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

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

June 15, 2023

Mr. Guillaume Thibodeau-Fortin
Laboratory Manager
Stove Builder International, Inc.
250 Rue De Copenhague
Saint-Augustin-de-Desmaures
Quebec, Canada
G3A 2H3

Re: Renewal of Certificate of Compliance Number 125-18 for 25CAB80, 55-SHPCAB80, 55-TRPCAB80, 25-CAB80S, 55-SHPCAB80S and 55-TRPCAB80S Pellet-Fired Freestanding Room Heater Models

Dear Mr. Thibodeau-Fortin:

I am pleased to inform Stove Builder International, Inc. that the above-referenced models have 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. Pursuant to the 2015 NSPS, this Certificate of Compliance is valid through June 15, 2028. This letter serves as your pellet heater Certificate of Compliance. Please refer to the above-referenced 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 March 15, 2018,[1] test report prepared by Intertek Building & Construction (B&C) demonstrating compliance with American Society of Testing and Materials (ASTM) methods E2515 and E2779, an April 13, 2018 ,[2] Certification of Conformity by Intertek Testing Services NA, Inc. and the information provided in your April 13, 2023, 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 renewing the Certificate of Compliance, and in doing so, the agency is waiving certification testing for the above-referenced models. You may not advertise for sale, offer for sale, or sell heaters under this Certificate of Compliance after June 15, 2028, without applying for and being issued another Certificate of Compliance with an updated expiration date.

All pellet heaters manufactured or sold under this Certificate of Compliance must comply with EPA labeling requirements found at § 60.536. These provisions require each pellet 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 that ensures that all units within a model line are similar to the pellet 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 models 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 affected pellet heater model offered for sale;

4. Placing a copy of the non-Confidential Business Information (non-CBI) certification test report on the manufacturer's website and available to the public within 30 days after the EPA issues a Certificate of Compliance, pursuant to § 60.533(b)(12). If later revised, the up-to-date non-CBI certification test report should remain posted on the manufacturer's website for as long as the model line is manufactured and offered for sale in the U.S.;

[1] Revised on April 13, 2018, and June 14, 2022.
[2] Revised on June 14, 2022, and June 9, 2023.

5. Submitting a report to the EPA every two years following the 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 pellet 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 request that manufacturers submit a copy of the Uniform Resource Locator (URL) or web address where the test report is posted to WoodHeaterReports@epa.gov within ten (10) days of posting.

Once we have verified that the revised test report has been posted on the manufacturer's website, the agency will continue to list the above-referenced models in the EPA-Certified Wood Heater Database.

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

Sincerely,

Vizard, Elizabeth

Digitally signed by Vizard, Elizabeth
Date: 2023.06.15 18:04:34 -04'00'

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

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CERTIFICATE OF CONFORMITY

Emissions – Pellet Heater

EPA 40 CFR Part 60, Subpart AAA, ASTM E2779-17, ASTM E2515-17, CSA B415.1-2010 (R2020)

WHI22 – 21514323

Organization

Stove Builder International
250 de Copenhauge
St Augustin de Desmaures, QC G3A 2H3
Canada

Product: 25-CAB80, 55-SHPCAB80, 55-TRPCAB80, 25-CAB80S, 55-SHPCAB80S and 55-TRPCAB80S

Catalytic: No
Maximum Output: 20,959 Btu/hr
Weighted Average Emissions: 1.13
Weighted Average Annual Delivered Efficiency (HHV): 64.1%
Test Fuel Type: Premium Grade Wood Pellets
Weighted Average CO Emissions Rate (g/min): 0.029
Conformance: Complies with 2020 particulate emissions standard
Product Evaluation No.: 104671974MID-001
Product Evaluation No.: 105096672MID-001b
Test Report No.: 103348206MID-001bR2

Certification Body: Intertek Testing Services NA, Inc.
Registered Address: 545 E. Algonquin Rd., Arlington Heights, IL 60005, USA
Initial Issue Date: 14-Jun-22
Issue Status: 2

This is a certificate of conformity to confirm that the bearer has successfully completed the requirements of the Intertek certification scheme which include the testing of products and the initial assessment. The bearer is subject to continuing assessments of their compliance through surveillance and testing of products samples taken from production (as applicable to the scheme) and has been registered within the scheme for the products detailed. The validity of this certificate is contingent to the listing's status on the Intertek Directory of Building Products: bpdirectory.intertek.com.

Jean-Philippe Kayl Vice President – Global Certification		09-Jun-23
Name	Signature	Date

Certificate of Conformity WHI22-21514323
Appendix A

Certificate of Conformity #:		Certificate of Conformity Issue Date:	
WHI22-21514323		June 14, 2022	
REVISION #	**REVISION DATE**	**REPORT PAGES**	**REVISION**
0	June 14, 2022	N/A	Original CoC Issue. Ownership transferred from England's Stove Works to Stove Builder International. Previous CoC WHI15-208507005 initially issued to England's Stove Works on April 13, 2018.
1	June 9, 2023	N/A	Corrected CoC to include missing models 55-TRPCAB80, 25-CAB80S, 55-SHPCAB80S and 55-TRPCAB80S.

Revised Report #:		Report Issue Date:	
103348206MID-001b		March 15, 2018	
REVISION #	**REVISION DATE**	**REPORT PAGES**	**REVISION**
0	March 15, 2018	N/A	Original Report Issue
1	April 13, 2018	19	Added similar models 55-SHPCAB80, 55-TRPCAB80, 25-CAB80S, 55-SHPCAB80S and 55-TRPCAB80S to conclusion of report.
2	June 14, 2022	3	Updated the conditioning burn information
		5	Test Fuel Properties updated to identify test fuel used
		17	Added anomalies, appropriateness, and validation statement. Added note for not measuring ambient particulates.
		18	added medium burn rate statement
		22	Added Appendices
		Appendix F	Added 50+ hours of conditioning burn data

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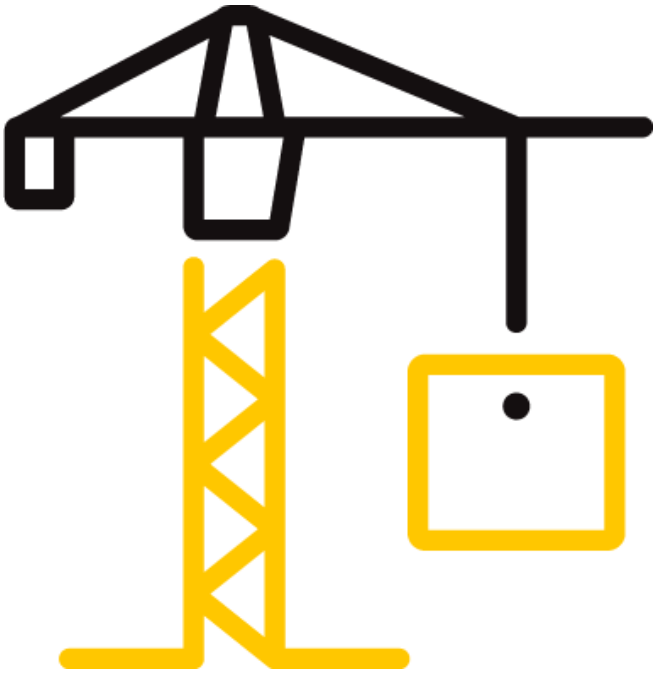
ENGLAND STOVE WORKS, INC.
TEST REPORT

SCOPE OF WORK
EPA EMISSIONS TESTING FOR MODEL 25CAB-80

REPORT NUMBER
103348206MID-001BR2

TEST DATE(S)
03/01/18

ISSUE DATE **[REVISED DATE]**
03/15/18 06/14/22



PAGES
23

DOCUMENT CONTROL NUMBER
GFT-OP-10c (05/10/17)

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TEST REPORT FOR ENGLAND STOVE WORKS, INC.
Report No.: 103348206MID-001BR2
Date: 06/14/22

REPORT ISSUED TO

ENGLAND STOVE WORKS, INC.
589 South Five Forks Road
Monroe, VA 24574-2821

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by England Stove Works, Inc., 589 South Five Forks Road, Monroe VA, 24574-2821 to perform testing in accordance with EPA 40 CFR Part 60 "Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces", ASTM E2515-11- Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel, ASTM E2779-10 - Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters, and CSA B415.1-10 - Performance Testing of Solid-Fuel-Burning Heating Appliances on their Model 25CAB-80, Pellet Fuel Room Heater. Results obtained are tested values and were secured by using the designated test method(s). Testing was conducted at Intertek test facility in Middleton, WI.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

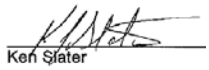
SECTION 2

SUMMARY OF TEST RESULTS

The appliance tests resulted in the following performance:

Particulate Emissions: 1.130 g/hr
Carbon Monoxide Emissions: 0.029 g/min
Heating Efficiency: 64.1 % (Higher Heating Value Basis)

For INTERTEK B&C:

COMPLETED BY:	Ken Slater	**REVIEWED BY:**	Brian Ziegler
TITLE:	Associate Engineer – Hearth	**TITLE:**	Technical Team Leader - Hearth
SIGNATURE:	 Ken Slater	**SIGNATURE:**	
DATE:	06/14/22	**DATE:**	06/14/22

aaa:bbb

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SECTION 3
TEST METHOD(S)

The specimen was evaluated in accordance with the following:

EPA 40 CFR Part 60-2015 - Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces

ASTM E2515-2011 - Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel

ASTM E2779-2010 - Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters

CSA B415.1-2010 - Performance Testing of Solid-Fuel-Burning Heating Appliances

SECTION 4
MATERIAL SOURCE

A sample was submitted to Intertek directly from the client. The sample was not independently selected for testing. The test unit was received at Intertek in Middleton, WI on 2/21/18 and was shipped via the client. The unit was assigned sample ID # MID1802211213-001. The unit was inspected upon receipt and found to be in good condition. The unit was set up following the manufacturer's instructions without difficulty.

Following assembly, the unit was placed on the test stand. Prior to beginning the emissions tests, the manufacturer operated the unit for a minimum of 48 hours at high-to-medium burn rates to break in the stove. This break-in period was witnessed by England Stove Works, Inc. staff and data is included in the final report. The unit was found to be operating satisfactory during this break-in. The 48 plus hours of pre-burning was conducted prior to the test dates. The fuel used for the break-in process was wood pellets.

Following the pre-burn break-in process the unit was allowed to cool and ash and residue was removed from the firebox. The unit's chimney system and laboratory dilution tunnels were cleaned using standard wire brush chimney cleaning equipment. On 3/1/18 the unit was set-up for testing.

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SECTION 5
EQUIPMENT

Equipment	INV Number	Calibration Due	MU
Platform Scale	008	7/17/18	± 30g
Balance	713	7/17/18	0.47mg
Data Logger	986	4/12/18	0.21°F
Scale	1134	7/17/18	± 30g
Timer	646	4/10/18	±0.3 sec
Timer	1213	4/10/18	±0.3 sec
Flow Meter	1413	7/31/18	± 17mL/min
Flow Meter	1414	7/31/18	± 17mL/min
Barometer	1420	4/19/18	0.069.6°F, 0.51% RH, 0.011 in Hg
DGM	1210	6/29/18	0.009925 ft^3

SECTION 6
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Ken Slater	Intertek B&C

SECTION 7
TEST PROCEDURE

On 3/1/18, the unit was tested for EPA emissions. For pellet stoves, the test was conducted in accordance with ASTM E2779-10. The fuel used for the test run was premium-Grade Pellets (Marthwood).

The applicable EPA regulatory limits are:

Step 1 – 2015 – 4.5 grams per hour.

Step 2 – 2020 – 2.0 grams per hour.

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TEST SET-UP DESCRIPTON

A 3” horizontal flue is connected by a 90° elbow and adapters to a standard 6” diameter vertical single wall pipe and insulated chimney system was installed to 15’ above floor level. The singe wall pipe extended to 8 feet above the floor and insulated chimney extended the remaining height.

AIR SUPPLY SYSTEM

Combustion air enters a 2” inlet pipe located on the back of the heater, which is directed to the pellet burn pot. All gases exit through the 3” flue also located at the back of the heater. The exhaust gases are assisted by a combustion blower.

TEST FUEL PROPERTIES

Wood pellets used for the testing were manufactured by Marthwood, which are certified Premium by PFI and contain oak and maple wood. The pellets have a measured heating value of 8528 Btu/hr (19836 kJ/kg) and a moisture content of 3.0% on a dry basis and 3.1% on a wet basis.

SAMPLING LOCATIONS

Particulate samples are collected from the dilution tunnel at a point 20 feet from the tunnel entrance. The tunnel has two elbows and two mixing baffles in the system ahead of the sampling section. (See Figure 3.) The sampling section is a continuous 13 foot section of 6 inch diameter pipe straight over its entire length. Tunnel velocity pressure is determined by a standard Pitot tube located 60 inches from the beginning of the sampling section. The dry bulb thermocouple is located six inches downstream from the Pitot tube. Tunnel samplers are located 60 inches downstream of the Pitot tube and 36 inches upstream from the end of this section. (See Figure 1.)

Stack gas samples are collected from the steel chimney section 8 feet ± 6 inches above the scale platform. (See Figure 2.)

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Report No.: 103348206MID-001BR2
Date: 06/14/22

FIGURE 1 – DILUTION TUNNEL

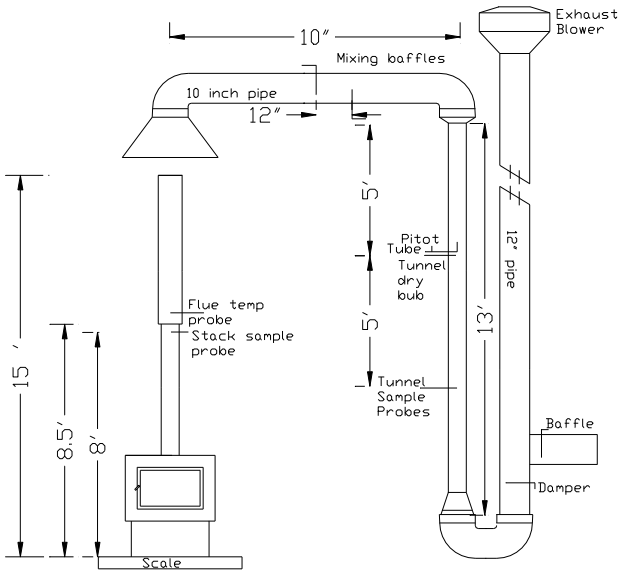
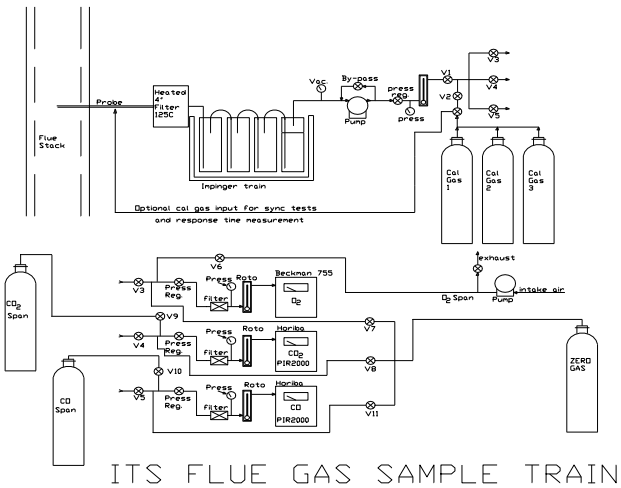


FIGURE 1

FIGURE 2 – STACK GAS SAMPLE TRAIN



ITS FLUE GAS SAMPLE TRAIN

FIGURE 2

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FIGURE 3 – DILUTION TUNNEL SAMPLE SYSTEMS

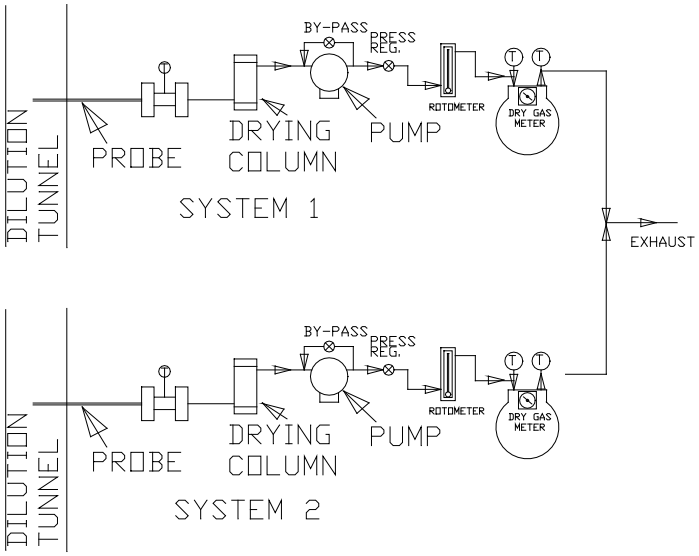

Figure 3

SAMPLING METHODS

PARTICULATE SAMPLING

Particulates were sampled in strict accordance with ASTM E2515-2011. This method uses two identical sampling systems with Gelman A/E 61631 binder free, 47-mm diameter filters. The dryers used in the sample systems are filled with “Drierite” before each test run. In order to measure first-hour emissions rates the a third filter set is prepared at one hour into the test run, the filter sets are changed in one of the two sample trains. The two filter sets used for this train are analyzed individually to determine the first hour and total emissions rate.

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INSTRUMENT CALIBRATION

DRY GAS METERS

At the conclusion of each test program the dry gas meters are checked against our standard dry gas meter. Three runs are made on each dry gas meter used during the test program. The average calibration factors obtained are then compared with the six-month calibration factor and, if within 5%, the six-month factor is used to calculate standard volumes. Results of this calibration are contained in Appendix D.

An integral part of the post test calibration procedure is a leak check of the pressure side by plugging the system exhaust and pressurizing the system to 10" W.C. The system is judged to be leak free if it retains the pressure for at least 10 minutes.

The standard dry gas meter is calibrated every 6 months using a Spirometer designed by the EPA Emissions Measurement Branch. The process involves sampling the train operation for 1 cubic foot of volume. With readings made to .001 ft^3, the resolution is .1%, giving an accuracy higher than the ±2% required by the standard.

STACK SAMPLE ROTAMETER

The stack sample rotometer is checked by running three tests at each flow rate used during the test program. The flow rate is checked by running the rotometer in series with one of the dry gas meters for 10 minutes with the rotometer at a constant setting. The dry gas meter volume measured is then corrected to standard temperature and pressure conditions. The flow rate determined is then used to calculate actual sampled volumes.

GAS ANALYZERS

The continuous analyzers are zeroed and spanned before each test with appropriate gases. A mid-scale multi-component calibration gas is then analyzed (values are recorded). At the conclusion of a test, the instruments are checked again with zero, span and calibration gases (values are recorded only). The drift in each meter is then calculated and must not exceed 5% of the scale used for the test.

At the conclusion of each unit test program, a three-point calibration check is made. This calibration check must meet accuracy requirements of the applicable standards. Consistent deviations between analyzer readings and calibration gas concentrations are used to correct data before computer processing. Data is also corrected for interferences as prescribed by the instrument manufacturer's instructions.

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TEST METHOD PROCEDURES

LEAK CHECK PROCEDURES

Before and after each test, each sample train is tested for leaks. Leakage rates are measured and must not exceed 0.02 CFM or 4% of the sampling rate. Leak checks are performed checking the entire sampling train, not just the dry gas meters. Pre-test and post-test leak checks are conducted with a vacuum of 10 inches of mercury. Vacuum is monitored during each test and the highest vacuum reached is then used for the post test vacuum value. If leakage limits are not met, the test run is rejected. During, these tests the vacuum was typically less than 2 inches of mercury. Thus, leakage rates reported are expected to be much higher than actual leakage during the tests.

TUNNEL VELOCITY/FLOW MEASUREMENT

The tunnel velocity is calculated from a center point Pitot tube signal multiplied by an adjustment factor. This factor is determined by a traverse of the tunnel as prescribed in EPA Method 1. Final tunnel velocities and flow rates are calculated from EPA Method 2, Equation 6.9 and 6.10. (Tunnel cross sectional area is the average from both lines of traverse.)

Pitot tubes are cleaned before each test and leak checks are conducted after each test.

PM SAMPLING PROPORTIONALITY

Proportionality was calculated in accordance with ASTM E2515-11. The data and results are included in Appendix C.

DEVIATIONS FROM STANDARD METHOD:

SECTION 8
TEST CALCULATIONS

WEIGHT OF TEST FUEL BURNED (DRY) – ASTM E2779

$$M_{Bdb} = (M_{Swb} - M_{Ewb})(100/(100 + FM))$$

where:
FM = average fuel moisture of test fuel, % dry basis,
M_{Swb} = weight of test fuel in hopper at start of test run, wet basis, kg (lb),
M_{Ewb} = weight of test fuel in hopper at end of test run, wet basis, kg (lb), and
M_{Bdb} = weight of test fuel burned during test run, dry basis, kg (lb).

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WEIGHT OF TEST FUEL BURNED PER TEST SEGMENT (DRY) – ASTM E2779

$$M_{BSidb} = (M_{SSiwb} – M_{ESiwb}) (100/(100 + FM))$$

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

AVERAGE BURN RATE FOR FULL TEST (DRY) – ASTM E2779

$$BR = 60\ M_{Bdb}/\theta$$

where:
BR = average dry burn rate over the full integrated test run, kg/h (lb/h), and
θ = total length of full integrated test run, min.

AVERAGE BURN RATE PER TEST SEGMENT (DRY) – ASTM E2779

$$BR_{Si} = 60\ M_{BSidb}/\ \theta_{Si}$$

where:
BR_{Si} = average dry burn rate over test run segment *i*, kg/h (lb/h), and
θ_{Si} = total length of test run segment *i*, min.

AVERAGE EMISSION RATE FOR FULL TEST (g/hr) – ASTM E2779

$$PM_R = 60(E_T/\theta)$$

where:
E_T = total particulate emissions for full integrated test run measured using Test Method E2515, g (lb),
θ = total length of test run, min, and
PM_R = average particulate emission rate over the full integrated test run, g/h.

AVERAGE EMISSION FACTOR FOR FULL TEST (g/kg dry) – ASTM E2779

$$PM_F = E_T/M_{Bdb}$$

where:
PM_F = average particulate emission factor over the full integrated test run, g/dry kg of fuel burned.

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AVERAGE EMISSIONS FOR FULL TEST (g/MJ or lb/MMBtu) – ASTM E2779

$$PM_H = E_T/E_O$$

where:

E_O = average measured overall heat output over the full integrated test run from Annex A1, MJ (MMBTU), and

PM_H = average particulate emissions in accordance with unit of average heat output over the full integrated test run, g/MJ (lb/MMBtu).

NOMENCLATURE FOR ASTM E2515:

A = Cross-sectional area of tunnel m2 (ft2).

B_{ws} = Water vapor in the gas stream, proportion by volume (assumed to be 0.02 (2.0 %)).

C_p = Pitot tube coefficient, dimensionless (assigned a value of 0.99).

c_r = Concentration of particulate matter room air, dry basis, corrected to standard conditions, g/dscm (gr/ dscf) (mg/dscf).

c_s = Concentration of particulate matter in tunnel gas, dry basis, corrected to standard conditions, g/dscm (gr/dscf) (mg/dscf).

E_T = Total particulate emissions, g.

F_p = Adjustment factor for center of tunnel pitot tube placement.

$F_p = V_{strav}/V_{scent}$

K_P = Pitot Tube Constant, $34.97 \frac{m}{\sec} \left[\frac{\left(\frac{g}{g}\blacksquare mole\right)(mm\ Hg)}{(K)(mm\ water)}\right]^{\frac{1}{2}}$

or

= Pitot Tube Constant, $85.49 \frac{ft}{\sec} \left[\frac{\left(\frac{lb}{lb}-mole\right)(in\ Hg)}{(R)(in\ water)}\right]^{\frac{1}{2}}$

L_a = Maximum acceptable leakage rate for either a pretest or post-test leak- check, equal to 0.0003 m3/min (0.010 cfm) or 4 % of the average sampling rate, whichever is less.

L_p = Leakage rate observed during the post-test leak-check, m3/min (cfm).

m_p = mass of particulate from probe, mg.

m_f = mass of particulate from filters, mg.

m_g = mass of particulate from filter gaskets, mg.

m_r = mass of particulate from the filter, filter gasket, and probe assembly from the room air blank filter holder assembly, mg.

m_n = Total amount of particulate matter collected, mg.

M_s = the dilution tunnel dry gas molecular weight (may be assumed to be 29 g/g mole (lb/lb mole).

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_g = Static Pressure in the tunnel (in. water).

P_R = Percent of proportional sampling rate.

P_s = Absolute average gas static pressure in dilution tunnel, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{std} = Average gas flow rate in dilution tunnel.

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$Q_{std} = 60 (1 - B_{ws}) V_s A [T_{std} P_s/T_s P_{std}]$
dscm/min (dscf/min).

T_m = Absolute average dry gas meter temperature, K (R).

T_{mi} = Absolute average dry gas meter temperature during each 10-min interval, *i*, of the test run.

$T_{mi} = (T_{mi(b)} + T_{mi(e)})/2$

where:

$T_{mi(b)}$ = Absolute dry gas meter temperature at the beginning of each 10-min test interval, i, of the test run, K (R), and

$T_{mi(e)}$ = Absolute dry gas meter temperature at the end of each 10-min test interval, i, of the test run, K (R).

Ts = Absolute average gas temperature in the dilution tunnel, K (R).

Tsi = Absolute average gas temperature in the dilution tunnel during each 10-min interval, i, of the test run, K (R).

$T_{si} = (T_{si(b)} + T_{m=si(e)})/2$

where:

$T_{si(b)}$ = Absolute gas temperature in the dilution tunnel at the beginning of each 10-min test interval, i, of the test run, K (R), and

$T_{si(e)}$ = Absolute gas temperature in the dilution tunnel at the end of each 10-min test interval, i, of the test run, K (R).

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

V_{mc} = Volume of gas sampled corrected for the post test leak rate, dcm (dcf).

V_{mi} = Volume of gas sample as measured by dry gas meter during each 10-min interval, i, of the test run, dcm.

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions.

$V_{m(std)} = K_1 V_m Y [(P_{bar} + (\Delta H/13.6))/T_m]$

where:

K_1 = 0.3855 K/mm Hg for SI units and = 17.64 R/in. Hg for inch-pound units.

$V_{m(std)} = K_1 V_{mc} Y [(P_{bar} + (\Delta H/13.6))/T_m]$

where:

V_{mc} = Vm– (Lp– La)u

V_{mr} = Volume of room air sample as measured by dry gas meter, dcm (dcf), and

$V_{mr(std)}$ = Volume of room air sample measured by the dry gas meter, corrected to standard conditions.

$V_{m(std)} = K_1 V_{mr} Y [(P_{bar} + (\Delta H/13.6))/T_m]$

Where:

K_1 = 0.3855 K/mm Hg for SI units and = 17.64 R/in. Hg for inch-pound units, and

V_s = Average gas velocity in the dilution tunnel.

$V_s = F_p K_p C_p (\sqrt{\Delta P_{avg}})(\sqrt{(T_s/P_s M_s)})$

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V_{si} = Average gas velocity in dilution tunnel during each 10-min interval, i, of the test run.

$$V_{si} = F_p K_p C_p (\sqrt{\Delta P_i})(\sqrt{(T_{si}/P_s M_s)})$$

V_{scent} = Average gas velocity at the center of the dilution tunnel calculated after the Pitot tube traverse.

V_{strav} = Average gas velocity calculated after the multipoint Pitot traverse.

Y = Dry gas meter calibration factor.

ΔH = Average pressure at the outlet of the dry gas meter or the average differential pressure across the orifice meter, if used, mm water (in. water).

ΔP_{avg} = Average velocity pressure in the dilution tunnel, mm water (in. water).

ΔP_i = Velocity pressure in the dilution tunnel as measured with the Pitot tube during each 10-min interval, i, of the test run.

$$\Delta P_i = (\Delta P_{i(b)} + \Delta P_{i(e)})/2$$

where:

$\Delta P_{i(b)}$ = Velocity pressure in the dilution tunnel as measured with the Pitot tube at the beginning of each 10-min interval, i, of the test run, mm water (in. water), and

$\Delta P_{i(e)}$ = Velocity pressure in the dilution tunnel as measured with the Pitot tube at the end of each 10-min interval, i, of the test run, mm water (in. water).

θ = Total sampling time, min.

10 = ten min, length of first sampling period.

13.6 = Specific gravity of mercury.

100 = Conversion to percent.

TOTAL PARTICULATE WEIGHT – ASTM E2515

$$M_n = m_p + m_f + m_g$$

PARTICULATE CONCENTRATION – ASTM E2515

$$C_s = K_2(m_n/V_{m(std)}) \text{ g/dscm (g/dscf)}$$

where:

K_2 = 0.001 g/mg

TOTAL PARTICULATE EMISSIONS (g) – ASTM E2515

$$E_T = (C_s - C_r)Q_{std}\theta$$

PROPORTIONAL RATE VARIATION (%) – ASTM E2515

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

MEASUREMENT OF UNCERTAINTY – ASTM E2515

$$MU_{weighing} = \sqrt{0.1^2} \bullet X$$

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GENERAL FORMULA – ASTM E2515

$$uY = \sqrt{((\delta Y/\delta x_1) \times u_1)^2 + \ldots + ((\delta Y/\delta x_n) \times u_n)^2}$$

Where:
$\delta Y/\delta x_i$ = Partial derivative of the combining formula with respect to individual measurement xi,
u_i = is the uncertainty associated with that measurement.

TOTAL PARTICULATE EMISSIONS – ASTM E2515

$$E_T = (c_s - c_r)\, Q_{std}\, \theta$$

where:
c_s = sample filter catch/(sample flow rate x test duration), g/dscf,
c_r = room background filter catch/(sample flow x sampling time), g/dscf,
Q_{std} = average dilution tunnel flow rate, dscf/min, and
θ = sampling time, minutes.

MU OF c_s

$c_s = F_c/(Q_{sample} \times \theta) = 0.025/(0.25 \times 180) = 0.0005555$
$\delta c_s/\delta F_c = 1/Q_{sample} \bullet \Theta = 1/0.25 \bullet 180 = 0.0222$
$\delta c_s/\delta Q_{sample} = -F_c/Q^2_{sample} \bullet \Theta = -0.025/0.25^2 \bullet 180 = -0.00222$
$\delta c_s/\delta \Theta = -F_c/Q_{sample} \bullet \Theta^2 = -0.025/0.25 \bullet 180^2 = -0.000003$
$MUc_s = \sqrt{(0.00027 \bullet 0.0222)^2 + (0.0025 \bullet -0.00222)^2}$
$\sqrt{} + (0.1 \bullet -0.000003)^2 = 0.0000091g$
Thus, c_s would be 0.555 mg/dscf ± 0.0081 mg/dscf at 95% confidence level.

MU OF c_r

$c_r = BG_c/(QBG \times \theta) = 0.002/(0.15 \times 180) = 0.000074$
$\delta c_r/\delta BG_c = 1/Q_{BG} \bullet \Theta = 1/0.15 \bullet 180 = 0.03704$
$\delta c_r/\delta Q_{BG} = -BG_c/Q^2_{BG} \bullet \Theta = -0.002/0.15^2 \bullet 180 = -0.0004938$
$\delta c_r/\delta \Theta = -BG_c/Q_{BG} \bullet \Theta^2 = -0.002/0.15 \bullet 180^2 = -0.0000004$
$MUc_r = \sqrt{(0.00027 \bullet 0.03704)^2 + (0.0015 \bullet -0.0004938)^2}$
$\sqrt{} + (0.1 \bullet -0.0000004)^2 = 0.00001g$
Thus, c_r would be 0.074 mg/dscf ± 0.01 mg/dscf at 95% confidence level.

E_T AND MU_{ET}

$E_T = (c_s - c_r)\, Q_{sd}\, \theta = (0.000555 - 0.000074) \times 150 \times 180 = 13.00g$
$\delta E_T/\delta c_s = Q_{std} \bullet \Theta = 150 \bullet 180 = 27{,}000$
$\delta E_T/\delta c_r = Q_{std} \bullet \Theta = 150 \bullet 180 = 27{,}000$
$\delta E_T/\delta Q_{std} = c_s \bullet \Theta - c_r \bullet \Theta = 0.000555 \bullet 180 - 0.000074 \bullet 180 = 0.08667$
$\delta E_T/\delta \Theta = c_s \bullet Q_{std} - c_r \bullet Q_{std} = 0.000555 \bullet 180 - 0.000074 \bullet 180 = 0.07222$
$MU_{ET} = \sqrt{(27{,}000 \bullet 0.0000081)^2 + (27{,}000 \bullet 0.00001)^2\, (0.08667 \bullet 3)^2}$
$\sqrt{} + (0.07222 \bullet 0.1)^2 = 0.436$

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Thus the result in this example would be:
ET = 13.00g ± 0.44 g at a 95% confidence level.

EFFICIENCY – CSA B415.1

The change in enthalpy of the circulating air shall be calculated using the moisture content and temperature rise of the circulating air, as follows:

$$\Delta h = \Delta t\ (1.006 + 1.84x)$$

Where:
Δh = change in enthalpy, kJ/kg
Δt = temperature rise, °C
1.006 = specific heat of air, kJ/kg °C
1.84 = specific heat of water vapor, kJ/kg °C
x = humidity ratio, kg/kg

The equivalent duct diameter shall be calculated as follows:

$$ED = 2HW/H+W$$

Where:
ED = equivalent duct diameter
H = duct height, m
W = duct width, m

The air flow velocity shall be calculated as follows:

$$V = F_p \times C_p \times 34.97 \times \sqrt{T/28.56(P_{baro} + P_s)}$$

where
V = velocity, m/s
F_P = Pitot tube calibration factor determined from vane anemometer measurements
C_P = Pitot factor
= 0.99 for a standard Pitot tube or as determined by calibration for a Type S Pitot tube
34.97 = Pitot tube constant
Note: The Pitot tube constant is determined on the basis of the following units: $m/s[g/g\ mole\ (mm\ Hg)/(K)(mm\ H_2O)]^{0.5}$
ΔP = velocity pressure, mm H2O
T = temperature, K
28.56 = molecular weight of air
P_{Baro} = barometric pressure, mm Hg
P_s = duct static pressure, mm Hg

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The mass flow rate shall be calculated as follows:

$$m = 3600VAp$$

where:
m = mass flow rate, kg/h
V = air flow velocity, m/s
3600 = number of seconds per hour
A = duct cross-sectional area, m2
p = density of air at standard temperature and pressure (use 1.204 kg/m3)

The rate of heat release into the circulating air shall be calculated using the air flow and change in enthalpy, as follows:

$$\Delta e = \Delta h \times m$$

Where:
Δe = rate of heat release into the circulating air, kJ/h
Δh = change in enthalpy of the circulating air, kJ/kg
m = mass air flow rate, kg/h

The heat output over any time interval shall be calculated as the sum of the heat released over each measurement time interval, as follows:

$$E_t = \sum(\Delta e \times i) \text{ for } i = t_1 \text{ to } t_2$$

Where:
Et = delivered heat output over any time interval $t_2 – t_1$, kJ
i = time interval for each measurement, h

The average heat output rate over any time interval shall be calculated as follows:

$$e_t = E_t / t$$

where
e_t = average heat output, kJ/h
t = time interval over which the average output is desired, h

The total heat output during the burn shall be calculated as the sum of all the heat outputs over each time interval, as follows:

$$E_d = \sum(E_t) \text{ for } t = t_0 \text{ to } t_{final}$$

Where:
E_d = heat output over a burn, kJ/h (Btu/h)
E_t = heat output during each time interval, kJ/h (Btu/h)

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The efficiency shall be calculated as the total heat output divided by the total energy input, expressed as a percentage as follows:

$$\text{Efficiency, \%} = 100 \times E_d/I$$

Where:

E_d = total heat output of the appliance over the test period, kJ/kg

I = input energy (fuel calorific value as-fired times weight of fuel charge), kJ/kg (Btu/lb)

SECTION 9
TEST SPECIMEN DESCRIPTION

The model 25-CAB80 Pellet Fuel Room Heater is constructed of sheet steel. The outer dimensions are 2.35-inches deep, 38.5-inches high, and 23.5-inches wide. The unit has a door located on the front with a viewing glass.

SECTION 10
TEST RESULTS

DESCRIPTION OF TEST RUNS:

RUN #1 (3/1/18): The test for pellet heaters is a continuous test with three separate burn rates. At 6:37am the unit was started and operated for a minimum of 1 hour for the pretest operation. At 8:22am the unit was set to the maximum feed rate (level M9) with a burn rate of 1.68 kg/hr, the scale was tared and a 25-lb weight was added to the scale to determine feed rate of the fuel, and the sampling system was started. At 9:22am, the system #3 sampling filter was changed out and the unit was set to ≤50% feed rate (level M2) with a burn rate of 1.18 kg/hr. At 11:22am, the heater was changed to the minimum feed rate (level M1) with a burn rate of 1.04 kg/hr. At 2:22pm, testing was completed. The total burn time was 360 minutes.

The test run has been found to be appropriate, with no anomalies, and the test run has been validated and is deemed compliant. No negative weight was found on the filters, as the filters and gaskets are weighed together to eliminate filter material transfer to gaskets. All weightings were handled property, with no negative weight on gaskets or probes.

No attempt was made to collect the ambient background particulate during testing. Any collection that would have been made, would subtract from the particulate collected in the dilution tunnel. The particulate collected in the dilution tunnel has been deemed worst case.

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With the maximum burn rate at 1.68 kg/hr and the minimum burn rate at 1.04 kg/hr, this heater cannot achieve the required ≤50% of the maximum burn rate at the medium burn setting. The EPA letter issued on February 2, 2022, is being implemented to determine the required medium burn rate. The medium burn rate is determined by adding the maximum burn rate and the minimum burn rate and dividing by 2 [(1.68 + 1.04)/2=1.36 kg/hr]. This heater was operated at a level 2 setting to achieve a burn rate of 1.18 kg/hr, which is less than the required 1.36 kg/hr and complies with this requirement.

TABLE 1 – EMISSIONS

RUN#	TEST DATE	BURN RATES (kg/hr)(Dry)		PARTICULATE EMISSION RATE (g/hr)	1st HOUR EMISSIONS (g)	CO EMISSIONS (g/min)	HEATING EFFICIENCY (%HHV)
1	3/1/18	H*	1.63	1.130	1.36	0.029	64.1
		M*	1.14				
		L*	1.01				
		OA*	1.16				

*Notes: H= High burn rate, M= Medium burn rate, L= low burn rate, OA= overall burn rate.

TABLE 2 – TEST FACILITY CONDITIONS

RUN #	ROOM TEMP BEFORE (°F)	ROOM TEMP AFTER (°F)	BARO PRES BEFORE (in/Hg)	BARO PRES AFTER (in/Hg)	R. H. BEFORE (%)	R. H. AFTER (%)	AIR VEL BEFORE (ft/min)	AIR VEL AFTER (ft/min)
1	71	69	28.93	29.03	28.0	23.0	0	0

TABLE 3 – DILUTION TUNNEL FLOW RATE MEASUREMENTS AND SAMPLING DATA

RUN #	BURN TIME (min)	VELOCITY (ft/sec)	VOLUMETRIC FLOW RATE (dscf/min)	AVG TEMP (°R)	SAMPLE VOLUME (dscf)		PARTICULATE CATCH (mg)	
					1	2	1	2
1	360	21.10	225.93	550.95	81.66	81.52	6.70	6.90

TABLE 4 - DILUTION TUNNEL DUAL TRAIN PRECISION

RUN #	SAMPLE RATIOS		TOTAL EMISSIONS (g)		DEVIATION (%)	DEVIATION (g/kg)
	TRAIN 1	TRAIN 2	TRAIN 1	TRAIN 2		
1	996.00	997.72	6.67	6.88	1.56	0.029

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TABLE 5 - GENERAL SUMMARY OF RESULTS

RUN #	BURN RATE (kg/hr)(wet) (OVERALL)	INITIAL DRAFT (in/H_2O)	RUN TIME (min)	AVERAGE DRAFT (in/H_2O)
1	1.193	0.033	360	0.029

TABLE 6 - CSA B415.1 RESULTS

BURN RATE (kg/hr)(dry)	CO EMISSIONS (g/min)	HEATING EFFICIENCY (% HHV)	HEAT OUTPUT (Btu/hr)
HIGH – 1.63	0.029	68.3	20,959
MEDIUM – 1.14	0.035	61.8	13,310
LOW – 1.01	0.026	61.1	11,641
OVERALL – 1.16	0.029	64.1	13,985

SECTION 11
CONCLUSION

This test demonstrates that the model 25CAB-80 is an affected facility under the definition given in the regulation. The emission rate of 1.130 g/hr meets the EPA requirements for the Step 2 limits.

Similar models 55-SHPCAB80, 55-TRPCAB80, 25-CAB80S, 55-SHPCAB80S and 55-TRPCAB80S are identical to the model 25-CAB80, therefore are deemed to be compliant with these requirements as well.

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SECTION 12
PHOTOGRAPHS

Photo No. 1
Emissions Test

Photo No. 2
Start Number security tape

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Photo No. 3
End Number security tape

Photo No. 4
Final security wrap

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SECTION 13
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	03/15/18	N/A	Original Report Issue
1	04/13/18	N/A	Added similar models 55-SHPCAB80, 55-TRPCAB80, 25-CAB80S, 55-SHPCAB80S and 55-TRPCAB80S to conclusion of report.
2	6/14/22	3	Updated the conditioning burn information
		5	Test Fuel Properties updated to identify test fuel used
		17	Added anomalies, appropriateness, and validation statement. Added note for not measuring ambient particulates.
		18	added medium burn rate statement
		22	Added Appendices
		Appendix F	Added 50+ hours of conditioning burn data

The following are Appendices to this report:
Appendix A – Laboratory Operating Procedure
Appendix B – Data and Calculation Forms
Appendix C – Calibration Documents
Appendix D – Unit Drawings and Installation Manual (CBI), Installation Manual (Non-CBI)
Appendix E – Dry Gas Meter Calibration Data
Appendix F – Unit Preburn Documentation
Appendix G - Pictures

INTRODUCTION

This document provides a systematic guide for the technician conducting tests to EPA standard requirements. Procedures outlined here, when followed, will result in tests in conformance with ASTM E2779 and ASTM E2515. This guide cannot cover every possible contingency that may develop during a particular test program. Many questions that may arise can be answered by a complete understanding of the test standards and their intent. When in doubt on any detail check with the laboratory manager and be sure you understand the procedures involved.

