grams/hour
Total PM Emissions	8.22	grams	8.40	grams
Average Total PM Emissions	8.31	grams		
AVERAGE PARTICLATE EMISSIONS RATE	1.99	grams/hour		
% OF AVERAGE	98.9		101.1	
Emissions Factor	2.021	g/Kg -Dry	2.064	g/Kg -Dry

PREBURN

JOB # 035-S-075-1
TECHNICIAN BTN
DATE: 2_15_17
RUN #: EPA2
READING INTERVAL: 10
.
Run Time: 60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.036	0.043	0.040	0.040	0.042	0.041	0.040	0.033	0.039
Temperature	105	105	105	105	105	105	105	105	105.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	6.5	-0.063	387	417	465	578	170	403.4
10	5.4	-0.047	410	428	471	601	179	417.8
20	4.5	-0.04	397	410	451	596	180	406.8
30	3.8	-0.033	387	395	435	593	179	397.8
40	3.5	-0.026	376	380	432	557	175	384
50	2.7	-0.025	373	379	441	488	174	371
60	2.6	-0.024	356	360	417	429	174	347.2

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.36743	ft/sec.
Intial Tunnel Flow:	145.8342	scfm
Average Tunnel Flow:	147.6837	scfm

Run #	EPA2
Date:	2/15/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.036	0.043	0.040	0.040	0.042	0.041	0.040	0.033	0.039
Temperature	105	105	105	105	105	105	105	105	105.000

Tunnel Velocity:	13.367	ft/sec.
Intial Tunnel Flow:	145.83	scfm
Average Tunnel Flow	147.68	scfm

JOB #	035-S-075-1															
TECHNICIA	BTN							ROOM TEMP (F)	70.0				BEG	MID	END	AVG
DATE:	2_15_17								BAROMETRIC				29.72	29.72	29.72	29.72
RUN #:	EPA2															
READING INTERVAL:	10															
SAMPLE BOX :	A	METER Y FACTOR:		1.01					PROBE MATERIAL:				SS			
FRONT FILTER #:	3034&3039				REAR FILTER #	REAR FILTER #:		3035								
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG					
Run Time:		310		AMBIENT FILTER #:		3038	VOLUME	1736.481	LITERS	FUEL MOISTURE DB				20.3	%	
				FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG							
TEST START TIME:		13:39							1	2	3	4	5	6		
									TEMPERATURES							
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
0	0.000	0.000	0.039	0	-0.04		NA	10.6	0	90	229	72	414	667.55	74	70
10	1.388	0.139	0.039	2.01	-0.82	13.371	101	9.9	0.7	91	244	75	375	768.67	75	70
20	2.782	0.139	0.039	1.98	-1.49	13.346	101	9.3	0.6	89	233	75	346	857.3	78	70
30	4.189	0.141	0.039	2.01	-0.7	13.334	101	8.7	0.6	88	234	75	340	867.06	81	70
40	5.605	0.142	0.039	2.01	-1.49	13.322	101	8.2	0.5	87	230	75	338	880.21	84	70
50	7.021	0.142	0.039	2.03	-0.94	13.334	101	7.5	0.7	88	249	74	338	898.99	87	69
60	8.446	0.143	0.039	2.03	-1.53	13.346	101	6.6	0.9	89	264	75	343	899.71	89	70
70	9.871	0.143	0.039	2.04	-0.98	13.358	101	5.8	0.8	90	270	76	351	929.5	91	70
80	11.298	0.143	0.039	2.01	-1.54	13.371	101	5.1	0.7	91	270	76	364	928.88	93	70
90	12.724	0.143	0.039	2.01	-1.32	13.371	101	4.4	0.7	91	262	75	364	893.87	94	70
100	14.147	0.142	0.039	2.01	-1.07	13.358	100	4	0.4	90	246	75	365	913.84	95	71
110	15.578	0.143	0.039	2.03	-1.18	13.346	100	3.6	0.4	89	248	75	368	1014.68	96	71
120	17.005	0.143	0.039	2.02	-0.94	13.334	100	3.3	0.3	88	237	75	372	955.09	96	70
130	18.436	0.143	0.039	2.01	-0.99	13.334	100	3	0.3	88	226	75	373	919.43	97	70
140	19.869	0.143	0.039	2.01	-1.37	13.322	100	2.8	0.2	87	217	75	374	900.65	97	70
150	21.299	0.143	0.039	2.03	-1.25	13.310	100	2.6	0.2	86	212	75	371	893.74	97	70
160	22.735	0.144	0.039	2.03	-0.73	13.310	100	2.3	0.3	86	208	74	367	847.57	98	70
170	24.171	0.144	0.039	2.03	-1.53	13.310	100	2	0.3	86	207	74	369	903.68	98	70
180	25.604	0.143	0.039	2.04	-0.79	13.310	100	1.8	0.2	86	206	74	372	894.59	98	70
190	27.039	0.144	0.039	2.04	-0.83	13.310	100	1.7	0.1	86	197	74	373	837.54	98	70
200	28.478	0.144	0.039	2.03	-0.77	13.298	100	1.5	0.2	85	189	74	371	795.98	98	70
210	29.913	0.144	0.039	2.03	-1.11	13.285	100	1.4	0.1	84	184	74	367	774.88	98	70
220	31.346	0.143	0.039	2.02	-0.71	13.285	100	1.3	0.1	84	179	74	364	756.65	98	70
230	32.785	0.144	0.039	2.01	-0.74	13.285	100	1.2	0.1	84	175	74	360	759.13	98	70
240	34.223	0.144	0.039	2.03	-0.78	13.285	100	1	0.2	84	173	74	353	762.97	98	70
250	35.657	0.143	0.039	2.03	-1.53	13.285	100	0.8	0.2	84	172	74	349	753.26	98	70
260	37.094	0.144	0.039	2.02	-1.33	13.273	100	0.8	0	83	169	74	344	745.05	99	70
270	38.532	0.144	0.039	2.01	-1.23	13.285	100	0.5	0.3	84	179	74	342	714.2	99	70

TEST START TIME:		13:39								1	2	3	4	5	6	
										TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
280	39.968	0.144	0.039	2.03	-1.33	13.285	100	0.4	0.1	84	169	74	334	682.36	99	70
290	41.405	0.144	0.039	2.04	-0.92	13.273	100	0.3	0.1	83	162	74	328	649.25	99	70
300	42.845	0.144	0.039	2.04	-0.68	13.273	100	0.1	0.2	83	156	73	326	630.85	99	70
310	44.281	0.144	0.039	2.01	-1.13	13.261	100	0	0.1	82	153	73	329	628.26	99	70

TEST START TIME:	13:39								1	2	3	4	5	6	
									TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	44.281		0.039	2.02		13.315	100.3			87	211				94	70

JOB #	035-S-075-1						
TECHNICIA	BTN						
DATE:	2_15_17						
RUN #:	EPA2						
READING INTERVAL:	10						
SAMPLE BOX :	*B*	METER Y FACTOR:	1.002		PROBE MATERIAL:	**SS**	
FRONT FILTER #:	3036			REAR FILTER #:	3037		
FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG

Run Time: 310 **Firebox Delta T** **76.8**

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
0	0	0	NA	0	0	1	354	358	72	424	174	73	345	Run No
10	1.365	0.137	101	-0.03	2	1.35	317	313	75	372	170	74	309	
20	2.742	0.138	101	-0.03	1.97	1.68	289	282	75	352	169	77	288	
30	4.128	0.139	101	-0.03	2	1.99	276	270	75	356	167	80	282	
40	5.517	0.139	101	-0.03	1.99	2.06	276	267	74	361	165	83	281	
50	6.910	0.139	101	-0.03	1.99	1.81	278	271	74	413	161	86	292	
60	8.307	0.140	101	-0.03	1.99	1.8	290	288	74	474	156	88	310	
70	9.708	0.140	101	-0.03	1.98	1.77	304	306	75	513	152	90	325	
80	11.110	0.140	101	-0.04	1.98	1.75	317	318	75	538	149	91	337	
90	12.514	0.140	101	-0.04	1.98	1.94	328	329	75	547	146	92	343	
100	13.926	0.141	101	-0.03	2	1.76	333	334	75	526	143	93	340	
110	15.333	0.141	100	-0.03	2	1.98	334	332	75	497	141	94	334	
120	16.746	0.141	100	-0.03	1.99	1.71	334	327	75	465	139	95	327	
130	18.157	0.141	100	-0.03	2	1.3	333	324	75	440	139	95	322	
140	19.570	0.141	100	-0.02	1.98	1.7	331	320	75	420	139	96	317	
150	20.983	0.141	100	-0.02	1.99	1.86	327	317	74	408	138	96	312	
160	22.397	0.141	100	-0.02	2.01	1.92	325	315	74	406	139	96	310	
170	23.810	0.141	100	-0.02	1.99	1.81	324	315	74	412	140	96	312	
180	25.223	0.141	100	-0.02	2	2.05	324	315	74	407	140	96	312	
190	26.638	0.142	100	-0.01	2.01	1.9	321	313	74	395	140	97	308	
200	28.051	0.141	100	-0.02	2.01	1.33	318	310	74	384	141	97	305	
210	29.467	0.142	100	-0.01	1.99	1.64	314	307	74	373	141	97	300	
220	30.879	0.141	100	-0.01	1.98	1.95	310	303	74	363	140	97	296	

							1	2	3	4	5	6	
							TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T
230	32.294	0.142	100	-0.01	1.98	1.98	305	299	74	356	140	97	292
240	33.706	0.141	100	-0.01	2	1.67	301	297	74	354	140	97	289
250	35.123	0.142	100	-0.01	1.98	1.5	299	296	74	352	139	97	287
260	36.536	0.141	100	-0.01	2	1.94	296	294	74	349	139	97	284
270	37.952	0.142	100	-0.02	1.99	1.57	296	289	74	343	139	97	282
280	39.366	0.141	100	-0.02	1.98	1.73	294	283	74	338	139	97	278
290	40.780	0.141	100	-0.01	2	1.43	290	278	74	328	140	97	273
300	42.195	0.142	100	0	1.99	1.84	285	274	73	317	140	97	268
310	43.609	0.141	100	-0.01	1.99	1.81	284	272	73	314	141	97	268

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
	43.609	0.141	100.262	-0.021	1.991613	1.735313	310	304	74	403	146	92	77	
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER: 035-S-075-1
TECHNICIAN: BTN
DATE: 2_15_17
RUN NUMBER: EPA2

METER Y FACTOR: **0.997**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	80	0	0
End	1736.481	98.5	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1736.481	Liters
Total Sample Volume - Vm	61.323	ft^3
Average Sample Rate	0.20	ft^3/min
Sample Time	310.00	Minutes
Average Meter Temperature	89.25	°F
Total Sample Volume (Standard Conditions) - Vmstd	58.381	dscf
Total Particulates	0.2	mg
Particulate Concentration (dry-standard)	0.000003426	grams/dscf
Particulate Emission Rate	0.000038710	grams/hour

JOB NUMBER 035-S-075-1

RUN # EPA2

DATE: 2_15_17

BURN RATE 0.77 KG/HR DRY

FILTER A PARTICULATE 5.3 mg

FILTER B PARTICULATE 5.1 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	44.28		43.61	
Average Gas Velocity in Dilution Tunnel - vs	13.37	feet/second	13.37	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8861.02	dscf/hour	8861.02	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	42.58	dscf	41.70	dscf
Average Tunnel Temperature	86.6	F	86.6	F
Average Delta p	0.039		0.039	
Average Gas Meter Temperature	94	F	92	F
Average Delta H	2.02	in-h20	1.99	in-h20
Total Time of Test	310	min	310	min
Total Particulates	5.3	mg	5.1	mg
Particulate Concentration (dry-standard)	0.00012	grams/dscf	0.00012	grams/dscf
Ambient Train (dry-standard)	0.000003426	grams/dscf	0.000003426	grams/dscf
Net (dry-standard)	0.000121058	grams/dscf	0.00011887	grams/dscf
Particulate Emission Rate	1.07	grams/hour	1.05	grams/hour
Total PM Emissions	5.54	grams	5.44	grams
Average Total PM Emissions	5.49	grams		
AVERAGE PARTICLATE EMISSIONS RATE	1.06	grams/hour		
% OF AVERAGE	100.9		99.1	
Emissions Factor	1.387	g/Kg -Dry	1.362	g/Kg -Dry

PREBURN

035-S-075-1
BTN
2_14_17
EPA1
NTERVAL: 10

60

Model Designation ARADA_FARRINGDON16

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.032	0.036	0.042	0.040	0.035	0.040	0.043	0.036	0.038
Temperature	100	100	100	100	100	100	100	100	100.000

		1	2	3	4	5	
		TEMPERATURES					
SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
5.2	-0.066	429	431	483	609	149	420.2
4.3	-0.042	436	438	484	613	162	426.6
3.6	-0.036	407	409	455	588	171	406
3.2	-0.026	386	387	430	556	175	386.8
3	-0.015	369	366	419	504	178	367.2
2.7	-0.015	357	352	413	449	179	350
2.6	-0.02	341	338	403	406	180	333.6

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Tunnel Velocity:	13.08	ft/sec.
Intial Tunnel Flow:	144.6789	scfm
Average Tunnel Flow:	147.059	scfm

Run #	EPA1
Date:	2/14/17

Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Dilution Tunnel H2O:	2.00	%
Dilution Tunnel Static:	-0.400	In H20
Tunnel Area:	0.196	ft^2
Pitot Tube Cp:	0.99	

Dilution Tunnel Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.032	0.036	0.042	0.040	0.035	0.040	0.043	0.036	0.038
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	13.08	ft/sec.
Intial Tunnel Flow:	144.68	scfm
Average Tunnel Flow	147.06	scfm

JOB #	035-S-075-1															
TECHNICIA	BTN							ROOM TEMP (F)		70.0				BEG	MID	END	AVG
DATE:	2_14_17								BAROMETRIC					30.06	30.06	30.06	30.06
RUN #:	EPA1																
READING INTERVAL:		10															
SAMPLE BOX :		A	METER Y FACTOR:		1.01					PROBE MATERIAL:				SS			
FRONT FILTER #:		3028&3033				REAR FILTER #	REAR FILTER #:		3029								
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG					
Run Time:		420	AMBIENT FILTER #:				3032	VOLUME	2305.638	LITERS	FUEL MOISTURE DB				20.6	%	
			FINAL LEAK RATE (CFM):				<0.01	@	19	IN-HG							
TEST START TIME:		15:18								1	2	3	4	5	6		
										TEMPERATURES							
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT	
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	
0	0.000	0.000	0.038	0	-0.13		NA	10.9	0	89	206	72	402	609.39	72	69	
10	1.371	0.137	0.038	1.98	-0.7	13.099	101	10.4	0.5	89	212	74	365	758.11	74	69	
20	2.752	0.138	0.038	1.99	-1.48	13.075	101	9.9	0.5	87	194	74	342	874.81	77	69	
30	4.139	0.139	0.038	2.01	-1.46	13.051	101	9.4	0.5	85	200	74	334	951.59	80	69	
40	5.537	0.140	0.038	2.02	-0.77	13.051	101	8.8	0.6	85	204	73	334	990.19	83	69	
50	6.944	0.141	0.038	2.02	-1.47	13.051	101	8.2	0.6	85	211	74	339	1087.04	86	70	
60	8.352	0.141	0.038	2	-1.46	13.063	101	7.6	0.6	86	233	74	350	1125.14	88	70	
70	9.767	0.142	0.038	2.01	-1.43	13.075	101	6.8	0.8	87	246	75	361	1112.36	91	70	
80	11.181	0.141	0.038	2.02	-0.71	13.087	101	5.9	0.9	88	252	75	374	1096.09	92	71	
90	12.601	0.142	0.038	2.03	-1.06	13.087	101	5.2	0.7	88	239	75	387	1153.44	94	71	
100	14.020	0.142	0.038	2.02	-0.79	13.075	100	4.8	0.4	87	223	75	385	1104.24	95	71	
110	15.444	0.142	0.038	2.02	-1	13.063	101	4.5	0.3	86	199	75	379	919.18	95	71	
120	16.866	0.142	0.038	2.03	-0.92	13.051	100	4.4	0.1	85	181	75	372	829.03	96	71	
130	18.296	0.143	0.038	2.03	-1.11	13.039	101	4.2	0.2	84	170	75	364	783.82	97	71	
140	19.720	0.142	0.038	2.04	-0.65	13.039	100	4.1	0.1	84	161	75	359	757	97	71	
150	21.148	0.143	0.038	2.01	-0.97	13.028	100	3.9	0.2	83	153	74	354	727.44	97	71	
160	22.578	0.143	0.038	2.04	-1.37	13.016	100	3.8	0.1	82	148	74	349	706.26	98	71	
170	24.005	0.143	0.038	2.03	-0.72	13.016	100	3.7	0.1	82	143	74	346	686.67	98	71	
180	25.437	0.143	0.038	2.04	-1.52	13.003	100	3.5	0.2	81	139	74	342	672.36	98	71	
190	26.868	0.143	0.038	2.03	-0.67	13.028	100	3.5	0	83	135	74	339	664.64	98	72	
200	28.296	0.143	0.038	2.05	-0.74	13.039	100	3.1	0.4	84	147	75	341	709.3	98	72	
210	29.729	0.143	0.038	2.03	-0.79	13.039	101	2.9	0.2	84	148	75	352	751.9	98	73	
220	31.157	0.143	0.038	2.04	-1.43	13.051	100	2.6	0.3	85	159	76	357	903.72	99	73	
230	32.587	0.143	0.038	2.04	-1.45	13.063	100	2.2	0.4	86	173	76	359	955.4	99	73	
240	34.019	0.143	0.038	2.04	-1.24	13.063	101	1.8	0.4	86	181	76	361	956.41	99	73	
250	35.449	0.143	0.038	2.05	-1.42	13.063	100	1.5	0.3	86	177	76	363	1009.87	100	71	
260	36.881	0.143	0.038	2.04	-0.93	13.039	100	1.3	0.2	84	169	75	363	863.17	100	70	
270	38.314	0.143	0.038	2.04	-1.22	13.028	100	1.2	0.1	83	158	74	361	792.15	99	69	

TEST START TIME:	15:18								1	2	3	4	5	6	
									TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	TUNNEL DELTA P	ORIFICE DELTA H	FILTER VAC	TUNNEL VEL FT/SEC	Proportional Rate (%)	Scale Weight	Weight Chg	TUNNEL TEMP	FLUE TEMP	FILTER TEMP	FB REAR TEMP	CAT TEMP	METER TEMP	AMBIENT TEMP
280	39.743	0.143	0.038	2.03	-0.73	13.016	100	1.1	0.1	82	150	73	358	744.19	99	69
290	41.174	0.143	0.038	2.04	-0.98	13.016	100	1	0.1	82	144	73	352	717.31	99	69
300	42.603	0.143	0.038	2.02	-1.39	13.016	100	0.9	0.1	82	140	73	345	697.5	99	69
310	44.029	0.143	0.038	2.03	-0.96	13.003	100	0.9	0	81	137	72	341	680.28	98	69
320	45.461	0.143	0.038	2.02	-1.29	12.991	100	0.8	0.1	80	134	72	336	666.27	98	68
330	46.886	0.143	0.038	2.04	-0.72	12.991	100	0.7	0.1	80	131	72	329	662.35	98	68
340	48.315	0.143	0.038	2.03	-1.25	12.991	100	0.6	0.1	80	129	72	323	654.21	98	68
350	49.745	0.143	0.038	2.03	-1.12	12.979	100	0.5	0.1	79	128	71	316	645.53	98	68
360	51.167	0.142	0.038	2.02	-0.83	12.979	99	0.4	0.1	79	127	71	311	633.2	98	68
370	52.599	0.143	0.038	2.02	-1.37	12.979	100	0.4	0	79	125	71	305	635.23	97	68
380	54.024	0.143	0.038	2.03	-1.19	12.979	100	0.3	0.1	79	124	71	302	629.11	97	68
390	55.451	0.143	0.038	2.02	-0.7	12.967	100	0.2	0.1	78	123	71	300	620.4	97	67
400	56.879	0.143	0.038	2.03	-1.19	12.967	100	0.1	0.1	78	122	71	295	607.12	97	68
410	58.302	0.142	0.038	2.02	-1.36	12.967	100	0.1	0	78	120	71	290	607.42	97	69
420	59.732	0.143	0.038	2.02	-1.51	12.967	100	0	0.1	78	120	71	284	596.01	97	69

TEST START TIME:	15:18								1	2	3	4	5	6	
									TEMPERATURES						
	GAS METER	SAMPLE	TUNNEL	ORIFICE	FILTER	TUNNEL VEL	Proportional	Scale	Weight	TUNNEL	FLUE	FILTER	FB REAR	CAT	METER	AMBIENT
ET	VOLUME	RATE(FT3/MIN)	DELTA P	DELTA H	VAC	FT/SEC	Rate (%)	Weight	Chg	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
	59.732		0.038	2.03		13.029	100.3			83	165				95	70

JOB #	035-S-075-1						
TECHNICIA	BTN						
DATE:	2_14_17						
RUN #:	EPA1						
READING INTERVAL:	10						
SAMPLE BOX :	*B*	METER Y FACTOR:	1.002		PROBE MATERIAL:	**SS**	
FRONT FILTER #:	3030			REAR FILTER #:	3031		
FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	18 IN-HG

Run Time: 420 **Firebox Delta T** **98.2**

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
0	0	0	NA	0	0	1	339	336	72	402	180	72	332	Run No
10	1.350	0.135	101	-0.03	1.97	1.37	306	298	74	356	175	73	300	
20	2.711	0.136	101	-0.02	1.97	1.48	283	271	74	344	173	76	283	
30	4.082	0.137	101	-0.03	1.99	1.56	271	256	74	345	171	79	275	
40	5.463	0.138	101	-0.02	1.99	1.93	266	249	73	354	166	82	274	
50	6.848	0.139	101	-0.03	1.99	1.94	268	248	73	371	163	85	278	
60	8.236	0.139	101	-0.03	2	1.3	273	250	74	408	158	87	288	
70	9.626	0.139	101	-0.04	1.99	1.46	283	257	75	437	154	89	298	
80	11.018	0.139	101	-0.04	1.98	1.52	297	268	75	454	151	91	309	
90	12.415	0.140	101	-0.03	1.99	1.34	312	281	75	465	149	92	319	
100	13.812	0.140	101	-0.02	1.99	1.43	326	298	75	475	147	93	326	
110	15.209	0.140	100	-0.02	1.98	1.77	329	308	75	456	147	94	324	
120	16.611	0.140	101	-0.01	1.97	2.08	327	309	75	418	147	94	315	
130	18.013	0.140	100	-0.01	1.99	1.22	323	306	75	391	147	95	306	
140	19.413	0.140	100	-0.01	1.99	1.67	316	302	75	372	147	95	299	
150	20.819	0.141	100	-0.01	1.99	1.7	309	298	74	358	147	96	293	
160	22.221	0.140	100	-0.01	1.98	1.88	303	294	74	344	147	96	287	
170	23.625	0.140	100	-0.01	1.99	1.47	297	288	74	336	146	96	283	
180	25.031	0.141	100	0	1.98	1.5	291	283	74	328	146	96	278	
190	26.436	0.141	100	0	1.98	1.39	287	279	74	321	146	96	274	
200	27.839	0.140	100	-0.01	1.99	1.95	279	275	75	318	146	96	272	
210	29.246	0.141	100	-0.01	1.98	1.65	275	279	75	326	145	97	275	
220	30.649	0.140	100	-0.01	1.99	1.65	274	280	76	347	145	97	281	

							1	2	3	4	5	6	
							TEMPERATURES						
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T
230	32.054	0.141	100	-0.02	1.98	1.34	279	280	76	376	144	97	288
240	33.459	0.141	100	-0.01	1.97	1.53	288	283	76	402	144	98	296
250	34.863	0.140	100	-0.01	1.99	1.64	295	286	76	414	143	98	300
260	36.271	0.141	100	-0.01	1.99	1.81	298	287	75	405	144	98	299
270	37.677	0.141	100	-0.01	1.98	1.78	299	288	74	388	144	98	296
280	39.082	0.141	100	0	1.99	1.77	296	286	73	369	145	98	291
290	40.493	0.141	100	0	1.99	1.92	292	281	73	354	146	97	285
300	41.898	0.141	100	0	1.99	2	288	275	73	343	146	97	279
310	43.307	0.141	100	0	1.99	1.98	284	269	72	333	146	97	275
320	44.714	0.141	100	0	1.99	1.91	279	264	72	325	146	96	270
330	46.120	0.141	100	0	2	1.97	275	259	72	317	145	96	265
340	47.529	0.141	100	0	1.98	1.72	272	254	71	313	144	96	261
350	48.932	0.140	100	0	1.98	2	268	250	71	308	143	96	257
360	50.342	0.141	100	0	1.99	1.95	265	246	71	302	142	96	253
370	51.748	0.141	100	0	2	1.82	260	241	71	297	140	96	249
380	53.153	0.141	100	0	2	1.94	256	239	71	293	139	95	246
390	54.563	0.141	100	0	1.99	1.82	252	236	71	291	138	95	243
400	55.967	0.140	100	0	2	1.47	248	235	71	287	137	95	240
410	57.374	0.141	100	0	1.99	1.53	242	233	71	282	135	95	236
420	58.780	0.141	100	0	1.99	1.78	237	232	71	280	135	95	234

							1	2	3	4	5	6		
							TEMPERATURES							
ET	GAS METER VOLUME	SAMPLE RATE(FT3/MIN)	PROPORTIONAL RATE	FLUE DRAFT	ORIFICE DELTA H	FILTER VAC	LEFT SIDE	RIGHT SIDE	FILTER	FB TOP	FB BOT	METER	STOVE AVG T	
	58.78	0.140	100.280	-0.011	1.986905	1.673023	286	273	74	358	149	93	98	
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT	

Ambient Sample Results:

JOB NUMBER: 035-S-075-1
TECHNICIAN: BTN
DATE: 2_14_17
RUN NUMBER: EPA1

METER Y FACTOR: **0.997**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	74	0	0
End	2305.638	93	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	2305.638	Liters
Total Sample Volume - Vm	81.423	ft^3
Average Sample Rate	0.19	ft^3/min
Sample Time	420.00	Minutes
Average Meter Temperature	83.5	°F
Total Sample Volume (Standard Conditions) - Vmstd	79.232	dscf
Total Particulates	0.4	mg
Particulate Concentration (dry-standard)	0.000005048	grams/dscf
Particulate Emission Rate	0.000057143	grams/hour

JOB NUMBER 035-S-075-1

RUN # EPA1

DATE: 2_14_17

BURN RATE 0.59 KG/HR DRY

FILTER A PARTICULATE 6.6 mg

FILTER B PARTICULATE 5.8 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	59.73		58.78	
Average Gas Velocity in Dilution Tunnel - vs	13.08	feet/second	13.08	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8823.54	dscf/hour	8823.54	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	58.00	dscf	56.78	dscf
Average Tunnel Temperature	83.2	F	83.2	F
Average Delta p	0.038		0.038	
Average Gas Meter Temperature	95	F	93	F
Average Delta H	2.03	in-h20	1.99	in-h20
Total Time of Test	420	min	420	min
Total Particulates	6.6	mg	5.8	mg
Particulate Concentration (dry-standard)	0.00011	grams/dscf	0.00010	grams/dscf
Ambient Train (dry-standard)	0.000005048	grams/dscf	0.000005048	grams/dscf
Net (dry-standard)	0.000108750	grams/dscf	0.00009710	grams/dscf
Particulate Emission Rate	0.96	grams/hour	0.86	grams/hour
Total PM Emissions	6.72	grams	6.00	grams
Average Total PM Emissions		6.36		grams
AVERAGE PARTICLATE EMISSIONS RATE		0.91		grams/hour
% OF AVERAGE	105.7		94.3	
Emissions Factor	1.638	g/Kg -Dry	1.463	g/Kg -Dry

DIRIGO LABORATORIES INC.

Client:	**Arada**
Model:	**Farringdon 16**
Tracking No.:	**75**
Project No.:	**035-S-075-1**
Test Dates:	**2/14/17 - 2/17/17**

Run Number	(kg/hr) Burn Rate	% Overall Efficiency
1	**0.59**	**81.1**
2	**0.77**	**83.4**
3	**0.98**	**79.5**
4	**1.29**	**75.0**
5	**2.01**	**71.7**

Total Runs: **5**

CSA B415.1-10 Weighted Average

DIRIGO LABORATORIES INC.

Weighted Average: 77.2 %

Client:	Arada
Model:	Farringdon 16
Tracking No.:	75
Project No.:	035-S-075-1
Test Dates:	2/14/17 - 2/17/17

Burn Rate Category	1
Burn Rate (kg/hr-dry)	0.59
OA Efficiency %	81.1
Emissions Rate Cap (g/hr)	15
Weighting Factor	10.96%
Run Number	1

Burn Rate Category	1
Burn Rate (kg/hr-dry)	0.77
OA Efficiency %	83.4
Emissions Rate Cap (g/hr)	15
Weighting Factor	14.42%
Run Number	2

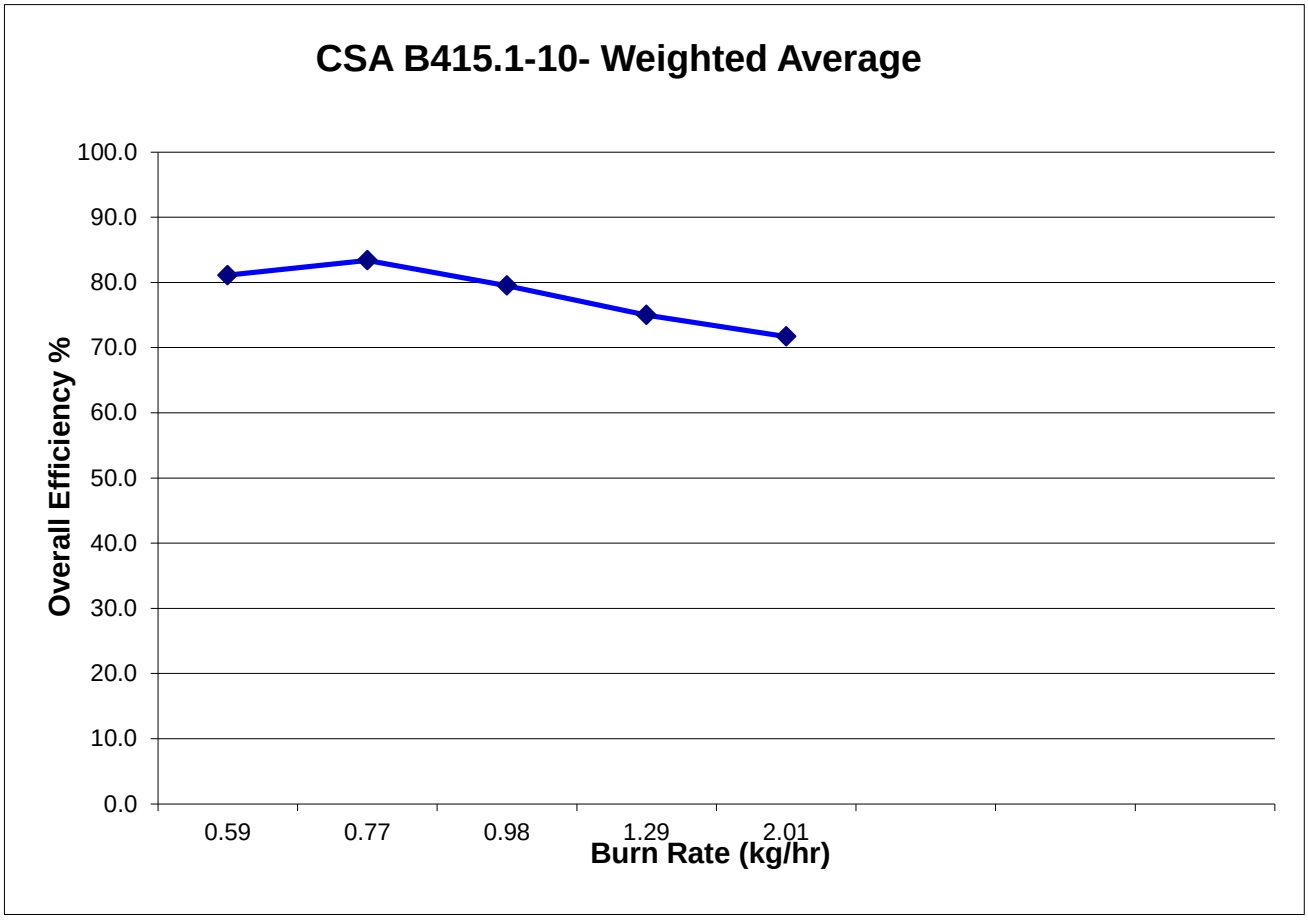
Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.98
OA Efficiency %	79.5
Emissions Rate Cap (g/hr)	15
Weighting Factor	22.65%
Run Number	3

Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.29
OA Efficiency %	75.0
Emissions Rate Cap (g/hr)	15
Weighting Factor	30.52%
Run Number	4

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.01
Emissions Rate (g/hr)	71.7
Emissions Rate Cap (g/hr)	18
Weighting Factor	21.45%
Run Number	5

DIRIGO LABORATORIES INC.

Client: Arada
Model: Farringdon 16
Tracking No.: 75
Project No.: 035-S-075-1
Test Dates: 2/14/17 - 2/17/17



Test No.	Burn Rate	Pi	Ei	Ki	KiEi
1	0.59	0.097	81.1	0.199	16.14
2	0.77	0.199	83.4	0.262	21.85
3	0.98	0.359	79.5	0.411	32.71
4	1.29	0.610	75.0	0.554	41.58
5	2.01	0.914	71.7	0.390	27.93
0	5.00	1.000	0.0	0.000	0.00
0	5.00	1.000	0.0	0.000	0.00
0	5.00	1.000	0.0	0.000	0.00
		1.000		1.816	140.21

Nomenclature:
Pi = Probability for burn rate during test run
Ei = Emissions Rate for test run
Ki = Test run weighting factor

Burn Rate (kg/hr-dry)	Cum. Probability (P)
0.00	0.0000
0.01	0.0004
0.02	0.0008
0.03	0.0012
0.04	0.0016
0.05	0.0020
0.06	0.0030
0.07	0.0040
0.08	0.0050
0.09	0.0060
0.10	0.0070
0.11	0.0080
0.12	0.0090
0.13	0.0100
0.14	0.0110
0.15	0.0120
0.16	0.0128
0.17	0.0136

VERSION: 2.4 **4/15/2010**

lanufacturer: Arada
Model: Farringdon 16
Date: 2/21/2017
Run: 5
Control #: 035-S-075-1
est Duration: 120
urn Category 4

Appliance Type: Cat (Cat, Non-Cat, Pe

Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY):	19.9
Wood Moisture (% wet):	16.60
Load Weight (lb wet):	10.60
Burn Rate (dry kg/h):	2.01
Total Particulate Emissions:	3.36 g

Fuel Data

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.90	
%Ash	0.50	

Averages		**482.3**	**71.5**	**11.14**	**9.51**	**0.29**
		Temp. (F)				
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**Flue Gas Composition (%) O2**	**CO2**	**CO**
0	10.6	451.0	70.0	15.33	5.05	0.13
10	8.4	588.0	70.0	2.16	18.46	1.65
20	5.9	610.0	70.0	1.85	19.24	0.90
30	4.4	553.0	70.0	9.32	12.11	0.04
40	3.1	543.0	71.0	9.89	11.33	0.04
50	2.3	505.0	70.0	12.31	8.47	0.08
60	1.8	473.0	71.0	13.06	7.52	0.11
70	1.3	454.0	72.0	13.09	7.50	0.11
80	1.0	441.0	73.0	13.73	6.49	0.17
90	0.6	428.0	73.0	13.13	7.23	0.15
100	0.4	415.0	73.0	13.47	6.91	0.15
110	0.2	407.0	73.0	13.56	6.85	0.14
120	0.0	402.0	73.0	13.88	6.51	0.14

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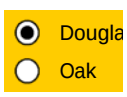


Manufacturer:	Arada
Model:	Farringdon 16
Date:	2/21/2017
Run:	5
Control #:	035-S-075-1
Test Duration:	120 min

	HHV	LHV
Eff	71.7%	77.5%
Comb Eff	96.8%	96.8%
HT Eff	74.1%	80.1%
Output	28,489	kJ/h
Burn Rate	2.01	kg/h
Grams CO	183	g
Input	39,731	kJ/h
MC wet	16.60	

Ultimate CO2

CO2-ult 19.64

F_0 1.062

Averages	0.29	9.51	136.1%	20.29	10.63	250.2

INPUT DATA				**Oxygen Calculation**			**Input**
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**
0	4.81	0.13	5.05	279.2%	20.60	15.48	232.8
10	3.81	1.65	18.46	-2.3%	19.61	0.33	308.9
20	2.68	0.90	19.24	-2.5%	19.61	-0.08	321.1
30	2.00	0.04	12.11	61.7%	20.14	8.01	289.4
40	1.41	0.04	11.33	72.8%	20.19	8.84	283.9
50	1.04	0.08	8.47	129.7%	20.38	11.87	262.8
60	0.82	0.11	7.52	157.4%	20.44	12.86	245.0
70	0.59	0.11	7.50	158.1%	20.44	12.88	234.4
80	0.45	0.17	6.49	194.9%	20.50	13.93	227.2
90	0.27	0.15	7.23	166.2%	20.45	13.15	220.0
100	0.18	0.15	6.91	178.2%	20.47	13.49	212.8
110	0.09	0.14	6.85	181.0%	20.48	13.56	208.3
120	0.00	0.14	6.51	195.4%	20.50	13.92	205.6
0							

				Air Fuel Ratio (A/F)		
Overall Heating Efficiency:	71.7%		Dry Molecular Weight (Md)		29.95	
Combustion Efficiency:	96.8%		Dry Moles Exhaust Gas (Nr):		397.71	%HC
Heat Transfer Efficiency:	74.1%		Air Fuel Ratio (A/F)		11.40	0.88

Heat Output:	27,025	Btu/h	28,489	kJ/h
Heat Input:	37,689	Btu/h	39,731	kJ/h

2

Burn Duration:	2	h		
Burn Rate:	4.4	lb/h	2.0	kg/h
Stack Temp:	484.9	Deg. F	251.6	Deg. C

21.9	98.4%	71.3%	70.2%	14.2	1.40	70.97	0.02	70.97
Data	**Combust**	**Heat**	**Net**	**Air**	**Wet Wt**	**% Wet**	**Dry Wt.**	**% Dry**
Room Temp (ºC)	**Eff %**	**Transfer %**	**Eff %**	**Fuel Ratio**	**Now Wt**	**Consumed x**	**Now Wtdn**	**Comsumed y**
21.1	98.7%	62.5%	61.7%	22.8	4.81	0.00	4.01	0.00
21.1	93.1%	76.9%	71.6%	5.8	3.81	20.75	3.18	20.75
21.1	96.2%	77.0%	74.1%	5.9	2.68	44.34	2.23	44.34
21.1	99.9%	73.6%	73.5%	9.8	2.00	58.49	1.67	58.49
21.7	99.9%	73.1%	73.0%	10.5	1.41	70.75	1.17	70.75
21.1	99.6%	70.1%	69.8%	13.9	1.04	78.30	0.87	78.30
21.7	99.3%	69.6%	69.1%	15.5	0.82	83.02	0.68	83.02
22.2	99.3%	70.6%	70.1%	15.6	0.59	87.74	0.49	87.74
22.8	98.4%	68.8%	67.7%	17.8	0.45	90.57	0.38	90.57
22.8	98.8%	71.4%	70.5%	16.0	0.27	94.34	0.23	94.34
22.8	98.8%	71.3%	70.5%	16.8	0.18	96.23	0.15	96.23
22.8	98.9%	71.6%	70.8%	16.9	0.09	98.11	0.08	98.11
22.8	98.8%	71.1%	70.3%	17.8	0.00	100.00	0.00	100.00
							0.00	

