Pacific Energy

Project # 034-S-074-1
Model: TN20 (series B), TN20 Insert (series B), (AKA: True North 20)
Type: Free Standing / Insert
Residential Non-catalytic Wood Fired Heater
January 27, 2017
Revised: 11/12/2021, 12/7/2021

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

Contact:
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Revision History:

11/11/2021: The following revisions were made to the report.

- CO added in g/m - page 12
- Negative filter weight statement- page 17
- Added additional fuel load pictures to body of report-page 28
- Confirmed conditioning data compliant.
- Added firebox volume- page 21
- Added precision statement- page 14
- 1-hour filter pull data added– page 14
- Confirmed minimum chimney height recommendation and warranty in manual.

12/7/2021

- Updated “Process Operation and Description” to include reference to operating procedures that were supplied by the manufacturer.

11/12/2021:

Request for renewal submitted. New Certificate of Conformity Issued by PFS.

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Affidavit:

Dirigo Laboratories, Inc. was contracted by Pacific Energy Fireplace Products Ltd. to provide testing services for the True North 20 (series B) non-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 12/13/2016 and ending on 12/20/2016. 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 E2515-10 *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.

Ben Nelke

Digitally signed by Ben Nelke
DN: cn=Ben Nelke, o, ou, email=Bnelke@dirigolab.com, c=US
Date: 2017.02.01 11:45:26 -08'00'

Ben Nelke, Test Technician

Doug Towne

Digitally signed by Doug Towne
DN: cn=Doug Towne, o=Dirigo, ou=QA/QC, email=dtowne@dirigolab.com, c=US
Date: 2017.02.01 11:39:08 -08'00'

Doug Towne, QA Manager

Introduction:

Pacific Energy Fireplace Products Ltd. of Duncan, BC, contracted with Dirigo Laboratories, Inc. to perform EPA certification testing for their Model True North 20 (series B) non-catalytic wood heater. All testing was performed at Dirigo Laboratories, Inc. Testing was performed by Mr. Ben Nelke and Mr. Gary Nelke, CMfgE.

Notes:

- A 50 hour break-in was performed on the appliance: 37 hours by the manufacturer prior to the test series; and 13 hours during assessment runs at Dirigo Laboratories, Inc.
- Prior to testing, the dilution tunnel was cleaned with a steel brush.
- Run #'s 1, 2, 3, 4 & 5 were performed with the convection blower in operation. Run #6 was the blower confirmation run and was performed with the convection blower off.
- Front filters were changed on sample train A at one hour for all runs.

Wood Heater Identification and Testing:

- Appliance Tested: ***TN20 (series B) Free Standing***
- Serial Number: ***TN20 001***
- Manufacturer: ***Pacific Energy Fireplace Products Ltd.***
- Catalyst: ***No***
- Heat exchange blower: ***Optional***
- Type: ***Wood Stove***
- Style: ***Free Standing***
- Date Received: ***Friday, December 02, 2016***
- Wood Heater Aging: ***November 20 - December 8, 2016***
- Testing Period – Start: ***Tuesday, December 13, 2016*** Finish: ***Tuesday, December 20, 2016***
- 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, Gary Nelke**
- Observers: ***Ken Davis***

Test Procedures and Equipment:

All Sampling and analytical procedures were performed by Ben Nelke and Gary Nelke. All procedures used are directly from EPA Method 28R, ASTM E2780-10 and ASTM E2515-10. 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:

The weighted average emission rate is **1.6 g/hr** with a weighted average efficiency of **72.7%** and an average CO of **1.56 g/min**. The Pacific Energy Fireplace Products Ltd. Model True North 20 (series B) non-catalytic 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: 1.6 (g/hr)

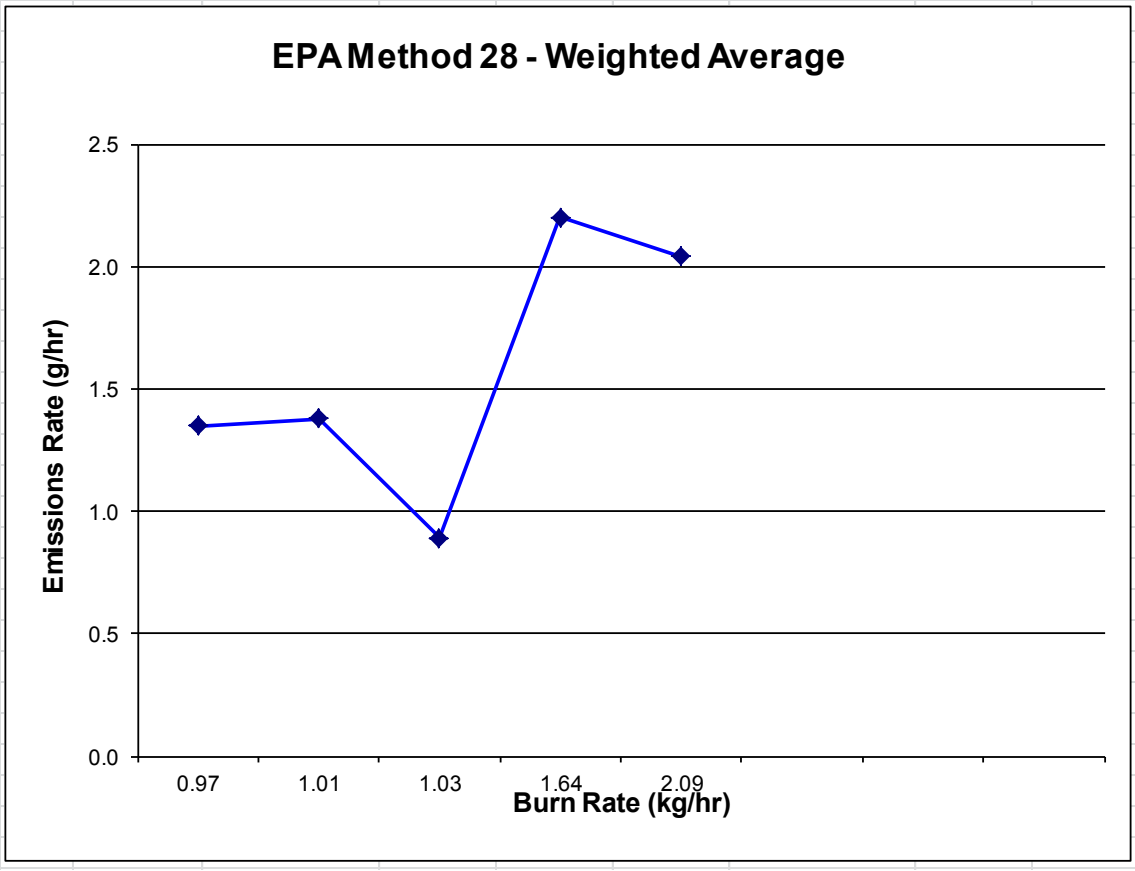
Client:	Pacific Energy
Model:	TN20 (series B)
Tracking No.:	74
Project No.:	034-S-74-1
Test Dates:	12/13/16 - 12/20/16

Burn Rate Category	2	Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.97	Burn Rate (kg/hr-dry)	1.01
Emissions Rate (g/hr)	1.4	Emissions Rate (g/hr)	1.4
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	24.47%	Weighting Factor	3.01%
Run Number	5	Run Number	2
Burn Rate Category	2	Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.03	Burn Rate (kg/hr-dry)	1.64
Emissions Rate (g/hr)	0.9	Emissions Rate (g/hr)	2.2
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	18
Weighting Factor	27.59%	Weighting Factor	33.51%
Run Number	1	Run Number	3
Burn Rate Category	4		
Burn Rate (kg/hr-dry)	2.09		
Emissions Rate (g/hr)	2.0		
Emissions Rate Cap (g/hr)	18		
Weighting Factor	11.43%		
Run Number	4		

EPA Method 28 - Weighted Average

DIRIGO LABORATORIES INC.

Client:	Pacific Energy
Model:	TN20 (series B)
Tracking No.:	74
Project No.:	034-S-74-1
Test Dates:	12/13/16 - 12/20/16



Efficiency:

All efficiency values use the HHV.

DIRIGO LABORATORIES INC.

CSA B415.1-10 Weighted Average

Weighted Average: 72.7 %

Client:	Pacific Energy
Model:	TN20 (series B)
Tracking No.:	74
Project No.:	034-S-74-1
Test Dates:	12/13/16 - 12/20/16

Burn Rate Category	2	Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.97	Burn Rate (kg/hr-dry)	1.01
OA Efficiency %	72.2	OA Efficiency %	72.9
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	24.47%	Weighting Factor	3.01%
Run Number	5	Run Number	2

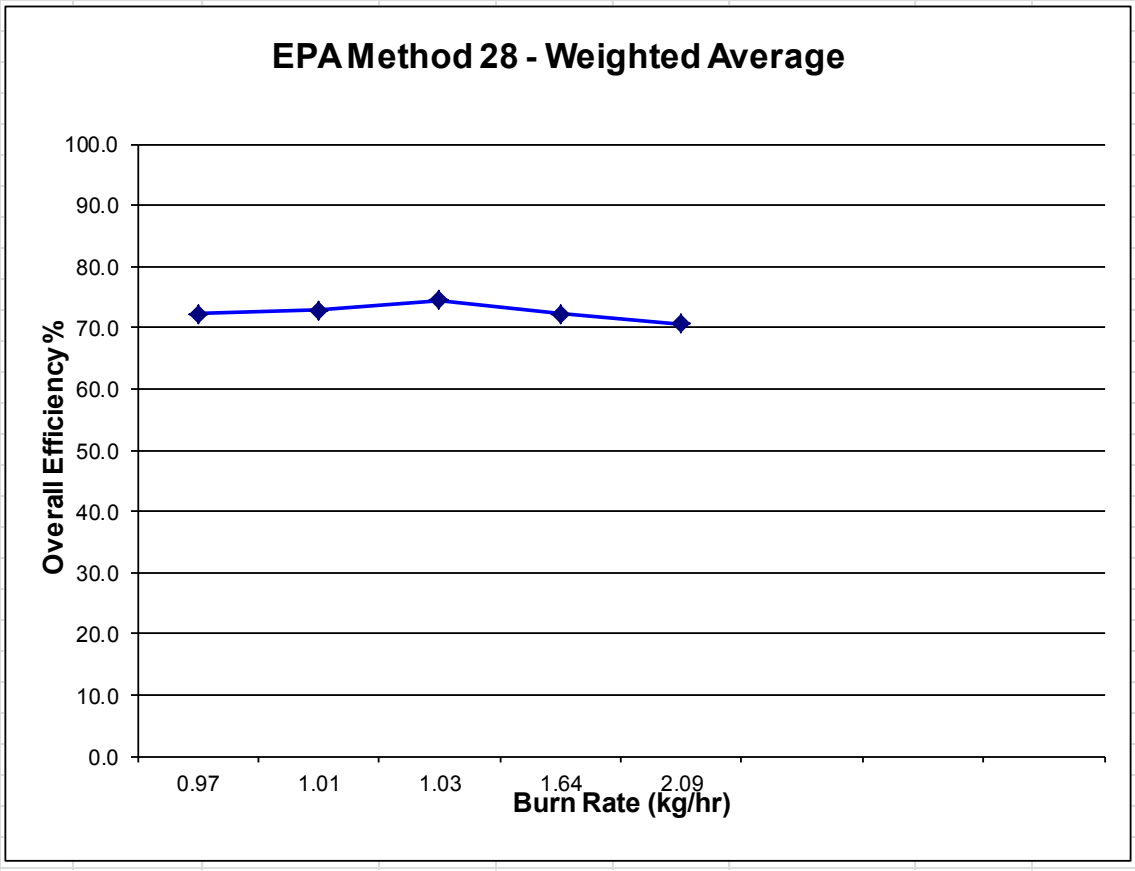
Burn Rate Category	2	Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.03	Burn Rate (kg/hr-dry)	1.64
OA Efficiency %	74.5	OA Efficiency %	72.2
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	18
Weighting Factor	27.59%	Weighting Factor	33.51%
Run Number	1	Run Number	3

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.09
Emissions Rate (g/hr)	70.6
Emissions Rate Cap (g/hr)	18
Weighting Factor	11.43%
Run Number	4

CSA B415.1-10 - Weighted Average

DIRIGO LABORATORIES INC.

Client:	Pacific Energy
Model:	TN20 (series B)
Tracking No.:	74
Project No.:	034-S-74-1
Test Dates:	12/13/16 - 12/20/16



Summary Table:

Category 2 < 1.00 kg/hr		Category 2 0.80 to 1.25 kg/hr		Category 2 0.80 to 1.25 kg/hr		Category 3 1.25 to 1.90 kg/hr		Category 4 Maximum	
Run Number	**5**	**Run Number**	**2**	**Run Number**	**1**	**Run Number**	**3**	**Run Number**	**4**
Emissions Rate g/hr	1.35	Emissions Rate g/hr	1.38	Emissions Rate g/hr	0.89	Emissions Rate g/hr	2.20	Emissions Rate g/hr	2.04
Burn Rate kg/hr	0.97	Burn Rate kg/hr	1.01	Burn Rate kg/hr	1.03	Burn Rate kg/hr	1.64	Burn Rate kg/hr	2.09
BTU/hr (HHV)	13,931	BTU/hr (HHV)	24,633	BTU/hr (HHV)	15,161	BTU/hr (HHV)	23,451	BTU/hr (HHV)	29,208
CO g/min	1.75	CO g/min	1.65	CO g/min	1.32	CO g/min	1.51	CO g/min	1.55
OA Efficiency (HHV)	72.2%	OA Efficiency (HHV)	72.9%	OA Efficiency (HHV)	74.5%	OA Efficiency (HHV)	72.2%	OA Efficiency (HHV)	70.6%

Run 1:

An attempt at a category II burn rate <1.00 kg/hr was performed on 12/13/16, resulting in a 1.03 kg/hr category II burn rate. The test duration was 5 hours 10 minutes. The fuel weight was 14.0 lbs. There was an average particulate emissions rate of 0.89 g/hr. The run had an overall efficiency of 74.5%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.57g/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 additional attempt at a category II burn rate <1.00 kg/hr was performed on 12/14/16, resulting in a 1.01 kg/hr category II burn rate. The test duration was 5 hours 10 minutes. The fuel weight was 13.8 lbs. There was an average particulate emissions rate of 1.38 g/hr. The run had an overall efficiency of 72.9%. The A filter was changed at 1 hr. The 1-hour filter catch was 6.5 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 3:

Run 3 was a category III burn rate performed on 12/14/16. The test duration was 3 hours 10 minutes. The fuel weight was 13.7 lbs. There was an average particulate emissions rate of 2.20 g/hr. The run had an overall efficiency of 72.2%. The A filter

was changed at 1 hr. The 1-hour filter catch was 5.91 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 a category IV burn rate performed on 12/15/16. The test duration was 2 hours 30 minutes. The fuel weight was 13.6 lbs. There was an average particulate emissions rate of 2.04 g/hr. The run had an overall efficiency of 70.6%. The A filter was changed at 1 hr. The 1-hour filter catch was 4.52 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, performed on 12/16/16 and resulting in 0.97 kg/hr, was a successful category II burn rate <1.00 kg/hr. The test duration was 5 hours 20 minutes. The fuel weight was 13.7 lbs. There was an average particulate emissions rate of 1.35 g/hr. The run had an overall efficiency of 72.2%. The A filter was changed at 1 hr. The 1-hour filter catch was 5.65 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 6:

Run 6 was the fan confirmation run performed on 12/20/16. The test duration was 5 hours. The fuel weight was 13.6 lbs. There was an average particulate emissions rate of 2.16 g/hr. The one-hour filter catch was 10.74 g/hr. Per Method 28 & ASTM E2515-10 a category II run was performed with the fan in the off position. The emission rate resulting from this test run without the blower operating is equal to or less than the emissions rate plus 1.0 g/h for the test run in the medium burn rate category with the blower operating. Because of this, the wood heater is considered to have the same average emissions rate with or without the blower operating. Additional test runs without the blower operating are unnecessary. Results from Run 6 are not included in the calculation of results.

One Hour Particulate Data:

Run Number	Total Estimated PM Emissions at 1 hour
1	3.57
2	6.5
3	5.91
4	4.52
5	5.65
6*	10.74

*-Fan confirmation

Precision Statement:

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	100.1	99.9	0.1	✓	**Or**				
2	104.5	95.5	4.5	✓					
3	99.9	100.1	0.1	✓					
4	99.0	101.0	1.0	✓					
5	100.3	99.7	0.3	✓					
6	104.7	95.3	4.7	✓					

Filter Catch & Negative Weights Statement:

Run 1:

Project #	034-S-74-1				MFG	Pacific Enerfy								
Run #	1				Model	TN20 (series B)								
Date	12/20/16													
Train A	Front	Rear	Filter #	Tare	Final	Net				**Train B**	Front	Rear	Filter #	Tare	Final	Net
First Hour	☑		2992	0.1187	0.1219	0.0032					☑	☐	2994			
	☐	☑	2993								☐	☑	2995	0.2383	0.2419	
	☑	☐	2997	0.2380	0.2387						☑	☐	O ring			
	☑	☐	O Ring								☐	☑	O ring	3.5411	3.5416	0.0041
	☐	☑	O Ring	3.5766	3.5770	0.0011										
						4.3	mg									4.1 mg
Nozzle										Nozzle						
#	TARE		FINAL		Net					#	TARE		FINAL		Net	
9A	116.7186		116.7186		0.0000	0.0				9B	117.1380		117.1381		0.0001	0.1
Train A Total Catch						4.3				Train B Total Catch						4.2
Ambient ☐	Filter #		Tare	Final	Net	Vol (liter)										
	2996		0.1186	0.1186	0.0000	1715.259										
	O ring		1.6849	1.6850	0.0002											
				Total	0.2	mg										
Notes:	Train A Total: 4.3mg		Train B Total: 4.2mg		Ambient Total: 0.2mg		1 Hour Catch: 3.2mg									

Run 2:

Project #	034-S-74-1				MFG	Pacific Energy								
Run #	2				Model	TN20 (series B)								
Date	12/20/16													
Train A	Front	Rear	Filter #	Tare	Final	Net				**Train B**	Front	Rear	Filter #	Tare	Final	Net
First Hour	☑		2998	0.1181	0.1240	0.0059					☑	☐	3000			
	☐	☑	2999								☐	☑	3001	0.2365	0.2425	
	☑	☐	3003	0.2358	0.2364						☑	☐	O ring			
	☑	☐	O Ring								☐	☑	O ring	3.5164	3.5166	0.0062
	☐	☑	O Ring	3.5799	3.5804	0.0011										
						7.0	mg									6.2 mg
Nozzle										Nozzle						
#	TARE		FINAL		Net					#	TARE		FINAL		Net	
11A	117.0372		117.0372		0.0000	0.0				11B	116.6756		116.6757		0.0001	0.1
Train A Total Catch						7.0	mg			Train B Total Catch						6.3 mg
Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)										
	3002		0.1184	0.1186	0.0002	1726.447										
	O ring		1.6564	1.6565	0.0001											
				Total	0.3	mg										
Notes:	Train A Total: 7.0mg		Train B Total: 6.3mg		Ambient Total: 0.3mg		1 Hour Catch: 5.9mg									

Run 3:

Project #	034-S-74-1		MFG	Pacific Energy		
Run #	3		Model	TN20 (series B)		
Date	12/20/16					

Train A First Hour	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	3004	0.1181	0.1234	0.0053
	☐	☑	3005			
	☑	☐	3009	0.2366	0.2367	
	☑	☐	O Ring			
	☐	☑	O Ring	3.5745	3.5749	0.0005
						5.8 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	3006			
	☐	☑	3007	0.2367	0.2420	
	☑	☐	O ring			
	☐	☑	O ring	3.5597	3.5603	0.0059
						5.9 mg

Nozzle #	TARE	FINAL	Net	
7A	116.7505	116.7510	0.0005	0.5
Train A Total Catch				6.3 mg

Nozzle #	TARE	FINAL	Net	
7B	117.3054	117.3057	0.0003	0.3
Train B Total Catch				6.2 mg

Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)
	3008		0.1189	0.1189	0.0000	1054.703
	O ring		1.6639	1.6639	0.0000	
				Total	0.0 mg	

Notes: Train A Total: 6.3mg Train B Total: 6.2mg Ambient Total: 0.0mg 1 Hour Catch: 5.3mg

Run 4:

Project #	034-S-74-1		MFG	Pacific Energy		
Run #	4		Model	TN20 (series B)		
Date	12/20/16					

Train A First Hour	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	3010	0.1187	0.1228	0.0041
	☐	☑	3011			
	☑	☐	3015	0.2362	0.2363	
	☑	☐	O Ring			
	☐	☑	O Ring	3.5379	3.5384	0.0006
						4.7 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	☑	☐	3012			
	☐	☑	3013	0.2388	0.2429	
	☑	☐	O ring			
	☐	☑	O ring	3.5897	3.5900	0.0044
						4.4 mg

Nozzle #	TARE	FINAL	Net	
8A	116.8311	116.8311	0.0000	0.0
Train A Total Catch				4.7 mg

Nozzle #	TARE	FINAL	Net	
8B	116.8259	116.8262	0.0003	0.3
Train B Total Catch				4.7 mg

Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)
	3014		0.1188	0.1188	0.0000	833.188
	O ring		1.6864	1.6865	0.0001	
				Total	0.0 mg	

Notes: Train A Total: 4.7mg Train B Total: 4.7mg Ambient Total: 0.1mg 1 Hour Catch: 4.1mg

Run 5:

	Project #	034-S-74-1				MFG	Pacific Energy											
	Run #	5				Model	TN20 (series B)											
	Date	12/20/16																
	Train A	Front	Rear	Filter #	Tare	Final	Net		**Train B**	Front	Rear	Filter #	Tare	Final	Net			
	First Hour	☑		3016	0.1173	0.1224	0.0051			☑	☐	3018						
		☐	☑	3017						☐	☑	3019	0.2337	0.2395				
		☑	☐	3021	0.2347	0.2357				☑	☐	O ring						
		☑	☐	O Ring						☐	☑	O ring	3.5450	3.5454	0.0062			
		☐	☑	O Ring	3.5390	3.5393	0.0013											
							6.4	mg									6.2	mg
	Nozzle								Nozzle									
	#	TARE		FINAL		Net			#	TARE		FINAL		Net				
	2A	116.2355		116.2355		0.0000	0.0		2B	116.3287		116.3287		0.0000	0.0			
	Train A Total Catch						6.4	mg	Train B Total Catch								6.2	mg
	Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)											
		3020		0.1164	0.1164	0.0000	1721.635											
		O ring		1.6834	1.6834	0.0000												
					Total	0.0	mg											
Notes:	Train A Total: 6.4mg			Train B Total: 6.2mg			Ambient Total: 0.0mg		1 Hour Catch: 5.1mg									

Run 6 – Fan Confirmation:

	Project #	034-S-74-1				MFG	Pacific Energy										
	Run #	6				Model	TN20 (series B)										
	Date	12/22/16															
	Train A	Front	Rear	Filter #	Tare	Final	Net		**Train B**	Front	Rear	Filter #	Tare	Final	Net		
	First Hour	☑		3022	0.1171	0.1264	0.0093			☑	☐	3024					
		☐	☑	3023						☐	☑	3025	0.2350	0.2437			
		☑	☐	3027	0.2361	0.2365				☑	☐	O ring					
		☑	☐	O Ring						☐	☑	O ring	3.5701	3.5706	0.0092		
		☐	☑	O Ring	3.5809	3.5814	0.0009										
							10.2	mg							9.2	mg	
	Nozzle								Nozzle								
	#	TARE		FINAL		Net			#	TARE		FINAL		Net			
	3A	116.0714		116.0714		0.0000	0.0		3B	116.3383		116.3383		0.0000	0.0		
	Train A Total Catch						10.2		Train B Total Catch						9.2		
	Ambient ☑	Filter #		Tare	Final	Net	Vol (liter)										
		3026		0.1170	0.1172	0.0002	1565.189										
		O ring		1.6737	1.6740	0.0003											
					Total	0.5	mg										
Notes:	Train A Total: 10.2mg			Train B Total: 9.2mg			Ambient Total: 0.5mg		1 Hour Catch: 9.3mg								

There were no negative filter weights recorded.

Test Condition Summary:

All testing conditions for all runs fell within allowable specifications of EPA Method 28R, ASTM E2780-10 and ASTM E2515-10. 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.)	Test Fuel Moisture (Dry Basis)	Run Time (Min.)
	Pre	Post				
1	70	69	30.20	14.0	19.7	310
2	70	71	29.96	13.8	19.6	310
3	74	72	29.96	13.7	19.8	190
4	75	74	29.91	13.6	19.9	150
5	71	72	30.12	13.7	19.7	320
6	77	73	30.30	13.6	19.7	300

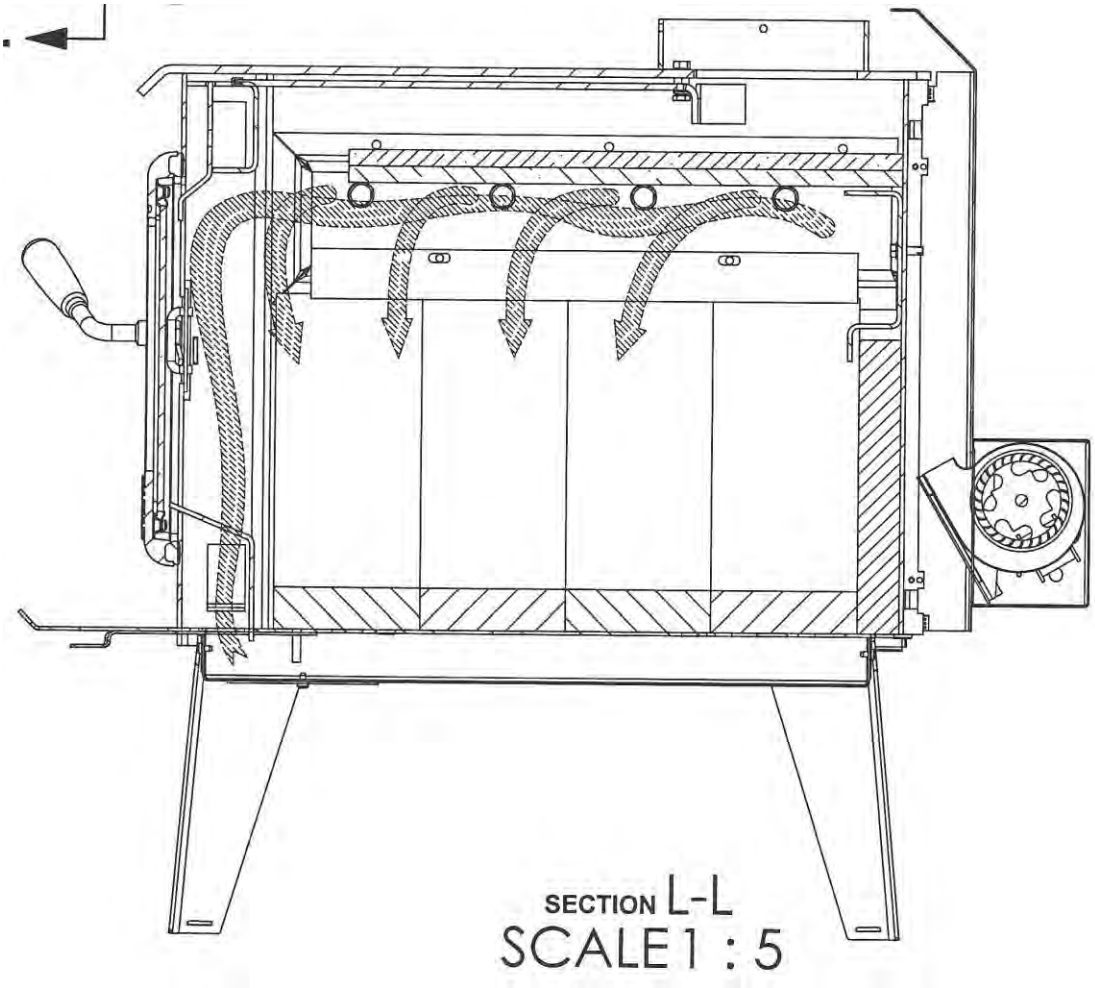
Heater Specifications:

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
11.469”	15.25”	18.094”	1.996 ft^3	255 lbs

Air Flow Schematic



Firebox Volume:

DESCRIPTION: USEABLE FIREBOX VOLUME

MODEL: TN20

SERIES: B

DRAWING # TN20 #9

VOLUME: DEPTH X WIDTH X HEIGHT

VOLUME 1: 17 27/32 X 15 1/4 X 11 15/32 = 3120.844 IN^3

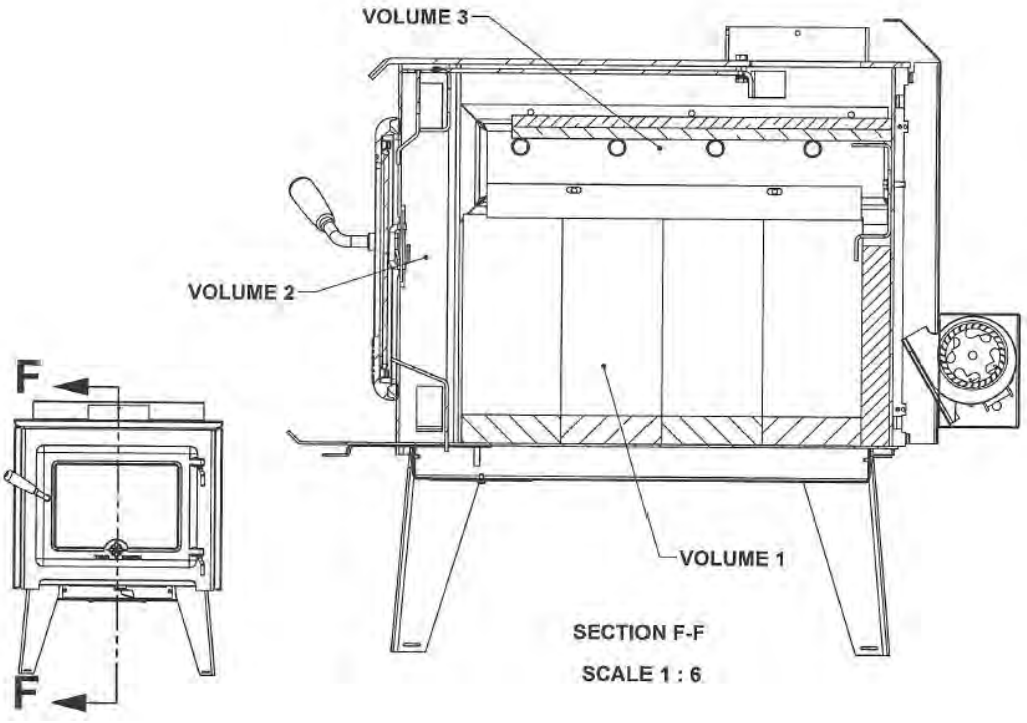
VOLUME 2: 2 5/16 X 14 3/32 X 8 17/32 = 278.049 IN^3

VOLUME 3: 4 1/4 X 15 1/4 X 25/32 = 0.029 IN^3

USEABLE FIREBOX VOLUME= VOLUME 1 + VOLUME 2 + VOLUME 3

USEABLE FIREBOX VOLUME = 3210.844 + 278.049 + 0.029 =3449.528 IN^3

USEABLE FIREBOX VOLUME = 1.996 FT^3



Front

Left

Right

Rear

Process Operations and Description:

The appliance was operated according to procedures as described in the Operations Manual. Detailed run instructions were provided to the lab and are consistent with the general instructions in the Operations Manual. 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 0.212". Start at 1054	Category II. Test start: 1155 – Door open 1 minute 30 seconds, Primary fully open. At 5 mins Primary air set to 0.212", fan off. Fan set to high at 1215. Front Filter change at 1255. END test: 1705 – Run time 5 hours, 10 minutes.
Run 2	Primary set to 0.165". Start at 1249	Category II. Test start: 1350 – Door open 2 minutes, Primary fully open. At 5 mins Primary air set to 0.165", fan off. Fan set to high at 1410. Front Filter change at 1450. END test: 1900 – Run time 5 hours, 10 minutes.
Run 3	Primary set to 0.720". Start at 2037	Category III: Test start: 2138 – Door open 1 minute 30 seconds, Primary fully open. At 5 mins Primary set to 0.0720", fan off. Fan set to high at 2158. Front filter change at 2238. END Test: 0048 – Run time 3 hours 10 mins.
Run 4	Primary fully open. Start at 0309	Category IV: Test start: 0415. Door Open 1 minute 30 seconds, Primary air fully open and left open. Fan on high. Front filter changed at 0515. END test: 0645 – Run Time: 2 hours 30 minutes.
Run 5	Primary set to 0.125". Start at 1348	Category II (average below 1.00 kg/hr): Test start: 1450 – Door open 1 minute 30 seconds, At 5 mins primary set to 0.125", fan off. Fan set to high at 1510. Front filter changed at 1550. END test: 2030 – Run time 5 hours 20 minutes.
Run 6	Primary set to 0.125". Start at 1230	Fan Confirmation – Fan OFF. Category II: Test start: 1341. Door open 1 minute 30 seconds, Primary open for 5 minutes, fan off. Fan remained off for entire test. Changed front filter at 1441. END test: 1841 – Run time: 5 hours.

Test Fuel Properties:

Fuel consisted of 2”x4”x18.25” and 4”x4”x18.25” Green, Douglas fir. Detailed fuel load specifications for each run can be found in the corresponding digital folders submitted with this report.

Fuel Load Run Pictures:

Run 1

Run 2

Run 3

Run 4

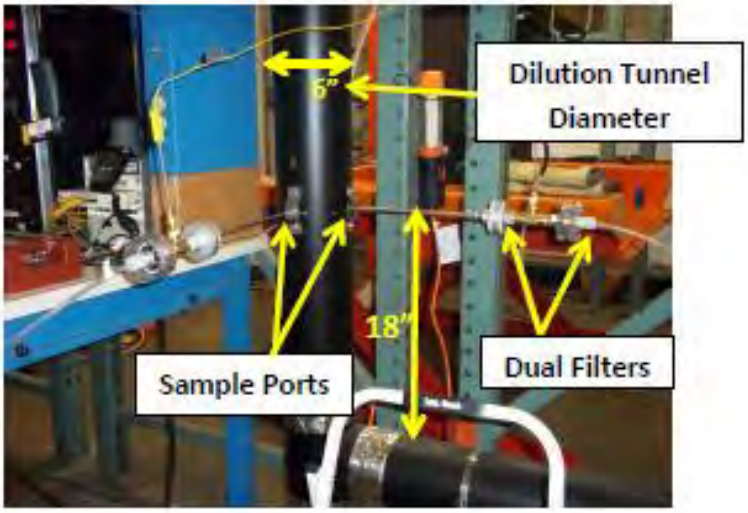
Run 5

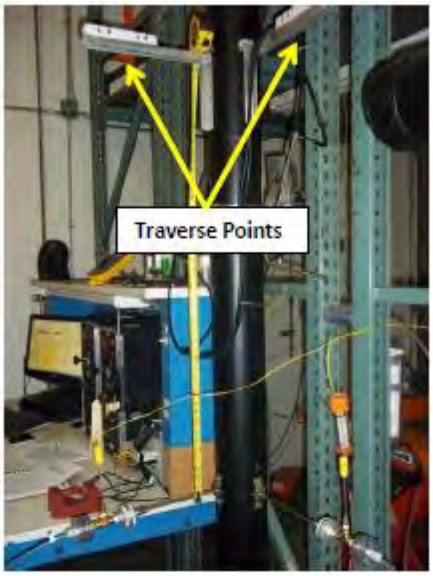
Detailed fuel data for all runs in appendix.

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: 2975 Allenby Road, Duncan, BC, Canada, V9L 6V8.

Sealing Label

Sealed Unit


ATTENTION:
NOT TO BE BROKEN WITHOUT PRIOR AUTHORIZAT
NITED STATES ENVIRONMENTAL PROTECTION AG
PLIANCE HAS BEEN SEALED IN ACCORDANCE W
MENTS OF 40 CFR PART 60 SUBPART AAA
34-S-74-1
DATE SEALED
ER Pacific Energy
MODEL #

Appendices:

Appendix A:

Sampling and Analytical Procedures

All Sampling and analytical procedures were performed by Ben Nelke and Gary 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.

Appendix B:

Participants

The following personnel performed all testing:

- Ben Nelke, Gary Nelke, CMfgE

Analysis and Report Writing

The following people were involved with analysis and report writing:

- Ben Nelke, Gary Nelke, CMfgE, Doug Towne

Observers:

The following people were observers during testing:

- Ken Davis

Appendix C:

Appliance Updates

No updates to the appliance were made.

Appendix D:

Test Equipment Calibration Audit:

- Calibrations for the platform scale and bench scale were performed with Certified Class F weights
- Moisture meter calibration was performed with Delmhorst moisture meter calibrator
- Gas Analyzer calibration performed with certified EPA Protocol gases
- 47mm filters weighed to a constant weight with calibrated analytical balance

All equipment calibration data submitted in separate digital file along with this report.

Appendix E:

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

CSA B415.1-10 Weighted Average

DIRIGO LABORATORIES INC.

Weighted Average: 72.7 %

Client:	Pacific Energy
Model:	TN20 (series B)
Tracking No.:	74
Project No.:	034-S-74-1
Test Dates:	12/13/16 - 12/20/16

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.97
OA Efficiency %	72.2
Emissions Rate Cap (g/hr)	15
Weighting Factor	24.47%
Run Number	5

Burn Rate Category	2
Burn Rate (kg/hr-dry)	1.01
OA Efficiency %	72.9
Emissions Rate Cap (g/hr)	15
Weighting Factor	3.01%
Run Number	2

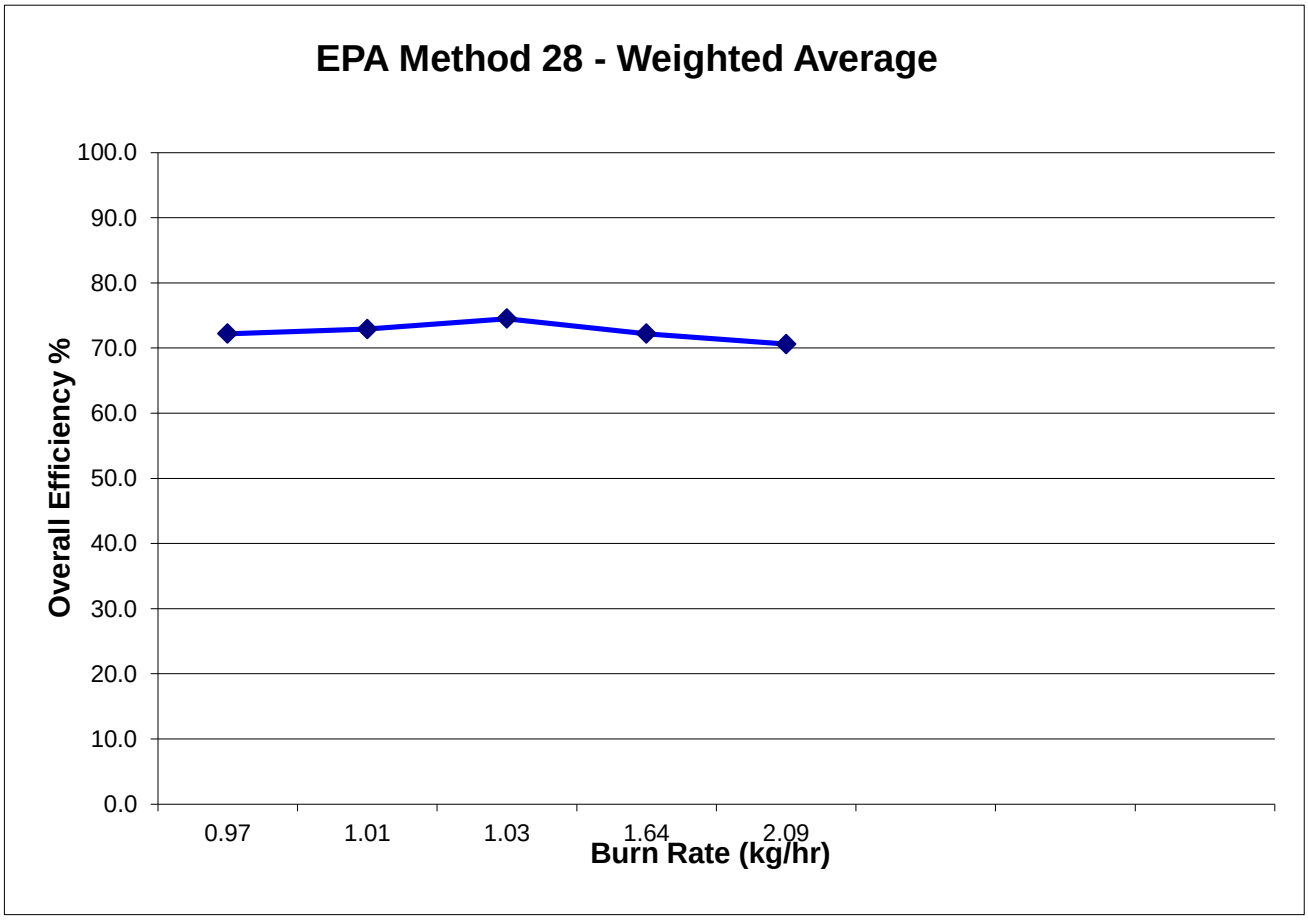
Burn Rate Category	2
Burn Rate (kg/hr-dry)	1.03
OA Efficiency %	74.5
Emissions Rate Cap (g/hr)	15
Weighting Factor	27.59%
Run Number	1

Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.64
OA Efficiency %	72.2
Emissions Rate Cap (g/hr)	18
Weighting Factor	33.51%
Run Number	3

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.09
Emissions Rate (g/hr)	70.6
Emissions Rate Cap (g/hr)	18
Weighting Factor	11.43%
Run Number	4

DIRIGO LABORATORIES INC.

Client: Pacific Energy
Model: TN20 (series B)
Tracking No.: 74
Project No.: 034-S-74-1
Test Dates: 12/13/16 - 12/20/16



VERSION: 2.4 4/15/2010

lanufacturer: Pacific Energy
Model: TN20
Date: 12/22/2016
Run: 6
Control #: 034-S-74-1
est Duration: 300
urn Category 2

Appliance Type: Non-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): 13.60
Burn Rate (dry kg/h): 1.03
Total Particulate Emissions: 10.82 g

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

Averages		280.1	75.0	13.16	7.10	0.95
		Temp. (F)				
Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas	Room Temp	Flue Gas Composition (%) O2	CO2	CO
0	13.6	240.0	77.0	16.67	3.20	0.92
10	12.7	292.0	77.0	14.57	6.03	0.67
20	11.7	350.0	76.0	11.24	9.59	0.48
30	10.5	386.0	76.0	9.28	11.64	0.68
40	9.0	439.0	76.0	7.58	13.37	0.89
50	7.5	448.0	76.0	7.59	13.21	1.09
60	6.2	437.0	76.0	8.50	12.67	0.48
70	5.1	417.0	77.0	9.37	11.57	0.36
80	4.3	385.0	77.0	10.13	10.21	0.59
90	3.7	353.0	76.0	11.53	9.03	0.40
100	3.2	324.0	76.0	12.40	7.98	0.51
110	2.8	312.0	76.0	11.78	8.57	0.54
120	2.5	296.0	76.0	12.92	7.11	0.70
130	2.4	272.0	76.0	13.55	6.52	0.76
140	2.2	258.0	75.0	13.74	6.42	0.80
150	2.0	248.0	75.0	13.91	6.18	0.89
160	1.8	242.0	75.0	13.88	6.19	1.13
170	1.7	237.0	75.0	14.11	5.75	1.43
180	1.5	231.0	74.0	14.38	5.49	1.36
190	1.4	225.0	74.0	14.44	5.44	1.37
200	1.3	220.0	74.0	14.51	5.48	1.28
210	1.2	216.0	74.0	14.62	5.42	1.19
220	0.9	214.0	74.0	14.77	5.32	1.12
230	0.9	213.0	74.0	14.76	5.34	1.17
240	0.7	211.0	74.0	14.92	5.18	1.19
250	0.6	209.0	74.0	15.09	4.96	1.25
260	0.5	207.0	73.0	15.27	4.75	1.26
270	0.5	204.0	73.0	15.36	4.59	1.33
280	0.3	201.0	73.0	15.64	4.32	1.30
290	0.2	199.0	73.0	15.70	4.35	1.25
300	0.0	196.0	73.0	15.86	4.22	1.21

Manufacturer:	Pacific Energy
Model:	TN20
Date:	12/22/2016
Run:	6
Control #:	034-S-74-1
Test Duration:	300 min

	HHV	LHV
Eff	73.0%	78.9%
Comb Eff	93.4%	93.4%
HT Eff	78.1%	84.4%
Output	14,901	kJ/h
Burn Rate	1.03	kg/h
Grams CO	481	g
Input	20,424	kJ/h
MC wet	16.46	

Overall Heating Efficiency:
Combustion Efficiency:
Heat Transfer Efficiency:

Heat Output: 14,135
Heat Input: 19,375

Ultimate CO2
CO2-ult 19.64
F_0
1.061

Burn Duration: 5
Burn Rate: 2.3
Stack Temp: 281.4

Averages	0.95	7.10	167.1%	20.41	12.83	137.8	23.9	89.1%	78.5%

INPUT DATA				Oxygen Calculation			Input Data		Combust	Heat
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**	**Room Temp (ºC)**	**Eff %**	**Transfer %**
0	6.17	0.92	3.20	376.8%	20.67	17.01	115.6	25.0	82.7%	71.9%
10	5.76	0.67	6.03	193.2%	20.50	14.13	144.4	25.0	92.2%	76.6%
20	5.31	0.48	9.59	95.1%	20.28	10.45	176.7	24.4	96.3%	78.6%
30	4.76	0.68	11.64	59.4%	20.13	8.15	196.7	24.4	95.5%	79.0%
40	4.08	0.89	13.37	37.7%	20.00	6.18	226.1	24.4	94.9%	78.4%
50	3.40	1.09	13.21	37.4%	20.00	6.24	231.1	24.4	93.7%	78.0%
60	2.81	0.48	12.67	49.4%	20.07	7.16	225.0	24.4	97.1%	78.1%
70	2.31	0.36	11.57	64.7%	20.15	8.40	213.9	25.0	97.6%	78.0%
80	1.95	0.59	10.21	81.9%	20.23	9.72	196.1	25.0	95.6%	77.9%
90	1.68	0.40	9.03	108.3%	20.32	11.09	178.3	24.4	96.8%	78.0%
100	1.45	0.51	7.98	131.4%	20.38	12.14	162.2	24.4	95.3%	78.0%
110	1.27	0.54	8.57	115.6%	20.34	11.50	155.6	24.4	95.4%	79.2%
120	1.13	0.70	7.11	151.5%	20.42	12.96	146.7	24.4	92.9%	78.1%
130	1.09	0.76	6.52	169.8%	20.46	13.56	133.3	24.4	91.8%	78.5%
140	1.00	0.80	6.42	172.1%	20.46	13.64	125.6	23.9	91.3%	79.0%

150	0.91	0.89	6.18	177.8%	20.47	13.85	120.0	23.9	90.0%	79.2%
160	0.82	1.13	6.19	168.3%	20.46	13.70	116.7	23.9	87.7%	79.4%
170	0.77	1.43	5.75	173.6%	20.47	14.00	113.9	23.9	84.1%	78.9%
180	0.68	1.36	5.49	186.8%	20.49	14.32	110.6	23.3	84.1%	78.8%
190	0.64	1.37	5.44	188.4%	20.49	14.37	107.2	23.3	83.9%	79.1%
200	0.59	1.28	5.48	190.6%	20.49	14.37	104.4	23.3	84.9%	79.5%
210	0.54	1.19	5.42	197.2%	20.50	14.49	102.2	23.3	85.7%	79.7%
220	0.41	1.12	5.32	205.0%	20.51	14.63	101.1	23.3	86.2%	79.7%
230	0.41	1.17	5.34	201.7%	20.51	14.59	100.6	23.3	85.7%	79.8%
240	0.32	1.19	5.18	208.4%	20.52	14.74	99.4	23.3	85.1%	79.6%
250	0.27	1.25	4.96	216.3%	20.53	14.94	98.3	23.3	84.0%	79.3%
260	0.23	1.26	4.75	226.8%	20.54	15.16	97.2	22.8	83.4%	79.0%
270	0.23	1.33	4.59	231.8%	20.55	15.29	95.6	22.8	82.2%	78.8%
280	0.14	1.30	4.32	249.5%	20.57	15.60	93.9	22.8	81.7%	78.5%
290	0.09	1.25	4.35	250.8%	20.57	15.60	92.8	22.8	82.3%	78.8%
300	0.00	1.21	4.22	261.7%	20.58	15.76	91.1	22.8	82.4%	78.7%

	Air Fuel Ratio (A/F)		
73.0%	Dry Molecular Weight (Md)	29.65	
93.4%	Dry Moles Exhaust Gas (Nr):	453.34	%HC
78.1%	Air Fuel Ratio (A/F)	12.93	1.32

Combustion Efficiency:	93.4%
Total Input (kJ):	102,122
Total Output (kJ):	74,505
Efficiency:	73.0%
Total CO (g):	480.73

Btu/h	14,901	kJ/h
Btu/h	20,424	kJ/h
h		
lb/h	1.0	kg/h
Deg. F	138.6	Deg. C

70.0%	15.7	1.65	73.22	0.04	73.22	102873	4.06	6.87	2.74	19810.00	16.46
Net Eff %	**Air Fuel Ratio**	**Wet Wt Now Wt**	**% Wet Consumed x**	**Dry Wt. Now Wtdn**	**% Dry Comsumed y**	**Fuel Properties**					**Mw Moisture Fuel Burnt**
						Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	
59.4%	27.8	6.17	0.00	5.16	0.00	0	4.06	6.87	2.74	19810.00	16.46
70.6%	17.4	5.76	6.62	4.81	6.62	10513	4.06	6.87	2.74	19810.00	16.46
75.7%	11.7	5.31	13.97	4.43	13.97	8260	4.06	6.87	2.74	19810.00	16.46
75.5%	9.5	4.76	22.79	3.98	22.79	10137	4.06	6.87	2.74	19810.00	16.46
74.4%	8.2	4.08	33.82	3.41	33.82	11263	4.06	6.87	2.74	19810.00	16.46
73.1%	8.2	3.40	44.85	2.84	44.85	10513	4.06	6.87	2.74	19810.00	16.46
75.8%	9.0	2.81	54.41	2.35	54.41	9011	4.06	6.87	2.74	19810.00	16.46
76.2%	9.9	2.31	62.50	1.93	62.50	7133	4.06	6.87	2.74	19810.00	16.46
74.5%	10.9	1.95	68.38	1.63	68.38	5256	4.06	6.87	2.74	19810.00	16.46
75.4%	12.5	1.68	72.79	1.40	72.79	4130	4.06	6.87	2.74	19810.00	16.46
74.3%	13.8	1.45	76.47	1.21	76.47	3379	4.06	6.87	2.74	19810.00	16.46
75.5%	12.9	1.27	79.41	1.06	79.41	2628	4.06	6.87	2.74	19810.00	16.46
72.6%	15.0	1.13	81.62	0.95	81.62	1502	4.06	6.87	2.74	19810.00	16.46
72.0%	16.0	1.09	82.35	0.91	82.35	1126	4.06	6.87	2.74	19810.00	16.46
72.1%	16.1	1.00	83.82	0.83	83.82	1502	4.06	6.87	2.74	19810.00	16.46

71.3%	16.4	0.91	85.29	0.76	85.29	1502	4.06	6.87	2.74	19810.00	16.46
69.6%	15.8	0.82	86.76	0.68	86.76	1126	4.06	6.87	2.74	19810.00	16.46
66.3%	15.9	0.77	87.50	0.64	87.50	1126	4.06	6.87	2.74	19810.00	16.46
66.3%	16.7	0.68	88.97	0.57	88.97	1126	4.06	6.87	2.74	19810.00	16.46
66.4%	16.8	0.64	89.71	0.53	89.71	751	4.06	6.87	2.74	19810.00	16.46
67.5%	17.0	0.59	90.44	0.49	90.44	751	4.06	6.87	2.74	19810.00	16.46
68.3%	17.4	0.54	91.18	0.45	91.18	1502	4.06	6.87	2.74	19810.00	16.46
68.7%	17.9	0.41	93.38	0.34	93.38	1126	4.06	6.87	2.74	19810.00	16.46
68.4%	17.7	0.41	93.38	0.34	93.38	751	4.06	6.87	2.74	19810.00	16.46
67.8%	18.0	0.32	94.85	0.27	94.85	1126	4.06	6.87	2.74	19810.00	16.46
66.6%	18.4	0.27	95.59	0.23	95.59	751	4.06	6.87	2.74	19810.00	16.46
65.9%	19.0	0.23	96.32	0.19	96.32	375	4.06	6.87	2.74	19810.00	16.46
64.8%	19.3	0.23	96.32	0.19	96.32	751	4.06	6.87	2.74	19810.00	16.46
64.1%	20.3	0.14	97.79	0.11	97.79	1126	4.06	6.87	2.74	19810.00	16.46
64.9%	20.4	0.09	98.53	0.08	98.53	1877	4.06	6.87	2.74	19810.00	16.46
64.9%	21.0	0.00	100.00	0.00	100.00	751	4.06	6.87	2.74	19810.00	16.46

				Moisture Content MCwb:	16.46
		Moisture of Wood (wet basis):	16.46	Dry kg :	5.16
96,857	(Btu)	Initial Dry Weight Wtdo (kg):	5.16	CA:	48.73
70,665	(Btu)	Moisture Content Dry	19.70	HY:	6.87
				OX:	43.90

Load Weight (kg):	6.17					
Fuel Heating:	HHV	LHV		HHV	LHV	
Value in kJ/kg - CV:	19810.00	18328.69	Btu/lb	8522.48	7885.21	

79.11	20.99	2.01	6.68	0.12	0.20	34.65	73.98	5.48	0.68	430.40	33.16
Mass Balance (moles/100 mole dry flue gas)					**kg Wood per 100 mole dfp**	**Moles per kg of Dry Wood**					
[h]	**[u]**	**[w]**	**[j]**	**[k]**	**Nk**	**CO2**	**O2**	**CO**	**HC**	**N2**	**H2O**
78.87	20.92	1.04	3.36	0.11	0.10	30.90	164.22	8.88	1.03	761.57	32.46
79.17	21.00	1.67	5.58	0.07	0.17	36.32	85.14	4.04	0.45	476.91	33.62
79.48	21.08	2.49	8.46	0.05	0.25	38.66	42.11	1.94	0.21	320.45	34.09
79.53	21.10	3.06	10.32	0.09	0.30	38.29	26.80	2.24	0.28	261.64	33.96
79.56	21.10	3.54	11.92	0.12	0.35	37.95	17.55	2.53	0.34	225.80	33.84
79.46	21.08	3.56	11.92	0.15	0.35	37.31	17.63	3.08	0.42	224.44	33.68
79.69	21.14	3.25	11.06	0.06	0.32	39.15	22.13	1.48	0.18	246.23	34.16
79.67	21.13	2.95	10.05	0.04	0.29	39.45	28.65	1.23	0.13	271.66	34.26
79.48	21.08	2.68	9.05	0.07	0.27	38.33	36.50	2.22	0.26	298.40	33.99
79.48	21.08	2.33	7.93	0.04	0.23	38.91	47.78	1.72	0.17	342.53	34.17
79.37	21.05	2.10	7.12	0.05	0.21	38.11	58.01	2.44	0.26	379.07	34.00
79.39	21.06	2.26	7.64	0.06	0.22	38.14	51.17	2.40	0.27	353.33	33.99
79.23	21.01	1.94	6.51	0.08	0.19	36.77	67.05	3.62	0.42	409.75	33.68
79.16	21.00	1.81	6.06	0.09	0.18	36.11	75.10	4.21	0.49	438.42	33.54
79.14	20.99	1.80	6.00	0.09	0.18	35.82	76.12	4.46	0.53	441.55	33.47

79.08	20.98	1.77	5.86	0.11	0.18	35.14	78.74	5.06	0.61	449.67	33.30
78.98	20.95	1.84	6.03	0.14	0.18	33.85	74.93	6.18	0.78	431.92	32.96
78.82	20.91	1.81	5.86	0.19	0.18	31.86	77.57	7.92	1.03	436.71	32.46
78.83	20.91	1.73	5.59	0.18	0.17	31.89	83.18	7.90	1.02	457.97	32.49
78.82	20.91	1.72	5.56	0.18	0.17	31.78	83.92	8.00	1.03	460.46	32.46
78.87	20.92	1.70	5.53	0.16	0.17	32.30	84.73	7.55	0.96	464.90	32.60
78.90	20.93	1.66	5.42	0.15	0.17	32.72	87.47	7.18	0.91	476.34	32.71
78.93	20.94	1.62	5.29	0.14	0.16	33.00	90.78	6.95	0.87	489.55	32.79
78.90	20.93	1.64	5.34	0.15	0.16	32.74	89.42	7.17	0.90	483.74	32.72
78.89	20.92	1.61	5.22	0.15	0.16	32.43	92.30	7.45	0.94	493.81	32.65
78.85	20.91	1.57	5.07	0.16	0.16	31.79	95.78	8.01	1.01	505.30	32.50
78.83	20.91	1.52	4.90	0.16	0.15	31.42	100.31	8.34	1.05	521.47	32.42
78.79	20.90	1.50	4.81	0.17	0.15	30.76	102.51	8.91	1.13	528.05	32.25
78.78	20.90	1.42	4.56	0.16	0.14	30.48	110.06	9.17	1.16	555.85	32.20
78.80	20.90	1.42	4.56	0.16	0.14	30.84	110.56	8.86	1.11	558.65	32.29
78.81	20.91	1.37	4.42	0.15	0.14	30.86	115.22	8.85	1.10	576.34	32.31

