Certificate of Conformity

Emissions – Adjustable burn rate wood burning heater

EPA 40 CFR Part 60, Subpart AAA, EPA Method 28R, ASTM E2515-2011, ASTM E2780-2010, CSA B415.1-2010

Certificate number: WHI19 – 208507008

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: Model 15-SSW01, 50-SHSSW01, 50-TRSSW01, 15-W03, 50-SHW03, 50-TRW03
Maximum Output: 27,500 Btu/hour
Weighted Average Emissions Rate: 1.956 g/hr
Weighted Average Efficiency: 73.77%
Test Fuel Type: Douglas fir Crib
Compliance: Certified to comply with 2020 particulate emissions standard.
Report Number: 103758222MID-001R1

Certification body: Intertek Testing Services NA, Inc.
Initial registration: April 5, 2019
Date of expiry: NA
Issue status: 3

Charles Meyers Director – Product Certification		7/16/2020
Name	Signature	Date

www.intertek.com

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

intertek
Total Quality. Assured.

ENGLAND STOVE WORKS. INC.
TEST REPORT

SCOPE OF WORK
EPA EMISSIONS TESTING FOR MODEL 15-SSW01

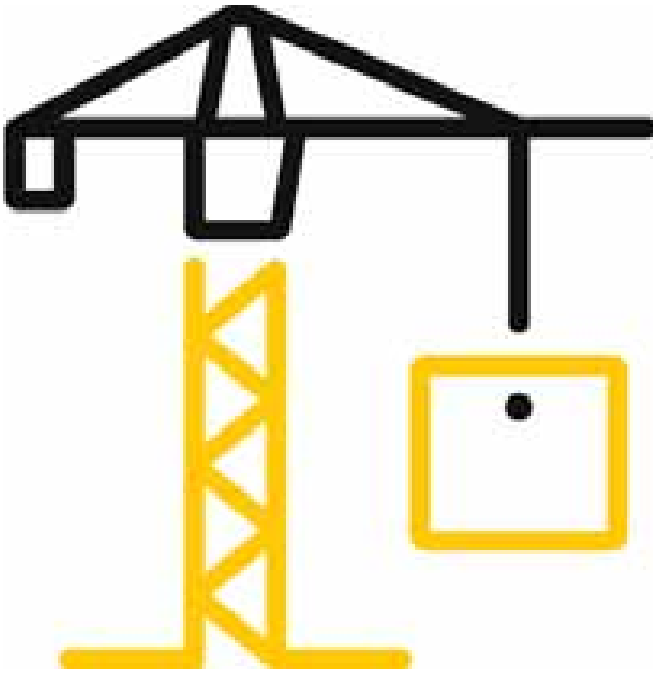
REPORT NUMBER
103758222MID-001R1

TEST DATE(S)
01/24/19 THROUGH 2/05/19

ISSUE DATE **REVISED DATE**
11/18/19 1/23/20

PAGES
19

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



intertek
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.: 103758222MID-001R1
Date: 1/23/20

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, 589 South Five Forks Road, Monroe, VA 24574-2821 to perform testing in accordance with, ASTM E2515-2011 "Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel", ASTM E2780-2010 "Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters" on their Model 15-SSW01, Wood 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: 1.956 g/hr
Carbon Monoxide: 1.659 g/min
Heating Efficiency: 73.77% (Higher Heating Value Basis)

For INTERTEK B&C:

COMPLETED BY:	Ken Slater	**REVIEWED BY:**	Brian Ziegler
TITLE:	Associate Engineer – Hearth	**TITLE:**	Technical Team Leader - Hearth
SIGNATURE:		**SIGNATURE:**	
DATE:	01/23/20	**DATE:**	01/23/20

aaa:bbb

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.: 103758222MID-001R1
Date: 1/23/20

SECTION 3
TEST METHOD(S)

The specimen was evaluated in accordance with the following:

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

ASTM E2780-2010 – Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters

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 01/18/19 and was shipped via the client. The unit was assigned sample ID # MID1901181005-001. 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 50 hours at high-to-medium burn rates to break in the stove. This break-in period was witnessed by England Stove Works, Inc. staff.

The unit's chimney system and laboratory dilution tunnels were cleaned using standard wire brush chimney cleaning equipment. On 01/24/19 the unit was set-up for testing.

SECTION 5
EQUIPMENT

Equipment	INV Number	Calibration Due	MU
Platform Scale	008	4/10/19	± 27g
Balance	713	4/10/19	± 0.47mg
Data Logger	986	4/10/19	± 0.33°F
Scale	1134	4/10/19	± 27g

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.: 103758222MID-001R1
Date: 1/23/20

Timer	1212	4/4/19	±0.3 sec
Timer	1213	4/4/19	±0.3 sec
Flow Meter	1413	7/18/19	± 17mL/min
Flow Meter	1414	7/18/19	± 17mL/min
Barometer	1420	4/12/19	± 0.24°F,1.7%RH, 0.011 in Hg
Dry Gas Meter	1210	6/27/19	± 0.00284 cfm

SECTION 6
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Ken Slater	Intertek B&C
John Wray	England Stove Works, Inc.

SECTION 7
TEST PROCEDURE

From 01/24/19 to 02/05/19, the unit was tested for emissions. The tests were conducted in accordance with ASTM E2780-10. The fuel used for the test run was Douglas Fir.

TEST SET-UP DESCRIPTON

A 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 uninsulated chimney extended the remaining height.

AIR SUPPLY SYSTEM

Combustion air enters the rear of the unit, which is directed to the firebox. All gasses exit through the 6" flue located at the top of the heater

TEST FUEL PROPERTIES

Wood used for the testing is nominal 4" x 4" Douglas Fir Cribs. Douglas Fir has a default heating value of 8523 Btu/hr (19810 kJ/kg) and a moisture content between 19% and 25% on a dry basis.

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.: 103758222MID-001R1
Date: 1/23/20

SAMPLING LOCATIONS

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

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

FIGURE 1 – DILUTION TUNNEL

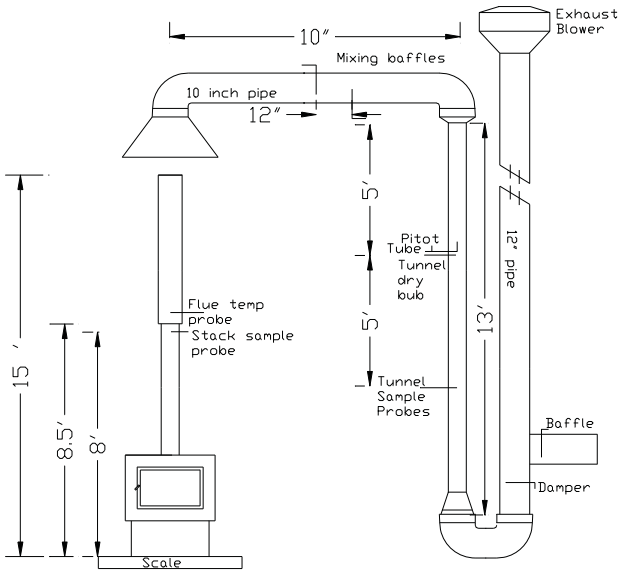


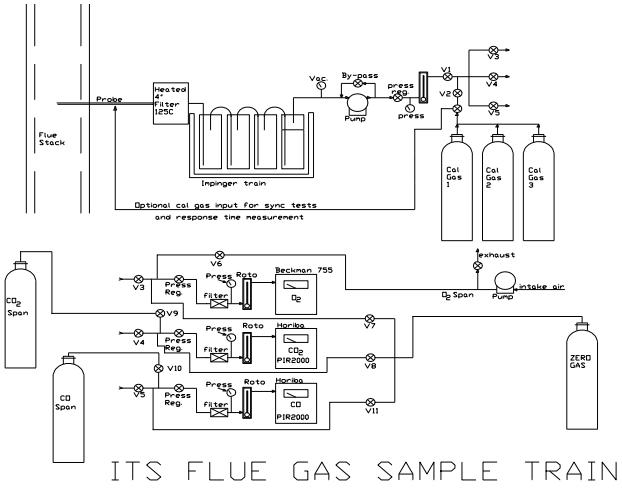
FIGURE 1

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.: 103758222MID-001R1
Date: 1/23/20

FIGURE 2 – STACK GAS SAMPLE TRAIN



ITS FLUE GAS SAMPLE TRAIN

FIGURE 2

FIGURE 3 – DILUTION TUNNEL SAMPLE SYSTEMS

8431 Murphy Drive
Middleton, WI 53562

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

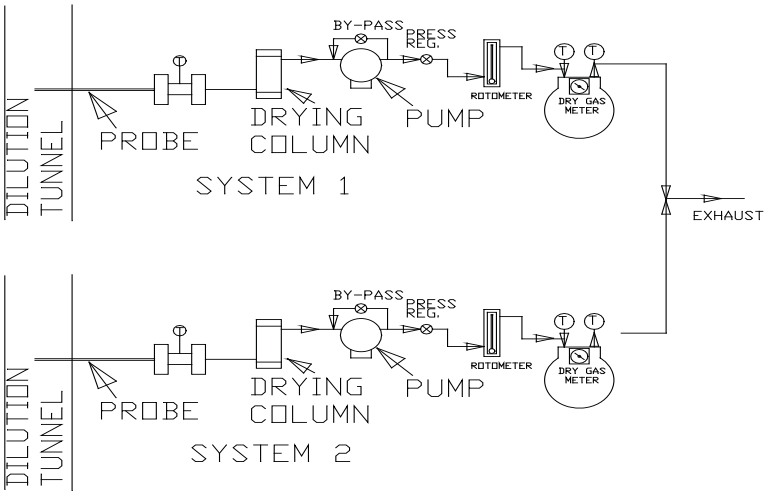


Figure 3

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.

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

8431 Murphy Drive
Middleton, WI 53562

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

and, if within 5%, the six-month factor is used to calculate standard volumes. Results of this calibration are contained in Appendix D.

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

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

STACK SAMPLE ROTAMETER

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

GAS ANALYZERS

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

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

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

8431 Murphy Drive
Middleton, WI 53562

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

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

NOMENCLATURE FOR ASTM E2515:

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

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

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

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

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

E_T = Total particulate emissions, g.

F_p = Adjustment factor for center of tunnel pitot tube placement.
$F_p = V_{strav}/V_{scent}$

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

or

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

8431 Murphy Drive
Middleton, WI 53562

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

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.

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

dscm/min (dscf/min).

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

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

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

where:

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

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

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

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

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

where:

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

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

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

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

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

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.: 103758222MID-001R1
Date: 1/23/20

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

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

where:

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

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

where:

V_{mc} = Vm– (Lp– La)u

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

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

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

Where:

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

V_s = Average gas velocity in the dilution tunnel.

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

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

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

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

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

Y = Dry gas meter calibration factor.

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

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

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

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

where:

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

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

θ = Total sampling time, min.

10 = ten min, length of first sampling period.

13.6 = Specific gravity of mercury.

100 = Conversion to percent.

TOTAL PARTICULATE WEIGHT – ASTM E2515

$$M_n = m_p + m_f + m_g$$

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.: 103758222MID-001R1
Date: 1/23/20

PARTICULATE CONCENTRATION – ASTM E2515

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

where:

K_2 = 0.001 g/mg

TOTAL PARTICULATE EMISSIONS (g) – ASTM E2515

$E_T = (C_s – C_r)Q_{std}\theta$

PROPORTIONAL RATE VARIATION (%) – ASTM E2515

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

MEASUREMENT OF UNCERTAINTY – ASTM E2515

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

GENERAL FORMULA – ASTM E2515

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

Where:

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

TOTAL PARTICULATE EMISSIONS – ASTM E2515

$E_T = (c_s – c_r)\ Q_{std}\ \theta$

where:

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

MU OF c_s

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

MU OF c_r

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.: 103758222MID-001R1
Date: 1/23/20

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

E_T AND MU_{ET}

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

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.: 103758222MID-001R1
Date: 1/23/20

The air flow velocity shall be calculated as follows:

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

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

The mass flow rate shall be calculated as follows:

$$m = 3600VAp$$

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

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

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

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

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

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

Where:

8431 Murphy Drive
Middleton, WI 53562

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

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

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

$$e_t = E_t / t$$

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

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

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

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

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 15-SSW01 Wood Fuel Room Heater is constructed of sheet steel. The outer dimensions are 35.75-inches high, 22-inches wide, and 27-inches deep. The unit has a door located on the front with a viewing glass.

SECTION 10
TEST RESULTS

DESCRIPTION OF TEST RUNS:

RUN #1 (01/24/19): Air control set for a category 1 burn rate with a burn time of 292 minutes. The test was loaded in 60 seconds with the door remaining open for 5 minutes after the fuel was

8431 Murphy Drive
Middleton, WI 53562

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

added. Air shutter was fully closed. The fan was set to low position. The results of the test ended as a category 3 burn rate of 1.283 kg/hr. This test was not used.

RUN #2 (01/25/1): Air control set for a category 1 burn rate with a burn time of 167 minutes. The test was loaded in 60 seconds with the door remaining open for 3.5 minutes after the fuel was added. The fan was set to low position. The bi-metal spring did not activate as required and the test resulted in a category 4 with a burn rate of 2.208 kg/hr. This test was not used

RUN #3 (01/28/19): Air control set for a category 1 burn rate with a burn time of 340 minutes. The test was loaded in 60 seconds with the door remaining open for 4.5 minutes after the fuel was added. Air shutter fully closed. The fan was set to low position. The results of the test ended as a category 2 burn rate of 1.155 kg/hr. This test was not used.

RUN #4 (01/29/19): Air control set for a category 2 burn rate with a burn time of 312 minutes. The test was loaded in 60 seconds with the door remaining open for 1 minute after the fuel was added. Air shutter fully closed. The fan was set to low position. The results of the test ended as a category 2 burn rate of 1.217 kg/hr.

RUN #5 (01/31/19): Air control set for a category 4 burn rate with a burn time of 70 minutes. The test was loaded in 60 seconds with the door remaining open for 3 minutes after the fuel was added. Air shutter full open. The fan was set to low position. The filters began to plug after 30 minutes of testing and became completely plugged at 70 minutes, Test was discontinued. This test was not used.

RUN #6 (01/31/19): Air control set for a category 4 burn rate with a burn time of 182 minutes. The test was loaded in 60 seconds with the door remaining open for 5 minutes after the fuel was added. Air shutter full open. The fan was set to high position. The results of the test ended as a category 4 burn rate of 2.021 kg/hr.

RUN #7 (02/01/19): Air control set for a category 3 burn rate with a burn time of 187 minutes. The test was loaded in 60 seconds with the door remaining open for 1 minute after the fuel was added. Air shutter set at 1/8” from fully closed. The fan was set to high position. The results of the test ended as a category 4 burn rate of 2.005 kg/hr. This test was not used.

RUN #8 (02/04/19): Air control set for a category 3 burn rate with a burn time of 260 minutes. The test was loaded in 60 seconds with the door remaining open for 1.75 minutes after the fuel was added. Air shutter set at 1/6” from fully closed. The fan was set to high position. The results of the test ended as a category 3 burn rate of 1.466 kg/hr.

RUN #9 (02/05/19): Air control set for a category 1 burn rate with a burn time of 387 minutes. The test was loaded in 60 seconds with the door remaining open for 5 minutes after the fuel was

8431 Murphy Drive
Middleton, WI 53562

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

added. Air shutter fully closed. The fan was set to low position. The results of the test ended as a category 1 burn rate of 0.923 kg/hr.

TABLE 1 – EMISSIONS

RUN#	TEST DATE	BURN RATES (kg/hr)(Dry)	PARTICULATE EMISSION RATE (g/hr)	1st HOUR EMISSIONS (g)	CO EMISSIONS (g/min)	HEATING EFFICIENCY (%HHV)
4	01/29/19	1.217	2.228	11.62	1.62	73.9
6	01/31/19	2.021	2.562	7.137	1.97	73.1
8	02/04/19	1.446	0.858	3.042	1.56	74.4
9	02/05/19	0.923	2.166	9.934	1.49	73.6

TABLE 2 – WEIGHTED AVERAGE CALCULATION

RUN #	BURN RATE	(E) AVERAGE EMISSION RATE g/hr	(CO) AVERAGE EMISSION RATE g/hr	(OHE)	HEAT OUTPUT (Btu/hr)	PROBABILITY	(K) WEIGHTING FACTOR	(KxE)	(KxOHE)
9	0.923	2.166	89.26	73.60	11129.72	0.3129	0.5575	1.2075	41.03
4	1.217	2.228	97.16	73.90	14674.83	0.5575	0.4181	0.9315	30.90
8	1.466	0.858	93.54	74.40	17677.32	0.7310	0.3579	0.3071	26.63
6	2.021	2.562	118.36	73.10	24369.62	0.9154	0.2690	0.6893	19.67

TABLE 3 – 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)
4	69	70	28.82	28.83	14.0	13.0	0	0
6	68	72	29.29	29.26	11.0	11.0	0	0
8	72	71	28.57	28.69	31.0	28.0	0	0
9	70	68	29.10	29.03	24.0	19.0	0	0

intertek
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.: 103758222MID-001R1
Date: 1/23/20

TABLE 4 – 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
4	312	18.77	201.70	546.31	73.93	73.82	14.30	12.90
6	182	17.68	186.44	565.30	43.94	43.84	10.50	9.60
8	260	19.60	207.01	551.99	59.37	59.30	4.60	3.60
9	387	22.72	248.89	540.19	90.71	90.58	14.10	12.20

TABLE 5 - DILUTION TUNNEL DUAL TRAIN PRECISION

RUN #	SAMPLE RATIOS		TOTAL EMISSIONS (g)		DEVIATION (%)	DEVIATION (g/kg)
	TRAIN 1	TRAIN 2	TRAIN 1	TRAIN 2		
4	851.22	852.54	12.17	11.00	5.07	0.186
6	772.32	774.01	8.11	7.43	4.37	0.111
8	906.62	907.67	4.17	3.27	12.14	0.142
9	1061.85	1063.42	14.97	12.97	7.15	0.336

TABLE 6 - GENERAL SUMMARY OF RESULTS

RUN #	BURN RATE (kg/hr)(dry) (OVERALL)	INITIAL DRAFT (in/H_2O)	RUN TIME (min)	AVERAGE DRAFT (in/H_2O)
4	1.217	0.033	312	0.026
6	2.021	0.028	182	0.035
8	1.466	0.046	260	0.029
9	0.923	0.036	387	0.021

TABLE 7 - CSA B415.1 RESULTS

BURN RATE (kg/hr)(dry)	CO EMISSIONS (g/min)	HEATING EFFICIENCY (% HHV)	HEAT OUTPUT (Btu/hr)
Run #4 – 1.20	1.62	73.9	16,622
Run #6 – 2.01	1.97	73.1	27,546
Run #8 – 1.44	1.56	74.4	20,162
Run #9 – 0.91	1.49	73.6	12,617

intertek
Total Quality. Assured.

8431 Murphy Drive
Middleton, WI 53562

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

SECTION 11
CONCLUSION

This test demonstrates that this unit is an affected facility under the definition given in the regulation. The emission rate of 1.956 g/hr meets the EPA requirements for the Step 2 limits.

Model 15-SSW01 is a representative for similar models 50-SHSSW01, 50-TRSSW01, 15-W03, 50-SHW03 and 50-TRW03. All models have the same internal design, electrical components, and controls. The only differences are external cosmetic designs.

Models 15-W03, 50-SHW03 and 50-TRW03 have a shorter pedestal below the firebox, but are otherwise identical to the models 15-SSW01, 50-SHSSW01, and 50-TRSSW01.

SECTION 12
PHOTGRAPHS

Photo No. 1

Final security wrap

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.: 103758222MID-001R1
Date: 1/23/20

SECTION 13
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	11/18/19	N/A	Original Report Issue
1	1/23/20	19	Models 15-W03, 50-SHW03 and 50-TRW03 added as similar models.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATION FORM
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

Disclaimer: The statutory provisions and the EPA regulations described in this document contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. In the event of a discrepancy, please refer to 40 CFR PART 60 Subparts AAA AND QQQQ, Sections 60.533 and 60.5475. This document may be revised periodically without public notice. If you have additional questions, please contact Rafael Sanchez at 202-564-7028 or via email at sanchez.rafael@epa.gov.

- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

GENERAL INFORMATION						
Manufacturer's Name: **England's Stove Works, Inc.**						
Appliance Type (Circle One):	Adjustable Burn Rate Wood Heater	Pellet Stove	Single Burn Rate Heater	Hydronic Heater	Forced Air Furnace	Other:
Hydronic Heater Type (Circle One):	Traditional	Full Storage	Partial Storage	Indoor/Outdoor	Other:	
Forced-Air Furnace Type (Circle One):	Small (less than 65,000 BTU/hr heat output)		Large (greater than 65,000 BTU/hr heat output)		Other:	
Fuel Type:	Crib	Pellet	Cordwood	Other:		
Model Name and Number: **15-SSW01, 50-SHSSW01, 50-TRSSW01**						
Catalyst: Yes_____ No___X____						
Mailing Address: **PO BOX 206 MONROE, VA 24574**						
Street Address: **589 SOUTH FIVE FORKS ROAD**						
City: **MONROE**	**State:** **VA**	**ZIP Code:** **24574**				
Phone: **434-929-0120**	**Fax:** **434-929-4810**	**Web Site:** **WWW.HEATREDEFINED.COM**				
Address of Manufacturing Facility: **100 WEST PROGRESS LANE**						
City: **MADISON HEIGHTS**	**State** **VA**	**ZIP Code:** **24572**				

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATION FORM
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

Disclaimer: The statutory provisions and the EPA regulations described in this document contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. In the event of a discrepancy, please refer to 40 CFR PART 60 Subparts AAA AND QQQQ, Sections 60.533 and 60.5475. This document may be revised periodically without public notice. If you have additional questions, please contact Rafael Sanchez at 202-564-7028 or via email at sanchez.rafael@epa.gov.

- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

EPA APPROVED TEST LABORATORY		
Name and Title of Authorized Representative: **Brian Ziegler – Technical Team Leader - Hearth**		
Company: **Intertek**		
Phone: **608-824-7425**	**E-mail:** **brian.ziegler@intertek.com**	**Fax:** **608-831-9279**
City: **Middleton**	**State:** **WI**	**ZIP Code:** **53562**
EPA APPROVED THIRD-PARTY CERTIFIER		
Name and Title of Authorized Representative: **Charles Meyers – Certification Manager**		
Company: **Intertek**		
Phone: **312-906-7783**	**E-mail:** **charles.meyers@intertek.com**	**Fax:**
City: **Arlington Heights**	**State:** **IL**	**ZIP Code:** **60005**
COMPLIANCE TEST INFORMATION		
Test Method(s): **EPA METHOD 28A, ASTM E2780 and ASTM E2515**		
Date(s) of Proposed Test: **01/21/19**		
Testing Location: **Intertek** **8431 Murphy Drive** **Middleton, WI 53562**		

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
30-DAY NOTIFICATION FORM
PURSUANT TO 40 CFR PART 60 SUBPARTS AAA AND QQQQ
2015 STANDARDS OF PERFORMANCE FOR NEW RESIDENTIAL WOOD HEATERS, NEW RESIDENTIAL HYDRONIC HEATERS AND FORCED-AIR FURNACES

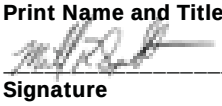
Disclaimer: The statutory provisions and the EPA regulations described in this document contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. In the event of a discrepancy, please refer to 40 CFR PART 60 Subparts AAA AND QQQQ, Sections 60.533 and 60.5475. This document may be revised periodically without public notice. If you have additional questions, please contact Rafael Sanchez at 202-564-7028 or via email at sanchez.rafael@epa.gov.

- **The manufacturer of an affected wood/pellet heater/central heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to WoodHeaterReports@epa.gov.**
- **This notice must be received by the EPA at least 30 days before the start of testing.**

Michael Speight, Purchasing

_____

Print Name and Title of Authorized Official



_____

Signature

12/11/18

_____

Date

Remarks:

v1

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 EPA Method 28R, ASTM E2780, 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. EPA Method 28R
2. ASTM E2780
3. ASTM E2515

I. APPLIANCE INSPECTION AND SET-UP

A. Incoming Inspection

1. Check for completeness of unit including parts, accessories, installation and operating instructions, drawings and specifications, etc. Note any discrepancies or missing parts.
2. Check for shipping damage. If damage has occurred, notify the laboratory manager. In some cases repairs may be made, provided the manufacturer and laboratory manager concur that repairs will not affect the unit's performance. If damage is irreparable, a new unit will need to be obtained.
3. Note whether unit is catalytic or non-catalytic.
4. Mark unit with manufacturer's name, model number, work order number, and date received.
5. 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. Thermocouples must be attached to surfaces of wood heaters prior to testing. EPA requires a thermocouple on the outside bottom of the firebox. This must be installed prior to putting the unit on the scale. In some cases the required thermocouple locations will be inaccessible on finished units. Check with the laboratory manager if problems are encountered in proper thermocouple attachment.
4. Prior to placing unit on scale, the scale must be turned on and allowed to warm up for 1-hour minimum.
5. 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.)
6. 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.
7. Measure firebox dimensions and record on appropriate data form. Make a three dimensional sketch of the firebox including firebrick, baffles, and obstructions. Calculate firebox volume in cubic feet. See Section 9.3 of ASTM E2780-10 for details.
8. If unit is equipped with a catalyst additional thermocouples must be installed downstream of the catalyst.

9. Plug thermocouples into data acquisition system jacks and verify that all instrumentation is working properly.
10. Dilution tunnel must be cleaned prior to each certification test series, and at anytime a higher burn rate follows a lower burn rate.

II. SAMPLING SYSTEMS SET-UP

A. Gas Analysis

1. All instruments should be turned on and allowed to warm up for 1-hour minimum.
2. Prior to calibrating, make sure that the outlet pressure on each calibration gas bottle reads 10 PSI. Adjust flow meters at each gas analyzer to required flow.

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

Calibrate analyzers as follows:

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

3. Response time synchronization check.

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

4. Sample clean-up train.

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

c. Place Impingers in container and connect with greased "U TUBES". (Grease carefully on bottom half of ball joint so that grease will not get into tubes.)
d. Connect filter to impinger #1 and sample line to impinger #4.
e. Connect stack probe to filter.
f. Leak check system as follows:
1) Plug probe.
2) Turn on sample system and increase flow rate slowly.
3) Set vacuum-adjust valve to obtain a vacuum of 10 inches mercury.
4) If sapphire float in rotometer does not stabilize below 10 on scale, system must be resealed.
5) Repeat leak-check procedure until satisfactory results are obtained.
6) Unplug probe slowly, then decrease flow rate slowly before shutting off system.

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

B. Dilution Tunnel Sample Train Set-Up:

1. Filters and holders.
a. Clean probes and filter holder front housings carefully and desiccate to a constant weight prior to use.
b. Filters and filter probe combinations should be numbered and labeled prior to use.
c. Weigh desiccated filters and probe filter units on analytical balance. Record the weights on the appropriate form. Note that the probe and front half of the front filter holder is to be weighed as a unit.
d. Carefully assemble the filter holder units and connect to sampling systems.
e. Change desiccate columns with dry absorbent before each test series.

2. Leak checking.

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

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

      If CFM_1 or CFM_2 is greater than 0.02 cfm, or $_1$S greater than 0.04 x Sample Rate, leakage is unacceptable and system must be resealed. For most tests the sample rate will be 0.25 cfm, thus leakage rates in excess of 0.04 x 0.25 = 0.010 cfm are not acceptable.
   e. To prevent contamination, do not insert probes in tunnel until the start of the test run.

III. TEST CONDUCT

A. Pre-Test Fuel Load

1. Using 2x4 Douglas fir cut enough pieces to approximate test load weight. (Piece length must be greater than 1/3 of the test load length.)
2. Measure percent moisture content using Delmhorst moisture meter. The average percent moisture must be within 19 to 25 percent.

B. Test Fuel Load

1. Determine optimum load weight by multiplying firebox volume (cubic feet) by 7. This is the ideal load weight.
2. Determine piece size mix i.e. <1.5 cubic feet volume use 2x4's only; 1.5 ft^3 to 3.0 ft^3 use a mix of 2.4's and 4x4's; >3.0 ft_3 use only 4x4's. Ideal length is 5/6 of the longest firebox dimension.
3. Weigh out test load and appropriate number of spacers and adjust weight by shortening or lengthening all pieces equally if necessary.
4. Construct test loads by attaching spacers as shown in ASTM E2780.
5. Measure and record moisture content of each fuel piece (use three sides).

Determine if fuel load moisture content is within required range (19-25%). If not, construct new fuel pieces using wood with required moisture content.
All wood in the humidity chamber is Douglas fir and should be within range. Contact laboratory manager if you cannot find suitable pieces.

C. Unit Start-Up

1. With all doors and air controls closed, zero draft Magnehelic using screw located at bottom of meter.
2. Before lighting a fire turn on dilution tunnel and set flow rate to 140 scfm (approximately 715 fpm) if burn rate is to be less than 3 kg/hr. For higher burn rates set flow for a 150:1 air fuel ratio (see chart for approximate values).
3. Check draft imposed on cold stove. All inlets must be closed and a draft gauge in the chimney. If draft is greater than 0.005 inches water column, adjust tunnel to stack gap until draft is less than 0.005 inches water column.
4. With hot wire anemometer check for ambient airflow around unit (must be less than 50 ft/min).
5. Zero scale and start fire with newspaper and Douglas Fir kindling. (Make sure stack sample probe is on the unit.)
6. Once kindling is burning well, add preload fuel. Operate at high fire for sufficient time to get fuel load 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 load must burn for a minimum of 1 hour. Record stove surface, catalyst, room, and flue temperatures.
9. Stir fire often during preburn (after a reading) to get a good coal bed. Fire can only be raked once (door open 1 minute or less) during the 15 minutes prior to the start of the test.

D. Test Run

1. Stack gas analyzers should be on and in the sample mode.
2. When the fuel bed is between 20-25% of the test load weight 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. Record initial readings.
   d. Turn on probe sample systems and start timing test.
   e. Tare platform scale.
   f. Open stove doors and load stove. Close door or follow manufacturer's start-up procedures. Five minutes is the maximum time before all doors and controls must be set to final positions for duration of test.

g. Record length of time door and bypass are open, include any air control setting adjustments.
h. 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.
i. Filter temperatures shall not exceed 90ºF anytime during the test. If the filters are approaching 90ºF turn on cooling pump. Filters must be kept above the dilution tunnel wet bulb temperature in order to prevent condensation.
j. Regularly check impinger train for ice level during test.
k. After 30 seconds of 0.00 lbs. weight, and on the minute, shut off sample trains and record last reading.
l. Record final dry gas meter values.

IV. POST TEST PROCEDURES

A. Leak Checks

1. Dilution Tunnel
   a. Remove both 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 scrape gasket with scalpel. 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 Stationary Sources; New Residential Wood Heaters, Intertek Testing Services seals certified wood heaters by:

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

Test No.	Burn Rate	Emission Rate g/hr	(OHE)	Output (BTU/HR)	Prob.	Weighting Factor	(KxE)	KxOHE
9	0.923	2.166	73.60	11129.72	0.3129	0.5575	1.2075	41.03
4	1.217	2.228	73.90	14674.83	0.5575	0.4181	0.9315	30.90
8	1.466	0.858	74.40	17677.32	0.7310	0.3579	0.3071	26.63
6	2.021	2.562	73.10	24369.62	0.9154	0.2690	0.6893	19.67
				0.00	1.0000	0.0000	0.0000	0.00
				0.00	1.0000	0.0000	0.0000	0.00
				0.00	1.0000	0.0000	0.0000	0.00
				0.00	1.0000	0.0000	0.0000	0.00
				0.00	1.0000	0.0000	0.0000	0.00
						0.0000	0.0000	0.00
				0.00				
						1.60248	3.1353	118.22

emissions rate:	1.9565
Weighted Average OHE	73.77

England Stove Works

Manufacturer: England Stoves
Model: 15SSW01
Date: 01/24/19
Run: 1
Control #: G103758222
Test Duration: 292
Output Category: 3

Technicians: Ken Slater

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	74.0%	80.0%
Combustion Efficiency	94.4%	94.4%
Heat Transfer Efficiency	78%	84.8%

Output Rate (kJ/h)	18,559	17,605	**(Btu/h)**
Burn Rate (kg/h)	1.27	2.79	**(lb/h)**
Input (kJ/h)	25,063	23,775	**(Btu/h)**

Test Load Weight (dry kg)	6.16	13.57	**dry lb**
MC wet (%)	16.88		
MC dry (%)	20.31		
Particulate (g)	7.71		
CO (g)	488		
Test Duration (h)	4.87		

Emissions	**Particulate**	**CO**	
g/MJ Output	0.09	5.41	
g/kg Dry Fuel	1.25	79.29	
g/h	1.58	100.31	1.671886
lb/MM Btu Output	0.20	12.56	

Air/Fuel Ratio (A/F)	13.87

VERSION: **2.2** **12/14/2009**

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	70	0	28.76	28.82	20.0	19.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
292	18.74	200.68	547.40	68.76	68.71	9.30	8.20

	Dilution Tunnel Dual Train Precision				
	Sample Ratios		Total Emissions (g)		
	Train 1	Train 2	Train 1	Train 2	Deviation (%)
	852.14	852.84	7.92	6.99	6.24%

Burn				Initial		Run	Average
Rate		Surface		Draft		Time	Draft
1.283		0.000		0.024		292.000	0.026

Run	Date	Burn Rate	Emission
1	1/24/2019	1.283	1.533

England Stove Works

Manufacturer: England Stoves
Model: 15SSW01
Date: 01/25/19
Run: 2
Control #: G103758222
Test Duration: 167
Output Category: 4

Technicians: Ken Slater

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.2%	81.3%
Combustion Efficiency	96.8%	96.8%
Heat Transfer Efficiency	78%	84.0%

Output Rate (kJ/h)	32,988	31,292	**(Btu/h)**
Burn Rate (kg/h)	2.21	4.88	**(lb/h)**
Input (kJ/h)	43,870	41,615	**(Btu/h)**

Test Load Weight (dry kg)	6.16	13.58	**dry lb**
MC wet (%)	16.26		
MC dry (%)	19.42		
Particulate (g)	8.96		
CO (g)	281		
Test Duration (h)	2.78		

Emissions	**Particulate**	**CO**	
g/MJ Output	0.10	3.06	
g/kg Dry Fuel	1.45	45.61	
g/h	3.22	101.01	1.683532
lb/MM Btu Output	0.23	7.12	

Air/Fuel Ratio (A/F)	12.43

VERSION: **2.2** **12/14/2009**

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	69	0	29.10	29.10	16.0	15.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
167	18.82	197.55	564.52	39.05	39.04	8.40	7.80

	Dilution Tunnel Dual Train Precision				
	Sample Ratios		Total Emissions (g)		
	Train 1	Train 2	Train 1	Train 2	Deviation (%)
	844.75	845.12	7.10	6.59	3.68%

Burn			Initial		Run	Average
Rate		Surface	Draft		Time	Draft
2.208		0.000	0.029		167.000	0.036

Run	Date	Burn Rate	Emission
2	1/25/2019	2.208	2.459

ABC Laboratories, Inc.

Manufacturer: England Stoves
Model: 15SSW01
Date: 01/21/19
Run: 1
Control #: G103758222
Test Duration: 252
Output Category: 4

Technicians: Ken Slater

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	73.5%	79.4%
Combustion Efficiency	97.4%	97.4%
Heat Transfer Efficiency	75%	81.6%

Output Rate (kJ/h)	20,058	19,027	**(Btu/h)**
Burn Rate (kg/h)	1.38	3.04	**(lb/h)**
Input (kJ/h)	27,297	25,894	**(Btu/h)**

Test Load Weight (dry kg)	5.79	12.76	**dry lb**
MC wet (%)	17.33		
MC dry (%)	20.96		
Particulate (g)	4.33		
CO (g)	250		
Test Duration (h)	4.20		

Emissions	**Particulate**	**CO**	
g/MJ Output	0.05	2.96	
g/kg Dry Fuel	0.75	43.14	
g/h	1.03	59.45	0.990799
lb/MM Btu Output	0.12	6.89	

Air/Fuel Ratio (A/F)	18.77

VERSION: **2.2** **12/14/2009**

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	71	0	28.50	28.66	18.0	16.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
340	18.67	199.07	545.68	76.66	76.58	20.30	17.50

Dilution Tunnel Dual Train Precision

Sample Ratios		Total Emissions (g)		
Train 1	Train 2	Train 1	Train 2	Deviation (%)
882.92	883.85	17.92	15.47	7.35%

Burn			Initial		Run	Average
Rate		Surface	Draft		Time	Draft
1.155		0.000	0.036		340.000	0.024

Run	Date	Burn Rate	Emission
3	1/28/2019	1.155	2.946

ABC Laboratories, Inc.

Manufacturer: England Stoves
Model: 15SSW01
Date: 01/29/19
Run: 4
Control #: G103758222
Test Duration: 312
Output Category: 2

Technicians: Ken Slater

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	73.9%	79.9%
Combustion Efficiency	94.3%	94.3%
Heat Transfer Efficiency	78%	84.7%

Output Rate (kJ/h)	17,522	16,622	**(Btu/h)**
Burn Rate (kg/h)	1.20	2.64	**(lb/h)**
Input (kJ/h)	23,700	22,482	**(Btu/h)**

Test Load Weight (dry kg)	6.22	13.71	**dry lb**
MC wet (%)	16.48		
MC dry (%)	19.73		
Particulate (g)	11.59		
CO (g)	505		
Test Duration (h)	5.20		

Emissions	**Particulate**	**CO**	
g/MJ Output	0.13	5.54	
g/kg Dry Fuel	1.86	81.21	
g/h	2.23	97.16	1.619259
lb/MM Btu Output	0.30	12.89	

Air/Fuel Ratio (A/F)	13.97

VERSION: **2.2** **12/14/2009**

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run # 4 Cat E

Date 1-29-19
Tech

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 28.82 (inches Hg.) Static pressure (P_g) -.336 (inches w.c.)
Inside diameter: Port A ____ in Port B ____ in Tunnel cross sectional area: ____ Ft^2
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.103		
B-Centroid	3.00	.104		
A-1	0.50	.090		
A-2	1.50	.098		
A-3	4.50	.101		
A-4	5.50	.094		
B-1	0.50	.090		
B-2	1.50	.100		
B-3	4.50	.095		
B-4	5.50	.089		
		AVERAGE		

Adjustment factor application

Pitot correction 96.67

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

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

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured) Adjustment factor for alternative Pitot tube placement

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

K_p = 85.49 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 H_2O)

Intertek

Manufacturer: England Stoves_____ Model : 15-SSW01_____
Job #_G103758222_____ Run #4 Cat 3

Date 1-29-19
Tech [signature]

Pre/Post Checks

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	✓ fpm	✓ fpm
Smoke Capture Check	✓	✓
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	1-21-19	
Date Dilution Tunnel Cleaned	1-21-19	
Induced Draft Check	✓	✓
Tunnel Velocity	112	109
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)		°F
Proportional Checks:		
CO Analyzer Drift Check		✓
CO_2 Analyzer Check		✓
O_2 Analyzer Check		✓
Thermocouple check		

Sampling Train ID Numbers:	Train 1	Train 2
Probe	E	J
Filter Front	37	39
Filter Back	38	40
Filter Thermocouple	19	22
Filter 5G-3 (<90°F)		

TSP-N
1
1
2

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #4 CAT 2

Page 3 of 10
Date 1-29-19
Tech [signature]

Pre-Test Scale Audit

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

LIMITS OF WEIGHT RANGES

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

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run # 4 Cat 2

Date 1-29-'9
Tech

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers
Leakage Checks Tunnel Samplers

	SAMPLE 1		SAMPLE 2		SAMPLE 3	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-test	Post Test
Vacuum (inches Hg.)	10"	10"	10"	10"	10"	10"
Final 1 minute DGM (ft^3)	0	0	0	0	426.086	435.879
Initial 1 minute DGM (ft^3)	0	0	0	0	426.086	435.879
Change (C) (ft^3)	0	0	0	0	0	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

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

Intertek

Manufacturer: England Stoves ___ Model : 15-SSW01
Job # G103758222 Run #4 cat c

Page 5 of 10
Date 1-29-19
Tech

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO_2	0	0	24.88	24.85	11.95	11.99
CO	0	0	8.976	8.976	4.06	4.004
O_2	0	0	20.95	2095	9.99	10.01
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO_2	0.01	24.75	11.87	.01	.13	.12	✓	
CO	-.009	8.52	3.80	.09	.45	.26	✓	
O_2	0.02	20.89	9.95	.02	.06	.04	✓	

* Greater than = 5% of the range used.

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job #_G103758222 Run #4 Cert 3

Page 6 of 10
Date 1-29-19
Tech

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2	System 3
Final (ft^3)	77.31	77.29	435.859
Initial (ft^3)	0	0	426.086

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	72.5	70.8
Temperature (°F)	14	13
Humidity (%)	28.82	28.83

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #4 Cat 2

Date 1-23-19
Tech

READING #	REAL TIME	ELAPSED TIME	DOM 1	ROTOMETER 1	DOM 2	ROTOMETER 2	DOM 3	ROTOMETER 3	DRAFT	MAX DOM PRESSURE
0	907	0					426.086			
1		10					427.660			
2		20					429.300			
3		30					430.930			
4		40					432.560			
5		50					434.290			
6		60					435.859			
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								

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #4 CAT2

Page 8 of 10
Date 1-27-19
Tech

COMMENTS

7:13 AM - PRETEST STARTED

907 AM - TEST STARTED
DOOR REMAINED OPEN FOR 1 MINUTE
AIR SHUTTER FULLY CLOSED
SHUTTER ACTIVATED @ 4 MINUTES

Intertek

Page 9 of 10
Date 1-29-19
Tech

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #4 cont 2

FUEL DATA

PRE-TEST LOAD

FUEL DESCRIPTION:
Kindling weight: 4.6 lbs. Consisting of: Scrap and paper Fire lit Time:
Pre-test load weight: 16.15 lbs. Consisting of: 2X4X inches Time loaded:
Pre-test moisture content: Uncorrected: % Corrected Dry: % Wet: %

Test Air Control Settings: Time:
Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	15.12 Lbs.	16.80 lbs.	18.48 Lbs.

Fire Box Volume:	2.4 Ft.³	Ideal Length:	Inches
Load Volume:	Ft.³	Loading Density:	lbs/ft.³
Spacer weight	2.81 Lbs	Load Density:	lbs/ft.³

Piece Size	Weight	Meter Moisture Content (% dry)*		
2 x 4 x 15 in.	1.53 lbs.	19.7 %	20 %	21 %
2 x 4 x 15 in	1.38 lbs.	19.9 %	18.1 %	22.1 %
2 x 4 x 15 in	1.20 lbs.	19.3 %	20.2 %	19.7 %
2 x 4 x 15 in	1.33 lbs.	19.2 %	19.4 %	19.9 %
2 x 4 x 15 in	1.21 lbs.	20.7 %	18.4 %	19.7 %
4 x 4 x 15 in	3.60 lbs.	18.5 %	18 %	18.6 %
4 x 4 x 15 in	3.65 lbs.	20.5 %	20.8 %	20.8 %
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%

TEST LOAD WEIGHT: 16.761 lbs. **DRY WEIGHT:** 6.37 kg.
AVERAGE MOISTURE CONTENT:
(DRY) 19.73 % CORRECTED TO TWO PIN: (DRY) 19.73 % (WET) 16.48 %
COAL BED RANGE:
3.4 lbs. to 4.1 lbs. (10% to 15% of test load)
lbs. to lbs. (20% to 25% of test load)
TEST CHARGE:
Time loaded: 9:07 Coal bed weight: 3.7 lbs. Coal bed weight = % of test load weight

CHARCOALIZATION: good|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|poor

Intertek

Manufacturer: Ford Motor Co
Job #: G10375822

Model: 15.5L V-8
Run #4 CAT 2

Page 10 of 10
Date 1-29-19
Tech [illegible]

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Pre-test Weight Record		SYSTEM 1			SYSTEM 2			SYSTEM 3			Temp	Humidity
		Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number		
Date	Time	7	37	38	5	39	40	1	1	2	°F	%
1-24-19	10:10a	89.6811	1.8610	1.8347	92.0497	3.2763	3.3407	91.3695	1.8499	1.7932	61.7	19
1-24-19	2:40p	89.6809	1.8608	1.8346	92.0497	3.2761	3.3406	91.3693	1.8447	1.8789	66.4	14
		Total:	3.6954		Total:	6.6167		Total:	3.6338			

Post-test Weight Record		SYSTEM 1		SYSTEM 2		SYSTEM 3		Temp	Humidity
		Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number		
Date	Time	7	37+38	5	39+40	1	1+2	°F	%
1-29-19	2:28	89.6823	3.7111	92.0504	6.6302	91.3682	3.6444	71.8	13
1-31-19	7:47	89.6809	3.7097	92.0497	6.6296	91.3673	3.6428	56.9	11
2-1-19	8:18	—	3.7097	—	6.6296	—	3.6428	64.5	13
2-4-19	7:02	—	3.7097	—	6.6295	—	3.6428	68.9	21

Dry Down Weight

Date	Time	P1	F1	P2	F2	P3	F3	Gr/hr	Lb/MMBtu
1-29-19	2:28	1.4	15.7	.7	13.5	.9	10.6	2.544	1.217
1-31-19	7:47	0	14.3	0	12.9	0	9.0	2.228	
2-1-19	8:18	0	14.3	0	12.9	0	9.0		
2-4-19	7:02	0	14.3	0	12.8	0	9.0		

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	69	70	28.82	28.83	14.0	13.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
312	18.77	201.70	546.31	73.93	73.82	14.30	12.90

	Dilution Tunnel Dual Train Precision				
	Sample Ratios		Total Emissions (g)		
	Train 1	Train 2	Train 1	Train 2	Deviation (%)
	851.22	852.54	12.17	11.00	5.07%

Burn				Initial		Run	Average
Rate		Surface		Draft		Time	Draft
1.217		0.000		0.033		312.000	0.026

Run	Date	Burn Rate	Emission
4	1/29/2019	1.217	2.228

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	69	0	29.29	28.83	12.0	13.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
70	17.91	180.03	588.53	6.97	7.33	16.00	15.60

Dilution Tunnel Dual Train Precision

Sample Ratios		Total Emissions (g)		
Train 1	Train 2	Train 1	Train 2	Deviation (%)
1808.74	1719.09	28.94	26.82	3.81%

Burn			Initial		Run	Average
Rate		Surface	Draft		Time	Draft
5.650		0.000	0.042		70.000	0.046

Run	Date	Burn Rate	Emission
5	1/31/2019	5.650	23.896

ABC Laboratories, Inc.

