UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

August 16, 2022

Robert F. Beck
President
Sierra Products, Inc.
63 Laxalt Drive
Carson City, Nevada 89706

Re: Renewal of Certificate of Compliance Number 83-17 for the EasyFire Pellet Heater Model

Dear Mr. Beck:

I am pleased to inform Sierra Products, Inc. that the above-referenced model has been approved for renewal of a Certificate of Compliance pursuant to the 2015 New Source Performance Standard (NSPS) for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces at 40 CFR Part 60, Subpart AAA (2015 NSPS) by the United States Environmental Protection Agency (EPA). Pursuant to the 2015 NSPS, this Certificate of Compliance is valid through August 16, 2027. This letter serves as your wood heater Certificate of Compliance. Please refer to the above Certificate of Compliance number in all future correspondence.

In accordance with the 2015 Wood Heater Rule at 40 CFR Part 60, § 60.533(i)(2), a manufacturer of a heater model line may apply to EPA for renewal of the model line's Certificate of Compliance. To do so, the manufacturer may affirm in writing that the heaters in the model line continue to be similar in all material respects that would affect emissions to the representative heater submitted for testing on which the original Certificate of Compliance was based. In making such an affirmation, the manufacturer also may request a potential waiver from certification testing.

Based on a January 24, 2017[1] test report by Myren Consulting, Inc., a February 10, 2017[2] Certification of Conformity by PFS TECO, and your March 29, 2022, request for renewal of the Certificate of Compliance, EPA has determined that the model line continues to meet the certification requirements at § 60.533. Therefore, pursuant to §§ 60.533(i)(2) and (i)(3), EPA is

[1] Revised on March 4, 2021 and May 27, 2022.
[2] Revised on March 4, 2021, March 29, 2022 and May 27, 2022.

renewing the Certificate of Compliance and in doing so, the agency is waiving certification testing for the above-referenced model. You may not advertise for sale, offer for sale or sell heaters under this Certificate of Compliance after August 16, 2027, without applying for and being issued another Certificate of Compliance with an updated expiration date.

All wood heaters manufactured or sold under this Certificate of Compliance must comply with EPA labeling requirements found at § 60.536. These provisions require each wood heater to have a permanent label affixed to it, including the month and year of manufacture, model name or number, serial number, certification test emission value, test method, standard met, and compliance certification statement.

In addition, you must comply with all applicable requirements of the regulation, including:

1. Conducting a third-party certifier-approved quality assurance program which ensures that all units within a model line are similar to the wood heater submitted for certification testing in all respects that would affect emissions and are in compliance with the applicable emission limit, pursuant to § 60.533(m);

2. Applying for recertification whenever any change is made to the above-referenced model that affect or is presumed to affect the particulate matter emission rate for the model line, pursuant to § 60.533(k)(1);

3. Providing an owner's manual that includes the information listed in § 60.536(g)(1) with each affected wood heater model offered for sale;

4. Placing a copy of the certification test report and summary on the manufacturer's website. The test report and summary shall be available to the public within 30 days after the EPA issues a Certificate of Compliance, pursuant to § 60.533(b)(12);

5. Submitting a report to the EPA every two years following issuance of a Certificate of Compliance for each model line. This report must include the sales for each model by state and certify that no changes in the design or manufacture of this model line have been made that require recertification under § 60.533(k);

6. Retaining records and submitting reports as required at § 60.537; and

7. Submitting wood heaters for audit testing if selected by the EPA under § 60.533(n)(1)(i) and (2)(i).

Failure to comply with these requirements may result in revoking this Certificate of Compliance and enforcement action, including penalties as specified under the Clean Air Act. To promote transparency in implementing the Wood Heater Program, we suggest that manufacturers submit a copy of any revised test report and the Uniform Resource Locator (URL) or web address where the test report is posted to WoodHeaterReports@epa.gov within ten (10) days of posting the test

report.

If you have any questions concerning this letter, please contact the Wood Heater Program at WoodHeaterReports@epa.gov.

Sincerely,

Elizabeth Vizard
Acting Director
Monitoring, Assistance, and Media Programs Division
Office of Compliance
Office of Enforcement and Compliance Assurance

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

MAY 04 2017

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

Robert F. Beck
Sierra Products, Inc.
63 Laxalt Drive
Carson City, Nevada 89706

Re: EasyFire Pellet Stove Model Non-Catalytic Wood Heater Certificate Number 83-17

Dear Mr. Beck:

I am pleased to inform Sierra Products, Inc. (SPI) that the EasyFire Pellet Stove model, non-catalytic wood heater, has been approved for certification pursuant to the 2015 New Source Performance Standard (NSPS) for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces at 40 CFR Part 60, Subpart AAA (2015 NSPS) by the United States Environmental Protection Agency (EPA). Certification under the 2015 NSPS is valid through April 27, 2022. This letter serves as your wood heater certification and no separate certification is required. Please refer to certification letter number 83-17 in all future correspondence.

Based on a January 24, 2017 test report prepared by Myren Consulting, Inc. and your February 20, 2017 application, the EasyFire Pellet Stove model is certified as meeting the 2015 NSPS. Under the 2015 NSPS and based on PFS Corporation's February 10, 2017 certification of conformity, the model's emission rate of 0.82 g/hr meets the 2020 NSPS particulate matter emissions limit of 2.0 g/hr. The heat output range and overall heating efficiency for the EasyFire Pellet Stove model are 7,943 – 17,732 BTU/hr and 63%, respectively. The carbon monoxide emission rate for this model line is 0.56 g/Min.

This certification is valid for the model name referenced above and cannot be transferred to another model line without applying for certification. This certification allows SPI to manufacture and sell the EasyFire Pellet Stove model through April 27, 2022. Thereafter, SPI may not manufacture, advertise for sale, offer for sale, or sell wood heaters under this certification without applying for and obtaining another compliance certification.

All wood heaters manufactured or sold under this certification must comply with EPA labeling requirements found at §60.536. These provisions require each wood heater to have a permanent label affixed to it that includes the month and year of manufacture, model name or number, serial number, certification test emission value, test method, standard met, and compliance certification statement.

In addition, SPI must comply with all applicable requirements of the regulation, including:

1. Conducting a third-party certifier-approved quality assurance program which ensures that all units within a model line are similar to the wood heater submitted for certification testing in all respects that would affect emissions and are in compliance with the applicable emission limit, pursuant to §60.533(m);

2. Applying for recertification whenever any change is made to the EasyFire Pellet Stove model that affects or is presumed to affect the particulate matter emission rate for the model line, pursuant to §60.533(k)(1);

3. Providing an owner's manual that includes the information listed in §60.536(g)(1) with each EasyFire Pellet Stove model offered for sale;

4. Placing a copy of the certification test report and summary on the manufacturer's website. The test report and summary shall be available to the public within 30 days after the EPA issues a certificate of compliance, pursuant to §60.533(b)(12) and §60.537(g);

5. Submitting a report to the EPA every 2 years following issuance of a certificate of compliance for each model line. This report must include the sales for each model by state and certify that no changes in the design or manufacture of this model line have been made that require recertification under §60.533(k);

6. Retaining records and submitting reports as required at §60.537; and

7. Submitting wood heaters for audit testing if selected by the EPA under §60.533(n)(1)(i) and (2)(i).

Failure to comply with these requirements may result in a revocation of this approval and an enforcement action, including penalties as specified under the Clean Air Act.

To promote transparency in the implementation of the Wood Heater Program, we suggest that manufacturers submit the Uniform Resource Locator (URL) or web address where the test report is posted to WoodHeaterReports@epa.gov within ten (10) days of posting the test report.

If you have any questions concerning this letter, please contact Rafael Sanchez of my staff at (202) 564-7028 or via email at sanchez.rafael@epa.gov.

Sincerely,

Edward J. Messina, Director
Monitoring, Assistance, and Media Programs Division
Office of Compliance

Certificate of Conformity

Issued to:	Sierra Products, Inc Mr. Robert Beck 63 Laxalt Dr. Carson City, NV 89706 775-241-2586
Model:	EasyFire Pellet Stove
Effective Date:	2/10/2017
Revised Date*:	3/4/2021
Report #	F17-028

*See revision schedule on page 2 for full list of revision dates.

Certification tests were performed by Myren Consulting, Inc. located at 512 Williams Lake Road Colville, WA 99144

PFS TECO certifies conformity to the following per 40 CFR Part 60 §60.533 (f) (A):

- The test report is complete and accurate.
- The instrumentation used for the test was properly calibrated.
- The representative model tested meets the applicable emission limits.
- The tests have been conducted per the appropriate guidelines.
- The manufacturer's Quality Control Plan has been reviewed to ensure that all production units are similar in all material respects that would affect emissions to the tested/certified model and that the units in the model line will meet all (other) applicable requirements.

PFS TECO certifies that the emissions levels as measured in the test report are in compliance with the 2020 PM emission limit of ≤ 2.0 g/hr using pellet fuel.

The average emissions for the EasyFire Pellet Stove is **0.82 g/hr** with an average efficiency of **63.6%.** Average CO emissions are **0.6 g/min (33.7 g/hr).**

Issued by: PFS TECO
11785 SE Highway 212
Suite 305
Clackamas, OR 97015

John Steinert, General Manager, Hearth Products Div.

PFS TECO is accredited by IAS to ISO 17020:2012 "Criteria For Bodies Performing Inspections, ISO 17025: 2005 "Requirements For Testing Laboratories", and by Standards Council of Canada to ISO 17065: 2012 "Requirements For Bodies Operating Product Certification Systems".

Revision Summary

Date: 2/10/2017 – Original Issue

Date: 3/4/2021 –

Addendum letter issued by Myren Consulting attesting to test runs validity and appropriateness, as well as clarifying the location within the original test report of the test fuel specifications.

Received updated manuals from manufacturer clarifying stack height information and fuel selection recommendations.

Updated CoC to current format from that from the original issue date.

Myren Consulting, Inc.

512 Williams Lake Road
Colville, WA 99114

Office: (509) 684-1154 Lab: (509) 685-9458
Fax: (509) 684-3987 email: <myren.ben@gmail.com>

Date: 24 January 2017

To: Robert Beck, Sierra

From: Ben Myren Ben

RE: TSIERRA EASY FIRE Pellet Stove Test Report

Please find enclosed your copy of the EPA test report for the SIERRA EASY FIRE pellet stove. Look over the info that is pertinent to your end, i.e., addresses, phone numbers, blueprints (especially), etc., to make certain that they are correct. If there are any corrections, call me and I will take care of them immediately. As soon as I receive the signed *Authorization* form, I will send the reports to PFS.

Remember to send in your EPA Wood Heater Certification Application to PFS and EPA ASAP. Section 60.533(b)(1) through (15) in the *FEDERAL REGISTER* contains the information that needs to be included in your application.

If you have any questions or comments, call.

Regards, Ben

Myren Consulting, Inc.

512 Williams Lake Road
Colville, WA 99114

Office: (509) 684-1154 Lab: (509) 685-9458
Fax: (509) 684-3987 email:<myren.ben@gmail.com>

24 January 2017

Dan Showman
PFS
1420 Lizzy Court
Keller, TX 76248

Dan:

Please find enclosed a copy of the certification test report for Sierra Easy Fire pellet stove for submittal to EPA. The CBI information has been left in your copy in the Blueprint section but should be redacted from EPA's two copies of the test report and sent to EPA as CBI seperately.

If you or anyone else has any questions about the information or data in this test report, please contact me immediately.

Sincerely,

Ben Myren

Alben T. Myren Jr.
President
ATM/im

Myren Consulting, Inc.

512 Williams Lake Road
Colville, WA 99114

Office: (509) 684-1154 Lab: (509) 685-9458
Fax: (509) 684-3987 email:<myren.ben@gmail.com>

24 January 2017

Dr. Rafael Sanchez, PhD.
U.S.EPA
Office of Enforcement and Compliance Assurance
Office of Compliance
William Jefferson Clinton Building, South
Room 7419D
1200 Pennsylvania Ave., N.W.
Washington, DC 20003

Dear Dr. Sanchez:

Please find enclosed the required two (2) copies of the certification test report for Sierra Easy Fire pellet stove. As the test results indicate, the unit's emissions are well below both the 2015 EPA standard of 4.5 g/h and 2020 EPA standard of 2.0 g/h.

Our report format has been revised to comply with EPA's specified format for pellet stoves and is organized in basically the same way as the previous pellet stove test reports Myren Consulting, Inc. has submitted to EPA. While the report is basically organized like the reports submitted under the old NSPS, some parts of the report have been reorganized/ revised to insure compliance with the rules in the new NSPS. Thus look at the relevant pages, e.g., Individual Test Run Page Index, in the Introduction Section to find the required information.

If you or anyone else has any questions about the information or data in this test report, please contact me immediately.

Sincerely,

Ben Myren

Alben T. Myren Jr.
President
ATM/im

US EPA WOOD HEATER CERTIFICATION TEST REPORT

SIERRA PRODUCTS, INC.
SIERRA EASY FIRE PELLET STOVE

JANUARY 24, 2017

MYREN CONSULTING, INC.

OFFICE
512 WILLIAMS LAKE ROAD
COLVILLE, WA 99114
PHONE 509-684-1154
FAX 509-684-3987

LABORATORY
501 C WILLIAMS LAKE ROAD
COLVILLE, WA 99114
PHONE 509-685-9458
EMAIL myren.ben@gmail.com

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Confidential

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The data and information in this test report is confidential, proprietary information and is not to be released to and/or discussed with any party who is not authorized by the manufacturer or the testing laboratory to receive such data.

****

Confidential

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Report Certification

The sampling and analysis for the appliance described in this report was carried out under my direction and supervision.

Date: 1/20/17 Signature: Albert T. Myers Jr
Title: President

I have reviewed all of the test data and test results found in this report and hereby certify that the test report is authentic and accurate.

Date: 1/20/17 Signature: Albert T. Myers Jr
Title: President

PELLET STOVE
TABLE OF CONTENTS

TESTING LOCATION AND PERSONNELL INFORMATION

Unit Name: SIERRA EASY FIRE PELLET STOVE

Manufacturer Name: SIERRA PRODUCTS, INC.

Manufacturer Address: 63 Laxalt Drive
Carson City NV 89706

Manufacturer Phone: 775 241 2586
Fax:

Manufacturer Contact Person: Robert Beck
email: rbeck@thelinco.com

Observers & Affiliation: None

SUPERVISOR: Ben Myren

MYREN CONSULTING'S LAB TEAM: Ilse Myren, Ben Myren, Eric Schaefer

LAB LOCATION: Myren Consulting's lab in Colville, WA 99114

ELEVATION: ~ 1650 FEET

MYREN CONSULTING, INC.

LABORATORY
501-C WILLIAMS LAKE ROAD
COLVILLE, WA 99114
509 685 9458
509 684 3987(Fax)

OFFICE
512 WILLIAMS LAKE ROAD
COLVILLE, WA 99114
509 684 1154
email: <myren.ben@gmail.com>

Pellet Stove Test Report Page Number Index

Pellet Stove Page Number Index

d. Humidity Gauge Calibration (Sling Psychrometer)	Cal Data	P. 13
F. Combustion Gas (CO_2, O_2, CO) Train Response Check	Cal Data	P. 20
G. CO_2 Analyzer		
1. Calibration	Cal Data	P. 22
2. Pre and Post Test Zero/Span	Individual Test Run	Data Sheet #15-3
B. CO Analyzer		
1. Calibration	Cal Data	P. 24
2. Pre and Post Test Zero/Span	Individual Test Run	Data Sheet #15-1
C. Calibration Gas Certificates of Analysis		
15. Quality Checks		
A. Leak Checks		
1. Particulate Sampling Train	Individual Test Runs	P.1 of Data Sheet #2
2. Combustion Gas (CO_2, O_2, CO) (CEM) Train	Individual Test Runs	Data Sheet #16
B. Proportional Checks	Individual Test Runs	Table 1
16. Sample Calculations		
A. Dry Burn Rate	Individual Test Runs	Data Sheet # 8; Computer Printout
17. Raw Test Data	Individual Test Runs	Data Sheets #1-16
18. Analytical Data		
A. Filter and Beaker Tares	Individual Test Runs	Data Sheets #4-1, 4-2
B. Solvent Blanks	Individual Test Runs	Data Sheets #4-3, 5
C. Particulate Catches		
1. Gross	Individual Test Runs	Data Sheet #5
2. Blanks	Individual Test Runs	Data Sheet #5
3. Net	Individual Test Runs	Data Sheet #5
D. Constant Weight Weighings		
1. Tares	Individual Test Runs	Data Sheets # 4-1, 4-2
2. Finals	Individual Test Runs	Data Sheet #4-3
3. Analytical Balance QC Checks	Individual Test Runs	Data Sheet #4-4 (Variable pp.)

ASTM E2515/ EPA M5G-1 Individual Test Run Page Index (Pellet Stove)

The data sheets in the individual test runs are organized in the following sequence.

Page Description	# of Pages
Filters photo	1
CSA B415.1-10 "Report" computer spreadsheet printout	Variable
CSA B415.1-10 "Data Input" computer spreadsheet printout	Variable
Dilution Tunnel Traverse data	1
Dilution Tunnel Gas Velocity and Volumetric Flow Rate Calculations	1
Train 1 Emission Rate/ Dilution Tunnel Calculations computer spreadsheet printout	Variable
Train 1 0-60 Minute Emission Rate/ Dilution Tunnel Calculations computer spreadsheet printout	Variable
Train 1 0-60 Minute Particulate Sampling data (Meter Box data)	Variable
Train 1 60 Minute Plus Particulate Sampling data (Meter Box data)	Variable
Filter Constant Tare Weight data	Variable
Beaker Constant Tare Weight data	Variable
Acetone Blank Beaker Constant Final Weight data	1
Train 1 0-60 Minute PM Sample Constant Final Weight data	1
Train 1 60 Minute Plus Constant Final Weight data	1
Train 1 Particulate Matter Catch Calculations	Variable
Train 2 Emission Rate/ Dilution Tunnel Calculations computer spreadsheet printout	Variable
Train 2 Particulate Sampling data (Meter Box data)	Variable
Train 2 PM Sample Constant Final Weight data	1
Train 2 Particulate Matter Catch Calculations	1
Train 3 Room Blank Sampling Rate and PM Concentration Calculations computer spreadsheet printout	Variable
Train 3 Particulate Sampling data (Meter Box data)	Variable
Train 3 PM Sample Constant Final Weight data	1
Train 3 Particulate Matter Catch Calculations	1
Analytical Balance QA/ QC data	Variable
Woodstove Data Sheet #8 Miscellaneous data	1
Woodstove Data Sheet #9 Pellet Stove Operating data	1
Woodstove Data Sheet #10 Preburn and Fuel Load Moisture Determination data	1
Woodstove Data Sheet #11 ASTM E2780 Fuel Load Calculations	1
Woodstove Data Sheet #13 Pre Burn Data	Variable
Woodstove Data Sheet #14 Burn Rate, Flue Gas and Temperature Data	Variable
Woodstove Data Sheet #15-1 CO_2 Pre and Post Test Zero/Span Audits	1
Woodstove Data Sheet #15-3 CO Pre and Post Test Zero/Span Audits	1
Woodstove Data Sheet #16 Quality Checks	1

TEST SERIES INFORMATION AND DISCUSSION

MODEL LINE: SIERRA EASY FIRE PELLET STOVE AND INSERT

TEST UNIT: SIERRA EASY FIRE PELLET STOVE (FREESTANDING)

Manufacturer: SIERRA PRODUCTS INC.

Date Received: 9.15.16

Date(s) Aged: 10/3 - 6, 2016. See AGING Section

Test Date(s): 10/21/2016

PM Sampling Method(s): ASTM E2515 using 4" filters (EPA M5G-1)

Operating and Fueling Protocol: EPA M28R, ASTM E2779

Number of Test Runs: 1

The SIERRA EASY FIRE Pellet stove manufactured by SIERRA PRODUCTS INC. located in Carson City, NV was tested by Myren Consulting, Inc. using the Environmental Protection Agency's (EPA) Test Method 28R, *"Certification and Auditing of Wood Heaters"*, ASTM E2515-11, *"Standard Test Method for Determination of Particulate Emissions Collected in a Dilution Tunnel"* and ASTM E2779-10, *Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters"*. (See the Federal Register/ Vol.80, No.50/ Monday, March 16, 2015. [pp.13672-13753]). On March 28, 2015 Myren Consulting, Inc. requested approval from EPA to use four-inch filters when conducting all PM emission certification tests and received the approval to do so on April 7, 2015. Thus the PM sampling and PM sample processing procedures used during the certification tests found in this test report are what are found in EPA M5G-1 in the previous NSPS. (See the Federal Register/ Vol.53,No.38/ Friday, February 26, 1988/ pp.5860-54926, especially in Method 5G in Appendix A on pp. 5884-5892.) The particulate matter (PM) emission data was calculated as specified in the Wood Heater New Source Performance Standard (NSPS) dated March 16, 2015. The percent overall efficiency (%OE) for the overall test run and for each test segment (High, Medium and Low) was calculated using the %OE algorithm found in CSA's B415.1-10.

All events and information pertinent to the test data are recorded on the data sheets for the test run, particularly on pp. 9, 13 and 14.

Any deviations made or noted from the promulgated methods other than those that were accepted and certified by EPA during the laboratory accreditation process are listed and discussed below. The SIERRA EASY FIRE pellet stove was tested at Myren Consulting's lab in Colville, WA using Myren Consulting laboratory's lab accreditation. A copy of the letter from EPA (Johnson) granting Myren Consulting, Inc. accreditation under the new NSPS and a copy of Myren Consulting's new Laboratory Accreditation Certificate (#2) are included in the following pages.

A brief note about how the four-inch (EPA M5G-1) particulate samples were processed is necessary to help the reviewer understand the net catch values. First, filters are weighed in pairs to reduce weighing errors. Second, experience has shown that the small portions of the filters that are left on the frits (filter supports) in the M5G-1 filter housing apparatus after the filters are removed are full of static electricity. When these small portions are removed to a plastic petri dish, they quickly adhere to the petri dish. Because trying to recapture these small pieces of filter material during weighing causes them to disintegrate into smaller and smaller pieces, which makes obtaining accurate catch weights difficult, it was decided to place this filter material in with the particulate captured with the acetone wash, where it shows up as catch. Some of the filter material was already following this pathway. Thus, there may be negative filter catch weights that are used during the particulate emission rate calculation process. However, the filter material lost off the filters is accounted for in the acetone wash catch.

ASTM E2778-10 Equation 1 calls for a dry moisture content for the test fuel used during testing. There is no way to measure the moisture content of pellets on a dry basis. Instead one can determine the wet basis moisture content by drying a sample. This is what done and the data for this is on Data Sheet 11 in the test run. Once the wet basis moisture content is known, it is then possible to calculate the fuel burnt on a dry basis, which again is what was done. The dry burn rate (DBR) determination is the same. The revised procedures and equations used to determine the actual DBR are to be found on the page after Data Sheet 11.

The following pages contain: (1.) A discussion of test results. (2.) A diagram showing the height of the appliance and chimney used during testing (3" ICC EXCEL Pellet Pipe) and the location of the sampling ports in the chimney. (3.) A diagram of the EPA 6" diameter dilution tunnel used by Myren Consulting during EPA Certification testing, (4.) 3 pages with photos showing (1.) the front, back and right and left sides of the test unit. Note that the back photo shows how the venting system was attached to the stove along with the static pressure probe and the stack temperature at 1 foot. There is also a full page photo of the testing installation configuration, i.e., the stove with attached flue pipe venting into the dilution tunnel hood, (5.) A copy of the letter from EPA granting Myren Consulting, Inc accreditation under the new NSPS. (6.) a copy of the new EPA Laboratory Accreditation Certificates for Myren Consulting's Colville lab, (7.) a copy of the 30 day advance certification test notification sent to EPA for the week the unit was tested and (8.) three pages with information that is pertinent to the test run.

DISCUSSION:

(1.) The test series was done at Myren Consulting's lab in Colville, WA.
(2.) The test series required 1 test run.
(3.) Because the whole testing format for pellet stoves has changed in the new NSPS, there are several revisions to the report format. Specifically the following changes have been made:
    a. The first page in the Data Summary section is titled Summary Results which reports the test data in the format requested by EPA.
    b. Because the pellet stove test is now an integrated sample test, there are no weighted average calculations because collecting the integrated sample "automatically" generates an "integrated weighted average". Instead of the pages used to calculate a weighted average, there is now a single page titled *Integrated Average Test Results,* which reports the PM emission rate (g/h and lbs./MM Btu output), the overall efficiency (%OE)(HHV and LHV) and CO (g/h and g/lb. of dry fuel) for the unit.
    c. A new page has been added to the Data Summary Section (p. 3) which summarizes the PM Sampling Train Performance information and addresses the *Dual Train Comparison* criteria found in ASTM E2515 Section 11.7. The average emission rate calculated

and reported on this new page using the data from the 2 PM sampling trains is then also reported on the page titled *Integrated Test Results*. Also reported on this page are the performance data for the "Room Blank" train and the PM emission rate (g/h) and dry burn rate (DBR) (kg/h) data for the 0-60 minute filter set from Train 1.

d. Section 60.534(d) requires that filter sets be changed (switched) at 1 h into a test run on one of the PM sampling trains. This was done on Train 1 during the test run. Thus there are additional data sheets in each test run for the 2 filter sets used in Train 1 to accomplish this requirement. There is also a photo of the filters from the test run in the section with the raw data sheets for the test run. As noted above, the PM emission rate for the first hour is reported on the computer spreadsheet for that PM sample and again in the Data Summary section itself.

d. ASTM E2515 requires 2 PM sampling trains and a third "Room Blank" train. That means there are also additional data sheets for Trains 2 and 3 in the section with the Raw Data sheets for the test run and in the Cal Data Section where the calibration and post test audit data is presented for the equipment used in all 3 of these trains.

Please look at the Table of Contents (p. iv), the Pellet Stove Test Report Page Number Index (pp. vi-vii) and the Individual Test Run Page Index (p. viii) to find any pages of interest. Or call Myren Consulting, Inc. at either 509 685 9458 or 509 684 1154 if further assistance is needed.

Stack Measurements and Sampling Port Locations

Total Stack Height
15.0' ± 1' (M28R 4.1.1
ASTM E2780 9.2.1) 173 11/16" / 14' 5 9/16"

Class A Chimney

Manufacturer: ICC

Model: Excel Pellet

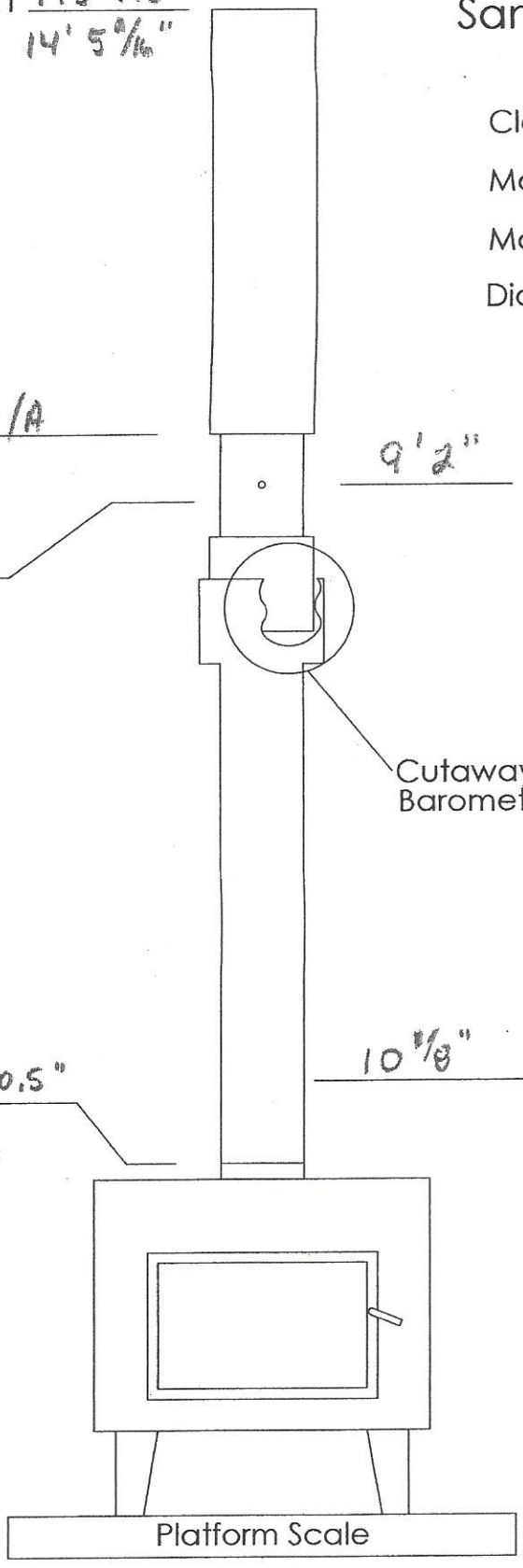
Diameter: 3"

Steel Flue Pipe Ht.
8.5' ± .5' (M28R 4.1.1
ASTM E2780 9.2.1) N/A

9' 2"

Combustion Gas
Sample Port
2" Above Stack Temp
Probe Ht.
(CSA B415 6.3.2)

