

# SMG HEARTH AND HOME, LLC TEST REPORT

**SCOPE OF WORK**

EPA EMISSIONS TESTING FOR MODEL HP22

**REPORT NUMBER**

104780922MID-001R2

**TEST DATE(S)**

10/21/21

**ISSUE DATE**

10/26/21

**[REVISED DATE]**

9/28/22

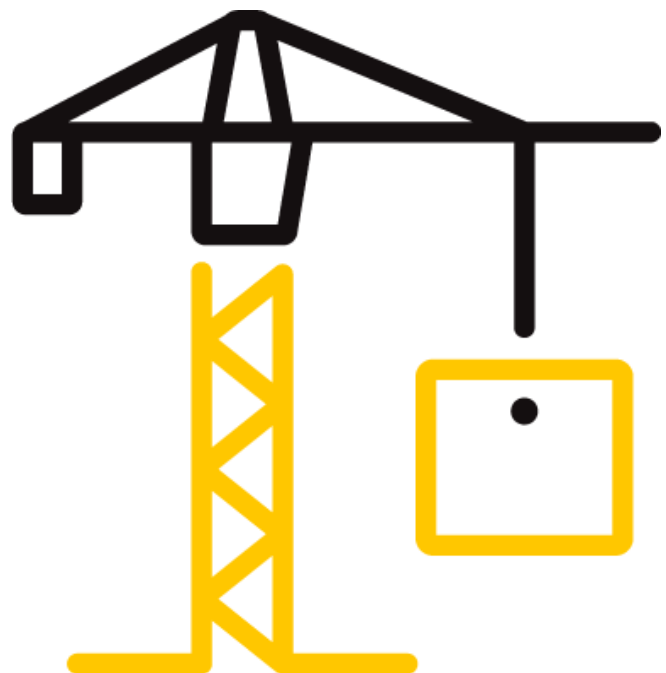
**PAGES**

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**DOCUMENT CONTROL NUMBER**

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

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## TEST REPORT FOR SMG HEARTH AND HOME, LLC

Report No.: 104780922MID-001R2

Date: 9/28/22

### REPORT ISSUED TO

#### SMG HEARTH AND HOME, LLC

9241 Globe Center Dr.

Suite 120

Morrisonville, NC 27560

### SECTION 1

#### SCOPE

Intertek Building & Construction (B&C) was contracted by SMG Hearth and Home, LLC, to perform testing in accordance with EPA 40 CFR Part 60 "Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces", ASTM E2515-17 - Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel, ASTM E2779-17 - Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters, CSA B415.1-2010 (R2020) - Performance Testing of Solid-Fuel-Burning Heating Appliances on their Model HP22, Pellet Fuel Room Heater. Results obtained are tested values and were secured by using the designated test method(s). Testing was conducted at Intertek test facility in Middleton, WI.

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

### SECTION 2

#### SUMMARY OF TEST RESULTS

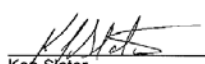
The appliance tests resulted in the following performance for test # 1:


Particulate Emissions: 1.01 g/hr

Carbon Monoxide Emissions: 0.00024 g/min

Heating Efficiency: 80.5 % (Higher Heating Value Basis)

For INTERTEK B&C:

**COMPLETED BY:** Ken Slater  
Associate Engineer –  
Hearth  
**TITLE:**  
**SIGNATURE:**   
**DATE:** 10/28/21  
aaa:bbb

**REVIEWED BY:** Brian Ziegler  
Technical Team Leader -  
Hearth  
**TITLE:**  
**SIGNATURE:**   
**DATE:** 10/28/21

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**SECTION 3****TEST METHOD(S)**

The specimen was evaluated in accordance with the following:

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

**ASTM E2515-2017** - Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel

**ASTM E2779-2017** - Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters

**CSA B415.1-2010 (R2020)** - Performance Testing of Solid-Fuel-Burning Heating Appliances

**SECTION 4****MATERIAL SOURCE**

A sample was submitted to Intertek directly from the client. The sample was not independently selected for testing. The test unit was received at Intertek in Middleton, WI on 10/14/21 and was shipped via the client. The unit was assigned sample ID # MID2110141337-001. 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 unit was operated for a minimum of 48 hours at high-to-medium burn rates to break in the stove. This break-in period was conducted by SMG Hearth and Home staff and a copy of the data is included in the final report. The unit was found to be operating satisfactory during this break-in. The 48 plus hours of pre-burning were conducted from 10/05/21 through 10/11/21. The fuel used for the break-in process was wood pellets.

Following the pre-burn break-in process the unit was allowed to cool and ash and residue was removed from the firebox. The unit's chimney system and laboratory dilution tunnels were cleaned using standard wire brush chimney cleaning equipment. On 10/21/21 the unit was set-up for testing.

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### SECTION 5

#### EQUIPMENT

Equipment	INV Number	Calibration Due	MU
Timer	1212	4/5/22	0.7 sec
Timer	646	4/5/22	0.7 sec
Pressure Transducer	1406	1/13/22	0.00007" H <sup>2</sup> O
Data Acquisition	986	4/12/22	0.06°F
Platform Scale	1134	4/6/22	.118 lbs
Hygrometer	1450	11/23/21	0.35 RH
Flow Meter	1413	2/20/22	0.020 slpm
Flow Meter	1414	2/20/22	0.020 slpm
Flow Meter	1519	2/20/22	0.020 slpm
Balance	713	4/11/22	0.00006g

### SECTION 6

#### LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Ken Slater	Intertek B&C
Justin Buck	Intertek B&C
Glenn Turley	SMG Hearth and Home
Patrick Flannagan	SMG Hearth and Home

### SECTION 7

#### TEST PROCEDURE

On 10/21/21 the unit was tested for EPA emissions. For pellet stoves, the test was conducted in accordance with ASTM E2779-17. The fuel used for the test run was premium-Grade Pellets (Marthwood).

The applicable EPA regulatory limits are:

Step 1 – 2015 – 4.5 grams per hour.

Step 2 – 2020 – 2.0 grams per hour.



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**TEST SET-UP DESCRIPTION**

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

**AIR SUPPLY SYSTEM**

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

**TEST FUEL PROPERTIES**

Wood pellets used for the testing were Marth premium grade hardwood pellets, with a majority of the wood species consisting of oak and maple. The pellets have PFI a measured heating value of 8160 Btu/hr (18967 kJ/kg) and a moisture content of 3.36% on a dry basis and 3.25% on a wet basis.

**SAMPLING LOCATIONS**

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

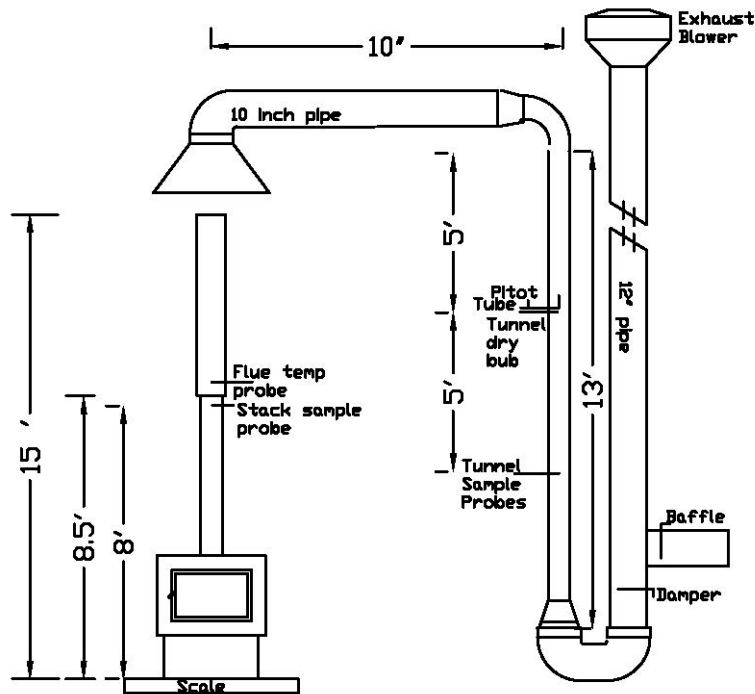
Stack gas samples are collected from the steel chimney section 8 feet ± 6 inches above the scale platform. (See Figure 2.)

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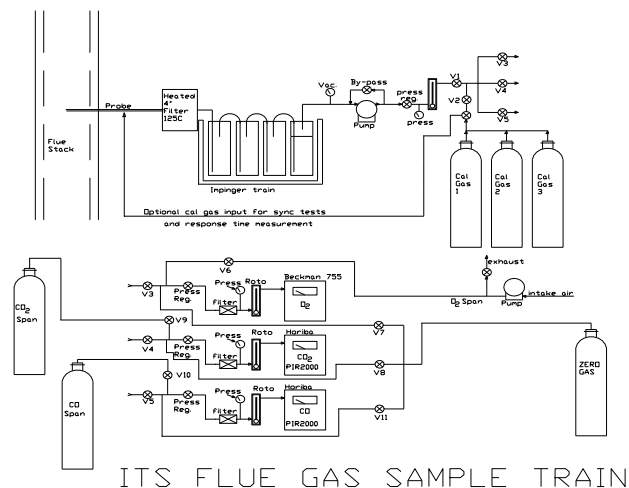
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**FIGURE 1 – DILUTION TUNNEL**



**FIGURE 1**

**FIGURE 2 – STACK GAS SAMPLE TRAIN**



**FIGURE 2**

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### FIGURE 3 – DILUTION TUNNEL SAMPLE SYSTEMS

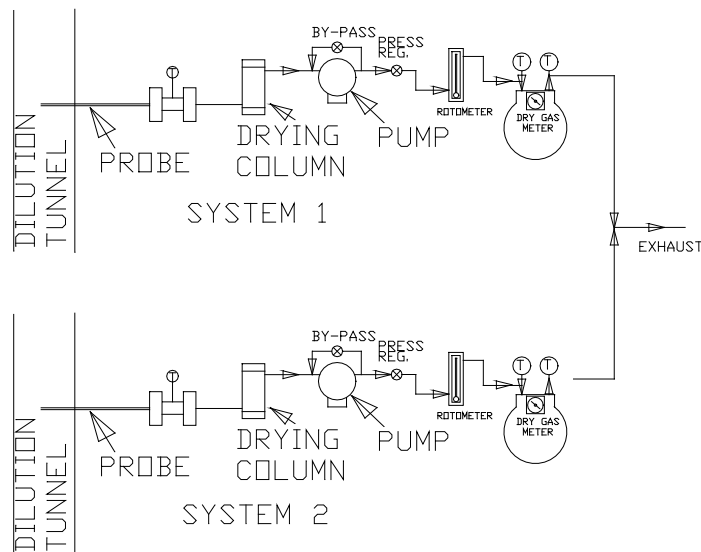


Figure 3

## SAMPLING METHODS

### PARTICULATE SAMPLING

Particulates were sampled in strict accordance with ASTM E2515. 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 a third filter set is prepared at one hour into the test run, the filter sets are changed in one of the two sample trains. The two filter sets used for this train are analyzed individually to determine the first hour and total emissions rate.

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**INSTRUMENT CALIBRATION****DRY GAS METERS**

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

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

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

**STACK SAMPLE ROTAMETER**

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

**GAS ANALYZERS**

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

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

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**TEST METHOD PROCEDURES****LEAK CHECK PROCEDURES**

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

**TUNNEL VELOCITY/FLOW MEASUREMENT**

The tunnel velocity is calculated from a center point Pitot tube signal multiplied by an adjustment factor. This factor is determined by a traverse of the tunnel as prescribed in ASTM E2515. Final tunnel velocities and flow rates are calculated from ASTM E2515, Equations 3 and 9. (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. The data and results are included in Appendix C.

**DEVIATIONS FROM STANDARD METHOD:**

None

**SECTION 8****TEST CALCULATIONS****WEIGHT OF TEST FUEL BURNED (DRY) – ASTM E2779**

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

where:

FM = average fuel moisture of test fuel, % dry basis,

$M_{Swb}$  = weight of test fuel in hopper at start of test run, wet basis, kg (lb),

$M_{Ewb}$  = weight of test fuel in hopper at end of test run, wet basis, kg (lb), and

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$M_{Bdb}$  = weight of test fuel burned during test run, dry basis, kg (lb).

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

$$M_{BSdb} = (M_{SSiwb} - M_{ESiwb}) (100 / (100 + FM))$$

where:

$M_{SSiwb}$  = weight of test fuel in hopper at start of test run segment  $i$ , wet basis, kg (lb),

$M_{ESiwb}$  = weight of test fuel in hopper at end of test run segment  $i$ , wet basis, kg (lb),

$M_{BSdb}$  = weight of test fuel burned during test run segment  $i$ , dry basis, kg (lb), and

$i$  = test run segments in accordance with 9.4, Table 1.

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

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

where:

$BR$  = average dry burn rate over the full integrated test run, kg/h (lb/h), and

$\theta$  = total length of full integrated test run, min.