10.94	410.96	4564.04	3423.14	3325.90	3289.63	4419.04	3979.06	297.04	5060.45	6634.92	48571.16
Moisture	Stack Temp	Heat Content Change - Ambient to Stack Temperature Flue Gas Constituent						Room Temp	Energ		
Present	K	CO2	O2	CO	N2	CH4	H2O	K	CO2	O2	CO
10.94	388.71	3576.89	2705.15	2633.83	2603.95	3414.21	3152.83	298.15	110.52	444.25	2537.04
10.94	417.59	4768.02	3583.67	3483.73	3445.35	4600.03	4168.48	298.15	173.20	305.10	1156.25
10.94	449.82	6146.35	4588.79	4453.22	4405.76	5997.33	5326.12	297.59	237.64	193.24	556.25
10.94	469.82	7003.84	5207.20	5047.96	4995.30	6881.74	6035.72	297.59	268.19	139.55	644.35
10.94	499.26	8287.37	6124.18	5927.63	5867.74	8224.56	7084.56	297.59	314.48	107.48	729.81
10.94	504.26	8507.83	6280.67	6077.49	6016.43	8457.41	7263.15	297.59	317.45	110.71	890.00
10.94	498.15	8238.48	6089.44	5894.34	5834.72	8173.01	7044.89	297.59	322.53	134.75	428.46
10.94	487.04	7730.32	5726.23	5545.88	5489.13	7641.74	6629.39	298.15	304.98	164.06	354.20
10.94	469.26	6958.65	5173.60	5015.40	4963.07	6837.35	5996.78	298.15	266.75	188.84	637.98
10.94	451.48	6217.36	4640.19	4502.70	4454.80	6070.17	5385.17	297.59	241.94	221.71	495.58
10.94	435.37	5534.26	4144.40	4025.08	3981.53	5372.52	4815.05	297.59	210.94	240.40	699.15
10.94	428.71	5253.80	3939.93	3827.87	3786.17	5088.08	4579.57	297.59	200.39	201.62	689.31
10.94	419.82	4881.86	3667.93	3565.31	3526.11	4712.71	4266.00	297.59	179.52	245.94	1037.44
10.94	406.48	4328.24	3261.26	3172.31	3136.94	4157.94	3796.48	297.59	156.29	244.91	1204.53
10.94	398.71	4028.88	3041.14	2959.53	2926.25	3858.44	3542.26	297.04	144.32	231.50	1276.38

10.94	393.15	3800.98	2872.55	2796.31	2764.69	3632.64	3347.17	297.04	133.57	226.19	1446.30
10.94	389.82	3664.67	2771.54	2698.46	2667.85	3498.00	3230.20	297.04	124.06	207.68	1765.52
10.94	387.04	3551.32	2687.43	2616.97	2587.20	3386.27	3132.78	297.04	113.14	208.48	2262.95
10.94	383.71	3436.79	2602.96	2535.25	2506.29	3272.25	3035.12	296.48	109.61	216.51	2255.90
10.94	380.37	3301.40	2502.23	2437.58	2409.65	3139.37	2918.33	296.48	104.91	209.98	2284.27
10.94	377.59	3188.81	2418.36	2356.23	2329.16	3029.11	2821.05	296.48	103.01	204.91	2153.06
10.94	375.37	3098.91	2351.31	2291.19	2264.80	2941.21	2743.27	296.48	101.40	205.67	2049.56
10.94	374.26	3054.01	2317.81	2258.67	2232.64	2897.37	2704.38	296.48	100.78	210.40	1981.67
10.94	373.71	3031.57	2301.06	2242.42	2216.55	2875.47	2684.94	296.48	99.25	205.75	2045.96
10.94	372.59	2986.72	2267.57	2209.92	2184.40	2831.73	2646.07	296.48	96.85	209.29	2124.53
10.94	371.48	2941.91	2234.09	2177.42	2152.25	2788.06	2607.20	296.48	93.52	213.98	2284.51
10.94	370.37	2918.32	2216.98	2160.95	2135.93	2763.93	2587.54	295.93	91.70	222.39	2376.88
10.94	368.71	2851.23	2166.80	2112.23	2087.73	2698.65	2529.26	295.93	87.71	222.11	2541.46
10.94	367.04	2784.21	2116.65	2063.52	2039.55	2633.53	2471.00	295.93	84.86	232.96	2614.62
10.94	365.93	2739.58	2083.22	2031.06	2007.44	2590.21	2432.17	295.93	84.48	230.31	2525.68
10.94	364.26	2672.70	2033.11	1982.39	1959.29	2525.35	2373.94	295.93	82.48	234.26	2521.57

SUMS				AVERAGE	SUMS					
39790.63	18847.71	49321.71	16267.84	5951.43	27616	6737	20879.90	75256	6737	480.73
y Losses (kJ/kg of Dry Fuel)				**Total**						
Flue Gas Constituent				**Loss**	**Total**	**Chemical**	**Sensible and**	**Total**	**Chem**	**Grams Pro**
N2	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**	**Loss**	**Loss 1**	**Latent Loss**	**Output**	**Loss 2**	**CO**
1983.09	920.99	1529.63	515.73	8041.25	0	0	0.00	0	0	0.00
1643.11	403.86	1618.38	526.84	5826.74	3092	819	2272.72	7420	819	59.97
1411.83	192.08	1680.66	539.51	4811.21	2006	308	1698.16	6254	308	22.59
1306.99	253.83	1697.99	547.28	4858.19	2486	453	2033.17	7651	453	32.05
1324.91	305.43	1727.79	558.76	5068.64	2882	579	2303.39	8382	579	40.21
1350.34	377.81	1725.59	560.71	5332.61	2830	661	2168.88	7683	661	45.75
1436.66	162.23	1742.71	558.32	4785.66	2177	264	1912.76	6834	264	18.89
1491.15	119.27	1733.35	553.78	4720.77	1700	168	1532.25	5434	168	12.38
1480.97	236.96	1698.55	546.85	5056.90	1342	229	1113.04	3914	229	16.46
1525.88	156.30	1686.62	540.16	4868.19	1015	134	880.84	3115	134	10.06
1509.29	234.41	1658.61	533.92	5086.71	868	157	710.32	2511	157	11.63
1337.78	239.92	1650.00	531.34	4850.37	643	122	521.61	1985	122	8.93
1444.81	375.72	1624.69	527.91	5436.02	412	106	306.10	1090	106	7.68
1375.31	440.67	1601.92	522.77	5546.40	315	93	222.69	811	93	6.70
1292.07	472.20	1590.02	519.99	5526.49	419	131	287.56	1083	131	9.47

1243.21	546.11	1575.66	517.85	5688.89	431	150	281.47	1071	150	10.74
1152.30	697.29	1555.78	516.57	6019.21	342	139	203.31	784	139	9.84
1129.86	920.48	1529.03	515.51	6679.45	380	180	200.15	747	180	12.61
1147.81	909.39	1527.02	514.44	6680.68	380	179	201.20	746	179	12.58
1109.54	921.49	1521.94	513.16	6665.29	253	121	131.99	498	121	8.49
1082.83	860.63	1525.15	512.10	6441.68	244	113	130.72	507	113	8.01
1078.82	809.60	1527.94	511.24	6284.24	476	215	261.10	1025	215	15.25
1093.00	773.94	1530.39	510.82	6200.99	353	156	196.93	774	156	11.06
1072.24	805.27	1526.48	510.61	6265.55	237	107	130.13	513	107	7.61
1078.68	837.05	1521.88	510.18	6378.46	363	167	195.36	764	167	11.86
1087.54	905.14	1513.51	509.75	6607.94	250	120	130.34	500	120	8.50
1113.83	940.83	1509.14	509.54	6764.32	128	62	65.72	247	62	4.42
1102.43	1012.93	1499.74	508.90	6975.28	264	134	130.50	486	134	9.46
1133.68	1035.60	1495.49	508.26	7105.47	404	206	197.71	722	206	14.60
1121.46	994.37	1498.52	507.84	6962.66	660	332	328.21	1217	332	23.51
1129.22	985.91	1497.51	507.20	6958.15	264	132	131.57	487	132	9.39

33.75

oduced HC
0.00
3.83
1.43
2.32
3.09
3.57
1.31
0.77
1.12
0.58
0.71
0.57
0.51
0.45
0.64

0.74
0.71
0.94
0.93
0.63
0.58
1.10
0.79
0.55
0.85
0.61
0.32
0.69
1.06
1.69
0.67

Dirigo Laboratories, Inc.

Manufacturer:	**Pacific Energy**
Model:	**TN20**
Date:	**12/22/2016**
Run:	**6**
Control #:	**034-S-74-1**
Test Duration:	**300**
Output Category:	**2**

	HHV Basis	LHV Basis
Overall Efficiency	73.0%	78.9%
Combustion Efficiency	93.4%	93.4%
Heat Transfer Efficiency	78.1%	84.4%

HHV Output Rate (kJ/h)	14,901	14,135	**(Btu/h)**
Burn Rate (kg/h)	1.03	2.27	**(lb/h)**
Input (kJ/h)	20,424	19,375	**(Btu/h)**

Test Load Weight (dry kg)	5.2	11.4	**dry lb**
MC wet (%)	16.46		
MC dry (%)	19.70		
Particulate (g)	10.82		
CO (g)	481		
Test Duration (h)	5		

Emissions	**Particulate**	**CO**
g/MJ Output	0.15	6.45
g/kg Dry Fuel	2.10	93.25
g/h	2.16	96.15
lb/MM Btu Output	0.34	15.00

Air/Fuel Ratio (A/F)	12.93

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: Pacific Energy
Model: TN20
Date: 12/20/2016
Run: 4
Control #: 034-S-74-1
est Duration: 150
urn Category 4

Appliance Type: Non-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):	13.80
Burn Rate (dry kg/h):	2.09
Total Particulate Emissions:	5.11 g

Fuel Data

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

Averages		**451.8**	**74.9**	**11.85**	**8.50**	**0.53**
		Temp. (F)				
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**Flue Gas Composition (%) O2**	**CO2**	**CO**
0	13.8	321.0	75.0	16.94	2.96	0.85
10	12.5	503.0	74.0	9.92	10.96	0.44
20	10.0	663.0	75.0	4.80	15.67	0.78
30	7.6	667.0	75.0	4.59	15.90	0.54
40	5.9	600.0	76.0	7.45	13.33	0.12
50	4.3	578.0	76.0	8.02	12.85	0.12
60	3.0	540.0	75.0	9.89	10.78	0.03
70	2.2	489.0	75.0	11.58	8.94	0.02
80	1.7	440.0	75.0	13.27	7.08	0.14
90	1.5	392.0	75.0	14.27	5.83	0.59
100	1.2	365.0	75.0	14.60	5.55	0.66
110	1.0	348.0	75.0	14.89	5.25	0.76
120	0.7	347.0	75.0	14.21	5.99	0.45
130	0.5	333.0	74.0	15.10	4.96	0.83
140	0.3	325.0	74.0	15.02	5.00	1.04
150	0.0	317.0	74.0	15.05	4.89	1.09

Manufacturer:	Pacific Energy
Model:	TN20
Date:	12/20/2016
Run:	4
Control #:	034-S-74-1
Test Duration:	150 min

	HHV	LHV
Eff	70.6%	76.3%
Comb Eff	96.9%	96.9%
HT Eff	72.8%	78.7%
Output	29,208	kJ/h
Burn Rate	2.09	kg/h
Grams CO	233	g
Input	41,380	kJ/h
MC wet	16.60	

Overall Heating Efficiency:
Combustion Efficiency:
Heat Transfer Efficiency:

Heat Output:	27,707
Heat Input:	39,254
Burn Duration:	2.5
Burn Rate:	4.6
Stack Temp:	460.5

	Ultimate CO2
CO2-ult	19.64
	F_0
	1.062

	Averages	0.53	8.50	159.0%	20.34	11.58	233.2	23.8	93.8%	71.4%
INPUT DATA				**Oxygen Calculation**			**Input Data**		**Combust**	**Heat**
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**	**Room Temp (ºC)**	**Eff %**	**Transfer %**
0	6.26	0.85	2.96	415.6%	20.69	17.30	160.6	23.9	82.8%	61.4%
10	5.67	0.44	10.96	72.3%	20.19	9.01	261.7	23.3	97.0%	74.1%
20	4.54	0.78	15.67	19.4%	19.85	3.79	350.6	23.9	96.1%	73.4%
30	3.45	0.54	15.90	19.5%	19.85	3.68	352.8	23.9	97.3%	73.6%
40	2.68	0.12	13.33	46.0%	20.05	6.66	315.6	24.4	99.4%	73.5%
50	1.95	0.12	12.85	51.4%	20.08	7.17	303.3	24.4	99.4%	73.7%
60	1.36	0.03	10.78	81.7%	20.23	9.43	282.2	23.9	100.0%	72.6%
70	1.00	0.02	8.94	119.2%	20.35	11.40	253.9	23.9	100.2%	71.9%
80	0.77	0.14	7.08	172.1%	20.46	13.31	226.7	23.9	98.9%	70.5%
90	0.68	0.59	5.83	206.0%	20.52	14.39	200.0	23.9	92.9%	69.8%
100	0.54	0.66	5.55	216.3%	20.53	14.65	185.0	23.9	91.8%	70.7%
110	0.45	0.76	5.25	226.8%	20.54	14.91	175.6	23.9	90.1%	70.8%
120	0.32	0.45	5.99	205.0%	20.51	14.30	175.0	23.9	94.7%	73.1%
130	0.23	0.83	4.96	239.3%	20.56	15.18	167.2	23.3	88.8%	70.8%
140	0.14	1.04	5.00	225.2%	20.54	15.02	162.8	23.3	86.4%	71.5%

150	0.00	1.09	4.89	228.5%	20.55	15.11	158.3	23.3	85.6%	71.7%

	Air Fuel Ratio (A/F)		
70.6%	Dry Molecular Weight (Md)	29.82	
96.9%	Dry Moles Exhaust Gas (Nr):	410.83	%HC
72.8%	Air Fuel Ratio (A/F)	11.74	1.32

Combustion Efficiency:	96.9%
Total Input (kJ):	103,451
Total Output (kJ):	73,019
Efficiency:	70.6%
Total CO (g):	233.36

Btu/h	29,208	kJ/h
Btu/h	41,380	kJ/h
h		
lb/h	2.1	kg/h
Deg. F	238.0	Deg. C

67.1%	15.4	1.88	70.02	0.03	70.02	104575	4.06	6.87	2.74	19810.00	16.60
Net Eff %	**Air Fuel Ratio**	**Wet Wt Now Wt**	**% Wet Consumed x**	**Dry Wt. Now Wtdn**	**% Dry Comsumed y**	**Fuel Properties**					**Mw Moisture Fuel Burnt**
						Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	
50.8%	30.1	6.26	0.00	5.22	0.00	0	4.06	6.87	2.74	19810.00	16.60
71.8%	10.4	5.67	9.42	4.73	9.42	19116	4.06	6.87	2.74	19810.00	16.60
70.5%	7.2	4.54	27.54	3.78	27.54	18366	4.06	6.87	2.74	19810.00	16.60
71.6%	7.2	3.45	44.93	2.88	44.93	15368	4.06	6.87	2.74	19810.00	16.60
73.0%	8.8	2.68	57.25	2.23	57.25	12369	4.06	6.87	2.74	19810.00	16.60
73.2%	9.2	1.95	68.84	1.63	68.84	10870	4.06	6.87	2.74	19810.00	16.60
72.6%	11.0	1.36	78.26	1.14	78.26	7871	4.06	6.87	2.74	19810.00	16.60
72.1%	13.3	1.00	84.06	0.83	84.06	4873	4.06	6.87	2.74	19810.00	16.60
69.7%	16.4	0.77	87.68	0.64	87.68	2624	4.06	6.87	2.74	19810.00	16.60
64.8%	18.2	0.68	89.13	0.57	89.13	1874	4.06	6.87	2.74	19810.00	16.60
64.8%	18.8	0.54	91.30	0.45	91.30	1874	4.06	6.87	2.74	19810.00	16.60
63.8%	19.3	0.45	92.75	0.38	92.75	1874	4.06	6.87	2.74	19810.00	16.60
69.2%	18.2	0.32	94.93	0.26	94.93	1874	4.06	6.87	2.74	19810.00	16.60
62.9%	20.0	0.23	96.38	0.19	96.38	1499	4.06	6.87	2.74	19810.00	16.60
61.7%	19.1	0.14	97.83	0.11	97.83	2999	4.06	6.87	2.74	19810.00	16.60

61.3%	19.2	0.00	100.00	0.00	100.00	1124	4.06	6.87	2.74	19810.00	16.60

				Moisture Content MCwb:	16.60
		Moisture of Wood (wet basis):	16.60	Dry kg :	5.22
98,118	(Btu)	Initial Dry Weight Wtdo (kg):	5.22	CA:	48.73
69,255	(Btu)	Moisture Content Dry	19.90	HY:	6.87
				OX:	43.90

Load Weight (kg):	6.26					
Fuel Heating:	HHV	LHV		HHV	LHV	
Value in kJ/kg - CV:	19810.00	18328.69	Btu/lb	8522.48	7885.21	

79.39	21.06	2.24	7.57	0.06	0.22	37.25	69.89	3.20	0.35	421.71	33.81
Mass Balance (moles/100 mole dry flue gas)					**kg Wood per 100 mole dfp**	**Moles per kg of Dry Wood**					
[h]	**[u]**	**[w]**	**[j]**	**[k]**	**Nk**	**CO2**	**O2**	**CO**	**HC**	**N2**	**H2O**
78.89	20.92	0.96	3.11	0.10	0.10	30.93	180.79	8.88	1.00	824.24	32.52
79.59	21.11	2.82	9.59	0.05	0.28	39.07	32.11	1.57	0.18	283.71	34.17
79.76	21.16	4.08	13.79	0.11	0.41	38.62	9.35	1.92	0.27	196.59	33.99
79.88	21.19	4.07	13.82	0.07	0.40	39.30	9.11	1.33	0.18	197.42	34.16
79.89	21.19	3.31	11.37	0.01	0.33	40.43	20.20	0.36	0.02	242.29	34.48
79.86	21.18	3.20	10.96	0.01	0.32	40.42	22.56	0.38	0.02	251.17	34.49
79.76	21.16	2.66	9.16	-0.01	0.26	40.74	35.64	0.11	-0.04	301.42	34.60
79.64	21.13	2.20	7.60	-0.02	0.22	40.79	52.01	0.09	-0.07	363.39	34.66
79.47	21.08	1.78	6.11	0.00	0.18	40.03	75.27	0.79	-0.01	449.26	34.53
79.19	21.01	1.60	5.36	0.06	0.16	36.70	90.60	3.71	0.40	498.53	33.73
79.14	20.99	1.55	5.17	0.07	0.15	36.05	95.17	4.29	0.47	514.10	33.58
79.08	20.98	1.50	4.98	0.09	0.15	35.14	99.83	5.09	0.58	529.35	33.36
79.26	21.02	1.60	5.40	0.04	0.16	37.71	90.03	2.83	0.27	499.00	33.99
79.03	20.96	1.45	4.79	0.10	0.14	34.39	105.26	5.75	0.67	547.91	33.18
78.94	20.94	1.52	4.96	0.13	0.15	33.09	99.40	6.88	0.84	522.37	32.84

78.91	20.93	1.51	4.90	0.13	0.15	32.64	100.85	7.28	0.90	526.69	32.73

11.06	506.34	8690.62	6385.11	6170.90	6110.52	8705.92	7372.35	296.97	5295.66	5741.73	14757.15
Moisture	Stack Temp	Heat Content Change - Ambient to Stack Temperature Flue Gas Constituent						Room Temp	Energ		
Present	K	CO2	O2	CO	N2	CH4	H2O	K	CO2	O2	CO
11.06	433.71	5485.23	4109.61	3991.77	3948.48	5320.69	4775.35	297.04	169.64	743.00	2548.38
11.06	534.82	9913.20	7274.61	7028.36	6960.06	9949.80	8396.06	296.48	387.28	233.56	454.87
11.06	623.71	14010.99	10102.28	9715.09	9630.23	14455.60	11591.15	297.04	541.17	94.47	562.76
11.06	625.93	14116.90	10174.29	9783.23	9698.01	14574.40	11672.09	297.04	554.76	92.65	390.75
11.06	588.71	12340.59	8957.59	8629.59	8550.96	12601.44	10300.95	297.59	498.90	180.98	106.13
11.06	576.48	11773.05	8566.17	8257.74	8181.38	11976.93	9858.76	297.59	475.82	193.28	109.93
11.06	555.37	10824.16	7909.61	7633.43	7561.02	10937.45	9116.16	297.04	440.97	281.92	32.95
11.06	527.04	9542.50	7012.78	6777.97	6711.55	9555.39	8097.75	297.04	389.25	364.73	26.44
11.06	499.82	8333.03	6157.93	5960.29	5900.07	8269.88	7123.59	297.04	333.54	463.48	228.70
11.06	473.15	7169.09	5326.98	5163.32	5109.61	7050.84	6173.41	297.04	263.12	482.62	1070.30
11.06	458.15	6523.43	4862.39	4716.77	4666.92	6382.62	5640.71	297.04	235.19	462.74	1233.53
11.06	448.71	6120.25	4570.91	4436.26	4388.90	5968.36	5305.96	297.04	215.09	456.31	1462.30
11.06	448.15	6096.61	4553.79	4419.78	4372.56	5944.15	5286.29	297.04	229.91	409.96	814.26
11.06	440.37	5787.85	4330.75	4205.18	4159.86	5626.48	5030.22	296.48	199.03	455.87	1652.69
11.06	435.93	5600.08	4194.19	4073.56	4029.45	5435.34	4873.08	296.48	185.29	416.91	1975.62

11.06	431.48	5412.89	4057.81	3942.04	3899.16	5245.30	4716.05	296.48	176.67	409.25	2087.54

SUMS				AVERAGE	SUMS					
36421.71	5089.13	27795.52	9081.79	6511.42	30431	3192	27238.73	74144	3192	233.36
y Losses (kJ/kg of Dry Fuel)				**Total**						
Flue Gas Constituent				**Loss**	**Total**	**Chemical**	**Sensible and**	**Total**	**Chem**	**Grams Pr**
N2	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**	**Loss**	**Loss 1**	**Latent Loss**	**Output**	**Loss 2**	**CO**
3254.51	898.81	1584.93	538.90	9738.18	0	0	0.00	0	0	0.00
1974.63	159.29	1789.24	578.93	5577.80	5382	580	4802.06	13734	580	42.38
1893.20	239.91	1888.61	614.25	5834.37	5409	723	4685.86	12957	723	49.91
1914.56	162.76	1900.86	615.15	5631.49	4369	417	3951.42	10999	417	28.99
2071.80	18.55	1871.31	599.99	5347.67	3339	76	3263.28	9030	76	6.36
2054.89	16.89	1856.26	595.10	5302.16	2909	68	2841.56	7960	68	5.80
2279.08	-36.78	1836.97	586.89	5422.01	2154	-2	2156.05	5717	-2	1.26
2438.91	-63.32	1804.81	575.63	5536.45	1362	-9	1370.86	3511	-9	0.63
2650.69	-5.14	1764.43	564.86	6000.57	795	29	765.76	1829	29	2.94
2547.29	355.00	1691.37	554.36	6964.05	659	133	526.07	1215	133	9.84
2399.26	423.04	1665.84	548.47	6968.06	659	155	504.69	1215	155	11.36
2323.25	520.63	1643.84	544.77	7166.19	678	185	492.82	1196	185	13.48
2181.90	240.27	1674.01	544.55	6094.86	577	98	478.17	1298	98	7.50
2279.22	599.70	1625.97	541.72	7354.21	557	168	388.24	943	168	12.19
2104.87	755.23	1603.78	539.98	7581.67	1148	408	739.19	1851	408	29.17

2053.66	804.30	1593.27	538.24	7662.93	435	162	272.71	689	162	11.56

14.99

oduced HC
0.00
2.73
3.93
2.23
0.21
0.16
-0.26
-0.28
-0.01
0.60
0.71
0.88
0.41
0.81
2.04

0.82

Dirigo Laboratories, Inc.

Manufacturer:	**Pacific Energy**
Model:	**TN20**
Date:	**12/20/2016**
Run:	**4**
Control #:	**034-S-74-1**
Test Duration:	**150**
Output Category:	**4**

	HHV Basis	LHV Basis
Overall Efficiency	70.6%	76.3%
Combustion Efficiency	96.9%	96.9%
Heat Transfer Efficiency	72.8%	78.7%

HHV Output Rate (kJ/h)	29,208	27,707	**(Btu/h)**
Burn Rate (kg/h)	2.09	4.60	**(lb/h)**
Input (kJ/h)	41,380	39,254	**(Btu/h)**

Test Load Weight (dry kg)	5.2	11.5	**dry lb**
MC wet (%)	16.60		
MC dry (%)	19.90		
Particulate (g)	5.11		
CO (g)	233		
Test Duration (h)	2.5		

Emissions	**Particulate**	**CO**
g/MJ Output	0.07	3.20
g/kg Dry Fuel	0.98	44.69
g/h	2.04	93.35
lb/MM Btu Output	0.16	7.43

Air/Fuel Ratio (A/F)	11.74

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: Pacific Energy
Model: TN20
Date: 12/20/2016
Run: 3
Control #: 034-S-74-1
est Duration: 190
urn Category 3

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

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

Wood Moisture (% DRY): 19.8
Wood Moisture (% wet): 16.53
Load Weight (lb wet): 13.70
Burn Rate (dry kg/h): 1.64
Total Particulate Emissions: 6.97 g

Fuel Data

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

Averages		**377.5**	**73.3**	**12.17**	**8.26**	**0.61**
		Temp. (F)				
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**Flue Gas Composition (%) O2**	**CO2**	**CO**
0	13.7	300.0	74.0	16.29	3.79	0.74
10	12.0	531.0	74.0	7.92	12.84	0.43
20	9.9	591.0	74.0	5.52	15.10	0.92
30	7.7	587.0	74.0	5.01	15.41	1.14
40	5.9	563.0	74.0	5.77	14.84	0.37
50	4.4	540.0	74.0	7.46	13.02	0.33
60	3.4	465.0	74.0	10.80	9.87	0.09
70	2.7	415.0	74.0	12.06	8.53	0.10
80	2.3	378.0	74.0	12.75	7.65	0.17
90	1.9	350.0	74.0	13.41	6.80	0.44
100	1.7	321.0	73.0	13.75	6.53	0.58
110	1.5	306.0	73.0	13.80	6.54	0.69
120	1.2	297.0	73.0	13.94	6.46	0.71
130	1.0	292.0	73.0	14.07	6.31	0.61
140	0.8	284.0	73.0	14.59	5.85	0.73
150	0.6	277.0	72.0	14.94	5.48	0.73
160	0.4	269.0	72.0	14.98	5.40	0.81
170	0.2	266.0	72.0	15.05	5.32	0.86
180	0.1	261.0	72.0	15.36	4.98	0.86
190	0.0	256.0	72.0	15.85	4.49	0.88

Manufacturer:	Pacific Energy
Model:	TN20
Date:	12/20/2016
Run:	3
Control #:	034-S-74-1
Test Duration:	190 min

	HHV	LHV
Eff	72.2%	78.1%
Comb Eff	96.1%	96.1%
HT Eff	75.2%	81.2%
Output	23,451	kJ/h
Burn Rate	1.64	kg/h
Grams CO	287	g
Input	32,459	kJ/h
MC wet	16.53	

Overall Heating Efficiency:
Combustion Efficiency:
Heat Transfer Efficiency:

Heat Output: 22,246
Heat Input: 30,791

Ultimate CO2
CO2-ult 19.64
F_0
1.062

Burn Duration: 3.166666667
Burn Rate: 3.6
Stack Temp: 381.5

Averages	0.61	8.26	155.2%	20.35	11.79	191.9	22.9	93.6%	75.2%

INPUT DATA				Oxygen Calculation			Input Data		Combust	Heat
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**	**Room Temp (ºC)**	**Eff %**	**Transfer %**
0	6.22	0.74	3.79	333.6%	20.64	16.48	148.9	23.3	87.4%	68.8%
10	5.44	0.43	12.84	48.0%	20.06	7.01	277.2	23.3	97.4%	75.1%
20	4.49	0.92	15.10	22.6%	19.88	4.32	310.6	23.3	95.2%	75.0%
30	3.49	1.14	15.41	18.7%	19.85	3.87	308.3	23.3	94.3%	75.3%
40	2.68	0.37	14.84	29.1%	19.94	4.91	295.0	23.3	98.0%	75.8%
50	2.00	0.33	13.02	47.1%	20.06	6.87	282.2	23.3	98.1%	75.0%
60	1.54	0.09	9.87	97.2%	20.28	10.37	240.6	23.3	99.5%	74.3%
70	1.23	0.10	8.53	127.6%	20.37	11.79	212.8	23.3	99.4%	74.5%
80	1.04	0.17	7.65	151.2%	20.42	12.69	192.2	23.3	98.6%	74.8%
90	0.86	0.44	6.80	171.3%	20.46	13.44	176.7	23.3	95.4%	74.6%
100	0.77	0.58	6.53	176.3%	20.47	13.65	160.6	22.8	93.7%	75.6%
110	0.68	0.69	6.54	171.7%	20.46	13.58	152.2	22.8	92.5%	76.4%
120	0.54	0.71	6.46	174.0%	20.47	13.65	147.2	22.8	92.2%	76.8%
130	0.45	0.61	6.31	183.9%	20.48	13.87	144.4	22.8	93.2%	76.9%
140	0.36	0.73	5.85	198.5%	20.51	14.29	140.0	22.8	91.3%	76.4%

150	0.27	0.73	5.48	216.3%	20.53	14.68	136.1	22.2	90.8%	76.0%
160	0.18	0.81	5.40	216.3%	20.53	14.72	131.7	22.2	89.8%	76.3%
170	0.09	0.86	5.32	217.8%	20.53	14.78	130.0	22.2	89.1%	76.3%
180	0.05	0.86	4.98	236.4%	20.55	15.14	127.2	22.2	88.4%	75.8%
190	0.00	0.88	4.49	265.8%	20.59	15.66	124.4	22.2	87.2%	74.9%

	Air Fuel Ratio (A/F)		
72.2%	Dry Molecular Weight (Md)	29.79	
96.1%	Dry Moles Exhaust Gas (Nr):	417.08	%HC
75.2%	Air Fuel Ratio (A/F)	11.92	1.32

Combustion Efficiency:	96.1%
Total Input (kJ):	102,787
Total Output (kJ):	74,261
Efficiency:	72.2%
Total CO (g):	286.61

Btu/h	23,451	kJ/h
Btu/h	32,459	kJ/h
h		
lb/h	1.6	kg/h
Deg. F	194.2	Deg. C

70.4%	15.2	1.62	73.94	0.03	73.94	103162	4.06	6.87	2.74	19810.00	16.53
Net Eff %	**Air Fuel Ratio**	**Wet Wt Now Wt**	**% Wet Consumed x**	**Dry Wt. Now Wtdn**	**% Dry Comsumed y**	**Fuel Properties**					**Mw Moisture Fuel Burnt**
						Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	
60.1%	25.5	6.22	0.00	5.19	0.00	0	4.06	6.87	2.74	19810.00	16.53
73.2%	8.9	5.44	12.41	4.54	12.41	20632	4.06	6.87	2.74	19810.00	16.53
71.5%	7.3	4.49	27.74	3.75	27.74	16131	4.06	6.87	2.74	19810.00	16.53
71.0%	7.1	3.49	43.80	2.92	43.80	15005	4.06	6.87	2.74	19810.00	16.53
74.3%	7.8	2.68	56.93	2.23	56.93	12379	4.06	6.87	2.74	19810.00	16.53
73.6%	8.9	2.00	67.88	1.67	67.88	9378	4.06	6.87	2.74	19810.00	16.53
74.0%	11.9	1.54	75.18	1.29	75.18	6377	4.06	6.87	2.74	19810.00	16.53
74.1%	13.7	1.23	80.29	1.02	80.29	4126	4.06	6.87	2.74	19810.00	16.53
73.8%	15.1	1.04	83.21	0.87	83.21	3001	4.06	6.87	2.74	19810.00	16.53
71.2%	16.2	0.86	86.13	0.72	86.13	2251	4.06	6.87	2.74	19810.00	16.53
70.9%	16.5	0.77	87.59	0.64	87.59	1501	4.06	6.87	2.74	19810.00	16.53
70.7%	16.1	0.68	89.05	0.57	89.05	1876	4.06	6.87	2.74	19810.00	16.53
70.8%	16.3	0.54	91.24	0.45	91.24	1876	4.06	6.87	2.74	19810.00	16.53
71.6%	16.9	0.45	92.70	0.38	92.70	1501	4.06	6.87	2.74	19810.00	16.53
69.8%	17.7	0.36	94.16	0.30	94.16	1501	4.06	6.87	2.74	19810.00	16.53

69.0%	18.7	0.27	95.62	0.23	95.62	1501	4.06	6.87	2.74	19810.00	16.53
68.5%	18.7	0.18	97.08	0.15	97.08	1501	4.06	6.87	2.74	19810.00	16.53
67.9%	18.7	0.09	98.54	0.08	98.54	1125	4.06	6.87	2.74	19810.00	16.53
67.1%	19.8	0.05	99.27	0.04	99.27	1125	4.06	6.87	2.74	19810.00	16.53
65.3%	21.5	0.00	100.00	0.00	100.00	375	4.06	6.87	2.74	19810.00	16.53

				Moisture Content MCwb:	16.53
		Moisture of Wood (wet basis):	16.53	Dry kg :	5.19
97,488	(Btu)	Initial Dry Weight Wtdo (kg):	5.19	CA:	48.73
70,433	(Btu)	Moisture Content Dry	19.80	HY:	6.87
				OX:	43.90

Load Weight (kg):	6.22					
Fuel Heating:	HHV	LHV		HHV	LHV	
Value in kJ/kg - CV:	19810.00	18328.69	Btu/lb	8522.48	7885.21	

79.34	21.05	2.20	7.42	0.07	0.22	37.12	68.39	3.32	0.37	415.72	33.77
Mass Balance (moles/100 mole dry flue gas)					**kg Wood per 100 mole dfp**	**Moles per kg of Dry Wood**					
[h]	**[u]**	**[w]**	**[j]**	**[k]**	**Nk**	**CO2**	**O2**	**CO**	**HC**	**N2**	**H2O**
78.99	20.95	1.14	3.74	0.08	0.11	33.54	145.86	6.55	0.72	699.09	33.08
79.72	21.15	3.28	11.17	0.05	0.33	39.34	21.47	1.32	0.16	244.24	34.21
79.66	21.13	3.98	13.40	0.13	0.40	38.17	10.92	2.33	0.32	201.34	33.88
79.58	21.11	4.11	13.81	0.16	0.41	37.64	9.45	2.78	0.39	194.37	33.74
79.88	21.19	3.76	12.81	0.05	0.37	39.70	13.14	0.99	0.12	213.69	34.28
79.78	21.16	3.30	11.25	0.04	0.33	39.69	20.95	1.01	0.11	243.21	34.30
79.67	21.13	2.45	8.43	0.00	0.24	40.46	42.50	0.37	-0.01	326.59	34.55
79.58	21.11	2.12	7.31	0.00	0.21	40.36	55.79	0.47	-0.02	376.53	34.56
79.49	21.09	1.93	6.61	0.00	0.19	39.90	66.18	0.89	0.02	414.63	34.48
79.32	21.04	1.79	6.08	0.04	0.18	38.11	75.33	2.47	0.24	444.51	34.05
79.24	21.02	1.77	5.94	0.06	0.18	37.16	77.67	3.30	0.36	450.88	33.81
79.19	21.01	1.80	6.02	0.08	0.18	36.52	75.82	3.85	0.44	442.21	33.64
79.18	21.00	1.79	5.97	0.08	0.18	36.36	76.83	4.00	0.46	445.62	33.60
79.21	21.01	1.72	5.78	0.07	0.17	36.86	81.01	3.56	0.39	462.72	33.74
79.13	20.99	1.64	5.47	0.08	0.16	35.83	87.53	4.47	0.51	484.66	33.50

79.11	20.98	1.55	5.16	0.08	0.15	35.54	95.24	4.73	0.54	513.04	33.45
79.07	20.97	1.55	5.14	0.09	0.15	34.96	95.32	5.24	0.61	511.84	33.30
79.04	20.97	1.55	5.11	0.10	0.15	34.56	96.04	5.59	0.66	513.52	33.20
79.02	20.96	1.46	4.82	0.10	0.15	34.21	104.04	5.91	0.69	542.81	33.14
78.97	20.95	1.35	4.42	0.10	0.13	33.48	116.74	6.56	0.77	588.91	32.99

11.00	465.07	6920.77	5124.66	4962.78	4912.10	6845.63	5932.22	296.07	5231.87	5595.19	19057.59
Moisture	**Stack Temp**	**Heat Content Change - Ambient to Stack Temperature Flue Gas Constituent**						**Room Temp**	**Energ**		
Present	**K**	**CO2**	**O2**	**CO**	**N2**	**CH4**	**H2O**	**K**	**CO2**	**O2**	**CO**
11.00	422.04	5017.02	3768.59	3662.94	3622.71	4845.14	4382.74	296.48	168.29	549.70	1877.13
11.00	550.37	10617.48	7767.18	7498.15	7426.57	10709.78	8955.31	296.48	417.67	166.78	382.69
11.00	583.71	12150.29	8830.03	8509.40	8431.29	12383.96	10158.34	296.48	463.72	96.46	677.84
11.00	581.48	12047.10	8758.86	8441.79	8364.09	12270.41	10077.94	296.48	453.42	82.73	811.45
11.00	568.15	11430.97	8332.79	8036.71	7961.56	11594.93	9596.14	296.48	453.80	109.47	288.06
11.00	555.37	10845.35	7925.97	7649.44	7576.84	10956.94	9135.36	296.48	430.49	166.09	292.40
11.00	513.71	8968.61	6609.61	6392.96	6329.33	8940.06	7639.28	296.48	362.85	280.89	106.76
11.00	485.93	7745.43	5740.71	5560.72	5503.64	7649.48	6647.39	296.48	312.61	320.25	136.53
11.00	465.37	6854.68	5102.19	4947.63	4895.71	6722.28	5916.23	296.48	273.52	337.69	255.33
11.00	449.82	6188.74	4621.52	4485.25	4437.39	6036.33	5364.51	296.48	235.84	348.14	708.87
11.00	433.71	5527.60	4142.34	4023.80	3980.11	5359.66	4813.74	295.93	205.38	321.74	947.22
11.00	425.37	5177.63	3886.94	3777.40	3736.03	5005.28	4519.51	295.93	189.09	294.70	1104.93
11.00	420.37	4968.61	3734.00	3629.75	3589.79	4794.52	4343.17	295.93	180.65	286.89	1145.33
11.00	417.59	4852.81	3649.13	3547.78	3508.61	4678.04	4245.26	295.93	178.87	295.62	1021.04
11.00	413.15	4667.98	3513.48	3416.73	3378.83	4492.56	4088.70	295.93	167.26	307.53	1280.58

11.00	409.26	4527.90	3411.30	3318.15	3281.18	4350.64	3970.99	295.37	160.93	324.89	1355.53
11.00	404.82	4344.15	3275.98	3187.30	3151.63	4167.24	3814.64	295.37	151.86	312.28	1500.63
11.00	403.15	4275.39	3225.29	3138.26	3103.08	4098.75	3756.03	295.37	147.78	309.76	1598.77
11.00	400.37	4160.97	3140.85	3056.56	3022.19	3984.94	3658.40	295.37	142.35	326.76	1689.95
11.00	397.59	4046.78	3056.48	2974.90	2941.36	3871.57	3560.80	295.37	135.49	356.82	1876.55

SUMS				AVERAGE	SUMS					
35925.68	6696.78	33723.36	10978.36	5860.44	28525	3994	24531.92	74636	3994	286.61
y Losses (kJ/kg of Dry Fuel)				**Total**						
Flue Gas Constituent				**Loss**	**Total**	**Chemical**	**Sensible and**	**Total**	**Chem**	**Grams Pr**
N2	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**	**Loss**	**Loss 1**	**Latent Loss**	**Output**	**Loss 2**	**CO**
2532.59	644.41	1599.60	531.87	7903.59	0	0	0.00	0	0	0.00
1813.86	141.87	1810.42	582.17	5315.46	5536	534	5001.82	15096	534	38.42
1697.53	290.06	1833.83	595.41	5654.85	4605	769	3835.81	11526	769	53.02
1625.75	352.55	1823.61	594.52	5744.04	4351	860	3490.65	10654	860	59.05
1701.31	111.05	1836.02	589.22	5088.93	3180	244	2936.56	9199	244	17.32
1842.77	101.77	1821.31	584.15	5238.97	2480	182	2297.83	6898	182	13.34
2067.07	-13.12	1783.16	567.70	5155.30	1660	29	1630.18	4718	29	3.33
2072.31	-18.66	1749.51	556.78	5129.34	1068	24	1044.42	3058	24	2.76
2029.92	20.43	1719.90	548.74	5185.52	786	41	744.48	2216	41	3.76
1972.47	213.51	1679.62	542.67	5701.13	648	103	544.38	1603	103	7.84
1794.54	318.90	1649.36	536.61	5773.77	437	95	342.59	1063	95	7.00
1652.13	393.57	1631.31	533.38	5799.10	549	140	408.78	1327	140	10.21
1599.70	410.67	1623.52	531.44	5778.20	547	146	401.35	1329	146	10.59
1623.50	348.17	1626.96	530.36	5624.52	426	103	323.42	1074	103	7.56
1637.57	457.10	1609.97	528.64	5988.64	454	130	323.33	1047	130	9.48

1683.38	480.27	1603.53	527.34	6135.89	465	138	327.08	1036	138	10.04
1613.13	546.43	1591.22	525.62	6241.18	473	154	319.15	1028	154	11.12
1593.50	590.18	1584.60	524.98	6349.57	361	123	237.51	765	123	8.89
1640.47	620.36	1578.13	523.91	6521.92	371	130	240.44	755	130	9.40
1732.19	687.26	1567.78	522.83	6878.92	130	48	82.14	245	48	3.48

19.72

oduced HC
0.00
2.62
4.19
4.73
1.23
0.86
-0.08
-0.07
0.06
0.43
0.43
0.67
0.70
0.47
0.62

0.65
0.74
0.60
0.63
0.23

Dirigo Laboratories, Inc.

Manufacturer:	**Pacific Energy**
Model:	**TN20**
Date:	**12/20/2016**
Run:	**3**
Control #:	**034-S-74-1**
Test Duration:	**190**
Output Category:	**3**

	HHV Basis	LHV Basis	
Overall Efficiency	72.2%	78.1%	
Combustion Efficiency	96.1%	96.1%	
Heat Transfer Efficiency	75.2%	81.2%	
HHV Output Rate (kJ/h)	23,451	22,246	**(Btu/h)**
Burn Rate (kg/h)	1.64	3.61	**(lb/h)**
Input (kJ/h)	32,459	30,791	**(Btu/h)**
Test Load Weight (dry kg)	5.2	11.4	**dry lb**
MC wet (%)	16.53		
MC dry (%)	19.80		
Particulate (g)	6.97		
CO (g)	287		
Test Duration (h)	3.166666667		

Emissions	**Particulate**	**CO**
g/MJ Output	0.09	3.86
g/kg Dry Fuel	1.34	55.24
g/h	2.20	90.51
lb/MM Btu Output	0.22	8.97

Air/Fuel Ratio (A/F)	11.92

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: Pacific Energy
Model: TN20
Date: 12/20/2016
Run: 2
Control #: 034-S-74-1
est Duration: 310
urn Category 2

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

Wood Moisture (% DRY): 19.6
Wood Moisture (% wet): 16.39
Load Weight (lb wet): 13.80
Burn Rate (dry kg/h): 1.01
Total Particulate Emissions: 7.11 g

Fuel Data

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

Averages		**253.1**	**69.6**	**12.94**	**7.03**	**1.11**
		Temp. (F)				
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**Flue Gas Composition (%) O2**	**CO2**	**CO**
0	13.8	244.0	70.0	16.15	3.57	1.00
10	12.6	343.0	70.0	13.62	6.99	0.61
20	11.3	399.0	70.0	9.96	10.85	0.61
30	9.8	423.0	70.0	8.26	12.49	1.06
40	8.2	428.0	69.0	7.74	13.02	1.19
50	6.8	430.0	70.0	7.42	13.43	0.70
60	5.5	405.0	70.0	8.50	12.33	0.43
70	4.7	363.0	70.0	10.40	10.35	0.26
80	4.1	318.0	70.0	12.34	8.05	0.50
90	3.6	305.0	70.0	11.40	9.00	0.38
100	3.0	319.0	70.0	10.13	9.81	0.59
110	2.7	282.0	70.0	12.38	7.26	0.61
120	2.5	254.0	70.0	12.70	7.12	0.72
130	2.3	238.0	70.0	12.77	7.21	0.71
140	2.1	228.0	70.0	13.05	6.94	0.74
150	1.8	220.0	70.0	13.32	6.65	0.78
160	1.8	212.0	70.0	13.71	6.09	1.10
170	1.6	206.0	70.0	13.67	6.07	1.22
180	1.5	200.0	69.0	14.07	5.65	1.33
190	1.3	196.0	69.0	13.90	5.78	1.45
200	1.2	192.0	69.0	14.07	5.59	1.52
210	1.1	188.0	68.0	14.19	5.45	1.54
220	0.9	185.0	68.0	14.20	5.45	1.59
230	0.8	183.0	68.0	14.54	5.06	1.78
240	0.7	180.0	68.0	14.79	4.82	1.58
250	0.6	175.0	69.0	14.78	4.76	1.72
260	0.5	172.0	69.0	15.14	4.52	1.48
270	0.4	168.0	70.0	15.30	4.13	1.75
280	0.3	164.0	70.0	15.31	4.21	1.58
290	0.2	161.0	70.0	15.49	3.98	1.69
300	0.1	160.0	71.0	15.27	4.20	1.75
310	0.0	157.0	71.0	15.45	4.04	1.67

Manufacturer:	Pacific Energy
Model:	TN20
Date:	12/20/2016
Run:	2
Control #:	034-S-74-1
Test Duration:	310 min

	HHV	LHV
Eff	72.9%	78.8%
Comb Eff	93.1%	93.1%
HT Eff	78.3%	84.7%
Output	14,633	kJ/h
Burn Rate	1.01	kg/h
Grams CO	511	g
Input	20,073	kJ/h
MC wet	16.39	

Overall Heating Efficiency:
Combustion Efficiency:
Heat Transfer Efficiency:

Heat Output: 13,881
Heat Input: 19,041

Ultimate CO2
CO2-ult 19.64
F_0
1.061

Burn Duration: 5.166666667
Burn Rate: 2.2
Stack Temp: 253.4

Averages	1.11	7.03	161.5%	20.40	12.82	122.8	20.9	87.4%	79.7%

INPUT DATA				Oxygen Calculation			Input Data		Combust	Heat
Elapsed Time	**Weight Remaining (kg)**	**% CO [e]**	**% CO2 [d]**	**Excess Air EA**	**Total O2**	**Calc. % O2 [g]**	**Flue Gas (ºC)**	**Room Temp (ºC)**	**Eff %**	**Transfer %**
0	6.26	1.00	3.57	329.8%	20.64	16.57	117.8	21.1	82.9%	72.5%
10	5.72	0.61	6.99	158.5%	20.44	13.14	172.8	21.1	93.7%	75.1%
20	5.13	0.61	10.85	71.4%	20.18	9.03	203.9	21.1	95.7%	77.7%
30	4.45	1.06	12.49	45.0%	20.05	7.03	217.2	21.1	93.6%	78.1%
40	3.72	1.19	13.02	38.2%	20.00	6.39	220.0	20.6	93.1%	78.3%
50	3.09	0.70	13.43	39.0%	20.01	6.23	221.1	21.1	95.9%	78.7%
60	2.50	0.43	12.33	53.9%	20.10	7.55	207.2	21.1	97.3%	78.8%
70	2.13	0.26	10.35	85.1%	20.24	9.76	183.9	21.1	98.2%	78.7%
80	1.86	0.50	8.05	129.7%	20.38	12.08	158.9	21.1	95.5%	78.1%
90	1.63	0.38	9.00	109.4%	20.32	11.13	151.7	21.1	96.9%	79.8%
100	1.36	0.59	9.81	88.9%	20.25	10.15	159.4	21.1	95.5%	79.8%
110	1.23	0.61	7.26	149.6%	20.42	12.86	138.9	21.1	93.9%	78.8%
120	1.13	0.72	7.12	150.5%	20.42	12.94	123.3	21.1	92.8%	80.0%
130	1.04	0.71	7.21	148.0%	20.42	12.85	114.4	21.1	92.9%	80.9%
140	0.95	0.74	6.94	155.8%	20.43	13.12	108.9	21.1	92.4%	81.1%

150	0.82	0.78	6.65	164.4%	20.45	13.41	104.4	21.1	91.7%	81.2%
160	0.82	1.10	6.09	173.2%	20.47	13.83	100.0	21.1	87.8%	80.8%
170	0.73	1.22	6.07	169.5%	20.46	13.78	96.7	21.1	86.6%	81.0%
180	0.68	1.33	5.65	181.4%	20.48	14.16	93.3	20.6	84.8%	80.7%
190	0.59	1.45	5.78	171.7%	20.46	13.96	91.1	20.6	83.9%	81.0%
200	0.54	1.52	5.59	176.3%	20.47	14.12	88.9	20.6	82.9%	81.0%
210	0.50	1.54	5.45	181.0%	20.48	14.26	86.7	20.0	82.4%	80.9%
220	0.41	1.59	5.45	179.0%	20.48	14.23	85.0	20.0	81.9%	81.1%
230	0.36	1.78	5.06	187.2%	20.49	14.54	83.9	20.0	79.2%	80.5%
240	0.32	1.58	4.82	206.9%	20.52	14.91	82.2	20.0	80.3%	80.5%
250	0.27	1.72	4.76	203.1%	20.51	14.89	79.4	20.6	78.8%	80.7%
260	0.23	1.48	4.52	227.4%	20.54	15.28	77.8	20.6	80.4%	80.7%
270	0.18	1.75	4.13	234.1%	20.55	15.55	75.6	21.1	76.4%	80.1%
280	0.14	1.58	4.21	239.3%	20.56	15.56	73.3	21.1	78.4%	80.7%
290	0.09	1.69	3.98	246.4%	20.57	15.74	71.7	21.1	76.4%	80.4%
300	0.05	1.75	4.20	230.1%	20.55	15.47	71.1	21.7	76.7%	81.0%
310	0.00	1.67	4.04	244.0%	20.56	15.69	69.4	21.7	76.8%	81.0%

	Air Fuel Ratio (A/F)		
72.9%	Dry Molecular Weight (Md)	29.64	
93.1%	Dry Moles Exhaust Gas (Nr):	449.22	%HC
78.3%	Air Fuel Ratio (A/F)	12.80	1.32

Combustion Efficiency:	93.1%
Total Input (kJ):	103,710
Total Output (kJ):	75,606
Efficiency:	72.9%
Total CO (g):	511.42

Btu/h	14,633	kJ/h
Btu/h	20,073	kJ/h
h		
lb/h	1.0	kg/h
Deg. F	123.0	Deg. C

69.6%	15.3	1.53	75.59	0.04	75.59	104086	4.06	6.87	2.74	19810.00	16.39
Net Eff %	**Air Fuel Ratio**	**Wet Wt Now Wt**	**% Wet Consumed x**	**Dry Wt. Now Wtdn**	**% Dry Comsumed y**	**Fuel Properties**					**Mw Moisture Fuel Burnt**
						Total Input	**Carbon /12= [a]**	**Hydrogen /1= [b]**	**Oxygen /16= [c]**	**Calorific Value**	
60.1%	25.0	6.26	0.00	5.24	0.00	0	4.06	6.87	2.74	19810.00	16.39
70.4%	15.4	5.72	8.70	4.78	8.70	13903	4.06	6.87	2.74	19810.00	16.39
74.4%	10.3	5.13	18.12	4.29	18.12	10521	4.06	6.87	2.74	19810.00	16.39
73.1%	8.6	4.45	28.99	3.72	28.99	11649	4.06	6.87	2.74	19810.00	16.39
72.9%	8.2	3.72	40.58	3.11	40.58	11273	4.06	6.87	2.74	19810.00	16.39
75.5%	8.3	3.09	50.72	2.58	50.72	10146	4.06	6.87	2.74	19810.00	16.39
76.7%	9.3	2.50	60.14	2.09	60.14	7891	4.06	6.87	2.74	19810.00	16.39
77.3%	11.2	2.13	65.94	1.78	65.94	5261	4.06	6.87	2.74	19810.00	16.39
74.5%	13.7	1.86	70.29	1.56	70.29	4133	4.06	6.87	2.74	19810.00	16.39
77.3%	12.6	1.63	73.91	1.37	73.91	4133	4.06	6.87	2.74	19810.00	16.39
76.2%	11.3	1.36	78.26	1.14	78.26	3382	4.06	6.87	2.74	19810.00	16.39
74.0%	14.9	1.23	80.43	1.02	80.43	1879	4.06	6.87	2.74	19810.00	16.39
74.2%	14.9	1.13	81.88	0.95	81.88	1503	4.06	6.87	2.74	19810.00	16.39
75.2%	14.7	1.04	83.33	0.87	83.33	1503	4.06	6.87	2.74	19810.00	16.39
74.9%	15.2	0.95	84.78	0.80	84.78	1879	4.06	6.87	2.74	19810.00	16.39

74.4%	15.7	0.82	86.96	0.68	86.96	1127	4.06	6.87	2.74	19810.00	16.39
70.9%	16.1	0.82	86.96	0.68	86.96	752	4.06	6.87	2.74	19810.00	16.39
70.2%	15.8	0.73	88.41	0.61	88.41	1127	4.06	6.87	2.74	19810.00	16.39
68.4%	16.4	0.68	89.13	0.57	89.13	1127	4.06	6.87	2.74	19810.00	16.39
68.0%	15.8	0.59	90.58	0.49	90.58	1127	4.06	6.87	2.74	19810.00	16.39
67.1%	16.0	0.54	91.30	0.46	91.30	752	4.06	6.87	2.74	19810.00	16.39
66.7%	16.3	0.50	92.03	0.42	92.03	1127	4.06	6.87	2.74	19810.00	16.39
66.4%	16.2	0.41	93.48	0.34	93.48	1127	4.06	6.87	2.74	19810.00	16.39
63.8%	16.5	0.36	94.20	0.30	94.20	752	4.06	6.87	2.74	19810.00	16.39
64.6%	17.7	0.32	94.93	0.27	94.93	752	4.06	6.87	2.74	19810.00	16.39
63.6%	17.5	0.27	95.65	0.23	95.65	752	4.06	6.87	2.74	19810.00	16.39
64.9%	18.9	0.23	96.38	0.19	96.38	752	4.06	6.87	2.74	19810.00	16.39
61.2%	19.2	0.18	97.10	0.15	97.10	752	4.06	6.87	2.74	19810.00	16.39
63.3%	19.5	0.14	97.83	0.11	97.83	752	4.06	6.87	2.74	19810.00	16.39
61.4%	19.9	0.09	98.55	0.08	98.55	752	4.06	6.87	2.74	19810.00	16.39
62.1%	18.9	0.05	99.28	0.04	99.28	1127	4.06	6.87	2.74	19810.00	16.39
62.2%	19.7	0.00	100.00	0.00	100.00	376	4.06	6.87	2.74	19810.00	16.39

				Moisture Content MCwb:	16.39
		Moisture of Wood (wet basis):	16.39	Dry kg :	5.24
98,364	(Btu)	Initial Dry Weight Wtdo (kg):	5.24	CA:	48.73
71,709	(Btu)	Moisture Content Dry	19.60	HY:	6.87
				OX:	43.90

Load Weight (kg):	6.26					
Fuel Heating:	HHV	LHV		HHV	LHV	
Value in kJ/kg - CV:	19810.00	18328.69	Btu/lb	8522.48	7885.21	

79.04	20.97	2.04	6.72	0.14	0.20	33.70	71.75	6.31	0.80	419.49	32.91
Mass Balance (moles/100 mole dry flue gas)					**kg Wood per 100 mole dfp**	**Moles per kg of Dry Wood**					
[h]	**[u]**	**[w]**	**[j]**	**[k]**	**Nk**	**CO2**	**O2**	**CO**	**HC**	**N2**	**H2O**
78.86	20.92	1.15	3.73	0.12	0.11	31.07	144.20	8.70	1.04	686.39	32.45
79.26	21.02	1.89	6.35	0.07	0.19	37.20	69.96	3.25	0.36	421.85	33.80
79.51	21.09	2.84	9.61	0.07	0.28	38.39	31.95	2.16	0.26	281.34	34.00
79.42	21.07	3.37	11.30	0.14	0.34	37.23	20.94	3.16	0.43	236.72	33.67
79.40	21.06	3.54	11.83	0.16	0.35	36.97	18.14	3.38	0.46	225.46	33.60
79.64	21.13	3.50	11.85	0.09	0.35	38.54	17.87	2.01	0.26	228.55	33.99
79.69	21.14	3.15	10.74	0.05	0.31	39.28	24.06	1.37	0.16	253.87	34.20
79.63	21.12	2.62	8.95	0.02	0.26	39.73	37.46	1.00	0.09	305.67	34.35
79.37	21.05	2.12	7.17	0.05	0.21	38.19	57.28	2.37	0.25	376.53	34.02
79.49	21.08	2.32	7.89	0.04	0.23	39.00	48.24	1.65	0.16	344.48	34.20
79.45	21.07	2.58	8.72	0.07	0.26	38.24	39.56	2.30	0.27	309.71	33.98
79.27	21.03	1.95	6.58	0.07	0.19	37.33	66.09	3.14	0.35	407.57	33.82
79.22	21.01	1.95	6.53	0.08	0.19	36.67	66.66	3.71	0.43	408.00	33.66
79.23	21.02	1.97	6.60	0.08	0.20	36.77	65.54	3.62	0.42	404.04	33.68
79.20	21.01	1.91	6.40	0.09	0.19	36.47	68.96	3.89	0.46	416.16	33.61