Stack Temp.
Probe Ht.
8.5' ± .5'
(ASTM E2780 9.2.4) 9.0



Unit: Easy Fire

Date: 10/20/16

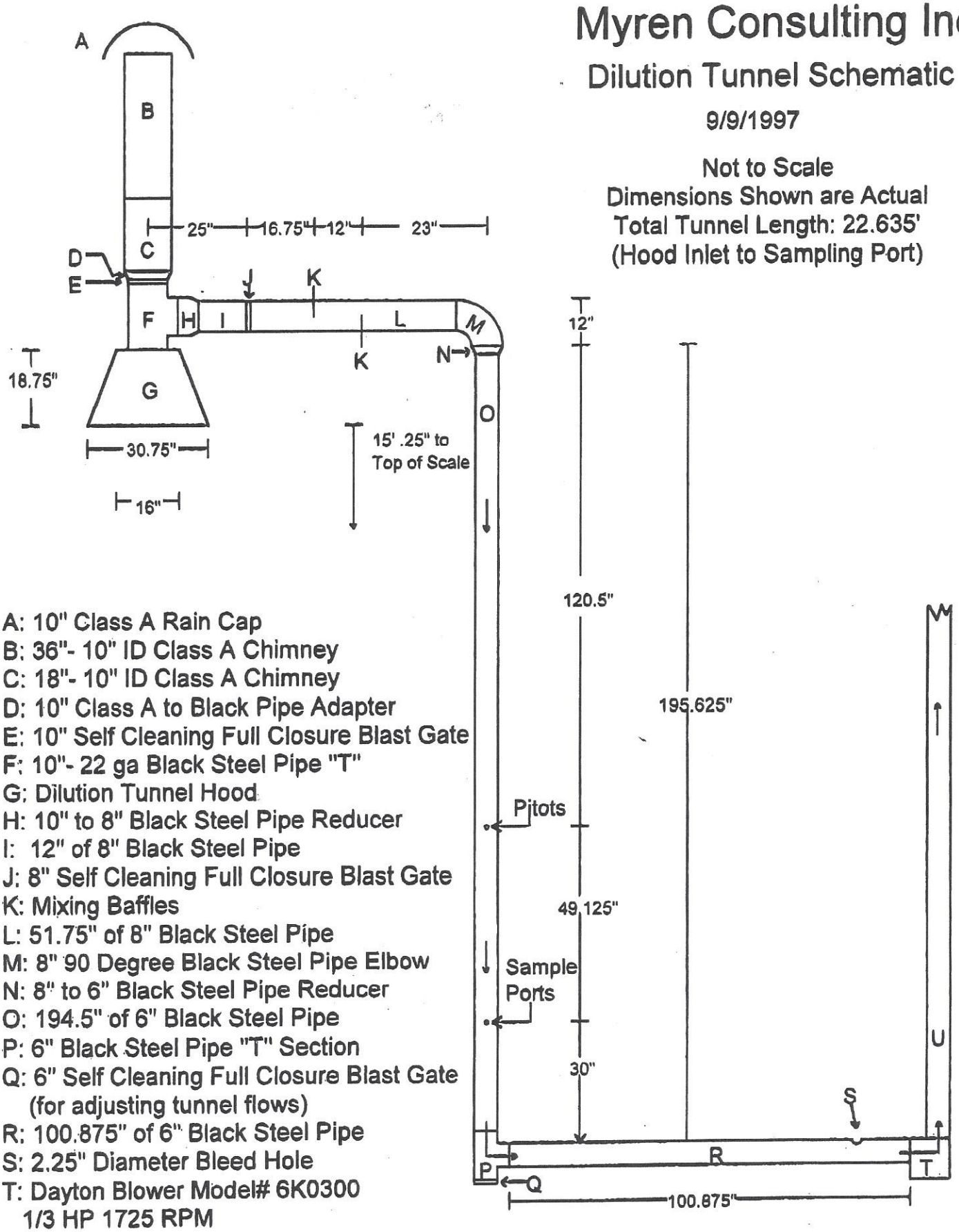
Technician(s):
ATM ESS

Myren Consulting Inc

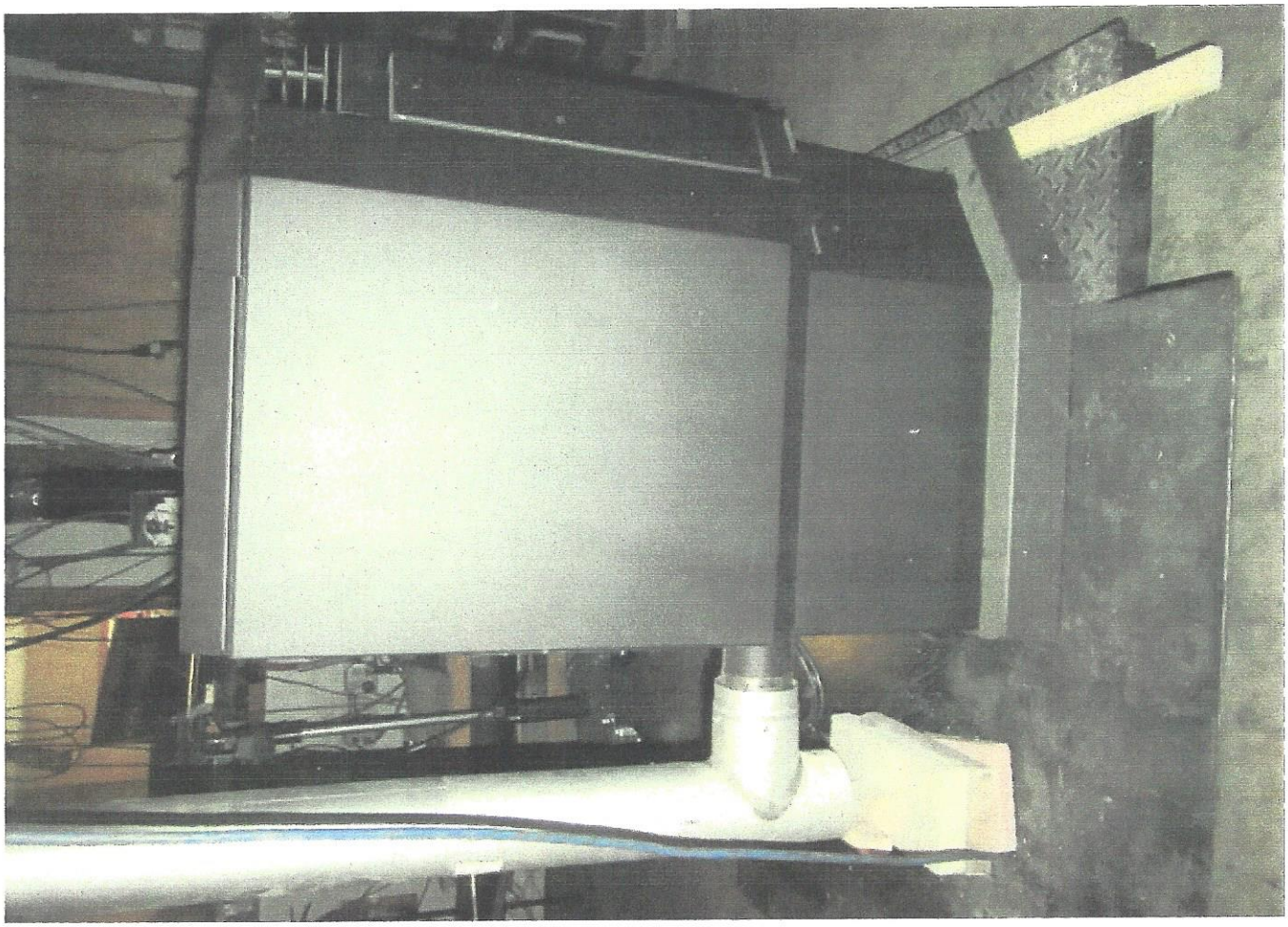
Dilution Tunnel Schematic

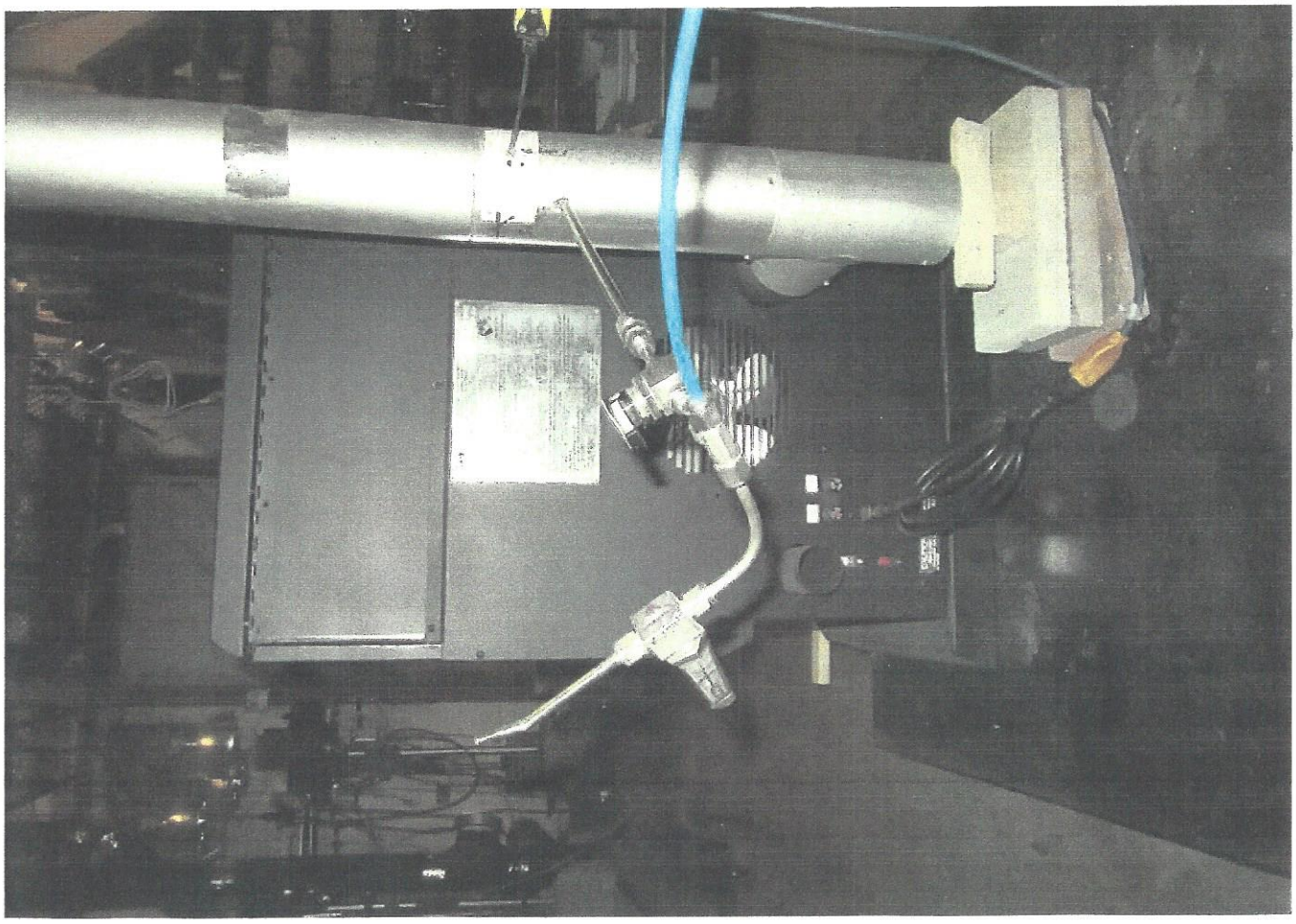
9/9/1997

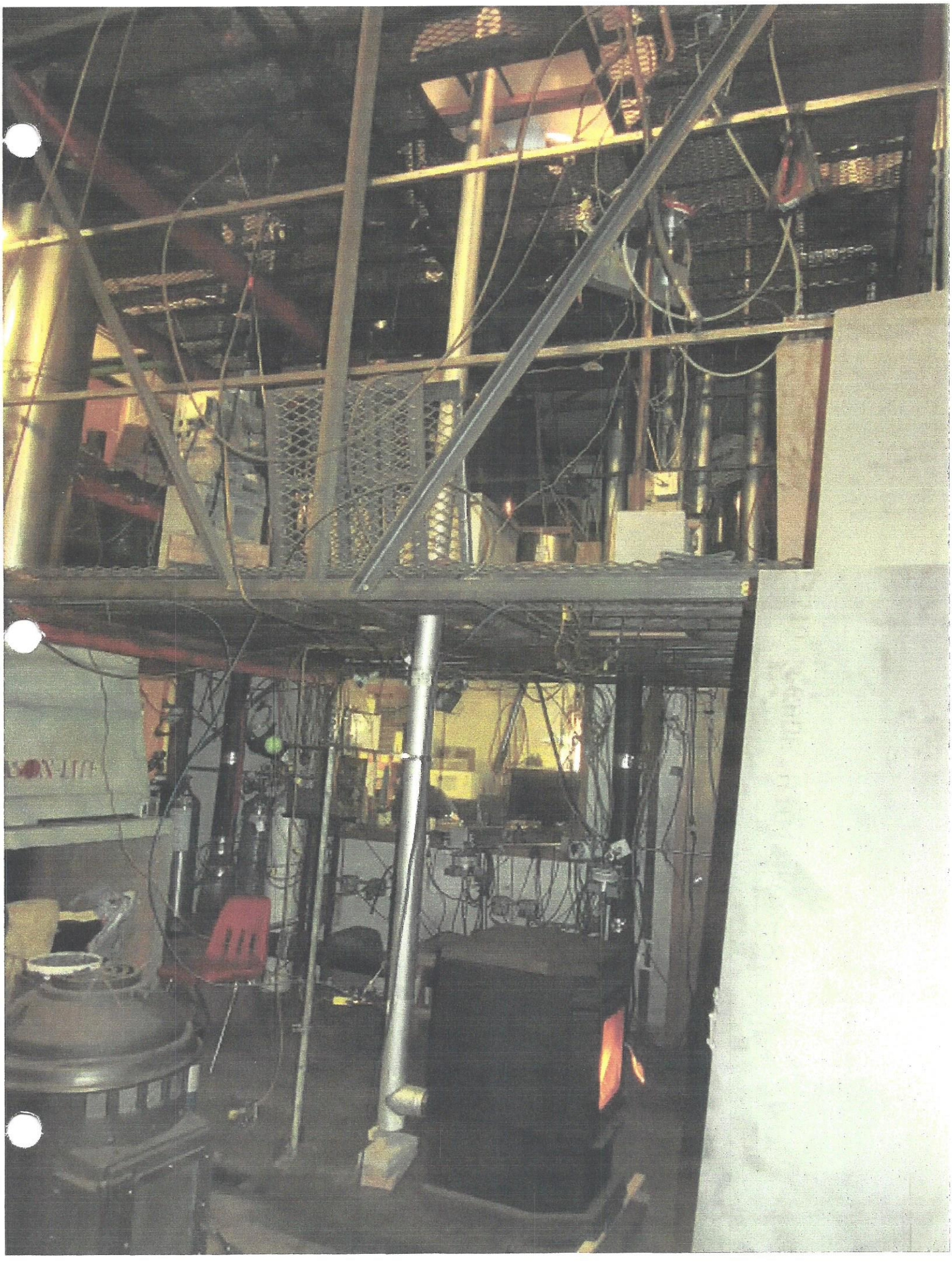
Not to Scale
Dimensions Shown are Actual
Total Tunnel Length: 22.635'
(Hood Inlet to Sampling Port)



A: 10" Class A Rain Cap
B: 36"- 10" ID Class A Chimney
C: 18"- 10" ID Class A Chimney
D: 10" Class A to Black Pipe Adapter
E: 10" Self Cleaning Full Closure Blast Gate
F: 10"- 22 ga Black Steel Pipe "T"
G: Dilution Tunnel Hood
H: 10" to 8" Black Steel Pipe Reducer
I: 12" of 8" Black Steel Pipe
J: 8" Self Cleaning Full Closure Blast Gate
K: Mixing Baffles
L: 51.75" of 8" Black Steel Pipe
M: 8" 90 Degree Black Steel Pipe Elbow
N: 8" to 6" Black Steel Pipe Reducer
O: 194.5" of 6" Black Steel Pipe
P: 6" Black Steel Pipe "T" Section
Q: 6" Self Cleaning Full Closure Blast Gate
(for adjusting tunnel flows)
R: 100.875" of 6" Black Steel Pipe
S: 2.25" Diameter Bleed Hole
T: Dayton Blower Model# 6K0300
1/3 HP 1725 RPM
U: 6" black Steel Pipe Exhaust







UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

NOV 12 2015

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Ben Myren
Myren Consulting, Inc.
512 Williams Lake Road
Coleville, WA 99114

Dear Mr. Myren:

Thank you for your recent inquiry regarding the United States Environmental Protection Agency (EPA) wood heater laboratory accreditation program. The review of your reaccreditation letter that you submitted November 10, 2015 is complete and acceptable. Enclosed is your current certificate of accreditation. Myren Consulting, Inc. is accredited under Subpart AAA 40 CFR Standards of Performance for New Residential Wood Heaters Sections (60.534, 60.535) and Subpart QQQQ 40 CFR Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces Sections (60.5476, 60.5477). Please follow the requirements for EPA Test Method 28R Certification and Auditing of Wood Heaters in Appendix A-8 to Part 60-Test Methods 26 through 30B. This approval expires on March 16, 2018, unless renewed by Myren Consulting, Inc.

As a condition of your lab accreditation, Myren Consulting, Inc. must abide by the following provisions:
(i) Agree to participate biennially in an independently operated proficiency testing program with no direct ties to the laboratories participating;
(ii) Agree to allow the EPA, regulatory agencies and certifying bodies access to observe certification testing;
(iii) Agree to comply with calibration, reporting and recordkeeping requirements that affect testing laboratories; and
(iv) Agree to perform a compliance audit test at the manufacturer's expense at the testing cost normally charged to such manufacturer if the laboratory is selected by the EPA to conduct a compliance audit test of the manufacturer's model line;
(v) Have no conflict of interest and receive no financial benefit from the outcome of certification testing conducted pursuant to §60.5475;
(vi) Agree to not perform initial certification tests on any models manufactured by a manufacturer for which the laboratory has conducted research and development design services within the last 5 years;
(vii) Agree to seal any wood heater on which it performed certification tests, immediately upon completion or suspension of certification testing, by using a laboratory-specific seal.
(viii) Agree to immediately notify the EPA of any suspended tests through email and in writing, giving the date suspended, the reason(s) why, and the projected date for restarting.

Emission test reports should be submitted to EPA's Office of Enforcement and Compliance Assurance, at one of the following addresses:

U.S. Postal Service
U.S. EPA
Office of Enforcement and Compliance
Assurance, Office of Compliance
William Jefferson Clinton Building, South
Mail Code 2227A
1200 Pennsylvania Ave, NW
Washington, DC 20003

Attn: Wood heater Certification Lead

Private Courier
U.S. EPA
Office of Enforcement and Compliance
Assurance, Office of Compliance
William Jefferson Clinton Building, South
Room 7419D
1200 Pennsylvania Ave, NW
Washington, DC 20003

Attn: Woodheater Certification Lead

I would like to thank you for your cooperation in the wood heater certification program.

Sincerely,

Steffan Johnson
Measurement Technology Group

Enclosure (2)

cc.
Julius Banks, OECA (2227A)
Rafael Sanchez, OECA (2227A)
Adam Baumgart-Getz, OID (C304-05)
Amanda Aldridge, OID (C304-05)
David Cole, OID (C304-05)

CERTIFICATE OF ACCREDITATION

This certifies that:

Myren Consulting, 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.

November 12, 2015 - March 16, 2018
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

2
CERTIFICATE NUMBER

Myren Consulting, Inc.

512 Williams Lake Road
Colville, WA 99114

Office: (509) 684-1154 Lab: (509) 685-9458
Fax: (509) 684-3987 email:myren.ben@gmail.com

DATE: 20 September 2016

TO: Dr. Rafael Sanchez, PhD., EPA

CC: Robert Beck, Thelin
Dan Shoman, PFS; Wayne Terpstra, PFS

FROM: Ben Myren

RE: Wood Heater 30 Day Advance Certification Test Notification

Section 60.534(e)(1) of the Wood Heater NSPS requires that EPA be notified at least 30 days in advance of the start or resumption of EPA Certification Testing for each specific model line. To comply with the above requirement, Myren Consulting, Inc. hereby notifies EPA that Myren Consulting, Inc., 512 Williams Lake Road, Colville, WA 99114 plans to start an EPA Certification Test series on the unit identified below.

UNIT: SIERRA EASY FIRE PELLET STOVE

Manufactured by:

SIERRA PRODUCTS, INC.
63 Laxalt Drive
Carson City, NV 89706

Contact Person: Robert Beck
Phone: 775 241 2586
F:
email: rbeck@thelinco.com

starting on:

Thursday October 20, 2016.

The testing will be conducted at:

Myren Consulting, Inc.
512 Williams Lake Road
Colville, WA 99114

Contact Person: Ben Myren
Lab: 509 685 9458 F: 509 684 3987
email: myren.ben@gmail.com

The 3rd Party Certifying Entity will be

PFS
1420 Lizzy Court
Keller, TX 76248

Contact Person; Dan Shoman
P: 975 489 6017 F: 817 742 0007
email: dshoman@pfscorporation.com

If you have any questions about this notification, contact me immediately.

MYREN CONSULTING, INC.

Unit: Sierra Easy Fire

Date: 10/20/16

Tech: ATM ESS

Rev 0 5.21.2016

INDUCED DRAFT CHECK

Depending upon the unit being tested, once the appliance was installed on the platform scale or in the test facility and the tunnel flow was determined for 100% smoke capture (See ASTN E 2515, Section 9.2.4), an induced draft check was performed as per EPA M28/ M28R Section 4.1.2/ ASTM E2515 Section 9.2.3 to verify that the dilution tunnel was not inducing a draft of >0.005" H_2O on the unit.

The static pressure probe located ≤1.0 foot above the flue collar (EPA M28/ M28R Section 6.2.3/ ASTM E2515 Section 9.2.3) that was connected to a 0.05-0-0.25 inch H_2O manometer was used to make the induced draft determination. The reading resolution on the 0.05-0-0.25 inch H_2O manometer is 0.001 inch H_2O, which is greater than the 0.002 inch H_2O resolution stipulated in EPA M28/ M28R Section 3.9 for the instruments used to measure static pressure.

The results of the induced draft check are as follows:

Flue Damper: n/a

Door Open: Primary Air Control Closed*: .000 " H_2O

Primary Air Control Open: .000 " H_2O

Door Closed: Primary Air Control Closed*: .000 " H_2O

Primary Air Control Open: .000 " H_2O

*Note: In units with a "stop" in the primary air control, the primary air "closed" induced draft check was conducted with the primary air control set at the "stop". In units that had no "stop", the induced draft check was conducted with the primary air control either fully closed or set so that the amount the primary air orifice was open was at the minimum amount possible.

Room Blank Probe Location

Myren Consulting Inc.

Unit: Sierra Easy Fire

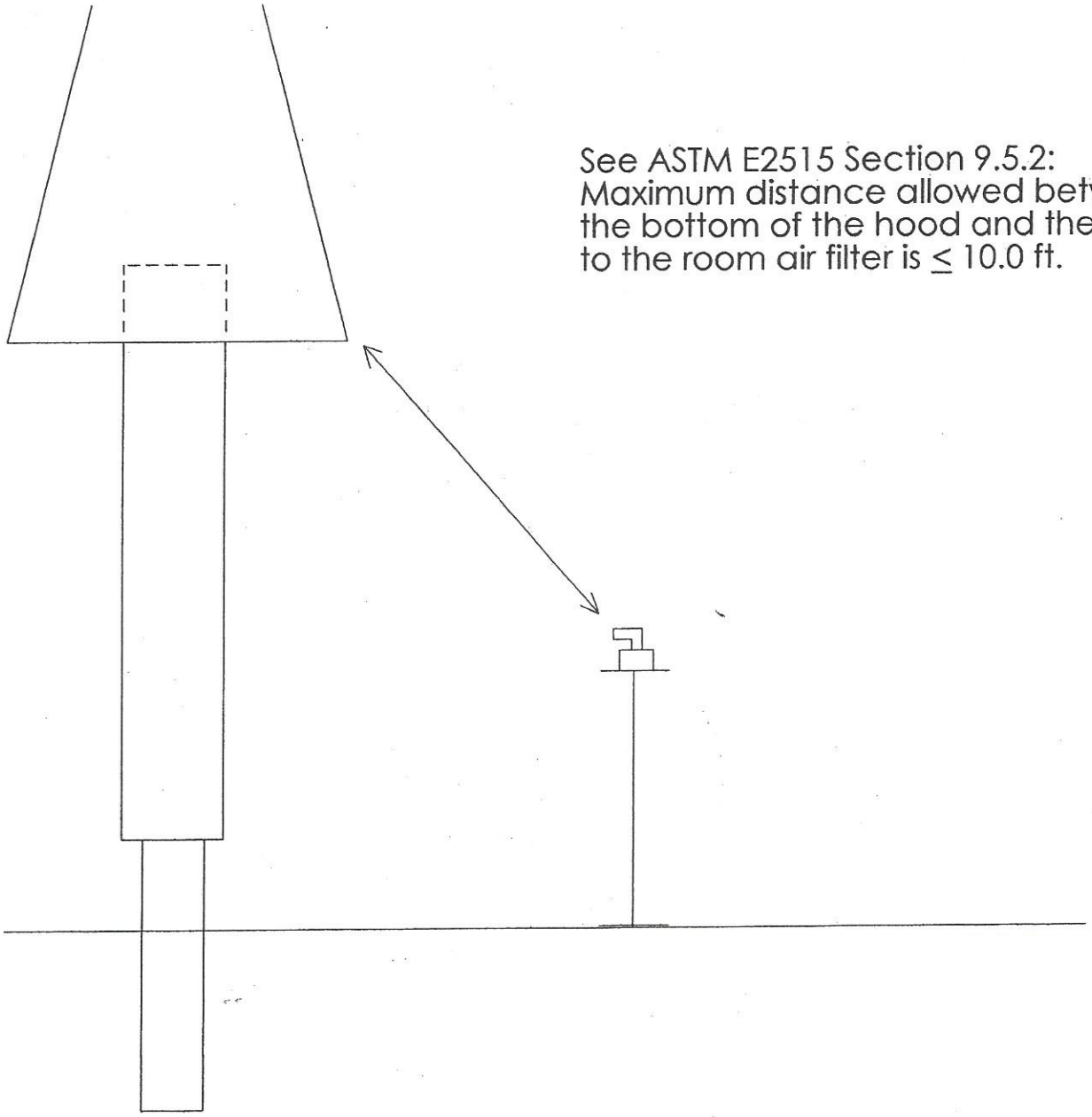
Date: 10/20/16

Tech: ATM E2515

Run: EPA 1

The room blank probe inlet was located 43 "

from the bottom of the dilution tunnel hood.



See ASTM E2515 Section 9.5.2:
Maximum distance allowed between the bottom of the hood and the inlet to the room air filter is ≤ 10.0 ft.

MYREN CONSULTING, INC. ASTM E2515 DATA SHEET # 5-3 PAGE 1 OF 1

DETERMINATION OF TUNNEL FLOW FOR 100% SMOKE CAPTURE

Rev 2 - 10/2/16

UNIT: Sierra Easy Fire DATE: 10/21/16 TECHNICIAN(S): ATM ESS

Δp @ 100% Smoke Capture: .028 * Tunnel Temperature: 415 °F = 875 °A BP: 28.50 in. Hg

Tunnel Diameter: (6" tunnel = 0.1963 ft², 12" tunnel = 0.7854 ft²)

Gas Velocity in the Center of the Dilution Tunnel (Vscent) (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) $V_{strav} = (85.49)(\underset{\{2\}}{0.99}\ cp)(\underset{\{2\}}{.1673}\ \sqrt{\Delta P}\ "H_2O)\sqrt{\dfrac{\underset{\{0\}}{875}\ Ts\ °A}{(\underset{\{2\}}{28.50}\ Ps\ "Hg)(28.78\ lb./\ lb.\ mole)}} = \underset{\{5\}}{14.6246}\ fps$

Estimated Pitot Correction Factor (Fp): $\underset{\{3\}}{.96}$

Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) Qsd = 3600(1 − 0.02 Bws)(14.6246 fps)(.1963 ft²)(.96 [Fp])[(528 °A)(28.50 Ps "Hg)/

(875 T_s °A)(29.92" Hg) = 5588.714 dscfhr (or dscfh)

(10A) 5588.714 dscfhr ÷ 60 = 93.1452 dscfmin (or dscfm) X 5 = 465.726 dscfm - Maximum Allowed Qsd

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

* The Easy Fire is a pellet stove with a forced draft combustion system. Smoke Capture determination was done with unit set on High.

Becherini Scale Center, Inc.
317 E. Sprague
Spokane, WA 99202

SCALE CALIBRATION RECORD

Customer: MYREN | Date: 3/30/16

Work Order Number: 49901 | PO Number:

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
1. PANTHER	4466459	1000 x .1	Ø	Ø	Ø
	(Pass)..Fail		50	49.9	50.0
Notes: SQUARE - CALIBRATED			100	99.9	100.0
CINDER BLOCK = 27.1 Lbs			200	199.9	200.0
			300	299.9	300.0
			Ø	Ø	Ø

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
2. PANTHER	00155556CH	5K x 1	Ø		
	Pass...Fail		50		
Notes: Did not Check			100		
			300		
			650		
			Ø		

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
3. PANTHER	00025236AJ	1000 x .1	Ø	Ø	
	(Pass)..Fail		50	50.0	
Notes: South			100	100.0	
			200	200.0	
			300	300.0	
			Ø	Ø	

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
4. PANTHER	00926516KL	1000 x .1	Ø	Ø	Ø
	(Pass)..Fail		50	50.0	50.0
Notes: CENTER Calibrated			100	99.9	100.0
			200	199.9	200.0
			300	299.9	300.0
			Ø	Ø	Ø

Additional Comments:

Last Checked: 9/15 | Next Check Due: 9/16

Weights Certified: 10/14 | Technician:

Calibration checked IAW NIST handbook 44

DENSITY STANDARD USED FOR TROEMNER PRECISION WEIGHTS

Troemner Inc. adjusts all new weights and all weights received for recalibration on the basis of apparent mass versus material of density 8.0g/cm³ at 20°C. This action is in accordance with the recommendations of the American Society for Testing and Materials specification ANSI/ASTM E 617 and the International Organization of Legal Metrology (OIML) International Recommendation No. 20.

Previously, all weights had usually been adjusted on the basis of apparent mass versus "brass," a hypothetic material of defined density 8.4g/cm³ at 0°C and 8.3909g/cm³ at 20°C. This practice originated in the early 1800's and was adopted in all of the English speaking countries as well as a number of other countries. Now most mass standards and test weights are made from stainless steel (density ranges from 7.77g/cm³ to 8.0g/cm³). A number of countries have adopted the recommendations of OIML and the foremost balance manufacturers are adjusting the built-in weights in their balances on the basis of apparent mass versus 8.0g/cm³. In order to smooth the transition in this country, the Reports of Calibration of the National Bureau of Standards are reporting the corrections to calibrated mass standards on both bases.

In terms of normal weighing procedures the change is very small. For a given weight, the mass value assigned on the basis of apparent mass versus density 8.0g/cm³ material will be 7 parts per million higher than the value assigned on the basis of apparent mass versus "density 8.4g/cm³" material. In many cases the allowed weight adjustment tolerances are so large that this change is immaterial although closely adjusted weights often have a smaller tolerance than the correction change. For example at the 1 kilogram level the change is 7 mg. For comparison the ANSI/ASTM E 617 Class 6 tolerance for 1 kilogram is 100 mg while the Class 1 tolerance is 2.5 mg. A detailed discussion of mass and mass values is given in Reference 3.

Precision Weights manufactured by Troemner Inc. to ASTM Class 1, 1.1, 2, 3, 4, 5, and 6 tolerances and the equivalent OIML and NBS tolerances are of the following materials:

Designation	*Base Material*	*Density*	*Weight Range*
Stainless Steel	18-8	7.84g/cm³ at 20°C	1 g & larger
Stainless Steel	18-8	8.0g/cm³ at 20°C	50 mg to 500 mg
Aluminum	1100	2.7g/cm³ at 20°C	30 mg & smaller

References:

1. ANSI/ASTM E 617
   Available from: Troemner Inc. 6825 Greenway Ave., Phila. Pa. 19142 215-724-0800 or American Society for Testing and Materials, 1916 Race Street, Phila., Pa. 19103
2. OIML INTERNATIONAL RECOMMENDATION No. 20
   Available from: Organisation Internationale De Metrologie Legale 11 Rue Trugot - 75009 Paris, France
3. NBS MONOGRAPH 133, MASS AND MASS VALUES
   Available from: Superintendent of Documents, U.S. Government Printing Office Washington, D.C. 20402 Order by SD Catalog No. C13,44:1331 Stock Number 0303-01178

TROEMNER INC. *Manufacturers of Precision Weights... Mass Standards • Balances • Laboratory Apparatus* 6825 Greenway Avenue - Philadelphia, Pa. 19142 215/724-0800

Wts. used for Scale QC Checks, P. 4-4.

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Myren Consulting
512 Williams Lake Road
Colville, WA 99114

Report Number: MYRC0224850860161020

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	CPA224S	24850860	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	10/20/16	4/13/16	4/2017

FUNCTIONAL CHECKS

ECCENTRICITY
Test Wt: 100 Tol: 0.0003
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

LINEARITY
Test Wt: 50 x 4 Tol: 0.0002
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

STANDARD DEVIATION
Test Wt: 100 Tol: 0.0001

1. 100.0000	5. 100.0000	9. 100.0000
2. 100.0000	6. 100.0000	10. 100.0000
3. 99.9999	7. 99.9999	**Result**
4. 100.0000	8. 100.0000	0.00004

ENVIRONMENTAL CONDITIONS
☐ Good ☑ Fair ☐ Poor
Temperature: 19.8°C

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	199.9997	200.0000	0.00014
100	99.9998	100.0000	0.00014
50	49.9999	49.9999	0.00014
10	10.0000	9.9999	0.00014
1	1.0000	1.0000	0.00014
0.1	0.1000	0.1000	0.00014

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	30 kg-1mg	S751	1/4/16	1/2017	20160003

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Report prepared/reviewed by: _____ **Date:** 10·2016

Technician: R. Hintz
Signature: _____

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

PT ID: MYRC02

Member: National Conference of Standards Laboratories and Weights & Measures

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Myren Consulting
512 Williams Lake Road
Colville, WA 99114

Report Number: MYRC0224850860160413

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	CPA224S	24850860	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	4/13/16	11/4/15	10/2016

FUNCTIONAL CHECKS

ECCENTRICITY
Test Wt: 100 Tol: 0.0003
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

LINEARITY
Test Wt: 50 x 4 Tol: 0.0002
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

STANDARD DEVIATION
Test Wt: 100 Tol: 0.0001

1. 100.0000	5. 100.0000	9. 100.0001
2. 100.0001	6. 100.0000	10. 100.0001
3. 100.0000	7. 100.0001	**Result**
4. 100.0001	8. 100.0001	0.00005

ENVIRONMENTAL CONDITIONS
☐ Good ☑ Fair ☐ Poor
Temperature: 19.8°C

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	200.0004	200.0000	0.00015
100	100.0001	100.0000	0.00015
50	50.0000	49.9999	0.00015
10	10.0000	9.9999	0.00015
1	0.9999	1.0000	0.00015
0.1	0.0999	0.1000	0.00015

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	30 kg-1mg	S751	1/4/16	1/2017	20160003

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:
4/16 Performed internal span overwrite adjustment.

Report prepared/reviewed by: R. Hintz **Date:** 4.13.2016 **Technician:** R. Hintz **Signature:**

e uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with e observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

ALTEK

CERTIFICATE OF CALIBRATION

This is to Certify that your Altek Unit has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology (formerly NBS) within the limits of the NIST Calibration Services. Actual records pertaining to these standards are on file and are available for examination.

Certified by: Altek Industries Corp.
Recommend Recalibration: Annually

In service date 4/11/96

Model K2100F Serial No. Serial # 177533

T. Kuech
Calibration Technician

31 AUG 95
Factory Calibration Date

ALTEK INDUSTRIES CORP
210 Commerce Drive, Rochester, NY 14623 U.S.A.
(716) 334-3720 FAX: (716) 334-6673
800-32-ALTEK
800-322-5835
Anywhere in USA

MYREN CONSULTING, INC.
512 Williams Lake Road
Colville, WA 99114
Office: 509 684 1154
Lab: 509 685 9458

Calibration Data Sheet # 65
Revision 1 3/3/04

THERMOCOUPLE READOUT CALIBRATION

DATE: 5/19/16
TECHNICIAN: ATM ESS

Thermocouple Readout Manufacturer: Omega

Model #: 400 8-TC Serial #: 11020109 Type: K Range: 0-2100°F

Location: Center Dial Station - Dial Station # 2

Calibrated with: Altec SN 177553 0-2100°F

As found: 0° F = 1 Adjusted to: 0
2100° F = 2100 Adjusted to: —

		% Dif			% Dif			% Dif
0 =	0	0 ✓	800 =	802	-.0016 ✓	1600 =	1601	-.00049 ✓
100 =	97	+.0054 ✓	900 =	898	+.0015 ✓	1700 =	1700	0 ✓
200 =	201	-.0015 ✓	1000 =	1001	-.00068 ✓	1800 =	1801	-.00044 ✓
300 =	297	+.0039 ✓	1100 =	1099	+.00064 ✓	1900 =	1900	0 ✓
400 =	399	+.0012 ✓	1200 =	1199	+.00060 ✓	2000 =	2001	-.00041 ✓
500 =	498	+.0021 ✓	1300 =	1299	+.00057 ✓	2100 =	2100	0 ✓
600 =	602	-.0019 ✓	1400 =	1400	0 ✓			
700 =	698	+.0017 ✓	1500 =	1500	0 ✓			

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °F + 460) - (\text{Readout Temperature } °F + 460)}{\text{Reference Temperature } °F + 460}$$

Or

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °C + 273) - (\text{Readout Temperature } °C + 273)}{\text{Reference Temperature } °C + 273}$$

MYREN CONSULTING, INC.
512 Williams Lake Road
Colville, WA 99114
Office: 509 684 1154
Lab: 509 685 9458

Calibration Data Sheet # 65
Revision 1 3/3/04

THERMOCOUPLE READOUT CALIBRATION

DATE: 5/19/16
TECHNICIAN: ATM ESS

Thermocouple Readout Manufacturer: Omega

Model #: 115 KIF Serial #: 004487KIF Type: K Range: 0-1900°F

Location: Apex 45G-P Meter Box

Calibrated with: Altec SN 177533 0-2100°F

As found: 0° F = 0 Adjusted to: —
1900° F = 1901 Adjusted to: 1900

		% Dif			% Dif			% Dif
0 =	0	0 ✓	800 =	800	0 ✓	1600 =	1600	0 ✓
100 =	96	+.0071 ✓	900 =	897	+.0022 ✓	1700 =	1699	+.00046 ✓
200 =	203	-.0045 ✓	1000 =	1001	-.00068 ✓	1800 =	1800	0 ✓
300 =	299	+.0013 ✓	1100 =	1099	+.00064 ✓	1900 =	1900	0 ✓
400 =	400	0 ✓	1200 =	1199	+.00060 ✓	2000 =	—	—
500 =	498	+.0021 ✓	1300 =	1297	+.0017 ✓	____ =	____	____
600 =	600	0 ✓	1400 =	1399	+.00054 ✓			
700 =	696	+.0034 ✓	1500 =	1498	+.0010 ✓			

$$\%\ \text{Dif} = \frac{(\text{Reference Temperature } °F + 460) - (\text{Readout Temperature } °F + 460)}{\text{Reference Temperature } °F + 460}$$

Or

$$\%\ \text{Dif} = \frac{(\text{Reference Temperature } °C + 273) - (\text{Readout Temperature } °C + 273)}{\text{Reference Temperature } °C + 273}$$

MYREN CONSULTING, INC.
512 Williams Lake Road
Colville, WA 99114
Office: 509 684 1154
Lab: 509 685 9458

Calibration Data Sheet # 65
Revision 1 3/3/04

THERMOCOUPLE READOUT CALIBRATION

DATE: 5/19/16
TECHNICIAN: ATM ESS

Thermocouple Readout Manufacturer: JENCO

Model #: 768-KF-02 Serial #: 900167 Type: K Range: 0-1999 °F

Location: Apex 511-M Meter Box

Calibrated with: Alec SN 177533 0-2100°F

As found: 0° F = 2 Adjusted to: 0
1900° F = 1900 Adjusted to: —

		% Dif			% Dif			% Dif
0 =	0	0 ✓	800 =	800	0 ✓	1600 =	1614	-.0068 ✓
100 =	94	+.0107 ✓	900 =	899	+.00074 ✓	1700 =	1710	-.0046 ✓
200 =	199	+.0015 ✓	1000 =	1006	-.0041 ✓	1800 =	1806	-.0027 ✓
300 =	295	+.0066 ✓	1100 =	1107	-.0045 ✓	1900 =	1900	0 ✓
400 =	394	+.0070 ✓	1200 =	1210	-.0060 ✓	2000 =	—	—
500 =	491	+.0094 ✓	1300 =	1312	-.0068 ✓	___ =		
600 =	595	+.0047 ✓	1400 =	1415	-.0081 ✓			
700 =	693	+.0060 ✓	1500 =	1514	-.0071 ✓			

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °F + 460) - (\text{Readout Temperature } °F + 460)}{\text{Reference Temperature } °F + 460}$$

Or

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °C + 273) - (\text{Readout Temperature } °C + 273)}{\text{Reference Temperature } °C + 273}$$

Woodstove Data Sheet # 55
Revision 0 12/18/01

THERMOMETER CALIBRATION DATE: 5/19/16 TECHNICIAN: A. T. Myren

MANUFACTURER:	ERTCO	ERTCO	Fisher	Taylor	Taylor	Premium	
CAT #.	1053F6	E17	ASTM 59F	1330 N/A	1330 N/A	—	
SERIAL NO.	1697	K35473	AD4544	—	—	—	
RANGE:	-1 to 100°C	0-260°C	0-180°F	20-170°F	20-120°F	0-220°F	
GRADUATIONS:	0.1°C	1°C	1°F	1°F	1°F	2°F	
TYPE:	Tube	Tube	Tube	Tube	Tube	dial	
TEMP. POINT							
1	.8	1.0	33	33	34	36	
2	7.5	8.0	47	48	49	48	
3	13.8	14.0	58	59	60	60	
4	24.6	25.0	78	79	80	80	

COMMENTS:

The 2 Taylors are in the Sling Psychrometer

°F = (°C X 9/5) + 32
°C = (5/9) (°F -32)

EVER READY THERMOMETER CO., INC.
228 LACKAWANNA AVENUE
WEST PATTERSON, NJ 07424
(201) 812-7474

R E P O R T O F C A L I B R A T I O N

LIQUID-IN-GLASS-THERMOMETER

CALIBRATED BY EVER READY THERMOMETER CO.