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

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

where:

$BR_{Si}$  = average dry burn rate over test run segment  $i$ , kg/h (lb/h), and

$\theta_{Si}$  = total length of test run segment  $i$ , min.

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

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

where:

$E_T$  = total particulate emissions for full integrated test run measured using Test Method E2515, g (lb),

$\theta$  = total length of test run, min, and

$PM_R$  = average particulate emission rate over the full integrated test run, g/h.

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

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

where:

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

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

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$$PM_H = E_T/E_O$$

where:

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

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

### NOMENCLATURE FOR ASTM E2515:

$A$  = Cross-sectional area of tunnel  $m^2$  ( $ft^2$ ).

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

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

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

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

$E_T$  = Total particulate emissions, g.

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

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

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

or

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

$L_a$  = Maximum acceptable leakage rate for either a pretest or post-test leak-check, equal to 0.0003  $m^3/min$  (0.010  $cfm$ ) or 4 % of the average sampling rate, whichever is less.

$L_p$  = Leakage rate observed during the post-test leak-check,  $m^3/min$  ( $cfm$ ).

$m_p$  = 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.

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

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dscm/min (dscf/min).

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

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

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

where:

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

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

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

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

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

where:

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

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

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

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

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

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

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

where:

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

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

where:

$V_{mc}$  =  $V_m - (L_p - L_a)u$

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

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

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

Where:

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

$V_s$  = Average gas velocity in the dilution tunnel.

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

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



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

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

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

$Y$  = Dry gas meter calibration factor.

$\Delta H$  = 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).

$\Delta P_{avg}$  = Average velocity pressure in the dilution tunnel, mm water (in. water).

$\Delta P_i$  = 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).

$\theta$  = Total sampling time, min.

10 = ten min, length of first sampling period.

13.6 = Specific gravity of mercury.

100 = Conversion to percent.

### TOTAL PARTICULATE WEIGHT – ASTM E2515

$$M_n = m_p + m_f + m_g$$

### PARTICULATE CONCENTRATION – ASTM E2515

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

where:

$K_2$  = 0.001 g/mg

### TOTAL PARTICULATE EMISSIONS (g) – ASTM E2515

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

### PROPORTIONAL RATE VARIATION (%) – ASTM E2515

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

### MEASUREMENT OF UNCERTAINTY – ASTM E2515

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

### GENERAL FORMULA – ASTM E2515

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

Where:

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

 $u_i$  = is the uncertainty associated with that measurement.

### TOTAL PARTICULATE EMISSIONS – ASTM E2515

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

where:

 $c_s$  = sample filter catch/(sample flow rate x test duration), g/dscf,

 $c_r$  = room background filter catch/(sample flow x sampling time), g/dscf,

 $Q_{std}$  = average dilution tunnel flow rate, dscf/min, and

 $\theta$  = sampling time, minutes.

#### MU OF $c_s$

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

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

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

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

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

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

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

#### MU OF $c_r$

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

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

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

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

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

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

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

#### $E_T$ AND $MU_{ET}$

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

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

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

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

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

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

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

Thus the result in this example would be:

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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:

$\Delta h$  = change in enthalpy, kJ/kg

$\Delta t$  = temperature rise, °C

1.006 = specific heat of air, kJ/kg °C

1.84 = specific heat of water vapor, kJ/kg °C

x = humidity ratio, kg/kg

The equivalent duct diameter shall be calculated as follows:

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

Where:

ED = equivalent duct diameter

H = duct height, m

W = duct width, m

The air flow velocity shall be calculated as follows:

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

where

V = velocity, m/s

$F_p$  = Pitot tube calibration factor determined from vane anemometer measurements

$C_p$  = Pitot factor

= 0.99 for a standard Pitot tube or as determined by calibration for a Type S Pitot tube

34.97 = Pitot tube constant

**Note:** The Pitot tube constant is determined on the basis of the following units:

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

$\Delta P$  = velocity pressure, mm H<sub>2</sub>O

T = temperature, K

28.56 = molecular weight of air

$P_{\text{Baro}}$  = barometric pressure, mm Hg

$P_s$  = duct static pressure, mm Hg

The mass flow rate shall be calculated as follows:

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$$m = 3600VAp$$

where:

m = mass flow rate, kg/h

V = air flow velocity, m/s

3600 = number of seconds per hour

A = duct cross-sectional area, m<sup>2</sup>

p = density of air at standard temperature and pressure (use 1.204 kg/m<sup>3</sup>)

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:

$\Delta e$  = rate of heat release into the circulating air, kJ/h

$\Delta h$  = change in enthalpy of the circulating air, kJ/kg

m = mass air flow rate, kg/h

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

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

Where:

$E_t$  = delivered heat output over any time interval  $t_2 - t_1$ , kJ

i = time interval for each measurement, h

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

$$e_t = E_t / t$$

where

$e_t$  = average heat output, kJ/h

t = time interval over which the average output is desired, h

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

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

Where:

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

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

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

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

Where:

 $E_d$  = total heat output of the appliance over the test period, kJ/kg $I$  = input energy (fuel calorific value as-fired times weight of fuel charge), kJ/kg (Btu/lb)**SECTION 9****TEST SPECIMEN DESCRIPTION**

The model HP22 Pellet Fuel Room Heater is constructed of sheet steel. The outer dimensions are 28.5-inches deep, 33-inches high, and 23.5-inches wide. The unit has a door located on the front with a viewing glass.

**SECTION 10****TEST RESULTS****DESCRIPTION OF TEST RUNS:**

RUN #1 (10/21/21): The test for pellet heaters is a continuous test with three separate burn rates. At 8:05 am the unit was started and operated for a minimum of 1 hour for the pretest operation. At 9:06 am the unit was set to the maximum feed rate (level 5) with a burn rate of 2.95 kg/hr (wet), the scale was tared and a 25-lb weight was added to the scale to determine feed rate of the fuel, and the sampling system was started. At 10:06 am, the system #3 sampling filter was turned off and the unit was set to ≤50% feed rate (level 2) with a burn rate of 1.16 kg/hr (wet). At 12:06 pm, the heater was changed to the minimum feed rate (level 1) with a burn rate of 0.92 kg/hr (wet). At 3:06 pm, testing was completed. The total burn time was 360 minutes.

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

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**TABLE 1 – EMISSIONS**

RUN#	TEST DATE	BURN RATES (kg/hr)(Dry)		PARTICULATE EMISSION RATE (g/hr)	1 <sup>st</sup> HOUR EMISSIONS (g)	CO EMISSIONS (g/min)	HEATING EFFICIENCY (%HHV)
1	10/21/21	H*	2.86	1.01	1.54	0.00024	80.5
		M*	0.96				
		L*	0.69				
		OA*	1.30				

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

**TABLE 2 – TEST FACILITY CONDITIONS**

RUN #	ROOM TEMP BEFORE (°F)	ROOM TEMP AFTER (°F)	BARO PRES BEFORE (in/Hg)	BARO PRES AFTER (in/Hg)	R. H. BEFORE (%)	R. H. AFTER (%)	AIR VEL BEFORE (ft/min)	AIR VEL AFTER (ft/min)
1	74	72	28.84	29	45.1	29.2	0	0

**TABLE 3 – DILUTION TUNNEL FLOW RATE MEASUREMENTS AND SAMPLING DATA**

RUN #	BURN TIME (min)	VELOCITY (ft/sec)	VOLUMETRIC FLOW RATE (dscf/min)	AVG TEMP (°R)	SAMPLE VOLUME (dscf)		PARTICULATE CATCH (mg)	
					1	2	1	2
1	360	21.78	233.23	549.82	48.79	48.23	3.40	3.60

**TABLE 4 – DILUTION TUNNEL DUAL TRAIN PRECISION**

RUN #	SAMPLE RATIOS		TOTAL EMISSIONS (g)		DEVIATION (%)	DEVIATION (g/kg)
	TRAIN 1	TRAIN 2	TRAIN 1	TRAIN 2		
1	1720.78	1740.97	5.85	6.27	3.44%	0.052

**TABLE 5 – GENERAL SUMMARY OF RESULTS**

RUN #	BURN RATE (kg/hr)(dry) (OVERALL)	INITIAL DRAFT (in/H <sub>2</sub> O)	RUN TIME (min)	AVERAGE DRAFT (in/H <sub>2</sub> O)
1	1.34	0.030	360	0.024

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**TABLE 6 - CSA B415.1 RESULTS**

**RUN#1**

<b>BURN RATE (kg/hr)(dry)</b>	<b>CO EMISSIONS (g/min)</b>	<b>HEATING EFFICIENCY (% HHV)</b>	<b>HEAT OUTPUT (Btu/hr)</b>
HIGH – 2.86	0.00081	79.1	40,689
MEDIUM – 1.12	0.00012	80.6	16,274
LOW – 0.89	0.00015	79.8	12,820
OVERALL – 1.30	0.00024	80.5	18,780

### SECTION 11

#### CONCLUSION

This test demonstrates that the model HP22 is an affected facility under the definition given in the regulation. The emission rate of 1.01 g/hr meets the EPA requirements for the Step 2 limits.

Model HP22 was tested as a representative model for similar models HP22i, which is a fireplace insert version of HP22, and HP22N, which includes an extended hopper for additional pellet capacity. All models use the same internal components and firebox. The models HP22i and HP22N incorporate only external cosmetic differences.



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### SECTION 11

#### PHOTOGRAPHS

Photo # 1 Emissions test 1





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**Photo No. 2**  
**EPA Security Tape # 1**



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**Photo No. 3**  
**EPA Security Tape # 2**



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**SECTION 12****REVISION LOG**

REVISION #	DATE	PAGES	REVISION
0	10/26/21	N/A	Original Report Issue
		5	Corrected heating value for the pellets.
1	10/28/21	19	Changed heat output in Table 6 from kJ/hr to Btu/hr.
2	9/28/22	2, 18, 19	Updated CO emissions g/min results to two significant figures.

# CERTIFICATE OF CONFORMITY

## Emissions – Pellet Heater

EPA 40 CFR Part 60, Subpart AAA, ASTM E2515-2017, ASTM E2779-2017, CSA B415.1-2010

WHI15 – 25702303

### Organization

**SMG Hearth & Home, LLC**  
9241 Globe Center Drive, Suite 120  
Morrisville, NC 27560  
USA

### Product: HP22, HP22i, HP22N

**Catalytic:** No

**Maximum Output:** 40,689 Btu/hr

**Weighted Average Emissions:** 1.01 g/hr

**Weighted Average Annual Delivered Efficiency (HHV):** 80.5%

**Test Fuel Type:** Premium wood pellets

**Weighted Average CO Emissions Rate (g/min):** 0.00024

**Conformance:** Complies with 2020 particulate emissions standard

**Test Report No.:** 104780922MID-001R2

**Certification Body:** Intertek Testing Services NA, Inc.

**Registered Address:** 545 E. Algonquin Rd., Arlington Heights, IL 60005, USA


**Initial Issue Date:** 22-Dec-16

**Date of Expiry:** 06-May-27

**Issue Status:** 7

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

Jean-Philippe Kayl  
Vice President – Global  
Certification



29-Sep-22

Name

Signature

Date

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

Version: 11 November 2021 SFT-BCH-OP-19c



# Certificate of Conformity WHI15-25702303

## Appendix A

Certificate of Conformity #:		Certificate of Conformity Issue Date:	
WHI15-25702303		December 22, 2016	
REVISION #	REVISION DATE	REPORT PAGES	REVISION
0	December 22, 2016	N/A	Original Report Issue
1	September 25, 2018	N/A	Added model HP22i
2	July 31, 2019	N/A	Added model HP22N
3	May 28, 2020	N/A	Additional emissions test with higher input
4	December 29, 2021	N/A	New CoC format for retesting of unit
5	May 6, 2022	N/A	Updated CBI and Non-CBI report.
6	September 28, 2022	N/A	Updated CO emissions to two significant figures

Revised Report #:		Report Issue Date:	
102542233MID-003		December 19, 2016	
REVISION #	REVISION DATE	REPORT PAGES	REVISION
0	December 19, 2016	N/A	Original Report Issue
1	July 16, 2018	All	Added data to new branding format and added similar model HP22i insert.
2	June 27, 2019	1, 19	Added similar model HP22N.
3	February 7, 2020	2, 17, 18	Corrected CO emissions from g/hr to g/min.

Revised Report #:		Report Issue Date:	
104271806MID-002		April 14, 2020	
REVISION #	REVISION DATE	REPORT PAGES	REVISION
0	April 14, 2020	N/A	Original Report Issue – Replaces report 102542233MID-003 in its entirety with all new testing.
1	September 16, 2020	1, 19	Added revision date to report, added similar models and model descriptions to conclusion

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

Version: 11 November 2021 SFT-BCH-OP-19c

# Certificate of Conformity WHI15-25702303

## Appendix A

Revised Report #:		Report Issue Date:	
104780922MID-001		October 26, 2021	
REVISION #	REVISION DATE	REPORT PAGES	REVISION
0	October 26, 2021	N/A	Original Report Issue – Replaces report 102542233MID-003 in its entirety with all new testing.
1	October 28, 2021	5, 19	Corrected heating value for the pellets. Changed heat output in Table 6 from kJ/hr to Btu/hr.
2	May 6, 2022	Appendix D	Added revised instruction manual with replacement part information to Appendix D.
3	September 28, 2022	2, 18, 19	Updated CO emissions g/min results to two significant figures.