79.16	21.00	1.85	6.18	0.09	0.18	36.08	72.75	4.23	0.50	429.50	33.52
78.98	20.95	1.80	5.92	0.14	0.18	33.92	77.00	6.13	0.77	439.89	32.98
78.93	20.94	1.83	5.99	0.16	0.18	33.27	75.53	6.69	0.85	432.65	32.82
78.86	20.92	1.76	5.71	0.17	0.18	32.25	80.84	7.59	0.98	450.04	32.57
78.81	20.91	1.83	5.90	0.19	0.18	31.80	76.78	7.98	1.04	433.56	32.44
78.77	20.89	1.80	5.78	0.20	0.18	31.21	78.85	8.49	1.11	439.85	32.30
78.75	20.89	1.77	5.68	0.20	0.18	30.93	80.92	8.74	1.14	446.92	32.24
78.73	20.88	1.79	5.71	0.21	0.18	30.68	80.12	8.95	1.18	443.26	32.17
78.62	20.85	1.74	5.51	0.24	0.17	29.18	83.85	10.27	1.36	453.46	31.80
78.69	20.87	1.63	5.18	0.21	0.16	29.78	92.09	9.76	1.27	486.14	31.97
78.63	20.86	1.65	5.22	0.23	0.16	28.97	90.62	10.47	1.38	478.47	31.76
78.72	20.88	1.52	4.85	0.19	0.15	29.80	100.75	9.76	1.26	518.90	32.00
78.57	20.84	1.50	4.71	0.23	0.15	27.59	103.84	11.69	1.54	524.83	31.45
78.65	20.86	1.48	4.66	0.21	0.15	28.66	105.91	10.76	1.40	535.42	31.73
78.59	20.85	1.45	4.54	0.22	0.14	27.57	109.05	11.71	1.53	544.46	31.46
78.58	20.84	1.52	4.77	0.23	0.15	27.74	102.17	11.56	1.52	518.91	31.48
78.60	20.85	1.46	4.58	0.22	0.15	27.81	108.00	11.50	1.50	541.13	31.52

10.89	395.96	4065.91	3056.91	2971.89	2939.11	3920.58	3556.11	294.05	4613.66	5765.21	57604.54
	Stack	**Heat Content Change - Ambient to Stack Temperature**						**Room**			**Energ**
Moisture	**Temp**	**Flue Gas Constituent**						**Temp**			
Present	**K**	**CO2**	**O2**	**CO**	**N2**	**CH4**	**H2O**	**K**	**CO2**	**O2**	**CO**
10.89	390.93	3815.94	2886.98	2811.12	2779.17	3640.11	3365.14	294.26	118.57	416.32	2487.26
10.89	445.93	6108.03	4567.12	4433.90	4386.29	5944.77	5303.56	294.26	227.25	319.50	933.21
10.89	477.04	7443.41	5529.55	5359.34	5303.67	7323.43	6407.68	294.26	285.76	176.64	622.37
10.89	490.37	8024.31	5944.69	5757.62	5698.67	7930.88	6882.56	294.26	298.72	124.47	912.25
10.89	493.15	8167.13	6047.72	5856.73	5796.90	8078.09	7000.81	293.71	301.94	109.68	976.02
10.89	494.26	8194.71	6066.07	5873.97	5814.08	8109.92	7021.26	294.26	315.82	108.40	580.27
10.89	480.37	7588.16	5633.18	5458.82	5402.31	7474.36	6526.30	294.26	298.07	135.54	395.15
10.89	457.04	6581.73	4909.84	4763.80	4713.24	6430.93	5697.26	294.26	261.49	183.93	287.19
10.89	432.04	5520.94	4140.27	4022.51	3978.68	5346.80	4812.43	294.26	210.83	237.17	680.76
10.89	424.82	5217.87	3919.00	3809.01	3767.20	5040.12	4557.48	294.26	203.51	189.04	472.31
10.89	432.59	5544.32	4157.31	4038.95	3994.96	5370.51	4832.06	294.26	212.02	164.46	660.15
10.89	412.04	4685.36	3528.66	3432.00	3393.83	4504.69	4107.14	294.26	174.88	233.22	898.27
10.89	396.48	4043.48	3055.46	2974.27	2940.66	3865.21	3560.16	294.26	148.28	203.67	1060.45
10.89	387.59	3679.84	2786.03	2713.31	2682.38	3505.88	3248.21	294.26	135.31	182.60	1034.49
10.89	382.04	3453.74	2618.00	2550.44	2521.20	3283.54	3053.48	294.26	125.95	180.53	1110.34

10.89	377.59	3273.49	2483.78	2420.27	2392.40	3106.91	2897.82	294.26	118.11	180.71	1207.87
10.89	373.15	3093.82	2349.73	2290.20	2263.71	2931.39	2742.27	294.26	104.93	180.92	1747.71
10.89	369.82	2959.45	2249.32	2192.73	2167.28	2800.48	2625.68	294.26	98.47	169.88	1907.11
10.89	366.48	2846.54	2165.35	2111.32	2086.73	2689.60	2528.34	293.71	91.79	175.04	2164.09
10.89	364.26	2757.35	2098.52	2046.41	2022.52	2603.08	2450.69	293.71	87.67	161.13	2273.66
10.89	362.04	2668.30	2031.74	1981.54	1958.35	2516.84	2373.07	293.71	83.29	160.20	2418.76
10.89	359.82	2600.53	1981.36	1932.69	1910.01	2450.27	2314.66	293.15	80.43	160.33	2490.13
10.89	358.15	2533.95	1931.34	1884.07	1861.93	2385.98	2256.49	293.15	77.75	154.74	2550.21
10.89	357.04	2489.61	1898.00	1851.66	1829.88	2343.21	2217.71	293.15	72.66	159.15	2924.34
10.89	355.37	2423.16	1848.02	1803.07	1781.82	2279.18	2159.56	293.15	72.15	170.19	2779.86
10.89	352.59	2291.45	1748.43	1706.11	1685.96	2153.41	2043.50	293.71	66.37	158.45	2979.85
10.89	350.93	2225.21	1698.52	1657.55	1637.95	2089.80	1985.39	293.71	66.30	171.13	2777.12
10.89	348.71	2115.88	1615.66	1576.84	1558.16	1985.81	1888.76	294.26	58.37	167.78	3326.38
10.89	346.48	2027.83	1549.19	1512.15	1494.20	1901.51	1811.33	294.26	58.12	164.07	3060.06
10.89	344.82	1961.89	1499.37	1463.66	1446.25	1838.46	1753.29	294.26	54.10	163.51	3330.46
10.89	344.26	1918.77	1466.42	1431.49	1414.46	1798.06	1714.75	294.82	53.22	149.83	3286.96
10.89	342.59	1852.94	1416.63	1383.01	1366.54	1735.22	1656.72	294.82	51.54	153.00	3269.48

SUMS				AVERAGE	SUMS					
35344.82	22989.76	50100.82	16559.99	6030.59	28104	7202	20901.91	75982	7202	511.42
y Losses (kJ/kg of Dry Fuel)				**Total**						
Flue Gas Constituent				**Loss**	**Total**	**Chemical**	**Sensible and**	**Total**	**Chem**	**Grams Pr**
N2	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**	**Loss**	**Loss 1**	**Latent Loss**	**Output**	**Loss 2**	**CO**
1907.58	926.61	1535.95	515.42	7907.71	0	0	0.00	0	0	0.00
1850.36	323.25	1665.47	536.53	5855.56	4110	870	3239.38	9794	870	63.80
1492.12	236.24	1712.61	548.55	5074.30	2695	449	2246.17	7826	449	32.10
1349.01	383.34	1712.12	553.72	5333.63	3136	749	2387.12	8512	749	52.02
1306.99	416.22	1712.37	555.01	5378.23	3060	779	2281.61	8212	779	53.84
1328.80	237.20	1733.39	555.23	4859.10	2489	412	2077.04	7657	412	28.81
1371.50	144.50	1726.97	549.84	4621.58	1841	212	1629.43	6050	212	15.28
1440.68	76.40	1706.14	540.81	4496.65	1194	95	1098.97	4067	95	7.42
1498.10	227.08	1659.32	531.18	5044.44	1053	187	865.38	3081	187	13.86
1297.73	145.42	1659.50	528.40	4495.91	938	127	810.67	3195	127	9.62
1237.30	243.23	1658.23	531.39	4706.78	804	152	651.13	2578	152	10.99
1383.22	313.86	1625.98	523.50	5152.94	489	114	374.92	1390	114	8.33
1199.79	387.39	1599.64	517.54	5116.76	388	109	279.34	1115	109	7.88
1083.80	377.44	1590.18	514.15	4917.96	373	106	266.87	1130	106	7.69
1049.23	407.30	1580.47	512.03	4965.84	471	143	328.11	1408	143	10.33

1027.53	446.49	1571.11	510.33	5062.15	288	93	194.59	839	93	6.74
995.78	686.90	1540.74	508.64	5765.63	219	92	126.99	533	92	6.51
937.68	761.94	1529.05	507.37	5911.50	336	151	185.48	791	151	10.66
939.12	871.78	1514.41	506.31	6262.53	356	172	184.67	771	172	12.09
876.88	927.76	1506.05	505.46	6338.62	361	181	179.60	767	181	12.71
861.37	991.20	1496.94	504.62	6516.38	247	129	118.59	504	129	9.02
853.62	1020.94	1491.96	503.98	6601.39	376	199	176.97	752	199	13.93
825.32	1049.64	1487.10	503.35	6648.11	378	204	174.58	749	204	14.26
829.78	1215.24	1468.71	502.93	7172.81	272	156	115.91	479	156	10.91
866.22	1137.55	1474.88	502.29	7003.16	266	148	117.84	486	148	10.37
806.68	1231.31	1461.49	501.03	7205.17	273	159	114.37	478	159	11.12
849.93	1124.28	1470.66	500.40	6959.82	264	147	116.74	487	147	10.36
817.77	1371.08	1442.18	499.34	7682.90	291	177	114.07	460	177	12.42
800.02	1246.61	1452.50	498.50	7279.88	276	163	113.51	475	163	11.42
787.42	1365.85	1438.43	497.87	7637.63	290	177	112.34	462	177	12.44
733.98	1355.94	1438.23	497.45	7515.60	428	263	164.57	700	263	18.41
739.48	1339.75	1438.05	496.82	7488.11	142	87	54.96	234	87	6.11

36.54

oduced HC
0.00
4.05
2.24
4.02
4.22
2.16
1.03
0.36
0.85
0.54
0.74
0.53
0.53
0.51
0.69

0.46
0.47
0.78
0.89
0.95
0.67
1.04
1.07
0.83
0.77
0.84
0.76
0.93
0.85
0.93
1.38
0.46

Dirigo Laboratories, Inc.

Manufacturer:	**Pacific Energy**
Model:	**TN20**
Date:	**12/20/2016**
Run:	**2**
Control #:	**034-S-74-1**
Test Duration:	**310**
Output Category:	**2**

	HHV Basis	LHV Basis
Overall Efficiency	72.9%	78.8%
Combustion Efficiency	93.1%	93.1%
Heat Transfer Efficiency	78.3%	84.7%

HHV Output Rate (kJ/h)	14,633	13,881	**(Btu/h)**
Burn Rate (kg/h)	1.01	2.23	**(lb/h)**
Input (kJ/h)	20,073	19,041	**(Btu/h)**

Test Load Weight (dry kg)	5.2	11.5	**dry lb**
MC wet (%)	16.39		
MC dry (%)	19.60		
Particulate (g)	7.11		
CO (g)	511		
Test Duration (h)	5.166666667		

Emissions	**Particulate**	**CO**
g/MJ Output	0.09	6.76
g/kg Dry Fuel	1.36	97.69
g/h	1.38	98.99
lb/MM Btu Output	0.22	15.72

Air/Fuel Ratio (A/F)	12.80

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: Pacific Energy
Model: TN20
Date: 12/20/2016
Run: 1
Control #: 034-S-74-1
est Duration: 310
urn Category 2

Appliance Type: Non-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):	14.00
Burn Rate (dry kg/h):	1.03
Total Particulate Emissions:	4.62 g

Fuel Data

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

Averages		**255.8**	**70.1**	**12.89**	**7.30**	**0.94**
		Temp. (F)				
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas**	**Room Temp**	**Flue Gas Composition (%) O2**	**CO2**	**CO**
0	14.0	247.0	70.0	16.02	3.84	0.78
10	12.8	354.0	70.0	12.43	8.36	0.45
20	11.4	395.0	70.0	10.15	10.83	0.37
30	10.1	413.0	70.0	8.47	12.57	0.72
40	8.6	424.0	71.0	8.31	12.81	0.64
50	7.5	382.0	71.0	10.34	10.95	0.39
60	6.4	384.0	71.0	9.54	11.83	0.28
70	5.4	370.0	71.0	10.69	10.38	0.25
80	4.7	336.0	71.0	11.56	9.14	0.38
90	4.1	311.0	70.0	12.16	8.44	0.32
100	3.7	295.0	70.0	12.11	8.39	0.40
110	3.2	299.0	70.0	11.51	9.11	0.31
120	2.8	282.0	70.0	12.58	7.16	1.02
130	2.6	245.0	70.0	13.21	6.54	1.01
140	2.4	226.0	70.0	13.32	6.50	1.02
150	2.2	215.0	70.0	13.59	6.34	1.02
160	2.1	207.0	70.0	13.64	6.20	1.19
170	1.9	202.0	70.0	13.59	6.25	1.21
180	1.8	200.0	70.0	13.49	6.42	1.18
190	1.6	198.0	70.0	13.74	6.12	1.25
200	1.5	194.0	70.0	13.99	5.82	1.34
210	1.3	191.0	70.0	14.00	5.80	1.29
220	1.2	189.0	70.0	14.00	5.78	1.38
230	1.0	187.0	70.0	14.02	5.71	1.42
240	0.9	185.0	70.0	14.28	5.44	1.37
250	0.8	183.0	70.0	14.31	5.40	1.39
260	0.6	181.0	70.0	14.35	5.29	1.46
270	0.5	180.0	70.0	14.43	5.28	1.50
280	0.4	180.0	70.0	14.39	5.40	1.44
290	0.2	178.0	70.0	14.50	5.46	1.00
300	0.1	177.0	69.0	14.59	5.40	1.09
310	0.0	176.0	69.0	15.30	4.61	1.27

Manufacturer:	Pacific Energy
Model:	TN20
Date:	12/20/2016
Run:	1
Control #:	034-S-74-1
Test Duration:	310 min

	HHV	LHV
Eff	74.5%	80.5%
Comb Eff	94.6%	94.6%
HT Eff	78.8%	85.2%
Output	15,161	kJ/h
Burn Rate	1.03	kg/h
Grams CO	410	g
Input	20,347	kJ/h
MC wet	16.46	

	Ultimate CO2
CO2-ult	19.64
	F_0
	1.061

Averages	0.94	7.30	152.2%	20.40	12.63	124.3

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	6.35	0.78	3.84	325.2%	20.63	16.40	119.4
10	5.81	0.45	8.36	123.0%	20.36	11.77	178.9
20	5.17	0.37	10.83	75.4%	20.20	9.19	201.7
30	4.58	0.72	12.57	47.8%	20.06	7.13	211.7
40	3.90	0.64	12.81	46.0%	20.05	6.92	217.8
50	3.40	0.39	10.95	73.2%	20.19	9.05	194.4
60	2.90	0.28	11.83	62.2%	20.14	8.17	195.6
70	2.45	0.25	10.38	84.8%	20.24	9.73	187.8
80	2.13	0.38	9.14	106.3%	20.31	10.98	168.9
90	1.86	0.32	8.44	124.2%	20.36	11.76	155.0
100	1.68	0.40	8.39	123.5%	20.36	11.77	146.1
110	1.45	0.31	9.11	108.5%	20.32	11.05	148.3
120	1.27	1.02	7.16	140.1%	20.40	12.73	138.9
130	1.18	1.01	6.54	160.2%	20.44	13.40	118.3
140	1.09	1.02	6.50	161.2%	20.44	13.43	107.8
150	1.00	1.02	6.34	166.9%	20.45	13.60	101.7
160	0.95	1.19	6.20	165.8%	20.45	13.66	97.2
170	0.86	1.21	6.25	163.3%	20.45	13.59	94.4
180	0.82	1.18	6.42	158.5%	20.44	13.43	93.3
190	0.73	1.25	6.12	166.5%	20.45	13.71	92.2
200	0.68	1.34	5.82	174.3%	20.47	13.98	90.0
210	0.59	1.29	5.80	177.1%	20.47	14.03	88.3
220	0.54	1.38	5.78	174.3%	20.47	14.00	87.2
230	0.45	1.42	5.71	175.5%	20.47	14.05	86.1
240	0.41	1.37	5.44	188.4%	20.49	14.37	85.0
250	0.36	1.39	5.40	189.3%	20.49	14.40	83.9
260	0.27	1.46	5.29	191.0%	20.49	14.47	82.8

270	0.23	1.50	5.28	189.7%	20.49	14.46	82.2
280	0.18	1.44	5.40	187.2%	20.49	14.37	82.2
290	0.09	1.00	5.46	204.1%	20.51	14.55	81.1
300	0.05	1.09	5.40	202.7%	20.51	14.57	80.6
310	0.00	1.27	4.61	234.1%	20.55	15.31	80.0

			Air Fuel Ratio (A/F)		
Overall Heating Efficiency:	74.5%	Dry Molecular Weight (Md)		29.67	
Combustion Efficiency:	94.6%	Dry Moles Exhaust Gas (Nr):		444.52	%HC
Heat Transfer Efficiency:	78.8%	Air Fuel Ratio (A/F)		12.68	1.32

Heat Output:	14,382	Btu/h	15,161	kJ/h
Heat Input:	19,301	Btu/h	20,347	kJ/h

2

Burn Duration:	5.166666667	h		
Burn Rate:	2.3	lb/h	1.0	kg/h
Stack Temp:	256.1	Deg. F	124.5	Deg. C

21.2	89.8%	80.0%	71.8%	14.9	1.67	73.71	0.05	73.71
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	86.9%	73.4%	63.8%	25.0	6.35	0.00	5.31	0.00
21.1	96.1%	76.8%	73.8%	13.4	5.81	8.57	4.85	8.57
21.1	97.4%	77.9%	75.9%	10.5	5.17	18.57	4.32	18.57
21.1	95.6%	78.6%	75.1%	8.9	4.58	27.86	3.83	27.86
21.7	96.1%	78.5%	75.4%	8.8	3.90	38.57	3.26	38.57
21.7	97.3%	78.5%	76.4%	10.4	3.40	46.43	2.84	46.43
21.7	98.2%	79.2%	77.8%	9.8	2.90	54.29	2.43	54.29
21.7	98.3%	78.5%	77.2%	11.1	2.45	61.43	2.05	61.43
21.7	97.0%	78.6%	76.2%	12.4	2.13	66.43	1.78	66.43
21.1	97.3%	78.9%	76.8%	13.5	1.86	70.71	1.55	70.71
21.1	96.5%	79.6%	76.8%	13.4	1.68	73.57	1.40	73.57
21.1	97.6%	80.1%	78.2%	12.5	1.45	77.14	1.21	77.14
21.1	90.0%	78.4%	70.6%	14.2	1.27	80.00	1.06	80.00
21.1	89.3%	79.5%	71.0%	15.3	1.18	81.43	0.99	81.43
21.1	89.2%	80.5%	71.8%	15.4	1.09	82.86	0.91	82.86
21.1	89.0%	80.9%	72.0%	15.7	1.00	84.29	0.83	84.29
21.1	87.1%	81.1%	70.7%	15.6	0.95	85.00	0.80	85.00
21.1	87.0%	81.4%	70.9%	15.4	0.86	86.43	0.72	86.43
21.1	87.6%	81.8%	71.6%	15.2	0.82	87.14	0.68	87.14
21.1	86.4%	81.5%	70.4%	15.6	0.73	88.57	0.61	88.57
21.1	85.0%	81.3%	69.1%	16.0	0.68	89.29	0.57	89.29
21.1	85.5%	81.5%	69.6%	16.2	0.59	90.71	0.49	90.71
21.1	84.6%	81.5%	68.9%	16.0	0.54	91.43	0.45	91.43
21.1	84.1%	81.5%	68.5%	16.0	0.45	92.86	0.38	92.86
21.1	83.9%	81.3%	68.3%	16.8	0.41	93.57	0.34	93.57
21.1	83.7%	81.4%	68.1%	16.8	0.36	94.29	0.30	94.29
21.1	82.7%	81.3%	67.3%	16.9	0.27	95.71	0.23	95.71

21.1	82.3%	81.3%	67.0%	16.8	0.23	96.43	0.19	96.43
21.1	83.2%	81.6%	67.8%	16.7	0.18	97.14	0.15	97.14
21.1	87.7%	82.1%	72.0%	17.9	0.09	98.57	0.08	98.57
20.6	86.7%	81.9%	71.0%	17.7	0.05	99.29	0.04	99.29
20.6	82.9%	80.7%	66.9%	19.4	0.00	100.00	0.00	100.00

Combustion Efficiency:	94.6%		
Total Input (kJ):	105,125	99,706	(Btu)
Total Output (kJ):	78,332	74,294	(Btu)
Efficiency:	74.5%		
Total CO (g):	410.23		

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

105501	4.06	6.87	2.74	19810.00	16.46	79.13	20.99	2.06
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	78.98	20.95	1.16
14267	4.06	6.87	2.74	19810.00	16.46	79.42	21.07	2.18
10137	4.06	6.87	2.74	19810.00	16.46	79.61	21.12	2.77
10513	4.06	6.87	2.74	19810.00	16.46	79.58	21.11	3.30
9762	4.06	6.87	2.74	19810.00	16.46	79.63	21.12	3.33
8260	4.06	6.87	2.74	19810.00	16.46	79.61	21.12	2.80
7884	4.06	6.87	2.74	19810.00	16.46	79.72	21.15	2.99
6383	4.06	6.87	2.74	19810.00	16.46	79.64	21.12	2.62
4881	4.06	6.87	2.74	19810.00	16.46	79.50	21.09	2.35
3754	4.06	6.87	2.74	19810.00	16.46	79.48	21.08	2.16
3379	4.06	6.87	2.74	19810.00	16.46	79.44	21.07	2.17
3379	4.06	6.87	2.74	19810.00	16.46	79.53	21.09	2.33
2253	4.06	6.87	2.74	19810.00	16.46	79.09	20.98	2.05
1502	4.06	6.87	2.74	19810.00	16.46	79.05	20.97	1.89
1502	4.06	6.87	2.74	19810.00	16.46	79.05	20.97	1.88
1126	4.06	6.87	2.74	19810.00	16.46	79.04	20.96	1.84
1126	4.06	6.87	2.74	19810.00	16.46	78.95	20.94	1.86
1126	4.06	6.87	2.74	19810.00	16.46	78.95	20.94	1.88
1126	4.06	6.87	2.74	19810.00	16.46	78.97	20.95	1.91
1126	4.06	6.87	2.74	19810.00	16.46	78.92	20.93	1.85
1126	4.06	6.87	2.74	19810.00	16.46	78.86	20.92	1.81
1126	4.06	6.87	2.74	19810.00	16.46	78.88	20.92	1.79
1126	4.06	6.87	2.74	19810.00	16.46	78.84	20.91	1.81
1126	4.06	6.87	2.74	19810.00	16.46	78.82	20.91	1.80
751	4.06	6.87	2.74	19810.00	16.46	78.82	20.91	1.72
1126	4.06	6.87	2.74	19810.00	16.46	78.81	20.91	1.72
1126	4.06	6.87	2.74	19810.00	16.46	78.78	20.90	1.71

751	4.06	6.87	2.74	19810.00	16.46	78.76	20.89	1.72
1126	4.06	6.87	2.74	19810.00	16.46	78.79	20.90	1.73
1126	4.06	6.87	2.74	19810.00	16.46	78.99	20.95	1.62
1126	4.06	6.87	2.74	19810.00	16.46	78.94	20.94	1.63
375	4.06	6.87	2.74	19810.00	16.46	78.81	20.91	1.49

Moisture Content MCwb: 16.46

Moisture of Wood (wet basis): 16.46
Initial Dry Weight Wtdo (kg): 5.31
Moisture Content Dry 19.70

Dry kg : 5.31
CA: 48.73
HY: 6.87
OX: 43.90

6.35

HHV	LHV		HHV	LHV
19810.00	18328.69	Btu/lb	8522.48	7885.21

6.84	0.12	0.20	35.02	67.58	5.15	0.64	407.17	33.24
flue gas)		kg Wood per 100 mole dfp	Moles per kg of Dry Wood					
[j]	[k]	Nk	CO2	O2	CO	HC	N2	H2O
3.81	0.09	0.12	33.29	142.23	6.76	0.76	684.71	33.01
7.40	0.05	0.22	38.52	54.25	2.07	0.21	365.96	34.09
9.43	0.04	0.28	39.33	33.35	1.34	0.14	289.10	34.24
11.13	0.09	0.33	38.33	21.75	2.20	0.29	242.67	33.95
11.28	0.08	0.33	38.63	20.88	1.93	0.25	240.15	34.03
9.54	0.04	0.28	39.26	32.44	1.40	0.15	285.46	34.22
10.21	0.03	0.30	39.78	27.47	0.94	0.09	268.05	34.34
8.97	0.02	0.26	39.77	37.30	0.96	0.08	305.16	34.36
8.01	0.04	0.23	39.03	46.89	1.62	0.16	339.47	34.20
7.38	0.03	0.22	39.20	54.62	1.49	0.13	369.12	34.27
7.39	0.04	0.22	38.78	54.40	1.85	0.18	367.20	34.16
7.94	0.03	0.23	39.35	47.75	1.34	0.12	343.55	34.29
6.77	0.13	0.20	35.17	62.53	5.01	0.63	388.51	33.26
6.24	0.13	0.19	34.77	71.23	5.37	0.67	420.34	33.19
6.21	0.13	0.19	34.69	71.69	5.44	0.68	421.87	33.17
6.08	0.13	0.18	34.56	74.16	5.56	0.69	430.84	33.14
6.08	0.15	0.18	33.55	73.91	6.44	0.82	427.27	32.88
6.13	0.15	0.19	33.50	72.85	6.49	0.83	423.14	32.87
6.26	0.15	0.19	33.81	70.71	6.21	0.79	415.85	32.94
6.05	0.16	0.18	33.17	74.30	6.77	0.87	427.74	32.79
5.86	0.17	0.18	32.39	77.79	7.46	0.96	438.93	32.60
5.81	0.17	0.18	32.63	78.90	7.26	0.93	443.72	32.66
5.85	0.18	0.18	32.14	77.84	7.67	0.99	438.47	32.54
5.82	0.18	0.18	31.86	78.39	7.92	1.03	439.80	32.46
5.56	0.18	0.17	31.78	83.92	8.00	1.03	460.46	32.46
5.54	0.18	0.17	31.62	84.31	8.14	1.05	461.52	32.42
5.49	0.19	0.17	31.11	85.13	8.59	1.11	463.29	32.29

5.51	0.20	0.17	30.89	84.62	8.78	1.14	460.80	32.24
5.57	0.19	0.17	31.36	83.45	8.36	1.08	457.63	32.35
5.32	0.12	0.16	33.85	90.24	6.20	0.76	489.74	33.01
5.33	0.14	0.16	33.26	89.73	6.71	0.83	486.29	32.85
4.79	0.16	0.15	31.15	103.42	8.58	1.08	532.50	32.35