Manufacturer: England Stoves
Model: 15SSW01
Date: 01/31/19
Run: 6
Control #: G103758222
Test Duration: 182
Output Category: 4

Technicians: Ken Slater

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	73.1%	79.0%
Combustion Efficiency	95.8%	95.8%
Heat Transfer Efficiency	76%	82.5%

Output Rate (kJ/h)	29,039	27,546	**(Btu/h)**
Burn Rate (kg/h)	2.01	4.42	**(lb/h)**
Input (kJ/h)	39,719	37,678	**(Btu/h)**

Test Load Weight (dry kg)	6.08	13.40	**dry lb**
MC wet (%)	17.33		
MC dry (%)	20.96		
Particulate (g)	7.77		
CO (g)	359		
Test Duration (h)	3.03		

Emissions	**Particulate**	**CO**	
g/MJ Output	0.09	4.08	
g/kg Dry Fuel	1.28	59.03	
g/h	2.56	118.36	1.972696
lb/MM Btu Output	0.21	9.47	

Air/Fuel Ratio (A/F)	12.94

VERSION: **2.2** **12/14/2009**

Intertek

Manufacturer: England Stoves Model : 13-SSW01
Job # G103758222 Run # 6 Cert 4

Page 1 of 10
Date 1-31-19
Tech

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 27.69 (inches Hg.) Static pressure (P_g) .363 (inches w.c.)
Inside diameter: Port A ___ in Port B ___ in Tunnel cross sectional area: ___ Ft^2
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.102		
B-Centroid	3.00	.103		
A-1	0.50	.089		
A-2	1.50	.097		
A-3	4.50	.100		
A-4	5.50	.095		
B-1	0.50	.089		
B-2	1.50	.099		
B-3	4.50	.095		
B-4	5.50	.088		
		AVERAGE		

Adjustment factor application

Pitot correction .9859

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

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

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured) Adjustment factor for alternative Pitot tube placement

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

K_p = 85.49 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 H_2O)

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # GI03758222 Run #6 of 14

Page 2 of 10
Date 1-31-19
Tech

Pre/Post Checks

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	✓ fpm	✓ fpm
Smoke Capture Check	✓	✓
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	1-21-19	
Date Dilution Tunnel Cleaned	1-21-19	
Induced Draft Check	✓	✓
Tunnel Velocity	.101	.099
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)		✓ °F
Proportional Checks:		
CO Analyzer Drift Check		✓
CO_2 Analyzer Check		✓
O_2 Analyzer Check		✓
Thermocouple check		

Sampling Train ID Numbers:	Train 1	Train 2
Probe	5	6
Filter Front	9	11
Filter Back	10	12
Filter Thermocouple	19	22
Filter 5G-3 (<90°F)		

7
13
14

mm

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run 6 of 4

Date 1-31-19
Tech

Pre-Test Scale Audit

Scale Type	Audit Weight		Measured Weight	
Platform	25.00	lbs., Class F	25.00	lbs.
Wood	10.00	lbs., Class F	10.00	lbs.
Analytical	100.00	mg. Class S	100.800	mg.

LIMITS OF WEIGHT RANGES

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

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #4 & Part 4

Date 1-31-19
Tech

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers
Leakage Checks Tunnel Samplers

	SAMPLE 1		SAMPLE 2		SAMPLE 3	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-test	Post Test
Vacuum (inches Hg.)	10"	10"	10	10	10	10
Final 1 minute DGM (ft^3)	0	0	0	0	442.675	452.416
Initial 1 minute DGM (ft^3)	0	0	0	0	442.675	453.416
Change (C) (ft^3)	0	0	0	0	0	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	10	10"
Rotometer Reading (mm)	0	6
Flow Rate (CFM)	0	0
Allowable (.04 x Sample Rate)		
Check OK	✓	✓

Intertek

Manufacturer: England Stoves_____ Model : 15-SSW01_____
Job #_G103758222_____ Run #6 cert 4

Page 5 of 10
Date 1-31-19
Tech [signature]

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO_2	0	0	24.86	24.88	11.97	11.99
CO	0	0	8.876	8.876	4.03	4.001
O_2	0	0	20.95	20.95	10.00	12.01
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO_2	-0.05	24.83	11.89	.05	.05	.08	✓	
CO	-0.07	8.71	3.87	.07	.26	.16	✓	
O_2	0.02	20.95	9.97	.02	0	.03	✓	

* Greater than ± 5% of the range used.

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #6 Cat 4

Page 6 of 10
Date 1-21-19
Tech

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2	System 3
Final (ft^3)	45.75	45.33	453.495
Initial (ft^3)	0	0	443.635

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.29	29.26
Temperature (°F)	71.0	73.4
Humidity (%)	11	11

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run# 10 cont 4

Page 7 of 10
Date 1-31-19
Tech

READING #	REAL TIME	ELAPSED TIME	DOM 1	ROTOMETER 1	DOM 2	ROTOMETER 2	DOM 3	ROTOMETER 3	DRAFT	MAX DOM PRESSURE
0	1225	0					443.(3)			
1		10					445.215			
2		20					446.850			
3		30					448.585			
4		40					450.110			
5		50					451.730			
6		60					453.495			
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								

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #4 CAT 4

Date 1-31-19
Tech

FUEL DATA

PRE-TEST LOAD

FUEL DESCRIPTION:
Kindling weight: 4.5 lbs. Consisting of: Scrap and paper Fire lit Time:
Pre-test load weight: 16.03 lbs. Consisting of: 2X4X inches Time loaded:
Pre-test moisture content: Uncorrected: % Corrected Dry: % Wet: %

Test Air Control Settings: Time:
Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	15.12 Lbs.	16.80 lbs.	18.48 Lbs.

Fire Box Volume:	2.4 Ft³	Ideal Length:	Inches
Load Volume:	Ft³	Loading Density:	lbs/ft³
Spacer weight	2.96 Lbs	Load Density:	lbs/ft³

Piece Size	Weight	Meter Moisture Content (% dry)*		
4 x 4 x 15 in.	3.43 lbs.	22.7 %	22.1 %	22.2 %
4 x 4 x 15 in	3.48 lbs.	22.7 %	22.3 %	22.5 %
2 x 4 x 15 in	1.36 lbs.	18.0 %	18.1 %	18.3 %
2 x 4 x 15 in	1.29 lbs.	21.8 %	21.0 %	22.5 %
2 x 4 x 15 in	1.2 lbs.	21.2 %	21.4 %	22.2 %
2 x 4 x 15 in	1.42 lbs.	19.1 %	18.6 %	18.9 %
2 x 4 x 15 in	1.22 lbs.	21.1 %	20.8 %	22.8 %
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%

TEST LOAD WEIGHT: 16.35 lbs. **DRY WEIGHT:** 6.13 kg
AVERAGE MOISTURE CONTENT:
(DRY) 20.97% CORRECTED TO TWO PIN: (DRY) 20.97% (WET) 17.32%
COAL BED RANGE:
2.7 lbs. to 4.0 lbs. (10% to 15% of test load)
lbs. to lbs. (20% to 25% of test load)
TEST CHARGE:
Time loaded: 12:45 Coal bed weight: 3.9 lbs. Coal bed weight = % of test load weight

CHARCOALIZATION: good|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|poor

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run # 4 cat 4

Date 1-31-09
Tech

COMMENTS

10:32 AM PRETEST STARTED

12:25 TEST DO STARTED

DOOR REMAINS OPEN FOR 5 MINUTES

SHUTTER FULL OPEN.

Intertek

Manufacturer: England Sons
Job # G103758272

Model: 15-55GW01
Run # 6 CAT 4

Page 10 of 10
Date 1-31-19
Tech K. Scott

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Pre-test Weight Record		SYSTEM 1			SYSTEM 2			SYSTEM 3			Temp	Humidity
		Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number		
Date	Time	5	9	10	6	11	12	7	13	14	°F	%
1-27-19	10:00a	91.6159	1.8714	1.8210	91.5349	1.8402	1.8460	90.9218	1.8203	3.3013		
1-31-19	12:00p	91.0058	1.8396	1.8209	91.5349	1.8401	1.8460	90.9217	1.8231	3.3000	71.1	11
		Total:	3.6601		Total:	3.6861		Total:	5.1231			

Post-test Weight Record		SYSTEM 1		SYSTEM 2		SYSTEM 3		Temp	Humidity
		Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number		
Date	Time	5	9+10	6	11+12	7	13+14	°F	%
1-31-19	3:17	91.0058	3.6716	91.5349	3.6965	90.9217	5.1302	73.2	12.2
2-1-19		—	3.6706	—	3.6957	—	5.1292	64.3	12
2-4-19	7:02	—	3.6706	—	3.6957	—	5.1292	68.5	31
2-5-19	6:24	—	3.6706	—	3.6957	—	5.1292	66.9	22

Dry Down Weight

Date	Time	P1	F1	P2	F2	P3	F3	Gr/hr	Lb/MMBtu
1-31-19		0	11.5	0	10.4	0	7.1	2.791	2.021
2-1-19		0	10.5	0	9.4	0	6.1	2.562	
2-4-19	7:02	0	10.5	0	9.4	0	6.1	2.562	
2-5-19		0	10.5	0	9.4	0	6.1	2.562	

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	68	72	29.29	29.26	11.0	11.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
182	17.68	186.44	565.30	43.94	43.84	10.50	9.60

Dilution Tunnel Dual Train Precision

Sample Ratios		Total Emissions (g)		
Train 1	Train 2	Train 1	Train 2	Deviation (%)
772.32	774.01	8.11	7.43	4.37%

Burn			Initial		Run	Average
Rate		Surface	Draft		Time	Draft
2.021		0.000	0.028		182.000	0.035

Run	Date	Burn Rate	Emission
6	1/31/2019	2.021	2.562

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	66	71	29.23	29.26	13.0	15.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
187	17.61	187.30	559.88	44.58	44.53	5.40	3.90

Dilution Tunnel Dual Train Precision					
Sample Ratios		Total Emissions (g)			
Train 1	Train 2	Train 1	Train 2	Deviation (%)	
785.58	786.48	4.24	3.07	16.07%	

Burn				Initial		Run	Average
Rate		Surface		Draft		Time	Draft
2.005		0.000		0.042		187.000	0.036

Run	Date	Burn Rate	Emission
7	2/1/2019	2.005	1.173

ABC Laboratories, Inc.

Manufacturer: England Stoves
Model: 15SSW01
Date: 02/04/19
Run: 8
Control #: G103758222
Test Duration: 260
Output Category: 3

Technicians: Ken Slater

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	74.4%	80.4%
Combustion Efficiency	95.4%	95.4%
Heat Transfer Efficiency	78%	84.3%

Output Rate (kJ/h)	21,254	20,162	**(Btu/h)**
Burn Rate (kg/h)	1.44	3.18	**(lb/h)**
Input (kJ/h)	28,556	27,088	**(Btu/h)**

Test Load Weight (dry kg)	6.25	13.77	**dry lb**
MC wet (%)	16.66		
MC dry (%)	19.99		
Particulate (g)	7.44		
CO (g)	405		
Test Duration (h)	4.33		

Emissions	**Particulate**	**CO**	
g/MJ Output	0.08	4.40	
g/kg Dry Fuel	1.19	64.89	
g/h	1.72	93.54	1.55905
lb/MM Btu Output	0.19	10.23	

Air/Fuel Ratio (A/F)	12.81

VERSION: **2.2** **12/14/2009**

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #8 CAT 3

Date 2-4-19
Tech

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 28.59 (inches Hg.) Static pressure (P_g) .345 (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_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.105		
B-Centroid	3.00	.109		
A-1	0.50	.085		
A-2	1.50	.100		
A-3	4.50	.101		
A-4	5.50	.089		
B-1	0.50	.090		
B-2	1.50	.105		
B-3	4.50	.106		
B-4	5.50	.087		
		AVERAGE		

Adjustment factor application

Pitot correction .9547

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

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

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured) Adjustment factor for alternative Pitot tube placement:

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

K_p = 85.49 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 H_2O)

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run # 8 CAT 3

Page 2 of 10
Date 2-4-19
Tech

Pre/Post Checks

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	0 fpm	0 fpm
Smoke Capture Check	✓	✓
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	1-21-19	
Date Dilution Tunnel Cleaned	1-21-19	
Induced Draft Check	✓	✓
Tunnel Velocity	1105	.112
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)		✓ °F
Proportional Checks:		
CO Analyzer Drift Check		✓
CO_2 Analyzer Check		✓
O_2 Analyzer Check		✓
Thermocouple check		✓

Sampling Train ID Numbers:	Train 1	Train 2	TS in 5
Probe	A	B	C
Filter Front	21	23	25
Filter Back	22	24	26
Filter Thermocouple	19	22	
Filter 5G-3 (<90°F)			

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #8 OAT 3

Page 3 of 10
Date 2-4-19
Tech

Pre-Test Scale Audit

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

LIMITS OF WEIGHT RANGES

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

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run # 8 CAT 3

Page 4 of 10
Date 2-7-19
Tech

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers
Leakage Checks Tunnel Samplers

	SAMPLE 1		SAMPLE 2		SAMPLE 3	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-test	Post Test
Vacuum (inches Hg.)	10"	10"	10"	10"	10"	10"
Final 1 minute DGM (ft^3)	0	0	0	0	463.374	477.298
Initial 1 minute DGM (ft^3)	0	0	0	0	463.374	477.298
Change (C) (ft^3)	0	0	0	0	0	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

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

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #8 Cert 3

Page 5 of 10
Date 2.4.19
Tech

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO_2	0	0	24.88	24.88	11.89	11.99
CO	0	0	8.97	8.976	3.98	4.001
O_2	0	0	20.95	20.95	10.00	10.01
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO_2	-0.01	24.68	11.85	.01	.20	.03	✓	
CO	-0.07	8.63	3.75	.07	.34	.23	✓	
O_2	-0.01	20.79	9.92	.01	.16	.08	✓	

* Greater than ± 5% of the range used.

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run # 8 Cat 3

Date 2-4-19
Tech

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2	System 3
Final (ft^3)	62.89	62.89	473.279
Initial (ft^3)	0	0	463.374

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	28.57	28.69
Temperature (°F)	69.7	75.0
Humidity (%)	31	28

Intertek

Manufacturer: England Stoves Model: 15-SSW01
Job #: G103758222 Run: #3 Cat 3

Page: 7 of 10
Date: 2-8-19
Tech:

READING #	REAL TIME	ELAPSED TIME	DGM 1	ROTOMETER 1	DGM 2	ROTOMETER 2	DGM 3	ROTOMETER 3	DRAFT	MAX DGM PRESSURE
0	18:44	0					463.374			
1		10					464.775			
2		20					466.630			
3		30					468.390			
4		40					469.940			
5		50					471.600			
6		60					473.279			
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								

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #8 Cat 3

Date 2-4-19
Tech

FUEL DATA

PRE-TEST LOAD

FUEL DESCRIPTION:
Kindling weight: 5.6 lbs. Consisting of: Scrap and paper Fire lit Time:
Pre-test load weight: 16.76 lbs. Consisting of: 2X4X inches Time loaded:
Pre-test moisture content: Uncorrected: % Corrected Dry: % Wet: %

Test Air Control Settings: Time:
Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	15.12 Lbs.	16.80 lbs.	18.48 Lbs.

Fire Box Volume:	2.4 Ft.³	Ideal Length:	Inches
Load Volume:	Ft.³	Loading Density:	lbs/ft³
Spacer weight	2.76 Lbs	Load Density:	lbs/ft³

Piece Size	Weight	Meter Moisture Content (% dry)*		
2 x 4 x 15 in.	1.51 lbs.	19.4 %	18.3 %	19.9 %
2 x 4 x 15 in	1.48 lbs.	21.1 %	18.6 %	21.6 %
2 x 4 x 15 in	1.72 lbs.	18 %	21.3 %	19.9 %
2 x 4 x 15 in	1.60 lbs.	19.7 %	19.4 %	19.2 %
2 x 4 x 15 in	1.54 lbs.	20.2 %	18.7 %	20.3 %
4 x 4 x 15 in	3.44 lbs.	20.4 %	21.9 %	21.5 %
4 x 4 x 15 in	2.74 lbs.	19.4 %	20.1 %	20.3 %
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%

TEST LOAD WEIGHT: 16.80 lbs. **DRY WEIGHT:** kg.
AVERAGE MOISTURE CONTENT:
(DRY) 19.99 % CORRECTED TO TWO PIN: (DRY) 19.99 % (WET) 16.66 %
COAL BED RANGE: 3.4 lbs. to 4.2 lbs. (10% to 15% of test load)
lbs. to lbs. (20% to 25% of test load)
TEST CHARGE:
Time loaded: 10:26 Coal bed weight: 3.9 lbs. Coal bed weight = % of test load weight

CHARCOALIZATION: good|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|–|poor

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run 1st 8 Cat

Date 2-4-19
Tech

COMMENTS

8:22 AM PILOT STARTED

10:26 AM TEST STARTED
DOOR REMAINED OPEN FOR 1.45 MINUTES
SHUTTER SET @ 1/16" FROM FULLY CLOSED
TRIGGER ACTIVATED @ 22:39 MINUTES

Intertek

Manufacturer: England Stoves
Job # G103758272

Model: 15-SSW01
Run # 8 CAT 3

Page 10 of 10
Date 2-4-19
Tech [illegible]

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Pre-test Weight Record		SYSTEM 1 Probe & Housing Number	SYSTEM 1 Front Filter + gasket Number	SYSTEM 1 Back Filter + gasket Number	SYSTEM 2 Probe & Housing Number	SYSTEM 2 Front Filter + gasket Number	SYSTEM 2 Back Filter + gasket Number	SYSTEM 3 Probe & Housing Number	SYSTEM 3 Front Filter + gasket Number	SYSTEM 3 Back Filter + gasket Number	Temp	Humidity
Date	Time	A	21	22	B	23	24	C	25	26	°F	%
2-1-19	9:00am	92.4392	1.8218	1.8565	92.3396	3.2349	3.3233	90.8949	3.2295	3.2904	67.8	15
2-4-19	7:30a	92.4391	1.8216	1.8564	92.3396	3.2348	3.3232	90.8947	3.2274	3.2903	67.7	73%
		Total:	3.678		Total:	6.558		Total:	6.5197			

Post-test Weight Record		SYSTEM 1 Probe & Housing Number	SYSTEM 1 Combined Filter/gasket Number	SYSTEM 2 Probe & Housing Number	SYSTEM 2 Combined Filter/gasket Number	SYSTEM 3 Probe & Housing Number	SYSTEM 3 Combined Filter/gasket Number	Temp	Humidity
Date	Time	A	21+22	B	23+24	C	25+26	°F	%
2-4-19	2:39p	92.4391	3.6840	92.3396	6.5626	90.8947	6.5231	75.0	28
2-5-19	6:29	—	3.6830	—	6.5620	—	6.5222	66.0	23
2-6-19	7:03	—	3.6826	—	6.5616	—	6.5220		

Dry Down Weight

Date	Time	P1	F1	P2	F2	P3	F3	Gr/hr	Lb/MMBtu
2-4-19	2:39	0	6.0	0	4.6	0	3.4	1.109	1.466
2-5-19	6:29	0	5.0	0	4.0	0	2.5	.942	
2-6-19	7:03	0	4.6	0	3.6	0	2.3	.858	

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	72	71	28.57	28.69	31.0	28.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
260	19.60	207.01	551.99	59.37	59.30	4.60	3.60

	Dilution Tunnel Dual Train Precision				
	Sample Ratios		Total Emissions (g)		
	Train 1	Train 2	Train 1	Train 2	Deviation (%)
	906.62	907.67	4.17	3.27	12.14%

Burn				Initial		Run	Average
Rate		Surface		Draft		Time	Draft
1.466		0.000		0.046		260.000	0.029

Run	Date	Burn Rate	Emission
8	2/4/2019	1.466	0.858

ABC Laboratories, Inc.