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

Version: 11 November 2021 SFT-BCH-OP-19c

**LIMITED**  
**CERTIFICATE OF CALIBRATION**

Certificate Number: 43897

**CALIBRATION LABORATORY**

INTERTEK B&C  
130 DERRY COURT  
YORK, PA 17406

**OWNER**

INTERTEK - 625  
8431 MURPHY DRIVE  
MIDDLETON, WI 53562

**EQUIPMENT INFORMATION**

Asset Number: 001450  
Serial Number: 16962472  
Manufacturer: COMET  
Model Number: T7510  
Description: TEMPERATURE AND HUMIDITY SENSOR  
Size/Range: -30 to 80°C, 0 to 100% RH  
Resolution: 2

**CALIBRATION INFORMATION**

Procedure: 31-33 RH - TEMP  
Temp./RH: 76.1 °F / 36.8 %  
Cal Date: 11/23/20  
Due Date: 11/23/21  
Initial Calibration Result:  
Calibration Result: PASS  
Performed By: ED SULLIVAN

**CALIBRATION NOTES**

No Visual Defects.

Uncertainties 15% RH: 1.65, 50% RH: 0.35, 80% RH: 1.16, 59 F: 0.22, 73.4 F: 0.21



Architectural Testing, Inc., an Intertek company ("Intertek B&C"), certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST). Intertek B&C's Calibration Laboratory is accredited by the International Accreditation Service, Inc. (IAS) to ISO/IEC 17025:2005 (Certificate CL-118). The measurement uncertainties for this calibration are based upon 95% (k=2) confidence limits. This report may not be reproduced, except in full, without the written approval of Intertek B&C.

Servicing Technician:

A handwritten signature in black ink that reads "Edwin W. Sullivan".

ED SULLIVAN  
METROLOGY TECHNICIAN  
Intertek B&C

Approved By:

A handwritten signature in black ink that appears to read "Matt Rosario".

MATT ROSARIO  
CALIBRATIONS MANAGER  
Intertek B&C

This certificate is complete only when all data pages are included.

# CERTIFICATE OF CALIBRATION

Certificate Number: 43897

## TEST POINTS


Seq.	Description	Standard	Tolerance -	Tolerance +	As Found	As Left	Units	Uncertainty
1	59.0 Degr F	59.0	58.0	60.0	59.1	59.1	Degr F	0
2	59.0 Degr F	59.0	58.0	60.0	59.0	59.0	Degr F	0
3	59.0 Degr F	59.0	58.0	60.0	58.8	58.8	Degr F	0
4	15% RH (15 C)	15.0	12.5	17.5	16.0	16.0	%	0
5	15% RH (15 C)	15.0	12.5	17.5	16.0	16.0	%	0
6	15% RH (15 C)	15.0	12.5	17.5	15.8	15.8	%	0
7	50% RH (15 C)	50.0	47.5	52.5	49.7	49.7	%	0
8	50% RH (15 C)	50.0	47.5	52.5	49.7	49.7	%	0
9	50% RH (15 C)	50.0	47.5	52.5	49.5	49.5	%	0
10	80% RH (15 C)	80.0	77.5	82.5	78.4	78.4	%	0
11	80% RH (15 C)	80.0	77.5	82.5	78.5	78.5	%	0
12	80% RH (15 C)	80.0	77.5	82.5	78.5	78.5	%	0
13	73.4 Degr F	73.4	72.4	74.4	73.9	73.9	Degr F	0
14	73.4 Degr F	73.4	72.4	74.4	73.7	73.7	Degr F	0
15	73.4 Degr F	73.4	72.4	74.4	73.7	73.7	Degr F	0
16	15% RH (23 C)	15.0	12.5	17.5	17.3	17.3	%	0
17	15% RH (23 C)	15.0	12.5	17.5	17.0	17.0	%	0
18	15% RH (23 C)	15.0	12.5	17.5	16.9	16.9	%	0
19	50% RH (23 C)	50.0	47.5	52.5	49.6	49.6	%	0
20	50% RH (23 C)	50.0	47.5	52.5	49.6	49.6	%	0
21	50% RH (23 C)	50.0	47.5	52.5	49.8	49.8	%	0
22	80% RH (23 C)	80.0	77.5	82.5	78.2	78.2	%	0
23	80% RH (23 C)	80.0	77.5	82.5	78.2	78.2	%	0
24	80% RH (23 C)	80.0	77.5	82.5	78.3	78.3	%	0

## STANDARDS USED TO CALIBRATE EQUIPMENT

Company	I.D.	Description	Last Cal.	Cal. Due Date
INTERTEK - 118	005581	HUMIDITY & TEMPERATURE GENERATOR	7/10/2020	7/10/2021
INTERTEK - 118	INT01927	TEMPERATURE AND HUMIDITY SENSOR	5/22/2020	5/22/2021

END OF DATA



 Total Quality. Assured.	<b>CLIENT:</b> SMG Hearth & Home		<b>PERFORMED BY:</b> Ken Slater		
	<b>PROJECT #:</b> G104780922		<b>REVIEWED BY:</b>		
	<b>PRODUCT:</b> Pellet Fueled room heater		<b>MODEL:</b> HP22		
<b>SAMPLE ID #:</b> MID2110141337-001		<b>DATE:</b> 10/21/2021			
<b>STANDARD:</b> ASTM E2779		<b>VERSION YEAR:</b> 2017	<b>LOCATION:</b> Middleton		
<b>STANDARD TITLE:</b> Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters					
<b>RESULTS</b>					
<b>PASS</b>	X	<b>FAIL</b>	na	<b>NO PASS/FAIL</b>	na

Emissions Testing Initial Stove Check Out

Date Received	10/14/2021	Shipping Carrier	Fed Ex
---------------	------------	------------------	--------

Shipping Damage?	No	Yes	Describe Damage	NA	
	X	na			
			Is Damage Repairable?	Yes	No
				na	na

Repairs Affected by	na	Date	na
Client Notified about Irreparable Damage?	na	Date	na

Overall Unit Dimensions (in)			Unit Weight	
Height	Width	Depth	(lbs)	(Kg)
33	23.5	28.5	279	126.55

Unit Description (check appropriate box)					
Stove	na	Top Vent	na	Manual Draft	na
Insert	na	Rear Vent	X	Bimetal Spring	na
Catalytic	na	Grate	na	Remote T-Stat	X
Non-Catalytic	na	Ashpan	na	Blower	X
Other	Pellet Stove				

48-hr Conditioning Burn Dates	see client folder
-------------------------------	-------------------

Pre/Post Checks

Facility Conditions	Pre-Test	Post-Test
Air Velocity (fpm)	0	0
Smoke Capture Check	X	X
Heater Conditions		
Date Stack Cleaned	10/13/2021	na
Date Dilution Tunnel Cleaned	10/13/2021	na
Induced Draft Check	X	X
Tunnel Velocity	0.105	0.111
Pitot Leak Check		
Side A	X	X
Side B	X	X

Temperature System			
Ambient (between 65°F -90°F)		74	72
Proportional Checks			
CO Analyzer Drift Check		x	x
CO2 Analyzer Drift Check		x	x
O2 Analyzer Drift Check		x	x
Thermocouple Check		x	x
Sampling Train ID Numbers	Train 1	Train 2	Train 3
Probe	10	A	B
Filter - Front	31	33	35
Filter - Back	32	34	36
Filter <90°F	X	X	X

Pre-Test Scale Audit			
Scale Type	Audit Weight	Class	Measured Weight
Analytical (mg)	100.0000	S	100.0000
Platform (lbs)	10.00	F	10.00
Wood (lbs)	25.0	F	25.0

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%

Sampling Equipment Check out
------------------------------

Leakage Checks Tunnel Samplers						
Sample	1		2		3	
Test	Pre	Post	Pre	Post	Pre	Post
Vacuum (in Hg)	10	10	10	10	10	10
Final 1 min DGM (ft <sup>3</sup> )	0	0	0	0	0	0
Initial 1 min DGM (ft <sup>3</sup> )	0	0	0	0	0	0
Change (C) (ft <sup>3</sup> )	0	0	0	0	0	0
Allowable leakage (cfm)	0.04	0.04	0.04	0.04	0.04	0.04
Check Okay	X	X	X	X	X	X

Leakage Checks Flue Gas Sampler		
Plugged Probe	Pre Test	Post Test
Vacuum (in Hg)	10	10
Rotameter Reading	0	0
Flow Rate (cfm)	0	0
Allowable (cfm)	0.04	0.04
Check Okay	X	X

Unplugged Flow Rate = .25cfm
Allowable Leakage = .04 x Sample Rate or .02 cfm

## Continuous Analyzers

### Pre-Test (Adjust and Record)

Type	Zero		Span		Cal. (Record Only)	
	Actual	Should Be	Actual	Should Be	Actual	Should Be
CO <sub>2</sub>	0	0	24.91	24.92	12.06	11.99
CO	0	0	7.56	7.748	4	4.00
O <sub>2</sub>	0	0	20.81	20.89	9.77	10.01

85.809 74.22036

79.02147675

### Post Test (Record Only)

Type	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO <sub>2</sub>	0	24.81	12.01	0	0.1	0.05	X	na
CO	0	7.5	3.73	0	0.06	0.27	X	na
O <sub>2</sub>	0	20.81	9.74	0	0	0.03	X	na

## Test Data Log

### Raw Dry Gas Meter Readings

System	1	2	3
Final (ft <sup>3</sup> )	51.148	51.160	8.52
Initial (ft <sup>3</sup> )	0	0	0

Ambient Conditions	Start	End
Barometer (in Hg)	28.84	29
Dry Bulb (°F)	71.7	75.2
Humidity (%)	45.1	39.2

### Comments

Unit levels, (5)High, (2)Medium, and (1)Low.


8:05am-Pretest started,

9:06am- Test started - setting 5

10:06am changed to medium burn setting -2

12:06pm changed to low burning setting -1

3:06pm end of test

 Total Quality. Assured.	<b>CLIENT:</b> SMG Hearth & Home		<b>PERFORMED BY:</b> Ken Slater		
	<b>PROJECT #:</b> G104780922		<b>REVIEWED BY:</b> 0		
	<b>PRODUCT:</b> Pellet Fueled room heater		<b>MODEL:</b> HP22		
<b>SAMPLE ID #:</b> MID2110141337-001		<b>DATE:</b> 10/21/2021			
<b>STANDARD(S):</b> ASTM E2779	<b>VERSION YEAR:</b> 2017		<b>LOCATION:</b> Middleton		
<b>STANDARD TITLE:</b> Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters					
<b>RESULTS</b>					
PASS	X	FAIL	na	NO PASS/FAIL	na

Room Conditions							
Room Temp (°F)		Barometric Pressure (in Hg)		Relative Humidity (%)		Air Velocity (ft/sec)	
74	72	28.84	29	45.1	29.2	0	0

Ave Dilution Tunnel Measurements				Sample Data			
Burn Time (min)	Velocity (ft/sec)	Flow Rate (dscf/min)	Temp (R) (°F)	Total Sample		Particulate Catch	
				1	2	1	2
360	21.78	233.23	549.82	48.79	48.23	3.40	3.60

Dilution Tunnel Dual Train Precision					
Sample Ratios		Total Emissions (g)		Deviation	
Train 1	Train 2	Train 1	Train 2	(%)	(g/kg)
1720.78	1740.97	5.85	6.27	3.44%	0.052

Results			
Burn Rate (kg/hr)	Initial Draft (in/wc)	Run Time (min)	Ave Draft (in/wc)
1.34	0.030	360	0.024

Emissions	
(g/hr)	(g/kg)
1.010	0.754

Burn Rates (kg/hr)		
High	Medium	Low
2.95	1.16	0.92

Fuel Consumed (lbs)		
High	Medium	Low
6.51	5.11	6.10

Fuel Moisture (% wet)
3.3%





 Total Quality. Assured.	<b>CLIENT:</b>	SMG Hearth & Home	<b>PERFORMED BY:</b>	Ken Slater
	<b>PROJECT #:</b>	G104780922	<b>REVIEWED BY:</b>	0
	<b>PRODUCT:</b>	Pellet Fueled room heater	<b>MODEL:</b>	HP22
<b>SAMPLE ID #:</b>	MID2110141337-001			<b>DATE:</b> 10/21/2021
<b>STANDARD(S):</b>	ASTM E2779	<b>VERSION YEAR:</b>	2017	<b>LOCATION:</b> Middleton