10.94	397.49	4113.42	3093.98	3008.26	2975.00	3963.44	3599.74	294.31
Moisture Present	Stack Temp K	Heat Content Change - Ambient to Stack Temperature Flue Gas Constituent						Room Temp K
		CO2	O2	CO	N2	CH4	H2O	
10.94	392.59	3884.11	2937.50	2860.04	2827.60	3707.46	3423.63	294.26
10.94	452.04	6368.12	4755.48	4615.26	4566.01	6211.30	5520.01	294.26
10.94	474.82	7347.10	5460.51	5293.06	5237.94	7223.16	6328.63	294.26
10.94	484.82	7781.65	5771.52	5591.55	5533.95	7676.56	6684.57	294.26
10.94	490.93	8027.47	5945.67	5758.23	5699.34	7936.98	6883.18	294.82
10.94	467.59	7013.91	5220.11	5061.83	5008.74	6879.75	6052.73	294.82
10.94	468.71	7061.81	5254.55	5094.92	5041.55	6929.41	6092.20	294.82
10.94	460.93	6727.22	5013.71	4863.42	4812.04	6583.29	5816.03	294.82
10.94	442.04	5921.93	4431.07	4302.60	4256.23	5756.82	5146.75	294.82
10.94	428.15	5357.56	4021.06	3907.51	3864.77	5181.30	4675.12	294.26
10.94	419.26	4985.76	3749.11	3644.98	3604.74	4806.20	4361.57	294.26
10.94	421.48	5078.49	3817.03	3710.57	3669.70	4899.56	4439.91	294.26
10.94	412.04	4685.36	3528.66	3432.00	3393.83	4504.69	4107.14	294.26
10.94	391.48	3838.65	2903.82	2827.42	2795.31	3662.54	3384.63	294.26
10.94	380.93	3408.62	2584.43	2517.89	2488.99	3239.28	3014.55	294.26
10.94	374.82	3161.13	2399.98	2338.96	2311.96	2997.08	2800.58	294.26
10.94	370.37	2981.82	2266.04	2208.97	2183.35	2822.26	2645.11	294.26
10.94	367.59	2870.04	2182.43	2127.78	2103.04	2713.55	2547.99	294.26
10.94	366.48	2825.39	2149.00	2095.32	2070.92	2670.19	2509.15	294.26
10.94	365.37	2780.78	2115.58	2062.86	2038.82	2626.90	2470.33	294.26
10.94	363.15	2691.66	2048.78	1997.97	1974.63	2540.52	2392.69	294.26
10.94	361.48	2624.91	1998.71	1949.32	1926.51	2475.92	2334.48	294.26
10.94	360.37	2580.46	1965.34	1916.89	1894.44	2432.94	2295.69	294.26
10.94	359.26	2536.04	1931.99	1884.47	1862.37	2390.03	2256.90	294.26
10.94	358.15	2491.66	1898.64	1852.06	1830.32	2347.18	2218.12	294.26
10.94	357.04	2447.32	1865.31	1819.65	1798.27	2304.41	2179.34	294.26
10.94	355.93	2403.01	1831.98	1787.26	1766.23	2261.70	2140.58	294.26

10.94	355.37	2380.87	1815.33	1771.06	1750.21	2240.38	2121.19	294.26
10.94	355.37	2380.87	1815.33	1771.06	1750.21	2240.38	2121.19	294.26
10.94	354.26	2336.61	1782.02	1738.67	1718.19	2197.78	2082.44	294.26
10.94	353.71	2335.65	1781.72	1738.49	1717.98	2195.91	2082.25	293.71
10.94	353.15	2313.54	1765.07	1722.30	1701.97	2174.65	2062.87	293.71

SUMS							AVERAGE
4784.91	5750.66	47044.26	35687.11	18357.73	50629.68	16659.76	5591.07
Energy Losses (kJ/kg of Dry Fuel)							**Total**
Flue Gas Constituent							**Loss**
CO2	**O2**	**CO**	**N2**	**CH4**	**H2O Comb**	**H2O Fuel MC**	**Rate**
129.31	417.80	1932.89	1936.10	676.61	1564.37	518.69	7175.77
245.32	258.00	596.40	1670.98	192.71	1687.21	541.63	5192.25
288.94	182.14	387.33	1514.30	127.60	1722.10	550.48	4772.88
298.28	125.53	633.62	1342.92	255.93	1719.82	554.38	4930.48
310.14	124.12	557.35	1368.72	222.53	1730.35	556.55	4869.77
275.38	169.32	402.81	1429.81	136.04	1711.71	547.46	4672.54
280.90	144.36	271.23	1351.41	83.46	1718.93	547.90	4398.19
267.57	186.99	275.76	1468.43	71.41	1710.78	544.87	4525.82
231.12	207.78	466.18	1444.85	144.32	1679.78	537.55	4711.58
210.00	219.65	426.38	1426.55	115.28	1666.80	532.39	4597.04
193.36	203.96	529.98	1323.66	162.87	1650.91	528.96	4593.69
199.86	182.26	383.95	1260.74	105.97	1659.74	529.81	4322.33
164.79	220.66	1435.15	1318.55	563.43	1599.16	526.17	5827.91
133.48	206.84	1534.94	1174.97	597.27	1571.49	518.26	5737.25
118.25	185.29	1554.25	1050.03	605.88	1558.27	514.21	5586.18
109.25	177.98	1586.52	996.09	617.35	1549.95	511.87	5549.02
100.05	167.48	1836.68	932.88	732.09	1532.81	510.17	5812.16
96.14	159.00	1849.12	889.89	739.43	1528.84	509.11	5771.53
95.52	151.96	1771.45	861.20	707.12	1530.93	508.68	5626.85
92.24	157.18	1931.20	872.09	774.96	1522.59	508.26	5858.51
87.19	159.38	2125.47	866.72	858.76	1511.33	507.41	6116.26
85.64	157.70	2067.63	854.83	830.86	1512.32	506.77	6015.75
82.95	152.99	2186.57	830.65	886.77	1505.25	506.35	6151.52
80.80	151.45	2257.15	819.07	918.29	1500.72	505.92	6233.40
79.18	159.33	2279.59	842.78	920.67	1499.21	505.50	6286.25
77.39	157.26	2318.29	829.94	937.86	1496.17	505.07	6321.98
74.76	155.95	2445.26	818.28	994.76	1489.03	504.65	6482.68

73.55	153.61	2499.20	806.51	1020.17	1485.78	504.44	6543.24
74.67	151.49	2381.68	800.95	968.16	1491.15	504.44	6372.54
79.10	160.80	1765.41	841.46	676.96	1519.94	504.01	5547.70
77.69	159.87	1911.78	835.43	744.56	1512.96	504.01	5746.31
72.06	182.54	2443.06	906.30	967.65	1489.31	503.80	6564.71

SUMS						
26793	5699	21094.37	78708	5699	410.23	27.91
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
3739	560	3178.96	10528	560	41.82	2.48
2442	259	2183.02	7695	259	19.25	1.16
2616	464	2152.06	7896	464	32.62	2.42
2400	378	2021.79	7362	378	26.63	1.95
1948	221	1726.94	6312	221	16.33	1.01
1750	139	1611.48	6134	139	10.49	0.59
1458	110	1347.99	4924	110	8.64	0.41
1161	148	1012.38	3720	148	11.19	0.64
871	101	769.82	2883	101	7.89	0.39
784	117	666.67	2595	117	8.83	0.50
737	83	654.65	2642	83	6.40	0.32
663	225	437.73	1590	225	15.95	1.15
435	160	274.63	1067	160	11.40	0.81
423	163	260.93	1078	163	11.56	0.82
316	124	191.05	811	124	8.85	0.63
330	145	185.35	796	145	10.25	0.75
328	146	181.89	798	146	10.32	0.75
320	140	179.86	806	140	9.89	0.72
333	153	180.16	793	153	10.79	0.79
348	169	179.06	779	169	11.87	0.88
342	164	178.17	784	164	11.55	0.85
350	174	175.99	777	174	12.22	0.90
354	180	174.86	772	180	12.61	0.94
238	121	117.63	513	121	8.49	0.63
359	184	175.29	767	184	12.96	0.96
369	195	174.01	758	195	13.67	1.01

248	133	115.31	503	133	9.31	0.69
362	189	172.84	764	189	13.31	0.99
315	138	177.27	811	138	9.87	0.69
327	150	176.45	800	150	10.69	0.76
124	64	60.10	251	64	4.55	0.33

Dirigo Laboratories, Inc.

Manufacturer:	**Pacific Energy**
Model:	**TN20**
Date:	**12/20/2016**
Run:	**1**
Control #:	**034-S-74-1**
Test Duration:	**310**
Output Category:	**2**

	HHV Basis	LHV Basis
Overall Efficiency	74.5%	80.5%
Combustion Efficiency	94.6%	94.6%
Heat Transfer Efficiency	78.8%	85.2%

HHV Output Rate (kJ/h)	15,161	14,382	**(Btu/h)**
Burn Rate (kg/h)	1.03	2.26	**(lb/h)**
Input (kJ/h)	20,347	19,301	**(Btu/h)**

Test Load Weight (dry kg)	5.3	11.7	**dry lb**
MC wet (%)	16.46		
MC dry (%)	19.70		
Particulate (g)	4.62		
CO (g)	410		
Test Duration (h)	5.166666667		

Emissions	**Particulate**	**CO**
g/MJ Output	0.06	5.24
g/kg Dry Fuel	0.87	77.30
g/h	0.89	79.40
lb/MM Btu Output	0.14	12.17

Air/Fuel Ratio (A/F)	12.68

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

EPA Method 28 - Weighted Average

DIRIGO LABORATORIES INC.

Weighted Average: 1.6 (g/hr)

Client: Pacific Energy
Model: TN20 (series B)
Tracking No.: 74
Project No.: 034-S-74-1
Test Dates: 12/13/16 - 12/20/16

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.97
Emissions Rate (g/hr)	1.4
Emissions Rate Cap (g/hr)	15
Weighting Factor	24.47%
Run Number	5

Burn Rate Category	2
Burn Rate (kg/hr-dry)	1.01
Emissions Rate (g/hr)	1.4
Emissions Rate Cap (g/hr)	15
Weighting Factor	3.01%
Run Number	2

Burn Rate Category	2
Burn Rate (kg/hr-dry)	1.03
Emissions Rate (g/hr)	0.9
Emissions Rate Cap (g/hr)	15
Weighting Factor	27.59%
Run Number	1

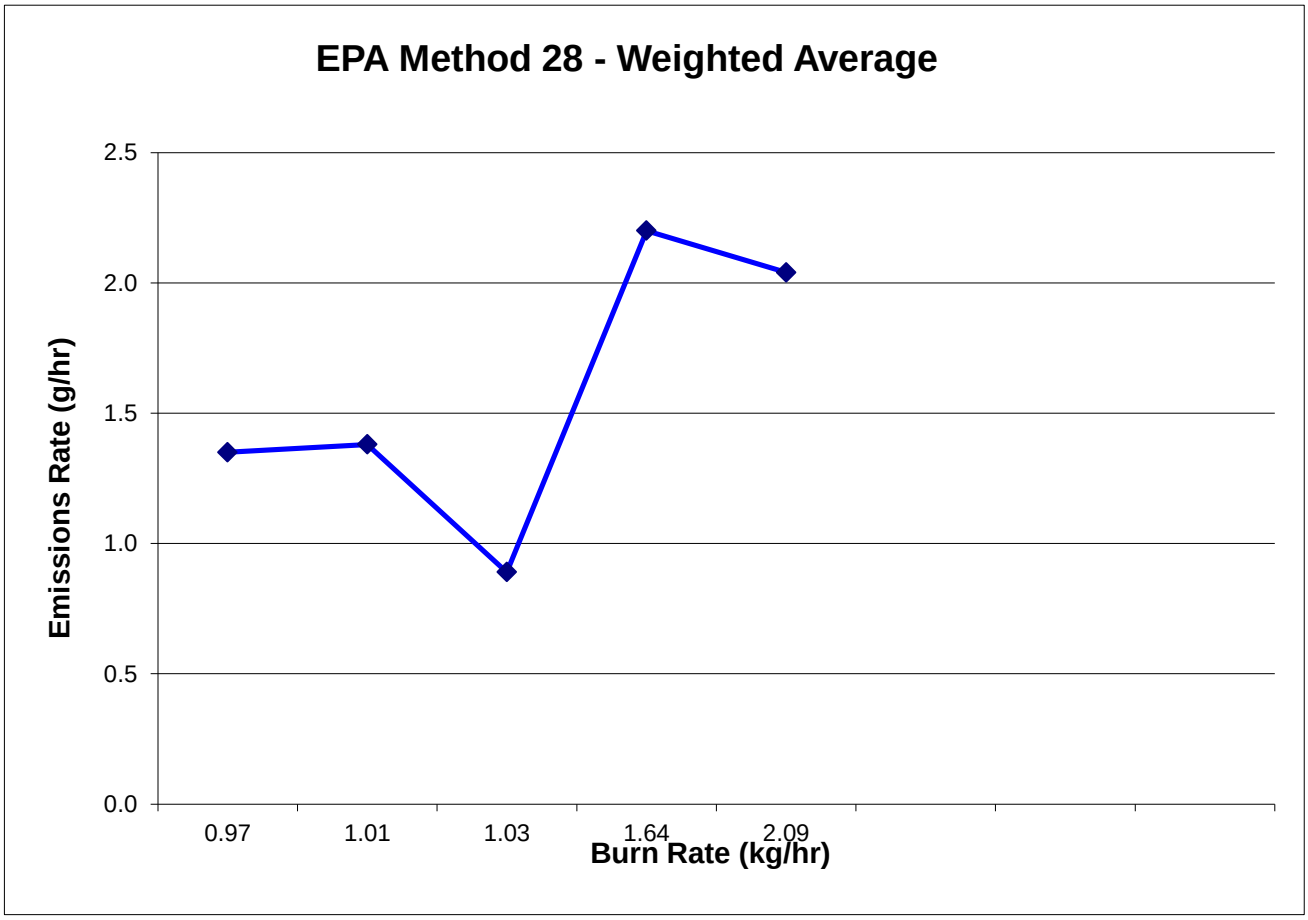
Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.64
Emissions Rate (g/hr)	2.2
Emissions Rate Cap (g/hr)	18
Weighting Factor	33.51%
Run Number	3

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.09
Emissions Rate (g/hr)	2.0
Emissions Rate Cap (g/hr)	18
Weighting Factor	11.43%
Run Number	4

EPA Method 28 - Weighted Average

DIRIGO LABORATORIES INC.

Client: Pacific Energy
Model: TN20 (series B)
Tracking No.: 74
Project No.: 034-S-74-1
Test Dates: 12/13/16 - 12/20/16



PREBURN

JOB # 034_S_74_1
TECHNICIAN GENBTN
DATE: 12_20_16
RUN #: 6
READING INTERVAL: 10

.

Run Time: 70

Model Designation TN20

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.045	0.044	0.049	0.045	0.042	0.044	0.046	0.039	0.044
Temperature	110	110	110	110	110	110	110	110	110.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	7.7	-0.082	542	567	513	849	446	583.4
10	6.2	-0.067	551	577	518	765	441	570.4
20	5.2	-0.058	540	567	513	673	431	544.8
30	4.3	-0.056	535	571	518	659	418	540.2
40	4	-0.044	524	553	515	574	409	515
50	3.4	-0.038	503	525	507	484	406	485
60	3.3	-0.026	464	473	463	411	402	442.6
70	3.2	-0.029	428	431	429	362	394	408.8

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:	14.1761	ft/sec.
Intial Tunnel Flow:	155.4647	scfm
Average Tunnel Flow:	157.1129	scfm

Run #	6
Date:	12/20/16

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	0.045	0.044	0.049	0.045	0.042	0.044	0.046	0.039	0.044
Temperature	110	110	110	110	110	110	110	110	110.000

Tunnel Velocity:	14.176	ft/sec.
Intial Tunnel Flow:	155.46	scfm
Average Tunnel Flow	157.11	scfm

JOB #	034_S_74_1							ROOM TEMP (F)	75.0					BEG	MID	END	AVG
TECHNICIA	GENBTN									BAROMETRIC				30.3	30.3	30.3	30.3
DATE:	12_20_16																
RUN #:	6																
READING INTERVAL:	10																
SAMPLE BOX :	A	METER Y FACTOR:		1.007					PROBE MATERIAL:					SS			
FRONT FILTER #:	3022&3027				REAR FILTER #	REAR FILTER #:		3023									
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG						
Run Time:		300		AMBIENT FILTER #:		3026	VOLUME	1565.189	LITERS	FUEL MOISTURE DB					19.7	%	
				FINAL LEAK RATE (CFM):		<0.01	@	15	IN-HG								
TEST START TIME:		13:41							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	0.044	0	-0.11		NA	13.6	0	97	240	76	426	4172.13	83	77	
10	1.376	0.138	0.044	2.01	-1.4	14.154	101	12.7	0.9	98	292	81	381	4172.45	84	77	
20	2.764	0.139	0.044	2.01	-1.17	14.205	102	11.7	1	102	350	82	342	4172.62	87	76	
30	4.159	0.140	0.044	2.02	-0.91	14.230	102	10.5	1.2	104	386	82	329	4172.7	90	76	
40	5.563	0.140	0.044	2.01	-0.82	14.306	103	9	1.5	110	439	83	342	4172.74	93	76	
50	6.966	0.140	0.044	2	-1.48	14.331	102	7.5	1.5	112	448	84	365	4172.78	96	76	
60	8.372	0.141	0.044	2.01	-0.73	14.318	102	6.2	1.3	111	437	85	390	4172.74	98	76	
70	9.788	0.142	0.044	2.02	-1.34	14.306	102	5.1	1.1	110	417	85	411	4172.7	100	77	
80	11.200	0.141	0.044	2.03	-0.71	14.268	101	4.3	0.8	107	385	84	430	4172.8	101	77	
90	12.621	0.142	0.044	2.01	-0.73	14.230	102	3.7	0.6	104	353	84	448	4172.85	102	76	
100	14.039	0.142	0.044	2.03	-0.8	14.192	101	3.2	0.5	101	324	83	454	4172.86	103	76	
110	15.462	0.142	0.044	2.02	-1.53	14.167	101	2.8	0.4	99	312	83	457	4172.82	104	76	
120	16.880	0.142	0.044	2.02	-1.32	14.154	100	2.5	0.3	98	296	82	455	4172.69	104	76	
130	18.301	0.142	0.044	2.04	-0.68	14.129	100	2.4	0.1	96	272	81	448	4172.53	105	76	
140	19.719	0.142	0.044	2.04	-1.5	14.103	100	2.2	0.2	94	258	81	440	4172.33	105	75	
150	21.138	0.142	0.044	2.02	-1.36	14.091	100	2	0.2	93	248	80	432	4172.09	105	75	
160	22.555	0.142	0.044	2.02	-1.53	14.078	100	1.8	0.2	92	242	80	424	4171.88	105	75	
170	23.972	0.142	0.044	2.02	-0.79	14.065	100	1.7	0.1	91	237	79	416	4171.63	105	75	
180	25.385	0.141	0.044	2.02	-1.07	14.052	99	1.5	0.2	90	231	79	410	4171.4	105	74	
190	26.799	0.141	0.044	2.02	-1.47	14.052	99	1.4	0.1	90	225	78	405	4171.17	105	74	
200	28.211	0.141	0.044	2.01	-1.46	14.040	99	1.3	0.1	89	220	78	400	4170.9	105	74	
210	29.627	0.142	0.044	2.01	-1.39	14.027	99	1.2	0.1	88	216	78	396	4170.59	105	74	
220	31.041	0.141	0.044	2.01	-1.46	14.027	99	0.9	0.3	88	214	78	394	4170.27	104	74	
230	32.463	0.142	0.044	2.02	-1.12	14.027	100	0.9	0	88	213	78	391	4169.95	104	74	
240	33.877	0.141	0.044	2.03	-0.86	14.027	99	0.7	0.2	88	211	77	388	4169.65	104	74	
250	35.296	0.142	0.044	2.01	-0.72	14.014	100	0.6	0.1	87	209	77	385	4169.31	104	74	
260	36.703	0.141	0.044	2.03	-1.06	14.014	99	0.5	0.1	87	207	77	381	4169.08	104	73	
270	38.116	0.141	0.044	2.03	-0.83	14.014	99	0.5	0	87	204	77	376	4168.87	104	73	

TEST START TIME:		13:41								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
280	39.526	0.141	0.044	2	-1.22	14.014	99	0.3	0.2	87	201	77	370	4168.58	104	73
290	40.939	0.141	0.044	2.01	-0.91	14.001	99	0.2	0.1	86	199	77	363	4168.42	104	73
300	42.348	0.141	0.044	2.01	-1.07	14.001	99	0	0.2	86	196	77	358	4168.15	104	73

TEST START TIME:	13:41								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
	42.348		0.044	2.02		14.121	100.3			95	280				101	75

JOB #	034_S_74_1										
TECHNICIAN	GENBTN										
DATE:	12_20_16										
RUN #:	6										
READING INTERVAL:	10										
SAMPLE BOX :	*B*	METER Y FACTOR:		1.002			PROBE MATERIAL:			**SS**	
FRONT FILTER #:	3024					REAR FILTER #:	3025				
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG	

Run Time: 300 **Firebox Delta T** **74.6**

							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	426	428	77	359	393	83	406
10	1.360	0.136	101	-0.04	1.96	1.49	389	381	81	379	382	84	382
20	2.732	0.137	101	-0.05	2	1.68	366	348	81	444	370	87	374
30	4.107	0.138	101	-0.06	1.98	1.96	365	350	82	494	357	90	379
40	5.486	0.138	102	-0.07	1.98	1.93	397	377	83	606	346	92	414
50	6.870	0.138	102	-0.07	1.98	1.39	439	409	84	656	337	95	441
60	8.263	0.139	102	-0.07	2	1.59	472	439	84	666	331	97	460
70	9.659	0.140	102	-0.06	1.99	1.34	490	461	84	654	327	99	469
80	11.058	0.140	102	-0.05	2	1.93	491	476	84	615	322	100	467
90	12.461	0.140	101	-0.05	2.01	1.72	490	488	83	566	319	101	462
100	13.864	0.140	101	-0.04	2.01	1.98	484	486	83	522	318	102	453
110	15.268	0.140	101	-0.05	2	1.7	478	487	82	485	319	103	445
120	16.672	0.140	101	-0.04	2	1.67	470	486	82	474	321	103	441
130	18.076	0.140	100	-0.03	2.01	1.59	460	471	81	434	325	103	428
140	19.479	0.140	100	-0.03	2	1.72	450	452	80	402	328	104	414
150	20.887	0.141	100	-0.03	2.01	1.65	441	438	80	381	330	104	404
160	22.289	0.140	100	-0.03	1.99	1.62	432	427	79	367	332	104	396
170	23.692	0.140	100	-0.03	1.99	1.71	424	416	79	356	334	104	389
180	25.095	0.140	100	-0.03	1.99	1.36	418	406	79	346	334	104	383
190	26.494	0.140	99	-0.03	2	1.64	409	400	78	335	334	104	377
200	27.899	0.141	100	-0.02	1.98	1.69	400	395	78	326	333	104	371

							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
210	29.302	0.140	99	-0.02	2	1.37	393	390	78	320	333	104	366
220	30.703	0.140	99	-0.02	1.99	1.52	388	385	78	315	332	104	363
230	32.108	0.141	100	-0.03	2	1.35	385	380	77	311	332	103	360
240	33.509	0.140	99	-0.02	1.99	2.05	382	376	77	308	332	103	357
250	34.911	0.140	99	-0.02	1.99	1.37	379	373	77	304	332	103	355
260	36.315	0.140	100	-0.02	2	1.58	374	368	77	300	331	103	351
270	37.717	0.140	99	-0.02	2	1.55	369	363	77	296	330	103	347
280	39.119	0.140	99	-0.02	2.01	1.17	362	358	77	291	328	103	342
290	40.523	0.140	99	-0.03	2	1.77	354	353	77	286	327	103	337
300	41.925	0.140	99	-0.02	2	1.32	347	349	76	281	324	103	332

							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
	41.925	0.140	100.275	-0.035	1.995333	1.593871	417	410	80	415	335	100	75
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER:	034_S_74_1
TECHNICIAN:	GENBTN
DATE:	12_20_16
RUN NUMBER:	6

METER Y FACTOR: **1.003**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	90	0	0
End	1565.189	101	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1565.189	Liters
Total Sample Volume - Vm	55.274	ft^3
Average Sample Rate	0.18	ft^3/min
Sample Time	300.00	Minutes
Average Meter Temperature	95.5	°F
Total Sample Volume (Standard Conditions) - Vmstd	53.365	dscf
Total Particulates	0.5	mg
Particulate Concentration (dry-standard)	0.000009369	grams/dscf
Particulate Emission Rate	0.000100000	grams/hour

JOB NUMBER: 034_S_74_1

RUN #: 6

DATE: 12_20_16

BURN RATE: 1.03 KG/HR DRY

FILTER A PARTICULATE: 10.2 mg

FILTER B PARTICULATE: 9.2 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	42.35		41.93	
Average Gas Velocity in Dilution Tunnel - vs	14.18	feet/second	14.18	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9426.77	dscf/hour	9426.77	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	40.86	dscf	40.31	dscf
Average Tunnel Temperature	95.5	F	95.5	F
Average Delta p	0.044		0.044	
Average Gas Meter Temperature	101	F	100	F
Average Delta H	2.02	in-h20	2.00	in-h20
Total Time of Test	300	min	300	min
Total Particulates	10.2	mg	9.2	mg
Particulate Concentration (dry-standard)	0.00025	grams/dscf	0.00023	grams/dscf
Ambient Train (dry-standard)	0.000009369	grams/dscf	0.000009369	grams/dscf
Net (dry-standard)	0.000240285	grams/dscf	0.00021887	grams/dscf
Particulate Emission Rate	2.27	grams/hour	2.06	grams/hour
Total PM Emissions	11.33	grams	10.32	grams
Average Total PM Emissions		10.82		grams
AVERAGE PARTICLATE EMISSIONS RATE		2.16		grams/hour
% OF AVERAGE	104.7		95.3	
Emissions Factor	2.198	g/Kg -Dry	2.002	g/Kg -Dry

PREBURN

JOB # 034_S_74_1
TECHNICIAN GENBTN
DATE: 12_16_16
RUN #: 5
READING INTERVAL: 10
.
Run Time: 60

Model Designation TN20

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.041	0.043	0.047	0.044	0.043	0.047	0.040	0.039	0.043
Temperature	100	100	100	100	100	100	100	100	100.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	7.2	-0.085	548	578	484	829	487	585.2
10	5.7	-0.064	560	587	222	687	482	507.6
20	4.7	-0.059	543	561	202	584	468	471.6
30	4	-0.044	529	551	197	506	448	446.2
40	3.8	-0.036	500	524	190	410	431	411
50	3.4	-0.032	475	494	181	344	420	382.8
60	3.2	-0.032	451	462	175	300	418	361.2

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:	13.96826	ft/sec.
Intial Tunnel Flow:	154.1486	scfm
Average Tunnel Flow:	155.8268	scfm

Technician_____

Run #	5
Date:	12/16/16

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	0.047	0.044	0.043	0.047	0.040	0.039	0.043
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	13.968	ft/sec.
Intial Tunnel Flow:	154.15	scfm
Average Tunnel Flow	155.83	scfm