Combustion Efficiency:	96.8%		
Total Input (kJ):	79,462	75,366	(Btu)
Total Output (kJ):	56,978	54,041	(Btu)
Efficiency:	71.7%		
Total CO (g):	183.05		

Load Weight (kg):
Fuel Heating:
Value in kJ/kg - CV:

80212	4.06	6.87	2.74	19810.00	16.60	79.56	21.10	2.42
Fuel Properties					**Mw**	**Mass Balance**		
Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	**Moisture Fuel Burnt**	**(moles/100 mole dry [h]**	**[u]**	**[w]**
0	4.06	6.87	2.74	19810.00	16.60	79.34	21.04	1.27
25863	4.06	6.87	2.74	19810.00	16.60	79.56	21.10	5.01
14993	4.06	6.87	2.74	19810.00	16.60	79.94	21.20	4.99
10495	4.06	6.87	2.74	19810.00	16.60	79.84	21.18	2.99
7871	4.06	6.87	2.74	19810.00	16.60	79.79	21.16	2.80
4873	4.06	6.87	2.74	19810.00	16.60	79.58	21.11	2.10
3748	4.06	6.87	2.74	19810.00	16.60	79.51	21.09	1.88
2999	4.06	6.87	2.74	19810.00	16.60	79.51	21.09	1.87
2624	4.06	6.87	2.74	19810.00	16.60	79.41	21.06	1.64
2249	4.06	6.87	2.74	19810.00	16.60	79.47	21.08	1.82
1499	4.06	6.87	2.74	19810.00	16.60	79.45	21.07	1.74
2249	4.06	6.87	2.74	19810.00	16.60	79.45	21.07	1.72
750	4.06	6.87	2.74	19810.00	16.60	79.43	21.07	1.64

Moisture Content MCwb: 16.60

Moisture of Wood (wet basis): 16.60
Initial Dry Weight Wtdo (kg): 4.01
Moisture Content Dry 19.90

Dry kg : 4.01
CA: 48.73
HY: 6.87
OX: 43.90

4.81

HHV	LHV		HHV	LHV
19810.00	18328.69	Btu/lb	8522.48	7885.21

8.27	0.03	0.24	39.82	59.74	0.95	0.04	390.04	34.44
flue gas)		kg Wood per 100 mole dfp	Moles per kg of Dry Wood					
[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O
4.39	-0.01	0.13	39.83	122.13	1.03	-0.05	625.80	34.62
16.73	0.24	0.50	37.02	0.66	3.31	0.48	159.57	33.56
16.88	0.13	0.50	38.74	-0.16	1.81	0.26	160.94	33.99
10.29	-0.01	0.30	40.70	26.91	0.13	-0.02	268.35	34.57
9.63	-0.01	0.28	40.70	31.75	0.14	-0.03	286.62	34.58
7.24	-0.01	0.21	40.47	56.69	0.38	-0.04	380.22	34.59
6.46	0.00	0.19	40.25	68.84	0.59	-0.02	425.55	34.57
6.44	0.00	0.19	40.25	69.13	0.59	-0.03	426.66	34.57
5.63	0.00	0.16	39.76	85.30	1.04	0.01	486.48	34.49
6.24	0.00	0.18	39.98	72.70	0.83	0.00	439.45	34.51
5.97	0.00	0.17	39.94	77.97	0.87	0.00	459.28	34.52
5.91	0.00	0.17	40.00	79.18	0.82	-0.01	463.99	34.54
5.63	0.00	0.16	39.97	85.46	0.86	-0.01	487.62	34.55

11.06	523.32	9471.59	6959.91	6726.68	6660.80	9486.04	8036.41	295.07
Moisture Present	**Stack Temp K**	**Heat Content Change - Ambient to Stack Temperature Flue Gas Constituent**						**Room Temp K**
		CO2	**O2**	**CO**	**N2**	**CH4**	**H2O**	
11.06	505.93	8708.55	6431.04	6223.54	6160.89	8652.15	7437.87	294.26
11.06	582.04	12157.56	8842.07	8522.72	8444.13	12376.57	10174.80	294.26
11.06	594.26	12727.07	9234.11	8894.96	8814.13	13004.89	10617.39	294.26
11.06	562.59	11260.45	8221.16	7932.25	7857.40	11394.23	9472.45	294.26
11.06	557.04	10984.99	8028.03	7747.93	7674.39	11098.02	9252.98	294.82
11.06	535.93	10047.95	7375.15	7125.91	7056.57	10081.44	8512.72	294.26
11.06	518.15	9229.92	6798.34	6574.56	6509.32	9208.94	7855.96	294.82
11.06	507.59	8739.95	6450.57	6241.52	6178.89	8691.36	7459.07	295.37
11.06	500.37	8399.88	6208.03	6008.96	5948.22	8334.67	7181.82	295.93
11.06	493.15	8082.49	5982.31	5792.70	5733.67	8000.35	6924.05	295.93
11.06	485.93	7766.61	5757.07	5576.73	5519.45	7668.96	6666.58	295.93
11.06	481.48	7572.98	5618.69	5443.97	5387.79	7466.48	6508.29	295.93
11.06	478.71	7452.25	5532.29	5361.05	5305.56	7340.49	6409.41	295.93

SUMS							AVERAGE
4893.32	4928.96	3597.41	32054.24	504.53	23278.28	7474.39	5902.39
Energy Losses (kJ/kg of Dry Fuel)							**Total**
Flue Gas Constituent							**Loss**
CO2	**O2**	**CO**	**N2**	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**
346.90	785.41	296.51	3855.51	-42.26	1779.53	568.34	7589.94
450.10	5.80	964.66	1347.39	434.40	1817.07	598.59	5618.00
493.00	-1.48	528.89	1418.58	238.78	1855.60	603.49	5136.86
458.32	221.26	39.11	2108.53	-21.37	1847.47	590.83	5244.16
447.08	254.90	41.78	2199.63	-27.16	1840.57	588.40	5345.19
406.60	418.08	110.88	2683.03	-31.95	1815.53	580.22	5982.39
371.49	467.97	170.48	2770.02	-22.42	1791.72	572.96	6122.22
351.76	445.94	170.73	2636.29	-22.63	1778.02	568.57	5928.69
333.95	529.57	300.96	2893.68	13.08	1764.37	565.51	6401.12
323.13	434.92	239.53	2519.66	3.54	1756.56	562.66	5840.00
310.23	448.90	250.22	2534.97	0.85	1747.98	559.81	5852.96
302.94	444.88	235.82	2499.86	-7.37	1743.44	558.06	5777.63
297.83	472.80	247.83	2587.09	-10.96	1740.42	556.97	5891.97

SUMS						
22484	2551	19932.91	57727	2551	183.05	12.60
Total Loss	**Chemical Loss 1**	**Sensible and Latent Loss**	**Total Output**	**Chem Loss 2**	**Grams Produced**	
					CO	**HC**
0	0	0.00	0	0	0.00	0.00
7334	1782	5552.58	18528	1782	120.96	10.05
3888	566	3321.53	11105	566	38.40	3.20
2778	9	2769.28	7717	9	1.99	-0.20
2124	5	2118.34	5747	5	1.60	-0.19
1471	19	1452.66	3401	19	2.63	-0.14
1158	27	1131.05	2590	27	3.12	-0.08
897	22	875.51	2101	22	2.50	-0.06
848	41	807.05	1776	41	3.86	0.03
663	27	635.94	1586	27	2.64	0.01
443	19	424.34	1056	19	1.84	0.00
656	25	630.47	1593	25	2.60	-0.01
223	9	214.17	527	9	0.91	-0.01

Dirigo Laboratories, Inc.

Manufacturer:	**Arada**
Model:	**Farringdon 16**
Date:	**2/21/2017**
Run:	**5**
Control #:	**035-S-075-1**
Test Duration:	**120**
Output Category:	**4**

	HHV Basis	LHV Basis
Overall Efficiency	71.7%	77.5%
Combustion Efficiency	96.8%	96.8%
Heat Transfer Efficiency	74.1%	80.1%

HHV Output Rate (kJ/h)	28,489	27,025	**(Btu/h)**
Burn Rate (kg/h)	2.01	4.42	**(lb/h)**
Input (kJ/h)	39,731	37,689	**(Btu/h)**

Test Load Weight (dry kg)	4.0	8.8	**dry lb**
MC wet (%)	16.60		
MC dry (%)	19.90		
Particulate (g)	3.36		
CO (g)	183		
Test Duration (h)	2		

Emissions	**Particulate**	**CO**
g/MJ Output	0.06	3.21
g/kg Dry Fuel	0.84	45.64
g/h	1.68	91.53
lb/MM Btu Output	0.14	7.47

Air/Fuel Ratio (A/F)	11.40

Test Results in Accordance with CSA B415.1-10

Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

VERSION: 2.4 4/15/2010

lanufacturer: Arada
Model: Farringdon 16
Date: 2/21/2017
Run: 4
Control #: 035-S-075-1
est Duration: 190
urn Category 3

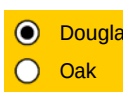
Appliance Type: Cat (Cat, Non-Cat, Pe
Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY):	19.7
Wood Moisture (% wet):	16.46
Load Weight (lb wet):	10.80
Burn Rate (dry kg/h):	1.29
Total Particulate Emissions:	4.84 g

Fuel Data	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.90	
%Ash	0.50	

Averages		357.1	68.2	11.14	9.63	0.43
		Temp. (F)				
Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas	Room Temp	Flue Gas Composition (%) O2	CO2	CO
0	10.8	318.0	67.0	16.37	4.23	0.07
10	9.8	367.0	68.0	9.91	11.44	0.21
20	8.4	441.0	68.0	3.42	17.09	2.31
30	6.7	467.0	68.0	2.87	16.63	4.59
40	5.5	428.0	69.0	8.99	12.44	0.07
50	4.4	421.0	69.0	8.13	13.32	0.05
60	3.6	402.0	69.0	10.50	10.53	0.04
70	3.1	375.0	68.0	12.57	8.21	0.08
80	2.8	369.0	69.0	11.90	8.99	0.08
90	2.3	354.0	68.0	11.33	9.61	0.07
100	1.9	349.0	68.0	10.77	10.13	0.06
110	1.6	342.0	68.0	12.06	8.55	0.09
120	1.3	334.0	68.0	11.79	8.97	0.10
130	1.1	335.0	68.0	12.45	8.19	0.11
140	0.9	326.0	67.0	13.12	7.54	0.11
150	0.7	318.0	68.0	12.75	7.94	0.11
160	0.5	310.0	68.0	13.50	7.15	0.10
170	0.3	300.0	68.0	13.34	7.35	0.10
180	0.2	295.0	69.0	13.57	7.08	0.10
190	0.0	290.0	69.0	13.51	7.11	0.10

ellet)



Manufacturer:	Arada
Model:	Farringdon 16
Date:	2/21/2017
Run:	4
Control #:	035-S-075-1
Test Duration:	190 min

	HHV	LHV
Eff	75.0%	81.0%
Comb Eff	95.8%	95.8%
HT Eff	78.3%	84.6%
Output	19,197	kJ/h
Burn Rate	1.29	kg/h
Grams CO	245	g
Input	25,609	kJ/h
MC wet	16.46	

Ultimate CO2
CO2-ult 19.64
F0
1.062

Averages	0.43	9.63	121.0%	20.28	10.44	180.6

INPUT DATA				**Oxygen Calculation**			**Input**
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**
0	4.90	0.07	4.23	356.8%	20.66	16.39	158.9
10	4.45	0.21	11.44	68.6%	20.17	8.63	186.1
20	3.81	2.31	17.09	1.3%	19.66	1.41	227.2
30	3.04	4.59	16.63	-7.4%	19.54	0.61	241.7
40	2.50	0.07	12.44	57.0%	20.11	7.64	220.0
50	2.00	0.05	13.32	46.9%	20.06	6.71	216.1
60	1.63	0.04	10.53	85.8%	20.24	9.69	205.6
70	1.41	0.08	8.21	136.9%	20.39	12.14	190.6
80	1.27	0.08	8.99	116.6%	20.34	11.31	187.2
90	1.04	0.07	9.61	102.9%	20.30	10.66	178.9
100	0.86	0.06	10.13	92.8%	20.27	10.11	176.1
110	0.73	0.09	8.55	127.3%	20.37	11.77	172.2
120	0.59	0.10	8.97	116.6%	20.34	11.32	167.8
130	0.50	0.11	8.19	136.7%	20.39	12.15	168.3
140	0.41	0.11	7.54	156.8%	20.43	12.84	163.3
150	0.32	0.11	7.94	144.0%	20.41	12.41	158.9
160	0.23	0.10	7.15	170.9%	20.46	13.26	154.4
170	0.14	0.10	7.35	163.7%	20.45	13.05	148.9
180	0.09	0.10	7.08	173.6%	20.47	13.34	146.1
190	0.00	0.10	7.11	172.4%	20.46	13.30	143.3

			Air Fuel Ratio (A/F)		
Overall Heating Efficiency:	75.0%	Dry Molecular Weight (Md)		29.96	
Combustion Efficiency:	95.8%	Dry Moles Exhaust Gas (Nr):		388.75	%HC
Heat Transfer Efficiency:	78.3%	Air Fuel Ratio (A/F)		11.14	0.88

Heat Output:	18,210	Btu/h	19,197	kJ/h
Heat Input:	24,293	Btu/h	25,609	kJ/h

2

Burn Duration:	3.166666667	h
Burn Rate:	2.8	lb/h
	1.3	kg/h
Stack Temp:	359.1	Deg. F
	181.7	Deg. C

20.1	98.2%	77.6%	76.1%	13.3	1.50	69.49	0.03	69.49
Data	**Combust**	**Heat**	**Net**	**Air**	**Wet Wt**	**% Wet**	**Dry Wt.**	**% Dry**
Room Temp (ºC)	**Eff %**	**Transfer %**	**Eff %**	**Fuel Ratio**	**Now Wt**	**Consumed x**	**Now Wtdn**	**Comsumed y**
19.4	99.7%	68.8%	68.7%	27.6	4.90	0.00	4.09	0.00
20.0	98.7%	79.4%	78.4%	10.2	4.45	9.26	3.71	9.26
20.0	90.1%	79.8%	71.9%	6.0	3.81	22.22	3.18	22.22
20.0	82.2%	78.4%	64.4%	5.3	3.04	37.96	2.54	37.96
20.6	99.7%	78.2%	77.9%	9.5	2.50	49.07	2.08	49.07
20.6	99.8%	79.0%	78.9%	8.9	2.00	59.26	1.67	59.26
20.6	99.9%	77.4%	77.4%	11.2	1.63	66.67	1.36	66.67
20.0	99.6%	75.7%	75.4%	14.3	1.41	71.30	1.18	71.30
20.6	99.6%	77.1%	76.8%	13.1	1.27	74.07	1.06	74.07
20.0	99.7%	78.3%	78.1%	12.3	1.04	78.70	0.87	78.70
20.0	99.8%	79.1%	78.9%	11.7	0.86	82.41	0.72	82.41
20.0	99.5%	77.7%	77.3%	13.7	0.73	85.19	0.61	85.19
20.0	99.4%	78.5%	78.1%	13.1	0.59	87.96	0.49	87.96
20.0	99.3%	77.5%	77.0%	14.3	0.50	89.81	0.42	89.81
19.4	99.3%	77.0%	76.4%	15.5	0.41	91.67	0.34	91.67
20.0	99.3%	78.0%	77.4%	14.7	0.32	93.52	0.27	93.52
20.0	99.4%	77.3%	76.8%	16.3	0.23	95.37	0.19	95.37
20.0	99.4%	78.1%	77.6%	15.9	0.14	97.22	0.11	97.22
20.6	99.4%	78.0%	77.5%	16.5	0.09	98.15	0.08	98.15
20.6	99.4%	78.3%	77.8%	16.4	0.00	100.00	0.00	100.00

Combustion Efficiency:	95.8%		
Total Input (kJ):	81,097	76,916	(Btu)
Total Output (kJ):	60,790	57,656	(Btu)
Efficiency:	75.0%		
Total CO (g):	244.76		

Load Weight (kg):
Fuel Heating:
Value in kJ/kg - CV:

81847	4.06	6.87	2.74	19810.00	16.46	79.51	21.09	2.49
Fuel Properties					**Mw**	**Mass Balance**		
Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	**Moisture Fuel Burnt**	**(moles/100 mole dry [h]**	**[u]**	**[w]**
0	4.06	6.87	2.74	19810.00	16.46	79.31	21.04	1.05
12765	4.06	6.87	2.74	19810.00	16.46	79.72	21.15	2.87
11639	4.06	6.87	2.74	19810.00	16.46	79.19	21.00	4.86
10888	4.06	6.87	2.74	19810.00	16.46	78.17	20.73	5.39
8635	4.06	6.87	2.74	19810.00	16.46	79.85	21.18	3.08
7133	4.06	6.87	2.74	19810.00	16.46	79.92	21.20	3.29
4881	4.06	6.87	2.74	19810.00	16.46	79.74	21.15	2.60
3004	4.06	6.87	2.74	19810.00	16.46	79.57	21.11	2.04
3004	4.06	6.87	2.74	19810.00	16.46	79.62	21.12	2.23
3379	4.06	6.87	2.74	19810.00	16.46	79.66	21.13	2.38
2628	4.06	6.87	2.74	19810.00	16.46	79.70	21.14	2.51
2253	4.06	6.87	2.74	19810.00	16.46	79.59	21.11	2.13
1877	4.06	6.87	2.74	19810.00	16.46	79.61	21.12	2.23
1502	4.06	6.87	2.74	19810.00	16.46	79.55	21.10	2.04
1502	4.06	6.87	2.74	19810.00	16.46	79.51	21.09	1.88
1502	4.06	6.87	2.74	19810.00	16.46	79.54	21.10	1.98
1502	4.06	6.87	2.74	19810.00	16.46	79.49	21.08	1.78
1126	4.06	6.87	2.74	19810.00	16.46	79.50	21.09	1.83
1877	4.06	6.87	2.74	19810.00	16.46	79.48	21.08	1.77
751	4.06	6.87	2.74	19810.00	16.46	79.49	21.08	1.77

Moisture Content MCwb:	16.46

Moisture of Wood (wet basis):	16.46	Dry kg :	4.09
Initial Dry Weight Wtdo (kg):	4.09	CA:	48.73
Moisture Content Dry	19.70	HY:	6.87
		OX:	43.90

4.90

HHV	LHV		HHV	LHV
19810.00	18328.69	Btu/lb	8522.48	7885.21

8.45	0.05	0.25	39.67	53.25	1.07	0.07	365.15	34.38
flue gas)		**kg Wood per 100 mole dfp**	**Moles per kg of Dry Wood**					
[j]	**[k]**	**Nk**	**CO2**	**O2**	**CO**	**HC**	**N2**	**H2O**
3.66	-0.02	0.10	40.30	156.16	0.67	-0.15	755.58	34.83
9.84	0.02	0.29	40.02	30.17	0.73	0.06	278.89	34.41
16.02	0.33	0.48	35.34	2.92	4.78	0.69	163.76	33.14
17.18	0.67	0.54	31.01	1.14	8.56	1.25	145.75	32.03
10.58	0.00	0.31	40.59	24.93	0.23	-0.01	260.55	34.54
11.31	0.00	0.33	40.67	20.49	0.15	-0.01	244.02	34.54
8.95	-0.01	0.26	40.70	37.46	0.15	-0.04	308.16	34.60
7.02	-0.01	0.20	40.46	59.84	0.39	-0.04	392.09	34.60
7.68	-0.01	0.22	40.48	50.93	0.36	-0.03	358.52	34.58
8.20	-0.01	0.24	40.55	44.96	0.30	-0.03	336.12	34.58
8.63	-0.01	0.25	40.60	40.51	0.24	-0.03	319.46	34.58
7.32	-0.01	0.21	40.41	55.66	0.43	-0.03	376.19	34.58
7.68	0.00	0.22	40.38	50.96	0.45	-0.02	358.36	34.56
7.02	0.00	0.20	40.29	59.75	0.54	-0.02	391.34	34.56
6.48	0.00	0.19	40.25	68.54	0.59	-0.02	424.44	34.57
6.81	0.00	0.20	40.27	62.97	0.56	-0.02	403.44	34.56
6.14	-0.01	0.18	40.29	74.72	0.56	-0.04	447.88	34.60
6.31	-0.01	0.18	40.30	71.54	0.55	-0.04	435.90	34.59
6.08	-0.01	0.18	40.28	75.88	0.57	-0.04	452.23	34.60
6.11	-0.01	0.18	40.28	75.38	0.57	-0.04	450.36	34.60

10.94	453.73	6489.68	4840.66	4696.55	4646.73	6342.09	5616.79	293.26
	Stack	**Heat Content Change - Ambient to Stack Temperature**						**Room**
Moisture	**Temp**	**Flue Gas Constituent**						**Temp**
Present	**K**	**CO2**	**O2**	**CO**	**N2**	**CH4**	**H2O**	**K**
10.94	432.04	5584.36	4189.31	4070.52	4026.09	5404.97	4869.99	292.59
10.94	459.26	6719.19	5011.22	4861.86	4810.32	6567.79	5814.45	293.15
10.94	500.37	8505.66	6289.79	6088.99	6027.25	8431.79	7277.76	293.15
10.94	514.82	9144.97	6742.62	6522.39	6457.30	9109.18	7794.18	293.15
10.94	493.15	8167.13	6047.72	5856.73	5796.90	8078.09	7000.81	293.71
10.94	489.26	7996.86	5926.38	5740.40	5681.51	7899.28	6862.13	293.71
10.94	478.71	7536.89	5597.70	5425.08	5368.79	7418.22	6486.17	293.71
10.94	463.71	6909.96	5148.71	4994.07	4941.38	6764.74	5972.18	293.15
10.94	460.37	6745.69	5029.23	4878.90	4827.27	6597.53	5834.69	293.71
10.94	452.04	6410.41	4788.17	4647.27	4597.62	6250.10	5558.38	293.15
10.94	449.26	6292.05	4702.51	4564.81	4515.90	6128.69	5459.97	293.15
10.94	445.37	6126.73	4582.70	4449.43	4401.57	5959.44	5322.27	293.15
10.94	440.93	5938.32	4445.95	4317.69	4271.02	5767.05	5165.00	293.15
10.94	441.48	5961.84	4463.03	4334.15	4287.33	5791.04	5184.65	293.15
10.94	436.48	5771.62	4325.71	4202.05	4156.39	5595.15	5027.03	292.59
10.94	432.04	5563.23	4172.97	4054.52	4010.29	5385.60	4850.80	293.15
10.94	427.59	5376.54	4036.74	3923.10	3880.11	5196.53	4693.88	293.15
10.94	422.04	5143.99	3866.71	3758.98	3717.55	4961.74	4497.87	293.15
10.94	419.26	5006.91	3765.46	3660.99	3620.54	4825.61	4380.75	293.71
10.94	416.48	4891.19	3680.61	3579.04	3539.39	4709.30	4282.86	293.71

SUMS							AVERAGE
5116.20	4732.37	6167.93	32354.99	1262.24	34089.28	10853.87	4728.84
Energy Losses (kJ/kg of Dry Fuel)							**Total**
Flue Gas Constituent							**Loss**
CO2	**O2**	**CO**	**N2**	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**
225.05	654.20	191.41	3042.04	-137.94	1701.09	534.52	6210.37
268.90	151.21	211.46	1341.55	52.49	1712.83	544.86	4283.30
300.62	18.39	1381.02	987.04	621.53	1698.28	560.87	5567.75
283.57	7.72	2477.81	941.14	1120.23	1658.04	566.52	7055.03
331.51	150.74	65.97	1510.37	-6.11	1760.30	557.84	4370.63
325.24	121.46	44.08	1386.38	-9.63	1755.91	556.32	4179.76
306.72	209.67	44.59	1654.47	-33.86	1745.65	552.21	4479.45
279.56	308.08	113.53	1937.46	-34.80	1727.98	546.58	4878.38
273.08	256.16	103.70	1730.68	-26.40	1722.29	545.08	4604.58
259.92	215.27	84.95	1545.34	-26.25	1712.71	542.05	4334.00
255.47	190.50	69.15	1442.63	-27.00	1709.39	540.98	4181.13
247.61	255.06	122.28	1655.82	-24.67	1704.38	539.47	4499.94
239.78	226.58	129.33	1530.57	-14.67	1697.84	537.75	4347.18
240.19	266.68	155.48	1677.81	-15.46	1698.61	537.96	4561.27
232.31	296.49	168.64	1764.14	-22.11	1693.89	536.24	4669.60
224.06	262.75	160.16	1617.90	-17.88	1687.34	534.31	4468.63
216.60	301.63	161.66	1737.83	-34.10	1683.68	532.59	4599.91
207.30	276.63	157.22	1620.48	-31.49	1676.61	530.45	4437.21
201.69	285.71	163.10	1637.34	-35.03	1672.94	529.17	4454.91
197.04	277.44	162.37	1594.00	-34.62	1669.51	528.09	4393.83

SUMS						
20306	3430	16876.78	61541	3430	244.76	17.18
Total Loss	**Chemical Loss 1**	**Sensible and Latent Loss**	**Total Output**	**Chem Loss 2**	**Grams Produced**	
					CO	**HC**
0	0	0.00	0	0	0.00	0.00
2760	168	2592.54	10005	168	13.25	0.60
3271	1156	2115.16	8368	1156	78.59	6.50
3878	1941	1936.95	7010	1941	131.71	10.95
1905	26	1879.65	6730	26	2.79	-0.05
1505	12	1492.99	5628	12	1.54	-0.06
1104	3	1101.15	3777	3	1.07	-0.15
740	12	727.98	2264	12	1.67	-0.09
698	11	686.66	2305	11	1.53	-0.07
739	10	729.45	2640	10	1.41	-0.08
555	5	549.23	2073	5	0.89	-0.06
512	11	500.80	1741	11	1.35	-0.05
412	11	401.26	1465	11	1.19	-0.02
346	10	335.34	1156	10	1.15	-0.02
354	11	343.07	1148	11	1.25	-0.03
339	11	328.14	1163	11	1.18	-0.02
349	10	339.20	1153	10	1.20	-0.05
252	7	245.25	874	7	0.87	-0.03
422	12	410.20	1455	12	1.51	-0.06
167	5	161.77	584	5	0.60	-0.02

Dirigo Laboratories, Inc.

Manufacturer:	**Arada**
Model:	**Farringdon 16**
Date:	**2/21/2017**
Run:	**4**
Control #:	**035-S-075-1**
Test Duration:	**190**
Output Category:	**3**

	HHV Basis	LHV Basis
Overall Efficiency	75.0%	81.0%
Combustion Efficiency	95.8%	95.8%
Heat Transfer Efficiency	78.3%	84.6%

HHV Output Rate (kJ/h)	19,197	18,210	**(Btu/h)**
Burn Rate (kg/h)	1.29	2.85	**(lb/h)**
Input (kJ/h)	25,609	24,293	**(Btu/h)**

Test Load Weight (dry kg)	4.1	9.0	**dry lb**
MC wet (%)	16.46		
MC dry (%)	19.70		
Particulate (g)	4.84		
CO (g)	245		
Test Duration (h)	3.166666667		

Emissions	**Particulate**	**CO**
g/MJ Output	0.08	4.03
g/kg Dry Fuel	1.18	59.79
g/h	1.53	77.29
lb/MM Btu Output	0.19	9.36

Air/Fuel Ratio (A/F)	11.14

Test Results in Accordance with CSA B415.1-10

Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

VERSION: 2.4 4/15/2010

lanufacturer: Arada
Model: Farringdon 16
Date: 2/21/2017
Run: 3
Control #: 035-S-075-1
est Duration: 250
urn Category 2

Appliance Type: Cat (Cat, Non-Cat, Pe
Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY): 19.3
Wood Moisture (% wet): 16.18
Load Weight (lb wet): 10.70
Burn Rate (dry kg/h): 0.98
Total Particulate Emissions: 8.31 g

Fuel Data	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.90	
%Ash	0.50	

Averages	241.4	69.9	9.63	11.23	0.38	
	Temp. (F)					
Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas	Room Temp	Flue Gas Composition (%) O2	CO2	CO
0	10.7	229.0	72.0	14.52	5.80	0.02
10	10.1	245.0	70.0	14.35	6.40	0.02
20	9.4	239.0	70.0	12.87	8.27	0.03
30	9.0	246.0	69.0	12.01	9.26	0.05
40	8.5	253.0	69.0	10.71	10.78	0.06
50	7.9	290.0	69.0	6.34	15.11	0.12
60	6.8	330.0	69.0	5.32	14.99	2.62
70	5.7	320.0	69.0	5.13	15.65	1.51
80	4.6	320.0	70.0	4.92	15.03	3.90
90	3.7	304.0	70.0	5.07	15.60	1.19
100	3.2	268.0	70.0	9.65	11.19	0.03
110	2.9	255.0	70.0	10.64	10.13	0.03
120	2.6	247.0	70.0	10.64	10.21	0.03
130	2.3	240.0	70.0	10.58	10.39	0.03
140	1.9	245.0	70.0	9.15	12.06	0.06
150	1.6	241.0	70.0	9.51	11.40	0.03
160	1.4	229.0	70.0	9.42	11.43	0.04
170	1.2	220.0	70.0	9.69	11.09	0.02
180	1.0	208.0	70.0	10.04	10.75	0.02
190	0.9	201.0	70.0	9.50	11.27	0.02
200	0.7	198.0	70.0	9.60	11.21	0.02
210	0.6	195.0	70.0	10.32	10.60	0.02
220	0.5	191.0	70.0	10.27	10.57	0.03
230	0.3	189.0	70.0	9.79	11.23	0.02
240	0.2	187.0	70.0	10.07	10.90	0.02
250	0.0	186.0	70.0	10.38	10.57	0.02

Manufacturer:	Arada
Model:	Farringdon 16
Date:	2/21/2017
Run:	3
Control #:	035-S-075-1
Test Duration:	250 min

	HHV	LHV
Eff	79.5%	85.9%
Comb Eff	96.0%	96.0%
HT Eff	82.8%	89.5%
Output	15,379	kJ/h
Burn Rate	0.98	kg/h
Grams CO	231	g
Input	19,348	kJ/h
MC wet	16.18	

	Ultimate CO2
CO2-ult	19.64
	F_0
	1.063

Averages	0.38	11.23	81.6%	20.17	8.76	116.3

INPUT DATA				**Oxygen Calculation**			**Input**
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**
0	4.85	0.02	5.80	237.5%	20.56	14.75	109.4
10	4.58	0.02	6.40	206.0%	20.52	14.11	118.3
20	4.26	0.03	8.27	136.7%	20.39	12.11	115.0
30	4.08	0.05	9.26	111.0%	20.33	11.04	118.9
40	3.86	0.06	10.78	81.2%	20.22	9.41	122.8
50	3.58	0.12	15.11	29.0%	19.93	4.76	143.3
60	3.09	2.62	14.99	11.5%	19.78	3.48	165.6
70	2.59	1.51	15.65	14.5%	19.81	3.40	160.0
80	2.09	3.90	15.03	3.8%	19.69	2.71	160.0
90	1.68	1.19	15.60	17.0%	19.83	3.64	151.1
100	1.45	0.03	11.19	75.1%	20.20	8.99	131.1
110	1.32	0.03	10.13	93.3%	20.27	10.12	123.9
120	1.18	0.03	10.21	91.8%	20.26	10.04	119.4
130	1.04	0.03	10.39	88.5%	20.25	9.85	115.6
140	0.86	0.06	12.06	62.1%	20.14	8.05	118.3
150	0.73	0.03	11.40	71.9%	20.19	8.77	116.1
160	0.64	0.04	11.43	71.3%	20.18	8.73	109.4
170	0.54	0.02	11.09	76.8%	20.21	9.11	104.4
180	0.45	0.02	10.75	82.4%	20.23	9.47	97.8
190	0.41	0.02	11.27	74.0%	20.19	8.91	93.9
200	0.32	0.02	11.21	74.9%	20.20	8.98	92.2
210	0.27	0.02	10.60	85.0%	20.24	9.63	90.6
220	0.23	0.03	10.57	85.3%	20.24	9.66	88.3
230	0.14	0.02	11.23	74.6%	20.20	8.96	87.2
240	0.09	0.02	10.90	79.9%	20.22	9.31	86.1
250	0.00	0.02	10.57	85.5%	20.24	9.66	85.6

			Air Fuel Ratio (A/F)		
Overall Heating Efficiency:	79.5%	Dry Molecular Weight (Md)		30.15	
Combustion Efficiency:	96.0%	Dry Moles Exhaust Gas (Nr):		340.28	%HC
Heat Transfer Efficiency:	82.8%	Air Fuel Ratio (A/F)		9.75	0.88

Heat Output:	14,589	Btu/h	15,379	kJ/h
Heat Input:	18,353	Btu/h	19,348	kJ/h

2

Burn Duration:	4.166666667	h		
Burn Rate:	2.2	lb/h	1.0	kg/h
Stack Temp:	241.9	Deg. F	116.6	Deg. C

21.0	98.4%	83.7%	82.4%	11.0	1.70	64.88	0.04	64.88
Data	**Combust**	**Heat**	**Net**	**Air**	**Wet Wt**	**% Wet**	**Dry Wt.**	**% Dry**
Room Temp (ºC)	**Eff %**	**Transfer %**	**Eff %**	**Fuel Ratio**	**Now Wt**	**Consumed x**	**Now Wtdn**	**Comsumed y**
22.2	100.5%	80.1%	80.5%	20.4	4.85	0.00	4.07	0.00
21.1	100.4%	79.9%	80.2%	18.5	4.58	5.61	3.84	5.61
21.1	100.1%	82.3%	82.4%	14.3	4.26	12.15	3.57	12.15
20.6	99.9%	82.6%	82.5%	12.8	4.08	15.89	3.42	15.89
20.6	99.8%	83.3%	83.1%	11.0	3.86	20.56	3.23	20.56
20.6	99.4%	83.8%	83.3%	7.8	3.58	26.17	3.00	26.17
20.6	87.7%	81.9%	71.8%	6.5	3.09	36.45	2.59	36.45
20.6	92.7%	82.7%	76.7%	6.8	2.59	46.73	2.17	46.73
21.1	83.0%	81.8%	67.9%	6.0	2.09	57.01	1.75	57.01
21.1	94.1%	83.3%	78.4%	7.0	1.68	65.42	1.41	65.42
21.1	100.0%	83.0%	83.0%	10.6	1.45	70.09	1.22	70.09
21.1	100.0%	82.9%	82.9%	11.7	1.32	72.90	1.10	72.90
21.1	100.0%	83.2%	83.3%	11.6	1.18	75.70	0.99	75.70
21.1	100.0%	83.6%	83.6%	11.4	1.04	78.50	0.87	78.50
21.1	99.8%	84.2%	84.0%	9.8	0.86	82.24	0.72	82.24
21.1	100.0%	84.0%	84.0%	10.4	0.73	85.05	0.61	85.05
21.1	99.9%	84.5%	84.4%	10.4	0.64	86.92	0.53	86.92
21.1	100.1%	84.7%	84.7%	10.7	0.54	88.79	0.46	88.79
21.1	100.1%	85.0%	85.0%	11.0	0.45	90.65	0.38	90.65
21.1	100.1%	85.4%	85.5%	10.5	0.41	91.59	0.34	91.59
21.1	100.1%	85.5%	85.5%	10.6	0.32	93.46	0.27	93.46
21.1	100.1%	85.4%	85.5%	11.2	0.27	94.39	0.23	94.39
21.1	100.0%	85.5%	85.5%	11.2	0.23	95.33	0.19	95.33
21.1	100.1%	85.8%	85.9%	10.6	0.14	97.20	0.11	97.20
21.1	100.1%	85.8%	85.8%	10.9	0.09	98.13	0.08	98.13
21.1	100.1%	85.7%	85.8%	11.2	0.00	100.00	0.00	100.00

Combustion Efficiency:	96.0%		
Total Input (kJ):	80,615	76,459	(Btu)
Total Output (kJ):	64,081	60,778	(Btu)
Efficiency:	79.5%		
Total CO (g):	231.11		

Load Weight (kg):
Fuel Heating:
Value in kJ/kg - CV:

81368	4.06	6.87	2.74	19810.00	16.18	79.64	21.12	2.87
Fuel Properties					**Mw**	**Mass Balance**		
Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	**Moisture Fuel Burnt**	**(moles/100 mole dry [h]**	**[u]**	**[w]**
0	4.06	6.87	2.74	19810.00	16.18	79.43	21.07	1.43
7157	4.06	6.87	2.74	19810.00	16.18	79.47	21.08	1.58
4144	4.06	6.87	2.74	19810.00	16.18	79.59	21.11	2.04
3390	4.06	6.87	2.74	19810.00	16.18	79.65	21.13	2.29
4144	4.06	6.87	2.74	19810.00	16.18	79.75	21.15	2.67
6404	4.06	6.87	2.74	19810.00	16.18	80.01	21.22	3.75
8288	4.06	6.87	2.74	19810.00	16.18	78.91	20.93	4.43
8288	4.06	6.87	2.74	19810.00	16.18	79.44	21.07	4.28
7534	4.06	6.87	2.74	19810.00	16.18	78.36	20.79	4.80
5274	4.06	6.87	2.74	19810.00	16.18	79.57	21.11	4.18
3014	4.06	6.87	2.74	19810.00	16.18	79.79	21.16	2.76
2260	4.06	6.87	2.74	19810.00	16.18	79.72	21.14	2.50
2260	4.06	6.87	2.74	19810.00	16.18	79.72	21.15	2.52
2637	4.06	6.87	2.74	19810.00	16.18	79.73	21.15	2.56
2637	4.06	6.87	2.74	19810.00	16.18	79.83	21.18	2.98
1884	4.06	6.87	2.74	19810.00	16.18	79.80	21.17	2.81
1507	4.06	6.87	2.74	19810.00	16.18	79.80	21.17	2.82
1507	4.06	6.87	2.74	19810.00	16.18	79.78	21.16	2.73
1130	4.06	6.87	2.74	19810.00	16.18	79.76	21.16	2.65
1130	4.06	6.87	2.74	19810.00	16.18	79.80	21.17	2.78
1130	4.06	6.87	2.74	19810.00	16.18	79.79	21.16	2.76
753	4.06	6.87	2.74	19810.00	16.18	79.75	21.15	2.61
1130	4.06	6.87	2.74	19810.00	16.18	79.74	21.15	2.61
1130	4.06	6.87	2.74	19810.00	16.18	79.79	21.17	2.77
1884	4.06	6.87	2.74	19810.00	16.18	79.77	21.16	2.69
753	4.06	6.87	2.74	19810.00	16.18	79.75	21.15	2.60

Moisture Content MCwb: 16.18

Moisture of Wood (wet basis): 16.18
Initial Dry Weight Wtdo (kg): 4.07
Moisture Content Dry 19.30