Table of Test Equipment Used				
Description	Asset #	Calibration Due	MU	Used in Test(s)
Timer	1212	4/5/2022	0.7 sec	ASTM E2779
Timer	646	4/5/2022	0.7 sec	ASTM E2779
Pressure Transducer	1406	1/13/2022	0.00007 in H2O	ASTM E2779
Data Acquisition	986	10/16/2021	0.06 Degrees F	ASTM E2779
Scale	1134	4/1/2022	.118 lbs	ASTM E2779
Hygrometer	1450	11/23/2021	0.35 RH	ASTM E2779
Flow Meter	1413	2/20/2022	0.020 lpm	ASTM E2779
Flow Meter	1414	2/20/2022	0.020 lpm	ASTM E2779
Flow Meter	1519	2/20/2022	0.020 lpm	ASTM E2779
Balance	713	10/11/2021	0.00044 g	ASTM E2779
Anamometer	1457	5/14/2022	4 fpm	ASTM E2779

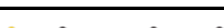
 <small>Total Quality Assurance</small>	CLIENT: SMG Hearth & Home		PERFORMED BY: Ken Slater	
	PROJECT #: G104780922		REVIEWED BY: 0	
	PRODUCT: Pellet Fueled room heater		MODEL: HP22	
	SAMPLE ID #: MID2110141337-001		DATE: 10/21/2021	
STANDARD(S): ASTM E2779		VERSION YEAR: 2017		LOCATION: Middleton

Pre-Burn Data																										
Time	Flue	Room	Tunnel	Meter #3	DGM 3	DGM 1	DGM 1	Filter 1	DGM 2	DGM 2	Filter 2	DGM 3	Filter 3	Meter #1	Meter #2	Draft	Tunnel	CO	CO2	O2	Scale	304.2521	Meter #1	Meter #2	Draft	Calculated
10.0	Temp 1	Temp 2	Dry Bulb 3	11	Out 12	In 13	Out 14	15	In 16	Out 17	18	In 19	20	21	22	23	24	%	%	%	lbs	Corrected	Cu Ft	Cu Ft		Tunnel
0.0	237.78	72.11	88.10	0.02	74.38	73.59	74.94	73.93	73.75	73.92	73.34	73.27	75.02	0.02	0.02	0.00	1.44	3.99	11.78	11.71	309.23	4.98	0.00	0.00	-0.24981	0.1090018
10.0	301.35	72.69	96.13	0.02	74.45	73.51	74.73	74.62	73.66	74.20	73.85	73.20	75.18	0.02	0.02	0.00	1.44	0.01	2.91	16.70	311.34	7.09	0.00	0.00	-0.24984	0.1098766
20.0	307.88	73.09	99.29	0.02	74.49	73.31	74.83	74.28	73.70	74.13	73.89	73.33	75.04	0.02	0.02	0.00	1.42	0.01	7.20	13.19	307.25	2.99	0.00	0.00	-0.24984	0.1055332
30.0	313.57	73.58	100.95	0.02	74.66	73.84	75.24	74.18	73.90	74.12	73.55	73.46	74.87	0.02	0.02	0.00	1.44	0.01	7.39	12.76	306.25	2.00	0.00	0.00	-0.24984	0.1093402
40.0	314.52	73.85	101.47	0.02	74.67	73.78	75.07	74.31	74.09	74.21	73.78	73.44	74.55	0.02	0.02	0.00	1.39	0.00	8.11	12.45	305.25	1.00	0.00	0.00	-0.24984	0.097968
50.0	315.01	74.16	102.63	0.02	74.73	73.96	75.18	74.47	74.33	74.41	74.22	73.34	74.87	0.02	0.02	0.00	1.42	0.00	8.19	12.30	304.25	0.00	0.00	0.00	-0.24984	0.1048992
60.0	321.18	74.06	102.74	0.02	75.07	73.97	75.04	74.40	74.35	74.37	73.97	73.21	74.30	0.02	0.02	0.00	1.42	0.00	8.17	12.08	312.05	7.80	0.00	0.00	-0.24984	0.1038629

<div>Intertek</div> <div><small>trial quality report</small></div>	CLIENT: SMG Hearth & Home			PERFORMED BY: Ken Slater		
	PROJECT #: G104780922			REVIEWED BY: 0		
	PRODUCT: Pellet Fueled room heater			MODEL: HP22		
	SAMPLE ID #: MID2110141337-001			DATE: 10/21/2021		
STANDARD(S): ASTM E2779		VERSION YEAR: 2017		LOCATION: Middleton		

Raw Data																																				
Time	Flue	Room	Tunnel	Meter #3	DGM 3	DGM 1	DGM 1	Filter 1	DGM 2	DGM 2	Filter 2	DGM 3	Filter 3	Meter #1	Meter #2	Draft	Tunnel	CO %	CO2 %	O2 %	Scale lbs	7.2983 Corrected	Meter #1	Meter #2	Meter #3	Draft	Calculated Tunnel	18.52	13.40	7.30	0.00					
10.0	Temp 1	Temp 2	Dry Bulb 3	11	Out 12	In 13	Out 14	15	In 16	Out 17	18	In 19	20	21	22	23	24	25	25	27	28	Scale	Cu Ft	Cu Ft	Cu Ft	Draft										
0.0	321.45	73.89	103.01	0.02	75.07	74.64	75.43	74.68	74.29	74.89	74.69	74.13	74.75	0.02	0.02	0.00	1.42	0.00	8.34	12.27	25.03	17.73	0.00	0.00	0.00	-0.25	0.105	6.51	NA							
10.0	326.41	74.08	103.65	4.03	76.63	75.85	78.01	78.02	75.31	77.10	79.70	75.75	79.02	4.03	4.02	0.00	1.41	0.00	8.66	11.79	23.93	16.63	1.42	1.42	1.42	-0.25	0.1024	5.41	NA							
20.0	321.60	74.00	103.96	4.01	76.86	75.93	78.50	79.19	75.71	77.66	80.76	75.94	79.99	4.01	4.03	0.00	1.43	0.00	8.79	12.02	22.82	15.52	1.42	1.42	1.42	-0.25	0.1063	4.30	NA							
30.0	321.68	74.43	103.74	4.04	77.28	76.45	79.06	80.25	76.09	77.77	81.64	76.23	80.99	4.04	4.04	0.00	1.42	0.00	8.40	12.07	21.84	14.54	1.42	1.43	1.43	-0.25	0.1047	3.32	NA							
40.0	324.83	73.64	104.50	4.03	77.25	76.32	79.01	80.92	75.96	78.04	82.17	76.36	81.75	4.02	4.01	0.00	1.40	0.00	8.36	11.79	20.73	13.43	1.42	1.42	1.42	-0.25	0.0999	2.21	NA							
50.0	320.80	73.86	104.99	4.02	77.53	76.73	79.33	81.72	76.30	78.21	82.78	76.75	82.30	4.01	4.02	0.00	1.50	0.00	8.76	11.65	19.62	12.33	1.42	1.42	1.42	-0.25	0.1252	1.11	NA							
60.0	323.85	73.51	105.34	4.01	77.87	76.74	79.37	82.14	76.48	78.44	83.19	76.89	82.96	4.03	4.03	0.00	1.39	0.00	8.35	11.39	18.52	11.22	1.42	1.42	1.42	-0.25	0.0984	0.00	5.11	NA						
70.0	235.48	73.24	94.80	0.02	76.79	76.85	79.89	81.74	76.54	78.57	82.29	76.81	79.73	4.02	4.02	0.00	1.47	0.00	6.85	15.18	18.01	10.71	1.42	1.42		-0.25	0.1173	4.61	NA							
80.0	223.13	72.87	92.40	0.02	76.33	76.74	79.62	81.29	76.35	78.71	81.35	76.27	78.86	4.02	4.01	0.00	1.39	0.00	5.85	15.37	17.51	10.21	1.42	1.42		-0.25	0.0965	4.11	NA							
90.0	215.81	72.74	90.74	0.02	76.27	76.73	79.57	80.95	76.42	78.58	81.11	76.41	78.54	4.01	4.00	0.00	1.43	0.00	4.79	15.54	17.00	9.71	1.42	1.41		-0.25	0.1073	3.60	NA							
100.0	209.00	72.80	89.92	0.02	76.48	76.71	79.44	80.82	76.04	78.57	80.53	76.55	78.06	4.03	4.02	0.00	1.43	0.00	4.53	16.26	16.61	9.31	1.42	1.42		-0.25	0.1065	3.21	NA							
110.0	207.12	72.50	88.99	0.02	76.40	76.70	79.65	80.47	76.21	78.75	80.28	76.54	77.54	4.03	4.02	0.00	1.42	0.00	4.08	16.82	16.11	8.81	1.42	1.42		-0.25	0.104	2.71	NA							
120.0	202.91	72.30	88.06	0.02	76.49	76.93	79.76	80.15	76.35	78.91	80.33	76.63	77.49	4.03	4.02	0.00	1.42	0.00	4.27	16.40	15.71	8.41	1.42	1.42		-0.25	0.1048	2.31	NA							
130.0	201.83	72.04	87.78	0.02	76.59	76.66	79.78	79.99	76.29	78.70	79.73	76.24	77.08	4.03	4.02	0.00	1.42	0.00	4.37	16.50	15.32	8.03	1.42	1.42		-0.25	0.1055	1.92	NA							
140.0	194.70	72.36	87.12	0.02	76.44	76.88	79.79	80.02	76.36	78.67	79.49	76.27	76.96	4.03	4.02	0.00	1.42	0.00	4.00	16.91	14.91	7.61	1.42	1.42		-0.25	0.106	1.51	NA							
150.0	195.64	72.25	87.27	0.02	76.25	76.38	79.67	79.73	76.05	78.48	79.19	76.01	76.63	4.03	4.02	0.00	1.43	0.00	3.95	16.69	14.50	7.20	1.42	1.42		-0.25	0.1086	1.10	NA							
160.0	197.50	72.16	86.86	0.02	76.29	76.45	79.51	79.67	76.00	78.45	79.10	75.96	76.55	4.03	4.02	0.00	1.46	0.00	3.86	16.52	14.11	6.81	1.42	1.42		-0.25	0.1149	0.71	NA							
170.0	195.27	72.02	86.51	0.02	76.28	76.73	79.86	79.48	76.18	78.46	79.04	75.99	76.35	4.03	4.02	0.00	1.44	0.00	3.97	17.31	13.71	6.41	1.42	1.42		-0.25	0.1089	0.31	NA							
180.0	192.32	71.78	86.00	0.02	76.46	76.83	79.86	79.61	76.31	78.60	79.10	76.20	76.56	4.03	4.03	0.00	1.46	0.00	4.03	16.62	13.40	6.10	1.42	1.42		-0.25	0.1152	0.00	6.10	NA						
190.0	188.47	72.01	85.69	0.02	76.60	76.88	79.65	79.45	76.17	78.46	78.81	75.86	76.35	4.03	4.03	0.00	1.45	0.00	4.06	16.91	13.00	5.71	1.42	1.42		-0.25	0.1133	5.71	NA							
200.0	184.65	71.97	85.32	0.02	76.43	76.64	79.54	79.08	76.02	78.28	78.73	75.71	76.21	4.03	4.03	0.00	1.44	0.00	3.73	17.63	12.70	5.40	1.42	1.42		-0.25	0.1094	5.40	NA							
210.0	183.35	72.20	85.16	0.02	76.62	76.78	79.75	79.12	76.16	78.45	78.73	76.24	76.38	4.03	4.03	0.00	1.41	0.00	3.47	17.57	12.29	4.99	1.42	1.42		-0.25	0.1037	4.99	NA							
220.0	182.37	72.22	84.84	0.02	76.72	76.75	79.71	79.20	76.19	78.56	78.65	76.10	76.47	4.03	4.03	0.00	1.44	0.00	3.52	18.01	12.00	4.71	1.42	1.42		-0.25	0.1096	4.71	NA							
230.0	183.22	71.88	85.20	0.02	76.48	76.70	79.58	78.88	76.17	78.36	78.51	75.88	76.12	4.02	4.03	0.00	1.44	0.00	3.61	17.22	11.70	4.40	1.42	1.42		-0.25	0.1104	4.40	NA							
240.0	182.70	71.65	84.96	0.02	76.30	76.73	79.67	79.06	76.05	78.60	78.33	76.07	76.12	4.02	4.03	0.00	1.45	0.00	3.35	17.01	11.31	4.01	1.42	1.42		-0.25	0.1123	4.01	NA							
250.0	182.37	72.17	84.94	0.02	76.52	76.58	79.54	78.69	75.89	78.17	78.29	75.85	75.94	4.02	4.03	0.00	1.45	0.00	3.63	16.73	10.99	3.69	1.42	1.42		-0.25	0.1118	3.69	NA							
260.0	185.46	71.82	85.29	0.02	76.50	76.46	79.63	78.62	76.03	78.24	78.53	75.98	75.94	4.02	4.02	0.00	1.41	0.00	3.90	16.80	10.60	3.31	1.42	1.42		-0.25	0.1026	3.31	NA							
270.0	183.71	71.79	84.97	0.02	76.32	76.61	79.79	79.00	76.28	78.46	78.23	75.74	75.92	4.02	4.03	0.00	1.39	0.00	3.29	17.28	10.29	2.99	1.42	1.42		-0.25	0.0994	2.99	NA							
280.0	182.14	71.88	84.88	0.02	76.57	76.79	80.00	79.02	76.33	78.59	78.32	78.19	76.01	4.01	4.02	0.00	1.47	0.00	3.49	17.41	9.89	2.59	1.42	1.42		-0.25	0.1166	2.59	NA							
290.0	182.92	72.15	84.83	0.02	76.76	76.62	79.87	78.83	76.36	78.34	78.22	76.07	75.96	4.01	4.03	0.00	1.40	0.00	3.06	17.31	9.60	2.30	1.42	1.42		-0.25	0.1012	2.30	NA							
300.0	176.42	71.86	84.16	0.02	76.68	76.86	79.87	79.91	76.15	78.52	78.40	76.06	76.18	4.03	4.03	0.00	1.41	0.00	3.47	18.15	9.29	1.99	1.42	1.42		-0.25	0.1023	1.99	NA							
310.0	178.72	71.59	84.28	0.02	76.24	76.63	79.83	79.92	76.16	78.69	78.39	76.25	76.23	4.04	4.03	0.00	1.47	0.00	3.33	17.46	9.00	1.70	1.42	1.42		-0.25	0.1169	1.70	NA							
320.0	179.72	71.47	84.45	0.02	76.44	76.60	79.65	78.74	76.09	78.41	78.21	75.96	76.01	4.03	4.03	0.00	1.39	0.00	3.57	17.38	8.59	1.29	1.42	1.42		-0.25	0.0982	1.29	NA							
330.0	181.23	71.59	84.48	0.02	76.29	76.68	79.63	78.83	76.05	78.63	78.15	76.23	75.93	4.04	4.03	0.00	1.42	0.00	3.39	16.97	8.30	1.00	1.42	1.42		-0.25	0.1055	1.00	NA							
340.0	178.25	71.74	84.25	0.02	76.40	76.83	79.88	78.71	76.03	78.38	78.01	75.97	76.08	4.03	4.03	0.00	1.43	0.00	3.14	17.69	7.99	0.69	1.42	1.42		-0.25	0.1086	0.69	NA							
350.0	182.81	72.00	85.27	0.02	76.80	76.84	79.82	79.15	76.34	78.69	78.43	76.22	76.26	4.03	4.03	0.00	1.41	0.00	3.29	16.82	7.70	0.40	1.42	1.42		-0.25	0.1032	0.40	NA							
360.0	183.14	71.82	84.75	0.02	76.54	76.63	79.79	78.90	76.44	78.50	78.30	75.85	75.99	4.03	4.03	0.00	1.44	0.00	3.51	17.43	7.30	0.00	1.42	1.42		-0.25	0.1112	0.00	NA							