Manufacturer: England Stoves
Model: 15SSW01
Date: 02/05/19
Run: 9
Control #: G103758222
Test Duration: 387
Output Category: 1

Technicians: Ken Slater

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	73.6%	79.5%
Combustion Efficiency	93.0%	93.0%
Heat Transfer Efficiency	79%	85.5%

Output Rate (kJ/h)	13,300	12,617	**(Btu/h)**
Burn Rate (kg/h)	0.91	2.01	**(lb/h)**
Input (kJ/h)	18,071	17,142	**(Btu/h)**

Test Load Weight (dry kg)	5.88	12.97	**dry lb**
MC wet (%)	15.94		
MC dry (%)	18.96		
Particulate (g)	13.97		
CO (g)	576		
Test Duration (h)	6.45		

Emissions	**Particulate**	**CO**	
g/MJ Output	0.16	6.71	
g/kg Dry Fuel	2.37	97.85	
g/h	2.17	89.26	1.487728
lb/MM Btu Output	0.38	15.60	

Air/Fuel Ratio (A/F)	13.62

VERSION: **2.2** **12/14/2009**

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #3 Cat 1

Date 2-5-19
Tech

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.10 (inches Hg.) Static pressure (P_g) -.343 (inches w.c.)
Inside diameter: Port A ___ in Port B ___ in Tunnel cross sectional area: ___ Ft^2
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.105		
B-Centroid	3.00	.108		
A-1	0.50	.086		
A-2	1.50	.101		
A-3	4.50	.101		
A-4	5.50	.090		
B-1	0.50	.090		
B-2	1.50	.104		
B-3	4.50	.105		
B-4	5.50	.088		
		AVERAGE		

Adjustment factor application

Pitot correction .9575

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

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

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured)

Adjustment factor for alternative Pitot tube placement

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

K_p = 85.49 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 H_2O)

Intertek

Manufacturer: England Stoves _____ Model : 15-SSW01 _____
Job #_G103758222 _____ Run #1 Cert 1

Date 2-2-19
Tech [illegible]

Pre/Post Checks

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	✓ fpm	✓ fpm
Smoke Capture Check	0	0
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	1-21-19	
Date Dilution Tunnel Cleaned	1-21-19	
Induced Draft Check	✓	✓
Tunnel Velocity	.105	.145
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)		°F
Proportional Checks:		
CO Analyzer Drift Check		✓
CO_2 Analyzer Check		✓
O_2 Analyzer Check		✓
Thermocouple check		✓

Sampling Train ID Numbers:	Train 1	Train 2	Train 3
Probe	D	E	F
Filter Front	27	29	31
Filter Back	28	30	32
Filter Thermocouple	19	22	
Filter 5G-3 (<90°F)			

mm

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #9 CAT 1

Page 3 of 10
Date 2-5-19
Tech

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	25.00 lbs., Class F	25.00 lbs.
Wood	10.00 lbs., Class F	10.00 lbs.
Analytical	101.006 mg. Class S	100.032 mg.

LIMITS OF WEIGHT RANGES

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

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job #_G103758222 Run #9 CAT 1

Page 4 of 10
Date 2-5-19
Tech

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers
Leakage Checks Tunnel Samplers

	SAMPLE 1		SAMPLE 2		SAMPLE 3	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-test	Post Test
Vacuum (inches Hg.)	10	10	10	10	10	10
Final 1 minute DGM (ft^3)	0	0	0	0	473.310	483.274
Initial 1 minute DGM (ft^3)	0	0	0	0	473.310	483.274
Change (C) (ft^3)	0	0	0	0	0	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

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

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #9 CAT 1

Date 2-5-19
Tech

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO_2	0	0	24.88	24.88	11.88	11.99
CO	0	0	8.97	8.976	4.00	4.001
O_2	0	0	20.95	20.95	9.94	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	-.07	24.78	11.89	.07	.10	.01	✓	
CO	-0.10	8.68	3.88	.10	.29	.12	✓	
O_2	-0.03	20.86	9.93	.03	.09	.01	✓	

* Greater than ± 5% of the range used.

Intertek

Manufacturer: England Stoves___ Model : 15-SSW01
Job #_G103758222 Run #9 Cat 1

Page 6 of 10
Date 2-5-19
Tech

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2	System 3
Final (ft^3)	94.15	94.15	483.275
Initial (ft^3)	0	0	472.310

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.10	29.03
Temperature (°F)	69.3	72.6
Humidity (%)	24	19

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #9 CERT 1

Date 2-5-19
Tech

READING #	REAL TIME	ELAPSED TIME	DOM 1	ROTOMETER 1	DOM 2	ROTOMETER 2	DOM 3	ROTOMETER 3	DRAFT	MAX DOM PRESSURE
0	9:28	0					473.310			
1		10					474.900			
2		20					476.570			
3		30					478.235			
4		40					479.900			
5		50					481.565			
6		60					483.275			
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								

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #1 CRAFT

Date 2-5-19
Tech

COMMENTS

7:13 AM PRETEST STARTED

9:28 TEST STARTED
DOOR REMAINS OPEN FOR 5 MINUTES
SHUTTER SET @ FULLY CLOSED
~~STO~~ TRISEC ACTIVATED @ 31 MINUTES

ROOM FAN SET TO LOW

Intertek

Manufacturer: England Stoves Model : 15-SSW01
Job # G103758222 Run #9 cat 1

Page 9 of 10
Date 2-5-19
Tech

FUEL DATA

PRE-TEST LOAD

FUEL DESCRIPTION:
Kindling weight: 4.5 lbs. Consisting of: Scrap and paper Fire lit Time:
Pre-test load weight: 16.32 lbs. Consisting of: 2X4X inches Time loaded:
Pre-test moisture content: Uncorrected: % Corrected Dry: % Wet: %

Test Air Control Settings: Time:
Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	15.12 Lbs.	16.80 lbs.	18.48 Lbs.

Fire Box Volume:	2.4 Ft.³	Ideal Length:	Inches
Load Volume:	Ft.³	Loading Density:	lbs/ft³
Spacer weight	2.46 Lbs	Load Density:	lbs/ft³

Piece Size	Weight	Meter Moisture Content (% dry)*		
2 x 4 x 15 in.	1.59 lbs.	19.2 %	19.5 %	19.6 %
2 x 4 x 15 in	1.53 lbs.	18.5 %	18.7 %	18.2 %
2 x 4 x 15 in	1.26 lbs.	18.2 %	18 %	18.7 %
2 x 4 x 15 in	1.40 lbs.	18.5 %	18.1 %	19.1 %
2 x 4 x 15 in	1.54 lbs.	18.0 %	20.8 %	20.5 %
4 x 4 x 15 in	2.93 lbs.	20.5 %	20.3 %	19.7 %
4 x 4 x 15 in	2.90 lbs.	18.0 %	18.2 %	18.0 %
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%
x x in	lbs.	%	%	%

TEST LOAD WEIGHT: 15.60 lbs. **DRY WEIGHT:** kg.
AVERAGE MOISTURE CONTENT:
(DRY) 18.97 % CORRECTED TO TWO PIN: (DRY) 18.97 % (WET) 15.94 %
COAL BED RANGE:
3.2 lbs. to 3.9 lbs. (10% to 15% of test load)
lbs. to lbs. (20% to 25% of test load)
TEST CHARGE:
Time loaded: 9:28 Coal bed weight: 3.9 lbs. Coal bed weight = % of test load weight

CHARCOALIZATION: good |--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--| poor

Intertek

Manufacturer: Greenwood Stoves
Job # G103758222

Model: 15-350WJ
Run #9 OAT 1

Page 8 of 10
Date 2-5-19
Tech [illegible]

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Pre-test Weight Record		SYSTEM 1			SYSTEM 2			SYSTEM 3				
		Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Probe & Housing Number	Front Filter + gasket Number	Back Filter + gasket Number	Temp	Humidity
Date	Time	D	27	28	E	29	30	F	31	32	°F	%
2-4-19	7:30A	180.9107	32968	32371	92.5591	32595	32584	90.9604	33007	33406	67.7	23
2-5-19	6:30a	180.9106	32968	3.2370	92.5590	3.2594	3.2584	90.9603	33006	3.3406	65.8	23
		Total:	6.5338		Total:	6.5578		Total:	6.6412			

Post-test Weight Record		SYSTEM 1		SYSTEM 2		SYSTEM 3			
		Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number	Probe & Housing Number	Combined Filter/gasket Number	Temp	Humidity
Date	Time	D	27+28	E	29+30	F	31+32	°F	%
2-5-19	3:48	180.9141	6.5490	92.6009	6.5712	90.9615	6.6494	72.9	19
2-6-19	6:52	180.9110	6.5483	92.5996	6.5703	90.9603	6.6483	68.0	22
2-7-19	7:30a	180.9110	6.5480	92.5995	6.5701	—	6.6480	66.7	18
2-8-19	7:30a	180.9106	6.5479	92.5990	6.5700	—	6.6480	65.7	13

Dry Down Weight

Date	Time	P1	F1	P2	F2	P3	F3	Gr/hr	Lb/MMBtu
2-5-19	3:48	3.3	15.2	1.9	13.4	1.2	8.2	2.801	.940 .923
2-6-19	6:52	.4	14.5	.6	12.5	Ø	7.1	2.306	
2-7-19	7:30	.4	14.2	.5	12.3	Ø	6.8	2.257	
2-8-19	7:30a	Ø	14.1	Ø	12.2	Ø	6.8	2.166	

	Room Temp		Bar Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	70	68	29.10	29.03	24.0	19.0	0	0

Average Dilution Tunnel Measurements						Sample Data	
Burn	Velocity	Flow Rate	Temp	Total Sample		Particulate Catch	
Time	(Ft/sec)	(dscf/min)	(R)	1	2	1	2
387	22.72	248.89	540.19	90.71	90.58	14.10	12.20

Dilution Tunnel Dual Train Precision					
Sample Ratios		Total Emissions (g)			
Train 1	Train 2	Train 1	Train 2	Deviation (%)	
1061.85	1063.42	14.97	12.97	7.15%	

Burn				Initial		Run	Average
Rate		Surface		Draft		Time	Draft
0.923		0.000		0.036		387.000	0.021

Run	Date	Burn Rate	Emission
9	2/5/2019	0.923	2.166

Certificate Number
A2993447
Issue Date: 10/22/18

Certificate of Calibration

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

P.O. Number:

ID Number: 008

Description:	SCALE	Calibration Date:	10/10/2018
Manufacturer:	GSE	Calibration Due:	04/10/2019
Model Number:	450	Procedure:	TMI-SCALES Rev: 5/13/2014
Serial Number:	101722	Temperature:	68 F
Technician:	ARMIN AHMETOVIC	Humidity:	33 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

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

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

TMI's Quality System is accredited to ISO/IEC 17025:2017 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.

Assessments 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

ilac-MRA ANAB ACCREDITED AC-2000.03

Certificate Number
A2993447
Issue Date: 10/22/18

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	AD/AF/AIL
Shift Test Center	25.00	24.90	25.10	25.00	25.00	0.06	lbs	
Shift Test RF	25.00	24.90	25.10	25.00	25.00	0.06	lbs	
Shift Test RR	25.00	24.90	25.10	25.00	25.00	0.06	lbs	
Shift Test LF	25.00	24.90	25.10	25.00	25.00	0.06	lbs	
Shift Test LR	25.00	24.90	25.10	25.00	25.00	0.06	lbs	
Weight Accuracy	25.00	24.90	25.10	25.00	25.00	0.06	lbs	
Weight Accuracy	50.00	49.90	50.10	50.00	50.00	0.06	lbs	
Weight Accuracy	75.00	74.90	75.10	74.99	74.99	0.06	lbs	
Weight Accuracy	100.00	99.90	100.10	100.00	100.00	0.06	lbs	

Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax 779-774-3884
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-2080.03

Certificate Number
A2993455
Issue Date: 10/22/18

Certificate of Calibration

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

P.O. Number:

ID Number: 713

Description:	SCALE	Calibration Date:	10/10/2018
Manufacturer:	OHAUS	Calibration Due:	04/10/2019
Model Number:	E12140	Procedure:	TMI-SCALES Rev: 5/13/2014
Serial Number:	B258010639	Temperature:	68 F
Technician:	ARMIN AHMETOVIC	Humidity:	33 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

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

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

TMI's Quality System is accredited to ISO/IEC 17025:2017 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.

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-WT-1	RICE LAKE	RFD-WT-1	5/8/2018	5/8/2020

TMI Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax: 779-774-3884
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-2660.03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/FAIL
Shift Test Center	10.0000	9.9900	10.0100	10.0005	10.0005	0.00047	Grams
Shift Test RF	10.0000	9.9900	10.0100	10.0002	10.0002	0.00047	Grams
Shift Test RR	10.0000	9.9900	10.0100	10.0002	10.0002	0.00047	Grams
Shift Test LF	10.0000	9.9900	10.0100	10.0005	10.0005	0.00047	Grams
Shift 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	49.9950	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	200.0039	200.0039	0.00047	Grams

TMI Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax 779-774-3884
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-3080.03

Certificate Number
A2993577
Issue Date: 10/22/18

Certificate of Calibration

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

P.O. Number:

ID Number: 986

Description:	DATA ACQUISITION SYSTEM	Calibration Date:	10/10/2018
Manufacturer:	OMEGA	Calibration Due:	04/10/2019
Model Number:	OMB-DAQ-56	Procedure:	OMEGA OM-DAQ-USB-2401 Rev: 1/12/2012
Serial Number:	NSN	Temperature:	75.5 F
Technician:	PERRY MURBARGER	Humidity:	71.7 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

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

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

TMI's Quality System is accredited to ISO/IEC 17025:2017 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.

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-156	FLUKE	7526A-156	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

ilac-MRA ANAB ACCREDITED AC-3080.03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/FAIL
Thermocouple Accuracy (K Type) Input 1	1000.0	998.2	1001.8	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	0.0059	V
Voltage Accuracy 2	10.0	9.5	10.5	10.1	10.1	0.0059	V
Voltage Accuracy 3	10.0	9.5	10.5	10.0	10.0	0.0059	V
Voltage Accuracy 4	10.0	9.5	10.5	10.1	10.1	0.0059	V
Voltage Accuracy 5	10.0	9.5	10.5	10.0	10.0	0.0059	V
Voltage Accuracy 6	10.0	9.5	10.5	9.9	9.9	0.0059	V

Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax 779-774-3884
www.tmicalibration.com

AC-3080.03

Certificate Number
A2993412
Issue Date: 10/22/18

Certificate of Calibration

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

P.O. Number:

ID Number: 1134

Description:	SCALE	Calibration Date:	10/10/2018
Manufacturer:	RICE LAKE	Calibration Due:	04/10/2019
Model Number:	520-1A	Procedure:	TMI-SCALES Rev: 5/13/2014
Serial Number:	1494600044	Temperature:	68 F
Technician:	ARMIN AHMETOVIC	Humidity:	33 % RH
On-Site Calibration:	☑	**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

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

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

TMI's Quality System is accredited to ISO/IEC 17025:2017 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.

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-2660.03

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/FAIL
Weight Accuracy	100.0	99.4	100.6	99.8	99.8	0.00	lbs
Weight Accuracy	200.0	199.4	200.6	199.4	199.4	0.00	lbs
Weight Accuracy	300.0	299.4	300.6	299.5	299.5	0.00	lbs
Weight Accuracy	400.0	399.4	400.6	399.5	399.5	0.00	lbs
Weight Accuracy	500.0	499.4	500.6	499.4	499.4	0.00	lbs
Weight Accuracy	1000.0	999.4	1000.6	999.4	999.4	0.00	lbs
Shift Test RF	100.0	99.4	100.6	99.9	99.9	0.00	lbs
Shift Test LF	100.0	99.4	100.6	99.9	99.9	0.00	Lbs
Shift Test RR	100.0	99.4	100.6	99.9	99.9	0.00	lbs
Shift Test LR	100.0	99.4	100.6	99.9	99.9	0.00	lbs
Shift Test Center	100.0	99.4	100.6	99.9	99.9	0.00	lbs

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 Number
A2799975
Issue Date: 04/09/18

Certificate of Calibration

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

P.O. Number:
ID Number: 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 960-12
Rev: 1/1/2009
Temperature: 68 F
Humidity: 40 % RH
As Found Condition: IN TOLERANCE
Calibration Results: IN TOLERANCE

Limiting Attribute:

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

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

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

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

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

B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
0515114046	OMEGA	OM-73	2/1/2018	2/1/2019
RFD606	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

ilac-MRA ANAB ACCREDITED AC-2090.03

Certificate of Calibration

Data Sheet

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

TMI Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax 779-774-3884
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-2080.03

Certificate Number
A2794500
Issue Date: 04/04/18

Certificate of Calibration

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

P.O. Number:
ID Number: 001213

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

Limiting Attribute:

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

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

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

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

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

B. SCHICKOWSKI, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

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

TMI Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax: 779-774-3884
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-2080.03

Certificate of Calibration

Data Sheet

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

TMI Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax: 779-774-3884
www.tmicalibration.com

Certificate Number
A2984135
Issue Date: 10/12/18

Certificate of Calibration

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

P.O. Number: ONSITE

ID Number: 001420

Description:	THERMAL HYGROMETER	Calibration Date:	10/12/2018
Manufacturer:	CONTROL COMPANY	Calibration Due:	04/12/2019
Model Number:	68000-49	Procedure:	TMI-M-HYGROTHERMOGRAPHS Rev: 2/22/2011
Serial Number:	150810334	Temperature:	68 F
Technician:	ARMIN AHMETOVIC	Humidity:	33 % RH
		As Found Condition:	**IN TOLERANCE**
On-Site Calibration: ☐		**Calibration Results:**	**IN TOLERANCE**

Comments:

Limiting Attribute:

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

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

TMI's Quality System is accredited to ISO/IEC 17025:2017 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.

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

TMI Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax 779-774-3884
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED

AC-3080.03

Certificate of Calibration

Data Sheet

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

TMI Technical Maintenance, Inc.
3248 FOREST VIEW ROAD, ROCKFORD, IL 61109
Phone: 779-774-3877 Fax 779-774-3884
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED
ANSI/NCSL Z540-1
ANSI/NCSL Z540-3
AC-3060.03

Model ☐15-W03 ☐50-SHW03 ☐50-TRW03
Solid Fuel Burning Room Heater; Free Standing Model "SUITABLE FOR MOBILE-HOME INSTALLATION (USA ONLY)"
Certified to UL-1482 & ULC-627-00, EPA METHOD 28A, ASTM E2780, ASTM E2515

Intertek
W/N# 22302

SERIAL NO.	
MFG. DATE	

Manufactured by:
England's Stove Works, Inc.
589 S. Five Forks Rd.
Monroe, VA 24574

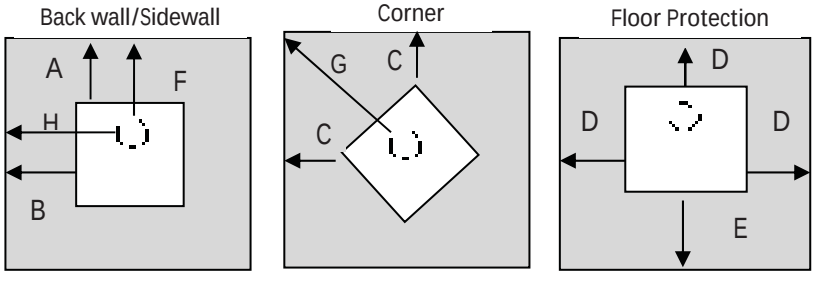
DO NOT REMOVE OR COVER THIS LABEL

- 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.

INSTALLATION REQUIREMENTS

- DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.
- USE A RESIDENTIAL TYPE MASONRY OR FACTORY BUILT CHIMNEY LISTED TO UL-103 HT (US) AND ULC-629 (CANADA).
- USE 24 GAUGE MSG BLACK SINGLE WALL CHIMNEY CONNECTOR OR LISTED DOUBLE WALL CHIMNEY CONNECTOR.
- REFER TO LOCAL CODES AND THE CHIMNEY MANUFACTURER'S INSTRUCTIONS FOR PRECAUTIONS REQUIRED FOR PASSING A CHIMNEY THROUGH A COMBUSTIBLE WALL OR CEILING.
- FOR THE US: PLACE ON A NON-COMBUSTIBLE TYPE 1 UL SPARK AND EMBER FLOOR PROTECTOR, WHICH EXTENDS 16.0 IN. TO THE FRONT AND 8.0 IN. TO EACH SIDE OF THE FUEL LOADING OPENING.
- FOR CANADA: PLACE ON A NON-COMBUSTIBLE TYPE 1 ULC SPARK AND EMBER FLOOR PROTECTOR, WHICH EXTENDS 450.0 MM. TO THE FRONT AND 200.0 MM. TO EACH SIDE OF THE FUEL LOADING OPENING.
- ADHERE TO THE LISTED MINIMUM CLEARANCES TO COMBUSTIBLES WHEN USING SINGLE WALL CHIMNEY CONNECTOR. SEE THE OWNER'S MANUAL FOR ADDITIONAL CLEARANCE INFORMATION.
- ONLY OPERATE THIS UNIT WITH THE DOOR CLOSED AND LATCHED TIGHTLY.
- THE MAIN LOADING DOOR CONTAINS A CERAMIC VIEWING WINDOW; DO NOT SLAM THE DOOR OR STRIKE THIS VIEWING WINDOW AT ANY TIME.
- IF THE GLASS IS CRACKED OR BROKEN, REPLACE WITH CERAMIC GLASS ONLY.
- Emission value – 1.956 grams/hr
- U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using crib wood fuel.
- OPTIONAL PART- BLOWER PART NUMBER AC-30 (FASCO) ELECTRICAL RATING 115 V, 60 HZ., 0.8 A
- OPTIONAL PARTS- SIDE HEAT SHIELDS PART NUMBER AC-W01SHS (ESW INC.)
- Refer to Intertek's Directory of Building Products (HTTPS:BPDIRECTORY.INTERTEK.COM) for detailed information.

OPERATION REQUIREMENTS: FOR USE WITH SOLID WOOD FUEL ONLY. DO NOT OVER-FIRE, IF HEATER OR CHIMNEY CONNECTOR GLOWS YOU ARE OVER-FIRING. INSPECT AND CLEAN CHIMNEY FREQUENTLY, UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY. DO NOT USE A GRATE OR ELEVATE THE FIRE, BURN WOOD FIRE DIRECTLY ON THE HEARTH. RISK OF SMOKE AND FLAME SPILLAGE, OPERATE ONLY WITH DOOR FULLY CLOSED.
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.



A = 7.5 inches (190.5 mm)
B = 21.5 inches (546.1 mm)
C = 9.5 inches (241.3 mm)
D = 8 inches (200 mm)
E = 16 inches (450mm)
F = 12 inches (304.8mm)
G = 19 inches (482.6 mm)
H = 29 inches (736.6 mm)

CAUTION - HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING, AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS.

15-W03, 50-SHW03, 50-TRW03
INSTALLATION & OPERATION MANUAL

Manufactured By:
England's Stove Works, Inc.
PO Box 206
Monroe, VA 24574
www.heatredefined.com
(800) 245-6489

Rev. 1/2020

CAUTION

Please read this entire manual before installation and use of this wood fuel-burning appliance. Keep children, furniture, fixtures and all combustibles away from any heating appliance.