MARKED: ERTCO CAT 1005-3FC S/N-1697
RANGE: -1 TO +101 DEGREES C IN 0.1 DEGREE GRADUATIONS.

THERMOMETER READING	CORRECTION (ITS-90)**
0.00 C	0.00 C
10.00	0.00
20.00	0.00
30.00	0.00
37.00	0.00
40.00	0.00
50.00	0.00
56.00	0.00
60.00	0.02
70.00	0.00
80.00	0.00
90.00	0.00
100.00	0.00

** ALL TEMPERATURES IN THIS REPORT ARE BASED ON THE INTERNATIONAL TEMPERATURE SCALE OF 1990 (ITS-90) PUBLISHED IN THE METROLGIA 27, NO. 1, 3/10/90.

THIS THERMOMETER WAS CALIBRATED AGAINST A STANDARD CALIBRATED AT THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) FORMERLY THE NATIONAL BUREAU OF STANDARDS (NBS) IN ACCORDANCE WITH ASTM METHOD E 77, AND NBS MONOGRAPH 174.

FOR A DISCUSSION OF ACCURACIES ATTAINABLE WITH SUCH THERMOMETERS SEE NBS MONOGRAPH 250-23.

IF NO SIGN IS GIVEN ON THE CORRECTION, THE TRUE TEMPERATURE IS HIGHER THAN THE INDICATED TEMPERATURE; IF THE SIGN GIVEN IS NEGATIVE, THE TRUE TEMPERATURE IS LOWER THAN THE INDICATED TEMPERATURE. TO USE THE CORRECTIONS PROPERLY, REFERENCE SHOULD BE MADE TO THE NOTES GIVEN BELOW.

CONTINUED

TEST NUMBER: 152439
DATE: 07/16/96
STANDARD SERIAL NO. 128239
NIST IDENTIFICATION NO. 88024

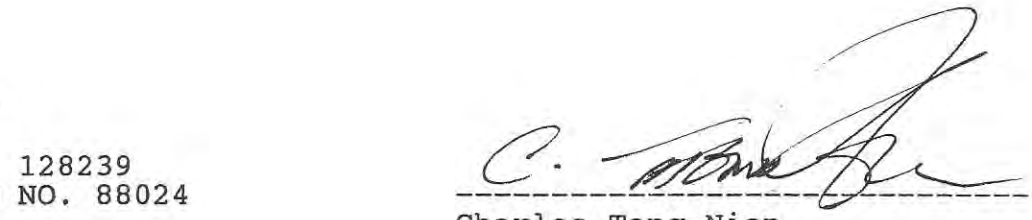
R E P O R T O F C A L I B R A T I O N

LIQUID-IN-GLASS-THERMOMETER

THE THERMOMETER WAS TESTED IN A LARGE, CLOSED-TOP, ELECTRICALLY HEATED, LIQUID BATH, BEING "IMMERSED" 76MM. THE TEMPERATURE OF THE ROOM WAS ABOUT 25 DEGREES C (77 DEGREES F). IF THE THERMOMETER IS USED UNDER CONDITIONS WHICH WOULD CAUSE THE AVERAGE TEMPERATURE OF THE EMERGENT LIQUID COLUMN TO DIFFER MARKEDLY FROM THAT PREVAILING IN THE TEST, APPRECIABLE DIFFERENCES IN THE INDICATIONS OF THE THERMOMETER WOULD RESULT.

THE TABULATED CORRECTIONS APPLY PROVIDED THE ICE-POINT READING, TAKEN AFTER EXPOSURE FOR NOT LESS THAN 3 DAYS TO A TEMPERATURE OF ABOUT 20 DEGREES C (70 DEGREES F) IS 0.00 DEGREES C. IF THE ICE-POINT READING IS FOUND TO BE HIGHER (OR LOWER) THAN STATED, ALL OTHER READINGS WILL BE HIGHER (OR LOWER) TO THE SAME EXTENT. IF THE THERMOMETER IS USED AT A GIVEN TEMPERATURE SHORTLY AFTER BEING HEATED TO A HIGHER TEMPERATURE. AN ERROR OF 0.01 DEGREES OR LESS, FOR EACH 10 DEGREE DIFFERENCE BETWEEN THE TWO TEMPERATURES, MAY BE INTRODUCED. THE TABULATED CORRECTIONS APPLY IF THE THERMOMETER IS USED IN THE UPRIGHT POSITION; IF USED IN A HORIZONTAL POSITION, THE INDICATIONS MAY BE A FEW HUNDREDTHS OF A DEGREE HIGHER.

TEST NUMBER: 152439
DATE: 07/16/96
STANDARD SERIAL NO. 128239
NIST IDENTIFICATION NO. 88024



Charles Tang-Nian
QUALITY CONTROL MANAGER

Revised 7/11

Dry Gas Meter Calibration Data

Date: 5/17/16 Technician: ATM, ESS

Calibration Meter Mfr: Rockwell SN: 1052202 Y: 0.9963

Meter Box ID 45G-P Meter Mfr: Rockwell SN: 265561

Electrical Check OK Pitot Leak Check N/A by ATM

Leak Check Front Half OVER Back Half OVER

BP = 28.61 in. Hg

Orifice (Δh) in. H_2O		Gas Volume			Temperature			Time (Θ), Min.	
			Cal. Meter (Vc), (cu.ft.)	Dry Gas Meter (Vm), (ft³)		Cal. Meter (Tc), °F	Dry Gas Meter Inlet (Tmi), (°F) (°C)	Dry Gas Meter Outlet (Tmo), (°F)(°C)	
.80									VAC
.80	initial		587.295	490.300	initial	67.5	69	69	0
.80	final		592.590	495.750	mid	68.5	70	70	0
.80					final	66.5	72	72	0
	total		5.295	5.450	avg.	67.5	69.7	69.7	
.90				.490 ft³/min		527.5	529.7	529.7	
.90	initial		593.027	496.200	initial	67	70	70	0
.90	final		598.160	501.527	mid	67.5	74.5	74.5	0
.90					final	68	77	77	0
	total		5.133	5.327	avg.	67.5	73.8	73.8	
1.00				.533 ft³/min		527.5	533.8	533.8	
1.00	initial		598.807	502.200	initial	68	73	73	0
1.00	final		603.985	507.605	mid	68.5	78	78	0
					final	69	79	79	
	total		5.178	5.405	avg.	68.5	76.7	76.7	
2.00				.569 ft³/min		528.5	536.7	536.7	
2.00	initial		604.466	508.100	initial	69.5	71	71	0
2.00	final		609.913	513.744	mid	70	77	77	0
2.00					final	70	78	78	0
	total		5.447	5.644	avg.	69.8	75.3	75.3	
2.75				.806 ft³/min		529.8	5353	535.3	
2.75	initial		610.450	514.300	initial	70	76	76	0
2.75	final		616.295	520.345	mid	70.5	79	79	0
2.75					final	70.5	81	81	0
	total		5.845	6.045	avg.	70.3	78.7	78.7	
				.930 ft³/min		530.3	538.7	538.7	

$$Y = \frac{(Y)(Vc)(Pb)(Tm + 460)}{(Vm)(Pb + \Delta h/13.6)(Tc + 460)} \qquad \Delta h@ = \frac{(0.0317)(\Delta h)}{Pb(Tmo + 460)} \qquad [(Tc + 460)(\Theta)] / [(Vc)(Yc)]^2$$

Back Half Leak Check

Leg 1 Pressure		Leg 2 Pressure	
	mano Rdg.		mano Rdg.
Start	+8.62	Start	+9.63
Stop	+8.62	Stop	+9.63
Δ	.00	Δ	.00

Front Half Leak Check

	Vac in Hg	M+R Reading Start	M+R Reading Stop	Leak Rate cmm	Leak Rate cfm
DGM	-19.25	.750	.7515	—	.0015
TM	-19.25	.676	.678	—	.002

Meter Box: 45 G-P
Date: 5/17/16
Page: 2 of 3
Rev 6-10

Meter Box Calibration Page 2

/ by AM

$$Y = \frac{(Y_c)(V_c)(BP)(T_m + 460)}{(V_m)(BP + \Delta H/13.6)(T_c + 460)} =$$

529.7

$$Y = \frac{(.9963)(5.295)(28.61)(69.7 + 460)}{(5.450)(28.61 + .80/13.6)(67.5 + 460)} = \frac{79,947.323}{82,419.284} = .9700$$

527.5

533.8

$$Y = \frac{(.9963)(5.133)(28.61)(73.8 + 460)}{(5.327)(28.61 + .90/13.6)(67.5 + 460)} = \frac{78,101.221}{80,579.841} = .9692$$

527.5

536.7

$$Y = \frac{(.9963)(5.178)(28.61)(76.7 + 460)}{(5.405)(28.61 + 1.00/13.6)(68.5 + 460)} = \frac{79,213.943}{81,935.721} = .9668$$

528.5

535.3

$$Y = \frac{(.9963)(5.447)(28.61)(75.3 + 460)}{(5.644)(28.61 + 2.00/13.6)(69.8 + 460)} = \frac{83,111.784}{85,989.104} = .9665$$

529.8

538.7

$$Y = \frac{(.9963)(5.845)(28.61)(78.7 + 460)}{(6.045)(28.61 + 2.75/13.6)(70.3 + 460)} = \frac{89,751.038}{92,362.237} = .9717$$

530.3

690,539

Y Factor	Variation (± 0.02 Allowed From Average Y)
.9700	+.0012
.9692	+.0004
.9668	-.0020
.9665	-.0023
.9717	+.0029

Avg Y .9688

4.8442

METER BOX 45 G-P
DATE 5/17/16

64 ATM

$$\Delta H@ = \frac{(0.0317)(\Delta H)}{(Pb)(T_{mo} + 460)} \cdot \left[\frac{(T_w + 460)(\Theta)}{(Y_c)(V_c)}\right]^2 =$$

527.5

$$\Delta H@ = \frac{(0.0317)(.80)}{(28.61)(69.7 + 460)} \cdot \left[\frac{(67.5 + 460)(11.13)}{(.9963)(5.295)}\right]^2 = 2.0726$$

529.7 527.5

$$\Delta H@ = \frac{(0.0317)(.90)}{(28.61)(73.8 + 460)} \cdot \left[\frac{(67.5 + 460)(10.0)}{(.9963)(5.133)}\right]^2 = 1.9691$$

538.8 528.5

$$\Delta H@ = \frac{(0.0317)(1.00)}{(28.61)(76.7 + 460)} \cdot \left[\frac{(68.5 + 460)(9.5)}{(.9963)(5.178)}\right]^2 = 1.9554$$

536.7 529.8

$$\Delta H@ = \frac{(0.0317)(2.00)}{(28.61)(75.3 + 460)} \cdot \left[\frac{(69.8 + 460)(7.0)}{(.9963)(5.447)}\right]^2 = 1.9333$$

535.3 532.3

$$\Delta H@ = \frac{(0.0317)(2.75)}{(28.61)(78.7 + 460)} \cdot \left[\frac{(70.3 + 460)(6.5)}{(.9963)(5.845)}\right]^2 = 1.9967$$

538.7

ΔH@	VARIATION (± 0.20 ALLOWED)
2.0726	+.08718
1.9691	+.01632
1.9554	-.03002
1.9333	-.05212
1.9967	-.01128

AVG ΔH@ 1.98542

9.9271

Post Test
Meter Box Audit
Woodstove Data Sheet #32

T1

Unit: Easy Fire
Date: 11/15/16
Technician: ATM
WST9-Form2, Rev 6/11

Meter Box Calibration Audit
Test Data

Run #	1	2	3	4	5	6	7	8	9	10
Avg.Δh	.90									
Max Vac	0									

Avg. Test Series Δh: .90 in H_2O. Test Series Max Vac: 0 in Hg

Audit Dry Gas Meter Mfr: Rockwell SN: 1052202 Correction Factor (Y): 0.9963
Test Dry Gas Meter Mfr: Rockwell SN: 265561 Correction Factor (Y): 0.9688

Audit Data

		Audit #1	Audit #2	Audit #3
BP ("Hg):		28.19	28.20	28.20
Vac("Hg):		0	0	0
Audit Meter:	Final Vol	823.905	829.514	835.119
	Initial Vol	818.827	824.279	829.883
	Vol (V_c, Ft^3)	5.078	5.235	5.236
Audit Meter Temp (°F) (Tc)	Initial	63.5	63.5	64.5
	Mid	63.5	64	64.5
	Final	63.5	64	64.5
	Avg (°F/°A)	63.5 (523.5)	63.8 (523.8)	64.5 (524.5)
Δh("H_2O)	Initial	.90	.90	.90
	Mid	.90	.90	.90
	Final	.90	.90	.90
	Avg	.90	.90	.90
Dry Gas Meter:	Final Vol	223.400	229.404	235.401
	Initial Vol	218.000	223.800	229.800
	Vol(V_d)(ft^3)(m^3)	5.400	5.604	5.601
Dry Gas Meter Temp (°F) : Inlet (T_m)	Initial	76	79	76
	Mid	80	82	82
	Final	81	82.5	82
	Avg(°F/°A)	79 (539)	81.2 (541.2)	80 (540)
Dry Gas Meter Temp (°F) : Outlet (T_m)	Initial	76	79	76
	Mid	80	82	82
	Final	81	82.5	82
	Avg(°F/°A)	79 (539)	81.2 (541.2)	80 (540)
Avg Dry Gas Meter Temp (T_m - °F/°A)		79 (539)	81.2 (541.2)	80 (540)
Time (minutes)		9:51	10:13	10:07

Note: If volume is in m^3, multiply by 35.314667 to obtain ft^3.
Note: Add 460° to all temperatures for degrees Absolute.

T1

BACK HALF LEAK CHECK

	START	STOP	Δ
Leg 1	+8.40" H_2O	+8.40" H_2O	0.00" H_2O OK
Leg 2	+7.380" H_2O	+7.380" H_2O	0.000" H_2O OK

$Y = \frac{(V_c)(MCF)(BP)(T_m)}{(V_d)(BP + \Delta h/13.6)(T_c)}$ Y Factor % Difference = $\frac{Act - Exp}{Exp}$ X 100

Note: MCF = Meter Correction Factor (Y) for Dry Gas Meter used as a Transfer Standard

Run 1

$Y = \frac{(5.078)(.9963)(28.19)(539)}{(5.400)(28.19 + .90/13.6)(523.5)} = \frac{76,871.732}{79,877.385} = .9624$

$\Delta\% = \frac{(.9624 - .9692)}{.9692} \times 100 = -0.70\ \%$

Run 2

$Y = \frac{(5.235)(.9963)(28.20)(541.2)}{(5.604)(28.20 + .90/13.6)(523.8)} = \frac{79,600.118}{82,971.833} = .9594$

$\Delta\% = \frac{(.9594 - .9692)}{.9692} \times 100 = -1.01\ \%$

Run 3

$Y = \frac{(5.236)(.9963)(28.20)(540)}{(5.601)(28.20 + .90/13.6)(524.5)} = \frac{79,438.793}{83,038.239} = .9567$

$\Delta\% = \frac{(.9567 - .9692)}{.9692} \times 100 = -1.29\ \%$

Note: The Y Factor % Difference must be < ±5.0% to be acceptable. Avg. Δ%= -1.00 %

Determination of Interpolated Y Factor for Average Certification Test Series Δ H from Dry Gas Meter Calibration Data:

.90 (A) inch H_2O Δh= .9692 (C) Calculated Calibration Y Factor (from Calibration)

_____ (B) inch H_2O Δ h = _____ (D) Calculated Calibration Y Factor (from Calibration)

_____ (B) - _____ (A) = _____ X100 = _____ (E) _____ (D) - _____ (C) = _____ / _____ (E) = _____ (F)

_____ Avg Δ h - _____ (A) = _____ X 100 = _____ (G)

$\left(\frac{\text{F}}{\text{F}} \times \frac{\text{G}}{\text{G}}\right) + \frac{\text{C}}{\text{C}} =$ Interpolated Y Factor For Avg. Test Series Δ h

Dry Gas Meter Back Half Leak Check: .000 **inch H_2O in One Minute**

Front Half Leak Check **Meter Reading** **Leak Rate**

Meter	Vac In. Hg	Start	Stop	cmm	cfm
DGM	15.9	.2425	.243	—	.0005
TM	15.9	.952	.952	—	.000

Revised 7/11

Dry Gas Meter Calibration Data

Date: 5/17/16 Technician: ATM / ESS

Calibration Meter Mfr: Rockwell SN: 1052202 Y: 0.9963

Meter Box ID 511-M Meter Mfr: Rockwell SN: 322914

Electrical Check Ok Pitot Leak Check N/A

Leak Check Front Half OK over Back Half Ok over

BP = 28.59 in. Hg

Orifice (Δh) in. H_2O	Gas Volume			Temperature				Time (Θ), Min.	VA
		Cal. Meter (Vc), (cu.ft.)	Dry Gas Meter (Vm), (m^3)(ft^3)		Cal. Meter (Tc), °F	Dry Gas Meter Inlet (Tmi), (°F) (°C)	Dry Gas Meter Outlet (Tmo), (°F)(°C)		
.70	initial	617.261	253.700	initial	70.5	72	72	12:00	0
.70	final	622.704	259.345	mid	70.5	73	72		0
.70				final	71	74	72		0
	total	5.443	5.645	avg.	70.7	73	72		
			.470 ft^3/min.		530.7	533	532	72.5	532
.75	initial	623.149	259.800	initial	71.5	74	73	10:30	0
.75	final	628.355	265.176	mid	72	75	73		0
.75				final	71.5	76	74		0
	total	5.206	5.376	avg.	71.7	75	73.3		
			.512 ft^3/min.		531.7	535	533.3	74.2	534
.800	initial	628.764	265.600	initial	72	75	74	10:00	0
.800	final	633.848	270.861	mid	72	76	75		0
.800				final	72	76	75		0
	total	5.084	5.261	avg.	72	75.7	74.7		
			.526 ft^3/min		532	536.7	534.7	75.2	535
1.50	initial	635.430	272.500	initial	72	76	75	7:30	0
1.50	final	640.629	277.889	mid	72	77	75		0
1.50				final	72	78	76		0
	total	5.199	5.389	avg.	72	77	75.3		
			.719 ft^3/min.		532	537	535.3	76.2	536
1.90	initial	641.229	278.500	initial	72	77	76	6:30	-1.
1.90	final	646.379	283.846	mid	73	78	76		-1.
1.90				final	73	78	76		-1.
	total	5.150	5.346	avg.	72.7	77.7	76		
			.822 ft^3/min		532.7	537.7	536.6	76.8	536.

$$Y = \frac{(Y)(Vc)(Pb)(Tm + 460)}{(Vm)(Pb + \Delta h/13.6)(Tc + 460)} \qquad \Delta h@ = \frac{(0.0317)(\Delta h)}{Pb(Tmo + 460)} \qquad [(Tc + 460)(\Theta)] / [(Vc)(Yc)]^2$$

Back Half Leak Check

Leg 1	Pressure	Leg 2	Pressure
Start	+7.20 "H_2O	Start	6.89
Stop	+7.20	Stop	6.89
Δ	.00	Δ	.00

FRONT HALF	Vac in Hg	Leak Check Meter Reading Start	Stop	Leak Rate cmm	cfm
OGM	-20.0	.945	.949	–	.004
TM	-20.0	.438	.445	–	.007

Meter Box: 511-M
Date: 5/17/16

Rev 6-10

Meter Box Calibration Page 2

by AFM

$$Y = \frac{(Y_c)(V_c)(BP)(T_m + 460)}{(V_m)(BP + \Delta H/13.6)(T_c + 460)} =$$

$$Y = \frac{(.9963)(5.443)(28.59)(72.5 + 460)}{(5.645)(28.59 + .70/13.6)(70.7 + 460)} = \frac{82,558.583}{85,804.161} = .96217$$

$$Y = \frac{(.9963)(5.206)(28.59)(74.2 + 460)}{(5.376)(28.59 + .75/13.6)(71.7 + 460)} = \frac{79,215.895}{81,879.838} = .9675$$

$$Y = \frac{(.9963)(5.084)(28.59)(75.2 + 460)}{(5.261)(28.59 + .80/13.6)(72 + 460)} = \frac{77,504.324}{80,183.817} = .9666$$

$$Y = \frac{(.9963)(5.199)(28.59)(76.2 + 460)}{(5.389)(28.59 + 1.50/13.6)(72 + 460)} = \frac{79,405.560}{82,282.251} = .9650$$

$$Y = \frac{(.9963)(5.150)(28.59)(76.8 + 460)}{(5.346)(28.59 + 1.90/13.6)(72.7 + 460)} = \frac{78,745.108}{81,816.864} = .9705$$

Y Factor	Variation (± 0.02 Allowed From Average Y)
.9622	-.0042
.9675	+.0011
.9666	+.0002
.9650	-.0014
.9705	+.0041

Avg Y .96636

4.8318

METER BOX 511-M
DATE 5/17/16
Page 3 of 3

by AM

$$\Delta H@ = \frac{(0.0317)(\Delta H)}{(Pb)(T_{mo} + 460)} \cdot \left[\frac{(T_w + 460)(\Theta)}{(Y_c)(V_c)}\right]^2 =$$

$$\Delta H@ = \frac{(0.0317)(.70)}{(28.59)(72 + 460)} \cdot \left[\frac{(70.7 + 460)(12.0)}{(.9963)(5.443)}\right]^2 = 2.0120$$ (532, 530.7)

$$\Delta H@ = \frac{(0.0317)(.75)}{(28.59)(73.3 + 460)} \cdot \left[\frac{(71.7 + 460)(10.5)}{(.9963)(5.206)}\right]^2 = 1.8066$$ (533.3, 531.7)

$$\Delta H@ = \frac{(0.0317)(.80)}{(28.59)(74.7 + 460)} \cdot \left[\frac{(72 + 460)(10.0)}{(.9963)(5.084)}\right]^2 = 1.8300$$ (534.7, 532)

$$\Delta H@ = \frac{(0.0317)(1.50)}{(28.59)(75.3 + 460)} \cdot \left[\frac{(72 + 460)(7.5)}{(.9963)(5.199)}\right]^2 = 1.8436$$ (535.3, 532)

$$\Delta H@ = \frac{(0.0317)(1.90)}{(28.59)(76 + 460)} \cdot \left[\frac{(72.7 + 460)(6.5)}{(.9963)(5.150)}\right]^2 = 1.7879$$ (536.6, 532.7)

ΔH@	VARIATION (± 0.20 ALLOWED)
2.0120	+.1559
1.8066	−.0494
1.8300	−.0260
1.8436	−.0124
1.7879	−.0681

AVG ΔH@ 1.8560

9,2801

Post Test
Meter Box Audit
Woodstove Data Sheet #32

T2

Unit: EASY FIRE
Date: 11/16/16
Technician: ESS
WST9-Form2, Rev 6/11

Meter Box Calibration Audit
Test Data

Run #	1	2	3	4	5	6	7	8	9	10
Avg.Δh	0.75									
Max Vac	0									

Avg. Test Series Δh: .75 in H_2O. Test Series Max Vac: 0 in Hg

Audit Dry Gas Meter Mfr: Rockwell SN: 10522202 Correction Factor (Y): 0.9963
Test Dry Gas Meter Mfr: Rockwell SN: 322914 Correction Factor (Y): 0.96636

Audit Data

		Audit #1	Audit #2	Audit #3
BP ("Hg):		28.36	28.37	28.38
Vac("Hg):		0	0	0
Audit Meter:	Final Vol	944.185	949.772	955.207
	Initial Vol	939.108	944.609	950.108
	Vol (V_c, Ft^3)	5.077 X	5.163 X	5.099 X
Audit Meter				
Temp (°F) (Tc)	Initial	60.5	60.5	60.5
	Mid	60.5	60	60.5
	Final	60.5	60.5 X	60.5 X
	Avg (°F/°A)	60.5 X (520.5) X	60.3 X (520.3) X	60.5 X (520.5) X
Δh("H_2O)	Initial	.75	.75	.75
	Mid	.75	.75	.75
	Final	.75	.75	.75
	Avg	.75 X	.75 X	.75 X
Dry Gas Meter:	Final Vol	867.970	873.754	879.391
	Initial Vol	862.700	868.400	874.100
	Vol(V_d)(ft^3)(m^3)	5.270 X	5.354 X	5.291 X
Dry Gas Meter	Initial	66	67	67
Temp (°F) : Inlet	Mid	67	67	67
(T_m)	Final	67 X X	67 X	67 X
	Avg(°F/°A)	66.7 (526.7)	67 X (527) X	67 X (527) X
Dry Gas Meter	Initial	65	65	66
Temp (°F) : Outlet	Mid	65	65	65
(T_m)	Final	65 X X	66 X	66 X
	Avg(°F/°A)	65 X (525)	65.3 X (525.3)	65.7 X (525.7) X
Avg Dry Gas		X X	X X	X X
Meter Temp (T_m - °F/°A)		65.8 (525.8)	66.2 (526.2)	66.3 (526.3)
Time (minutes)		10:20	10:30	10:20

Note: If volume is in m^3, multiply by 35.314667 to obtain ft^3.
Note: Add 460° to all temperatures for degrees Absolute.

$Y = \frac{(V_c)(MCF)(BP)(T_m)}{(V_d)(BP + \Delta h/13.6)(T_c)}$

Y Factor % Difference = $\frac{\text{Act} - \text{Exp}}{\text{Exp}} \times 100$ 72

EASY Fire 11/16 Nu

Note: MCF = Meter Correction Factor (Y) for Dry Gas Meter used as a Transfer Standard

Run 1

$Y = \frac{(5.077)(.9963)(28.36)(525.8)}{(5.270)(28.36 + .75/13.6)(520.5)} = \frac{75,426.525}{77,943.743} = 0.9677$

$\Delta\% = \frac{(.9677 - .9675)}{.9675} \times 100 = +0.02\ \%$

Run 2

$Y = \frac{(5.163)(.9963)(28.37)(526.2)}{(5.354)(28.37 + .75/13.6)(520.3)} = \frac{76,789.605}{79,183.540} = 0.9698$

$\Delta\% = \frac{(.9698 - .9675)}{.9675} \times 100 = +0.24\ \%$

Run 3

$Y = \frac{(5.099)(.9963)(28.38)(526.3)}{(5.291)(28.38 + .75/13.6)(520.5)} = \frac{75,878.879}{78,309.414} = 0.9690$

$\Delta\% = \frac{(.9690 - .9675)}{.9675} \times 100 = +0.16\ \%$

Note: The Y Factor % Difference must be < ±5.0% to be acceptable. Avg. Δ%= +0.14 %

Determination of Interpolated Y Factor for Average Certification Test Series Δ H from Dry Gas Meter Calibration Data:

0.75 (A) inch H_2O Δh= .9675 (C) Calculated Calibration Y Factor (from Calibration)

____ (B) inch H_2O Δ h = ____ (D) Calculated Calibration Y Factor (from Calibration)

____ (B) - ____ (A) = ____ X100 = ____ (E) ____ (D) - ____ (C) = ____ / ____ (E) = ____ (F)

____ Avg Δ h - ____ (A) = ____ X 100 = ____ (G)

$\left(\frac{\text{F}}{\text{G}} \times \right) + \text{C} =$ Interpolated Y Factor For Avg. Test Series Δ h

Back Half Leak Check
Start + 7.43" H_2O
End + 7.42" H_2O
Δ .000" H_2O

Dry Gas Meter Back Half Leak Check: .000 inch H_2O in One Minute

Front Half Leak Check — Meter Reading — Leak Rate

Meter	Vac In. Hg	Start	Stop	cmm	cfm
DGM	-16.0	.674	.6745	-	.0005
TM	-16.0	.757	.7575		.0005

.1416

Revised 7/11

Dry Gas Meter Calibration Data

Date: 5/17/16 Technician: ATM ESS

Calibration Meter Mfr: Rockwell SN: 1052202 Y: 0.9963

Meter Box ID Train 3 Meter Mfr: Kimmon SN: 8000571

Electrical Check OK Pitot Leak Check N/A

Leak Check Front Half OUBL Back Half OUBL

BP = 28.55 in. Hg

Orifice (Δh) in. H_2O	Gas Volume			Temperature				Time (Θ), Min.	
		Cal. Meter (Vc), (cu.ft.)	Dry Gas Meter (Vm), (m^3)		Cal. Meter (Tc), °F	Dry Gas Meter Inlet (Tmi), (°F) (°C)	Dry Gas Meter Outlet (Tmo), (°F)(°C)		
.100	initial	647.887	218.6650	initial	73	76	76	11:00	0
.100	final	652.921	218.8114 .1464 m^3	mid	73.5	78	76		0
.100				final	73.5	78	76		0
	total	5.034	5.170	avg.	73.3	77.3	76		
			.470 ft^3/min		533.3	537.3	536	76.7	536
.110	initial	653.625	218.8320	initial	74	78	77	10:30	0
.110	final	658.814	218.9830 .1510 m^3	mid	74	79	77		0
.110				final	74.5	80	77		0
	total	5.189	5.333	avg.	74.2	79	77		
			.508 ft^3/min		534.2	539	537	78	538
.120	initial	659.574	219.0050	initial	74	79	77	10:00	0
.120	final	664.737	219.1550 .1500 m^3	mid	74.5	80	77		0
				final	74.5	80	77		0
	total	5.163	5.297	avg.	74.3	79.7	77		
			.530 ft^3/min		534.3	539.7	537	78.3	538
.135	initial	665.427	219.1750	initial	75	80	78	9:30	0
.135	final	670.640	219.3265 .1515 m^3	mid	75	81	78		0
.135				final	75.5	82	78		
	total	5.213	5.350	avg.	75.2	81	78		
			.563 ft^3/min		535.2	541	538	79.5	539
	initial			initial					
	final			mid					
				final					
	total			avg.					

VA

$$Y = \frac{(Y)(Vc)(Pb)(Tm + 460)}{(Vm)(Pb + \Delta h/13.6)(Tc + 460)} \qquad \Delta h@ = \frac{(0.0317)(\Delta h)}{Pb(Tmo + 460)} \quad [(Tc + 460)(\Theta)] / [(Vc)(Yc)]^2$$

Back Half Leak Check

Pressure inch H2O

~~Start~~	8.30
Stop	8.30
Δ	.00

Front Half Leak Check

	Vac in Hg	Meter Reading Start	Stop	Leak Rate cmm	cfm
DGM	-19.0	.6295	.6295	.0000	.000
TM	-19.0	.567	.568	—	.001

Meter Box: Train 3
Date: 5/17/16

Rev 6-10

Meter Box Calibration Page 2

hg ✓ Amu

$$Y = \frac{(Y_c)(V_c)(BP)(T_m + 460)}{(V_m)(BP + \Delta H/13.6)(T_c + 460)} =$$

536.7

$$Y = \frac{(.9963)(5.034)(28.55)(76.7 + 460)}{(5.170)(28.55 + .100/13.6)(73.3 + 460)} = \frac{76,849.501}{78,737.220} = .9760$$

533.3 538

$$Y = \frac{(.9963)(5.189)(28.55)(78 + 460)}{(5.333)(28.55 + .110/13.6)(74.2 + 460)} = \frac{79,407.622}{81,358.812} = .9760$$

534.2 538.3

$$Y = \frac{(.9963)(5.163)(28.55)(78.3 + 460)}{(5.297)(28.55 + .120/13.6)(74.3 + 460)} = \frac{79,063.799}{80,826.814} = .9781$$

531.3 535

$$Y = \frac{(.9963)(5.213)(28.55)(79.5 + 460)}{(5.350)(28.55 + .135/13.6)(75.2 + 460)} = \frac{79,997.316}{81,776.209} = .9782$$

535.2

$$Y = \frac{(\quad)(\quad)(\quad)(\quad + 460)}{(\quad)(\quad + \quad/13.6)(\quad + 460)} = \quad = \quad$$

Y Factor	Variation (± 0.02 Allowed From Average Y)
.9760	-.0011
.9760	-.0011
.9781	+.0010
.9782	+.0009

Avg Y .9771

3.9083

Post Test
Meter Box Audit
Woodstove Data Sheet #32

T3

Unit: Easy Fire
Date: 11/16/16
Technician: ESS
WST9-Form2, Rev 6/11

Meter Box Calibration Audit
Test Data

Run #	1	2	3	4	5	6	7	8	9	10
Avg.Δh	.110									
Max Vac	-2.0									

Avg. Test Series Δh: .110 in H_2O. Test Series Max Vac: -2.0 in Hg

Audit Dry Gas Meter Mfr: Rockwell SN: 1052202 Correction Factor (Y): 0.9963
Test Dry Gas Meter Mfr: Kimmon SN: 8000571 Correction Factor (Y): 0.9771

Audit Data

		Audit #1	Audit #2	Audit #3
BP ("Hg):		28.34	28.33	28.33
Vac("Hg):		-2.0	-2.0	-2.0
Audit Meter:	Final Vol	883.025	889.109	895.302
	Initial Vol	877.491	883.811	890.133
	Vol (V_c, Ft^3)	5.534	5.298	5.169
Audit Meter Temp (°F) (Tc)	Initial	60	60	60
	Mid	60	60.5	60.5
	Final	60	60.5	61
	Avg (°F/°A)	60 (520)	60.3 (520.3)	60.5 (520.5)
Δh("H_2O)	Initial	.110	.110	.110
	Mid	.110	.110	.110
	Final	.110	.110	.110
	Avg	.110	.110	.110
Dry Gas Meter:	Final Vol	308.0430	308.2200	308.4024
	Initial Vol	307.8820	308.06660	308.2500
	Vol(V_d)(□)(m^3)	.1610 m^3 (5.686 Ft^3)	.1540 m^3 (5.438 Ft^3)	.1504 m^3 (5.311 Ft^3)
Dry Gas Meter Temp (°F) : Inlet (T_m)	Initial	64	65	66
	Mid	66	66	67
	Final	66	67	67
	Avg(°F/°A)	65.3 (525.3)	66 (526)	66.7 (526.7)
Dry Gas Meter Temp (°F) : Outlet (T_m)	Initial	63	64	64
	Mid	63	63	64
	Final	63	64	65
	Avg(°F/°A)	63 (523)	63.7 (523.7)	64.3 (524.3)
Avg Dry Gas Meter Temp (T_m - °F/°A)		64.2 (524.2)	64.8 (524.8)	65.5 (525.5)
Time (minutes)		11:36	11:08	10:55

Note: If volume is in m^3, multiply by 35.314667 to obtain ft^3.
Note: Add 460° to all temperatures for degrees Absolute.