Dry kg : 4.07
CA: 48.73
HY: 6.87
OX: 43.90

4.85

HHV	LHV		HHV	LHV
19810.00	18328.69	Btu/lb	8522.48	7885.21

9.77	0.04	0.29	39.84	35.97	0.90	0.07	300.33	34.38
flue gas)		kg Wood per 100 mole dfp	Moles per kg of Dry Wood					
[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O
4.95	-0.02	0.14	40.82	103.77	0.14	-0.15	559.03	34.82
5.45	-0.02	0.16	40.81	89.95	0.13	-0.13	506.78	34.77
7.04	-0.02	0.20	40.74	59.64	0.15	-0.07	392.08	34.67
7.89	-0.01	0.23	40.64	48.45	0.22	-0.05	349.56	34.61
9.18	-0.01	0.27	40.61	35.47	0.23	-0.02	300.42	34.57
12.87	0.01	0.37	40.46	12.76	0.32	0.03	214.26	34.47
14.46	0.38	0.44	34.01	7.89	5.94	0.85	179.06	32.81
14.27	0.21	0.43	36.76	7.99	3.55	0.50	186.60	33.51
15.36	0.56	0.48	31.47	5.67	8.16	1.18	164.05	32.16
14.01	0.17	0.42	37.54	8.75	2.86	0.40	191.51	33.72
9.50	-0.01	0.27	40.74	32.75	0.11	-0.04	290.48	34.60
8.61	-0.01	0.25	40.74	40.72	0.12	-0.05	320.59	34.62
8.68	-0.01	0.25	40.74	40.06	0.12	-0.05	318.10	34.62
8.83	-0.01	0.26	40.74	38.61	0.12	-0.04	312.64	34.61
10.26	0.00	0.30	40.62	27.12	0.20	-0.01	268.91	34.55
9.68	-0.01	0.28	40.74	31.34	0.11	-0.03	285.18	34.59
9.71	-0.01	0.28	40.70	31.09	0.14	-0.03	284.14	34.58
9.41	-0.01	0.27	40.78	33.49	0.07	-0.04	293.39	34.61
9.12	-0.01	0.26	40.78	35.92	0.08	-0.05	302.60	34.62
9.56	-0.01	0.28	40.78	32.26	0.07	-0.04	288.75	34.61
9.51	-0.01	0.27	40.78	32.66	0.07	-0.04	290.28	34.61
9.00	-0.01	0.26	40.78	37.05	0.08	-0.05	306.85	34.62
8.98	-0.01	0.26	40.74	37.21	0.12	-0.04	307.36	34.61
9.53	-0.01	0.28	40.78	32.53	0.07	-0.04	289.77	34.61
9.25	-0.01	0.27	40.78	34.83	0.07	-0.05	298.47	34.61
8.97	-0.01	0.26	40.78	37.28	0.08	-0.05	307.71	34.62

10.72	389.47	3767.01	2847.34	2771.87	2740.51	3599.20	3317.95	294.20
Moisture Present	**Stack Temp K**	**Heat Content Change - Ambient to Stack Temperature Flue Gas Constituent**						**Room Temp K**
		CO2	**O2**	**CO**	**N2**	**CH4**	**H2O**	
10.72	382.59	3433.98	2602.09	2534.70	2505.69	3266.83	3034.57	295.37
10.72	391.48	3838.65	2903.82	2827.42	2795.31	3662.54	3384.63	294.26
10.72	388.15	3702.50	2802.85	2729.61	2698.51	3528.20	3267.70	294.26
10.72	392.04	3882.52	2937.01	2859.74	2827.26	3704.40	3423.31	293.71
10.72	395.93	4041.83	3054.95	2973.95	2940.31	3862.03	3559.83	293.71
10.72	416.48	4891.19	3680.61	3579.04	3539.39	4709.30	4282.86	293.71
10.72	438.71	5823.19	4361.29	4235.85	4189.99	5651.88	5067.22	293.71
10.72	433.15	5588.85	4190.70	4071.39	4027.05	5413.65	4870.87	293.71
10.72	433.15	5567.70	4174.35	4055.38	4011.25	5394.24	4851.68	294.26
10.72	424.26	5194.61	3902.00	3792.60	3750.94	5016.65	4537.88	294.26
10.72	404.26	4363.54	3291.79	3202.96	3167.06	4183.26	3833.48	294.26
10.72	397.04	4066.28	3072.32	2990.59	2956.82	3887.82	3579.67	294.26
10.72	392.59	3884.11	2937.50	2860.04	2827.60	3707.46	3423.63	294.26
10.72	388.71	3725.17	2819.67	2745.91	2714.64	3550.55	3287.18	294.26
10.72	391.48	3838.65	2903.82	2827.42	2795.31	3662.54	3384.63	294.26
10.72	389.26	3747.85	2836.50	2762.21	2730.77	3572.91	3306.67	294.26
10.72	382.59	3476.31	2634.79	2566.72	2537.31	3305.69	3072.94	294.26
10.72	377.59	3273.49	2483.78	2420.27	2392.40	3106.91	2897.82	294.26
10.72	370.93	3004.20	2282.78	2225.21	2199.42	2844.05	2664.53	294.26
10.72	367.04	2847.71	2165.71	2111.55	2086.98	2691.86	2528.57	294.26
10.72	365.37	2780.78	2115.58	2062.86	2038.82	2626.90	2470.33	294.26
10.72	363.71	2713.92	2065.48	2014.19	1990.67	2562.09	2412.10	294.26
10.72	361.48	2624.91	1998.71	1949.32	1926.51	2475.92	2334.48	294.26
10.72	360.37	2580.46	1965.34	1916.89	1894.44	2432.94	2295.69	294.26
10.72	359.26	2536.04	1931.99	1884.47	1862.37	2390.03	2256.90	294.26
10.72	358.71	2513.85	1915.31	1868.26	1846.35	2368.60	2237.51	294.26

SUMS							AVERAGE
3859.17	2488.38	6694.72	20688.68	1701.01	42254.92	13182.66	3494.98
Energy Losses (kJ/kg of Dry Fuel)							**Total**
Flue Gas Constituent							**Loss**
CO2	**O2**	**CO**	**N2**	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**
140.17	270.03	40.18	1400.75	-130.83	1636.45	503.99	3860.74
156.66	261.20	36.45	1416.62	-112.74	1646.72	507.74	3912.65
150.84	167.16	42.23	1058.04	-66.50	1637.76	506.49	3496.02
157.78	142.30	62.73	988.28	-41.09	1640.46	508.15	3458.62
164.14	108.34	64.64	883.32	-21.56	1643.11	509.62	3351.62
197.92	46.96	92.09	758.33	23.55	1663.24	517.37	3299.47
198.07	34.41	1707.57	750.26	764.93	1609.11	525.78	5590.13
205.45	33.49	1018.20	751.44	451.52	1636.83	523.68	4620.61
175.20	23.68	2343.73	658.05	1057.70	1570.10	523.47	6351.93
195.03	34.15	821.36	718.35	361.11	1635.45	520.11	4285.56
177.77	107.79	31.26	919.97	-32.88	1653.78	512.55	3370.24
165.66	125.09	34.50	947.93	-42.84	1646.06	509.83	3386.24
158.24	117.67	34.22	899.46	-42.01	1640.57	508.16	3316.31
151.76	108.87	33.61	848.70	-40.19	1635.66	506.70	3245.10
155.94	78.74	57.77	751.69	-12.66	1636.11	507.74	3175.33
152.69	88.90	30.64	778.76	-31.10	1635.37	506.90	3162.16
141.48	81.93	40.67	720.94	-26.15	1626.76	504.40	3090.04
133.50	83.18	20.99	701.91	-38.55	1622.01	502.52	3025.56
122.52	82.00	21.64	665.54	-41.73	1614.27	500.02	2964.26
116.13	69.86	20.63	602.61	-36.92	1609.06	498.56	2879.94
113.40	69.10	20.74	591.83	-37.45	1607.10	497.94	2862.66
110.68	76.52	21.93	610.83	-43.20	1605.69	497.31	2879.77
106.94	74.38	32.95	592.13	-38.40	1602.50	496.48	2866.98
105.24	63.93	20.69	548.94	-37.26	1601.04	496.06	2798.64
103.43	67.29	21.32	555.86	-40.28	1600.01	495.65	2803.27
102.52	71.39	21.98	568.14	-43.49	1599.67	495.44	2815.67

SUMS						
16534	3231	13302.71	64835	3231	231.11	16.09
Total Loss	**Chemical Loss 1**	**Sensible and Latent Loss**	**Total Output**	**Chem Loss 2**	**Grams Produced**	
					CO	**HC**
0	0	0.00	0	0	0.00	0.00
1414	-28	1441.18	5744	-28	1.29	-0.73
731	-5	736.39	3412	-5	0.87	-0.25
592	4	588.30	2798	4	1.05	-0.13
701	9	692.19	3443	9	1.32	-0.08
1067	37	1029.65	5337	37	2.91	0.14
2339	1022	1316.82	5949	1022	69.64	5.72
1933	608	1325.36	6354	608	41.55	3.37
2416	1279	1137.15	5118	1279	86.95	7.19
1141	311	829.54	4133	311	21.35	1.72
513	0	512.98	2501	0	0.47	-0.09
386	-1	387.33	1874	-1	0.39	-0.09
378	-1	379.28	1882	-1	0.38	-0.09
432	-1	432.86	2205	-1	0.44	-0.10
423	6	416.74	2214	6	0.75	-0.03
301	0	300.72	1583	0	0.29	-0.05
235	1	233.96	1272	1	0.30	-0.04
230	-1	231.47	1277	-1	0.16	-0.05
169	-1	170.25	961	-1	0.12	-0.04
164	-1	165.23	966	-1	0.12	-0.04
163	-1	164.26	967	-1	0.12	-0.04
110	-1	110.33	644	-1	0.08	-0.03
164	0	163.87	967	0	0.18	-0.04
160	-1	160.60	970	-1	0.12	-0.04
267	-2	268.34	1617	-2	0.20	-0.07
107	-1	107.90	646	-1	0.08	-0.03

Dirigo Laboratories, Inc.

Manufacturer:	**Arada**
Model:	**Farringdon 16**
Date:	**2/21/2017**
Run:	**3**
Control #:	**035-S-075-1**
Test Duration:	**250**
Output Category:	**2**

	HHV Basis	LHV Basis
Overall Efficiency	79.5%	85.9%
Combustion Efficiency	96.0%	96.0%
Heat Transfer Efficiency	82.8%	89.5%

HHV Output Rate (kJ/h)	15,379	14,589	**(Btu/h)**
Burn Rate (kg/h)	0.98	2.15	**(lb/h)**
Input (kJ/h)	19,348	18,353	**(Btu/h)**

Test Load Weight (dry kg)	4.1	9.0	**dry lb**
MC wet (%)	16.18		
MC dry (%)	19.30		
Particulate (g)	8.31		
CO (g)	231		
Test Duration (h)	4.166666667		

Emissions	Particulate	CO
g/MJ Output	0.13	3.61
g/kg Dry Fuel	2.04	56.79
g/h	1.99	55.47
lb/MM Btu Output	0.30	8.38

Air/Fuel Ratio (A/F)	9.75

Test Results in Accordance with CSA B415.1-10

Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

VERSION: 2.4 **4/15/2010**

lanufacturer: Arada
Model: Farringdon 16
Date: 2/21/2017
Run: 2
Control #: 035-S-075-1
est Duration: 310
urn Category 1

Appliance Type: Cat (Cat, Non-Cat, Pe

Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY):	20.3
Wood Moisture (% wet):	16.87
Load Weight (lb wet):	10.60
Burn Rate (dry kg/h):	0.77
Total Particulate Emissions:	5.49 g

Fuel Data

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.90	
%Ash	0.50	

Averages		**210.9**	**70.0**	**9.89**	**10.70**	**0.08**
		Temp. (F)				
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**Flue Gas Composition (%) O2**	**CO2**	**CO**
0	10.6	229.0	70.0	14.76	5.07	0.01
10	9.9	244.0	70.0	13.89	6.46	0.04
20	9.3	233.0	70.0	11.01	9.85	0.03
30	8.7	234.0	70.0	11.71	9.05	0.03
40	8.2	230.0	70.0	10.41	10.67	0.02
50	7.5	249.0	69.0	5.09	15.49	1.49
60	6.6	264.0	70.0	5.79	15.31	0.23
70	5.8	270.0	70.0	5.88	15.34	0.09
80	5.1	270.0	70.0	6.19	14.90	0.10
90	4.4	262.0	70.0	7.85	12.96	0.01
100	4.0	246.0	71.0	6.93	13.48	0.16
110	3.6	248.0	71.0	9.60	10.92	0.04
120	3.3	237.0	70.0	10.05	10.58	0.02
130	3.0	226.0	70.0	10.24	10.32	0.02
140	2.8	217.0	70.0	10.45	10.15	0.02
150	2.6	212.0	70.0	9.56	10.99	0.02
160	2.3	208.0	70.0	9.40	11.31	0.01
170	2.0	207.0	70.0	9.67	11.19	0.01
180	1.8	206.0	70.0	10.06	10.55	0.02
190	1.7	197.0	70.0	10.37	10.09	0.02
200	1.5	189.0	70.0	10.41	9.98	0.01
210	1.4	184.0	70.0	10.70	9.64	0.01
220	1.3	179.0	70.0	10.79	9.57	0.01
230	1.2	175.0	70.0	9.68	10.95	0.02
240	1.0	173.0	70.0	9.99	10.43	0.02
250	0.8	172.0	70.0	10.20	10.20	0.01
260	0.8	169.0	70.0	10.62	9.75	0.02
270	0.5	179.0	70.0	10.99	9.59	0.02
280	0.4	169.0	70.0	11.42	9.05	0.01
290	0.3	162.0	70.0	11.37	9.01	0.02
300	0.1	156.0	70.0	10.77	9.62	0.01
310	0.0	153.0	70.0	10.53	9.87	0.02

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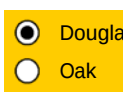


Manufacturer:	Arada
Model:	Farringdon 16
Date:	2/21/2017
Run:	2
Control #:	035-S-075-1
Test Duration:	310 min

	HHV	LHV
Eff	83.4%	90.1%
Comb Eff	99.3%	99.3%
HT Eff	83.9%	90.7%
Output	12,781	kJ/h
Burn Rate	0.77	kg/h
Grams CO	49	g
Input	15,329	kJ/h
MC wet	16.87	

Ultimate CO2

CO2-ult 19.64

F0 1.062

Averages	0.08	10.70	92.1%	20.23	9.49	99.4

INPUT DATA				**Oxygen Calculation**			**Input**
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**
0	4.81	0.01	5.07	286.7%	20.60	15.53	109.4
10	4.49	0.04	6.46	202.2%	20.51	14.03	117.8
20	4.22	0.03	9.85	98.8%	20.29	10.42	111.7
30	3.95	0.03	9.05	116.3%	20.34	11.28	112.2
40	3.72	0.02	10.67	83.8%	20.23	9.55	110.0
50	3.40	1.49	15.49	15.7%	19.82	3.58	120.6
60	2.99	0.23	15.31	26.4%	19.91	4.49	128.9
70	2.63	0.09	15.34	27.3%	19.92	4.54	132.2
80	2.31	0.10	14.90	31.0%	19.95	5.00	132.2
90	2.00	0.01	12.96	51.4%	20.08	7.12	127.8
100	1.81	0.16	13.48	44.0%	20.04	6.48	118.9
110	1.63	0.04	10.92	79.2%	20.22	9.28	120.0
120	1.50	0.02	10.58	85.3%	20.24	9.65	113.9
130	1.36	0.02	10.32	90.0%	20.26	9.93	107.8
140	1.27	0.02	10.15	93.1%	20.27	10.11	102.8
150	1.18	0.02	10.99	78.4%	20.21	9.21	100.0
160	1.04	0.01	11.31	73.5%	20.19	8.88	97.8
170	0.91	0.01	11.19	75.4%	20.20	9.01	97.2
180	0.82	0.02	10.55	85.8%	20.24	9.68	96.7
190	0.77	0.02	10.09	94.3%	20.27	10.17	91.7
200	0.68	0.01	9.98	96.6%	20.28	10.30	87.2
210	0.64	0.01	9.64	103.6%	20.30	10.66	84.4
220	0.59	0.01	9.57	105.0%	20.31	10.73	81.7
230	0.54	0.02	10.95	79.1%	20.22	9.26	79.4
240	0.45	0.02	10.43	88.0%	20.25	9.81	78.3
250	0.36	0.01	10.20	92.4%	20.27	10.06	77.8
260	0.36	0.02	9.75	101.1%	20.29	10.53	76.1

270	0.23	0.02	9.59	104.4%	20.31	10.71	81.7
280	0.18	0.01	9.05	116.8%	20.34	11.29	76.1
290	0.14	0.02	9.01	117.5%	20.34	11.32	72.2
300	0.05	0.01	9.62	104.0%	20.30	10.68	68.9
310	0.00	0.02	9.87	98.6%	20.29	10.41	67.2

			Air Fuel Ratio (A/F)			
Overall Heating Efficiency:	83.4%		Dry Molecular Weight (Md)		30.09	
Combustion Efficiency:	99.3%		Dry Moles Exhaust Gas (Nr):		364.54	%HC
Heat Transfer Efficiency:	83.9%		Air Fuel Ratio (A/F)		10.46	0.88

Heat Output:	12,124	Btu/h	12,781	kJ/h
Heat Input:	14,541	Btu/h	15,329	kJ/h

2

Burn Duration:	5.166666667	h
Burn Rate:	1.7	lb/h
Stack Temp:	210.3	Deg. F

21.1	99.8%	84.5%	84.4%	11.6	1.60	66.83	0.04	66.83

Data Room Temp (ºC)	Combust Eff %	Heat Transfer %	Net Eff %	Air Fuel Ratio	Wet Wt Now Wt	% Wet Consumed x	Dry Wt. Now Wtdn	% Dry Comsumed y
21.1	100.7%	78.6%	79.2%	23.4	4.81	0.00	4.00	0.00
21.1	100.1%	79.9%	80.0%	18.3	4.49	6.60	3.73	6.60
21.1	100.1%	83.4%	83.5%	12.0	4.22	12.26	3.51	12.26
21.1	100.1%	82.9%	83.0%	13.1	3.95	17.92	3.28	17.92
21.1	100.1%	84.0%	84.1%	11.1	3.72	22.64	3.09	22.64
20.6	92.7%	84.5%	78.3%	6.9	3.40	29.25	2.83	29.25
21.1	98.8%	84.5%	83.5%	7.7	2.99	37.74	2.49	37.74
21.1	99.6%	84.4%	84.0%	7.7	2.63	45.28	2.19	45.28
21.1	99.5%	84.2%	83.8%	7.9	2.31	51.89	1.92	51.89
21.1	100.1%	83.8%	83.9%	9.2	2.00	58.49	1.66	58.49
21.7	99.1%	84.5%	83.8%	8.7	1.81	62.26	1.51	62.26
21.7	99.9%	83.5%	83.4%	10.8	1.63	66.04	1.36	66.04
21.1	100.1%	83.7%	83.8%	11.2	1.50	68.87	1.24	68.87
21.1	100.1%	84.0%	84.1%	11.5	1.36	71.70	1.13	71.70
21.1	100.1%	84.2%	84.3%	11.7	1.27	73.58	1.06	73.58
21.1	100.1%	84.8%	84.8%	10.8	1.18	75.47	0.98	75.47
21.1	100.2%	85.0%	85.2%	10.5	1.04	78.30	0.87	78.30
21.1	100.2%	85.0%	85.2%	10.6	0.91	81.13	0.75	81.13
21.1	100.1%	84.8%	84.9%	11.2	0.82	83.02	0.68	83.02
21.1	100.1%	85.0%	85.1%	11.8	0.77	83.96	0.64	83.96
21.1	100.2%	85.2%	85.4%	11.9	0.68	85.85	0.57	85.85
21.1	100.2%	85.3%	85.5%	12.3	0.64	86.79	0.53	86.79
21.1	100.2%	85.5%	85.7%	12.4	0.59	87.74	0.49	87.74
21.1	100.1%	86.1%	86.2%	10.8	0.54	88.68	0.45	88.68
21.1	100.1%	86.0%	86.1%	11.4	0.45	90.57	0.38	90.57
21.1	100.2%	86.0%	86.2%	11.6	0.36	92.45	0.30	92.45
21.1	100.1%	85.9%	86.1%	12.2	0.36	92.45	0.30	92.45

21.1	100.2%	85.5%	85.6%	12.4	0.23	95.28	0.19	95.28
21.1	100.3%	85.7%	85.9%	13.1	0.18	96.23	0.15	96.23
21.1	100.2%	86.0%	86.1%	13.2	0.14	97.17	0.11	97.17
21.1	100.2%	86.4%	86.6%	12.3	0.05	99.06	0.04	99.06
21.1	100.1%	86.6%	86.7%	12.0	0.00	100.00	0.00	100.00

Combustion Efficiency:	99.3%		
Total Input (kJ):	79,198	75,115	(Btu)
Total Output (kJ):	66,033	62,629	(Btu)
Efficiency:	83.4%		
Total CO (g):	49.06		

Load Weight (kg):
Fuel Heating:
Value in kJ/kg - CV:

79571	4.06	6.87	2.74	19810.00	16.87	79.73	21.15	2.65
Fuel Properties					**Mw**	**Mass Balance**		
Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	**Moisture Fuel Burnt**	**(moles/100 mole dry [h]**	**[u]**	**[w]**
0	4.06	6.87	2.74	19810.00	16.87	79.39	21.06	1.25
7471	4.06	6.87	2.74	19810.00	16.87	79.47	21.08	1.60
4483	4.06	6.87	2.74	19810.00	16.87	79.70	21.14	2.43
4109	4.06	6.87	2.74	19810.00	16.87	79.64	21.13	2.23
4483	4.06	6.87	2.74	19810.00	16.87	79.76	21.16	2.63
5977	4.06	6.87	2.74	19810.00	16.87	79.44	21.07	4.23
6351	4.06	6.87	2.74	19810.00	16.87	79.97	21.21	3.83
5604	4.06	6.87	2.74	19810.00	16.87	80.03	21.23	3.80
5230	4.06	6.87	2.74	19810.00	16.87	80.00	21.22	3.70
4109	4.06	6.87	2.74	19810.00	16.87	79.91	21.20	3.19
2989	4.06	6.87	2.74	19810.00	16.87	79.88	21.19	3.36
2615	4.06	6.87	2.74	19810.00	16.87	79.76	21.16	2.70
2241	4.06	6.87	2.74	19810.00	16.87	79.75	21.15	2.61
1868	4.06	6.87	2.74	19810.00	16.87	79.73	21.15	2.54
1494	4.06	6.87	2.74	19810.00	16.87	79.72	21.15	2.50
1868	4.06	6.87	2.74	19810.00	16.87	79.78	21.16	2.71
2241	4.06	6.87	2.74	19810.00	16.87	79.80	21.17	2.78
1868	4.06	6.87	2.74	19810.00	16.87	79.79	21.17	2.75
1121	4.06	6.87	2.74	19810.00	16.87	79.75	21.15	2.60
1121	4.06	6.87	2.74	19810.00	16.87	79.72	21.15	2.49
1121	4.06	6.87	2.74	19810.00	16.87	79.71	21.14	2.46
747	4.06	6.87	2.74	19810.00	16.87	79.69	21.14	2.37
747	4.06	6.87	2.74	19810.00	16.87	79.69	21.14	2.36
1121	4.06	6.87	2.74	19810.00	16.87	79.77	21.16	2.70
1494	4.06	6.87	2.74	19810.00	16.87	79.74	21.15	2.57
747	4.06	6.87	2.74	19810.00	16.87	79.73	21.15	2.51
1121	4.06	6.87	2.74	19810.00	16.87	79.70	21.14	2.40

1494	4.06	6.87	2.74	19810.00	16.87	79.68	21.14	2.36
747	4.06	6.87	2.74	19810.00	16.87	79.65	21.13	2.23
1121	4.06	6.87	2.74	19810.00	16.87	79.65	21.13	2.22
1494	4.06	6.87	2.74	19810.00	16.87	79.69	21.14	2.37
374	4.06	6.87	2.74	19810.00	16.87	79.70	21.14	2.43

Moisture Content MCwb: 16.87

Moisture of Wood (wet basis): 16.87
Initial Dry Weight Wtdo (kg): 4.00
Moisture Content Dry 20.30

Dry kg : 4.00
CA: 48.73
HY: 6.87
OX: 43.90

4.81

HHV	LHV		HHV	LHV
19810.00	18328.69	Btu/lb	8522.48	7885.21

9.12	0.00	0.26	40.62	40.23	0.23	-0.03	318.43	34.59
flue gas)		kg Wood per 100 mole dfp	Moles per kg of Dry Wood					
[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O
4.32	-0.02	0.12	40.92	125.34	0.08	-0.19	640.79	34.90
5.52	-0.02	0.16	40.67	88.32	0.25	-0.11	500.26	34.73
8.37	-0.01	0.24	40.74	43.11	0.12	-0.05	329.63	34.63
7.70	-0.01	0.22	40.74	50.76	0.14	-0.06	358.53	34.65
9.06	-0.01	0.26	40.78	36.52	0.08	-0.05	304.85	34.62
14.12	0.21	0.42	36.77	8.51	3.54	0.50	188.58	33.52
13.11	0.03	0.38	40.14	11.77	0.60	0.07	209.67	34.38
13.05	0.01	0.38	40.56	11.99	0.24	0.02	211.61	34.49
12.68	0.01	0.37	40.52	13.60	0.27	0.02	217.57	34.49
10.98	-0.01	0.32	40.81	22.42	0.03	-0.03	251.65	34.59
11.52	0.01	0.33	40.30	19.37	0.48	0.04	238.79	34.45
9.28	-0.01	0.27	40.70	34.57	0.15	-0.03	297.27	34.59
8.98	-0.01	0.26	40.78	37.20	0.08	-0.05	307.42	34.62
8.76	-0.01	0.25	40.78	39.23	0.08	-0.05	315.11	34.63
8.62	-0.01	0.25	40.79	40.62	0.08	-0.05	320.34	34.63
9.33	-0.01	0.27	40.78	34.19	0.07	-0.04	296.04	34.61
9.59	-0.01	0.28	40.82	32.04	0.04	-0.05	288.04	34.62
9.49	-0.01	0.27	40.82	32.85	0.04	-0.05	291.11	34.62
8.96	-0.01	0.26	40.78	37.43	0.08	-0.05	308.29	34.62
8.57	-0.01	0.25	40.79	41.12	0.08	-0.05	322.24	34.63
8.47	-0.02	0.24	40.83	42.12	0.04	-0.06	326.15	34.65
8.18	-0.02	0.24	40.84	45.15	0.04	-0.07	337.59	34.66
8.12	-0.02	0.23	40.84	45.80	0.04	-0.07	340.04	34.66
9.29	-0.01	0.27	40.78	34.47	0.07	-0.04	297.11	34.61
8.85	-0.01	0.26	40.78	38.36	0.08	-0.05	311.81	34.62
8.65	-0.01	0.25	40.83	40.27	0.04	-0.06	319.16	34.64
8.28	-0.01	0.24	40.79	44.07	0.08	-0.06	333.39	34.64

8.15	-0.01	0.24	40.79	45.53	0.09	-0.06	338.91	34.64
7.68	-0.02	0.22	40.84	50.94	0.05	-0.08	359.47	34.67
7.66	-0.02	0.22	40.79	51.27	0.09	-0.07	360.58	34.66
8.16	-0.02	0.24	40.84	45.33	0.04	-0.07	338.29	34.66
8.38	-0.01	0.24	40.79	43.01	0.08	-0.06	329.37	34.64

11.28	372.54	3074.27	2332.65	2273.02	2246.84	2917.74	2721.51	294.28
	Stack	**Heat Content Change - Ambient to Stack Temperature**						**Room**
Moisture	**Temp**	**Flue Gas Constituent**						**Temp**
Present	**K**	**CO2**	**O2**	**CO**	**N2**	**CH4**	**H2O**	**K**
11.28	382.59	3476.31	2634.79	2566.72	2537.31	3305.69	3072.94	294.26
11.28	390.93	3815.94	2886.98	2811.12	2779.17	3640.11	3365.14	294.26
11.28	384.82	3566.68	2701.98	2631.85	2601.76	3394.49	3150.82	294.26
11.28	385.37	3589.29	2718.79	2648.14	2617.88	3416.73	3170.30	294.26
11.28	383.15	3498.89	2651.59	2583.00	2553.42	3327.87	3092.41	294.26
11.28	393.71	3950.75	2987.54	2908.68	2875.70	3771.85	3481.81	293.71
11.28	402.04	4271.92	3224.21	3137.59	3102.33	4092.04	3755.35	294.26
11.28	405.37	4409.41	3325.59	3235.66	3199.43	4228.97	3872.55	294.26
11.28	405.37	4409.41	3325.59	3235.66	3199.43	4228.97	3872.55	294.26
11.28	400.93	4226.16	3190.44	3104.91	3069.98	4046.54	3716.30	294.26
11.28	392.04	3840.22	2904.30	2827.73	2795.65	3665.57	3384.94	294.82
11.28	393.15	3885.69	2937.99	2860.35	2827.94	3710.52	3423.94	294.82
11.28	387.04	3657.19	2769.22	2697.02	2666.25	3483.56	3228.73	294.26
11.28	380.93	3408.62	2584.43	2517.89	2488.99	3239.28	3014.55	294.26
11.28	375.93	3206.05	2433.49	2371.48	2344.13	3040.96	2839.47	294.26
11.28	373.15	3093.82	2349.73	2290.20	2263.71	2931.39	2742.27	294.26
11.28	370.93	3004.20	2282.78	2225.21	2199.42	2844.05	2664.53	294.26
11.28	370.37	2981.82	2266.04	2208.97	2183.35	2822.26	2645.11	294.26
11.28	369.82	2959.45	2249.32	2192.73	2167.28	2800.48	2625.68	294.26
11.28	364.82	2758.48	2098.88	2046.63	2022.77	2605.28	2450.91	294.26
11.28	360.37	2580.46	1965.34	1916.89	1894.44	2432.94	2295.69	294.26
11.28	357.59	2469.49	1881.97	1835.86	1814.29	2325.79	2198.73	294.26
11.28	354.82	2358.74	1798.67	1754.86	1734.20	2219.07	2101.82	294.26
11.28	352.59	2270.30	1732.08	1690.10	1670.16	2134.01	2024.31	294.26
11.28	351.48	2226.13	1698.80	1657.73	1638.15	2091.58	1985.58	294.26
11.28	350.93	2204.06	1682.17	1641.55	1622.14	2070.39	1966.21	294.26
11.28	349.26	2137.91	1632.28	1593.01	1574.15	2006.93	1908.12	294.26

11.28	354.82	2358.74	1798.67	1754.86	1734.20	2219.07	2101.82	294.26
11.28	349.26	2137.91	1632.28	1593.01	1574.15	2006.93	1908.12	294.26
11.28	345.37	1983.86	1515.97	1479.82	1462.23	1859.46	1772.63	294.26
11.28	342.04	1852.17	1416.39	1382.86	1366.37	1733.73	1656.57	294.26
11.28	340.37	1786.45	1366.63	1334.41	1318.47	1671.10	1598.57	294.26

SUMS							AVERAGE
3990.05	2896.47	2076.42	22498.54	-902.71	51672.99	16850.22	3096.31
Energy Losses (kJ/kg of Dry Fuel)							**Total**
Flue Gas Constituent							**Loss**
CO2	**O2**	**CO**	**N2**	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**
142.26	330.26	23.05	1625.87	-169.67	1641.88	530.53	4124.17
155.18	254.99	71.97	1390.32	-94.20	1644.08	533.83	3956.15
145.30	116.48	35.44	857.61	-45.81	1631.53	531.41	3271.97
146.23	138.00	38.58	938.58	-55.38	1633.21	531.63	3370.84
142.70	96.83	21.83	778.40	-42.54	1629.16	530.75	3157.14
145.28	25.42	1011.31	542.30	448.69	1590.49	535.14	4298.64
171.48	37.95	172.54	650.47	61.67	1640.99	538.23	3273.33
178.84	39.89	68.11	677.03	13.77	1650.14	539.55	3167.33
178.68	45.22	77.84	696.11	15.89	1649.92	539.55	3203.21
172.48	71.52	9.01	772.56	-28.15	1649.22	537.79	3184.43
154.74	56.25	136.70	667.56	34.46	1631.13	534.05	3214.91
158.14	101.57	42.61	840.65	-30.29	1639.34	534.49	3286.51
149.15	103.01	22.03	819.66	-43.44	1633.98	532.29	3216.68
139.02	101.39	22.57	784.30	-46.10	1626.84	529.87	3157.90
130.76	98.85	22.93	750.93	-47.91	1620.97	527.90	3104.43
126.17	80.33	21.17	670.15	-39.46	1616.72	526.80	3001.90
122.64	73.15	10.29	633.52	-41.34	1614.23	525.93	2938.42
121.73	74.45	10.40	635.59	-42.45	1613.67	525.71	2939.10
120.70	84.19	22.05	668.15	-43.71	1613.13	525.49	2990.00
112.51	86.30	23.04	651.81	-48.54	1607.58	523.52	2956.22
105.37	82.79	11.66	617.88	-55.17	1602.90	521.77	2887.19
100.85	84.97	12.07	612.48	-59.32	1599.97	520.67	2871.69
96.32	82.37	12.15	589.70	-60.20	1596.70	519.58	2836.63
92.59	59.71	21.21	496.23	-39.80	1591.91	518.71	2740.55
90.79	65.17	22.26	510.79	-44.89	1591.10	518.27	2753.48
89.99	67.75	11.39	517.73	-52.61	1591.22	518.05	2743.53
87.20	71.94	23.81	524.81	-52.38	1589.18	517.40	2761.96

96.21	81.90	24.22	587.74	-54.31	1596.09	519.58	2851.44
87.32	83.14	12.84	565.87	-67.24	1590.71	517.40	2790.04
80.92	77.72	25.76	527.26	-61.80	1585.46	515.87	2751.18
75.64	64.21	12.07	462.23	-59.53	1581.20	514.56	2650.38
72.86	58.77	23.50	434.26	-50.96	1578.32	513.90	2630.66

SUMS						
13165	523	12642.26	66406	523	49.06	0.49
Total Loss	**Chemical Loss 1**	**Sensible and Latent Loss**	**Total Output**	**Chem Loss 2**	**Grams Produced**	
					CO	**HC**
0	0	0.00	0	0	0.00	0.00
1492	-9	1500.60	5979	-9	2.66	-0.64
740	-2	742.81	3742	-2	0.79	-0.19
699	-4	702.75	3410	-4	0.78	-0.21
714	-5	719.14	3768	-5	0.48	-0.17
1297	437	860.17	4680	437	29.88	2.42
1049	74	974.99	5301	74	5.41	0.35
896	23	873.01	4708	23	1.88	0.07
846	24	821.18	4384	24	2.01	0.08
661	-4	664.53	3449	-4	0.18	-0.10
485	26	459.41	2504	26	2.02	0.09
434	2	432.25	2181	2	0.55	-0.07
364	-2	366.39	1877	-2	0.24	-0.09
298	-2	299.98	1570	-2	0.21	-0.08
234	-2	236.06	1260	-2	0.17	-0.06
283	-2	284.78	1585	-2	0.20	-0.07
332	-4	335.98	1909	-4	0.11	-0.08
277	-3	280.14	1591	-3	0.10	-0.07
169	-1	170.38	952	-1	0.12	-0.04
167	-1	168.69	953	-1	0.13	-0.05
163	-2	165.80	957	-2	0.06	-0.06
108	-2	110.09	639	-2	0.04	-0.04
107	-2	108.80	640	-2	0.05	-0.04
155	-1	156.10	966	-1	0.12	-0.04
208	-2	209.41	1287	-2	0.17	-0.06
103	-2	105.03	644	-2	0.04	-0.04
156	-2	157.87	964	-2	0.13	-0.05

215	-2	217.36	1279	-2	0.18	-0.07
105	-2	107.28	642	-2	0.05	-0.05
156	-2	157.68	965	-2	0.14	-0.06
200	-4	203.50	1294	-4	0.09	-0.08
50	-1	50.13	324	-1	0.04	-0.02

Dirigo Laboratories, Inc.