SAVE THESE INSTRUCTIONS

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.

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 (Approved for USA only):
This freestanding wood 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.

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 rear of the unit. Have this information on hand if you phone the factory or your dealer regarding this product.

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.
- Hot while in operation! Keep clothing, furniture, draperies and other combustibles away. Contact may cause skin burns!
- 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.

WELCOME!

NOTE: CLEARANCES MAY ONLY BE REDUCED BY MEANS APPROVED BY THE REGULATORY AUTHORITY HAVING JURISDICTION

DO NOT CONNECT TO ANY AIR DISTRIBUTION DUCT OR SYSTEM.

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

DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.

<u>Thank you</u> 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 his or her 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.

From our <u>free,</u> downloadable service sheets to our "wizard-style," click-through Troubleshooting guide on our web site, we have always tried to help our customers stay "heat-ready," especially when oil and electricity prices continue to skyrocket.

Please look at our vast Help section on our web site and call our Technical Support department at (800) 245-6489 if you need any help with your unit. We are nearly <u>always</u> able to help "walk you through" any repairs, problems or questions you may have.

<u>PLEASE NOTE</u>: While information obtained on our web site and through our 800 number is always free of charge, there will be a service charge incurred with any "on-site" repairs or maintenance that we may arrange.

Wishing you years of efficient, quality and "comfy" heating,
England's Stove Works
Technical Support Department

www.HeatRedefined.com
(800) 245-6489

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.

<u>PLEASE NOTE</u>: 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.

SPECIFICATIONS

Heating Specifications

- Maximum Burn Time** ..... 6-8 hours
- Approximate Square Footage Heated*** ..... 2000 sq. ft.
- Firebox Capacity..... 35 pounds
- Flue Collar ..... 6.0 in. round

Dimensions (Inches)

- 22” Wide x 30” High x 27” Deep

EPA and Safety Compliance Specifications

- EPA Compliance Status ..... Certified to comply with 2020 particulate emission standards using crib wood fuel.
- U.S. Test Standard ..... US EPA 40 CFR Part 60, Subpart 60.536
- Particulate Emissions ..... 1.956 grams/hr
- CO Emissions ..... 1.659 grams/min
- Heat Output Range ..... 11,129 – 24,369 Btu/hr
- Efficiency..... ..... 73.77% (HHV)
- Tested To EPA Test Method 28A, ASTM E2780, ASTM E2515, ULC/ORD-C1482 & ULC S627-00

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

*** - 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.

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 – The engine which drives a wood stove is the chimney system, so it is important to consider precisely how the chimney system will be integrated into the stove installation. Ideally, a wood stove chimney will run completely vertical from the flue collar of the unit all the way to the termination point above the roof line. Keeping the entire chimney system inside the heated envelope of the home will ensure a strong, easy to initiate draft in the chimney. Although exterior chimney systems often function properly, they are more likely to suffer from cold down drafts at start up or provide weak draft to the unit. Also, consider the cross-sectional area of the chimney; although existing masonry chimneys can often be used, a large external masonry chimney will result in a unit that is difficult or impossible to operate properly. In that case, an insulated chimney liner will often be required to supply the necessary draft.

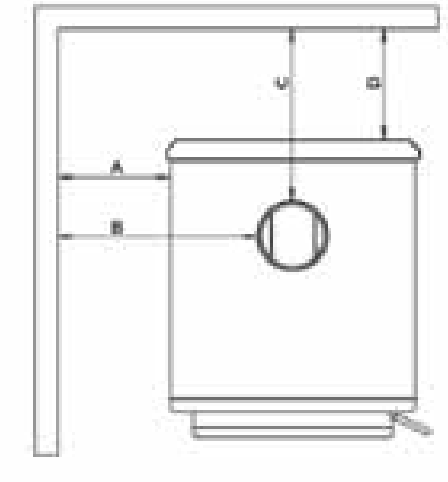
4. Wall Construction – Locating the stove so that the exhaust system can pass between studs will simplify the installation and eliminate the need to reframe any sections of the wall or ceiling to accommodate the wall thimble or ceiling box.

WARNING

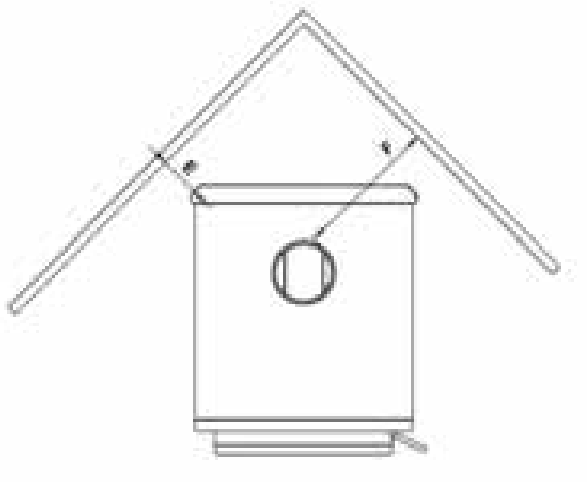
- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- Do Not Over-fire – If any external part starts to glow, you are over-firing. Reduce intake air supply. Over-firing will void your warranty.
- Comply with all minimum clearances to combustibles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

INSTALLATION

Clearances to Combustibles



Parallel Wall Installation



Corner Installation

WARNING - INSTALL VENT AT CLEARANCES SPECIFIED BY THE VENT MANUFACTURER

	Unit to Side Wall *	Chimney Connector to Side Wall	Chimney Connector to Rear Wall	Unit to Rear Wall	Unit to Corner	Chimney Connector to Corner
	A	B	C	D	E	F
	in. (mm.)	in. (mm.)	in. (mm.)	in. (mm.)	in. (mm.)	in. (mm.)
Single Wall Chimney Connector Unprotected Surface	21.5 (546.1)	29 (736.6)	12 (304.8)	7.5 (190.5)	9.5 (241.3)	19 (482.6)
Double Wall Chimney Connector Unprotected Surface	N/A	N/A	N/A	N/A	N/A	N/A
Single Wall Chimney Connector Unprotected Surface with side shields.	17.5 (445.5)	25 (635)	12 (304.8)	7.5 (190.5)	5.5 (139.7)	15 (381)
Double Wall Chimney Connector Unprotected Surface with side shields.	N/A	N/A	N/A	N/A	N/A	N/A

INSTALLATION

Venting Introduction

This wood stove operates on a natural draft system, in which the chimney system pulls air through the stove. 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. Avoid make-shift compromises when installing the venting system. England's Stove Works is not responsible for any damage incurred due to a poor or unsafe installation.

Be certain that all aspects of the venting system are installed to the venting manufacturer's instructions, particularly the required clearances to combustibles. Also, be certain to use an attic radiation shield to prevent insulation from contacting a chimney which passes through an attic.

The chimney system is the "engine" which drives a wood stove, so it is imperative for proper unit function that the venting system be installed exactly as described in the following section.

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 strongly recommend contacting a local NFI certified installer to perform the installation.

Venting Guidelines

- **ALWAYS** install vent pipe in strict adherence to the instructions and clearances included with your venting system.
- **DO NOT** connect this wood 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.
- **INSTALL** three sheet metal screws at every chimney connector joint.
- **AVOID** excessive horizontal runs and elbows, as both will reduce the draft of the venting system and will result in poor stove performance.
- **INSPECT** your venting system often, to be certain it is clear of creosote, fly-ash and other restrictions.
- **CLEAN** the venting system as detailed in the maintenance section of this manual.
- **ADHERE** to the 10-3-2 rule regarding chimney terminations.
- **INSTALL** single wall chimney connector with the male end **down** to prevent creosote leakage. Follow double wall chimney connector manufacturer's instructions regarding proper pipe installation.

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

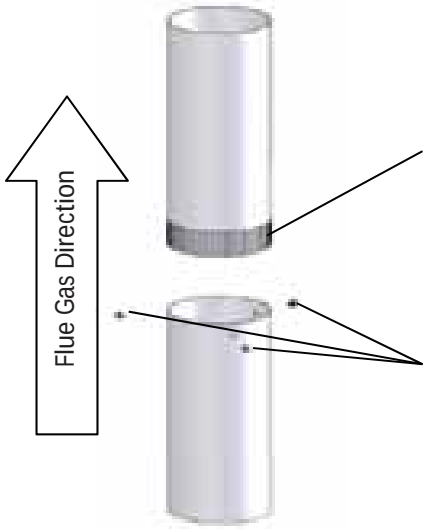
INSTALLATION

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 chimney height of 15.0 ft. Chimney systems shorter than this may not create the amount of draft which is required to operate this wood burning unit.
- Do not use makeshift compromises when installing the venting system; have existing chimney systems inspected before use and be certain all new chimney systems are installed to the manufacturer's specifications and with only UL listed components (ULC if Canada).
- Prefabricated venting systems used for this stove must be listed to ULC S629 (Canada) and UL 103HT (US).
- Never install a draft inducer or any other system which increases the natural draft of the chimney; similarly, do not install a barometric or stovepipe damper with this unit.
- Never use single wall or double chimney connector as a chimney system; never pass either type of chimney connector through a combustible wall without carefully following the manufacturer's instructions and those listed in the following page on Wall Pass-Throughs. NEVER pass chimney connector through an attic, floor, closet or roof.
- Only use 24 gauge MSG black single wall chimney connector or UL Listed (ULC if Canada) double wall chimney connector.

Single Wall Chimney Connector Installation

The male end of single wall chimney connector is installed facing down so that any liquid creosote in the flue will run into the unit instead of onto the outside of the pipe (the natural draft in the chimney system will prevent smoke leakage at the joints).



Crimped or male end of single wall chimney connector must face down.

Fasten each single wall chimney connector joint with three sheet metal screws.

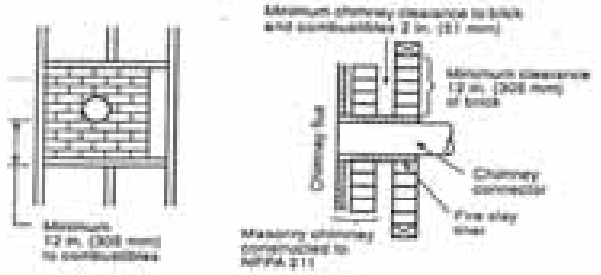
WARNING

- **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.

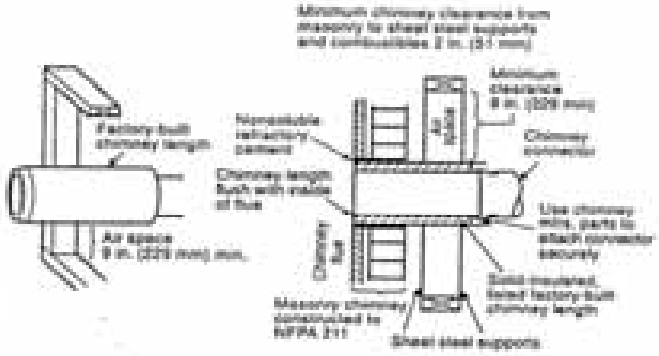
INSTALLATION

Wall Pass-Throughs

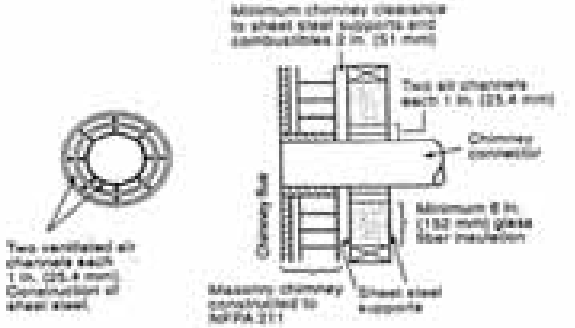
Chimney Connector Systems and Clearances from Combustible Walls for Residential Heating Appliances



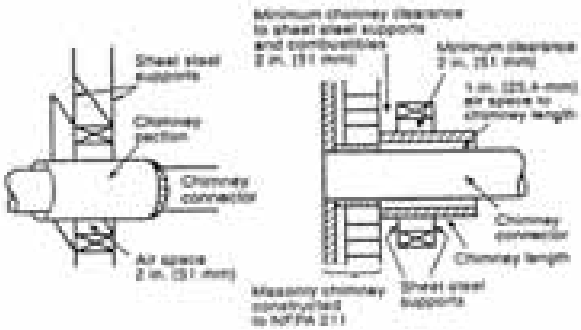
A Minimum 3.5-in thick brick masonry all framed into combustible wall with a minimum of 12-in brick separation from clay liner to combustibles. The fireclay liner shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.



B Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1-in. or more of insulation with a minimum 9-in. air space between the outer wall of the chimney length and combustibles.



C Sheet steel chimney connector, minimum 24 gauge in thickness, with a ventilated thimble, minimum 24 gauge in thickness, having two 1-in. air channels, separated from combustibles by a minimum of 6-in. of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge in thickness.

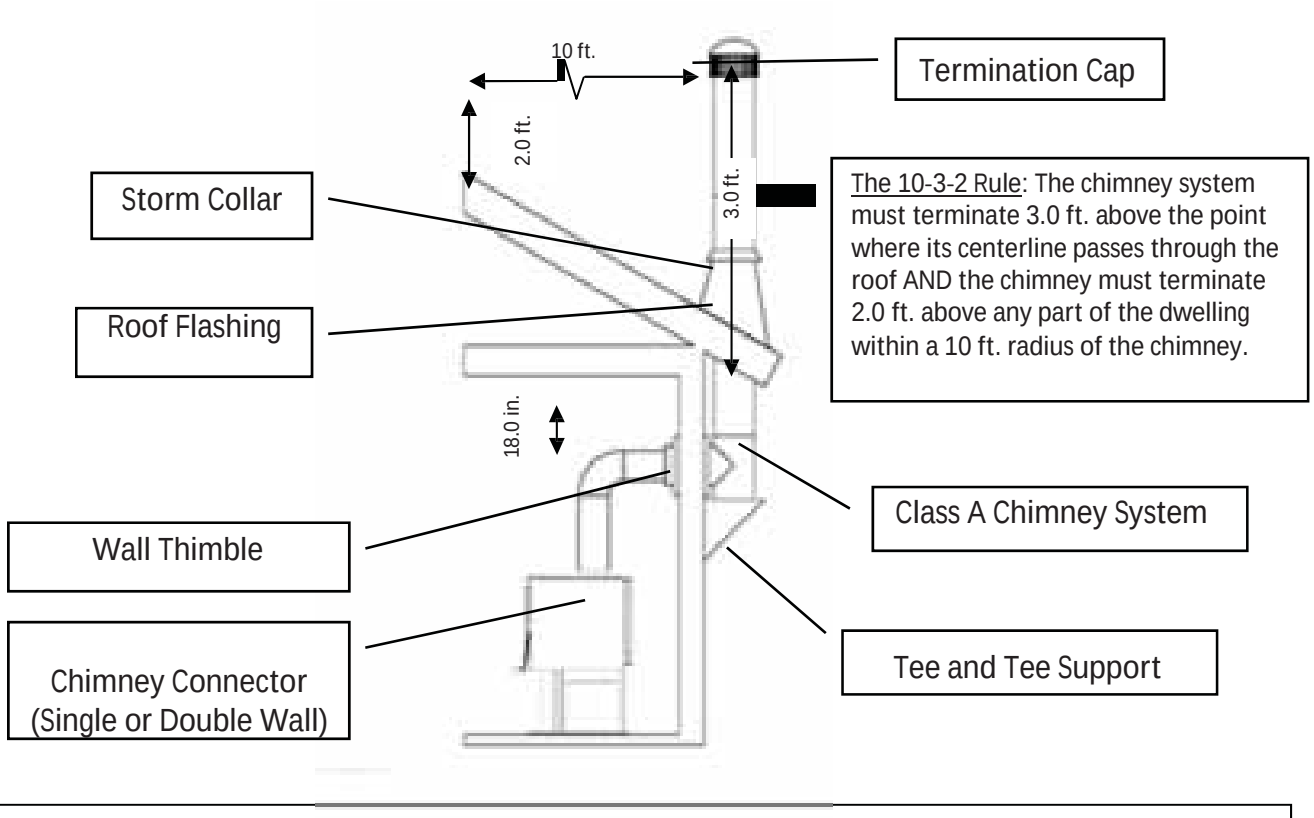


D Solid insulated, listed factory-built chimney length with an inside diameter 2-in. larger than the chimney connector and having 1-in. or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gauge thickness, with a minimum 2-in. air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12-in. chimney section spaced 1-in. away from connector using sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports securely fastened to wall surfaces of minimum 24 gauge thickness. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

For Canada: A chimney connector shall not pass through an attic, roof space, closet, floor, ceiling, or similar concealed space. Where passage through a wall or partition of combustible construction is desired, the installation shall conform with CAN/CSA-B365.

INSTALLATION

Approved Venting Method 1: Through the Wall Factory Built Chimney

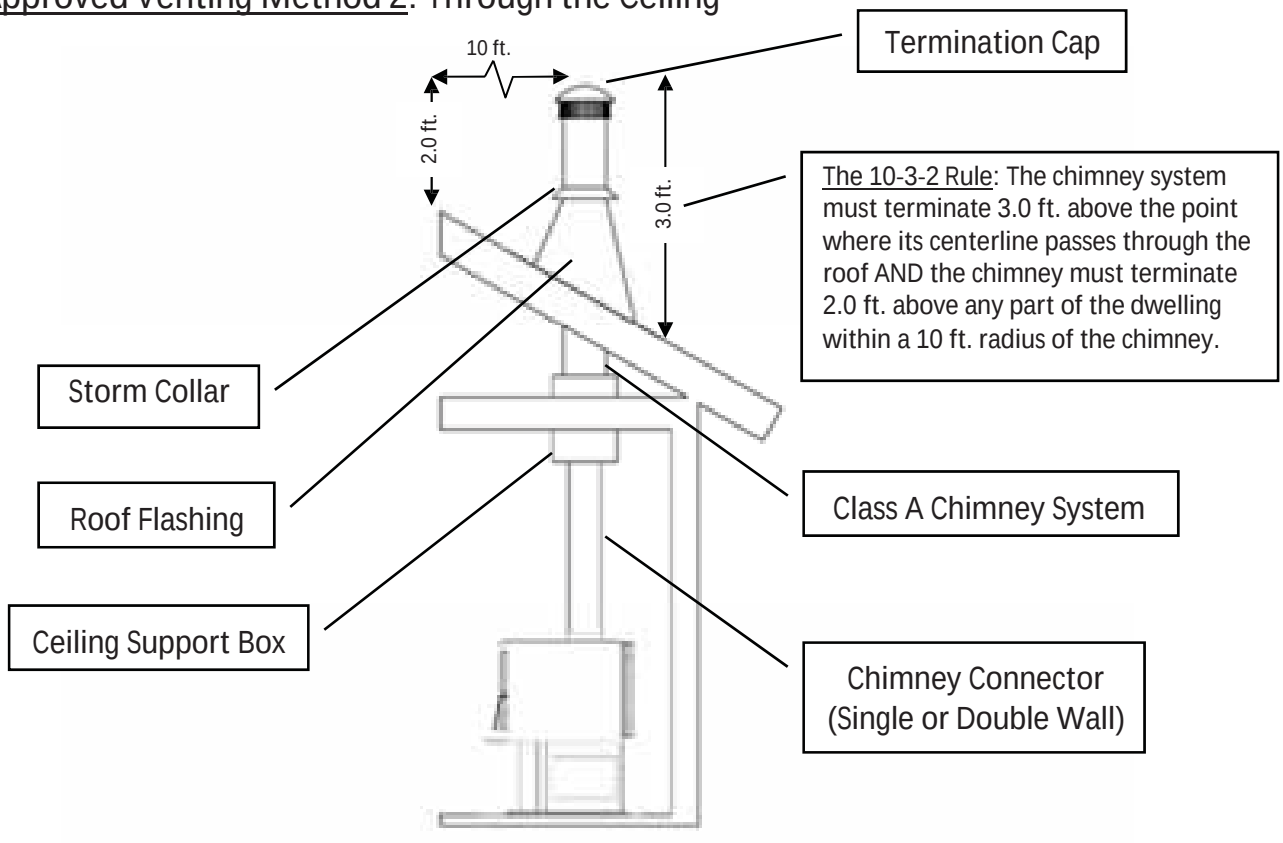


- Prefabricated chimney systems must conform to UL-103HT (2100 °F) for the U.S. and ULC-S629 (650°C) for Canada.
- This wood burning unit is only listed for installation with 6.0" diameter chimney connector and chimney systems. Installing this unit on prefabricated chimneys larger than 6.0" diameter will result in decreased draft and the potential for poor unit performance.
- Follow all venting system manufacturer's installation requirements and required clearances.
- Use three sheet metal screws at each single wall chimney connector joint (check manufacturer's recommendations when double wall chimney connector is used).
- Drill three holes in the flue collar of the unit and attach the chimney connector to the unit using sheet metal screws (holes should be pre-drilled in flue collar from factory).
- Properly attach the prefabricated chimney system to the home in strict accordance with the prefabricated chimney system manufacturer's instructions.
- Avoid numerous elbows and excessive horizontal runs as both will lead to poor draft and increased creosote accumulation. Horizontal runs of chimney connector must never exceed 4.0 ft. and the overall length of the chimney connector must not exceed 8.0 ft.
- Special adapters and slip connectors are available to eliminate the need to cut single wall chimney connector. Double wall chimney connector must be used with these slip connectors, as it cannot be trimmed to length.