BACK HALF LEAK CHECK

START	STOP	Δ
+7.410" H_2O	+7.410" H_2O	0.00" H_2O OK

$Y = \frac{(V_c)(MCF)(BP)(T_m)}{(V_d)(BP + \Delta h/13.6)(T_c)}$ Y Factor % Difference = $\frac{\text{Act} - \text{Exp}}{\text{Exp}} \times 100$

Note: MCF = Meter Correction Factor (Y) for Dry Gas Meter used as a Transfer Standard

Run 1

$Y = \frac{(5.534)(.9963)(28.34)(524.2)}{(5.686)(28.34 + .110/13.6)(520)} = \frac{81,907.967}{83,817.359} = 0.9772$

$\Delta\% = \frac{(.9772 - .9760)}{.9760} \times 100 = 0.12\%$

Run 2

$Y = \frac{(5.298)(.9963)(28.33)(524.8)}{(5.438)(28.33 + .118/13.6)(520.3)} = \frac{78,477.019}{80,179.543} = 0.9788$

$\Delta\% = \frac{(.9780 - .9760)}{.9760} \times 100 = 0.29\%$

Run 3

$Y = \frac{(5.169)(.9963)(28.33)(525.5)}{(5.311)(28.33 + .110/13.6)(520.5)} = \frac{76,668.322}{78,337.117} = 0.9787$

$\Delta\% = \frac{(.9787 - .9760)}{.9760} \times 100 = 0.27\%$

Note: The Y Factor % Difference must be < ±5.0% to be acceptable. Avg. Δ%= +0.22%

Determination of Interpolated Y Factor for Average Certification Test Series Δ H from Dry Gas Meter Calibration Data:

.110 (A) inch H_2O Δh= .9760 (C) Calculated Calibration Y Factor (from Calibration)

_____ (B) inch H_2O Δ h = _____ (D) Calculated Calibration Y Factor (from Calibration)

_____ (B) - _____ (A) = _____ X100 = _____ (E) _____ (D) - _____ (C) = _____ / _____ (E) = _____ (F)

_____ Avg Δ h - _____ (A) = _____ X 100 = _____ (G)

$\left(\frac{\text{F}}{\text{F}} \times \frac{\text{G}}{\text{G}}\right) + \frac{\text{C}}{\text{C}} =$ _____ Interpolated Y Factor For Avg. Test Series Δ h

Dry Gas Meter Back Half Leak Check: 0.00 **inch H_2O in One Minute**

Front Half Leak Check **Meter Reading** **Leak Rate**

Meter	Vac In. Hg	Start	Stop	cmm	cfm
DGM	15.5	.1458	.1458	.0000	.000
TM	15.5	.1145	.1145	—	.000

APEX INSTRUMENTS REFERENCE METER VERIFICATION

USING WET-TEST METER #11AE6

Myren Consulting

Calibration Meter Information	
WTM Model #	AL20
WTM Serial #	11AE6
WTM Gamma	0.9999
Original 15Pt Gamma	**0.9963**

Calibration Conditions			
Date	Time	4-Apr-16	8:30
Barometric Pressure		29.69	in Hg
Calibration Tech		EW	
DGM Serial Number		S-110-1052202	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	°R/in Hg

Calibration Data												Results		
Run Time	Metering Console						Calibration Meter					Dry Gas Meter		
	DGM Input	Volume	Volume	Volume	Outlet Temp		Volume	Volume	Volume	Outlet Temp		Calibration Factor		Flowrate
Elapsed	Pressure	Initial	Final	Sample	Initial	Final	Initial	Final	Sample	Initial	Final	Previous	Current	Std & Corr
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(V_m)	(t_{mi})	(t_{mf})	(Vw_i)	(Vw_f)	(V_m)	(t_{wi})	(t_{wf})	(Y)	(Y)	($Q_{m(std)(corr)}$)
min	in H_2O	cubic feet	cubic feet	cubic feet	°F	°F	cubic feet	cubic feet	cubic feet	°F	°F			cfm
6.00	-3.6	508.805	514.920	6.115	69.8	71.6	380.520	386.540	6.020	70	70	0.9955	0.9946	0.992
											Variation	0.09%	must be less than 1.5%	
10.00	-2.2	514.920	520.503	5.583	71.6	71.6	386.540	392.140	5.600	70	70	0.9988	1.0116	0.554
											Variation	1.28%	must be less than 1.5%	

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, App A, Method 5, Paragraph 7.1.2.2, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature Eric Myren Date 4/4/16

APEX INSTRUMENTS REFERENCE METER CALIBRATION
USING WET-TEST METER #11AE6
15-POINT ENGLISH UNITS

Calibration Meter Information	
WTM Model #	AL-20
WTM Serial #	11AE6
WTM Gamma	0.9999

Calibration Conditions			
Date	Time	18-Feb-14	9:15
Barometric Pressure		29.8	in Hg
Calibration Technician		EW	
DGM Serial Number		S-110-1052202	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	°R/in Hg

Calibration Data												Results		
Run Time	Dry Gas Meter						Calibration Meter					Dry Gas Meter		
												Calibration Factor		Flowrate
Elapsed	Meter Pressure	Volume Initial	Volume Final	Sample Volume	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Sample Volume	Outlet Temp Initial	Outlet Temp Final	Value	Variation	Std & Corr
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(V_m)	(t_{mi})	(t_{mf})	(V_{wi})	(V_{wf})	(V_w)	(t_{wi})	(t_{wf})	(Y)	(ΔY)	($Q_{m(std)(corr)}$)
min	in H_2O	cubic feet	cubic feet	cubic feet	°F	°F	cubic feet	cubic feet	cubic feet	°F	°F			cfm
5	-5.1	657.117	663.335	6.218	73.4	73.4	677.080	683.140	6.060	68.0	68.0	0.9970	0.00149	1.21
5	-5.1	663.335	669.550	6.215	73.4	73.4	683.140	689.180	6.040	68.0	68.0	0.9942	-0.00133	1.20
5	-5.1	669.550	675.768	6.218	73.4	73.4	689.180	695.230	6.050	68.0	68.0	0.9954	-0.00016	1.21
											Passed Calibration Fa	0.9955	Averages	1.21
6	-3.7	694.023	699.987	5.964	75.2	75.2	713.145	718.970	5.825	68.0	68.0	0.9990	0.00269	0.97
6	-3.7	699.987	705.997	6.010	75.2	75.2	718.970	724.820	5.850	68.0	68.0	0.9956	-0.00071	0.97
6	-3.7	705.997	712.025	6.028	75.2	75.2	724.820	730.680	5.860	68.0	68.0	0.9944	-0.00198	0.97
											Passed Calibration Fa	0.9963	Averages	0.97
7	-2.8	712.025	717.674	5.649	75.2	75.2	730.680	736.190	5.510	68.0	68.0	0.9955	0.00082	0.78
7	-2.8	717.674	723.317	5.643	75.2	75.2	736.190	741.690	5.500	68.0	68.0	0.9947	0.00007	0.78
7	-2.8	723.317	728.975	5.658	75.2	77.0	741.690	747.190	5.500	68.0	68.0	0.9938	-0.00090	0.78
											Passed Calibration Fa	0.9947	Averages	0.78
10	-2.0	728.975	734.645	5.670	77.0	77.0	747.190	752.730	5.540	68.0	68.0	0.9986	0.00215	0.55
10	-2.0	734.645	740.312	5.667	77.0	77.0	752.730	758.260	5.530	68.0	68.0	0.9973	0.00088	0.55
10	-2.0	740.312	745.991	5.679	77.0	77.0	758.260	763.780	5.520	68.0	68.0	0.9934	-0.00303	0.55
											Passed Calibration Fa	0.9964	Averages	0.55
15	-1.9	675.768	681.868	6.100	73.4	75.2	695.230	701.215	5.985	68.0	68.0	0.9974	-0.00135	0.40
15	-1.9	681.868	687.947	6.079	75.2	75.2	701.215	707.180	5.965	68.0	68.0	0.9992	0.00043	0.40
15	-1.9	687.947	694.023	6.076	75.2	75.2	707.180	713.145	5.965	68.0	68.0	0.9997	0.00092	0.40
											Passed Calibration Fa	0.9988	Averages	0.40
											Overall Average Y	**0.9963**		

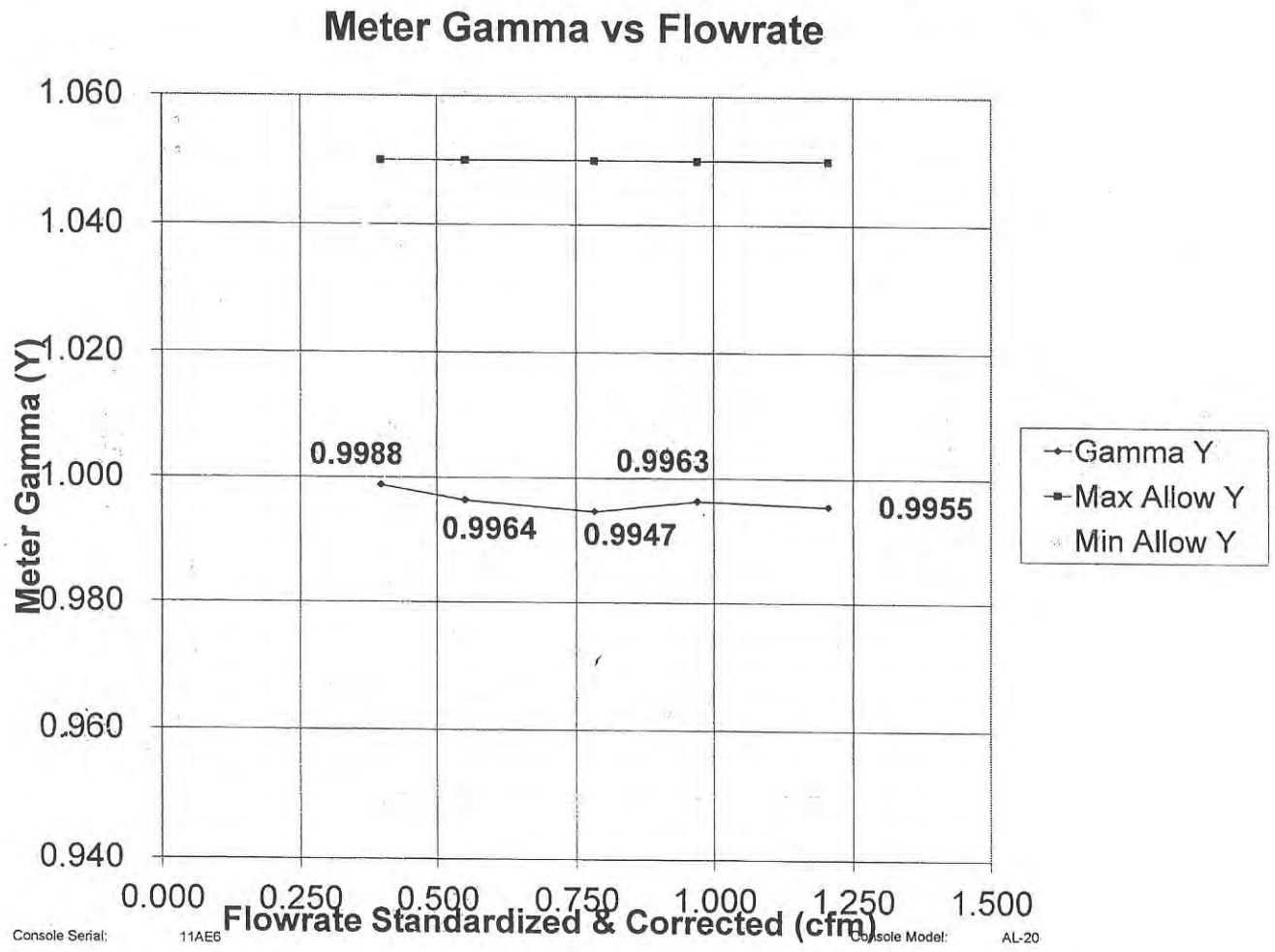
Note:: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature Eric Work Date 2/18/14

Calibration Date: 2-18-2014

Calibration Technician: EW

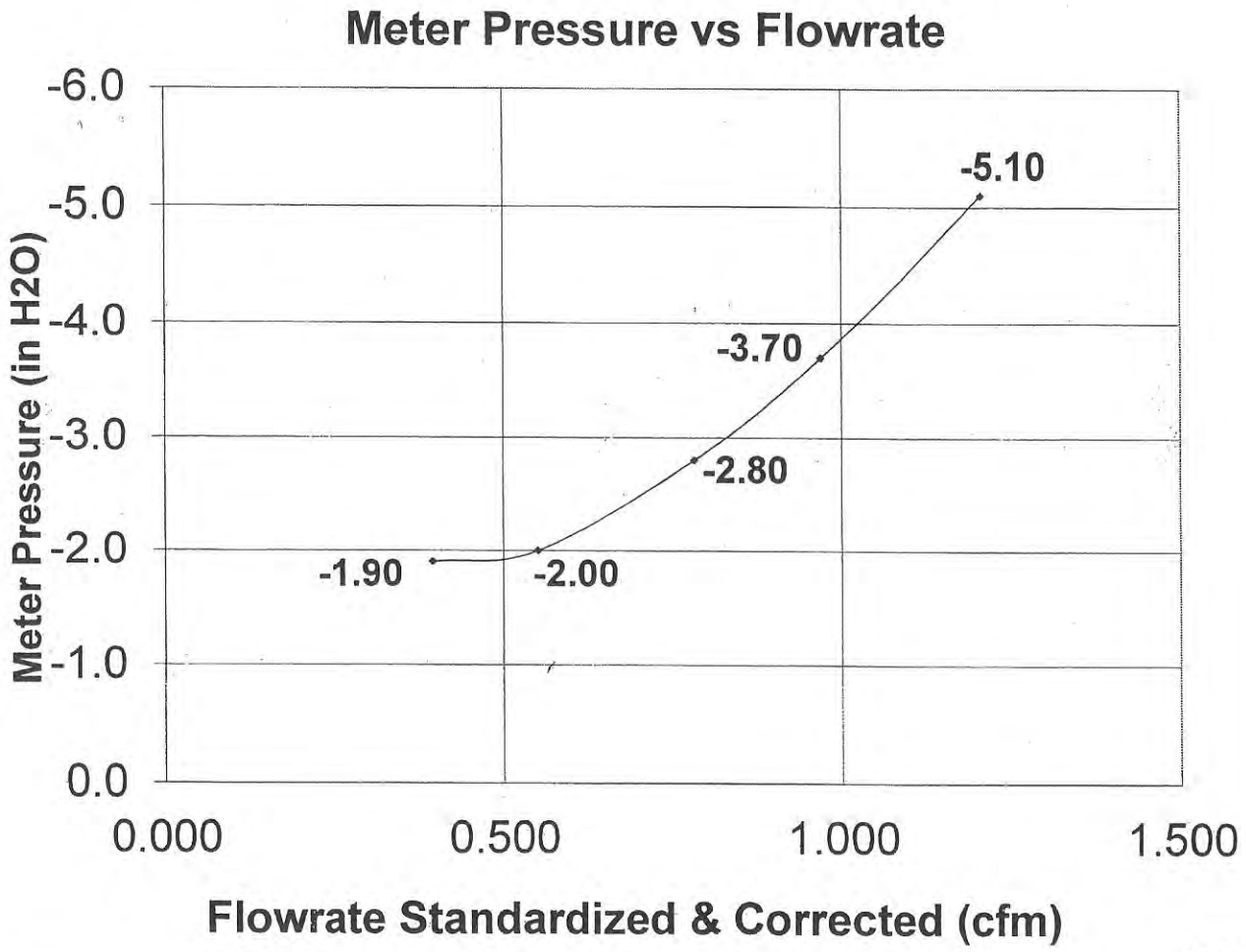


Console Serial: 11AE6

Console Model: AL-20

Calibration Date: 2-18-2014

Calibration Technician:



Console Serial: 11AE6

Console Model: AL-20

VANEOMETER CALIBRATION

Myren Consulting used a Dwyer Model 3480 Vaneometer to measure test chamber air velocity. The manufacturer's specifications for accuracy are ± 5.0% from 0 to 100 fpm and ± 10% from 100 to the top of the scale. Myren Consulting insures that the instrument is level and clean prior taking each reading. According to EPA personnel (Westlin, RTP) no further calibration is necessary.

DRAFT GUAGE CALIBRATION

Myren Consulting used a Dwyer Model 115 AV, a -0.05 - 0.0 - 0.25" inclined red oil manometer (readability resolution ± 0.001" H_2O) to measure the static pressure in the stack. Once leveled and zeroed as per the manufacturer's written operating instructions, the Dwyer manometer is a primary standard and needs no further calibration.

The manometer is leveled and zeroed at the start of each test, checked as necessary during a run to verify that the settings have not changed and again at the end of each test run. The results of these checks are recorded on Woodstove Data Sheet #16 in each individual test.

BAROMETER CALIBRATION

Myren Consulting used a Princo Model 453 SN W14275 Mercury barometer and a Weems and Plath aneroid barometer to measure the barometric pressure (BP). The Weems and Plath barometer was calibrated daily by comparing it to the Princo and adjusting it as necessary. The Princo when calibrated following the manufacturer's instructions is a primary standard and needs no further calibration.

MOISTURE METER CALIBRATION

Myren Consulting uses a Delmhorst J-2000 which was calibrated daily using the "Check" feature. Then the operation of the moisture meter was checked with a Delmhorst Moisture Content Standard Model MCS-1 at 12.6 and 23.8%. The results of these checks are recorded on Data Sheet #10.

The readings obtained with the moisture meter are then corrected as per the manufacturer's written instructions for temperature. If Delmhorst #496 insulated pins are used, the meter is set at 222 using the Set Pin Calibration instructions. The meter is set at 1 for the Species correction. 1 is the setting for D. Fir

Woodstove Data Sheet #26-A
CEM Gas Train Response Time
Semi Annual Check

Date	5/18/16	→	→	→	→	→					
Technicians	ATM	→	→	→	→	→					
Elapsed Time	CO_2 Conc.(V)	CO_2 Conc.(V)	CO_2 Conc.(V)	CO Conc.(V)	CO Conc.(V)	CO Conc.(V)	O_2 Conc.(V)	O_2 Conc.(V)	O_2 Conc.(V)	Conc.(V)	Conc.(V)
0 Seconds	.367	.366	.365	1.52	1.54	1.56					
15	.366	.366	.364	1.52	1.53	1.56					
30	.198	.197	.195	1.40	1.41	1.44					
45	.102	.100	.099	.70	.71	.73					
60	.042	.041	.040	.44	.46	.48					
75	(.006)	(.006)	(.005)	.30	.29	.31					
90	.005	.004	.004	.11	.09	.13					
105	.003	.003	.002	(.05)	(.05)	(.06)					
12	.002	.002	.001	.04	.04	.05					
135	.001	.001	.001	.03	.03	.04					
150	.001	.001	.001	.03	.03	.03					
165	.001	.001	.001	.02	.02	.02					
180	.001	.001	.001	.01	.01	.01					
Initial Response Time (seconds)	~28 Seconds	~30 Seconds	~30 Seconds	~35-40 Sec	~35-40 Sec	~35-40 Sec					
95% Response Time (seconds)	>60 <75	>60, <75	>60, <75	>90, <105	>90 <105	>90 <105					
Analyser Flow Rate	1.5 scfh	→				→					

Comments:

Myren Consulting Inc.
512 Williams Lake Rd; Colville, WA 99114; (509)685-9458
QA WS, REV 1/10

Pre Easy Fire

CO_2 Analyzer

Multipoint Calibration Report Form

Site: Myren Lab, Colville, WA Date: 10/21/16

Analyzer: Make: Horiba Model: PIR 2000 SN: 607204

Calibration by: A.T. Myren

Cal Gas Flow: 1.5 scfh Measured by: Rotameter: X Mass Flowmeter: _____

BP: 2851 "Hg Instrument ID: Princo

Temp: 61 °F Instrument ID: Omega Digicator

Analyzer Last Calibrated: 5/25/16 By: A.T. Myren

Cylinders:

1. # DOT 3AA2265 Concentration: 0.00 %CO_2 Cyl. Press.: 1800 psi.
   Certified By: Oxarc Date: 2/25/16
2. # EB-0041761 Concentration: 12.45 %CO_2 Cyl. Press.: 1020 psi.
   Certified by: Liquid Technology Coop Date: 4/15/15
3. # 250-1175 Concentration: 21.0 %CO_2 Cyl. Press.: 675 psi.
   Certified by: Oxarc Date: 8/22/97
4. # SX-40585 Concentration: 6.04 %CO_2 Cyl. Press.: 1200 psi.
   Certified by: Matheson Tri Gas Date: 4/12/10

Analyzer: Calibrated Range: 0 – 25 % Output: 0 – 1.0 v.

Flow: 1.5 scfh Measured by: Rotameter: X Mass Flowmeter: _____

Calibration Results

Point #	Cyl. #	% CO_2	Expected		Actual		Adj.		% Dif.	Curve Conc.	Potentiometer	
			Meter	DVM	Meter	DVM	Meter	DVM			Unadj.	Adj.
1	1	0.00	0.00	.000	-0.01	-.001	.00	0.00			4.03	4.07
2	2	12.45	49.8	.498	48.15	.489	49.0	.498			8.96	9.32
3	3	21.0	84.0	.840	84.5	.844	—	—			—	—
4	4	6.04	.242	.242	234	.224	—	—			—	—
5	1	0.00	0.00	.000			—	—			—	—

Comments:

.000V = 0.09788709 = +0.09+8709 = +0.39%
.498V = 12.45260051 = +0.0026051 = +0.020%
.844V = 21.0364165 = +0.0364165 = +0.17%
.234V = 5.903107S = −0.136892S = −2.27%

Linear Regression Results

Y= MX + B

Slope M= 0.0403035

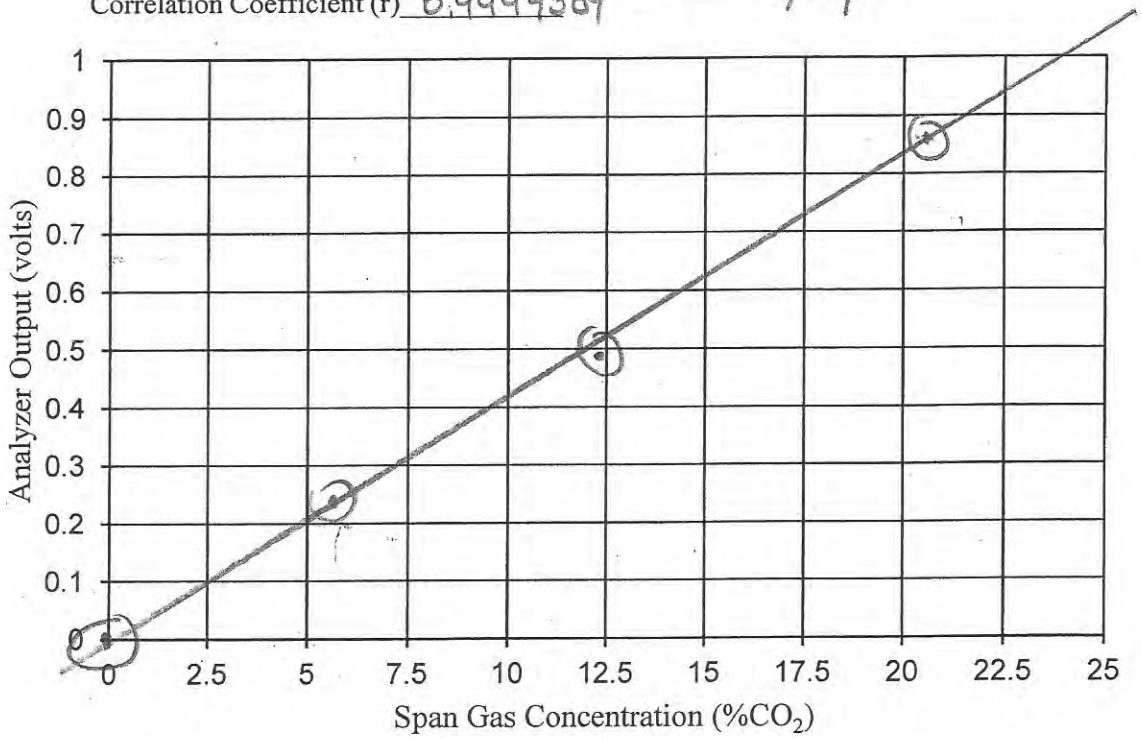
Y Intercept (B)= -0.0038964

Correlation Coefficient (r) 0.9999389

Analyzer: Horiba PIR 2000

SN: 607204

Date: 10/21/16



Comments:

Pre EASY Fire

Myren Consulting Inc.
512 Williams Lake Rd; Colville, WA 99114; (509)685-9458
QA WS, REV 1/10

CO Analyzer

Multipoint Calibration Report Form

Site: Myren Consulting Lab Date: 10/21/16

Analyzer: Make: CAI Model: 200 SN: 1M12002

Calibration by: A.T. Myren

Cal Gas Flow: 1.5 dscfh Measured by: Rotameter: X Mass Flowmeter:

BP: 28.51 "Hg Instrument ID: Princo

Temp: 61 °F Instrument ID: Omega Digi-sense

Analyzer Last Calibrated: 5/25/16 By: A.T. Myren

Cylinders:

1. DOT #3AA 2265 Concentration: 0.00 %CO Cyl. Press.: 1800 psi.
   Certified By: Oxarc Date: 2/25/16
2. EB-0041761 # Concentration: 2.61 %CO Cyl. Press.: psi.
   Certified by: Liquid Technology Corp Date: 4/15/15
3. #250-1175 Concentration: 4.03 %CO Cyl. Press.: 675 psi.
   Certified by: Oxarc Date: 8/22/97
4. #SX-40585 Concentration: 1.29 %CO Cyl. Press.: psi.
   Certified by: Matheson Tri Gas Date: 4/12/10

Analyzer: Calibrated Range: 0-10% % Output: 0-10.0 v.

Flow: 1.5 dscfh Measured by: Rotameter: X Mass Flowmeter:

Calibration Results

Point #	Cyl. #	% CO	Expected		Actual		Adj.		Curve Conc.	% Dif.	Potentiometer	
			Meter	DVM	Meter	DVM	Meter	DVM			Unadj.	Adj.
1	1	0.00	0.00	.000	0.06	-.061	0.00	.000			4.69	4.68
2	2	2.61	2.61	2.61	2.65	2.64	2.62	2.61			4.43	4.26
3	3	4.03	4.03	4.03	4.03	4.21	—	—				
4	4	1.29	1.29	1.29	1.34	1.34	—	—				
5	1	0.00	0.00	0.00			—	—				

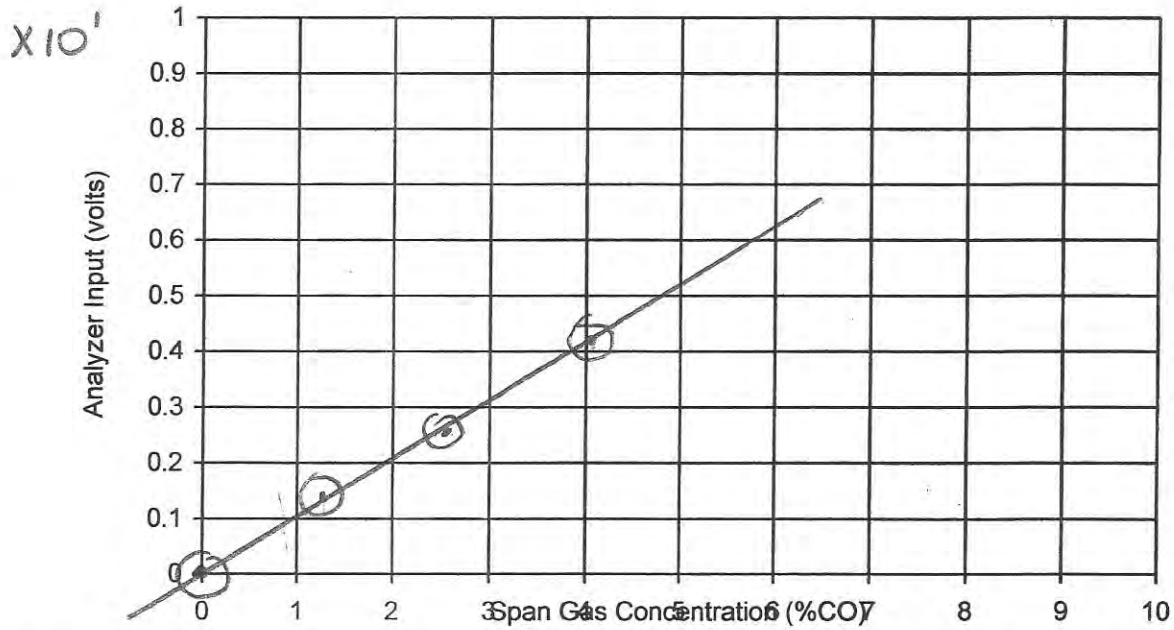
Comments:

.000 V = 0.0173987 = +0.0173987 = +0.35%
2.61 V = 2.53157124 = -0.0784276 = -3.00%
4.21 V = 4.0728283 = +0.0428283 = +1.06%
1.34 V = 1.3082005 = +0.0182005 = +1.41%

Linear Regression Results

Analyzer: CAI Model 200
SN:1M12002
Date: 10/21/16

Y= MX + B
Slope M= 1.037198
Y Intercept (B)= -0.0160900
Correlation Coefficient (r) 0.9995208



Comments:

LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	OXARC, Inc (Spokane, WA)
Date	April 15, 2015
Delivery Receipt	DR-56053
Gas Standard	2.50% CO, 12.50% Carbon Dioxide/Nitrogen - EPA PROTOCOL
Final Analysis Date	April 15, 2015
Expiration Date	April 16, 2023
Component	Carbon Monoxide, Carbon Dioxide
Balance Gas	Nitrogen

Analytical Data:
EPA Protocol, Section No. 2.2, Procedure G-1.

DO NOT USE BELOW 100 psig

Replicate Concentrations

Carbon Monoxide: 2.61% +/- 0.02%
Carbon Dioxide: 12.45% +/- 0.10%
Nitrogen: Balance

Reference Standards:

	SRM/GMIS:	GMIS	GMIS Traceability
Cylinder Number:	SRM CAL-017030	GMIS EB-0051547	SRM-2745 CAL-016193
Concentration:	4.009% CO (+/- 0.017%)	9.923% CO2 (+/- 0.062%)	15.633% CO2 (+/- 0.037%)
Expiration Date:	07/15/19	02/04/22	06/02/17
NIST Sample Number:	52-D-54	NA	9-C-55

Certification Instrumentation

Component:	Carbon Monoxide	Carbon Dioxide
Make/Model:	Nicolet 6700	Nicolet 6700
Serial Number:	APW1100563	APW1100563
Principal of Measurement:	FTIR	FTIR
Last Calibration:	April 15, 2015	April 04, 2015

Cylinder Data

Cylinder Serial Number:	EB-0041761	Cylinder Outlet:	CGA 350
Cylinder Volume:	119 Cubic Feet	Cylinder Pressure:	1700 psig, 70°F

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by: Cole Dylewski

Cole Dylewski

PGVP Vendor ID: E12015

WELDING PRODUCTS
INDUSTRIAL SUPPLIES
INDUSTRIAL GASES
MEDICAL GASES

SPECIALTY GASES
BEVERAGE SYSTEMS
SAFETY PRODUCTS
FIRE EQUIPMENT

WWW.OXARC.COM

MAIN OFFICE
SPOKANE, WA 99220
4003 E. BROADWAY
P.O. BOX 2605
(509) 535-7794
FAX (509) 535-0368

BOISE, ID 83709
7615 W. LEMHI ST.
(208) 376-0377
FAX (208) 376-1133

COEUR D'ALENE, ID 83814
3530 RAMSEY RD.
(208) 765-3311
FAX (208) 667-5974

COLVILLE, WA 99114
328 W. 1ST.
(509) 684-3776
FAX-(509) 684-6742

ELLENSBURG, WA 98926
704 N. WENAS
(509) 925-1518
FAX (509) 925-1136

HERMISTON, OR 97838
HERMISTON-
McNARY HIWAY
(503) 567-7377
FAX (503) 567-2265

KENNEWICK, WA 99336
800 W. COLUMBIA DR.
(509) 582-4202
FAX (509) 586-9859

LEWISTON, ID 83501
2513 3RD. AVE., NORTH
(208) 743-6571
FAX (208) 746-8374

MOSES LAKE, WA 98837
1401 WHEELER ROAD
(509) 765-9247
FAX (509) 766-9958

OKANOGAN, WA 98840
2256 ELMWAY
(509) 826-3205
FAX (509) 826-3905

PASCO, WA 99302
716 SOUTH OREGON
(509) 547-2494
FAX (509) 547-3103

TWIN FALLS, ID 83303
729 COMMERCIAL AVE.
(208) 734-9711
FAX (208) 734-7923

WENATCHEE, WA 98801
OHME GARDENS RD.
(509) 662-8417
FAX (509) 662-1229

YAKIMA, WA 98903
1004 EAST MEAD
(509) 248-0827
FAX (509) 452-8704

Primary Standard Certificate of Analysis
Method of Analysis Micro GC / Gravimetric
Customer: Myren Consulting **Reference # PM7234-2**
P.O.# **Cylinder # 250-1175**

Results of Investigation

Component	Requested	Concentration
Air	N/A	N/A
Argon	N/A	N/A
Carbon Dioxide	21.0%	21.0%
Carbon Monoxide	4.00%	4.03%
Helium	N/A	N/A
Hydrogen	N/A	N/A
Methane	N/A	N/A
Nitrogen	Balance	Balance
Oxygen	21.0%	21.0%

Hazard Class	**UN 1956**
DOT Shipping Name	**Compressed Gas NOS**
Shipping Volume (scf approximate)	**160 scf @ ntp**
Cylinder Pressure	**1500 psig**
CGA Valve Connection	**350**

Oxarc Primary Standard mixtures are prepared with gravimetric techniques using weights traceable to NIST. Mixture blended to +/- 1% relative to minor component and certified to +/- 1% analytical accuracy.

