

Certificate of Conformity

Emissions – Pellet burning heater

EPA 40 CFR Part 60, Subpart AAA, ASTM E2779-10, ASTM E2515-11, CSA B415.1-2010

Certificate number: WHI19 – 208507007

This is a certificate of conformity to certify that the bearer has successfully completed the requirements of the above scheme which include the testing of products, the initial assessment, and are subject to continuing annual assessments of their compliance and testing of samples of products taken from production (as applicable to the scheme) and has been registered within the scheme for the products detailed.

Organization:

Company Name: England's Stove Works, Inc.

Address: 589 S. Five Forks Road

City, State: Monroe, VA

Zip Code: 24574

Country: USA

Product: 25-CBEP, 55-SHPCBEP, 55-TRPCBEP

Maximum Output: 15,000 Btu/hour

Weighted Average Emissions Rate: 1.030 g/hr

Weighted Average Efficiency: 63.0%

Test Fuel Type: Premium Grade Wood Pellets

Compliance: Certified to comply with 2020 particulate emissions standard.

Report Number: 103536876MID-001

Certification body: Intertek Testing Services NA, Inc.

Initial registration: January 3, 2019

Date of expiry: NA

Issue status: 1

Charles Meyers
Certification Manager


Signature

1/3/2019
Date

Registered address:
Intertek Testing Services NA, Inc. 545 E. Algonquin Rd. Arlington Heights, IL 60005 USA

www.intertek.com

The certificate and schedule are held in force by regular annual surveillance visits by Intertek Testing Services NA, Inc. and the reader or user should contact Intertek to validate its status. This certificate remains the property of Intertek Testing Services NA, Inc. and must be returned to them on demand. This Certificate is for the exclusive use of Intertek's Client and is provided pursuant to the Certification agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this certificate. Only the Client is authorized to permit copying or distribution of this certificate and then only in its entirety. Use of Intertek's Certification mark is restricted to the conditions laid out in the agreement. Any further use of the Intertek name for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. Initial Factory Assessments and Follow up Services are for the purpose of assuring appropriate usage of the Certification mark in accordance with the agreement, they are not for the purposes of production quality control and do not relieve the Client of their obligations in this respect.

ENGLAND STOVE WORKS, INC. TEST REPORT

SCOPE OF WORK

EPA EMISSIONS TESTING FOR MODEL 25-CBEP

REPORT NUMBER

103536876MID-001

TEST DATE(S)

11/05/18

ISSUE DATE

11/12/18

[REVISED DATE]

PAGES

23

DOCUMENT CONTROL NUMBER

GFT-OP-10c (05/10/17)

© 2017 INTERTEK



TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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 25-CBEP, 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: 1.030 g/hr

Carbon Monoxide Emissions: 0.017 g/min

Heating Efficiency: 63.0 % (Higher Heating Value Basis)

For INTERTEK B&C:

COMPLETED

BY:

Ken Slater

TITLE:

Associate Engineer –
Hearth

SIGNATURE:



DATE:

11/12/18

aaa:bbb

REVIEWED BY:

Brian Ziegler

TITLE:

Technical Team Leader -
Hearth

SIGNATURE:



DATE:

11/12/18

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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 11/5/18 and was shipped via the client. The unit was assigned sample ID # MID1811050827-001. 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 10 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 a signed document is included in the final report. The unit was found to be operating satisfactory during this break-in. The 10 plus hours of pre-burning were conducted on 11/2/18. 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 11/5/18 the unit was set-up for testing.

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

SECTION 5 EQUIPMENT

Equipment	INV Number	Calibration Due	MU
Platform Scale	008	4/10/19	$\pm 27\text{g}$
Balance	713	4/10/19	0.47mg
Data Logger	986	4/10/19	0.33°F
Scale	1134	4/10/19	$\pm 27\text{g}$
Timer	1212	4/4/19	$\pm 0.3\text{ sec}$
Timer	1213	4/4/19	$\pm 0.3\text{ sec}$
Flow Meter	1413	2/8/19	$\pm 17\text{mL/min}$
Flow Meter	1414	2/8/19	$\pm 17\text{mL/min}$
Barometer	1420	4/9/19	0.24°F, 1.7%RH, 0.011 in Hg
DGM	1210	1/2/19	0.009925 ft ³

SECTION 6 LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Ken Slater	Intertek B&C
Michael Speight	England Stoves
John Wray	England Stoves

SECTION 7 TEST PROCEDURE

On 11/5/18, 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.

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

TEST SET-UP DESCRIPTION

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 single 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. The pellets have a measured heating value of 8528 Btu/hr (19836 kJ/kg) and a moisture content of 5.04% on a dry basis and 4.79% 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 \pm 6 inches above the scale platform. (See Figure 2.)

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

FIGURE 1 – DILUTION TUNNEL

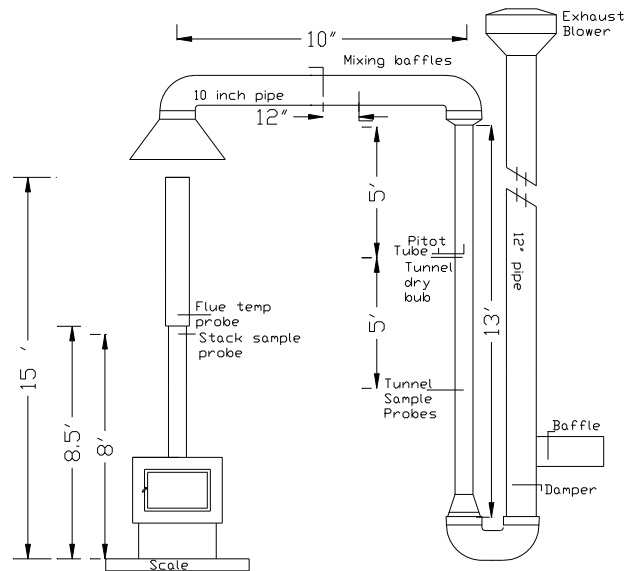
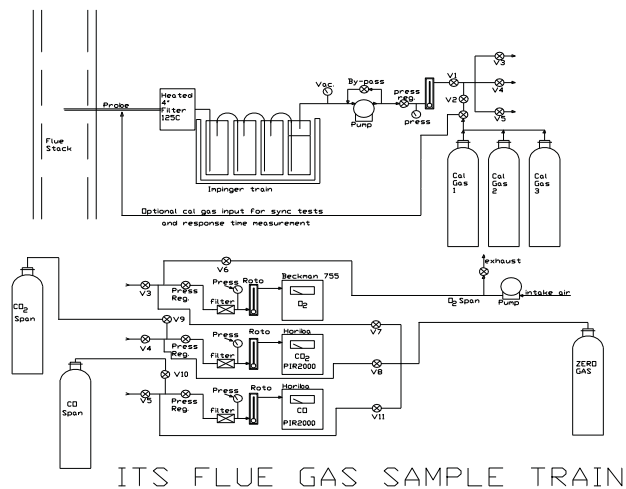


FIGURE 1

FIGURE 2 – STACK GAS SAMPLE TRAIN



ITS FLUE GAS SAMPLE TRAIN

FIGURE 2

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

FIGURE 3 – DILUTION TUNNEL SAMPLE SYSTEMS

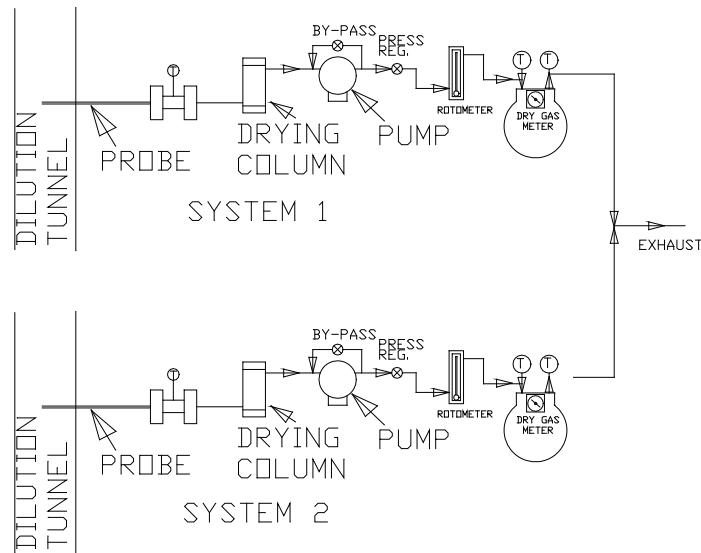


Figure 3

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.

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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 ft³, the resolution is .1%, giving an accuracy higher than the $\pm 2\%$ 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.

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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).

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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.

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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, $34.97 \frac{m}{sec} \left[\frac{\left(\frac{g}{g} \cdot mole \right) (mm\ Hg)}{(K)(mm\ water)} \right]^{\frac{1}{2}}$

or

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

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.

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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

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).

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

T_{si} = 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} = $V_m - (L_p - L_a)u$

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.

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

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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

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

$$K_2 = 0.001 \text{ g/mg}$$

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

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

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

GENERAL FORMULA – ASTM E2515

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

Where:

$\delta Y / \delta x_i$ = Partial derivative of the combining formula with respect to individual measurement x_i ,

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

$$c_s = F_c / (Q_{sample} \times \theta) = 0.025 / (0.25 \times 180) = 0.0005555$$

$$\delta c_s / \delta F_c = 1 / Q_{sample} \cdot \theta = 1 / 0.25 \cdot 180 = 0.0222$$

$$\delta c_s / \delta Q_{sample} = -F_c / Q_{sample}^2 \cdot \theta = -0.025 / 0.25^2 \cdot 180 = -0.00222$$

$$\delta c_s / \delta \theta = -F_c / Q_{sample} \cdot \theta^2 = -0.025 / 0.25 \cdot 180^2 = -0.000003$$

$$MU_{c_s} = \sqrt{(0.00027 \cdot 0.0222)^2 + (0.0025 \cdot -0.00222)^2}$$

$$\sqrt{+ (0.1 \cdot -0.000003)^2} = 0.0000091g$$

Thus, c_s would be 0.555 mg/dscf \pm 0.0081 mg/dscf at 95% confidence level.

MU OF c_r

$$c_r = BG_c / (Q_{BG} \times \theta) = 0.002 / (0.15 \times 180) = 0.000074$$

$$\delta c_r / \delta BG_c = 1 / Q_{BG} \cdot \theta = 1 / 0.15 \cdot 180 = 0.03704$$

$$\delta c_r / \delta Q_{BG} = -BG_c / Q_{BG}^2 \cdot \theta = -0.002 / 0.15^2 \cdot 180 = -0.0004938$$

$$\delta c_r / \delta \theta = -BG_c / Q_{BG} \cdot \theta^2 = -0.002 / 0.15 \cdot 180^2 = -0.0000004$$

$$MU_{c_r} = \sqrt{(0.00027 \cdot 0.03704)^2 + (0.0015 \cdot -0.0004938)^2}$$

$$\sqrt{+ (0.1 \cdot -0.0000004)^2} = 0.00001g$$

Thus, c_r would be 0.074 mg/dscf \pm 0.01 mg/dscf at 95% confidence level.

E_T AND MU_{ET}

$$E_T = (c_s - c_r) Q_{std} \theta = (0.000555 - 0.000074) \times 150 \times 180 = 13.00g$$

$$\delta E_T / \delta c_s = Q_{std} \cdot \theta = 150 \cdot 180 = 27,000$$

$$\delta E_T / \delta c_r = Q_{std} \cdot \theta = 150 \cdot 180 = 27,000$$

$$\delta E_T / \delta Q_{std} = c_s \cdot \theta - c_r \cdot \theta = 0.000555 \cdot 180 - 0.000074 \cdot 180 = 0.08667$$

$$\delta E_T / \delta \theta = c_s \cdot Q_{std} - c_r \cdot Q_{std} = 0.000555 \cdot 180 - 0.000074 \cdot 180 = 0.07222$$

$$MU_{ET} = \sqrt{(27,000 \cdot 0.0000081)^2 + (27,000 \cdot 0.00001)^2 + (0.08667 \cdot 3)^2}$$

$$\sqrt{+ (0.07222 \cdot 0.1)^2} = 0.436$$

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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:

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

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:
 $\text{m/s}[\text{g/g mole (mm Hg)/(K)(mm H}_2\text{O)}]^{0.5}$

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

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

The mass flow rate shall be calculated as follows:

$$m = 3600VA\rho$$

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

ρ = 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:

E_t = 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:

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

Where:

E_d = heat output over a burn, kJ/h (Btu/h)

E_t = heat output during each time interval, kJ/h (Btu/h)

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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-CBEP Pellet Fuel Room Heater is constructed of sheet steel. The outer dimensions are 25-inches deep, 30.75-inches high, and 25-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 (11/5/18): The test for pellet heaters is a continuous test with three separate burn rates. At 8:30am the unit was started and operated for a minimum of 1 hour for the pretest operation. At 10:06am the unit was set to the maximum feed rate (level M9) with a burn rate of 1.46 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 11:06am, the system #3 sampling filter was changed out and the unit was set to ≤50% feed rate (level M3) with a burn rate of 1.02 kg/hr. At 1:06am, the heater was changed to the minimum feed rate (level M1) with a burn rate of 0.64 kg/hr. At 4:06pm, testing was completed. The total burn time was 360 minutes.

TABLE 1 – EMISSIONS

RUN#	TEST DATE	BURN RATES (kg/hr)(Dry)		PARTICULATE EMISSION RATE (g/hr)	1 st HOUR EMISSIONS (g)	CO EMISSIONS (g/min)	HEATING EFFICIENCY (%HHV)
1	11/5/18	H*	1.39	1.030	1.25	0.017	63.0
		M*	0.97				
		L*	0.61				
		OA*	0.86				

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

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

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	69	68	28.85	28.73	43.0	38.0	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	18.02	191.74	550.97	81.59	81.45	7.70	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	846.06	847.52	6.51	5.85	5.39	0.123

TABLE 5 - GENERAL SUMMARY OF RESULTS

RUN #	BURN RATE (kg/hr)(dry) (OVERALL)	INITIAL DRAFT (in/H ₂ O)	RUN TIME (min)	AVERAGE DRAFT (in/H ₂ O)
1	0.900	0.028	360	0.023

TABLE 6 - CSA B415.1 RESULTS

BURN RATE (kg/hr)(dry)	CO EMISSIONS (g/min)	HEATING EFFICIENCY (% HHV)	HEAT OUTPUT (Btu/hr)
HIGH – 1.69	0.103	58.6	15,318
MEDIUM – 0.82	0.052	57.5	10,535
LOW – 0.72	0.034	69.3	7,918
OVERALL – 0.92	0.017	63.0	10,194

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

SECTION 11

CONCLUSION

This test demonstrates that the model 25-CBEP is an affected facility under the definition given in the regulation. The emission rate of 1.030 g/hr meets the EPA requirements for the Step 2 limits.

Similar models 55-SHPCBEP and 55-TRPCBEP are identical to the model 25-CBEP, therefore are deemed to be compliant with these requirements as well.

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

SECTION 12

PHOTOGRAPHS

Photo # 1 Emissions test



Photo No. 2
Start Number security tape



TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

Photo No 3

End Number security tape



Photo No. 4

Final security wrap





Total Quality. Assured.

8431 Murphy Drive
Middleton, WI 53562

Telephone: 608-836-4400
Facsimile: 608-831-9279
www.intertek.com/building

TEST REPORT FOR ENGLAND STOVE WORKS, INC.