Manufacturer:	**Arada**
Model:	**Farringdon 16**
Date:	**2/21/2017**
Run:	**2**
Control #:	**035-S-075-1**
Test Duration:	**310**
Output Category:	**1**

	HHV Basis	LHV Basis	
Overall Efficiency	83.4%	90.1%	
Combustion Efficiency	99.3%	99.3%	
Heat Transfer Efficiency	83.9%	90.7%	
HHV Output Rate (kJ/h)	12,781	12,124	**(Btu/h)**
Burn Rate (kg/h)	0.77	1.71	**(lb/h)**
Input (kJ/h)	15,329	14,541	**(Btu/h)**
Test Load Weight (dry kg)	4.0	8.8	**dry lb**
MC wet (%)	16.87		
MC dry (%)	20.30		
Particulate (g)	5.49		
CO (g)	49		
Test Duration (h)	5.166666667		

Emissions	**Particulate**	**CO**
g/MJ Output	0.08	0.74
g/kg Dry Fuel	1.37	12.27
g/h	1.06	9.49
lb/MM Btu Output	0.19	1.73

Air/Fuel Ratio (A/F)	10.46

Test Results in Accordance with CSA B415.1-10

Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

VERSION: 2.4 **4/15/2010**

lanufacturer: Arada
Model: Farringdon 16
Date: 2/21/2017
Run: 1
Control #: 035-S-075-1
est Duration: 420
urn Category 1

Appliance Type: Cat (Cat, Non-Cat, Pe

Temp. Units F (F or C)
Weight Units lb (kg or lb)

Wood Moisture (% DRY): 20.6
Wood Moisture (% wet): 17.08
Load Weight (lb wet): 10.90
Burn Rate (dry kg/h): 0.59
Total Particulate Emissions: 6.36 g

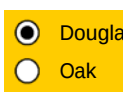
Fuel Data

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.90	
%Ash	0.50	

Averages	**165.5**	**69.9**	**8.36**	**11.99**	**0.41**	
	Temp. (F)					
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**Flue Gas Composition (%) O2**	**CO2**	**CO**
0	10.9	206.0	69.0	13.31	6.61	0.02
10	10.4	212.0	69.0	12.98	7.44	0.02
20	9.9	194.0	69.0	11.14	9.67	0.03
30	9.4	200.0	69.0	9.74	11.28	0.03
40	8.8	204.0	69.0	9.05	12.14	0.03
50	8.2	211.0	70.0	6.82	14.33	0.04
60	7.6	233.0	70.0	5.71	14.34	2.74
70	6.8	246.0	70.0	5.63	13.68	4.23
80	5.9	252.0	71.0	5.52	13.11	5.00
90	5.2	239.0	71.0	5.77	14.35	1.55
100	4.8	223.0	71.0	7.89	12.59	0.06
110	4.5	199.0	71.0	10.22	10.13	0.01
120	4.4	181.0	71.0	10.37	9.91	0.02
130	4.2	170.0	71.0	10.21	10.03	0.01
140	4.1	161.0	71.0	9.71	10.58	0.02
150	3.9	153.0	71.0	9.77	10.49	0.01
160	3.8	148.0	71.0	9.72	10.52	0.01
170	3.7	143.0	71.0	9.71	10.48	0.01
180	3.5	139.0	71.0	9.55	10.65	0.01
190	3.5	135.0	72.0	8.63	11.54	0.01
200	3.1	147.0	72.0	7.11	13.75	0.01
210	2.9	148.0	73.0	6.34	14.53	0.01
220	2.6	159.0	73.0	5.01	15.72	0.57
230	2.2	173.0	73.0	5.04	15.31	1.66
240	1.8	181.0	73.0	4.92	15.07	1.44
250	1.5	177.0	71.0	5.50	15.10	0.02
260	1.3	169.0	70.0	7.32	13.30	0.01
270	1.2	158.0	69.0	8.26	12.10	0.02
280	1.1	150.0	69.0	8.33	12.04	0.01
290	1.0	144.0	69.0	7.96	12.28	0.01
300	0.9	140.0	69.0	8.16	12.06	0.01
310	0.9	137.0	69.0	8.17	12.00	0.01
320	0.8	134.0	68.0	7.89	12.51	0.02

330	0.7	131.0	68.0	7.99	12.34	0.02
340	0.6	129.0	68.0	8.06	12.36	0.01
350	0.5	128.0	68.0	8.53	11.82	0.01
360	0.4	127.0	68.0	8.77	11.65	0.01
370	0.4	125.0	68.0	8.45	11.96	0.02
380	0.3	124.0	68.0	8.63	11.72	0.02
390	0.2	123.0	67.0	9.32	11.02	0.01
400	0.1	122.0	68.0	9.33	11.33	0.02
410	0.1	120.0	69.0	9.09	11.41	0.02
420	0.0	120.0	69.0	9.98	10.40	0.02

ellet)



Manufacturer:	Arada
Model:	Farringdon 16
Date:	2/21/2017
Run:	1
Control #:	035-S-075-1
Test Duration:	420 min

	HHV	LHV
Eff	81.1%	87.7%
Comb Eff	95.0%	95.0%
HT Eff	85.4%	92.3%
Output	9,411	kJ/h
Burn Rate	0.59	kg/h
Grams CO	285	g
Input	11,605	kJ/h
MC wet	17.08	

	Ultimate CO2
CO2-ult	19.64
	F_0
	1.063

Averages	0.41	11.99	65.3%	20.12	7.92	74.1

INPUT DATA				**Oxygen Calculation**			**Input**
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**
0	4.95	0.02	6.61	196.3%	20.50	13.88	96.7
10	4.72	0.02	7.44	163.3%	20.45	13.00	100.0
20	4.49	0.03	9.67	102.5%	20.30	10.61	90.0
30	4.26	0.03	11.28	73.7%	20.19	8.90	93.3
40	3.99	0.03	12.14	61.4%	20.14	7.98	95.6
50	3.72	0.04	14.33	36.7%	19.99	5.64	99.4
60	3.45	2.74	14.34	15.0%	19.81	4.10	111.7
70	3.09	4.23	13.68	9.7%	19.76	3.96	118.9
80	2.68	5.00	13.11	8.5%	19.74	4.13	122.2
90	2.36	1.55	14.35	23.5%	19.89	4.77	115.0
100	2.18	0.06	12.59	55.3%	20.10	7.48	106.1
110	2.04	0.01	10.13	93.7%	20.27	10.14	92.8
120	2.00	0.02	9.91	97.8%	20.28	10.36	82.8
130	1.91	0.01	10.03	95.6%	20.28	10.24	76.7
140	1.86	0.02	10.58	85.3%	20.24	9.65	71.7
150	1.77	0.01	10.49	87.1%	20.25	9.75	67.2
160	1.72	0.01	10.52	86.5%	20.24	9.72	64.4
170	1.68	0.01	10.48	87.3%	20.25	9.76	61.7
180	1.59	0.01	10.65	84.3%	20.24	9.58	59.4
190	1.59	0.01	11.54	70.1%	20.18	8.63	57.2
200	1.41	0.01	13.75	42.8%	20.03	6.28	63.9
210	1.32	0.01	14.53	35.1%	19.98	5.44	64.4
220	1.18	0.57	15.72	20.6%	19.86	3.86	70.6
230	1.00	1.66	15.31	15.8%	19.82	3.68	78.3
240	0.82	1.44	15.07	19.0%	19.85	4.06	82.8
250	0.68	0.02	15.10	29.9%	19.94	4.83	80.6
260	0.59	0.01	13.30	47.6%	20.06	6.76	76.1

270	0.54	0.02	12.10	62.1%	20.14	8.03	70.0
280	0.50	0.01	12.04	63.0%	20.14	8.10	65.6
290	0.45	0.01	12.28	59.8%	20.13	7.84	62.2
300	0.41	0.01	12.06	62.7%	20.14	8.08	60.0
310	0.41	0.01	12.00	63.6%	20.15	8.14	58.3
320	0.36	0.02	12.51	56.8%	20.11	7.59	56.7
330	0.32	0.02	12.34	58.9%	20.12	7.77	55.0
340	0.27	0.01	12.36	58.8%	20.12	7.76	53.9
350	0.23	0.01	11.82	66.0%	20.16	8.33	53.3
360	0.18	0.01	11.65	68.5%	20.17	8.52	52.8
370	0.18	0.02	11.96	64.0%	20.15	8.18	51.7
380	0.14	0.02	11.72	67.3%	20.16	8.43	51.1
390	0.09	0.01	11.02	78.1%	20.21	9.19	50.6
400	0.05	0.02	11.33	73.1%	20.19	8.85	50.0
410	0.05	0.02	11.41	71.9%	20.19	8.77	48.9
420	0.00	0.02	10.40	88.5%	20.25	9.84	48.9

			Air Fuel Ratio (A/F)			
Overall Heating Efficiency:	81.1%	Dry Molecular Weight (Md)		30.24		
Combustion Efficiency:	95.0%	Dry Moles Exhaust Gas (Nr):		319.88	%HC	
Heat Transfer Efficiency:	85.4%	Air Fuel Ratio (A/F)		9.16	0.88	

Heat Output:	8,928	Btu/h	9,411	kJ/h
Heat Input:	11,009	Btu/h	11,605	kJ/h

2

Burn Duration:	7	h		
Burn Rate:	1.3	lb/h	0.6	kg/h
Stack Temp:	164.5	Deg. F	73.6	Deg. C

21.1	98.2%	86.4%	84.9%	10.0	1.56	68.40	0.06	68.40
Data	**Combust**	**Heat**	**Net**	**Air**	**Wet Wt**	**% Wet**	**Dry Wt.**	**% Dry**
Room Temp (ºC)	**Eff %**	**Transfer %**	**Eff %**	**Fuel Ratio**	**Now Wt**	**Consumed x**	**Now Wtdn**	**Comsumed y**
20.6	100.4%	82.2%	82.5%	17.9	4.95	0.00	4.10	0.00
20.6	100.3%	82.6%	82.9%	15.9	4.72	4.59	3.91	4.59
20.6	100.1%	84.8%	84.9%	12.2	4.49	9.17	3.72	9.17
20.6	100.0%	85.2%	85.2%	10.5	4.26	13.76	3.54	13.76
20.6	100.0%	85.4%	85.3%	9.8	3.99	19.27	3.31	19.27
21.1	99.9%	85.7%	85.6%	8.3	3.72	24.77	3.08	24.77
21.1	86.7%	84.1%	73.0%	6.7	3.45	30.28	2.86	30.28
21.1	80.6%	83.1%	67.0%	6.3	3.09	37.61	2.56	37.61
21.7	77.5%	82.4%	63.9%	6.1	2.68	45.87	2.22	45.87
21.7	91.9%	84.4%	77.6%	7.3	2.36	52.29	1.96	52.29
21.7	99.8%	84.9%	84.7%	9.4	2.18	55.96	1.81	55.96
21.7	100.2%	84.9%	85.1%	11.7	2.04	58.72	1.69	58.72
21.7	100.1%	85.5%	85.6%	12.0	2.00	59.63	1.66	59.63
21.7	100.2%	86.0%	86.2%	11.8	1.91	61.47	1.58	61.47
21.7	100.1%	86.5%	86.6%	11.2	1.86	62.39	1.54	62.39
21.7	100.2%	86.8%	86.9%	11.3	1.77	64.22	1.47	64.22
21.7	100.2%	87.0%	87.1%	11.3	1.72	65.14	1.43	65.14
21.7	100.2%	87.1%	87.3%	11.3	1.68	66.06	1.39	66.06
21.7	100.2%	87.3%	87.5%	11.2	1.59	67.89	1.32	67.89
22.2	100.1%	87.7%	87.8%	10.3	1.59	67.89	1.32	67.89
22.2	100.1%	87.6%	87.6%	8.7	1.41	71.56	1.17	71.56
22.8	100.1%	87.7%	87.7%	8.2	1.32	73.39	1.09	73.39
22.8	97.1%	87.3%	84.8%	7.3	1.18	76.15	0.98	76.15
22.8	91.9%	86.5%	79.5%	6.9	1.00	79.82	0.83	79.82
22.8	92.7%	86.3%	80.0%	7.1	0.82	83.49	0.68	83.49
21.7	100.0%	86.9%	86.9%	7.9	0.68	86.24	0.56	86.24
21.1	100.1%	86.8%	86.9%	8.9	0.59	88.07	0.49	88.07

20.6	100.1%	86.9%	86.9%	9.8	0.54	88.99	0.45	88.99
20.6	100.1%	87.1%	87.2%	9.9	0.50	89.91	0.41	89.91
20.6	100.1%	87.4%	87.5%	9.7	0.45	90.83	0.38	90.83
20.6	100.1%	87.5%	87.6%	9.9	0.41	91.74	0.34	91.74
20.6	100.1%	87.6%	87.7%	9.9	0.41	91.74	0.34	91.74
20.0	100.0%	87.7%	87.7%	9.5	0.36	92.66	0.30	92.66
20.0	100.0%	87.8%	87.8%	9.6	0.32	93.58	0.26	93.58
20.0	100.1%	87.8%	87.9%	9.6	0.27	94.50	0.23	94.50
20.0	100.1%	87.8%	87.9%	10.1	0.23	95.41	0.19	95.41
20.0	100.1%	87.8%	87.9%	10.2	0.18	96.33	0.15	96.33
20.0	100.1%	87.9%	88.0%	9.9	0.18	96.33	0.15	96.33
20.0	100.1%	87.9%	88.0%	10.1	0.14	97.25	0.11	97.25
19.4	100.2%	87.8%	88.0%	10.8	0.09	98.17	0.08	98.17
20.0	100.1%	87.9%	88.0%	10.5	0.05	99.08	0.04	99.08
20.6	100.1%	88.0%	88.1%	10.4	0.05	99.08	0.04	99.08
20.6	100.1%	87.9%	88.0%	11.4	0.00	100.00	0.00	100.00

Combustion Efficiency:	95.0%		
Total Input (kJ):	81,237	77,049	(Btu)
Total Output (kJ):	65,880	62,484	(Btu)
Efficiency:	81.1%		
Total CO (g):	285.48		

Load Weight (kg):
Fuel Heating:
Value in kJ/kg - CV:

81609	4.06	6.87	2.74	19810.00	17.08	79.67	21.13	3.07
Fuel Properties					**Mw**	**Mass Balance**		
Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	**Moisture Fuel Burnt**	**(moles/100 mole dry [h]**	**[u]**	**[w]**
0	4.06	6.87	2.74	19810.00	17.08	79.49	21.08	1.63
5590	4.06	6.87	2.74	19810.00	17.08	79.54	21.10	1.83
3726	4.06	6.87	2.74	19810.00	17.08	79.69	21.14	2.39
4099	4.06	6.87	2.74	19810.00	17.08	79.79	21.16	2.78
4472	4.06	6.87	2.74	19810.00	17.08	79.85	21.18	2.99
4472	4.06	6.87	2.74	19810.00	17.08	79.99	21.22	3.54
5217	4.06	6.87	2.74	19810.00	17.08	78.82	20.91	4.30
6335	4.06	6.87	2.74	19810.00	17.08	78.13	20.72	4.56
5962	4.06	6.87	2.74	19810.00	17.08	77.76	20.62	4.64
4099	4.06	6.87	2.74	19810.00	17.08	79.33	21.04	3.97
2609	4.06	6.87	2.74	19810.00	17.08	79.87	21.18	3.11
1491	4.06	6.87	2.74	19810.00	17.08	79.72	21.15	2.49
1118	4.06	6.87	2.74	19810.00	17.08	79.71	21.14	2.44
1118	4.06	6.87	2.74	19810.00	17.08	79.72	21.15	2.47
1118	4.06	6.87	2.74	19810.00	17.08	79.75	21.15	2.61
1118	4.06	6.87	2.74	19810.00	17.08	79.75	21.15	2.58
745	4.06	6.87	2.74	19810.00	17.08	79.75	21.15	2.59
1118	4.06	6.87	2.74	19810.00	17.08	79.75	21.15	2.58
745	4.06	6.87	2.74	19810.00	17.08	79.76	21.16	2.62
1491	4.06	6.87	2.74	19810.00	17.08	79.82	21.17	2.84
2236	4.06	6.87	2.74	19810.00	17.08	79.96	21.21	3.39
1863	4.06	6.87	2.74	19810.00	17.08	80.02	21.22	3.58
2609	4.06	6.87	2.74	19810.00	17.08	79.85	21.18	4.03
2981	4.06	6.87	2.74	19810.00	17.08	79.35	21.05	4.24
2609	4.06	6.87	2.74	19810.00	17.08	79.43	21.07	4.12
1863	4.06	6.87	2.74	19810.00	17.08	80.05	21.23	3.72
1118	4.06	6.87	2.74	19810.00	17.08	79.93	21.20	3.28

745	4.06	6.87	2.74	19810.00	17.08	79.85	21.18	2.98
745	4.06	6.87	2.74	19810.00	17.08	79.85	21.18	2.96
745	4.06	6.87	2.74	19810.00	17.08	79.87	21.18	3.02
373	4.06	6.87	2.74	19810.00	17.08	79.85	21.18	2.97
373	4.06	6.87	2.74	19810.00	17.08	79.85	21.18	2.95
745	4.06	6.87	2.74	19810.00	17.08	79.88	21.19	3.08
745	4.06	6.87	2.74	19810.00	17.08	79.87	21.18	3.04
745	4.06	6.87	2.74	19810.00	17.08	79.87	21.19	3.04
745	4.06	6.87	2.74	19810.00	17.08	79.84	21.18	2.91
373	4.06	6.87	2.74	19810.00	17.08	79.82	21.17	2.87
373	4.06	6.87	2.74	19810.00	17.08	79.84	21.18	2.95
745	4.06	6.87	2.74	19810.00	17.08	79.83	21.17	2.89
745	4.06	6.87	2.74	19810.00	17.08	79.78	21.16	2.71
373	4.06	6.87	2.74	19810.00	17.08	79.80	21.17	2.79
745	4.06	6.87	2.74	19810.00	17.08	79.80	21.17	2.81
373	4.06	6.87	2.74	19810.00	17.08	79.74	21.15	2.56

Moisture Content MCwb: 17.08

Moisture of Wood (wet basis): 17.08
Initial Dry Weight Wtdo (kg): 4.10
Moisture Content Dry 20.60

Dry kg : 4.10
CA: 48.73
HY: 6.87
OX: 43.90

4.95

HHV	LHV		HHV	LHV
19810.00	18328.69	Btu/lb	8522.48	7885.21

10.44	0.05	0.31	39.75	28.90	0.97	0.09	273.38	34.33
flue gas)		kg Wood per 100 mole dfp	Moles per kg of Dry Wood					
[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O
5.63	-0.02	0.16	40.81	85.71	0.12	-0.12	490.74	34.76
6.33	-0.02	0.18	40.80	71.28	0.11	-0.10	436.22	34.72
8.22	-0.01	0.24	40.74	44.72	0.13	-0.05	335.71	34.63
9.58	-0.01	0.28	40.74	32.14	0.11	-0.04	288.18	34.59
10.30	-0.01	0.30	40.74	26.78	0.10	-0.03	267.96	34.58
12.16	0.00	0.35	40.71	16.03	0.11	-0.01	227.23	34.54
13.99	0.39	0.43	33.49	9.58	6.40	0.92	184.10	32.69
14.45	0.61	0.45	30.15	8.73	9.32	1.34	172.17	31.83
14.49	0.72	0.46	28.41	8.96	10.84	1.57	168.51	31.39
13.20	0.22	0.39	36.34	12.07	3.92	0.55	200.88	33.42
10.70	0.00	0.31	40.63	24.15	0.19	-0.01	257.73	34.54
8.59	-0.01	0.25	40.83	40.85	0.04	-0.06	321.35	34.64
8.42	-0.01	0.24	40.79	42.66	0.08	-0.06	328.05	34.64
8.51	-0.02	0.25	40.83	41.70	0.04	-0.06	324.54	34.64
8.98	-0.01	0.26	40.78	37.20	0.08	-0.05	307.42	34.62
8.90	-0.01	0.26	40.83	37.96	0.04	-0.06	310.39	34.63
8.92	-0.01	0.26	40.83	37.72	0.04	-0.06	309.51	34.63
8.89	-0.01	0.26	40.83	38.03	0.04	-0.06	310.69	34.63
9.03	-0.01	0.26	40.83	36.73	0.04	-0.05	305.76	34.63
9.78	-0.01	0.28	40.82	30.54	0.04	-0.04	282.34	34.61
11.65	-0.01	0.34	40.81	18.63	0.03	-0.03	237.32	34.57
12.31	-0.01	0.36	40.80	15.29	0.03	-0.02	224.71	34.56
13.69	0.08	0.40	39.20	9.62	1.42	0.19	199.12	34.14
14.08	0.24	0.42	36.31	8.73	3.94	0.56	188.22	33.40
13.73	0.20	0.41	36.80	9.91	3.52	0.50	193.96	33.53
12.80	0.00	0.37	40.77	13.05	0.05	-0.01	216.14	34.55
11.27	-0.01	0.33	40.81	20.73	0.03	-0.03	245.27	34.58

10.26	-0.01	0.30	40.78	27.06	0.07	-0.03	269.11	34.59
10.21	-0.01	0.29	40.82	27.46	0.03	-0.04	270.71	34.60
10.41	-0.01	0.30	40.82	26.07	0.03	-0.04	265.46	34.60
10.22	-0.01	0.30	40.82	27.34	0.03	-0.04	270.26	34.60
10.17	-0.01	0.29	40.82	27.69	0.03	-0.04	271.60	34.60
10.61	-0.01	0.31	40.78	24.75	0.07	-0.03	260.37	34.58
10.47	-0.01	0.30	40.78	25.69	0.07	-0.03	263.92	34.59
10.48	-0.01	0.30	40.82	25.62	0.03	-0.04	263.76	34.60
10.02	-0.01	0.29	40.82	28.78	0.03	-0.04	275.71	34.61
9.88	-0.01	0.29	40.82	29.84	0.04	-0.04	279.70	34.61
10.15	-0.01	0.29	40.78	27.89	0.07	-0.03	272.23	34.59
9.94	-0.01	0.29	40.78	29.35	0.07	-0.04	277.75	34.60
9.35	-0.01	0.27	40.82	34.03	0.04	-0.05	295.57	34.62
9.61	-0.01	0.28	40.78	31.86	0.07	-0.04	287.23	34.60
9.68	-0.01	0.28	40.78	31.33	0.07	-0.04	285.23	34.60
8.83	-0.01	0.25	40.78	38.60	0.08	-0.05	312.70	34.62

11.44	347.30	2067.93	1576.66	1538.19	1520.09	1946.06	1842.28	294.22
	Stack	**Heat Content Change - Ambient to Stack Temperature**						**Room**
Moisture	**Temp**	**Flue Gas Constituent**						**Temp**
Present	**K**	**CO2**	**O2**	**CO**	**N2**	**CH4**	**H2O**	**K**
11.44	369.82	2980.59	2265.66	2208.73	2183.09	2819.89	2644.86	293.71
11.44	373.15	3114.97	2366.08	2306.21	2279.52	2950.80	2761.45	293.71
11.44	363.15	2712.81	2065.13	2013.97	1990.43	2559.93	2411.88	293.71
11.44	366.48	2846.54	2165.35	2111.32	2086.73	2689.60	2528.34	293.71
11.44	368.71	2935.87	2232.21	2176.26	2150.96	2776.39	2606.02	293.71
11.44	372.59	3071.40	2332.99	2273.95	2247.64	2909.53	2722.83	294.26
11.44	384.82	3566.68	2701.98	2631.85	2601.76	3394.49	3150.82	294.26
11.44	392.04	3861.38	2920.66	2843.73	2811.46	3684.99	3404.13	294.26
11.44	395.37	3976.74	3005.39	2925.62	2892.54	3800.63	3501.95	294.82
11.44	388.15	3681.35	2786.50	2713.60	2682.70	3508.78	3248.51	294.82
11.44	379.26	3319.86	2517.74	2453.06	2424.88	3153.59	2936.99	294.82
11.44	365.93	2781.92	2115.94	2063.08	2039.06	2629.11	2470.55	294.82
11.44	355.93	2381.85	1815.63	1771.25	1750.42	2242.28	2121.39	294.82
11.44	349.82	2138.80	1632.56	1593.18	1574.34	2008.64	1908.29	294.82
11.44	344.82	1940.73	1483.02	1447.65	1430.44	1819.04	1734.10	294.82
11.44	340.37	1765.29	1350.28	1318.40	1302.67	1651.68	1579.38	294.82
11.44	337.59	1655.93	1267.41	1237.68	1222.87	1547.64	1482.74	294.82
11.44	334.82	1546.79	1184.61	1157.00	1143.11	1444.03	1386.14	294.82
11.44	332.59	1459.64	1118.42	1092.49	1079.35	1361.45	1308.89	294.82
11.44	330.37	1351.47	1035.92	1011.99	999.80	1259.71	1212.48	295.37
11.44	337.04	1612.92	1234.49	1205.53	1191.10	1507.44	1444.22	295.37
11.44	337.59	1613.59	1234.70	1205.66	1191.25	1508.73	1444.36	295.93
11.44	343.71	1854.48	1417.11	1383.31	1366.87	1738.19	1657.03	295.93
11.44	351.48	2162.64	1649.74	1609.71	1590.72	2033.25	1928.01	295.93
11.44	355.93	2339.51	1782.92	1739.23	1718.81	2203.38	2083.01	295.93
11.44	353.71	2293.34	1749.02	1706.47	1686.37	2157.08	2043.87	294.82
11.44	349.26	2137.91	1632.28	1593.01	1574.15	2006.93	1908.12	294.26

11.44	343.15	1917.18	1465.92	1431.18	1414.12	1794.98	1714.44	293.71
11.44	338.71	1741.95	1333.25	1301.97	1286.39	1628.03	1559.76	293.71
11.44	335.37	1610.90	1233.87	1205.14	1190.67	1503.55	1443.83	293.71
11.44	333.15	1523.72	1167.67	1140.62	1126.90	1420.91	1366.57	293.71
11.44	331.48	1458.42	1118.05	1092.25	1079.09	1359.10	1308.65	293.71
11.44	329.82	1414.34	1084.80	1059.90	1047.10	1316.85	1269.93	293.15
11.44	328.15	1349.21	1035.22	1011.56	999.32	1255.36	1212.04	293.15
11.44	327.04	1305.83	1002.19	979.34	967.48	1214.45	1173.45	293.15
11.44	326.48	1284.16	985.68	963.23	951.56	1194.02	1154.17	293.15
11.44	325.93	1262.49	969.17	947.13	935.65	1173.61	1134.88	293.15
11.44	324.82	1219.18	936.16	914.92	903.82	1132.85	1096.31	293.15
11.44	324.26	1197.54	919.66	898.82	887.91	1112.49	1077.02	293.15
11.44	323.71	1197.04	919.50	898.73	887.80	1111.52	1076.93	292.59
11.44	323.15	1154.29	886.66	866.63	856.10	1071.82	1038.46	293.15
11.44	322.04	1089.94	837.33	818.44	808.49	1011.84	980.73	293.71
11.44	322.04	1089.94	837.33	818.44	808.49	1011.84	980.73	293.71

SUMS							AVERAGE
3472.01	1921.83	11887.38	17615.53	3638.76	67618.68	22544.42	2992.99
Energy Losses (kJ/kg of Dry Fuel)							**Total**
Flue Gas Constituent							**Loss**
CO2	**O2**	**CO**	**N2**	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**
121.63	194.18	35.21	1071.33	-107.06	1620.41	533.47	3469.18
127.10	168.65	31.29	994.36	-88.14	1622.48	534.81	3390.55
110.52	92.35	36.02	668.22	-47.78	1606.15	530.81	2996.29
115.97	69.59	30.89	601.36	-32.06	1608.55	532.14	2926.44
119.61	59.79	28.71	576.37	-25.37	1610.54	533.03	2902.67
125.03	37.39	32.41	510.73	-8.23	1612.78	534.37	2844.48
119.47	25.89	1828.00	478.98	819.84	1540.23	539.26	5351.67
116.41	25.50	2664.43	484.04	1201.98	1508.04	542.16	6542.56
112.99	26.93	3098.16	487.42	1399.14	1490.23	543.28	7158.14
133.76	33.62	1121.31	538.90	493.91	1577.88	540.38	4439.77
134.88	60.81	55.27	624.97	-9.50	1620.32	536.82	3023.57
113.59	86.44	11.49	655.26	-53.44	1608.77	531.48	2953.60
97.15	77.45	23.44	574.22	-50.54	1596.38	527.48	2845.58
87.33	68.07	11.59	510.93	-54.56	1589.41	525.04	2737.83
79.15	55.17	21.93	439.75	-43.36	1582.23	523.05	2657.92
72.07	51.25	11.07	404.34	-49.40	1577.50	521.28	2588.11
67.61	47.81	11.03	378.49	-49.07	1574.12	520.17	2550.16
63.15	45.05	11.07	355.15	-49.49	1570.81	519.07	2514.82
59.59	41.08	10.89	330.02	-47.70	1567.96	518.18	2480.03
55.17	31.63	10.05	282.29	-39.20	1563.76	517.08	2420.77
65.82	23.00	8.43	282.68	-22.87	1570.11	519.73	2446.91
65.84	18.88	7.98	267.68	-18.29	1569.65	519.73	2431.48
72.69	13.64	404.20	272.16	170.98	1557.64	522.17	3013.48
78.54	14.40	1120.62	299.40	499.55	1533.09	525.27	4070.87
86.09	17.68	1001.21	333.38	443.16	1544.09	527.04	3952.67
93.50	22.82	15.37	364.49	-11.70	1589.69	526.60	2600.77
87.25	33.84	8.73	386.10	-25.77	1586.45	525.04	2601.64

78.18	39.67	19.17	380.55	-30.07	1580.19	522.83	2590.52
71.10	36.61	9.64	348.24	-34.99	1575.34	521.06	2527.00
65.75	32.17	9.45	316.08	-33.08	1571.14	519.73	2481.23
62.19	31.92	9.62	304.56	-34.82	1568.64	518.84	2460.96
59.53	30.96	9.66	293.08	-35.30	1566.69	518.18	2442.81
57.67	26.85	18.52	272.63	-27.02	1564.51	517.74	2430.89
55.02	26.59	18.77	263.74	-28.25	1562.63	517.08	2415.58
53.30	25.68	9.38	255.18	-32.45	1561.72	516.63	2389.44
52.42	28.37	9.81	262.35	-36.79	1561.49	516.41	2394.07
51.54	28.92	9.95	261.70	-38.23	1560.97	516.19	2391.03
49.72	26.11	19.36	246.05	-31.13	1558.92	515.75	2384.77
48.84	26.99	19.76	246.62	-33.04	1558.45	515.53	2383.14
48.87	31.29	10.52	262.40	-43.99	1559.55	515.53	2384.17
47.07	28.25	20.43	245.90	-36.33	1557.44	515.09	2377.86
44.45	26.23	20.29	230.61	-35.63	1555.38	514.43	2355.75
44.45	32.32	22.26	252.81	-45.15	1556.34	514.43	2377.46

SUMS						
15357	4063	11293.84	66253	4063	285.48	21.16
Total Loss	**Chemical Loss 1**	**Sensible and Latent Loss**	**Total Output**	**Chem Loss 2**	**Grams Produced**	
					CO	**HC**
0	0	0.00	0	0	0.00	0.00
957	-16	972.72	4633	-16	0.87	-0.45
564	-2	565.86	3163	-2	0.67	-0.16
606	0	605.81	3494	0	0.63	-0.12
655	1	654.50	3817	1	0.64	-0.10
642	5	636.68	3830	5	0.72	-0.03
1409	692	717.32	3808	692	47.19	3.87
2092	1226	865.86	4243	1226	83.46	6.88
2154	1342	812.18	3808	1342	91.32	7.54
919	332	587.06	3180	332	22.74	1.83
398	6	392.17	2210	6	0.71	-0.02
222	-3	225.39	1268	-3	0.08	-0.07
161	-2	162.11	957	-2	0.13	-0.05
155	-2	156.93	963	-2	0.06	-0.06
150	-1	151.20	968	-1	0.12	-0.04
146	-2	148.22	972	-2	0.06	-0.05
96	-1	97.37	649	-1	0.04	-0.03
142	-2	144.08	976	-2	0.06	-0.05
93	-1	94.69	652	-1	0.04	-0.03
182	-2	184.34	1308	-2	0.07	-0.05
276	-2	277.80	1960	-2	0.09	-0.05
229	-1	229.66	1635	-1	0.07	-0.03
397	75	321.37	2212	75	5.24	0.40
613	243	369.92	2369	243	16.59	1.35
520	189	331.23	2088	189	12.96	1.05
245	0	244.28	1619	0	0.14	-0.02
147	-1	147.78	971	-1	0.05	-0.03

97	0	97.87	648	0	0.07	-0.02
95	-1	96.02	650	-1	0.04	-0.02
93	-1	94.24	652	-1	0.04	-0.02
46	0	46.77	326	0	0.02	-0.01
46	0	46.43	327	0	0.02	-0.01
91	0	91.78	654	0	0.07	-0.02
91	0	91.24	654	0	0.07	-0.02
90	-1	90.76	655	-1	0.03	-0.02
90	-1	91.08	655	-1	0.04	-0.02
45	-1	45.51	328	-1	0.02	-0.01
45	0	45.08	328	0	0.04	-0.01
90	-1	90.16	656	-1	0.07	-0.02
90	-1	90.96	656	-1	0.04	-0.03
45	0	45.03	328	0	0.04	-0.01
89	-1	89.21	657	-1	0.08	-0.02
45	0	45.15	328	0	0.04	-0.02

Dirigo Laboratories, Inc.

Manufacturer:	**Arada**
Model:	**Farringdon 16**
Date:	**2/21/2017**
Run:	**1**
Control #:	**035-S-075-1**
Test Duration:	**420**
Output Category:	**1**

	HHV Basis	LHV Basis	
Overall Efficiency	81.1%	87.7%	
Combustion Efficiency	95.0%	95.0%	
Heat Transfer Efficiency	85.4%	92.3%	
HHV Output Rate (kJ/h)	9,411	8,928	**(Btu/h)**
Burn Rate (kg/h)	0.59	1.29	**(lb/h)**
Input (kJ/h)	11,605	11,009	**(Btu/h)**
Test Load Weight (dry kg)	4.1	9.0	**dry lb**
MC wet (%)	17.08		
MC dry (%)	20.60		
Particulate (g)	6.36		
CO (g)	285		
Test Duration (h)	7		

Emissions	**Particulate**	**CO**
g/MJ Output	0.10	4.33
g/kg Dry Fuel	1.55	69.62
g/h	0.91	40.78
lb/MM Btu Output	0.22	10.07

Air/Fuel Ratio (A/F)	9.16

Test Results in Accordance with CSA B415.1-10

Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Project #	035-S-075-1	MFG	Arada
Run #	5	Model	Farringdon 16
Date	2/21/17		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		3052	0.1172	0.1202	0.0030
☐	☑	3053			
☑	☐	3057	0.2345	0.2346	
☑	☐	O Ring			
☐	☑	O Ring	3.5771	3.5771	0.0001
					3.1 mg

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	3054			
☐	☑	3055	0.2354	0.2385	
☑	☐	O ring			
☐	☑	O ring	3.5135	3.5135	0.0031
					3.1 mg

Nozzle

#	TARE	FINAL	Net	
13A	117.4532	117.4532	0.0000	0.0

Nozzle

#	TARE	FINAL	Net	
13B	117.0625	117.0626	0.0001	0.1

Train A Total Catch	3.1 mg	Train B Total Catch	3.2 mg

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
3056		0.1180	0.1180	0.0000	633.178
O ring		1.6545	1.6546	0.0001	
			Total	0.1	mg

Notes: Train A Total: 3.1mg Train B Total: 3.2mg Ambient Total: 0.1mg 1 Hour Catch: 3.0mg

Project #	035-S-075-1	MFG	Arada
Run #	4	Model	Farringdon 16
Date	2-21-2-17		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		3046	0.1174	0.1216	0.0042
☐	☑	3047			
☑	☐	3051	0.2346	0.2347	
☑	☐	O Ring			
☐	☑	O Ring	3.5734	3.5734	0.0001
					0.1 mg

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	3048			
☐	☑	3049	0.2357	0.2402	
☑	☐	O ring			
☐	☑	O ring	3.5379	3.5379	0.0045
					4.5 mg

Nozzle

#	TARE	FINAL	Net	
12A	116.8890	116.8890	0.0000	0.0

Nozzle

#	TARE	FINAL	Net	
12B	117.0523	117.0523	0.0000	0.0

Train A Total Catch	0.1 mg	Train B Total Catch	4.5 mg

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
3050		0.1175	0.1175	0.0000	1003.027
O ring		1.6823	1.6823	0.0000	
			Total	0.0	mg

Notes: Train A Total: 4.3mg Train B Total: 4.5mg Ambient Total: 0.0mg 1 Hour Catch: 4.2mg

Project #	035-S-075-1	MFG	Arada
Run #	3	Model	Farringdon 16
Date	2/21/17		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		3040	0.1181	0.1234	0.0053
☐	☑	3041			
☑	☐	3045	0.2358	0.2380	
☑	☐	O Ring			
☐	☑	O Ring	3.5420	3.5420	0.0022
					7.5 mg

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	3042			
☐	☑	3043	0.2361	0.2435	
☑	☐	O ring			
☐	☑	O ring	3.5593	3.5593	0.0074
					7.4 mg

Nozzle

#	TARE	FINAL	Net	
10A	116.8265	116.8265	0.0000	0.0

Nozzle

#	TARE	FINAL	Net	
10B	117.1676	117.1677	0.0001	0.1

Train A Total Catch	7.5 mg	Train B Total Catch	7.5 mg

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
3044		0.1177	0.1179	0.0002	1403.742
O ring		1.6416	1.6416	0.0000	
			Total	0.0002 mg	

Notes: Train A Total: 7.5mg Train B Tota: 7.5mg Ambient Total: 0.2mg 1 Hour Catch: 5.3mg

Project #	035-S-075-1	MFG	Arada
Run #	2	Model	Farringdon 16
Date	2/21/17		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		3034	0.1179	0.1212	0.0033
☐	☑	3035			
☑	☐	3039	0.2360	0.2366	
☑	☐	O Ring			
☐	☑	O Ring	3.5158	3.5168	0.0016
					4.9 mg

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	3036			
☐	☑	3037	0.2354	0.2395	
☑	☐	O ring			
☐	☑	O ring	3.5554	3.5562	0.0049
					4.9 mg

Nozzle

#	TARE	FINAL	Net	
6A	116.5641	116.5645	0.0004	0.4

Nozzle

#	TARE	FINAL	Net	
6B	116.1165	116.1167	0.0002	0.2

Train A Total Catch	5.3 mg	Train B Total Catch	5.1 mg

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
3038		0.1174	0.1174	0.0000	1736.481
O ring		1.6482	1.6484	0.0002	
			Total	0.2 mg	

Notes: Train A Total: 5.3mg Train B Total: 5.1mg Ambient Total: 0.2mg 1 Hour Catch: 3.3mg

Project #	035-S-075-1	MFG	Arada
Run #	1	Model	Farringdon 16
Date	2/21/17		

Train A
First Hour

Front	Rear	Filter #	Tare	Final	Net
☑		3028	0.1175	0.1206	0.0031
☐	☑	3029			
☑	☐	3033	0.2348	0.2372	
☑	☐	O Ring			
☐	☑	O Ring	3.5909	3.5917	0.0032
					6.3 mg

Train B

Front	Rear	Filter #	Tare	Final	Net
☑	☐	3030			
☐	☑	3031	0.2341	0.2392	
☑	☐	O ring			
☐	☑	O ring	3.5446	3.5452	0.0057
					5.7 mg

Nozzle

#	TARE	FINAL	Net	
1A	115.6254	115.6257	0.0003	0.3

Nozzle

#	TARE	FINAL	Net	
1B	115.9004	115.9005	0.0001	0.1

Train A Total Catch	6.6 mg	Train B Total Catch	5.8 mg

Ambient ☑

Filter #		Tare	Final	Net	Vol (liter)
3032		0.1169	0.1170	0.0001	2305.638
O ring		1.6727	1.6730	0.0003	
			Total	0.4	mg

Notes: Train A Total: 6.6mg Train B Total: 5.8mg Ambient Total: 0.4mg 1 Hour Catch: 3.1mg


22.1


912


4.43
19.9
1.83
19


2.9
19
41.43
19.9
19
1.83

Troutdale, OR

History

Weather History for KTTD - February, 2017

February 17 2017 Friday, February 17, 2017 View

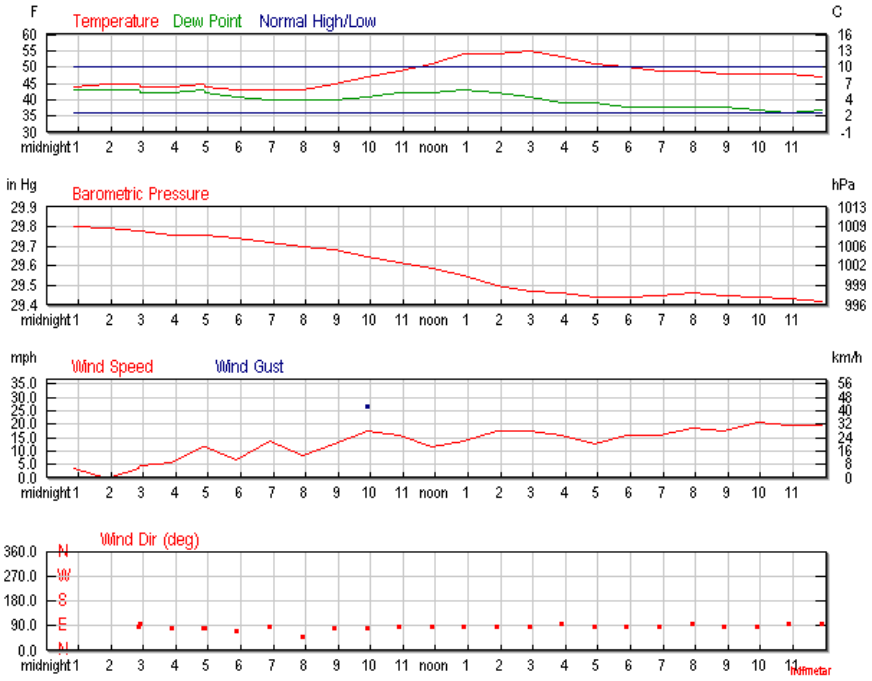
Daily Weekly Monthly Custom

Actual	Average	Record
49 °F	**43** °F	
55 °F	**50** °F	**66** °F (1948)
43 °F	**36** °F	**24** °F (2006)
16	22	
403	390	
0	0	
0	0	
40 °F		
78		
96		
59		
0.00 in	**0.16** in	**2.36** in (1949)
5.96	3.14	
8.33	9.32	
29.60 in		
13 mph (East)		
22 mph		
26 mph		
10 miles		

T = Trace of Precipitation, MM = Missing Value

Source: NWS Daily Summary

Daily Weather History Graph



Search for Another Location

Airport or City:

KTTD

Submit

Trip Planner

Search our weather history database for the weather conditions in past years. The results will help you decide how hot, cold, wet, or windy it might be!