The primary measurements to be obtained are particulate emission data and efficiency data. The technician's duties include the following steps. It is critical that all spaces on the data forms be properly filled in. Each test must be represented by a complete record of what was done and when.

I. APPLIANCE INSPECTION AND SET-UP
   - A. Incoming Inspection
   - B. Unit Set-Up

II. SAMPLING SYSTEMS - SET-UP
   - A. Gas Analysis
   - B. Dilution Tunnel

III. TEST CONDUCT
   - A. Pre-Test Fuel Load
   - B. Test Fuel Load
   - C. Unit Start - up
   - D. Test Run

IV. POST TEST PROCEDURE
   - A. Leak Checks
   - B. Particulate Sample Recovery

The technician running this test must be familiar with the following documents that are to be kept in the laboratory at all times.

1. ASTM E2779
2. ASTM E2515

I. APPLIANCE INSPECTION AND SET-UP

A. Incoming Inspection

1. Check for completeness of unit including parts, accessories, installation and operating instructions, drawings and specifications, etc. Note any discrepancies or missing parts.
2. Check for shipping damage. If damage has occurred, notify the laboratory manager. In some cases repairs may be made, provided the manufacturer and laboratory manager concur that repairs will not affect the unit's performance. If damage is irreparable, a new unit will need to be obtained.
3. Mark unit with manufacturer's name, model number, work order number, and date received.
4. If unit is safety listed, note label data including listing agency and serial number.

B. Unit Set-Up

1. All units must be operated by the manufacturer or Intertek for a break-in period of 50 hours at a medium burn rate. NOTE: Inserts are tested as if they are freestanding stoves.
2. Once break-in is completed, allow unit to cool then clean unit thoroughly.
3. Prior to placing unit on scale, the scale must be turned on and allowed to warm up for 1-hour minimum.
4. Place unit on scale and align so chimney will be centered in hood. Record the weight of the unit and all accessories. (Do not weigh with chimney attached.)
5. Chimney and connector should be cleaned with a wire brush prior to mounting. Attach chimney and connector then seal all joints. Be sure the single wall stove pipe terminates and insulated pipe starts at proper level above scale platform. Chimney must be supported from scale so that it does not touch test enclosure or hood walls.
6. Plug thermocouples into data acquisition system jacks and verify that all instrumentation is working properly.
7. Dilution tunnel must be cleaned prior to each certification test series, and at anytime a higher burn rate follows a lower burn rate.

II. SAMPLING SYSTEMS SET-UP

A. Gas Analysis

1. All instruments should be turned on and allowed to warm up for 1-hour minimum.

2. Prior to calibrating, make sure that the outlet pressure on each calibration gas bottle reads 10 PSI. Adjust flow meters at each gas analyzer to required flow.

The gas analyzer (CO_2, CO, O_2) is zeroed on nitrogen. The O_2, CO_2 and CO analyzer is spanned with a certified span gas mixture.

Calibrate analyzers as follows:

a. With calibration switch at "SPAN", adjust all span controls to values specified on span gas label.
b. Switch to "ZERO" and adjust zero controls to provide 0.00 readout on all analyzers.
c. Repeat a. and b. until no further adjustment is required.
d. Record these values on the appropriate data sheet.
e. Switch to "CAL." and record all analyzer values.

3. Response time synchronization check.

a. With switch at "SAMPLE" and no fire in unit, allow readings to stabilize (O_2 analyzer should read 20.93, CO and CO_2 should read 0.00).
b. Switch to "CAL" setting and start the stopwatch. Note the time required for each unit to reach the calibration gas bottle value. If all three analyzers reach this value within 5 seconds of each other, synchronization is adequate. If not, contact the laboratory manager. Synchronization is adjusted by either internal instrument setting or adjustment of sample line length.
c. Use EPA Method 5H 6.7-6.9 procedures to check calibration of instruments.

4. Sample clean-up train.

a. Load a new filter in 4-inch glass filter holder.
b. Load four Impingers as follows:
   #1: 100 ml. distilled water
   #2: 100 ml. distilled water
   #3: Empty
   #4: 200-300 grams Drierite.

c. Place Impingers in container and connect with greased "U TUBES". (Grease carefully on bottom half of ball joint so that grease will not get into tubes.)
d. Connect filter to impinger #1 and sample line to impinger #4.
e. Connect stack probe to filter.
f. Leak check system as follows:

1) Plug probe.
2) Turn on sample system and increase flow rate slowly.
3) Set vacuum-adjust valve to obtain a vacuum of 10 inches mercury.
4) If sapphire float in rotometer does not stabilize below 10 on scale, system must be resealed.
5) Repeat leak-check procedure until satisfactory results are obtained.
6) Unplug probe slowly, then decrease flow rate slowly before shutting off system.

g. Just prior to starting test, fill impinger container with ice.

B. Dilution Tunnel Sample Train Set-Up:

1. Filters and holders.
   a. Clean probes and filter holder front housings carefully and desiccate to a constant weight prior to use.
   b. Filters and filter probe combinations should be numbered and labeled prior to use.
   c. Weigh desiccated filters and probe filter units on analytical balance. Record the weights on the appropriate form. Note that the probe and front half of the front filter holder is to be weighed as a unit.
   d. Carefully assemble the filter holder units and connect to sampling systems.
   e. System #1 (Filter set #1) will have one filter set and System #2 (Filter set #2 and #3) will have two filter sets. Filter set #2 will be changed 1-hour into the test.
   e. Change desiccate columns with dry absorbent before each test series.

2. Leak checking.

   a. Each sample system is to be checked for leakage prior to inserting probes in tunnel.
   b. Plug probes and start the samplers. Adjust pump bypass valve to produce a vacuum reading of 10 inches mercury. NOTE: During test, highest vacuum recorded is required for posttest leak check.
   c. Allow vacuum indication to stabilize at 10" mercury, record dry gas meter readings, (DGM_1, DGM_2). At a convenient DGM value start stopwatch. Time for 1 minute then stop vacuum pumps. Record dry gas meter readings again, (DGM_3, DGM_4). NOTE: If rotometer ball is floating above the 5-mm mark, system is leaking too much and all seals should be checked.

d. Calculate leakage rate as follows.

System 1: DGM3-DGM_1 = CFM_1
System 2: DGM4-DGM_2 = CFM_2

If CFM_1 or CFM_2 is greater than 0.02 cfm, or $_1S$ greater than 0.04 x Sample Rate, leakage is unacceptable and system must be resealed. For most tests the sample rate will be 0.25 cfm, thus leakage rates in excess of 0.04 x 0.25 = 0.010 cfm are not acceptable.

e. To prevent contamination, do not insert probes in tunnel until the start of the test run.

III. TEST CONDUCT

A. Pre-Test Fuel Load

1. Fill hopper with pellets, tare the scale, and place a 25lb weight on the scale to measure fuel consumed.

B. Test Fuel Load

1. Determine moisture content of pellets per ASTM E871 by weighing pellets before and after oven drying.
2. Verify and document the pellet manufacturer and grade of pellets used for test.
3. Confirm enough pellets are in the hopper to complete the test, add if necessary. Tare scale and place a 25lb weight on the scale to measure fuel consumed.

C. Unit Start-Up

1. With all doors and air controls closed, zero draft Magnehelic using screw located at bottom of meter.
2. Before lighting a fire turn on dilution tunnel and set flow rate to 140 scfm (approximately 715 fpm) if burn rate is to be less than 3 kg/hr. For higher burn rates set flow for a 150:1 air fuel ratio (see chart for approximate values).
3. Check draft imposed on cold stove. All inlets must be closed and a draft gauge in the chimney. If draft is greater than 0.005 inches water column, adjust tunnel to stack gap until draft is less than 0.005 inches water column.
4. With hot wire anemometer check for ambient airflow around unit (must be less than 50 ft/min).

5. Tare scale and start fire by turning the unit on per manufacturer's instructions. (Make sure stack sample probe is on the unit.)
6. Once fuel is burning well, operate at high fire for sufficient time to get the fuel burning well. Then adjust settings to intended test run levels.
7. Perform the dilution tunnel traverse as prescribed in ASTM E2515, Section 9.3.2 (Pitot tube should be carefully cleaned prior to each test.)
8. Pretest must burn for a minimum of 1 hour. Record room and flue temperatures.

D. Test Run

1. Stack gas analyzers should be on and in the sample mode.
2. When the 1-hour pre-burn is complete, the test is to be started.
   a. Insert the sample probes into the tunnel being careful not to hit sides of tunnel with probe tip.
   b. Check tunnel Pitot tube for proper position.
   c. Confirm heater is set to the maximum burn rate.
   d. Record initial readings.
   e. Turn on probe sample systems and start timing test.
   f. Tare platform scale and add 25lb weight.
   g. Every 10 minutes record the following:
      1) Dry gas meter readings.
      2) Weight remaining.
      3) All thermocouple temperatures.
      4) Tunnel Pitot tube reading.
      5) Draft reading.
      6) Rotometer readings.
   h. Filter temperatures shall not exceed 90ºF anytime during the test. If the filters are approaching 90ºF turn on cooling pump. Filters must be kept above the dilution tunnel wet bulb temperature in order to prevent condensation.
   i. Regularly check impinger train for ice level during test.
   j. At 1-hour, Filter set #2 is to be removed from the dilution tunnel and Filter set #3 is added. The heater is changed from the high burn setting to the ≤50% of maximum burn rate setting and operated for 2-hours.
   k. At the 3-hour point, the heater is changed to the lowest burn rate setting.
   l. At the 6-hour point, shut off sample trains and record last reading.
   m. Record final dry gas meter values.
   n. Shut down heater per manufacturer's instructions.

IV. POST TEST PROCEDURES

A. Leak Checks

1. Dilution Tunnel
   a. Remove sample probes from tunnel and plug with rubber stopper.
   b. Turn on sample system and set vacuum to 10" mercury or to the highest value reached during the test.
   c. At a convenient value start stopwatch and record the DGM starting value.
   d. After 1 minute stop sample system and record ending DGM value.
   e. Calculate leakage rate per pre-test description (see II.B.2.c.).

2. Gas Analyzers

   a. Set stack sample flow to about 75 mm on the rotometer.
   b. Plug with rubber stopper.
   c. Adjust vacuum to 10" mercury.
   d. Let system stabilize then record rotometer readings.
   e. If the rotometer readings do not equal zero, check with the laboratory manager.
   f. SLOWLY unplug probe and decrease flow rate to zero.
   g. Turn off stack sampling system.
   h. Zero, span and calibrate the analyzers (see Gas Analysis). RECORD ONLY these meter values.

B. Particulate Sample Recovery

1. Disassemble filter holder and collect all loose material on filters.
2. Weigh and record probes and filters for each train. NOTE: 24 hours of desiccation must pass before final "no change" weight values can be recorded.
3. Weigh and record probes and fillers at 6-hour intervals until weight change between weighing is less than 0.5 mg.

V. DISPOSITION OF TESTED UNIT.

In order to meet the requirements of section 60.533(b)(8) of the EPA's 40CFR Part 60 Standards of Performance for New Residential Wood Heaters, Intertek Testing Services seals certified wood heaters by:

1) Applying tamper-indicating tape to the firebox door, ash pan door, and the air controls.

2) Totally covering the unit with stretch wrap and stamping the stretch wrap with our WHI logo at various locations.
3) Strapping the door and ash pan closed with plastic banding so that the banding goes both around the unit laterally and from top to bottom. The banding is then stamped with our WHI logo so that the banding can't be simply replaced.
4) The certificate is then placed on the top of the unit and a second layer of stretch wrap is applied and stamped with our WHI logo.
5) The unit is placed on a pallet and strapped down with additional strapping to keep it on the pallet. It is then shipped back to the manufacturer.

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) __28.93__ (inches Hg.) Static pressure (P_q)__.232___ (inches w.c.)
Inside diameter: Port A ____in__ Port B __in Tunnel cross sectional area: ____Ft^2
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.099		.3146
B-Centroid	3.00	.094		.3066
A-1	0.50	.085		.2915
A-2	1.50	.093		.3050
A-3	4.50	0.105		.3240
A-4	5.50	.066		.2569
B-1	0.50	.088		.5966
B-2	1.50	.096		.3098
B-3	4.50	.099		.3146
B-4	5.50	.072		.2683
		AVERAGE		.2988

Adjustment factor application

Pitot correction _____.9620_____

Where,
C_p = Pitot tube coefficient = 0.99 for standard pitot
Δ_p = manometer reading (inches H_2O)
T_s = average absolute dilution tunnel temperature (°F + 460)
P_s = absolute dilution tunnel gas pressure or Pbar + P_g

P_g = static pressure $\frac{inches H_2O}{13.6}$

$$V_s = K_p C_p F_p \left(\sqrt{\Delta_p}\right) AVG \sqrt{\frac{T_s}{P_s M_s}} \qquad V_s = K_p C_p \left(\sqrt{\Delta_p}\right) avg. \sqrt{\frac{T_s}{P_s M_s}} \qquad F_p = \frac{\left(\sqrt{\Delta_p}\right) avg}{\left(\sqrt{\Delta_p}\right) centroid}$$

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured)
K_p = 85.49 Pitot tube constant, (conversion factor for English units)

Adjustment factor for alternative Pitot tube placement:

$\left(\sqrt{\Delta_p}\right) avg.$ = Average of the square roots of the velocity heads ()$_p$) measured at each traverse point.

$\left(\sqrt{\Delta_p}\right) centroid$ = Average of the square roots of the velocity heads measured at the tunnel centroid (inches of H_2O)

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

Pre/Post Checks

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity……	0 fpm	0 fpm
Smoke Capture Check…….	X	X
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned……	2/27/18	
Date Dilution Tunnel Cleaned……..	2/27/18	
Induced Draft Check……	X	X
Tunnel Velocity……	0	0.099
Pitot Leak Check:		
Side A…….	X	X
Side B……..	X	X
Temperature System:		
Ambient (65°- 90°F)……..		°F
Proportional Checks:		
CO Analyzer Drift Check……..		X
CO_2 Analyzer Check……..		X
O_2 Analyzer Check……		X
Thermocouple check……..		X

Sampling Train ID Numbers:	Train 1	Train 2	Train 3
Probe……..	1	2	3
Filter Front……	1	3	5
Filter Back……..	2	4	6
Filter Thermocouple……			
Filter 5G-3 (<90°F)……			

mn

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

Pre-Test Scale Audit

Scale Type	Audit Weight		Measured Weight	
Platform	25.00	lbs., Class F	25.00	lbs.
Wood	10.00	lbs., Class F	10.00	lbs.
Analytical	100.000	mg, Class S	100.000	mg.

LIMITS OF WEIGHT RANGES

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

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SAMPLE 1		SAMPLE 2		SAMPLE 3	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-test	Post Test
Vacuum (inches Hg.)	10”	10”	10”	10”	10”	10”
Final 1 minute DGM (ft^3)	0	0	0	0	347.220	356.586
Initial 1 minute DGM (ft^3)	0	0	0	0	347.220	356.586
Change (C) (ft^3)	0	0	0	0	0	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
Check OK	X	X	X	X	X	X

Leakage Checks Flue Gas Sampler

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

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO_2	0	0	24.88	24.88	11.86	11.99
CO	0	0	8.976	8.976	3.93	4.001
O_2	0	0	20.95	20.95	9.99	10.01
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO_2	0.00	25.07	11.89	0	0.19	0.03	X	
CO	0.04	8.60	3.74	0.04	0.37	0.19	X	
O_2	0.03	20.91	10.00	0.03	0.04	0.01	X	

* Greater than ± 5% of the range used.

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2	System 3
Final (ft^3)	85.25	85.24	356.574
Initial (ft^3)	0	0	347.220

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	28.93	29.03
Dry Bulb (°F)	69.2	76.1
Humidity (%)	28%	23%

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

FUEL LOAD DATA

FUEL PELLETS USED:

MOISTURE CONTENT (OVEN DRY METHOD): WET:_____ DRY:

BOMB CALORIMETER TEST: _____ BTU/LB. (DRY)

WEIGHT USED DURING TEST:_____LBS.

BURN RATE: _____Kg./HOUR

TEST UNIT SETTINGS: _____

_____

TIME: _____

COMMENTS:

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

COMMENTS

6:37am: Pretest started
8:22am: Scale zeroed, 50lbs of weight added to scale and test started.
9:22am: 1 Hour at full rate completed, Unit turned down to M2 (medium rate) per client instructions
11:22am: 2 hours at medium rate completed, Unit turned down to M1(Low rate) per client instructions
2:22pm: Test complete.

Intertek

Manufacturer__England Stoves__ _____ Model _25-CAB80_____ Date_ 3/1/18 _____
Job #_G103348206_____ Run__1_____ Tech_ Ken Slater _____

READING #	REAL TIME	ELAPSED TIME	DGM 1	ROTOMETER 1	DGM 2	ROTOMETER 2	DGM 3	ROTOMETER 3	DRAFT	MAX DGM PRESSURE
0	8:22	0	0.00		0.00		347.220			
1		10	2.45		2.44		348.720			
2		20	4.88		4.85		350.320			
3		30	7.32		7.29		351.880			
4		40	9.74		9.75		353.445			
5		50	12.16		12.17		355.010			
6	9:22	60	14.56		14.58		356.574			
7		70	16.97		16.99					
8		80	19.38		19.39					
9		90	21.79		21.79					
10		100	24.19		24.19					
11		110	26.59		26.58					
12		120	28.98		28.97					
13		130	31.37		31.37					
14		140	33.76		33.76					
15		150	36.13		36.14					
16		160	38.51		38.52					
17		170	40.87		40.89					
18	11:22	180	43.24		43.25					
19		190	45.60		45.60					
20		200	47.94		47.96					
21		210	50.29		50.31					
22		220	52.64		52.65					
23		230	54.99		55.00					
24		240	57.33		57.34					
25		250	59.68		59.67					
26		260	62.01		62.01					
27		270	64.35		64.34					
28		280	66.68		66.67					
29		290	69.01		69.01					
30		300	71.33		71.33					
31		310	73.66		73.66					
32		320	75.97		75.98					
33		330	78.29		78.30					
34		340	80.61		80.61					
35		350	82.93		82.93					
36		360	85.25		85.24					

Timber Products Inspection, Inc.

CERTIFICATE OF QUALIFICATION

This is to signify that

MARTH WOOD SHAVING SUPPLY, INC.

6752 State Highway 107 North
Marathon, WI 54448

Is hereby qualified as registration #16006
May 30, 2014

Marth Wood Shaving Supply, Inc. is compliant with the PFI Standards Program as audited by Timber Products Inspection and accredited by the American Lumber Standards Committee. In order to maintain compliance, the producer agrees to:

- Maintain complete and up to date Densified Fuel production records
- Produce and market quality products, which conform to PFI & ALSC program documents
- Apply the quality mark only to products which have been proven through applicable monitoring

Chris Wiberg, Densified Fuel Program Manager
Timber Products Inspection, Inc.
1641 Sigman Road, Conyers GA 30012 770.922.8000

Manufacturer : England Stoves
Job #G103348206

Model:25*CAB80
Run___1_____

Date_2/26/18_____
Tech_ Karl Slater_

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Pre-test Weight Record		SYSTEM 1			SYSTEM 2			SYSTEM 3			Temp	Humidity
		Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number		
Date	Time	1	1	2	2	3	4	3	5	6	°F	%
2/26/18	7:30a	91.3823	1.8640	1.8425	91.5878	1.8562	1.8414	93.0577	1.8172	1.8267		
2/27/18	7:30a	91.3822	1.8640	1.8424	91.5877	1.8562	1.8413	93.0576	1.8171	1.8267		
2/28/18	6:45a	91.3821	1.8639	1.8424	91.5876	1.8560	1.8411	93.0576	1.8170	1.8266		
3/1/18	7:30a	91.3821	1.8639	1.8423	91.5876	1.8560	1.8411	93.0575	1.8170	1.8265	71.7	28.93
		Total:	3.7062		Total:	3.6971		Total:	3.6435			

Post-test Weight Record		SYSTEM 1		SYSTEM 2		SYSTEM 3		Temp	Humidity
		Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number		
Date	Time	1	1 & 2	2	3 & 4	3	5 & 6	°F	%
3/1/18	3:00p	91.3834	3.7153	91.5876	3.7063	93.0575	3.6465		
3/2/18	7:30a	91.3821	3.7135	Ø	3.7046	Ø	3.6448		
3/5/18	7:30a	Ø	3.7129	Ø	3.7040	Ø	3.6444		
3/6/18	7:30a	Ø	3.7129	Ø	3.7040	Ø	3.6444		

Dry Down Weight

Date	Time	P1	F1	P2	F2	P3	F3	Gr/hr	Lb/MMbtu
3/1/18	2:30p	1.3	9.1	Ø	9.2	Ø	3.0	1.628	
3/2/18	7:30a	Ø	7.3	Ø	7.5	Ø	1.3	1.229	
3/5/18	7:30a	Ø	6.7	Ø	6.9	Ø	0.9	1.130	
3/6/18	7:30a	Ø	6.7	Ø	6.9	Ø	0.9	1.130	

Intertek Pharmaceutical Services
P.O. Box 470
Salem Industrial Park Bldg. #5
Whitehouse, NJ 08888
Phone 908.534.4445
Fax 908.534.1054

Analytical Report

Report Number: 186096
Report Status: *Interim*

Brian Ziegler
Intertek
8431 Murphy Dr.
Middleton, WI 53562

Sample: Marth wood pellets

C	H	N	O
46.87 %	6.41 %	0.06 %	To Follow.

ROI	LOD
< 0.1 %	4.32 %

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File name:1635187237.186096.pdf

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Analytical Report

Report Number: 186096
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non-GMP Statement

All experimental work at Intertek Whitehouse is conducted under the auspices of a rigorous Quality Management System; however, the data presented in this report was generated using procedures that have not been validated in accordance with 21 CFR, parts 210 and 211.

Intertek makes no claims to the applicability of the data and the Client is solely responsible for determining whether the information provided in this report is suitable for the intended application.

This document has been electronically approved by Michael Stecker, Research Chemist on 10/25/2021 at 2:40:47 PM.
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																CO	CO2	O2	scale	33.93208	Meter	Meter				46.02	40.82	33.93
Time	Flue	Room	Tunnel	DGM 1	DGM 1	Filter 1	DGM 2	DGM 2	Filter 2	DGM 3	Filter 3	Meter #1	Meter #2	Draft	Tunnel	%	%	%	Lbs	Corrected	#1	#2	Draft	Calculated					
10.0	Temp 1	Temp 2	Dry Bulb 3	In 13	Out 14	15	In 16	Out 17	18	In 19	20	21	22	23	24	25	25	27	28	Scale	Cu Ft	Cu Ft		Tunnel					
0.0	363.97	71.33	94.94	74.14	72.48	73.30	74.66	73.86	72.60	72.46	72.53	0.02	0.02	1.13	1.41	0.01	4.81	15.83	49.72	15.79	0.00	0.00	0.032916	0.10314	3.70				
10.0	359.51	70.96	95.02	73.19	74.88	77.86	73.70	75.58	76.92	72.38	75.58	6.94	6.91	1.13	1.41	0.02	4.51	16.31	49.12	15.18	2.45	2.44	0.032051	0.10159	3.10				
20.0	363.76	70.51	94.83	72.97	74.53	78.41	73.75	75.46	78.01	72.56	76.54	6.90	6.83	1.13	1.39	0.00	5.68	15.06	48.42	14.49	2.44	2.41	0.032956	0.09749	2.40				
30.0	359.93	70.72	94.93	73.29	74.59	79.42	73.91	75.29	78.73	72.54	77.40	6.90	6.92	1.13	1.40	0.00	4.89	15.91	47.82	13.89	2.44	2.44	0.032493	0.09965	1.80				
40.0	364.09	70.47	94.49	73.15	74.45	80.03	73.86	75.30	79.39	72.49	77.52	6.86	6.96	1.13	1.43	0.00	5.49	15.30	47.22	13.29	2.42	2.46	0.032569	0.10633	1.20				
50.0	366.13	69.73	94.81	72.96	74.55	80.23	73.72	75.16	79.67	72.30	77.99	6.85	6.85	1.13	1.43	0.00	5.17	15.61	46.62	12.69	2.42	2.42	0.033255	0.10703	0.61				
60.0	363.34	70.24	94.22	73.19	74.66	80.31	74.00	75.37	80.12	72.60	78.39	6.81	6.83	1.13	1.39	0.00	5.54	15.23	46.02	12.09	2.41	2.41	0.032316	0.09779	0.00	5.19			
70.0	359.98	69.77	94.76	73.19	74.53	80.56	73.91	75.51	79.97	72.52	75.94	6.81	6.82	1.13	1.41	0.00	4.60	16.23	45.42	11.49	2.40	2.41	0.032544	0.10152		4.59			
80.0	333.12	69.57	93.38	72.99	74.34	80.48	73.84	75.26	80.05	72.65	75.48	6.84	6.81	1.12	1.39	0.01	2.98	17.86	45.02	11.08	2.42	2.40	0.030353	0.097		4.19			
90.0	319.52	69.00	92.13	72.84	74.51	80.28	74.05	75.48	79.91	72.97	75.12	6.82	6.81	1.12	1.42	0.01	2.77	18.08	44.61	10.68	2.41	2.40	0.029536	0.10469		3.79			
100.0	315.06	69.11	91.64	73.19	74.52	80.08	73.88	75.14	79.59	72.59	74.78	6.80	6.79	1.12	1.40	0.01	2.81	18.01	44.13	10.20	2.40	2.40	0.029051	0.10046		3.30			
110.0	310.78	69.76	91.06	73.17	74.39	80.00	73.92	75.40	79.53	72.86	74.50	6.79	6.78	1.11	1.41	0.00	2.89	17.93	43.72	9.78	2.40	2.39	0.028747	0.10137		2.89			
120.0	309.06	69.35	90.90	73.07	74.51	80.16	73.91	75.42	79.55	72.91	74.38	6.78	6.77	1.12	1.42	0.01	2.26	18.59	43.32	9.39	2.39	2.39	0.028905	0.1062		2.49			
130.0	306.45	69.29	90.11	73.27	74.61	79.99	73.81	75.44	79.34	72.93	74.26	6.77	6.78	1.12	1.42	0.00	2.79	18.05	42.92	8.99	2.39	2.39	0.028838	0.10446		2.10			
140.0	307.66	68.86	90.28	73.16	74.59	79.89	73.92	75.40	79.34	72.85	73.98	6.75	6.78	1.12	1.40	0.00	3.32	17.51	42.43	8.50	2.38	2.39	0.028835	0.10097		1.60			
150.0	300.32	69.46	89.82	73.15	74.58	79.91	73.98	75.54	79.12	72.80	73.85	6.74	6.76	1.11	1.42	0.00	4.02	16.75	42.02	8.09	2.38	2.39	0.028591	0.10435		1.20			
160.0	297.85	69.14	90.04	73.09	74.62	79.86	73.97	75.54	79.22	72.99	73.92	6.72	6.75	1.11	1.41	0.00	3.97	16.78	41.61	7.68	2.37	2.38	0.027741	0.10197		0.79			
170.0	300.16	69.17	90.40	73.08	74.69	79.69	74.12	75.60	79.14	73.15	73.94	6.71	6.70	1.11	1.41	0.00	2.74	18.05	41.23	7.29	2.37	2.36	0.028494	0.10175		0.40			
180.0	299.68	68.86	90.02	73.04	74.59	79.43	74.06	75.25	79.02	72.83	73.87	6.70	6.68	1.11	1.38	0.01	2.24	18.59	40.82	6.89	2.36	2.36	0.027948	0.09459		0.00	6.89		
190.0	301.77	68.79	90.07	73.00	74.55	79.26	73.89	75.46	79.13	73.06	73.79	6.68	6.68	1.11	1.40	0.01	2.41	18.44	40.43	6.50	2.36	2.36	0.028439	0.09921			6.50		
200.0	283.53	69.27	89.65	73.29	74.80	79.32	73.88	75.48	78.97	72.89	73.73	6.65	6.66	1.11	1.40	0.00	3.53	17.22	40.04	6.11	2.35	2.35	0.027076	0.10048			6.11		
210.0	293.67	69.62	89.47	73.22	74.62	79.30	74.01	75.43	78.83	73.24	73.73	6.64	6.66	1.11	1.42	0.03	1.96	18.87	39.63	5.70	2.34	2.35	0.027704	0.104			5.70		
220.0	288.57	69.03	88.89	72.94	74.41	78.96	73.95	75.35	78.68	72.93	73.65	6.67	6.65	1.11	1.42	0.00	2.70	18.14	39.22	5.29	2.35	2.35	0.027509	0.10466			5.29		
230.0	287.37	69.40	89.06	73.10	74.49	78.89	73.82	75.44	78.81	72.81	73.57	6.66	6.64	1.11	1.41	0.00	2.74	18.06	38.93	5.00	2.35	2.34	0.027247	0.10203			5.00		
240.0	292.35	69.70	89.49	73.28	75.05	78.85	74.02	75.50	79.14	73.21	73.70	6.65	6.63	1.11	1.39	0.01	1.83	19.01	38.53	4.60	2.35	2.34	0.027351	0.09854			4.60		
250.0	287.52	68.99	89.51	73.19	74.78	78.93	74.24	75.82	79.12	73.11	73.83	6.63	6.62	1.11	1.44	0.00	3.36	17.45	38.13	4.20	2.34	2.34	0.027582	0.10915			4.20		
260.0	288.29	69.29	89.38	73.25	74.82	78.88	74.23	75.93	78.93	73.25	73.59	6.62	6.62	1.11	1.39	0.00	2.42	18.39	37.73	3.80	2.34	2.34	0.027204	0.09835			3.80		
270.0	295.66	68.86	89.43	73.05	74.98	79.13	74.29	75.71	79.17	73.37	73.68	6.62	6.61	1.11	1.41	0.00	2.72	18.13	37.33	3.39	2.34	2.33	0.027942	0.10226			3.39		
280.0	285.73	69.03	88.96	73.02	74.76	79.35	74.08	75.76	79.29	73.51	73.89	6.61	6.61	1.11	1.42	0.00	4.07	16.68	37.03	3.10	2.33	2.33	0.027262	0.1058			3.10		
290.0	301.02	68.87	89.46	72.97	74.57	79.24	73.93	75.69	79.32	73.17	73.68	6.60	6.60	1.11	1.40	0.00	2.62	18.22	36.54	2.60	2.33	2.33	0.028384	0.10062			2.60		
300.0	289.49	68.89	89.35	72.99	74.74	79.04	73.82	75.49	79.25	73.24	73.34	6.58	6.59	1.11	1.38	0.00	3.77	17.02	36.14	2.21	2.32	2.33	0.028295	0.09587			2.21		
310.0	291.76	68.61	89.25	72.71	74.66	78.92	73.84	75.42	78.89	72.99	73.61	6.58	6.59	1.11	1.40	0.00	2.62	18.19	35.85	1.91	2.32	2.32	0.027357	0.1012			1.91		
320.0	288.02	68.90	88.81	73.04	74.74	78.98	73.95	75.58	79.17	73.30	73.70	6.57	6.57	1.11	1.39	0.00	2.58	18.26	35.43	1.50	2.32	2.32	0.027692	0.09723			1.50		
330.0	280.36	68.69	89.17	73.22	74.70	79.00	74.11	75.68	79.23	73.00	154.10	6.55	6.57	1.11	1.41	0.00	3.50	17.28	35.10	1.17	2.31	2.32	0.026695	0.10151			1.17		
340.0	293.83	68.71	89.05	73.12	74.46	79.14	73.79	75.45	79.09	72.96	133.65	6.58	6.56	1.11	1.39	0.00	2.02	18.84	34.62	0.69	2.32	2.32	0.027878	0.09825			0.69		
350.0	291.73	69.02	89.01	73.02	74.65	78.96	73.94	75.66	79.30	73.10	130.53	6.57	6.55	1.11	1.43	0.00	3.26	17.57	34.34	0.41	2.32	2.31	0.027854	0.1063			0.41		
360.0	284.56	68.92	89.53	73.09	74.53	79.09	74.19	75.49	79.32	72.97	130.99	6.56	6.54	1.11	1.42	0.00	2.88	17.90	33.93	0.00	2.32	2.31	0.026817	0.1058			0.00		

Certificate Number
A2633896
Issue Date: 10/23/17

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 001420

Description:	DIGITAL BAROMETER	Calibration Date:	10/19/2017
Manufacturer:	CONTROL COMPANY	Calibration Due:	10/19/2018
Model Number:	68000-49	Procedure:	TMI-M-HYGROTHERMOGRAPHS Rev: 2/22/2011
Serial Number:	150810334	Temperature:	60 F
Technician:	BRIAN SCHICKOWSKI	Humidity:	43 % RH
		As Found Condition:	**IN TOLERANCE**
On-Site Calibration: ☐		**Calibration Results:**	**IN TOLERANCE**

Comments:

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

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TMI's Quality System is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2005 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration is within the current Scope of Accreditation and complies with the requirements of ISO/IEC 17025:2005 and TMI's Quality Manual, QM-1.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

Measurements not currently on TMI's Scope of Accreditation are identified with an asterisk.

CHASE LOVETTE, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	1/23/2017	1/23/2018
RFD406	VAISALA	HMP46/HMI41	2/8/2017	4/26/2018
RFD500	MKS INTRUMENTS	670BD21	4/28/2017	3/5/2018

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AC-2080.03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Temperature Accuracy	60.0	59.3	60.7	60.4	60.4	0.24	°F	
Temperature Accuracy	70.0	69.3	70.7	69.6	69.6	0.24	°F	
Temperature Accuracy	80.0	79.3	80.7	79.5	79.5	0.24	°F	
Humidity Accuracy	33	30	36	35	35	1.7	%RH	
Humidity Accuracy	50	47	53	51	51	1.7	%RH	
Humidity Accuracy	75	72	78	77	77	1.7	%RH	
Pressure Accuracy (Ambient)	29.21	29.09	29.33	29.29	29.29	0.011	inHg	

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ANSI/NCSL Z540.3

AC-2080.03

Certificate Number
A2794553
Issue Date: 04/04/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 008

Description:	SCALE	Calibration Date:	04/04/2018
Manufacturer:	GSE	Calibration Due:	10/04/2018
Model Number:	450	Procedure:	TMI-SCALES Rev: 5/13/2014
Serial Number:	101722	Temperature:	68 F
Technician:	ARMIN AHMETOVIC	Humidity:	40 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

TMI's Quality System is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2005 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration is within the current Scope of Accreditation and complies with the requirements of ISO/IEC 17025:2005 and TMI's Quality Manual, QM-1.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

Measurements not currently on TMI's Scope of Accreditation are identified with an asterisk.

B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	2/1/2018	2/1/2019
RFD710	RICE LAKE	500LBS	7/12/2017	7/12/2018

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AC-2080.03

Certificate Number
A2794553
Issue Date: 04/04/18

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Shift Test Center	25.00	24.90	25.10	25.01	25.01	27 grams	lbs	
Shift Test RF	25.00	24.90	25.10	24.95	24.95	27 grams	lbs	
Shift Test RR	25.00	24.90	25.10	25.00	25.00	27 grams	lbs	
Shift Test LF	25.00	24.90	25.10	24.98	24.98	27 grams	lbs	
Shift Test LR	25.00	24.90	25.10	25.01	25.01	27 grams	lbs	
Weight Accuracy	25.00	24.90	25.10	25.00	25.00	27 grams	lbs	
Weight Accuracy	50.00	49.90	50.10	50.01	50.01	27 grams	lbs	
Weight Accuracy	75.00	74.90	75.10	75.01	75.01	27 grams	lbs	
Weight Accuracy	100.00	99.90	100.10	100.01	100.01	27 grams	lbs	

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ANSI/NCSL Z540.3

AC-2080.03

Certificate Number
A2794492
Issue Date: 04/04/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 000646

Description:	TIMER	Calibration Date:	04/04/2018
Manufacturer:	COLE PARMER	Calibration Due:	04/04/2019
Model Number:	94440-10	Procedure:	NIST SP 960-12 Rev: 1/1/2009
Serial Number:	NSN	Temperature:	68 F
Technician:	ARMIN AHMETOVIC	Humidity:	40 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

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Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

Measurements not currently on TMI's Scope of Accreditation are identified with an asterisk

B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	2/1/2018	2/1/2019
RFD806	HEWLETT PACKARD	53181A	5/9/2017	5/9/2018

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AC-2080.03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Timer Accuracy	60	59	61	60	60	0.3	sec	
Timer Accuracy	300	299	301	300	300	0.3	sec	
Timer Accuracy	1800	1799	1801	1800	1800	0.3	sec	

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Certificate Number
A2794623
Issue Date: 04/04/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 713

Description:	SCALE	Calibration Date:	04/04/2018
Manufacturer:	OHAUS	Calibration Due:	10/04/2018
Model Number:	E12140	Procedure:	TMI-SCALES Rev: 5/13/2014
Serial Number:	B258010639	Temperature:	69 F
Technician:	ARMIN AHMETOVIC	Humidity:	34 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

TMI's Quality System is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2005 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration is within the current Scope of Accreditation and complies with the requirements of ISO/IEC 17025:2005 and TMI's Quality Manual, QM-1.

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B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	2/1/2018	2/1/2019
RFD-WT-2	RICE LAKE	RFD-WT-2	11/18/2016	11/18/2018

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Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Shift Test Center	10.0000	9.9900	10.0100	9.9985	9.9985	0.47 mg	Grams	
Shift Test RF	10.0000	9.9900	10.0100	9.9990	9.9990	0.47 mg	Grams	
Shift Test RR	10.0000	9.9900	10.0100	9.9985	9.9985	0.47 mg	Grams	
Shift Test LF	10.0000	9.9900	10.0100	9.9990	9.9990	0.47 mg	Grams	
Shift Test LR	10.0000	9.9900	10.0100	9.9980	9.9980	0.47 mg	Grams	
Weight Accuracy	10.0000	9.9900	10.0100	9.9990	9.9990	0.47 mg	Grams	
Weight Accuracy	50.0000	49.9900	50.0100	50.0004	50.0004	0.47 mg	Grams	
Weight Accuracy	100.0000	99.9900	100.0100	100.0004	100.0004	0.47 mg	Grams	
Weight Accuracy	150.0000	149.9900	150.0100	150.0003	150.0003	0.47 mg	Grams	
Weight Accuracy	200.0000	199.9900	200.0100	200.0058	200.0058	0.47 mg	Grams	

Certificate Number
A2799991
Issue Date: 04/09/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 986

Description:	DATA ACQUISITION SYSTEM	Calibration Date:	04/05/2018
Manufacturer:	OMEGA	Calibration Due:	10/05/2018
Model Number:	NMN	Procedure:	OMEGA OM-DAQ-USB-2401 Rev: 1/12/2012
Serial Number:	NSN	Temperature:	69 F
Technician:	ARMIN AHMETOVIC	Humidity:	34 % RH
		As Found Condition:	**IN TOLERANCE**
On-Site Calibration:	☑	**Calibration Results:**	**IN TOLERANCE**
Comments:			

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

TMI's Quality System is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2005 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration is within the current Scope of Accreditation and complies with the requirements of ISO/IEC 17025:2005 and TMI's Quality Manual, QM-1.

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B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	2/1/2018	2/1/2019
RFD825	ADDITEL CORPORATION	ADT222A	5/26/2017	5/26/2018

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Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Thermocouple Accuracy (K Type) Input 1	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 2	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 3	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 4	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 5	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 6	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 7	1000.0	998.2	1001.8	999.8	999.8	0.33	°F	
Thermocouple Accuracy (K Type) Input 8	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (T Type) Input 9	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (T Type) Input 10	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (T Type) Input 11	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (T Type) Input 12	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 13	1000.0	998.2	1001.8	999.6	999.6	0.33	°F	
Thermocouple Accuracy (K Type) Input 14	1000.0	998.2	1001.8	999.8	999.8	0.33	°F	
Thermocouple Accuracy (K Type) Input 15	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 16	1000.0	998.2	1001.8	999.9	999.9	0.33	°F	
Thermocouple Accuracy (K Type) Input 17	1000.0	998.2	1001.8	999.8	999.8	0.33	°F	
Thermocouple Accuracy (K Type) Input 18	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 19	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 20	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Voltage Accuracy 21	10.0	9.5	10.5	9.8	9.8	0.0059	V	
Voltage Accuracy 22	10.0	9.5	10.5	9.9	9.9	0.0059	V	
Voltage Accuracy 23	10.0	9.5	10.5	9.9	9.9	0.0059	V	
Voltage Accuracy 24	10.0	9.5	10.5	9.7	9.7	0.0059	V	
Voltage Accuracy 25	10.0	9.5	10.5	9.8	9.8	0.0059	V	
Voltage Accuracy 26	10.0	9.5	10.5	9.8	9.8	0.0059	V	
Voltage Accuracy 27	10.0	9.5	10.5	9.8	9.8	0.0059	V	
Voltage Accuracy 28	10.0	9.5	10.5	9.9	9.9	0.0059	V	
Voltage Accuracy 29	10.0	9.5	10.5	9.7	9.7	0.0059	V	

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AC-2080.03

Certificate Number
A2794588
Issue Date: 04/04/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 1134

Description:	SCALE	Calibration Date:	04/04/2018
Manufacturer:	RICE LAKE	Calibration Due:	10/04/2018
Model Number:	520-1A	Procedure:	TMI-SCALES Rev: 5/13/2014
Serial Number:	1494600044	Temperature:	68 F
Technician:	ARMIN AHMETOVIC	Humidity:	40 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

TMI's Quality System is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2005 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration is within the current Scope of Accreditation and complies with the requirements of ISO/IEC 17025:2005 and TMI's Quality Manual, QM-1.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

Measurements not currently on TMI's Scope of Accreditation are identified with an asterisk

B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	2/1/2018	2/1/2019
RFD710	RICE LAKE	500LBS	7/12/2017	7/12/2018

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Certificate Number
A2794588
Issue Date: 04/04/18

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Weight Accuracy	100.0	99.7	100.3	99.8	99.8	27 grams	lbs	
Weight Accuracy	200.0	199.7	200.3	199.8	199.8	27 grams	lbs	
Weight Accuracy	300.0	299.7	300.3	299.8	299.8	27 grams	lbs	
Weight Accuracy	400.0	399.7	400.3	399.9	399.9	27 grams	lbs	
Weight Accuracy	500.0	499.7	500.3	499.8	499.8	27 grams	lbs	
Weight Accuracy	1000.0	999.7	1000.3	999.8	999.8	27 grams	lbs	
Shift Test RF	100.0	99.7	100.3	99.8	99.8	27 grams	lbs	
Shift Test LF	100.0	99.7	100.3	99.7	99.7	27 grams	Lbs	
Shift Test RR	100.0	99.7	100.3	99.8	99.8	27 grams	lbs	
Shift Test LR	100.0	99.7	100.3	99.8	99.8	27 grams	lbs	
Shift Test Center	100.0	99.7	100.3	99.7	99.7	27 grams	lbs	

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AC-2080.03

Certificate Number
A2794500
Issue Date: 04/04/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 001213

Description:	TIMER
Manufacturer:	COLE PARMER
Model Number:	94440-10
Serial Number:	NSN
Technician:	ARMIN AHMETOVIC
On-Site Calibration:	☑
Comments:	

Calibration Date:	04/04/2018
Calibration Due:	04/04/2019
Procedure:	NIST SP 960-12 Rev: 1/1/2009
Temperature:	68 F
Humidity:	40 % RH
As Found Condition:	**IN TOLERANCE**
Calibration Results:	**IN TOLERANCE**

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

TMI's Quality System is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2005 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration is within the current Scope of Accreditation and complies with the requirements of ISO/IEC 17025:2005 and TMI's Quality Manual, QM-1.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

Measurements not currently on TMI's Scope of Accreditation are identified with an asterisk

B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	2/1/2018	2/1/2019
RFD806	HEWLETT PACKARD	53181A	5/9/2017	5/9/2018

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AC-2080.03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Timer Accuracy	60	59	61	60	60	0.3	sec	
Timer Accuracy	300	299	301	300	300	0.3	sec	
Timer Accuracy	1800	1799	1801	1800	1800	0.3	sec	

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INSTALLATION & OPERATION MANUAL

25-CAB80
55-SHPCAB80
55-TRPCAB80
25-CAB80S
55-SHPCAB80S
55-TRPCAB80S

Manufactured By:
Stove Builder International inc.
PO Box 206
Monroe, VA 24574

www.englander-stoves.com
Support: (877) 356-6663
Email: tech@sbi-international.com

CAUTION

PLEASE READ THIS ENTIRE MANUAL BEFORE INSTALLATION AND USE OF THIS PELLET FUEL-BURNING APPLIANCE. KEEP CHILDREN, FURNITURE, AND ALL COMBUSTIBLES AWAY FROM ANY HEATING APPLIANCE.