Authorized Signature Travis Auger **Date** 8/25/97

Comments:

MATHESON TRI•GAS
ask. . .The Gas Professionals™
1650 Enterprise Parkway
Twinsburg, Ohio 44087
215-648-4000

Certificate of Analysis - EPA Protocol Mixtures

Customer: OXARC INC
Cylinder Number: SX-40586
Cylinder pressure: 1600 psig
Last Analysis date: 4/9/2010
Expiration Date: 3/18/2013

Protocol:	Reference #	Lot #
G1	519323	109-96-17643

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 150 PSIG

REPLICATE RESPONSES

		Date: 3/18/2010	Date:
Component :	Oxygen	5.98%	
Certified Conc:	5.98% ± 1% REL	5.98%	
		5.99%	

		Date: 3/18/2010	Date:
Component:	Carbon Dioxide	6.03%	
Certified Conc:	6.04% ± 1% REL	6.07%	
		6.01%	

		Date: 4/2/2010	Date: 4/9/2010
Component:	Carbon Monoxide	1.30%	1.29%
Certified Conc:	1.29% ± 1% REL	1.30%	1.28%
		1.30%	1.29%

ANCE GAS: Nitrogen

REFERENCE STANDARDS

Component:	Oxygen	Carbon Dioxide	Carbon Monoxide
SRM #:	NTRM-82658	SRM-1674b	SRM-2639a
Sample #:	01110212	7-F-05	54-D-51
Cylinder #:	SX-20658	CAL-014611	CAL-013889
Concentration:	10.09%	6.876 %	0.991 %

CERTIFICATION INSTRUMENTS

Component:	Oxygen	Carbon Dioxide	Carbon Monoxide
Make/Model:	Rosemount 755	Varian 3800 GC	Varian 3800 GC
Serial Number:	2002832	LR-92489	LR-92489
Measurement Principle:	Paramagnetic	TC, FID	TC, FID
Last Calibration:	2/26/2010	3/16/2010	4/2/2010

Notes: T134744

This certification was performed according to EPA Traceability Protocol for Assay & Certification of Gaseous Calibration Standards September 1997, using procedure G1 and/or G2.

Analyst Phil D. Mott Date 4/12/2010

AGING DATA

The Sierra Easy Fire Pellet Stove was aged by Myren Consulting, Inc. The Aging installation configuration was the same as the installation used during certification testing. During Aging the stove was run on the Medium setting used during certification testing and the temperature and the (wet) burn rate data were collected using a Data Acquisition System (DAS). The Aging data was then transferred from the DAS spreadsheet to the Aging data pages in this section.

Unit: Easy Fire Pellet Stove
Date(s): 10/3-6/16
Technicians: ATM ESS
Page: 1 of 2

PELLET STOVE AGING DATA
Woodstove Test Data Sheet #25P
WST5-Form 3A, Rev 12/15

T/C#

HOUR #	2016 DATE	TIME	POUNDS BURNT	STACK TEMP	COMMENTS
1	10/3	1555	2.2	296	Fire Started 1455 on 10.3.16
2	10/4	1745	2.3	290	Fire Started 1645 on 10.4.16
3		1845	2.3	299	
4		1945	2.3	302	All Aging was done with
5		2045	2.3	308	Harmetics pellets from
6		2145	2.3	297	Sandpoint, ID
7		2245	2.4	311	
8	↓	2345	2.3	307	
9	10/5	0045	2.4	305	
10		0145	2.3	294	
11		0245	2.3	309	
12		0345	2.3	307	
13		0445	2.4	313	
14		0545	2.3	307	
15		0645	2.3	294	
16		0745	2.3	306	
17		0930	2.3	312	Hopper Filled @ 0830
18		1030	2.4	309	
19		1130	2.4	311	
20		1230	2.3	313	
21		1330	2.4	319	
22		1430	2.3	317	
23		1530	2.4	312	
24		1630	2.2	300	Hopper Filled @ 1700
25		1730	2.4	321	
26		1830	2.3	319	
27		1930	2.3	322	
28		2130	2.4	311	
29	↓	2230	2.3	317	

Unit: Easy Fire Pellet Stove

PELLET STOVE AGING DATA
Woodstove Test Data Sheet #25P
WST5-Form 3A, Rev 12/15

Date(s): 10/3-6/16
Technicians: ATM EES
Page: 2 of 2

T/C# 1

HOUR #	DATE	TIME	POUNDS BURNT	STACK TEMP	COMMENTS
30	10/5	2330	2.4	317	
81	10/6	0030	2.3	319	
32	↓	0130	2.3	313	
33		0230	2.4	314	
34		0330	2.3	315	
35		0430	2.4	308	
36		0530	2.3	305	
37		0630	2.4	309	
38		0730	2.4	314	
39		0830	2.4	315	
40		0930	2.4	314	Hopper filled @ 0838
41		1030	2.4	319	
42		1130	2.4	322	
43		1325	2.4	318	Restarted Computer @ 1225
44		1425	2.5	331	
45		1525	2.2	218	
46		1625	2.0	310	Hoopper filled @ 1610
47		1725	2.4	330	
48		1825	2.3	327	
49		1925	2.4	323	
50		2025	2.3	323	
51	↓	2125	2.4	321	

MYREN CONSULTING, INC.

Manufacturer: SIERRA
Model: EASY FIRE
Date: 10.21.16
Run: EPA 1
Control #:
Test Duration: 360
Output Category: Integrated Test

Technicians: A.T. MYREN

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	63.6%	68.7%
Combustion Efficiency	98.9%	98.9%
Heat Transfer Efficiency	64%	69.5%

Output Rate (kJ/h)	11,993	11,376	**(Btu/h)**
Burn Rate (kg/h)	0.95	2.10	**(lb/h)**
Input (kJ/h)	18,854	17,885	**(Btu/h)**

Test Load Weight (dry kg)	5.71	12.59	**dry lb**
MC wet (%)	6.074		
MC dry (%)	6.47		
Particulate (g)	4.93525		
CO (g)	203		
Test Duration (h)	6.00		

Emissions	**Particulate**	**CO**
g/MJ Output	0.07	2.81
g/kg Dry Fuel	0.86	35.47
g/h	0.82	33.76
lb/MM Btu Output	0.16	6.54

Air/Fuel Ratio (A/F)	35.44

VERSION: 2.2 12/14/2009

VERSION: 2.2 12/14/2009

Manufacturer: SIERRA
Model: EASY FIRE
Date: 10.21.16
Run: EPA 1
Control #:
Test Duration: 360
Output Category: Integrated Test

Appliance Type: PELLET (Cat, Non-Cat, Pellet)

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

Fuel Data

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

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

Wood Moisture (% wet): 6.07
Load Weight (lb wet): 13.40
Burn Rate (dry kg/h): 0.95
Total Particulate Emissions: 4.93525 g

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurence and the next reading showing a decrease in weight.

	Averages	0.10	3.35	17.54	317.46	61.35
					Temp. (°F)	
Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%) CO	CO_2	O_2	Flue Gas	Room Temp
0	13.40	0.05	4.69	16.23	412.0	59.0
10	12.90	0.05	5.88	15.04	423.0	59.0
20	12.20	0.06	5.08	15.83	416.0	60.0
30	11.80	0.05	5.13	15.79	413.0	60.0
40	11.10	0.06	4.36	16.55	411.0	60.0
50	10.40	0.06	4.69	16.22	409.0	60.0
60	9.90	0.05	5.23	15.69	415.0	61.0
70	9.20	0.11	3.25	17.64	360.0	60.0
80	8.80	0.13	2.68	18.20	331.0	61.0
90	8.60	0.09	3.62	17.28	330.0	61.0
100	8.30	0.10	3.35	17.54	322.0	61.0
110	7.90	0.12	3.32	17.56	317.0	61.0
120	7.50	0.08	3.40	17.50	324.0	61.0
130	7.10	0.08	3.87	17.03	337.0	61.0
140	6.50	0.07	3.79	17.12	337.0	61.0
150	6.10	0.09	3.65	17.25	324.0	62.0
160	5.90	0.09	3.50	17.40	318.0	62.0
170	5.60	0.09	3.65	17.25	335.0	62.0
180	4.90	0.10	3.94	16.95	338.0	62.0
190	4.40	0.13	2.31	18.57	287.0	62.0
200	4.20	0.14	2.73	18.14	276.0	62.0
210	4.00	0.13	2.41	18.47	267.0	62.0
220	3.80	0.11	2.90	17.99	273.0	62.0
230	3.60	0.13	2.75	18.13	273.0	62.0
240	3.40	0.11	2.78	18.11	279.0	62.0
250	3.00	0.21	2.03	18.81	268.0	62.0
260	2.70	0.11	3.20	17.69	286.0	62.0
270	2.50	0.09	3.45	17.45	277.0	62.0
280	2.20	0.09	2.93	17.97	281.0	62.0
290	1.90	0.10	3.65	17.24	277.0	62.0
300	1.60	0.17	2.11	18.75	261.0	62.0
310	1.30	0.11	2.63	18.26	270.0	62.0
320	1.10	0.12	2.48	18.40	266.0	62.0
330	0.80	0.14	2.21	18.66	262.0	62.0
340	0.60	0.17	1.81	19.05	253.0	62.0
350	0.30	0.13	2.58	18.30	264.0	62.0
360	0.00	0.13	1.96	18.92	254.0	62.0

ABC Laboratories, Inc.

Manufacturer: SIERRA
Model: EASY FIRE
Date: 10.21.16
Run: EPA 1
Control #:
Test Duration: 60
Output Category: HIGH SEGMENT

Technicians: _____

_____

_____

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	63.3%	68.4%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	64%	68.7%

Output Rate (kJ/h)	18,693	17,732	**(Btu/h)**
Burn Rate (kg/h)	1.49	3.29	**(lb/h)**
Input (kJ/h)	29,548	28,029	**(Btu/h)**

Test Load Weight (dry kg)	1.49	3.29	**dry lb**
MC wet (%)	6.074		
MC dry (%)	6.47		
Particulate (g)	0.8484		
CO (g)	20		
Test Duration (h)	1.00		

Emissions	**Particulate**	**CO**
g/MJ Output	0.05	1.08
g/kg Dry Fuel	0.57	13.60
g/h	0.85	20.28
lb/MM Btu Output	0.11	2.52

Air/Fuel Ratio (A/F)	24.19

VERSION: 2.2 12/14/2009

VERSION: 2.2 12/14/2009

Manufacturer: SIERRA
Model: EASY FIRE
Date: 10.21.16
Run: EPA 1
Control #:
Test Duration: 60
Output Category: HIGH SEGMENT

Appliance Type: PELLET (Cat, Non-Cat, Pellet)

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

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

Fuel Data

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Wood Moisture (% wet): 6.07
Load Weight (lb wet): 3.50
Burn Rate (dry kg/h): 1.49
Total Particulate Emissions: 0.8484 g

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurence and the next reading showing a decrease in weight.

					Temp. (°F)	
		Flue Gas Composition (%)			Flue	Room
Elapsed Time (min)	Fuel Weight Remaining (lb)	CO	CO_2	O_2	Gas	Temp
Averages		**0.05**	**5.01**	**15.90**	**414.14**	**59.86**
0	3.50	0.05	4.69	16.23	412.0	59.0
10	3.00	0.05	5.88	15.04	423.0	59.0
20	2.30	0.06	5.08	15.83	416.0	60.0
30	1.90	0.05	5.13	15.79	413.0	60.0
40	1.20	0.06	4.36	16.55	411.0	60.0
50	0.50	0.06	4.69	16.22	409.0	60.0
60	0.00	0.05	5.23	15.69	415.0	61.0

Er Calc Sheet

Unit: EASY FIRE

Run: EPA 1

Date: 10/21/16

Cs = K2 x (Mn/ Vstd)

= .001 (3.0 / 29.012) = .0001034

Er = (Cs-Cr) x Qsd X θ

= ✓ x 136.730 x 60 = .8483

MYREN CONSULTING, INC.

Manufacturer: SIERRA
Model: EASY FIRE
Date: 10.21.16
Run: EPA 1
Control #:
Test Duration: 120
Output Category: ΞDIUM SEGMENT

Technicians: ATM

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	61.1%	66.0%
Combustion Efficiency	99.1%	99.1%
Heat Transfer Efficiency	62%	66.7%

Output Rate (kJ/h)	12,896	12,233	**(Btu/h)**
Burn Rate (kg/h)	1.07	2.35	**(lb/h)**
Input (kJ/h)	21,106	20,021	**(Btu/h)**

Test Load Weight (dry kg)	2.13	4.70	**dry lb**
MC wet (%)	6.074		
MC dry (%)	6.47		
Particulate (g)	N/A		
CO (g)	71		
Test Duration (h)	2.00		

Emissions	Particulate	CO
g/MJ Output	#VALUE!	2.74
g/kg Dry Fuel	#VALUE!	33.15
g/h	#VALUE!	35.32
lb/MM Btu Output	#VALUE!	6.36

Air/Fuel Ratio (A/F)	32.86

VERSION: 2.2 12/14/2009

VERSION: 2.2 12/14/2009

Manufacturer: SIERRA
Model: EASY FIRE
Date: 10.21.16
Run: EPA 1
Control #:
Test Duration: 120
Output Category: MEDIUM SEGMENT

Appliance Type: Non-Cat (Cat, Non-Cat, Pellet)

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

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

Wood Moisture (% wet): 6.07
Load Weight (lb wet): 5.00
Burn Rate (dry kg/h): 1.07
Total Particulate Emissions: N/A g

Fuel Data

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurence and the next reading showing a decrease in weight.

Averages	**0.09**	**3.63**	**17.26**	**337.54**	**61.23**	
				Temp. (°F)		
Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%) CO	CO_2	O_2	Flue Gas	Room Temp
0	5.00	0.05	5.23	15.69	415.0	61.0
10	4.30	0.11	3.25	17.64	360.0	60.0
20	3.90	0.13	2.68	18.20	331.0	61.0
30	3.70	0.09	3.62	17.28	330.0	61.0
40	3.40	0.10	3.35	17.54	322.0	61.0
50	3.00	0.12	3.32	17.56	317.0	61.0
60	2.60	0.08	3.40	17.50	324.0	61.0
70	2.20	0.08	3.87	17.03	337.0	61.0
80	1.60	0.07	3.79	17.12	337.0	61.0
90	1.20	0.09	3.65	17.25	324.0	62.0
100	1.00	0.09	3.50	17.40	318.0	62.0
110	0.70	0.09	3.65	17.25	335.0	62.0
120	0.00	0.10	3.94	16.95	338.0	62.0

MYREN CONSULTING, INC.

Manufacturer:	SIERRA
Model:	EASY FIRE
Date:	10.21.16
Run:	EPA 1
Control #:	
Test Duration:	180
Output Category:	LOW

Technicians: ATM

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	60.7%	65.6%
Combustion Efficiency	97.6%	97.6%
Heat Transfer Efficiency	62%	67.2%

Output Rate (kJ/h)	8,373	7,943	**(Btu/h)**
Burn Rate (kg/h)	0.70	1.53	**(lb/h)**
Input (kJ/h)	13,789	13,080	**(Btu/h)**

Test Load Weight (dry kg)	2.09	4.60	**dry lb**
MC wet (%)	6.074		
MC dry (%)	6.47		
Particulate (g)	N/A		
CO (g)	125		
Test Duration (h)	3.00		

Emissions	**Particulate**	**CO**
g/MJ Output	#VALUE!	4.97
g/kg Dry Fuel	#VALUE!	59.75
g/h	#VALUE!	41.59
lb/MM Btu Output	#VALUE!	11.54

Air/Fuel Ratio (A/F)	43.67

VERSION: 2.2 12/14/2009

VERSION: 2.2 12/14/2009

Manufacturer: SIERRA
Model: EASY FIRE
Date: 10.21.16
Run: EPA 1
Control #:
Test Duration: 180
Output Category: LOW

Appliance Type: Non-Cat (Cat, Non-Cat, Pellet)

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

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

Wood Moisture (% wet):	6.07	
Load Weight (lb wet):	4.90	
Burn Rate (dry kg/h):	0.70	
Total Particulate Emissions:	N/A	g

Fuel Data

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurence and the next reading showing a decrease in weight.

Averages		**0.13**	**2.68**	**18.20**	**274.32**	**62.00**
					Temp. (°F)	
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas Composition (%) CO**	**CO_2**	**O_2**	**Flue Gas**	**Room Temp**
0	4.90	0.10	3.94	16.95	338.0	62.0
10	4.40	0.13	2.31	18.57	287.0	62.0
20	4.20	0.14	2.73	18.14	276.0	62.0
30	4.00	0.13	2.41	18.47	267.0	62.0
40	3.80	0.11	2.90	17.99	273.0	62.0
50	3.60	0.13	2.75	18.13	273.0	62.0
60	3.40	0.11	2.78	18.11	279.0	62.0
70	3.00	0.21	2.03	18.81	268.0	62.0
80	2.70	0.11	3.20	17.69	286.0	62.0
90	2.50	0.09	3.45	17.45	277.0	62.0
100	2.20	0.09	2.93	17.97	281.0	62.0
110	1.90	0.10	3.65	17.24	277.0	62.0
120	1.60	0.17	2.11	18.75	261.0	62.0
130	1.30	0.11	2.63	18.26	270.0	62.0
140	1.10	0.12	2.48	18.40	266.0	62.0
150	0.80	0.14	2.21	18.66	262.0	62.0
160	0.60	0.17	1.81	19.05	253.0	62.0
170	0.30	0.13	2.58	18.30	264.0	62.0
180	0.00	0.13	1.96	18.92	254.0	62.0

MYREN CONSULTING, INC.
Dilution Tunnel Traverse Data with 8
Traverse Points Rev 3, 10.2.16

Unit: Thelin Easy Fire
Run #: EPA 1
Date: 10/21/16
Technicians: AM, ESS
TIME: 1817

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	T_{trav}	T_{cent}
W-1	0.5"	.043	.207 ✓			86	
2	1.5	.044	.210 ✓			87	
Center	Center			.042	.205 ✓		87
3	4.5	.040	.200 ✓			87	
4	5.5	.035	.187 ✓			86	
S-1	0.5	.041	.202 ✓			86	
2	1.5	.043	.207 ✓			86	
Center	Center			.043	.207 ✓		86
3	4.5	.039	.197 ✓			86	
4	5.5	.039	.197 ✓			85	
	Totals		1.607 ✓		.412 ✓	689 ✓	173 ✓
	Average		.2009 ✓		.2060 ✓	86.1 ✓	86.5 ✓
	°R = (°F + 460)					546.1 ✓	546.5 ✓

BP = 28.40 "Hg Ps = BP = 28.40 " Hg

LEAK CHECKS: Manometer Pre Test Check - Level: OK ✓ Zeroed: OK ✓ Tech: [illegible]

Manometer Post Test Check - Level: OK ✓ Zeroed: OK ✓ Tech: [illegible]

Pg Leg: Pre Test: Pressure: 6.900 " H_2O Movement: .000 " H_2O Tech: [illegible]

Post Test: Pressure: 6.480 " H_2O Movement: .000 " H_2O Tech: [illegible]

Velocity Head Leg: Pre Test: Pressure: 6.410 " H_2O Movement: .000 " H_2O Tech: [illegible]

Post Test: Pressure: 7.580 " H_2O Movement: .000 " H_2O Tech: [illegible]

MYREN CONSULTING, INC. **ASTM E2515 DATA SHEET # 5-2** **PAGE 2 OF 2**

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS

Rev 6/6/11

UNIT: Thelin Easy Fire DATE: 10/21/16 RUN #: EPA 1 TECHNICIAN(S): ATM ESS

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515 EQN 7)

(9) V_{strav} = (85.49) (0.99 cp) (.2009 $\bar{X}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{546.1 \text{ Ts °A}}{(28.40 \text{ Ps "Hg}) (28.78 \text{ lb./ lb. mole})}}$ = 13.89831 fps

{4} {1} {3} {5}

(9A) Vs = (13.89831 fps) (60) = 833.899 fpm

{5} {3}

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515 EQN 7)

(9) Vscent = (85.49) (0.99 cp) (.2060 $\bar{X}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{546.5 \text{ Ts °A}}{(28.40 \text{ Ps "Hg}) (28.78 \text{ lb./ lb. mole})}}$ = 14.25635 fps

{4} {1} {3} {5}

(9A) Vs = (14.25635 fps) (60) = 855.381 fpm

{5} {3}

EPA M5G1 Section 4.2.2, ASTM E 2515 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

Fp = Vstrav/ Vscent = 13.89831 ÷ 14.25635 = .97489

{5} {5} {5}

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515 EQN 3)

(10) Qsd = 3600 (1 - 0.02 Bws) (13.89831 fps) (.1963 ft^2) [(528 °A) (28.40 Ps "Hg) / (546.1 T_s °A) (29.92" Hg) =

{5} {4} {3} {1}

8833.430 dscfhr (or dscfh)

{3}

(10A) 8833.430 dscfhr ÷ 60 = 147.22 dscfmin (or dscfm)

{3} {2}

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

EPA 1 T 1 10.21.16

DILUTION TUNNEL CALCULATIONS — MYREN CONSULTING CERTIFICATION TEST DATA

4/15/10, Ms=28.78, Bws=2.0%

	6"Tunnel
File Name:	EPA 1 T 1
Manufacturer:	SIERRA
Model Number:	EASY FIRE
Lab Name:	MYREN
Test Date:	10.21.16
Run Number:	EPA 1 T 1
Meter Box Y Factor:	0.9688
Barometric Pressure (in Hg):	28.433
Dry Gas Meter Temp(avg.)(F):	**83**
Delta H(Avg.)(in H2)):	**0.900**
Gas meter initial reading:	299.5000
Gas meter final reading:	494.7460
Total Particulate Catch(mg):	16.6
Sampling Flow Rate(cfm):	0.542
Tunnel Flow (Qsd) (dscfm)	**140.891**
Emission Rate(g/hr):	**0.802**
Emission Factor(g/kg)	**0.840**
Avg. of Delta P Sq. Roots:	**0.1990**
Vs (Avg.)(ft/min):	**812.184**
Tunnel Avg. Temperature (F):	**96.432**
Test time(min):	360
Fuel Load: (lbs. Dry):	12.6330
Wood moisture(%wet):	6.074
Burn rate(dry kg/hr):	**0.955**
Sample Volume (dscf)	**175.003**
Avg. Tunnel Static (-inch H2O):	**0.0000**
Room Blank Catch (mg/dscf):	0
Total PM Emissions(Er))(g):	**4.8112**
Pitot Correction Factor:	0.97489
Front Filter Number:	249, 347
Back Filter Number:	248, 346
Beaker number:	37, 32
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	EASY FIRE
RUN:	EPA 1 T 1
DATE:	10.21.16
DBR:	0.955
EMISSION RATE (g/hr)(unadj):	0.8019
EMISSION FACTOR (g/kg):	0.8396
AVG. % PROPORTIONALITY :	99.539

RUN TIME (min)	PITOT DELTAP (in H2O)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER READING (M3)
0	0.040	109	299.500	61	0.900	825.63			0.000	0.20000	
10	0.040	109	305.122	66	0.900	825.63	112.3	5.230	0.000	0.20000	
20	0.039	110	310.310	69	0.900	820.80	102.5	4.790	0.000	0.19748	
30	0.039	110	315.580	73	0.900	815.96	103.4	4.834	0.000	0.19748	
40	0.039	110	320.627	76	0.900	815.96	98.1	4.599	0.000	0.19748	
50	0.039	111	325.830	79	0.900	816.32	100.0	4.715	0.000	0.19748	
60	0.039	112	331.146	81	0.900	817.04	101.4	4.795	0.000	0.19748	
70	0.040	102	336.488	82	0.900	819.00	100.3	4.805	0.000	0.20000	
80	0.040	99	341.850	82	0.900	819.44	99.2	4.818	0.000	0.20000	
90	0.040	99	347.236	83	0.900	818.35	99.3	4.835	0.000	0.20000	
100	0.040	98	352.629	84	0.900	817.98	99.0	4.833	0.000	0.20000	
110	0.040	98	358.045	84	0.900	817.61	99.2	4.849	0.000	0.20000	
120	0.040	99	363.453	85	0.900	817.98	99.0	4.837	0.000	0.20000	
130	0.040	99	368.885	85	0.900	818.35	99.3	4.854	0.000	0.20000	
140	0.040	100	374.324	85	0.900	818.71	99.5	4.861	0.000	0.20000	
150	0.040	99	379.766	86	0.900	818.71	99.3	4.859	0.000	0.20000	
160	0.040	99	385.198	86	0.900	818.35	98.9	4.845	0.000	0.20000	
170	0.040	100	390.647	86	0.900	818.71	99.3	4.861	0.000	0.20000	
180	0.040	100	396.098	86	0.900	819.08	99.4	4.862	0.000	0.20000	
190	0.040	93	401.543	86	0.900	816.51	98.8	4.857	0.000	0.20000	
200	0.040	91	406.997	87	0.900	813.21	98.3	4.861	0.000	0.20000	
210	0.040	90	412.457	87	0.900	812.10	98.2	4.862	0.000	0.20000	
220	0.040	89	417.935	87	0.900	811.36	98.5	4.878	0.000	0.20000	
230	0.040	89	423.409	87	0.900	810.99	98.4	4.874	0.000	0.20000	
240	0.040	90	428.880	87	0.900	811.36	98.4	4.871	0.000	0.20000	
250	0.040	90	434.371	87	0.900	811.73	98.8	4.889	0.000	0.20000	
260	0.040	90	439.826	87	0.900	811.73	98.2	4.857	0.000	0.20000	
270	0.040	90	445.328	88	0.900	811.73	98.8	4.894	0.000	0.20000	
280	0.040	90	450.818	87	0.900	811.73	98.6	4.884	0.000	0.20000	
290	0.040	89	456.310	87	0.900	811.36	98.8	4.890	0.000	0.20000	
300	0.040	88	461.799	87	0.900	810.62	98.6	4.887	0.000	0.20000	
310	0.040	89	467.297	87	0.900	810.62	98.8	4.895	0.000	0.20000	
320	0.040	88	472.781	87	0.900	810.62	98.5	4.883	0.000	0.20000	
330	0.040	88	478.259	87	0.900	810.25	98.4	4.878	0.000	0.20000	
340	0.040	87	483.749	87	0.900	809.88	98.5	4.888	0.000	0.20000	
350	0.040	87	489.241	87	0.900	809.51	98.5	4.890	0.000	0.20000	
360	0.040	87	494.746	87	0.900	809.51	98.8	4.902	0.000	0.20000	
370											
380											

EPA 1 T 1 0-60

DILUTION TUNNEL CALCULATIONS — MYREN CONSULTING CERTIFICATION TEST DATA

1\25\09, Md=28.56, Bws=4% 6" Tunnel

File Name:	EPA 1 T 1 0-60
Manufacturer:	SIERRA
Model Number:	EASY FIRE
Lab Name:	MYREN
Test Date:	10.21.16
Run Number:	EPA 1 T 1 0-60
Meter Box Y Factor:	0.9688
Barometric pressure (in):	28.48
Gas meter temp (ave):	**72**
delta H(avg):	**0.900**
Gas meter initial reading:	299.5000
Gas meter final reading:	331.1460
Front catch (acetone) mg:	3.8
first filter catch (mg):	-0.8
second filter catch (mg):	0
Tunnel Flow (Qsd) (dscfm)	**136.730**
Emission Rate(g/hr):	**0.848**
Emission Rate(M5H) :	**1.588**
Avg. of Delta P Sq. Roots:	**0.1982**
Vs (Avg.)(ft/min):	**823.080**
Tunnel Avg. Temperature (F):	**110.143**
Test time(min):	60
Fuel Load(lb. wet):	3.500
Wood moisture(%wet):	6.074
Burn rate(dry kg/hr):	**1.491**
Sample Volume (dscf)	**29.012**
Avg. Tunnel Static (-inch H2O):	**0.0000**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**0.5689**
Pitot Correction Factor:	0.97489
front filter number	249
back filter number	248
Beaker Number:	37
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	EASY FIRE
RUN:	EPA 1 T 1 0-60
DATE:	10.21.16
DBR:	1.491
EMISSION RATE (g/hr)(M5H)	1.5877
EMISSION FACTOR (g/kg):	0.5689
AVG. % PROPORTIONALITY :	99.997

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
0	0.040	109	299.500	61	0.900	828.12			0.000	0.20000	
10	0.040	109	305.122	66	0.900	829.28	109.2	5.239	0.000	0.20000	
20	0.039	110	310.310	69	0.900	824.43	99.5	4.798	0.000	0.19748	
30	0.039	110	315.580	73	0.900	819.57	100.5	4.842	0.000	0.19748	
40	0.039	110	320.627	76	0.900	819.57	95.2	4.606	0.000	0.19748	
50	0.039	111	325.830	79	0.900	819.93	97.1	4.722	0.000	0.19748	
60	0.039	112	331.146	81	0.900	820.65	98.4	4.803	0.000	0.19748	
80											
90											
100											
110											
120											
130											
140											
150											
160											
170											
180											
190											
200											
210											
220											
230											
240											
250											
260											
270											
280											
290											
300											
310											
320											
330											
340											
350											
360											
370											
380											

T1 0-60

Method 5G Particulate Sampling Data

Unit: Easy Rider
Run: EHA 1
Date: 10/21/2016
Page: 1 of _____ Rev 12/15

Meter Box 456-P Meter Y 0.9688 Filter #'s: (F) 249 (R) 248

.8525/.8525 Filter/O-Ring ID #: —

Pre Test Leak Check: .000 CFM@ -18.0 in Hg Filter Size: Reg. 110 mm

.827/.827 Probe ID #: —

Post Test Leak Check: .000 CFM@ -11.25 in Hg Probe Length: 36 in SS

Time		Meter Reading (m^3) (ft^3)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1200	00	299.500	.040		109	61	0.90	0
10	10	305.122	.040		109	66	.90	0
20	20	310.310	.039		110	69	.90	0
30	30	315.580	.039		110	73	.90	0
40	40	320.627	.039		110	76	.90	0
50	50	325.830	.039		111	79	.90	0
1300	60	331.146	.039		112	81	.90	0
	70							
	80							
	90							
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00	28.49		
60	28.47		
	Avg. = 28.48		in Hg"

Pre Test Filter Tare Weight Check
F 1.2724
R _____

End of Test Weight
F 1.2725 R _____

1.2725
.0000

Metallic T1-60+

Method 5G Particulate Sampling Data

Unit: EPA 54 / T1.215
Run: EPA 1
Date: 10 / 31 / 2016
Page: 1 of 2 Rev 12/15

Meter Box 5G-P Meter Y 0.968 Filter #'s: (F) 347 (R) 346

.918/.918

Filter/O-Ring ID #: —

Pre Test Leak Check: .000 CFM@ -18.0 in Hg Filter Size: Reg 110 mm

.768/.768

Probe ID #: —

Post Test Leak Check: .000 CFM@ -11.25 in Hg Probe Length: 24" in Glass

Time		Meter Reading (ft^3)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
	00							
	10							
	20							
	30							
	40							
	50							
1300	(60)	331.146	.039		112	81	.90	0
10	70	336.488	.040		102	82	.90	0
20	80	341.850	.040		99	82	.90	0
30	90	347.236	.040		99	83	.90	0
40	100	352.629	.040		98	84	.90	0
50	110	358.045	.040		98	84	.90	0
1400	(120)	363.453	.040		99	85	.90	0
10	130	368.885	.040		99	85	.90	0
20	140	374.324	.040		100	85	.90	0
30	150	379.766	.040		99	86	.90	0
40	160	385.198	.040		99	86	.90	0
50	170	390.647	.040		100	86	.90	0
1500	(180)	396.098	.040		100	86	.90	0
10	190	401.543	.040		93	86	.90	0

BP

00	28.49	300	28.40
60	28.47	360	28.40
120	28.45		
180	28.42		
240	28.40		

Avg. = 28.433 in Hg"

Pre Test Filter Tare Weight Check
F 1.2619
R

End of Test Weight
F 1.2709 R

1.2619
.0090

metallic T1-607

Method 5G Particulate Sampling Data

Unit: Easy Fire
Run: EPA 1
Date: 10/21/2016
Page: 2 of 2 Rev 12/15

Meter Box 456-P Meter Y 0.9688 Filter #'s: (F) 347 (R) 346

.918/.918 Filter/O-Ring ID #:

Pre Test Leak Check: .000 CFM@ −18.0 in Hg Filter Size: Reg 110 mm

.768/.768 Probe ID #:

Post Test Leak Check: .000 CFM@ −1.25 in Hg Probe Length: 24 in Glass

Time		Meter Reading (ft³)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1520	200	406.997	.040		91	87	.90	0
30	210	412.457	.040		90	87	.90	0
40	220	417.935	.040		89	87	.90	0
50	230	423.409	.040		89	87	.90	0
1600	(240)	428.880	.040		90	87	.90	0
10	250	434.371	.040		90	87	.90	0
20	260	439.826	.040		90	87	.90	0
30	270	445.328	.040		90	88	.90	0
40	280	450.818	.040		90	87	.90	0
50	290	456.310	.040		89	87	.90	0
1700	(300)	461.799	.040		88	87	.90	0
10	310	467.297	.040		89	87	.90	0
20	320	472.781	.040		88	87	.90	0
30	330	478.259	.040		88	87	.90	0
40	340	483.749	.040		87	87	.90	0
50	350	489.241	.040		87	87	.90	0
1800	(360)	494.746	.040		87	87	.90	0
	70							
	80							
	90							