. 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

Approved Venting Method 2: Through the Ceiling

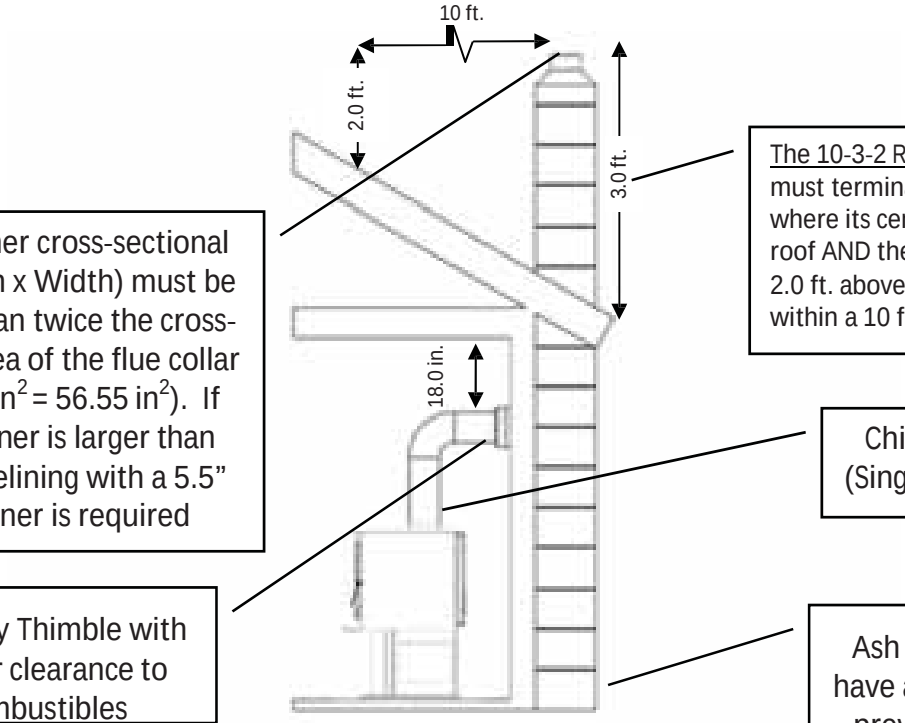


- Prefabricated chimney systems must conform to UL-103HT (2100 °F) for the U.S. and ULC-S629 (650°C) for Canada.
- This wood burning unit is only listed for installation with 6.0" diameter chimney connector and chimney systems. Installing this unit on prefabricated chimneys larger than 6.0" diameter will result in decreased draft and the potential for poor unit performance.
- Follow all venting system manufacturer's installation requirements and required clearances.
- Use three sheet metal screws at each single wall chimney connector joint (check manufacturer's recommendations when double wall chimney connector is used).
- Drill three holes in the flue collar of the unit and attach the chimney connector to the unit using sheet metal screws (holes should be pre-drilled in flue collar from factory).
- Properly attach the prefabricated chimney system to the home in strict accordance with the prefabricated chimney system manufacturer's instructions.
- The overall length of the chimney connector must not exceed 8.0 ft. In the case of cathedral ceilings, the prefabricated chimney system should extend to 8.0 ft. from the top of the unit.
- Special adapters and slip connectors are available to eliminate the need to cut single wall chimney connector. Double wall chimney connector must be used with these slip connectors, as it cannot be trimmed to length.

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

Approved Venting Method 3: Internal or External Masonry Chimney System



Chimney liner cross-sectional area (Length x Width) must be no larger than twice the cross-sectional area of the flue collar (2 x 28.27 in^2 = 56.55 in^2). If chimney liner is larger than 56.55 in^2, relining with a 5.5" or 6.0" liner is required

The 10-3-2 Rule: The chimney system must terminate 3.0 ft. above the point where its centerline passes through the roof AND the chimney must terminate 2.0 ft. above any part of the dwelling within a 10 ft. radius of the chimney.

Chimney Connector (Single or Double Wall)

Masonry Thimble with proper clearance to combustibles

Ash Cleanouts must have an airtight seal to prevent weak draft.

- Follow the rules listed above concerning maximum permissible flue liner size; installing this unit on masonry chimneys exceeding 56.55 in^2 in cross-sectional area will result in decreased draft and the potential for poor unit performance.
- Use three sheet metal screws at each single wall chimney connector joint (check manufacturer's recommendations when double wall chimney connector is used).
- Drill three holes in the flue collar of the unit and attach the chimney connector to the unit using sheet metal screws (holes should be pre-drilled in flue collar from factory).
- Avoid numerous elbows and excessive horizontal runs as both will lead to poor draft and increased creosote accumulation. Horizontal runs of chimney connector must never exceed 4.0 ft. and the overall length of the chimney connector must not exceed 8.0 ft.
- A tight seal at the thimble is crucial for proper unit performance and to create a safe installation. Use the proper adapter designed for connecting single or double wall chimney connector to a masonry thimble.
- Have existing masonry chimneys inspected for safety and proper clearances to combustibles before putting them into service; a qualified chimney sweep can perform this inspection.
- External masonry chimneys often suffer cold downdrafts and poor draft performance even when they meet the cross-sectional area rules. In this case, a 6.0" insulated liner may be necessary.

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

INSTALLATION INTO A MASONRY FIREPLACE

Preparation
Measure your hearth to ensure it is large enough to accept the unit.

Unit must have a 36” clearance from the top of the stove to a mantel in accordance with NFPA 211

For the USA: Hearth must extend at least 16 in. from the front of the fuel opening.

For Canada: Hearth must extend at least 18 in (450.0 mm) from the front of the fuel opening.

Keep in mind that this type of a installation will make it difficult to change speeds on the blower frequently. We recommend picking a blower speed and sticking with it, since adjusting the blower will be difficult because of the tight installation.

WARNING: DO NOT ATTEMPT TO ADJUST BLOWER DURING OPERATION. SKIN BURNS MAY OCCUR WHEN MAKING CONTACT WITH THE UNIT. WAIT FOR UNIT TO COMPLETELY COOL BEFORE ATTEMPTING TO ADJUST BLOWER.

Inspect your hearth to be sure it is constructed of a noncombustible material such as brick or stone. Do **not** install this stove on a hearth that is constructed of wood framework that is covered by brick or stone and do **not** install this unit in a zero (0) clearance fireplace. The manufacturer will not be held responsible for an accident resulting from this stove being installed on a hearth constructed of a combustible material.

Inspect your fireplace to ensure it is in proper working order and free of any obstructions.

Prior to installation, remove the existing damper or wire it to fasten it open.

Venting Your Stove - Direct Connect
When this unit is direct connected it will require six inch (6”) diameter 24 gauge pipe from the stove through the damper opening. (**NOTE: The chimney connector must be attached to the appliance with a minimum of three (3) screws, and 3 screws should be used to attach each adjoining section.)**
We highly recommend having the chimney fully lined with a 6 inch liner to ensure proper draft. This will make it necessary to block off the open area on both sides of the pipe that passes through the damper opening, which can be done with sheet metal or by packing flame retardant fiberglass insulation in the open areas (no paper or combustibles). You must be sure the draft from the chimney is being pulled through the stove, and not around the connector pipe.

We highly recommend you have this done by a professional. You should also contact your local authorities to be sure you are following all codes.

INSTALLATION

WARNING
DO NOT INSTALL IN A SLEEPING ROOM.

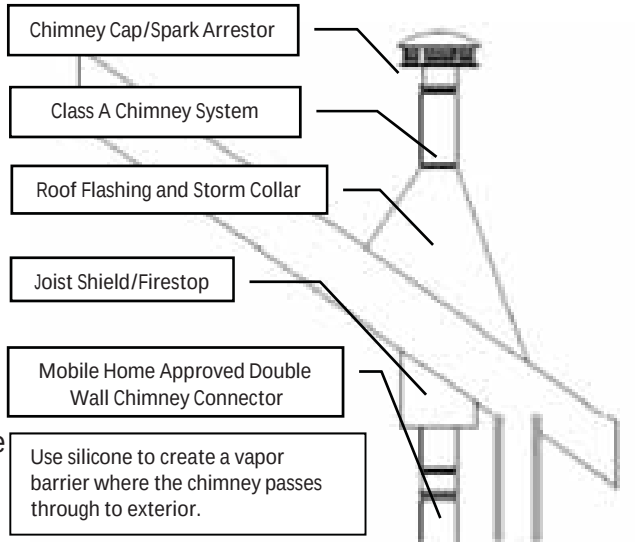
CAUTION

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

Caution
NEVER draw outside combustion air from:
Wall, floor or ceiling cavity or
enclosed space such as an attic, garage or crawl space.

Mobile Home Installation **(USA ONLY, NOT APPROVED FOR CANADIAN MOBILE HOME INSTALLATION)**

- The wood stove **MUST** be secured to the floor of the mobile home using lag bolts and the holes provided in the bottom of the unit for this purpose. Use a #8 copper wire to ground stove to frame of mobile home.
- The wood stove must be connected to the chimney system with double wall chimney connector which is UL listed for use in mobile and manufactured homes.
- 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.

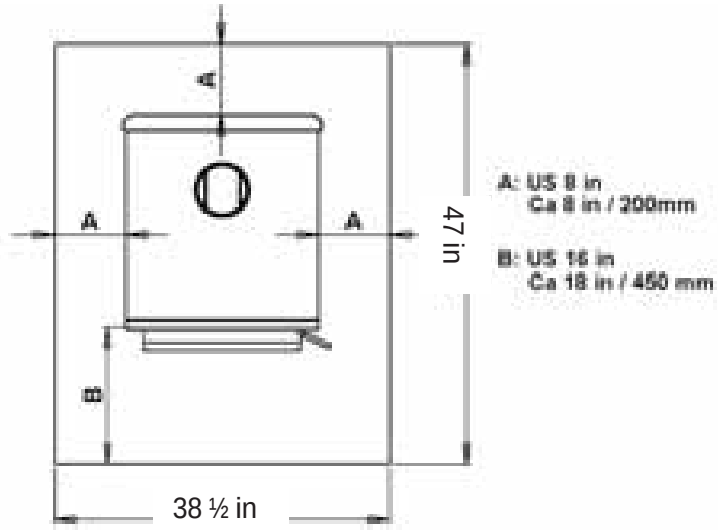


Outside Combustion Air

- The use of outside combustion air is **mandatory** when installing this wood stove in a mobile or manufactured home.
- The outside air connection pipe protrudes from the bottom center of the stove; a kit is available from England's Stove Works, Inc. designed for connecting this unit to outside combustion air. [Part No. AC-OAK3]
- If it is not feasible to use the AC-OAK3 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 2.75 in.
    - Keep pipe runs short and use a mechanical fastener at each pipe joint.
    - 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. Inspect the outside combustion air inlet for block and debris monthly.

FLOOR PROTECTION

- This wood stove requires a UL listed type 1 spark and ember 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 UL listed type 1 spark and ember 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 located near the stove.
- The spark and ember floor protector should be UL approved or equivalent (ULC if Canada) and must be noncombustible. Since the majority of the heat from this unit is radiant, 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 pad. No R Value is necessary.
- For the US: The floor protector must extend at least 16 in. from the front of the fuel opening, 8 in. from the sides of the door opening and 8 in. from the rear of the unit.
- For Canada: The floor protector must extend at least 450.0 mm from the front of the fuel opening, 200.0 mm from the sides of the door opening and 200.0 mm from the rear of the unit.



- The spark and ember floor protector must extend 2 in. (50.8 mm.) on either side of any horizontal venting runs and extend directly underneath any vertical venting pipe.

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.

OPERATION

Break-In Fires

- This wood burning unit is constructed of heavy gauge steel and cast iron and is built to last a long time. However, in order to ensure no excessive thermal stresses are induced on the metal during the first fire, three break-in fires should be burned, each one slightly hotter than the last. These break-in fires will not only help the stove body acclimate to the high temperatures of the fire, but will also slowly cure the high temperature stove paint, which will ensure the high quality finish lasts for years.
- This stove has a single air control rod which regulates the wood burn rate; when the primary air control slide is pulled all the way out of the unit, the stove will burn more slowly and put out heat over a longer time period. Conversely, when the air control slide is pushed all the way in, the unit will burn more quickly and put out a larger amount of heat over a relatively shorter time period. Do not attempt to modify the range of air control adjustment for any reason.
- The first break-in fire should be just a large kindling fire, getting the stove to about 300°F as measured by a magnetic thermometer on the right or left side of the stove, above the door. Once this temperature has been reached, allow the fire to die out with the air control open. The second and third break-in fires should be a bit larger, with some small dry splits added to the kindling load. The temperature goal during these fires is about 350°F – 450°F; don't let the fire get hotter than that.

Continuous Operation

- After the break-in fires are complete, this unit is ready for continuous operation. When burning the stove continuously, do not allow ash and coals to accumulate higher than the air hole in the dog box. Excessive coaling is often a result of burning wood at too high a burn rate, and the coal bed should be allowed to burn down before reloading the stove with fresh wood.
- Combustion air is delivered to the stove at two locations: The majority of the primary combustion air enters the firebox via the air-wash system which keeps the glass clean and feeds the primary combustion flames on the top surfaces of the wood; some primary combustion air is feed into the coal bed via the dog box hole in the bottom, front box of the stove. (This air is supplied from under the unit.) Every effort must be taken to maintain the area in front of this hole free of ash.
- When loading the stove for a long term burn, it is most useful to rake a "v" in the center of the coal bed, to allow the primary air bleed hole to push air all the way to the rear of the unit.
- After loading the stove with a full firebox of fresh wood, it is important to operate the unit with the air control in the full open position to properly char the wood load and drive off the initial moisture in the fresh wood. Once the wood has been properly charred and is completely ignited, the air control can then be set to the desired heat output level.
- This unit also offers a new feature. When loading the stove for a long low burn, you can set the air control damper to allow the unit to heat up and get a good burn going before the air is closed off to the low position. Simply pull the rod out to low and turn it counter-clockwise until you hear a slight "click" (about a quarter of a turn). When it is ready the damper will shut itself. This will work for low and medium low settings.

OPERATION

- England's Stove Works, Inc. always recommends the use of a magnetic stove thermometer, so that the temperature of the unit can be monitored. When using a magnetic stove thermometer, locate the thermometer above the door on either the left or right side of the stove and use the following temperatures as rough guidelines to determine the burn rate and heat output level of the stove:
    - Normal wood stove operation should occur between 350°F (177°C) and 550°F (288°C), with 350°F (177°C) to 450°F (232°C) being a low to medium heat output level and 450°F (232°C) to 550°F (288°C) being a medium to high heat output level. Operating the stove at 600°F (316°C) would be considered the maximum continuous operating temperature permissible and unit damage may result from operating at that high of a burn rate for extended time periods. Allowing the unit to reach 650°F (343°C) or higher is defined as over-firing and will result in unit damage.
- The optional room air convection blower was designed to extract the maximum amount of heat from the stove, for the highest possible heat transfer into the room. Since the blower is so efficient at removing heat from the unit, it is very important to only operate the room air blower after a fresh wood load has been allowed to burn for at least thirty (30) minutes. Allowing a fresh load of wood to burn without the blower on ensures that the entire unit reaches proper operation temperatures and that the secondary combustion system is functioning properly. Additionally, follow the guidelines below for acceptable blower speeds.
- When using the optional room air convection blower (Part No. AC-16, or you can upgrade to the AC-30), the blower should be operated as follows depending on heat output level:

Burn Rate	High	Medium High	Medium	Medium Low	Low
Blower Speed AC-16	High	High	Low	Low	Low
Blower Speed AC-30	High	Medium High	Medium	Medium Low	Low

<u>Creosote – Formation and Need for Removal</u>

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire. The chimney and chimney connector should be inspected at least once every two months during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the risk of chimney fire.

DO NOT USE GRATE OR ELEVATE FIRE – BUILD WOOD FIRE DIRECTLY ON HEARTH
DO NOT OPERATE WITH THE MAIN DOOR OPEN – OPERATING THE STOVE WITH THE MAIN DOOR OPEN WILL CREATE AN OVER-FIRE

In the event of a creosote or soot fire (chimney fire), close the air control on the stove, contact the local fire department and get out! Do not throw water on the fire! Contact your local fire authority for more information on how to handle a chimney fire and develop a safe evacuation plan for you and your family in the event of a chimney fire.

DO NOT STORE FUEL CLOSER THAN SPECIFIED CLEARANCES TO COMBUSTIBLES OR WITHIN THE SPACE NEEDED FOR LOADING THE STOVE AND FOR ASH REMOVAL.

OPERATION

Additional Safety Guidelines

CAUTION: When adding fuel to the stove, the blower must be turned OFF.

- The installation of smoke detectors is highly recommended when installing this or any other solid fuel burning appliance. Smoke detectors should be located near or in every room of the home, particularly sleeping rooms.
- A smoke detector can be installed in the same room as this cordwood burning unit; installing the smoke detector too close to the unit can lead to nuisance alarms due to slight wisps of smoke emitted during the fire starting or reloading process. Due to this, the smoke detector in the same room as the unit will be most useful if it is located as far from the unit as the room will permit.
- This stove is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried, seasoned hardwoods, as compared to soft woods or to green or freshly-cut hardwoods. DO NOT BURN **garbage, lawn clippings or yard waste, materials containing rubber, including tires; Materials containing plastic: Waster petroleum products, paints 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 previously salt water saturated materials; Paper products, cardboard, plywood, or particleboard. The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater. Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke.**
- Burning fuels other than cordwood, particularly coal and charcoal, can result in hazardous concentrations of carbon monoxide being emitted into the dwelling. For these reasons, NEVER burn coal or charcoal in this cordwood stove. Installing a carbon monoxide detector and being aware of the symptoms of carbon monoxide poisoning can help reduce the risk of carbon monoxide related issues.
- This unit was designed for operation only with the loading door closed and tightly latched. Operating this unit with the loading door latched loosely or open will allow excessive combustion air to reach the fire and will result in dangerously high unit temperatures. High unit temperatures can damage the unit, void the warranty or ignite creosote deposited in the chimney system by previous, slow burning fires.
- The natural draft that pulls air through this unit and allows the fire to burn uses the indoor air of the dwelling for combustion, unless the unit is connected to an outside combustion air source. Kitchen range vent hoods, furnaces and other air movement appliances in the home are often also removing air from the dwelling; if the amount of air filtration or leakage back into the home is exceeded by the air being removed, negative pressure may be created in the home.
- Since this is a natural draft appliance, it will often be the first appliance to have problems related to negative pressure. If smoke is forced out the chimney connector joints or out of the air induction system of the unit, the unit is likely fighting negative pressure in the dwelling. Cracking a window or door near the appliance can help equalize the negative pressure;

ultimately, an unrestricted source of outside combustion may be necessary for proper unit function.

- If the unit is connected to outside air, be certain to monitor the exterior inlet to the combustion system for icing or snow accumulation. Allowing the outside air connection to become restricted will result in air starvation to the unit.

Safe Wood-Burning Practices

Once your wood-burning appliance is properly installed, follow these guidelines for safe operation:

- Keep all flammable household items-drapes, furniture, newspapers, and books-far away from the appliance.

  Start fires only with newspaper, dry kindling and all natural or organic fire starters. Never start a fire with gasoline, kerosene, or charcoal starter.

  Do not burn wet or green (unseasoned) logs.

Do not use logs made from wax and sawdust in your wood stove-they are made for open hearth fireplaces. If you use manufactured logs, choose from those made from 100 percent compressed saw dust.

Build hot fires. For most appliances, a smoldering fire is not a safe or efficient fire.

Keep the doors to your wood-burning appliance closes unless loading or stoking the live fire. Harmful chemicals, like carbon monoxide, can be released into your home.

Regularly remove ashes from your wood-burning appliance into a metal container with a cover. Store the container of ashes outdoors on a cement or brick slab (not on a wood deck or near wood). See ash removal instructions in your owner's manual.
Keep a fire extinguisher handy.
Remember to check your local air quality forecast before you burn.

MAINTENANCE

Daily Maintenance

- Inspect the firebox for ash accumulation; remove excess ash and follow instructions below regarding disposal. Ash should not be allowed to accumulate in the stove to the point that it covers the dog box hole.

Monthly Maintenance

- Check the blower for dust accumulation (if installed); check the door handle for proper operation and to be certain an airtight seal is still being made by the door.
- Inspect the chimney system and chimney connector and sweep if necessary. Although cleaning may be required less than monthly, ALWAYS inspect the venting system monthly to decrease the chance of a chimney fire.
- Visually inspect the ceramic fiber insulating boards in the firebox for cracks and/or breakage. Slight surface cracks will not affect the performance of the boards, but cracked or crumbling boards should be replaced immediately.
- Visually inspect the secondary combustion tubes for cracks, warping and corrosion. Although these tubes are constructed from stainless steel, they operate at very high temperatures and can eventually wear out from normal use.

Yearly Maintenance

- Check all gaskets (window and door) for wear and to be certain they still maintain an airtight seal. See the following page for instructions.
- Thoroughly clean the chimney system and the chimney connector system. Since the chimney connector is generally exposed to high exhaust temperatures, inspect it carefully for leaks and weak spots; replace any questionable pieces. [In the case of straight through the roof chimney system, be certain to remove the ceramic fiber baffles **before** pushing the chimney sweeping brush down into the firebox. Forcefully hitting the top of the baffle with a cleaning brush or rod can damage or destroy the baffle.]
- Remove all ash from the stove, including the ash which accumulates on the top of the firebox baffles. Leave the air control open during the non-heating months to allow some air to flow through the stove to help prevent corrosion. A small open container of cat litter in the stove can help prevent corrosion during the humid summer months; be certain to remove it before building a fire in the fall.

IMPROPER GASKET MAINTENANCE, INCLUDING FAILURE TO REPLACE GASKETS, CAN CAUSE AIR LEAKS RESULTING IN AN UNCONTROLLABLE FIRE IN THE UNIT.

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.

MAINTENANCE

Inspecting Gaskets

An airtight seal at the door opening is crucial to proper stove performance. Any air leakage at this area can cause an over-fire situation and is therefore a serious safety threat. Because of this, gaskets should always be maintained in good condition. 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).
- Close and tighten the door then 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 visually inspect the window gasket for any leaks. Leaks in the window gasket can generally be located by following the prevailing soot trails left on the window after burning the unit.
- 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 of this manual.
- Gaskets should only be replaced with equivalent fiberglass gaskets purchased from England's Stove Works ® specifically for this unit.

Gaskets

1. Door - This unit comes with a ¾" rope gasket around the door that should be replaced at least every year. To replace the door gasket (Part # AC-DGKHD), the old gasket must first be removed entirely — prior to adding the new adhesive, you may have to scrape the old cement from the 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 # AC-GGK), the new gasket will already have adhesive on one side. First, remove the old gasket. Next, 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.

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.

REPLACING COMPONENTS

Glass

This unit has a ceramic glass panel (Part No. AC-G50) in the viewing door; self adhesive window gasket is included with replacement windows purchased directly from England's Stove Works. Never replace ceramic glass with tempered or any other type of glass and never operate this unit with cracked or broken glass.

- Glass Size: 12.75 in. (323.85 mm) x 16.75 in. (425.45 mm)
- Glass Type: 5mm Ceramic Glass (Keralite Pyroceram)
- Glass Manufacturer: Eurokera

Glass Precautions

1. Never replace ceramic glass with tempered or any other type of glass.
2. Never operate this unit with cracked or broken glass.
3. Do not slam the door or strike the glass with any objects.
4. Do not build the fire directly against the glass.