JOB #	034_S_74_1															
TECHNICIA	GENBTN							ROOM TEMP (F)		71.2				BEG	MID	END	AVG
DATE:	12_16_16								BAROMETRIC					30.12	30.12	30.12	30.12
RUN #:	5																
READING INTERVAL:		10															
SAMPLE BOX :		A	METER Y FACTOR:		1.007					PROBE MATERIAL:				SS			
FRONT FILTER #:		3016&3021				REAR FILTER #	REAR FILTER #:		3017								
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG					
Run Time:		320	AMBIENT FILTER #:				3020	VOLUME	1721.635	LITERS	FUEL MOISTURE DB				19.7	%	
			FINAL LEAK RATE (CFM):				<0.01	@	15	IN-HG							
TEST START TIME:		14:50								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	0.043	0.01	-0.06		NA	13.7	0	89	229	74	177	4164.07	80	71	
10	1.634	0.163	0.043	2.02	-1	14.009	119	12.7	1	96	302	77	323	4164.08	81	71	
20	3.030	0.140	0.043	2.02	-1.08	14.059	102	11.5	1.2	100	379	77	320	4164.1	83	71	
30	4.428	0.140	0.043	2	-0.94	14.059	102	10.3	1.2	100	399	78	147	4163.97	86	71	
40	5.830	0.140	0.043	2.02	-0.68	14.097	101	8.8	1.5	103	428	78	145	4163.78	90	71	
50	7.241	0.141	0.043	2.02	-1.1	14.059	101	7.6	1.2	100	397	78	151	4163.63	92	70	
60	8.649	0.141	0.043	2.03	-1.19	14.059	101	6.5	1.1	100	399	78	156	4163.38	94	70	
70	10.069	0.142	0.043	2.03	-1.17	14.047	101	5.4	1.1	99	391	78	162	4163.23	96	70	
80	11.485	0.142	0.043	2.03	-1.47	13.996	100	4.7	0.7	95	337	77	167	4163.07	97	70	
90	12.909	0.142	0.043	2.04	-1.03	13.959	100	4.1	0.6	92	304	77	168	4162.83	98	70	
100	14.329	0.142	0.043	2.04	-1.47	13.933	100	3.6	0.5	90	294	76	168	4162.59	98	70	
110	15.752	0.142	0.043	2.04	-0.92	13.921	100	3.1	0.5	89	297	75	171	4162.33	99	69	
120	17.170	0.142	0.043	2.03	-0.9	13.895	99	2.8	0.3	87	274	75	172	4162.1	99	70	
130	18.592	0.142	0.043	2.02	-1.33	13.870	99	2.5	0.3	85	247	74	169	4161.8	99	69	
140	20.014	0.142	0.043	2.02	-0.71	13.857	99	2.4	0.1	84	230	74	166	4161.51	100	69	
150	21.434	0.142	0.043	2.04	-1.48	13.895	99	2.2	0.2	87	217	74	166	4161.68	100	70	
160	22.858	0.142	0.043	2.01	-0.7	13.882	100	2.1	0.1	86	211	75	164	4162.07	100	71	
170	24.276	0.142	0.043	2.01	-0.75	13.870	99	1.9	0.2	85	204	75	161	4162.46	100	71	
180	25.701	0.143	0.043	2.02	-1.51	13.870	99	1.8	0.1	85	198	75	159	4162.86	101	72	
190	27.123	0.142	0.043	2.02	-0.89	13.870	99	1.6	0.2	85	193	76	156	4163.28	101	72	
200	28.550	0.143	0.043	2.05	-0.67	13.870	99	1.5	0.1	85	188	76	153	4163.73	102	73	
210	29.971	0.142	0.043	2.02	-0.74	13.870	99	1.4	0.1	85	183	76	150	4164.1	102	73	
220	31.397	0.143	0.043	2.03	-0.73	13.870	99	1.2	0.2	85	179	76	148	4164.51	102	73	
230	32.825	0.143	0.043	2.04	-1.38	13.857	99	1.1	0.1	84	177	76	146	4164.78	102	73	
240	34.247	0.142	0.043	2.04	-0.69	13.857	99	1	0.1	84	176	76	144	4165.08	103	73	
250	35.678	0.143	0.043	2.03	-1.47	13.844	99	0.8	0.2	83	178	76	143	4165.33	103	72	
260	37.102	0.142	0.043	2.04	-0.73	13.844	99	0.7	0.1	83	178	76	143	4165.45	103	72	
270	38.530	0.143	0.043	2.03	-1.2	13.844	99	0.5	0.2	83	178	76	142	4165.53	103	72	

TEST START TIME:		14:50								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
280	39.960	0.143	0.043	2.03	-1.48	13.844	99	0.4	0.1	83	176	76	141	4165.71	103	72
290	41.383	0.142	0.043	2.04	-0.95	13.844	99	0.3	0.1	83	175	75	139	4165.78	103	72
300	42.815	0.143	0.043	2.04	-0.73	13.844	99	0.2	0.1	83	174	75	138	4165.82	103	72
310	44.240	0.143	0.043	2.03	-1.22	13.844	99	0.1	0.1	83	171	75	136	4165.87	103	72
320	45.669	0.143	0.043	2.04	-1.39	13.832	99	0	0.1	82	169	75	135	4165.89	103	72

TEST START TIME:	14:50								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
	45.669		0.043	2.03		13.915	100.3			89	249				98	71

JOB #	034_S_74_1									
TECHNICIAN	GENBTN									
DATE:	12_16_16									
RUN #:	5									
READING INTERVAL:	10									
SAMPLE BOX :	*B*	METER Y FACTOR:	1.002			PROBE MATERIAL:	**SS**			
FRONT FILTER #:	3018				REAR FILTER #:	3019				
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG	FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG	

Run Time: 320 **Firebox Delta T** **101**

							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	447	456	73	293	418	80	358
10	1.364	0.136	102	-0.05	1.98	1.66	415	407	76	404	418	81	393
20	2.738	0.137	102	-0.06	2	1.63	390	363	76	465	410	83	390
30	4.114	0.138	102	-0.06	1.97	1.56	394	371	77	495	396	86	361
40	5.497	0.138	102	-0.06	2	1.95	419	385	77	535	381	89	373
50	6.885	0.139	102	-0.06	1.99	1.3	436	405	77	535	368	92	379
60	8.277	0.139	102	-0.06	1.98	1.42	442	419	77	526	356	93	380
70	9.668	0.139	101	-0.05	1.99	1.51	453	434	77	532	345	95	385
80	11.062	0.139	101	-0.05	1.99	1.37	457	446	76	475	334	96	376
90	12.461	0.140	101	-0.05	1.99	1.84	445	442	75	416	326	97	359
100	13.859	0.140	100	-0.04	1.99	1.29	432	434	75	385	320	98	348
110	15.256	0.140	100	-0.04	1.99	1.38	431	441	74	388	316	98	349
120	16.657	0.140	100	-0.04	1.98	1.96	430	441	74	370	314	99	345
130	18.060	0.140	100	-0.03	1.99	1.47	423	431	73	334	314	99	334
140	19.459	0.140	100	-0.03	2	1.63	415	419	73	302	317	99	324
150	20.861	0.140	100	-0.03	1.98	1.88	408	411	74	283	321	99	318
160	22.264	0.140	100	-0.03	1.99	1.2	402	404	74	271	324	99	313
170	23.663	0.140	100	-0.02	1.99	1.96	394	397	75	261	327	100	308
180	25.066	0.140	100	-0.02	2	1.31	385	389	75	253	328	100	303
190	26.469	0.140	100	-0.02	2	1.97	375	380	75	244	329	101	297
200	27.870	0.140	100	-0.02	1.98	1.97	364	372	75	236	329	101	291

							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
210	29.275	0.141	100	-0.02	1.97	1.68	355	361	76	228	329	102	285
220	30.678	0.140	100	-0.02	1.98	1.91	347	352	76	222	328	102	279
230	32.081	0.140	100	-0.02	1.99	1.57	338	344	75	217	326	102	274
240	33.487	0.141	100	-0.01	1.99	1.52	331	339	76	214	324	102	270
250	34.891	0.140	99	-0.01	1.99	1.55	328	338	75	215	323	103	269
260	36.294	0.140	99	-0.02	1.99	1.63	326	340	75	215	324	103	270
270	37.702	0.141	100	-0.01	2	1.7	324	341	75	216	325	103	270
280	39.105	0.140	99	-0.02	2	1.71	321	339	75	214	326	103	268
290	40.512	0.141	100	-0.02	1.99	1.94	318	332	75	212	327	103	266
300	41.918	0.141	100	-0.02	2	1.47	315	326	75	210	328	102	263
310	43.322	0.140	99	-0.02	1.99	1.51	311	320	75	206	328	102	260
320	44.729	0.141	100	-0.02	1.99	1.54	308	312	75	203	328	102	257

							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
	44.729	0.140	100.286	-0.031	1.989375	1.605758	384	385	75	320	340	97	101
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER: 034_S_74_1
TECHNICIAN: GENBTN
DATE: 12_16_16
RUN NUMBER: 5

METER Y FACTOR: **1.003**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	90.5	0	0
End	1721.635	100.7	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1721.635	Liters
Total Sample Volume - Vm	60.799	ft^3
Average Sample Rate	0.19	ft^3/min
Sample Time	320.00	Minutes
Average Meter Temperature	95.6	°F
Total Sample Volume (Standard Conditions) - Vmstd	58.339	dscf
Total Particulates	0.0	mg
Particulate Concentration (dry-standard)	0.000000000	grams/dscf
Particulate Emission Rate	0.000000000	grams/hour

RESULTS

RUN # 5

DATE: 12_16_16

BURN RATE 0.97 KG/HR DRY

FILTER A PARTICULATE 6.4 mg

FILTER B PARTICULATE 6.2 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	45.67		44.73	
Average Gas Velocity in Dilution Tunnel - vs	13.97	feet/second	13.97	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9349.61	dscf/hour	9349.61	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	44.04	dscf	42.95	dscf
Average Tunnel Temperature	88.6	F	88.6	F
Average Delta p	0.043		0.043	
Average Gas Meter Temperature	98	F	97	F
Average Delta H	2.03	in-h20	1.99	in-h20
Total Time of Test	320	min	320	min
Total Particulates	6.4	mg	6.2	mg
Particulate Concentration (dry-standard)	0.00015	grams/dscf	0.00014	grams/dscf
Ambient Train (dry-standard)	0.000000000	grams/dscf	0.000000000	grams/dscf
Net (dry-standard)	0.000145336	grams/dscf	0.00014437	grams/dscf
Particulate Emission Rate	1.36	grams/hour	1.35	grams/hour
Total PM Emissions	7.25	grams	7.20	grams
Average Total PM Emissions		7.22		grams
AVERAGE PARTICLATE EMISSIONS RATE		1.35		grams/hour
% OF AVERAGE	100.3		99.7	
Emissions Factor	1.396	g/Kg -Dry	1.387	g/Kg -Dry

PREBURN

JOB # 034_S_74_1
TECHNICIAN GENBTN
DATE: 12_15_16
RUN #: 4
READING INTERVAL: 10
.
Run Time: 60

Model Designation TN20

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.037	0.044	0.045	0.043	0.043	0.044	0.044	0.039	0.042
Temperature	155	155	155	155	155	155	155	155	155.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	11	-0.081	547	563	477	593	479	531.8
10	8.1	-0.082	535	571	224	754	479	512.6
20	5.5	-0.08	560	608	231	787	466	530.4
30	4	-0.069	599	651	238	699	463	530
40	3.9	-0.065	583	636	226	570	456	494.2
50	3.3	-0.051	548	580	208	455	446	447.4
60	3.1	-0.048	500	513	188	375	434	402

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:	14.25454	ft/sec.
Intial Tunnel Flow:	145.5136	scfm
Average Tunnel Flow:	149.1462	scfm

Technician_____

Run #	4
Date:	12/15/16

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	0.044	0.045	0.043	0.043	0.044	0.044	0.039	0.042
Temperature	155	155	155	155	155	155	155	155	155.000

Tunnel Velocity:	14.255	ft/sec.
Intial Tunnel Flow:	145.51	scfm
Average Tunnel Flow	149.15	scfm

JOB #	034_S_74_1																
TECHNICIA	GENBTN							ROOM TEMP (F)		74.9				BEG	MID	END	AVG
DATE:	12_15_16								BAROMETRIC					29.91	29.91	29.91	29.91
RUN #:	4																
READING INTERVAL:		10															
SAMPLE BOX :		A	METER Y FACTOR:		1.007					PROBE MATERIAL:				SS			
FRONT FILTER #:		3010&3015				REAR FILTER #	REAR FILTER #:		3011								
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG					
Run Time:		150		AMBIENT FILTER #:			3014	VOLUME	833.188	LITERS	FUEL MOISTURE DB				19.9	%	
				FINAL LEAK RATE (CFM):			<0.01	@	15	IN-HG							
TEST START TIME:		4:15								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	13.8	0	110	321	69	179	4169.08	84	75	
10	1.393	0.139	0.042	2.01	-0.85	14.227	101	12.5	1.3	123	503	77	154	4169.48	84	74	
20	2.794	0.140	0.042	2.04	-1.01	14.493	103	10	2.5	145	663	82	148	4170.01	86	75	
30	4.197	0.140	0.042	2.02	-0.72	14.553	103	7.6	2.4	150	667	85	159	4170.26	89	75	
40	5.612	0.142	0.042	2.02	-0.83	14.445	103	5.9	1.7	141	600	84	167	4170.4	92	76	
50	7.024	0.141	0.042	2.02	-0.84	14.409	102	4.3	1.6	138	578	84	178	4170.39	95	76	
60	8.448	0.142	0.042	2.04	-1.57	14.336	101	3	1.3	132	540	84	193	4170.23	97	75	
70	9.870	0.142	0.042	2.02	-1.54	14.251	100	2.2	0.8	125	489	86	205	4170.17	99	75	
80	11.298	0.143	0.042	2.02	-1.16	14.178	100	1.7	0.5	119	440	86	207	4170.09	100	75	
90	12.722	0.142	0.042	2.01	-1.25	14.105	99	1.5	0.2	113	392	85	199	4170.07	101	75	
100	14.152	0.143	0.042	2.02	-1.4	14.068	99	1.2	0.3	110	365	84	191	4170.02	102	75	
110	15.584	0.143	0.042	2.03	-1.51	14.043	99	1	0.2	108	348	84	184	4169.98	103	75	
120	17.015	0.143	0.042	2.02	-1.11	14.030	99	0.7	0.3	107	347	83	182	4169.88	103	75	
130	18.450	0.144	0.042	2.02	-1.28	14.006	99	0.5	0.2	105	333	82	180	4169.66	104	74	
140	19.884	0.143	0.042	2.02	-0.96	13.993	99	0.3	0.2	104	325	82	175	4169.48	104	74	
150	21.316	0.143	0.042	2.03	-1	13.981	98	0	0.3	103	317	82	173	4169.3	104	74	

TEST START TIME:		4:15								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:		4:15								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
	21.316		0.042	2.02		14.208	100.3			121	452				97	75

JOB #	034_S_74_1										
TECHNICIAN	GENBTN										
DATE:	12_15_16										
RUN #:	4										
READING INTERVAL:	10										
SAMPLE BOX :	*B*	METER Y FACTOR:		1.002			PROBE MATERIAL:			**SS**	
FRONT FILTER #:	3012					REAR FILTER #:	3013				
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG	

Run Time: 150 **Firebox Delta T** **29.4**

							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	472	477	69	339	425	84	378
10	1.371	0.137	101	-0.07	1.96	1.8	421	421	77	389	412	84	359
20	2.748	0.138	103	-0.08	1.98	1.74	425	450	81	629	396	86	410
30	4.131	0.138	103	-0.08	1.99	1.78	482	514	84	733	383	89	454
40	5.521	0.139	102	-0.08	1.99	2.1	532	547	83	674	376	92	459
50	6.918	0.140	102	-0.07	1.99	1.61	563	572	83	650	372	95	467
60	8.322	0.140	102	-0.07	1.99	2.23	581	590	83	629	372	97	473
70	9.725	0.140	100	-0.06	1.99	1.66	575	589	85	559	373	99	460
80	11.130	0.141	100	-0.06	1.99	2.02	556	574	84	489	375	100	440
90	12.538	0.141	99	-0.05	1.99	1.65	524	550	84	422	379	101	415
100	13.945	0.141	99	-0.05	1.98	1.57	493	526	83	374	382	102	393
110	15.357	0.141	99	-0.05	1.98	1.83	467	504	82	344	383	102	376
120	16.767	0.141	99	-0.05	1.98	1.89	449	488	81	329	383	103	366
130	18.181	0.141	99	-0.04	1.99	2.16	444	482	81	322	383	103	362
140	19.592	0.141	99	-0.04	1.99	1.92	433	474	81	310	384	103	355
150	21.004	0.141	98	-0.04	1.99	1.47	425	464	80	300	383	104	349

							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
	21.004	0.140	100.290	-0.056	1.985333	1.776875	490	514	81	468	385	97	29
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER: 034_S_74_1
TECHNICIAN: GENBTN
DATE: 12_15_16
RUN NUMBER: 4

METER Y FACTOR: **1.003**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	86.8	0	0
End	833.188	104	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	833.188	Liters
Total Sample Volume - Vm	29.424	ft^3
Average Sample Rate	0.20	ft^3/min
Sample Time	150.00	Minutes
Average Meter Temperature	95.4	°F
Total Sample Volume (Standard Conditions) - Vmstd	28.047	dscf
Total Particulates	0.1	mg
Particulate Concentration (dry-standard)	0.000003565	grams/dscf
Particulate Emission Rate	0.000040000	grams/hour

JOB NUMBER 034_S_74_1

RUN # 4

DATE: 12_15_16

BURN RATE 2.09 KG/HR DRY

FILTER A PARTICULATE 4.7 mg

FILTER B PARTICULATE 4.7 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	21.32		21.00	
Average Gas Velocity in Dilution Tunnel - vs	14.25	feet/second	14.25	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8948.77	dscf/hour	8948.77	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	20.45	dscf	20.06	dscf
Average Tunnel Temperature	120.8	F	120.8	F
Average Delta p	0.042		0.042	
Average Gas Meter Temperature	97	F	97	F
Average Delta H	2.02	in-h20	1.99	in-h20
Total Time of Test	150	min	150	min
Total Particulates	4.7	mg	4.7	mg
Particulate Concentration (dry-standard)	0.00023	grams/dscf	0.00023	grams/dscf
Ambient Train (dry-standard)	0.000003565	grams/dscf	0.000003565	grams/dscf
Net (dry-standard)	0.000226225	grams/dscf	0.00023074	grams/dscf
Particulate Emission Rate	2.02	grams/hour	2.06	grams/hour
Total PM Emissions	5.06	grams	5.16	grams
Average Total PM Emissions		5.11		grams
AVERAGE PARTICLATE EMISSIONS RATE		2.04		grams/hour
% OF AVERAGE	99.0		101.0	
Emissions Factor	0.969	g/Kg -Dry	0.989	g/Kg -Dry

PREBURN

JOB # 034_S_74_1
TECHNICIAN BTN GEN
DATE: 12_14_16
RUN #: 3
READING INTERVAL: 10
.
Run Time: 60

Model Designation TN 20

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.042	0.045	0.042	0.041	0.038	0.044	0.044	0.038	0.042
Temperature	125	125	125	125	125	125	125	125	125.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	7.6	-0.082	508	556	437	868	359	545.6
10	5.4	-0.075	537	580	218	788	360	496.6
20	4.3	-0.065	552	592	207	649	362	472.4
30	3.8	-0.056	537	576	201	517	361	438.4
40	3.5	-0.044	521	549	195	428	360	410.6
50	3.3	-0.039	503	522	187	373	361	389.2
60	3	-0.036	487	502	186	336	365	375.2

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:	14.08156	ft/sec.
Intial Tunnel Flow:	148.2256	scfm
Average Tunnel Flow:	150.9783	scfm

Run #	3
Date:	12/14/16

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	0.042	0.045	0.042	0.041	0.038	0.044	0.044	0.038	0.042
Temperature	125	125	125	125	125	125	125	125	125.000

Tunnel Velocity:	14.082	ft/sec.
Intial Tunnel Flow:	148.23	scfm
Average Tunnel Flow	150.98	scfm

JOB #	034_S_74_1													BEG	MID	END	AVG
TECHNICIA	BTN GEN							ROOM TEMP (F)		73.3							
DATE:	12_14_16								BAROMETRIC					29.96	29.96	29.96	29.96
RUN #:	3																
READING INTERVAL:		10															
SAMPLE BOX :		A	METER Y FACTOR:			1.007				PROBE MATERIAL:				SS			
FRONT FILTER #:		3004&3009					REAR FILTER #	REAR FILTER #:		3005							
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG			FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG				
Run Time:		190		AMBIENT FILTER #:			3008	VOLUME		1054.703	LITERS	FUEL MOISTURE DB			19.8	%	
				FINAL LEAK RATE (CFM):			<0.01	@		15	IN-HG						
TEST START TIME:		21:38									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	0.01	-0.11		NA	13.7	0	104	300	69	225	4165.9	83	74	
10	1.387	0.139	0.042	2.01	-1.35	14.203	102	12	1.7	122	531	77	348	4166.17	83	74	
20	2.787	0.140	0.042	2	-1.51	14.324	103	9.9	2.1	132	591	80	359	4166.43	86	74	
30	4.187	0.140	0.042	2.02	-0.99	14.312	102	7.7	2.2	131	587	81	172	4166.71	89	74	
40	5.596	0.141	0.042	2.03	-1.01	14.288	102	5.9	1.8	129	563	81	173	4166.86	92	74	
50	7.011	0.142	0.042	2.01	-0.75	14.252	102	4.4	1.5	126	540	81	181	4167.01	94	74	
60	8.433	0.142	0.042	2.02	-1.56	14.166	101	3.4	1	119	465	81	190	4167.04	96	74	
70	9.857	0.142	0.042	2.02	-1.26	14.093	101	2.7	0.7	113	415	83	192	4167.06	98	74	
80	11.286	0.143	0.042	2.03	-1.45	14.043	101	2.3	0.4	109	378	83	190	4167.1	99	74	
90	12.713	0.143	0.042	2.02	-1.09	13.994	100	1.9	0.4	105	350	82	189	4167.11	100	74	
100	14.142	0.143	0.042	2.02	-1.09	13.944	100	1.7	0.2	101	321	81	184	4167.16	101	73	
110	15.575	0.143	0.042	2.03	-0.73	13.932	100	1.5	0.2	100	306	81	181	4167.13	102	73	
120	17.003	0.143	0.042	2.02	-1.46	13.907	99	1.2	0.3	98	297	80	180	4167.1	102	73	
130	18.438	0.144	0.042	2.03	-0.96	13.895	99	1	0.2	97	292	80	178	4166.93	102	73	
140	19.873	0.144	0.042	2.01	-1.45	13.882	99	0.8	0.2	96	284	79	174	4166.83	103	73	
150	21.303	0.143	0.042	2.03	-0.92	13.882	99	0.6	0.2	96	277	79	172	4166.71	103	72	
160	22.739	0.144	0.042	2.03	-0.78	13.870	99	0.4	0.2	95	269	79	169	4166.58	103	72	
170	24.175	0.144	0.042	2.05	-0.68	13.857	99	0.2	0.2	94	266	78	167	4166.44	103	72	
180	25.607	0.143	0.042	2.02	-1.44	13.857	99	0.1	0.1	94	261	78	167	4166.28	103	72	
190	27.042	0.144	0.042	2.03	-0.67	13.857	99	0	0.1	94	256	78	165	4166.1	102	72	

TEST START TIME:		21:38								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:		21:38								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
	27.042		0.042	2.02		14.029	100.3			108	377				97	73

JOB #	034_S_74_1										
TECHNICIAN	BTN GEN										
DATE:	12_14_16										
RUN #:	3										
READING INTERVAL:	10										
SAMPLE BOX :	*B*	METER Y FACTOR:		1.002			PROBE MATERIAL:			**SS**	
FRONT FILTER #:	3006					REAR FILTER #:	3007				
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG	

Run Time: 190 **Firebox Delta T** **63.6**

							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	486	499	69	340	366	83	383
10	1.368	0.137	101	-0.07	1.97	1.79	460	447	77	552	371	84	436
20	2.751	0.138	103	-0.08	1.99	1.71	463	446	79	710	372	86	470
30	4.137	0.139	103	-0.08	1.97	1.47	499	478	80	702	367	89	444
40	5.525	0.139	102	-0.07	2	1.64	528	506	81	696	361	91	453
50	6.922	0.140	102	-0.07	1.99	2.14	551	535	81	687	355	94	462
60	8.325	0.140	102	-0.06	1.99	1.96	555	556	81	599	351	96	450
70	9.729	0.140	101	-0.06	2	1.74	543	544	82	513	348	98	428
80	11.132	0.140	100	-0.05	1.98	2.02	529	521	82	453	347	99	408
90	12.540	0.141	100	-0.05	1.97	1.47	517	509	81	408	349	100	394
100	13.948	0.141	100	-0.05	1.99	2.16	502	487	80	366	351	100	378
110	15.355	0.141	99	-0.04	1.98	1.43	489	468	80	336	355	101	366
120	16.767	0.141	99	-0.04	1.99	2.23	481	456	79	320	359	102	359
130	18.176	0.141	99	-0.04	1.98	1.42	473	446	79	311	363	102	354
140	19.590	0.141	99	-0.04	1.99	1.6	463	435	78	301	365	102	348
150	20.999	0.141	99	-0.04	1.98	1.61	454	423	78	293	366	102	342
160	22.413	0.141	99	-0.04	2	1.89	446	412	78	284	366	102	335
170	23.825	0.141	99	-0.04	2	1.79	435	403	77	276	364	102	329
180	25.238	0.141	99	-0.04	1.99	1.64	426	397	77	270	361	102	324
190	26.651	0.141	99	-0.03	2.01	1.41	418	392	77	264	359	102	320

							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
	26.651	0.140	100.264	-0.050	1.987895	1.706	486	468	79	434	360	97	64
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER:	034_S_74_1
TECHNICIAN:	BTN GEN
DATE:	12_14_16
RUN NUMBER:	3

METER Y FACTOR: **1.003**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	85	0	0
End	1054.703	102.5	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1054.703	Liters
Total Sample Volume - Vm	37.246	ft^3
Average Sample Rate	0.20	ft^3/min
Sample Time	190.00	Minutes
Average Meter Temperature	93.75	°F
Total Sample Volume (Standard Conditions) - Vmstd	35.669	dscf
Total Particulates	0.0	mg
Particulate Concentration (dry-standard)	0.000000000	grams/dscf
Particulate Emission Rate	0.000000000	grams/hour

JOB NUMBER 034_S_74_1

RUN # 3

DATE: 12_14_16

BURN RATE 1.64 KG/HR DRY

FILTER A PARTICULATE 6.3 mg

FILTER B PARTICULATE 6.2 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	27.04		26.65	
Average Gas Velocity in Dilution Tunnel - vs	14.08	feet/second	14.08	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9058.70	dscf/hour	9058.70	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	25.97	dscf	25.48	dscf
Average Tunnel Temperature	107.8	F	107.8	F
Average Delta p	0.042		0.042	
Average Gas Meter Temperature	97	F	97	F
Average Delta H	2.02	in-h20	1.99	in-h20
Total Time of Test	190	min	190	min
Total Particulates	6.3	mg	6.2	mg
Particulate Concentration (dry-standard)	0.00024	grams/dscf	0.00024	grams/dscf
Ambient Train (dry-standard)	0.000000000	grams/dscf	0.000000000	grams/dscf
Net (dry-standard)	0.000242616	grams/dscf	0.00024334	grams/dscf
Particulate Emission Rate	2.20	grams/hour	2.20	grams/hour
Total PM Emissions	6.96	grams	6.98	grams
Average Total PM Emissions		6.97		grams
AVERAGE PARTICLATE EMISSIONS RATE		2.20		grams/hour
% OF AVERAGE	99.9		100.1	
Emissions Factor	1.342	g/Kg -Dry	1.346	g/Kg -Dry

PREBURN

JOB # 034_S_74_1
TECHNICIAN BTN GEN
DATE: 12_14_16
RUN #: 2
READING INTERVAL: 10
.
Run Time: 60

Model Designation TN 20

Tunnel Traverse Information									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.036	0.042	0.042	0.041	0.038	0.041	0.043	0.040	0.040
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	7.2	-0.083	553	576	463	853	469	582.8
10	5.5	-0.068	564	584	221	712	458	507.8
20	4.7	-0.06	548	568	202	603	445	473.2
30	4	-0.047	534	564	199	514	428	447.8
40	3.7	-0.036	518	540	194	428	415	419
50	3.5	-0.032	493	504	184	360	409	390
60	3.3	-0.029	466	468	177	315	406	366.4

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:	13.48719	ft/sec.
Intial Tunnel Flow:	148.3334	scfm
Average Tunnel Flow:	150.1255	scfm

Run #	2
Date:	12/14/16

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	0.042	0.042	0.041	0.038	0.041	0.043	0.040	0.040
Temperature	105	105	105	105	105	105	105	105	105.000

Tunnel Velocity:	13.487	ft/sec.
Intial Tunnel Flow:	148.33	scfm
Average Tunnel Flow	150.13	scfm