BP

00	28.49	300	28.40
60	28.47	360	28.40
180	28.45		
180	28.42		
240	28.40	Avg. =	28432 in Hg"

Pre Test Filter Tare Weight Check
F 1.2619
R

End of Test Weight
F 1.2709 R

1.2619

.0090

Woodstove Data Sheet #4-1: Initial Filter Weights (Tare Weights)

Into Dessicator: Date 6/14/15 Time 0900 By ATM Front Half X Back Half X

Manufacturer: PaM Size: 110 Lot.No.: 742414 Grade: AE Glass Mfn

Balance Used: Sartorius Model: CP224S SN: 24850860

Filter #	First Wt	20% Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
224												
225	1.2397	6/15	1448	ATM	1.2396	6/21	1150	ESS				
226												
227	1.2469	6/15	1449	ATM	1.2468	6/21	1149	ESS				
228												
229	1.2512	6/15	1451	ATM	1.2509	6/21	1148	ESS	1.2509	6/24	1547	ATM
230												
231	1.2587	6/15	1452	ATM	1.2587	6/21	1146	ESS				
232												
233	1.2618	6/15	1453	ATM	1.2619	6/21	1145	ESS				
234												
235	1.2579	6/15	1454	ATM	1.2576	6/21	1144	ESS	1.2575	6/24	1550	ATM
236												
237	1.2615	6/15	1455	ATM	1.2614	6/21	1143	ESS				
238												
239	1.2623	6/15	1456	ATM	1.2623	6/21	1142	ESS				
240												
241	1.2679	6/15	1457	ATM	1.2678	6/21	1140	ESS				
242												
243	1.2619	6/15	1458	ATM	1.2617	6/21	1139	ESS				
244												
245	1.2627	6/15	1459	ATM	1.2625	6/21	1138	ESS				
246												
247	1.2668	6/15	1501	ATM	1.2666	6/21	1136	ESS	← T2			

Checked by A.T. Myrem **Date:** 6/24/15 **Time:** 1552

QA Reweigh

Filter #	WT	Date	Time	By
246/247	1.2668	6/25	1820	DMW
240/241	1.2679	6/25	1827	DMW
236/237	1.2613	6/25	1829	DMW
228/229	1.2509	6/25	1831	DMW

Balance Room Environmental Conditions

WB	DB	%RH	Date 2015	Time	By
52	63	46	6/15	1047	ATM
58	70	48	6/21	942	ESS
59	71	48	6/24	1520	ATM
56	68	48	6/25	1802	ATM

Post Weighing	Date	1st 6/15	2nd 6/21	3rd 6/24	4th 6/25	5th
	0.0000g	0.0000	0.0000	0.0000	0.0000	
Scale Check	100.0000g	99.9992	99.9992	99.9992	99.9993	

Woodstove Data Sheet #4-1: Initial Filter Weights (Tare Weights)

Into Dessicator: Date 6/14/15 Time 0900 By ATM Front Half X Back Half X

Manufacturer: Pall Size: 110 Lot.No.: 7424 14 Grade: AE Glass 1 µm

Balance Used: Sartorius Model: CP224S SN: 24850860

Filter #	First Wt	2016 Date	Time	By	Second Wt	2016 Date	Time	By	Third Wt	2016 Date	Time	By
248												
249	1.2725	6/15	1504	ATM	1.2725	6/21	1221	ESS	T10-60			
250												
251	1.2676	6/15	1506	ATM	1.2674	6/21	1221	ESS	RW			
253												
253	1.2364	6/15	1507	ATM	1.2364	6/21	1220	ESS	RW			
254												
255	1.2346	6/15	1508	ATM	1.2344	6/21	1219	ESS	-			
256												
257	1.2358	6/15	1510	ATM	1.2360	6/21	1218	ESS	RW			
258												
259	1.2415	6/15	1511	ATM	1.2415	6/21	1217	ESS	- [redacted]			
260												
261	1.2363	6/15	1511	ATM	1.2361	6/21	1215	ESS	RW			
262												
263	1.2390	6/15	1513	ATM	1.2390	6/21	1214	ESS	-			
264												
265	1.2556	6/15	1514	ATM	1.2556	6/21	1213	ESS				RW
266												
267	1.2566	6/15	1516	ATM	1.2562	6/21	1212	ESS	1.2564	6/24	1556	ATM
268												
269	1.2630	6/15	1517	ATM	1.2628	6/21	1211	ESS				RW
270												
271	1.2700	6/15	1518	ATM	1.2698	6/21	1210	ESS				RW

Checked by A.T. Myrum **Date:** 6/24/16 **Time:** 1557

QA Reweigh

Filter #	WT	Date	Time	By
266/269	1.2630	6/25	1846	[illegible]
264/265	1.2558	6/25	1847	[illegible]
256/257	1.2559	6/25	1850	[illegible]
252/253	1.2363	6/25	1852	[illegible]

Balance Room Environmental Conditions

WB	DB	%RH	Date 2016	Time	By
52	63	46	6/15	1047	ESS
58	70	48	6/21	942	ESS
59	71	48	6/24	1520	ATM
56	65	48	6/25	1802	ATM

Post	Date	1st 6/15	2nd 6/21	3rd 6/24	4th 6/25	5th
Weighing	0.0000g	0.0000	0.0000	0.0000	0.0000	
Scale Check	100.0000g	99.9992	99.9992	99.9992	99.9993	

Woodstove Data Sheet #4-1: Initial Filter Pair Tare Weights

Into Desiccator: Date: 6/24/16 Time: 1730 By: ATM Front Half X Back Half X

Manufacturer: Pall Size: 110 mm Lot. No.: T-42414 Grade: AE Glass 1.0 µm

Balance Used: Sartorius Model: CP224S SN: 24850860

Filter #'s	First Wt.	2016 Date	Time	By	Second Wt.	2016 Date	Time	By	Third Wt.	Date	Time	I
326/327	1.2311	8/2	1354	ESS	1.2315	8/18	1530	ATM	1.2312	9/8	0657	J
	1.2309	9/13	706	ATM	1.2312	9/18	1417	JW	1.2309	9/19	1745	A
328/329	1.2333	8/2	1355	ESS	1.2335	8/18	1531	ATM				
330/331	1.2335	8/2	1356	ESS	1.2337	8/18	1532	ATM				
332/333	1.2581	8/2	1358	ESS	1.2580	8/18	1533	ATM				
334/335	1.2630	8/2	1359	ESS	1.2632	8/18	1534	ATM	1.2635	9/8	0658	J
	1.2631	9/13	708	ATM	1.2639	9/18	1416	JW	1.2633	9/19	1730	AT
336/337	1.2579	8/2	1401	ESS	1.2580	8/18	1535	ATM				
338/339	1.2590	8/2	1402	ESS	1.2589	8/18	1536	ATM				
340/341	1.2638	8/2	1404	ESS	1.2638	8/18	1537	ATM				
342/343	1.2619	8/2	1405	ESS	1.2619	8/18	1538	ATM				
344/345	1.2643	8/2	1407	ESS	1.2643	8/18	1539	ATM				
346/347	1.2617	8/2	1408	ESS	1.2616	8/18	1540	ATM	1.2621	9/18	1418	JW
	1.2619	9/19	1732	AM	/EPA	1	T	1	60+			
348/349	1.2570	8/2	1409	ESS	1.2569	8/18	1541	ATM				

Checked by _____ **Date:** _____ **Time:** _____

QA Reweigh

Filter #	WT	Date	Time	By

Balance Room Environmental Conditions

WB	DB	%RH	Date 2016	Time	By
55	66	48	8/2	1345	ESS
54	65	48	8/18	1244	ATM
58	70	49	9/8	612	JAM
54	67	41	9/18	1200	JW

	1st	2nd	3rd	4th	5th
Date	8/2/16	8/18/16	9/8/16	9/18/16	
Post Weighing 0.0000g	0.0000	0.0000	.0000	.0000	
Scale Check 100.0000g	99.9993	99.9991	99.9998	99.9992	

Room Blank F. Filters WST5-Form 9, Pg2, Rev 12/09

Woodstove Data Sheet #4-1: Initial Filter Pair Tare Weights

Into Desiccator: Date: 6/24/16 Time: 1730 By: ATM Front Half X Back Half X

Manufacturer: Pall Size: 110 mm Lot. No.: 7424 14 Grade: AE Glass 1 µm

Balance Used: Sartorius Model: CP224S SN: 24850860

Filter #'s	First Wt.	2016 Date	Time	By	Second Wt.	2016 Date	Time	By	Third Wt.	2016 Date	Time	
301	.6172	6/29	1156	ATM	.6171	6/30	958	ESS	307 Ht. .6204	7/6	1043	E
302	.6207		1155	ATM	.6203		1002	ESS	.6206	7/2	1820	A
303	.6219		1154	ATM	.6214		1003	ESS	.6216	7/2	1818	A
304	.6215		1154	ATM	.6210		1004	ESS	.6212	7/2	1816	A
305	.6203		1153	ATM	.6201		1006	ESS				
306	.6222		1152	ATM	.6220		1007	ESS				
307	.6216		1151	ATM	.6215		1008	ESS				
308	.6227		1150	ATM	.6223		1009	ESS	.6224	7/2	1814	A
309	.6206		1149	ATM	.6204		1010	ESS	RB T3			
310	.6212		1148	ATM	.6207		1011	ESS	.6207	7/2	1813	A
311	.6291		1148	ATM	.6288		1013	ESS	.6289	7/2	1812	A
312	.6295		1146	ATM	.6292		1014	ESS	.6294	7/2	1811	A
313	.6280		1145	ATM	.6278		1015	ESS				
314	.6297		1139	ATM	.6299		1016	ESS				
315	.6331		1136	ATM	.6332		1017	ESS				
316	.6330		1135	ATM	.6330		1018	ESS				
317	.6326		1134	ATM	.6329		1019	ESS	.6329	7/2	1808	A
318	.6327		1134	ATM	.6337		1020	ESS				
319	.6358		1132	ATM	.6360		1021	ESS				
320	.6317		1132	ATM	.6321		1022	ESS	.6321	7/2	1807	A
321	.6322		1131	ATM	.6356		1024	ESS	.6357	7/2	1806	A
322	.6362		1130	ATM	.6365		1025	ESS	.6365	7/2	1805	A
323	.6330		1129	ATM	.6329		1026	ESS				
324	.6359		1127	ATM	.6361		1027	ESS				
325	.6342	6/29	1127	ATM	.6342	—	1028	ESS				

Checked by A.T. Myun Date: 7/17/16 Time: 1645

QA Reweigh

Filter #	WT	Date	Time	By
305	.6201	7/17	1717	Jm
312	.6292	7/17	1719	Jm
317	.6327	7/17	1720	Jm
322	.6363	7/17	1722	Jm

Balance Room Environmental Conditions

WB	DB	%RH	Date 2016	Time	By
56	68	48	6/29	1035	ATM
57	69	46	6/30	956	SSB
57	69	46	7/1	1746	ATM
62	75	47	7/6	955	ESS

	1st	2nd	3rd	4th	5th
Date	6/29	6/30	7/2/16	7/6/16	7/17/16
Post Weighing 0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000
Scale Check 100.0000g	99.9992	99.9993	99.9992	99.9992	99.9992

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Into Dessicator: Date 10/9/16 Time 1640 By ATM/JM

Balance Used: Sartorius Model: CP224S SN:24850860

	Bkr #	First Wt	2016 Date	Time	By	Second Wt	2016 Date	Time	By	Third Wt	Date	Time	By
	30	70.7845	10/15	1204	Jm	70.7858	10/17	1612	AM	70.7848	10/18	1959	Jm
	30	70.7843	10/19	1704	AM	70.7842	10/23	1408	AM	70.7841	10/25	1135	AM
	31	69.6656	10/15	1153	Jm	69.6657	10/17	1617	AM	69.6648	10/25	1442	AM
	31	69.6664	11/22	0906	Jm	69.6657	11/24	0810	AM				
	32	53.5984	10/15	1159	Jm	53.5997	10/17	1548	AM	53.5981	10/18	2015	Jm
EF Lot	32	53.5980	10/19	1652	ATM	← T1 60+							
	33	53.1483	10/15	1205	Jm	53.1498	10/17	1610	AM	53,1484	10/18	2060	Jm
EF 2	33	53.1484	10/19	1702	ATM	← T2							
	34	53.2618	10/15	1154	Jm	53.2632	10/17	1604	AM	53,2617	10/18	2008	Jm
73	34	53.2619	10/19	1706	ATM								
	35	53.2811	10/15	1200	Jm	53,2823	10/17	1608	AM	53,2821	10/18	1951	Jm
	35	53,2812	10/19	1710	ATM	53,2809	11/25	0812	Jm	53,2811	11/26	959	ATM
	36	53.5740	10/15	1202	Jm	53.5756	10/17	1606	AM	53.5749	10/18	1952	Jm
	36	53.5747	10/19	1708	ATM								
	37	53,7260	10/15	1157	Jm	53.7276	10/17	1550	AM	53.7259	10/18	2017	Jm
EF 060	37	53.7260	10/19	1649	ATM	← T1 0-60							
	38	53.2517	10/15	1152	Jm	53.2529	10/17	1613	AM	53.2521	10/18	2002	Jm
VCU 76	38	53,2522	10/19	1700	ATM								
	39	53.1496	10/15	1156	Jm	53.1508	10/17	1602	AM	53.1493	10/18	2013	Jm
EF 3	39	53.1491	10/19	1686	AM	← T3	RB						

Checked by_____ Date:_____ Time:_____

QA Reweigh

Beaker #	WT	Date	Time	By

Balance Room Environmental Conditions

WB	DB	%RH	Date	Time	By
56	67	49	10/15	1002	ATM
55	66	48	10/17	1523	ATM
56	68	46	10/18	1938	ATM
57	69	46	10/19	1548	ATM
			10/23		

	1st	2nd	3rd	4th	5th
Date	10/15/16	10/17/16	10/18/16	10/19/16	10/23
Post Weighing 0.0000g	0.0000	0.0000	0.0000	0.0000	
Scale Check 100.0000g	99.9992	99.9992	99.9992	99.9992	

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Into Dessicator: Date 7/18/16 Time 1745 By ATM
Balance Used: Sartorius Model: CP224S SN:24850860

Bkr #	First Wt	2016 Date	Time	By	Second Wt	2016 Date	Time	By	Third Wt	2016 Date	Time	By
40	53.4613	7/19	1532	ATM	53.4617	7/20	1135	ESS	53.4618	7/21	910	ATM
40												
41	52.8358	7/20	1150	ESS	52.8360	7/21	901	ATM	Blank	Tare		
41									↙			
42	53.8686	7/19	1817	ATM	53.8693	7/20	1150	ESS	53.8691	7/21	909	ATM
42												
43	53.2303	7/19	1530	ATM	53.2309	7/20	1141	ESS	53.2310	7/21	903	ATM
43	53.2302	8/4	1543	ATM	53.2307	8/6	1155	JM	53.2310	8/7	1144	ATM
44	70.0934	7/19	1542	ATM	70.0937	7/20	1148	ESS	70.0937	7/21	856	ATM
44												
45	69.8107	7/20	1137	ESS	69.8109	7/21	913	ATM				
45												
46	69.8099	7/19	1815	ATM	68.3644	7/20	1146	ESS	68.3646	7/21	912	ATM
46												
47	70.3554	7/19	1537	ATM	70.3556	7/20	1140	ESS				
47												
48	70.7885	7/19	1535	ATM	70.7889	7/20	1133	ESS	70.7888	7/21	907	ATM
48	70.7884	8/4	1545	ATM	70.7888	8/6	1153	JM	70.7888	8/7	1134	ATM
49	70.0456	7/19	1540	ATM	70.0460	7/20	1144	ESS	70.0460	7/21	905	ATM
49	70.0454	8/4	1548	ATM	70.0458	8/6	1149	JM	70.0460	8/7	1129	ATM
43	53.2301	8/14	1643	JM	53.2300	8/17	1410	ATM				

Checked by_____ **Date:**_____ **Time:**_____

QA Reweigh

Beaker #	WT	Date	Time	By

Balance Room Environmental Conditions

WB	DB	%RH	2016 Date	Time	By
58	71	45	7/19	1506	ATM
57	69	46	7/20	1110	ATM
55	66	48	7/21	836	ATM
56	67	49	8/4	1344	ATM
56	67	49	8/6	1117	JM

	1st	2nd	3rd	4th	5th
Date	7/19/16	7/20/16	7/21/16	8/4/16	8/6/16
Post Weighing 0.0000g	0.0000	0.0000	0.0000	0.0000	.0000
Scale Check 100.0000g	99.9992	99.9993	99.9993	99.9991	99.9991

8/17 0.0000 99.9992 8/17 0.0000 99.9992

Blank 50 ml
Fisher Optima Acetone Lot # 158570 7/23/16

Woodstove Data Sheet #4-3: Constant Final Weights

Unit EASY 1.25
Run # EPA 1
Date: 10/21/16
WST5-Form 9, Pg 1, Rev 10/10

Final Beaker Weights

Beaker	Into	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
42	53.8700	7/24	810	ATM	53.8693	7/25	1326	ESS	53.8688	8/4	1356	ATM	53.8687	8/6	1216	[illegible]

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F																	
R																	

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	2016 Date	Time	By	WB	DB	%RH
1	7/25	1324	ESS	56	68	46
2	8/4	1344	ATM	56	67	49
3	8/6	1117	ATM	56	67	49
4						
5						
6						
7						

Scale Room Environmental Conditions

8						
9						
10						
11						
12						

Comment Beaker ✓ wt. 53.8691
Tare Wt. 53.8691

T1
0-60

Unit EASY T2E
Run # EPA 1
Date: 10/21/2016

Woodstove Data Sheet #4-3: Constant Final Weights

WST5-Form 9, Pg 1, Rev 10/10

75 ml

Final Beaker Weights

Beaker	Into	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
37	53.7321	10/24	1859	ATM	53.7297	10/25	1749	[illegible]	53.7312	10/26	1508	ATM	53.7300	11/1	1149	ESS
					53.7298	11/2	1837	ATM								

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	248,949	1.2725	10/22	1400	ATM	1.2717	10/24	1758	ATM	1.2717	10/25	1807	[illegible]				
R																	

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	2016 Date	Time	By	WB	DB	%RH
1	10/24	1742	ATM	58	70	48
2	10/25	1712	ATM	58	70	48
3	10/26	1444	ATM	55	66	48
4	11/1	1132	ESS	57	69	46
5	11/2	1808	ATM	59	69	46
6						
7						

Scale Room Environmental Conditions

8						
9						
10						
11						
12						

Comment

Woodstove Data Sheet #4-3: Constant Final Weights

T1 60+

Unit EASY LIZE
Run # EP10 1
Date: 10/21/2016
WST5-Form 9, Pg 1, Rev 10/10

60 MJ

Final Beaker Weights

Beaker	Into	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
32	53.6054	10/24	1842	ATM	53.6042	10/25	1731	JMC	53.6053	10/26	1516	ATM	53.6044	11/1	1140	ESS
					53.6043	11/2	1827	ATM								

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	346,347	1.2709	10/22	829	ATM	1.1702	10/24	1813	ATM	1.2694	10/25	1759	JMC	1.2692	10/26	1528	ATM
R																	

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	Date (2016)	Time	By	WB	DB	%RH
1	10/24	1742	ATM	58	70	48
2	10/25	1712	ATM	58	70	48
3	10/26	1444	ATM	55	66	48
4	11/1	1132	ESS	57	69	46
5	11/2	1808	ATM	57	69	46
6						
7						

Scale Room Environmental Conditions

8						
9						
10						
11						
12						

Comment

Train 1 Woodstove Particulate Catch Processing Sheet
Woodstove Data Sheet #5
ASTM E 2515/ EPA M5G-1

T1
0-60
60+

Unit: EASY FIRE
Run: EPA 1 **Train** 1
Date: 10/21/2016
Technicians: ATM ESD
Revised 11/15 - Data Sheet #5

0-60 Minutes:
Filters:

Filter # (Front): 248,249 **Beaker #:** 37 **Final Wt.:** 53.7298 g
Tare Wt.: 1.2725 g **ml** 75 **Tare Wt.:** 53.7260 g
Filter # (Rear): _____ **Desiccant: Acetone** **Net Wt.:** .0038 g
Tare Wt.: _____ g **Beaker Tare Wt,. Check:** 53.7259 g
0-60 Minute Combined Filter Final Weight: 1.2717 g
0-60 Minute Combined Filter Tare Weight: 1.2725 g
0-60 Minute Combined Net Catch Weight: -.0008 g

60 Minutes Plus:

Filter # (Front): 346,347 **Beaker #:** 32 **Final Wt.:** 53.6043 g
Tare Wt.: 1.2619 g **ml** 60 **Tare Wt.:** 53.5980 g
Filter # (Rear): _____ **Desiccant: Acetone** **Net Wt.:** .0063 g
Tare Wt.: _____ g **Beaker Tare Wt. Check:** 53.5979 g
60 Minute Plus Combined Filter Final Weight: 1.2692 g
60 Minute Plus Combined Filter Tare Weight: 1.2619 g
60 Minute Plus Combined Net Catch Weight: .0073 g

Acetone Blank Calculation: Blank Date: 7/13/16 **Blank Beaker #:** 42 **Desiccant: 50 ml Acetone**
Final Wt.: 53.8687 g - **Tare Wt.:** 53.8691 g = **Net Catch Wt.:** -.0004 = .0000 g
Net Catch Weight: .0000 g / **50 ml Acetone =** .0000 **g/ml Acetone Blank Residual Value**

0-60 Minute Acetone Residue Value Calculation:
(.0000 g/ml Acetone)(75 ml Acetone) = .0000 g **Residue Value**

60 Minute Plus Acetone Residue Value Calculation:
(.0000 g/ml Acetone)(60 ml Acetone) = .0000 g **Residue Value**

Total Particulate Catch Calculations:	**0-60 Minute**	**60 Minute Plus**
Combined Filter Net Catch Weight:	-.0008 g	.0073 g
Acetone Wash Catch Weight:	.0038 g	.0063 g
Less Acetone Residual Value:	- .0000 g	- .0000 g
Equals Net Acetone Wash Catch:	.0038 g	.0062 g
Total Net Catch (Combined Filter + Acetone Catch):	.0030 g	.0136 g
	3.0 mg	13.6 mg

Total Train 1 Net Catch (0-60 Minute + 60 Minute Plus Catches): 16.6 mg

EPA 1 T 2 10.21.16

DILUTION TUNNEL CALCULATIONS — MYREN CONSULTING CERTIFICATION TEST DATA

4/15/10, Ms=28.78, Bws=2.0%

	6"Tunnel
File Name:	EPA 1 T 2
Manufacturer:	SIERRA
Model Number:	EASY FIRE
Lab Name:	MYREN
Test Date:	10.21.16
Run Number:	EPA 1 T 2
Meter Box Y Factor:	0.9664
Barometric Pressure (in Hg):	28.433
Dry Gas Meter Temp(avg.)(F):	**67**
Delta H(Avg.)(in H2)):	**0.075**
Gas meter initial reading:	962.5000
Gas meter final reading:	1144.4900
Total Particulate Catch(mg):	16.7
Sampling Flow Rate(cfm):	0.506
Tunnel Flow (Qsd) (dscfm)	**140.891**
Emission Rate(g/hr):	**0.843**
Emission Factor(g/kg)	**0.883**
Avg. of Delta P Sq. Roots:	**0.1990**
Vs (Avg.)(ft/min):	**812.184**
Tunnel Avg. Temperature (F):	**96.432**
Test time(min):	360
Fuel Load: (lbs. Dry):	12.6330
Wood moisture(%wet):	6.074
Burn rate(dry kg/hr):	**0.955**
Sample Volume (dscf)	**167.421**
Avg. Tunnel Static (-inch H2O):	**0.0000**
Room Blank Catch (mg/dscf):	0
Total PM Emissions(Er))(g):	**5.0593**
Pitot Correction Factor:	0.97489
Front Filter Number:	247
Back Filter Number:	246
Beaker number:	33
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	EASY FIRE
RUN:	EPA 1 T 2
DATE:	10.21.16
DBR:	0.955
EMISSION RATE (g/hr)(unadj):	0.8432
EMISSION FACTOR (g/kg):	0.8829
AVG. % PROPORTIONALITY :	99.598

RUN TIME (min)	PITOT DELTAP (in H2O)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER READING (M3)
0	0.040	109	962.500	60.0	0.075	825.63			0.000	0.20000	
10	0.040	109	967.485	61.0	0.075	825.63	101.7	4.643	0.000	0.20000	
20	0.039	110	972.498	62.0	0.075	820.80	102.3	4.660	0.000	0.19748	
30	0.039	110	977.510	63.0	0.075	815.96	102.5	4.650	0.000	0.19748	
40	0.039	110	982.536	63.0	0.075	815.96	102.9	4.659	0.000	0.19748	
50	0.039	111	987.578	64.0	0.075	816.32	103.1	4.669	0.000	0.19748	
60	0.039	112	992.634	64.5	0.075	817.04	103.2	4.676	0.000	0.19748	
70	0.040	102	997.669	65.0	0.075	819.00	101.6	4.652	0.000	0.20000	
80	0.040	99	1002.691	65.0	0.075	819.44	100.0	4.637	0.000	0.20000	
90	0.040	99	1007.735	65.5	0.075	818.35	100.1	4.656	0.000	0.20000	
100	0.040	98	1012.779	66.5	0.075	817.98	99.8	4.649	0.000	0.20000	
110	0.040	98	1017.780	66.5	0.075	817.61	98.7	4.605	0.000	0.20000	
120	0.040	99	1022.817	67.0	0.075	817.98	99.4	4.636	0.000	0.20000	
130	0.040	99	1027.896	67.0	0.075	818.35	100.2	4.672	0.000	0.20000	
140	0.040	100	1032.928	67.0	0.075	818.71	99.3	4.629	0.000	0.20000	
150	0.040	99	1037.968	67.5	0.075	818.71	99.3	4.634	0.000	0.20000	
160	0.040	99	1043.005	67.5	0.075	818.35	99.1	4.629	0.000	0.20000	
170	0.040	100	1048.054	68.0	0.075	818.71	99.4	4.638	0.000	0.20000	
180	0.040	100	1053.104	68.5	0.075	819.08	99.2	4.635	0.000	0.20000	
190	0.040	93	1058.189	68.5	0.075	816.51	99.3	4.665	0.000	0.20000	
200	0.040	91	1063.282	68.5	0.075	813.21	99.0	4.672	0.000	0.20000	
210	0.040	90	1068.373	68.5	0.075	812.10	99.0	4.670	0.000	0.20000	
220	0.040	89	1073.443	68.5	0.075	811.36	98.5	4.651	0.000	0.20000	
230	0.040	89	1078.505	68.5	0.075	810.99	98.4	4.643	0.000	0.20000	
240	0.040	90	1083.578	68.5	0.075	811.36	98.7	4.654	0.000	0.20000	
250	0.040	90	1088.664	68.5	0.075	811.73	99.0	4.665	0.000	0.20000	
260	0.040	90	1093.728	69.0	0.075	811.73	98.4	4.643	0.000	0.20000	
270	0.040	90	1098.796	69.0	0.075	811.73	98.4	4.645	0.000	0.20000	
280	0.040	90	1103.867	69.0	0.075	811.73	98.5	4.647	0.000	0.20000	
290	0.040	89	1108.948	69.0	0.075	811.36	98.6	4.656	0.000	0.20000	
300	0.040	88	1114.023	69.5	0.075	810.62	98.3	4.649	0.000	0.20000	
310	0.040	89	1119.099	69.5	0.075	810.62	98.2	4.647	0.000	0.20000	
320	0.040	88	1124.175	69.5	0.075	810.62	98.2	4.647	0.000	0.20000	
330	0.040	88	1129.249	69.5	0.075	810.25	98.1	4.646	0.000	0.20000	
340	0.040	87	1134.318	69.5	0.075	809.88	98.0	4.641	0.000	0.20000	
350	0.040	87	1139.399	68.5	0.075	809.51	98.4	4.656	0.000	0.20000	
360	0.040	87	1144.490	68.5	0.075	809.51	98.8	4.670	0.000	0.20000	
370											
380											

T2

Method 5G Particulate Sampling Data

Unit: Easy Fire
Run: EPA 1
Date: 10 / 21 / 16
Page: 1 of 2 Rev 12/15

Meter Box 511-M Meter Y 0.9664 Filter #'s: (F) 247 (R) 246

.845 / .840

Filter/O-Ring ID #: —

Pre Test Leak Check: .003 CFM@ -21.25 in Hg Filter Size: Req 110 mm

.5495 / .550

Probe ID #: —

Post Test Leak Check: .005 CFM@ -16.2 in Hg Probe Length: 24 in glass

Time		Meter Reading (m^3)(ft^3)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1200	00	962.500	.040	—	109	60	.75	0.0
10	10	967.485	.040		109	61	.75	0
20	20	972.498	.039		110	62	.75	0
30	30	977.510	.039		110	63	.75	0
40	40	982.536	.039		110	63	.75	0
50	50	987.578	.039		111	64	.75	0
1300	60	992.634	.039		112	64.5	.75	0
10	70	997.669	.040		102	65	.75	0
20	80	1002.691	.040		99	65	.75	0
30	90	1007.735	.040		99	65.5	.75	0
40	100	1012.779	.040		98	66.5	.75	0
50	110	1017.780	.040		98	66.5	.75	0
1400	120	1022.817	.040		99	67	.75	0
10	130	1027.896	.040		99	67	.75	0
20	140	1032.928	.040		100	67	.75	0
30	150	1037.968	.040		99	67.5	.75	0
40	160	1043.005	.040		99	67.5	.75	0
50	170	1048.054	.040		100	68	.75	0
1500	180	1053.104	.040		100	68.5	.75	0
10	190	1058.189	.040		93	68.5	.75	0

BP

00	28.49	300	28.40
60	28.47	360	28.40
120	28.45		
180	28.42		
240	28.40		

Avg. = 28.433 in Hg"

Pre Test Filter Tare Weight Check
F 1.2666
R —

End of Test Weight
F 1.2777 R —

1.2666
.0111

T2

Method 5G Particulate Sampling Data

Unit: Easy Fire
Run: EPA 1
Date: 10/21/16
Page: 2 of 2 Rev 12/15

Meter Box 511-M Meter Y 0.9664 Filter #'s: (F) 247 (R) 246

.845 / .848

Filter/O-Ring ID #: —

Pre Test Leak Check: .003 CFM@ -21.25 in Hg Filter Size: Reg 110 mm

.5495 / .550

Probe ID #: —

Post Test Leak Check: .0005 CFM@ -16.2 in Hg Probe Length: 24 in Glass

Time		Meter Reading (m^3)(ft^3)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1520	200	1063.282	.040		91	68.5	.75	0
30	210	1068.373	.040		90	68.5	.75	0
40	220	1073.443	.040		89	68.5	.75	0
50	230	1078.505	.040		89	68.5	.75	0
1600	(240)	1083.578	.040		90	68.5	.75	0
10	250	1088.664	.040		90	68.5	.75	0
20	260	1093.728	.040		90	69	.75	0
30	270	1098.796	.040		90	69	.75	0
40	280	1103.867	.040		90	69	.75	0
50	290	1108.948	.040		89	69	.75	0
1700	(300)	1114.023	.040		88	69.5	.75	0
10	310	1119.099	.040		89	69.5	.75	0
20	320	1124.175	.040		88	69.5	.75	0
30	330	1129.249	.040		88	69.5	.75	0
40	340	1134.318	.040		87	69.5	.75	0
50	350	1139.399	.040		87	68.5	.75	0
1800	(360)	1144.490	.040		87	68.5	.75	0
	70							
	80							
	90							

BP

00	28.49	300	28.40
60	28.47	360	28.40
120	28.45		
180	28.42		
240	28.40		

Avg. = 28.433 in Hg"

Pre Test Filter Tare Weight Check
F 1.2666
R _____

End of Test Weight
F 1.2771 R _____

1.2666

.0111

Woodstove Data Sheet #4-3: Constant Final Weights

T2

Unit EASY F.125
Run # 15[illegible]1
Date: 10 / 21 / 2016

WST5-Form 9, Pg 1, Rev 10/10

70 M1

Final Beaker Weights

Beaker	Into	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
33	53.1575	10/24	1840	AM	53.1556	10/25	1735	JWL	53.1570	10/26	1514	AM	53.1553	11/1	1143	ESS
					53.1551	11/2	1841	ATM								

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	246, 247	1.2777	10/22	0945	ATM	1.2768	10/24	1804	ATM	1.2766	10/25	1810	JWL				
R																	

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	2016 Date	Time	By	WB	DB	%RH
1	10/24	1742	ATM	58	70	48
2	10/25	1712	ATM	58	70	48
3	10/26	1444	AM	55	66	48
4	11/1	1132	ESS	57	69	46
5						
6						
7						

Scale Room Environmental Conditions

8						
9						
10						
11						
12						

Comment

Train 2/ Room Blank Woodstove
Particulate Catch Processing Sheet T2
Woodstove Data Sheet #5
ASTM E 2515/ EPA M5G-1

Unit: BASY LARGE
Run: Effic 1 **Train** 2
Date: 10 / 21 / 2016
Technicians: ATM ESS
Revised 11/15 - Data Sheet #5A

Filters:

Filter # (Front): 246, 147 **Beaker #:** 33 **Final Wt.:** 53,1551 g
Tare Wt.: 1,2666 g **ml** 70 **Tare Wt.:** 53.1484 g
Filter # (Rear): _____ **Desiccant: Acetone** **Net Wt.:** .0067 g
Tare Wt.: _____ g **Beaker Tare Wt,. Check:** 53.1483 g
Combined Filter Final Weight: 1.2766 g
Combined Filter Tare Weight: 1.2666 g
Combined Net Catch Weight: .0100 g

Acetone Blank Calculation: **Blank Date:** 7/13/16 **Blank Beaker #:** 42 **Desiccant: 50 ml Acetone**
Final Wt.: 53.8687 g - **Tare Wt.:** 53.8691 g = **Net Catch Wt.:** -.0004 = 0.0000 g
Net Catch Weight: .0000 g / **50 ml Acetone =** .0000 **g/ml Acetone Blank Residual Value**

Acetone Residue Value Calculation:
(.0000 **g/ml Acetone)(** 70 **ml Acetone) =** .0000 **g Residue Value**

Total Particulate Catch Calculations:

Combined Filter Net Catch Weight: .0100 g
Acetone Wash Catch Weight: .0067 g
Less Acetone Residual Value: - .0000 g
Equals Net Acetone Wash Catch: .0067 g
Total Net Catch (Combined Filter + Acetone Catch): .0167 g
16.7 mg