Glass Cleaning

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

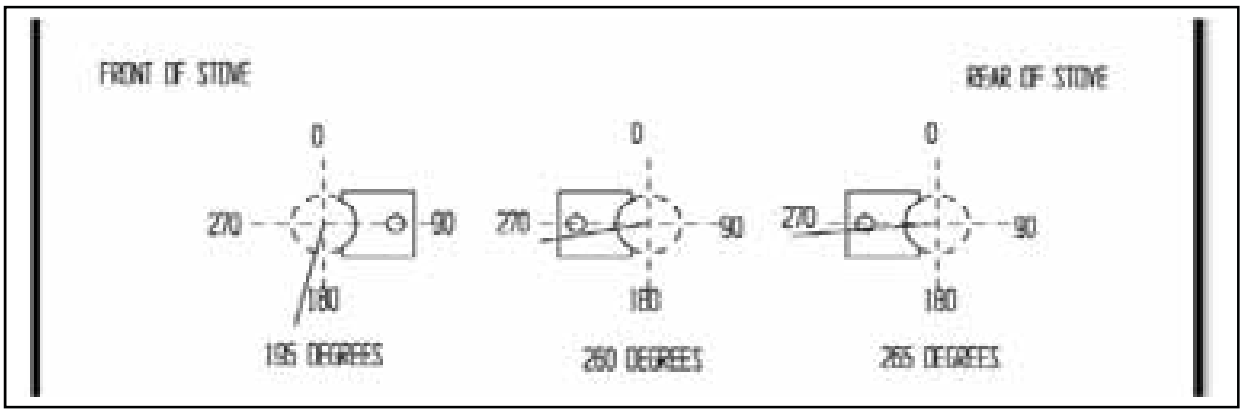
Glass Replacement

1. Remove the door from the stove and rest it face down on a firm work surface.
2. Using a 5/16" wrench, remove the four window bracket retaining screws.
3. Remove the four window tabs from the door. Take extra care to avoid shards of glass if the glass window has been broken.
4. Lift the old glass panel out of the door and discard.
5. The glass panel must be wrapped with a self-adhesive fiberglass tape gasket (AC-GGK). If you purchased a new glass, it will come already wrapped. If reusing the same piece of glass, remove old gasket, scrape off old adhesive and wrapped with the AC-GGK. This gasket serves to cushion the glass from the cast iron door.
6. Reinstall the window retaining tabs using the four screws previously removed. Do not over-tighten the screws.

REPLACING COMPONENTS

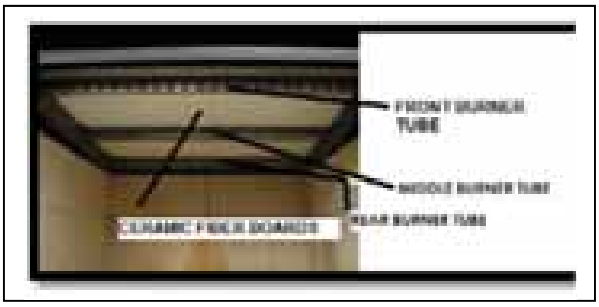
Burner tube replacement

There are three different burner tubes in the top of the stove. To replace a tube, first be sure that you order the correct tube you need to replace. Then using a 5/16" socket or open end wrench, remove the screw located on the left side of the tube. Be sure to keep the screw. Push the tube to the right then remove the tube (pulling the tube back to the left after that side has been removed from the hole). To replace, reverse the above procedure…make sure to install the tubes in the correct order. (Front to Back)



Ceramic fiberboard replacement

To replace a cracked or broken board, first remove the front burner tube. Then remove the board you need to replace. Install the new board (the two boards should sit flush on the tubes side by side). Replace the tube previously removed.



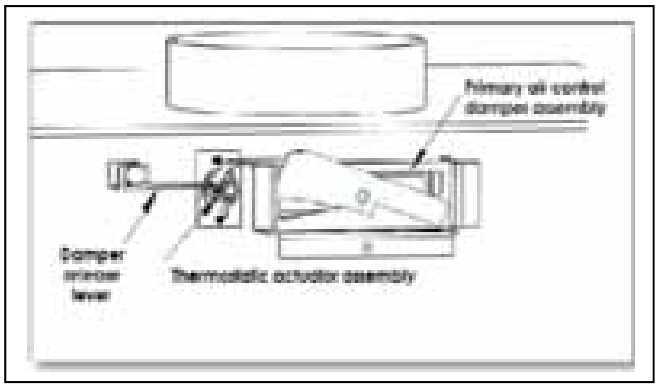
Door hinges

The hinges on this unit were designed to be adjustable. The plates are secured using a ½" bolt and nut. To adjust the hinge plates in or out first remove the door, then use a ½" socket and ½" open ended wrench (one on the nut and one on the bolt head) and loosen the bolt/nut. Slide the plate in/out as desired and then use the socket and wrench to tighten the bolt/nut. * Use care when adjusting hinges. If enough room is not left for the door to clear the side of the unit, the hinge could break. *

Heat shield and back panel removal (to access other components)

There are two 5/16" screws that are on the rear of the heat shield. To remove the heat shield, using a 5/16" socket or open ended wrench, remove the two screws. Then pull the heat shield up and back off the back panel. Next to remove the back panel, there are three 5/16" screws on the rear of the panel. Using a 5/16" socket or open ended wrench, remove the three screws. It may be necessary to pry the top of the panel with a flat head screwdriver (at the top of the stove). Lift the panel up and off the stove.

Other Components continued:

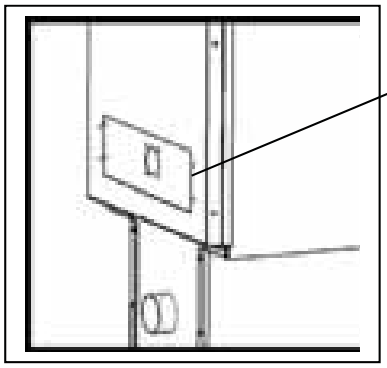


At this point you can access the primary air control damper assembly, thermostatic actuator assembly and the damper release lever. Although these shouldn't need to be replaced, they can be, easily. The primary air control damper assembly can be replaced by removing the small spring handle from the front of the unit, then sliding the assembly out. Replace by sliding the new assembly through the same hole and the rod through the front of the stove. Replace the spring handle. The thermostatic actuator assembly can be replaced by using a 5/16" socket to remove the two screws that hold the assembly. Install the new assembly using the same two screws. The damper release lever can be replaced by removing the ½" bolt. When reinstalling the damper be sure it is installed the same as when removed.

OPTIONAL ACCESSORIES

Blower: The wood stove was also designed for use with a convection blower for additional heat circulation. The stove is constructed with side convection channels which allow the room air blower to pick up heat from the hottest regions of the stove and transfer it into the home. The mounting screws for the blower are installed into the rear convection channel at the factory; mounting the blower only requires a 5/16" open end or socket wrench to remove these screws and install the blower. When routing the power cord, take care to keep away from hot areas of the unit and remember that this blower is for use only with the stove. Please see the diagram below for clarification on the room air blower installation. This unit can use the AC-16 (which comes standard with the unit) or the AC-30 upgrade blower. Both are installed using the four factory installed 5/16" screws.

The optional heat circulation blower on this stove requires periodic lubrication; this lubrication should be performed no less than every three months of normal operation. To properly lubricate the blower, use an eye dropper or similar dispensing device to drip 5-7 droplets of SAE 20 oil into the oil port on the side of the blower motor.

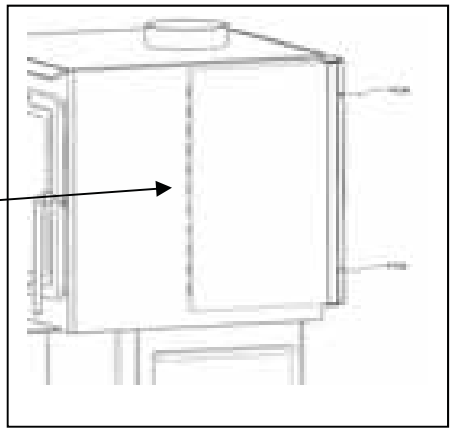


(4) 5/16" head, self-tapping screws (pre-installed in unit).

Warning: Disconnect power from fan before installation.

Side Heat Shield (Part AC-W01SHS):

Install the side heat shield behind the side flange of the rear panel. Align the two mounting holes and secure with the two screws provided.



TROUBLESHOOTING

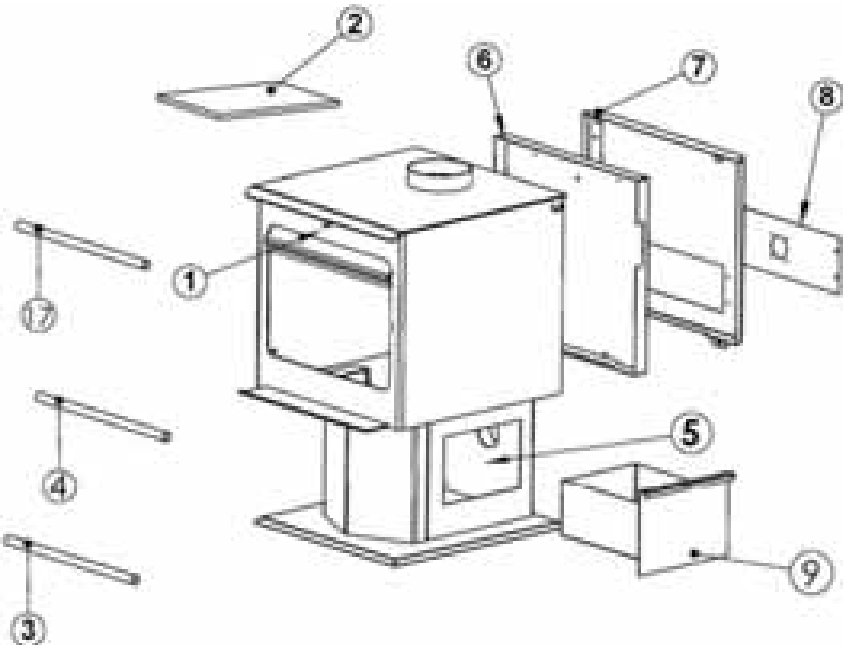
Issue	Cause	Solution(s)
Stove smokes into room	1. Weak Draft	1.1 Be certain chimney is sufficiently tall to meet the 10-3-2 rule.
		1.2 Add additional height to the chimney.
	2. Negative Pressure in the Home	2.1 Add an outside combustion air hookup to the unit.
Fire is hard to start	3. Weak Draft	3.1 Be certain chimney is sufficiently tall to meet 10-3-2 rule.
		3.2 Add additional height to the chimney system.
	4. Cold Chimney	4.1 Heat the flue first by burning crumbled newspaper in the stove.
		4.2 Install an insulated chase around external chimneys.
	5. Downdraft in Chimney	5.1 Be certain chimney is sufficiently tall to meet 10-3-2 rule.
		5.2 Try heating the flue with a hair-dryer to correct the draft.
Glass is dirty	6. Wet or Green Wood	6.1 Only burn wood that is seasoned for at least one year and that is dry and free of ice and snow.
	7. Operating Stove at Low Burn Rate	7.1 Operate the stove at higher burn rates to allow the air-wash system to keep the glass clean.
	8. Wood Loaded Too Close to Glass	8.1 Never load wood so that it is touching the ceramic glass viewing window.
Coals build up in firebox	9. Operating Stove at High Burn Rates	9.1 Reduce combustion air control and allow coals to burn down before reloading.
Fire burns out of control	10. Excessive Draft	10.1 Reduce chimney height.
	11. Air Leakage	11.1 Inspect window and door gaskets and replace if necessary.
	12. Burning Excessively Dry Wood	12.1 Only burn seasoned cord wood. Do not burn kiln dried wood or pallet wood.
Excessive smoke from stack	13. Operating Stove at Low Burn Rate	13.1 Operate the stove at a higher burn rate which will create secondary combustion.
	14. Wet or Green Wood	14.1 Only burn wood that is seasoned for at least one year and that is dry and free of ice and snow.
	15. Not Charring Fresh Wood Load	15.1 Char the fresh wood load until it is completely ignited and active secondary combustion is present in the firebox.

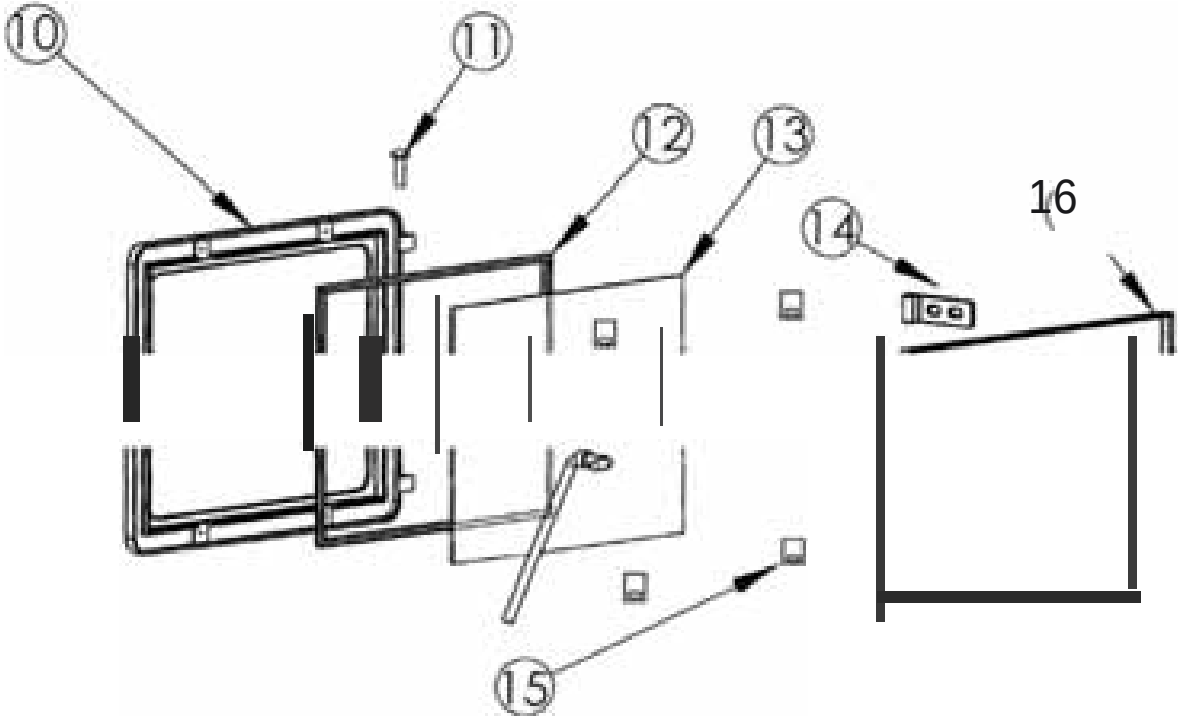
REPLACEMENT PARTS LIST

Diagram No.	Description	Part No.	Per Unit
7	Rear heat shield (BOLT ON)	AC-W01HS	1
6	Rear panel (BOLT ON)	AC-W01RP	1
1	Primary air control damper assembly	AC-W01PDA	1
Not shown	Damper release lever	AC-W01DRL	1
Not shown	Thermostatic actuator assembly	AC-W01TAA	1
9	Ash drawer	AC-ADW01	1
10	Door	CA-W01	1
14	Door hinges	AC-DHW01	2
Not shown	Side heat shields	AC-W01SHS	2
Not shown	Large Upgrade Blower (optional)	AC-30	1
Not shown	Small standard blower	AC-16	1
12	Glass gasket kit 3/4" flat	AC-GGK	1
16	Door gasket kit 3/4" high density	AC-DGKHD	1
3	Front burner tube	AC-W01FBT	1
17	Middle burner tube	AC-W01MBT	1
4	Rear burner tube	AC-W01RBT	1
13	Glass size 12.75” X 16.75”	AC-G50	1
2	Ceramic fiberboard	AC-W01CFB	2
Not shown	Small spring handle Nickel/Brass	AC-SH4N/AC-SH4	1
Not shown	Large spring handle Nickel/Brass	AC-SHN/AC-SH	1
8	Blower back cover	AC-BBC30	1
15	Glass tabs	AC-W01GT	4
11	Hinge pins	AC-HP	2
Not shown	Outside Air Kit (Optional)	AC-OAK3	1

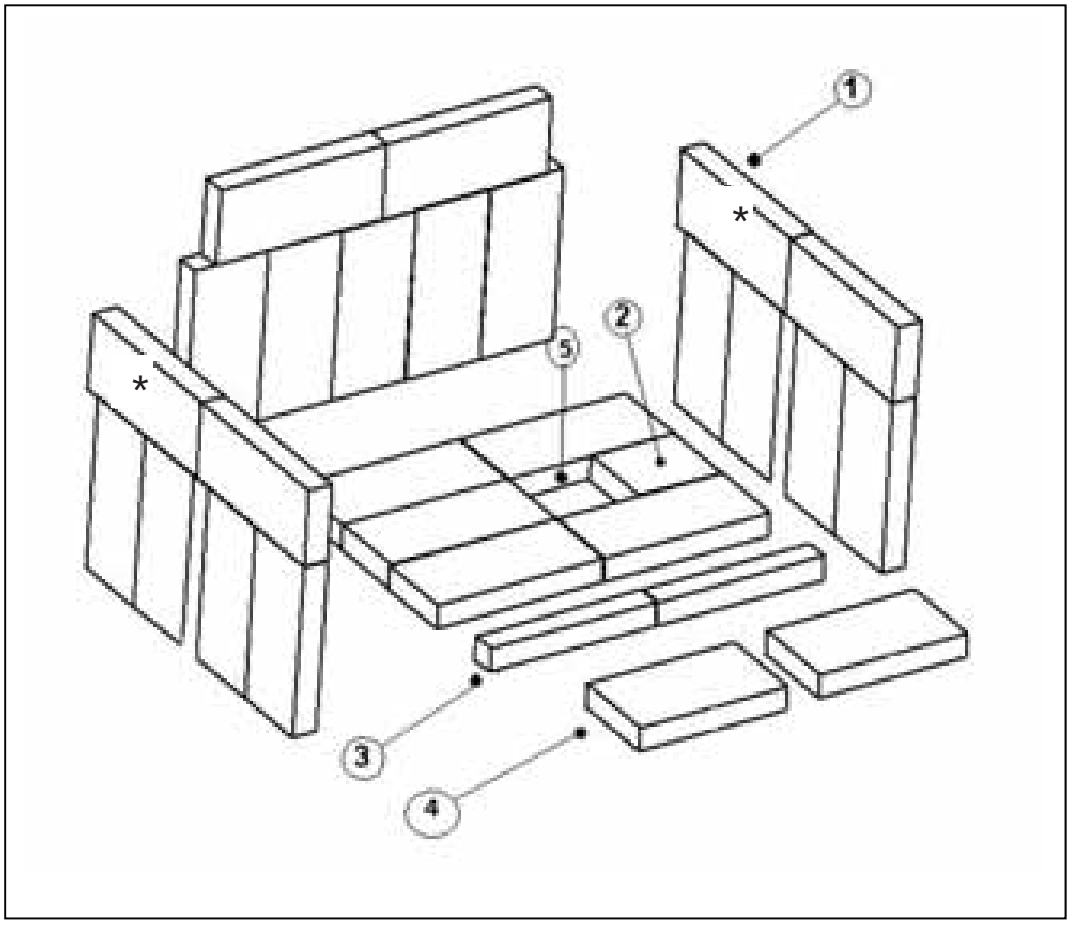
FOR BRICK LAYOUT AND PART NUMBERS PLEASE SEE PAGE 29.

ILLUSTRATED PARTS DIAGRAM





BRICK LAYOUT AND REPLACEMENT



NOTE: The bricks on the sides and rear will need to be installed after delivery

**Top rear bricks on each side may or may not be notched. If notched, order part number AC-SBN1X3.*

DIAGRAM NUMBER	BRICK SIZE	PART NUMBER	QUANTITY PER STOVE
1	9" X 4" X 1.25"	AC-SB	24
2	4.5" X 4" X 1.25"	AC-SB4.5	1
3	7.75" X 2.25" X 1.25"	AC-SB7.75X2.25	2
4	7.75" X 4" X 1.25"	AC-SB7.75	2
5	ASH DUMP PLUG	CA-30ADP	1

Model ☐15-W03 ☐50-SHW03 ☐50-TRW03
Solid Fuel Burning Room Heater; Free Standing Model "SUITABLE FOR MOBILE-HOME INSTALLATION (USA ONLY)"
Certified to UL-1482 & ULC-627-00, EPA METHOD 28A, ASTM E2780, ASTM E2515

Intertek
W/Tell xxxxx

SERIAL NO.	
MFG. DATE	

Manufactured by:
England's Stove Works, Inc.
589 S. Five Forks Rd.
Monroe, VA 24574

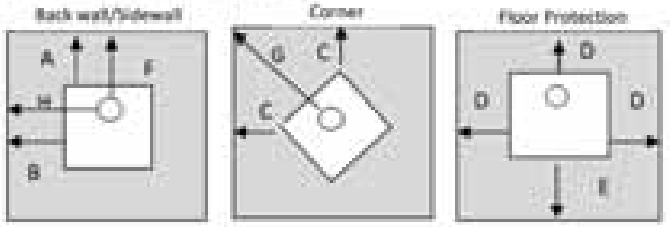
DO NOT REMOVE OR COVER THIS LABEL

- 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.