Report No.: 103536876MID-001

Date: 11/12/18

SECTION 13

REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	11/12/18	N/A	Original Report Issue



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

MAR 13 2019

John Wray
R&D Technician
England's Stove Works, Inc.
100 West Progress Lane
Madison Heights, Virginia 24572

Re: 55-SHPCBEP, 55-TRPCBEP, and 25-CBEP Pellet Heater Models Certification Letter
Number 174-19

Dear Mr. Wray:

I am pleased to inform England's Stove Works, Inc. (England's) that the above-referenced models have been approved for certification pursuant to the 2015 New Source Performance Standard (NSPS) for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces at 40 CFR Part 60, Subpart AAA (2015 NSPS) by the United States Environmental Protection Agency (EPA). Certification under the 2015 NSPS is valid through March 21, 2024. This letter serves as your wood heater certification and no separate certification is required. Please refer to the certification letter number above in all future correspondence.

Based on a November 12, 2018 test report prepared by Intertek Building and Construction and the information provided in your January 4, 2019 application, the above-referenced models are certified as meeting the 2015 NSPS. Under the 2015 NSPS and based on Intertek Testing Services NA, Inc.'s January 3, 2019 certification of conformity, the models' emission rate of 1.0 g/hr meets the 2020 NSPS particulate matter emissions limit of 2.0 g/hr. The heat output range and overall heating efficiency for the above-referenced models are 7,918 – 15,318 BTU/hr and 63%, respectively. The carbon monoxide emission rate for this model line is 0.017 g/min.

This certification is valid for the above-referenced models and cannot be transferred to another model line without applying for certification. This certification allows England's to manufacture and sell the above-referenced models through March 21, 2024. Thereafter, England's may not manufacture, advertise for sale, offer for sale, or sell wood heaters under this certification without applying for and obtaining another compliance certification.

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

In addition, England's must comply with all applicable requirements of the regulation, including:

1. Conducting a third-party certifier-approved quality assurance program which ensures that all units within a model line are similar to the wood heater submitted for certification testing in all respects that would affect emissions and are in compliance with the applicable emission limit, pursuant to §60.533(m);
2. Applying for recertification whenever any change is made to the above-referenced models that affect or is presumed to affect the particulate matter emission rate for the model line, pursuant to §60.533(k)(1);
3. Providing an owner's manual that includes the information listed in §60.536(g)(1) with each affected wood heater model offered for sale;
4. Placing a copy of the certification test report and summary on the manufacturer's website. The test report and summary shall be available to the public within 30 days after the EPA issues a certificate of compliance, pursuant to §60.533(b)(12);
5. Submitting a report to the EPA every 2 years following issuance of a certificate of compliance for each model line. This report must include the sales for each model by state and certify that no changes in the design or manufacture of this model line have been made that require recertification under §60.533(k);
6. Retaining records and submitting reports as required at §60.537; and
7. Submitting wood heaters for audit testing if selected by the EPA under §60.533(n)(1)(i) and (2)(i).

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

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

Once EPA has verified that the full non-CBI certification test report has been posted on the manufacturer's website, the Agency will add the above-referenced models to the EPA-Certified Wood Heater List. If you have any questions concerning this letter, please contact Rafael Sanchez of my staff at (202) 564-7028 or via email at sanchez.rafael@epa.gov.

Sincerely,



Martha Segall, Acting Director
Monitoring, Assistance, and Media Programs Division
Office of Compliance

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 1 of 8

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

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 2 of 8

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.

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 3 of 8

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:

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 4 of 8

- 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, (DGM₁, DGM₂). At a convenient DGM value start stopwatch. Time for 1 minute then stop vacuum pumps. Record dry gas meter readings again, (DGM₃, DGM₄). NOTE: If rotometer ball is floating above the 5-mm mark, system is leaking too much and all seals should be checked.

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 5 of 8

- 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 $0.04 \times$ 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 $0.04 \times 0.25 = 0.010$ 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).

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 6 of 8

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 90°F anytime during the test. If the filters are approaching 90°F 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.

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 7 of 8

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.

INTERTEK/WARNOCK HERSEY
SFBA EMISSIONS AND EFFICIENCY TESTING LABORATORY
OPERATING PROCEDURES

pg. 8 of 8

- 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-C6LP

Page 1 of 3

Date 11-5-18

Job #G103536876

Run

#1

Tech

K. White
Karl White

Emissions Testing Initial Stove Check Out

Date received: 11-5-18

Carrier: client

Shipping damage? ☒ No ☐ Yes

Describe damage

If damaged, repairable? ☐ No ☐ Yes

Repairs affected by: _____ Date: _____

Client notified about
irreparable damage by: _____ Date: _____

Disposition:

Safety Certified by: _____ Safety Control# _____

Overall Unit Dimensions: High 30.75" Wide 25" Deep 25"

Comments:

m101811050327-001

Initialed: _____

Manufacturer: England Stoves

Model 25-CBEPDate 11-5-18

Job #G103536876

Run # 1Tech K. Watson
Karl Watson**EMISSIONS TESTING UNIT PREPARATION**

Unit description (check all that apply)

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

Unit received with all parts: ☐ Yes ☐ NoManual: ☐ Yes ☐ NoDrawings: ☐ Yes ☐ NoSpecifications: ☐ Yes ☐ No

Materials of construction: _____

Air introduction: _____

Control mechanism: _____

Unit net weight with all components: 191 lbs _____ Kg.

Thermocouples attached: _____ Attached by: _____ (attach T/C map)

Unit conditioned prior to test
☒ 10 hours at medium
burn rate (non-catalytic)
(attach burn log)

☐ 50 hours at medium
burn rate (attach burn log)
Date started: 11-2-18Date completed: 11-2-18

Catalyst manufacturer: _____

Serial number: _____ Dimensions: _____ Cell size: _____ cells/in.²Unit ready for testing (date): 11-5-18 Initialed: KS

Manufacturer England Stoves

Model 25 CDS

Job #G103536876

Run #1

Tech

Ref: 103536876

Page 3 of 3

Date 1-5-18

PELLET MOISTURE SHEET OVEN DRY METHOD

DATE	TIME	TARE WEIGHT OF VESSEL	GROSS WEIGHT VESSEL AND PELLETS	NET WEIGHT OF PELLETS
10-30-18	6:45 a	0.36	1.84	1.50
11-1-18	9:00 A	0.36	1.78	1.42
11-5-18	7:05 A~	0.36	1.78	1.42

MOISTURE CONTENT OF PELLETS

WET BASIS: (M_w) _____ %DRY BASIS: (M_d) _____ %

CALCULATIONS:

$$M_d = \frac{M_d}{W_d}$$

$$M_w = \frac{M_d}{W_i}$$

WHERE:

M_d = MOISTURE CONTENT ON THE DRY BASIS

M_w = WEIGHT OF MOISTURE REMOVED IN THE OVEN

M_d = MOISTURE CONTENT ON THE WET BASIS

W_d = WEIGHT OF OVEN DRY WOOD

W_i = INITIAL WEIGHT OF WOOD INCLUDING MOISTURE

Manufacturer: England Stoves
Job #: G103536876

Model: 25-CBEP
Run #1

Page 1 of 9
Date 11/5/18
Tech [Signature]

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.83 (inches Hg.) Static pressure (P_s) 265 (inches w.c.)

Inside diameter: Port A in Port B in Tunnel cross sectional area: Ft²

Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H ₂ O)	Tunnel Temperature (°F)	$\sqrt{\Delta_p}$
A-Centroid	3.00	.077		
B-Centroid	3.00	.079		
A-1	0.50	.064		
A-2	1.50	.071		
A-3	4.50	.074		
A-4	5.50	.063		
B-1	0.50	.067		
B-2	1.50	.077		
B-3	4.50	.076		
B-4	5.50	.068		
AVERAGE				

Adjustment factor application

Pitot correction .9574

Where:

C_p = Pitot tube coefficient = 0.99 for standard pitot

Δ_p = manometer reading (inches H₂O)

T_s = average absolute dilution tunnel temperature (°F + 460)

P_s = absolute dilution tunnel gas pressure or $P_{bar} + P_s$

P_s = static pressure $\frac{\text{inches H}_2\text{O}}{13.6}$

M = 28.98, wet molecular weight of stack gas (alternatively, it may be measured)

Adjustment factor for alternative Pitot tube placement:

$$V_s = K_p C_p F_r \left(\sqrt{\Delta_p} \right)_{AVG} \sqrt{\frac{T_s}{P_s M_s}} \quad V_s = K_p C_p \left(\sqrt{\Delta_p} \right)_{avg} \sqrt{\frac{T_s}{P_s M_s}} \quad F_r = \frac{\left(\sqrt{\Delta_p} \right)_{avg}}{\left(\sqrt{\Delta_p} \right)_{centroid}}$$

K_p = 32.49 Pitot tube constant (conversion factor for English units)

$\left(\sqrt{\Delta_p} \right)_{avg}$ = Average of the square roots of the velocity heads (Δ_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 H₂O)

Manufacturer: England Surveys
Job #: G103536876

Model: 25-CBEP
Run: #1

Page 2 of 9
Date: 11/5/18
Tech: Allyson

Pre/Post Checks

	Pre-Test	Post-Test	
Facility Conditions:			
Air Velocity.....	<u>0</u> fpm	<u>0</u> fpm	
Smoke Capture Check.....	<u>✓</u>	<u>✓</u>	
Wood Heater Conditions:			
Date Wood Heater Stack Cleaned.....	<u>11-5-18</u>		
Date Dilution Tunnel Cleaned.....	<u>11-5-18</u>		
Induced Draft Check.....	<u>✓</u>	<u>✓</u>	
Tunnel Velocity.....	<u>0</u>	<u>.076</u>	
Pitot Leak Check:			
Side A.....	<u>✓</u>	<u>✓</u>	
Side B.....	<u>✓</u>	<u>✓</u>	
Temperature System:			
Ambient (65°- 90°F).....		<u>7</u>	
Proportional Checks:			
CO Analyzer Drift Check.....		<u>✓</u>	
CO ₂ Analyzer Check.....		<u>✓</u>	
O ₂ Analyzer Check.....		<u>✓</u>	
Thermocouple check.....		<u>✓</u>	
Sampling Train ID Numbers:			
	Train 1	Train 2	Train 3
Probe.....	<u>1</u>	<u>2</u>	<u>3</u>
Filter Front.....	<u>A 7</u>	<u>A 9</u>	<u>A 11</u>
Filter Back.....	<u>A 8</u>	<u>A 10</u>	<u>A 12</u>
Filter Thermocouple.....			
Filter SG-3 (<90°F).....			

Manufacturer: England Stoves
Job # G103536876

Model: 25-CBEP
Run #1

Page 3 of 9
Date 11/5/18
Tech [Signature]

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	<u>25.00</u> lbs., Class F	<u>25.00</u> lbs.
Wood	<u>10.10</u> lbs., Class F	<u>10.00</u> lbs.
Analytical	<u>100.000</u> mg, Class S	<u>100.000</u> mg.

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE 30%-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%

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)	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>505.649</u>	<u>515.375</u>
Initial 1 minute DGM (ft^3)	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>505.649</u>	<u>515.375</u>
Change (C) (ft^3)	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
Check OK	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>

Leakage Checks Flue Gas Sampler

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

Manufacturer: England Stoves
Job #: G103536876

Model: ECBEP
Run: #1

Page: 5 of 9
Date: 11/5/18
Tech: [Signature]

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO ₂	<u>0</u>	0	<u>24.88</u>	24.88	<u>11.95</u>	11.99
CO	<u>0</u>	0	<u>8.976</u>	8.976	<u>3.97</u>	4.001
O ₂	<u>0</u>	0	<u>20.95</u>	20.95	<u>10.00</u>	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	<u>0.01</u>	<u>24.64</u>	<u>11.85</u>	<u>.01</u>	<u>.24</u>	<u>.10</u>	<u>✓</u>	
CO	<u>-0.04</u>	<u>8.71</u>	<u>3.66</u>	<u>.04</u>	<u>.66</u>	<u>.31</u>	<u>✓</u>	
O ₂	<u>8.04</u>	<u>20.57</u>	<u>9.96</u>	<u>.04</u>	<u>.38</u>	<u>.14</u>	<u>✓</u>	

* Greater than ± 5% of the range used.

Manufacturer: England Stoves
Job #: G103536876

Model: 25-CBEP
Run #1 _____

Page 6 of 9
Date 11/5/18
Tech _____

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2	System 3
Final (ft ³)	<u>85.64</u>	<u>85.66</u>	<u>515.357</u>
Initial (ft ³)	<u>0</u>	<u>0</u>	<u>505.649</u>

AMBIENT CONDITIONS

	Start	End
Barometer (inches Hg)	<u>28.85</u>	<u>28.73</u>
Dry Bulb (°F)	<u>69.0</u>	<u>71.9</u>
Humidity (%)	<u>43%</u>	<u>38</u>

Manufacturer: England Stoves
Job #: G100536876

Model: 25 CBGP
Run #1

Page 7 of 9
Date 11/3/18
Tech [Signature]

COMMENTS

8:30 AM, PROTEST STARTED

10:06 AM TEST STARTED

FWD IAR SET @ 9 (max)

11:06 AM - Feed rate adjusted to (3) medium

1.06 A - Feed rate Adjusted To (1) Low

Manufacturer: England Stoves
Job #: G103536876

Model: 25-CBEP
Run #1

Page 8 of 9
Date 11/5/18
Tech AMT

READING #	REAL TIME	ELAPSED TIME	DGM 1	ROTOMETER 1	DGM 2	ROTOMETER 2	DGM 3	ROTOMETER 3	DRAFT	MAX DGM PRESSURE
0	10:36	0					505.649			
1		10					507.210			
2		20					508.820			
3		30					510.445			
4		40					512.170			
5		50					513.790			
6		60					515.357			
7		70								
8		80								
9		90								
10		100								
11		110								
12		120								
13		130								
14		140								
15		150								
16		160								
17		170								
18		180								
19		190								
20		200								
21		210								
22		220								
23		230								
24		240								
25		250								
26		260								
27		270								
28		280								
29		290								
30		300								
31		310								
32		320								
33		330								
34		340								
35		350								
36		360								

Manufacturer: Grand Series

Job # GA03536876

Abstract

References

Page 9 of 9
Date 11-5-18
Tech C. Senter

DILUTION TUNNEL PARTICULATE SAMPLER DATA


THE UNIVERSITY OF CHICAGO PRESS

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
Date	Time									°F	%
11-1-18	9:00A	61 2642	7 33006	8 32910	91 5770	9 33025	10 33215	53 0411	11 33106	12 32368	
11-5-18	8:33A	91 3680	7 33005	8 32910	91 5769	9 33027	10 33215	93 0410	11 33105	12 32367	64.4 44
		Total:	6.5915	Total:	6.6239	Total:	6.5472				

[illegible]

Dry Down Weight

[illegible]

	CLIENT:	England Stoves	PERFORMED BY:	Ken Slater
	PROJECT #:	G103536876	REVIEWED BY:	
	PRODUCT:	Pellet Room Heater	MODEL:	25-CBEP
SAMPLE ID #:	MID1811050827-001		DATE:	11/5/2018
STANDARD(S):	CSA B415.1		LOCATION:	Middleton, WI
EQUIPMENT				
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
CONDITIONING				
SAMPLE CONDITIONING (IF APPLICABLE):				
AMBIENT TEMPERATURE:				