SAFETY NOTICE

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN PROPERTY DAMAGE, BODILY INJURY OR EVEN DEATH. FOR YOUR SAFETY AND PROTECTION, FOLLOW THE INSTALLATION INSTRUCTIONS OUTLINED IN THIS MANUAL. CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION REQUIREMENTS (INCLUDING PERMITS) IN YOUR AREA.

THIS WOOD HEATER NEEDS PERIODIC INSPECTION AND REPAIR FOR PROPER OPERATION. CONSULT THE OWNER'S MANUAL FOR FURTHER INFORMATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH THE OPERATING INSTRUCTIONS IN THE OWNER'S MANUAL.

SAVE THESE INSTRUCTIONS

46311A
2022-06-14

IMPORTANT: IF YOU HAVE A PROBLEM WITH THIS UNIT, DO NOT RETURN IT TO THE DEALER. CONTACT TECHNICAL SUPPORT @ 1-877-356-6663

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

Mobile Home Use:
This freestanding pellet unit is approved for mobile home or doublewide installation with the outside combustion air hook-up See the "Installation" section of this manual for details pertaining to mobile home installations. Mobile home installation must be in accordance with the Manufactured Home and Safety Standard (HUD), CFR 3280, Part 24.

WARNING:
USE OF OUTSIDE COMBUSTION AIR IS MANDATORY WITH THIS UNIT.
DO NOT OPERATE WITH THE HOPPER OPEN; LID MUST BE SHUT AND TIGHTLY LATCHED DURING OPERATION. DO NOT OVER-FIRE YOUR UNIT.

Note: England's Stove Works does not recommend using a pellet stove as your only source of heat.

Retain for your files

Model Number_____

Date of Purchase_____

Date of Manufacture_____

Serial Number_____

IMPORTANT! READ AND FOLLOW **ALL** INSTALLATION AND MAINTENANCE INSTRUCTIONS, INCLUDING CLEANING THE UNIT AS SPECIFIED, AND REPLACING GASKETS ANNUALLY, AND PARTS AS NEEDED.

ENGLAND'S STOVE WORKS IS NOT RESPONSIBLE FOR ANY DAMAGE OR INJURY INCURRED DUE TO NEGLECT, OR DUE TO UNSAFE INSTALLATION OR USAGE OF THIS PRODUCT. CALL TECHNICAL SUPPORT WITH ANY QUESTIONS.

Welcome!

INTRODUCTION

Thank you for purchasing this fine product from England's Stove Works! England's Stove Works was started, and is still owned by, a family that believes strongly in a "Do It Yourself" spirit; that's one reason you found this product at your favorite "Do It Yourself" store.

We intentionally design and build our stoves so that any homeowner can maintain their stove with basic tools, and we're always more than happy to help you do the job as easily and as inexpensively as possible. However, while remaining simple, our stoves are designed to perform extremely efficiently, helping deliver more heat from less fuel.

Please look at the extensive Help section on our website and call our Technical Support Department at (877) 356-6663 if you need any help with your stove. We are nearly always able to "walk you through" any installation issues, repairs, problems or other questions that you may have.

Wishing you years of efficient, quality and "comfy" heating,

Everyone at England's Stove Works

Please Note: While information obtained from our web site and through our Technical Support line is always free of charge, there will be a service charge incurred with any "on-site" repairs or maintenance that we may arrange.

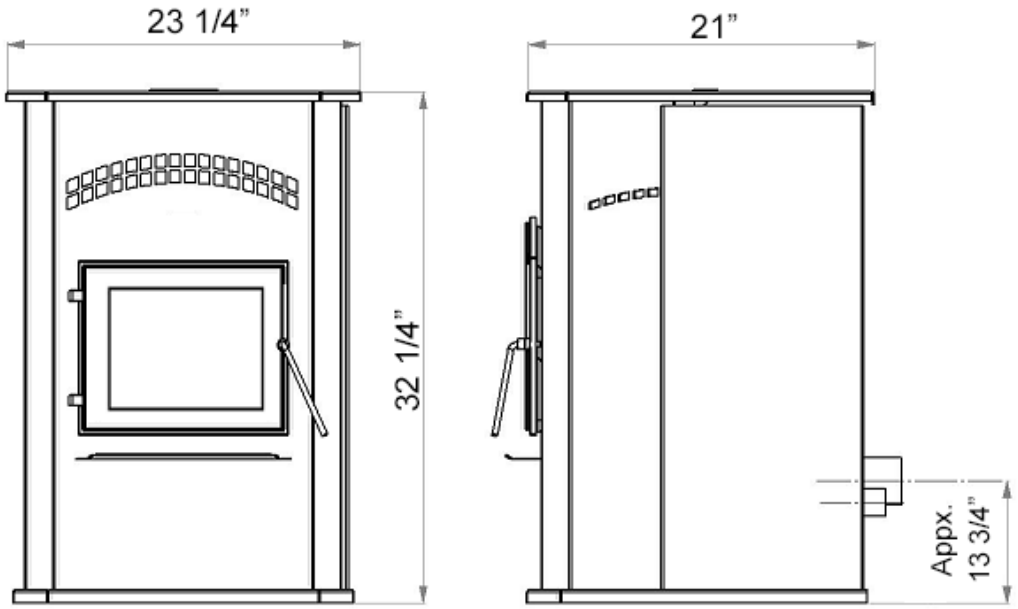
CAUTION: Stove is heavy.

In addition, when handling any sheet metal products, be aware that there may be sharp edges or burrs. Although we make every effort to eliminate any sharp edges, please use caution when handling any metal parts. Remember to disconnect (unplug) the stove from the power source and allow it to completely cool down before performing any maintenance.

SPECIFICATIONS

Heating Specifications

- Approximate Pellet Burn Rate**……1.0 to 1.8 kg/hr (2.2 to 3.8 lbs/hr)
- Maximum Burn Time**……..36 hours
- Approximate Square Footage Heated***…….up 2,000 sq. ft.
- Hopper Capacity (fuel)……..80 pounds



Dimensions

EPA and Safety Compliance Specifications

- EPA Compliance Status ……. Certified to comply with 2020 particulate emission standards using pellet fuel.
- U.S. Test Standard: US EPA 40 CFR Part 60, Subpart 60.536
- Heat output range****……. 11,641 BTU/h to 20,959 BTU/h (3.41kW to 6.14 kW)
- Particulate Emissions …… 1.130 grams/hr
- CO Emissions ……. 0.029 grams/hr
- Efficiency…… 64.1 % (HHV)
- BTU rating …….. 20,511 BTU/hr
- Tested To ASTM E 1509, ASTM E2779, ASTM E2515, CSA B415.1 & ULC S627

Notes for this unit: Product may vary slightly from diagram. Clearances are the minimum for **this unit** and may need to be increased in the rear to have proper vent clearances. **Follow all venting manufacturer clearances and local codes.**

*- As tested per ASTM 2779

** - Heat output, burn rate and maximum burn time are heavily dependent on the type of pellets burned in the stove; as such, these numbers may vary.

*** - The maximum heating capacity of this unit can vary greatly based on climate, construction style, insulation and a myriad of other factors. Use this information in conjunction with a BTU loss calculation for your home to determine if this unit will be sufficient for your needs.

**** - As measured per CSA B415.1-10 stack loss method.

INSTALLATION

Installation Overview

When choosing a location for your new stove, there are a multitude of factors that should be taken into account before beginning the installation.

1. Traffic Patterns – To help prevent accidents, the stove should be placed in a location where it is out of the way of normal travel through the home.

2. Heat Flow and Efficiency – When deciding on a location for the stove, consider the way heat moves throughout your home. Install the stove where you need the heat; basement installations often do not allow sufficient heat to flow to the upper floors and a top floor installation will not allow any heat to reach the floors below. Always consider that heat rises and will take the path of least resistance while it is still hot.

3. Exhaust Location – Outside walls are generally the best place to install a stove, since they allow easy exhaust and intake air installation (using our Dura Vent AC-3000 Kit, AC-33000 if Canada). If there is not a feasible way to install the stove on an outside wall, there are methods for venting the stove up through the roof, but they tend to be more costly because they involve the use of more pellet vent pipe and can often make outside air installation more difficult.

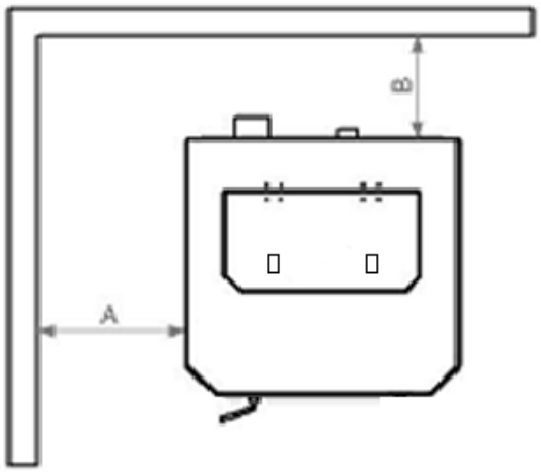
4. Wall Construction – Locating the stove so that the exhaust system can pass between studs will simplify the installation and eliminate the need to reframe any sections of the wall to accommodate the wall thimble.

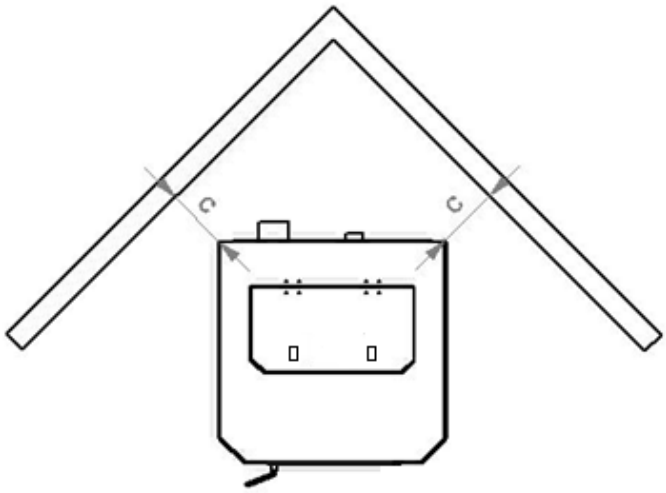
Warning

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- Do Not Over fire – If any external part starts to glow, you are over firing. Reduce feed rate. Over firing will void your warranty.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may result in a house fire.
- Tested and approved for **wood pellets only**. Burning any other fuel will void your warranty.
- For use with Premium grade wood pellets only.

INSTALLATION

Clearances to Combustibles





Unit to Side Wall (A)	Unit to Rear Wall (B)	Unit to Corner (C)
7 in.	0 in.	5 in.
178 mm	0 mm	127 mm

CAUTION

- Unit can be very HOT while in operation. Keep children away.
- Supervise children in the same room as this appliance.
- Alert children and adults to the hazards of high temperatures.
- Do NOT operate with protective barriers open or removed.
- Keep clothing, furniture, draperies and other combustibles away.
- Installation MUST comply with local, regional, state and national codes and regulations.
- Consult local building, fire officials or authorities having jurisdiction about restrictions, installation inspection, and permits.

DO NOT CONNECT TO ANY AIR DISTRIBUTION DUCT OR SYSTEM

INSTALLATION

Venting Introduction

This pellet stove operates on a negative draft system, which pulls combustion air through the burn pot and pushes the exhaust air through the vent pipe and out of the building. This unit must be installed in accordance with the following detailed descriptions of venting techniques; not installing the stove in accordance with the details listed here can result in poor stove performance, property damage, bodily injury or death. England's Stove Works is not responsible for any damage incurred due to a poor or unsafe installation.

If questions arise pertaining to the safe installation of the stove, our Technical Support line (877-356-6663) is available. Contact your local code official to be certain your installation meets local and national fire codes and if you're uncertain about how to safely install the stove, we strongly recommend contacting a local NFI certified installer to perform the installation.

Venting Guidelines

- WARNING - INSTALL VENT AT CLEARANCES SPECIFIED BY THE VENT MANUFACTURER**.**
- **ALWAYS** install vent pipe in strict adherence with the instructions and clearances included with your venting system.
- **DO NOT** connect this pellet stove to a chimney flue which also serves another appliance.
- **DO NOT** install a flue pipe damper or any other restrictive device in the exhaust venting system of this unit.
- **USE** an approved wall thimble when passing through a wall and a ceiling support/fire stop when passing through a ceiling.
- **ONLY** use 3.0" or 4.0" Type L or Type PL pipe approved for pellet stove venting; **DO NOT** use galvanized or B-Vent pipe.
- **SEAL** each joint of pellet vent with high temperature silicone (Part # AC-RTV3) to prevent smoke spillage into the home.
- **AVOID** excessive horizontal runs and elbows, as both will reduce the draft of the venting system and will result in poor stove performance.
- **INCLUDE** as much vertical pipe as possible to prevent smoke from the unit from entering your home in the event of a power outage.
- **INSPECT** your venting system often, to be certain it is clear of fly-ash and other restrictions.
- **CLEAN** the venting system as detailed in the maintenance section of this manual.

WARNING

- **INSTALL VENT AT CLEARANCES SPECIFIED BY THE VENT MANUFACTURER.**
- **HOT! Do not touch! Severe burns or clothing ignition may result.**
- **Glass and other surfaces are hot during operation.**
- **Do not attempt to touch or open the front, side or back panels during operation. This could result in severe burns or injury.**

INSTALLATION

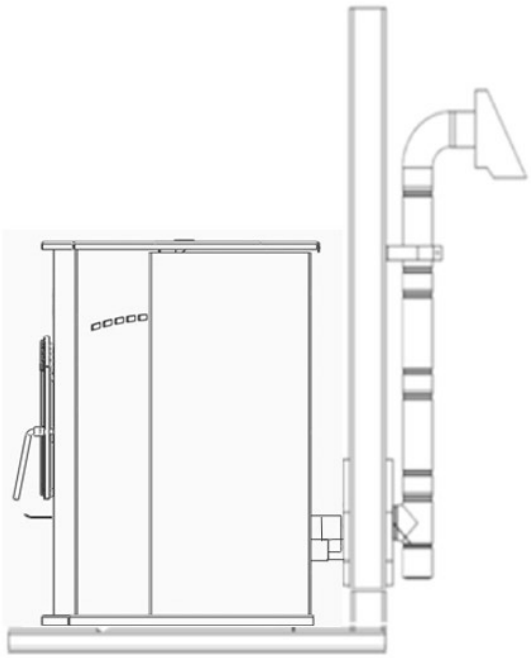
Additional Venting Information

- Do not mix and match components from different pipe manufacturers when assembling your venting system (i.e. Do **NOT** use venting pipe from one manufacturer and a thimble from another).
- We **require** a minimum vertical rise of 36 in. (3 ft.) of pipe to create natural draft in the system. This helps evacuate smoke from the stove in the event of a power failure or combustion blower failure.
- Venting systems 15.0 ft. or shorter may be composed entirely of 3.0 in. pellet pipe; to reduce frictional losses, venting systems longer than 15.0 ft. should be composed of 4.0 in. pellet pipe.
- Do not terminate the venting system directly beneath any combustible structure such as a porch or deck.
- Follow NFPA 211 rules listed below for venting system termination location relative to windows and other openings in the dwelling.
    - NFPA 211 (2006 ed.) Section 10.4 Termination: 10.4.5
      (1) The exit terminal of a mechanical draft system other than direct vent appliances (sealed combustion system appliances) shall be located in accordance with the following:
        - (a) Not less than 3 ft. (.91 m) above any forced air inlet located within 10 ft. (3.0m).
        - (b) Not less than 4 ft. (1.2 m) below, 4 ft. (1.2 m) horizontally from or 1 ft. (305 mm) above any door, window or gravity air inlet into any building.
        - (c) Not less than 2 ft. (0.61 m) from an adjacent building and not less than 7 ft. (2.1 m) above grade when located adjacent to public walkways.
- Distance between the termination opening and grade should be a minimum of 2 ft. (24 in.) contingent on the grade surface below the termination. When determining the termination height above grade, consider snow drift lines and combustibles such as grass or leaf accumulation. In areas where significant snowfall is possible, the termination height must be sufficiently high to keep the termination free of snow accumulation.
- Do not use makeshift compromises during installation or install any component of the unit or venting system in such a manner that could result in a hazardous installation.
- A chimney connector shall not pass through an attic or roof space, closet or similar concealed space, or a floor, or ceiling.
- Where passage through a wall or partition of combustible material is desired, the installation shall conform to CAN/CSA-B365.

WARNING:
Venting system surfaces get HOT, and can cause burns if touched.
Noncombustible shielding or guards may be required.

INSTALLATION

Approved Venting Method 1: Through the Wall



- Generally the simplest installation method, venting through the wall using our AC-3000 kit, AC-33000 if Canada (or similar venting system) is also the preferred venting method. It minimizes horizontal pipe, allows the stove to be installed close to the wall and keeps the clean-out tee on the outside of the house, for ease of cleaning.
- When installing any venting system, **Type L** or **Type PL** pipe must be used and all clearances to combustibles (listed by the pipe manufacturer) must be strictly adhered to.
- Use the pipe manufacturer's approved thimble for passing through a combustible wall, and maintain at least the minimum clearances to combustibles.
- Use an appliance collar where the pellet vent connects to the exhaust output of the pellet stove and attach the appliance collar to the exhaust blower output using three sheet metal screws.
- Secure the pellet vent to the outside of the house using a wall strap just below the 90 degree elbow.
- Seal each pipe connection joint with high temperature RTV Silicone, to ensure the system is leak free (Check with the specific venting system manufacturer's instructions before doing so).
- If the pellet vent pipe being used is not a "Twist Lock" system, three (3) sheet metal screws are required at each pipe joint.
- Connect the pellet stove to outside combustion air using the kit included with your stove or using an alternative method, as described in the "Outside Air" section, on page 15.

This installation type can be modified for basement **(Basement installations should always be performed by a professional installer)** or other installations wherein the tee and vertical section of the pipe would be inside the home and the venting system would simply pass horizontally through the thimble and then terminate.

For high altitude installations (above 4,000 ft.), the vent pipe should be increased from 3-inch (3") to four-inch (4").

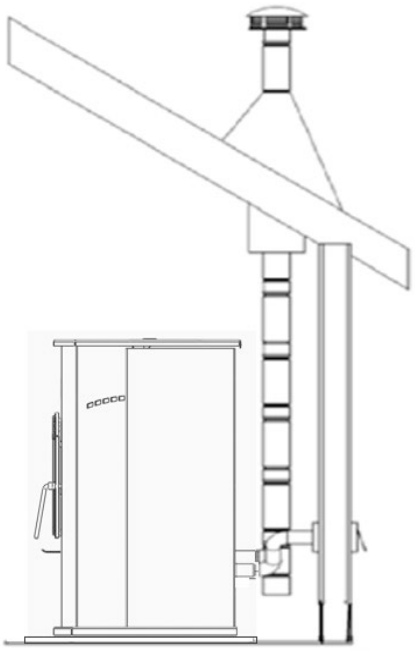
Please Note:

Installation diagrams are for reference purposes only and are not drawn to scale, nor meant to be used as plans for each individual installation. Please follow all venting system requirements, maintain the required clearances to combustibles, and follow all local codes.

INSTALLATION

For high altitude installations (above 4,000 ft.), the vent pipe should be increased from 3-inch (3") to four-inch (4").

Approved Venting Method 2: Through the Ceiling



- Venting through the ceiling/roof may be the only feasible venting option in some cases and is a factory recommended installation.
- When installing any venting system, **Type L** or **Type PL** pipe must be used and all clearances to combustibles listed by the pipe manufacturer must be strictly adhered to.
- Use the pipe manufacturer's approved ceiling support for passing through a combustible ceiling, as well as the required fire stops, radiation shields, flashing and storm collar.
- Be certain to follow the manufacturer's required height of termination above the roof line, and maintain at least the minimum clearances to combustibles.
- Use an appliance collar where the pellet vent connects to the exhaust output of the pellet stove and attach the appliance collar to the exhaust blower output using three sheet metal screws.
- Seal each pipe connection joint with high temperature RTV Silicone, to ensure the system is leak free (Check with the specific pipe manufacturer's instructions before doing so).
- If the pellet vent pipe being used is not a "Twist Lock" system, three (3) sheet metal screws are required at each pipe joint.
- Connect the pellet stove to outside combustion air using the kit included with your stove or using an alternative method, as described in the "Outside Air" section, on page 15.
- This venting method can also be modified so that the venting system runs horizontally through the wall from the stove, then transitions to vertical and terminates above the roofline. When using this modified version of this installation be certain to carefully follow the venting system manufacturer's instructions diligently.

Please Note:

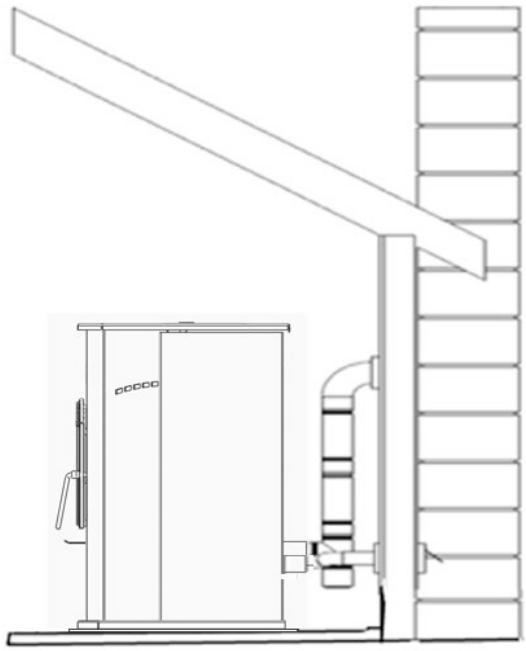
Installation diagrams are for reference purposes only and are not drawn to scale, nor meant to be used as plans for each individual installation. Please follow all venting system requirements, maintain the required clearances to combustibles, and follow all local codes.

INSTALLATION

For high altitude installations (above 4,000 ft.), the vent pipe should be increased from 3-inch (3") to four-inch (4").

Approved Venting Method 3: Existing Chimney System

- Using an existing masonry or factory built chimney for venting is the only other acceptable method for venting this pellet unit.



- Use **Type L** or **Type PL** venting pipe until entering the existing chimney. Use the appropriately sized adapter when transitioning from the pellet vent pipe to the masonry or factory built thimble and be certain that the adapter is sealed tightly to both the pellet venting system and the existing chimney.
- Before using an existing chimney, be certain it is in good condition (A chimney sweep inspection is highly recommended). Also, make sure the chimney meets the minimum standards listed in NFPA 211 (A chimney professional can confirm this upon inspection).
- If connecting this stove to a factory built chimney, it may **ONLY** be a 6" flue, UL103 HT venting system (ULC S629 if Canada). Connection to any other factory built chimney may result in a poorly operating or dangerous stove installation.
- When connecting to an existing masonry chimney, the cross-sectional area of the flue must be considered. A chimney with a flue larger than 6" round (28.27 sq. in.) may require relining with an approved pellet stove chimney lining system.
- Use an appliance collar where the pellet vent connects to the exhaust output of the pellet stove and attach the appliance collar to the exhaust blower output using three sheet metal screws.
- Seal each pipe connection joint with high temperature RTV Silicone, to ensure the system is leak free (Check with the specific pipe manufacturer's instructions before doing so).
- If the pellet vent pipe being used is not a "Twist Lock" system, three (3) sheet metal screws are required at each pipe joint.
- Connect the pellet stove to outside combustion air using the kit included with your stove or using an alternative method, as described in the "Outside Air" section, on page 15.

Please Note:

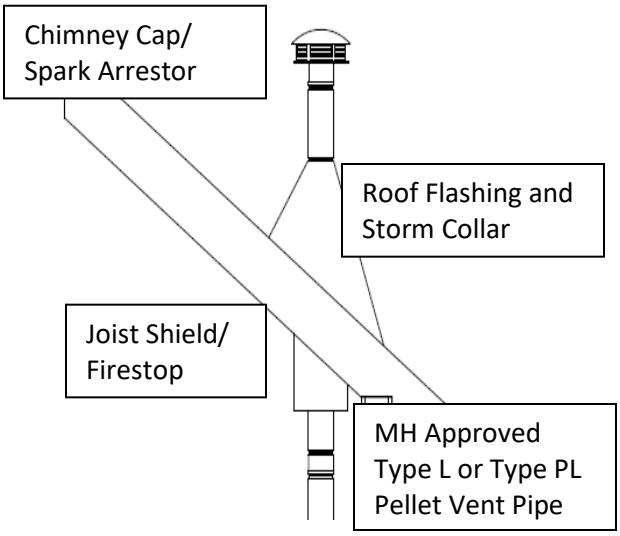
Installation diagrams are for reference purposes only and are not drawn to scale, nor meant to be used as plans for each individual installation. Please follow all venting system requirements, maintain the required clearances to combustibles, and follow all local codes.

INSTALLATION

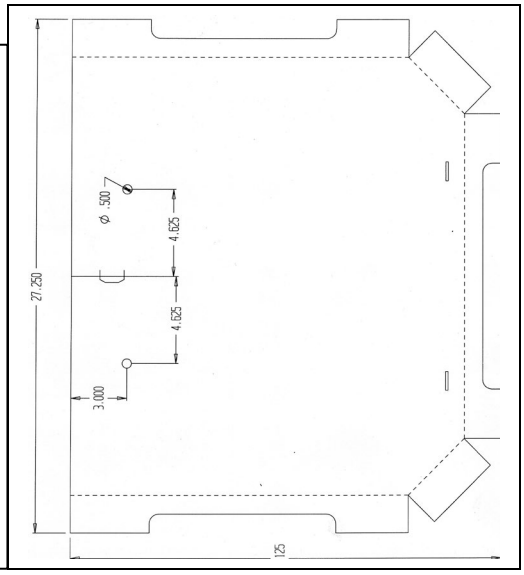
For high altitude installations (above 4,000 ft.), the vent pipe should be increased from 3-inch (3") to four-inch (4").

Mobile Home Installation

- The England's Stove Works, Inc. outside air kit **MUST** be used for installation of this unit in a mobile home. Please see the "Outside Air" section on page 15 for more information regarding outside air connections.
- The outside air inlet must be kept clear of leaves, ice and other debris. Keeping the outside air inlet free of restriction is crucial to preventing air starvation and smoke spillage.
- The pellet stove **MUST** be secured to the floor of the mobile home using lag bolts and the holes provided in the bottom of the base for this purpose. Outdoor-aired space heaters must be attached to the structure.
- The pellet stove **MUST** be grounded with #8 solid copper grounding wire (or equivalent), terminated at each end with an NEC approved grounded device.
- Carefully follow all clearances listed in the appropriate section of this manual AND follow the venting manufacturer's minimum clearance requirements. Similarly, be certain the venting system used is approved for mobile home use.
- Installation must be in accordance with Manufacturers Home & Safety Standard (HUD) CFR 3280, Part 24 as well as any applicable local codes.
- Use silicone to create an effective vapor barrier at the location where the chimney or outside air ducting passes through to the exterior of the structure.



If your unit does not have holes pre-drilled for Mobile Home installation, you may drill two holes in the floor of your unit that are ½" (approx.. 1.25 cm) in diameter. Each hole should be drilled approximately 3" (7.6 cm) inside the rear of the unit, and approximately 4.625" (11.75 cm) away from the center of the floor.



CAUTION

THE STRUCTURAL INTEGRITY OF THE MANUFACTURED HOME FLOOR, WALL AND CEILING/ROOF MUST BE MAINTAINED. DO NOT CUT THROUGH FLOOR JOISTS, WALL STUDS, CEILING TRUSSES OR ANY OTHER SUPPORTING MATERIAL WHICH COULD BE DETRIMENTAL TO THE STRUCTURAL INTEGRITY OF THE HOME.

WARNING: DO NOT INSTALL IN A SLEEPING ROOM.

VENT TERMINATION CLEARANCES

A) Min. 4-ft clearance below or beside any door or window that opens.

B) Min. 1-ft clearance above any door or window that opens.

C) Min. 2-ft clearance from any adjacent building.

D) Min. 7-ft clearance from any grade when adjacent to public walkways.

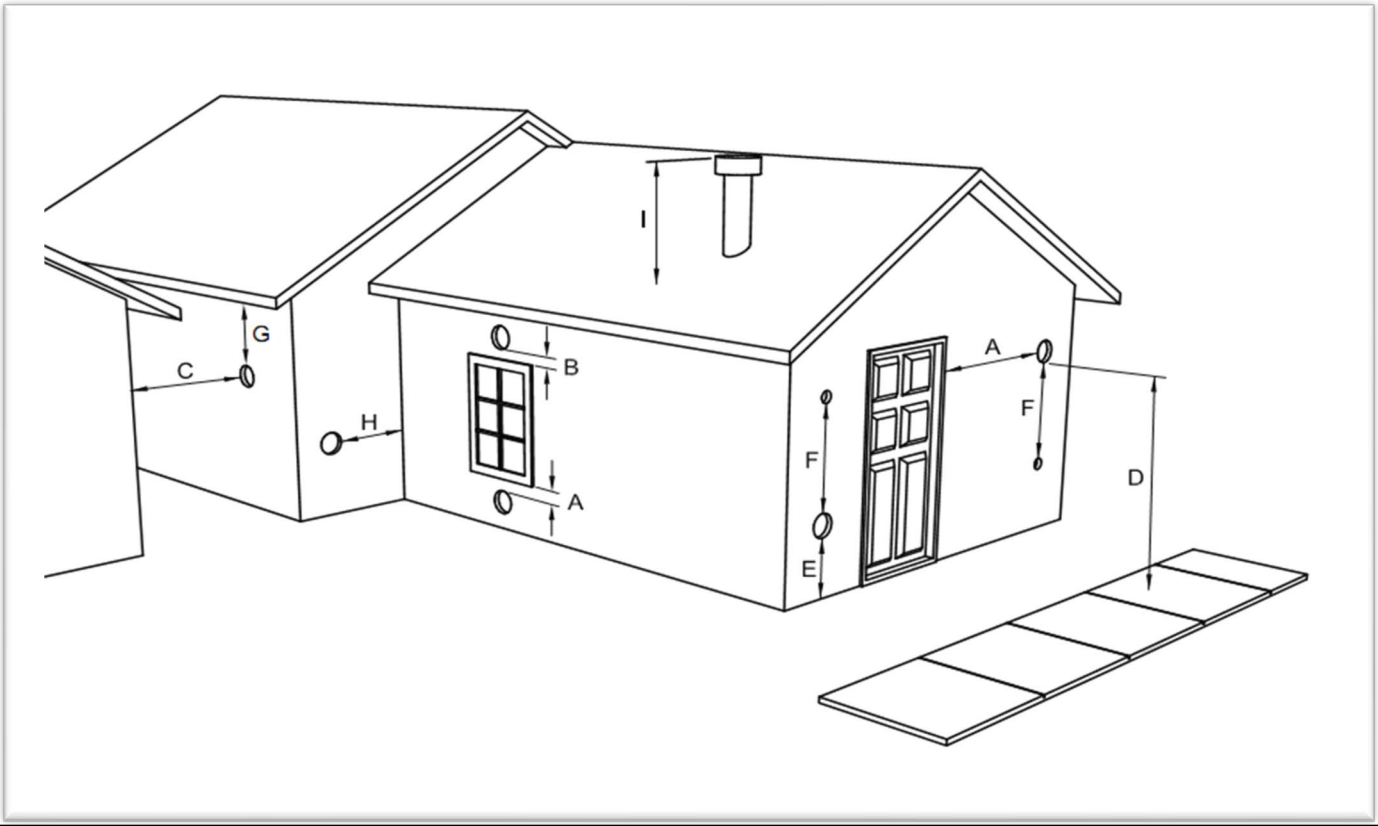
E) Min. 2-ft clearance above any grass, plants, or other combustible materials.

F) Min. 3-ft clearance from a forced air intake of any appliance.

G) Min. 2-ft clearance below eaves or overhang.

H) Min. 1-ft clearance horizontally from combustible wall.

I) Vents installed with mechanical exhausters shall terminate not less than 12 in. (305mm) above the highest point where they pass through the roof surface.



Notes on termination of Pellet Vent Pipe from NFPA 211 (2006 ed.) Section 10.4 Termination: 10.4.5
(See also "INSTALLATION" section of manual AND additional notes above):

- Not less than three (3) feet above any forced air inlet located within ten (10) feet.
- Not less than four (4) feet below, four (4) feet horizontally from, or one (1) foot above any door, window or gravity air inlet into any building.
- Not less than two (2) feet from an adjacent building, and not less than seven (7) feet above grade where located adjacent to public walkways.

The exhaust exit shall be arranged so that the flue gases are not directed so that it will affect people, overheat combustible structures, or enter buildings. Forced draft systems and all parts of induced draft systems under positive pressure during operation shall be installed gastight or to prevent leakage of combustion products into a building. Through-the-wall vents shall not terminate over public walkways, or where condensate or vapor could create hazards or a nuisance.

Be sure to follow local codes and all manufacturer's instructions (including exhaust pipe).
Consult a professional installer and/or call Technical Support if you have any questions.

OUTSIDE AIR HOOK-UP

- The use of outside combustion air is **mandatory** on this pellet stove.
- The outside air connection pipe protrudes from the lower rear center of the stove; use the included outside air kit to attach your stove to outside combustion air. Instructions and all the parts needed to make the outside air connection to your pellet stove are included with the outside air kit.
- If it is not feasible to use the included outside air hookup kit in your stove installation, other materials may be used, provided the following rules are followed:
    - The pipe used for outside air hookup must be metal, with a minimum thickness of .0209 in. (25 gauge mild steel) or greater and an inside diameter of approximately 2.0 in.
    - All pipe joints and connections should be sealed with pipe clamps or other mechanical means, to insure a leak free outside air connection.
    - Long runs of pipe and excessive elbows for outside air should be avoided. Due to frictional resistance in pipe, any excessive outside air piping can result in poor stove performance.
    - A screen or other protection device must be fitted over the outside air termination point to prevent rain, debris and nuisance animals from entering the piping system.
    - Increase the outside air pipe size to 3.0 in. diameter pipe if the outside air connection is more than 6 ft. in length, more than two (2) elbows are used or if the stove is installed in a basement.
- The outside air connection system should be inspected at least annually to be certain it is free from blockage.

Caution

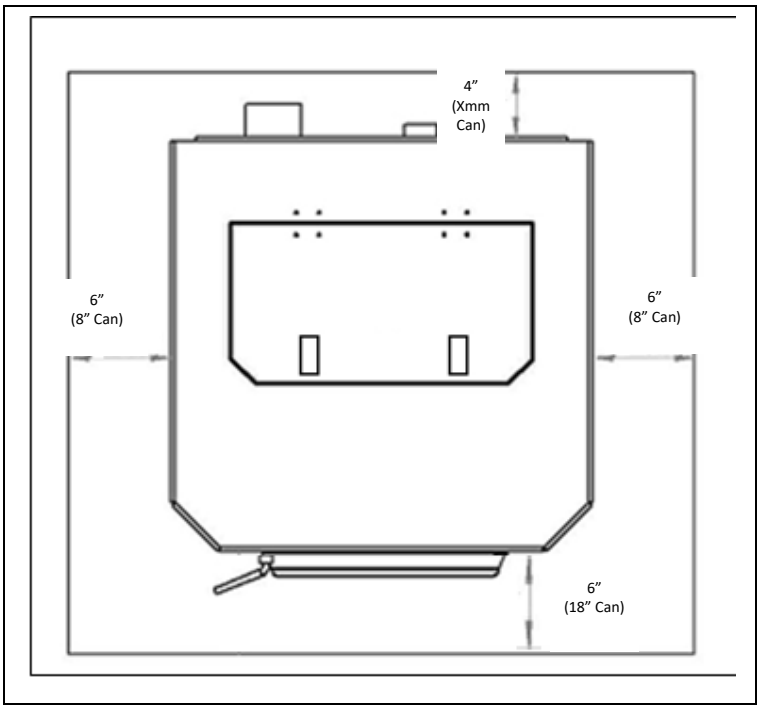
NEVER draw outside combustion air from:

1. Wall, floor or ceiling cavity.

2. Enclosed space such as an attic, garage or crawl space.

FLOOR PROTECTION

- This pellet stove requires a non-combustible floor protector if the stove is to be installed on a combustible floor. If the floor the stove is to be installed on is already non-combustible (i.e. a concrete floor in a basement) and has an R value equal to or higher than .2, no floor protection is needed (although a decorative floor protector can still be used for aesthetic reasons).
- Prefabricated floor protectors which are UL listed (ULC if Canada) or equivalent can be purchased or a floor protector can be built from standard materials: two sheets of .5" thick cement board covered with ceramic tile would be a suitable floor protector which meets the .2 R-value requirement.
- When using any floor protector, consider that this stove is not only heavy but will induce heating and cooling cycles on the floor protector which can damage tile and loosen mortar and grout joints. A hearth rug is **NOT** an approved substitute for a proper hearth pad.
- **For the US**: The floor protector must extend at least 6 in. (152.4 mm) from the front & sides and 4 in. (101.6 mm) from the rear.
- **For Canada**: The floor protector must extend at least 18.0 in. (457.2 mm) from the front of the unit, 8.0 in. (203.2 mm) from the sides of the unit and 4.0 in. (101.6 mm) from the rear.
- **In Canada**, it is required that the non-combustible floor protector is underneath and extends 2 in. (50.8 mm.) on either side of any horizontal venting runs **AND/OR** is directly underneath any vertical venting pipe.



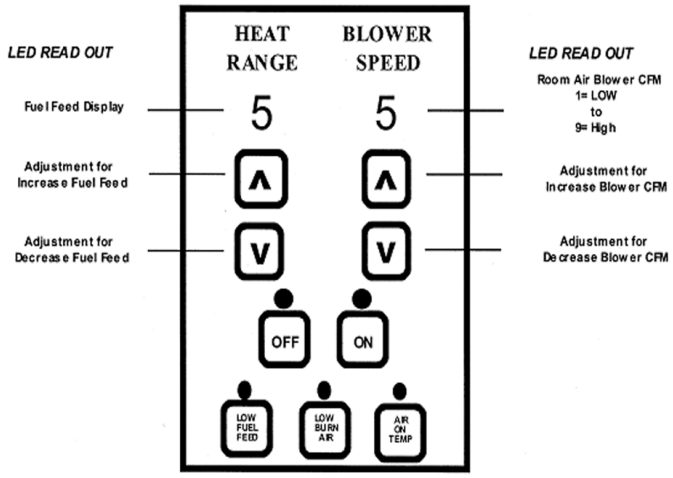
CONTROL BOARD TYPES

Control Board Types

Your stove may come equipped with a control board that is mounted on the top of the stove, behind the hopper ("Top Mount"), or it may come equipped with a control board that is mounted on the side wall of the unit ("Side Mount").

For reference, a Top Mount control board looks like this:

And a side mount control board has separate windows for Heat Range and Blower Speed, like this:



PLEASE NOTE that some instructions in this manual apply to the TOP MOUNT board, and other instructions apply to the SIDE MOUNT board.
Differences will be called out so that you may know what instructions apply to your particular stove.

DAILY OPERATION

Getting Started

- Check to see that the hopper is clean and free from foreign materials. Be sure to connect this unit to a working outlet; we recommend using a surge protector to help protect the electronic components from damage.
- **BEFORE** your first fire, dry run your unit (**no** pellet fuel in the hopper) for twenty minutes; pressing the "ON" button with the unit plugged in will initiate the dry run.
    - When the "ON" button is pressed:
        - Top Mount control boards: the board will scroll the message "DID YOU CLEAN BURN POT BEFORE STARTING? HOLD ON TO CONFIRM". Press and hold the "ON" button for **3 seconds** to start the unit.
        - Side Mount boards: After a few seconds, the letters "S U" will appear in the display windows.
    - Once the unit starts, you should immediately hear the exhaust blower start and operate continuously. The board will display the last setting it was set to for the duration of its operation, or until the setting is adjusted. (Side Mount control boards will continue to show "S U").
    - After about three to five minutes, look for the red glow of the igniter in the igniter port of the burn pot to be certain it is operating normally.
    - Hold the hopper lid switch (See "Illustrated Parts Diagram" at rear of this manual) down with your finger and check to see that the auger is turning. Release the hopper lid switch and be certain that the auger stops turning. **DO NOT PUT YOUR FINGERS IN THE HOPPER OR NEAR THE ROTATING AUGER**.
    - Top Mount boards Please Note: If the lid switch is left disengaged (not pressed down) for 60 seconds, the unit will shut down with an error message of "HOPPER LEFT OPEN. SHUTTING DOWN – if this happens, the unit must be allowed to shut down and the dry run would then need to be repeated from the beginning.
    - Note that the front door must be closed for the auger to cycle (the board will not give a vacuum loss error, as the board does not look for this until proof of fire is met, but the auger will not cycle if the door is open).
    - Top Mount boards: After approximately twenty minutes, the control board should display "FAILED TO START SHUTTING DOWN" several times, and then it will continue to display "FAILED TO START". To clear the error message simply press the "OFF" button.
        - Side Mount boards will display "E-2" in the two display windows (more information on Error Codes can be found in the Error Code section of this manual).
    - At this point, the dry run is complete and your pellet heating appliance is ready for normal operation.