 Total Quality Assurance	CLIENT: SMG Hearth & Home		PERFORMED BY: Ken Slater		
	PROJECT #: G104780922		REVIEWED BY: 0		
	PRODUCT: Pellet Fueled room heater		MODEL: HP22		
	SAMPLE ID #: MID2110141337-001		DATE: 10/21/2021		
STANDARD(S): ASTM E2779		VERSION YEAR: 2017		LOCATION: Middleton	
RESULTS					
PASS		X		FAIL	
		na		NO PASS/FAIL	
				na	

Test Duration (min)	360.0
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	Start	End
Barometer (in Hg)	28.84	29
Dry Bulb (F)	71.7	75.2
Humidity (%)	45.1	29.2

Moisture content of wood (Wet) (%)		17.73																				
Average		0.00	4.78	15.97	216.57	72.44	89.82															
Actual	Elapsed	Weight	*	*	*	*1	*2	*3	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Time	Remaining	CO	CO <sub>2</sub>	O <sub>2</sub>	Flue Gas	Room Temp	Tunnel Dry Bulb	DGM 1 Reading	DGM 1 Inlet T	DGM 1 Outlet T	Filter 1 Temp	DGM 2 Reading	DGM 2 Inlet T	DGM 2 Outlet T	Filter 2 Temp	DGM 3 Reading	DGM 3 Inlet T	DGM 3 Outlet T	Filter 3 Temp	Tunnel Velocity	Draft
	Minutes	lbs																				
9:06 AM	0.0	17.73	0.00	8.34	12.27	321.45	73.89	103.01	0.00	74.64	75.43	74.68	0.00	74.29	74.89	74.69	0.00	74.13	75.07	74.75	0.105	0.030
9:16 AM	10.00	16.63	0.00	8.66	11.79	326.41	74.08	103.65	1.42	75.85	78.01	78.02	1.42	75.31	77.10	79.70	1.42	75.75	76.63	79.02	0.102	0.030
9:26 AM	20.00	15.52	0.00	8.79	12.02	321.60	74.00	103.96	2.84	75.93	78.50	79.19	2.84	75.71	77.66	80.76	2.84	75.94	76.86	79.99	0.106	0.030
9:36 AM	30.00	14.54	0.00	8.40	12.07	321.68	74.43	103.74	4.26	76.45	79.06	80.25	4.27	76.09	77.77	81.64	4.27	76.23	77.28	80.99	0.105	0.030
9:46 AM	40.00	13.43	0.00	8.36	11.79	324.83	73.64	104.50	5.68	76.32	79.01	80.92	5.68	75.96	78.04	82.17	5.69	76.36	77.25	81.75	0.100	0.030
9:56 AM	50.00	12.33	0.00	8.76	11.65	320.80	73.86	104.99	7.10	76.73	79.33	81.72	7.10	76.30	78.21	82.78	7.11	76.75	77.53	82.30	0.125	0.030
10:06 AM	60.00	11.22	0.00	8.35	11.39	323.85	73.51	105.34	8.52	76.74	79.37	82.14	8.52	76.48	78.44	83.19	8.52	76.89	77.87	82.96	0.098	0.029
10:16 AM	70.00	10.71	0.00	6.85	15.18	235.48	73.24	94.80	9.94	76.85	79.89	81.74	9.94	76.54	78.57	82.29					0.117	0.029
10:26 AM	80.00	10.21	0.00	5.85	15.37	223.13	72.87	92.40	11.36	76.74	79.62	81.29	11.36	76.35	78.71	81.35					0.097	0.027
10:36 AM	90.00	9.71	0.00	4.79	15.54	215.81	72.74	90.74	12.77	76.73	79.57	80.95	12.77	76.42	78.58	81.11					0.107	0.025
10:46 AM	100.00	9.31	0.00	4.53	16.26	209.00	72.80	89.92	14.19	76.71	79.44	80.82	14.19	76.04	78.57	80.53					0.107	0.025
10:56 AM	110.00	8.81	0.00	4.08	16.82	207.12	72.50	88.99	15.62	76.70	79.65	80.47	15.61	76.21	78.75	80.28					0.104	0.025
11:06 AM	120.00	8.41	0.00	4.27	16.40	202.91	72.30	88.06	17.04	76.93	79.76	80.15	17.03	76.35	78.91	80.33					0.105	0.024
11:16 AM	130.00	8.03	0.00	4.37	16.50	201.83	72.04	87.78	18.46	76.66	79.78	79.99	18.45	76.29	78.70	79.73					0.105	0.024
11:26 AM	140.00	7.61	0.00	4.00	16.91	194.70	72.36	87.12	19.88	76.88	79.79	80.02	19.87	76.36	78.67	79.49					0.106	0.024
11:36 AM	150.00	7.20	0.00	3.95	16.69	195.64	72.25	87.27	21.30	76.38	79.67	79.73	21.29	76.05	78.48	79.19					0.109	0.024
11:46 AM	160.00	6.81	0.00	3.86	16.52	197.50	72.16	86.86	22.72	76.45	79.51	79.67	22.71	76.00	78.45	79.10					0.115	0.024
11:56 AM	170.00	6.41	0.00	3.97	17.31	195.27	72.02	86.51	24.14	76.73	79.86	79.48	24.13	76.18	78.46	79.04					0.109	0.024
12:06 PM	180.00	6.10	0.00	4.03	16.62	192.32	71.78	86.00	25.57	76.83	79.86	79.61	25.56	76.31	78.60	79.10					0.115	0.024
12:16 PM	190.00	5.71	0.00	4.06	16.91	188.47	72.01	85.69	26.99	76.88	79.65	79.45	26.98	76.17	78.46	78.81					0.113	0.023
12:26 PM	200.00	5.40	0.00	3.73	17.63	184.65	71.97	85.32	28.41	76.64	79.54	79.08	28.40	76.02	78.28	78.73					0.109	0.023
12:36 PM	210.00	4.99	0.00	3.47	17.57	183.35	72.20	85.16	29.83	76.78	79.75	79.12	29.82	76.16	78.45	78.73					0.104	0.023
12:46 PM	220.00	4.71	0.00	3.52	18.01	182.37	72.22	84.84	31.25	76.75	79.71	79.20	31.25	76.19	78.56	78.65					0.110	0.023
12:56 PM	230.00	4.40	0.00	3.61	17.22	183.22	71.88	85.20	32.67	76.70	79.58	78.88	32.67	76.17	78.36	78.51					0.110	0.020
1:06 PM	240.00	4.01	0.00	3.35	17.01	182.70	71.65	84.96	34.09	76.73	79.67	79.06	34.09	76.05	78.60	78.33					0.112	0.020
1:16 PM	250.00	3.69	0.00	3.63	16.73	182.37	72.17	84.94	35.51	76.58	79.54	78.69	35.51	75.89	78.17	78.29					0.112	0.020
1:26 PM	260.00	3.31	0.00	3.90	16.80	185.46	71.82	85.29	36.93	76.46	79.63	78.82	36.93	76.03	78.24	78.53					0.103	0.020
1:36 PM	270.00	2.99	0.00	3.29	17.28	183.71	71.79	84.97	38.35	76.61	79.79	79.00	38.35	76.28	78.46	78.23					0.098	0.020
1:46 PM	280.00	2.59	0.00	3.49	17.41	182.14	71.88	84.98	39.76	76.79	80.00	79.02	39.77	76.33	78.59	78.32					0.117	0.020
1:56 PM	290.00	2.30	0.00	3.06	17.31	182.92	72.15	84.83	41.18	76.62	79.87	78.83	41.19	76.36	78.34	78.22					0.101	0.020
2:06 PM	300.00	1.99	0.00	3.47	18.15	176.42	71.86	84.16	42.61	76.86	79.87	78.91	42.62	76.15	78.52	78.40					0.102	0.020
2:16 PM	310.00	1.70	0.00	3.33	17.46	178.72	71.59	84.28	44.03	76.63	79.83	78.92	44.04	76.16	78.69	78.39					0.117	0.020
2:26 PM	320.00	1.29	0.00	3.57	17.38	179.72	71.47	84.45	45.45	76.60	79.65	78.74	45.47	76.09	78.41	78.21					0.098	0.020
2:36 PM	330.00	1.00	0.00	3.39	16.97	181.23	71.59	84.48	46.88	76.68	79.63	78.83	46.89	76.05	78.63	78.15					0.105	0.020
2:46 PM	340.00	0.69	0.00	3.14	17.69	178.25	71.74	84.25	48.30	76.83	79.88	78.71	48.31	76.03	78.38	78.01					0.109	0.020
2:56 PM	350.00	0.40	0.00	3.29	16.82	182.81	72.00	85.27	49.73	76.84	79.82	79.15	49.74	76.34	78.69	78.43					0.103	0.020
3:06 PM	360.00	0.00	0.00	3.51	17.43	183.14	71.82	84.75	51.15	76.63	79.79	78.90	51.16	76.44	78.50	78.30					0.111	0.020