Run: 1
Test Duration: 60
Output Category: High

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	58.6%	63.1%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	59%	63.4%


Output Rate (kJ/h)	16,148	15,318	(Btu/h)
Burn Rate (kg/h)	1.39	3.06	(lb/h)
Input (kJ/h)	27,579	26,161	(Btu/h)

Test Load Weight (dry kg)	1.39	3.06	dry lb
MC wet (%)	4.79		
MC dry (%)	5.03		
Particulate (g)	6.18		
CO (g)	0		
Test Duration (h)	1.00		

Emissions	Particulate	CO
g/MJ Output	0.38	0.00
g/kg Dry Fuel	4.46	0.00
g/h	6.18	0.00
lb/MM Btu Output	0.89	0.00

0.103 g/m

Air/Fuel Ratio (A/F)	45.14
----------------------	-------

	CLIENT:	England Stoves	PERFORMED BY:	Ken Slater
	PROJECT #:	G103536876	REVIEWED BY:	
	PRODUCT:	Pellet Room Heater	MODEL:	25-CBEP
SAMPLE ID #:	MID1811050827-001		DATE:	11/5/2018
STANDARD(S):	CSA B415.1		LOCATION:	Middleton, WI
EQUIPMENT				
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
CONDITIONING				
SAMPLE CONDITIONING (IF APPLICABLE):				
AMBIENT TEMPERATURE:				

Run: 1
Test Duration: 120
Output Category: Medium

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	57.5%	61.9%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	58%	62.2%


Output Rate (kJ/h)	11,106	10,535	(Btu/h)
Burn Rate (kg/h)	0.97	2.14	(lb/h)
Input (kJ/h)	19,325	18,332	(Btu/h)

Test Load Weight (dry kg)	1.94	4.28	dry lb
MC wet (%)	4.79		
MC dry (%)	5.03		
Particulate (g)	6.18		
CO (g)	0		
Test Duration (h)	2.00		

Emissions	Particulate	CO
g/MJ Output	0.28	0.00
g/kg Dry Fuel	3.18	0.00
g/h	3.09	0.00
lb/MM Btu Output	0.65	0.00

0.052 g/m

Air/Fuel Ratio (A/F)	58.35
----------------------	-------

	CLIENT:	England Stoves	PERFORMED BY:	Ken Slater
	PROJECT #:	G103536876	REVIEWED BY:	
	PRODUCT:	Pellet Room Heater	MODEL:	25-CBEP
SAMPLE ID #:	MID1811050827-001		DATE:	11/5/2018
STANDARD(S):	CSA B415.1		LOCATION:	Middleton, WI
EQUIPMENT				
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
ASSET # - DESCRIPTION:			CALIBRATION DUE:	
CONDITIONING				
SAMPLE CONDITIONING (IF APPLICABLE):				
AMBIENT TEMPERATURE:				

Run: 1
Test Duration: 180
Output Category: Low

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	69.3%	74.6%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	70%	75.0%


Output Rate (kJ/h)	8,347	7,918	(Btu/h)
Burn Rate (kg/h)	0.61	1.33	(lb/h)
Input (kJ/h)	12,045	11,426	(Btu/h)

Test Load Weight (dry kg)	1.82	4.00	dry lb
MC wet (%)	4.79		
MC dry (%)	5.03		
Particulate (g)	6.18		
CO (g)	0		
Test Duration (h)	3.00		

Emissions	Particulate	CO
g/MJ Output	0.25	0.00
g/kg Dry Fuel	3.40	0.00
g/h	2.06	0.00
lb/MM Btu Output	0.57	0.00

0.034 g/m

Air/Fuel Ratio (A/F)	61.97
----------------------	-------

	CLIENT: England Stoves	PERFORMED BY: Ken Slater
	PROJECT #: G103536876	REVIEWED BY:
	PRODUCT: Pellet Room Heater	MODEL: 25-CBEP
SAMPLE ID #: MID1811050827-001		DATE: 11/5/2018
STANDARD(S): CSA B415.1		LOCATION: Middleton, WI
EQUIPMENT		
ASSET # - DESCRIPTION:		CALIBRATION DUE:
ASSET # - DESCRIPTION:		CALIBRATION DUE:
ASSET # - DESCRIPTION:		CALIBRATION DUE:
CONDITIONING		
SAMPLE CONDITIONING (IF APPLICABLE):		
AMBIENT TEMPERATURE:		

Run: 1
Test Duration: 360
Output Category: Overall

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis	
Overall Efficiency	63.0%	67.8%	
Combustion Efficiency	99.5%	99.5%	
Heat Transfer Efficiency	63%	68.2%	

Output Rate (kJ/h)	10,746	10,194	(Btu/h)
Burn Rate (kg/h)	0.86	1.89	(lb/h)
Input (kJ/h)	17,061	16,184	(Btu/h)

Test Load Weight (dry kg)	5.15	11.34	dry lb
MC wet (%)	4.79		
MC dry (%)	5.03		
Particulate (g)	6.18		
CO (g)	0		
Test Duration (h)	6.00		

Emissions	Particulate	CO	
g/MJ Output	0.10	0.00	
g/kg Dry Fuel	1.20	0.00	
g/h	1.03	0.00	0.017
lb/MM Btu Output	0.22	0.00	

Air/Fuel Ratio (A/F)	56.72
----------------------	-------

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

P.O. Number:

ID Number: 008



Description: SCALE
Manufacturer: GSE
Model Number: 450
Serial Number: 101722
Technician: ARMIN AHMETOVIC
On-Site Calibration: ☒
Comments:

Calibration Date: 10/10/2018
Calibration Due: 04/10/2019
Procedure: TMI-SCALES
Rev: 5/13/2014
Temperature: 68 F
Humidity: 33 % 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 17025:2017 and ANSI/NCCL Z540-1-1994. ISO/IEC 17025:2017 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 17025:2017 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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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
DLOG-4	EXTECH	42270	3/5/2018	3/5/2019
RFD-500LBSET	RICE LAKE	500LBS	5/24/2018	6/30/2019



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com



Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Scale Test Center	25.00	24.90	25.10	25.00	25.00	0.00	g	
Scale Test 90	25.00	24.90	25.10	25.00	25.00	0.00	g	
Scale Test 80	25.00	24.90	25.10	25.00	25.00	0.00	g	
Scale Test LF	25.00	24.90	25.10	25.00	25.00	0.00	g	
Scale Test LR	25.00	24.90	25.10	25.00	25.00	0.00	g	
Weight Accuracy	25.00	24.90	25.10	25.00	25.00	0.00	g	
Weight Accuracy	50.00	49.90	50.10	50.00	50.00	0.00	g	
Weight Accuracy	75.00	74.90	75.10	74.99	74.99	0.00	g	
Weight Accuracy	100.00	99.90	100.10	100.00	100.00	0.00	g	



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com



ANAB
ACCREDITED

ANAB
ACCREDITED

AC-2000.03

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

P.O. Number:

ID Number: 713



Description: SCALE
Manufacturer: OHAUS
Model Number: E12140
Serial Number: B258010639
Technician: ARMIN AHMETOVIC
On-Site Calibration: ☒
Comments:

Calibration Date: 10/10/2018
Calibration Due: 04/10/2019
Procedure: TMI-SCALES
Rev: 5/13/2014
Temperature: 68 F
Humidity: 33 % 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 17025:2017 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2017 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 17025:2017 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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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
DLOG-4	EXTECH	42270	3/5/2018	3/5/2018
RFD-WT-1	RICE LAKE	RFD-WT-1	5/8/2018	5/8/2020



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com



AC-2000-03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/FAIL
Slit Test Center	10.0000	9.9900	10.0100	10.0005	10.0005	0.00047	Grams
Slit Test RP	10.0000	9.9900	10.0100	10.0002	10.0002	0.00047	Grams
Slit Test RR	10.0000	9.9900	10.0100	10.0002	10.0002	0.00047	Grams
Slit Test LF	10.0000	9.9900	10.0100	10.0005	10.0005	0.00047	Grams
Slit Test LR	10.0000	9.9900	10.0100	10.0005	10.0005	0.00047	Grams
Weight Accuracy	10.0000	9.9900	10.0100	10.0002	10.0002	0.00047	Grams
Weight Accuracy	50.0000	49.9900	50.0100	50.0010	50.0010	0.00047	Grams
Weight Accuracy	100.0000	99.9900	100.0100	100.0018	100.0018	0.00047	Grams
Weight Accuracy	150.0000	149.9900	150.0100	150.0020	150.0020	0.00047	Grams
Weight Accuracy	200.0000	199.9900	200.0100	200.0038	200.0038	0.00047	Grams



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com



AC-2088.03

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

Manufacturer: OMEGA

Model Number: OMB-DAQ-56

Serial Number: NSN

Technician: PERRY MURBARGER

On-Site Calibration: ☒

Comments:

Calibration Date: 10/10/2018

Calibration Due: 04/10/2019

Procedure: OMEGA OM-DAQ-USB-2401

Rev: 1/12/2012

Temperature: 75.5 F

Humidity: 71.7 % 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 17025:2017 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2017 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 17025:2017 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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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
RFD7526A-150	FLUKE	7526A-150	8/4/2017	10/20/2018



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com

AC-2000.03

Certificate of Calibration**Data Sheet**

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FIL
Thermocouple Accuracy (K Type) Input 1	1000.0	998.2	1001.8	999.8	999.8	0.33	°F	
Thermocouple Accuracy (K Type) Input 2	1000.0	998.2	1001.8	1000.1	1000.1	0.33	°F	
Thermocouple Accuracy (K Type) Input 3	1000.0	998.2	1001.8	1000.6	1000.6	0.33	°F	
Thermocouple Accuracy (K Type) Input 4	1000.0	998.2	1001.8	1000.2	1000.2	0.33	°F	
Thermocouple Accuracy (K Type) Input 5	1000.0	998.2	1001.8	999.7	999.7	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	1000.3	1000.3	0.33	°F	
Thermocouple Accuracy (K Type) Input 8	1000.0	998.2	1001.8	1000.6	1000.6	0.33	°F	
Thermocouple Accuracy (T Type) Input 9	1000.0	998.2	1001.8	999.8	999.8	0.33	°F	
Thermocouple Accuracy (T Type) Input 10	1000.0	998.2	1001.8	1000.2	1000.2	0.33	°F	
Thermocouple Accuracy (T Type) Input 11	1000.0	998.2	1001.8	999.9	999.9	0.33	°F	
Thermocouple Accuracy (T Type) Input 12	1000.0	998.2	1001.8	1000.5	1000.5	0.33	°F	
Thermocouple Accuracy (K Type) Input 13	1000.0	998.2	1001.8	1000.6	1000.6	0.33	°F	
Thermocouple Accuracy (K Type) Input 14	1000.0	998.2	1001.8	999.7	999.7	0.33	°F	
Thermocouple Accuracy (K Type) Input 15	1000.0	998.2	1001.8	1000.3	1000.3	0.33	°F	
Thermocouple Accuracy (K Type) Input 16	1000.0	998.2	1001.8	1000.6	1000.6	0.33	°F	
Thermocouple Accuracy (K Type) Input 17	1000.0	998.2	1001.8	1000.8	1000.8	0.33	°F	
Thermocouple Accuracy (K Type) Input 18	1000.0	998.2	1001.8	1000.4	1000.4	0.33	°F	
Thermocouple Accuracy (K Type) Input 19	1000.0	998.2	1001.8	1000.6	1000.6	0.33	°F	
Thermocouple Accuracy (K Type) Input 20	1000.0	998.2	1001.8	1000.7	1000.7	0.33	°F	
Thermocouple Accuracy (K Type) Input 21	1000.0	998.2	1001.8	999.6	999.6	0.33	°F	
Thermocouple Accuracy (K Type) Input 22	1000.0	998.2	1001.8	1000.0	1000.0	0.33	°F	
Thermocouple Accuracy (K Type) Input 23	1000.0	998.2	1001.8	1000.3	1000.3	0.33	°F	
Thermocouple Accuracy (K Type) Input 24	1000.0	998.2	1001.8	1000.2	1000.2	0.33	°F	
Voltage Accuracy 1	10.0	9.5	10.5	10.1	10.1	0.0099	V	
Voltage Accuracy 2	10.0	9.5	10.5	10.1	10.1	0.0099	V	
Voltage Accuracy 3	10.0	9.5	10.5	10.0	10.0	0.0099	V	
Voltage Accuracy 4	10.0	9.5	10.5	10.1	10.1	0.0099	V	
Voltage Accuracy 5	10.0	9.5	10.5	10.0	10.0	0.0099	V	
Voltage Accuracy 6	10.0	9.5	10.5	9.9	9.9	0.0099	V	



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com

AC-2080.03

Certificate of Calibration

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

P.O. Number:

ID Number: 1134



Description: SCALE
Manufacturer: RICE LAKE
Model Number: 520-1A
Serial Number: 1494800044
Technician: ARMIN AHMETOVIC
On-Site Calibration: ☒
Comments:

Calibration Date: 10/10/2018
Calibration Due: 04/10/2019
Procedure: TMI-SCALES
Rev: 5/13/2014
Temperature: 68 F
Humidity: 33 % 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 17025:2017 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2017 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 17025:2017 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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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
DLOG-4	EXTECH	42270	3/5/2018	3/5/2019
RFD-500LBSET	RICE LAKE	500LBS	5/24/2018	6/30/2019



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com

AC-2000-03

Certificate of Calibration**Data Sheet**

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/ENL
Weight Accuracy	100.0	99.4	100.6	99.9	99.9	0.05	g
Weight Accuracy	200.0	199.4	200.6	199.4	199.4	0.05	g
Weight Accuracy	300.0	299.4	300.6	299.5	299.5	0.05	g
Weight Accuracy	400.0	399.4	400.6	399.5	399.5	0.05	g
Weight Accuracy	500.0	499.4	500.6	499.4	499.4	0.05	g
Weight Accuracy	1000.0	999.4	1000.6	999.4	999.4	0.05	g
Roll Test 80°	100.0	99.4	100.6	99.9	99.9	0.05	g
Roll Test 17°	100.0	99.4	100.6	99.9	99.9	0.05	g
Roll Test 90°	100.0	99.4	100.6	99.9	99.9	0.05	g
Roll Test 18°	100.0	99.4	100.6	99.9	99.9	0.05	g
Roll Test Center	100.0	99.4	100.6	99.9	99.9	0.05	g

**Technical Maintenance, Inc.**

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com

AC-2000.03

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

P.O. Number:
ID Number: 001212

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 980-12
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 of 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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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
0515114048	OMEGA	OM-73	2/1/2018	2/1/2019
RFD806	HEWLETT PACKARD	53181A	5/9/2017	5/9/2018



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax: 779-774-3884

www.tmicalibration.com



AC-2086.03

Certificate of Calibration

Data Sheet

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



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com



AC-2089.03

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

Calibration Date: 04/04/2018
Calibration Due: 04/04/2019
Procedure: NIST SP 980-12
Rev: 1/1/2008
Temperature: 68 F
Humidity: 40 % RH
As Found Condition: IN TOLERANCE
Calibration Results: IN TOLERANCE

On-Site Calibration ☒
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.