JOB #	034_S_74_1													BEG	MID	END	AVG
TECHNICIA	BTN GEN							ROOM TEMP (F)		69.6				29.96	29.96	29.96	29.96
DATE:	12_14_16								BAROMETRIC								
RUN #:	2																
READING INTERVAL:		10															
SAMPLE BOX :		B	METER Y FACTOR:		1.007					PROBE MATERIAL:				SS			
FRONT FILTER #:		2998&3003				REAR FILTER #	REAR FILTER #:		2999								
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG					
Run Time:		310		AMBIENT FILTER #:			3002	VOLUME	1726.447	LITERS	FUEL MOISTURE DB				19.6	%	
				FINAL LEAK RATE (CFM):			<0.01	@	15	IN-HG							
TEST START TIME:		13:50								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	0.04	0.01	-0.11		NA	13.8	0	91	244	72	189	4161.32	77	70	
10	1.380	0.138	0.04	2	-1.18	13.560	102	12.6	1.2	97	343	76	329	4161.48	78	70	
20	2.771	0.139	0.04	2	-1.41	13.596	102	11.3	1.3	100	399	76	325	4161.54	81	70	
30	4.174	0.140	0.04	2.02	-0.66	13.596	102	9.8	1.5	100	423	77	151	4161.56	84	70	
40	5.578	0.140	0.04	2.02	-1.22	13.608	102	8.2	1.6	101	428	77	148	4161.52	87	69	
50	6.988	0.141	0.04	2.03	-1.09	13.608	102	6.8	1.4	101	430	77	153	4161.53	90	70	
60	8.404	0.142	0.04	2.02	-1.39	13.584	102	5.5	1.3	99	405	77	159	4161.6	92	70	
70	9.823	0.142	0.04	2.04	-0.65	13.548	101	4.7	0.8	96	363	77	166	4161.76	94	70	
80	11.247	0.142	0.04	2.02	-1.21	13.499	101	4.1	0.6	92	318	76	169	4161.83	95	70	
90	12.674	0.143	0.04	2.03	-1.11	13.487	101	3.6	0.5	91	305	76	168	4161.94	97	70	
100	14.100	0.143	0.04	2.03	-1.16	13.487	101	3	0.6	91	319	75	169	4162.03	98	70	
110	15.532	0.143	0.04	2.03	-1.37	13.450	101	2.7	0.3	88	282	75	171	4162.1	99	70	
120	16.961	0.143	0.04	2.03	-0.75	13.437	100	2.5	0.2	87	254	75	168	4162.35	99	70	
130	18.393	0.143	0.04	2.03	-1.17	13.413	100	2.3	0.2	85	238	74	166	4162.53	100	70	
140	19.826	0.143	0.04	2.03	-1.39	13.401	100	2.1	0.2	84	228	74	164	4162.61	100	70	
150	21.255	0.143	0.04	2.04	-1.52	13.388	100	1.8	0.3	83	220	73	162	4162.61	101	70	
160	22.685	0.143	0.04	2.03	-1.24	13.376	100	1.8	0	82	212	73	158	4162.52	101	70	
170	24.118	0.143	0.04	2.04	-0.9	13.376	100	1.6	0.2	82	206	73	155	4162.44	101	70	
180	25.545	0.143	0.04	2.04	-1.14	13.364	99	1.5	0.1	81	200	73	152	4162.2	101	69	
190	26.978	0.143	0.04	2.05	-1.43	13.351	100	1.3	0.2	80	196	72	149	4161.89	101	69	
200	28.409	0.143	0.04	2.03	-0.82	13.351	99	1.2	0.1	80	192	72	148	4161.64	101	69	
210	29.837	0.143	0.04	2.05	-0.76	13.339	99	1.1	0.1	79	188	72	146	4161.4	101	68	
220	31.271	0.143	0.04	2.03	-1.41	13.339	100	0.9	0.2	79	185	71	144	4161.18	100	68	
230	32.698	0.143	0.04	2.03	-1.2	13.326	99	0.8	0.1	78	183	71	143	4160.9	100	68	
240	34.129	0.143	0.04	2.02	-0.95	13.326	99	0.7	0.1	78	180	71	140	4160.63	100	68	
250	35.559	0.143	0.04	2.04	-1.4	13.376	100	0.6	0.1	82	175	72	138	4160.63	100	69	
260	36.987	0.143	0.04	2.04	-0.62	13.364	99	0.5	0.1	81	172	72	136	4160.97	100	69	
270	38.417	0.143	0.04	2.03	-0.97	13.376	100	0.4	0.1	82	168	73	134	4161.23	100	70	

TEST START TIME:		13:50								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
280	39.849	0.143	0.04	2.02	-0.87	13.364	100	0.3	0.1	81	164	73	132	4161.49	100	70
290	41.274	0.143	0.04	2.02	-1.47	13.376	99	0.2	0.1	82	161	73	130	4161.65	100	70
300	42.710	0.144	0.04	2.03	-0.74	13.388	100	0.1	0.1	83	160	74	128	4161.9	101	71
310	44.141	0.143	0.04	2.03	-1.37	13.401	100	0	0.1	84	157	74	126	4162.39	101	71

TEST START TIME:	13:50								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
	44.141		0.040	2.03		13.434	100.3			87	253				96	70

JOB #	034_S_74_1										
TECHNICIAN	BTN GEN										
DATE:	12_14_16										
RUN #:	2										
READING INTERVAL:	10										
SAMPLE BOX :	*B*	METER Y FACTOR:		1.002			PROBE MATERIAL:			**SS**	
FRONT FILTER #:	3000					REAR FILTER #:	3001				
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG	

Run Time: 310 **Firebox Delta T** **124.4**

							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	464	465	71	313	406	77	367
10	1.366	0.137	102	-0.05	1.98	1.35	428	413	75	431	404	78	401
20	2.737	0.137	102	-0.06	1.99	1.83	403	373	76	525	396	80	404
30	4.112	0.138	102	-0.07	1.97	1.77	412	383	76	546	381	83	375
40	5.492	0.138	102	-0.06	2.01	1.44	435	397	76	565	367	86	382
50	6.883	0.139	102	-0.06	2	1.28	457	423	77	585	354	89	394
60	8.280	0.140	102	-0.06	2.01	2.06	474	446	77	582	343	91	401
70	9.679	0.140	101	-0.05	2	1.94	482	454	76	539	333	93	395
80	11.077	0.140	101	-0.04	1.99	1.8	478	447	76	469	325	95	378
90	12.481	0.140	101	-0.04	1.98	1.49	462	442	75	421	319	96	362
100	13.885	0.140	101	-0.05	2.01	1.65	449	452	75	415	315	97	360
110	15.289	0.140	100	-0.04	1.98	2.06	440	468	75	404	314	98	359
120	16.697	0.141	100	-0.03	2.01	1.66	429	447	74	351	316	99	342
130	18.104	0.141	100	-0.03	1.99	1.74	418	432	74	318	319	99	331
140	19.512	0.141	100	-0.03	1.99	1.7	409	425	73	299	322	100	324
150	20.922	0.141	100	-0.03	2.01	1.47	401	416	73	285	325	100	318
160	22.331	0.141	100	-0.03	1.98	1.86	391	406	73	274	327	100	311
170	23.743	0.141	100	-0.03	1.99	1.31	381	394	72	263	328	101	304
180	25.152	0.141	99	-0.02	1.99	1.62	372	383	72	254	328	100	298
190	26.565	0.141	100	-0.02	1.99	1.42	363	374	72	246	328	100	292
200	27.975	0.141	99	-0.02	2	1.7	355	368	71	239	327	100	287

							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
210	29.386	0.141	99	-0.02	1.99	1.72	349	365	71	236	325	100	284
220	30.799	0.141	100	-0.02	1.99	1.83	342	364	71	232	322	100	281
230	32.209	0.141	99	-0.02	2.01	1.77	335	362	71	228	320	100	278
240	33.624	0.142	100	-0.02	1.99	1.95	328	361	70	224	317	100	274
250	35.034	0.141	100	-0.01	1.99	1.36	321	359	71	221	315	99	271
260	36.447	0.141	100	-0.01	2	1.37	313	352	72	215	313	99	266
270	37.857	0.141	100	-0.01	2	2.05	306	344	72	210	311	100	261
280	39.269	0.141	100	-0.01	1.99	1.49	298	337	73	203	308	100	256
290	40.679	0.141	100	-0.01	1.99	1.4	290	330	73	198	305	100	251
300	42.089	0.141	100	-0.01	1.98	2.01	283	325	73	194	302	100	246
310	43.503	0.141	100	-0.01	2	1.62	278	321	74	191	299	101	243

							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
	43.503	0.140	100.262	-0.030	1.993548	1.6475	386	395	73	334	332	96	124
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	**DT**

Ambient Sample Results:

JOB NUMBER:	034_S_74_1
TECHNICIAN:	BTN GEN
DATE:	12_14_16
RUN NUMBER:	2

METER Y FACTOR: **1.003**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	90	0	0
End	1726.447	98	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1726.447	Liters
Total Sample Volume - Vm	60.969	ft^3
Average Sample Rate	0.20	ft^3/min
Sample Time	310.00	Minutes
Average Meter Temperature	94	°F
Total Sample Volume (Standard Conditions) - Vmstd	58.360	dscf
Total Particulates	0.3	mg
Particulate Concentration (dry-standard)	0.000005141	grams/dscf
Particulate Emission Rate	0.000058065	grams/hour

JOB NUMBER 034_S_74_1

RUN # 2

DATE: 12_14_16

BURN RATE 1.01 KG/HR DRY

FILTER A PARTICULATE 7 mg

FILTER B PARTICULATE 6.3 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	44.14		43.50	
Average Gas Velocity in Dilution Tunnel - vs	13.49	feet/second	13.49	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9007.53	dscf/hour	9007.53	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	42.46	dscf	41.68	dscf
Average Tunnel Temperature	86.9	F	86.9	F
Average Delta p	0.040		0.040	
Average Gas Meter Temperature	96	F	96	F
Average Delta H	2.03	in-h20	1.99	in-h20
Total Time of Test	310	min	310	min
Total Particulates	7	mg	6.3	mg
Particulate Concentration (dry-standard)	0.00016	grams/dscf	0.00015	grams/dscf
Ambient Train (dry-standard)	0.000005141	grams/dscf	0.000005141	grams/dscf
Net (dry-standard)	0.000159723	grams/dscf	0.00014602	grams/dscf
Particulate Emission Rate	1.44	grams/hour	1.32	grams/hour
Total PM Emissions	7.43	grams	6.80	grams
Average Total PM Emissions		7.11		grams
AVERAGE PARTICLATE EMISSIONS RATE		1.38		grams/hour
% OF AVERAGE	104.5		95.5	
Emissions Factor	1.420	g/Kg -Dry	1.298	g/Kg -Dry

PREBURN

JOB # 034_S_74_1
TECHNICIAN BTN GEN
DATE: 12_13_16
RUN #: 1
READING INTERVAL: 10
.
Run Time: 60

Model Designation TN 20

	Tunnel Traverse Information								
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
dP	0.038	0.040	0.042	0.041	0.038	0.044	0.042	0.039	0.041
Temperature	100	100	100	100	100	100	100	100	100.000

			1	2	3	4	5	
			TEMPERATURES					
ET	SCALE READING	FLUE DRAFT	LEFT SIDE	RIGHT SIDE	BACK	TOP	BOTTOM	STOVE AVG T
0	7.2	-0.085	521	555	473	842	487	575.6
10	5.5	-0.071	536	567	224	706	476	501.8
20	4.4	-0.052	531	557	208	620	462	475.6
30	3.8	-0.051	511	531	198	498	443	436.2
40	3.5	-0.04	488	506	191	423	426	406.8
50	3.3	-0.031	465	472	182	350	418	377.4
60	3.1	-0.029	446	447	214	313	417	367.4

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:	13.59449	ft/sec.
Intial Tunnel Flow:	149.8319	scfm
Average Tunnel Flow:	152.6641	scfm

Run #	1
Date:	12/13/16

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	0.038	0.040	0.042	0.041	0.038	0.044	0.042	0.039	0.041
Temperature	100	100	100	100	100	100	100	100	100.000

Tunnel Velocity:	13.594	ft/sec.
Intial Tunnel Flow:	149.83	scfm
Average Tunnel Flow	152.66	scfm

JOB #	034_S_74_1															
TECHNICIA	BTN GEN							ROOM TEMP (F)		70.1				BEG	MID	END	AVG
DATE:	12_13_16								BAROMETRIC					30.2	30.2	30.2	30.2
RUN #:	1																
READING INTERVAL:		10															
SAMPLE BOX :		A	METER Y FACTOR:			1.007					PROBE MATERIAL:				SS		
FRONT FILTER #:		2992&2997					REAR FILTER #	REAR FILTER #:		2993							
FINAL LEAK RATE (CFM):		<0.01	@	19	IN-HG			FINAL LEAK RATE (CFM)		<0.01	@	19	IN-HG				
Run Time:		310		AMBIENT FILTER #:				2996	VOLUME	1715.259	LITERS	FUEL MOISTURE DB			19.7	%	
				FINAL LEAK RATE (CFM):				<0.01	@	15	IN-HG						
TEST START TIME:		11:55									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	0.041	0	-0.01		NA	14	0	92	247	72	236	4161.33	76	70
10	1.372	0.137	0.041	2.01	-0.72	13.686	102	12.8	1.2	98	354	76	339	4161.64	78	70
20	2.761	0.139	0.041	2.04	-1.47	13.710	103	11.4	1.4	100	395	77	335	4161.76	80	70
30	4.156	0.140	0.041	2.01	-1.2	13.710	102	10.1	1.3	100	413	77	152	4161.91	84	70
40	5.553	0.140	0.041	2.03	-1.13	13.710	102	8.6	1.5	100	424	77	147	4161.9	87	71
50	6.955	0.140	0.041	2.01	-1.06	13.686	102	7.5	1.1	98	382	77	150	4161.97	90	71
60	8.367	0.141	0.041	2.03	-1.32	13.673	102	6.4	1.1	97	384	77	153	4162.14	92	71
70	9.778	0.141	0.041	2.04	-0.69	13.661	101	5.4	1	96	370	78	159	4162.22	94	71
80	11.198	0.142	0.041	2.05	-1.15	13.637	101	4.7	0.7	94	336	77	163	4162.24	96	71
90	12.614	0.142	0.041	2.03	-1.45	13.600	101	4.1	0.6	91	311	76	164	4162.25	97	70
100	14.039	0.143	0.041	2.03	-1.31	13.575	101	3.7	0.4	89	295	76	166	4162.23	98	70
110	15.461	0.142	0.041	2.04	-0.74	13.575	101	3.2	0.5	89	299	75	166	4162.19	99	70
120	16.887	0.143	0.041	2.02	-1.35	13.563	101	2.8	0.4	88	282	75	166	4162.17	99	70
130	18.304	0.142	0.041	2.02	-1.16	13.538	100	2.6	0.2	86	245	74	165	4162.15	99	70
140	19.725	0.142	0.041	2.02	-0.77	13.513	100	2.4	0.2	84	226	74	162	4162.1	100	70
150	21.143	0.142	0.041	2.02	-0.75	13.501	100	2.2	0.2	83	215	74	159	4162.18	100	70
160	22.564	0.142	0.041	2.02	-1.42	13.488	100	2.1	0.1	82	207	73	157	4162.29	100	70
170	23.986	0.142	0.041	2.02	-0.91	13.488	100	1.9	0.2	82	202	73	154	4162.37	100	70
180	25.406	0.142	0.041	2.03	-1.41	13.476	100	1.8	0.1	81	200	73	153	4162.45	100	70
190	26.830	0.142	0.041	2.03	-1.24	13.476	100	1.6	0.2	81	198	73	152	4162.57	101	70
200	28.250	0.142	0.041	2.02	-1.2	13.476	99	1.5	0.1	81	194	73	151	4162.5	101	70
210	29.674	0.142	0.041	2.02	-0.65	13.463	100	1.3	0.2	80	191	73	148	4162.61	101	70
220	31.092	0.142	0.041	2.02	-1.05	13.463	99	1.2	0.1	80	189	72	146	4162.72	101	70
230	32.517	0.143	0.041	2.03	-1.14	13.463	100	1	0.2	80	187	72	145	4162.7	101	70
240	33.935	0.142	0.041	2.03	-0.76	13.463	99	0.9	0.1	80	185	72	143	4162.72	101	70
250	35.357	0.142	0.041	2.03	-1.39	13.463	99	0.8	0.1	80	183	72	141	4162.81	101	70
260	36.777	0.142	0.041	2.02	-1.36	13.463	99	0.6	0.2	80	181	72	139	4162.79	101	70
270	38.199	0.142	0.041	2.03	-1.45	13.451	99	0.5	0.1	79	180	72	138	4162.75	101	70

TEST START TIME:		11:55								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
280	39.621	0.142	0.041	2.02	-1.44	13.451	99	0.4	0.1	79	180	72	138	4162.66	101	70
290	41.041	0.142	0.041	2.02	-0.76	13.451	99	0.2	0.2	79	178	72	137	4162.47	101	70
300	42.465	0.142	0.041	2.02	-1.47	13.438	99	0.1	0.1	78	177	72	136	4162.17	101	69
310	43.884	0.142	0.041	2.01	-0.7	13.438	99	0	0.1	78	176	71	135	4161.92	100	69

TEST START TIME:		11:55								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
	43.884		0.041	2.02		13.540	100.3			86	256				96	70

JOB #	034_S_74_1										
TECHNICIAN	BTN GEN										
DATE:	12_13_16										
RUN #:	1										
READING INTERVAL:	10										
SAMPLE BOX :	*B*	METER Y FACTOR:		1.002			PROBE MATERIAL:			**SS**	
FRONT FILTER #:	2994					REAR FILTER #:	2995				
FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG		FINAL LEAK RATE (CFM):	<0.01	@	19	IN-HG	

Run Time: 310 **Firebox Delta T** **106.4**

							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	445	446	72	315	417	76	372
10	1.340	0.134	101	-0.05	1.97	1.92	425	406	76	438	416	77	405
20	2.697	0.136	102	-0.06	1.99	1.34	414	381	76	523	407	80	412
30	4.065	0.137	102	-0.06	1.98	1.57	425	376	77	536	392	83	376
40	5.437	0.137	102	-0.06	1.98	2.04	449	394	77	563	376	86	386
50	6.814	0.138	102	-0.05	1.99	1.93	458	405	77	528	361	89	380
60	8.195	0.138	102	-0.06	1.98	1.6	460	412	77	514	348	91	377
70	9.580	0.139	101	-0.06	1.99	1.84	466	427	77	525	336	93	383
80	10.967	0.139	101	-0.05	1.98	1.77	460	436	76	478	325	95	372
90	12.354	0.139	101	-0.05	1.98	1.94	445	435	76	432	315	96	358
100	13.743	0.139	100	-0.04	1.98	1.78	434	435	75	399	308	97	348
110	15.136	0.139	100	-0.04	1.97	1.2	425	439	75	384	303	98	343
120	16.530	0.139	100	-0.04	1.97	1.76	419	444	75	396	300	98	345
130	17.923	0.139	100	-0.03	1.98	1.58	413	429	74	342	299	99	330
140	19.317	0.139	100	-0.03	1.99	1.6	405	418	74	304	300	99	318
150	20.713	0.140	100	-0.03	1.99	1.32	395	411	73	282	303	99	310
160	22.110	0.140	100	-0.03	2	1.56	386	404	73	268	306	99	304
170	23.504	0.139	100	-0.02	1.99	1.93	377	398	73	259	309	100	299
180	24.900	0.140	100	-0.02	1.99	1.28	371	394	73	253	311	100	296
190	26.299	0.140	100	-0.02	1.98	1.3	366	393	72	249	312	100	294
200	27.696	0.140	100	-0.02	1.98	1.52	360	391	72	246	314	100	292

							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
210	29.092	0.140	99	-0.02	1.98	1.78	353	389	72	240	315	100	289
220	30.491	0.140	100	-0.02	1.98	1.53	346	386	72	236	316	100	286
230	31.889	0.140	100	-0.02	1.99	1.35	340	383	72	233	316	100	283
240	33.284	0.140	99	-0.02	1.98	1.95	335	377	72	230	317	101	280
250	34.682	0.140	99	-0.02	1.99	1.52	331	370	72	226	318	101	277
260	36.083	0.140	100	-0.02	2	1.64	327	363	72	224	318	101	274
270	37.481	0.140	99	-0.02	2	1.8	323	359	72	221	318	101	272
280	38.877	0.140	99	-0.02	1.99	1.32	320	355	72	220	318	101	270
290	40.278	0.140	100	-0.02	1.99	1.92	320	350	72	218	318	101	269
300	41.678	0.140	100	-0.02	1.99	1.98	319	344	71	216	318	100	267
310	43.077	0.140	100	-0.02	1.99	1.8	318	340	71	215	319	100	265

							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
	43.077	0.139	100.252	-0.033	1.985161	1.636563	388	397	74	335	330	96	106
	TOTAL	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DT

Ambient Sample Results:

JOB NUMBER: 034_S_74_1
TECHNICIAN: BTN GEN
DATE: 12_13_16
RUN NUMBER: 1

METER Y FACTOR: **1.003**

	Sample Volume (L)	Meter Temp °F	ΔH	ΔP
Start	0	91	0	0
End	1715.259	97	0	0

	SAMPLE INFORMATION	
Total Sample Volume - Vm	1715.259	Liters
Total Sample Volume - Vm	60.574	ft^3
Average Sample Rate	0.20	ft^3/min
Sample Time	310.00	Minutes
Average Meter Temperature	94	°F
Total Sample Volume (Standard Conditions) - Vmstd	58.446	dscf
Total Particulates	0.2	mg
Particulate Concentration (dry-standard)	0.000003422	grams/dscf
Particulate Emission Rate	0.000038710	grams/hour

JOB NUMBER 034_S_74_1

RUN # 1

DATE: 12_13_16

BURN RATE 1.03 KG/HR DRY

FILTER A PARTICULATE 4.3 mg

FILTER B PARTICULATE 4.2 mg

	SAMPLE A INFORMATION		SAMPLE B INFORMATION	
Total Sample Volume - Vm	43.88		43.08	
Average Gas Velocity in Dilution Tunnel - vs	13.59	feet/second	13.59	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9159.84	dscf/hour	9159.84	dscf/hour
Total Sample Volume (Standard Conditions) - Vmstd	42.55	dscf	41.60	dscf
Average Tunnel Temperature	86.4	F	86.4	F
Average Delta p	0.041		0.041	
Average Gas Meter Temperature	96	F	96	F
Average Delta H	2.02	in-h20	1.99	in-h20
Total Time of Test	310	min	310	min
Total Particulates	4.3	mg	4.2	mg
Particulate Concentration (dry-standard)	0.00010	grams/dscf	0.00010	grams/dscf
Ambient Train (dry-standard)	0.000003422	grams/dscf	0.000003422	grams/dscf
Net (dry-standard)	0.000097646	grams/dscf	0.00009754	grams/dscf
Particulate Emission Rate	0.89	grams/hour	0.89	grams/hour
Total PM Emissions	4.62	grams	4.62	grams

Average Total PM Emissions	4.62	grams
AVERAGE PARTICLATE EMISSIONS RATE	0.89	grams/hour

% OF AVERAGE	100.1	99.9
Emissions Factor	0.871 g/Kg -Dry	0.870 g/Kg -Dry

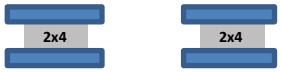
Fuel Load Information

Project Number	Client	Date
034-S-74-1	Pacific Energy	12/20/2016

Firebox Volume (ft^3)	2	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	18.25"

Test Fuel Charge Range	**13.2**	-	**14.2**
Coal bed range (lbs)	**2.80**	-	**3.50**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		
Fuel Piece Length	**15.25 Inches**	

Run # 6

Test Run Fuel Moisture (db)

Piece	S1	S2	S3	S4	Hydronic Heater S5	S6	AVG (%)		Weight Without Cleats (Lbs) Fuel	
1	19.5	19.2	19.1					**19.3**		**1.50**
2	19.6	19.1	19.0					**19.2**		**1.46**
3	19.2	19.9	19.2					**19.4**		**1.65**
4	19.7	22.4	22.3					**21.5**		**3.62**
5	21.2	19.2	19.3					**19.9**		**3.55**
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	19				Fuel Average			**19.7**	**Total:**	**13.6lbs**

Signature

Date

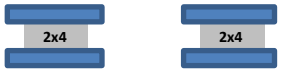
Fuel Load Information

Project Number	Client	Date
034-S-74-1	Pacific Energy	12/16/2016

Firebox Volume (ft^3)	2	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	18.25"

Test Fuel Charge Range	**13.2**	-	**14.2**
Coal bed range (lbs)	**2.80**	-	**3.50**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**15.25 Inches**

Run # 5

Test Run Fuel Moisture (db) — Hydronic Heater — Weight (Lbs)

Piece	S1	S2	S3	S4	S5	S6	AVG (%)		Fuel	
1	19.0	20.4	20.1					**19.8**		**1.48**
2	19.0	19.0	19.6					**19.2**		**1.65**
3	19.6	19.0	19.4					**19.3**		**1.61**
4	21.6	22.3	21.6					**21.8**		**4.17**
5	19.0	19.4	19.3					**19.2**		**3.30**
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	19				Fuel Average			**19.7**	**Total:**	**13.7 lbs**

Signature _____ Date _____

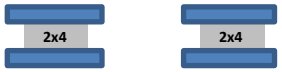
Fuel Load Information

Project Number	Client	Date
034-S-74-1	Pacific Energy	12/15/2016

Firebox Volume (ft^3)	2	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	18.25"

Test Fuel Charge Range	**13.2**	-	**14.2**
Coal bed range (lbs)	**2.80**	-	**3.50**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**15.25 Inches**

Run # 4

Test Run Fuel Moisture (db)

Piece	S1	S2	S3	S4	Hydronic Heater S5	Hydronic Heater S6	AVG (%)		Weight Without Cleats (Lbs) Fuel	
1	19.5	20.4	20.4					**20.1**		**1.63**
2	19.0	20.3	19.6					**19.6**		**1.65**
3	19.3	19.0	20.6					**19.6**		**1.76**
4	21.3	22.1	19.0					**20.8**		**3.48**
5	19.1	19.0	20.3					**19.5**		**3.42**
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	19.5				Fuel Average			**19.9**	**Total:**	**13.8lbs**

Signature

Date

Fuel Load Information

Project Number	Client	Date
034-S-74-1	Pacific Energy	12/14/2016

Firebox Volume (ft^3)	2	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	18.25"

Test Fuel Charge Range	**13.2**	-	**14.2**
Coal bed range (lbs)	**2.80**	-	**3.50**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**15.25 Inches**

Run # 3

Test Run Fuel Moisture (db)

Weight Without Cleats (Lbs)

Piece	S1	S2	S3	S4	Hydronic Heater S5	S6	AVG (%)		Fuel	
1	19.7	19.1	19.0					**19.3**		**1.68**
2	19.3	19.5	19.2					**19.3**		**1.52**
3	20.4	19.3	20.1					**19.9**		**1.79**
4	20.5	19.6	19.5					**19.9**		**3.31**
5	21.4	21.6	20.4					**21.1**		**3.84**
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	19.5				Fuel Average			**19.8**	**Total:**	**13.7lbs**

Signature

Date

Fuel Load Information

Project Number	Client	Date
034-S-74-1	Pacific Energy	12/14/2016

Firebox Volume (ft^3)	2	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	18.25"

Test Fuel Charge Range	**13.2**	-	**14.2**
Coal bed range (lbs)	**2.80**	-	**3.50**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**15.25 Inches**

Run # 2

Test Run Fuel Moisture (db)

Piece	S1	S2	S3	S4	Hydronic Heater S5	Hydronic Heater S6	AVG (%)		Weight Without Cleats (Lbs) Fuel	
1	19.3	20.0	19.6					**19.6**		**1.68**
2	19.4	19.0	19.2					**19.2**		**1.70**
3	19.2	19.5	20.6					**19.8**		**1.79**
4	19.4	20.3	21.0					**20.2**		**3.24**
5	20.4	19.9	19.0					**19.8**		**3.88**
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	19				Fuel Average			**19.6**	**Total:**	**13.8lbs**

Signature

Date

Fuel Load Information

Project Number	Client	Date
034-S-074-1	Pacific Energy	12/13/2016

Firebox Volume (ft^3)	2	Assessment	No

Longest useable measurement parallel or perpendicular to front of unit.	18.25"

Test Fuel Charge Range	**13.2**	-	**14**
Coal bed range (lbs)	**2.80**	-	**3.50**

Vol ≤ 1.5 ft^3	**Vol > 1.5 ≤ 3.0 ft^3**	**Vol > 3.0 ft^3**
		
		

Fuel Piece Length	**15.25 Inches**

Run # 1

Test Run Fuel Moisture (db)

Piece	S1	S2	S3	S4	Hydronic Heater S5	Hydronic Heater S6	AVG (%)		Weight Without Cleats (Lbs) Fuel	
1	20.2	19.4	21.0					**20.2**		**1.72**
2	20.5	19.0	19.0					**19.5**		**1.57**
3	19.1	19.0	19.0					**19.0**		**1.61**
4	20.2	20.8	19.7					**20.2**		**3.24**
5	20.3	20.6	19.0					**20.0**		**4.19**
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Spacer Average	19				Fuel Average			**19.7**	**Total:**	**14.0 lbs**

Signature

Date


TRUE NORTH


CERTIFIED FOR CANADA AND U.S.A. - SERIES / SÉRIE: A MODEL / MODÈLE: TN20
LISTED ROOM HEATER, SOLID FUEL TYPE.
ALSO FOR USE IN MOBILE HOMES
TESTED TO/ ÉPROUVÉ SELON: CAN/ULC S627-00 AND IN THE USA CONFORMS TO UL 1482-
DO NOT REMOVE THIS LABEL
SN: 407
CAUTION
CANADA/ FABRIQUÉ AU CANADA


4.19
3.24
1.57
1.72
1.91


3.24
TRUE NORTH


3.24
1.88
1.68
1.29
1.78


3.24


3.84
3.31


3.84
3.31

3.48

3.72

1.76

1.65

1.63


3.48
3.42
1.63
1.76
1.65


3.3
4.17


3.62
3.55


3.55
1.46


TRUE NORTH


ATTENTION:
NOT TO BE BROKEN WITHOUT PRIOR AUTHORIZAT
NITED STATES ENVIRONMENTAL PROTECTION AG
PLIANCE HAS BEEN SEALED IN ACCORDANCE WI
MENTS OF 40 CFR PART 60 SUBPART AAA §60.5
34-5-74-1
DATE SEALED
ER Pacific Energy
MODEL #