6" Tunnel 0.1963 ft2  
12" Tunnel 0.7854 ft2

										Wood moisture (% wet):		0.03											
										Load Weight (lbs wet):		17.7274718											
										Burn Rate (Dry kg/hr):		1.340											
Total Gas Volume (DGM 1):										48.766		Final Temperature (DGM #1) Degrees Rankin:										538.029	
Total Gas Volume (DGM 2):										48.201		Final Temperature (DGM #2) Degrees Rankin:										537.217	
Average Barometric Pressure:										28.92		Final Tunnel Temperature Degrees Rankin:										549.824	
Molecular Weight:										29		Final Tunnel Velocity (feet per second):										21.777505	
Pitot Correction:										0.970701		Standardized Tunnel Flow (dscfm):										233.226878	
Calibration Factor (DGM #1):										1.0057													
Calibration Factor (DGM #2):										0.9923													
(1) VS:										0.048733		Average Inlet + Outlet Temp.										Average Inlet + Outlet Temp.	
(2) VS:										0.049304		Average 99.9										Average 99.9	
												#1 dDGM										#2 dDGM	
												Average 99.9										Average 99.9	
												Proportional Rates										Vol. Std.	
												PR1										PR2	
												Vol. Std.										Vol. Std.	
												Time										SQRT	
												Delta-P										Delta-P	
Elapsed Time	DGM 1 Reading	DGM 1 Inlet T	DGM 1 Outlet T	DGM 2 Reading	DGM 2 Inlet T	DGM 2 Tunnel Dry Bulb	Velocity DGM 1	Filter Face Velocity DGM 2	Delta-P (in. H2O)	Tunnel Velocity	Temp. F/Sec	Meter 1 Deg. R	Meter 2 Deg. R	Proportional Rates		Vol. Std.		Time		SQRT			
0.00	0.00	74.64	75.43	0.00	74.2908429	74.89321	103.0133		0.105	21.802	535.0	534.6			0		0.3240269						
10.00	1.42	75.85	78.01	1.42	75.3143005	77.10136	103.6509	11.70	11.55	0.102	514.00	536.9	103.99	103.85	1.357	1.340	10	0.31995488					
20.00	2.84	75.93	78.50	2.84	75.7074127	77.65511	103.9565	11.67	11.57	0.106	21.956	537.2	536.7	101.74	102.02	1.353	1.342	20	0.3260416				
30.00	4.26	76.45	79.06	4.27	76.085701	77.77236	103.7396	11.72	11.58	0.105	21.782	537.8	536.9	102.86	102.87	1.359	1.344	30	0.32352175				
40.00	5.68	76.32	79.01	5.68	75.9567373	78.04499	104.4989	11.67	11.50	0.100	21.300	537.7	537.0	104.87	104.61	1.353	1.335	40	0.31614057				
50.00	7.10	76.73	79.33	7.10	76.2986069	78.20615	104.9941	11.64	11.53	0.125	23.851	538.0	537.3	103.49	93.64	1.350	1.337	50	0.33585491				
60.00	8.52	76.74	79.37	8.52	76.4834976	78.4379	105.3412	11.68	11.55	0.098	21.151	538.1	537.5	105.83	105.82	1.355	1.340	60	0.31370641				
70.00	9.94	76.85	79.89	9.94	76.5371933	78.56522	94.80408	11.66	11.52	0.117	22.873	538.4	537.6	95.80	95.77	1.352	1.336	70	0.34244271				
80.00	11.36	76.74	79.62	11.36	76.3522644	78.71495	92.40496	11.65	11.50	0.097	20.708	538.2	537.5	105.36	105.20	1.352	1.335	80	0.31069938				
90.00	12.77	76.73	79.57	12.77	76.4210205	78.58292	90.73895	11.64	11.47	0.107	21.803	538.2	537.5	99.64	99.29	1.350	1.330	90	0.32763167				
100.00	14.19	76.71	79.44	14.19	76.0359116	78.56593	89.91781	11.69	11.54	0.107	21.703	538.1	537.3	100.39	100.27	1.356	1.339	100	0.32636863				
110.00	15.62	76.70	79.65	15.61	76.2143631	78.75108	88.99266	11.69	11.53	0.104	21.425	538.2	537.5	101.55	101.26	1.357	1.337	110	0.32246481				
120.00	17.04	76.93	79.76	17.03	76.3485413	78.90533	88.0559	11.67	11.53	0.105	21.491	538.3	537.6	100.86	100.73	1.354	1.337	120	0.32372425				
130.00	18.46	76.66	79.78	18.45	76.294075	78.70362	87.78069	11.69	11.53	0.105	21.556	538.2	537.5	100.62	100.42	1.355	1.337	130	0.32479586				
140.00	19.88	76.88	79.79	19.87	76.3602371	78.66939	87.12309	11.67	11.53	0.106	21.596	538.3	537.5	100.21	100.11	1.354	1.337	140	0.32559258				
150.00	21.30	76.38	79.67	21.29	76.0534439	78.47638	87.27137	11.68	11.54	0.109	21.857	538.0	537.3	99.61	99.07	1.355	1.338	150	0.32948245				
160.00	22.72	76.45	79.51	22.71	76.0032043	78.44622	86.86253	11.68	11.53	0.115	22.479	538.0	537.2	96.35	96.24	1.355	1.338	160	0.33898053				
170.00	24.14	76.73	79.86	24.13	76.1787262	78.4611	86.50807	11.68	11.54	0.109	21.878	538.3	537.3	98.88	98.81	1.355	1.338	170	0.33007283				
180.00	25.57	76.83	79.86	25.56	76.3106232	78.59969	86.00497	11.68	11.55	0.115	22.493	538.3	537.3	96.07	96.12	1.355	1.340	180	0.33045675				
190.00	26.99	76.88	79.86	26.98	76.1713181	78.46639	85.68687	11.69	11.55	0.113	22.295	538.3	537.3	96.93	96.92	1.356	1.340	190	0.33656665				
200.00	28.41	76.64	79.54	28.40	76.0157394	78.27804	85.31911	11.69	11.56	0.109	21.899	538.1	537.1	98.65	98.73	1.356	1.341	200	0.33071058				
210.00	29.83	76.78	79.75	29.82	76.1628265	78.44521	85.16269	11.68	11.55	0.104	21.322	538.3	537.3	101.16	101.31	1.354	1.340	210	0.32202972				
220.00	31.25	76.75	79.71	31.25	76.1889191	78.55831	84.84298	11.68	11.54	0.110	21.912	538.2	537.4	98.40	98.40	1.355	1.339	220	0.33104222				
230.00	32.67	76.70	79.58	32.67	76.1712036	78.35988	85.20333	11.67	11.55	0.110	22.004	538.1	537.3	98.01	98.13	1.354	1.340	230	0.33232418				
240.00	34.09	76.73	79.67	34.09	76.046524	78.60332	84.96037	11.67	11.55	0.112	22.181	538.2	537.3	97.32	97.32	1.353	1.340	240	0.33506444				
250.00	35.51	76.58	79.54	35.51	75.8919449	78.16763	84.9391	11.66	11.55	0.112	22.135	538.1	537.0	97.34	97.58	1.353	1.340	250	0.33439058				
260.00	36.93	76.46	79.63	36.93	76.0341492	78.23621	85.29186	11.66	11.54	0.103	21.210	538.0	537.1	101.59	101.73	1.352	1.338	260	0.3203072				
270.00	38.35	76.71	79.79	38.35	76.2844391	78.45972	84.96957	11.65	11.54	0.098	20.768	538.2	537.4	103.63	103.82	1.352	1.338	270	0.31772094				
280.00	39.76	76.79	80.00	39.77	76.3338013	78.5894	84.98189	11.64	11.53	0.117	22.602	538.4	537.5	95.09	95.33	1.350	1.338	280	0.3414265				
290.00	41.18	76.62	79.87	41.19	76.3648376	78.33993	84.83305	11.64	11.54	0.101	21.060	538.2	537.4	102.09	102.36	1.351	1.339	290	0.31816844				
300.00	42.61	76.86	79.87	42.62	76.152153	78.52154	84.16297	11.70	11.56	0.102	21.154	538.4	537.3	101.94	101.99	1.357	1.341	300	0.31979766				
310.00	44.03	76.63	79.83	44.04	76.1554413	78.69215	84.27676	11.71	11.56	0.117	22.616	538.2	537.4	95.48	95.39	1.358	1.341	310	0.34185921				
320.00	45.45	76.60	79.65	45.47	76.0880127	78.41055	84.45492	11.70	11.57	0.098	20.730	538.1	537.2	104.17	104.20	1.357	1.342	320	0.31329317				
330.00	46.88	76.68	79.63	46.89	76.0466232	78.6302	84.47906	11.71	11.56	0.105	21.490	538.2	537.3	100.54	100.45	1.358	1.341	330	0.32478178				
340.00	48.30	76.83	79.88	48.31	76.0260849	78.3821	84.25223	11.69	11.57	0.109	21.799	538.4	537.2	98.88	99.04	1.356	1.342	340	0.32951483				
350.00	49.73	76.84	79.82	49.74	76.3362961	78.69229	85.27238	11.70	11.56	0.103	21.276	538.3	537.5	101.58	101.55	1.357	1.341	350	0.32130478				
360.00	51.15	76.63	79.79	51.16	76.4423447	78.50385	84.75485	11.69	11.56	0.111	22.071	538.2	537.5	97.81	97.81	1.356	1.341	360	0.33346687				

RESULTS									
Average emission rate:(gr/hr) 1.010									
Burn Rate (Dry kg/hr): 1.340									
Stack Static (neg): -0.32									
Barometer:: 28.92									
Average Room Temp: 72.44									
PRESSURE FACTOR: 0.96658									
BAROMETRIC PRESSURE									
Average:: 28.92									
TEMPERATURE FACTORS									
Start:: 28.84									
DGM #1: 0.98136									
End: 29									
DGM #2: 0.98284									
DRY GAS METER VALUES									
Final: 51.148									
Initial: 0.001									
DGM #1: 48.79282									
DGM #2: 48.22685									
DGM #2 Final: 51.160									
Initial: 0.001									
TOTAL TUNNEL VOLUME (scf): 83962									
SAMPLE RATIOS									
TEMPERATURES (DEG. RANKIN)									
Sample Train 1: 1720.779									
DGM #1: 538.029									
Sample Train 2: 1740.974									
DGM #2: 537.217									
TOTAL EMISSIONS									
CALIBRATION FACTORS									
Sample Train 1 (g): 5.85									
DGM #1: 1.0057									
Sample Train 2 (g): 6.27									
DGM #2: 0.9923									
EMISSION RATES									
TUNNEL FLOW RATE: 233.227									
Sample Train 1 (g/hr): 0.98									
Sample Train 2 (g/hr): 1.04									
PARTICULATE CATCH (mg)									
Total Sample Train 1: 3.4									
Total Sample Train 2: 3.6									
Filter and seal Sample Train 1: 3.4									
Filter and seal Sample Train 2: 3.6									
MAX Allowed 7.50%									
Probe Sample Train 1: 0									
DEVIATION: 3.44%									
Probe Sample Train 2: 0									
Room Particulate Correction									
Train 1 Train 2									
Cs 6.96824E-05 7.46472E-05									
Mr 0 Milligram Catch (mg)									
Cr 0 0 Vmr 46.5264 Total Volume Sampled (dscf)									
Et 5.85 6.27 Rotometer (glass) at 100									
flow rate is 0.12924 cfm									
Et AVERAGE 6.05907772									
Deviation (g/kg)									
Train #1 0.7278 #DIV/0!									
Train #2 0.7797 #DIV/0!									
Deviation 0.0519									

Stack Static (neg): -0.32  
Barometer:: 28.92  
Average Room Temp: 72.44

PRESSURE FACTOR: 0.96658  
BAROMETRIC PRESSURE  
Average:: 28.92  
Start:: 28.84  
End: 29

DRY GAS METER VALUES  
Final: 51.148  
Initial: 0.001  
DGM #1: 48.79282  
DGM #2: 48.22685  
DGM #2 Final: 51.160  
Initial: 0.001

SAMPLE RATIOS  
TEMPERATURES (DEG. RANKIN)  
Sample Train 1: 1720.779  
DGM #1: 538.029  
Sample Train 2: 1740.974  
DGM #2: 537.217

TOTAL EMISSIONS  
CALIBRATION FACTORS  
Sample Train 1 (g): 5.85  
DGM #1: 1.0057  
Sample Train 2 (g): 6.27  
DGM #2: 0.9923

EMISSION RATES  
TUNNEL FLOW RATE: 233.227  
Sample Train 1 (g/hr): 0.98  
Sample Train 2 (g/hr): 1.04

PARTICULATE CATCH (mg)  
Total Sample Train 1: 3.4  
Total Sample Train 2: 3.6  
Filter and seal Sample Train 1: 3.4  
Filter and seal Sample Train 2: 3.6  
MAX Allowed 7.50%  
Probe Sample Train 1: 0  
DEVIATION: 3.44%  
Probe Sample Train 2: 0


Room Particulate Correction  
Train 1 Train 2  
Cs 6.96824E-05 7.46472E-05  
Mr 0 Milligram Catch (mg)  
Cr 0 0 Vmr 46.5264 Total Volume Sampled (dscf)  
Et 5.85 6.27 Rotometer (glass) at 100  
flow rate is 0.12924 cfm  
Et AVERAGE 6.05907772

Deviation (g/kg)  
Train #1 0.7278 #DIV/0!  
Train #2 0.7797 #DIV/0!  
Deviation 0.0519

Room Temp: Before 74, After 72  
Bar Pressure: Before 28.84, After 29.00  
Relative Humidity: Before 45.1, After 29.2  
Air Velocity: Before 0, After 0  
Average Dilution Tunnel Measurements  
Burn Time: 360, Velocity (Ft/sec): 21.78, Flow Rate (dscf/min): 233.23, Temp (R): 549.82  
Total Sample: 1 2, Particulate Catch: 1 2  
Sample Data: 3.4 3.6

Dilution Tunnel Dual Train Precision  
Sample Ratios: Train 1 1720.779, Train 2 1740.974  
Total Emissions (g): Train 1 5.85, Train 2 6.27  
Deviation (%): 3.44%, g/kg: 0.051859