TM'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 TM'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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

Measurements not currently on TM'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



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com



AC-2010-03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/EAL
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



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax: 779-774-3884

www.tmicalibration.com



ANAB
ACCREDITED

ANAB
ACCREDITED

AC-2010-03

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

P.O. Number: ONSITE

ID Number: 001420



Description: THERMAL HYGROMETER
Manufacturer: CONTROL COMPANY
Model Number: 68000-49
Serial Number: 150810334
Technician: ARMIN AHMETOVIC

Calibration Date: 10/12/2018
Calibration Due: 04/12/2019
Procedure: TMI-M-HYGROTHERMOGRAPHS
Rev: 2/22/2011
Temperature: 68 F
Humidity: 33 % RH
As Found Condition: IN TOLERANCE
Calibration Results: IN TOLERANCE

On-Site Calibration: ☐
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 17025:2017 and ANSI/NCCL Z340-1-1994. ISO/IEC 17025:2017 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 17025:2017 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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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
0515114048	OMEGA	OM-73	2/1/2018	2/1/2019
RFD805	THUNDER SCIENTIFIC	1200	7/30/2018	7/30/2019



Technical Maintenance, Inc.

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com



Certificate of Calibration**Data Sheet**

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/EAR
Temperature Accuracy	60.0	59.3	60.7	60.3	60.3	0.24	°F
Temperature Accuracy	70.0	69.3	70.7	70.4	70.4	0.24	°F
Temperature Accuracy	80.0	79.3	80.7	80.4	80.4	0.24	°F
Humidity Accuracy	33	30	36	34	34	1.7	%RH
Humidity Accuracy	50	47	53	51	51	1.7	%RH
Humidity Accuracy	75	72	78	76	76	1.7	%RH

**Technical Maintenance, Inc.**

3248 FOREST VIEW ROAD, ROCKFORD, IL 61109

Phone: 779-774-3877 Fax 779-774-3884

www.tmicalibration.com

AC-2009.03



Intertek

W/N# xxxxx

Model ☐ 25-CBEP ☐ 55-SHPCBEP ☐ 55-TRPCBPEP

Pellet Fuel Room Heater; Free Standing Model Also For Use In Mobile Homes

Certified to UL 1482-11 /ASTM E 1509-12 / ULC S627-00

EPA Test Method ASTM 2779-10

Manufactured by:

England's Stove Works, Inc.

589 S. Five Forks Rd.

Monroe, VA 24574

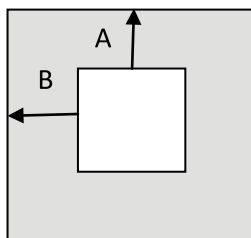
Manufacture Date	
Serial Number	

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, ¼ 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.
- Input Rating – 3.7 lbs/hr
- Emission value – 1.030 grams/hr
- U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using pellet fuel.
- U.S. Test Standard: US EPA 40 CFR Part 60, Subpart 60.536
- Use only Approved type L or P Pellet Vent Pipe.
- Inspect and Clean Exhaust Venting System Frequently.

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. Place on non-combustible floor protection, which extends 6-inches to the front and 6-inches on each side of the fuel opening. See owner's manual for additional clearance information.

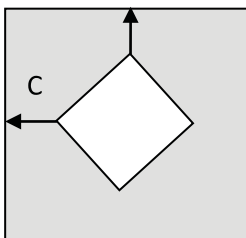
Back Wall/Sidewall



A = 6 inches (152 mm)

C = 6 inches (152 mm)

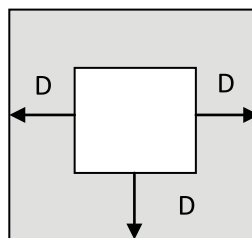
Corner



B = 6 inches (152 mm)

D = 6 inches (152mm)

Floor Protection



ELECTRICAL RATING: 5.0 A, 115 V, 60 HZ. 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 for detailed information

CAUTION – Moving Parts May Cause Injury. Do Not Operate Unit 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 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 NAMEPLATE AND INSTRUCTIONS.

CBEP PELLET STOVE INSTALLATION & OPERATION MANUAL

Manufactured By:
England's Stove Works,
Inc.
PO Box 206
Monroe, VA 24574
Rev. 1/2019



www.heatredefined.com

Parts: (800) 516-3636

Support: (800) 245-6489

MODELS 25-CBEP 55-SHPCBEP 55-TRPCBEP



CAUTION

Please read this entire manual before installation and use of this pellet fuel-burning appliance. Keep children, furniture, fixtures 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.

SAVE THESE INSTRUCTIONS



IMPORTANT: IF YOU HAVE A PROBLEM WITH THIS UNIT, DO NOT RETURN IT TO THE DEALER. CONTACT TECHNICAL SUPPORT @ 1-800-245-6489

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.

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 _____

* This information can be found on the safety tag attached to the underside of the hopper lid. Have this information on hand if you phone the factory or your dealer regarding this product.

WELCOME!

Introduction

- Thank You4

Specifications

- Heating Specifications5
- EPA Compliance.....5
- Dimensions5

Installation

- Installation Overview6
- Clearances to Combustibles7
- Venting Introduction8
- Venting Guidelines8
- Additional Venting Information ...9
- Vent Termination Clearances10
- Approved Venting Methods
 - Through the Wall11
 - Through the Ceiling12
 - Existing Chimney.....13
- Mobile Home Installation14
- Outside Air Hook-Up.....15
- Floor Protection16

Daily Operation

- Getting Started17
- Lighting a Fire.....17
- Control Board Settings.....19
- Error Codes20
- Power Failure21
- Thermostat Installation22
- Thermostat Operation23

Maintenance

- Daily
 - Important Notes24
 - Daily Ash Removal.....25
 - Cleaning the Burnpot26

- Bi-Weekly
 - Important Notes27
 - Exhaust Cover Removal .28
- Monthly
 - Important Notes30
 - Venting Pipe.....31
- Yearly
 - Important Notes32
 - Exhaust Blower33
 - Convection Blower33
 - Hopper Fines.....35
 - Checking Gaskets.....36

Troubleshooting Guide

- Troubleshooting37

Replacing Components

- Auger Motor.....39
- Convection Blower40
- Combustion Blower40
- Vacuum Switch41
- Igniter41
- Gaskets42
- Finish.....42
- Glass.....42
- Control Board.....43
- Wiring Diagram44

Standard & Optional Accessories

- Thermostat45
- Air Wash45

Illustrated Parts Detail

- Exploded Parts Diagram46
- Parts List47
- Sample Safety Tag48

Warranty

- Warranty Details49
- Warranty Reg. Form51
- EPA & Safety53

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 unit with basic tools, and we're always more than happy to show you how to 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 our vast Help section on our website and call our Technical Support Department at (800) 245-6489 if you need any help with your unit. 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.

This manual is available for free download on the manufacturer's web site. It is a copyrighted document and resale is strictly prohibited. The manufacturer may update this manual occasionally and cannot be responsible for problems including injuries or damages resulting from the use of information found in any manual from unauthorized sources.

PLEASE NOTE: If you purchased this model from certain stores, their model number may end in "L" "LC" "H" "CT", etc. This manual does apply to those models as well. For simplicity, the model number "25-CBEP" is used throughout the manual, but these instructions apply to all models listed on the front cover and above.

SPECIFICATIONS

Heating Specifications

- Heat Output Range**7,918 BTU/hr – 15,318 BTU/hr
- Approximate Pellet Burn Rate** 3.7 lb/hr
- Maximum Burn Time**30 hours
- Approximate Square Footage Heated*** 800 - 2000 sq. ft.
- Hopper Capacity45 pounds

EPA and Safety Compliance Specifications

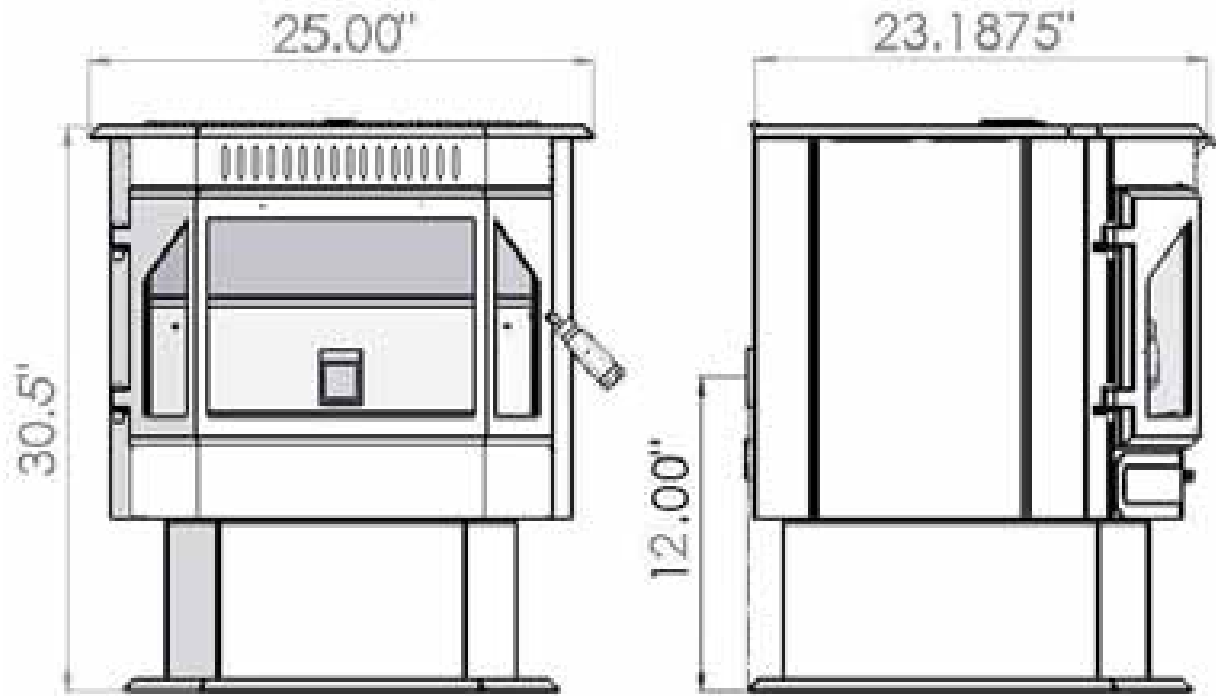
- EPA ComplianceCertified to comply with 2020 particulate emissions standards using pellet fuel.
- U.S. Test Standard: US EPA 40 CFR Part 60, Subpart 60.536
- Particulate Emissions 1.030 grams/hr
- Efficiency* 63 %
- Tested To UL 1482, ULC S627, ASTM E 1509

*- HHV overall result.

** - 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.

DIMENSIONS



WARNING

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- Do Not Overfire – If any external part starts to glow, you are overfiring. Reduce feed rate. Overfiring 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.

INSTALLATION

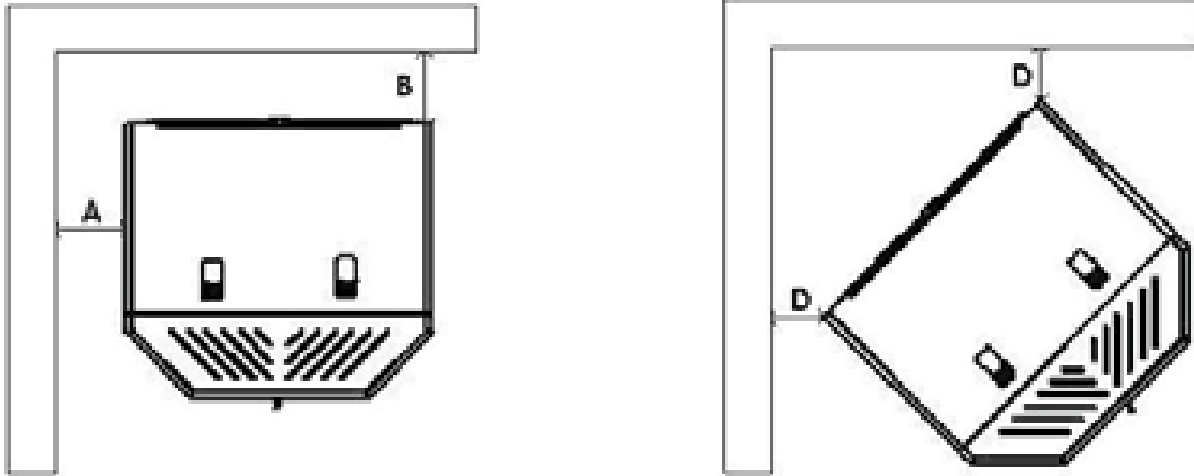
Installation Overview

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 – 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 DuraVent 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.

INSTALLATION

Clearances to Combustibles



<u>Unit Clearances to Combustibles</u>		
Side (A)	Rear (B)	Corner (D)
6 IN.	6 IN.	6 IN.
152 MM.	152 MM.	152 MM.

Note: Leaving 6 in. clearance also gives room for easier cleaning and maintenance

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.**

CAUTION

- 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.

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 to 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 (800-245-6489) 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 recommend contacting a local NFI certified installer to perform the installation.

Venting Guidelines

- **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.

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

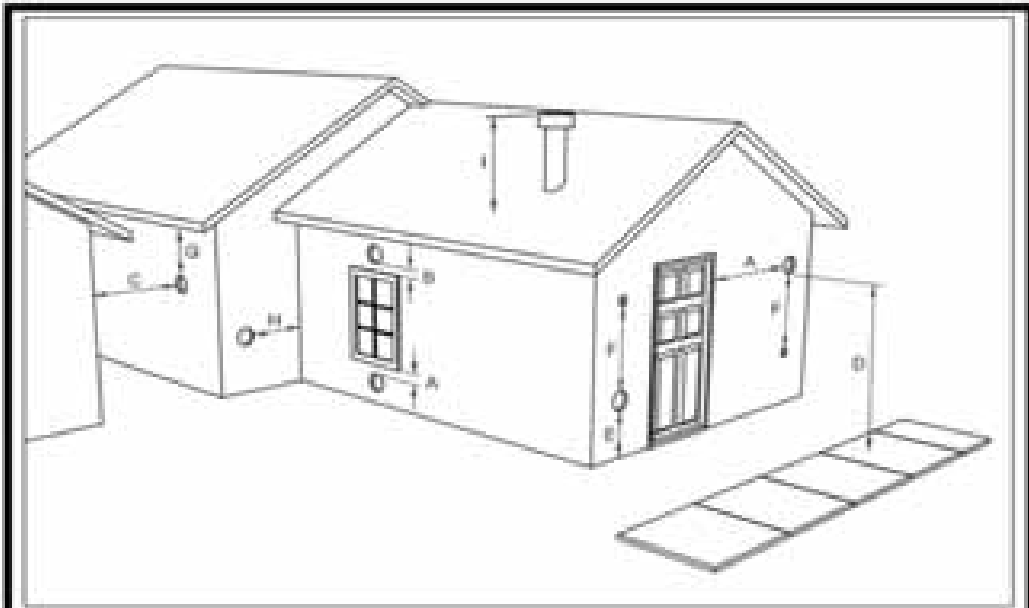
INSTALLATION

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, which 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 (see also Vent Termination Clearances).
 - 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 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.

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):

1. Not less than three (3) feet above any forced air inlet located within ten (10) feet.
2. 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.
3. 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.