Date:

February 17 Submit

Astronomy

Feb. 17, 2017	Rise	Set
Actual Time	7:07 AM PST	5:40 PM PST
Civil Twilight	6:37 AM PST	6:10 PM PST
Nautical Twilight	6:02 AM PST	6:45 PM PST
Astronomical Twilight	5:28 AM PST	7:19 PM PST
Moon	No Moon Rise	10:33 AM PST (2/17)
Length of Visible Light	11h 33m	
Length of Day	10h 32m	

Waning Gibbous, 59% of the Moon is Illuminated

Feb 17	Feb 18	Feb 26	Mar 5	Mar 12
Waning Gibbous	Last Quarter	New	First Quarter	Full

Hourly Weather History & Observations

Temp.	Windchill	Dew Point	Humidity	Pressure	Visibility	Wind Dir	Wind Speed	Gust Speed	Precip	Events	Conditions
44.1 °F	**42.5** °F	**43.0** °F	96%	**29.80** in	**10.0** mi	ESE	**3.5** mph	-	N/A		Overcast
45.0 °F	-	**43.0** °F	93%	**29.79** in	**10.0** mi	Calm	Calm	-	N/A		Overcast
44.6 °F	**43.1** °F	**42.8** °F	93%	**29.78** in	**10.0** mi	East	**3.5** mph	-	N/A		Overcast
44.1 °F	**41.5** °F	**42.1** °F	93%	**29.78** in	**10.0** mi	East	**4.6** mph	-	N/A		Overcast
44.1 °F	**40.8** °F	**42.1** °F	93%	**29.76** in	**10.0** mi	East	**5.8** mph	-	N/A		Overcast
44.6 °F	**38.8** °F	**42.8** °F	93%	**29.76** in	**10.0** mi	East	**11.5** mph	-	N/A		Overcast
44.1 °F	**38.1** °F	**42.1** °F	93%	**29.76** in	**10.0** mi	East	**11.5** mph	-	N/A		Overcast

43.0 °F	**38.8** °F	**41.0** °F	93%	**29.74** in	**10.0** mi	ENE	**6.9** mph	-	N/A	Partly Cloudy
43.0 °F	**36.0** °F	**39.9** °F	89%	**29.72** in	**10.0** mi	East	**13.8** mph	-	N/A	Clear
43.0 °F	**38.2** °F	**39.9** °F	89%	**29.70** in	**10.0** mi	NE	**8.1** mph	-	N/A	Clear
45.0 °F	**38.9** °F	**39.9** °F	82%	**29.68** in	**10.0** mi	East	**12.7** mph	**18.4** mph	N/A	Clear
46.9 °F	-	**41.0** °F	80%	**29.65** in	**10.0** mi	East	**17.3** mph	**26.5** mph	N/A	Clear
48.9 °F	-	**42.1** °F	77%	**29.62** in	**10.0** mi	East	**16.1** mph	-	N/A	Clear
51.1 °F	-	**42.1** °F	71%	**29.59** in	**10.0** mi	East	**11.5** mph	-	N/A	Clear
54.0 °F	-	**43.0** °F	66%	**29.55** in	**10.0** mi	East	**13.8** mph	-	N/A	Clear
54.0 °F	-	**42.1** °F	64%	**29.50** in	**10.0** mi	East	**17.3** mph	-	N/A	Clear
55.0 °F	-	**41.0** °F	59%	**29.47** in	**10.0** mi	East	**17.3** mph	-	N/A	Clear
53.1 °F	-	**39.0** °F	59%	**29.46** in	**10.0** mi	East	**16.1** mph	-	N/A	Clear
51.1 °F	-	**39.0** °F	63%	**29.44** in	**10.0** mi	East	**12.7** mph	-	N/A	Clear
50.0 °F	-	**37.9** °F	63%	**29.44** in	**10.0** mi	East	**16.1** mph	-	N/A	Clear
48.9 °F	-	**37.9** °F	66%	**29.45** in	**10.0** mi	East	**16.1** mph	-	N/A	Clear
48.9 °F	-	**37.9** °F	66%	**29.46** in	**10.0** mi	East	**18.4** mph	**25.3** mph	N/A	Clear
48.0 °F	-	**37.9** °F	68%	**29.45** in	**10.0** mi	East	**17.3** mph	-	N/A	Clear
48.0 °F	-	**37.0** °F	66%	**29.44** in	**10.0** mi	East	**20.7** mph	-	N/A	Overcast
48.0 °F	-	**36.0** °F	63%	**29.43** in	**10.0** mi	East	**19.6** mph	-	N/A	Overcast
46.9 °F	-	**37.0** °F	68%	**29.42** in	**10.0** mi	East	**19.6** mph	-	N/A	Mostly Cloudy

Troutdale, OR

History

Weather History for KTTD - February, 2017

February 16 2017 Thursday, February 16, 2017 View

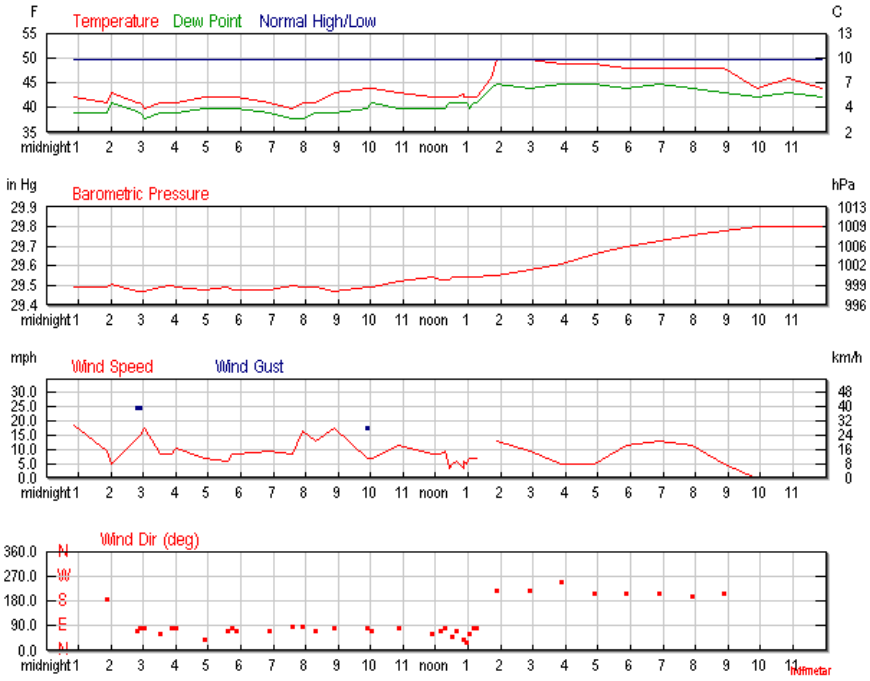
Daily Weekly Monthly Custom

Actual	Average	Record
46 °F	**43** °F	
51 °F	**50** °F	**63** °F (1981)
40 °F	**35** °F	**17** °F (1956)
19	22	
387	368	
0	0	
0	0	
41 °F		
88		
96		
80		
1.14 in	**0.16** in	**1.65** in (1970)
5.96	2.98	
8.33	9.16	
29.56 in		
9 mph (East)		
26 mph		
32 mph		
7 miles		
Rain		

T = Trace of Precipitation, MM = Missing Value

Source: NWS Daily Summary

Daily Weather History Graph



Search for Another Location

Airport or City:

KTTD

Submit

Trip Planner

Search our weather history database for the weather conditions in past years. The results will help you decide how hot, cold, wet, or windy it might be!

Date:

February 16 2017 Submit

Astronomy

Feb. 16, 2017	Rise	Set
Actual Time	7:09 AM PST	5:38 PM PST
Civil Twilight	6:38 AM PST	6:09 PM PST
Nautical Twilight	6:04 AM PST	6:43 PM PST
Astronomical Twilight	5:29 AM PST	7:18 PM PST
Moon	11:52 PM PST	10:03 AM PST
Length of Visible Light	11h 30m	
Length of Day	10h 29m	

Waning Gibbous, 68% of the Moon is Illuminated

Feb 16	Feb 18	Feb 26	Mar 5	Mar 12
Waning Gibbous	Last Quarter	New	First Quarter	Full

Hourly Weather History & Observations

Temp.	Windchill	Dew Point	Humidity	Pressure	Visibility	Wind Dir	Wind Speed	Gust Speed	Precip	Events	Conditions
42.1 °F	**33.6** °F	**39.0** °F	89%	**29.49** in	**7.0** mi	East	**18.4** mph	-	**0.03** in	Rain	Light Rain
41.0 °F	**35.2** °F	**39.0** °F	93%	**29.49** in	**4.0** mi	South	**9.2** mph	-	**0.09** in	Rain	Rain
43.0 °F	**40.3** °F	**41.0** °F	93%	**29.51** in	**3.0** mi	Variable	**4.6** mph	**17.3** mph	**0.02** in	Rain	Rain
41.0 °F	**33.5** °F	**39.2** °F	93%	**29.47** in	**5.0** mi	ENE	**13.8** mph	**24.2** mph	**0.11** in	Rain	Rain
41.0 °F	**33.1** °F	**39.0** °F	93%	**29.47** in	**5.0** mi	East	**15.0** mph	**24.2** mph	**0.11** in	Rain	Light Rain
39.9 °F	**31.1** °F	**37.9** °F	93%	**29.47** in	**6.0** mi	East	**17.3** mph	-	**0.02** in	Rain	Light Rain
41.0 °F	**35.8** °F	**39.0** °F	93%	**29.49** in	**6.0** mi	ENE	**8.1** mph	-	**0.05** in	Rain	Light Rain

41.0 °F	**35.8** °F	**39.0** °F	93%	**29.50** in	**4.0** mi	East	**8.1** mph	-	**0.11** in	Rain	Rain
41.0 °F	**34.7** °F	**39.0** °F	93%	**29.49** in	**4.0** mi	East	**10.4** mph	-	**0.02** in	Rain	Rain
42.1 °F	**37.7** °F	**39.9** °F	92%	**29.48** in	**10.0** mi	NE	**6.9** mph	-	**0.05** in	Rain	Light Rain
42.1 °F	**38.4** °F	**39.9** °F	92%	**29.49** in	**10.0** mi	ENE	**5.8** mph	-	**0.00** in	Rain	Light Rain
42.1 °F	**37.1** °F	**39.9** °F	92%	**29.48** in	**10.0** mi	East	**8.1** mph	-	**0.00** in	Rain	Light Rain
42.1 °F	**37.1** °F	**39.9** °F	92%	**29.48** in	**10.0** mi	ENE	**8.1** mph	-	**0.01** in		Overcast
41.0 °F	**35.2** °F	**39.0** °F	93%	**29.48** in	**10.0** mi	ENE	**9.2** mph	-	N/A		Overcast
39.9 °F	**34.5** °F	**37.9** °F	93%	**29.50** in	**3.0** mi	East	**8.1** mph	-	**0.04** in	Rain	Light Rain
41.0 °F	**32.8** °F	**37.9** °F	89%	**29.49** in	**7.0** mi	East	**16.1** mph	-	**0.06** in	Rain	Light Rain
41.0 °F	**33.9** °F	**39.0** °F	93%	**29.49** in	**10.0** mi	ENE	**12.7** mph	-	**0.00** in		Overcast
43.0 °F	**35.1** °F	**39.0** °F	86%	**29.47** in	**10.0** mi	East	**17.3** mph	**24.2** mph	**0.00** in		Overcast
44.1 °F	**40.1** °F	**39.9** °F	85%	**29.49** in	**9.0** mi	East	**6.9** mph	**17.3** mph	**0.00** in	Rain	Light Rain
44.1 °F	**40.1** °F	**41.0** °F	89%	**29.49** in	**10.0** mi	ENE	**6.9** mph	-	**0.00** in	Rain	Light Rain
43.0 °F	**36.8** °F	**39.9** °F	89%	**29.52** in	**6.0** mi	East	**11.5** mph	-	**0.07** in	Rain	Light Rain
42.1 °F	**37.1** °F	**39.9** °F	92%	**29.54** in	**3.0** mi	ENE	**8.1** mph	-	**0.13** in	Rain	Rain
42.1 °F	**37.1** °F	**39.9** °F	92%	**29.53** in	**4.0** mi	ENE	**8.1** mph	-	**0.04** in	Rain	Light Rain
42.1 °F	**36.6** °F	**39.9** °F	92%	**29.53** in	**2.5** mi	East	**9.2** mph	-	**0.07** in	Rain	Rain
42.1 °F	**40.2** °F	**41.0** °F	96%	**29.53** in	**3.0** mi	Variable	**3.5** mph	-	**0.12** in	Rain	Heavy Rain
42.1 °F	**39.2** °F	**41.0** °F	96%	**29.54** in	**3.0** mi	NE	**4.6** mph	-	**0.17** in	Rain	Heavy Rain
42.1 °F	**38.4** °F	**41.0** °F	96%	**29.54** in	**3.0** mi	ENE	**5.8** mph	-	**0.20** in	Rain	Rain
42.8 °F	**41.1** °F	**41.0** °F	93%	**29.54** in	**2.5** mi	Variable	**3.5** mph	-	**0.24** in	Rain	Rain
42.1 °F	**38.4** °F	**41.0** °F	96%	**29.54** in	**2.5** mi	NE	**5.8** mph	-	**0.24** in	Rain	Rain
42.1 °F	**39.2** °F	**41.0** °F	96%	**29.54** in	**2.5** mi	NNE	**4.6** mph	-	**0.00** in	Rain	Light Rain
42.1 °F	**37.7** °F	**39.9** °F	92%	**29.54** in	**3.0** mi	ENE	**6.9** mph	-	**0.04** in	Rain	Rain
42.1 °F	**37.7** °F	**41.0** °F	96%	**29.54** in	**2.5** mi	East	**6.9** mph	-	**0.05** in	Rain	Light Rain
42.1 °F	**37.7** °F	**41.0** °F	96%	**29.54** in	**4.0** mi	East	**6.9** mph	-	**0.05** in	Rain	Light Rain
46.0 °F	-	**44.1** °F	93%	**29.55** in	**10.0** mi	North	-	-	**0.06** in	Rain	Light Rain
50.0 °F	-	**45.0** °F	83%	**29.55** in	**10.0** mi	SW	**12.7** mph	-	**0.06** in	Rain	Light Rain
50.0 °F	-	**44.1** °F	80%	**29.58** in	**10.0** mi	SW	**9.2** mph	-	**0.01** in	Rain	Light Rain
48.9 °F	-	**45.0** °F	86%	**29.61** in	**10.0** mi	WSW	**4.6** mph	-	**0.02** in	Rain	Light Rain
48.9 °F	-	**45.0** °F	86%	**29.66** in	**10.0** mi	SSW	**4.6** mph	-	**0.04** in	Rain	Light Rain
48.0 °F	-	**44.1** °F	86%	**29.70** in	**9.0** mi	SSW	**11.5** mph	-	**0.05** in	Rain	Light Rain
48.0 °F	-	**45.0** °F	89%	**29.73** in	**10.0** mi	SSW	**12.7** mph	-	**0.06** in	Rain	Light Rain
48.0 °F	-	**44.1** °F	86%	**29.76** in	**10.0** mi	SSW	**11.5** mph	-	**0.00** in		Overcast
48.0 °F	-	**43.0** °F	83%	**29.78** in	**10.0** mi	SSW	**4.6** mph	-	N/A		Overcast
44.1 °F	-	**42.1** °F	93%	**29.80** in	**10.0** mi	Calm	Calm	-	N/A		Mostly Cloudy
46.0 °F	-	**43.0** °F	89%	**29.80** in	**10.0** mi	Calm	Calm	-	N/A		Overcast

44.1 °F	-	**42.1** °F	93%	**29.80** in	**10.0** mi	Calm	Calm	-	N/A	Overcast

Troutdale, OR

History

Weather History for KTTD - February, 2017

February 15 2017 Wednesday, February 15, 2017 View

Daily Weekly Monthly Custom

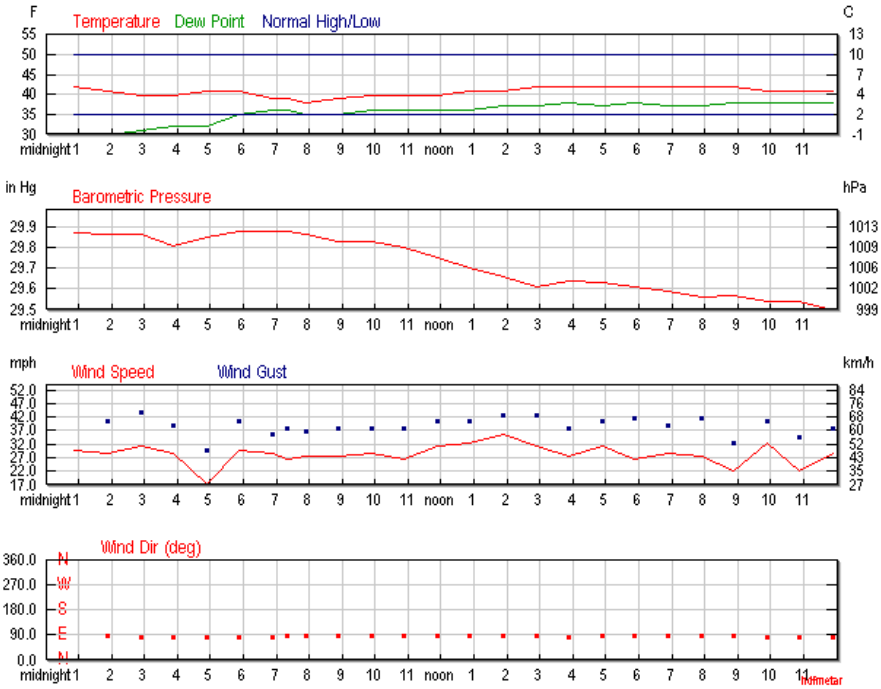
Actual	Average	Record
41 °F	**42** °F	
43 °F	**50** °F	**63** °F (1981)
38 °F	**35** °F	**17** °F (1956)
24	22	
368	346	
0	0	
0	0	
36 °F		
81		
92		
70		
0.61 in	**0.17** in	**1.01** in (1960)
4.82	2.82	
7.19	9.00	
29.72 in		
28 mph (East)		
37 mph		
46 mph		
8 miles		

Rain

T = Trace of Precipitation, MM = Missing Value

Source: NWS Daily Summary

Daily Weather History Graph



Search for Another Location

Airport or City:

KTTD

Submit

Trip Planner

Search our weather history database for the weather conditions in past years. The results will help you decide how hot, cold, wet, or windy it might be!

Date:

February 15 Submit

Astronomy

Feb. 15, 2017	Rise	Set
Actual Time	7:10 AM PST	5:37 PM PST
Civil Twilight	6:40 AM PST	6:07 PM PST
Nautical Twilight	6:05 AM PST	6:42 PM PST
Astronomical Twilight	5:31 AM PST	7:16 PM PST
Moon	10:52 PM PST (2/15)	9:35 AM PST (2/15)
Length of Visible Light	11h 27m	
Length of Day	10h 26m	

Waning Gibbous, 77% of the Moon is Illuminated

Feb 15	Feb 18	Feb 26	Mar 5	Mar 12
Waning Gibbous	Last Quarter	New	First Quarter	Full

Hourly Weather History & Observations

Temp.	Windchill	Dew Point	Humidity	Pressure	Visibility	Wind Dir	Wind Speed	Gust Speed	Precip	Events	Conditions
42.1 °F	**31.3** °F	**30.0** °F	62%	**29.87** in	**10.0** mi	East	**29.9** mph	**43.7** mph	**0.00** in		Overcast
41.0 °F	**30.0** °F	**30.0** °F	65%	**29.86** in	**10.0** mi	East	**28.8** mph	**40.3** mph	**0.00** in	Rain	Light Rain
39.9 °F	**28.2** °F	**30.9** °F	70%	**29.86** in	**10.0** mi	East	**31.1** mph	**43.7** mph	**0.04** in	Rain	Light Rain
39.9 °F	**28.6** °F	**32.0** °F	73%	**29.81** in	**10.0** mi	East	**28.8** mph	**39.1** mph	**0.00** in		Overcast
41.0 °F	**32.5** °F	**32.0** °F	70%	**29.85** in	**10.0** mi	East	**17.3** mph	**29.9** mph	**0.00** in		Overcast
41.0 °F	**29.8** °F	**35.1** °F	79%	**29.88** in	**10.0** mi	East	**29.9** mph	**40.3** mph	**0.00** in	Rain	Light Rain
39.0 °F	**27.4** °F	**36.0** °F	89%	**29.88** in	**5.0** mi	East	**28.8** mph	**35.7** mph	**0.01** in	Rain	Light Rain
39.0 °F	**27.8** °F	**36.0** °F	89%	**29.88** in	**4.0** mi	East	**26.5** mph	**38.0** mph	**0.01** in	Rain	Light Rain
37.9 °F	**26.1** °F	**35.1** °F	89%	**29.86** in	**6.0** mi	East	**27.6** mph	**36.8** mph	**0.03** in	Rain	Light Rain
39.0 °F	**27.6** °F	**35.1** °F	86%	**29.83** in	**9.0** mi	East	**27.6** mph	**38.0** mph	**0.02** in	Rain	Light Rain
39.9 °F	**28.6** °F	**36.0** °F	86%	**29.83** in	**5.0** mi	East	**28.8** mph	**38.0** mph	**0.05** in	Rain	Light Rain
39.9 °F	**29.0** °F	**36.0** °F	86%	**29.80** in	**5.0** mi	East	**26.5** mph	**38.0** mph	**0.06** in	Rain	Light Rain
39.9 °F	**28.2** °F	**36.0** °F	86%	**29.75** in	**6.0** mi	East	**31.1** mph	**40.3** mph	**0.03** in	Rain	Light Rain
41.0 °F	**29.5** °F	**36.0** °F	82%	**29.70** in	**9.0** mi	East	**32.2** mph	**40.3** mph	**0.05** in	Rain	Light Rain
41.0 °F	**29.0** °F	**37.0** °F	86%	**29.66** in	**9.0** mi	East	**35.7** mph	**42.6** mph	**0.02** in	Rain	Light Rain
42.1 °F	**31.1** °F	**37.0** °F	82%	**29.61** in	**10.0** mi	East	**31.1** mph	**42.6** mph	**0.03** in		Overcast
42.1 °F	**31.7** °F	**37.9** °F	85%	**29.64** in	**5.0** mi	East	**27.6** mph	**38.0** mph	**0.03** in	Rain	Light Rain
42.1 °F	**31.1** °F	**37.0** °F	82%	**29.63** in	**7.0** mi	East	**31.1** mph	**40.3** mph	**0.04** in	Rain	Light Rain
42.1 °F	**31.9** °F	**37.9** °F	85%	**29.61** in	**10.0** mi	East	**26.5** mph	**41.4** mph	**0.04** in	Rain	Light Rain
42.1 °F	**31.5** °F	**37.0** °F	82%	**29.59** in	**10.0** mi	East	**28.8** mph	**39.1** mph	**0.00** in	Rain	Light Rain
42.1 °F	**31.7** °F	**37.0** °F	82%	**29.56** in	**10.0** mi	East	**27.6** mph	**41.4** mph	**0.01** in	Rain	Light Rain
42.1 °F	**32.8** °F	**37.9** °F	85%	**29.57** in	**9.0** mi	East	**21.9** mph	**32.2** mph	**0.03** in	Rain	Light Rain
41.0 °F	**29.5** °F	**37.9** °F	89%	**29.54** in	**9.0** mi	East	**32.2** mph	**40.3** mph	**0.04** in	Rain	Light Rain
41.0 °F	**31.4** °F	**37.9** °F	89%	**29.54** in	**6.0** mi	East	**21.9** mph	**34.5** mph	**0.05** in	Rain	Light Rain
41.0 °F	**30.0** °F	**37.9** °F	89%	**29.50** in	**10.0** mi	East |	**28.8** mph	**38.0** mph	**0.03** in	Rain	Light Rain

Troutdale, OR

History

Weather History for KTTD - February, 2017

February 14 2017 Tuesday, February 14, 2017 View

Daily Weekly Monthly Custom

Actual	Average	Record
43 °F	**42** °F	
47 °F	**50** °F	**62** °F (1977)
38 °F	**35** °F	**18** °F (1990)
22	23	
344	324	
0	0	
0	0	
28 °F		
57		
64		
49		
T in	**0.18** in	**0.82** in (1948)
4.21	2.65	
6.58	8.83	
30.06 in		
28 mph (East)		
38 mph		
49 mph		

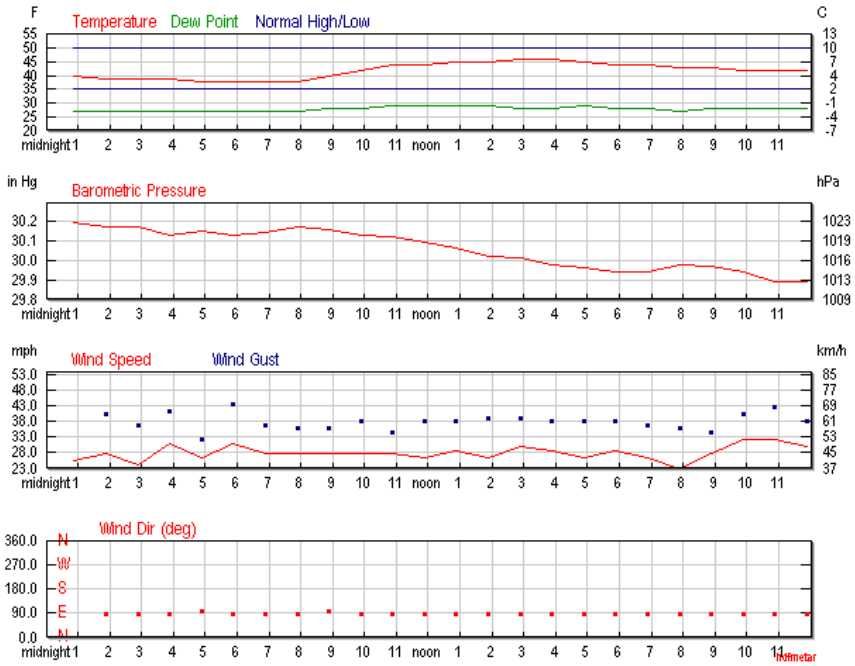
10 miles

Rain

T = Trace of Precipitation, MM = Missing Value

Source: NWS Daily Summary

Daily Weather History Graph



Search for Another Location

Airport or City:

KTTD

Submit

Trip Planner

Search our weather history database for the weather conditions in past years. The results will help you decide how hot, cold, wet, or windy it might be!

Date:

February 14 Submit

Astronomy

Feb. 14, 2017	Rise	Set
Actual Time	7:12 AM PST	5:35 PM PST
Civil Twilight	6:41 AM PST	6:06 PM PST
Nautical Twilight	6:07 AM PST	6:41 PM PST
Astronomical Twilight	5:32 AM PST	7:15 PM PST
Moon	9:51 PM PST (2/14)	9:07 AM PST (2/14)
Length of Visible Light	11h 24m	
Length of Day	10h 23m	

Waning Gibbous, 85% of the Moon is Illuminated

Feb 14	Feb 18	Feb 26	Mar 5	Mar 12
Waning Gibbous	Last Quarter	New	First Quarter	Full

Hourly Weather History & Observations

Temp.	Windchill	Dew Point	Humidity	Pressure	Visibility	Wind Dir	Wind Speed	Gust Speed	Precip	Events	Conditions
39.9 °F	29.2 °F	27.0 °F	60%	30.19 in	10.0 mi	East	25.3 mph	35.7 mph	N/A		Clear
39.0 °F	27.6 °F	27.0 °F	62%	30.17 in	10.0 mi	East	27.6 mph	40.3 mph	N/A		Clear
39.0 °F	28.3 °F	27.0 °F	62%	30.17 in	10.0 mi	East	24.2 mph	36.8 mph	N/A		Clear
39.0 °F	27.0 °F	27.0 °F	62%	30.13 in	10.0 mi	East	31.1 mph	41.4 mph	N/A		Clear
37.9 °F	26.3 °F	27.0 °F	65%	30.15 in	10.0 mi	East	26.5 mph	32.2 mph	N/A		Clear
37.9 °F	25.5 °F	27.0 °F	65%	30.13 in	10.0 mi	East	31.1 mph	43.7 mph	N/A		Clear
37.9 °F	26.1 °F	27.0 °F	65%	30.14 in	10.0 mi	East	27.6 mph	36.8 mph	N/A		Clear
37.9 °F	26.1 °F	27.0 °F	65%	30.17 in	10.0 mi	East	27.6 mph	35.7 mph	N/A		Clear
39.9 °F	28.8 °F	28.0 °F	63%	30.16 in	10.0 mi	East	27.6 mph	35.7 mph	N/A		Clear
42.1 °F	31.7 °F	28.0 °F	58%	30.13 in	10.0 mi	East	27.6 mph	38.0 mph	N/A		Clear
44.1 °F	34.4 °F	28.9 °F	55%	30.12 in	10.0 mi	East	27.6 mph	34.5 mph	N/A		Clear
44.1 °F	34.6 °F	28.9 °F	55%	30.09 in	10.0 mi	East	26.5 mph	38.0 mph	N/A		Clear
45.0 °F	35.4 °F	28.9 °F	53%	30.06 in	10.0 mi	East	28.8 mph	38.0 mph	N/A		Clear
45.0 °F	35.8 °F	28.9 °F	53%	30.02 in	10.0 mi	East	26.5 mph	39.1 mph	N/A		Clear
46.0 °F	36.7 °F	28.0 °F	50%	30.01 in	10.0 mi	East	29.9 mph	39.1 mph	N/A		Mostly Cloudy
46.0 °F	36.9 °F	28.0 °F	50%	29.98 in	10.0 mi	East	28.8 mph	38.0 mph	N/A		Mostly Cloudy
45.0 °F	35.8 °F	28.9 °F	53%	29.96 in	10.0 mi	East	26.5 mph	38.0 mph	N/A		Partly Cloudy
44.1 °F	34.2 °F	28.0 °F	53%	29.94 in	10.0 mi	East	28.8 mph	38.0 mph	N/A		Scattered Clouds
44.1 °F	34.6 °F	28.0 °F	53%	29.94 in	10.0 mi	East	26.5 mph	36.8 mph	N/A		Overcast
43.0 °F	33.8 °F	27.0 °F	53%	29.98 in	10.0 mi	East	23.0 mph	35.7 mph	N/A		Overcast
43.0 °F	32.9 °F	28.0 °F	56%	29.97 in	10.0 mi	East	27.6 mph	34.5 mph	N/A		Overcast
42.1 °F	31.0 °F	28.0 °F	58%	29.94 in	10.0 mi	East	32.2 mph	40.3 mph	N/A		Overcast
42.1 °F	31.0 °F	28.0 °F	58%	29.89 in	10.0 mi	East	32.2 mph	42.6 mph	0.00 in		Overcast
42.1 °F	31.3 °F	28.0 °F	58%	29.89 in	10.0 mi	East	29.9 mph	38.0 mph	0.00 in	Rain	Light Rain

Appendix B:

Labels and Manuals

Operating & Installation Manual

Farringdon 16 Wood Stove

BK685
UL 1482-11 or ULC S627-00

Rev 11
July 2022

Congratulations on your choice of an Arada Stove.

Read all instructions carefully before installing your wood burning stove. If you are in any doubt about the instruction to install your appliance correctly, we suggest to call a professional master installer. A wrong installation may result with a fire, burns and possible death.

Keep these instructions.
This appliance must be connect to
· A HT type factory-built chimney approved UL103 or ULC 629 with a 6 inches dia. (15.24 cm)
· A code-approved masonry chimney with a flue liner with a 6 inches diameter (15.24cm)

N.B: Be warned that local codes and rules can have more specific requirements than those detailed in this manual.

You should consult a master installer, fire officials or local building office about restriction and installation inspection in your area and to determine if you need to obtain a permit Prior to installation.

Install and operate this stove only in accordance with these instruction Applicable standards: UL 1482-11, ULC S627-00

This manual describes the installation and operation of the Arada, Farringdon 16 catalytic equipped wood heater. This heater meets the 2020 U.S. Environmental Protection Agency's crib wood emission limits for wood heaters sold after May 15, 2020.
This wood heater was tested to EPA Method 28R using Crib fuel with an emissions value of 1.5g/hr.
Under specific test conditions this heater has been shown to deliver heat at rates ranging from 8,000 to 55,000 Btu/hr 2.4 - 16kw/hr

This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed.

We recommend our wood burning stoves be fitted by an installation engineer certified in the US by
The National Fireplace Institute (NFI)
And in Canada by the Wood Energy Technology (WETT)

PLEASE NOTE— *Arada has a policy of continuous product development and therefore we reserve the right to amend the specification without prior notice.*
Due to printing cycles, items or options may be described before they are generally available or after they have ceased, so please check with your retailer or dealer.

Contents

WARNING

**THIS STOVE MUST NOT BE CONNECTED
TO A SHARED FLUE SYSTEM SERVING ANOTHER APPLIANCE**

**TO ALL USERS
THIS APPLIANCE IS SUITABLE FOR WOOD BURNING ONLY**

**ANY FORM OF COAL
SHOULD NEVER BE USED IN YOUR STOVE**

**TO USE ANY FUEL OTHER THAN WOOD WILL INVALIDATE
THE APPLIANCE GUARANTEE.**

THIS APPLIANCE IS NOT SUITABLE FOR USE IN A MOBILE HOME

DO NOT CONNECT OR USE IN CONJUCTION WITH ANY AIR DISTRIBUTION DUCTWORK UNLESS SPECIFICALLY APPROVED FOR SUCH INSTALLATIONS

DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE

DO NOT CONNECT THIS STOVE TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE

**Installation of wood burning stoves must be safe and legal.
The Farringdon 16 is designed for installation in main living areas of your home only.**

If your Farringdon stove is not installed correctly, it may cause a house fire.
To reduce the risk of fire, the installation instructions must be followed carefully.
Do not allow makeshift compromises to endanger property and personal safety. Contact the local building officials about restrictions and installation inspection in your area.

Under no circumstances make impromptu alterations or modifications to this stove.
It is an approved appliance and changes to the product or tampering with the design will render it **non-compliant**
This also applies to ’ad hoc ‘ repairs using non Arada approved components

**FOR FURTHER INFORMATION,
REFER TO THE NATIONAL FIRE PROTECTION ASSOCIATION
ANSI/NFPA 211 STANDARD FOR CHIMNEYS, FIREPLACES, VENTS AND SOLID FUEL BURNING APPLIANCES.**

SAFETY

A fireguard should be used in the presence of children and elderly or infirm people.
Please note, This appliance should be used with the fire door closed at all times except when re-fuelling or de-ashing.

REMEMBER THE STOVE IS VERY HOT DURING OPERATION. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS.

Do not use aerosol sprays or any other flammable materials near the appliance under fire.
Do not fit an extractor fan in the same room as the appliance.
Fire cement is caustic, hand and eye protection should always be worn, prolonged contact with the skin should be avoided.

Arada Ltd will not be responsible for any consequential or incidental loss or injury however caused.

Before continuing any further, with the installation of this appliance please read the following guide to manual handling.

- Always obtain assistance when lifting the appliance
- When lifting always keep your back straight, bend your legs not your back
- Avoid twisting at the waist. It is better to reposition your feet.
- Avoid upper body/top heavy bending. Do not lean forwards or sideways when handling the fire
- Always grip with the palms of your hands do not use your fingertips for support
- Always keep the stove as close to the body as possible as this will minimise the cantilever action.
- Use gloves to provide additional grip.

THE PRINCIPLE OF THE STOVE

Your **Arada** stove is built to the highest standard of craftsmanship using the best materials and the most modern equipment available. It is a highly efficient and sophisticated piece of machinery and when properly installed and operated should provide a lifetime of heating satisfaction.

Safety is the most important consideration when installing your fire. If not properly installed and operated a house fire may result. Installation must comply with the Building Regulations and conform to all safety standards.

Arada produce a variety of appliances ranging from the traditional to the modern in style and appearance.

The fire door is fitted with a special high temperature ceramic glass panel through which the fire can be viewed.

The stove is lined with firebricks or heat reflective panels which ensure complete combustion and provide a good heat store to even out fluctuations in burning.

An internal throat plate produces turbulence to encourage secondary combustion and direct the flue gas around the whole upper firebox before allowing it to escape up the chimney.

Grate Bars

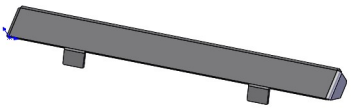
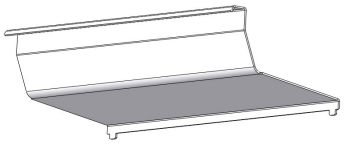
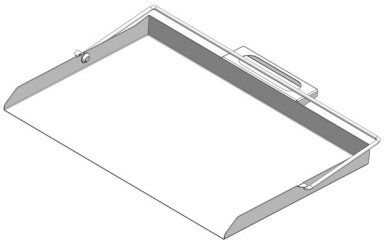
The **Farringdon 16** wood stove is fitted with a riddling grate system to support the fuel above the ash pit containing the removable ash pan.

The stove is designed to burn wood only on the grate and the stove MUST NOT be used without the grate fitted. Spare grate bars are available see page 34 for part number details

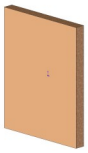
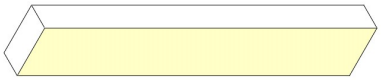
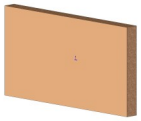
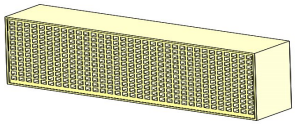
Arada stoves are also fitted with an ‘air wash’ so called because it provides a curtain of high speed preheated air behind the glass to help keep it clean and provide secondary air/over draught.

CHECK LIST

Inside the appliance body you should find the following:

Part Description & Visual Aid (not to scale)	Farringdon 16
1. Fuel Retainer 	1
2. Throat Plate 	1
3. Ash Pan 	1
4. Throat Plate Insulation Blanket 	1
5. Instruction Manual 	1

Inside the appliance you should find the following :

Description & Visual Aid (not to scale)	Farringdon 16
6. Back Side Liners 	4
7. Front Side Liners 	2
8. Rear Liner 	2
9. Grate Bars 	14
10. Stove Mitten (Hot Glove) 	2
11. Fire Door Handle 	1
12. Ceramic Catalyst 	1

DATA LABEL PLATE A

CONTACT YOUR LOCAL BUILDING OFFICIAL ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA
CONTACTER VOTRE RESPONSABLE D'INSTALLATION LOCAL POUR CONNAITRE LES RESTRICTIONS ET INSPECTIONS S INSTALLATIONS DANS VOTRE REGION

F17-129

Listed Room Heater. Wood Fuel type, Poêle à bois homologué

Not suitable for use in a Mobile Home
Ne pas utiliser dans les maisons mobiles

Manufactured by, Fabriqué par Arada Ltd
Axminster, Devon
United Kingdom EX13 5HU

Serial #, No. de série -

Model Name, Modèle Farringdon 16 Catalyst Stove

Tested To, Mis à l'épreuve selon la norme:-
UL1482-11, ULC S627-00

WARNINGS - ATTENTION

Do **NOT** burn with the grate system removed
Ne pas utiliser sans la grille

Do **NOT** overfire, If the chimney connector glows you are overfiring. (See Manual)
Ne pas surchauffer. Si le collet de la cheminée devient rouge. Le poêle surchauffe (Voir notice d'utilisation)

Do **NOT** obstruct the space under the heater
Ne Rien entreposer sous le poêle

Do **NOT** connect this unit to a chimney serving another appliance
Ne pas brancher cet appareil sur une cheminée servant à un autre appareil

Do **NOT** burn fuel **OTHER THAN WOOD** as this will damage the catalyst and will render it inactive
Ne pas brûler d'autre combustible que du bois car cela endommagerait le catalyseur et le rendrait inactif.
The Combustor is fragile and must be handled carefully.
L'ensemble comprenant le catalyseur est fragile et doit être manipulé avec soin.

Replacement catalyst part No. **CatFAR16.01**
Pièce de rechange pour le catalyseur No. **CatFAR16.01**
This stove is only to be operated with the door **CLOSED**
Le poêle doit être utilisé porte **FERMEE**

*** PREVENT HOUSE FIRES* * EVITER LES INCENDIES***

Install and use only in accordance with manufacturers installation instructions and your local building codes
Installer et utiliser seulement conformément aux instructions du fabricant et aux normes d'installation dans votre région

Caution: Special methods are required when passing chimney through a wall or ceiling, refer to local building codes. Do not connect this stove to a chimney serving another appliance.
Attention: Des procédés spéciaux doivent être employés pour passer un conduit de cheminée au travers de murs ou de plafonds. Référez-vous aux normes d'installation de votre région. Ne pas brancher cet appareil sur une cheminée servant à un autre appareil.

Note: Replace glass only with 5mm minimum Ceramic IR or Neoceram IR glass
Remarque: Remplacer la vitre seulement avec un verre Ceramic IR ou Neoceram IR de 5mm d'épaisseur

Warning: This unit is not suitable for use in a Mobile Home
Attention: Ne pas utiliser dans les maisons mobiles

Inspect and clean the chimney frequently.
Under certain conditions of use, creosote buildup can occur RAPIDLY.

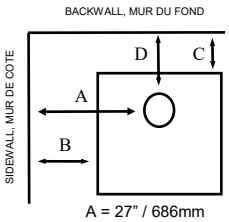
Inspecter et nettoyer la cheminée régulièrement. Dans certaines conditions d'utilisation , la créosote peut s'accumuler rapidement

Caution - Attention:

THE STOVE IS VERY HOT DURING OPERATION. DO NOT TOUCH, KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT WITH SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS.