Burn Rate: 1.340  
Initial Draft: 0.030  
Average Draft: 0.024


 Total Quality. Assured.	<b>CLIENT:</b> SMG Hearth & Home		<b>PERFORMED BY:</b> Ken Slater		
	<b>PROJECT #:</b> G104780922		<b>REVIEWED BY:</b> 0		
	<b>PRODUCT:</b> Pellet Fueled room heater		<b>MODEL:</b> HP22		
<b>SAMPLE ID #:</b> MID2110141337-001			<b>DATE:</b> 10/21/2021		
<b>STANDARD(S):</b> ASTM E2779		<b>VERSION YEAR:</b> 2017	<b>LOCATION:</b> Middleton		
<b>EQUIPMENT</b>					
<b>ASSET # - DESCRIPTION:</b> See Equipment Tab			<b>CALIBRATION DUE:</b> See Equipment Tab		
<b>CONDITIONING</b>					
<b>SAMPLE CONDITIONING (IF APPLICABLE):</b> 48 hr conditioning burn					
<b>AMBIENT TEMPERATURE (°F):</b> 73.89					
<b>RESULTS</b>					
<b>PASS</b>	X	<b>FAIL</b>	na	<b>NO PASS/FAIL</b>	na

### E&E Tunnel Traverse Worksheet

Static Pressure (in Hg)	<b>0.321</b>
Barometer (in Hg)	28.84

Position	Tunnel Velocity	
	(ft/sec)	(ft/sec <sup>2</sup> )
A CENTER	0.101	0.3178
B CENTER	0.1	0.3162
A1	0.086	0.2933
A2	0.101	0.3178
A3	0.106	0.3256
A4	0.084	0.2898
B1	0.101	0.3178
B2	0.101	0.3178
B3	0.089	0.2983
B4	0.08	0.2828
Average		0.3077

	Pitot
Constant =	0.9707

 Total Quality. Assured.	<b>CLIENT:</b> SMG Hearth & Home		<b>PERFORMED BY:</b> Ken Slater
	<b>PROJECT #:</b> G104780922		<b>REVIEWED BY:</b> 0
	<b>PRODUCT:</b> Pellet Fueled room heater		<b>MODEL:</b> HP22
<b>SAMPLE ID #:</b>	MID2110141337-001		<b>DATE:</b> 10/21/2021
<b>STANDARD(S):</b>	ASTM E2779	<b>VERSION YEAR:</b> 2017	<b>LOCATION:</b> Middleton

#### E&E Pellet Fuel Data

<b>Brand of Pellets Used</b>	Marthwood
------------------------------	-----------


	<b>Wet</b>	<b>Dry</b>
<b>Moisture Content (%)</b>	3.25%	3.36%

<b>Weight Used During Test</b>	
<b>Wet (lbs)</b>	<b>Dry (kg)</b>
17.73	8.04

<b>Burn Rate (kg/hr)</b>	1.339752
--------------------------	----------

<b>Moisture Calculation</b>	
Before Weight of Pellets - Wet (lbs)	1.23
After weight of pellets - Dry (lbs)	1.19
Weight of moisture removed from oven (lbs)	0.04

<b>Weight added to Scale (lbs)</b>	25.00
------------------------------------	-------

 Total Quality. Assured.	<b>CLIENT:</b> SMG Hearth & Home		<b>PERFORMED BY:</b> Ken Slater	
	<b>PROJECT #:</b> G104780922		<b>REVIEWED BY:</b> 0	
	<b>PRODUCT:</b> Pellet Fueled room heater		<b>MODEL:</b> HP22	
<b>SAMPLE ID #:</b>	MID2110141337-001			<b>DATE:</b> 10/21/2021
<b>STANDARD(S):</b>	ASTM E2779	<b>VERSION YEAR:</b>	2017	<b>LOCATION:</b> Middleton

<b>Test Duration (min)</b>	60.0
----------------------------	------

	Start	End
Barometer (in Hg)	28.84	29
Dry Bulb (F)	71.7	75.2
Humidity (%)	45.1	29.2

<b>Moisture content of wood (Wet) (%)</b>			17.73								
<b>Average</b>			0.00	8.52	11.85	322.95	73.92	104.17		76.09	76.93
<b>Actual</b>	<b>Elapsed</b>	<b>Weight</b>	*	*	*	*1	*2	*3	*	*	*
	<b>Time</b>	<b>Remaining</b>				Flue	Room	Tunnel	DGM 3	DGM 3	DGM 3
<b>Time</b>	<b>Minutes</b>	<b>lbs</b>	CO	CO <sub>2</sub>	O <sub>2</sub>	Gas	Temp	Dry Bulb	Reading	Inlet T	Outlet T
0:00:00	0.0	17.73	0.00	8.34	12.27	321.45	73.89	103.01	0.00	74.64	75.07
0:00:00	10.00	16.63	0.00	8.66	11.79	326.41	74.08	103.65	1.42	75.85	76.63
0:00:00	20.00	15.52	0.00	8.79	12.02	321.60	74.00	103.96	2.84	75.93	76.86
0:00:00	30.00	14.54	0.00	8.40	12.07	321.68	74.43	103.74	4.27	76.45	77.28
0:00:00	40.00	13.43	0.00	8.36	11.79	324.83	73.64	104.50	5.69	76.32	77.25
0:00:00	50.00	12.33	0.00	8.76	11.65	320.80	73.86	104.99	7.11	76.73	77.53
0:00:00	60.00	11.22	0.00	8.35	11.39	323.85	73.51	105.34	8.52	76.74	77.87




68.40	0.11	-0.25
*	*	*
Filter 3	Tunnel	Draft
Temp	Velocity	
74.75	0.105	-0.250
79.02	0.102	-0.250
79.99	0.106	-0.250
80.99	0.105	-0.250
81.75	0.100	-0.250
82.30	0.125	-0.250
0.00	0.098	-0.250

Total Gas Volume (DGM 3): 8.038  
 Average Barometric Pressure: 28.92  
 Molecular Weight: 29  
 Pitot Correction: 0.970701  
 Calibration Factor (DGM #3): 0.9924  
 (1) VS: #DIV/0!

				Filter Face
Elapsed Time	DGM 3 Reading	DGM 3 Inlet T	DGM 3 Outlet T	Tunnel Dry Bulb
0.00	0.00	74.64	75.07	103.0133
10.00	1.42	75.85	76.63	103.6509
20.00	2.84	75.93	76.86	103.9565
30.00	4.27	76.45	77.28	103.7396
40.00	5.69	76.32	77.25	104.4989
50.00	7.11	76.73	77.53	104.9941
60.00	8.52	76.74	77.87	105.3412
				11.58
				11.53
				11.60
				11.57
				11.52
				11.50




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		1st hour emission rate:(gr/hr)		1.535	
				Stack Static (neg):	
				Fuel Moisture (Dry):	
				Barometer:	
				Average Room Temp:	
PRESSURE FACTOR:		0.96658		BAROMETRIC PRESSURE	
				Average:	
				28.92	
TEMPERATURE FACTORS				Start:	
				28.84	
DGM #1:		0.98414		End:	
				29	
				DRY GAS METER VALUES	
VOLUMES SAMPLED				DGM #3	
				Final:	
				8.523	
DGM #3:		8.04545		Initial:	
				0.001	
TOTAL TUNNEL VOLUME (scf):		13722			
SAMPLE RATIOS				TEMPERATURES (DEG. RANKIN)	
Sample Train 3:		1705.547		DGM #1:	
				536.510	
TOTAL EMISSIONS				CALIBRATION FACTORS	
Sample Train 3 (g):		1.53		DGM #1:	
				0.9924	
				TUNNEL FLOW RATE:	
				228.698	

Stack Static (neg):  
Fuel Moisture (Dry):  
Barometer:  
Average Room Temp:

PRESSURE FACTOR:	0.96658
------------------	---------

## BAROMETRIC PRESSURE

## TEMPERATURE FACTORS

Average:	28.92
----------	-------

DGM #1: 0.98414

Start:	28.84
--------	-------

End: 29

### DRY GAS METER VALUES

## VOLUMES SAMPLED

DGM #3	Final:	8.523
--------	--------	-------

DGM #3: 8.04545

Initial: 0.001

TOTAL TUNNEL VOLUME (scf):	13722
----------------------------	-------

## SAMPLE RATIOS

TEMPERATURES (DEG. RANKIN)

Sample Train 3:	1705.547
-----------------	----------

DGM #1:	536.510
---------	---------

TOTAL EMISSIONS

## CALIBRATION FACTORS

Sample Train 3 (g):	<b>1.53</b>
---------------------	-------------

DGM #1:	0.9924
---------	--------

TUNNEL FLOW RATE:	228.698
-------------------	---------

				PARTICULATE CATCH (mg)
			Total Sample Train 3:	0.9
			Filter and seal Sample Train 3:	0.9
				0
			Probe Sample Train 3:	0

-0.321

0.03

28.92

73.92

-0.321

0.03

28.92

73.92

Category	Value
Blue	-0.321
Orange	0.03
Green	28.92
Red	73.92

Category	Value
Blue	-0.321
Orange	0.03
Green	28.92
Red	73.92

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## Timber Products Inspection, Inc.

# CERTIFICATE OF QUALIFICATION

---

*This is to signify that*

## MARTH WOOD SHAVING SUPPLY, INC.

6752 State Highway 107 North

Marathon, WI 54448

---

Is hereby qualified as registration #16006

May 30, 2014

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

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



A handwritten signature in blue ink, reading 'Chris Wiberger', written in a cursive style.

---

**Chris Wiberger**, Densified Fuel Program Manager

Timber Products Inspection, Inc.  
1641 Sigman Road, Conyers GA 30012 770.922.8000



Date: 10/10/2021

**Memo**

To: Intertek  
8431 Murphy Drive  
Middleton, WI 53562

From: SMG Hearth and Home

Re: Startup Procedure for the ComfortBilt HP22 and HP50 Pellet Stoves

To Whom It May Concern,

The following page is the startup procedure for operating the ComfortBilt HP22 and HP50 Pellet stoves. If you need any other information please let me know.

Sincerely,

Bryan Warner

COO

SMG Hearth and Home, LLC

1. **Check Hopper** - Make sure the hopper is clean and free of foreign matter.
  2. **Fill Hopper** - Fill the hopper with wood pellets. *(Make sure that NO parts of the bag or any foreign objects enter the hopper, as this may cause harm to the auger feed system).*
  3. **Close Hopper Lid** - Take care to ensure there is no pellet material on the hopper lid seating surfaces. *(This stove has a safety switch that will not allow pellets to feed with the hopper door open or ajar).*
  4. **Check Igniter** - Ensure that the igniter rod is in a good position, and did not shift during transit. *(Centered in the tube and 1/4" - 1/2" back from flush)*
  5. **Check Burn Pot** - Seat the burn pot flush on the air intake/igniter cradle. Ensure that the igniter port hole is toward the back, and that the lip of the burn pot is not resting atop the front square catch.
  6. **Check Glass Air-wash** - Adjust the glass air-wash damper to the open position. *(to the right)*
  7. **Close Front Door** - Ensure the main glass door is closed. *(This stove has a safety switch that will not allow pellets to feed unless there is a negative pressure detected inside the stove).*
  8. **Check Ash Pan Latches** - Check the adjustable side latches for the ash pan. Both should be snug and have close to even pressure.
  9. **Adjust Heat Tube Scraper** - Push the heat tube scraper all the way in and out of the way. *(Knob and rod may get extremely hot during operation)*
  10. **Check Air Damper** - Make sure the air damper gate is at least 1/2 way open. *(End of handle should be flush with stove body)*
  11. **Check Fans** - Ensure that combustion and convection fans freely spin when flicked and that no damage or seizing occurred during transport. *(There should be little resistance and the fan blades will spin like a skate wheel)*
  12. **Plug Unit In** - Plug the power cable into the main power switch assembly block at the back of the stove and switch the power switch to the On position. *(- is on, 0 is off)*
  13. **Boot Up** - The panel will boot up, displaying the logo screen and the current program being used..
  14. **Prime Auger** - Now test and prime the auger system. Press the Combination Function button on the control panel. *(red indicator light will come on).* Then the Enter button. "Feeding On" message will display on the screen, and the auger will engage to slowly draw pellets into the drop chute. After about a minute, pellets should start dropping into the burn pot. Once pellets start to feed, press the Exit button to stop the feeding. "Feeding Off" message will display. Now press the Combination Function button again *(red indicator light will go out).*
  15. **Ready to start** - The stove is now ready to start.
- For Testing Purposes Only
16. Start stove on level 5 burn rate for 1 hour, then change to level 2 for 2 hours and then level 1 for 3 hours