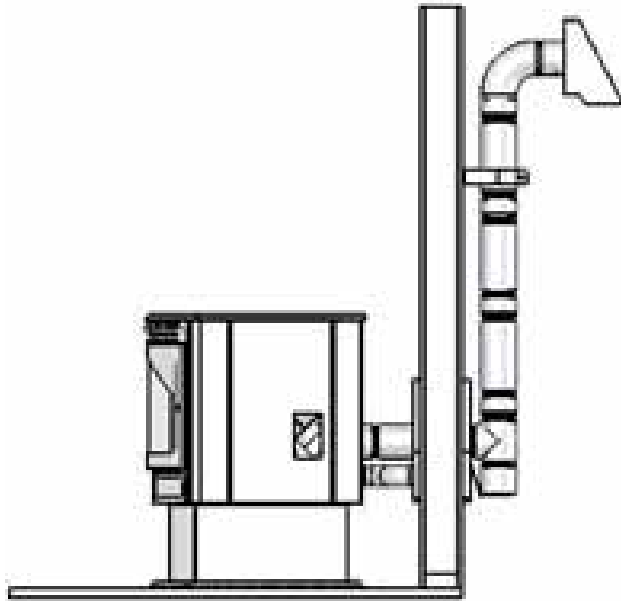
Be sure to follow local codes and all manufacturer's instructions (including exhaust pipe).

Consult a professional installer and/or call Technical Support if you have any questions.

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 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.

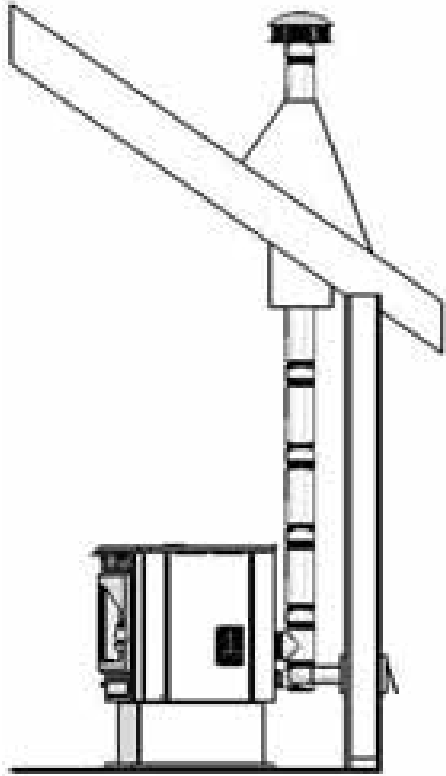
Please Note:

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 firestops, 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.

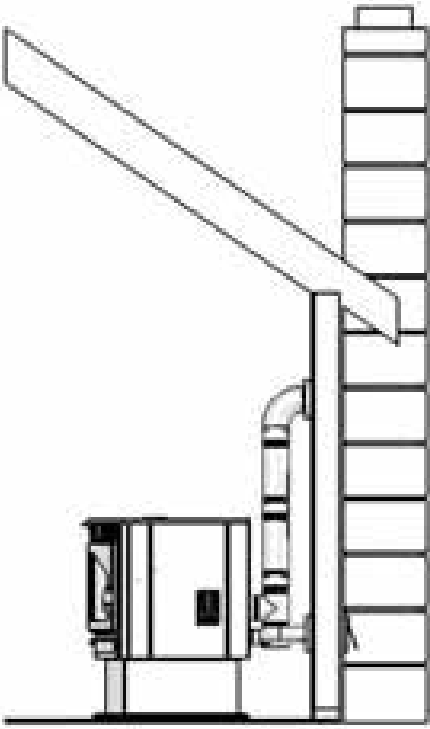
Please Note:

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

Mobile Home Installation

- As with all installations involving this unit, the use of outside combustion air is mandatory and **MUST** be used. Please see the “Outside Air” section on page 15 for more information regarding outside air connections.
- 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 pedestal for this purpose.
- 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.

CAUTION

THE STRUCTURAL INTEGRITY OF THE MANUFACTURED HOME FLOOR, WALL AND CEILING/ROOF MUST BE MAINTAINED.

-The instructions below are for all installations-

Caution

NEVER draw outside combustion air from:

- Wall, floor or ceiling cavity.
- Enclosed space such as an attic, garage or crawl space.

WARNING

DO NOT INSTALL IN A SLEEPING ROOM.

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

Do not install or operate this unit outside, in a greenhouse, or in any area that is high in moisture.

OUTSIDE AIR HOOK-UP

- The use of outside combustion air is **mandatory** on the 25-CBEP.
- 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 .0209in. (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 regularly to be certain it is free from blockage.

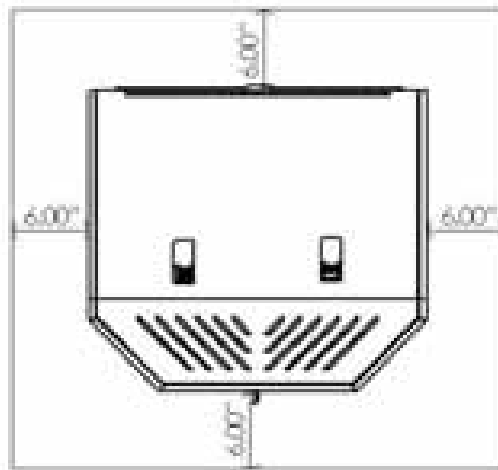
Caution

NEVER draw outside combustion air from:

- Wall, floor or ceiling cavity.
- Enclosed space such as an attic, garage or crawl space.

FLOOR PROTECTION

- The 25-CBEP 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), no floor protection is needed (although a decorative floor protector can still be used for aesthetic reasons).
- 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.
- The floor protector should be UL approved or equivalent (ULC if Canada) and must only be noncombustible. Since the majority of the radiant heat from this unit is projected forward, the floor protector only serves to keep ashes and sparks from landing on combustible flooring near the unit. A hearth rug is **NOT** an approved substitute for a proper hearth extension pad.
- U.S.A.-The floor protector must extend at least 6 in. (152.4 mm) from the front, sides and rear of the 25-CBEP, as shown in the diagram below:



- In the USA, it is not required that the non-combustible floor protector extends beneath the venting system, but is highly recommended.
- 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. Canada requires 450mm floor protection in front of unit, and 200mm on sides & rear of unit.

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.
 - Once the “ON” button is pressed, you should immediately hear the exhaust blower start and operate continuously.
 - 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” for your unit at the 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.**
- After about twenty minutes, the control board should 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 using the flush-mount handle and pour the pellet fuel directly into the hopper.
 - ❖ 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.

- The 25-CBEP 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.
- The 25-CBEP is equipped with an automatic pellet ignition system; the only user input required to light the stove is a simple press of the “On” button.
- Shortly after pressing the “On” button, the letters “S U” will appear in the heat range and blower speed windows of the control board. 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, although we recommend starting the stove on Heat Range 5, to help ensure a strong fire is initiated.
- After approximately fifteen minutes, the fire should be burning brightly and the “S U” should disappear from the control board. At this point, the stove has begun normal operation and the display windows on the control board will remain empty, unless the Heat Range or Blower Speed is adjusted.

Daily Operation Notes

- Only high quality, ¼” (.25 in.) diameter wood pellets, should be used in this stove. Using low grade wood pellets with high ash content can cause the burnpot 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 fuel is uniform in size, which can affect the way pellets are fed into the burnpot. Although the flame height may increase and decrease during operation, the temperature of the exhaust gas remains relatively constant and there is no loss of efficiency.

CAUTION

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.

CONTROL BOARD SETTINGS

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.

ERROR CODES

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 37, 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 burnpot 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 (800) 245-6489.

POWER FAILURE

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	Start-Up
Start-Up	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 power outage. Open the closest outside door and a window to reduce the chance of any combustion byproducts entering the home.
- Wait for the power to be restored and then press the “ON” button to restart the unit, if 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.

THERMOSTAT OPERATION

Thermostat Installation

1. Unplug the unit and remove the back panel of the stove.
2. Locate the thermostat connect block, labeled J18, on the rear of the control board, near the bottom (See image below and page 44 of this manual for a control board diagram). It will have a small wire “jumper” installed in it from the factory. This jumper bypasses the thermostat and should be saved.
3. Loosen the two screws using a small slotted “jewelers” screwdriver and remove the “jumper.”
4. Insert the two thermostat wires in place of the “jumper” and retighten the screws.
5. Reinstall the back panel and mount the thermostat; the control board automatically reads the thermostat and your stove is now ready for thermostat operation.



Connect
thermostat
wires here
(J18)

THERMOSTAT OPERATION

Thermostat Operation Details

- The 25-CBEP was designed to operate equally well in both manual and thermostat mode. While using the control board for heating control gives the user control over the heat output of the stove, the thermostat allows the stove to “start-up” and “shutdown” independently, which will help maintain your house at a more constant temperature and save pellet fuel.
- The 25-CBEP can be connected to either a wall thermostat (Part # PU-DTSTAT) or wireless remote thermostat (Part # AC-3003). Although either thermostat will operate the stove properly, we highly recommend the wireless thermostat for the convenience of starting your pellet stove from anywhere in the house.
- THERMOSTAT OPERATION: This stove is equipped with a unique, new feature that allows two options for thermostatic operation: The stove comes from the factory pre-programmed in “On/Off mode,” which turns the stove on and off when the call for heat comes or leaves, like a furnace. The second, or “High/Low mode,” burns at whichever heat range you set the stove at until the call for heat leaves, at which point the stove goes to the Low heat range setting.
- To set the stove in the “High/Low mode,” unplug the unit and plug it back in, then press and release both down arrows; H L appears in the heat range and blower speed windows. The unit is now in “High/Low mode.” (Note: Repeat this to change back to “On/Off mode;” a 0 0 will appear in the heat range and blower speed windows). Using a thermostat in On/Off mode may shorten the life of your stove’s igniter.
- Please note: Certain units may not respond to this; if your unit does not respond in this manner please contact Technical Support at (800) 245-6489.
- Remember to locate the thermostat near the stove in a central location; putting the thermostat in a distant room can cause the stove to overheat the room it’s located in because the thermostat will only sense the temperature of the room in which it is installed.
- Although all heat range and blower speed settings are available in thermostat mode, the two settings specifically designed for thermostat mode are heat ranges 3 and 8.
 - Heat range 3 is intended for thermostat operation under normal operating conditions.
 - Heat range 8 is ideal for thermostat operation in large or poorly insulated homes.

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

DAILY MAINTENANCE

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 shut-down 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.
- Store ashes in a metal container with a tight fitting lid, and only place this container on a non-combustible surface.
- Different pellets will generate varying amounts of ash and burnpot 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 ash 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.

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.

DAILY MAINTENANCE

Ash Removal and Disposal

- Press the “Off” button and allow the stove to complete the shut-down cycle and cool completely.
- Because of the open design of the firebox, the majority of the ash will already be in the bottom of the stove. Open the main door of the stove and use an old paint brush or putty knife to move ash from around the burnpot into the floor of the stove below.
- Use a long handled screwdriver or putty knife to remove any deposits left in the burnpot, being careful to remove them from the burnpot and not allow them to filter down into the cradle area. Excessive ash build-up in the cradle can cause poor stove performance (See “Cleaning the Burnpot” page 26).
- Remove the ashes from the bottom of the stove with a scoop, or by using an ash (utility type) vacuum such as our Part Number AC-SV. Follow all appliance directions.
- When using a utility type vacuum for ash clean-out, be certain the vacuum is equipped with a filter capable of preventing fine ash particles from being blown into the room. Similarly, always be certain the stove is completely cool and that ALL ashes are cool before vacuuming.
- Dump the ashes into a metal container (as described above) and store them on a non-combustible surface to allow any embers to cool before disposal.
- The stove is now ready to resume normal operation.

DAILY MAINTENANCE

Cleaning the Burnpot

Along with removing ashes from the stove, cleaning the burnpot 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 burnpot over time. Some pellets will contain much higher amounts of these fusible impurities, therefore extra vigilance may be required to maintain a clean burnpot. Allowing impurities to build up in the burnpot can restrict the air-flow to the fire, resulting in a dirty, inefficient burn.

Instructions

- Always allow the stove to finish the shut-down cycle and cool completely before performing any maintenance inside the firebox.
- Open the main door of the stove and remove the burnpot by lifting it straight up and out of the cradle. **WARNING** – The burnpot can remain HOT long after the fire has gone out, so wear protective gloves whenever handling a potentially hot burnpot.
- Once the burnpot is out of the stove, use a long handled screwdriver or putty knife, as previously mentioned, to remove any deposits from the inside of the burnpot.
- Be certain all air orifices are clear and unrestricted by fusible ash matter; a fine tipped screwdriver or scratch awl can be useful in removing stubborn matter from these orifices.
- Remove any ash material from the bottom of the cradle and brush any ash from the top of the cradle into the floor of the stove below. Keeping the top of cradle free of ash is crucial in allowing the burnpot to make a positive air-tight seal with the top of the cradle.
- Insert the burnpot back into the cradle using the reverse of the procedure detailed above.

BIWEEKLY 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.
- Biweekly maintenance should include the steps listed in this section **AS WELL AS** the steps listed in the previous “Daily Maintenance” section.
- Burning some brands of pellets may lead to increased ash build-up behind the exhaust cover and in the igniter tube. Diligent maintenance in the first year will help you understand the location of ash build-up as well as the necessary intervals between cleanings.
- Although not specifically listed in this section, the gaskets and latches on the main door should always be inspected to ensure a proper seal is being made. As previously mentioned, an airtight seal at all stove openings is crucial to proper operation.
- When using a utility type vacuum for ash clean-out during biweekly maintenance, be certain the vacuum is equipped with a filter capable of preventing fine ash particles from being blown into the room. Similarly, always be certain the stove is completely cool and that **ALL** ashes are cool before vacuuming.
- Clean-out tees and other low spots in venting systems are areas prone to fly ash accumulation. Be certain these areas are inspected frequently for excessive ash accumulation.

BIWEEKLY MAINTENANCE

Exhaust Cover Removal & Cleaning

- Fly ash will accumulate behind the exhaust cover and in other non-visible areas.
- The firebox exhaust cover is a one-piece design, held in place with two (2) 5/16” screws.
- Remove the exhaust cover plate by first removing the two (2) 5/16” screws, then lifting the entire exhaust cover from the stove.
 - Remember, **always** use extreme caution when handling potentially hot stove parts, even if you think they should be cold.
- When the exhaust cover is out of the stove, the area where fly-ash accumulates on the firebox shelf will be clearly seen.
- The use of a utility (or ash) vacuum such as our Part Number AC-SV is highly recommended.

Exhaust Chamber Cleaning

The exhaust chamber of the stove (seen when the cover is removed) was intentionally designed as an ash accumulation area. Allowing ash to accumulate here prevents excess ash build-up in the combustion blower and the venting system.

Instructions

- BEFORE vacuuming the chamber out, observe the type and quantity of ash build-up. The ash deposited in the exhaust chamber should be light, fluffy, grey or white in color, and should be no higher than half way up the clean-out port.
 - If the ash is dark brown or black, it is generally evidence of incomplete pellet combustion.
 - Do **NOT** allow the ash to accumulate very high in this area; significant ash accumulation in this area can “choke” the combustion blower and cause poor stove performance.

- Using a utility type vacuum cleaner, as previously mentioned in this manual, vacuum the fly ash out of the exhaust chamber. A short piece of hose can be attached to the end of the utility vacuum line and can be useful in accessing hard-to-reach areas.
- After removing all fly-ash from behind the cover and exhaust chamber area, reinsert the cover into the stove, using the two (2) 5/16" screws that were previously removed.
- Be certain to tighten the screws down to sufficiently seal, but do not over-tighten them, as it possible to damage the screws.

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.

Burn ONLY wood pellets.

Carbon Monoxide Detector

England's Stove Works, Inc. highly recommends the use of a carbon monoxide detector in the proximity of the stove and one per floor of the home.