ROOM BLANK SAMPLE FLOW PROPORTIONALITY

MYREN CONSULTING CERTIFICATION TEST DATA

5/1/2008

File Name:	EPA 1 T 3
Manufacturer:	SIERRA
Model Number:	EASY FIRE
Lab Name:	MYREN
Test Date:	10.21.16
Run Number:	EPA 1 T 3
Initial Meter Reading (cf):	9983.9155
Final Meter Reading (cf):	10160.6618
Test Time (Min):	360.0
Average Sample Rate (cfm):	0.4910
Preliminary Results:	
Final results:	AUDITED
BP:	28.433
Average Δh:	0.110
Avg. Dry Gas Meter Temp (F):	68.3
Sample Volume (dscf):	164.017
Dry Gas Meter Y:	0.9771
Total Room Blank Catch (mg):	0.000
Room Blank mg/dscf	0.000000
Avg. Sampling Rate $\Delta s(s)$:	-0.554

RUN TIME (min)	GAS METER READING (Cu, Ft,)	INTERVAL SAMPLE VOLUME (Cu. Ft.)	SAMPLING RATE % DIFFERENCE	INTERVAL SAMPLING RATE (cfm)	DRY GAS METER READING (M3)	DRY GAS METER Δh	DRY GAS TEMP F
0	9983.9155				282.7130	0.110	60.0
10	9988.8524	4.9370	0.0000	0.49370	282.8528	0.110	61.0
20	9993.7329	4.8805	-1.1445	0.48805	282.9910	0.110	63.5
30	9998.5993	4.8664	-1.4306	0.48664	283.1288	0.110	64.5
40	10003.4091	4.8099	-2.5751	0.48099	283.2650	0.110	65.0
50	10008.2402	4.8310	-2.1459	0.48310	283.4018	0.110	65.5
60	10013.0748	4.8346	-2.0744	0.48346	283.5387	0.110	66.5
70	10017.9199	4.8452	-1.8598	0.48452	283.6759	0.110	66.5
80	10022.7828	4.8628	-1.5021	0.48628	283.8136	0.110	66.5
90	10027.6597	4.8770	-1.2160	0.48770	283.9517	0.110	67.5
100	10032.5084	4.8487	-1.7883	0.48487	284.0890	0.110	67.5
110	10037.3571	4.8487	-1.7883	0.48487	284.2263	0.110	68.0
120	10042.1882	4.8310	-2.1459	0.48310	284.3631	0.110	68.5
130	10047.0228	4.8346	-2.0744	0.48346	284.5000	0.110	68.5
140	10051.8538	4.8310	-2.1459	0.48310	284.6368	0.110	68.5
150	10056.7272	4.8734	-1.2876	0.48734	284.7748	0.110	68.5
160	10061.5936	4.8664	-1.4306	0.48664	284.9126	0.110	68.5
170	10066.4388	4.8452	-1.8598	0.48452	285.0498	0.110	69.5
180	10071.3864	4.9476	0.2146	0.49476	285.1899	0.110	69.5
190	10076.3269	4.9405	0.0715	0.49405	285.3298	0.110	70.5
200	10081.3133	4.9864	1.0014	0.49864	285.4710	0.110	70.5
210	10086.2574	4.9441	0.1431	0.49441	285.6110	0.110	70.0
220	10091.2297	4.9723	0.7153	0.49723	285.7518	0.110	70.5
230	10096.2126	4.9829	0.9299	0.49829	285.8929	0.110	70.5
240	10101.1884	4.9758	0.7868	0.49758	286.0338	0.110	70.5
250	10106.1113	4.9229	-0.2861	0.49229	286.1732	0.110	70.5
260	10111.0659	4.9546	0.3577	0.49546	286.3135	0.110	70.0
270	10116.0347	4.9688	0.6438	0.49688	286.4542	0.110	70.5
280	10120.9929	4.9582	0.4292	0.49582	286.5946	0.110	69.5
290	10125.9404	4.9476	0.2146	0.49476	286.7347	0.110	70.5
300	10130.8951	4.9546	0.3577	0.49546	286.8750	0.110	70.0
310	10135.8497	4.9546	0.3577	0.49546	287.0153	0.110	70.0
320	10140.8115	4.9617	0.5007	0.49617	287.1558	0.110	70.5
330	10145.7802	4.9688	0.6438	0.49688	287.2965	0.110	70.5
340	10150.7349	4.9546	0.3577	0.49546	287.4368	0.110	70.5
350	10155.6931	4.9582	0.4292	0.49582	287.5772	0.110	68.5
360	10160.6618	4.9688	0.6438	0.49688	287.7179	0.110	68.5

T3

Method 5G Particulate Sampling Data

Unit: Easy Tiger
Run: EPA 1
Date: 10 / 21 / 2016
Page: 1 of 2 Rev 12/15

Meter Box Tandem 3 Meter Y 0.9771 Filter #'s: (F) 310 (R) —

.6943/.69435 = .00005 cmm Filter/O-Ring ID #: —

Pre Test Leak Check: _____ CFM@ -16.0 in Hg Filter Size: Reo 110 mm

.7189/.7189 = .0000 CMM Probe ID #: —

Post Test Leak Check: .000 CFM@ -10.0 in Hg Probe Length: — in N/A

Time		Meter Reading (m^3)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1200	(00)	282.7130				60	.110	-2.5
10	10	282.8528				61	.110	-2.0
20	20	282.9910				63.5	.110	-2.0
30	30	283.1288				64.5	.110	-2.0
40	40	283.2650				65	.110	-2.0
50	50	283.4018				65.5	.110	-2.0
1300	(60)	283.5387				66.5	.110	-2.0
10	70	283.6759				66.5	.110	-2.0
20	80	283.8136				66.5	.110	-2.0
30	90	283.9517				67.5	.110	-2.0
40	100	284.0890				67.5	.110	-2.0
50	110	284.2263				68	.110	-2.0
1400	(120)	284.3631				68.5	.110	-2.0
10	130	284.5000				68.5	.110	-2.0
20	140	284.6368				68.5	.110	-2.0
30	150	284.7748				68.5	.110	-2.0
40	160	284.9126				68.5	.110	-2.0
50	170	285.0498				69.5	.110	-2.0
1500	(180)	285.1899				69.5	.110	-2.0
10	190	285.3298				70.5	.110	-2.0

BP

00	28.49	300	28.40
60	28.47	360	28.40
120	28.45		
180	28.42		
240	28.40	Avg. =	28.4133 in Hg"

Pre Test Filter Tare Weight Check
F .6208
R _____

Lots went into Beaker

End of Test Weight
F .6001 R _____
_____ _____
_____ _____
.6207 _____
-.0206

T3

Method 5G Particulate Sampling Data

Unit: Easy Fire
Run: EPA 1
Date: 10/21/2016
Page: 2 of 2 Rev 12/15

Meter Box Train 3 Meter Y 0.9771 Filter #'s: (F) 310 (R) —

.6942 / .69435 = .00005 cmm Filter/O-Ring ID #: —

Pre Test Leak Check: _____ CFM@ -16.0 in Hg Filter Size: Reg 110 mm

.7189 / .7189 .00000 cmm Probe ID #: —

Post Test Leak Check: .000 CFM@ -10.0 in Hg Probe Length: — in N/A

Time		Meter Reading (m^3)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1520	200	285.4710				70.5	.110	-2.0
30	210	285.6110				70	.110	-2.0
40	220	285.7518				70.5	.110	-2.0
50	230	285.8929				70.5	.110	-2.0
1600	(240)	286.0338				70.5	.110	-2.0
10	250	286.1732				70.5	.110	-2.0
20	260	286.3135				70	.110	-2.0
30	270	286.4542				70.5	.110	-2.0
40	280	286.5946				69.5	.110	-2.0
50	290	286.7347				70.5	.110	-2.0
1700	(300)	286.8750				70	.110	-2.0
10	310	287.0153				70	.110	-2.0
20	320	287.1558				70.5	.110	-2.0
30	330	287.2965				70.5	.110	-2.0
40	340	287.4368				70.5	.110	-2.0
50	350	287.5772				69.5	.110	-2.0
1800	(360)	287.7179				69.5	.110	-2.0
	370							
	380							
	390							

BP

00	28.49	300	28.40
60	28.47	360	28.40
120	28.45		
180	28.42		
240	28.40	Avg. =	28.433 in Hg"

Pre Test Filter Tare Weight Check
F .6208
R _____

End of Test Weight
F .6001 R _____
_____ _____
_____ _____
.6207 _____
-.0206

Woodstove Data Sheet #4-3: Constant Final Weights

T3

Unit EASY, 2E
Run # EPA 1
Date: 10/21/2016

WST5-Form 9, Pg 1, Rev 10/10

40 ml

Final Beaker Weights

Beaker	Into	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
39	53.1707	10/24	1841	ATM	53.1690	10/25	1733	JMC	53.1702	10/26	1518	ATM	53.1690	11/1	1152	ESS
					53.1688	11/2	1835	ATM								

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	310	.6001	10/22	1341	ATM	0.5995	10/24	1809	AM	.5994	10/25	1802	JMC				
R																	

QA Reweigh: Final Weight			
Date	Beaker #	Final Wt	By
Date	Filter #	Final Wt	By

Scale Room Environmental Conditions						
Weighing Session	Date (2016)	Time	By	WB	DB	%RH
1	10/24	1742	ATM	58	70	48
2	10/25	1712	ATM	58	70	48
3	10/26	1444	ATM	55	66	48
4	11/1	1132	ESS	57	69	46
5	11/2	1808	ATM	57	69	46
6						
7						

	Scale Room Environmental Conditions					
8						
9						
10						
11						
12						
Comment						

Train 2/ Room Blank Woodstove
Particulate Catch Processing Sheet
Woodstove Data Sheet #5
ASTM E 2515/ EPA M5G-1

T3

Unit: Easy Fire
Run: EPA 1 **Train** 2
Date: 10 / 21 / 2014
Technicians: ATM CSS
Revised 11/15 - Data Sheet #5A

Filters:

Filter # (Front): 310 **Beaker #:** 39 **Final Wt.:** 53.1688 g
Tare Wt.: .6207 g **ml** 40 **Tare Wt.:** 53.1491 g
Filter # (Rear): _____ **Desiccant: Acetone** **Net Wt.:** .0197 g
Tare Wt.: _____ g **Beaker Tare Wt,. Check:** 53.1489 g
Combined Filter Final Weight: .5994 g
Combined Filter Tare Weight: .6207 g
Combined Net Catch Weight: -.0213 g

Acetone Blank Calculation: **Blank Date:** 7/23/16 **Blank Beaker #:** 42 **Desiccant: 50 ml Acetone**
Final Wt.: 53.8687 g - **Tare Wt.:** 53.8691 g = **Net Catch Wt.:** -.0004 = .0000 g
Net Catch Weight: .0000 g / **50 ml Acetone =** .0000 **g/ml Acetone Blank Residual Value**

Acetone Residue Value Calculation:
(.0000 **g/ml Acetone)(** 40 **ml Acetone) =** .0000 **g Residue Value**

Total Particulate Catch Calculations:

Combined Filter Net Catch Weight: -.0213 g
Acetone Wash Catch Weight: .0197 g
Less Acetone Residual Value: - .0000 g
Equals Net Acetone Wash Catch: .0197 g
Total Net Catch (Combined Filter + Acetone Catch): -.0016 g = 0.0000
0.0 mg

From: 9/16/16
Through: 11/4/16

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

Level	Recali-brated	100g Weight	10g Weight	1g Weight	100mg Weight	10mg Weight	2016 DATE	TIME	TECH	BP	LINE VOLTS	WET BULB	DRY BULB	% RH
Yes	No	99.9992	10.0000	1.0000	.1000	.0100	9/16	2145	ATM	28.	119	60	72	48
Yes	No	99.9992	10.0000	1.0000	.1000	.0100	9/17	1417	ATM	28.30	116	58	70	48
Yes	No	99.9991	9.9999	1.0000	.1000	.0101	9/18	1200	ATM	28.43	118	54	67	41
Yes	No	99.9992	9.9999	.9999	.1000	.0100	9/19	1048	ATM	28.50	120	56	67	49
Yes	No	99.9992	9.9999	1.0000	.1000	.0100	9/19	2220	ATM	28.53	120	53	65	44
Yes	NO	99.9991	9.9999	1.0000	0.1000	.0100	9/28	1413	ESS	28.44	120	54	65	47
yes	NO	99.9990	9.9999	1.0000	0.1000	0.0099	9/30	1457	ESS	28.33	118	60	72	48
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0100	10/2	910	ATM	28.49	120	53	64	47
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	10/3	929	ATM	28.35	120	52	63	46
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	10/8	1915	ATM	28.32	120	56	67	49
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0100	10/9	1057	ATM	28.49	120	56	68	46
Yes	No	99.9992	10.0000	0.9999	0.1000	0.0099	10/15	1002	ATM	28.19	120	56	67	49
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0101	10/17	1523	ATM	28.22	120	55	66	48
Yes	No	99.9992	10.0000	0.9999	0.1000	0.0100	10/18	1938	ATM	28.55	120	56	68	46
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	10/19	1548	ATM	28.72	119	57	69	46
Yes	Yes	QC Services Here - Post Visit (Weight ✓)					10/20	1640	ATM	28.43	120	—	—	—
Yes	Yes	99.9992	9.9999	1.0000	0.1000	0.0100	10/20	1705	ATM	28.45	120			—
Yes	Yes	99.9993	9.9999	1.0000	0.1000	0.0100	10/22	1846	ATM	28.46	119	56	67	49
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0100	10/23	1400	ATM	28.48	120	56	69	49
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0100	10/24	1742	ATM	28.28	119	58	70	48
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	10/25	1712	ATM	28.49	119	58	70	48
Yes	No	99.9992	10.0000	1.0000	0.1000	0.0100	10/26	1444	ATM	28.42	119	55	66	48
yes	NO	99.9992	10.0000	1.0000	0.1000	0.0100	11/1	1132	ESS	28.35	120	57	69	46
Yes	No	99.9991	9.9999	1.0000	0.1000	0.0100	11/2	1803	ATM	28.43	119	57	69	46
Yes	No	99.9992	9.9999	0.9999	0.0999	0.0100	11/3	1028	ATM	28.58	120	58	70	48
Yes	Yes	99.9992	9.9999	1.0000	0.1000	0.0100	11/4	1023	ATM	28.78	120	58	70	48

From: 7/17/2016

Through: 9/15/2016

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 7.15

Level	Recali-brated	100g Weight	10g Weight	1g Weight	100mg Weight	10mg Weight	2016 DATE	TIME	TECH	BP	LINE VOLTS	WET BULB	DRY BULB	% RH
Yes	No	99.9993	10.0000	1.0000	.1000	.0100	7/17	1600	ATM	28.51	119	54	65	48
Yes	Yes	99.9992	9.9999	1.0000	.1000	.0100	7/18	1757	ATM	28.49	118	56	67	49
Yes	No	99.9992	9.9999	.9999	.0999	.0100	7/19	1506	ATM	28.48	117	58	71	45
Yes	No	99.9993	9.9999	0.9999	.0999	.0100	7/20	1110	ATM	28.50	119	57	69	46
Yes	Yes	99.9993	10.0000	1.0000	0.0999	.0100	7/21	836	ATM	28.59	119	55	66	48
Yes	Yes	99.9991	9.9999	1.0000	0.1000	.0100	7/23	1200	ATM	28.59	120	56	68	46
Yes	No	99.9992	9.9999	1.0000	0.1000	.0100	7/24	734	ATM	28.58	118	58	70	48
Yes	NO	99.9991	10.0000	0.9999	0.1000	0.0100	7/25	1324	ESS	28.42	118	56	68	46
Yes	No	99.9992	9.9999	0.9999	0.1001	0.0101	8/2	1345	ESS	28.33	117	55	66	48
Yes	No	99.9991	9.9999	1.0000	0.1000	0.0100	8/4	1344	ATM	28.47	116	56	67	49
Yes	No	99.9991	9.9999	1.0000	0.1000	0.0101	8/6	1117	ATM	28.40	120	56	67	49
Yes	No	99.9991	9.9999	1.0000	0.1000	0.0100	8/7	1100	ATM	28.37	121	54	65	48
Yes	NO	99.9992	10.0000	0.9999	0.1000	0.0101	8/9	1045	ESS	28.42	120	53	64	47
Yes	No	99.9992	9.9999	0.9999	0.1000	0.0101	8/14	1618	ATM	28.34	120	56	67	49
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0100	8/17	1336	ATM	28.40	117	58	70	48
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0101	8/18	1244	ATM	28.45	119	54	65	48
Yes	No	99.9992	9.9999	0.9999	0.1000	0.0100	8/19	1652	ATM	28.49	117	58	70	48
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	8/24	851	ATM	28.47	120	55	67	45
Yes	No	99.9992	9.9999	0.9999	0.1000	0.0100	8/31	545	ATM	28.42	119	58	70	48
Yes	No	99.9993	9.9999	0.9999	0.1000	0.0100	9/3	1036	ATM	28.46	118	54	65	48
Yes	No	99.9992	10.0000	0.9999	0.1000	0.0100	9/4	0730	ATM	28.42	120	54	66	45
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	9/7	1721	ATM	28.40	118	57	69	46
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	9/8	612	ATM	28.50	118	58	70	48
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0100	9/13	554	ATM	28.61	120	53	64	47
Yes	No	99.9992	9.9999	1.0000	0.1000	0.0100	9/15	2058	ATM	28.47	120	54	65	48

From: 6/13/16

Through: 7/16/16

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 7.15

Level	Recali-brated	100g Weight	10g Weight	1g Weight	100mg Weight	10mg Weight	DATE	TIME	TECH	BP	LINE VOLTS	WET BULB	DRY BULB	% RH
Yes	Yes	99.9992	9.9999	1.0000	0.1000	0.0100	6/13/16	836	ESS	28.41	120	56	68	46
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0100	6/14/16	851	ATM	28.30	120	54	65	48
Yes	NO	99.9992	9.9999	1.0000	0.1000	0.0100	6/15/16	1047	ESS	28.38	120	52	63	46
Yes	No	99.9992	9.9999	1.0000	0.0999	0.0100	6/16/16	849	ATM	28.40	119	54	65	48
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0100	6/17/16	1331	ATM	28.57	118	57	69	47
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0100	6/19/16	917	ATM	28.74	118	56	68	48
Yes	No	99.9992	10.0000	1.0000	0.1000	0.0101	6/20/16	951	ATM	28.60	119	57	69	48
Yes	Yes	99.9991	9.9999	0.9999	0.1000	0.0100	6/21/16	942	ESS	28.59	119	58	70	48
Yes	No	99.9991	9.9999	1.0000	0.1000	0.0100	6/22/16	957	ATM	28.50	118	60	73	46
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0100	6/24/16	1520	ATM	28.52	121	59	71	48
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0100	6/25/16	1802	ATM	28.57	119	56	68	48
Yes	No	99.9992	9.9999	0.9999	0.0999	0.0100	6/26/16	1805	ATM	28.57	120	54	65	48
Yes	Yes	99.9992	9.9999	1.0000	0.1000	0.0100	6/27/16	1758	ATM	28.52	118	58	70	48
Yes	Yes	99.9992	9.9999	1.0000	0.1001	0.0100	6/28/16	1031	ATM	28.52	119	58	70	48
Yes	No	99.9993	9.9999	0.9999	0.1000	0.0100	6/29/16	1035	ATM	28.49	120	56	68	48
Yes	Yes	99.9991	10.0000	1.0000	0.1001	0.0101	6/30/16	956	ESS	28.45	117	57	69	46
Yes	No	99.9993	9.9999	1.0000	0.1000	0.0100	7/1/16	1534	ATM	28.36	118	57	69	46
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0101	7/2/16	1746	ATM	28.34	119	57	69	46
Yes	NO	99.9992	9.9999	1.0000	0.1000	0.0100	7/6/16	955	ESS	28.44	118	62	75	47
Yes	NO	99.9993	9.9999	1.0000	0.1000	0.0100	7/8/16	0704	ATM	28.40	118	58	70	48
Yes	Yes	99.9992	9.9999	0.9999	0.1000	0.0100	7/11/16	1954	ATM	28.40	119	58	70	48
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0100	7/12/16	1145	ATM	28.41	118	58	70	48
Yes	NO	99.9993	9.9999	0.9999	0.0999	0.0100	7/14/16	836	ATM	28.61	119	56	68	46
Yes	No	99.9993	10.0000	1.0000	0.1000	0.0100	7/15/16	942	ATM	28.55	118	56	68	46
Yes	No	99.9993	9.9999	0.9999	0.1000	0.0100	7/16/16	1620	AM	28.50	118	56	69	43

Unit: EASY FIR
Run # EPA 1
Date: 10/21/16
Technician: A.T. Myre
WST6-Form1, Rev 6/11

Miscellaneous Test Data
Woodstove Data Sheet #8

Useable Firebox Dimensions: See QC Section Useable Volume: N/A ft^3

Dilution Tunnel Draft (If Applicable): Start: .000 Stop: .000 Avg: .000 in. H_2O

Test Chamber Air Velocity: Start: >0, <5 Stop: >0, <5 Avg: >0, <5 ft./m.

Wet Bulb/ Start: WB: 55 °F DB: 62 °F % Amb Moisture: 1.25 %RH: 64

Dry Bulb Stop: WB: 58 °F DB: 66 °F % Amb Moisture: 1.40 %RH: 61.5

X Ambient Moisture(%Vol.) = 1.325 % X Relative Humidty (%RH) = 62.75%

Empty Stove Wt: _____ lbs.

Empty Stove Wt with Stack (inc oil seal) Wet: — lbs. Dry: — lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Paper: — lbs. Wood: — lbs. Total: — lbs.

Pre Burn Fuel Wt. 0.5 + 4.0 Total: 4.5 lbs.

Total Kindling and Pre Burn Fuel Wt. 4.5 lbs.

Coal Bed Wt.: Range(N/A - N/A) lbs. Actual: N/A lbs.

Allowable Amount of Charcoal That Can Be Removed:

Coal Bed Wt. Range (N/A (Upper Wt.) + N/A (Lower Wt.) /2) .25 = N/A lbs.

Test Fuel Wt.: Ideal — lbs. Range: — lbs. Actual: 13.4 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Spacers): — Pcs. — lbs.

2 x 4's x — " — Pcs. — lbs. — %

4 x 4's x — " — Pcs. — lbs. — %

5.7090 d kg.

Est. Dry Burn Rate(Kg/Hr.) $\frac{12.4 - (12.4 \times .06074) \times 60}{2.2046 \quad 360}$ = 0.9515 Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E)(Avg BTU's/Hr)(19,140) X .78 x .9515 = 14,205.2

100 EPA Heat Output (HO_E)BTU's/Hr

OPERATING INSTRUCTIONS
FOR THE
SIERRA EASY FIRE PELLET STOVE

Other than the Owner's manual, the manufacturer did not provide any additional operating instructions for the Sierra Easy Fire pellet stove. The unit's operating controls has 3 different speed settings labeled "HI", "MED" and "LO". Since these 3 speed settings coincide with the speed setting requirements in ASTM E2779, we followed the manufacturer's instructions in the Owner's Manual and used these 3 setting for the test. See a DWG of the control board on page 6 of the owner's manual.

Wood Density Determination
Woodstove Test Data Sheet #11

Unit: EASY FIRE
Run#: EPA # 1
Date: 10/21/16
Technician: AIM ESS

Rev 5/10

Wood Piece: Nominal Dimensions: _____ X _____ X _____

Depth (D): _____ cm
Width (W): _____ cm
Length(L): _____ cm
_____ cm Length $\overline{X}$ = _____ cm
_____ cm
_____ cm Volume: _____ cm^3

(D x W x L)

Room Temperature: _____ °F Correction Factor: _____

Meter Readings Corrected for temperature: Yes _____ No _____

Note: Record Moisture Meter readings to the nearest 0.5% or 0.1%

	Uncor	Cor	Avg % Moisture (Dry) _____ %
Top:		%	
Bottom:		%	Avg % Moisture (Wet) _____ %
Side:		%	Scale: Leveled In _____ Out _____
$\overline{X}$:		%	Zeroed: In _____ Out _____

Wet Weight: _____ g Dry Weight: _____ g

% Moisture Dried Basis: _____ %

([1 – (Dry Wt/Wet Wt)] X 100)

Density = _____ g/ _____ cm^3 = _____ g/cm^3

(dry wt) (volume)

	Date	Time	Temp
Into Dryer	10/21	1838	140 °F
Out of Dryer	10/26	0806	148 °F

(Minimum Time in Dryer: 24 hrs.)

Pellet Fuel Moisture Content Determintation

Pellet Name: Lignetics

Tare Beaker Wt. 65.5454 g
GLASS #5

Pellet Manufacturer: Lignetics - Sandpoint, Premium

Pellet Grade: _____

Wet Wt: 167.4928 g - 65.5454 g = 101.9474 g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: 161.3003 g - 65.5454 g = 95.7549 g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Wet Basis: 6.074 %

[1 – (Net Dry Wt./Net Wet Wt.)] X 100

PFI Pumafied Fuel Grade: Premium mill Reg # 03208

MYREN CONSULTING, INC.
ASTM E2779 Pellet Heater Equations
Forms/ Pellet Stoves/ Eqns.
Rev 5.6.16 P. 1 of 2

Unit: Easy Fire
Run #: EPA 1
Date: 10/21/16
Tech: AT Myren

ASTM E2779 EQN 1: Kilograms/ Pounds of dry fuel burnt, db (Revised)

Note: We do not tare our scale during testing, so the M_{Swb} = the mass of the stove with fuel at the start of the test, M_{SSwb} in the revised equation below, in this case 229.8 **lbs. And M_{SEwb} = the mass of the stove with residual fuel at the end of the test in the revised equation below, in this case** 216.4 **lbs.**

$$M_{Bdb} = (M_{SSwb} - M_{SEwb})(100)/(100 + FM)$$

FM = average fuel moisture content of test fuel, % wet basis,
M_{SSwb} = weight of the stove and test fuel in the hopper at the start of the test, wet basis kg(lb),
M_{SEwb} = weight of the stove and test fuel in the hopper at the end of the test, wet basis kg(lb), and
M_{Bdb} = weight of the fuel burned during the test run, dry basis, kg(lb).

M_{Bdb} = (229.8 **lbs -** 216.4 **lbs)(100)/(100+** 6.074 **) =** 12.633 **lbs / 2.2046 lbs/ kg =** 5.730 **kg**

ASTM EQN2: Kilograms/ Pounds of Dry Fuel Burnt During a Test Segment (S_1), db

Note: Again, we do not tare our scale during testing, so the M_{SSiwb} = the total weight of the stove with fuel at the start of a test segment and M_{SEiwb} = the mass of the stove with residual fuel at the end of a test segment.

$$M_{BSidb} = (M_{SSiwb} - M_{SESiwb})(100)/(100+FM) \text{ (Revised)}$$

M_{SSiwb} = weight of the test fuel in the hopper at the start of the test run segment *i*, wet basis kg(lb),
M_{ESiwb} = weight of the test fuel in the hopper at the end of the test run segment *I*, wet basis kg(lb),
M_{BSidb} = weight of the test fuel burned during test run segment *I*, dry basis, kg(lb) and,
***i* = test run segment in Accordance with 9.4 Table 1.**

Test Segment 1: 0-60 minutes:
M_{BS1db} =(229.8 **lbs -** 226.3 **lbs)(100)/(100+** 6.074 **) =** 3.2996 **lbs/ 2.2046 lbs/kg =** 1.497 **kg**
Test Segment 2: 60-180 minutes:
M_{BS2db} =(226.3 **lbs -** 221.3 **lbs)(100)/(100+** 6.074 **) =** 4.7137 **lbs/ 2.2046 lbs/kg =** 2.138 **kg**
Test Segment 3: 180-360 minutes:
M_{BS3db} = (221.3 **lbs -** 216.4 **lbs)(100)/(100+** 6.074 **) =** 4.6194 **lbs/ 2.2046 lbs/kg =** 2.095 **kg**

MYREN CONSULTING, INC.
ASTM E2779 Pellet Heater Equations
Forms/ Pellet Stoves/ Eqns.
Rev 5.6.16 P. 2 of 2

Unit: EASY FIRE
Run #: EPA 1
Date: 10/21/16
Tech: A.T. Myren

ASTM EQN 3: Average Dry Burn Rate BR (DBR)

BR (DBR) = (60(M_{Bdb}))/θ

BR (DBR) = Average dry burn rate over the full integrated test run, kg/h (lb/h), and Θ = total length of full integrated test run, min.

BR (DBR) = (60(5.730 **kg)/** 360 **=** 0.955 **kg/h**

ASTM EQN 4: Average Dry Burn Rate (DBR) over a Test Segment *i*, kg/h(lb/h)

BR $(DBR)_{Si}$ = (60(M_{Bidb}))/θ

BR $(DBR)_{Si}$ = Average dry burn rate over test run segment *i* , kg/h (lb/h), and Θ_{Si} = total length of test segment *i*, min.

Test Segment 1: 0-60 minutes
BR $(DBR)_{S1}$ = (60(1.497 **kg)/** 60 **=** 1.497 **kg/h**
Test Segment 2: 60-180 minutes
BR $(DBR)_{S2}$ = (60(2.138 **kg)/** 120 **=** 1.069 **kg/h**
Test Segment 3 : 180-360 minutes
BR $(DBR)_{S3}$ = (60(2.095 **kg)/** 180 **=** 0.698 **kg/h**

Pre Burn Data
Record Sheet #13

Unit: The Lin Easy Fire Date: 10/21/16
Run: EPA 1 Technician(s): ATM, ESS
Page: 1 of 1 WST2-Form 16, Rev 6/11

Preburn Start Wt. _____ Lbs. Up _____ lbs.
Test Start Wt Range _____ lbs.
Baro. Pressure 28.50 "Hg

Hot Box On ✓

Minute/⏱		Scale Weight	Burn Rate	T/C# 1 Stack	2 Stove Top	3 Left Side	4 Back	5 Right Side	6 Bottom	7 Firebox	8 2nd Burn Catalytic	9 Room Temp	Static	20 Stack @ 1'	Comments
0	1100	233.8	0.0	266	|	|	|	|	|	|		57	-.036	318	Primary Air Set At H1
5	05	233.6	.2	332	|	|	|	|	|	|		57	-.043	383	Secondary Air Set At N/A
10	10	233.2	.4	384	|	|	|	|	|	|		57	-.047	437	Fan: H1
15	15	232.8	.4	400	|	|	|	|	|	|		57	-.047	440	Tunnel on at: 1122
20	20	232.4	.4	403	|	|	|	|	|	|		57	-.047	437	Buckets Iced ✓
25	25	232.2	.2	404	|	|	|	|	|	|		58	-.048	454	Analyzers Spanned ✓
30	30	231.9	.3	408	|	|	|	|	|	|		58	-.046	449	Pumps Turned on at: 1150
35	35	231.4	.5	422	|	|	|	|	|	|		58	-.049	473	ΔT ΔΔT
40	40	231.1	.3	415	|	|	|	|	|	|		58	-.047	457	
45	45	230.7	.4	413	|	|	|	|	|	|		59	-.046	455	
50	50	230.3	.4	414	|	|	|	|	|	|		59	-.047	458	
55	55	230.0	.3	406	|	|	|	|	|	|		59	-.048	448	Tunnel ΔP
X		—		—	|	—	|	|	—	|	—		—	X	Probe In Tunnel —
60	1200	229.8	.2	412	|	|	|	|	|	|		59	-.048	455	
65															
70															
75		4.0 lbs burnt during preburn													
80															
85															
90															
95															
100															
105															
110				—	—	—	—	—	—	—	—				
115															

Myren Consulting Inc Data Sheet #14 P 1 of 7 Unit Thelin Easy Fire Date 10/21/16 Run EPA 1

Test End Wt. N/A ΔT N/A Barometric Pressure 28.49 "Hg Gas Flow @ 1.5" Technician(s) ATM, ESS

Time E/T Min	Time	Scale WT.	Lbs. Left	Burn Rate	CO_2 V.	CO_2 %	O_2 %	CO V.	CO %	Gas Bal	Stack Temp #1	Stack Static Pressure	Opacity	ON HIGH	T3 Part Notes cond. #18	Stack C.I. #20	GAS TRAIN VAC
0	1200	229.8	13.4	0.0	.185	4.69	16.23	.05	.05	93.7	412	-1048			45	455	-10.3
05	05	229.6	13.2	.2	.205	5.18	15.74	.04	.04	129.6	416	-.050	"		38	468	-10.3
10	10	229.3	12.9	.3	.233	5.88	15.04	.05	.05	117.6	423	-.051	"		37	465	-10.1
15	15	229.0	12.6	.3	.225	5.68	15.23	.06	.06	94.7	421	-.050	"		37	472	-10.1
20	20	228.6	12.2	.4	.201	5.08	15.83	.06	.06	84.7	416	-.049	"		37	461	-10.1
25	25	228.3	11.9	.3	.190	4.81	16.11	.04	.04	120.3	410	-.049	"		37	451	-10.1
30	30	228.2	11.8	.1	.203	5.13	15.78	.05	.05	102.7	413	-.049	"		37	457	-10.1
35	35	227.8	11.4	.4	.196	4.96	15.95	.05	.05	99.2	416	-.049	"		37	462	-10.1
40	40	227.5	11.1	.3	.172	4.36	16.55	.06	.06	72.7	411	-.047	"		37	461	-10.1
45	45	227.3	10.9	.2	.206	5.21	15.71	.05	.05	104.2	413	-.049	"		37	467	-10.1
50	50	226.8	10.4	.5	.185	4.69	16.22	.06	.06	78.1	409	-.049	"		37	453	-10.1
55	55	226.7	10.3	.1	.211	5.33	15.58	.06	.06	88.9	410	-.046	"		37	459	-10.1
Total											4970	-.586					

TRAIN 1 TRAIN 2 T3

Time E/T Min	Time	Top #2	Left #3	Back #4	Right #5	Bottom #6	Firebox #7	Fr. 2nd #8	Amb #9	Tnl. #10	C Gas Box #11	C Gas Impin #12	Part. Filt. #13	Part. Cond. #14	Part. Filter #15	Part. Cond. #16	Part. Filter #17
0	1200								59	109	234	32	62	52	60	53	63
05	05								59	109	224	32	65	37	64	38	63
10	10								59	109	220	32	68	37	67	37	64
15	15								60	110	221	32	69	37	69	37	64
20	20								60	110	224	32	71	37	71	37	65
25	25								60	110	225	32	72	37	73	37	65
30	30								60	110	225	32	73	37	74	37	65
35	35								60	110	224	32	73	37	74	37	66
40	40								60	110	224	32	72	38	74	38	66
45	45								60	111	223	33	71	38	74	38	66
50	50								60	111	222	33	71	38	74	38	67
55	55								60	111	223	33	71	38	74	38	67
Total									717								