Lighting a Fire

- In order for this stove to operate, the hopper must first be filled with pellet fuel. Lift the hopper lid and pour the pellet fuel directly into the hopper. Of course, your stove should be connected to your venting system at this point.
    - ❖ We recommend using only pellets manufactured by PFI Certified facilities, since pellets bearing the PFI stamp of approval will be low in ash and moisture, high in BTU's, and uniform in size and quality.
- This pellet stove will perform equally well using softwood and hardwood pellets, and although the ash may differ slightly in appearance or texture, both types of pellets will burn cleanly and efficiently in this stove.
    - This pellet stove is equipped with an automatic pellet ignition system. Simply press the "ON" button

    - Top Mount boards: when the “ON” button is pressed, the board will scroll the message “DID YOU CLEAN BURN POT BEFORE STARTING? HOLD ON TO CONFIRM”. Press and hold the “ON” button for **3 seconds** to start the unit.
    - Side Mount boards: Shortly after pressing the “ON” button, the letters “S U” will appear in the display windows of the board. This indicates the stove has entered the start-up sequence and is operating normally.
- After initiating the start-up as described above, the most recent setting will appear in the window of the control board (Side Mount boards will continue to show “S U”). This indicates the stove has entered the start-up sequence and is operating normally.
- The fuel feed rate and combustion air during start-up is determined by the control board, so the stove may be started on any heat range.
- After approximately fifteen minutes, the fire should be burning brightly. At this point, the stove has begun normal operation and the display windows on the control board will display your setting, unless the board is adjusted.
- It is normal for the unit to smoke during the first fire, as paints and oils cure. This should dissipate within the first hour. Open a door and/or window during the first fire to ventilate the area.

Daily Operation Notes

- Only high quality, Premium Grade ¼” (.25 in.) diameter wood pellets should be used in this stove. Using low grade wood pellets with high ash content OR wood pellets with a high moisture content can cause the burn pot to fill with ash at a more rapid pace and can cause intervals between periodic maintenance to become significantly shorter. Please read the “Maintenance” section of this manual thoroughly to understand how fuel selection affects stove operation, maintenance and cleaning.

- Variation in the flame height is normal; not all wood pellet fuel is uniform in size, which can affect the way pellets are fed into the burn pot. Although the flame height may increase and decrease during operation, there is no loss of efficiency.

- Always store wood pellet fuel in a dry location; storing wood pellet fuel in a dry location ensures the fuel will remain pelletized and low in moisture content. Also, be certain that all wood pellet fuel is stored at a safe distance from the pellet heater; storing fuel in close proximity to the stove can result in a fire. **Do not install or operate this unit outside, in a greenhouse, or in any area that is high in moisture.**

- This pellet burning room heater is equipped with a specially designed burn pot which comes preinstalled from the factory. This burn pot elevates the burning pellets and delivers air at the precisely-required locations. Pellets must only be burned in the factory burn pot; no modifications should be made to this burn pot and no additional grates or other fire elevators should be used.

- Top Mount board: The circuit board is equipped with “Reminder Messages” which will pop up and scroll on the display at various times.

- **<u>The following apply to the Top Mount board only</u>**:

- As noted above, the control board will ask the user if they have cleaned out the burn pot prior to every start with “HOLD ON TO CONFIRM”.

- “Daily cleaning reminder” - After the unit has run for 46 consecutive hours of burn time, the board will display a reminder to shut the unit down and perform daily cleaning with “PLEASE SHUT DOWN AND CLEAN BURN POT“. This reminder code does NOT shut the unit down, but WILL scroll until the unit is completely shut down by the user. Control of the stove is not affected by the scrolling message; the user can adjust the control board and it will display the adjustment and then revert back to the scrolling message until the user shuts the unit down.

- “Weekly maintenance reminder” - After 7 days of cumulative run time, the control board will display a scrolling reminder message to confirm the user has performed the weekly maintenance required with “DID YOU PERFORM WEEKLY MAINTENANCE? HOLD ON BUTTON TO CONFIRM”. Again, the message does not affect the unit’s operation, and in this case can be cleared by holding the “ON” button for 3 seconds, at which time the board status will return to its previous state.

<u>CAUTION</u>

NEVER USE GASOLINE, GASOLINE-TYPE LANTERN FUEL, KEROSENE, CHARCOAL LIGHTER FLUID, OR SIMILAR LIQUIDS TO START OR “FRESHEN UP” A FIRE IN THIS HEATER. KEEP ALL SUCH LIQUIDS WELL AWAY FROM THE HEATER WHILE IN USE. ADDITIONALLY, NEVER APPLY FIRE-STARTER TO ANY HOT SURFACE OR EMBERS IN THE STOVE. DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.

DO NOT BURN FLAMMABLE FLUIDS SUCH AS GASOLINE, NAPHTHA OR ENGINE OIL.

DO NOT BURN GARBAGE; LAWN CLIPPINGS OR YARD WASTE; MATERIALS CONTAINING RUBBER, INCLUDING TIRES; MATERIALS CONTAINING PLASTIC; WASTE PETROLEUM PRODUCTS, PAINT OR PAINT THINNERS, OR ASPHALT PRODUCTS; MATERIALS CONTAINING ASBESTOS; CONSTRUCTION OR DEMOLITION DEBRIS; RAILROAD TIES OR PRESSURE-TREATED WOOD; MANURE OR ANIMAL REMAINS; PAPER PRODUCTS, CARDBOARD, PLYWOOD OR PARTICLEBOARD. THE PROHIBITION AGAINST BURNING THESE MATERIALS DOES NOT PROHIBIT THE USE OF FIRESTARTERS MADE FROM PAPER, CARDBOARD, SAWDUST, WAX AND SIMILAR SUBSTANCES FOR THE PURPOSE OF STARTING A FIRE IN AN AFFECTED WOOD HEATER. BURNING THESE MATERIALS MAY RESULT IN RELEASE OF TOXIC FUMES OR RENDER THE HEATER INEFFECTIVE AND CAUSE SMOKE.

CONTROL BOARD SETTINGS – TOP MOUNT BOARD

Please Note: The following section gives instructions for stove models with the Top Mount control board (where the control board is mounted on the top of the stove, behind the hopper).
Please see the section of the manual "Control Board Settings – Side Mount Board" for instructions pertaining to stoves with a Side Mount control board.

Manual/Automatic Mode

Automatic Mode

Your stove will arrive from the factory programmed in automatic mode. First, make sure the thermocouple wire is resting loosely outside the back of the stove (so that it is reading the air temperature) in a safe location where it can't be damaged. It should not rest directly on the floor, or it will pick up the floor temperature. The thermocouple wire is the "room temperature heat sensor" whereby the control board will read the room temperature.
In this mode, after initiating the startup sequence, you select the desired room temperature (ranging from 60 to 90 degrees F) by pressing the Up or Down arrows, and the stove will operate the auger feed and blower speed according to the temperature you have selected.

The stove will heat to whichever temperature you set the stove at until the call for heat leaves, at which point the stove will adjust itself higher or lower as needed, depending on the room temperature readings supplied by the room heat sensor.
To turn the stove off completely, press the OFF button on the control board.

Manual Mode

Your stove can be changed to run in manual mode, if desired. In manual mode, after pressing the ON button, the stove will run continuously, based on desired heat range and blower speed settings. The heat range settings will be 1 through 9 (the Up arrow will increase the heat range and the Down arrow will decrease the heat range), with 1 being the lowest auger feed setting and 9 being the highest. The blower speed range will match the heat range that you have set.
Since the stove runs continuously at the selected heat range in this mode, it is generally recommended for stoves installed in less-insulated areas of the home and extremely cold climate regions.
To turn the stove off completely, press the OFF button on the control board.

Setting Stove in Manual Mode

- To set the stove in Manual Mode: With the stove plugged in press the down arrow and the up arrow button simultaneously. This will toggle your stove to Manual Mode.
- While in Manual Mode, the stove board will display M1 (the lowest setting) and can be adjusted with the up and down arrows.

Setting Stove in Automatic Mode

- To set the stove back into automatic mode, press the down arrow and the up arrow button simultaneously. This will toggle the stove to Automatic Mode.
- While in Automatic Mode, the stove board will display the Set Temperature.
- The control board on this stove allows the user to adjust the heat output and convection blower speed, turn the unit on and off, and test components for function (more on diagnostic mode later).

CAUTION

This unit is meant to operate only with door closed. Smoke spillage and an inefficient, lazy burn will result from attempting to operate the stove with the door open.

In addition, using fuel other than wood pellets can create an unsafe situation and can also generate excess carbon monoxide. Carbon monoxide is an odorless, colorless gas which can be deadly. Be sure to burn only wood pellets.

The use of a carbon monoxide detector is strongly recommended.

ERROR CODES – Top Mount Control Board

Error messages will appear and scroll across the display of the control board if the unit experiences an abnormal condition. When these errors occur, the unit will proceed to a shutdown cycle, during which time the control board will not permit the unit to be restarted. At the end of the shutdown cycle, the control board will allow the code to be cleared and/or the unit to be restarted. In the event an error message appears, however, it is recommended to refer to the troubleshooting section of the manual (or call Tech. Support if needed), to determine and correct the underlying cause of the message's appearance.

NOTE: See next section for information on Troubleshooting the Error Codes

Failed to start

- If the unit does not reach its minimum operating (or "Proof of Fire") temperature by the end of the allotted startup time, the control board display will scroll "FAILED TO START SHUTTING DOWN", at which time the unit will initiate a shutdown cycle. The message will continue to scroll during this time until the unit shuts completely off. During this time, the stove cannot be restarted; if the "ON" button is pressed during this shutdown, the unit will scroll "STOVE MUST SHUT DOWN TO CLEAR ERROR" once, before reverting to the previous message.

- Once the unit has shut down completely, the display will continue to scroll "FAILED TO START". At this point the stove can be restarted in its normal sequence by pressing the "ON" button, or the code can be cleared by pressing the "OFF" button.

Failed on Over Temp

- If, at any time while the unit is in operation and the firebox sensor reads too high of a temperature, the unit will display the following message: "FAILED ON OVER TEMP SHUTTING DOWN". The unit will then initiate a shutdown cycle, and the message will continue to scroll during this time until the unit shuts completely off. During this shutdown, the stove cannot be restarted; if the "ON" button is pressed during shutdown the unit will scroll "STOVE MUST SHUT DOWN TO CLEAR ERROR" once, before reverting to the previous message.

- Once the unit has shut down completely, the display will scroll "FAILED ON OVER TEMP". At this point the stove can be restarted in its normal sequence by pressing the "ON" button, or the code can be cleared by pressing the "OFF" button.

Vacuum Loss

- This unit is equipped with a vacuum actuated "Door Ajar" safety switch. If this switch is sensed as being open for a period of 30 continuous seconds, the control board will scroll

"FAILED ON VACUUM LOSS SHUTTING DOWN". The unit will then initiate a shutdown cycle, and the message will continue to scroll during this time until the unit shuts completely off. During this shutdown, the stove cannot be restarted; if the "ON" button is pressed during shutdown the unit will scroll "STOVE MUST SHUT DOWN TO CLEAR ERROR" once, before reverting to the previous message.

- Once the unit has shut down completely the control board will scroll "FAILED ON VACUUM LOSS". At this point the stove can be restarted in its normal sequence by pressing the "ON" button, or the code can be cleared by pressing the "OFF" button.

Hopper Left Open

- This unit is also equipped with a hopper lid safety switch that is actuated by a tab which is part of the hopper lid. The switch is a required safety device, which prevents the auger from cycling when the lid is open. An error message is triggered if the lid is left open for 60 continuous seconds - if this occurs, the control board will scroll "HOPPER LEFT OPEN SHUTTING DOWN". The unit will then initiate a shutdown cycle, and the message will continue to scroll during this time until the unit shuts completely off. During this shutdown, the stove cannot be restarted; if the "ON" button is pressed during shutdown the unit will scroll "STOVE MUST SHUT DOWN TO CLEAR ERROR" once, before reverting to the previous message.

- Once the unit has shut down completely the control board will scroll "HOPPER LEFT OPEN". At this point the stove can be restarted in its normal sequence by pressing the "ON" button, or the code can be cleared by pressing the "OFF" button.

If an error code continues to display, if the error code seems unexplainable, or if you have any other questions about error codes and what they mean, please contact Technical Support at (877) 356-6663.

ERROR MESSAGE TROUBLESHOOTING – Top Mount Board

NOTE: In some cases it will be recommended that you run "Diagnostic Mode" while Troubleshooting. See the section immediately following this section for information on running the Diagnostic Mode for your stove.

Failed to start

Each time the unit is powered up it should be clean; the burn pot should be empty; fuel should be already loaded into the hopper and both the loading door (hopper lid) and the front door **must** be closed. When powered up, the unit will start the draft (exhaust) blower and begin delivering fuel through the feed system. The igniter will begin to heat up, as well. Once the fuel has reached the level of the igniter hole in the burn pot, the heat from the igniter should quickly begin igniting the fuel. Once lit and burning, the unit will continue in this state until the firebox heat sensor recognizes "proof of fire," at which point the unit should exit the startup sequence and begin heating at the setting that was chosen by the user. If the unit does not reach the operating "proof of fire" temperature, a Failed to start error will appear.

Potential causes:

- Draft (exhaust) blower not running - if the draft blower is stuck, defective or plugged up and is unable to run, the unit will not feed. The airflow generated by the draft blower activates a vacuum switch that tells the control board the front door is closed and the draft blower is pulling sufficient air through the burn pot to support the fire.
    - Solution: Clean the stove and flue system. Clean out the draft blower and check to ensure the impellor rotates freely. Check wire connections at the blower; test in diagnostic mode. If the draft blower still does not run, replace the draft (exhaust) blower.

- Draft (exhaust) blower running but no fuel being fed (auger not turning) - This would indicate one of the following issues: Clogged auger or defective auger motor; Vacuum switch circuit open; Improper venting method; Hopper lid switch circuit open.
    - Clogged auger or defective auger motor - clear hopper and feed system. Check for "play" in auger. Test in diagnostic mode.
    - Defective auger motor - if auger is clear but will not run in diagnostic mode, replace the auger motor.
    - Vacuum switch open circuit - ensure the door closes tightly. Next, inspect the vacuum port (in the right rear wall of burn chamber to the right of the burn pot cradle) for blockage. To clean this vacuum port, insert a toothpick or similar implement into the mouth of the port and (gently) swirl it around while sliding it back out to ream out the opening. This port should not be vacuumed out aggressively (i.e. with any type of vacuum), as it could damage the switch. Next, clean the heat exchange areas and flue system. Test in diagnostic mode; if the circuit still shows 'open,' check the wire connections both at the switch and the control board. Test again in diagnostic mode; if still open replace vacuum switch.

- Improper venting method - as stated above, one of the key requirements for proper operation is proper airflow through the entire system. Venting systems with excessive elbows and/or long horizontal runs can restrict the flow of air to the point that the vacuum switch may not receive enough pressure to hold it closed. This would prevent feed, as the control board would assume the front door is open. A dirty flue system can restrict airflow in the same manner, even if installed correctly. Refer to the installation guide to determine if the installation is within specifications.
- Hopper lid switch circuit open - ensure the hopper lid is closing enough to engage the switch. Test in diagnostic mode. Ensure the switch can be pushed manually with hopper open. Check wires at switch and control board; test again in diagnostic mode. If the circuit still shows 'open,' replace the hopper lid switch.

- Feeds but doesn't light - Test igniter in diagnostic mode; remove the burn pot for observation. After energizing the ignitor circuit, allow approximately 4 minutes for the cartridge to fully heat up and observe the igniter sleeve. Check wires at igniter. Replace igniter.

- Stove lights but still has error - Test firebox sensor in diagnostic mode. Check connection at control board. Verify mounting screw for sensor on exhaust coupler is tight. Replace firebox heat sensor.

Over Temp

An over temp error message will appear when the firebox heat sensor reads too high of a temperature. The unit can produce a large amount of heat, which is convected out into the room by a convection (room air) blower that runs at a rate determined by the control board. If the stove is unable to shed the generated heat, the unit itself will retain a higher percentage of this heat and eventually will shut down.

Potential causes:

- Room air blower not running or dirty - test in diagnostic mode. If the blower does not run, remove rear panel and verify that the blower fan rotates freely. Clean out the fan. Check wire connections. Replace room air blower.

- Excessive ash buildup or improper venting - remove baffle and clean the heat exchange behind the baffle.

- Improper venting method / Clean flue system - as stated above, one of the key requirements for proper operation is proper airflow through the system. Venting systems with excessive elbows and/or long horizontal runs can restrict the flow of air, causing a buildup of fuel in the burn pot and higher exhaust temperatures. Also, a dirty vent system does not allow as much heat transfer, causing excessive heat to be wasted through the exhaust, where the firebox heat sensor is located.

- Confined space - If the unit is installed in a small room or alcove which does not allow proper circulation of heat, the unit itself could simply get too hot. Refer to the installation guide to determine if the installation is within specifications.

- Burning improper fuels - this unit is designed and approved to burn only premium grade wood pellets. Burning other fuels such as cherry pits, shelled corn, or pea/rice coal is not only prohibited, the practice can lead to significant damage done to the unit in a relatively short time.

- Defective firebox sensor - test in diagnostic mode; the display should read "firebox 87F" (or higher). If the sensor's temperature is below 87F, it will display "FIRE SENSOR UNPLUGGED OR COLD". Use a lighter to heat up the firebox sensor briefly and observe the display for a change in the sensor's reading. If the reading does not change, or - in the case of an over temp error is reading an extremely high number when the sensor is obviously cold - replace the sensor.

Vacuum loss:

When the stove is running, a vacuum sensor is monitoring the amount of airflow through the burn chamber. This device will stop feed if this flow is interrupted, and resume feeding when the flow is reestablished. If the airflow is interrupted for more than 30 seconds, the unit will shut down with a vacuum loss error.

Potential causes:

- Front door open/gasket leaking - the front door must remain closed to allow pressure to be registered by the vacuum switch. Also, the gasket that seals the door should make a relatively airtight seal to the face of the unit. Inspect this seal using a "dollar bill test": With the stove off and cool, fold a dollar bill in half long-ways and insert it between the open door and the stove face, then close and latch the door. Pull on the dollar bill and note there should be resistance to the bill, caused by being pinched between the gasket and the stove face. Repeat this process in several places around the door. If the bill will slip out with no resistance, the gasket should be replaced.

- Draft (exhaust) blower not running - if the draft blower is stuck, defective or plugged up and is unable to run, the unit will not feed. The airflow generated by the draft blower activates a vacuum switch that tells the control board the front door is closed and the draft blower is pulling sufficient air through the burn pot to support the fire.
    - Solution: Clean the stove and flue system. Clean out the draft blower and check to ensure the impellor rotates freely. Check wire connections at the blower; test in diagnostic mode. If the draft blower still does not run, replace the draft (exhaust) blower.

- Improper venting method - as stated above, one of the key requirements for proper operation is proper airflow through the system. Venting systems with excessive elbows and/or long horizontal runs can restrict the flow of air to the point that the vacuum switch may not receive enough pressure to hold it closed. This would prevent feed, as the control board would assume the front door is open. Refer to the installation guide to determine if the installation is within specifications.

- Blocked flue/excessive ash buildup in stove - for airflow to be sufficient to supply enough pressure to the vacuum switch, the flue and the stove itself must be clear of blockage or excessive buildup. This situation can reduce the amount of airflow to the extent that it causes the vacuum switch to open. Proper cleaning of both the flue system and the stove must be performed on schedule to ensure the required airflow can be maintained.

- Plugged vacuum port - the vacuum pressure that is read by the switch is pulled at a small port located in the back wall of the burn chamber, to the right of the burn pot cradle. This port can become restricted or blocked by ash buildup in the mouth of the port, causing the switch to either open, or not close fully, while the stove is running. To clear this port insert a toothpick or similar implement into the mouth of the port and (gently) swirl it around while sliding it back out to ream out the opening. This port should not be vacuumed out aggressively (i.e. with any type of vacuum) as it could damage the switch.

- Defective vacuum switch - rarely does this switch fail, so all of the above issues should be ruled out before replacing this switch. The switch can be tested in diagnostic mode.

Hopper left open:

This unit has a safety switch inside the hopper that prevents the auger from running when the hopper lid is open. If the lid is left open for more than 60 seconds, the unit will shut down with this error.

Potential causes:

- Ensure the hopper lid is closing enough to engage the switch. Test in diagnostic mode; the switch can be pushed manually with the hopper open. Check the wires at the switch and control board. Test again in diagnostic; if the circuit still shows open, replace the hopper lid switch.

Diagnostic Mode for Top Mount Control Board

To enter Diagnostic Mode, the unit must be off and completely shut down.

- Press the UP , DOWN and ON buttons simultaneously, and release.
- The unit will scroll “DIAGNOSTIC MODE” followed by “REV 3.4”, for example (or whatever revision is present on the board at the time).
- Press the ON button.
    - The board will flash the LED’s of the display. This is to test that all LED’s are functional.
- Press the ON button.
    - The board will scroll “AUGER OFF” at this point. To test the auger motor, press the UP arrow. The board will then scroll “AUGER ON” and the auger motor should run continuously. To stop the auger, press the DOWN arrow, and the board will revert to scrolling “AUGER OFF” and the motor will stop. (It is recommended the burn pot be installed during this portion of the test to prevent pellets from dropping into the cradle below the burn pot).
- Press the ON button.
    - The board will scroll “DRAFT OFF” at this point. To test the draft (exhaust) blower, press the UP arrow. The board will then scroll” DRAFT ON” and the draft blower will run at its highest output. To stop the draft blower, press the DOWN arrow, and the board will revert to scrolling “DRAFT OFF” and the blower will stop.
    - NOTE: the draft blower must be running to test the vacuum circuit later in the test, so, to leave it running, simply leave the board in the “DRAFT ON” configuration. Do not press the DOWN arrow; instead press ON button to skip to the next step leaving the draft blower running.
- Having pressed the ON button:
    - The board will scroll “ROOM AIR OFF” at this point. To test the room air (convection) blower, press the UP arrow. The board will scroll “ROOM AIR ON” and the room air blower will start running at its highest output. To stop the room air blower, press the DOWN arrow, and the board will revert to scrolling “ROOM AIR OFF” and the blower will stop.
- Press the ON button.
    - The board will scroll “IGNITER OFF”. To test the igniter, press the UP arrow. The board will then scroll “IGNITER ON” and the ignitor will energize and begin to heat up. After 3 to 4 minutes, the igniter should be at its full temperature and the glow from it should be visible in the mouth of the ignitor tube (it is recommended that the burn pot be removed during this part of the test (USE CAUTION AND NECESSARY PROTECTIVE GLOVES, GEAR, ETC.), especially if the burn pot has fuel in it from testing the auger. Also, the draft blower is running to pull air through the ignitor sleeve if all steps above were followed). To power down the igniter, press the DOWN arrow. The board will revert to scrolling “IGNITER OFF” and the ignitor will power down.
- Press the ON button.

- The board will scroll “FIRE 087F”, or whatever temperature the firebox sensor is reading at this point. The heat sensor can be tested using a lighter (or other heat producing device) to warm the sensor, and as the sensor is warmed the display will adjust to display the temperature at the sensor as it changes. If the firebox sensor is disconnected or reading below its scale, the board will scroll “FIRE SENSOR UNPLUGGED OR COLD”.

- Press the ON button.
  - The board will scroll “ROOM 67F”, or whatever temperature the room sensor is reading at this point. The room sensor can be tested by simply holding the bulb at the end of the wire in your hand, allowing body heat to warm it. As the bulb warms up, the scrolling display will indicate a higher temperature number. If the room temp. sensor is unplugged or defective, the display will scroll “CONNECT ROOM TEMP SENSOR”.
- Press the ON button.
  - The board will scroll “H1” or “H0”, “T1”, “V1” or “V0”, depending on the position of the hopper lid and front door.
  - The “H” indicates the status of the hopper lid switch, with “H1” meaning the lid is closed and “H0” meaning the lid is open.
  - The “T1” should always read as such, since that circuit is jumped closed and is not used on this model.
  - The “V” indicates the status of the vacuum switch, with “V1” meaning the door is closed and “V0” meaning the door is open.
  - (NOTE: the draft (exhaust) blower must be running to test this circuit).
  - To properly perform this portion of the diagnostic, read the codes as they scroll with both the front door and hopper lid closed. Then, open each, and note the scrolling readout to see if the board reflects the proper status of each switch.
- To cycle the board back to the beginning of the diagnostic mode press the ON button; this allows the user to cycle back around to turn the draft blower off or to re-run the test, if desired.
- To exit the test simply press the OFF button. Exiting the test can be done by pressing OFF at any point during the test. The user does not need to cycle to the end to exit, but it is recommended to cycle through and ensure each component test is set to the “OFF” status before exiting the diagnostic mode.

Please Note: The following section gives instructions for stove models with the <u>Side Mount control board</u> (where the control board is mounted on the side wall of the stove).
Please see the section of the manual “Control Board Settings – Top Mount Board” for instructions pertaining to stoves with a Top Mount control board.

CONTROL BOARD SETTINGS – SIDE MOUNT CONTROL BOARD

The control board on this stove allows the user to adjust the heat output and convection blower speed, turn the unit on and off, and test components for function (more on diagnostic mode later).

- The lower buttons on the control board (Low Fuel Feed, Low Burn Air, and Air on Temp) are not meant to be adjusted during normal operation of the unit. These buttons are factory preset and should not be adjusted by the user.

- To energize the unit and initiate a fire, press the "On" button. The LED above the button should turn green and the control board should display "S U" shortly after pressing the button.

- To shut the unit down, press the "Off" button. The LED above the button should turn red and the board should display "S d" shortly after pressing the button. This initiates the shut down sequence, and the stove will remain in shut down mode until it has cooled down.

- To increase the heat output of the stove, press the "Up" heat range button. The number in the heat range display window will increase, signifying that the control board is now adjusting the heat output to your desired level. The blower speed will increase the same amount as the heat range, because the stove is designed to operate with the blower speed greater than or equal to the heat range. Pressing the "Down" arrow will decrease the heat range and blower speed.

- To increase the blower speed without increasing the heat range, press the Blower Speed "Up" arrow until the desired blower speed is shown in the display window. Pressing the "Down" arrow will decrease the blower speed; however, the control board will not allow the blower speed to be set lower than the heat range.

Caution

This unit is meant to operate only with the main viewing door closed. Smoke spillage and an inefficient, lazy burn will result from attempting to operate the stove with the door open.

In addition, using fuel other than wood pellets can create an unsafe situation and can also generate excess carbon monoxide. Carbon monoxide is an odorless, colorless gas which can be deadly. Be sure to burn only wood pellets.

The use of a carbon monoxide detector is strongly recommended.

ERROR CODES – SIDE MOUNT CONTROL BOARD

Error codes, or "E-Codes," are alphanumeric codes that will appear in the Heat Range and Blower Speed windows of the Control Board if the unit experiences an abnormal condition. Error codes are the control board's way of telling the user that something isn't operating correctly within the stove, and that the unit should be carefully inspected before reigniting. See the "Trouble-Shooting Guide," page 41, for additional information on error codes.

E-0

- When this is displayed in the control board windows (typically when restarting after an "E-Code" shutdown), it means there are currently no errors and the stove will begin normal operation.

E-1

- This error code is not used on this stove. If it is displayed in the control board windows, please contact Technical Support and they will diagnose the cause of the false code.

E-2

- When this code is displayed in the control board window it indicates a failure to light. Although the stove may have ignited the pellets, the control board did not register a high enough temperature to determine the fire was lit. If a fire was ignited, wait for the unit to cool, clean the burn pot and restart the unit.

E-3

- This error code indicates the preset maximum allowable exhaust temperature was exceeded. Commonly referred to as "Over-Firing," the E-3 code means something in the stove is causing the exhaust gas to be hotter than expected.

E-4

- This code is displayed based on a drop in the exhaust temperature. This code means the fire or "proof of flame" has been lost. It usually results from the hopper being empty.

If an error code continues to display, if the error code seems unexplainable, or if you have any other questions about error codes and what they mean, please contact Technical Support at (877) 356-6663.

Hopper Lid Safety Switch - This unit is also equipped with a hopper lid safety switch (Part # AC-HLSB) which is directly connected to the auger motor. In the event the hopper lid is left open while the stove is in operation, the hopper lid switch will prevent the auger from turning. This is to prevent byproducts of combustion from entering the home through the open hopper lid and also to simply prevent operation with the hopper lid open. Improper hopper lid safety switch operation will result in an auger that will not turn and therefore a stove that will not burn. NEVER place your hand or any object near the auger while the stove is connected to power.

POWER FAILURE – Top and Side Mount Control Boards

If the power to the unit is interrupted for approximately three minutes or less, the unit will resume operation when power is restored according to the following table:

Unit's State Before Power Loss	State When Power Returns
ON	Warmup (Start-Up)
Warmup (Start-Up)	Warmup (Start-Up)
Shut-Down	Shut-Down
OFF	OFF

- If the power is interrupted for more than (approximately) three minutes, the unit will be "OFF" when power returns.
- **IMPORTANT** – Do **NOT** open the hopper lid or the door to the unit during a power outage. Open the closest outside door and a window to reduce the chance of any combustion byproducts entering the home from the stove. Wait for the power to be restored and then press the "ON" button to restart the unit, if necessary.

Smoke Detectors

England's Stove Works, Inc. highly recommends the use of smoke detectors in every room of the house. However, locating a smoke detector directly above this unit can result in nuisance alarms.

Caution – Shock Hazard

Press the "Off" button and let the appliance completely cool BEFORE unplugging the appliance and beginning any maintenance or component replacement.

Risk of shock if appliance is not unplugged before service

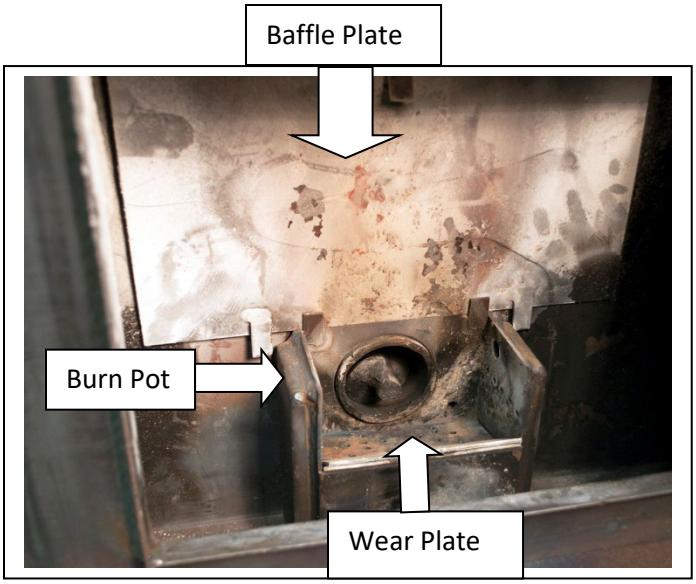
Failure to properly clean your stove can cause poor performance and possibly a burn back!

DAILY MAINTENANCE

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

Important Notes

- As with any maintenance concerning this unit, be sure the unit is "OFF" and has completed the Shut-Down cycle **BEFORE** beginning.
- Be aware that metal parts in the firebox can remain **HOT** long after the fire has gone out and **EVEN** after the Shut-Down cycle is complete. Always use extreme caution when handling potentially hot stove parts, even if you think they should be cold.
- Ashes should only be removed when the stove has been shutdown and has been allowed to cool thoroughly. Hot embers can remain under ashes long after the fire has gone out, so always be extra careful when handling any ashes from this (or any) stove.



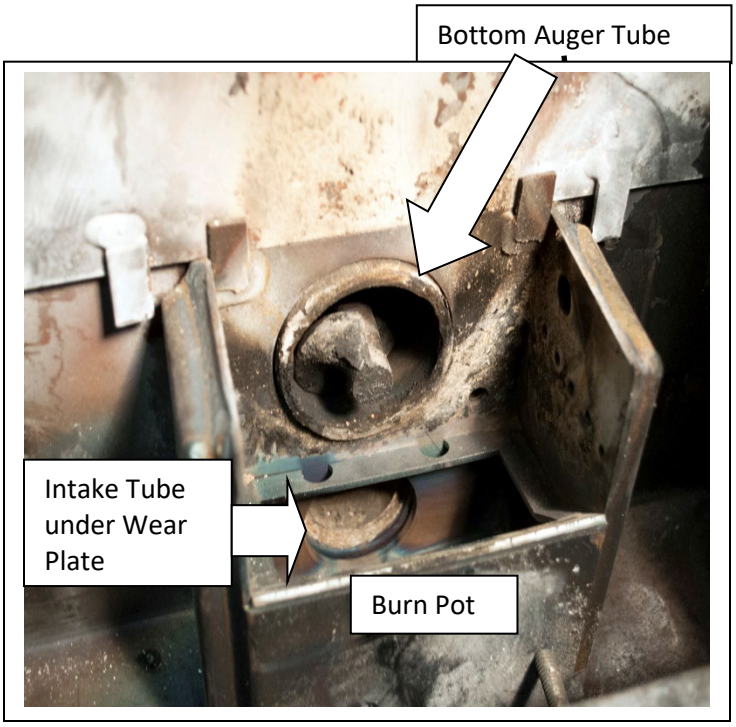
- Different pellets will generate varying amounts of ash and burn pot deposits. Carefully monitor the ash build up in the stove when first operating the unit, as well as whenever a different brand of pellets is burned.
- While the amount of ashes generated by this unit is not excessive compared to a traditional log-burning woodstove, keeping the unit clean and free of ash is ESSENTIAL for peak performance and maximum efficiency. Ash build-up hampers airflow, reduces efficiency, and can cause a smoke back.
- England's Stove Works® is not responsible for any damages incurred due to a poorly maintained and/or dirty stove. This pellet stove is a highly efficient machine and, as such, requires sufficient maintenance to keep it operating at its peak.

Ash Removal and Disposal (at least twice per week)

- Press the "Off" button and allow the stove to complete the shutdown cycle and cool completely.
- A long-handled screwdriver or long-handled putty knife can be used to scrape any build-up or crust into the burn pot area. This can then be pushed left or right into the ash storage area.
- Remove the ashes with a scoop. Follow the "Disposal of Ashes" instructions listed above (under Daily Maintenance).

Cleaning the Burn Pot

Along with removing ashes from the stove, cleaning the burn pot is the other essential part of daily maintenance that will keep the stove operating at its peak. Pellets contain varying amounts of impurities and fusible material that will accumulate in the burn pot over time. Some pellets will contain much higher amounts of these fusible impurities, therefore extra vigilance may be required to maintain a clean burn pot. Allowing impurities to build up in the burn pot can restrict the air flow to the fire, resulting in a dirty, inefficient burn and can shorten the life of the burn pot.



NOTE: The burn pot should actually be cleaned out **before each start-up** (before pressing the ON button), and daily.

- Always allow the stove to finish the shut-down cycle and cool completely before performing any maintenance inside the firebox.
- Open the front door to access the burn pot. **WARNING** – The burn pot can remain HOT long after the fire has gone out, so wear protective gloves whenever handling a potentially hot burn pot, if you remove it.
- Remove and clean the burn pot wear plate (refer to the exploded diagram in the rear of this manual, and the diagram on the previous page).
- Remove any ash build-up in the area below the wear plate. Also, be sure there are no ashes or obstructions in the intake tube under the wear plate. **IMPORTANT: Ash build-up under the wear plate can cause the unit to malfunction.**
- Check for any build-up in the front of the burn area. Clean out all air holes in the wear plate (if necessary, a 1/8” drill bit can be used) --these air holes should be kept clean, as they supply combustion air under and around the pellet fuel.
- The burn pot assembly should also be thoroughly cleaned, including the burn box. When replacing the wear plate, ensure that it lies flat in the firebox and no gaps (from ash residue) are under it. Insert the burn pot back into the cradle if you have removed the entire burn pot, and be sure to tighten the set screws, but do not over-tighten them.

WEEKLY MAINTENANCE

Baffle Removal

- As with any maintenance concerning this unit, be sure the unit is "OFF," has completed the Shut-Down cycle, and is completely cool BEFORE beginning. Be aware that metal parts in the firebox can remain HOT long after the fire has gone out and EVEN after the Shut-Down cycle is complete. Always use extreme caution when handling potentially hot stove parts, even if you think they should be cold.
- Weekly maintenance should include the steps listed in this section AS WELL AS the steps listed in the "Daily Maintenance" section.
- The large baffle plate that rests above and behind the burn pot (refer to the exploded diagram in the rear of this manual and the images in the Daily Maintenance section) should be removed weekly. This can be done by lifting up the plate and pulling it out. The area behind the plate should then be cleaned thoroughly, and the plate placed back in the original position.
- Use a screwdriver or chisel and break any creosote build-up in the front of the unit, where the pellets are fed into the burn pot from the Bottom Auger Tube (see Illustration in previous section). Moisture in the pellets and resulting build-up in this area can cause the bottom auger to "squeal" or squeak.
- Carbon Removal: During normal operation carbon from the combustion of pellet fuel will tend to build up on the tip of the auger, on the wear plate and sides of the fire pot, and in the mouth of the feed tube. It is essential that this residue be removed to ensure trouble free operation of the unit. The frequency with which this carbon must be removed varies with brands of pellets, depending on moisture content, wood type, foreign material (dirt, etc.) in pellets, and other factors.
- To remove this carbon, simply scrape it off using the blade of a flat tipped screwdriver or similar instrument; also, to remove carbon from the feed tube, scrape as much as can be easily reached, then insert an emery board (fingernail file made from a popsicle stick and sandpaper) between the feed auger and the feed tube and sand out any residue not removed from scraping alone. Clearing this carbon residue from the feed tube is essential for proper operation of the feed auger, which is designed to float freely in the feed tube allowing smooth fuel flow, a lesser possibility of a jam, and a quieter unit.
- Replace the baffle by reversing the above steps.
- If excess ash accumulation is found in the exhaust chamber or venting system during monthly maintenance, the interval between cleanings should be reduced to eliminate the possibility of poor stove performance due to ash accumulation.
- A specially designed ash vacuum and pellet stove cleaning kit is available from the England's Stove Works website; please see: englander-stoves.com

MONTHLY MAINTENANCE

A good rule of thumb for monthly maintenance is that it should be done each time an entire ton of pellets is burned **OR** once per month, whichever comes first.

Venting Pipe Cleaning

- Low spots and direction changes in the venting system (such as tees and elbows) are areas for potential fly-ash and creosote accumulation. **INSPECT** these areas diligently to keep the venting system in safe operating condition.
- Depending on the specific type of venting system your stove is connected to, it may be possible to remove the clean-out tee cover and simply run a pipe brush up the pipe to remove any fly-ash accumulation.
- Horizontal runs of pipe, such as from the exhaust connection on the stove to the vertical transition, will accumulate fly ash and should be inspected carefully and brushed clean.
- Check the termination cap to be certain it is not clogged or restricted by any fly-ash accumulation.
- After thoroughly cleaning the venting system, reseal any disassembled seams with high temperature silicone (Part # AC-RTV3) if applicable to your venting system.
- Inspect seams that were not disassembled to be certain a smoke-tight seal is still being made.
- After prolonged use, leaks in the venting system can usually be found by searching for fly-ash deposits on the outside of the pipe. Carefully check for leaks in the venting system and seal them accordingly.
- Although most pellet venting systems are designed to last a lifetime, pellet fly-ash can be corrosive under certain conditions. When cleaning your venting system, examine the pipe carefully for any signs of deterioration and replace sections that show excessive wear. It is unlikely that this will ever be a concern, but maintaining your venting system in safe operating condition is crucial to safe stove operation.

YEARLY MAINTENANCE

Important Notes

- As with any maintenance concerning this unit, be sure the unit is "OFF," has completed the Shut-Down cycle, and is completely cool BEFORE beginning.
- Be aware that metal parts in the firebox can remain HOT long after the fire has gone out and EVEN after the Shut-Down cycle is complete. Always use extreme caution when handling potentially hot stove parts, even if you think they should be cold.
- Yearly (or end of season) maintenance should include the steps listed in this section AS WELL AS the steps listed in the "Daily Maintenance," "Weekly Maintenance" and "Monthly Maintenance" sections of this manual.
- Yearly maintenance should be performed at the end of the burning season. Leaving ash and other build-up in the stove during the non-heating months can lead to premature metal degradation in the stove and venting system. Using extra attention to detail and being certain to be very thorough in the end of season cleaning will help increase the operating life of the stove and venting system.
- The unit should be unplugged during the summer months (and periods of non-use), to help protect against the possibility of damage due to lightning strikes and other power disruptions.

SOOT AND FLY ASH: FORMATION AND NEED FOR REMOVAL

The products of combustion will contain small particles of fly ash. The fly ash will collect in the exhaust venting system and restrict the flow of the flue gases. Incomplete combustion, such as that which occurs during startup, shutdown or incorrect operation of the room heater will lead to some soot formation which will collect in the exhaust venting system. The exhaust venting system should be thoroughly inspected at least once every year to determine if cleaning is necessary.

Caution – Shock Hazard

Press the "Off" button and let the appliance completely cool BEFORE unplugging the appliance and beginning any maintenance or component replacement.

Risk of shock if appliance is not unplugged before service.

YEARLY MAINTENANCE

- The stove and the flue system should be given a complete cleaning at the end of the heating season.

- **Burn Pot:** Remove the burn pot assembly, clean it thoroughly, and re-install it (refer to Exploded Parts Diagram in the rear of this manual and the Daily Maintenance section); this will require new gasket for the burn pot. Be sure to tighten the set screws when you replace them, but do not over-tighten.

- **Combustion (Exhaust) Blower Cleaning:** Although the combustion blower and blower housing were designed to minimize ash build-up, some fly-ash will still accumulate there throughout the burning season. The amount and type of ash will depend on the type of pellets and venting system, but generally this accumulation will be mild. If, when cleaning the combustion blower, a large accumulation of fly-ash is found, cleaning the blower and housing should be performed monthly or bimonthly to prevent this excess buildup.