A certain amount of carbon monoxide is produced within the stove as a by-product of combustion. All exhaust vent connections must be sealed with RTV Silicone to assure a tight seal. Any leaks into a confined area caused by faulty installation or improper operation of the stove could produce dizziness, nausea and in extreme cases, death. The CO concentration during testing was found to be 0.017 g/min.

MONTHLY 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.
- Monthly maintenance should include the steps listed in this section **AS WELL AS** the steps listed in the “Daily Maintenance” and “Biweekly Maintenance” sections.
- Intervals between monthly cleanings will depend on the duration that the stove is burning on a daily basis. A stove which is operated continuously will need more frequent monthly cleanings than a stove which is used periodically as supplemental heat.
- 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.
- 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.

MONTHLY MAINTENANCE

Venting Pipe Cleaning

- Low spots and direction changes in the venting system (such as tees and elbows) are areas for potential fly-ash 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. Brushes specifically made for cleaning pellet pipe are available at the retailer where you bought this stove, as well as at most hearth product dealers.
- 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,” “Biweekly 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.

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 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

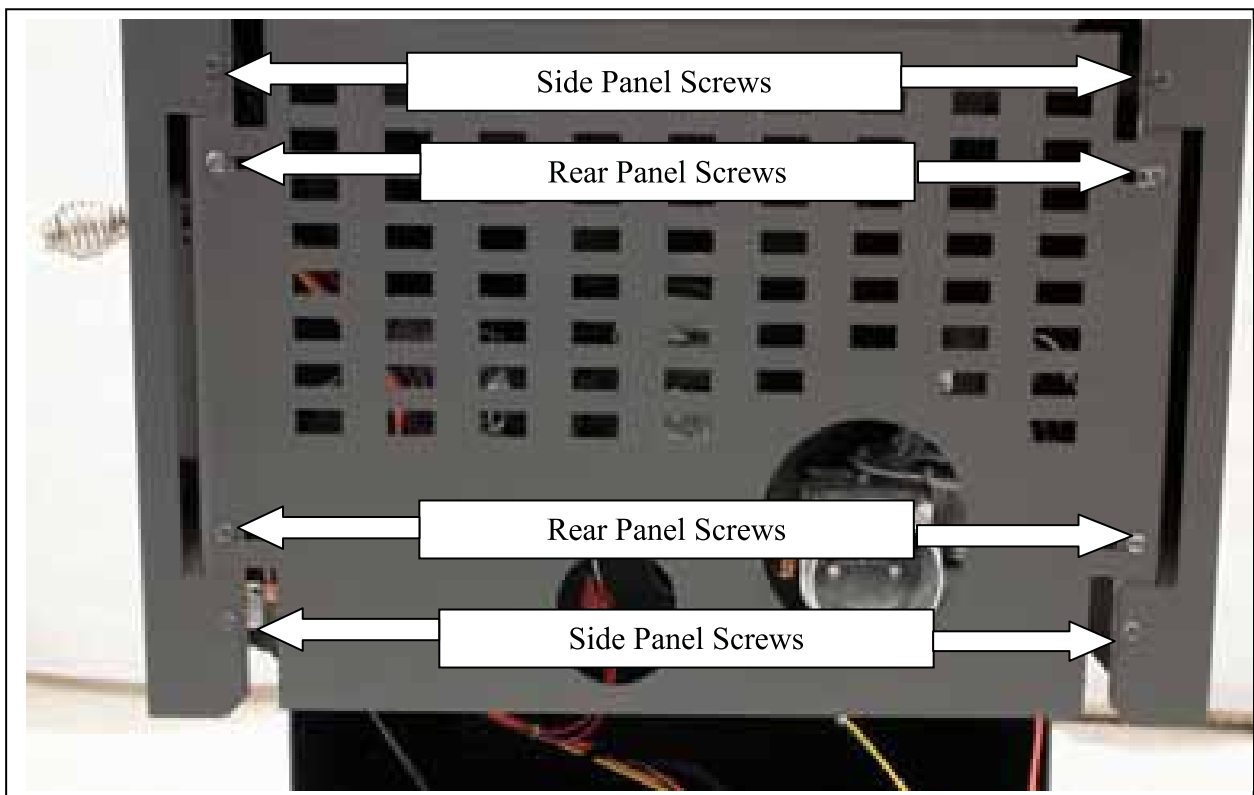
Exhaust Blower Cleaning

Although the exhaust 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 exhaust blower, a large accumulation of fly-ash is found, cleaning the exhaust blower and housing should be performed monthly or bimonthly to prevent this excess buildup.

Instructions

- **Before beginning the exhaust blower cleaning procedure, be certain the unit is unplugged and thoroughly cooled down.**
- To remove the side panel and access the exhaust blower:
 - Remove the two 5/16” screws on the rear of the unit that hold the side panel on, on the side nearest the exhaust blower (the left side when facing the front of the stove).
 - Pull the side panel straight back, supporting it carefully, and pull it away from the stove; the side panel should slip off of the key slot supports.
 - Once the side panel is removed, the exhaust blower will be clearly visible.
- Disconnect the venting system from the exhaust blower just enough that you will be able to remove the exhaust blower from the stove.
- Unplug the two wires which connect the stove wiring harness to the exhaust blower using the quick connect plugs.
- Loosen and remove the 5/16” screw, on the top of the exhaust blower output connection, which holds the thermal sensor to the exhaust blower.
- Loosen the five (5) 5/16” self-drilling screws which hold the exhaust blower to the exhaust blower tube. The lower screws are most easily accessed through the circular cutouts in the stove body. A 12” socket extension will likely be necessary to reach all of the screws.

- Lift the exhaust blower up and out of the stove. The gasket which seals the exhaust blower to the exhaust 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, it is best to replace this gasket (Part # PU-CBMG) every time the exhaust blower is removed.
- With the exhaust blower removed, use a utility (or ash) vacuum to remove any ash accumulation in the exhaust blower tube.
- Use a soft paint brush and carefully remove any ash accumulation from the inside of the exhaust blower, and from the exhaust blower fan blade.
- Inspect the exhaust 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 and side panel in the reverse order as described above. Remember to check the condition of the exhaust blower gasket AND remember to reconnect the thermal sensor to the top of the exhaust blower outlet before reinstalling the side panel.



YEARLY MAINTENANCE

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. The convection blower is located on the side of the stove opposite the combustion blower, and with the side panel removed from the stove, the convection blower should be visually inspected for any dust build-up. Any dust that has built up on the fan blades can usually be easily removed with a vacuum or a soft paint brush.

Cleaning Pellet Fines from the Hopper and Auger

Depending on the type and quality of pellets burned in the stove, some accumulation of pellet fines and dust is possible in the hopper. The lowest part of the auger, near the back of the stove, is where most fines will accumulate. With the stove off, **unplugged**, and with the hopper empty, use a utility vacuum to remove the fines from the auger tube. If the fines cannot be removed from the top of the hopper:

- Remove the panels:
 - Remove both side panels using the procedure described in the “Exhaust Blower Cleaning” section, found on page 33 of this manual.
 - Next, remove the back panel by removing the four 5/16” screws that hold it in place and carefully removing it from the stove. See image on pg. 34.
- Locate the auger motor assembly at the middle rear of the stove, and once it is found, find the two set screws on either side of the cast iron mounting collar.
- Using a 3/16” allen wrench, loosen the set screw on either side of the auger mounting collar.
- With a utility vacuum in hand, let the auger assembly slide out of the auger tube just enough so that the vacuum can be used to remove any fines from this area.
- Reinstall the auger assembly and tighten the two set screws; reinstall the back panel and the two side panels, being certain to tighten the eight (8) retaining screws on the rear of the stove.
- Refer to page 39 for an illustration and more information on the auger motor.

YEARLY MAINTENANCE

Checking Gaskets

An airtight seal at the door openings and hopper lid opening is crucial to proper stove performance. Any air leaks at these areas can not only cause a dirty, inefficient burn but can also pose a serious safety threat. Because of this, gaskets should always be maintained in good condition and should be replaced annually, or sooner if necessary. Gasket tightness can be checked using the “dollar-bill” method:

- * Place a dollar bill between the gasket and the stove body (at the location where the gasket meets the stove).
- * Tighten the latching mechanism down and attempt to pull the dollar bill out. If the dollar bill slides in and out easily, the gasket needs to be replaced. This test should be repeated around the entire gasket perimeter, as gaskets will sometimes seal tightly on one side, but will be worn and seal poorly on another side.
- * Perform this test around the entire perimeter of the door and hopper lid. If any area fails the test, the entire gasket should be replaced. The part number appropriate to the gasket being replaced can be found in the “Illustrated Parts” section at the rear of this manual.
- * Gaskets should only be replaced with equivalent fiberglass gaskets purchased from England’s Stove Works ® specifically for this unit. Instructions for gasket removal and replacement will accompany the gasket kit ordered, and can also be found in the instructional videos produced for this stove (see the DVD that accompanied your stove, or visit youtube.com/heatredefined).

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 your local dealer or Technical Support at 1-800-245-6489.

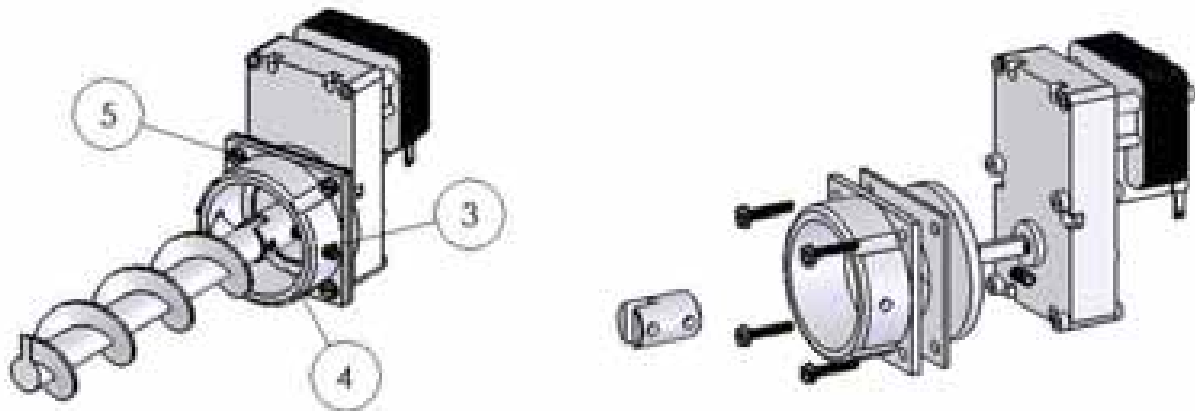
<u>Problem</u>	<u>Cause</u>	<u>Solution</u>
Auger not turning	1. Bad auger motor. 2. Foreign matter jamming auger. 3. Vacuum sensor.	1. Replace auger motor. 2. Remove pellets and object. 3. Check exhaust blower.
Smoke smell or dust in house	1. Improper exhaust connection.	1. Check exhaust connections 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.	1. Check both blowers for material.

	2. Loose exhaust fan set screw.	2. Check set screw for tightness.
"E-1" Code On Control Board	1. Vacuum bypass chip missing.	1. Contact Technical Support.
Unit Shuts Down in 15-20 minutes with an "E-2" code on control board.	1. Loose thermal sensor. 2. Control board settings. 3. Failure to light pellets.	1. Check both sides of thermal sensor connection (at exhaust blower and at control board). 2. Start stove on minimum Heat Range 5 to ensure a good fire is started. 3. Check igniter for buildup or failure.
"E-3" Code on Control Board (Overfire)	1. Convection (Room Air) blower failure. 2. Partially blocked flue. 3. Using fuel other than premium wood pellets.	1. Check convection blower for proper function, replace if necessary. 2. Check flue for obstructions. 3. Use ONLY premium wood pellets in this stove.
"E-4" Code on Control Board (Proof of flame lost)	1. The hopper is empty. 2. The hopper lid was left open too long during refueling. 3. Component failure. 4. Blower speed is set too high, cooling firebox too rapidly.	1. Refill the hopper with pellets and restart the stove. 2. Keep the hopper lid open for the shortest interval possible when refueling. The safety switch stops the auger when the hopper lid is open. 3. An auger motor failure or combustion motor failure can sometimes result in an "E-4" code. 4. Operate the stove with the blower speed and heat range at the same value.
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). 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 (800)245-6489.		

REPLACING COMPONENTS

Auger Motor

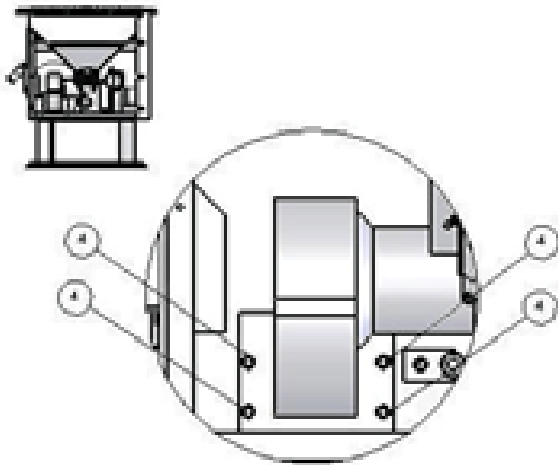
1. Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down. Also, make sure the hopper is empty before attempting to remove or replace the auger motor assembly.
2. Remove the side panels and back panels as previously detailed in this manual on Page 35 and in the “Exhaust Blower Cleaning” section. Before loosening any bolts, detach the wiring harness from the auger motor.
3. Locate the auger motor assembly at the rear of the stove, and begin by loosening the two allen set screws on either side of the cast iron auger motor coupler.
4. Slide the auger assembly out of the tube enough that the allen set screw, which holds the auger to the steel auger coupler, can be accessed. Loosen this set screw until the auger is free from the auger motor assembly.
5. Next, remove the four screws which hold the cast iron auger motor coupler to the auger motor, using a 5/16” wrench. Slide the cast iron auger motor coupler and the steel spacer plate off of the auger motor.
6. Loosen the allen set screw which holds the steel auger coupler to the auger motor output shaft, and remove the steel auger coupler, as well as the rubber vibration dampener.
7. Reinstall the parts in reverse order on the new auger motor, being careful not to over-tighten the bolts which hold the cast iron auger coupler to the auger motor.



REPLACING COMPONENTS

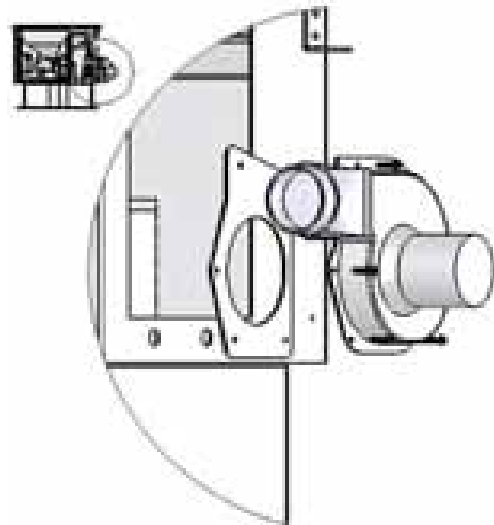
Convection Blower

1. Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
2. Remove the right side panel as previously detailed in this manual on Page 33 in the “Exhaust Blower Cleaning” section.
3. Detach the convection blower from the wiring harness before loosening the four screws which secure it to the convection shroud of the stove.
4. After loosening and removing the four screws which hold the blower to the stove, remove the blower from the stove.
5. Installation of the new blower is performed in reverse of removal; remember to reconnect the new blower to the wiring harness before reinstalling the side panel.