LE POELE EST TRES CHAUD PENDANT L'UTILISATION. NE PAS TOUCHER, GARDER LES ENFANTS, TISSUS ET MEUBLES A DISTANCE. LE CONTACT AVEC LA PEAU CAUSE BRULURES. VOIR LA PLAQUE SIGNALETIQUE ET LES INSTRUCTIONS.

Minimum Clearance to Combustible Materials*, Dégagement minimum aux matériaux combustibles*



A = 27" / 686mm
B = 18" / 457mm
C = 17" / 432mm
D = 14" / 356mm

When installed on a combustible floor, Non-combustible floor protection is required to cover the area beneath the stove, and extend at least 18" (458mm) to the front and 8" (203mm) to the sides and back.
Si le poêle est installé sur un sol combustible, alors un protège plancher incombustible doit être utilisé pour couvrir la surface sous le poêle et doit s'étendre au moins 18" (458mm) à l'avant et 8" (203mm) sur les cotés et a l'arriere.

* Refer to the Installation manual for additional clearance information, Installation instructions and Operating instructions.

Se réferrer à la notice d'utilisation pour des informations complémentaires sur les dégagaments, les instructions pour l'installation et l'utilisation.

VENT REQUIREMENTS:
6" (150mm) diameter, single wall,
Minimum 24 MSG blue steel connector with Listed factory-built Type HT chimney or masonry chimney.

CARACTERISTIQUES POUR LES CONDUITS
Raccord en acier bleu minimum 24MSG de 6" (150mm) paroi simple, avec une cheminée en acier fabriqué en usine homologué de type HT ou une cheminée de maçonnerie.

Minimum Clearance to Combustible Materials*, Dégagement minimum aux matériaux combustibles*

A = 25" / 635mm
B = 16" / 406mm
C = 9" / 229mm
D = 6" / 152mm

With optional **REAR HEAT SHIELD & DOUBLE WALLED FLUE PIPE** fitted. Please consult instruction manual for further installation instructions.
Avec **BOUCLIER THERMIQUE ARRIERE** en option et **TUYAU DE FUMEE A DOUBLE** paroi. Veuillez consulter le manual d'instructions pour d'autres instructions d'installations.

DO NOT connect this unit to a chimney serving another appliance.
NE PAS raccorder cet appareil à une cheminée desservant un autre appareil.

ARADA
DEVON

Manufactured by, Fabrique par Arada Ltd
Axminster, Devon
United Kingdom EX13 5HU

Serial #, No. de série: -

Model Name, Modèle: Farringdon 16 Catalyst Stove

Tested To, Mis à l'épreuve selon la norme:-
UL1482-11, ULC S627-00

U.S ENVIROMENTAL PROTECTION

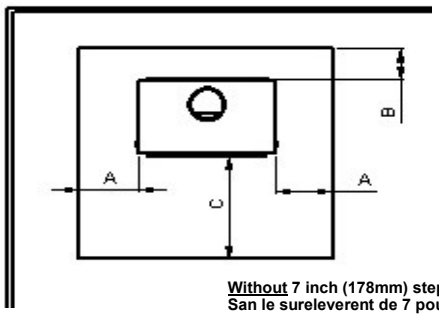
AGENCY Certified to comply with 2020 particulate emission standards using crib wood per EPA Method 28R at 1.5 g/hr.
This wood heater needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's manual.''

NOTE : The performance of the catalytic device fitted into this stove or its durability has not been evaluated as part of the EPA certification.

Homologue par la **U.S ENVIROMENTAL PROTECTION AGENCY** pour les emissions de particules par les appareils de chaffage au bois a partir de 2020.
Cet appareil de chaffage au bois doit etre repare regulierement pour assurer son bon fonctionnement. Consulter la notice du fabricant pour plus d'information. Il est contraine aux lois federales d'utillser ce poele en ne tenant pas compte des instructions donnees dans cette notice.
REMARQUE : Les performances du catalyeur installe dans ce poele ou sa durabillite n'ount pas ete testes lors de la certification EPA.

Floor Protection material R Values—Valeur R du materiau de la plaque de protection

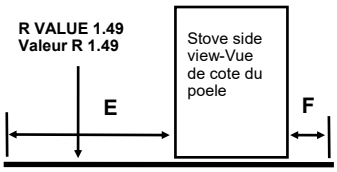
Thermal protection of R Value 1.49 is required 16 inches (406mm) in front of the stove when installed directly onto the floor or a step lower than 7 inches (178mm) See diagrams below.
Si le poele est installe directement sur la plaque de protection ou sureleve de la plaque de protection de moins de 7 pouces, alors ia valeur de la resistance thermique de cette plaque doit etre au moins egale a 1.49, et cette plaque doit depasser d'au moins 16 pouces (406mm) a l'avant du poele.



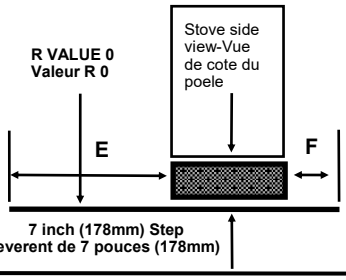
A	B	C (USA)	D (Canada)
203mm	203mm	406mm	458mm
8ins.	8ins.	16ins.	18ins.

E	F
406mm	203mm
16ins.	8ins.

Without 7 inch (178mm) step
San le sureleverent de 7 pouces (178mm)



With 7 inch (178mm) Step
Avec le sureleverent de 7 pouces (178mm)



U.S. ENVIROMENTAL PROTECTION AGENCY
Certified to comply with UL1482-11, ULC S627-00, 2020 particulate emissions standards

AGENCE U.S. POUR LA PROTECTION DE L'ENVIRONNEMENT
Certifié conforme à UL1482-11, ULC S627-00, 2020 norme d'émission de particules

Date of Manufacture, Date de Fabrication

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

DO NOT REMOVE THIS LABEL, NE PAS RETIRER CETTE PLAQUE SIGNALETIQUE

Made in England, Fabriqué en Angleterre

TECHNICAL DATA

TECHNICAL DATA	Farringdon 16
Maximum / Nominal Heat Output Kw	16
Mean Flue Gas Temperature °C	342
Height mm/inch (Canopy To Base Feet)	696/27.4
Width mm/inch (Across Canopy)	615/24.2
Depth mm/inch (Rear Heat Shield To Handle Boss—Handle Removed)	509/20
Flue Diameter mm/inch	152/6
Weight Packed Kg/lbs	190 / 419
Weight Nett Kg/lbs	172 / 379
Ideal Log Length mm/inch	432/17
Maximum Log Length mm/inch	533/21
Firebox size Cu. Inch / foot	2300/1.3
EPA Certified Emissions, grams per hour	1.5
HHV Tested Efficiency 1	77.2
EPA BTU	27000
Peak BTU/Hr	54,000
Fuel	Seasoned Cord wood

GENERAL PRECAUTIONS

Note : All local regulations, including those referring to National standards need to be complied with, when installing the appliance.

Any Manufacturer's Instructions must not be taken as overriding statutory requirements.

Before any installation work is undertaken consideration must be given to the Health and Safety . Safe working practices should be followed at all times.

During installation ensure that adequate precautions are taken to avoid unnecessary risk to yourself or any householder. In particular the danger from caustic nature of the fire cement should be avoided by using these accepted methods :

- Wear gloves when handling fire cement
- Wear goggles when chiselling or looking up chimneys.

Make sure that Building Regulations are adhered to during installation along with any local by-laws. In the case of heating systems make sure that the pipe work is correctly bonded to ensure electrical earth continuity.

ASBESTOS

All Arada stoves contain no asbestos in their manufacture or construction. If there is a possibility of disturbing any asbestos in the course of installation, then please seek specialist guidance and use appropriate protective equipment.

HANDLING

The safe handling guidelines are set out on page 5 of this manual, to make movement easier, internal fittings, fuel retainers, grates, firebox liners, flue outlets, hot plates, throat plates etc, can be removed. Care should be taken to make sure that the hinges are not damaged during installation.

HEARTH

The stove shall be installed on a floor with adequate load bearing capacity. If the existing construction does not meet this prerequisite, suitable measures (e.g.: load distributing plate) should be taken to achieve it.
Ideally, the appliance should stand on a constructional hearth of non-combustible materials not less than 125mm (5") thick conforming to Building Regulations.
Dimensions of the hearth should project at least 458mm (18") forward of the front of the appliance and 203mm (8") at the sides.
The surface of the hearth should be free of combustible materials. In most buildings with solid concrete or stone floors, the requirement will be met by the floor itself, but mark the hearth to ensure floor coverings are kept well away or use different levels to mark the hearth perimeter.

COMBUSTIBLE MATERIALS

Please view the technical data (See page 9) and observe the **minimum** distance to combustible materials, which is applicable to your stove model. Ideally, adjacent walls should be of suitable non combustible construction, preferably brickwork. In large fireplaces take care that any supporting beam is protected by a 13mm (0.5") sheet of Fire proof board spaced 13mm (0.5") off the surface with strips of non combustible material. Make sure that there is a gap between an un-insulated flue system and any combustible material. This gap must be at least 3X the outside diameter of the flue pipe, or 1.5X the flue diameter to non combustible surfaces.

AIR FOR COMBUSTION

There must always be a permanent means of providing air for combustion into the room in which the stove is installed. Failure to provide an adequate air supply can result in the stove smoking back into the room and poor draw on the chimney. A permanent vent with a total free area of at least 550mm² for every KW rated above 5KW should be connected directly to the outside air or to an adjacent room which itself has a permanent vent of the same size direct to the outside air. The positioning of any air vent must be so that it cannot be liable to blockage or obstruction. **Please note** : The fitting of an extractor fan to either of these rooms is not recommended.

FITTING THE FLUE OUTLET AND HOT PLATE (Where Provided)

Note:

Not applicable for units supplied with a fixed flue outlet spigot

The flue outlet spigot is found packed inside the appliance . The hot plate (blanking plate) is supplied fitted to the top opening and is removed by turning clockwise (as is the flue outlet).

Smear a very thin layer of fire cement on the mating faces of the flue outlet and the hot plate. Fit the outlet to the appliance in the desired position.
Lock into place by rotating anti-clockwise and tighten by tapping with a block of wood and mallet from inside of the appliance. Similarly, fit the hot plate (blanking plate) to the unused opening. Clean off any surplus fire cement.
Place appliance on the hearth and make sure that it is level and does not rock.
Connect the chimney ensuring all joints are sealed with fire cement.

Important note :

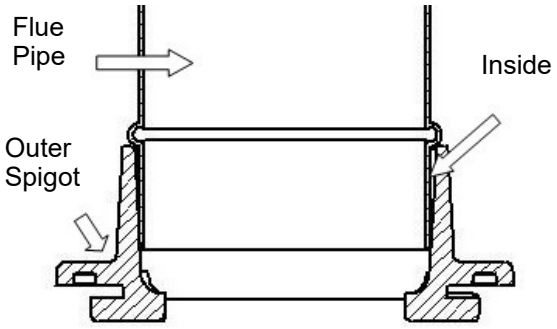


Fig. 1. Flue & Spigot Fitting

For fixed and removable flue spigot types:-

The flue pipe **must** be fitted **inside** the outlet spigot. Failure to do so could result in the spillage of condensation and combustion residues running down the flue onto the stove canopy. **(See Fig. 1)**

The chimney connector must be in good condition and kept clean

Chimney Connector:
The Chimney connector must be 6 inches diameter and have a minimum thickness of 24 gauge (0.025 inches 0.64 mm)

This must be secured into the flue spigot with 3 screws through the holes provided.

FLUES AND CHIMNEYS

The flue draw is critical on any installation and should be checked to ensure that it matches what is specified. If it is higher than recommended, provision must be made to correct the over draw. The draw can vary in different weather conditions and the customer should be made aware of this. Failure to correct an over-drawing flue will invalidate the warranty.

Please remember that chimney draught is dependent on four main factors :

- Flue gas temperature
- Flue height
- Flue size
- Flue terminal

The stove must be connected to a suitable and efficient flue so that products of combustion (fumes) from the stove are expelled to the outside air. To ensure a good up draught it is important that the flue gases are kept warm and that the flue size suits the stove. The termination of the outlet at the top of the flue also needs to comply with Local Building Codes.
The minimum effective height of the flue should be at least 15 feet from the top of the stove to the top of the flue outlet. When warm the flue draught should be between 0.1 to 0.2 mb. (1-2 " H2o)
A chimney may comply with regulations but could still be subject to down draught and similar problems. A chimney terminating above the ridge level is generally less likely to suffer such problems.
Excessive flue draught may cause over firing, *See page 29,* and very low flue draught (below 1" H2o) will result in poor combustion and greatly reduced heat output, and may prevent the stove reaching catalyst light-off temperature. Low draught can also cause the appliance to leak smoke into the room, and may cause the catalyst to become blocked

If a new chimney is being provided it should fully comply with the relevant Building Regulations that specify the requirements for solid fuel burning installations. Suitable types of chimney include the following :

Masonry Chimney:
A code-approved masonry chimney with a flue liner with a 6 inches diameter (15.24cm)

Factory Made Chimney:
A HT type factory-built chimney approved UL103 or ULC 629 with 6 inches diameter (15.24 cm)

The flue and chimney installation must be carefully checked by a competent person before fitting the stove to ensure it is suitable and will work safely.

If the chimney is old (ie: built of brick or stone without a liner) or being opened up for reuse additional checks and smoke testing should also be carried out to ensure the flue and chimney are good operating condition.

Check the existing flue is in good condition with suitable access for collection and removal of debris. If the flue size is more than 225mm (9") diameter or 200mm (8") X 200mm (8") square, a suitable lining of 150mm (6") diameter should be fitted, or if the flue length is over 5.5 metres one size larger than the appliance outlet should be fitted. This should be a double skin stainless steel flexible liner that is independently certified for use with solid fuel.
It is also important that suitable flue pipe is used to connect the stove to the flue in the chimney and that suitable access is provided into the flue for regular inspection and sweeping of the flue ways.

The installer should comply with regulation requirements in respect of providing a Notice Plate giving details on the chimney, flue lining, hearth and fireplace installation. Chimneys should be as straight as possible.
Horizontal runs should be avoided except where the rear outlet of the appliance (if available) is used, in which case the horizontal section should not exceed 150mm (6") in length.

WARNING: When wood is burnt slowly in a closed appliance it produces moisture , tar and Creosote which will create condensation and deposits in the chimney.
This effect can be minimised by burning hard for a short period, about 20 minutes, twice a day.
It is usually convenient to do this morning and night.

Note: To avoid chimney problems your fire should not be burnt slowly for longer than 12 hours without a period of fast burning.

Inspection is advised on a regular basis and accumulations of more than 3mm removed.

If the stove appears to be working hard but produces very little output to the room it is likely that excess draw is present in the chimney, and that heat is being sucked out of the appliance and up the chimney.

Important Note:

The chimney connector must not pass through an attic or roof space, closet or similar concealed space, or a floor, or ceiling.
Where passage through a wall or partition of combustible constriction is desired the installation shall conform to CAN/CSA-B365, Installation code for Solid Fuel Burning appliances and equipment

Carbon Monoxide:

A damaged or leaking Flue or Chimney may allow products of combustion to enter the living area, we would recommend a **Carbon Monoxide Detector** be fitted for this reason.
Carbon monoxide is a highly toxic gas and can be dangerous in even very small quantities symptoms include headache, dizziness and nausea, if you experience any of these symptoms when using your wood stove **Open all the windows, and leave the room at once and seek expert advice**

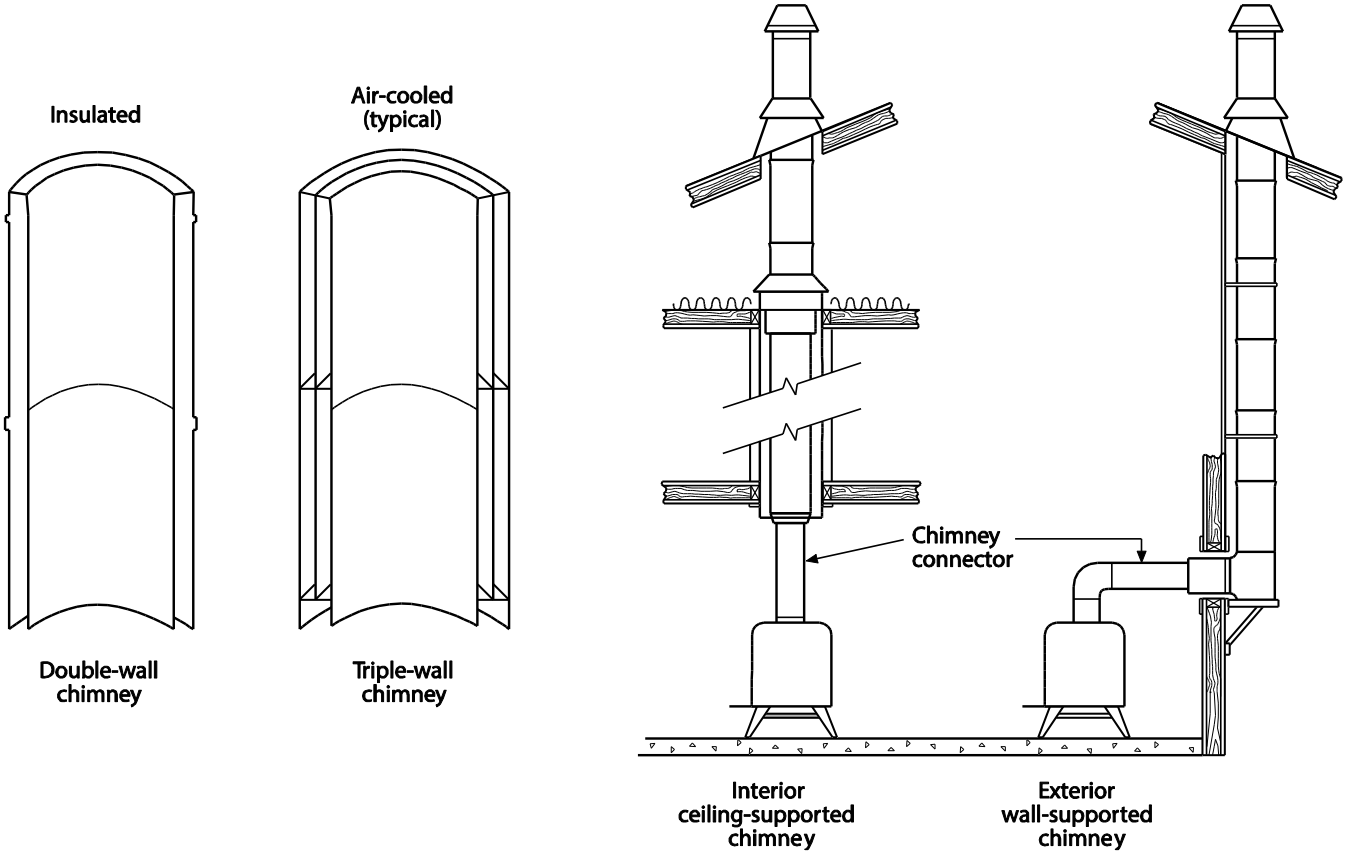
DO NOT CONNECT THIS STOVE TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE

FOR ALL APPLIANCES

Access for cleaning the flue should be incorporated in the system other than through the appliance (e.g. A soot door or access through the register plate). Purpose made soot doors and inspection lengths are available from manufacturers of all systems. Ensure that the whole length of the flue can be reached from the soot door.

Note: if the appliance is fitted with a draught stabiliser or if one is fitted to the flue pipe or chimney in the same room as the appliance, then the permanent air entry opening (or Openings) should be increased by 300 mm² for each KW of rated output.

Typical Factory built chimney installation in a single family residence

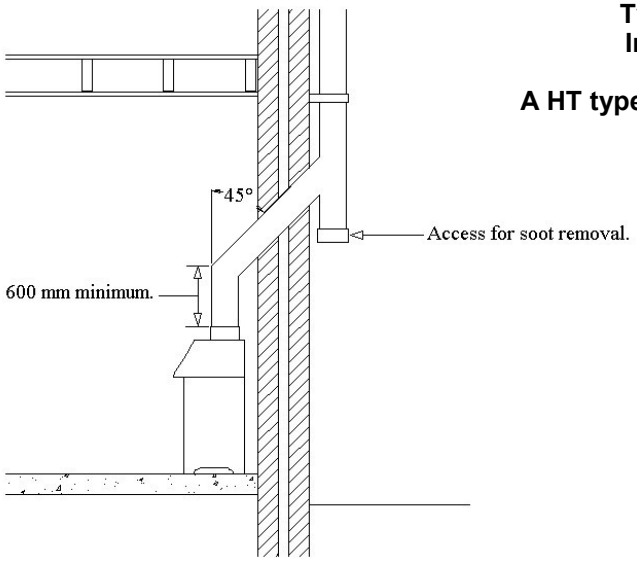


General.

Factory built chimneys and chimney units must be installed in accordance with the temperature and pressure conditions detailed in the manufacturers instructions.

Temperature and pressure limits.

Flue gas temperature and static pressure within the chimney must not exceed the limits used during listing tests

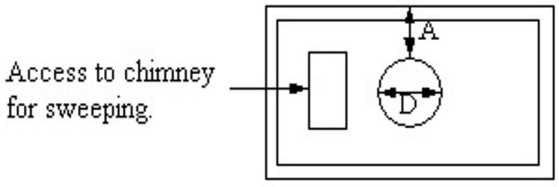


Typical Metal Insulated Chimney System Installed To The Chimney Manufactures Instructions
A HT type factory-built chimney approved UL103 or ULC 629 with 6 inches diameter (15.24 cm)

A code-approved masonry chimney with a flue liner with a 6 inches diameter (15.24cm)

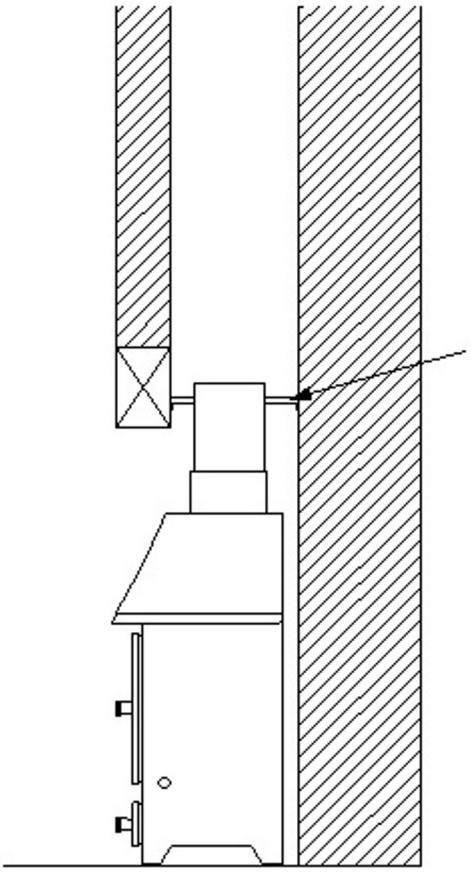
PLAN VIEW OF REGISTER PLATE AND CLEARANCES FOR NON INSULATED FLUES

(Plan View Of Steel Register Plate, 1.5mm Thick Minimum)

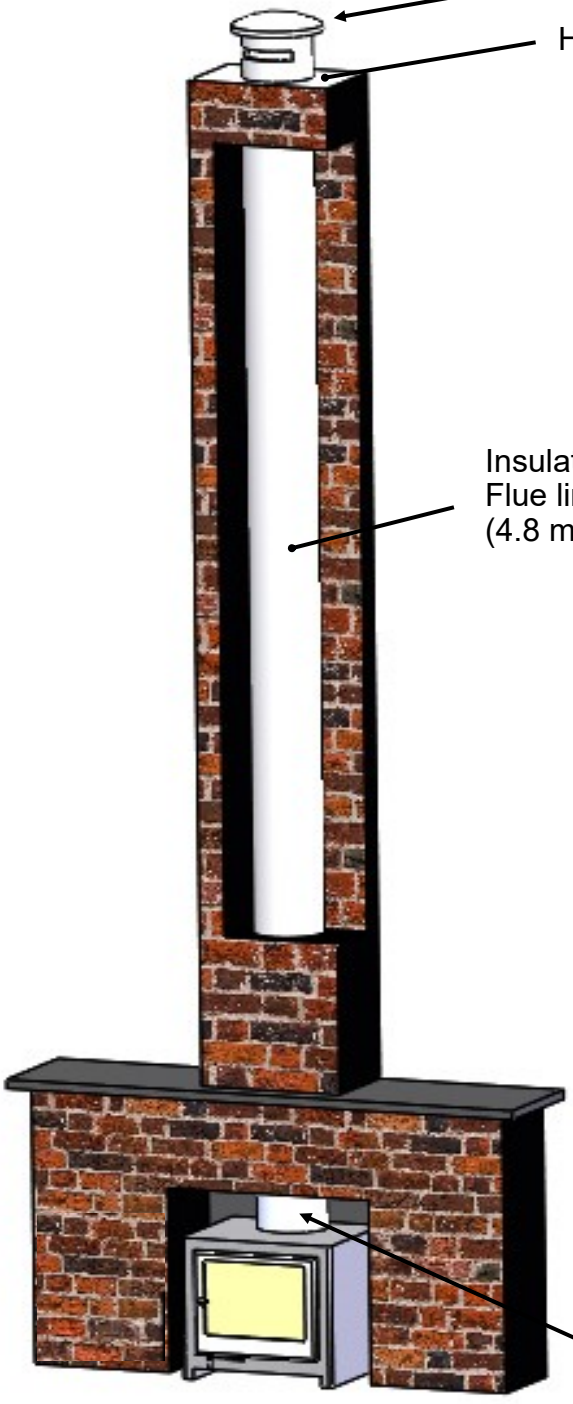


A (Minimum clearance for non-insulated flue) =

1.5 x D to a non-combustible surface/material
or
3 x D to a combustible surface/material



Masonry Chimney



Sample installation into existing chimney.
Chimney liner system has to be UL listed to UL 1777 in USA and ULC S635 in Canada.

Floor Protection

The stove must be installed on a non-combustible material plate to protect the floor and possible fire caused by

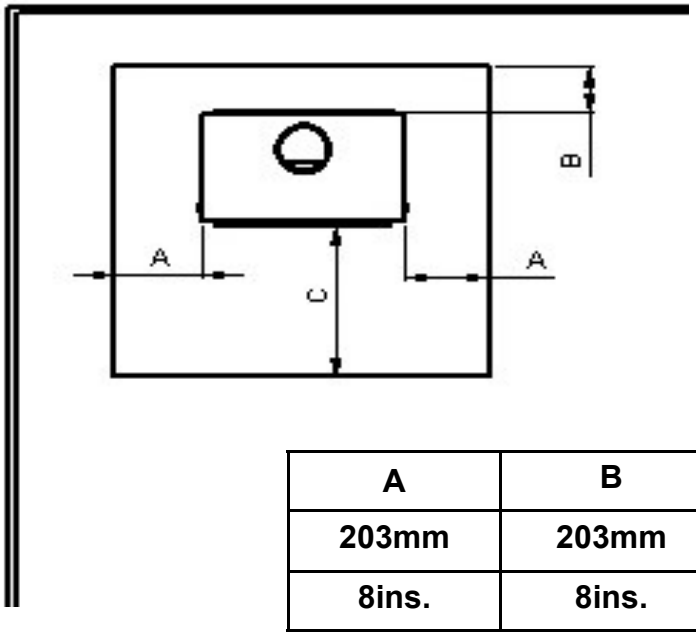
- Ejection of sparks and hot ashes when the stove door is opened for refuelling etc.
- Radiated heat caused by stove over firing
- Spillage of creosote as a result of a chimney fire

The surface used must be non-combustible and approved to UL 1618 for USA or local codes
(cement, brick, stone, ceramic etc)

Stove clearances on floor protection plate

The floor protection plate must be of Non-Combustible Material

Minimum dimensions listed may be increased

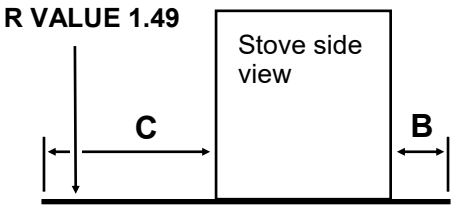


A	B	C (USA)	D (Canada)
203mm	203mm	406mm	458mm
8ins.	8ins.	16ins.	18ins.

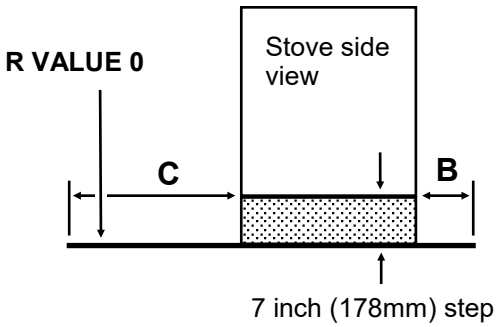
Floor Protection material R Values

Thermal protection of R Value 1.49 is required 16 inches (406mm) in front of the stove when installed directly onto the floor or a step lower than 7 inches (178mm) See diagrams below

Without 7 inch (178mm) Step



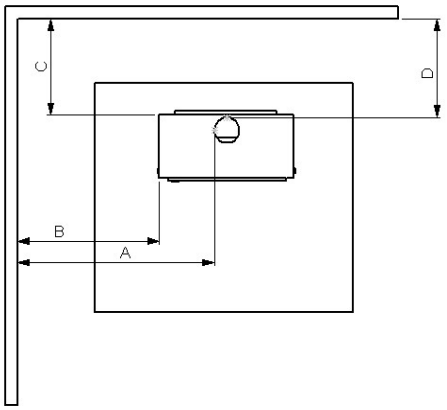
With 7 inch (178mm) Step



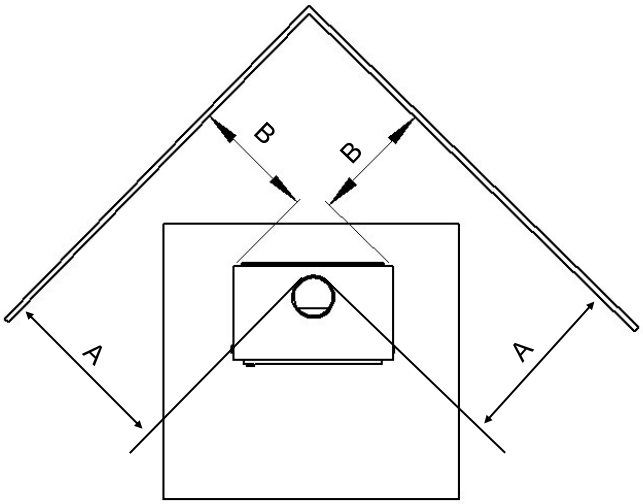
Stove clearances to combustible material.

Minimum dimensions listed may be increased. **Clearances may only be reduced by means approved by the regulatory authority.**

Straight Installation clearances



Corner Installation clearances



Standard Rear Heat shield and Single Wall flue pipe

A	B	C	D
685mm	457mm	432mm	356mm
27ins.	18ins.	17ins.	14ins.

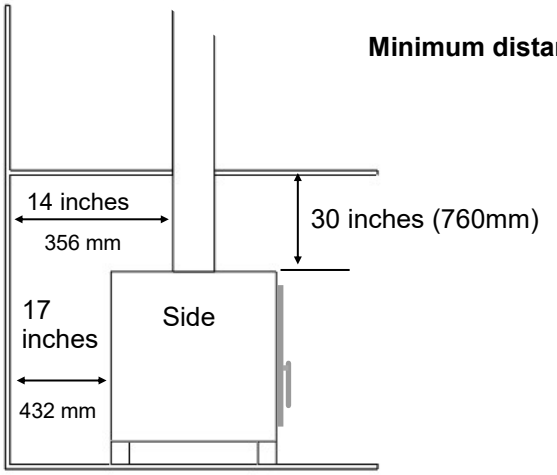
Deep Rear Heat shield and Double Wall flue pipe

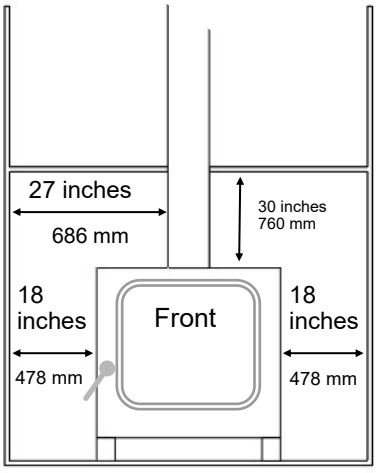
A	B	C	D
635mm	407mm	229mm	153mm
25ins.	16ins.	9ins.	6ins.

A	B
445mm	305mm
17.5ins.	12ins.

Alcove Installation

Minimum distances





Do **NOT** connect this unit to a chimney serving another appliance

FIREBOX LINER PANELS

The Arada Farringdon stove uses firebox liner panels to the sides and back. The throat plate sits on top of the perforated air tube at the front and into two slots in the rear air bar. These parts should come fitted to your stove, if however they are not, proceed as follows to fit them.

- Open the fire door.
- Remove the fuel retaining bar, by lifting free of the retaining slots.
- Set the rear liner (s) into the back of the firebox.
- Lift the throat plate into position with the front above the perforated air tube. Align the 2 tabs on the throat plate with the location slots in the rear air bar and drop into position (See Fig 4)
- Insert one of the side liner panels in each side at the back sitting on the side landing. Lift up one at a time past the throat pate as far as it will go and slide in the lower liner side liner.
  Repeat for the other set of rear side liners. (See Fig 2&3)
- Insert one front side liner in each side of the front of the stove. Secure in place with the front liner clamp as shown. (See Fig 2&3)

Note: Neither the rear firebox liners nor the side firebox liners are 'handed', both faces are suitable for direct contact with the fire bed.

Note : Cracking of the liner panels does not effect efficiency.

Overall View Of Liners & Throat Plate Assembly

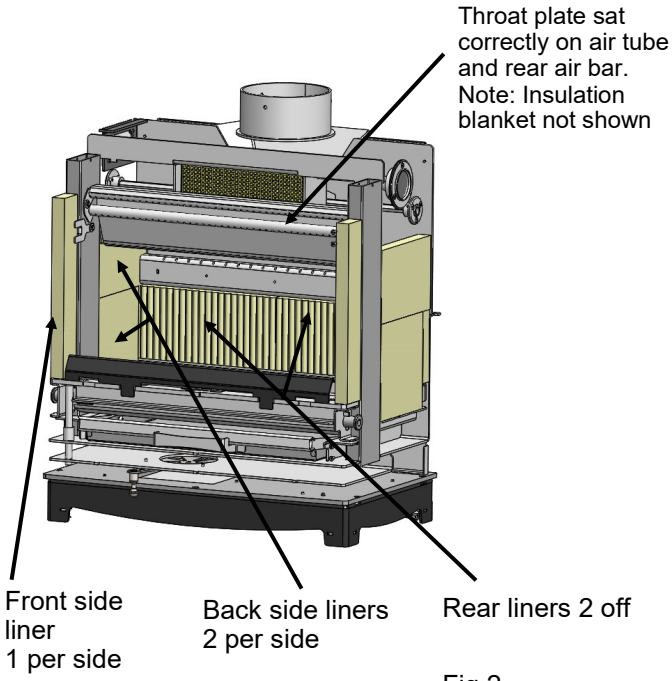


Fig 2

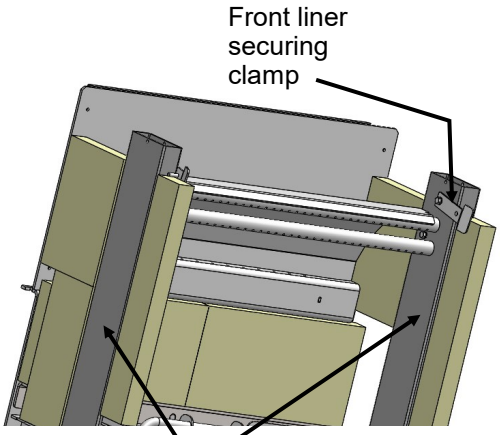


Fig 3

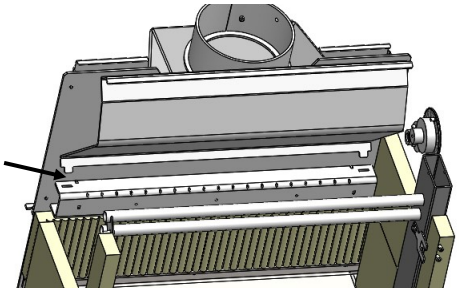


Fig 4

Catalyst Replacement

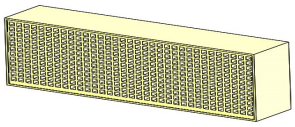
The catalyst in your Farringdon 16 wood stove should be replaced after approximately 12000 hours of burning, or if you notice a darkening of the smoke omitted from your chimney.

The catalyst should be replaced every 5 to 6 years irrespective of hours burned.

Replace with only a genuine Arada Catalyst
Part No. **CatFAR16.01** detailed on page 33.

The performance of the catalytic device or it durability has not been evaluated as part of the EPA certification

Replace as detailed below.



Farringdon Catalyst
P/No. CatFAR16.01

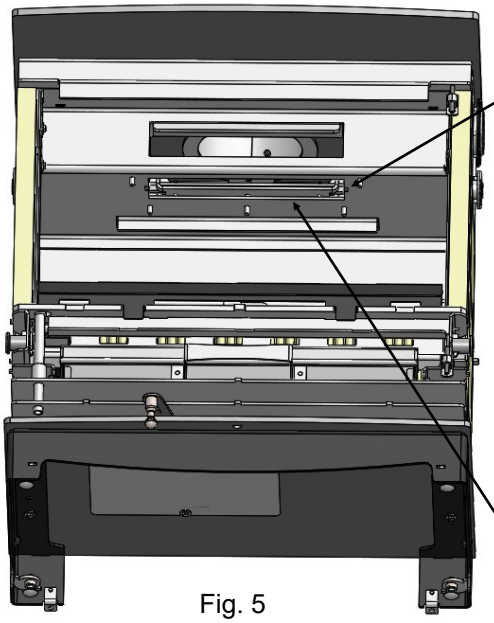


Fig. 5

Remove the throat plate as detailed on page 20,

Remove the 5 domed nuts and withdraw the catalyst cover and catalyst (Fig.5 & 6).
Discard the old catalyst in accordance with local regulations.

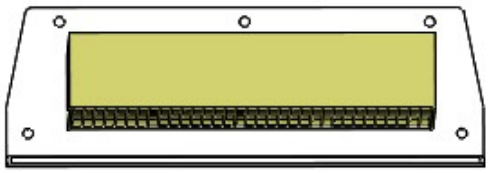


Fig. 6

Sit the new catalyst on the cover plate as shown in Fig. 6, (approximately central) offer the cat and cover plate back up to the stove gently sliding the cat through the aperture. **Do not** remove the CatGard wrap or the white tape securing it in place, this form the seal on first firing.

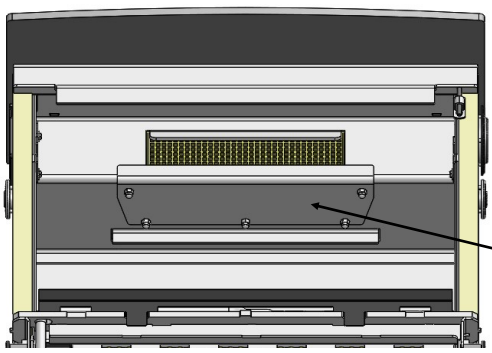


Fig. 7

Replace and tighten the 5 domed nuts firmly but do not over tighten (Fig.7).

Refit throat plate as detailed on page 20.

FINAL CHECK LIST

Before handing over the installation to the customer it is recommended that the appliance is lit and the functioning of the chimney system is checked for satisfactory operation.