Instructions

- Before beginning the combustion blower cleaning procedure, be certain the unit is unplugged and thoroughly cooled down.
- Disconnect the venting system from the combustion blower just enough that you will be able to remove the blower from the stove.
- Remove the left side access panel, using a 5/16" wrench.
- Remove the back panel of the unit, using a 5/16" wrench.
- Unplug the two power leads to the combustion blower, using the quick connect plugs.
- Loosen the five (5) $^{5}/_{16}$" self-drilling screws which hold the combustion blower to the blower tube.
- Lift the combustion blower up and out of the stove. The gasket which seals the blower to the blower tube is fragile, so take extra care when removing the blower. Even when being careful, though, it is easy to tear this fragile gasket, and since an airtight seal is crucial here, you should replace this gasket (Part # - PU-CBMG) every time the combustion blower is removed. Remove the gasket with a putty knife, and install the new gasket by applying adhesive to the blower and installing the new gasket (instructions and adhesive are provided with the gasket).
- With the combustion blower removed, use a utility vacuum to remove any ash accumulation in the combustion blower tube on the stove.
- Using a soft paint brush, carefully remove any ash accumulation from the inside of the combustion blower, and from the blower fan blade.
- Inspect the combustion blower motor for dust accumulation and carefully remove it, ensuring that all air cooling holes into the motor are open and free of dust deposits.
- Install the blower in the reverse order as described above. Remember to check the condition of the combustion blower gasket, and to reconnect the two wires which connect the blower to the stove's control board.

- Reinstall the venting system and panels.
- NOTE: As an option, there is a Combustion Motor Gasket that is included with Part # PU-CBMG, which allows you to remove the motor (only) from the combustion blower housing, clean the motor and inside of the blower housing, and replace the motor and its gasket without having to remove the entire Combustion Blower. Remember that the blower impeller, blower tube and steel blower exhaust tube on the stove should be brushed and vacuumed.

Convection Blower Cleaning

- As always, be certain the stove is cool and unplugged before servicing any components within the unit. Since the convection blower does not handle any by-products of combustion, it does not require serious cleaning like the exhaust blower.
- However, dust from the home and other debris in the air can accumulate on the blades of the convection blower. Any dust that has built up on the fan blades can usually be easily removed with a vacuum or a soft paint brush.
- The back panel will need to be removed from the stove, using a 5/16" wrench.
- The control (circuit) board will need to be removed, by removing the two 5/16" screws and pulling the control board out of the stove. Some wire ties may need to be cut so that the board can be pulled out of the way of the blower (remember to replace them).
- Four 5/16" screws will need to be removed in order to remove the convection blower from the stove. You will likely need a socket with a long extension.
- Install the blower in the reverse order as described above.
- Also see the Convection Blower removal instructions in the Replacing Components section of the manual.

FINISH

- This new unit has been painted with High-Temperature paint that should retain its original look for years.
- If the unit should get wet and rust spots appear, the spots can be sanded with fine steel wool and repainted. It is crucial that only High-Temperature Spray Paint is used (Part# AC-MBSP), as others may not adhere to the surface or withstand the high temperatures.
- Similarly, some brands of paint will not adhere to different brands of paint, so we highly recommend using our proprietary High-Temperature Spray Paint.

GASKETS

- Gaskets should be inspected and replaced annually. See the Gaskets page in Replacing Components (page 49) for information and instructions.

Trouble-Shooting Guide

WARNING: To avoid **ELECTRICAL SHOCK** always *disconnect* the unit from the power source **BEFORE** attempting any repair. If this guide does not correct the problem, call Technical Support at 1-877-356-6663.

*See ERROR CODES section earlier in this manual for information on troubleshooting Error Codes

Problem	Cause	Solution
Top Auger not turning	1. Bad auger motor. 2. Foreign matter jamming auger. 3. Vacuum sensor. 4.Hopper lid switch	1. Replace auger motor. 2. Remove pellets and object. 3. Check exhaust blower. 4.Make sure hopper lid is closed/replace switch
Bottom Auger not turning	1. Bad auger motor. 2. Foreign matter jamming auger.	1. Replace auger motor. 2. Remove pellets and object.
Smoke smell or dust in house	1. Improper exhaust connection.	1. Check exhaust connections for leaks, especially the exhaust blower connect. Seal leaks with silicone, aluminum tape or a hose clamp.
Room blower not operating	1. Loose thermal sensor. 2. Blower speed set higher than heat range, causing stove to cool and blower to cycle. 3. Loose connection.	1. Tighten connection on sensor. 2. Lower blower speed. 3. Check control board connection.
Exhaust blower not operating	1. Loose connection. 2. Bad blower. 3. Bad vacuum sensor.	1. Check control board connection. 2. Replace blower. 3. Replace vacuum sensor.
Lazy Fire	1. Bad exhaust blower. 2. Excessive pellet moisture. 3. Excessive ash build-up. 4. Low quality pellets.	1. Inspect and replace blower. 2. Keep pellets dry. 3. Thoroughly clean unit. 4. Use only **PFI** premium pellets.
Blown Fuse	1. Power surge. 2. Exposed wire. 3. Electrical component shorting.	1. Replace fuse; use surge protector. 2. Check for exposed or frayed wire and loose connections. 3. Check motors and blowers for obstructions or short circuits.
High Pellet Consumption	1. Low quality or non-uniformly sized pellets.	1. Use premium pellets or try another pellet brand.
Squeaking Noise	1. Obstruction in auger tube. 2. Blower Noise.	1. Check auger tube for foreign objects. 2. Remove, clean, and oil blower.
Pinging or Rattling Noise	1. Foreign material in blower. 2. Loose exhaust fan set screw.	1. Check both blowers for material. 2. Check set screw for tightness.

IMPORTANT! READ AND FOLLOW **ALL** INSTALLATION AND MAINTENANCE INSTRUCTIONS, INCLUDING CLEANING THE UNIT AS SPECIFIED, AND REPLACING GASKETS ANNUALLY, AND PARTS AS NEEDED.

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Error codes related only to side mounted control board		
Unit Shuts Down in 15-20 minutes with an "FS" code (Top Mount) or "E-2" code (Side Mount) on control board. (Failed Start)	1. Loose thermal sensor.	1. Check both sides of thermal sensor connection (exhaust blower and control board).
	2. Control board settings.	2. Start stove on minimum Heat Range 5 to ensure a good fire is started.
	3. Failure to light pellets.	3. Check igniter for buildup or failure.
"OT" Code (Top Mount) or "E-3" Code (Side Mount) on Control Board (OverTemp)	1. Convection (Room Air) blower failure.	1. Check convection blower for proper function, replace if necessary.
	2. Partially blocked flue.	2. Check flue for obstructions.
	3. Using fuel other than premium wood pellets.	3. Use ONLY premium wood pellets in this stove.

Notes:

1. Whenever instructed to check/replace the vacuum sensor, also check for loose or cracked vacuum hose. Also, be certain the vacuum measurement port in the firebox is kept clean (clean with a pipe cleaner or brush, **do not use a vacuum** to clean this port).

2. To restart and clear an error code displayed on the control board, push the "ON" button and the unit should reset the error and restart.

3. If you are uncertain about the meaning of an error code or have any questions at all, **PLEASE** contact Technical Support at (877)356-6663.

IMPORTANT SAFETY NOTE: If the unit or chimney connector pipe "glows" red (or white), the stove is over-fired. This condition could cause a house or chimney fire. Do not operate your unit too hot, or over-firing may result.

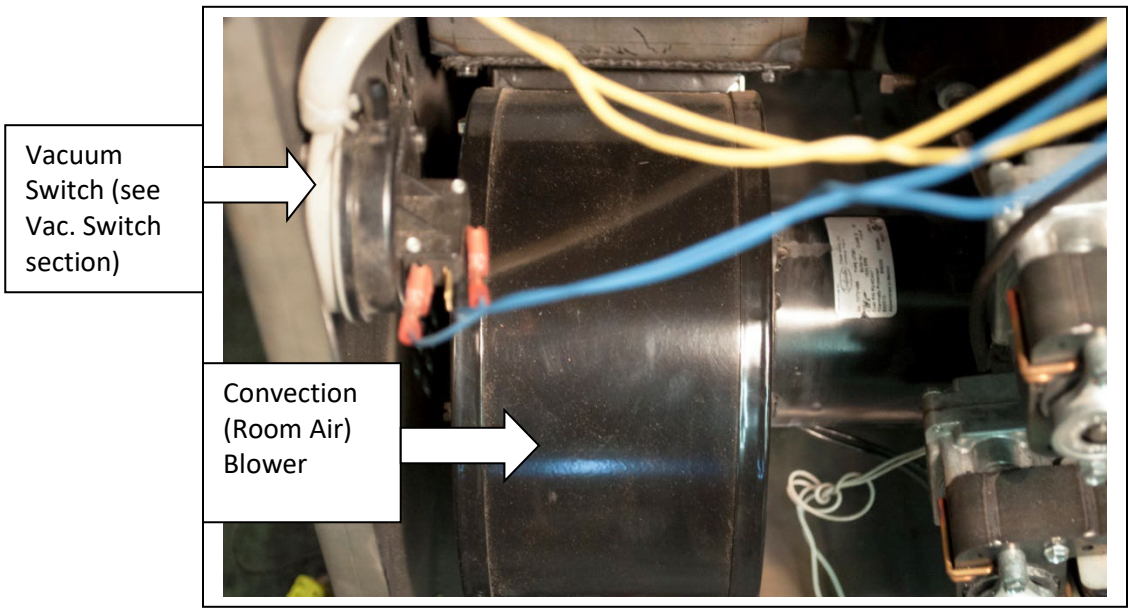
REPLACING COMPONENTS

See Exploded Diagram at rear of manual for parts reference

englander-stoves.com Questions: (877) 356-6663

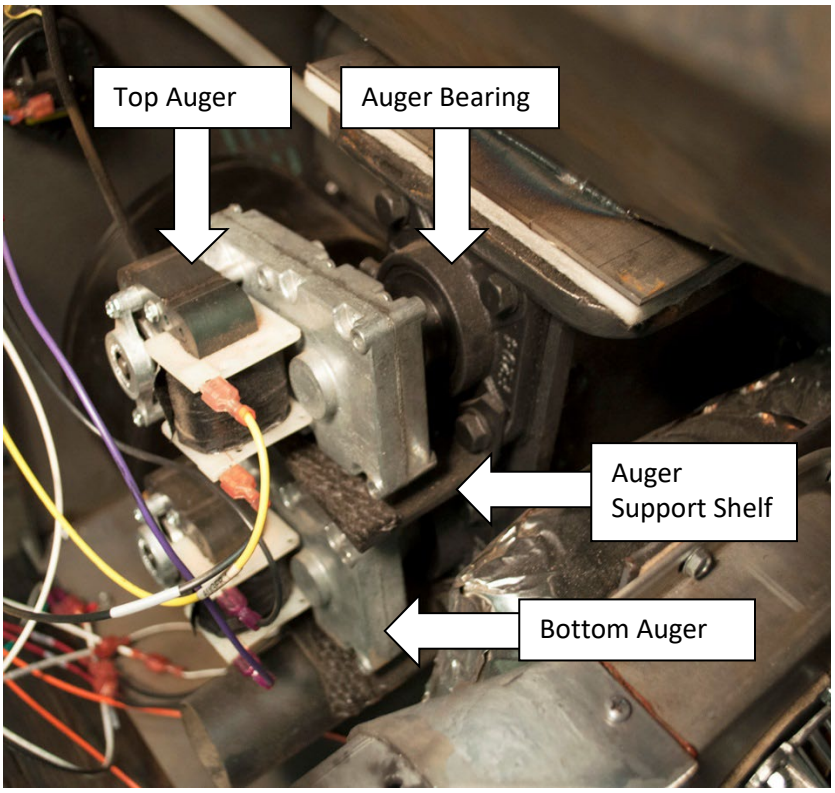
Convection (Room Air) Blower

- Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
- Remove the back panel of the unit, using a 5/16” wrench.
- If it is a side-mount control board, the control (circuit) board may need to be removed, by removing the two 5/16” screws and pulling the control board out of the stove. Some wire ties may need to be cut so that the board can be pulled out of the way of the blower (remember to replace them).
- Locate and detach the power leads to the convection blower.
- Using a socket with a long extension, loosen and remove the (4) $^{5}/_{16}$” screws which hold the blower to the stove; remove the blower from the stove.
- Installation of the new blower is performed in reverse of removal; remember to reconnect the power leads to the blower, and replace any wire ties before reinstalling the control board. (When installing the new blower, place the blower motor opening pointing UP, towards the top of the stove.)
- Visit youtube.com/heatredefined for detailed service ‘how to’ videos.

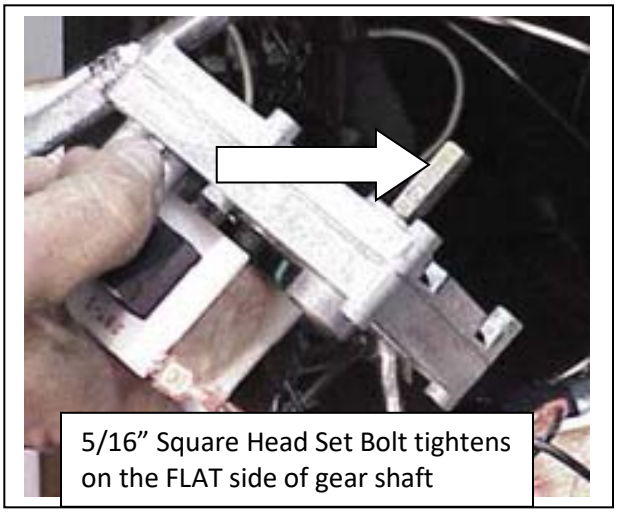


Auger Motors, Bearings & Shafts

- Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down. Also, make sure the hopper is empty before attempting to remove or replace the top auger motor assembly.
- Remove the back panel of the unit, using a $^{5}/_{16}$" wrench.
- Before loosening any auger motor bolts, detach the power leads from the auger motor.
- Locate the appropriate auger motor assembly at the rear of the stove, loosen the 5/16" square head set bolt that is positioned between the auger motor and the auger block bearing. This bolt tightens down on the flat side of the gear shaft, and locks the gear shaft and auger shaft together.
- Once the bolt is loosened, the assembly will slide from the locking collar and auger shaft.
- To replace the top auger, all pellet fuel must be removed from the hopper as well as from the top auger assembly.



- Once this is done, the four ½" bolts that hold in the bearing can be removed, and the complete auger assembly may be removed from the stove.
- The auger bearings are a sealed unit and do not require lubrication.
- Remove the ¾" shaft collar from the auger shaft/bearing assembly.
- Loosen the two (2) 1/8" set screws on the end of the auger bearing with a 1/8" Allen wrench, which will disconnect the bearing from the shaft (the bearing assembly and auger assembly can be replaced by reversing this procedure; pull the bearing flush against the ¾" collar before tightening the two 1/8" set screws).

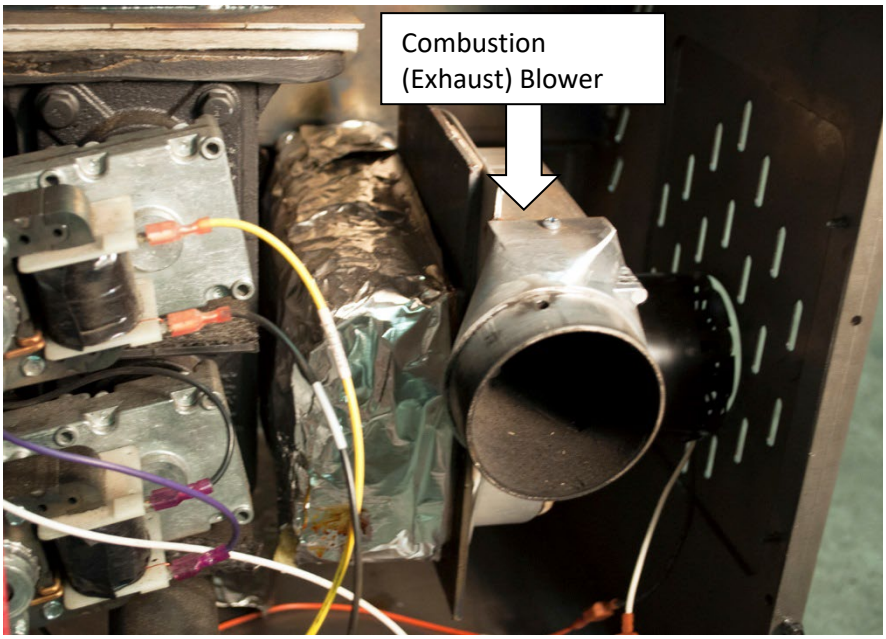


- Be sure to install a new auger bearing gasket when replacing an auger bearing.

- When placing the auger assembly in the unit, always tighten the four auger bearing bolts in a diagonal (criss-cross) pattern to ensure the bearings and shafts are aligned properly. Remember to install the auger shelf support, placing the two bottom bolts through the shelf and the auger bearing.
- NOTE: Follow the same procedure to work on the bottom auger, with the exception that the pellets do not necessarily have to be removed from the hopper.
- Visit youtube.com/heatredefined for detailed service 'how to' videos.

Combustion (Exhaust) Blower

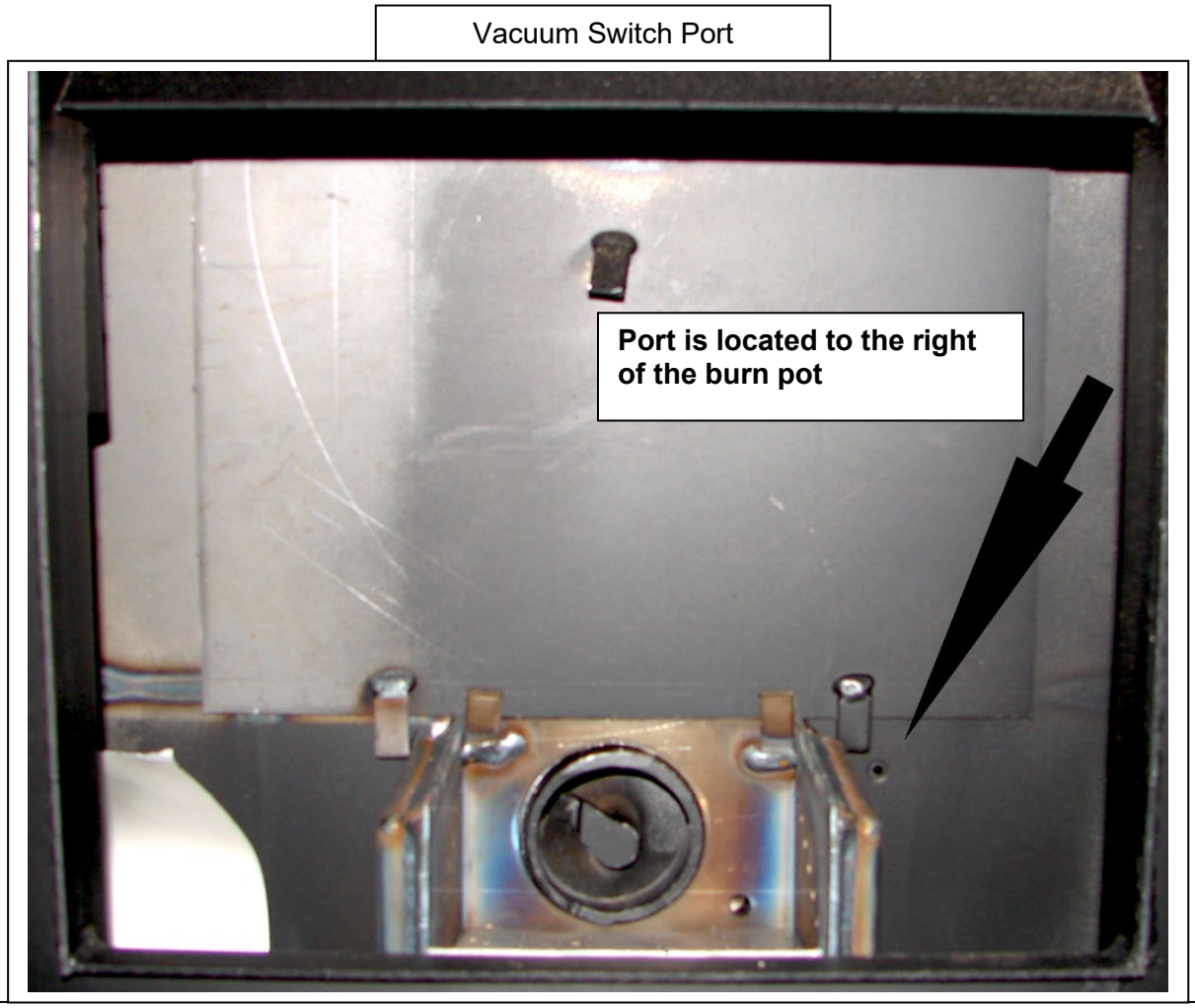
- Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
- Disconnect the pellet vent pipe so that the combustion blower may be accessed.
- Remove the left side access panel, using a 5/16" wrench..
- Remove the back panel of the unit, using a 5/16" wrench.
- Disconnect the power leads to the combustion blower.
- Remove all (5) screws which hold the exhaust blower to the exhaust blower tube. Once the screws have been removed, the blower can be lifted up and out of the stove.
- Replace the combustion blower gasket each time you remove the blower from the stove (Part # PU-CBMG). Remove the gasket with a putty knife, and install the new gasket by applying adhesive to the blower flange and installing the new gasket (instructions and adhesive are provided with the gasket).
- Reinstallation is the exact opposite of the steps above.
- Visit youtube.com/heatredefined for detailed service 'how to' videos.



REPLACING COMPONENTS

Vacuum Switch - Function

- This unit is equipped with a Vacuum Shut Down Switch (Part # CU-VS), which helps control various functions of the unit.
- If an operational error occurs in the unit, a switch will either stop the top (feed) auger or shut the unit off; if the unit turns off an error code will appear on the Control Board.
- Situations which could cause this include power failure, Combustion Blower failure, improper flue installation, a blocked flue (from rodents, nests, etc.), or "dirty burning" from burning improper fuel (see "Important Information" at the beginning of the manual).

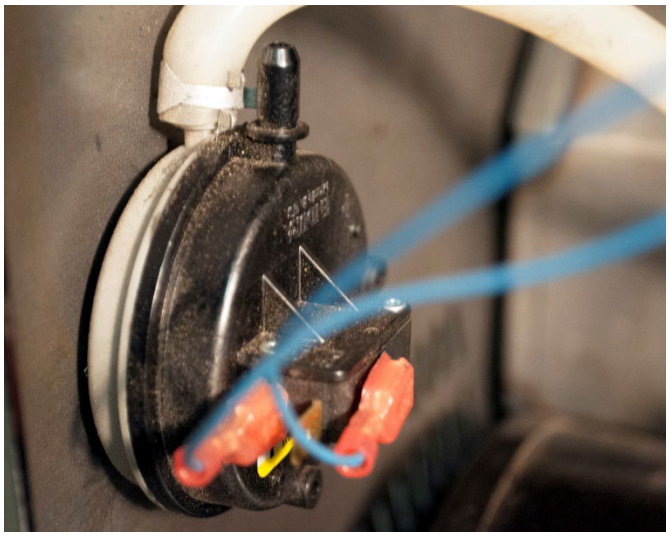


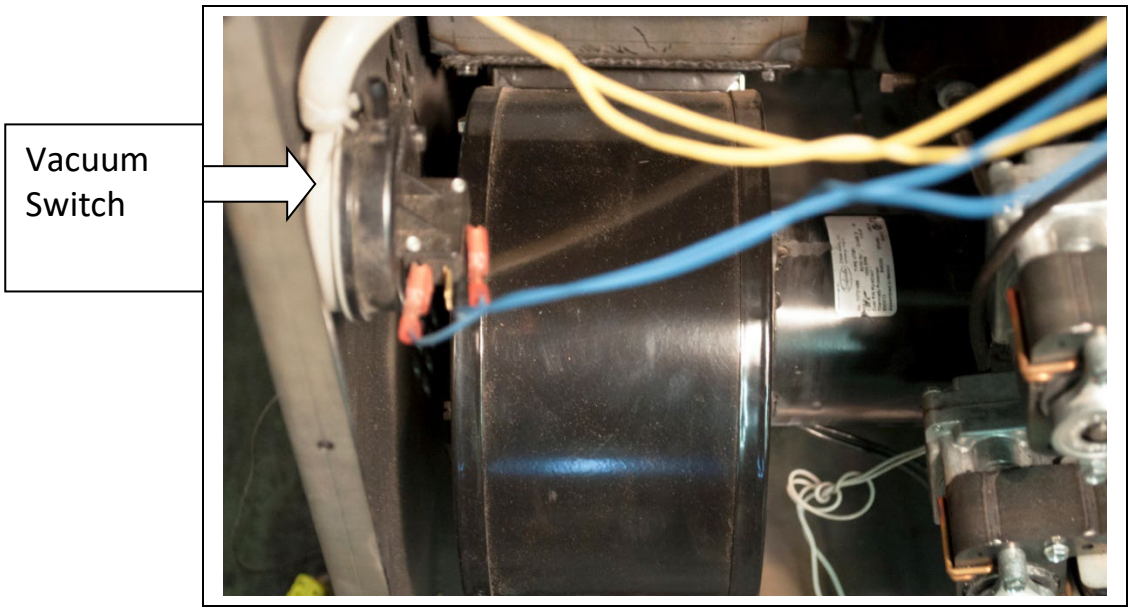
NOTE: The vacuum switch port must be kept clean, or the top auger will cease to function. Locate the port hole to the right of the burn pot and, with the stove unplugged and cooled down, use a brush or pipe cleaner (not a vacuum) to keep this port clear of ash or other debris (see picture).

REPLACING COMPONENTS

Vacuum Switch

- Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
- Remove the back panel of the unit, using a 5/16” wrench.
- Locate the vacuum switch as shown in the diagram below (on the left wall of the unit).
- Disconnect the power leads and vacuum hose from the vacuum switch, *taking note of where connections were made*.
- Remove the (2) screws which hold the vacuum switch to the vacuum switch bracket, using a Phillips screw driver.
- Installation is the reverse of removal; be absolutely certain the wires and vacuum hose are connected as they previously were (and according to the wiring diagram in this manual).
- Visit youtube.com/heatredefined for detailed service ‘how to’ videos.

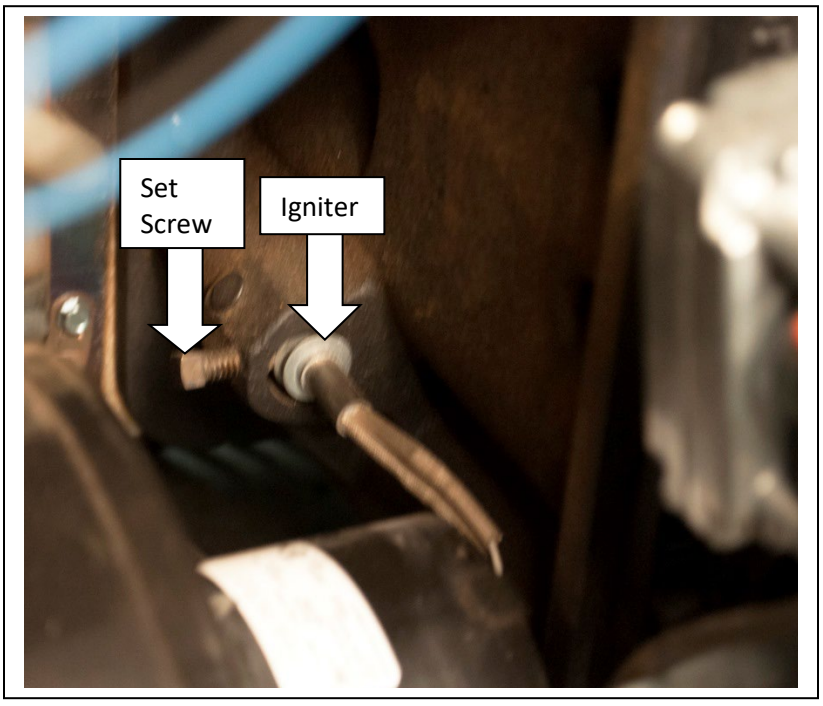




REPLACING COMPONENTS

Igniter

- Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
- Remove the back panel of the unit, using a 5/16” wrench.
- Locate the igniter on the left side of the feeder assembly (as viewed from the rear of the unit).
- Disconnect the power leads to the igniter.
- Loosen the 5/16” square head set screw from the igniter tube and remove the old igniter cartridge (your unit may have Allen set screw which needs a $^{1}/_{8}$” Allen wrench).
- Install the new igniter in the igniter tube, being sure the igniter is flush with the back of the housing.
- Retighten the set screw and remember to reconnect the power leads.
- Reinstall the rear panel.
- See youtube.com/heatredefined for a service video that shows how to replace the igniter.



REPLACING COMPONENTS

IMPROPER GASKET MAINTENANCE, INCLUDING FAILURE TO REPLACE GASKETS,
CAN CAUSE AIR LEAKS RESULTING IN SMOKE-BACKS.
IT IS MANDATORY TO REPLACE GASKETS ANNUALLY.

Gaskets

1. Door
   - This unit comes with a ¾" rope gasket in the channel around the door opening that should be replaced at least once every year. To replace the door gasket (Part # AC-DGKHD), the old gasket must first be removed entirely — prior to adding the new adhesive, you may have to scrape the old cement from the channel. Once the cement and gasket have been added, the door should be closed and latched for twenty-four hours to allow the cement to harden. See next page for more info.

2. Window
   - If you are replacing the window gasket (Part # AC-GGK), the new gasket will already have adhesive on one side. Remove the paper on the adhesive side and place the gasket around the outside edge of the glass, centered over the edge. Fold the gasket edges over on the glass, forming a "U" shape.

3. Combustion Blower
   - The Combustion Blower Gasket (Part # PU-CBMG) should be replaced whenever you remove or clean the Combustion Blower assembly.
   - Remove the gasket with a putty knife, and install the new gasket by applying adhesive to the blower flange and installing the new gasket (instructions and adhesive are provided with the gasket).

4. Combustion Blower Motor
   - The combustion blower motor gasket (Part # PU-CBMG) generally does not need replacement, as it is not normally removed from the unit. However, if the exhaust blower is cleaned by removing only the motor, rather than the entire blower assembly, this gasket must be inspected and replaced as necessary.

REPLACING COMPONENTS

Glass

This unit has one ceramic glass panel (Part # AC-G9) in the door; self adhesive window gasket is included with replacement windows purchased directly from England's Stove Works. Never replace ceramic glass with tempered or any other type of glass and never operate this unit with cracked or broken glass. Surface scratches are acceptable and normal, but if this glass becomes cracked in any area, the unit should be shut down and the glass replaced with this high-temperature ceramic glass.

Ceramic Glass Specifications

- Glass Size: 9.125 in. (231.78 mm) x 9.125 in. (231.78 mm)
- Glass Type: 5mm Ceramic Glass

Glass Precautions

- Never replace ceramic glass with tempered or any other type of glass.
- Never operate this unit with cracked or broken glass.
- Do not slam the door or strike the glass with any objects.

Glass Cleaning

1. Be certain the stove if Off, and the stove **and** the glass are completely cool.
2. The build-up on the glass will generally be light and water is normally sufficient to remove the deposits. If stubborn soot persists, use a cleaner made specifically for this purpose. Do not scrape the glass or use abrasive cleaners.
3. Rinse the glass with clean water and dry the glass before resuming normal operation.

Glass Replacement *(includes Door Gasket replacement instructions)*

1. Remove the door from the stove and rest it face-down on a firm work surface.

2. Remove the door gasket using a pair of pliers to pull it out of the channel.

3. Using a $^{5}/_{16}$" wrench, remove the (4) screws that hold the glass tabs in place on the door.

4. Lift the old glass panel out and discard (be especially careful if the old glass is broken or cracked).

5. The new glass panel must be wrapped with a self-adhesive fiberglass tape gasket (Part # AC-GGK). This gasket serves to cushion the glass from the steel door and brackets.

6. Reinstall the glass tabs using the screws previously removed. Do not over-tighten the screws.

7. Install the new door gasket (Part# AC-DGKHD) using the provided high temperature adhesive.

8. Hang the door back on the stove and close tightly and allow 24 hours for adhesive to cure.

See diagram on page 56 for door assembly.

REPLACING COMPONENTS

Top Mounted Control Board

BEFORE REPLACING THE CONTROL BOARD BE SURE THE UNIT IS COOLED COMPLETELY AND UNPLUGGED.

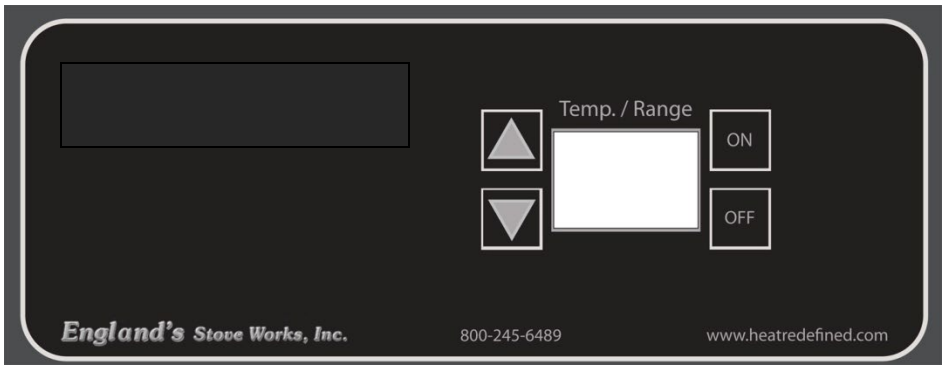
The Control Board (Part # PU-CB14) is a digital read-out board. To replace the control board, first unplug the power cord from the wall outlet. Remove the front face of the control board by pulling it forward. Once the board is apart, use a pair of needle nose pliers to disconnect the wiring harness, room sensor, thermostat, hopper lid and vacuum switch connectors.

When connecting the new board, reconnect the components mentioned above and snap the front face of the control panel back into place. Reconnect power when ready to use the unit.

Recommended Heat Ranges (For Manual Mode):

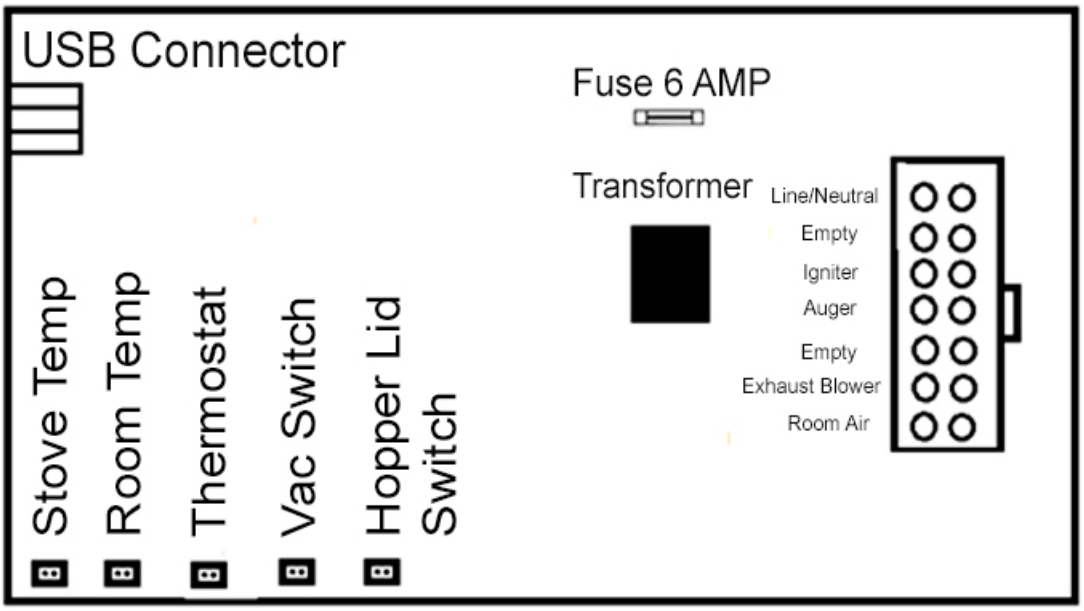
Low Burn:	Heat Range setting: 1	Room Air Blower setting: 1
Medium Low:	Heat Range setting: 2 – 3	Room Air Blower setting: *
Medium High:	Heat Range setting: 4 – 8	Room Air Blower setting: *
High Burn:	Heat Range setting: 9	Room Air Blower setting: 9

* *NOTE*: Blower Speed will automatically be adjusted to the desired Heat Range that you select.



Note: The overlay on your unit may vary in appearance.

Control Board Wiring – Top Mount Control Board



WIRE COLORS

Line Wire - Black
Neutral Wire - White
Igniter - White
Auger - Yellow/Black
Exhaust Blower - Orange
Room Air - Red

Caution – Shock Hazard

- Press the "Off" button and let the appliance completely cool BEFORE unplugging the appliance and beginning any maintenance or component replacement.
- Risk of shock if appliance is not unplugged before service.

Caution

Should you see any evidence of smoke in the hopper (smoke back), immediately close and latch the hopper lid and main door to the unit. Open the nearest windows and door to the outside, then press the OFF button and let the unit cool for at least 3 hours. Do not open the door or hopper lid. This is a maintenance problem that needs to be addressed.

Call Technical Support at (877) 356-6663

REPLACING COMPONENTS – SIDE MOUNTED CONTROL BOARD

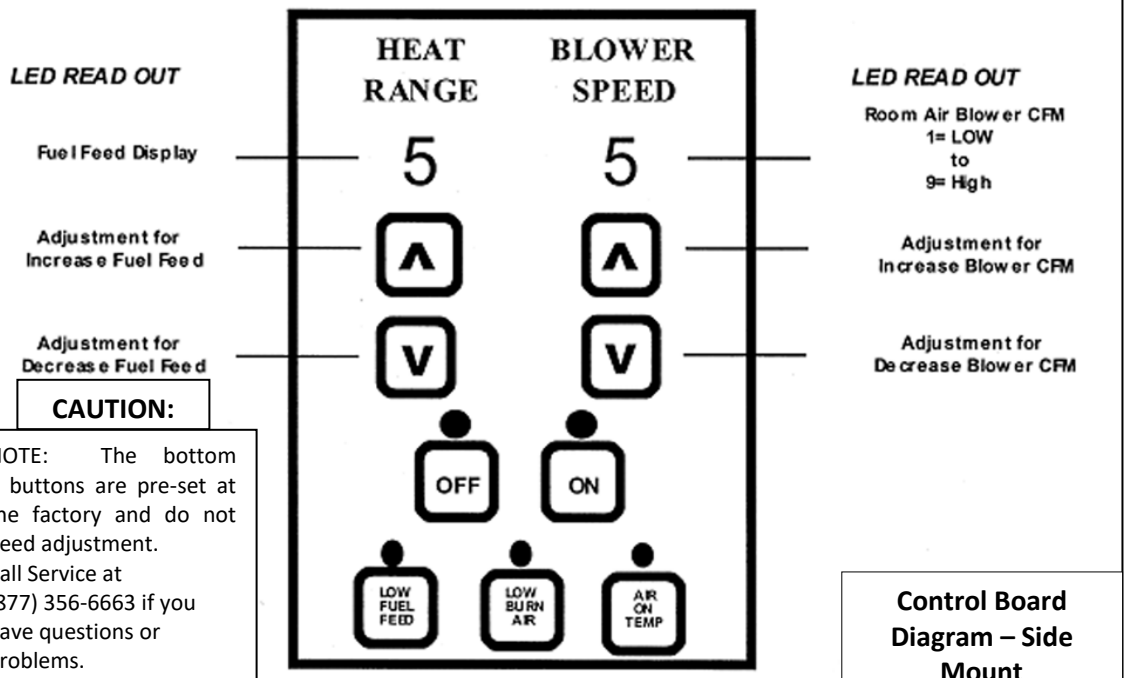
The Control Board (Part # **PU-CB19**) is a digital read-out board. This board offers a wide variety of settings to operate the unit. This part can be removed from the unit by loosening the two outside screws and pulling the board back to the inside of the stove. The rear access panel should be removed prior to removing the control board. A 6-amp "quick-blow" fuse (Part # **PU-CBF6**) is used on this Control Board.

NOTE: The bottom three control buttons are preset at the factory and should *not* require any changes. See "Operating Instructions" and "Daily Operation" section of the manual for instructions on other Control Board settings.

Recommended Heat Ranges:

Low Burn:	Heat Range setting: 1	Room Air Blower setting: 1
Medium Low:	Heat Range setting: 2 – 3	Room Air Blower setting: *
Medium High:	Heat Range setting: 5 – 8	Room Air Blower setting: *
High Burn:	Heat Range setting: 9	Room Air Blower setting: 9

* NOTE: Blower Speed should match the Heat Range setting.



CAUTION:

NOTE: The bottom 3 buttons are pre-set at the factory and do not need adjustment. Call Service at (877) 356-6663 if you have questions or problems.