Combustion Blower

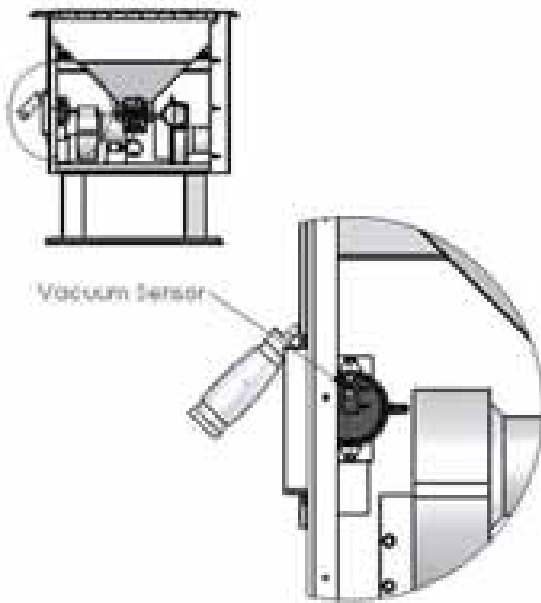
1. Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
2. Remove the left side panel as previously detailed on page 33.
3. Disconnect the venting system from the exhaust blower, and disconnect the exhaust blower from the stove wiring harness. Loosen and remove the thermal sensor screw on the top of the exhaust blower outlet using a 5/16” wrench.
4. Loosen and remove all five 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.
5. Reinstallation is the exact opposite of the steps above; however be certain to check the condition of the exhaust blower gasket and replace if necessary.



REPLACING COMPONENTS

Vacuum Switch

1. Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
2. Remove the right side panel and the back panel as previously detailed.
3. Locate the vacuum sensor as shown in the diagram below.
4. Disconnect the stove wiring harness and vacuum hose from the vacuum

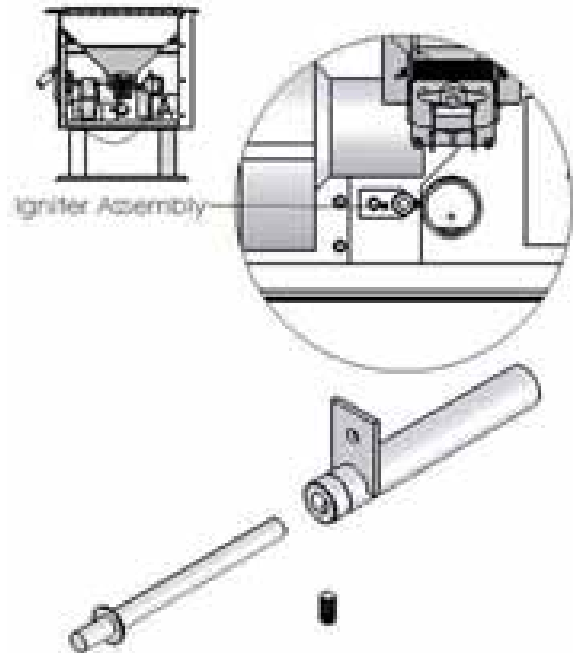


sensor, taking note of where connections were made.

5. Remove the two screws which hold the vacuum sensor to the vacuum sensor bracket, using a 5/16" wrench.
6. Installation is the reverse of removal; be absolutely certain the wires and vacuum hose are connected as they were, and according to the wiring diagram in this manual.

Igniter

1. Before beginning any component replacement, be certain the unit is unplugged and thoroughly cooled down.
2. Remove the right side panel and the back panel as previously detailed.
3. Locate the igniter as shown in the diagram below.
4. Disconnect the igniter wiring from the control board and use a 5/16"



wrench to remove the igniter retaining screw.

5. Loosen the allen set screw and remove the old igniter cartridge.
6. Install the new igniter in the igniter tube, retighten the set screw and reinstall the assembly into the stove. Be certain to reconnect the new igniter wires to the circuit board before reassembly.

REPLACING COMPONENTS

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

Gaskets

1. Door

- This unit comes with a $\frac{1}{2}$ " rope gasket around the door that should be replaced annually. To replace the door gasket (Part # AC-DGKEP), the old gasket must first be removed entirely — prior to adding the new adhesive, you may have to scrape the old cement from the door 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.

2. Window

- If you are replacing the window gasket (Part # PU-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 inspected whenever you remove or clean the Combustion Blower and replaced if necessary.

4. In addition, the Hopper Lid gasket should be inspected and replaced annually, or sooner if necessary (see “Checking Gaskets” in the Yearly Maintenance section).

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.

Glass

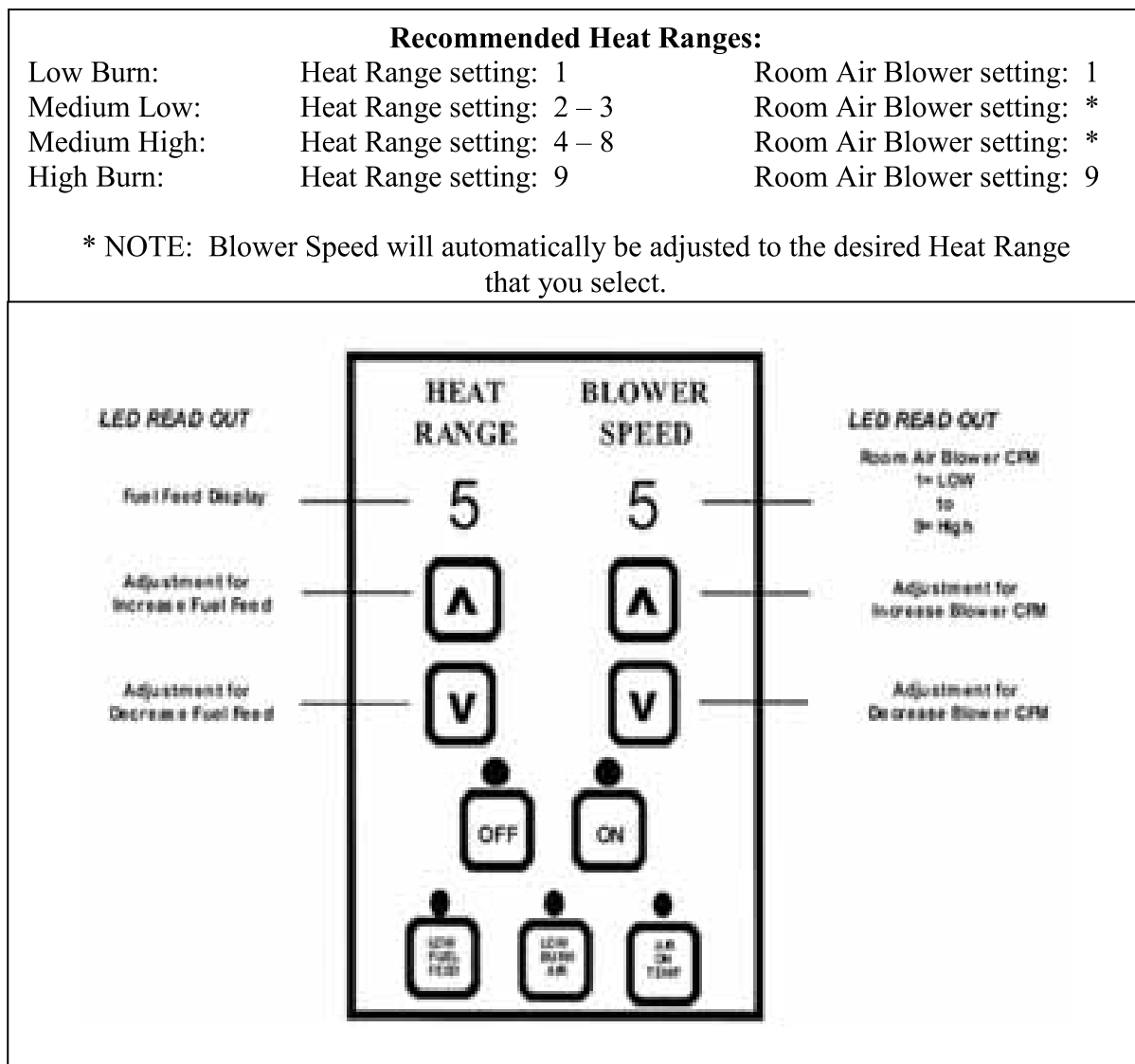
This unit has a three piece ceramic glass set (Part No. AC-G40 [Center Glass] & Part No. AC-G41 [Side Glass]) in the viewing door. Self adhesive window gasket is always included with replacement windows purchased directly from England’s Stove Works. Surface scratches are acceptable, but if this glass becomes cracked in any area, the unit should be shut down and the window replaced with ceramic glass bought from England’s Stove Works. Never replace ceramic glass with tempered or any other type of glass.

REPLACING COMPONENTS

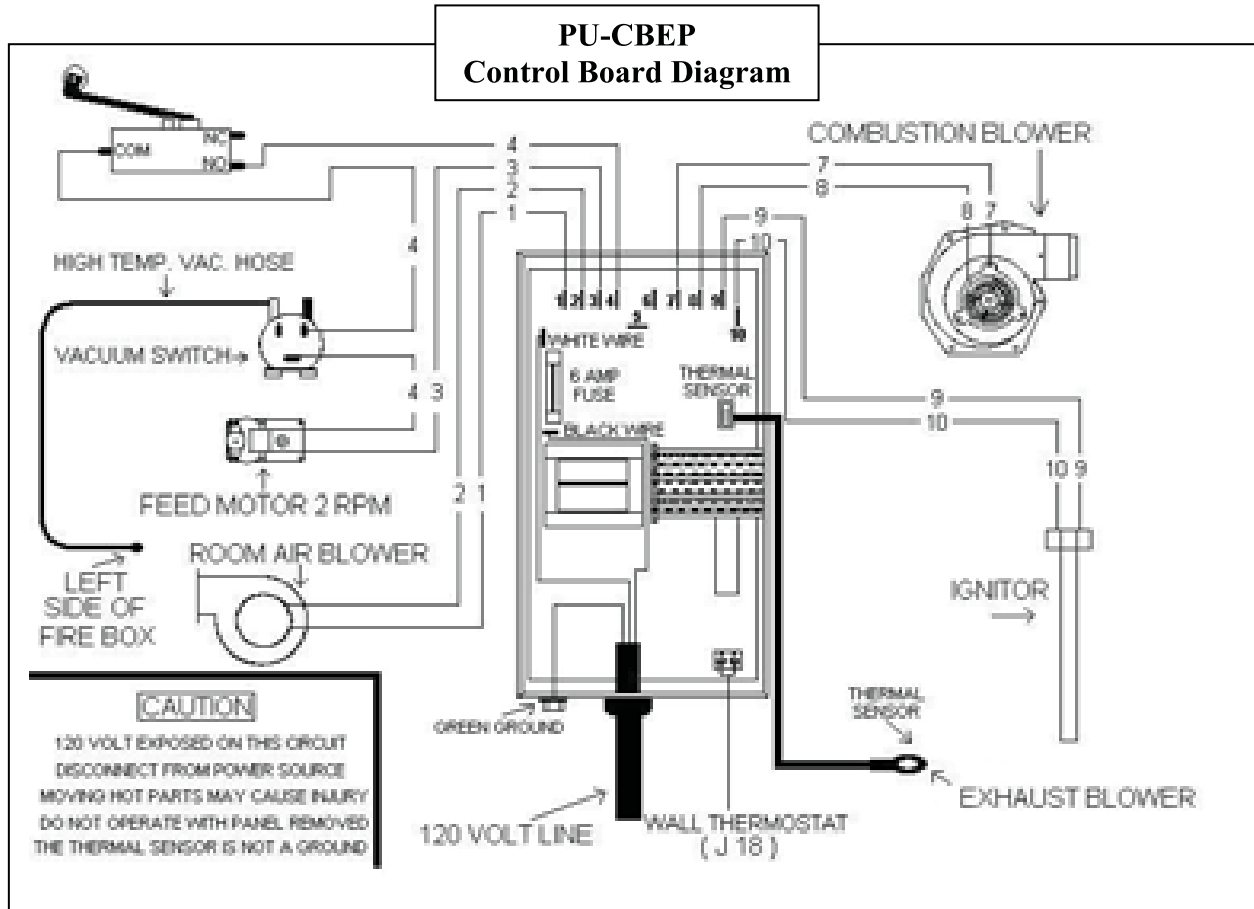
Control Board

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

NOTE: The bottom three control buttons are preset at the factory and are not user adjustable. See the “Daily Operation” section beginning on page 17 of the manual for more instructions on Control Board settings.



WIRING DIAGRAM



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.

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.

OPTIONAL ACCESSORIES

Wall Thermostat (PU-DTSTAT)

Installing this wall thermostat allows the 25-CBEP to operate on the same principle as a furnace: The stove will shut-down and relight as the call for heat comes and goes (in On/Off mode, see Thermostat Operation, page 23). This will maintain the house at a more constant temperature, while conserving pellets.

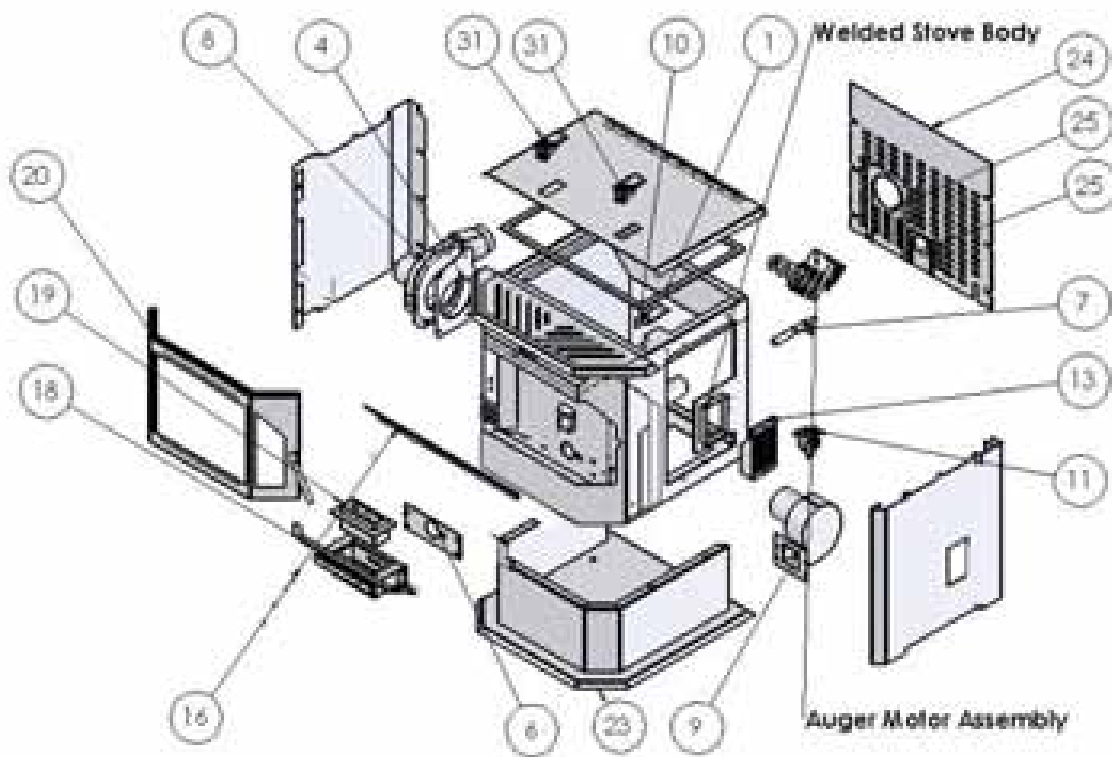
Remote Thermostat (AC-3003)

The remote thermostat for the 25-CBEP takes the convenience of thermostat operation one step further by allowing temperature adjustments from anywhere in the home. The remote thermostat allows precise temperature control from wherever you desire and only requires six (6) AA batteries to operate.