- **Be sure that the chimney is operating and ALL smoke and fumes are vented to the atmosphere through the chimney terminal.**
- **Check all joints and seals.**
- **Clean the outside of the appliance to prevent any stains becoming burnt on.**
- **Check the flue draught which should read 1—2mm, or 0.1—0.2 mbar.**
- **Explain the controls and operation of the appliance to the customer.**

The following details **must** be checked and completed in full by the installer at the time of installation. Please answer all questions as fully as possible. **Arada stoves** cannot be held responsible for the chimney or installation.

SUMMER STORAGE / NON USAGE

Please ensure that your stove is left clean and moving components are well lubricated for the summer months (during periods of prolonged non use). If possible store the throat plate outside of the stove, check all moveable components, at regular intervals, to ensure they are moving freely.

Allow air movement through the stove, by opening the primary air inlet control to about half way open or leave the door ajar. This will allow a free flow of air through the appliance thus preventing moisture and condensation
forming inside the stove and chimney. This preventative maintenance will ensure your stove stays in the best condition for the coming winter months.

MAINTENANCE

It is important that your appliance is regularly serviced in accordance with these instructions.

Note: Only use original Arada components for service replacements, NEVER substitute parts for similar items

Service / repairs should be carried out at least annually by a qualified person and should consist of the following as a minimum:

CLEANING:
Do not clean the stove or door glass when hot

Important:
Establish a routine for the fuel, wood burner and firing technique. Check daily for creosote build-up until experience shows how often you need to clean to be safe. Be aware that the hotter the fire the less creosote is deposited, and weekly cleaning may be necessary in the mild weather even though monthly cleaning may be enough in the coldest months. Contact you local municipal or provincial fire authority for information on how to handle a chimney fire. Have a clearly understood plan to handle a chimney fire.

To clean and inspect your stove properly remove the firebrick linings and throat plate,
inspect all rope gaskets on doors, glass etc, and re -order any items that may need replacing from your **Arada** dealer.

Sweep the chimney and confirm that it is sound. Examine all joints in the flue pipe etc, and re-seal if necessary. Re-assemble and leave with the air inlet and air wash control about half way open. This will allow a free flow of air through the appliance thus preventing moisture and condensation from building up inside the stove and chimney.

CHIMNEY SWEEPING

Sweeping should be carried out with an appropriate sized bristle brush and rods to suit chimney size and type. As with all appliances regular sweeping of the flue is essential.
Any existing chimney should be swept prior to installation of the appliance, and swept again a second time **within one month** of regular use after installation to establish frequency of sweeping required. This should be done by a competent person such as a chimney engineer who will provide a Certificate Of Chimney Sweeping.

The whole flue way including the outlet must be swept at least twice per burning season. It is important that the flue ways, flue pipe and chimney be cleaned prior to lighting the fire after a prolonged shut down period.

DOOR GLASS

The door glass should remain clear during normal burning. However, under certain conditions, such as burning at a low rate or damp wood, the glass may become somewhat blackened. To remedy this, operate the appliance at a fast rate. Alternatively:-

WHEN THE STOVE IS COLD

open the door and clean the inside face of the glass with a damp cloth or with glass cleaner (available from fire stockists). A piece of cloth moistened with vinegar and dipped in wood ash will provide a good soft scourer to remove the soot without scratching the glass.

Do Not Use Abrasive Cleaners

Do Not operate with Broken Glass

Do not operate with the fuel retainer not fitted as this may result in the fire being to close to the door glass

OUTER FINISH

The outer finish of the appliance is a durable high temperature paint. It is best cleaned, by brushing down, with a clean shoe brush. Do not allow moisture to remain on the appliance whilst cold or surface rust may form.
The high temperature paint should not require attention for some time, depending on use. The hotter the fire burns the sooner repainting will be necessary. Aerosol tins of paint are available for complete refurbishing.
Before repainting make sure that the fire is out and the stove is cold.

- Remove the door glass
- Lightly wire brush, or rub with wire wool, the body of the appliance to remove any loose paint or rust.
- Mask or remove items such as brass work.

Re-spray in a well ventilated area, avoid breathing the vapour. Refer to safety instructions on paint cans.

- Leave the appliance for eight hours before lighting a fire.
- Burn slowly for the first four hours, then build up heat slowly to gradually cure paint.

FIRE DOOR ROPE REPLACEMENT

Periodically, visually check over the fire door rope seal for any damage, cuts or tears and any detached sections. It is important to maintain these seals in good condition at all times

The rope gasket can be replaced, using the universal rope kit (Available from Arada), please follow the instructions below :

- Ensure the appliance is cold.
- Lift the door off the appliance and lay onto a flat surface with the rear face upwards.
- Carefully remove the old rope gasket and old adhesive. Take note of the layout of the old rope seal. Ensure no traces of the old adhesive or rust / flaky paint is present, as this will result in a unsound joint.
- Apply the rope adhesive following the instructions on the bottle.
- Press the rope gasket into the channel on the rear of the door casting, following the same layout as the old rope seal. See Fig. 8.
- Just before the final end, cut the rope seal to length and glue into position.
- Allow 30 minutes, before refitting the door to the appliance.

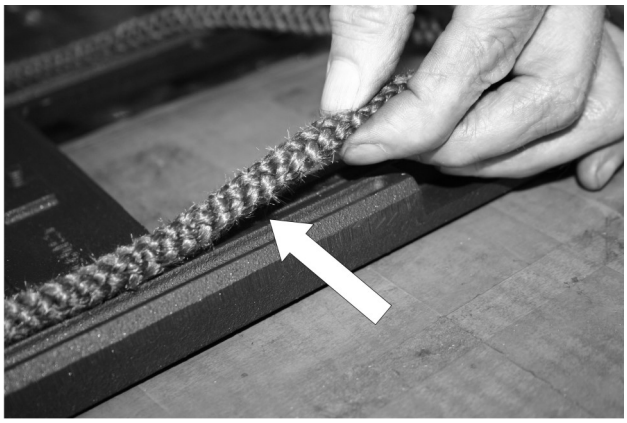


Fig. 8. Rope Replacement

Note: Images fig 8 & 9 for reference only

FIRE DOOR GLASS REPLACEMENT

In the event of the door glass being broken it can easily be replaced. Please follow :

- The door should be lifted off the hinges so that the operation can be carried out on a work bench or similar level surface.
- Unscrew the four screw fixings, securing the glass clips and remove, both clips and fixings.
- Carefully remove any pieces of broken glass, and sealing gasket, wearing suitable gloves as protection. Take note of the position and joint of the rope gasket.
- Replace the glass rope gasket; start at the bottom of the window, centrally, push the adhesive side of the rope into the groove on the rear of the casting. Gradually work your way around until the end of the rope meets. See Fig. 9.
- Re-seat the new glass, ensuring the glass sits flat against the gasket. See Fig. 10.
- Replace the four retaining clips and fixing screws. Do not over tighten the fixings as damage may occur to the glass. See Fig.11.
- Refit the door assembly back onto the stove; carefully lift the door over the hinge and slot into place.

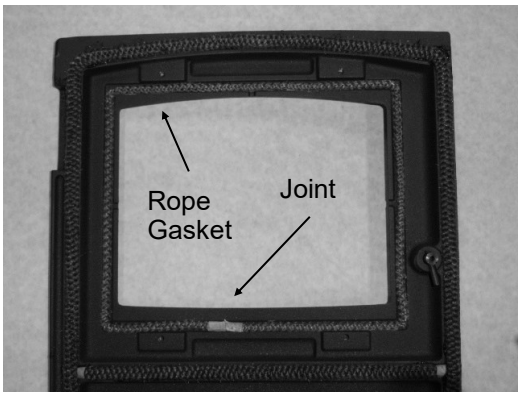


Fig. 9. Lining Up Gasket Rope

Please Note:

This should be carried out when the stove is cold and unlit.

Fig. 10. Positioning The Glass

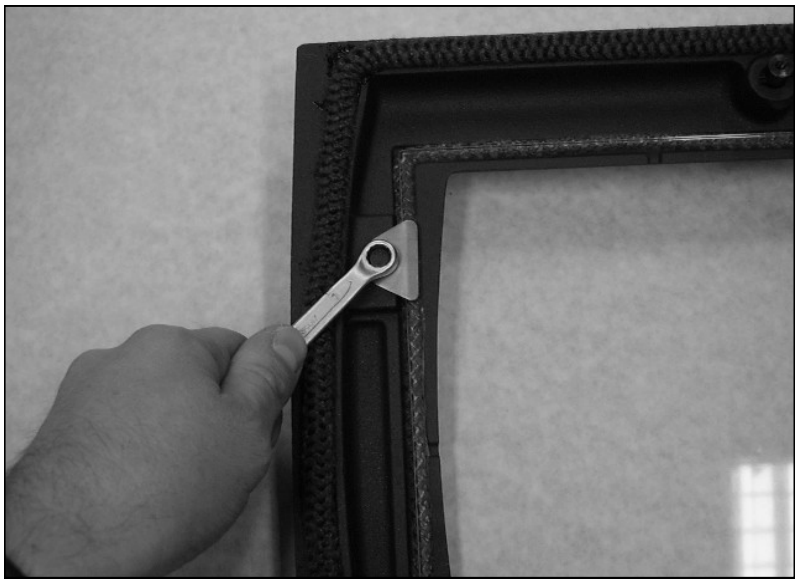


Fig. 11. Tightening The Glass Clip

The images used on pages 24 and 25 illustrating the door rope and glass replacement are generic images and may differ from the stove you have, but the procedure is identical.

Use only genuine Arada 5mm Neocrem Ceramic glass as detailed in the parts list shown on page 33. (Size 484mm wide x 368mm high)

Do not substitute with any other material type or size.

Service Record

Date of Visit	Company	Work Carried Out	Signature

Should you have any questions about your Arada Farringdon stove that have not been covered in this manual please contact your Arada dealer.

Please keep all repair receipts safely.

Please ensure you have this manual available when an engineer visits so they can complete the service record chart.

FUEL :

SAFETY NOTICE

The most efficient use of this appliance is with the fire door closed at all times, apart from re-fuelling (when alight) or cleaning (when cold). NEVER leave the appliance unattended for an extended length of time with the door open.

WOOD— Any type of wood is suitable provided it is well seasoned and has a moisture content below 20%. This usually implies that the timber has been suitably stored to allow moisture to evaporate for at least nine months in the case of soft woods, and at least eighteen months in the case of hard wood.

Do not exceed the maximum log length detailed in the technical data table on page 10.

WARNING : wet wood must not be used as this will greatly contribute to the creation of tar and creosote which may, in extreme cases, run down the chimney in liquid form. This will seriously damage both the chimney and the appliance, and increase the risk of a chimney fire.

FUEL STORAGE:

Bulk wood fuel should be stored so as to be kept dry with a good air circulation.

Fuel kept local to the heater for convenient use must not be stored within installation clearances to combustibles (see pages 18-20) or in the space required for charging or ash removal

Please Note : If you have sticky tar inside the appliance or chimney your wood is 'Green' or too wet.
Please Note : The burn classification for all appliances in these instructions are classed as intermittent use.

Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid or similar liquids to start or 'freshen up' a fire in this heater. Keep all such liquids well away from the heater while in use.

<u>Important:</u>
Never use any type of liquid fuel to start or refresh your stove and keep all such fluids well away from the stove when in use.

NEVER BURN CHARCOAL IN YOUR STOVE. Charcoal can produce high levels of Carbon Monoxide, a *highly toxic* gas.

Do not burn:-

1, Garbage;
2, Lawn clippings or yard waste;
3, Materials containing rubber, including tires;
4, Plastic or Materials containing plastics;
5, Waste petroleum products, paints or paint thinners, or asphalt products;
6, Materials containing asbestos;
7, Construction or demolition debris;
8, Railroad ties or pressure-treated wood;
9, Manure or animal remains;
10,Salt water driftwood or other previously salt water saturated materials;
11, Unseasoned wood; or
12, Paper products, cardboard, plywood, or particleboard. The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater. Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke.

LIGHTING THE STOVE

Prior to lighting the stove for the first time, check with the installer that :

- The chimney is sound and has been swept and is free from obstruction.
- Adequate provision for combustion air has been made, i.e. a permanent vent of at least 550mm sq per KW of rated output above 5KW, is fitted in the room in which the appliance is installed. That Local Building Codes have been followed during installation. See installation section of this manual.
- All firebox liner panels, throat plate and insulation blanket are in place.
- That the chimney draw has been checked and is within specification. With the chimney warm, the draught should be between 1-2 mm water gauge or 0.1 to 0.2 mbar.

ENSURE THAT YOU HAVE READ & UNDERSTOOD THESE INSTRUCTIONS BEFORE LIGHTING THE FIRE.

ALWAYS WEAR SUITABLE PROTECTIVE FIRE GLOVES WHEN REFUELLING YOUR STOVE.

DO NOT OPERATE THE STOVE WITH CRACKED OR BROKEN DOOR GLASS.

The Farringdon 16 is *NOT* designed to burn any type of coal

BURNING WOOD

- Set the fire by using rolled up newspaper and place a layer of dry kindling wood on top of this.
- Use 2 or 3 fire lighters to light the kindling.
- Set the primary air control to the fully open position. See page 30.
- After the kindling has caught light, you may leave the fire door ajar by about 20mm. If required to aid flue draw (Initial lighting on a very cold day for example)
- The flue draw should be established after 5 minutes, and the kindling well burnt down to form an ember bed.
- Carefully load the stove with a little more kindling and well seasoned wood.
  Avoid building up fuel close to the fire door glass.
  Keep fuel behind the fuel retainer well inside the firebox, and then close the fire door
- After 5 minutes, regulate the Primary air control, typically reduce to approximately half way.
- Refuel as necessary

The exact position of the air control will vary according to installation factors and some experimentation will be required to acquire the optimum position for burning

The primary air control (Left) should be used to vary the burn rate. 3/4 open will produce approximately 16 kwh for a 4.5kg load (1 hour burn time to refuelling) dependant on fuel quality and moisture content.

No attempt should be made to alter the air control adjustment range to increase firing for any reason

Do not charge the stove with more fuel than the firebox limit of 6kg of wood

Please Note : The high temperature paint acquires durability by being "cured" during the initial firings of the appliance. It will give off fumes which are non toxic, but certain persons may find they have an unpleasant or irritant effect. Ensure that the surrounding area is well ventilated during this time.

Please Note : To avoid chimney problems your appliance should not be burnt at a reduced burn rate without a period of fast burning.

Smoke Detectors:

It is always advisable to have a smoke detector fitted in the room where the wood stove is installed

Smoke detectors may be affected if small amounts of smoke are released into the room during re-fuelling. To avoid this always open the air supply control to maximum for a few moments prior to opening the fire door to refuel.
This will allow time for sufficient heat to build up within the firebox to clear and smoke still present in the lower portion of the flue/connector pipe.

Note:
Do not operate this stove with the fire door open other than for re-fuelling or de-ashing

Take care to avoid damaging the door glass by excessive slamming of the door, or striking with hard objects.

WARNING : Properly installed, with a suitable flue or chimney, operated and maintained correctly, this appliance will not emit fumes into the dwelling. Occasional fumes when de-ashing and re-fuelling may occur. However, persistent fume emission is potentially dangerous and must be investigated by a registered expert installer.
Stop using the appliance if you smell fumes or see smoke escaping.

If fume emission does persist, the following immediate actions should be taken :

- Open doors and windows to ventilate room.
- Let the fire die or extinguish and safely dispose of fuel from the appliance.
- Check for flue or chimney blockage, and clean if required.

Seek expert advice

OVER FIRING & CHIMNEY FIRES

DO NOT OVER FIRE THIS HEATER. Using flammable liquids or too much wood or firing the stove at maximum for prolonged periods or operating with **fire doors open** may result in over-firing. If the chimney connector or casing glows red the appliance is being over-fired this may result in permanent damage to the stove and a chimney fire. If this occurs :

- **Call the Fire Service**
- **Immediately close all of the air inlets to the appliance, to reduce the air supply to the stove.**
- **Move items of furniture and combustibles away from the stove, to reduce a risk of fire and to allow access for the fire service.**
- **Ensure access to the loft space is available.**
- **Evacuate the property.**
- **An uncontrolled burn or excessive temperature indicates excessive draft.**

The chimney fire may cause structural damage to the chimney. Do not use the appliance until the chimney and connector have been inspected and any damaged parts have been repaired or replaced. This should be done by a registered engineer.

Attempts to achieve heat output rates that exceed heater design specifications described in this manual can result in permanent damage to the heater and to the catalytic.
See page 37 for further details

ASH REMOVAL

The appliance will require ash to be removed periodically but an ash bed of approximately 20mm (3/4”) should be maintained. Ash may be removed with a small shovel whilst the fire is still lit by raking the embers of a low fire to one side of the firebox and carefully removing the ash, then repeating the procedure for the other side. Care must be taken not to risk burning of hands or household objects from falling embers.
The ash pan should be emptied when the level of ash reaches the top of the ash pan. On no account should the ash be allowed to build up to touch the underside of the grate bars, as this will greatly reduce the life span of the grate.
When burning wood it is acceptable to maintain an ash bed on top of the grate of approximately 20mm (3/4”) without any un-due effect upon the grate bars.

Ash Disposal.

Ashes should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a non-combustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled

TO EMPTY THE ASH PAN

The Farringdon stove is supplied with a unique ash pan. To empty or remove the ash pan, open the fire door, wearing a safety glove, draw out the ash pan and unfold the lifting handle of the ash pan and remove from the ash pit chamber.
Empty the ash into a suitable steel container with a tight fitting lid and moved outdoors immediately, Other waste should not be placed in this ash container

Replace the ash pan into the stove and close the fire door.

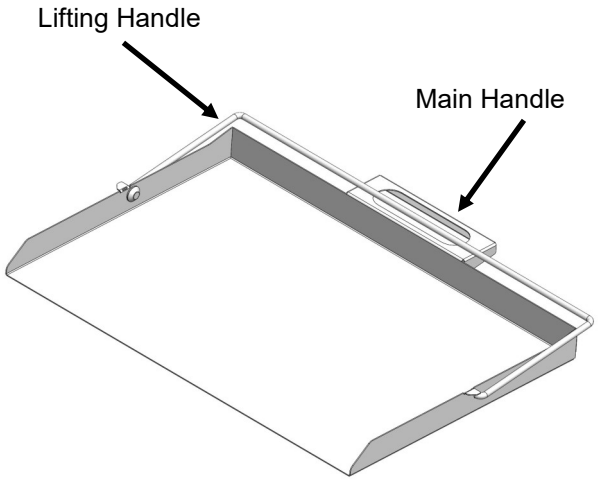


Fig. 12. Farringdon Ash Pan

AIR INLET CONTROL

The Arada Farringdon 16kw stove air inlet control.

The primary air inlet provides the main air supply to the fuel and the ***airwash*** system through the control slider located under fire door on the ***Left*** side. Placed fully to the **LEFT** is Low air, and to the **RIGHT** is High air. The air wash system, so called because its pre-heated high speed air, washes across the inner face of the door glass, keeping it clear. This also provides an over draught to the fuel bed. For combustion of the wood fuel

PRIMARY AIR

Air enters the appliance through the control at the bottom of the fire door. The Arada Farringdon has a single control slider sliding left to right.

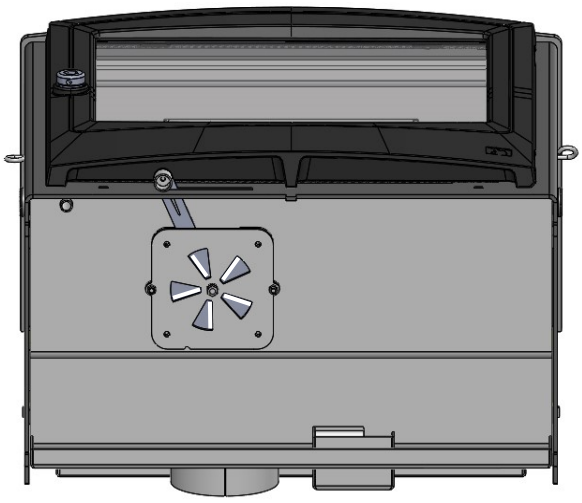
See Fig 13. & 14. below

Note:
The air supply does not fully close intentionally

The exact position of the air control will vary according to installation factors and some experimentation will be required to acquire the optimum position for burning

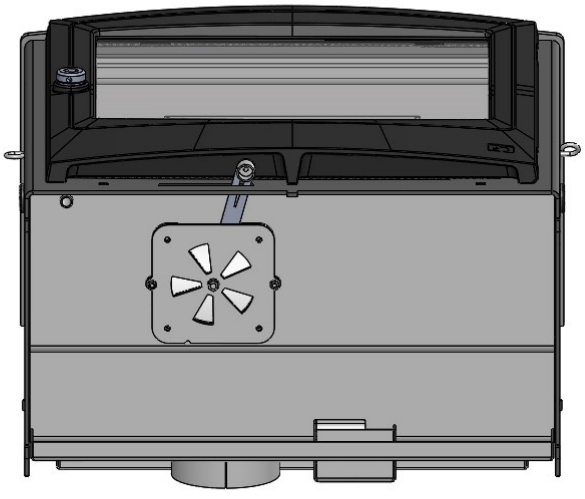
The primary air control (Left) should be used to vary the burn rate. 3/4 open will produce approximately 16 kwh for a 4.5kg load (1 hour burn time to refuelling) dependant on fuel quality and moisture content.

Operation at continuously low burn rates will increase the production of tar and other residues building up in the flue and chimney and should be avoided.



Minimum Closed Position

Fig. 13.



Fully Open Position

Fig. 14.

Catalyst

The Arada Farringdon 16kw stove is fitted with a ceramic catalyst to aid clean burning.

The catalyst should be inspected for damage annually and if necessary replaced. The catalyst part number can be found in the parts list on page 33.

Only replace with a genuine Arada Catalyst
(Details on page 22)

Catalyst Bypass Control.

The control for the catalyst bypass is on the left and right side of the stove in the position shown in Fig 15.

Actuation is as shown on the label on the right hand side. The bypass should be placed in the open position during the lighting stage and prior to opening the door for re-fuelling.

The Catalyst will be active when the thermometer indicates 300°C or above, the bypass door should then be closed. The stove should be run with sufficient combustion air to maintain a temperature above this level to ensure proper catalyst function. During re-fuelling or initial lighting the bypass should remain open until the minimum light-off temperature of 300°c is reach/re-established

The door/riddling tool is used to control the bypass by insertion into the tri-lobed boss.

Always run the stove with the bypass door closed during normal burning phase.

See Fig 17 & 18 for cutaway image of bypass actuation.

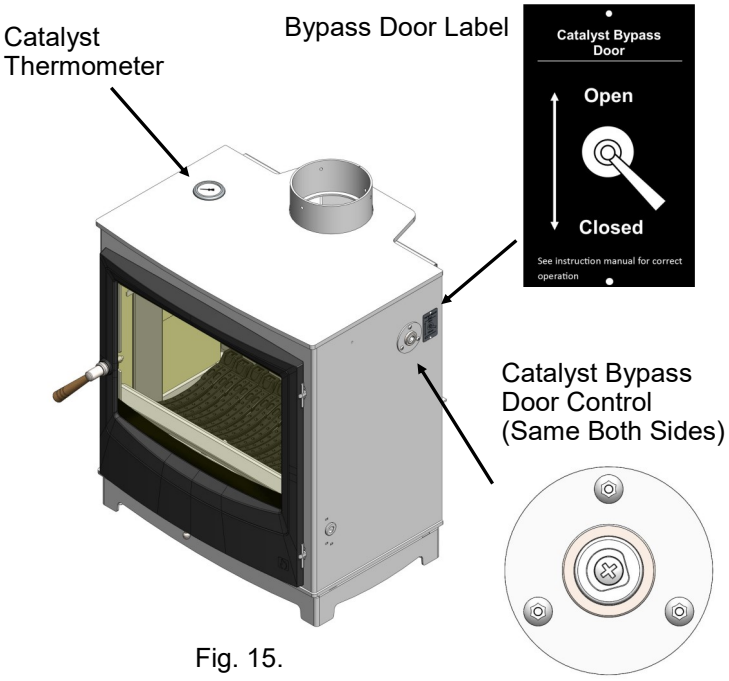


Fig. 15.

Stove thermometer

The stove thermometer indicates when the stove is at the correct temperature to close the by-pass door for normal running, and re-open for re-fueling and/or lighting, See Fig 16.

Fig. 16.

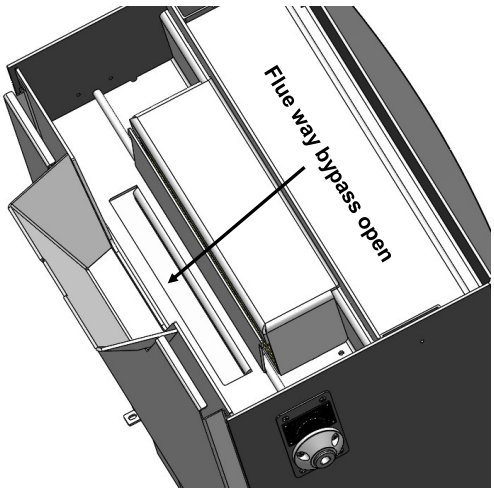


Fig. 17. **Open Position (Cat bypassed)**

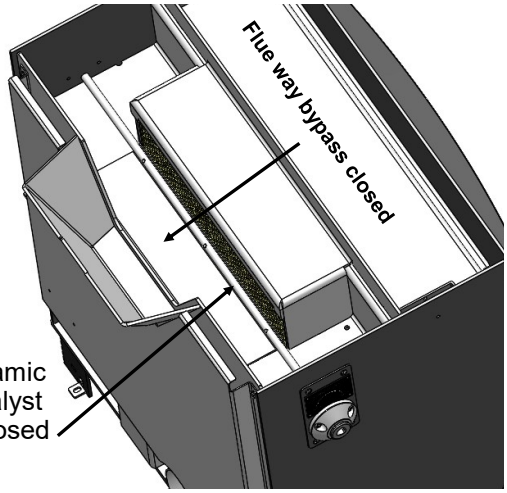


Fig. 18. **Closed Position**

MAIN FIRE DOOR HANDLE

A stove mitten is supplied with your Arada Farringdon stove, this is provided for the operation of the fire door handle whilst the stove is in use. Care must be taken when opening and closing the fire door as any surrounding areas of the stove will be very hot.

WARNING : Never attempt to open the fire door whilst the appliance is in use WITHOUT the use of the stove mitten or suitable gloves, serious injuries may occur.
Caution must be given when re-fuelling the appliance, always keep the stove mitten away from naked flames and sparks.

The fire door handle can also be used to operate the riddle mechanism, sockets located on either side of the stove body. This is to aid ash removal by agitating the ash bed and allowing it to drop into the ash pan below.

Fig. 19.

Fire Door Handle (Oak cladding)

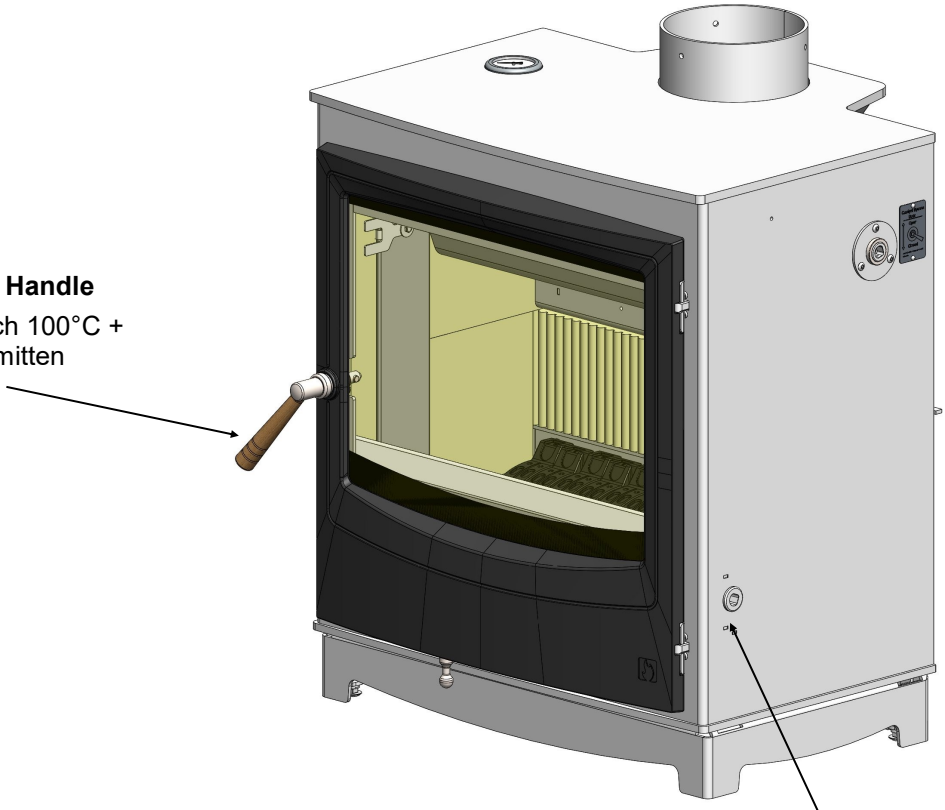
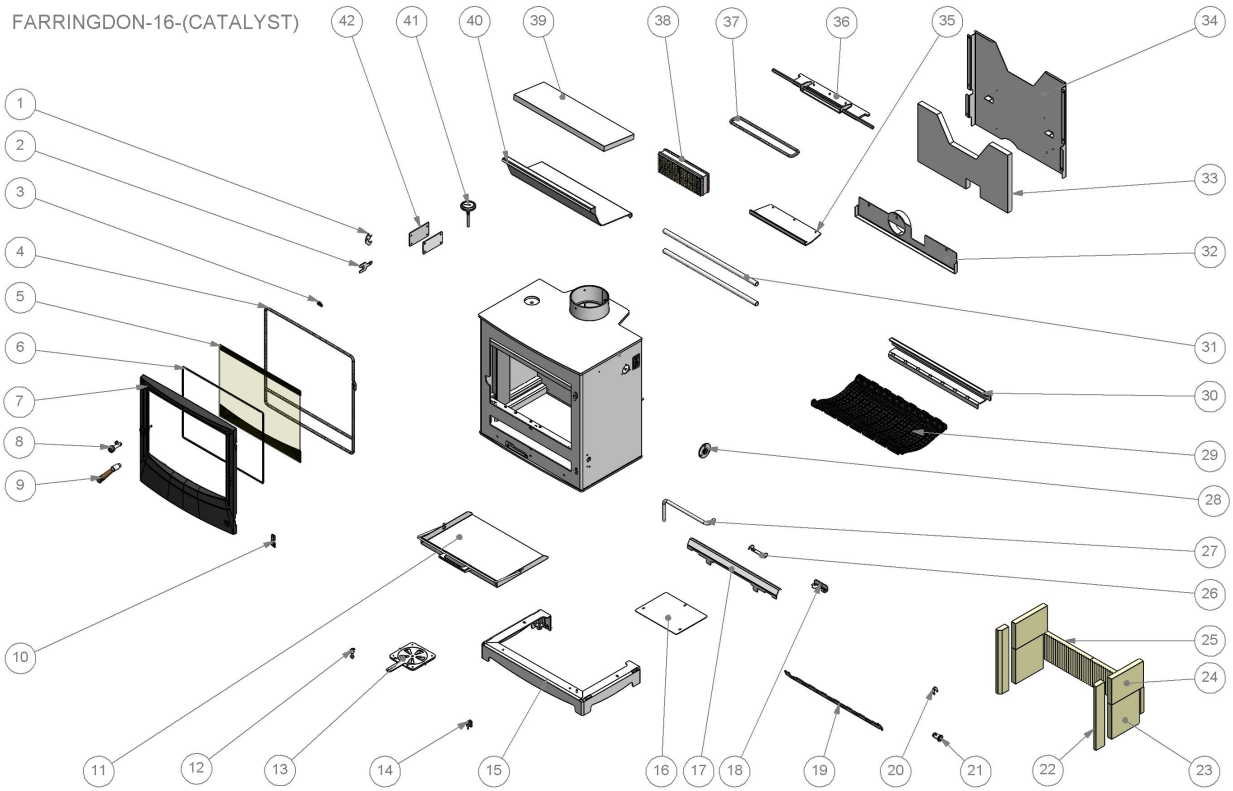


Fig. 20.



No.	Description	Part Number
1	Airwash Tube Clamp	AFS3655
2	Liner Fastener	AFS4452
3	Glass Clips	AFS1010
4	Rope Kit	ARA019
5	Glass Kit	AFS4130
6	Gasket & Glass Clips	AFS1361
7	Complete Fire Door	AFS4453-(xxxx)
8	Handle Boss	AFS4475
9	Handle Assembly	AFS4476
10	Hinge Catch Plate	AFS3865
11	Ash Pan	AFS4454
12	Control Knob	AFS3860
13	Air Slider Assembly	AFS4190
14	Body Hinge	AFS3690
15	Farringdon Feet	AFS4455-(xxxx)
16	Base Air Cover	AFS4185
17	Fuel Retainer	AFS4456-(xxxx)
18	Pilot Tube End Bracket	AFS3725
19	Comb	AFS4457
20	Comb Lock	AFS3855
21	Comb Extension	AFS4005
22	Liner 330x52x25	AFS4459
23	Liner 178x167x25	AFS4461

No.	Description	Part Number
24	Liner 196x135x25	AFS4460
25	Liner 300x132x25 Fluted	AFS4458
26	Pilot Tube Clamp	AFS3720
27	Pilot Tube	AFS4462
28	Gland Plate & Bypass Lever	AFS4463
29	Flexi Grate Bar Medium	AFS2025
30	Grate Bar Support	AFS4465
31	Air Wash Tube	AFS4471
32	Direct Air Adaptor	AFS4466-(xxxx)
33	Heatshield Insulation	AFS4467
34	Heatshield	AFS4468
35	Catalyst Door	AFS4469
36	Bypass Damper Assembly	AFS4470
37	Bypass Door Rope (Rope Kit 3)	ARA019
38	Catalyst Farringdon 16	CatFAR16.01
39	Throat Plate Insulation	AFS4472
40	Throat Plate	AFS4473
41	Catalytic Thermometer	AFS4464
42	Access Hatch & Seal	AFS4474-(xxxx)

Note : (xxxx) Denotes Colour Option

GUARANTEE

Arada Stoves – MANUFACTURER'S LIMITED WARRANTY

Effective 1st January 2017

The warranty policy applies to wood-burning products identified by the Arada and Aarrow trade names only.

Arada Stoves warrants that each stove body will be free of material defect for a period of 10-years from the date of original purchase. If a product is proved to contain a defective component, Arada Stoves will, at its sole discretion authorise repair or replace the defective part at Arada Stoves expense. Arada Stoves will not be responsible for any associated costs incurred by the owner as a result of loss of use.

The stove must have been purchased from an authorised Arada Distributor or Dealer. All products or component parts for which a warranty claim is being made must be returned (at the owners cost) to an authorised Arada distributor or dealer for inspection. If upon inspection, the damage is found to be the fault of the manufacturer, Arada Stoves will either repair the defective part or replace the defective part free of charge and send it to the authorised distributor or dealer.

This 10-year limited warranty is non-transferable and is extended only to, and is solely for the benefit of the original purchaser of the stove. Please retain your dated sales receipt as proof of purchase.

This limited 10-year limited warranty covers repair or replacement of defective body parts ONLY; it does not cover any associated labour or transport costs.

EXCLUSIONS AND LIMITATIONS

This 10-year limited warranty does not cover the following:

1. No warranty is extended to internal consumable parts, such as (but not limited to) baffle plates, baffle assemblies, grate-bars, fuel retainers, grate assemblies, firebricks/vermiculite liners, glass panels, ash pans, and sealing materials such as sealing rope. It is expected that such parts will be exposed to normal wear and tear and will require replacement from time to time.

2. Damage as a result of poor installation and usage other than as described in Arada's installation and operation instructions or if the installation does not conform to local building and fire and safety codes.

3. Handle components or assemblies.

4. Damage caused by over-firing or over-heating (as described in the operation manual). Warping and a red-oxide colouring will demonstrate the over- heating of internal parts; body paint which has turned dusty white is also indicative of such use.

5. Defects or faults caused by local conditions such as draft problems and chimney defects.

6. Damage caused by the use of the wrong fuel type.

7. Arada stoves modified by the user or any companies other than Arada are not covered under this guaranteed

8. Costs relating to the removal, repair or re-installation.

9. Parts supplied by any manufacturer other than Arada.

10. Catalyst element (Cat FAR16 01) limited 5yr warranty against thermal degradation and disintegration.

Arada Stoves – MANUFACTURER'S LIMITED WARRANTY Cont:-

11. Damage caused by modifications, inappropriate use or repair

12. Damage incurred while the stove is in transit; this should be claimed against the shipper or freight carrier. Contact the authorised dealer from whom you have purchased your stove. (Do not operate the appliance as this may negate the ability to process the claim with the carrier)

13. Any Damage caused by not following the servicing and maintenance schedule as set out in the operation manual.

Limited 1-year warranty:

• The stove must be installed in precise accordance with the official Arada instruction and operating manual and local building codes and fire and safety regulations.

• Repaired or replaced products are covered only for the remainder of the original warranty period.

Glass is warranted against damage resulting from thermal shock only, for a 12 month period from date of purchase.

In no event shall Arada Stoves be liable for incidental or consequential damages, injury to persons, property, or any other consequential loss.
Some States do not allow the disclaimer or limitation of damages so you should consult the laws of your State to determine if this limitation applies to you.

DISCLAIMER OF IMPLIED WARRANTIES

The foregoing limited warranty is exclusive and in lieu of all other warranties, guarantees, agreements and similar obligations of manufacturer or seller. Arada Stoves hereby disclaims all warranties implied by state law, including the implied warranties of merchantability and fitness for a particular purpose.

Some States do not allow implied warranties to be disclaimed. In that event, the implied warranties that cannot be disclaimed are hereby limited to the shortest duration allowed by the applicable state law. This warranty gives you specific legal rights, and you may also have other rights by state law, which vary from State to State.

If you believe your Arada Stove is defective you should return the defective part/stove at your expense together with the original proof of purchase and stove serial number to the place of purchase. If upon inspection the product is deemed to have a manufacturing defect, an official warranty claim will be processed on your behalf.

Fuel:

The Farringdon 16 is suitable for **wood burning** only Use any untreated well seasoned wood with a moisture content below 20%

Combustible:

Le Farringdon 16 est conçu pour ne brûler que du bois. Utiliser du bois non-traité et séché avec un pourcentage d'humidité inférieur à 20%.

Never burn:-
Any type of coal, charcoal, liquid fuels, garbage plastic of any other household waste
Further details can be seen on page 27.

Ne jamais utiliser :
Tous types de charbons, combustibles liquides, détritus, plastique ou tous autres déchets ménagers.
Plus d'explications en page 27.

Combustion air control :

Optimum setting are as follows..
The primary air control (on the left below the door) should be used to vary the burn rate. 3/4 open will produce approximately 16 kwh for a 4.5kg load (1 hour burn time to refuelling) dependant on fuel quality and moisture content.

Contrôle de l'air pour la combustion :

Les paramètres optimaux sont les suivants:
Le contrôle de l'air primaire (sous la porte, à gauche) est utilisé pour faire varier le taux de combustion. Si l'arrivée d'air est ouverte aux 3/4, le poêle produira environ 16 kwh pour un chargement de 4.5Kg de bois (pendant une heure jusqu'à rechargement), selon la qualité du combustible et sa teneur en humidité.

Catalyst Combustor:

The Farringdon 16 combustor part number is **CatFAR16.01** only replace with a genuine Arada replacement combustor. This is available from your local Arada agent/stove supplier, information and address details can be found on our web site as follows: **www.aradastoves.com**

Chambre de combustion catalytique :

La chambre de combustion catalytique du Farringdon 16 porte le numéro de pièce de rechange **CatFAR16.01**. Utilisez seulement une pièce de rechange authentique Arada, disponible chez votre revendeur agrée. Adresses et détails sont disponibles sur www.aradastoves.com.