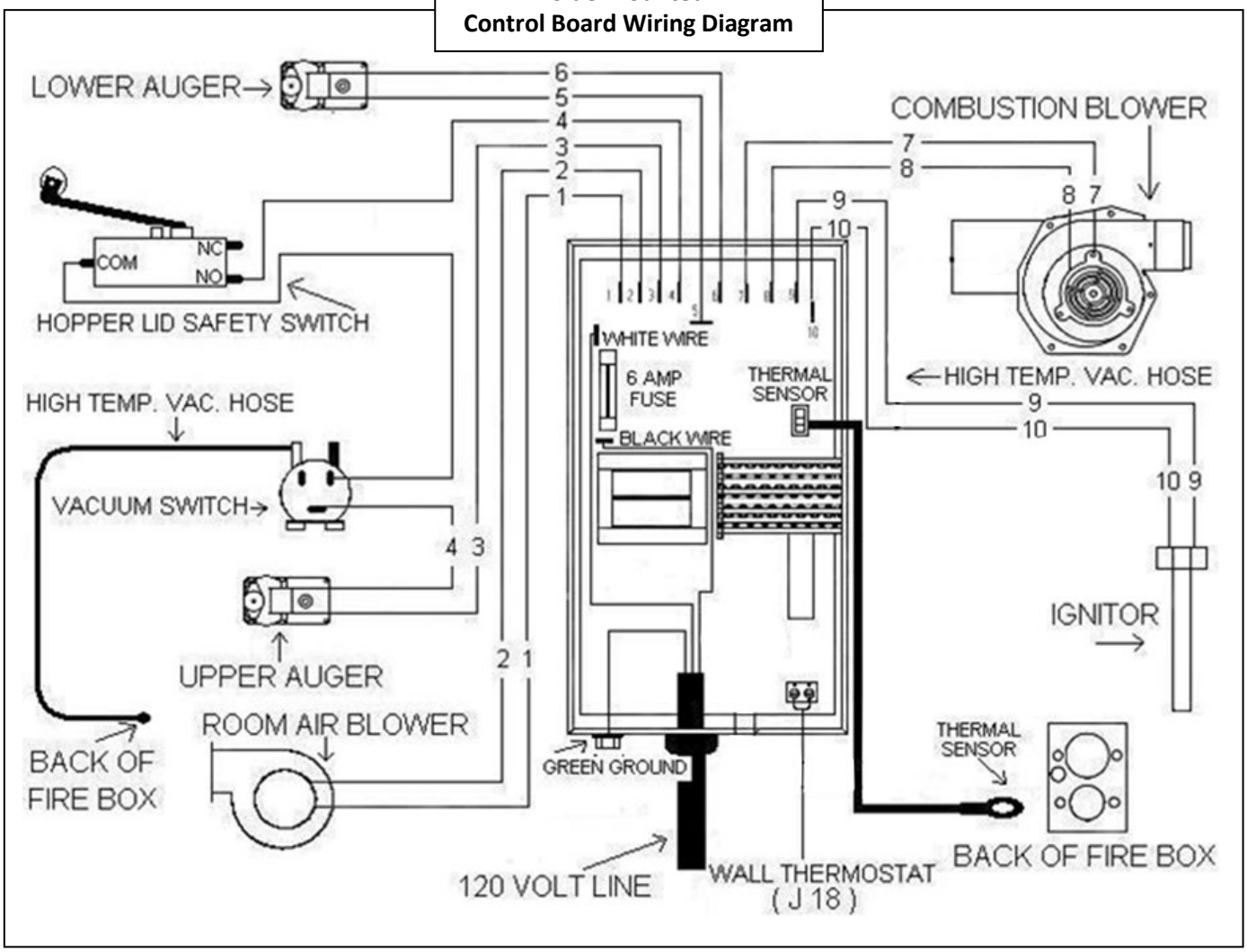
Control Board Diagram – Side Mount

Caution

Should you see any evidence of smoke in the hopper (smoke back), immediately close and latch the hopper lid and door to the unit. Open the nearest windows and door to the outside, then press the OFF button and let the unit cool for at least 3 hours. Do not open the door or hopper lid. This is a maintenance problem that needs to be addressed.

Call Technical Support at (877) 356-6663

Side Mounted
Control Board Wiring Diagram



CAUTION: Moving Parts May Cause Injury.
Do NOT Operate with Panel(s) Off.
DANGER: Parts May Be Hot. Risk of Electric Shock.
Disconnect Power Before Servicing Unit.

IMPORTANT SAFETY NOTE: If the unit or chimney connector pipe "glows" red (or white), the stove is over-fired. This condition could cause a house or chimney fire. Do not operate your unit too hot, or over-firing may result.

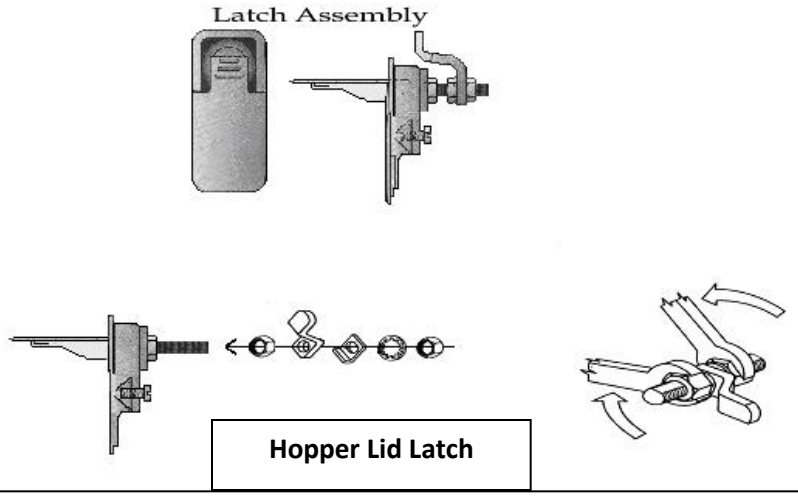
Adjusting Hopper Lid Latch

The seals around the top of the pellet hopper are important to safe and efficient operation of the unit. The latch installed on this unit is designed to pull the hopper lid tight against this seal. Over the course of operation as these seals "wear in" and compress, the tension of the latch should be tested periodically, and adjusted if necessary.

To adjust the lid latch, the following tools will be needed; two ½ inch wrenches, or a ½ inch wrench and a ½ inch socket.

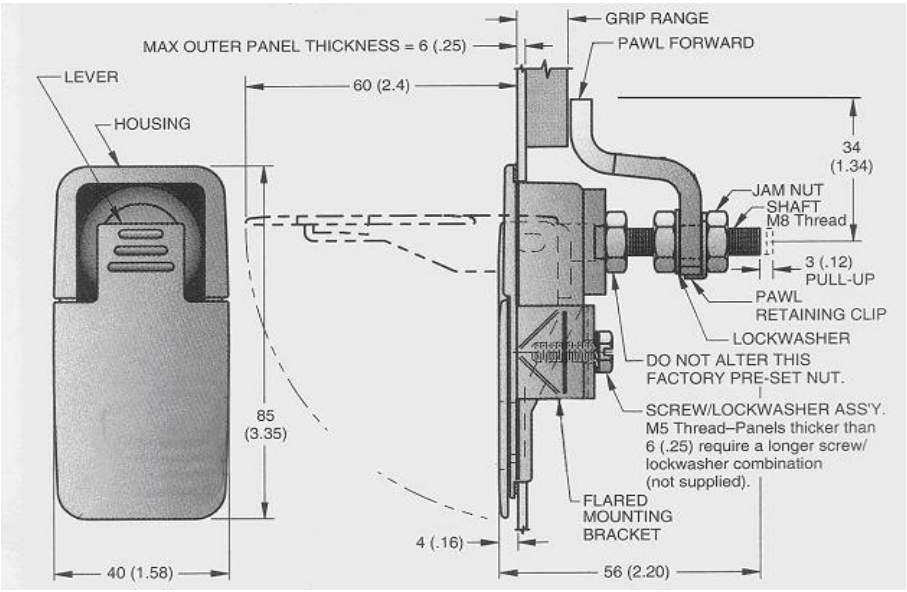
In order to adjust the latch, first (with the unit unplugged and cooled down) open the hopper lid and then lock the latch in its closed position. Take the ½ inch wrench and loosen the nut closest to the latch. This nut is then adjusted closer to the lid itself to tighten the latch. After adjusting this nut to the desired location, hold this nut in place with the ½ inch wrench, the tighten down the holding nut on the end of the latch shaft with the ½ inch socket (or second wrench) to hold the latching assembly in place.

After tightening the latch, test the latch for proper tension by locking the lid down and lifting each front corner of the lid. The lid should be firmly held down by the latch. Repeat the same procedure if the latch is still not tight enough.



Hopper Lid Latch

<u>Important</u>: Hopper Lid Latch must be checked periodically and kept tight so the top is sealed to prevent back-burn.

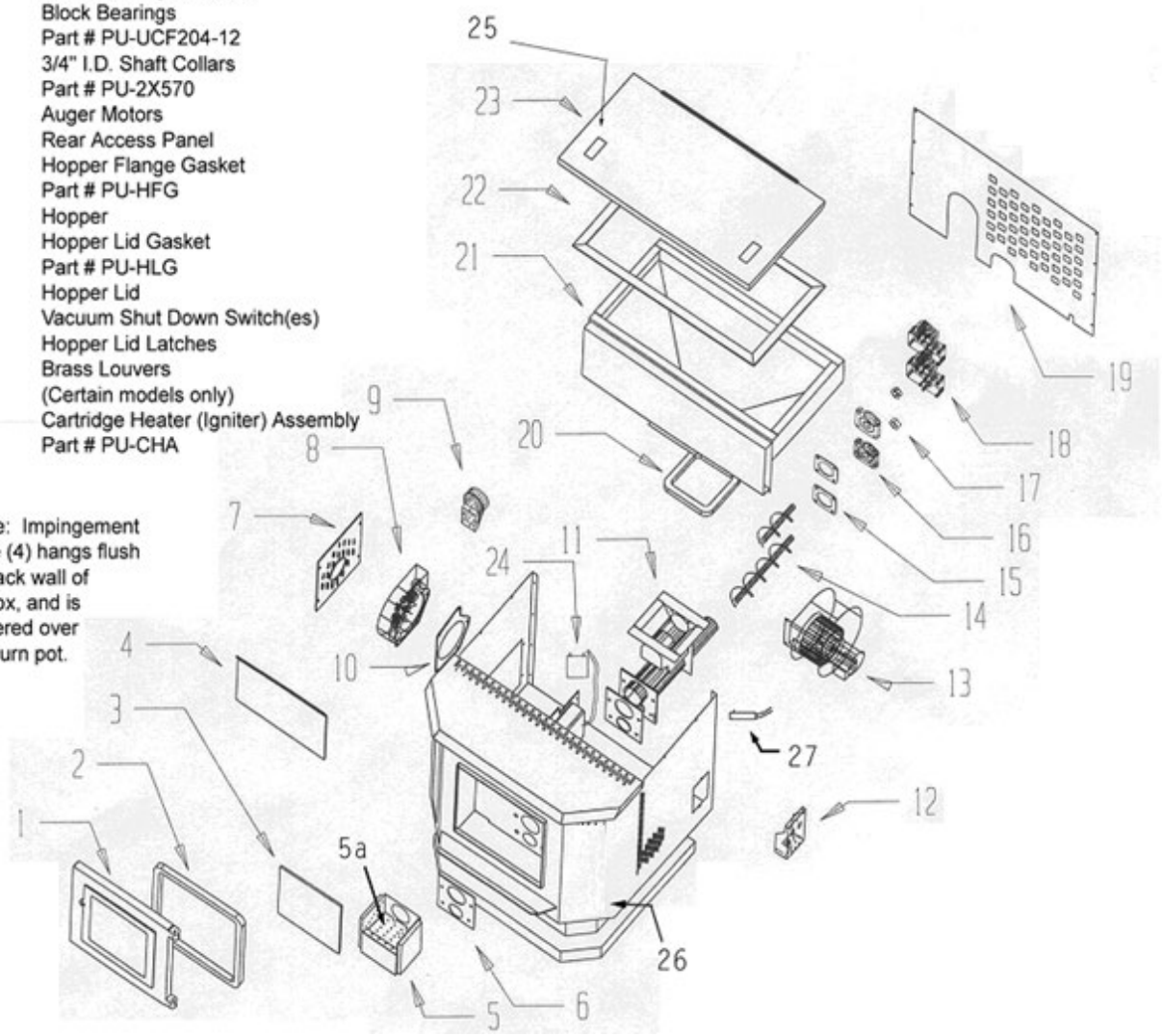


Pellet Stove – Exploded View Diagram

NUMBER	PART DESCRIPTION
1	Door (Part # CA-19A)
2	Door Gasket (Part # AC-DGKC)
3	Glass with Gasket (Part # AC-G9)
4	Impingement Plate*
5	Burn Pot
5a	Wear Plate for Burn Pot**
6	Burn Pot Gasket
7	Side Access Panel
8	Combustion Blower
9	3" Blower Adapter
10	Gasket for Combustion Blower Part # PU-CBG
11	Pellet Feeder Pot
12	Digital Control Board
13	Convection Blower
14	Augers: (Top Auger and Bottom Auger)
15	Block Bearing Gaskets
16	Block Bearings Part # PU-UCF204-12
17	3/4" I.D. Shaft Collars Part # PU-2X570
18	Auger Motors
19	Rear Access Panel
20	Hopper Flange Gasket Part # PU-HFG
21	Hopper
22	Hopper Lid Gasket Part # PU-HLG
23	Hopper Lid
24	Vacuum Shut Down Switch(es)
25	Hopper Lid Latches
26	Brass Louvers (Certain models only)
27	Cartridge Heater (Igniter) Assembly Part # PU-CHA

NOTE ON PART NUMBERS:
This diagram is a basic England's Stove Works pellet unit diagram. Your model may vary somewhat. See our online store at www.englanderstoves.com or the parts list in your manual for specific part numbers for your model stove.
If a part is not listed in the manual or on the website, or if you have questions, call (800) 245-6489.

*Note: Impingement Plate (4) hangs flush on back wall of firebox, and is centered over the burn pot.



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REPLACEMENT PARTS LIST

Part No	Description
AC-GGK	Glass Gasket Kit (gasket only, no glass)
AC-DGKC	Door Gasket Kit
AC-G9	9”x9” Glass with Gasket
AC-SHN	Nickel Door Spring Handle
AC-MBSP	Hi-Temperature Black Spray Paint
PU-047040	1 RPM Auger Motor Assembly
PU-BP18	Burn Pot Assembly
PU-BP18WP	Wear Plate (fits inside burn pot)
PU-076002B	Combustion (Exhaust) Blower – includes 3” adapter
PU-4C447	Convection (Room Air) Blower
PU-AF6T	Top Auger Shaft
PU-AF11B	Bottom Auger Shaft
PU-62-40-151-3	Hopper Lid Latch
PU-UCF204-12	Auger Bearing
PU-2X570	¾” Locking Collar
CU-VS	Vacuum Shut-Down Switch
PU-VH	Vacuum Hose
PU-CBMG	Combustion Blower & Motor Gasket
PU-BPG	Burn Pot Gasket
PU-ABGN	Auger Bearing Gasket
PU-HLG	Hopper Lid Gasket
PU-CHA	Cartridge Heater (Igniter) Assembly
PU-CBF6	6 AMP Control Board Fuse
AC-HLSB	Hopper Lid Safety Switch
AC-HP	Hinge Pin – rivet for cast door
PU-SSTCW	Thermocouple Wire *(only included on top mounted control board)*
IP-25PDVC	Top Baffle (inside firebox)
PU-SSCBHS	Heat Sensor for Control Board (for Top Mount models)
PU-CB14	Top Mounted Control Board (for Top Mount models)
AC-CMB	Control Board Mounting Box (included with top mounted control board)
PU-CB19	Side Mounted Control Board (for Side Mount models)

Parts may be ordered online at www.englander-stoves.com

If you have any questions, please contact the Technical Support Department:
Questions: (877) 356-6663
Website:
www.englander-stoves.com

You may write your unit's Manufacture Date and Serial Number in the blank spaces on this sample tag (next page), for future reference.
This sample tag also shows the safety info such as UL/ULC testing standard, etc. for your local officials, or anyone else who may need it for reference information.

C US
Intertek
W/N# 21944

MODEL ☐ 25-CAB80 ☐ 55-SHPCAB80 ☐ 55-TRPCAB80
☐ 25-CAB80S ☐ 55-SHPCAB80S ☐ 55-TRPCAB80S

Pellet Fuel Room Heater; Free Standing Model Also for Use in Mobile Homes
Certified to ASTM E 1509 / ULC S627 / ASTM E2779 / ASTM E2515 / CSA B415.1

U.S Test Santdard: US EPA 40 CFR Part 60, Subpart 60.536

Manufactured by:
Stove Builder International inc.
589 S. Five Forks Rd.
Monroe, VA 24574

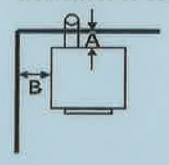
Manufacture Date	20130308
Serial Number	999998
Work Order	(# test)

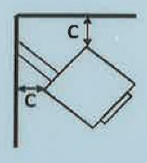
PREVENT HOUSE FIRES

- Install and use only in accordance with the Owner's manual provided with this appliance.
- Contact local building or fire officials about restrictions and installation inspections in your area.
- For use with wood pellet fuel only, 1/4 inch in diameter.
- Do not connect this unit to a chimney flue serving another appliance
- Keep viewing and ash removal doors tightly closed during operation.
- Maximum input rating: 3.8 lbs/hr
- 1.13 Grams/hr
- U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards.
- Use only approved type L or P pellet vent pipe.
- Room heater, pellet fuel-burning type, also for use in mobile homes.
- Inspect and clean chimney frequently. Under certain conditions of use, creosote buildup may occur rapidly.
- Replace with ceramic glass only.
- A source of fresh air must be provided to the room. When installed in a mobile home, air from outdoors must be provided.
- Do not obstruct combustion air opening.

FREESTANDING INSTALLATION REQUIREMENTS - Refer to local codes and the chimney manufacturer's instructions for precautions required for passing a chimney through a combustible wall or ceiling. The unit must be installed on a non-combustible floor protection, which extends 6-inches to the front and 6-inches on each side of the door opening. See owner's manual for additional clearance information.

Clearances to combustibles





A: 0 in.	0 mm	C: 5 in.	127 mm	E: 6 in.	152 mm
B: 7 in.	178 mm			F: 6 in.	152 mm

Electrical rating: 115 V, 60 Hz, 4 A. ROUTE THE POWER CORD SO THAT IT DOES NOT COME INTO CONTACT WITH ANY HOT SURFACES ON THE UNIT AND DOES NOT CROSS IN FRONT OF THE UNIT.

Refer to Intertek's directory of building products (https://bpdirectory.intertek.com) for detailed information.

CAUTION - Moving parts may cause injury. Do not operate with panels removed.
CAUTION - Hot parts. Do not operate unit with panels removed.
DANGER - Risk of electric shock. disconnect power before servicing unit.

CAUTION - Operate this unit only with the fuel hopper lid closed. Failure to do so may result in emission of products of combustion from the hopper under certain conditions. Maintain hopper seal in good condition. Do not overfill the hopper.

This wood heater needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against US federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's manual.

CAUTION

- HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAME-PLATE AND INSTRUCTIONS. OPERATE THIS UNIT ONLY WITH THE FUEL HOPPER LID CLOSED. FAILURE TO DO SO MAY RESULT IN EMISSION OF PRODUCTS OF COMBUSTION FROM THE HOPPER UNDER CERTAIN CONDITIONS. DO NOT OVERFILL THE HOPPER. MOVING PARTS MAY CAUSE INJURY. HOT PARTS. DO NOT OPERATE UNIT WITH THE SIDE OR REAR PANELS REMOVED. MAINTAIN HOPPER SEAL IN GOOD CONDITION.

WARNING: This product can expose you to carbon monoxide, which is known to the State of California to cause cancer, birth defects or other reproductive harm. (For more information go to www.p65warnings.ca.gov)

SBI
Fabricant de poêles international
Stove Builder International

27907

IMPORTANT! READ AND FOLLOW **ALL** INSTALLATION AND MAINTENANCE INSTRUCTIONS, INCLUDING CLEANING THE UNIT AS SPECIFIED, AND REPLACING GASKETS ANNUALLY, AND PARTS AS NEEDED.

ENGLAND'S STOVE WORKS IS NOT RESPONSIBLE FOR ANY DAMAGE OR INJURY INCURRED DUE TO NEGLECT, OR DUE TO UNSAFE INSTALLATION OR USAGE OF THIS PRODUCT. CALL TECHNICAL SUPPORT WITH ANY QUESTIONS.

LIMITED FIVE (5) YEAR WARRANTY

From the date of purchase to the original owner.

Model Numbers 25-CAB80 / 55-SHPCAB80 / 55-TRPCAB80

The manufacturer extends the following warranties:

Five Year Period:

1. Carbon steel and welded seams in the firebox are covered for five (5) years against splitting.
2. The steel door and hinges are covered for five (5) years against cracking.

One Year Period:

1. Component parts such as the hopper, auger, burn-pot, auger shaft and fasteners are covered for one (1) year against cracking, breakage and welded seam separation.
2. Electrical components, accessory items, glass and the painted surface of the stove are covered for one (1) year from the date of purchase.

Conditions and Exclusions

1. Damage resulting from over-firing will void your warranty.
2. This warranty does not apply if damage occurs because of an accident, improper handling, improper installation, improper operation, abuse or unauthorized repair made or attempted to be made.
3. The manufacturer is not liable for indirect, incidental, or consequential damages in connection with the product including any cost or expense, providing substitute equipment or service during periods of malfunction or non-use.*
4. All liability for any consequential damage for breach of any written or implied warranty is disclaimed and excluded.
5. This unit is EPA certified using high quality, Premium Grade pellet fuel. Warranty is void if the unit is used to burn materials for which the unit is not certified by the EPA. Warranty is void if unit is not used according to the owner's manual.

*Some states do not allow the exclusion of limitations of incidental or consequential damages, so the above may not apply to you

Procedure

Purchaser must give notice of claim of defect within the warranty period and pay transportation to and from a service center designated by the manufacturer. The dealer from which the unit was purchased or the factory, at our option, will perform the warranty service.

Other Rights

This warranty gives you specific legal rights; you may also have other rights, which may vary from state to state.

To submit a Warranty Claim, call (877) 356-6663 to speak with our Technical Support department. You may also file a Warranty Claim at www.englander-stoves.com

For parts, warranty replacement procedures may be found at our parts store site located at Englander-stoves.com

Important Notice

This registration information **MUST** be on file for this warranty to be valid. Please send this information within thirty (30) days from the original date of purchase.

Use any of these three easy ways to send your warranty information in!

Mailing Address

Stove Builder International inc.

250, rue de Copenhague,
St-Augustin-de-Desmaures
(Québec) Canada
G3A 2H3

Fax Number

(418) 878-3001 – Twenty-four hours a day

Online Registration

To register online, visit our warranty registration website at:

http://www.englander-stoves.com

Please Note: This warranty is null and void if the attached warranty registration AND a copy of the sales receipt is not returned within thirty (30) days from the date of purchase.

Warranty is not transferable.

WARRANTY REGISTRATION for England's Stove Works®

Purchaser Information*

I. Purchased By (Name)_____

II. Address_____

III. City_____State_____Zip Code_____

IV. Telephone Number_____

V. Email Address_____

Dealer Information*

VI. Purchased From_____

VII. Address_____

VIII. City_____ State_____ Zip Code_____

Unit Information*

IX. Model Number_____ Purchase Date_____

X. Purchase Price _____

XI. Serial Number_____ Mfg. Date_____

Purchase Questions

How did you first hear about our product? (Please check one)

Word of Mouth _____Burn Trailer Demonstration_____Internet____

Other:_____

Where did you receive information about our product?

Via Telephone_____Dealer (Name of dealer) _____Internet____

Other: _____

*** Required Information**

C US
Intertek
W/N# 21944

MODEL ☐ 25-CAB80 ☐ 55-SHPCAB80 ☐ 55-TRPCAB80
☐ 25-CAB80S ☐ 55-SHPCAB80S ☐ 55-TRPCAB80S

Pellet Fuel Room Heater; Free Standing Model Also for Use in Mobile Homes
Certified to ASTM E 1509 / ULC S627 / ASTM E2779 / ASTM E2515 / CSA B415.1

U.S Test Santdard: US EPA 40 CFR Part 60, Subpart 60.536

Manufactured by:
Stove Builder International inc.
589 S. Five Forks Rd.
Monroe, VA 24574

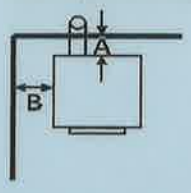
Manufacture Date	20130308
Serial Number	999998
Work Order	(# test)

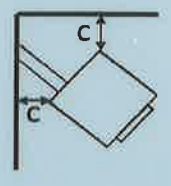
PREVENT HOUSE FIRES

- Install and use only in accordance with the Owner's manual provided with this appliance.
- Contact local building or fire officials about restrictions and installation inspections in your area.
- For use with wood pellet fuel only, 1/4 inch in diameter.
- Do not connect this unit to a chimney flue serving another appliance
- Keep viewing and ash removal doors tightly closed during operation.
- Maximum input rating: 3.8 lbs/hr
- 1.13 Grams/hr
- U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards.
- Use only approved type L or P pellet vent pipe.
- Room heater, pellet fuel-burning type, also for use in mobile homes.
- Inspect and clean chimney frequently. Under certain conditions of use, creosote buildup may occur rapidly.
- Replace with ceramic glass only.
- A source of fresh air must be provided to the room. When installed in a mobile home, air from outdoors must be provided.
- Do not obstruct combustion air opening.

FREESTANDING INSTALLATION REQUIREMENTS - Refer to local codes and the chimney manufacturer's instructions for precautions required for passing a chimney through a combustible wall or ceiling. The unit must be installed on a non-combustible floor protection, which extends 6-inches to the front and 6-inches on each side of the door opening. See owner's manual for additional clearance information.

Clearances to combustibles





Floor protection
Protection de plancher

A: 0 in.	0 mm	C: 5 in.	127 mm	E: 6 in.	152 mm
B: 7 in.	178 mm			F: 6 in.	152 mm

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CAUTION - Hot parts. Do not operate unit with panels removed.
DANGER - Risk of electric shock. disconnect power before servicing unit.

CAUTION - Operate this unit only with the fuel hopper lid closed. Failure to do so may result in emission of products of combustion from the hopper under certain conditions. Maintain hopper seal in good condition. Do not overfill the hopper.

This wood heater needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against US federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's manual.

CAUTION

- HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAME-PLATE AND INSTRUCTIONS. OPERATE THIS UNIT ONLY WITH THE FUEL HOPPER LID CLOSED. FAILURE TO DO SO MAY RESULT IN EMISSION OF PRODUCTS OF COMBUSTION FROM THE HOPPER UNDER CERTAIN CONDITIONS. DO NOT OVERFILL THE HOPPER. MOVING PARTS MAY CAUSE INJURY. HOT PARTS. DO NOT OPERATE UNIT WITH THE SIDE OR REAR PANELS REMOVED. MAINTAIN HOPPER SEAL IN GOOD CONDITION.

WARNING: This product can expose you to carbon monoxide, which is known to the State of California to cause cancer, birth defects or other reproductive harm. (For more information go to www.p65warnings.ca.gov)

SBI
Fabricant de poêles international
Stove Builder International

27907

Pellet Stoves
Wood Stoves
Multi-Fuel Stoves
Pellet Grills

P.O. Box 206 Monroe, VA 24574 www.heatredefined.com Phone: (800) 516-3636 Fax: (434) 929-4810

ATTN: Intertek Lab:

RE: Testing of our model 25-CAB80, 25-CAB80S, 55-SHPCAB80, 55-SHPCAB80S, 55-TRPCAB80, 55-TRPCAB80S

In regards to testing for the above listed model, you will find a copy of the following documents for this stove: manual, k-list, product markings, a proposed copy of the serial tag, a copy of the direction flow of air through the stove and dimensions or specifications of all the parts and components of the unit to be tested.

Please test this unit in accordance to ASTM E 2779-10(2017). The unit is to be fired on settings of 9 for the 1 hour pre burn. Leave the settings on 9 for the 1 hour during the beginning of the test, after 1 hour has expired change the settings on the stove to 2 for 120 minutes. After the 120 minutes, change the settings to 1 for 180 minutes to finish the test.

Using the top mounted control board, the settings can change from a temperature setting to manual settings by holding the up and down buttons at the same time. The setting will change from a 2 digit temperature setting (which automatically chooses a 1-9 feed rate on the control board based on heat needed) or a manual feed rate of 1-9 denoted by M1, M2, etc through to M9.

Sincerely,

R&D Team
England's Stove Works, Inc.

Certificate Number
A2740715
Issue Date: 02/12/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 001413

Description: MASS FLOW METER
Manufacturer: SIERRA
Model Number: M50L-AL-DD-2-PV2-V1-5PC
Serial Number: 189158
Technician:
On-Site Calibration: ☐
Comments:

Calibration Date: 01/31/2018
Calibration Due: 07/31/2018
Procedure: TB 9-6680-293-40
Rev: 3/28/2011
Temperature: 71 F
Humidity: 29 % RH
As Found Condition: IN TOLERANCE
Calibration Results: IN TOLERANCE

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

TMI's Quality System is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2005 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration is within the current Scope of Accreditation and complies with the requirements of ISO/IEC 17025:2005 and TMI's Quality Manual, QM-1.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

Measurements not currently on TMI's Scope of Accreditation are identified with an asterisk.

Scott Chamberlain

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
FL2146	FLUKE	A700K-A	4/11/2016	6/23/2018
FL6426	DH INSTRUMENTS	1E4-VCR-V-Q	2/26/2016	2/26/2018

TMI Technical Maintenance, Inc.

Phone: Fax
www.tmicalibration.com

ilac-MRA

ANAB ACCREDITED ISO/IEC 17025 ANSI/NCSL Z540-1 ANSI/NCSL Z540.3

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Flow Accuracy	0.000	-0.300	0.300	0.000	0.000	± 1 mL/min	slm	
Flow Accuracy	2.000	1.700	2.300	2.027	2.027	± 5.6 mL/min	slm	
Flow Accuracy	4.000	3.700	4.300	4.035	4.035	± 11 mL/min	slm	
Flow Accuracy	6.000	5.700	6.300	6.056	6.056	± 17 mL/min	slm	
Flow Accuracy	8.000	7.700	8.300	7.936	7.936	± 23 mL/min	slm	
Flow Accuracy	10.000	9.700	10.300	10.124	10.124	± 28 mL/min	slm	

Certificate Number
A2740717
Issue Date: 02/12/18

Certificate of Calibration

Customer: INTERTEK MIDDLETON
8431 MURPHY DR.
MIDDLETON, WI, 53562
608-824-7422

P.O. Number:
ID Number: 001414

Description: MASS FLOW METER
Manufacturer: SIERRA
Model Number: M50L-AL-DD-2-PV2-V1-5PC
Serial Number: 189157
Technician:
On-Site Calibration: ☐
Comments:

Calibration Date: 01/31/2018
Calibration Due: 07/31/2018
Procedure: TB 9-6680-293-40
Rev: 3/28/2011
Temperature: 71 F
Humidity: 29 % RH
As Found Condition: IN TOLERANCE
Calibration Results: IN TOLERANCE

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

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TMI Technical Maintenance, Inc.

ilac-MRA

ANAB ACCREDITED ISO/IEC 17025 ANSI/NCSL Z540-1 ANSI/NCSL Z540.3

Phone: Fax
www.tmicalibration.com

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Flow Accuracy	0.000	-0.300	0.300	0.000	0.000	± 1 mL/min	slm	
Flow Accuracy	2.000	1.700	2.300	2.174	2.174	± 5.6 mL/min	slm	
Flow Accuracy	4.000	3.700	4.300	4.179	4.179	± 11 mL/min	slm	
Flow Accuracy	6.000	5.700	6.300	6.184	6.184	± 17 mL/min	slm	
Flow Accuracy	8.000	7.700	8.300	8.173	8.173	± 23 mL/min	slm	
Flow Accuracy	10.000	9.700	10.300	10.202	10.202	± 28 mL/min	slm	

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	49	34.15
2	2	51	34.15
3	3	51	34.15
4	4	53	34.15
5	5	61	34.1
6	6	72	34.1
7	7	82	34.05
8	8	93	34.05
9	9	97	34
10	10	103	34
11	11	114	34
12	12	122	33.95
13	13	130	33.95
14	14	134	33.95
15	15	134	34
16	16	134	34
17	17	138	33.95
18	18	143	33.95
19	19	150	33.9
20	20	154	33.9
21	21	154	33.9
22	22	160	33.9
23	23	165	33.85
24	24	170	33.8
25	25	176	33.8
26	26	182	33.75
27	27	187	33.75
28	28	191	33.7
29	29	193	33.7
30	30	198	33.65
31	31	200	33.65
32	32	204	33.6
33	33	206	33.6
34	34	209	33.55
35	35	211	33.55
36	36	213	33.5
37	37	215	33.5
38	38	217	33.5
39	39	220	33.45
40	40	222	33.4
41	41	224	33.4
42	42	226	33.4
43	43	226	33.35
44	44	229	33.3
45	45	229	33.3

46	46	231	33.25
47	47	233	33.2
48	48	235	33.2
49	49	235	33.15
50	50	237	33.15
51	51	240	33.1
52	52	240	33.1
53	53	240	33.05
54	54	240	33.05
55	0	242	33
56	1	242	37.55
57	2	244	37.5
58	3	244	37.5
59	4	244	37.45
60	5	244	37.4
61	6	244	37.4
62	7	244	37.4
63	8	244	37.35
64	9	244	37.35
65	10	244	37.3
66	11	244	37.3
67	12	244	37.25
68	13	244	37.25
69	14	244	37.2
70	15	244	37.15
71	16	244	37.15
72	17	246	37.15
73	18	246	37.1
74	19	247	37.1
75	20	246	37.05
76	21	247	37
77	22	249	37
78	23	247	36.95
79	24	247	36.9
80	25	251	36.9
81	26	249	36.9
82	27	249	36.85
83	28	249	36.8
84	29	249	36.8
85	30	249	36.8
86	31	249	36.75
87	32	247	36.75
88	33	247	36.7
89	34	247	36.7
90	35	247	36.7
91	36	247	36.65
92	37	247	36.65

93	38	245	36.6
94	39	247	36.6
95	40	247	36.55
96	41	247	36.5
97	42	247	36.5
98	43	247	36.45
99	44	247	36.45
100	45	249	36.4
101	46	249	36.4
102	47	249	36.35
103	48	248	36.3
104	49	249	36.3
105	50	251	36.25
106	51	251	36.25
107	52	251	36.25
108	53	251	36.2
109	54	253	36.15
110	55	253	36.15
111	56	253	36.1
112	57	253	36.1
113	58	253	36.05
114	59	253	36.05
115	60	256	36
116	61	258	35.95
117	62	260	35.95
118	63	258	35.9
119	64	260	35.85
120	65	260	35.85
121	66	260	35.85
122	67	261	35.8
123	68	258	35.75
124	69	258	35.75
125	70	256	35.75
126	71	256	35.7
127	72	254	35.7
128	73	252	35.65
129	74	248	35.7
130	75	250	35.7
131	76	248	35.65
132	77	246	35.6
133	78	244	35.6
134	79	242	35.6
135	80	241	35.6
136	81	239	35.6
137	82	239	35.55
138	83	237	35.55
139	84	237	35.55

140	85	234	35.55
141	86	234	35.5
142	87	232	35.5
143	88	232	35.5
144	89	233	35.5
145	90	230	35.45
146	91	230	35.45
147	92	229	35.45
148	93	226	35.4
149	94	226	35.4
150	95	226	35.4
151	96	224	35.4
152	97	227	35.35
153	98	224	35.35
154	99	222	35.35
155	100	222	35.35
156	101	222	35.35
157	102	222	35.3
158	103	223	35.3
159	104	220	35.3
160	105	220	35.3
161	106	220	35.25
162	107	220	35.25
163	108	218	35.2
164	109	218	35.2
165	110	218	35.2
166	111	218	35.2
167	112	220	35.2
168	113	221	35.15
169	114	216	35.15
170	115	216	35.15
171	116	216	35.15
172	117	216	35.15
173	118	216	35.1
174	119	216	35.1
175	120	214	35.1
176	121	216	35.1
177	122	216	35.05
178	123	216	35.05
179	124	216	35.05
180	125	213	35.05
181	126	213	35
182	127	213	35
183	128	214	34.95
184	129	214	34.95
185	130	209	34.95
186	131	214	34.95

187	132	212	34.9
188	133	212	34.9
189	134	209	34.9
190	135	210	34.9
191	136	208	34.9
192	137	210	34.85
193	138	210	34.85
194	139	210	34.85
195	140	208	34.8
196	141	208	34.8
197	142	208	34.8
198	143	208	34.8
199	144	208	34.8
200	145	208	34.8
201	146	208	34.75
202	147	208	34.75
203	148	210	34.75
204	149	208	34.75
205	150	208	34.7
206	151	208	34.7
207	152	208	34.7
208	153	208	34.7
209	154	208	34.65
210	155	206	34.65
211	156	208	34.65
212	157	210	34.65
213	158	210	34.6
222	167	209	34.5
223	168	209	34.5
224	169	212	34.45
225	170	209	34.45
226	171	209	34.45
227	172	212	34.45
228	173	212	34.4
229	174	210	34.4
238	183	211	34.3
239	184	211	34.3
240	185	208	34.3
241	186	209	34.25
242	187	209	34.25
243	188	208	34.25
244	189	208	34.25
245	190	207	34.25
254	199	197	34.15
255	200	199	34.15
256	201	200	34.15
257	202	200	34.1

258	203	200	34.1
259	204	200	34.1
260	205	198	34.1
261	206	193	34.1
270	215	196	34
271	216	196	34
272	217	196	34
273	218	194	34
274	219	194	33.95
275	220	192	33.95
276	221	194	33.95
277	222	196	33.95
278	223	196	33.9
288	233	189	33.85
289	234	191	33.85
290	235	191	33.85
291	236	193	33.8
292	237	194	33.8
293	238	194	33.8
294	239	191	33.8
295	240	189	33.8
304	249	190	33.7
305	250	192	33.7
306	251	192	33.65
307	252	194	33.65
308	253	192	33.65
309	254	188	33.65
310	255	186	33.65
311	256	188	33.65
321	266	192	33.55
322	267	190	33.55
323	268	188	33.55
324	269	186	33.55
325	270	186	33.55
326	271	186	33.5
327	272	188	33.5
328	273	188	33.5
214	159	209	34.6
215	160	206	34.6
216	161	206	34.6
217	162	208	34.55
218	163	209	34.55
219	164	211	34.55
220	165	209	34.55
221	166	209	34.5
230	175	210	34.4
231	176	210	34.4

232	177	212	34.4
233	178	212	34.35
234	179	210	34.35
235	180	210	34.35
236	181	210	34.35
237	182	212	34.3
246	191	204	34.25
247	192	202	34.2
248	193	202	34.2
249	194	202	34.2
250	195	202	34.2
251	196	204	34.15
252	197	201	34.15
253	198	199	34.15
262	207	195	34.1
263	208	198	34.05
264	209	196	34.05
265	210	198	34.05
266	211	198	34.05
267	212	194	34.05
268	213	194	34.05
269	214	196	34
279	224	196	33.9
280	225	194	33.9
281	226	194	33.9
282	227	192	33.9
283	228	194	33.9
284	229	192	33.9
285	230	194	33.85
286	231	196	33.85
287	232	193	33.85
296	241	190	33.8
297	242	190	33.75
298	243	190	33.75
299	244	192	33.75
300	245	194	33.7
301	246	192	33.75
302	247	190	33.75
303	248	187	33.7
312	257	190	33.65
313	258	190	33.6
314	259	190	33.6
315	260	191	33.6
316	261	186	33.6
317	262	188	33.6
318	263	186	33.6
319	264	190	33.6

320	265	190	33.55
329	274	190	33.5
330	275	186	33.45
331	276	186	33.45
332	277	186	33.45
333	278	186	33.45
334	279	188	33.45
335	280	186	33.4
336	281	188	33.4
337	282	183	33.4
338	283	183	33.4
339	284	183	33.4
340	285	183	33.4
341	286	183	33.35
342	287	183	33.35
343	288	185	33.35
344	289	183	33.35
345	290	181	33.35
354	299	180	33.25
355	300	180	33.25
356	301	182	33.2
357	302	182	33.2
358	303	182	33.2
359	304	178	33.25
360	305	177	33.2
361	306	179	33.2
362	307	182	33.2
371	316	181	33.1
372	317	182	33.1
373	318	179	33.1
374	319	179	33.1
375	320	181	33.05
376	321	181	33.05
377	322	184	33
378	323	183	33
379	324	181	33
389	334	185	32.9
390	335	185	32.9
391	336	185	32.9
392	337	185	32.9
393	338	181	32.9
394	339	181	32.9
395	340	181	32.85
396	341	181	32.85
397	342	183	32.85
407	352	183	32.75
408	353	185	32.75

409	354	185	32.75
410	355	185	32.75
411	356	187	32.7
412	357	190	32.7
413	358	190	32.7
414	359	186	32.7
415	360	184	32.7
346	291	181	33.3
347	292	180	33.3
348	293	182	33.3
349	294	183	33.3
350	295	182	33.25
351	296	182	33.25
352	297	178	33.3
353	298	178	33.25
363	308	182	33.15
364	309	181	33.15
365	310	179	33.15
366	311	177	33.15
367	312	177	33.15
368	313	179	33.15
369	314	182	33.1
370	315	181	33.1
380	325	181	33
381	326	183	33
382	327	183	33
383	328	186	32.95
384	329	186	32.95
385	330	188	32.95
386	331	183	32.95
387	332	181	32.95
388	333	183	32.95
398	343	183	32.8
399	344	181	32.85
400	345	179	32.8
401	346	179	32.85
402	347	179	32.8
403	348	182	32.8
404	349	184	32.8
405	350	184	32.8
406	351	184	32.75

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	130	22.85
2	2	143	22.8
3	3	149	22.8
4	4	156	22.8
5	5	158	22.8
6	6	164	22.8
7	7	169	22.75
8	8	173	22.75
9	9	177	22.75
10	10	179	22.75
11	11	186	22.7
12	12	190	22.7
13	13	194	22.65
14	14	198	22.6
15	15	203	22.6
16	16	205	22.55
17	17	207	22.55
18	18	209	22.55
19	19	214	22.5
20	20	216	22.45
21	21	216	22.45
22	22	218	22.45
23	23	221	22.45
24	24	223	22.5
25	25	225	22.35
26	26	225	22.4
27	27	227	22.4
28	28	227	22.3
29	29	230	22.3
30	30	230	22.35
31	31	232	22.25
32	32	232	22.25
33	33	234	22.35
34	34	232	22.35
35	35	235	22.15
36	36	235	22.2
37	37	234	22.15
38	38	237	22.1
39	39	239	22.2
40	40	237	22.25
41	41	238	22.05
42	42	237	22.1
43	43	238	22
44	44	240	22
45	45	240	22

46	0	240	22.05
47	1	240	26.55
48	2	240	26.6
49	3	240	26.4
50	4	240	26.4
51	5	243	26.55
52	6	241	26.5
53	7	243	26.5
54	8	243	26.6
55	9	243	26.45
56	10	243	26.3
57	11	243	26.35
58	12	243	26.35
59	13	245	26.25
60	14	245	26.2
61	15	242	26.25
62	16	242	26.15
63	17	242	26.2
64	18	242	26.1
65	19	242	26.15
66	20	242	26.25
67	21	242	26.15
68	22	242	26
69	23	242	26.05
70	24	240	26
71	25	242	26
72	26	242	26.1
73	27	242	25.95
74	28	242	25.95
75	29	241	26.05
76	30	242	26
77	31	242	25.9
78	32	242	25.95
79	33	239	25.9
80	34	240	25.85
81	35	239	25.85
82	36	239	25.95
83	37	239	25.8
84	38	240	25.8
85	39	240	25.85
86	40	237	25.75
87	41	237	25.75
88	42	237	25.95
89	43	238	25.8
90	44	236	25.8
91	45	238	25.85
92	46	236	25.85