STANDARD ACCESSORIES

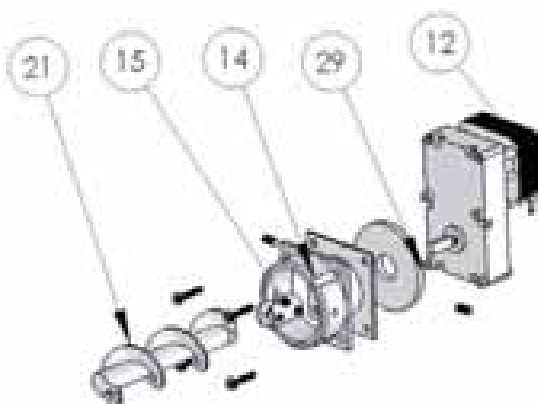


Your stove is equipped with a decorative steel air wash. While it is designed to enhance the beauty of the fire, it is also functional in that it helps to maintain a cleaner door glass. This air wash should lean forward (toward the glass) when the stove is in operation. Be sure to check heatredefined.com periodically for future air wash designs to change the look of your stove.



ILLUSTRATED PARTS DIAGRAM

Auger Motor Assembly



Steel Door Assembly



REPLACEMENT PARTS LIST

Part Number	Part Description	Diagram #
Gaskets		
PU-HLG	Hopper Lid Gasket	1
AC-DGKEP	Door Gasket	2
AC-GGKEP	Three Piece Window Gasket Kit	3
PU-CBMG	Exhaust Blower & Motor Gasket	4
PU-CGEP	Cradle Mating Gasket	6
Electrical Components		
PU-CHA	Igniter Cartridge Heater	7
PU-076002B	Exhaust Blower	8
PU-4C442	Room Air Blower	9
AC-HLSB	Hopper Lid Switch	10
CU-VS	.05" of WC Vacuum Switch	11
CU-047042	2 RPM Auger Motor	12
PU-CBEP	Control Board	13
Cast Iron		
CA-AMPP	Cast Iron Auger Motor Collar	14
Steel		
CA-AC	Steel Auger Coupler	15
IP-25EP	Exhaust Cover	16
PU-BPCEP	Cradle	18
PU-BPEP	Burnpot	19
CA-40	Steel Door	20
	Decorative Steel Air Wash	Not shown
PU-AFEP	Steel Auger	21
AC-GSEP	Glass Support Brackets	22
PU-BREP	Pedestal Base and Riser	23
PU-RAPEP	Rear Access Panel	24
PU-EPRCP	Exhaust and Intake Cover Plates	25
Glass		
AC-G40	Three Piece Glass - Center	27
AC-G41	Three Piece Glass - Side	28
Misc		
CU-RG	Rubber Auger Motor Bushing	29
PU-VH	High Temp. Vacuum Hose	Not Shown
PU-62-40-151-3	Hopper Lid Latch	31
AC-SHN	Nickel Spring Handle	Not Shown
AC-SH	Brass Spring Handle	Not Shown
PU-EDIC	Exhaust Tube Insulation Wrap	Not Shown

LIMITED FIVE (5) YEAR WARRANTY

From the date of purchase to the original owner

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, baffle plate, 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.

* 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.

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

*Refer to the sticker on the back of the manual or box to complete this section.

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: _____

Important Notice

This registration information **MUST** be on file for this warranty to be valid. Please mail 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

England's Stove Works, Inc.
Technical support Department
P.O. Box 206
Monroe, Virginia 24574

Fax Number

(434) 929-4810 – Twenty-four hours a day.

Online Registration

Visit our warranty registration website at:

<http://www.heatredefined.com>

PLEASE NOTE:

PELLET – Additional safety and emissions tips

EPA INFORMATION

The following additions to your owner's manual will enable you to achieve optimal emissions performance from your stove. Important safety tips are also included.

- *Proper Installation* – Please refer to the Installation section of your owner's manual and follow the guidelines listed therein for safety and for optimal emissions performance.

Additional information:

Venting:

Be sure to follow your owner's manual's recommendation for venting, including the proper types of flue systems and pellet vent pipe.

Also note that Outside Air Connection (combustion air) is MANDATORY for proper safe operation, and to achieve optimal emissions performance.

Observe the vent termination clearances specified in your owner's manual, and contact our Technical Support if you have any questions. Phone (800) 245-6489 or email service@englanderstoves.com.

Be certain that all aspects of the venting system are installed to the venting manufacturer's instructions, particularly the required clearances to combustibles.

Your 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 your owner's manual's detailed descriptions of venting techniques; not installing the stove in accordance with the details listed can result in poor stove performance (including poor emissions), property damage, bodily injury or death. England's Stove Works is not responsible for any damage incurred due to a poor or unsafe 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, which 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.

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.
- *Operation and Maintenance* – Please refer to the ‘Operation’ (Operating Instructions) and Maintenance (including Ash Removal/Disposal) sections of your owner’s manual and follow the guidelines listed therein for safety *and* for optimal emissions performance.

Additional Information:

Following the instructions in your owner’s manual for Start-Up (lighting a fire) will ensure a proper fire, as well as helping minimize visible emissions.

More:

- *Fuel loading and re-loading:* Practical Tips for Building a Fire – See your owner’s manual for information on loading (and re-loading) your fuel, as well as for fire-starting procedures.
- *Fuel Selection:* Once your appliance is properly installed, be sure to follow your owner’s manual regarding fuel selection and starting and operating your appliance, including the following practical tips that will help you obtain the best efficiency from your stove.
-

Daily Operation Notes

- Only high quality, 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.

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.

WHAT FUELS NOT TO USE:

CAUTION

- **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; SALT WATER DRIFTWOOD OR OTHER PREVIOUSLY SALT WATER SATURATED MATERIALS; UNSEASONED WOOD; 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.**

- *Air Controls:* Your pellet stove is equipped with a control board that automatically adjusts the air to fuel ratio for optimum emissions. See your owner’s manual for information on operating the control board, and for other operational information on achieving the best burn, including these tips:

The control board on this stove allows the user to adjust the heat output and convection blower speed, and turn the unit on and off.

- 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.

Carbon Monoxide Detector

England’s Stove Works, Inc. highly recommends the use of a carbon monoxide detector in the proximity of the stove and one per floor of the home. A certain amount of carbon monoxide is produced within the stove as a by-product of combustion. All exhaust vent connections must be sealed with RTV Silicone to assure a tight seal. Any leaks into a confined area caused by faulty installation or improper operation of the stove could produce dizziness, nausea and in extreme cases, death. The CO concentration during testing was found to be 0.013 g/min

- **ASH REMOVAL** – Follow your Owner’s manual’s instructions regarding removal and disposal of ashes. Also be sure to follow ALL Maintenance requirements as listed.

- *REPLACEMENT of parts that are critical to emissions performance* – Follow your Owner’s manual’s instructions regarding replacement of gaskets and other parts that are critical to emissions performance.

Remember: “This wood heater needs periodic inspection and repair for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual.”

- **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.

- *Compliance:* “This non-catalytic wood heater meets the 2015 U.S. Environmental Protection Agency’s wood emission limits for wood heaters sold after May 15, 2015.”
- *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.”
- *Warranty:* See your Owner’s manual for a Warranty Registration instruction page, as well as instructions for warranty procedures. For parts, warranty replacement procedures may be found at our parts store site: www.heatredefined.com

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

P.O. Number: C/C

ID Number: 001413



Description: MASS FLOW METER
Manufacturer: SIERRA
Model Number: M50L-AL-DD-2-PV2-V1-5PC
Serial Number: 189158
Technician: JEFF BAHMANN

Calibration Date: 08/08/2018
Calibration Due: 02/08/2019
Procedure: TB 9-6680-293-40
Rev: 4/28/2011
Temperature: 70 F
Humidity: 53 % RH
As Found Condition: IN TOLERANCE
Calibration Results: IN TOLERANCE

On-Site Calibration: ☐
Comments:

Limiting Attributes:

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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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

FRANK BAHMANN, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
FL2148	FLUKE	MOLBOX1+A700-A	7/3/2018	7/3/2020
FL6426	OH INSTRUMENTS	1E4-VCR-V-Q	3/8/2018	3/8/2020



Technical Maintenance, Inc.

12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637

Phone: 813-978-3054 Fax 813-978-3758

www.tmicalibration.com



AC-2080

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	0.6 mL/min	slm	
Flow Accuracy	2.000	1.700	2.300	1.998	1.998	5.8 mL/min	slm	
Flow Accuracy	4.000	3.700	4.300	3.995	3.995	12 mL/min	slm	
Flow Accuracy	6.000	5.700	6.300	5.992	5.992	17 mL/min	slm	
Flow Accuracy	8.000	7.700	8.300	7.974	7.974	23 mL/min	slm	
Flow Accuracy	10.000	9.700	10.300	9.969	9.969	29 mL/min	slm	



Technical Maintenance, Inc.

12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637

Phone: 813-978-3054 Fax: 813-978-3758

www.tmicalibration.com



ANAB
ACCREDITED

AC-2080

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

P.O. Number: C/C

ID Number: 001414



Description: MASS FLOW METER
Manufacturer: SIERRA
Model Number: M50L-AL-DD-2-PV2-V1-5PC
Serial Number: 189157
Technician: JEFF BAHMANN

Calibration Date: 08/08/2018
Calibration Due: 02/08/2019
Procedure: TB 9-6680-293-40
Rev: 4/28/2011
Temperature: 70 F
Humidity: 53 % RH
As Found Condition: IN TOLERANCE
Calibration Results: IN TOLERANCE

On-Site Calibration: ☐
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.

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.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

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

FRANK BAHMANN, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
FL2146	FLUKE	MOLBOX1+A700-A	7/3/2018	7/3/2020
FL6426	DH INSTRUMENTS	1E4-VCR-V-Q	3/8/2018	3/8/2020



Technical Maintenance, Inc.

12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637

Phone: 813-978-3054 Fax 813-978-3758

www.tmicalibration.com



AC-2080

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	0.8 mL/min	slm	
Flow Accuracy	2.000	1.700	2.300	2.006	2.000	5.8 mL/min	slm	
Flow Accuracy	4.000	3.700	4.300	3.995	3.995	12 mL/min	slm	
Flow Accuracy	6.000	5.700	6.300	5.992	5.992	17 mL/min	slm	
Flow Accuracy	8.000	7.700	8.300	7.985	7.985	23 mL/min	slm	
Flow Accuracy	10.000	9.700	10.300	9.977	9.977	29 mL/min	slm	



Technical Maintenance, Inc.


12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637

Phone: 813-978-3054 Fax 813-978-3758

www.tmicalibration.com



AC-3080

		Calibration Certificate Number	1210-MID-07-02-18
		Issue Date	07/02/18
Middleton Laboratory Local Calibration Data			
Asset Number	1210	Asset Description	Dry Gas Meter
Calibration Date	7/2/2018	Performed By	Ken Slater
Calibration Due	1/2/2019	Reviewed By	Brian Ziegler
Reference Equipment			
Asset Description - Asset Number	Spirometer - 051	Calibration Due	NA
Asset Description - Asset Number	Hygrometer - 1420	Calibration Due	10/9/2018
Asset Description - Asset Number	Omega Temp Reader - 1312	Calibration Due	1/16/2019
Asset Description - Asset Number	NA	Calibration Due	NA

Barometric Pressure (in Hg)	29.12	Ambient Temp (°F)	78.1	Relative Humidity (%)	53
-----------------------------	-------	-------------------	------	-----------------------	----

As Found Data										
Run Number	Meter Initial	Barometric Pressure (in Hg)	Spirometer Temp (°F)	Vapor Pressure of H2O (Hg)	Meter Temp (°F)	Meter Pressure (in Hg)	Measurement (in)	Spirometer Volume	Meter Final	γ
1	419.58	29.12	80.0	1.0220	76.0	4	22.875	1.0398	420.595	0.98113
2	420.595	29.12	80.0	1.0220	77.0	4	22.8125	1.0369	421.608	0.98221
3	421.608	29.12	80.0	1.0220	77.0	4	22.625	1.0284	422.614	0.98092
4	422.614	29.12	81.0	1.0560	78.0	4	22.625	1.0284	423.619	0.98072
5	423.621	29.12	81.0	1.0560	79.0	4	23	1.0455	424.646	0.97933
								1.0358	Ave	0.98086
								0.0074	Std Dev	0.00103
								M of U	0.00234	Pass

As Left Data										
Run Number	Meter Initial	Barometric Pressure (in Hg)	Spirometer Temp (°F)	Vapor Pressure of H2O (Hg)	Meter Temp (°F)	Meter Pressure (in Hg)	Measurement (in)	Spirometer Volume	Meter Final	γ
1	419.58	29.12	80.0	1.0220	76.0	4	22.875	1.0398	420.595	0.98113
2	420.595	29.12	80.0	1.0220	77.0	4	22.8125	1.0369	421.608	0.98221
3	421.608	29.12	80.0	1.0220	77.0	4	22.625	1.0284	422.614	0.98092
4	422.614	29.12	81.0	1.0560	78.0	4	22.625	1.0284	423.619	0.98072
5	423.621	29.12	81.0	1.0560	79.0	4	23	1.0455	424.646	0.97933
								1.0358	Ave	0.98086
								0.0074	Std Dev	0.00103
								M of U	0.00234	Pass

33	0.187	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.195	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	0.203	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.211	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	0.219	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	0.228	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	0.237	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	0.247	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
41	0.256	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	0.266	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
43	0.277	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
44	0.287	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
47	0.322	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
48	0.334	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
49	0.347	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
50	0.360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
51	0.373	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52	0.387	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
53	0.402	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54	0.417	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
55	0.432	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	0.448	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
57	0.465	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
58	0.482	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
59	0.499	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
60	0.517	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
61	0.536	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62	0.555	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
63	0.575	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.595	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
65	0.616	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
66	0.638	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
67	0.661	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
68	0.684	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
69	0.707	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
70	0.732	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
71	0.757	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
72	0.783	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
73	0.810	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
74	0.838	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
75	0.866	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
76	0.896	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

77	0.926	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
78	0.957	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
79	0.989	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
80	1.022	1.0220	1.0220	1.0220	0.0000	0.0000	1.0220	1.0220	1.0220	0.0000	0.0000
81	1.056	0.0000	0.0000	0.0000	1.0560	1.0560	0.0000	0.0000	0.0000	1.0560	1.0560
82	1.091	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
83	1.127	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
84	1.163	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
85	1.201	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
86	1.241	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
87	1.281	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
88	1.322	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
89	1.364	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
90	1.408	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
91	1.453	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
92	1.499	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
93	1.546	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
94	1.595	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
95	1.645	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
96	1.696	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
97	1.749	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
98	1.803	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
99	1.859	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000





A059948