Checking your combustor:

Inspect you combustor before each heating season Light grey ash and darker granular material will gradually build on the combustor surface and should be removed along with any sooty deposits. This should be done using a clean paint brush and vacuum cleaner. If any cells are block clean them through with a cotton swab or pipe cleaner.
Do not scrap the surface of the combustor with a hard scraper or knife as this may cause damage.

Vérifications de la chambre de combustion :

Inspectez votre chambre de combustion avant chaque saison de chauffage. De la suie, de la cendre gris-clair et de la matière granuleuse se déposent graduellement sur la surface de la chambre de combustion et doivent être retirés en utilisant un pinceau propre et un aspirateur. Si des alvéoles sont bouchées, nettoyez-les avec un coton-tige ou un cure-pipe. Ne raclez pas la surface de la chambre de combustion avec un objet dur ou un couteau, cela pourrait l'endommager.

Cont.:-

Replacement:
If the stove is operated in accordance with the instructions within this manual you combustor should last 5 to 6 years, (or approximately 12000 hrs of burn time)

The following symptoms would indicate it's time to renew the combustor:-

Decreased heat output for known fuel load and air settings

Sluggish draw from your chimney, (other causes - - investigated and ruled out)

Increased chimney smoke, (other causes - - investigated and ruled out)

The procedure for removing and refitting the combustor are found on page 21 of this manual.

If the combustor is found to be completely blocked with creosote or in other ways damaged and has to be replaced, **Do not operate the stove without a new catalyst fitted.**

Warning:

BURN UNTREATED WOOD ONLY. OTHER MATERIALS SUCH AS WOOD WITH PRESERVATIVES OR PAINT COATINGS, METAL FOILS, ANY TYPE OF COAL, PLASTIC, GARBAGE, SULPHUR OR OIL MAY DAMAGE THE CATALYST AND REQUIRE IST REPLACEMENT.

Remplacement :
Si le poêle est utilisé conformément aux instructions dans cette notice, votre chambre de combustion doit pouvoir être utilisée pendant 5 ou 6 ans.
(ou approximativement 12000hrs de combustion)

Les symptômes suivants peuvent indiquer qu'il est temps de remplacer votre chambre de combustion :

Production de chaleur réduite pour une quantité de combustible et un réglage de l'air connus.

Tirage paresseux du conduit (autre raison recherchée et exclue)

Production accrue de fumée par la cheminée (autre raison recherchée et exclue)

La procédure pour retirer et remplacer la chambre de combustion se trouve en page 21 de cette notice.

Si la chambre de combustion se trouve complètement bouchée par la créosote ou endommagée et qu'elle doit être remplacée, **N'utilisez pas le poêle sans qu'un nouveau catalyseur soit installé.**

Attention :

NE BRÛLER QUE DU BOIS NON-TRAITÉ. TOUT AUTRE MATÉRIAU COMME LE BOIS RECOUVERT DE PEINTURE OU CONTENANT DES CONSERVATEURS, LES EMBALLAGES MÉTALLIQUES, TOUS TYPES DE CHARBON, PLASTIQUE, DÉTRITUS, SOUFRE OU PÉTROLE PEUVENT ENDOMMAGER LE CATALYSEUR ET NÉCESSITER SON REMPLACEMENT.

CATALYST ADDITIONAL INFORMATION

It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions.

Following is a list of items that should be checked on a periodic basis:
Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Actual removal of the combustor is not recommended unless more detailed inspection is warranted because of decreased performance. If any of these conditions exists, refer to installation section on the catalyst on page 21 of this manual.
This catalytic heater is equipped with a temperature probe to monitor catalyst operation (see page 32).

Properly functioning combustors typically maintain temperatures in excess of 500 °F (260 °C), and often reach temperatures in excess of 1,000 °F ,(540 °C).

You can get an indication of whether the catalyst is working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalyst light-off has been achieved, to the amount of smoke leaving the chimney when the smoke is not routed through the combustor (bypass mode).

Step 1, Light stove in accordance with instructions on page 28

Step 2, With smoke routed through the catalyst, go outside and observe the emissions leaving the chimney.

Step 3, Engage the bypass mechanism and again observe the emissions leaving the chimney. Significantly more smoke will be seen when the exhaust is not routed through the combustor (bypass mode).

Inspection is recommended at least 3 times during the heating season to ensure the catalyst is in good order. Signs of cracking or blocking of the catalyst will require its replacement, further information can be found on page 36 of this manual.

Details on checking and replacing can be found on pages 26 and 33 of this manual, pay close attention to the use of the bypass door described in detail on page 31 of this manual.

Final Factory Check list

Stove Model ……..……

Serial No. ……

Quality / Finish	
Grate bars (14)	
Fuel Retainer	
Firebox Liners (8)	
Throat Plate	
Throat Plate Insulation Blanket	
Door / Riddle Handle	
Ash Pan	
Operating & Installation Manual	
Stove Mittens (2)	
Ceramic Catalyst (1 off fitted)	

I've checked it and its O.K !

Assembled By…….

Checked by……..

Date of Purchase……..

Name and Address of Supplier……...

……..

……..

Arada Ltd
The Fire Works
Weycroft Avenue
Axminster
Devon
EX13 5HU
United Kingdom
Tel: +44(0)1297 632050 www.aradastoves.com

CONTACT YOUR LOCAL BUILDING OFFICIAL ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA
CONTACTER VOTRE RESPONSABLE D'INSTALLATION LOCAL POUR CONNAITRE LES RESTRICTIONS ET INSPECTIONS S INSTALLATIONS DANS VOTRE REGION

F17-129

Listed Room Heater. Wood Fuel type, Poêle à bois homologué

Not suitable for use in a Mobile Home

Ne pas utiliser dans les maisons mobiles

Manufactured by, Fabriqué par Arada Ltd
Axminster, Devon
United Kingdom EX13 5HU

Serial #, No. de série: -

Model Name, Modèle: Farringdon 16 Catalyst Stove

Tested To, Mis à l'épreuve selon la norme:-
UL1482-11, ULC S627-00

WARNINGS - ATTENTION

Do **NOT** burn with the grate system removed
Ne pas utiliser sans la grille

Do **NOT** overfire, If the chimney connector glows you are overfiring. (See Manual)
Ne pas surchauffer. Si le collet de la cheminée devient rouge. Le poêle surchauffe (Voir notice d'utilisation)

Do **NOT** obstruct the space under the heater
Ne Rien entreposer sous le poêle

Do **NOT** connect this unit to a chimney serving another appliance
Ne pas brancher cet appareil sur une cheminée servant à un autre appareil

Do **NOT** burn fuel **OTHER THAN WOOD** as this will damage the catalyst and will render it inactive
Ne pas brûler d'autre combustible que du bois car cela endommagerait le catalyseur et le rendrait inactif.
The Combustor is fragile and must be handled carefully.
L'ensemble comprenant le catalyseur est fragile et doit être manipulé avec soin.

Replacement catalyst part No. **CatFAR16.01**
Pièce de rechange pour le catalyseur No. **CatFAR16.01**
This stove is only to be operated with the door **CLOSED**
Le poêle doit être utilisé porte **FERMEE**

Caution - Attention:

THE STOVE IS VERY HOT DURING OPERATION. DO NOT TOUCH, KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT WITH SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS.

LE POELE EST TRES CHAUD PENDANT L'UTILISATION. NE PAS TOUCHER, GARDER LES ENFANTS, TISSUS ET MEUBLES A DISTANCE. LE CONTACT AVEC LA PEAU CAUSE BRULURES. VOIR LA PLAQUE SIGNALETIQUE ET LES INSTRUCTIONS.

*** PREVENT HOUSE FIRES* * EVITER LES INCENDIES***

Install and use only in accordance with manufacturers installation instructions and your local building codes
Installer et utiliser seulement conformément aux instructions du fabricant et aux normes d'installation dans votre région

Caution: Special methods are required when passing chimney through a wall or ceiling, refer to local building codes. Do not connect this stove to a chimney serving another appliance.
Attention: Des procédés spéciaux doivent être employés pour passer un conduit de cheminée au travers de murs ou de plafonds. Référez-vous aux normes d'installation de votre région. Ne pas brancher cet appareil sur une cheminée servant à un autre appareil.

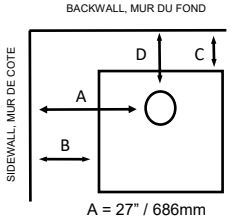
Note: Replace glass only with 5mm minimum Ceramic IR or Neoceram IR glass
Remarque: Remplacer la vitre seulement avec un verre Ceramic IR ou Neoceram IR de 5mm d'épaisseur

Warning: This unit is not suitable for use in a Mobile Home
Attention: Ne pas utiliser dans les maisons mobiles

Inspect and clean the chimney frequently.
Under certain conditions of use, creosote buildup can occur RAPIDLY.

Inspecter et nettoyer la cheminée régulièrement. Dans certaines conditions d'utilisation , la créosote peut s'accumuler rapidement

Minimum Clearance to Combustible Materials*, Dégagement minimum aux matériaux combustibles*



A = 27" / 686mm
B = 18" / 457mm
C = 17" / 432mm
D = 14" / 356mm

When installed on a combustible floor, Non-combustible floor protection is required to cover the area beneath the stove, and extend at least 18" (458mm) to the front and 8" (203mm) to the sides and back.

Si le poêle est installé sur un sol combustible, alors un protège plancher incombustible doit être utilisé pour couvrir la surface sous le poêle et doit s'étendre au moins 18" (458mm) à l'avant et 8" (203mm) sur les cotés et a l'arriere.

VENT REQUIREMENTS:
6" (150mm) diameter, single wall,
Minimum 24 MSG blue steel connector with Listed factory-built Type HT chimney or masonry chimney.

* Refer to the Installation manual for additional clearance information, Installation instructions and Operating instructions.

Se référer à la notice d'utilisation pour des informations complémentaires sur les dégagaments, les instructions pour l'installation et l'utilisation.

CARACTERISTIQUES POUR LES CONDUITS
Raccord en acier bleu minimum 24MSG de 6" (150mm) paroi simple, avec une cheminée en acier fabriqué en usine homologué de type HT ou une cheminée de maçonnerie.

Minimum Clearance to Combustible Materials*, Dégagement minimum aux matériaux combustibles*

A = 25" / 635mm
B = 16" / 406mm
C = 9" / 229mm
D = 6" / 152mm

With optional **REAR HEAT SHIELD & DOUBLE WALLED FLUE PIPE** fitted. Please consult instruction manual for further installation instructions.

Avec **BOUCLIER THERMIQUE ARRIERE** en option et **TUYAU DE FUMEE A DOUBLE** paroi. Veuillez consulter le manual d'instructions pour d'autres instructions d'installations.

DO NOT connect this unit to a chimney serving another appliance.
NE PAS raccorder cet appareil à une cheminée desservant un autre appareil.

ARADA
DEVON

Manufactured by, Fabrique par Arada Ltd
Axminster, Devon
United Kingdom EX13 5HU

Serial #, No. de série: -

Model Name, Modèle: Farringdon 16 Catalyst Stove

Tested To, Mis à l'épreuve selon la norme:-
UL1482-11, ULC S627-00

U.S ENVIROMENTAL PROTECTION AGENCY

Certified to comply with 2020 particulate emission standards using crib wood per EPA Method 28R at 1.5 g/hr.

This wood heater needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's

manual.''

NOTE : The performance of the catalytic device fitted into this stove or its durability has not been evaluated as part of the EPA certification.

Homologue par la **U.S ENVIROMENTAL PROTECTION AGENCY** pour les emissions de particules par les appareils de chaffage au bois a partir de 2020.

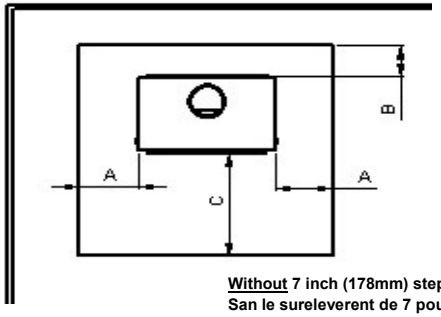
Cet appareil de chaffage au bois doit etre repare regulierement pour assurer son bon fonctionnement. Consulter la notice du fabricant pour plus d'information. Il est contraine aux lois federales d'utillser ce poele en ne tenant pas compte des instructions donnees dans cette notice.

REMARQUE : Les performances du catalyeur installe dans ce poele ou sa durabillite n'ount pas ete testes lors de la certification EPA.

Floor Protection material R Values—Valeur R du materiau de la plaque de protection

Thermal protection of R Value 1.49 is required 16 inches (406mm) in front of the stove when installed directly onto the floor or a step lower than 7 inches (178mm) See diagrams below.

Si le poele est installe directement sur la plaque de protection ou sureleve de la plaque de protection de moins de 7 pouces, alors ia valeur de la re-sistance thermique de cette plaque doit etre au moins egale a 1.49, et cette plaque doit depasser d'au moins 16 pouces (406mm) a l'avant du poele.

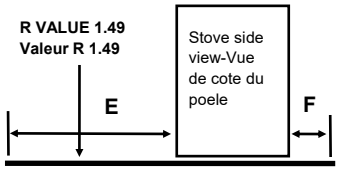


A	B	C (USA)	D (Canada)
203mm	203mm	406mm	458mm
8ins.	8ins.	16ins.	18ins.

Without 7 inch (178mm) step
San le sureleverent de 7 pouces (178mm)

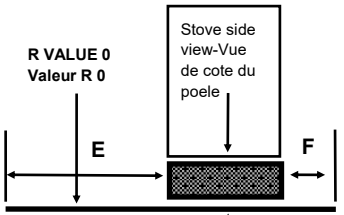
E	F
406mm	203mm
16ins.	8ins.

R VALUE 1.49
Valeur R 1.49



With 7 inch (178mm) Step
Avec le sureleverent de 7 pouces (178mm)

R VALUE 0
Valeur R 0



7 inch (178mm) Step
Sureleverent de 7 pouces (178mm)

U.S. ENVIROMENTAL PROTECTION AGENCY
Certified to comply with UL1482-11, ULC S627-00, 2020 particulate emissions standards

AGENCE U.S. POUR LA PROTECTION DE L'ENVIRONNEMENT
Certifié conforme à UL1482-11, ULC S627-00, 2020 norme d'émission de particules

Date of Manufacture, Date de Fabrication

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

DO NOT REMOVE THIS LABEL, NE PAS RETIRER CETTE PLAQUE SIGNALETIQUE

Made in England, Fabriqué en Angleterre

Appendix C:

Equipment Calibration Records

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Dirigo Laboratories
11785 SE Hwy 212, Ste 305
Clackamas, OR 97015

Report Number: DIRI01A05026161221

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Rice Lake	IQ+355E-2A x 100(	A05026	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	1	QC033	12/21/16	6/27/16	6/2017

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 250 Tol: 1	Test Wt: HB44 Tol: HB44	Test Wt: 100 Tol: 1	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 16.9°C
As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	999.8	999.8	0.5
700	699.8	699.8	0.5
500	500.0	500.0	0.5
300	300.0	300.0	0.5
100	100.0	100.0	0.5
50	50.0	50.0	0.5

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	11/4/15	11/2017	20152112

Permanent Information Concerning this Equipment:
2000lbs platform. Has a custom pan.

Comments/Information Concerning this Calibration

Report prepared/reviewed by: N.KILMER **Date:** 12.21.16

Technician: N.Kilmer
Signature:

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

DICK MUNNS COMPANY
LIQUID & GAS FLOW CALIBRATION

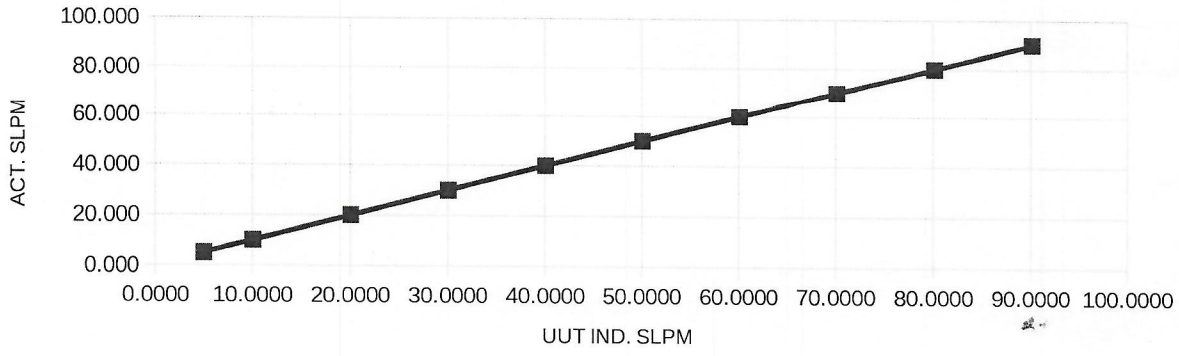
ISO 17025 IAS ACCREDITED
CL-122

CERTIFICATE OF CALIBRATION

CUSTOMER:	**DIRIGO LABORATORIES INC.** CLACKAMAS OR	**CALIBRATION DATE:**	02/04/16
PO NUMBER:	1009	**CALIBRATION DUE:**	02/04/17
INST. MANUFACTURER:	APEX	**PROCEDURE:**	NAVAIR 17-20MG-02
INST. DESCRIPTION:	DIGITAL DGM STANDARD	**CALIBRATION FLUID:**	AIR @ 14.7 PSIA 70 F
MODEL NUMBER:	SK25DA	**STANDARD(S) USED:**	A4, A24 DUE 06-2016
SERIAL NUMBER:	1101001	**NIST TRACE #' S:**	1331545884, 1390386562, 1424683640
RATED UNCERTAINTY:	+/- .5 % RD.	**AMBIENT CONDITIONS:**	769 mm HGA 34 % RH 68 F
UNCERTAINTY GIVEN:	TOTAL measurement uncertainty: +/- .190 % RD. K=2	**CERTIFICATE FILE #:**	449362.16

NOTES: AS RECEIVED/AS LEFT WITHIN SPECS. REFERENCE CONDITIONS ARE: 760 mm HGA 70 F

TEST POINT NUMBER	UUT INDICATED SLPM	DM.STD. ACTUAL SLPM	CORRECTION SLPM	K FACTOR
1	5.0128	5.008	0.99905	60.057
2	10.0236	9.997	0.99735	60.159
3	20.0431	20.003	0.99800	60.120
4	30.0586	30.013	0.99848	60.091
5	40.0721	40.009	0.99842	60.095
6	50.0826	49.972	0.99779	60.133
7	60.0911	59.993	0.99837	60.098
8	70.1133	70.012	0.99855	60.087
9	80.1376	80.028	0.99863	60.082
10	90.1653	89.984	0.99799	60.121
		AVERAGE (Y)=	0.99826376	



All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) used and the unit under test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the shown procedure number, in accordance with ISO 10012:2003, ISO 17025:2005, ANSI/NCSL-Z-540.3, and/or MIL-STD-45662A. Test methods: API2530-92 & ASME MFC-3M-1989.

Dick Munns Company • 10572 Calle Lee #130 • Los Alamitos, CA 90720
Phone (714) 827-1215 • Fax (714) 827-0823

Date: 2/4/2016

Approved By:

Calibration Technician: AT

Established 1974

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Dirigo Laboratories
11785 SE Hwy 212, Ste 305
Clackamas, OR 97015

Report Number: DIRI0128095160627

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Scientech	ZSA 210	28095	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/27/16	12/11/15	12/2016

FUNCTIONAL CHECKS

ECCENTRICITY
Test Wt: 100 Tol: 0.0004
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

LINEARITY
Test Wt: 50x4 Tol: 0.0003
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

STANDARD DEVIATION
Test Wt: 100 Tol: 0.0002

1. 100.0000	5. 100.0000	9. 100.0001
2. 100.0003	6. 100.0004	10. 100.0000
3. 99.9997	7. 100.0001	Result
4. 99.9999	8. 100.0002	0.00020

ENVIRONMENTAL CONDITIONS
☐ Good ☑ Fair ☐ Poor
Temperature: 19.2°C

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	200.0129	199.9998	0.00041
100	100.0066	99.9999	0.00041
50	50.0029	50.0000	0.00041
10	10.0003	10.0000	0.00041
1	1.0001	0.9999	0.00041
0.1	0.0995	0.1000	0.00041

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	20kg to 1mg	7133	4/29/16	4/2017	20160940

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:
6/16 External span adjustment completed.

Report prepared/reviewed by: M. Murray **Date:** 6-27-16 **Technician:** N.Kilmer
Signature:

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Established 1974

QUALITY CONTROL SERVICES

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Dirigo Laboratories
11785 SE Hwy 212, Ste 305
Clackamas, OR 97015

Report Number: DIRI0182484A0912013i161221

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Digiweigh	DWP12i 400x.01	82484A0912013i	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	0.01	QC033	12/21/16	6/27/16	6/2017

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 50 Tol: 0.05	Test Wt: HB44 Tol: HB44	Test Wt: 50 Tol: 0.01	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 16.7°C
As-Left: Pass:☐ Fail:☑	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
400	400.04	400.04	0.058
300	300.03	300.03	0.058
200	200.02	200.02	0.058
100	100.00	100.00	0.012
50	50.00	50.00	0.012
20	20.00	20.00	0.012

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	11/4/15	11/2017	20152112

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

Report prepared/reviewed by: N. KILMER **Date:** 12.21.16

Technician: N Kilmer
Signature:

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

Established 1974

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Dirigo Laboratories
11785 SE Hwy 212, Ste 305
Clackamas, OR 97015

Report Number: DIRI0182484A0912013i161221

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Digiweigh	DWP12i 400x.01	82484A0912013i	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	0.01	QC033	12/21/16	6/27/16	6/2017

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 50 Tol: 0.05	Test Wt: HB44 Tol: HB44	Test Wt: 50 Tol: 0.01	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 16.7°C
As-Left: Pass:☐ Fail:☑	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
400	400.04	400.04	0.058
300	300.03	300.03	0.058
200	200.02	200.02	0.058
100	100.00	100.00	0.012
50	50.00	50.00	0.012
20	20.00	20.00	0.012

Established 1974

QUALITY CONTROL SERVICES

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(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 01/15/16
Purchase Order: 1001
Traceable Number: 20152489

Test Item: 20lb and 10lb Individual Grip Handle Weights
Serial No.: Listed in Table

Manufacturer: Unknown

Material	Assumed Density	Range	Tolerance Class
Cast Iron	7.2 g/cm^3	20lb to 10lb	NIST HB 105-1 (F)

Method and Traceability
The procedure used for this calibration is NIST IR 6969 SOP 7 Single Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:
Avoirdupois Working Standards were calibrated: 06/18/2014 Due: 06/18/2016 Standards ID: 34AA
Mass Comparators Used: MET-09, 20 **Tested by:** D. Thompson

Conventional Mass: "The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). "Conventional Value of the Result of Weighing in Air" **(Previously known as "Apparent Mass vs. 8.0g/cm^3).**

Uncertainty Statement: The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor K=2 for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16

Signature David S. Thompson

Established 1974

QUALITY CONTROL SERVICES

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(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 01/15/16
Purchase Order: 1001
Traceable Number: 20152489

Test Item: 20lb and 10lb Individual Grip Handle Weights
Serial No.: Listed in Table

Manufacturer: Unknown

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.448	760.64	44.58

Conventional Mass Value

Nominal Value	As Found pounds	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
20lb #098	19.9995450	-206.4	6.4	910
10lb #097	10.0006510	295.3	5.1	450
10lb #051	10.0003421	155.2	5.1	450

*Correction is the difference between the conventional mass value of a weight and its nominal value.

Comments: These weights were received in good condition and were within NIST Handbook 105-1 Class F tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories.* This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16

Signature David S. Thompson

Established 1974

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A2LA ACCREDITED
CERTIFICATE #1550.01

Report of Calibration

Firm: PFS Teco
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 08/27/18
Submitted By: John Steinert
Traceable Number: 20181772

Test Item: 5 lb Individual Grip Handle Weight
Serial No.: 10744

Manufacturer: Rice Lake

Material	Assumed Density	Range	Tolerance Class
Cast Iron	7.2 g/cm^3	5 lb	ASTM Class 7

Method and Traceability
The procedure used for this calibration is NIST IR 6969 SOP 7 Single Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:
20 kg to 200 g Working Standards Were Calibrated: 03/22/18 Due: 03/31/19 Standards ID: 75388
100 g to 1 mg Working Standards Were Calibrated: 04/04/18 Due: 04/30/19 Standards ID: 723318
Mass Comparators Used: MET-08 **Tested by:** D. Thompson

Conventional Mass: "The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). "Conventional Value of the Result of Weighing in Air" **(Previously known as "Apparent Mass vs. 8.0 g/cm^3).**

Uncertainty Statement: The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor k=2 for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 08/28/18

Signature David S. Thompson

Established 1974

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A2LA ACCREDITED
CERTIFICATE #1550.01

Report of Calibration

Firm: PFS Teco
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 08/27/18
Submitted By: John Steinert
Traceable Number: 20181772

Test Item: 5 lb Individual Grip Handle Weight
Serial No.: 10744

Manufacturer: Rice Lake

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.838	762.06	52.23

Conventional Mass Value

Nominal Value	As Found pounds	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
5 lb	5.0006085	276.0	2.0	760

*Correction is the difference between the conventional mass value of a weight and its nominal value.

Comments: This weight was new from the manufacturer and was within ASTM Class 7 tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories.* This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 08/28/18

Signature David S. Thompson

DIRIGO LABORATORIES INC.

EPA Method 5 Dry Gas Meter Calibration for γ and ΔH@

Average DGM γ factor = **1.007**

Average Meter Orifice ΔH@ = **58.571**

Manufacturer / Model:	XC-60-ED
ID:	Box-A
Serial Number	1902130
Equipment No.:	Dirigo 053
Calibration Date:	9/7/2016
Next Calibration Due:	3/7/2017
Barometric Pressure:	30.15 inHg
Signature/Date:	9/7/16

	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	153.398	157.354	153.013
Standard Ave. Meter Temperature (°F), (Tstd)	76.1	77.3	78.3
DGM Initial Volume (cuft)	0.000	0.000	0.000
DGM Final Volume (cuft)	5.433	5.674	5.594
DGM Average Temperature (°F), (T_{DGM})	89.0	96.2	100.7
Time (min)	35.0	40.0	45.0
Orifice ΔH ("H2O)	2.49	2.03	1.53
Vacuum ("H2O)	0.00	0.00	0.00
Total Volume for Standard DGM (Vstd) (cuft)	5.417	5.557	5.404
Total Volume for DGM (V_{DGM}) (cuft)	5.433	5.674	5.594

Dry Gas Meter γ Factor	1.013	1.007	1.001
γ Factor Deviation From Average	0.006	0.000	0.006
Meter Orifice ΔH@	58.489	58.554	58.670
Orifice ΔH@ Deviation From Average	0.082	0.017	0.099

Standard Meter Data

Date	2/4/2016
γ Factor	0.998
Model	SK25DA
Serial Number	1101001

Pre-Calibration Data

Date	3/8/2016
γ Factor	1.002
ΔH@	58.685
Tolerance (5%)	0.050
Deviation	0.005

Pass

DGM Calibration Data

γ Deviation Tolerance	0.020
Maximum γ Deviation	0.006
ΔH@ Deviation Tolerance	0.200
Maximum dH@ Deviation	0.099

Pass

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. γ = (Vstd x (Std γ factor) x (P_{bar}) x (T_{DGM} + 460) / (V_{DGM} x (Tstd + 460) x (Pbar + (dH / 13.6)))
3. ΔH@ = 0.0319 x ΔH ((((T_{DGM}+ 460) x (Time^2)) / (P_{bar} x (γ factor^2) x (V_{DGM}^2)))

Measurement of uncertainty = +/- 0.14 cfm

DIRIGO LABORATORIES INC.

EPA Method 5 Dry Gas Meter Calibration for γ and ΔH@

Average DGM γ factor = **1.002**

Average Meter Orifice ΔH@ = **59.911**

Manufacturer / Model:	XC-60-ED
ID:	Box B
Serial Number	1902133
Equipment No.:	Dirigo 054
Calibration Date:	9/7/2016
Next Calibration Due:	3/7/2017
Barometric Pressure:	30.15 inHg
Signature/Date:	9/8/16

	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	151.554	154.122	150.749
Standard Ave. Meter Temperature (°F), (Tstd)	79.0	75.2	80.0
DGM Initial Volume (cuft)	0.000	0.000	0.000
DGM Final Volume (cuft)	5.464	5.587	5.505
DGM Average Temperature (°F), (T_{DGM})	97.7	93.6	101.6
Time (min)	35.0	40.0	45.0
Orifice ΔH ("H2O)	2.50	2.00	1.51
Vacuum ("H2O)	0.00	0.00	0.00
Total Volume for Standard DGM (Vstd) (cuft)	5.352	5.443	5.324
Total Volume for DGM (V_{DGM}) (cuft)	5.464	5.587	5.505

Dry Gas Meter γ Factor	1.005	1.001	1.000
γ Factor Deviation From Average	0.003	0.001	0.002
Meter Orifice ΔH@	59.869	59.935	59.930
Orifice ΔH@ Deviation From Average	0.043	0.024	0.019

Standard Meter Data

Date	2/4/2016
γ Factor	0.998
Model	SK25DA
Serial Number	1101001

Pre-Calibration Data

Date	3/8/2016
γ Factor	1.001
ΔH@	59.917
Tolerance (5%)	0.050
Deviation	0.001

Pass

DGM Calibration Data

γ Deviation Tolerance	0.020
Maximum γ Deviation	0.003
ΔH@ Deviation Tolerance	0.200
Maximum dH@ Deviation	0.043

Pass

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. γ = (Vstd x (Std γ factor) x (P_{bar}) x (T_{DGM} + 460) / (V_{DGM} x (Tstd + 460) x (Pbar + (dH / 13.6)))
3. ΔH@ = 0.0319 x ΔH ((((T_{DGM}+ 460) x (Time^2)) / (P_{bar} x (γ factor^2) x (V_{DGM}^2)))

Measurement of uncertainty = +/- 0.14 cfm

DIRIGO LABORATORIES INC.

EPA Method 5 Dry Gas Meter Calibration for γ and ΔH@

Average DGM γ factor = **1.003**

Average Meter Orifice ΔH@ = **32.449**

Manufacturer / Model:	Apex-AK-600
ID:	Ambient Box
Serial Number	810016
Equipment No.:	Dirigo 055
Calibration Date:	8/5/2016
Next Calibration Due:	2/5/2017
Barometric Pressure:	29.92 inHg
Signature/Date:	8/5/16

	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	179.160	160.699	149.637
Standard Ave. Meter Temperature (°F), (Tstd)	77.0	78.0	78.5
DGM Initial Volume (cuft)	0.000	0.000	0.000
DGM Final Volume (cuft)	6.354	5.658	5.231
DGM Average Temperature (°F), (T_{DGM})	80.0	81.0	83.5
Time (min)	30.0	30.0	33.0
Orifice ΔH ("H2O)	2.50	2.00	1.45
Vacuum ("H2O)	0.00	0.00	0.00
Total Volume for Standard DGM (Vstd) (cuft)	6.327	5.675	5.284
Total Volume for DGM (V_{DGM}) (cuft)	6.354	5.658	5.231

Dry Gas Meter γ Factor	0.993	1.002	1.014
γ Factor Deviation From Average	0.010	0.001	0.011
Meter Orifice ΔH@	32.516	32.315	32.517
Orifice ΔH@ Deviation From Average	0.067	0.135	0.067

Standard Meter Data

Date	2/4/2016
γ Factor	0.998
Model	SK25DA
Serial Number	1101001

Pre-Calibration Data

Date	1/9/2016
γ Factor	0.999
ΔH@	30.755
Tolerance (5%)	0.050
Deviation	0.004

Pass

DGM Calibration Data

γ Deviation Tolerance	0.020
Maximum γ Deviation	0.011
ΔH@ Deviation Tolerance	0.200
Maximum dH@ Deviation	0.135

Pass

Calculations:

1. Deviation = |Average value for all runs - current run value|
2. γ = (Vstd x (Std γ factor) x (P_{bar}) x (T_{DGM} + 460) / (V_{DGM} x (Tstd + 460) x (Pbar + (dH / 13.6)))
3. ΔH@ = 0.0319 x ΔH ((((T_{DGM}+ 460) x (Time^2)) / (P_{bar} x (γ factor^2) x (V_{DGM}^2)))

Measurement of uncertainty = +/- 0.14 cfm

PRAXAIR

Praxair
5700 South Alameda Street
Los Angeles, CA 90058
Tel: (323) 585-2154 Fax:(714) 542-6689
PGVPID: F22016

DocNumber: 000091012

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PRAXAIR WHSE VANCOUVER WA
603 SE VICTORY AVE
VANCOUVER WA 986610

Praxair Order Number: 33855113
Customer P. O. Number: 05949702
Customer Reference Number:

Fill Date: 2/25/2016
Part Number: NI CD10CO33E-AS
Lot Number: 109605601
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

Certified Concentration:

Expiration Date:	3/1/2024	NIST Traceable
Cylinder Number:	CC199294	Analytical Uncertainty:
9.91 %	CARBON DIOXIDE	± 0.5 %
2.51 %	CARBON MONOXIDE	± 0.8 %
10.50 %	OXYGEN	± 0.4 %
Balance	NITROGEN	

Certifcation Information: *Certification Date:* 3/1/2016 *Term:* 96 Months *Expiration Date:* 3/1/2024

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

O2 responses have been corrected for CO2 interference.

Analytical Data: *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

1. Component: CARBON DIOXIDE

Requested Concentration: 10 %
Certified Concentration: 9.91 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 2/26/2016

First Analysis Data: **Date:** 3/1/2016

Z:	0	R:	9.87	C:	9.91	Conc:	9.91
R:	9.87	Z:	0	C:	9.91	Conc:	9.91
Z:	0	C:	9.92	R:	9.87	Conc:	9.92

UOM: % **Mean Test Assay:** 9.913 %

Reference Standard Type: GMIS
Ref. Std. Cylinder # : SA17695
Ref. Std. Conc: 9.87%
Ref. Std. Traceable to SRM # : 1674b
SRM Sample # : 7-H-07
SRM Cylinder # : FF10631

Second Analysis Data: **Date:**

Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0

UOM: % **Mean Test Assay:** 0 %

2. Component: CARBON MONOXIDE

Requested Concentration: 2.5 %
Certified Concentration: 2.51 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 2/26/2016

First Analysis Data: **Date:** 3/1/2016

Z:	0	R:	2.01	C:	2.5	Conc:	2.5
R:	2.02	Z:	0	C:	2.51	Conc:	2.51
Z:	0	C:	2.51	R:	2.02	Conc:	2.51

UOM: % **Mean Test Assay:** 2.507 %

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC103175
Ref. Std. Conc: 2.017%
Ref. Std. Traceable to SRM # : 2640a
SRM Sample # : 53-C-38
SRM Cylinder # : CAL013925

Second Analysis Data: **Date:**

Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0

UOM: % **Mean Test Assay:** 0 %

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3. Component: OXYGEN

Requested Concentration:	10.5 %
Certified Concentration:	10.50 %
Instrument Used:	OXYMAT 5E
Analytical Method:	PARAMAGNETIC
Last Multipoint Calibration:	2/26/2016

First Analysis Data:					**Date:**	3/1/2016	
Z:	0	**R:**	20.04	**C:**	10.51	**Conc:**	10.501
R:	20.04	**Z:**	0	**C:**	10.51	**Conc:**	10.501
Z:	0	**C:**	10.51	**R:**	20.06	**Conc:**	10.501
UOM:	%			**Mean Test Assay:**			10.501 %

Analyzed by: King Yu

Reference Standard Type:	GMIS
Ref. Std. Cylinder # :	CC243259
Ref. Std. Conc:	20.03%
Ref. Std. Traceable to SRM # :	2659a
SRM Sample # :	71-E-19
SRM Cylinder # :	FF22331

Second Analysis Data:					**Date:**		
Z:	0	**R:**	0	**C:**	0	**Conc:**	0
R:	0	**Z:**	0	**C:**	0	**Conc:**	0
Z:	0	**C:**	0	**R:**	0	**Conc:**	0
UOM:	%			**Mean Test Assay:**			0 %

Certified by: Jose Vasquez

PRAXAIR

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PGVPID: F22015

DocNumber: 000085245

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PRAXAIR WHSE VANCOUVER WA
603 SE VICTORY AVE
VANCOUVER WA 986610

Praxair Order Number: 32589283
Customer P. O. Number: 05749997
Customer Reference Number:

Fill Date: 10/5/2015
Part Number: NI CD17CO8E-AS
Lot Number: 109527801
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 1290 psig 99 cu. ft.

Certified Concentration:

Expiration Date:		10/9/2023	NIST Traceable
Cylinder Number:		CC246162	Analytical Uncertainty:
16.76	**%**	**CARBON DIOXIDE**	± 0.2 %
4.26	**%**	**CARBON MONOXIDE**	± 0.4 %
17.04	**%**	**OXYGEN**	± 0.2 %
	Balance	**NITROGEN**	

Certifcation Information: *Certification Date:* 10/9/2015 *Term:* 96 Months *Expiration Date:* 10/9/2023

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

O2 resopnses have been corrected for CO2 interference.

Analytical Data: *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

1. Component: CARBON DIOXIDE

Requested Concentration: 17 %
Certified Concentration: 16.76 %
Instrument Used: Horiba VIA-510 S/N 2807014
Analytical Method: NDIR
Last Multipoint Calibration: 9/10/2015

First Analysis Data:						Date:	10/9/2015
Z:	0	R:	19.75	C:	16.71	Conc:	16.738
R:	19.75	Z:	0	C:	16.73	Conc:	16.758
Z:	0	C:	16.75	R:	19.77	Conc:	16.778
UOM:	%			Mean Test Assay:			16.758 %

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC158146
Ref. Std. Conc: 19.79%
Ref. Std. Traceable to SRM # : 2745
SRM Sample # : 9-C-36
SRM Cylinder # : CAL016135

Second Analysis Data:						Date:	
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	%			Mean Test Assay:			0 %

2. Component: CARBON MONOXIDE

Requested Concentration: 4.25 %
Certified Concentration: 4.26 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 10/5/2015

First Analysis Data:						Date:	10/9/2015
Z:	0	R:	3.95	C:	4.26	Conc:	4.264
R:	3.96	Z:	0	C:	4.27	Conc:	4.274
Z:	0	C:	4.25	R:	3.96	Conc:	4.254
UOM:	%			Mean Test Assay:			4.264 %

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC257812
Ref. Std. Conc: 3.96%
Ref. Std. Traceable to SRM # : 2641a
SRM Sample # : 59-C-02
SRM Cylinder # : FF13690

Second Analysis Data:						Date:	
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	%			Mean Test Assay:			0 %

PRAXAIR

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3 . Component: OXYGEN

Requested Concentration:	17 %
Certified Concentration:	17.04 %
Instrument Used:	OXYMAT 5E
Analytical Method:	PARAMAGNETIC
Last Multipoint Calibration:	10/8/2015

First Analysis Data:						**Date:**	10/9/2015
Z:	0	**R:**	20.04	**C:**	17.05	**Conc:**	17.036
R:	20.04	**Z:**	0	**C:**	17.05	**Conc:**	17.036
Z:	0	**C:**	17.05	**R:**	20.06	**Conc:**	17.036
UOM:	%			**Mean Test Assay:**			17.036 %

Reference Standard Type:	GMIS
Ref. Std. Cylinder # :	CC243259
Ref. Std. Conc:	20.03%
Ref. Std. Traceable to SRM # :	2659a
SRM Sample # :	71-E-19
SRM Cylinder # :	FF22331

Second Analysis Data:						**Date:**	
Z:	0	**R:**	0	**C:**	0	**Conc:**	0
R:	0	**Z:**	0	**C:**	0	**Conc:**	0
Z:	0	**C:**	0	**R:**	0	**Conc:**	0
UOM:	%			**Mean Test Assay:**			0 %

Analyzed by: Jacquelyne Fiero

Certified by: Jack Fu