93	47	236	25.75
94	48	234	25.75
95	49	234	25.8
96	50	236	25.75
97	51	237	25.75
98	52	237	25.7
99	53	237	25.65
100	54	237	25.65
101	55	237	25.6
102	56	237	25.6
103	57	237	25.55
104	58	234	25.55
105	59	236	25.55
106	60	236	25.5
107	61	236	25.5
108	62	239	25.5
109	63	239	25.4
110	64	237	25.35
111	65	241	25.4
112	66	239	25.35
113	67	237	25.35
114	68	239	25.35
115	69	237	25.3
116	70	234	25.3
117	71	234	25.3
118	72	234	25.3
119	73	234	25.3
120	74	232	25.25
121	75	231	25.25
122	76	229	25.25
123	77	227	25.25
124	78	226	25.25
125	79	226	25.25
126	80	226	25.25
127	81	227	25.15
128	82	224	25.2
129	83	222	25.2
130	84	222	25.2
131	85	224	25.15
132	86	224	25.1
133	87	222	25.15
134	88	219	25.15
135	89	219	25.1
136	90	219	25.1
137	91	219	25.05
138	92	219	25.05
139	93	219	25.1

140	94	217	25.1
141	95	217	25.05
142	96	219	25
143	97	219	25
144	98	217	25.05
145	99	218	25.05
146	100	217	24.95
147	101	217	24.95
148	102	219	24.95
149	103	217	24.95
150	104	217	24.95
151	105	217	24.9
152	106	217	24.9
153	107	217	24.85
154	108	215	24.9
155	109	215	24.9
156	110	215	24.9
157	111	215	24.85
158	112	215	24.8
159	113	215	24.8
160	114	213	24.85
161	115	213	24.8
162	116	215	24.8
163	117	216	24.75
164	118	213	24.75
165	119	213	24.75
166	120	211	24.8
167	121	213	24.75
168	122	213	24.7
169	123	213	24.65
170	124	214	24.7
171	125	211	24.7
172	126	211	24.7
173	127	211	24.65
174	128	214	24.65
175	129	211	24.65
176	130	211	24.65
177	131	212	24.65
178	132	211	24.6
179	133	212	24.55
180	134	209	24.6
181	135	209	24.6
182	136	207	24.6
183	137	209	24.55
184	138	209	24.55
185	139	210	24.5
186	140	209	24.5

187	141	208	24.55
188	142	210	24.5
189	143	210	24.45
190	144	210	24.45
191	145	210	24.45
192	146	208	24.45
193	147	210	24.45
194	148	210	24.4
195	149	212	24.35
196	150	210	24.4
197	151	210	24.4
198	152	210	24.4
199	153	210	24.35
200	154	210	24.3
201	155	210	24.3
202	156	210	24.35
203	157	210	24.35
204	158	210	24.3
205	159	210	24.3
206	160	212	24.25
207	161	210	24.3
208	162	212	24.25
209	163	212	24.2
210	164	212	24.2
211	165	212	24.15
212	166	210	24.25
213	167	210	24.2
214	168	210	24.2
223	177	210	24.05
224	178	211	24.05
225	179	211	24.05
226	180	211	24
227	181	213	24
228	182	211	24.05
229	183	211	24
230	184	211	24
231	185	211	23.9
240	194	204	23.9
241	195	205	23.9
242	196	203	23.9
243	197	200	23.9
244	198	198	23.9
245	199	200	23.85
246	200	200	23.85
247	201	198	23.85
256	210	194	23.8
257	211	192	23.8

258	212	192	23.75
259	213	194	23.75
260	214	196	23.75
261	215	196	23.7
262	216	194	23.7
263	217	192	23.7
264	218	192	23.7
274	228	195	23.6
275	229	195	23.6
276	230	195	23.6
277	231	190	23.6
278	232	191	23.6
279	233	190	23.6
280	234	190	23.55
281	235	193	23.55
290	244	191	23.5
291	245	188	23.5
292	246	189	23.45
293	247	186	23.45
294	248	189	23.45
295	249	189	23.45
296	250	191	23.4
297	251	191	23.4
307	261	187	23.35
308	262	187	23.3
309	263	189	23.3
310	264	191	23.3
311	265	190	23.3
312	266	189	23.3
313	267	186	23.3
314	268	187	23.25
323	277	189	23.2
324	278	191	23.15
325	279	193	23.15
326	280	189	23.15
327	281	187	23.15
328	282	185	23.15
329	283	185	23.15
330	284	189	23.15
215	169	210	24.15
216	170	210	24.15
217	171	213	24.15
218	172	211	24.15
219	173	208	24.15
220	174	208	24.1
221	175	210	24.1
222	176	212	24.1

232	186	211	23.95
233	187	209	24
234	188	207	24
235	189	207	24
236	190	207	23.95
237	191	207	23.9
238	192	207	23.9
239	193	207	23.9
248	202	198	23.85
249	203	196	23.85
250	204	196	23.85
251	205	196	23.8
252	206	198	23.8
253	207	198	23.8
254	208	198	23.8
255	209	194	23.8
265	219	192	23.7
266	220	194	23.7
267	221	194	23.65
268	222	197	23.65
269	223	194	23.65
270	224	192	23.65
271	225	190	23.65
272	226	194	23.65
273	227	195	23.6
282	236	194	23.55
283	237	192	23.55
284	238	191	23.55
285	239	191	23.5
286	240	193	23.5
287	241	192	23.5
288	242	193	23.5
289	243	193	23.5
298	252	186	23.4
299	253	186	23.4
300	254	186	23.4
301	255	187	23.4
302	256	189	23.4
303	257	191	23.35
304	258	191	23.35
305	259	189	23.35
306	260	187	23.35
315	269	189	23.25
316	270	191	23.25
317	271	193	23.25
318	272	191	23.2
319	273	189	23.2

320	274	187	23.2
321	275	187	23.2
322	276	189	23.2
331	285	189	23.1
332	286	189	23.1
333	287	189	23.1
334	288	187	23.1
335	289	185	23.1
336	290	188	23.1
337	291	188	23.05
338	292	187	23.05
339	293	192	23.05
340	294	189	23.05
341	295	187	23.05
342	296	189	23.05
343	297	189	23
344	298	189	23
345	299	189	23
346	300	189	23
347	301	189	22.95
357	311	187	22.9
358	312	190	22.9
359	313	192	22.85
360	314	192	22.85
361	315	190	22.85
362	316	188	22.85
363	317	185	22.85
364	318	186	22.85
365	319	188	22.8
375	329	194	22.7
376	330	192	22.7
377	331	189	22.7
378	332	190	22.7
379	333	189	22.7
380	334	190	22.7
381	335	189	22.65
382	336	192	22.65
391	345	188	22.6
392	346	186	22.6
393	347	188	22.6
394	348	188	22.55
395	349	190	22.55
396	350	190	22.55
397	351	188	22.55
398	352	186	22.55
399	353	186	22.55
348	302	187	22.95

349	303	187	22.95
350	304	187	22.95
351	305	189	22.95
352	306	189	22.95
353	307	191	22.9
354	308	191	22.9
355	309	187	22.9
356	310	187	22.9
366	320	190	22.8
367	321	192	22.8
368	322	194	22.75
369	323	190	22.75
370	324	188	22.8
371	325	188	22.75
372	326	190	22.75
373	327	192	22.75
374	328	194	22.7
383	337	190	22.65
384	338	187	22.65
385	339	188	22.65
386	340	185	22.65
387	341	188	22.6
388	342	188	22.6
389	343	192	22.6
390	344	190	22.6
400	354	186	22.5
401	355	186	22.5
402	356	188	22.5
403	357	188	22.5
404	358	190	22.45
405	359	188	22.45
406	360	188	22.45

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	106	24.35
2	2	121	24.3
3	3	136	24.3
4	4	151	24.25
5	5	160	24.2
6	6	162	24.2
7	7	160	24.25
8	8	166	24.3
9	9	172	24.3
10	10	179	24.2
11	11	186	24.15
12	12	187	24.15
13	13	192	24.15
14	14	200	24.15
15	15	207	24.1
16	16	209	24.05
17	17	218	24.05
18	18	224	24.05
19	19	231	24
20	20	237	24
21	21	244	23.95
22	22	248	23.9
23	23	253	23.9
24	24	255	23.85
25	25	259	23.8
26	26	262	23.8
27	27	266	23.8
28	28	268	23.75
29	29	273	23.7
30	30	273	23.7
31	31	275	23.65
32	32	280	23.6
33	33	281	23.55
34	34	284	23.55
35	35	284	23.5
36	36	286	23.5
37	37	286	23.45
38	38	288	23.5
39	39	290	23.4
40	40	289	23.4
41	41	290	23.35
42	42	293	23.3
43	43	291	23.3
44	44	293	23.25
45	45	293	23.25

46	46	293	23.15
47	47	295	23.2
48	48	295	23.1
49	49	293	23.05
50	50	296	23.1
51	51	296	23.1
52	52	296	23.1
53	53	294	22.9
54	54	296	22.9
55	55	296	22.85
56	56	294	22.9
57	57	296	22.85
58	58	294	22.85
59	59	294	22.75
60	60	292	22.75
61	61	294	22.7
62	0	294	22.65
63	1	296	27.15
64	2	296	27.1
65	3	296	27.1
66	4	296	27.05
67	5	299	27.05
68	6	297	27.05
69	7	299	27.05
70	8	297	27
71	9	299	26.95
72	10	299	26.9
73	11	299	26.85
74	12	301	26.9
75	13	299	26.85
76	14	299	26.75
77	15	299	26.7
78	16	299	26.75
79	17	299	26.65
80	18	300	26.65
81	19	302	26.65
82	20	302	26.55
83	21	299	26.6
84	22	301	26.55
85	23	301	26.55
86	24	301	26.5
87	25	299	26.45
88	26	302	26.35
89	27	301	26.35
90	28	302	26.3
91	29	302	26.25
92	30	302	26.25

93	31	304	26.25
94	32	302	26.15
95	33	302	26.15
96	34	304	26.15
97	35	302	26.2
98	36	302	26.15
99	37	300	26.1
100	38	302	26
101	39	302	25.95
102	40	302	26
103	41	302	25.9
104	42	300	25.9
105	43	303	25.75
106	44	301	25.75
107	45	302	25.7
108	46	301	25.75
109	47	303	25.65
110	48	303	25.65
111	49	300	25.6
112	50	303	25.6
113	51	301	25.6
114	52	301	25.5
115	53	303	25.55
116	54	305	25.4
117	55	305	25.5
118	56	305	25.4
119	57	303	25.35
120	58	303	25.35
121	59	300	25.35
122	60	302	25.25
123	61	301	25.25
124	62	301	25.15
125	63	303	25.1
126	64	303	25.05
127	65	301	25.1
128	66	302	25.1
129	67	301	25.1
130	68	300	25
131	69	300	25
132	70	301	25
133	71	298	25.05
134	72	296	25
135	73	296	25
136	74	292	25
137	75	290	25
138	76	287	24.95
139	77	283	24.95

140	78	283	24.95
141	79	281	24.9
142	80	279	24.9
143	81	277	24.9
144	82	277	24.85
145	83	274	24.8
146	84	275	24.8
147	85	272	24.75
148	86	270	24.8
149	87	268	24.75
150	88	270	24.75
151	89	268	24.7
152	90	266	24.7
153	91	266	24.7
154	92	266	24.65
155	93	266	24.65
156	94	264	24.6
157	95	261	24.6
158	96	261	24.65
159	97	262	24.65
160	98	261	24.55
161	99	261	24.5
162	100	261	24.55
163	101	261	24.6
164	102	262	24.55
165	103	261	24.45
166	104	259	24.45
167	105	259	24.5
168	106	257	24.5
169	107	260	24.45
170	108	260	24.4
171	109	260	24.4
172	110	256	24.45
173	111	258	24.4
174	112	258	24.4
175	113	260	24.35
176	114	258	24.35
177	115	255	24.4
178	116	256	24.4
179	117	256	24.4
180	118	258	24.25
181	119	256	24.25
182	120	254	24.25
183	121	254	24.3
184	122	254	24.25
185	123	254	24.2
186	124	253	24.25

187	125	254	24.25
188	126	252	24.25
189	127	251	24.25
190	128	252	24.1
191	129	252	24.2
192	130	252	24.1
193	131	249	24.15
194	132	252	24.15
195	133	254	24.05
196	134	252	24
197	135	252	24.05
198	136	252	24.1
199	137	252	24.1
200	138	251	24.05
201	139	252	23.95
202	140	249	23.95
203	141	249	24.05
204	142	249	24
205	143	247	23.95
206	144	247	24
207	145	247	23.9
208	146	245	23.95
209	147	245	23.95
210	148	245	23.9
219	157	243	23.8
220	158	243	23.8
221	159	246	23.85
222	160	244	23.75
223	161	243	23.8
224	162	242	23.8
225	163	241	23.75
226	164	241	23.7
235	173	244	23.65
236	174	244	23.5
237	175	244	23.45
238	176	242	23.55
239	177	242	23.6
240	178	241	23.6
241	179	244	23.55
242	180	243	23.4
243	181	239	23.5
253	191	233	23.35
254	192	231	23.35
255	193	232	23.35
256	194	227	23.4
257	195	225	23.4
258	196	225	23.4

259	197	225	23.35
260	198	227	23.25
261	199	225	23.25
270	208	218	23.3
271	209	216	23.25
272	210	214	23.3
273	211	218	23.2
274	212	218	23.1
275	213	218	23.1
276	214	218	23.1
277	215	218	23.1
278	216	214	23.25
288	226	212	23.1
289	227	214	22.95
290	228	215	22.95
291	229	217	22.95
292	230	214	23
293	231	212	23.05
294	232	210	23.05
295	233	212	23
296	234	213	22.95
306	244	213	22.8
307	245	210	22.95
308	246	206	22.95
309	247	208	22.9
310	248	213	22.85
311	249	212	22.75
312	250	212	22.75
313	251	214	22.75
314	252	208	22.9
324	262	208	22.75
325	263	210	22.6
326	264	215	22.55
327	265	212	22.55
328	266	210	22.75
329	267	206	22.8
330	268	208	22.75
331	269	206	22.7
332	270	208	22.65
211	149	245	23.85
212	150	245	23.8
213	151	243	23.9
214	152	243	23.95
215	153	241	23.9
216	154	246	23.85
217	155	246	23.75
218	156	246	23.75

227	165	244	23.65
228	166	242	23.65
229	167	242	23.7
230	168	241	23.7
231	169	244	23.65
232	170	244	23.5
233	171	239	23.7
234	172	242	23.7
244	182	237	23.5
245	183	237	23.55
246	184	239	23.5
247	185	237	23.35
248	186	239	23.4
249	187	237	23.45
250	188	235	23.5
251	189	235	23.4
252	190	233	23.4
262	200	225	23.25
263	201	223	23.4
264	202	221	23.35
265	203	223	23.3
266	204	223	23.25
267	205	225	23.15
268	206	225	23.15
269	207	221	23.25
279	217	212	23.2
280	218	214	23.2
281	219	212	23.1
282	220	214	23.05
283	221	217	23
284	222	217	23.05
285	223	214	23.1
286	224	210	23.15
287	225	210	23.1
297	235	215	22.9
298	236	215	22.85
299	237	215	22.95
300	238	210	23
301	239	208	23
302	240	210	23
303	241	211	22.9
304	242	213	22.8
305	243	213	22.8
315	253	206	22.9
316	254	210	22.9
317	255	210	22.8
318	256	213	22.7

319	257	213	22.65
320	258	211	22.7
321	259	211	22.8
322	260	206	22.85
323	261	206	22.75
333	271	210	22.5
334	272	210	22.5
335	273	210	22.5
336	274	205	22.65
337	275	208	22.65
338	276	210	22.6
339	277	212	22.45
340	278	209	22.45
341	279	207	22.45
342	280	210	22.5
343	281	205	22.65
344	282	207	22.6
345	283	207	22.55
346	284	209	22.4
347	285	212	22.35
348	286	209	22.45
349	287	205	22.5
350	288	203	22.55
360	298	210	22.3
361	299	213	22.25
362	300	208	22.25
363	301	204	22.45
364	302	206	22.45
365	303	208	22.3
366	304	208	22.2
367	305	210	22.2
368	306	210	22.15
378	316	208	22.3
379	317	208	22.25
380	318	210	22.15
381	319	212	22.05
382	320	210	22.05
383	321	206	22.15
384	322	208	22.15
385	323	208	22.1
386	324	210	22.1
396	334	206	22
397	335	204	22
398	336	204	22
399	337	206	21.95
400	338	208	21.95
401	339	210	21.95

402	340	208	21.95
403	341	204	21.95
404	342	204	21.95
414	352	211	21.8
415	353	211	21.8
416	354	209	21.8
417	355	207	21.8
418	356	209	21.8
419	357	212	21.75
420	358	214	21.75
421	359	214	21.75
422	360	212	21.75
351	289	205	22.5
352	290	205	22.45
353	291	205	22.45
354	292	205	22.4
355	293	209	22.3
356	294	204	22.4
357	295	202	22.5
358	296	204	22.45
359	297	206	22.35
369	307	208	22.25
370	308	204	22.4
371	309	206	22.35
372	310	208	22.3
373	311	208	22.25
374	312	210	22.15
375	313	212	22.1
376	314	206	22.15
377	315	206	22.3
387	325	210	22.1
388	326	208	22.05
389	327	208	22.05
390	328	204	22.1
391	329	203	22.05
392	330	206	22.05
393	331	210	22.05
394	332	210	22
395	333	208	22
405	343	206	21.9
406	344	209	21.9
407	345	211	21.9
408	346	211	21.9
409	347	209	21.85
410	348	205	21.9
411	349	209	21.85
412	350	209	21.85

413	351	211	21.85

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	134	34.75
2	2	140	34.7
3	3	144	34.7
4	4	148	34.85
5	5	161	34.8
6	6	174	34.75
7	7	187	34.75
8	8	192	34.75
9	9	196	34.75
10	10	207	34.65
11	11	213	34.55
12	12	214	34.55
13	13	216	34.6
14	14	226	34.6
15	15	226	34.5
16	16	231	34.55
17	17	237	34.6
18	18	242	34.55
19	19	248	34.55
20	20	255	34.5
21	21	259	34.35
22	22	264	34.35
23	23	270	34.35
24	24	272	34.3
25	25	279	34.4
26	26	283	34.3
27	27	286	34.3
28	28	292	34.3
29	29	294	34.15
30	30	294	34.2
31	31	298	34.2
32	32	300	34.15
33	33	305	34.05
34	34	307	34.05
35	35	309	34.1
36	36	312	34
37	37	318	34
38	38	320	33.9
39	39	321	33.9
40	40	325	33.85
41	41	329	33.8
42	42	330	33.8
43	43	331	33.75
44	44	334	33.75
45	45	334	33.75

46	46	338	33.75
47	47	338	33.75
48	48	342	33.75
49	49	344	33.6
50	50	345	33.6
51	51	345	33.55
52	52	349	33.55
53	53	349	33.5
54	54	351	33.55
55	55	351	33.55
56	0	353	33.5
57	1	353	37.9
58	2	356	38
59	3	355	37.9
60	4	357	37.9
61	5	358	37.9
62	6	359	37.85
63	7	360	37.8
64	8	362	37.75
65	9	360	37.8
66	10	362	37.8
67	11	364	37.75
68	12	364	37.7
69	13	366	37.55
70	14	365	37.5
71	15	367	37.55
72	16	369	37.55
73	17	369	37.45
74	18	369	37.4
75	19	369	37.35
76	20	369	37.35
77	21	374	37.3
78	22	374	37.3
79	23	374	37.25
80	24	376	37.2
81	25	375	37.15
82	26	373	37.05
83	27	376	37.15
84	28	376	37
85	29	378	37
86	30	374	36.95
87	31	376	36.95
88	32	373	36.95
89	33	375	37
90	34	375	37
91	35	377	36.85
92	36	375	36.85

93	37	378	36.85
94	38	380	36.75
95	39	380	36.65
96	40	380	36.6
97	41	380	36.65
98	42	382	36.6
99	43	382	36.45
100	44	382	36.4
101	45	382	36.4
102	46	382	36.4
103	47	384	36.4
104	48	382	36.4
105	49	384	36.35
106	50	382	36.25
107	51	384	36.3
108	52	384	36.3
109	53	384	36.25
110	54	384	36.2
111	55	384	36.25
112	56	384	36.15
113	57	384	36.2
114	58	384	36.15
115	59	382	35.95
116	60	382	36
117	61	382	36.05
118	62	385	35.9
119	63	382	35.8
120	64	384	35.8
121	65	385	35.8
122	66	385	35.75
123	67	382	35.75
124	68	383	35.7
125	69	382	35.65
126	70	382	35.65
127	71	380	35.65
128	72	378	35.6
129	73	378	35.55
130	74	376	35.55
131	75	376	35.5
132	76	373	35.5
133	77	371	35.5
134	78	369	35.5
135	79	371	35.45
136	80	368	35.35
137	81	368	35.35
138	82	368	35.4
139	83	368	35.25

140	84	366	35.25
141	85	364	35.2
142	86	366	35.2
143	87	366	35.15
144	88	363	35.2
145	89	363	35.1
146	90	363	35.1
147	91	361	35.05
148	92	361	35.05
149	93	361	35.1
150	94	361	35
151	95	361	35.05
152	96	357	34.9
153	97	359	34.9
154	98	359	34.85
155	99	359	34.9
156	100	358	34.95
157	101	357	34.85
158	102	359	34.85
159	103	357	34.7
160	104	356	34.75
161	105	356	34.65
162	106	356	34.75
163	107	354	34.65
164	108	356	34.6
165	109	354	34.6
166	110	354	34.6
167	111	354	34.6
168	112	352	34.6
169	113	354	34.55
170	114	354	34.55
171	115	357	34.5
172	116	354	34.35
173	117	354	34.4
174	118	354	34.4
175	119	354	34.4
176	120	354	34.35
177	121	354	34.25
178	122	352	34.2
179	123	350	34.2
180	124	352	34.25
181	125	352	34.15
182	126	352	34.25
183	127	352	34.1
184	128	352	34.05
185	129	352	34
186	130	352	34

187	131	352	34.05
188	132	350	33.95
189	133	352	34
190	134	352	33.9
191	135	352	33.9
192	136	350	33.85
193	137	350	33.85
194	138	348	33.9
195	139	348	33.85
196	140	348	33.85
197	141	347	33.75
198	142	348	33.75
199	143	348	33.75
200	144	348	33.7
201	145	348	33.75
202	146	348	33.65
203	147	348	33.65
204	148	348	33.55
205	149	348	33.5
206	150	350	33.5
207	151	350	33.45
216	160	350	33.3
217	161	350	33.25
218	162	347	33.15
219	163	349	33.2
220	164	348	33.2
221	165	350	33.2
222	166	350	33.15
223	167	350	33.05
232	176	348	32.85
233	177	348	32.85
234	178	345	32.75
235	179	345	32.8
236	180	345	32.75
237	181	344	32.65
238	182	345	32.75
239	183	342	32.65
248	192	343	32.4
249	193	341	32.35
250	194	343	32.4
251	195	340	32.3
252	196	341	32.3
253	197	341	32.3
254	198	339	32.25
255	199	341	32.3
264	208	341	32
265	209	341	32.05

266	210	339	31.95
267	211	338	32
268	212	339	31.95
269	213	338	31.95
270	214	341	31.95
271	215	339	31.85
280	224	341	31.65
281	225	339	31.6
282	226	341	31.6
283	227	338	31.55
284	228	339	31.55
285	229	341	31.45
286	230	339	31.45
287	231	339	31.45
296	240	344	31.25
297	241	342	31.15
298	242	342	31.15
299	243	342	31.2
300	244	342	31.15
301	245	342	31.1
302	246	342	31.1
303	247	342	31.1
312	256	342	30.75
313	257	343	30.75
314	258	343	30.8
315	259	343	30.75
316	260	345	30.75
317	261	341	30.65
318	262	341	30.65
319	263	341	30.7
208	152	350	33.5
209	153	350	33.4
210	154	350	33.4
211	155	348	33.35
212	156	350	33.4
213	157	347	33.35
214	158	350	33.3
215	159	350	33.35
224	168	350	33.1
225	169	349	33
226	170	348	32.95
227	171	348	32.95
228	172	350	32.95
229	173	350	32.9
230	174	348	32.9
231	175	350	32.9
240	184	345	32.6

241	185	342	32.55
242	186	343	32.6
243	187	343	32.6
244	188	342	32.5
245	189	340	32.55
246	190	343	32.5
247	191	342	32.45
256	200	339	32.2
257	201	340	32.2
258	202	338	32.2
259	203	340	32.2
260	204	341	32.1
261	205	339	32.05
262	206	339	32.1
263	207	338	32.05
272	216	341	31.85
273	217	341	31.8
274	218	341	31.75
275	219	341	31.7
276	220	339	31.7
277	221	341	31.75
278	222	339	31.65
279	223	339	31.7
288	232	339	31.4
289	233	339	31.45
290	234	339	31.4
291	235	341	31.35
292	236	341	31.4
293	237	342	31.3
294	238	341	31.3
295	239	342	31.2
304	248	344	31.05
305	249	342	30.95
306	250	345	30.95
307	251	345	30.95
308	252	345	30.9
309	253	345	30.9
310	254	343	30.8
311	255	343	30.85
320	264	341	30.6
321	265	341	30.6
322	266	341	30.6
323	267	343	30.55
324	268	343	30.55
325	269	341	30.45
326	270	341	30.45
327	271	342	30.4

328	272	341	30.35
329	273	344	30.4
330	274	342	30.3
331	275	341	30.3
332	276	342	30.25
333	277	342	30.3
334	278	344	30.25
335	279	344	30.2
344	288	342	30.05
345	289	344	30
346	290	344	29.95
347	291	345	29.9
348	292	344	29.9
349	293	344	29.85
350	294	345	29.85
351	295	345	29.85
360	304	343	29.55
361	305	345	29.55
362	306	343	29.5
363	307	343	29.55
364	308	343	29.55
365	309	343	29.5
366	310	343	29.5
367	311	343	29.4
376	320	343	29.15
377	321	343	29.2
378	322	346	29.15
379	323	343	29.1
380	324	346	29.1
381	325	345	29.1
382	326	345	29.05
383	327	346	29
392	336	346	28.8
393	337	346	28.75
394	338	346	28.75
395	339	346	28.7
396	340	346	28.65
397	341	346	28.7
398	342	347	28.65
399	343	344	28.65
408	352	346	28.35
409	353	347	28.3
410	354	347	28.3
411	355	347	28.25
412	356	347	28.2
413	357	347	28.25
414	358	347	28.25

415	359	344	28.15
336	280	346	30.2
337	281	344	30.1
338	282	344	30.15
339	283	344	30.1
340	284	342	30.1
341	285	344	30.1
342	286	342	30.05
343	287	344	30.05
352	296	343	29.75
353	297	345	29.8
354	298	343	29.75
355	299	342	29.7
356	300	343	29.7
357	301	342	29.6
358	302	343	29.65
359	303	342	29.65
368	312	343	29.35
369	313	343	29.3
370	314	343	29.35
371	315	343	29.3
372	316	345	29.25
373	317	346	29.3
374	318	343	29.2
375	319	343	29.2
384	328	346	28.95
385	329	346	28.9
386	330	346	28.9
387	331	346	28.9
388	332	346	28.85
389	333	346	28.85
390	334	344	28.85
391	335	346	28.85
400	344	347	28.6
401	345	347	28.55
402	346	347	28.55
403	347	347	28.5
404	348	349	28.5
405	349	347	28.4
406	350	347	28.4
407	351	347	28.35
416	360	347	28.15

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	179	33.3
2	2	188	33.3
3	3	197	33.35
4	4	207	33.3
5	5	214	33.3
6	6	212	33.2
7	7	212	33.3
8	8	218	33.25
9	9	225	33.25
10	10	225	33.15
11	11	223	33.2
12	12	227	33.25
13	13	232	33.15
14	14	236	33.1
15	15	234	33.1
16	16	238	33.15
17	17	244	33.05
18	18	244	33.05
19	19	251	33.05
20	20	257	33
21	21	262	32.95
22	22	268	33
23	23	271	32.9
24	24	272	32.9
25	25	277	32.9
26	26	279	32.85
27	27	286	32.85
28	28	288	32.8
29	29	290	32.8
30	30	294	32.7
31	31	299	32.7
32	32	303	32.7
33	33	303	32.6
34	34	307	32.6
35	35	310	32.55
36	36	310	32.55
37	37	312	32.6
38	38	312	32.5
39	39	314	32.6
40	40	316	32.5
41	41	319	32.45
42	42	319	32.45
43	43	321	32.45
44	44	323	32.45
45	45	325	32.4

46	46	327	32.4
47	47	330	32.35
48	48	332	32.25
49	49	332	32.2
50	50	334	32.2
51	51	336	32.15
52	52	338	32.2
53	53	338	32.05
54	54	338	32.05
55	55	341	32
56	56	343	32
57	57	345	31.95
58	58	345	31.9
59	59	347	31.95
60	0	349	31.9
61	1	350	36.4
62	2	352	36.45
63	3	351	36.4
64	4	354	36.3
65	5	356	36.35
66	6	353	36.35
67	7	356	36.2
68	8	358	36.15
69	9	358	36.1
70	10	358	36.05
71	11	360	36.05
72	12	360	36.05
73	13	360	35.95
74	14	362	35.95
75	15	362	36
76	16	362	35.9
77	17	362	35.95
78	18	363	35.8
79	19	363	35.85
80	20	365	35.8
81	21	365	35.8
82	22	365	35.8
83	23	367	35.7
84	24	367	35.75
85	25	367	35.65
86	26	367	35.6
87	27	370	35.5
88	28	370	35.5
89	29	370	35.45
90	30	372	35.45
91	31	370	35.45
92	32	370	35.5

93	33	372	35.45
94	34	372	35.4
95	35	372	35.3
96	36	372	35.25
97	37	372	35.2
98	38	372	35.25
99	39	372	35.2
100	40	372	35.2
101	41	374	35.2
102	42	374	35.15
103	43	374	35.05
104	44	375	35
105	45	372	34.9
106	46	372	34.95
107	47	372	34.95
108	48	375	34.95
109	49	372	34.85
110	50	372	34.75
111	51	372	34.75
112	52	372	34.8
113	53	373	34.75
114	54	373	34.8
115	55	372	34.7
116	56	372	34.65
117	57	373	34.7
118	58	372	34.65
119	59	373	34.65
120	60	372	34.6
121	61	374	34.55
122	62	375	34.55
123	63	374	34.5
124	64	374	34.5
125	65	376	34.45
126	66	376	34.3
127	67	376	34.35
128	68	376	34.3
129	69	374	34.3
130	70	376	34.3
131	71	374	34.25
132	72	374	34.15
133	73	372	34.05
134	74	370	34.05
135	75	370	34.05
136	76	368	34.1
137	77	368	34.1
138	78	368	34.1
139	79	366	34

140	80	368	34.05
141	81	364	33.95
142	82	364	33.85
143	83	364	33.9
144	84	364	33.9
145	85	364	33.85
146	86	364	33.8
147	87	362	33.85
148	88	362	33.8
149	89	362	33.75
150	90	362	33.65
151	91	362	33.65
152	92	360	33.65
153	93	364	33.65
154	94	362	33.6
155	95	362	33.55
156	96	363	33.55
157	97	365	33.5
158	98	365	33.5
159	99	362	33.35
160	100	364	33.4
161	101	365	33.4
162	102	364	33.4
163	103	365	33.35
164	104	367	33.35
165	105	365	33.2
166	106	365	33.2
167	107	367	33.15
168	108	365	33.15
169	109	365	33.2
170	110	363	33.2
171	111	365	33.15
172	112	365	33.15
173	113	365	33.1
174	114	363	33.05
175	115	365	33.05
176	116	365	33
177	117	367	32.95
178	118	366	32.9
179	119	365	32.85
180	120	365	32.85
181	121	365	32.85
182	122	365	32.8
183	123	365	32.8
184	124	366	32.8
185	125	366	32.65
186	126	365	32.75

187	127	366	32.6
188	128	367	32.65
189	129	367	32.6
190	130	369	32.65
191	131	367	32.55
192	132	367	32.5
193	133	368	32.55
194	134	368	32.45
195	135	368	32.45
196	136	370	32.45
197	137	371	32.35
198	138	371	32.3
199	139	371	32.3
200	140	369	32.25
201	141	371	32.25
202	142	371	32.2
203	143	372	32.2
204	144	369	32.15
205	145	367	32.1
206	146	369	32.15
207	147	370	32.1
216	156	373	31.85
217	157	371	31.8
218	158	371	31.8
219	159	372	31.8
220	160	372	31.75
221	161	372	31.65
222	162	374	31.6
223	163	374	31.55
232	172	373	31.35
233	173	371	31.4
234	174	371	31.35
235	175	373	31.35
236	176	374	31.2
237	177	371	31.15
238	178	370	31.15
239	179	370	31.1
248	188	362	30.85
249	189	363	30.9
250	190	361	30.8
251	191	359	30.8
252	192	359	30.8
253	193	359	30.8
254	194	358	30.8
255	195	356	30.75
264	204	353	30.45
265	205	354	30.45

266	206	349	30.45
267	207	349	30.5
268	208	349	30.45
269	209	349	30.4
270	210	349	30.4
271	211	349	30.35
280	220	344	30.15
281	221	346	30.1
282	222	349	30.05
283	223	346	29.95
284	224	346	30
285	225	346	29.95
286	226	343	29.9
287	227	344	30
296	236	346	29.75
297	237	346	29.65
298	238	346	29.6
299	239	346	29.6
300	240	346	29.6
301	241	346	29.6
302	242	346	29.6
303	243	343	29.45
312	252	345	29.3
313	253	346	29.2
314	254	346	29.3
315	255	345	29.2
316	256	345	29.15
317	257	345	29.1
318	258	343	29.1
319	259	343	29.15
208	148	370	32.1
209	149	370	32
210	150	373	31.95
211	151	373	32
212	152	371	32
213	153	371	31.95
214	154	373	31.95
215	155	371	31.85
224	164	372	31.6
225	165	374	31.6
226	166	374	31.5
227	167	372	31.55
228	168	373	31.5
229	169	375	31.5
230	170	373	31.45
231	171	371	31.4
240	180	370	31.1

241	181	367	31.05
242	182	367	31.05
243	183	367	31
244	184	365	31
245	185	364	30.95
246	186	364	30.95
247	187	364	30.9
256	196	356	30.75
257	197	356	30.65
258	198	356	30.65
259	199	356	30.7
260	200	356	30.65
261	201	356	30.55
262	202	356	30.55
263	203	354	30.45
272	212	349	30.3
273	213	347	30.25
274	214	349	30.25
275	215	346	30.3
276	216	346	30.25
277	217	346	30.25
278	218	344	30.15
279	219	344	30.15
288	228	344	29.95
289	229	344	29.9
290	230	346	29.9
291	231	344	29.8
292	232	344	29.85
293	233	344	29.75
294	234	344	29.75
295	235	344	29.8
304	244	346	29.5
305	245	343	29.5
306	246	343	29.5
307	247	345	29.45
308	248	345	29.35
309	249	346	29.35
310	250	345	29.35
311	251	346	29.35
320	260	343	29.1
321	261	346	29.05
322	262	343	29
323	263	343	28.95
324	264	343	29
325	265	345	29
326	266	343	28.9
327	267	343	28.95

328	268	345	28.85
329	269	343	28.85
330	270	343	28.8
331	271	343	28.85
332	272	341	28.8
333	273	343	28.75
334	274	343	28.75
335	275	340	28.65
344	284	338	28.5
345	285	338	28.45
346	286	338	28.4
347	287	337	28.45
348	288	338	28.35
349	289	336	28.35
350	290	336	28.4
351	291	335	28.35
360	300	335	28.15
361	301	335	28.1
362	302	334	28.1
363	303	337	28.1
364	304	337	28
365	305	337	28
366	306	337	27.9
367	307	337	27.95
376	316	338	27.7
377	317	338	27.65
378	318	338	27.65
379	319	338	27.6
380	320	339	27.55
381	321	338	27.6
382	322	339	27.6
383	323	340	27.45
392	332	338	27.35
393	333	340	27.3
394	334	340	27.3
395	335	340	27.2
396	336	340	27.15
397	337	340	27.2
398	338	340	27.15
399	339	342	27.1
408	348	342	26.85
409	349	340	26.85
410	350	342	26.9
411	351	342	26.8
412	352	342	26.85
413	353	340	26.75
414	354	340	26.75

415	355	340	26.7
336	276	341	28.7
337	277	341	28.7
338	278	341	28.65
339	279	338	28.65
340	280	340	28.6
341	281	340	28.55
342	282	338	28.5
343	283	338	28.5
352	292	335	28.3
353	293	338	28.25
354	294	335	28.25
355	295	335	28.2
356	296	335	28.15
357	297	337	28.2
358	298	335	28.15
359	299	335	28.1
368	308	337	27.9
369	309	339	27.85
370	310	339	27.9
371	311	337	27.75
372	312	336	27.8
373	313	336	27.75
374	314	339	27.7
375	315	338	27.75
384	324	341	27.5
385	325	338	27.5
386	326	338	27.45
387	327	340	27.5
388	328	338	27.4
389	329	338	27.35
390	330	338	27.35
391	331	338	27.3
400	340	343	27.1
401	341	340	27
402	342	342	27
403	343	340	26.95
404	344	340	27
405	345	340	27
406	346	342	26.9
407	347	343	26.9
416	356	338	26.65
417	357	340	26.7
418	358	338	26.65
419	359	338	26.6
420	360	340	26.65

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	166	32.8
2	2	184	32.9
3	3	201	32.8
4	4	214	32.8
5	5	231	32.75
6	6	242	32.65
7	7	249	32.7
8	8	259	32.7
9	9	264	32.6
10	10	268	32.7
11	11	275	32.65
12	12	279	32.45
13	13	286	32.6
14	14	295	32.6
15	15	301	32.45
16	16	310	32.45
17	17	314	32.3
18	18	318	32.3
19	19	325	32.25
20	20	332	32.25
21	21	338	32.2
22	22	344	32.1
23	23	349	32.1
24	24	354	32.05
25	25	358	32.05
26	26	362	32
27	27	367	31.95
28	28	369	31.95
29	29	371	31.9
30	30	376	31.8
31	31	378	31.9
32	32	380	31.8
33	33	383	31.8
34	34	385	31.75
35	35	387	31.85
36	36	390	31.75
37	37	390	31.8
38	38	392	31.75
39	39	392	31.75
40	40	394	31.8
41	41	394	31.65
42	42	396	31.65
43	43	399	31.6
44	44	399	31.45
45	45	399	31.35

46	46	399	31.35
47	47	401	31.35
48	48	401	31.4
49	49	401	31.4
50	50	401	31.35
51	51	404	31.15
52	52	404	31.25
53	53	404	31.2
54	54	406	31.15
55	55	406	31.1
56	56	406	31
57	57	408	31
58	58	408	31.1
59	59	409	30.9
60	0	408	30.9
61	1	411	35.35
62	2	411	35.2
63	3	411	35.15
64	4	411	35.1
65	5	411	35.1
66	6	411	35.05
67	7	411	35
68	8	412	34.95
69	9	411	34.9
70	10	414	34.85
71	11	412	34.85
72	12	412	34.8
73	13	414	34.75
74	14	414	34.75
75	15	416	34.7
76	16	414	34.6
77	17	414	34.6
78	18	417	34.55
79	19	415	34.45
80	20	417	34.4
81	21	417	34.4
82	22	417	34.35
83	23	417	34.3
84	24	417	34.3
85	25	417	34.25
86	26	417	34.15
87	27	417	34.2
88	28	419	34.15
89	29	417	34.1
90	30	417	34.05
91	31	418	34.25
92	32	418	33.95

93	33	418	33.9
94	34	415	33.9
95	35	415	33.8
96	36	416	33.8
97	37	416	33.75
98	38	416	33.7
99	39	418	33.6
100	40	416	33.6
101	41	416	33.55
102	42	414	33.5
103	43	416	33.5
104	44	416	33.5
105	45	419	33.45
106	46	418	33.35
107	47	417	33.25
108	48	414	33.25
109	49	414	33.25
110	50	417	33.15
111	51	415	33.1
112	52	417	33.1
113	53	415	33
114	54	417	33.05
115	55	415	32.95
116	56	415	32.95
117	57	417	32.9
118	58	415	32.85
119	59	415	32.85
120	60	417	32.7
121	61	415	32.75
122	62	415	32.7
123	63	418	32.6
124	64	418	32.6
125	65	418	32.55
126	66	418	32.45
127	67	416	32.45
128	68	414	32.4
129	69	414	32.4
130	70	412	32.35
131	71	410	32.35
132	72	407	32.25
133	73	405	32.35
134	74	404	32.25
135	75	401	32.3
136	76	399	32.2
137	77	397	32.2
138	78	393	32.1
139	79	391	32.15

140	80	391	32.15
141	81	391	32.05
142	82	389	32.05
143	83	389	32.05
144	84	386	32.05
145	85	384	31.95
146	86	385	31.95
147	87	385	31.8
148	88	384	31.9
149	89	382	31.75
150	90	382	31.75
151	91	378	31.7
152	92	380	31.7
153	93	381	31.7
154	94	379	31.7
155	95	376	31.65
156	96	376	31.55
157	97	377	31.65
158	98	374	31.6
159	99	374	31.55
160	100	374	31.6
161	101	374	31.55
162	102	374	31.5
163	103	375	31.45
164	104	375	31.4
165	105	375	31.4
166	106	375	31.3
167	107	375	31.25
168	108	377	31.25
169	109	377	31.1
170	110	375	31.2
171	111	373	31.15
172	112	372	31.2
173	113	370	31.1
174	114	368	31.15
175	115	370	31.15
176	116	368	31.05
177	117	368	31.1
178	118	366	31
179	119	366	31
180	120	366	31
181	121	366	31
182	122	366	31
183	123	364	30.9
184	124	364	30.85
185	125	364	30.8
186	126	362	30.8

187	127	364	30.8
188	128	362	30.75
189	129	365	30.75
190	130	364	30.8
191	131	362	30.7
192	132	363	30.75
193	133	360	30.6
194	134	360	30.7
195	135	360	30.6
196	136	360	30.55
197	137	360	30.6
198	138	358	30.5
199	139	358	30.55
200	140	358	30.45
201	141	359	30.4
202	142	356	30.45
203	143	356	30.4
204	144	359	30.4
205	145	359	30.4
206	146	356	30.3
207	147	358	30.2
216	156	357	30.1
217	157	354	30
218	158	354	29.95
219	159	357	30.1
220	160	355	29.95
221	161	355	30
222	162	355	30
223	163	355	29.9
232	172	357	29.65
233	173	357	29.65
234	174	357	29.65
235	175	355	29.5
236	176	357	29.1
237	177	357	29.6
238	178	360	29.55
239	179	360	29.5
248	188	339	29.4
249	189	336	29.4
250	190	334	29.35
251	191	330	29.3
252	192	321	29.3
253	193	317	29.35
254	194	312	29.35
255	195	312	29.35
264	204	285	29.15
265	205	281	29.2