INSTALLATION REQUIREMENTS

- DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.
- USE A RESIDENTIAL TYPE MASONRY OR FACTORY BUILT CHIMNEY LISTED TO UL-103 HT (US) AND ULC-629 (CANADA).
- USE 24 GAUGE MSG BLACK SINGLE WALL CHIMNEY CONNECTOR OR LISTED DOUBLE WALL CHIMNEY CONNECTOR.
- REFER TO LOCAL CODES AND THE CHIMNEY MANUFACTURER'S INSTRUCTIONS FOR PRECAUTIONS REQUIRED FOR PASSING A CHIMNEY THROUGH A COMBUSTIBLE WALL OR CEILING.
- FOR THE US: PLACE ON A NON-COMBUSTIBLE TYPE 1 UL SPARK AND EMBER FLOOR PROTECTOR, WHICH EXTENDS 16.0 IN. TO THE FRONT AND 8.0 IN. TO EACH SIDE OF THE FUEL LOADING OPENING.
- FOR CANADA: PLACE ON A NON-COMBUSTIBLE TYPE 1 ULC SPARK AND EMBER FLOOR PROTECTOR, WHICH EXTENDS 450.0 MM. TO THE FRONT AND 200.0 MM. TO EACH SIDE OF THE FUEL LOADING OPENING.
- ADHERE TO THE LISTED MINIMUM CLEARANCES TO COMBUSTIBLES WHEN USING SINGLE WALL CHIMNEY CONNECTOR. SEE THE OWNER'S MANUAL FOR ADDITIONAL CLEARANCE INFORMATION.
- ONLY OPERATE THIS UNIT WITH THE DOOR CLOSED AND LATCHED TIGHTLY.
- THE MAIN LOADING DOOR CONTAINS A CERAMIC VIEWING WINDOW; DO NOT SLAM THE DOOR OR STRIKE THIS VIEWING WINDOW AT ANY TIME.
- IF THE GLASS IS CRACKED OR BROKEN, REPLACE WITH CERAMIC GLASS ONLY.
- Emission value – 1.856 grams/hr
- U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using crib wood fuel.
- OPTIONAL PART- BLOWER PART NUMBER AC-30 (FASCO) ELECTRICAL RATING 115 V, 60 HZ., 0.8 A
- OPTIONAL PARTS- SIDE HEAT SHIELDS PART NUMBER AC-WD1SHS (ESW INC.)
- Refer to Intertek's Directory of Building Products (HTTPS:BPDIRECTORY.INTERTEK.COM) for detailed information.

OPERATION REQUIREMENTS: FOR USE WITH SOLID WOOD FUEL ONLY. DO NOT OVER-FIRE. IF HEATER OR CHIMNEY CONNECTOR GLOWS YOU ARE OVER-FIRING. INSPECT AND CLEAN CHIMNEY FREQUENTLY. UNDER CERTAIN CONDITIONS OF USE, CREOSOTE BUILDUP MAY OCCUR RAPIDLY. DO NOT USE A GRATE OR ELEVATE THE FIRE. BURN WOOD FIRE DIRECTLY ON THE HEARTH. RISK OF SMOKE AND FLAME SPILLAGE. OPERATE ONLY WITH DOOR FULLY CLOSED.
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.



A = 7.5 inches (190.5 mm) B = 21.5 inches (546.1 mm) C = 9.5 inches (241.3 mm)
D = 8 inches (200 mm) E = 16 inches (450mm) F = 12 inches (304.8mm)
G = 19 inches (482.6 mm) H = 29 inches (736.6 mm)

CAUTION - HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING, AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAMEPLATE AND INSTRUCTIONS.

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

For parts, warranty replacement procedures may be found at our parts store site:
heatredefined.com

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 cast iron door and hinges are covered for five (5) years against cracking.

One Year Period:

1. Electrical components, accessory items, glass and the painted surface of the stove are covered for one (1) year from the date of purchase.

Conditions and Exclusions

1. Damage resulting from over-firing will void your warranty.
2. This warranty does not apply if damage occurs because of an accident, improper handling, improper installation, improper operation, abuse or unauthorized repair made or attempted to be made.
3. The manufacturer is not liable for indirect, incidental, or consequential damages in connection with the product including any cost or expense, providing substitute equipment or service during periods of malfunction or non-use.*
4. All liability for any consequential damage for breach of any written or implied warranty is disclaimed and excluded.
5. This warranty does not cover internal wear parts of the combustion system, including the firebrick lining and gaskets.

****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.

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

(WARRANTY CARD LOCATED ON NEXT PAGE)

For parts, warranty replacement procedures may be found at our parts store site: www.heatredefined.com

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: _____

_____

PLEASE NOTE:

WOOD – EPA Certified to comply with 2020 particulate emission standards using crib wood fuel.

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 Introduction:

Draft: Draft is the force which moves air from the appliance up through the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors. Too much draft may cause excessive temperatures in the appliance and may damage the catalytic combustor. Inadequate draft may cause backpuffing into the room and 'plugging' of the chimney or the catalyst.
Inadequate draft will cause the appliance to leak smoke into the room through appliance and chimney connector joints.
An uncontrollable burn or excessive temperature indicates excessive draft.
Please be mindful of installation location: Inversion and other air quality issues can arise in valleys or if unit is installed close to neighboring homes.

This wood stove operates on a natural draft system, in which the chimney system pulls air through the stove. 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. Avoid make-shift compromises when installing the venting system. England's Stove Works is not responsible for any damage incurred

due to a poor or unsafe installation.

Be certain that all aspects of the venting system are installed to the venting manufacturer's instructions, particularly the required clearances to combustibles. Also, be certain to use an attic radiation shield to prevent insulation from contacting a chimney which passes through an attic.

The chimney system is the "engine" which drives a wood stove, so it is imperative for proper unit function that the venting system be installed exactly as described in the following section.

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 strongly recommend contacting a local NFI certified installer to perform the installation.

Venting Guidelines:

ALWAYS install vent pipe in strict adherence to the instructions and clearances included with your venting system.

- **DO NOT** connect this wood 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.
- **INSTALL** three sheet metal screws at every chimney connector joint.
- **AVOID** excessive horizontal runs and elbows, as both will reduce the draft of the venting system and will result in poor stove performance.
- **INSPECT** your venting system often, to be certain it is clear of creosote, fly-ash and other restrictions.
- **CLEAN** the venting system as detailed in the maintenance section of this manual.
- **ADHERE** to the 10-3-2 rule regarding chimney terminations.
- **INSTALL** single wall chimney connector with the male end **down** to prevent creosote leakage.

Follow double wall chimney connector manufacturer's instructions regarding proper pipe installation.

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

The 10-3-2 Rule: The chimney system must terminate 3.0 ft above the point where it's centerline passes through the roof AND the chimney must terminate 2.0 ft. above part of the dwelling within a 10 ft. radius of the chimney.

- *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 Building 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 (i.e. 'Building a Fire').
- *Top-Down Fires:* The US EPA recognizes 'the effectiveness of the top-down approach for starting fires.' A good tutorial for this approach may be found at http://woodheat.org/top-down-steps.html . When building top-down fires, be sure to follow the instructions found in your owner's manual and contact our Technical Support if you have any questions.
- *Fuel Selection:* Once your wood-burning appliance is properly installed, building an effective fire requires good firewood (using the right wood in the right amount) and good fire building practices. The following practical steps will help you obtain the best efficiency from your wood stove or fireplace.

- Season wood outdoors through the summer for at least 6 months before burning it. Properly seasoned wood is darker, has cracks in the end grain, and sounds hollow when smacked against another piece of wood.
- Store wood outdoors, stacked neatly off the ground with the top covered.
- Burn only dry, well-seasoned wood that has been split properly.
- Start fires with newspaper and dry kindling as discussed earlier in the manual.
- Burn hot fires.
- To maintain proper airflow, regularly remove ashes from your wood-burning appliance into a metal container with a cover and store outdoors.

Moisture Meter Information

- Firewood is ready at 10-25% moisture content.

- Newly-cut logs can have a moisture content (MC) of 80% or more, depending on species. Since wood shrinks, and can also split, twist or otherwise change shape as it dries, most wood is dried before being used. Air drying, or 'seasoning,' is the most common method used for cord wood. In most parts of the United States, the minimum moisture content that can be generally obtained in air drying is about 12 to 15 percent. Most air-dried material is usually closer to 20 percent moisture content when used
- To test your firewood, simply push the pins into the wood and wait for a reading. Remember, **don't just stick the meter into the ends of your firewood**. To get the most accurate reading, split the wood and test the center. The center of the log will contain the most moisture.

How Far Should I Drive Non-Insulated Pins into Wood?

- To full depth if possible. However, at moisture levels below 10%, it is usually sufficient to make good, positive contact with the wood. At higher levels of moisture and especially if you have a steep gradient, full penetration is a must.

- *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.**

- **Safe Wood-burning Practices**

Once your wood-burning appliance is properly installed, follow these guidelines for safe operation:

- Keep all flammable household items—drapes, furniture, newspapers, and books—far away from the appliance.
- Start fires only with newspaper, dry kindling and all natural or organic fire starters. Never start a fire with gasoline, kerosene, or charcoal starter.
- Do not burn wet or green (unseasoned) logs.
- Do not use logs made from wax and sawdust in your wood stove – they are made for open hearth fireplaces. If you use manufactured logs, choose those made from 100 percent compressed sawdust.
- Build hot fires. For most appliances, a smoldering fire is not a safe or efficient fire.
- Keep the doors of your wood-burning appliance closed unless loading or stoking the live fire. Harmful chemicals, like carbon monoxide, can be released into your home.
- Regularly remove ashes from your wood-burning appliance into a metal container with a cover. Store the container of ashes outdoors on a cement or brick slab (not on a wood deck or near wood). See ash removal instructions in your owner's manual.
- Keep a fire extinguisher handy.

- Remember to check your local air quality forecast before you burn.

- *Air Controls:* SEE YOUR OWNER'S MANUAL for information on the Proper Use of Air Controls (in the Operation section).
- *ASH REMOVAL* – Follow your Owner's manual's instructions regarding removal and disposal of ashes.
- *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."

More: Burner Tubes – To replace a tube, first be sure that you order the correct tube you need to replace. Then using a 5/16" socket or open end wrench, remove the screw located on the left side of the tube. Be sure to keep the screw. Push the tube to the right then remove the tube (pulling the tube back to the left after that side has been removed from the hole). To replace, reverse the above procedure…make sure to install the tubes in the correct order. (Front to Back)

- **<u>Smoke Detectors</u>**

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

CAUTION

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

Additionally, using prohibited fuels can create an unsafe situation and can also generate excess carbon monoxide. Carbon monoxide is an odorless, colorless gas which can be deadly.

The use of a carbon monoxide detector is strongly recommended.

- *Compliance:* EPA Certified to comply with 2020 particulate emission standards using crib wood fuel.

- *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

intertek Total Quality. Assured.	Issue Date	5/9/2018
	Revision Date	NA
	Revision Level	0
Middleton Laboratory Local Operating Procedure	Approved By	Brian Ziegler

This Calibration procedure applies to all Dry Gas Meters in Middleton, Wisconsin Laboratory.

Equipment used: Spirometer

Using the Spirometer: The Spirometer consists of two tanks. The green tank has a U-tube on it to show any pressure (either positive or negative) in the green tank. The sight glass vial with the ruler near it tells what the level of water is in the green tank.

The controls at the Spirometer consist of a water valve and a clamp for the hose. The valve controls the flow of water between the tanks. The clamp controls the up and down movement of the red tank. *NEVER STAND UNDER THE RED TANK WHEN IT IS ELEVATED!!*

When the Spirometer is not in use most of the water is stored in the red tank on the floor.

1. Connect hoses to Dry Gas Meter (DGM) and manometer as shown in figure 1 for leak test.

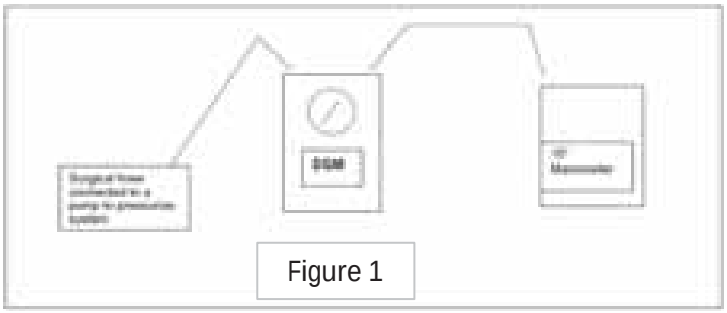


Figure 1

2. With spirometer clamped off pressurize the system by blowing into the hose, which is attached to the inlet port of the DGM. When there is 6 to 8 inches of pressure, clamp off the hose you just blew into. The manometer liquid will rise until pressure is equal in the system then stop. If the manometer does not stop rising there is a leak. Repair the leak as necessary and recheck.

3. Connect as in figure 2 for calibration of the meter. In this case, the manometer is used to monitor the pressure at the DGM. A reading of 2.0 in H2O with the system operating indicates a flow restriction that must be remedied before continuing the calibration.

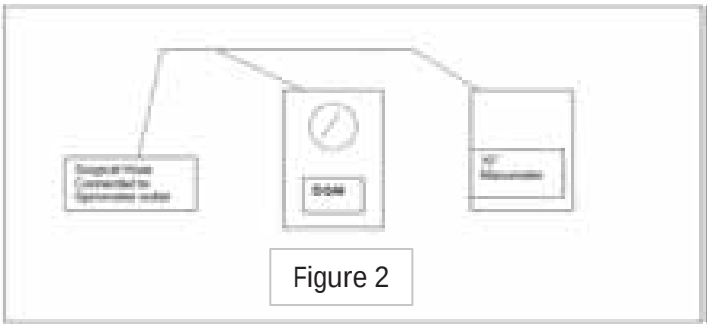


Figure 2

4. Raise the red tank above the green tank. Plug the manometer on the green tank. (Plugging the manometer hose when transferring water in either direction keeps the fluid in the manometer from being forced either out of the hose or into the green tank.) Using the water valve adjust the water in the green tank just enough to be able to adjust the ruler up or down to zero the ruler with the water level. Set the ruler bottom at the top of the meniscus. Unplug manometer slowly on green tank and using the water valve, toggle on and off until the manometer on the green tank shows no pressure at all. The fluid in the two tubes will be level when there is no pressure in the green tank. Leave the clamp open and reset the ruler if necessary. At this point, clamp open, water off, manometer levels the same and the ruler at the top of the meniscus in the water level vial, you are ready to start sampling.

5. Plug the manometer hose on the green tank. Turn the water valve on (to start water flowing into the green tank). (The sample rate is usually set on a "set up" run, as the first run will not be used in the calibrations.) Enter the initial DGM reading into the spreadsheet. Sample 1 cubic foot as near as possible then pinch off hose leading from the Spirometer (this prevents the DGM from being driven backwards) and quickly go out to the Spirometer and close the water valve. While sampling, include the barometric pressure, Spirometer temperature, meter temperature and meter pressure (from the manometer) into the spreadsheet.

6. Without removing the hose clamp at the meter, lower the red tank and adjust the water in the green tank using the water valve so there is no pressure in the green tank. This requires you to unplug the left manometer hose. Do this with care, as there might be enough pressure to either blow the fluid out of the hose or draw it into the green tank. Adjust the pressure in the constant volume tank (green) using the water valve. Normally you have to add water to the constant volume tank to equalize the pressure but if you go too far, it will be necessary to lower the red tank and allow some water out of the green tank. This takes some practice.

After adjusting the pressure in the green tank to zero using the water valve, measure the amount of water in the green tank with the ruler. (Typically around 22 inches ± 1 inch) Interpolate this measurement to the nearest 1/32 of an inch and convert to decimal. This figure is used in the Spirometer Calibration program found where these instructions were located. Enter this number into the spreadsheet and the final DGM number after the run.

7. Perform 5 runs to determine an average. Pass/fail criteria is ±1.0% for the measurement of uncertainty. If not passing, adjust and repeat the test.

Following the successful calibration of this piece of equipment a calibration sticker shall be attached to the instrument.

Measurement Uncertainty is calculated using the following formula: O.M.U. = k*((A.D.)2 + (S.D.)2 + (R.M.U.)2)1/2
O.M.U. = Overall Measurement Uncertainty
A.D. = Average Deviation of the percent difference of all measured results compared to the reference value.
S.D. = Standard Deviation of the percent difference of all measured results compared to the reference value.
k = Confidence Factor (2 for 95% confidence)
R.M.U. = Standard Measurement Uncertainty of Reference Measurement Equipment. R.M.U. is considered as the measurement uncertainty as stated on calibration certificates of equipment, or the tolerance listed in the calibration standard of the test equipment

intertek Total Quality. Assured.	8431 Murphy Drive Middleton, WI 53562	**Calibration Certificate Number**	**1210-MID-12-27**
		Issue Date	12/27/18

Middleton Laboratory Local Calibration Certificate

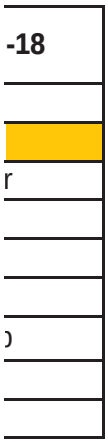
Asset Number	1210	Asset Description	Dry Gas Mete
Manufacturer	Rockwell	Model Number	DGM-110
Serial Number	974270	Calibration Date	12/27/2018
Procedure	See Procedure Tab	Calibration Due Date	6/27/2019
Ambient Temperature (^{o}F)	63.4	Calibration Location	Middleton Lab
Relative Humidity (%)	35	**As Found Condition**	**In Tolerance**
QA's Name	Christine Schultze	**As Left Condition**	**In Tolerance**
QA's Title	Quality Supervisor		
QA's Signature	Christine M Schultze		

Calibration Data Summary

Measurement of Uncertainty (MU)	Maximum	As Found	As Left	Adjusted?
	0.0100	0.0028	0.0028	No

The above results relate only to the equipment calibrated.

End of Calibration Certificate


-18
r
)

intertek		Calibration Certificate Number	1210-MID-12-27-18
		Issue Date	12/27/18

Middleton Laboratory Local Calibration Data

Asset Number	1210	Asset Description	Dry Gas Meter
Calibration Date	12/27/2018	Peformed By	Ken Slater
Calibration Due	6/27/2019	Reviewed By	Brian Ziegler

Reference Equipment

Asset Description - Asset Number	Spirometer - 051	Calibration Due	NA
Asset Description - Asset Number	Hygrometer - 1420	Calibration Due	4/12/2019
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)	28.88	Ambient Temp (^{0}F)	63.4	Relative Humidity (%)	35

As Found Data

Run Number	Meter Initial	Barometric Pressure (in Hg)	Spirometer Temp (^{0}F)	Vapor Pressure of H2O (Hg)	Meter Temp (^{0}F)	Meter Pressure (in Hg)	Measurement (in)	Spirometer Volume	Meter Final	Y	
1	363.115	28.88	69.6	0.7220	69.2	4	22.375	1.0170	364.117	0.98889	
2	364.124	28.88	69.3	0.7145	69.3	4	22.75	1.0341	365.146	0.9868	
3	365.153	28.88	69.9	0.7295	69.1	4	22.625	1.0284	366.165	0.98905	
4	366.165	28.88	69.4	0.7170	69.0	4	22.5625	1.0256	367.174	0.99044	
5	367.176	28.88	69.3	0.7145	68.9	4	22.375	1.0170	368.178	0.98916	
								1.0244	Ave	0.98887	
								0.0074	Std Dev	0.00131	
									M of U	0.00284	Pass

As Left Data

Run Number	Meter Initial	Barometric Pressure (in Hg)	Spirometer Temp (^{0}F)	Vapor Pressure of H2O (Hg)	Meter Temp (^{0}F)	Meter Pressure (in Hg)	Measurement (in)	Spirometer Volume	Meter Final	Y	
1	363.115	28.88	69.6	0.7220	69.2	4	22.375	1.0170	364.117	0.98889	
2	364.124	28.88	69.3	0.7145	69.3	4	22.75	1.0341	365.146	0.9868	
3	365.153	28.88	69.9	0.7295	69.1	4	22.625	1.0284	366.165	0.98905	
4	366.165	28.88	69.4	0.7170	69.0	4	22.5625	1.0256	367.174	0.99044	
5	367.176	28.88	69.3	0.7145	68.9	4	22.375	1.0170	368.178	0.98916	
								1.0244	Ave	0.98887	
								0.0074	Std Dev	0.00131	
									M of U	0.00284	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	0.7220	0.7145	0.7295	0.7170	0.7145	0.7220	0.7145	0.7295	0.7170	0.7145
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
81	1.056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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

Certificate Number
A2919100
Issue Date: 08/08/18

Certificate of Calibration

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

P.O. Number: C/C

ID Number: 001413

Description:	MASS FLOW METER	Calibration Date:	08/08/2018
Manufacturer:	SIERRA	Calibration Due:	02/08/2019
Model Number:	M50L-AL-DD-2-PV2-V1-5PC	Procedure:	TB 9-6680-293-40 Rev: 4/28/2011
Serial Number:	189158	Temperature:	70 F
Technician:	JEFF BAHMANN	Humidity:	53 % RH
On-Site Calibration: ☐		**As Found Condition:**	**IN TOLERANCE**
Comments:		**Calibration Results:**	**IN TOLERANCE**

Limiting Attribute:

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

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

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

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

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
FL8426	DH INSTRUMENTS	1E4-VCR-V-Q	3/8/2018	3/8/2020

TMI Technical Maintenance, Inc.
12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637
Phone: 813-978-3054 Fax 813-978-3758
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-2080

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit	ADJ/FAIL
Flow Accuracy	0.000	-0.300	0.300	0.000	0.000	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	

TMI Technical Maintenance, Inc.
12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637
Phone: 813-978-3054 Fax: 813-978-3759
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-2080

Certificate Number
A3074094
Issue Date: 01/18/19

Certificate of Calibration

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

P.O. Number:

ID Number: 001414

Description:	MASS FLOW METER	Calibration Date:	01/18/2019
Manufacturer:	SIERRA	Calibration Due:	07/18/2019
Model Number:	M50L-AL-DD-2-PV2-V1-5PC	Procedure:	TB 9-6680-293-40 Rev: 2/20/2013
Serial Number:	189157	Temperature:	71 F
Technician:	SEAN LEWIS	Humidity:	39 % RH
		As Found Condition:	**IN TOLERANCE**
On-Site Calibration: ☐		**Calibration Results:**	**IN TOLERANCE**

Comments:

Limiting Attribute:

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

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

TMI's Quality System is accredited to ISO/IEC 17025:2017 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.

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

TMI Technical Maintenance, Inc.
12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637
Phone: 813-978-3054 Fax 813-978-3758
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED ANSI/NCSL Z540-1 ANSI/NCSL Z540-3
AC-2080

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Uncertainty	Unit ADJ/FAIL
Flow Accuracy	0.000	-0.300	0.300	0.000	0.000	± 0.83 mL/min	slm
Flow Accuracy	2.000	1.700	2.300	2.002	2.002	± 5.8 mL/min	slm
Flow Accuracy	4.000	3.700	4.300	3.988	3.988	± 12 mL/min	slm
Flow Accuracy	6.000	5.700	6.300	5.968	5.968	± 17 mL/min	slm
Flow Accuracy	8.000	7.700	8.300	7.939	7.939	± 23 mL/min	slm
Flow Accuracy	10.000	9.700	10.300	9.936	9.936	± 30 mL/min	slm

TMI Technical Maintenance, Inc.
12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637
Phone: 813-978-3054 Fax 813-978-3758
www.tmicalibration.com

ilac-MRA ANAB ACCREDITED AC-3080