Myren Consulting Inc Data Sheet #14 P 2 of 7 Unit Thelin Easy Fire Date 10/21/16 Run EPA1

Test End Wt. N/A ΔT N/A Barometric Pressure 28.47 "Hg Gas Flow @ 1.5" Technician(s) ATM, ESS

Time E/T Min	Time	Scale WT.	Lbs. Left	Burn Rate	CO_2 V.	CO_2 %	O_2 %	CO V.	CO %	Gas Bal	Stack Temp #1	Stack Static Pressure	Opacity	*SET TO MED @ 60:00	T3 Part. Cond. #18	Notes	Stack @ 1 #20	GAS TRAIN °F
60	1300	226.3	9.9	.4	.207	5.23	15.68	.05	.05	104.7	415	-.048	C	Swapped T1 Filter	37		464	-10.1
65	05	225.8	9.4	.5	.138	3.52	17.35	.14	.14	25.2	385	-.046	"		37		421	-10.1
70	10	225.6	9.2	.2	.127	3.25	17.64	.11	.11	29.5	360	-.045	"		37		402	-10.1
75	15	225.4	9.0	.2	.132	3.37	17.51	.11	.11	30.7	345	-.043	"		37		368	-10.0
80	20	225.2	8.8	.2	.104	2.68	18.20	.13	.13	20.6	331	-.040	"		37		368	-10.0
85	25	225.1	8.7	.1	.127	3.25	17.66	.07	.07	46.4	333	-.042	"		37		373	-10.0
90	30	225.0	8.6	.1	.142	3.62	17.27	.09	.09	40.2	330	-.041	"		37		350	-10.0
95	35	224.8	8.4	.2	.115	2.95	17.95	.08	.08	36.9	313	-.039	"		37		332	-10.0
100	40	224.7	8.3	.1	.131	3.35	17.54	.10	.10	33.5	322	-.040	"		37		357	-10.0
105	45	224.4	8.6	.3	.148	3.77	17.13	.09	.09	41.9	320	-.039	"		37		350	-10.0
110	50	224.3	7.9	.1	.130	3.32	17.56	.12	.12	27.7	317	-.039	"		37		332	-10.0
115	55	224.0	7.6	.3	.135	3.45	17.46	.06	.06	57.5	324	-.040	"		37		365	-10.0
Total											4095	-.502						

TRAIN 1 TRAIN 2 T3

Time E/T Min	Time	Top #2	Left #3	Back #4	Right #5	Bottom #6	Firebox #7	Fr. 2nd #8	Amb #9	Tnl. #10	C Gas Box #11	C Gas Impin #12	Part. Filt. #13	Part. Cond. #14	Part. Filter #15	Part Cond. #16	Part. Filter #17
60	1300								61	112	224	33	71	38	74	38	67
65	05								60	106	225	33	67	38	74	38	67
70	10								60	102	225	33	69	38	73	38	67
75	15								60	101	225	33	71	38	73	38	67
80	20								61	99	225	33	73	38	73	38	68
85	25								61	99	224	33	73	38	73	38	68
90	30								61	99	224	33	73	38	72	38	68
95	35								61	98	224	33	73	38	72	38	68
100	40								61	98	223	33	72	38	72	38	68
105	45								61	98	223	33	72	38	72	38	68
110	50								61	98	223	33	72	39	72	38	68
115	55								61	98	223	33	72	39	73	38	68
Total									729								

Myren Consulting Inc Data Sheet #14 P 3 of 7 Unit Thelin Eagle Date 10/21/16 Run EPA 1

Test End Wt. N/A ΔT N/A Barometric Pressure 28.45 "Hg Gas Flow @ 1.5" Technician(s) ATM, ESS

Time E/T Min	Time ⏱	Scale WT.	Lbs. Left	Burn Rate	CO_2 V.	CO_2 %	O_2 %	CO V.	CO %	Gas Bal	Stack Temp #1	Stack Static Pressure	Opacity		T3 Part. Notes Cond #18	Stack @1 #20	GAS TRAIN VAC
120	1400	223.9	7.5	.1	.133	3.40	17.50	.08	.08	42.5	324	-.040	C		37	357	-10.0
125	05	223.6	7.2	.3	.147	3.74	17.16	.08	.08	46.8	328	-.040	"		37	346	-10.0
130	10	223.5	7.1	.1	.152	3.87	17.03	.08	.08	48.4	337	-.042	"		37	386	-10.0
135	15	223.2	6.8	.3	.157	3.99	16.91	.07	.07	57.0	339	-.041	"		37	368	-10.0
140	20	222.9	6.5	.3	.149	3.79	17.11	.07	.07	54.2	337	-.042	"		37	367	-10.0
145	25	222.6	6.2	.3	.128	3.27	17.63	.08	.08	40.9	329	-.040	"		37	361	-10.0
150	30	222.5	6.1	.1	.143	3.65	17.25	.09	.09	40.5	324	-.040	"		37	352	-10.0
155	35	222.4	6.0	.1	.134	3.42	17.48	.08	.08	42.8	317	-.038	"		37	339	-10.0
160	40	222.3	5.9	.1	.137	3.50	17.40	.09	.09	38.9	318	-.039	"		38	356	-10.0
165	45	222.2	5.8	.1	.121	3.10	17.79	.11	.11	28.2	327	-.040	"		38	371	-10.0
170	50	222.0	5.6	.2	.143	3.65	17.25	.09	.09	40.5	335	-.041	"		37	373	-10.0
175	55	221.7	5.3	.3	.097	2.50	18.35	.17	.17	14.7	327	-.040	"		37	371	-10.0
Total											3942	-.483					

TRAIN 1 TRAIN 2 T3

Time E/T Min	Time ⏱	Top #2	Left #3	Back #4	Right #5	Bottom #6	Firebox #7	Fr. 2nd #8	Amb #9	Tnl. #10	C Gas Box #11	C Gas Impin #12	Part. Filt. #13	Part. Cond. #14	Part. Filter #15	Part. Cond. #16	Part. Filter #17
120	1400								61	99	223	33	73	38	73	38	68
125	05								61	99	224	33	73	39	73	38	69
130	10								61	99	224	33	73	39	73	38	69
135	15								61	100	225	33	73	39	73	38	69
140	20								61	100	225	33	73	39	73	38	69
145	25								61	100	226	33	73	39	73	38	69
150	30								62	99	225	33	73	39	73	38	69
155	35								62	99	224	33	73	39	73	38	69
160	40								62	99	223	33	73	39	73	39	69
165	45								62	99	221	33	73	39	73	38	69
170	50								62	100	221	33	73	39	73	38	69
175	55								62	100	222	33	73	39	73	38	69
Total									738								

Myren Consulting Inc Data Sheet #14 P 4 of 7 Unit Thelin Easy Fire Date 10/21/16 Run EPA 1

Test End Wt. N/A ΔT N/A Barometric Pressure 28.42 "Hg Gas Flow @ 1.5" Technician(s) ATM, ESS

Time E/T Min	Time 🕐	Scale WT.	Lbs. Left	Burn Rate	CO_2 V.	CO_2 %	O_2 %	CO V.	CO %	Gas Bal	Stack Temp #1	Stack Static Pressure	Opacity	* SET TO Low @ 180:00	T3 Part. Cond. Notes #18	Stack @1' #20	GAS TRAIN VAC
180	1500	221.3	4.9	.4	.155	3.94	16.95	.10	.10	39.4	328	-.042	C		37	378	-10.0
185	05	221.1	4.7	.2	.104	2.68	18.20	.12	.12	22.3	307	-.040	"		37	328	-10.0
190	10	220.8	4.4	.3	.089	2.31	18.57	.13	.13	17.7	287	-.037	"		37	323	-10.0
195	15	220.7	4.3	.1	.084	2.18	18.68	.15	.15	14.5	272	-.034	"		37	297	-10.0
200	20	220.6	4.2	.1	.106	2.73	18.14	.14	.14	19.5	276	-.035	"		37	300	-10.0
205	25	220.5	4.1	.1	.093	2.41	18.47	.13	.13	18.5	263	-.033	"		37	284	-10.0
210	30	220.4	4.0	.1	.093	2.41	18.47	.13	.13	18.5	267	-.034	"		37	294	-10.0
215	35	220.3	3.9	.1	.089	2.31	18.57	.13	.13	17.7	264	-.034	"		38	292	-10.0
220	40	220.2	3.8	.1	.113	2.90	17.98	.11	.11	26.4	273	-.036	"		37	304	-10.0
225	45	220.1	3.7	.1	.109	2.80	18.08	.11	.11	25.5	271	-.035	"		37	290	-10.0
230	50	220.0	3.6	.1	.107	2.75	18.12	.13	.13	21.2	273	-.035	"		38	292	-10.0
235	55	219.9	3.5	.1	.097	2.50	18.37	.14	.14	17.9	276	-.036	"		37	306	-10.0
Total											3367	-.431					

TRAIN 1 TRAIN 2 T3

Time E/T Min	Time 🕐	Top #2	Left #3	Back #4	Right #5	Bottom #6	Firebox #7	Fr. 2nd #8	Amb #9	Tnl. #10	C Gas Box #11	C Gas Impin #12	Part. Filt. #13	Part. Cond. #14	Part. Filter #15	Part Cond #16	Part. Filter #17
180	1500								62	100	223	34	73	39	74	38	69
185	05								62	95	224	34	73	39	73	38	69
190	10								62	93	224	33	73	39	73	39	69
195	15								62	91	224	34	72	39	73	38	69
200	20								62	91	223	34	72	39	72	39	69
205	25								62	90	223	34	72	39	72	38	69
210	30								62	90	222	34	72	39	72	38	69
215	35								62	89	222	34	71	39	72	39	69
220	40								62	89	223	34	71	39	72	39	69
225	45								62	90	223	34	71	39	71	39	69
230	50								62	89	224	34	71	39	71	39	69
235	55								62	90	224	34	71	39	71	38	69
Total									744								

Myren Consulting Inc Data Sheet #14 P 5 of 7 Unit Thelin Easy Fire Date 10/21/16 Run EPA 1

Test End Wt. N/A ΔT N/A Barometric Pressure 28.40 "Hg Gas Flow @ 1.5" Technician(s) ATM, ESS

Time E/T Min	Time	Scale WT.	Lbs. Left	Burn Rate	CO_2 V.	CO_2 %	O_2 %	CO V.	CO %	Gas Bal	Stack Temp #1	Stack Static Pressure	Opacity		T3 Part. Cond. Notes #18	Stack @ 1' #20	GAS TRAIN VAC
240	1600	219.8	3.4	.1	.108	2.78	18.11	.11	.11	25.2	279	-.036	C		37	315	-10.0
245	05	219.6	3.2	.2	.121	3.10	17.79	.10	.10	31.0	276	-.036	"		37	307	-10.0
250	10	219.4	3.0	.2	.078	2.03	18.80	.21	.21	(9.7)	268	-.034	"		37	294	-10.0
255	15	219.3	2.9	.1	.111	2.85	18.01	.16	.16	(17.8)	280	-.036	"		38	299	-10.0
260	20	219.1	2.7	.2	.125	3.20	17.69	.11	.11	29.1	286	-.037	"		38	312	-10.0
265	25	219.0	2.6	.1	.133	3.40	17.50	.09	.09	37.7	277	-.036	"		38	302	-10.0
270	30	218.9	2.5	.1	.135	3.45	17.45	.09	.09	38.3	277	-.036	"		38	309	-10.0
275	35	218.8	2.4	.1	.084	2.18	18.67	.18	.18	12.1	270	-.034	"		38	296	-10.0
280	40	218.6	2.2	.2	.114	2.93	17.97	.09	.09	32.5	281	-.036	"		38	309	-10.0
285	45	218.4	2.0	.2	.101	2.60	18.27	.13	.13	20.0	272	-.035	"		38	299	-10.0
290	50	218.3	1.9	.1	.143	3.65	17.24	.10	.10	36.5	277	-.036	"		38	300	-10.0
295	55	218.1	1.7	.2	.090	2.33	18.53	.16	.16	14.6	270	-.035	"		38	285	-10.0
Total											(3313)	(-.427)					

TRAIN 1 TRAIN 2 T3

Time E/T Min	Time	Top #2	Left #3	Back #4	Right #5	Bottom #6	Firebox #7	Fr. 2nd #8	Amb #9	Tnl. #10	C Gas Box #11	C Gas Impin #12	Part. Filt. #13	Part. Cond. #14	Part. Filter #15	Part. Cond. #16	Part. Filter #17
240	1600	|	|	|	|	|	|	|	62	90	225	34	71	39	71	39	69
245	05	|	|	|	|	|	|	|	62	90	225	34	71	39	71	39	69
250	10	|	|	|	|	|	|	|	62	90	226	34	71	39	71	39	69
255	15	|	|	|	|	|	|	|	62	90	226	34	71	39	71	39	69
260	20	|	|	|	|	|	|	|	62	90	227	34	71	39	71	39	69
265	25	|	|	|	|	|	|	|	62	90	226	34	71	39	71	39	69
270	30	|	|	|	|	|	|	|	62	90	226	34	71	39	71	39	68
275	35	|	|	|	|	|	|	|	62	89	225	34	71	39	71	39	68
280	40	|	|	|	|	|	|	|	62	90	224	34	71	39	71	39	68
285	45	|	|	|	|	|	|	|	62	89	223	34	71	40	71	39	68
290	50	|	|	|	|	|	|	|	62	89	222	34	71	39	71	39	68
295	55								62	89	221	34	71	40	71	39	68
Total									(744)								

Myren Consulting Inc Data Sheet #14 P 6 of 7 Unit Thelin Easy Fire Date 10/21/16 Run EPA 1

Test End Wt. N/A ΔT N/A Barometric Pressure 28.40 "Hg Gas Flow @ 1.5" Technician(s) ATM, ESS

Time E/T Min	Time @	Scale WT.	Lbs. Left	Burn Rate	CO_2 V.	CO_2 %	O_2 %	CO V.	CO %	Gas Bal	Stack Temp #1	Stack Static Pressure	Opacity		T3 Part. Cond #18	Stack @ 1' #20	GAS TRAIN VAL
300	1700	218.0	1.6	.1	.081	2.11	18.75	.17	.17	12.4	261	-.033	C		38	288	-10.0
305	05	217.8	1.4	.2	.096	2.48	18.40	.12	.12	20.7	274	-.035	"		38	307	-10.0
310	10	217.7	1.3	.1	.102	2.63	18.26	.11	.11	23.9	270	-.035	"		38	305	-10.0
315	15	217.6	1.2	.1	.099	2.55	18.30	.18	.18	14.2	270	-.035	"		38	296	-10.0
320	20	217.5	1.1	.1	.096	2.48	18.40	.12	.12	20.7	266	-.035	"		38	287	-10.0
325	25	217.3	.9	.2	.104	2.68	18.21	.11	.11	24.3	276	-.036	"		38	310	-10.0
330	30	217.2	.8	.1	.085	2.21	18.66	.14	.14	15.8	262	-.034	"		38	297	-10.0
335	35	217.1	.7	.1	.078	2.03	18.84	.14	.14	14.5	257	-.034	"		38	286	-10.0
340	40	217.0	.6	.1	.069	1.81	19.05	.17	.17	10.6	253	-.032	"		38	287	-10.0
345	45	216.8	.4	.2	.105	2.70	18.18	.11	.11	24.6	262	-.034	"		38	294	-10.0
350	50	216.7	.3	.1	.100	2.58	18.30	.13	.13	19.8	264	-.035	"		38	286	-10.0
355	55	216.6	.2	.1	.070	1.83	19.03	.16	.16	11.5	258	-.033			38	289	-10.0
Total											3173	-.411					

TRAIN 1 TRAIN 2 T3

Time E/T Min	Time @	Top #2	Left #3	Back #4	Right #5	Bottom #6	Firebox #7	Fr. 2nd #8	Amb #9	Tnl. #10	C Gas Box #11	C Gas Impin #12	Part. Filt. #13	Part. Cond. #14	Part. Filter #15	Part. Cond. #16	Part. Filter #17
300	1700	/	/	/	/	/	/	/	62	88	221	34	71	40	71	39	68
305	05	/	/	/	/	/	/	/	62	89	221	34	71	40	71	39	68
310	10	/	/	/	/	/	/	/	62	89	222	34	71	40	71	39	68
315	15	/	/	/	/	/	/	/	62	88	223	34	70	40	71	39	68
320	20	/	/	/	/	/	/	/	62	88	223	34	70	40	71	39	68
325	25	/	/	/	/	/	/	/	62	88	224	34	70	40	70	39	68
330	30	/	/	/	/	/	/	/	62	88	224	34	70	40	70	39	68
335	35	/	/	/	/	/	/	/	62	87	224	34	70	40	70	39	67
340	40	/	/	/	/	/	/	/	62	87	223	34	70	40	70	39	67
345	45	/	/	/	/	/	/	/	62	87	223	35	70	40	70	39	67
350	50	/	/	/	/	/	/	/	62	87	223	35	70	40	70	39	67
355	55	/	/	/	/	/	/	/	62	87	223	35	70	40	70	39	67
Total									(744)								

Myren Consulting Inc Data Sheet #14 P 7 of 7 Unit Thelin Easy Fire Date 10/21/16 Run EPA 1

Test End Wt. N/A ΔT N/A Barometric Pressure 28.40 "Hg Gas Flow @ 1.5" Technician(s) ATM, ESS

Time E/T Min	Time 🕐	Scale WT.	Lbs. Left	Burn Rate	CO_2 V.	CO_2 %	O_2 %	CO V.	CO %	Gas Bal	Stack Temp #1	Stack Static Pressure	Opacity		T3 Part. Cond. #18 Notes	Stack @ 1' #20	GAS TRAIN Vac
360	1800	216.4	0	.2	.075	1.96	18.92	.13	.13	15.1	254	-.032	C		38	285	-10.0
365											(254)	(-.032)					
370											(23,114)	(-2.872)	Total				
375											(316.6)	(-.0393)	÷ 73				
380																	
385																	
390																	
395																	
400																	
405																	
410																	
415																	
Total																	

TRAIN 1 TRAIN 2 T3

Time E/T Min	Time 🕐	Top #2	Left #3	Back #4	Right #5	Bottom #6	Firebox #7	Fr. 2nd #8	Amb #9	Tnl. #10	C Gas Box #11	C Gas Impin #12	Part. Filt. #13	Part. Cond. #14	Part. Filter #15	Part. Cond. #16	Part Filter #17
360	1800								62	87	223	35	70	40	70	39	67
365									(62)								
370									(4478)		Total						
375									(61.3)		÷ 73						
380																	
385																	
390																	
395																	
400																	
405																	
410																	
415																	
Total																	

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-1

Site: Myren Consulting, Colville, WA Date: 10/21/16 Analyte: CO_2

Source: Easy Fire Run #: EPA 1

Zero Cyl #: DOT 3AA2265 Conc. 00.0 % CO_2 Cyl Press: 1900 psi

Certified By: Oxarc Date: 2/25/16

Span Cyl #: EB-0041761 Conc. 12.45 % CO_2 Cyl Press: 1020 psi

Certified By: Liquid Technology Corp Date: 4/15/15

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

Range: 0 - 25.0% CO_2 Analyzer Output: 0 – 1.0 v.

Flow: 1.5 SCFH Measured By: Rotameter: X Flowmeter: _____

EPA Span Values= 25.0% CO_2
EPA Control Limits = ± 2.5% of 25.0% CO_2 = ± 0.625% CO_2

Pre Run Audit: By: A.T. Myren Time: 1030 Temp: 61 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	000	.0097	+0.0097	+0.39
Span	49.3	.498	12.45	49.0	.498	12.4526	+0.0026	+0.02

Comments:

Post Run Audit: By: A.T. Myren Time: 1856 Temp: 66 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	.001	0.12	+0.12	+0.49
Span	49.3	.498	12.45	49.0	.496	12.40	-0.047	-0.38

Comments:

±CONC. Difference = Act % - Exp (Std) %

Zero % Difference (Δ%) = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference (Δ%) = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-3

Site: Myren Consulting, Inc. Lab, Colville, WA Date: 10/21/16 Analyte: CO

Source: Easy Fire Run #: EPA 1

Zero Cyl #: DOT 3AA 2265 Conc. 00.0 % CO Cyl Press: 1800 psi

Certified By: OXARC Date: 2/25/16

Span Cyl #: EB-0041761 Conc. ____ % CO Cyl Press: 1000 psi

Certified By: Liquid Technology Corp Date: 4/15/15

Analyzer: Make: California Analytical Instruments Model: 200 SN: 1M12002

Range: 0 – 10.0 % CO Analyzer Output: 0 – 10.0 v.

Flow: 1.5 scfh Measured By: Rotameter: X Flowmeter: ____

EPA Span Values = 0 - 5.0 % CO or 0 - 10.0 % CO
EPA Control Limits = ± 2.5% of 5.0 % CO = ± 0.125 % CO; ± 2.5% of 10.0 % CO = ± 0.250 % CO

Pre Run Audit: By: A.T.Myren Time: 1030 Temp: 61 °F

Pre Test Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.00	0.00	0.0173987	+0.0173987	+0.35
Span	2.61	2.61	2.61	2.62	2.61	2.5315724	-0.0784276	-3.00

Comments:

Post Run Audit: By: A.T.Myren Time: 1856 Temp: 66 °F

Post Test Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	.04	.005	0.0341586	+0.0341586	+0.68
Span	2.61	2.61	2.61	2.57	2.56	2.48341	-0.12659	-4.850

Comments:

±Conc. Difference = Act % - Exp (Std) %

Zero % Difference (Δ%) = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Full Scale Value}} \times 100$

Span % Difference (Δ%) = $\frac{\text{Act \% (ppm)} - \text{Exp \% (ppm)}}{\text{Exp \% (ppm)}} \times 100$

FIREPLACE DATA SHEET #10
Quality Checks (Revised 2/10)

Unit: The Insert Easy Fire
Run #: EPA 1
Date: 10/21/16

Ambient Blank Probe Inlet Location 38 " from the bottom of the hood (Spec = ≤ 6.6′) and 34 " from the chimney centerline (Spec = ≤ 3.3′).

Dilution Tunnel Draft: Start: .000 Stop: .000 Avg.: .000 "H_2O

Test Chamber Air Velocity: Start: >0, <5 Stop: >0, <5 Avg.: >0, <5 ft/min

Test Chamber Ambient Moisture (AM) / Relative Humidity (%RH)

Start: Wet Bulb 55 Dry Bulb 62 =%RH 64, %AM (%By Vol) 1.25
Stop: Wet Bulb 58 Dry Bulb 66 =%RH 61.5, %AM (% by Vol) 1.40
Avg. %RH 62.75, %AM (% by Vol) 1.325

Minimum Tunnel Flow For 100% Smoke Capture: Pitot Reading (Δp): _____
~ Tunnel Flow: _____ dscfm

Fireplace Back Wall Temperature Immediately Prior to Test Start: N/A °F

Scale Check: Pre (Wt., #): 197.5 − 192.5 = 5.0 lbs. / 5.0 lbs OK ✓
Post (Wt.,#): 221.0 − 216.0 = 5.0 lbs. / 5.0 lbs. OK ✓

Scale Zero Drift: Pre: N/A lbs. Post: N/A lbs. Drift: N/A lbs.

Combustion Gas (CO_2, O_2 &CO) Train Leak Checks: Pre: OK ✓ Post: OK ✓
Draft (Static [P_g]) Gauge Level and Zero Check: Pre: OK ✓ Post: OK ✓

THERMOCOUPLE CHECK (@ Ambient):

T/C #1:	59	T/C #2:	—	T/C #3:	—	T/C #4:	—
T/C #5:	—	T/C #6:	—	T/C #7:	—	T/C #8:	—
T/C #9:	57	T/C #10:	58	T/C #11:	58	T/C #12:	55
T/C #13:	58	T/C #14:	57	T/C #15:	57	T/C #16:	57
T/C #17:	57	T/C #18:	57	T/C #19:	—	T/C #20:	56
T/C #21:	55	T/C #22:	—				

Thermocouple Readout:

Pretest Zero & Span Check and Calibration
Zero (0° F): -0 ° F Adj to: — ° F
Span (2000° F): 1999 ° F Adj to: — ° F

Post Test Zero & Span Check
0° F 0 Δ%: 0
Span (2000° F): 2001 Δ%: +0.04

Pretest Thermocouple Readout Linearity Check:

0 °F =	-0	200 °F =	200	400 °F =	398	600 °F =	600
800 °F =	801	1000 °F =	1000	1200 °F =	1198	1400 °F =	1399
1600 °F =	1599	1800 °F =	1799	2000 °F =	1999		

Stack Cleaned Prior to Test: Yes ✓ No _____

Tunnel Cleaned Prior to Test: Yes ✓ No _____

Test Method 28R for Certification and Auditing of Wood Heaters

SUMMARY RESULTS-PELLET HEATERS

Run #	Date	Setting	Dry Burn Rate (kg/h)	Run Time (minutes)	Heat Output Btu/h	PM Emissions (g/h) 1st h	PM Emissions (g/h) Int. Avg.	CO Emissions (g/h) Segment	CO Emissions (g/h) Int. Avg.	%OE (%) (B415) (HHV) Segment	%OE (%) (B415) (HHV) Int. Avg.
1	10.21.16	High	1.491[1]	60	17,732	0.848		20.28		63.3	
1	1.15.16	Medium	1.07	120	12,233			35.32		61.1	
1	1.15.16	Low	0.70	180	7,943			41.59		60.7	
Integrated Averages:			0.955	360	11,376		0.823	33.76		63.6	

Note: (1.) There is no test run in Dry Burn Rate (BDR) Category 4 (>1.90 kg/h) because the unit's dry burn rates are controlled by its operating controls. When you push the HIGH button, you get a DBR of about 1.491 kg/h. The same is true for the MEDIUM and LOW buttons. There is nothing a consumer can do to change these DBR's without tampering with the operating controls which would void the unit's warranty.

THELIN GNOME PELLET STOVE
INTEGRATED AVERAGE TEST RESULTS

Integrated averages are different from weighted averages which are based upon the probability factors listed in EPA M28/ M28R, Table 1 and the calculation procedures shown in M28/ M28R Figure 28-5. Integrated averages are based on the test data generated by the test method itself (ASTM E2779) which requires that a pellet heater be operated at three different settings, each for a specific period of time, i.e., 1 h on High, 2 h on Medium and 3 h on Low. Since the sampling is continuous for the 6 h test period stipulated in ASTM E2779, the testing process "automatically" generates the Integrated Average.

The integrated average particulate matter (PM) emission rate (g/h) is

0.823 g/h.

The integrated average particulate matter (PM) emissions (lbs./ MM Btu output) is

0.16 lb./MM Btu output

The integrated average overall HHV efficiency (%OE) is

63.6%.

The integrated average overall LHV efficiency (%OE) for the is

68.7%.

The integrated average CO emissions (g/h) is

33.76 g/h

The integrated average CO emissions (g/ kg dry fuel) is

35.47 g/ dry kg of fuel

SUMMARY OF ASTM E2515 PARTICULATE EMISSIONS SAMPLING TRAIN PERFORMANCE

RUN #	DBR (kg/hr)	T1 CATCH (mg)	T1 SAMPLE RATE (cfm)	T1 SAMPLE VOl (dscf)	T1 AVG.% PROP	T1 EMISSIONS (g/h)	T2 CATCH (mg)	T2 SAMPLE RATE (cfm)	T2 SAMPLE VOL (dscf)	T2 AVG. % PROP	T2 EMISSIONS g/h)	Avg. g/h.	% DIFF
EPA 1	0.955	16.6	.542	175.003	99.539	0.802	16.7	.506	167.421	99.598	0.843	0.823	2.49

SUMMARY OF ASTM E2515 AMBIENT AIR (ROOM BLANK) SAMPLING TRAIN PERFORMANCE

RUN #	CATCH (mg)	SAMPLE RATE (cfm)	SAMPLE VOL. (dscf)	AMBIENT PM CONCENTRATION (mg/dscf)
EPA 1	0.0	0.491	164.017	0.00

TRAIN 1 0-60 MINUTE DBR and PM EMISSIONS

Run #	DBR (kg/h)	CATCH mg	EMISSIONS g/h
EPA 1	1.491	3.0	0.848

Unit: EASY FIRE

WST2-Form 12 Rev 11/2011

Woodstove Data Summary

	Run # 1							
Particulate Emissions:								
Emission Rate:	0.82							g/hr
Emission Factor:	0.86							g/kg
(Dry fuel weight basis)								
Efficiency Values: (CSA B415.10-1)								
Combustion Efficiency:	98.9							%
Heat Transfer Efficiency: HHV:	64.0							%
Heat Transfer Efficiency: LHV:	69.5							%
Overall Efficiency: HHV:	63.6							%
Overall Efficiency: LHV:	68.7							%
Heat Output:								
Avg. EPA Btu/hr. for test cycle	—							Btu/hr.
Avg. B415 Btu/hr. for test cycle	11,376							Btu/hr.
Fuel Burn Rates:								
Avg. Dry Burn Rate (Wet Basis)	1.013							kg/hr.
Avg. Dry Burn Rate (Dry Basis)	0.955							kg/hr.
PM Sampling Parameters:								
Avg. Tunnel Flow(Qsd):	140.891							dscfm
Avg. Tunnel Velocity(Vs):	812.184							ft./min.
Pitot Correction Factor:	.97489							
Total Sample Volume:	See page titled "Summary of ASTM E2515 Particulate Emissions Sampling Train Performance" in this Section.							dscf
Avg. Sampling Flow Rate:								cfm
Avg. % Proportionality:								%
Total Particulate Catch:								mg

Woodstove Data Summary

	Run #	1								
Fuel Moisture Content:										
Kindling (Wet basis):		N/A								%
Pre Test Fuel (Wet basis):		N/A								%
Test Fuel (Wet basis):		6.074								%
Air/Fuel Ratio:										
lbs. air/lbs. fuel:		35.44								
Average Stack Gas Composition:										
Avg. % CO_2:		3.35								%
Avg. % O_2: (stochiometrically)		17.54								%
Avg. % CO:		0.10								%
Average Stack Gas Flow Rate:										
Stack Flow Rate- EPA CMB										dscfm
Draft (static):		-0.0393								in. H_2O
Average Stack Gas Emission Factors:										
CO:		35.47								g/Kg
		33.76								g/hr.

Woodstove Data Summary

	Run #	1								
Average Temperatures:										
Stack Gas:		316.6								°F
Stove Top:		N/A								°F
Stove Left Sidewall:										°F
Stove Back:										°F
Stove Right Sidewall:										°F
Stove Bottom:										°F
Primary Combustion Chamber Gas:										°F
Secondary Combustion Chamber Gas:										°F
Catalytic Combustor Exit Gas:										°F
Stove Temperature Change:		N/A								°F
Test Chamber Environment:										
Avg. Barometric Pressure:		28.433								in. Hg
Avg. Temperature:		61.3								°F
Avg. % Ambient Moisture:		1.325								% H_2O
Avg. % Relative Humidity:		62.75								% RH
Avg. Air Velocity:		70, 45								ft/sec
Avg. Dilution Tunnel Draft: (If Applicable)		.000								in/H_2O
Test Fuel Weight and Burn Time:										
Density (Dry basis):		—								g/cm^3
Coal Bed Weight:		—								lbs.
Pre Test Fuel Weight (Inc. Kindling):		4.5								lbs.
Test Fuel Load Weight:		13.4								lbs.
Total Test Cycle Burn Time:		360								min.

Unit: Sierra Easy Fire
Date: 2/24/2021
Tech: A.T.Myren

DOCUMENT OF RUN APPROPRIATENESS
For the
TEST REPORT DATED
1/24/2017

The test run identified as Test Run # 1 in the Test Report prepared for the Sierra Easy Fire dated 1/24/2017 was conducted following all of the criteria found in the relevant test methods and specified in the letters received from EPA. Thus, it is an appropriate test run.

Signed: *Alben T. Myren Jr.*

Printed Name: Alben T. Myren Jr.

Title: PRESIDENT

Date: 2/24/2021

Unit: Sierra Easy Fire
Date: 2/24/2021
Tech: A.T.Myren

DOCUMENT OF TEST RUN ANOMALIES
For the
TEST REPORT DATED
1/24/2017

The test run identified as Test Run # 1 in the Test Report prepared for the Sierra Easy Fire dated 1/24/2017 was conducted following all of the criteria found in the relevant test methods and specified in the letters received from EPA and there were no test run anomalies.

Signed: *Albenm T. Myren Jr.*

Printed Name: Alben T. Myren Jr.

Title: PRESIDENT

Date: 2/24/2021

Unit: Sierra Easy Fire
Date: 2/24/2021
Tech: A.T.Myren

DOCUMENT OF RUN VALIDITY
For the
TEST REPORT DATED
1/24/2017

The test run identified as Test Run # 1 in the Test Report prepared for the Sierra Easy Fire dated 1/24/2017, was conducted following all of the criteria found in the relevant test methods and specified in the letters received from EPA and no testing criteria were exceeded. Thus, it is a valid test run.

Signed: *Alben T. Myren Jr.*

Printed Name: Alben T. Myren Jr.

Title: PRESIDENT

Date: 1/1/2021


THELIN
EASY FIRE

Revised 3.10.08

WOODSTOVE DATA SHEET # 30
STOVE STORAGE

The Sierra Easy Fire Pellet stove tested by Myren Consulting, Inc. is being held in custody by:

Thelin Hearth Products, LLC
63 Laxalt Drive
Carson City, NV 89706

Phone 775 241 2586

Contact: Robert Beck

The unit was tested at Myren Consulting's lab in Colville, WA. It was sealed on 10/22/16 after the unit had cooled after testing. The following page contains photos taken after the unit was sealed on 10/22/16.

The unit was sealed with several lengths of metal banding/strapping that were placed around the stove in a manner that prevents the door from being opened. At least two of these straps cross at 90° angles. At one or more of these crossings on the stove a label that clearly identifies the unit as a sealed EPA test stove and/ or a Myren Consulting, Inc. address label is placed over the crossing and taped into place with 2" clear packing tape. The stove was also loaded onto a pallet and strapped to a pallet for transport back to Sierra and to its final storage location. A sample stove storage label follows this page.

Once the unit is/ was certified by EPA, the unit will be returned to Sierra via common carries or manufacturer's truck.

Carrier: _____

Shipped on: _____

WST5-Form11

W A R N I N G

SEALED EPA TEST STOVE

DO NOT OPEN OR TAMPER WITH THE SEALS AND PACKAGING ON THIS STOVE.

TO DO SO WILL VOID THE CERTIFICATION ON THIS STOVE.

Sierra Easy Fire

WST5-Form11

W A R N I N G

SEALED EPA TEST STOVE

DO NOT OPEN OR TAMPER WITH THE SEALS AND PACKAGING ON THIS STOVE.

TO DO SO WILL VOID THE CERTIFICATION ON THIS STOVE.

Sierra Easy Fire