266	206	283	29.25
267	207	285	29.15
268	208	283	29.05
269	209	278	29
270	210	270	29.05
271	211	263	29.15
280	220	261	29.05
281	221	261	28.85
282	222	255	28.9
283	223	250	29
284	224	248	29.05
285	225	253	29
286	226	255	28.95
287	227	255	28.85
296	236	238	28.9
297	237	238	28.9
298	238	243	28.9
299	239	247	28.85
300	240	245	28.65
301	241	238	28.7
302	242	232	28.75
303	243	229	28.85
312	252	243	28.75
313	253	243	28.55
314	254	237	28.55
315	255	228	28.65
316	256	223	28.7
317	257	223	28.7
318	258	227	28.65
319	259	234	28.65
208	148	356	30.15
209	149	359	30.25
210	150	356	30.1
211	151	358	30.2
212	152	356	30.1
213	153	359	30.1
214	154	356	30.2
215	155	359	30.1
224	164	355	29.9
225	165	355	29.8
226	166	357	29.85
227	167	355	29.8
228	168	355	29.7
229	169	357	29.75
230	170	357	29.65
231	171	359	29.7
240	180	360	29.45

241	181	360	29.45
242	182	360	29.4
243	183	360	29.45
244	184	358	29.35
245	185	356	29.35
246	186	347	29.35
247	187	340	29.4
256	196	312	29.3
257	197	310	29.2
258	198	300	29.25
259	199	293	29.3
260	200	293	29.3
261	201	297	29.25
262	202	298	29.2
263	203	296	29.1
272	212	265	29.15
273	213	269	29.15
274	214	274	29.05
275	215	267	28.9
276	216	261	29
277	217	257	29.1
278	218	257	29.1
279	219	259	29.1
288	228	249	28.8
289	229	242	28.9
290	230	244	29
291	231	249	28.95
292	232	255	28.9
293	233	256	28.75
294	234	249	28.75
295	235	242	28.8
304	244	236	28.85
305	245	243	28.75
306	246	245	28.65
307	247	240	28.6
308	248	234	28.65
309	249	228	28.75
310	250	230	28.8
311	251	236	28.75
320	260	236	28.5
321	261	234	28.45
322	262	225	28.5
323	263	223	28.6
324	264	228	28.65
325	265	232	28.55
326	266	239	28.5
327	267	236	28.4

328	268	230	28.4
329	269	224	28.45
330	270	222	28.55
331	271	226	28.55
332	272	233	28.5
333	273	237	28.45
334	274	232	28.3
335	275	228	28.4
344	284	214	28.3
345	285	212	28.45
346	286	220	28.4
347	287	227	28.35
348	288	231	28.25
349	289	227	28.15
350	290	222	28.1
351	291	216	28.2
360	300	207	28.25
361	301	215	28.25
362	302	222	28.15
363	303	219	28.1
364	304	215	28.15
365	305	208	28.2
366	306	208	28.2
367	307	214	28.2
376	316	217	28.05
377	317	222	28
378	318	215	27.95
379	319	207	28
380	320	197	28.05
381	321	191	28.05
382	322	193	28.05
383	323	197	28.05
392	332	212	27.8
393	333	212	27.75
394	334	205	27.8
395	335	199	27.85
396	336	190	27.9
397	337	183	27.95
398	338	184	27.95
399	339	194	27.9
408	348	198	27.75
409	349	202	27.65
410	350	200	27.6
411	351	193	27.7
412	352	187	27.75
413	353	187	27.8
414	354	191	27.8

415	355	198	27.75
336	276	220	28.35
337	277	213	28.45
338	278	211	28.5
339	279	214	28.5
340	280	222	28.5
341	281	226	28.35
342	282	227	28.2
343	283	220	28.2
352	292	217	28.25
353	293	223	28.25
354	294	230	28.2
355	295	230	28.1
356	296	227	28.15
357	297	218	28.2
358	298	211	28.2
359	299	204	28.25
368	308	223	28.15
369	309	227	28.05
370	310	223	28.05
371	311	216	28.05
372	312	210	28.05
373	313	207	28.1
374	314	207	28.1
375	315	213	28.1
384	324	210	28.05
385	325	212	27.85
386	326	210	27.85
387	327	201	27.9
388	328	195	27.95
389	329	195	28
390	330	201	28
391	331	207	27.9
400	340	203	27.8
401	341	202	27.7
402	342	198	27.7
403	343	191	27.75
404	344	185	27.85
405	345	187	27.9
406	346	187	27.85
407	347	193	27.85
416	356	204	27.7
417	357	204	27.55
418	358	200	27.55
419	359	193	27.6
420	360	185	27.65

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	113	61.5
2	2	136	61.5
3	3	159	61.45
4	4	174	61.45
5	5	188	61.4
6	6	210	61.45
7	7	229	61.3
8	8	242	61.25
9	9	252	61.25
10	10	261	61.2
11	11	266	61.15
12	12	270	61.15
13	13	278	61.2
14	14	283	61.05
15	15	289	61.1
16	16	296	61.15
17	17	300	61
18	18	304	61
19	19	306	60.9
20	20	311	60.9
21	21	313	60.85
22	22	317	60.85
23	23	321	60.8
24	24	323	60.75
25	25	323	60.7
26	26	328	60.75
27	27	330	60.65
28	28	332	60.65
29	29	332	60.65
30	30	336	60.6
31	31	338	60.6
32	32	340	60.65
33	33	332	60.45
34	34	375	60.45
35	35	393	60.45
36	36	397	60.4
37	37	399	60.35
38	38	401	60.35
39	39	401	60.4
40	40	405	60.3
41	41	406	60.2
42	42	407	60.2
43	43	405	60.15
44	44	412	60.25
45	45	412	60.1

46	46	412	60.1
47	47	412	60.05
48	48	414	60.1
49	49	416	60.1
50	50	418	60.05
51	51	416	59.85
52	52	418	59.85
53	53	418	59.9
54	54	422	59.9
55	55	422	59.75
56	56	420	59.75
57	57	422	59.7
58	58	424	59.7
59	59	426	59.65
60	60	427	59.6
61	0	426	59.55
62	1	428	64.1
63	2	426	64.05
64	3	428	64
65	4	429	63.9
66	5	429	63.9
67	6	428	63.85
68	7	429	63.85
69	8	431	63.8
70	9	429	63.8
71	10	431	63.8
72	11	431	63.8
73	12	432	63.75
74	13	431	63.7
75	14	435	63.55
76	15	433	63.5
77	16	435	63.5
78	17	435	63.5
79	18	433	63.4
80	19	435	63.35
81	20	437	63.35
82	21	437	63.3
83	22	435	63.3
84	23	435	63.3
85	24	433	63.2
86	25	435	63.15
87	26	435	63.2
88	27	435	63.15
89	28	435	63.1
90	29	437	63.05
91	30	437	62.95
92	31	437	62.9

93	32	439	62.85
94	33	435	62.85
95	34	435	62.8
96	35	435	62.85
97	36	433	62.75
98	37	431	62.8
99	38	434	62.6
100	39	432	62.7
101	40	433	62.75
102	41	435	62.65
103	42	434	62.45
104	43	434	62.5
105	44	434	62.55
106	45	438	62.45
107	46	437	62.45
108	47	436	62.45
109	48	437	62.3
110	49	436	62.25
111	50	437	62.15
112	51	437	62.1
113	52	437	62.05
114	53	437	62.1
115	54	435	62
116	55	437	62.05
117	56	437	62
118	57	437	61.9
119	58	437	61.85
120	59	437	61.9
121	60	437	61.85
122	61	437	61.8
123	62	437	61.65
124	63	437	61.65
125	64	435	61.65
126	65	435	61.6
127	66	433	61.5
128	67	433	61.55
129	68	431	61.5
130	69	429	61.45
131	70	427	61.4
132	71	425	61.4
133	72	423	61.45
134	73	418	61.4
135	74	417	61.45
136	75	412	61.3
137	76	412	61.35
138	77	408	61.3
139	78	404	61.2

140	79	404	61.4
141	80	399	61.25
142	81	399	61.3
143	82	397	61.1
144	83	394	61.2
145	84	394	61.05
146	85	394	61.1
147	86	395	61.2
148	87	392	61
149	88	390	61.05
150	89	384	60.9
151	90	384	60.85
152	91	386	60.8
153	92	384	60.85
154	93	382	60.9
155	94	382	60.8
156	95	380	60.7
157	96	382	60.7
158	97	380	60.7
159	98	380	60.85
160	99	378	60.7
161	100	380	60.7
162	101	380	60.75
163	102	376	60.5
164	103	378	60.65
165	104	376	60.6
166	105	376	60.45
167	106	376	60.55
168	107	370	60.4
169	108	370	60.6
170	109	369	60.6
171	110	368	60.5
172	111	370	60.6
173	112	370	60.35
174	113	372	60.4
175	114	370	60.4
176	115	368	60.3
177	116	366	60.3
178	117	370	60.4
179	118	368	60.3
180	119	368	60.4
181	120	366	60.15
182	121	368	60.15
183	122	368	60.25
184	123	364	60.25
185	124	338	60.15
186	125	303	60

187	126	314	60
188	127	339	60.2
189	128	304	59.95
190	129	284	59.95
191	130	275	60.05
192	131	271	60
193	132	267	60
194	133	265	60
195	134	263	59.95
196	135	258	59.85
197	136	256	59.9
198	137	254	59.95
199	138	255	59.95
200	139	289	60
201	140	272	59.7
202	141	263	59.65
203	142	261	59.65
204	143	259	59.65
205	144	259	59.7
206	145	257	59.7
207	146	255	59.55
216	155	253	59.6
217	156	251	59.6
218	157	253	59.55
219	158	251	59.35
220	159	253	59.45
221	160	253	59.45
222	161	251	59.4
223	162	251	59.35
232	171	252	59.3
233	172	252	59.2
234	173	250	59.25
235	174	250	59.2
236	175	250	59.2
237	176	252	59.2
238	177	250	59.05
239	178	250	59.1
248	187	242	58.75
249	188	240	58.8
250	189	237	58.75
251	190	238	58.9
252	191	235	59
253	192	235	59.05
254	193	233	58.9
255	194	231	58.95
264	203	220	58.9
265	204	218	58.85

266	205	216	58.75
267	206	216	58.65
268	207	216	58.65
269	208	216	58.8
270	209	214	58.8
271	210	214	58.75
280	219	204	58.65
281	220	204	58.55
282	221	204	58.55
283	222	202	58.6
284	223	202	58.65
285	224	202	58.65
286	225	202	58.7
287	226	200	58.55
296	235	192	58.4
297	236	194	58.55
298	237	194	58.55
299	238	194	58.55
300	239	194	58.5
301	240	192	58.4
302	241	192	58.35
303	242	192	58.3
312	251	190	58.45
313	252	187	58.4
314	253	189	58.45
315	254	189	58.4
316	255	186	58.25
317	256	185	58.25
318	257	188	58.3
319	258	189	58.35
208	147	255	59.55
209	148	253	59.6
210	149	255	59.6
211	150	253	59.65
212	151	253	59.65
213	152	253	59.7
214	153	253	59.75
215	154	253	59.65
224	163	251	59.3
225	164	254	59.4
226	165	251	59.4
227	166	251	59.35
228	167	251	59.4
229	168	252	59.3
230	169	254	59.35
231	170	252	59.3
240	179	250	59.05

241	180	252	59
242	181	250	59.05
243	182	248	58.9
244	183	244	58.8
245	184	244	58.85
246	185	244	58.85
247	186	244	58.75
256	195	231	58.95
257	196	229	59
258	197	229	58.95
259	198	227	58.85
260	199	225	58.7
261	200	222	58.7
262	201	221	58.85
263	202	220	58.8
272	211	214	58.75
273	212	212	58.6
274	213	212	58.6
275	214	210	58.6
276	215	210	58.7
277	216	208	58.75
278	217	206	58.7
279	218	206	58.65
288	227	200	58.45
289	228	198	58.45
290	229	196	58.5
291	230	196	58.6
292	231	196	58.6
293	232	196	58.55
294	233	196	58.45
295	234	193	58.4
304	243	192	58.35
305	244	189	58.4
306	245	190	58.5
307	246	191	58.45
308	247	192	58.4
309	248	189	58.25
310	249	189	58.25
311	250	187	58.4
320	259	190	58.35
321	260	187	58.3
322	261	188	58.3
323	262	188	58.15
324	263	188	58.15
325	264	188	58.3
326	265	188	58.3
327	266	190	58.3

328	267	190	58.25
329	268	188	58.1
330	269	186	58.05
331	270	184	58.05
332	271	186	58.2
333	272	184	58.25
334	273	186	58.25
335	274	186	58.2
344	283	182	58.1
345	284	179	57.95
346	285	180	58
347	286	180	58.1
348	287	180	58.15
349	288	180	58.15
350	289	180	58.15
351	290	182	58.1
360	299	180	57.8
361	300	177	57.8
362	301	177	57.85
363	302	177	57.95
364	303	175	58
365	304	180	58
366	305	180	57.95
367	306	180	57.9
376	315	180	57.7
377	316	180	57.8
378	317	180	57.85
379	318	182	57.85
380	319	182	57.8
381	320	180	57.7
382	321	180	57.65
383	322	178	57.6
392	331	176	57.65
393	332	178	57.75
394	333	178	57.75
395	334	180	57.75
396	335	180	57.7
397	336	180	57.55
398	337	178	57.5
399	338	178	57.5
408	347	176	57.55
409	348	178	57.6
410	349	178	57.55
411	350	180	57.55
412	351	180	57.55
413	352	178	57.4
414	353	175	57.4

415	354	175	57.5
336	275	188	58.2
337	276	185	58
338	277	184	57.95
339	278	182	58
340	279	182	58.1
341	280	182	58.2
342	281	184	58.2
343	282	184	58.15
352	291	179	58
353	292	180	57.9
354	293	179	57.95
355	294	177	57.95
356	295	177	58.05
357	296	179	58.05
358	297	181	58.05
359	298	181	57.85
368	307	180	57.8
369	308	178	57.75
370	309	180	57.9
371	310	180	57.95
372	311	180	57.95
373	312	182	57.9
374	313	180	57.75
375	314	180	57.7
384	323	180	57.65
385	324	178	57.7
386	325	183	57.75
387	326	180	57.8
388	327	180	57.75
389	328	180	57.7
390	329	178	57.6
391	330	176	57.55
400	339	178	57.55
401	340	180	57.55
402	341	180	57.55
403	342	180	57.6
404	343	180	57.5
405	344	178	57.45
406	345	176	57.45
407	346	176	57.5
416	355	173	57.55
417	356	175	57.5
418	357	180	57.45
419	358	182	57.35
420	359	181	57.3
421	360	180	57.4

RecNum	TestTime	StkTemp	Scale
0	0	0	0
1	1	109	34.5
2	2	126	34.45
3	3	147	34.45
4	4	171	34.35
5	5	192	34.4
6	6	216	34.4
7	7	235	34.2
8	8	251	34.15
9	9	264	34.2
10	10	275	34.1
11	11	279	34.05
12	12	290	34.2
13	13	296	34.1
14	14	299	34
15	15	303	34.05
16	16	307	34.1
17	17	310	34
18	18	310	34.05
19	19	317	34
20	20	318	33.9
21	21	323	33.95
22	22	327	33.8
23	23	334	33.8
24	24	336	33.75
25	25	342	33.75
26	26	347	33.65
27	27	351	33.6
28	28	355	33.5
29	29	362	33.5
30	30	364	33.5
31	31	369	33.5
32	32	370	33.4
33	33	373	33.4
34	34	375	33.35
35	35	379	33.3
36	36	382	33.2
37	37	382	33.2
38	38	384	33.2
39	39	386	33.35
40	40	389	33.25
41	41	389	33.25
42	42	391	33.15
43	43	391	33.1
44	44	393	33.1
45	45	393	33.05

46	46	395	32.95
47	47	395	32.95
48	48	397	32.85
49	49	400	32.95
50	50	399	32.95
51	51	402	32.8
52	52	404	32.8
53	53	406	32.85
54	54	406	32.7
55	55	408	32.45
56	56	409	32.45
57	57	408	32.5
58	58	408	32.4
59	59	411	32.45
60	60	409	32.4
61	61	411	32.4
62	62	411	32.45
63	63	411	32.45
64	64	413	32.45
65	0	413	32.35
66	1	415	36.7
67	2	415	36.7
68	3	415	36.65
69	4	416	36.65
70	5	416	36.6
71	6	416	36.45
72	7	418	36.35
73	8	416	36.25
74	9	416	36.25
75	10	418	36.3
76	11	416	36.35
77	12	416	36.25
78	13	416	36.1
79	14	418	36.1
80	15	416	36.1
81	16	416	36.15
82	17	416	36.2
83	18	418	36.05
84	19	418	36.05
85	20	415	36.05
86	21	418	35.95
87	22	417	35.9
88	23	416	35.85
89	24	418	35.75
90	25	418	35.6
91	26	418	35.6
92	27	418	35.7

93	28	418	35.55
94	29	419	35.55
95	30	418	35.55
96	31	418	35.45
97	32	420	35.55
98	33	419	35.5
99	34	419	35.55
100	35	421	35.4
101	36	421	35.3
102	37	421	35.35
103	38	421	35.25
104	39	421	35.2
105	40	421	35.1
106	41	419	35.05
107	42	419	34.95
108	43	421	35.05
109	44	419	34.85
110	45	419	34.8
111	46	419	34.75
112	47	419	34.75
113	48	419	34.75
114	49	422	34.8
115	50	422	34.6
116	51	421	34.6
117	52	421	34.5
118	53	421	34.55
119	54	422	34.45
120	55	424	34.35
121	56	424	34.45
122	57	424	34.3
123	58	424	34.1
124	59	424	34.15
125	60	424	34.1
126	61	422	35
127	62	424	34.1
128	63	424	34.1
129	64	424	34.05
130	65	424	33.85
131	66	424	33.8
132	67	424	33.75
133	68	422	33.8
134	69	420	33.75
135	70	418	33.75
136	71	418	33.7
137	72	416	33.95
138	73	414	33.9
139	74	412	33.95

140	75	407	33.6
141	76	407	33.85
142	77	405	33.7
143	78	403	33.8
144	79	401	33.75
145	80	401	33.75
146	81	399	33.65
147	82	396	33.5
148	83	394	33.6
149	84	394	33.55
150	85	393	33.6
151	86	390	33.3
152	87	388	33.35
153	88	388	33.25
154	89	390	33.35
155	90	388	33.3
156	91	388	33.4
157	92	386	33
158	93	386	33.05
159	94	386	33.05
160	95	386	33.1
161	96	386	33.05
162	97	386	33
163	98	384	32.95
164	99	384	32.8
165	100	382	32.85
166	101	382	32.8
167	102	380	32.9
168	103	380	32.75
169	104	380	32.9
170	105	378	32.85
171	106	378	32.7
172	107	378	32.8
173	108	375	32.6
174	109	375	32.75
175	110	373	32.6
176	111	375	32.75
177	112	375	32.75
178	113	373	32.6
179	114	375	32.55
180	115	371	32.45
181	116	373	32.6
182	117	371	32.5
183	118	373	32.55
184	119	374	32.55
185	120	374	32.35
186	121	373	32.25

187	122	371	32.25
188	123	371	32.4
189	124	369	32.5
190	125	370	32.45
191	126	369	32.5
192	127	369	32.4
193	128	369	32.25
194	129	369	32.15
195	130	369	32.2
196	131	369	32.05
197	132	369	32.05
198	133	367	31.85
199	134	369	32
200	135	367	32.05
201	136	369	32
202	137	371	32.2
203	138	367	31.85
204	139	369	31.8
205	140	367	31.7
206	141	369	31.85
207	142	370	31.8
216	151	370	31.75
217	152	370	31.7
218	153	372	31.7
219	154	370	31.35
220	155	368	31.3
221	156	368	31.5
222	157	370	31.25
223	158	368	31.4
232	167	370	31.15
233	168	368	30.95
234	169	368	30.95
235	170	368	31
236	171	368	30.8
237	172	368	31.15
238	173	366	31
239	174	366	30.95
248	183	368	30.7
249	184	368	30.7
250	185	364	30.5
251	186	364	30.6
252	187	366	30.65
253	188	364	30.65
254	189	366	30.85
255	190	364	30.7
264	199	362	30.25
265	200	360	30.2

266	201	362	30.25
267	202	360	30.4
268	203	360	30.3
269	204	362	30.4
270	205	358	30.25
271	206	358	30.1
280	215	356	30.1
281	216	355	29.85
282	217	357	30
283	218	357	29.9
284	219	359	29.85
285	220	356	29.8
286	221	356	29.65
287	222	359	29.9
296	231	357	29.4
297	232	357	29.35
298	233	357	29.3
299	234	356	29.55
300	235	358	29.6
301	236	356	29.35
302	237	356	29.45
303	238	356	29.35
312	247	350	29.1
313	248	352	29.3
314	249	350	29.1
315	250	350	29.25
316	251	350	29.15
317	252	350	29
318	253	350	29.05
319	254	348	29.05
208	143	370	31.6
209	144	369	31.75
210	145	367	31.6
211	146	370	31.8
212	147	367	31.7
213	148	370	31.75
214	149	367	31.85
215	150	368	31.7
224	159	368	31.15
225	160	368	31.4
226	161	368	31.35
227	162	368	31.4
228	163	368	31.5
229	164	366	31.2
230	165	368	31.45
231	166	368	31.1
240	175	366	30.9

241	176	364	30.75
242	177	366	30.9
243	178	366	30.85
244	179	366	31
245	180	366	30.9
246	181	366	30.9
247	182	368	30.75
256	191	364	30.65
257	192	364	30.7
258	193	362	30.55
259	194	362	30.7
260	195	360	30.6
261	196	362	30.6
262	197	362	30.55
263	198	362	30.3
272	207	358	30.3
273	208	356	29.95
274	209	358	30.1
275	210	358	30.15
276	211	356	30.05
277	212	356	30.25
278	213	356	30.1
279	214	356	30.15
288	223	359	29.7
289	224	359	29.6
290	225	359	29.5
291	226	358	29.45
292	227	358	29.4
293	228	355	29.4
294	229	355	29.5
295	230	357	29.55
304	239	354	29.15
305	240	353	29.35
306	241	353	29.3
307	242	353	29.1
308	243	355	29.3
309	244	353	29.05
310	245	350	29.05
311	246	350	29.2
320	255	347	28.9
321	256	348	29
322	257	343	28.9
323	258	345	28.8
324	259	345	29.05
325	260	343	28.85
326	261	343	28.9
327	262	345	29

328	263	342	28.8
329	264	342	28.9
330	265	345	28.85
331	266	345	28.5
332	267	344	28.6
333	268	344	28.5
334	269	344	28.4
335	270	342	28.65
344	279	344	28.35
345	280	341	28.15
346	281	341	28.25
347	282	341	28.2
348	283	339	28.15
349	284	341	28.35
350	285	341	28.15
351	286	339	28.1
360	295	338	28.1
361	296	338	28.05
362	297	338	27.9
363	298	338	28
364	299	336	27.9
365	300	336	27.95
366	301	338	28.05
367	302	338	28
376	311	340	27.6
377	312	342	27.8
378	313	345	27.7
379	314	341	27.5
380	315	345	27.65
381	316	345	27.6
382	317	343	27.5
383	318	346	27.6
392	327	349	27.35
393	328	349	27.25
394	329	351	27.3
395	330	349	27.15
396	331	349	27
397	332	351	27
398	333	347	26.9
399	334	349	27.05
408	343	343	27.1
409	344	344	27.05
410	345	346	27.1
411	346	346	26.95
412	347	343	26.8
413	348	346	26.9
414	349	346	26.95

415	350	344	26.65
424	359	349	26.75
425	360	349	26.6
336	271	342	28.55
337	272	341	28.45
338	273	344	28.6
339	274	341	28.5
340	275	341	28.4
341	276	344	28.6
342	277	341	28.4
343	278	341	28.3
352	287	341	28.3
353	288	341	28.1
354	289	341	28
355	290	341	28
356	291	338	27.9
357	292	340	27.9
358	293	341	27.95
359	294	336	27.9
368	303	336	28.1
369	304	338	28.05
370	305	336	27.95
371	306	337	28
372	307	339	27.95
373	308	339	27.85
374	309	342	27.85
375	310	342	27.75
384	319	344	27.5
385	320	346	27.4
386	321	348	27.6
387	322	346	27.4
388	323	348	27.35
389	324	348	27.5
390	325	348	27.3
391	326	349	27.25
400	335	352	27.15
401	336	347	26.95
402	337	350	27.1
403	338	350	26.9
404	339	347	26.85
405	340	348	27.05
406	341	345	27
407	342	341	27
416	351	346	26.7
417	352	346	26.65
418	353	346	26.6
419	354	348	26.65

420	355	348	26.65
421	356	348	26.7
422	357	348	26.7
423	358	346	26.6

RecNum	TestTime	StkTemp	Scale
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1	1	55	27.5
2	2	55	27.5
3	3	57	27.5
4	4	57	27.55
5	5	59	27.55
6	6	69	27.45
7	7	78	27.25
8	8	86	27.25
9	9	99	27.25
10	10	110	27.2
11	11	116	27.2
12	12	124	27.15
13	13	133	27.15
14	14	142	27.15
15	15	148	27.15
16	16	154	27.15
17	17	156	27.1
18	18	159	27.15
19	19	162	27.2
20	20	167	27.15
21	21	171	27.05
22	22	173	27.05
23	23	178	27.05
24	24	182	27
25	25	186	26.95
26	26	193	27
27	27	197	26.9
28	28	201	26.9
29	29	206	26.85
30	30	210	26.8
31	31	212	26.8
32	32	218	26.75
33	33	221	26.7
34	34	225	26.7
35	35	228	26.65
36	36	230	26.6
37	37	232	26.6
38	38	234	26.55
39	39	236	26.5
40	40	238	26.5
41	41	241	26.45
42	42	241	26.4
43	43	243	26.4
44	44	245	26.35
45	45	245	26.35

46	46	247	26.3
47	47	247	26.25
48	48	249	26.25
49	49	250	26.2
50	50	250	26.2
51	51	252	26.15
52	52	252	26.15
53	53	252	26.05
54	54	252	26
55	55	252	26
56	56	254	25.95
57	57	254	25.9
58	58	255	25.9
59	59	254	25.85
60	60	257	25.8
61	61	257	25.8
62	62	259	25.75
63	63	257	25.7
64	64	259	25.7
65	65	259	25.65
66	66	259	25.65
67	0	259	25.55
68	1	261	30.1
69	2	261	30.05
70	3	261	30
71	4	261	30
72	5	261	30
73	6	262	29.95
74	7	262	29.95
75	8	262	29.9
76	9	261	29.85
77	10	262	29.8
78	11	261	29.8
79	12	259	29.75
80	13	259	29.7
81	14	262	29.65
82	15	262	29.65
83	16	262	29.6
84	17	262	29.55
85	18	262	29.55
86	19	262	29.5
87	20	264	29.45
88	21	264	29.4
89	22	264	29.4
90	23	264	29.4
91	24	262	29.35
92	25	264	29.35

93	26	265	29.3
94	27	265	29.25
95	28	262	29.2
96	29	264	29.2
97	30	263	29.15
98	31	265	29.1
99	32	262	29.1
100	33	265	29.05
101	34	263	29
102	35	263	29
103	36	263	29
104	37	6031	28.95
105	38	256	28.85
106	39	293	28.8
107	40	303	28.8
108	41	306	28.8
109	42	306	28.75
110	43	306	28.7
111	44	306	28.65
112	45	306	28.6
113	46	304	28.55
114	47	304	28.5
115	48	304	28.5
116	49	304	28.45
117	50	304	28.4
118	51	304	28.35
119	52	304	28.35
120	53	304	28.3
121	54	302	28.25
122	55	302	28.25
123	56	307	28.2
124	57	302	28.15
125	58	303	28.1
126	59	300	28.1
127	60	301	28.05
128	61	301	28.05
129	62	300	27.95
130	63	298	27.9
131	64	301	27.9
132	65	301	27.85
133	66	301	27.85
134	67	303	27.75
135	68	301	27.75
136	69	305	27.8
137	70	303	27.8
138	71	299	27.8
139	72	299	27.8

140	73	299	27.75
141	74	295	27.75
142	75	293	27.75
143	76	288	27.75
144	77	288	27.75
145	78	284	27.7
146	79	284	27.7
147	80	280	27.7
148	81	278	27.7
149	82	280	27.65
150	83	276	27.65
151	84	273	27.6
152	85	271	27.6
153	86	271	27.6
154	87	272	27.6
155	88	267	27.55
156	89	265	27.5
157	90	268	27.5
158	91	265	27.5
159	92	265	27.5
160	93	265	27.4
161	94	263	27.5
162	95	263	27.45
163	96	263	27.4
164	97	263	27.35
165	98	263	27.35
166	99	261	27.35
167	100	261	27.4
168	101	259	27.35
169	102	259	27.3
170	103	259	27.25
171	104	257	27.25
172	105	257	27.3
173	106	257	27.3
174	107	257	27.25
175	108	258	27.25
176	109	253	27.25
177	110	253	27.25
178	111	255	27.25
179	112	255	27.2
180	113	253	27.15
181	114	253	27.2
182	115	253	27.15
183	116	253	27.15
184	117	253	27.15
185	118	254	27.1
186	119	251	27.1

187	120	254	27.1
188	121	252	27.05
189	122	251	27.05
190	123	251	27.05
191	124	251	27
192	125	251	27
193	126	251	27
194	127	251	27
195	128	251	26.95
196	129	249	26.95
197	130	249	26.95
198	131	251	26.95
199	132	251	26.9
200	133	249	26.95
201	134	249	26.9
202	135	247	26.9
203	136	247	26.85
204	137	249	26.85
205	138	249	26.85
206	139	247	26.8
207	140	247	26.85
208	141	247	26.8
209	142	249	26.75
210	143	247	26.75
211	144	247	26.8
212	145	247	26.75
213	146	247	26.75
222	155	248	26.6
223	156	250	26.6
224	157	252	26.6
225	158	252	26.55
226	159	250	26.55
227	160	248	26.6
228	161	250	26.55
229	162	250	26.55
238	171	251	26.45
239	172	253	26.4
240	173	253	26.35
241	174	253	26.35
242	175	251	26.35
243	176	251	26.35
244	177	251	26.35
245	178	253	26.3
254	187	245	26.25
255	188	243	26.25
256	189	245	26.2
257	190	245	26.2

258	191	245	26.15
259	192	241	26.15
260	193	239	26.2
261	194	236	26.15
270	203	237	26.1
271	204	239	26.05
272	205	239	26.05
273	206	235	26
274	207	233	26.05
275	208	231	26.05
276	209	231	26
277	210	233	25.95
286	219	229	25.85
287	220	227	25.85
288	221	225	25.9
289	222	223	25.9
290	223	223	25.9
291	224	225	25.85
292	225	225	25.85
293	226	228	25.8
302	235	221	25.8
303	236	222	25.75
304	237	219	25.75
305	238	224	25.75
306	239	226	25.7
307	240	228	25.65
308	241	226	25.6
309	242	224	25.7
318	251	222	25.6
319	252	222	25.55
320	253	222	25.55
321	254	224	25.55
322	255	222	25.5
323	256	220	25.6
324	257	218	25.6
325	258	220	25.55
214	147	247	26.75
215	148	247	26.7
216	149	245	26.7
217	150	245	26.7
218	151	247	26.7
219	152	248	26.65
220	153	248	26.65
221	154	245	26.65
230	163	250	26.5
231	164	250	26.5
232	165	254	26.5

233	166	250	26.5
234	167	250	26.5
235	168	252	26.45
236	169	250	26.4
237	170	248	26.45
246	179	253	26.3
247	180	251	26.3
248	181	251	26.3
249	182	249	26.3
250	183	251	26.25
251	184	251	26.2
252	185	249	26.2
253	186	245	26.25
262	195	241	26.15
263	196	241	26.15
264	197	241	26.1
265	198	241	26.1
266	199	237	26.1
267	200	235	26.1
268	201	234	26.1
269	202	234	26.1
278	211	233	25.95
279	212	233	25.95
280	213	231	25.95
281	214	229	26
282	215	231	25.95
283	216	231	25.95
284	217	229	25.9
285	218	229	25.9
294	227	228	25.8
295	228	223	25.85
296	229	221	25.85
297	230	223	25.8
298	231	226	25.75
299	232	228	25.7
300	233	228	25.75
301	234	226	25.75
310	243	222	25.7
311	244	222	25.7
312	245	224	25.65
313	246	226	25.6
314	247	226	25.6
315	248	226	25.6
316	249	222	25.65
317	250	219	25.65
326	259	221	25.5
327	260	223	25.5

328	261	223	25.45
329	262	225	25.45
330	263	218	25.5
331	264	216	25.5
332	265	218	25.5
333	266	221	25.45
334	267	223	25.4
335	268	223	25.4
336	269	223	25.4
337	270	216	25.45
338	271	216	25.45
339	272	217	25.45
340	273	219	25.4
341	274	221	25.35
350	283	219	25.3
351	284	217	25.3
352	285	215	25.3
353	286	217	25.3
354	287	219	25.25
355	288	221	25.2
356	289	224	25.2
357	290	222	25.2
366	299	213	25.2
367	300	213	25.2
368	301	213	25.1
369	302	218	25.05
370	303	218	25.05
371	304	215	25.05
372	305	214	25.15
373	306	212	25.15
382	315	214	25.05
383	316	216	24.95
384	317	217	24.95
385	318	216	24.95
386	319	212	25
387	320	208	25
388	321	210	25
389	322	212	24.95
398	331	214	24.8
399	332	217	24.8
400	333	213	24.8
401	334	208	24.9
402	335	211	24.9
403	336	215	24.85
404	337	217	24.75
405	338	220	24.75
414	347	211	24.75

415	348	211	24.75
416	349	211	24.75
417	350	214	24.7
418	351	215	24.65
419	352	216	24.6
420	353	216	24.6
421	354	211	24.7
342	275	223	25.35
343	276	221	25.35
344	277	217	25.35
345	278	217	25.35
346	279	217	25.35
347	280	219	25.3
348	281	219	25.25
349	282	222	25.25
358	291	217	25.25
359	292	215	25.25
360	293	215	25.25
361	294	217	25.2
362	295	217	25.15
363	296	219	25.15
364	297	219	25.1
365	298	215	25.2
374	307	212	25.1
375	308	214	25.1
376	309	216	25.05
377	310	218	25
378	311	216	25
379	312	212	25.1
380	313	212	25.05
381	314	210	25.05
390	323	214	24.9
391	324	214	24.85
392	325	214	24.9
393	326	212	25
394	327	206	24.95
395	328	208	24.95
396	329	210	24.9
397	330	214	24.85
406	339	217	24.75
407	340	211	24.85
408	341	211	24.85
409	342	211	24.85
410	343	213	24.75
411	344	216	24.7
412	345	216	24.7
413	346	215	24.75

422	355	209	24.75
423	356	211	24.7
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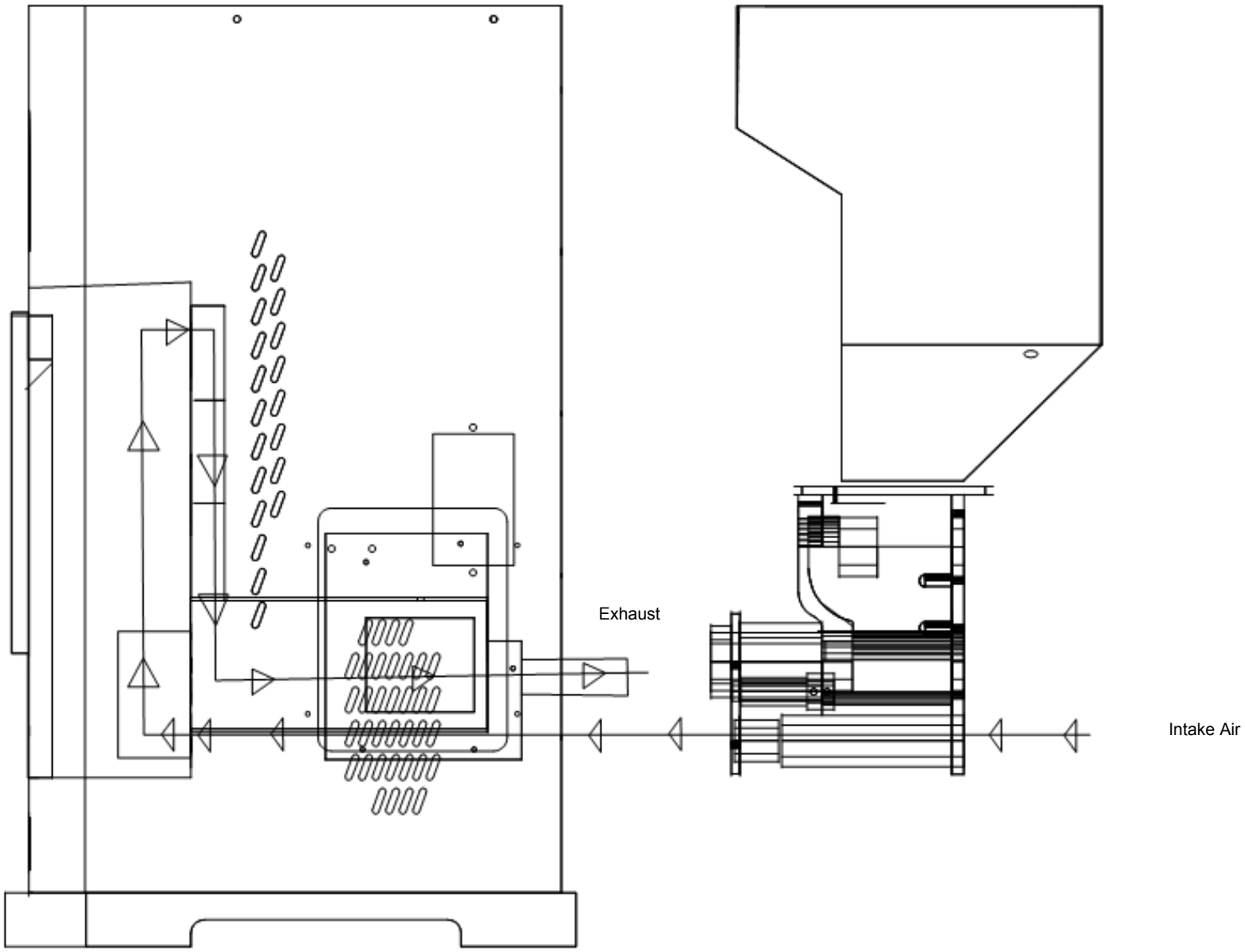
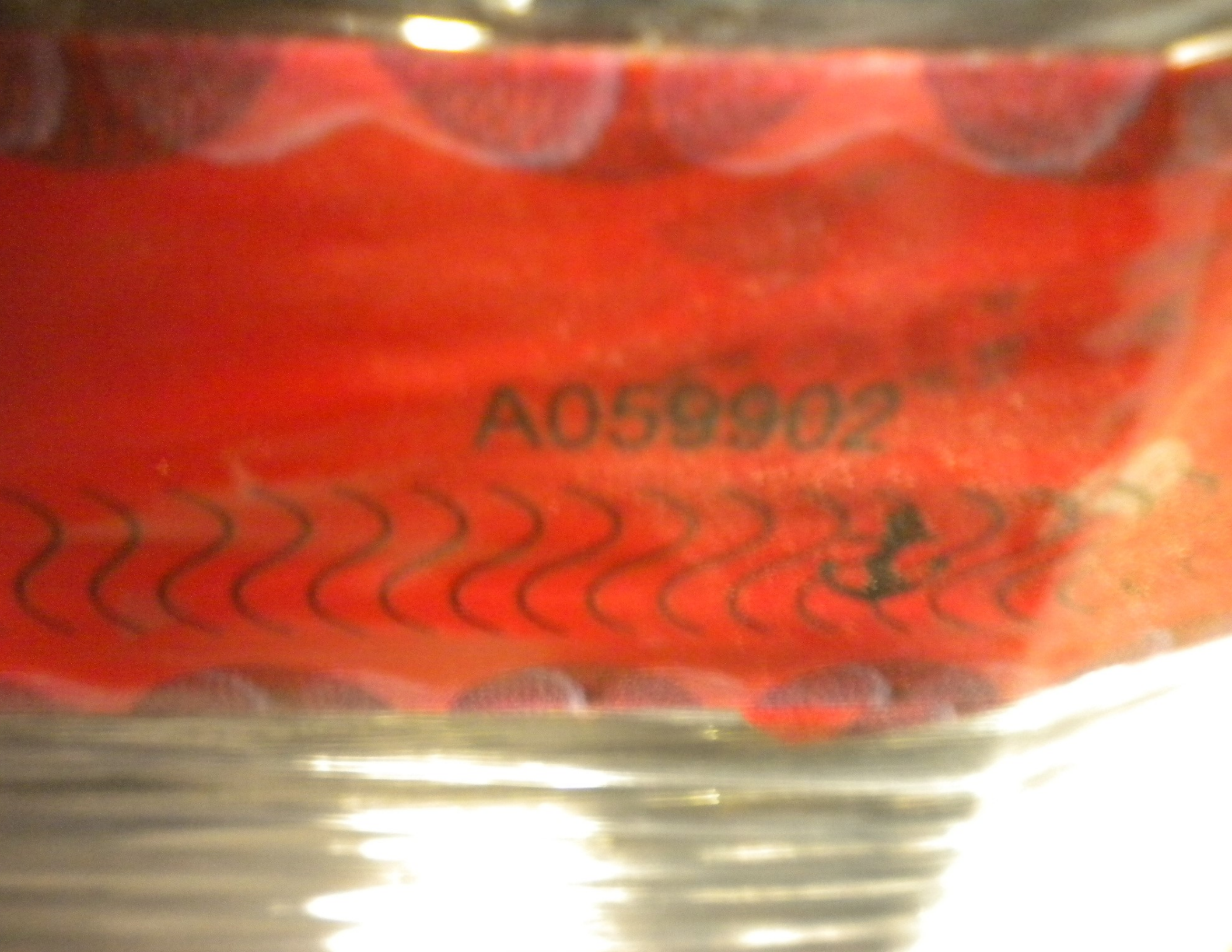
425	358	211	24.6
426	359	213	24.6
427	360	213	24.55

Airflow Diagram for 25-CAB80




G-103348204
3/1/18
ASTM E 2779
Run 1
RICE LAKE RoughDeck
FUEL PELLETS
MARTH
100% Renewable
Wood Resource
Net Wt. 40 LB / 18.1 kg
Marth Wood Fuel Pellets


M
A059869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