# CERTIFICATE OF NIST TRACEABLE CALIBRATION

Calibration Certificate No: 92433

## Customer Information

Customer: Intertek  
Address : 8431 Murphy Drive  
Middleton WI 53562



Customer PO #: Verbal - Brian Brunson

## Calibration Procedure Information

Procedure ID: GTP TMASS-LAM

Revision #: 11

Revision Date: 6/18/2019

## Calibration Standards Information

<u>Graftel ID</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Description</u>	<u>CAL Due</u>
10062	Graftel	9202	5-Channel Temperature Sensor	8/6/2024
10074	Meriam	50MJ10-14	Laminar Flowmeter	11/21/2021
10075	Meriam	50MJ10-9	Laminar Flowmeter	11/26/2021
10128	Furness	FCO352	Diff Pressure	5/7/2022
60030	Paroscientific	760-100A	Pressure, 100 psia	5/20/2022
T1830482	Vaisala	HMW95D	RH/Temp. Logger	12/22/2021
1A01JMGKP36	Graftel	N/A	Digital Barometer	12/22/2021
50789	Paroscientific	760-100A	Pressure Gauge	8/17/2022

## Sensor Information

Manufacturer: Sierra      Description: Mass Flow Meter      Method Used: Laminar  
Model #: M50L-AL-DD-2-PV2-V1-5PC      Rated Accuracy:  $\pm 1$  % of Full Scale      Accuracy Specified By: Sierra  
Instrument ID#: 001519      Range: 0 to 10 slpm      Condition: Functional  
Serial #: 231326

Comments: Calibration Date: 08/20/2021  
Calibration Due: 02/20/2022

*The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). The reported calibration uncertainty has a confidence level of 95% ( $k=2$ ). A calibration uncertainty ratio of 4:1 was maintained unless required uncertainty is supported by analysis. Graftel Quality Assurance System complies with applicable requirements of ISO/IEC-17025-2017, ANSI/NCSL Z540-I-1994 and ISO 9001. All results contained within this certificate relate only to item(s) calibrated. This certificate shall not be reproduced except in full and with the written consent of Graftel. Acceptance Criteria per Simple Acceptance Rule: Measurement Uncertainty is not applied to the measured value when in/out of tolerance statement is made.*

Performed By: L. Chan  
Lap Chan  
Calibration Technician

Date: 8/20/2021

Approved By: Scott Pickett  
Scott Pickett  
Vice President, Lab Services

Date: 8/20/2021

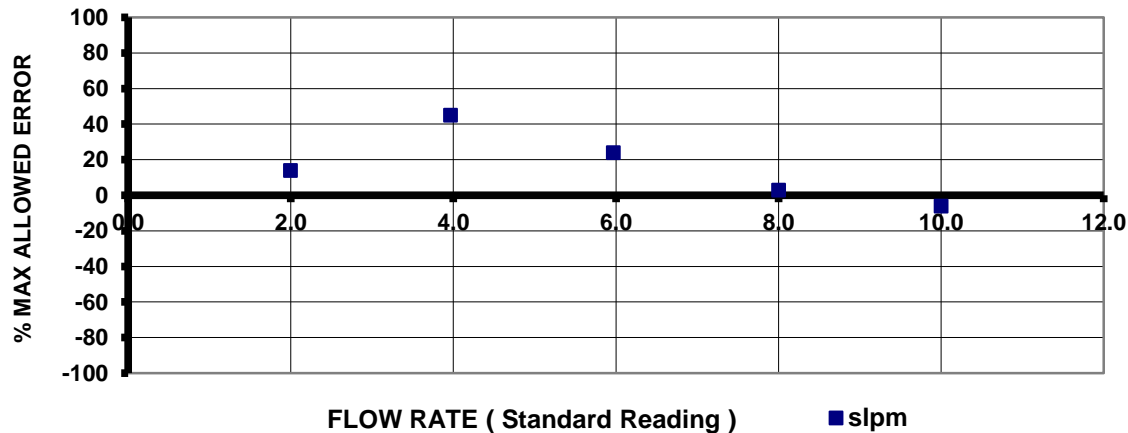
# ATTACHMENT TO CALIBRATION CERTIFICATE 92433

## AS FOUND / AS LEFT DATA

Page 2 of 2

Reading From Standard, slpm	Lower Limit of Meter Reading, slpm	Measured Reading From Meter, slpm	Upper Limit of Meter Reading, slpm	Error, slpm	Measurement Uncertainty (k=2) slpm	CMC (k=2) slpm	STATUS
1.998	1.898	2.012	2.098	0.014	0.010	0.010	Pass
3.966	3.866	4.011	4.066	0.045	0.020	0.020	Pass
5.967	5.867	5.991	6.067	0.024	0.030	0.030	Pass
8.002	7.902	8.005	8.102	0.003	0.040	0.040	Pass
9.999	9.899	9.993	10.099	-0.006	0.050	0.050	Pass

ERROR CHART ( Inlet Pressure = 10 psig )



Instrument Specifications		
Meter's Calibrated Fluid:	Air	
Test Fluid:	Air	
Meter's Standard Pressure:	14.7	psia
Meter's Standard Temperature:	70	°F
Lower Range:	0	slpm
Upper Range:	10	slpm
Resolution:	0.001	
Rated Accuracy:	1.0	% of Full Scale
Laboratory Ambient Conditions		
Pressure:	14.37	psia
Humidity:	54.67	%RH
Temperature:	70.04	°F



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FLOW - TEMPERATURE - HUMIDITY - PRESSURE - DESIGN - CONSULTING - ENGINEERING

## NIST Traceable Calibration Data Sheet

95 Chancellor Dr., Roselle, IL 60172

Phone: 847-364-2600

Fax: 847-364-3899



# CERTIFICATE OF NIST TRACEABLE CALIBRATION

## Calibration Certificate No: 92434

### Customer Information

Customer: Intertek  
Address : 8431 Murphy Drive  
Middleton WI 53562



Customer PO #: Verbal - Brian Brunson

### Calibration Procedure Information

Procedure ID: GTP TMASS-LAM

Revision #: 11

Revision Date: 6/18/2019

### Calibration Standards Information

<u>Graftel ID</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Description</u>	<u>CAL Due</u>
10062	Graftel	9202	5-Channel Temperature Sensor	8/6/2024
10074	Meriam	50MJ10-14	Laminar Flowmeter	11/21/2021
10075	Meriam	50MJ10-9	Laminar Flowmeter	11/26/2021
10128	Furness	FCO352	Diff Pressure	5/7/2022
60030	Paroscientific	760-100A	Pressure, 100 psia	5/20/2022
T1830482	Vaisala	HMW95D	RH/Temp. Logger	12/22/2021
1A01JMGKP36	Graftel	N/A	Digital Barometer	12/22/2021
50789	Paroscientific	760-100A	Pressure Gauge	8/17/2022

### Sensor Information

Manufacturer: Sierra      Description: Mass Flow Meter      Method Used: Laminar  
Model #: M50L-AL-DD-2-PV2-V1-5PC      Rated Accuracy:  $\pm 1$  % of Full Scale      Accuracy Specified By: Sierra  
Instrument ID#: 1414      Range: 0 to 10 slpm      Condition: Functional  
Serial #: 189157

Comments: Calibration Date: 08/20/2021  
Calibration Due: 02/20/2022

*The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). The reported calibration uncertainty has a confidence level of 95% (k=2). A calibration uncertainty ratio of 4:1 was maintained unless required uncertainty is supported by analysis. Graftel Quality Assurance System complies with applicable requirements of ISO/IEC-17025-2017, ANSI/NCSL Z540-I-1994 and ISO 9001. All results contained within this certificate relate only to item(s) calibrated. This certificate shall not be reproduced except in full and with the written consent of Graftel. Acceptance Criteria per Simple Acceptance Rule: Measurement Uncertainty is not applied to the measured value when in/out of tolerance statement is made.*

Performed By: L. Chan  
Lap Chan  
Calibration Technician

Date: 8/20/2021

Approved By: Scott Pickett  
Scott Pickett  
Vice President, Lab Services

Date: 8/20/2021

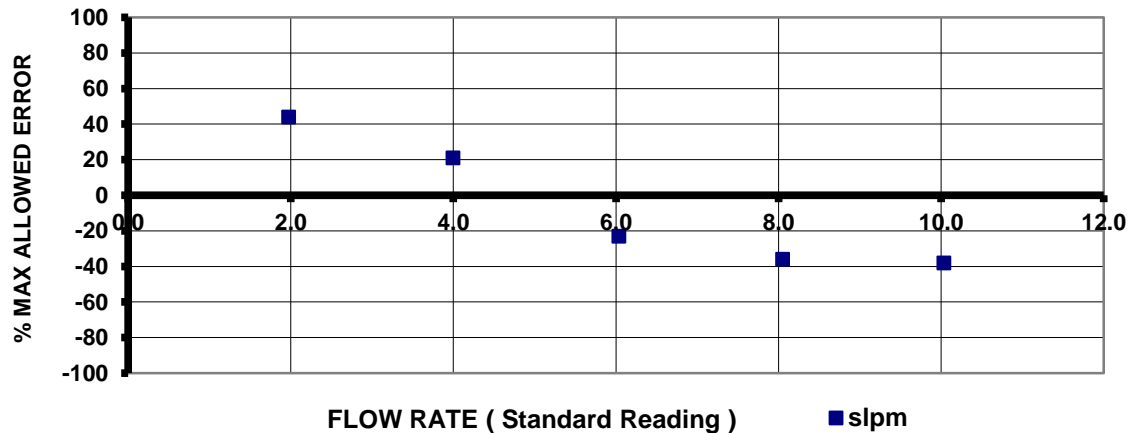
# ATTACHMENT TO CALIBRATION CERTIFICATE 92434

## AS FOUND / AS LEFT DATA

Page 2 of 2

Reading From Standard, slpm	Lower Limit of Meter Reading, slpm	Measured Reading From Meter, slpm	Upper Limit of Meter Reading, slpm	Error, slpm	Measurement Uncertainty (k=2) slpm	CMC (k=2) slpm	STATUS
1.975	1.875	2.019	2.075	0.044	0.010	0.010	Pass
3.996	3.896	4.017	4.096	0.021	0.020	0.020	Pass
6.034	5.934	6.011	6.134	-0.023	0.030	0.030	Pass
8.049	7.949	8.013	8.149	-0.036	0.040	0.040	Pass
10.032	9.932	9.994	10.132	-0.038	0.050	0.050	Pass

ERROR CHART ( Inlet Pressure = 10 psig )



Instrument Specifications		
Meter's Calibrated Fluid:	Air	
Test Fluid:	Air	
Meter's Standard Pressure:	14.7	psia
Meter's Standard Temperature:	70	°F
Lower Range:	0	slpm
Upper Range:	10	slpm
Resolution:	0.001	
Rated Accuracy:	1.0	% of Full Scale
Laboratory Ambient Conditions		
Pressure:	14.37	psia
Humidity:	53.48	%RH
Temperature:	70.02	°F



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FLOW - TEMPERATURE - HUMIDITY - PRESSURE - DESIGN - CONSULTING - ENGINEERING

## NIST Traceable Calibration Data Sheet

95 Chancellor Dr., Roselle, IL 60172

Phone: 847-364-2600

Fax: 847-364-3899



# CERTIFICATE OF NIST TRACEABLE CALIBRATION

## Calibration Certificate No: 92435

### Customer Information

Customer: Intertek  
Address : 8431 Murphy Drive  
Middleton WI 53562



Customer PO #: Verbal - Brian Brunson

### Calibration Procedure Information

Procedure ID: GTP TMASS-LAM

Revision #: 11

Revision Date: 6/18/2019

### Calibration Standards Information

<u>Graftel ID</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Description</u>	<u>CAL Due</u>
10062	Graftel	9202	5-Channel Temperature Sensor	8/6/2024
10074	Meriam	50MJ10-14	Laminar Flowmeter	11/21/2021
10075	Meriam	50MJ10-9	Laminar Flowmeter	11/26/2021
10128	Furness	FCO352	Diff Pressure	5/7/2022
60030	Paroscientific	760-100A	Pressure, 100 psia	5/20/2022
T1830482	Vaisala	HMW95D	RH/Temp. Logger	12/22/2021
1A01JMGKP36	Graftel	N/A	Digital Barometer	12/22/2021
50789	Paroscientific	760-100A	Pressure Gauge	8/17/2022

### Sensor Information

Manufacturer: Sierra      Description: Mass Flow Meter      Method Used: Laminar  
Model #: M50L-AL-DD-2-PV2-V1-5PC      Rated Accuracy:  $\pm 1$  % of Full Scale      Accuracy Specified By: Sierra  
Instrument ID#: 1413      Range: 0 to 10 slpm      Condition: Functional  
Serial #: 189158

Comments: Calibration Date: 08/20/2021  
Calibration Due: 02/20/2022

*The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). The reported calibration uncertainty has a confidence level of 95% (k=2). A calibration uncertainty ratio of 4:1 was maintained unless required uncertainty is supported by analysis. Graftel Quality Assurance System complies with applicable requirements of ISO/IEC-17025-2017, ANSI/NCSL Z540-I-1994 and ISO 9001. All results contained within this certificate relate only to item(s) calibrated. This certificate shall not be reproduced except in full and with the written consent of Graftel. Acceptance Criteria per Simple Acceptance Rule: Measurement Uncertainty is not applied to the measured value when in/out of tolerance statement is made.*

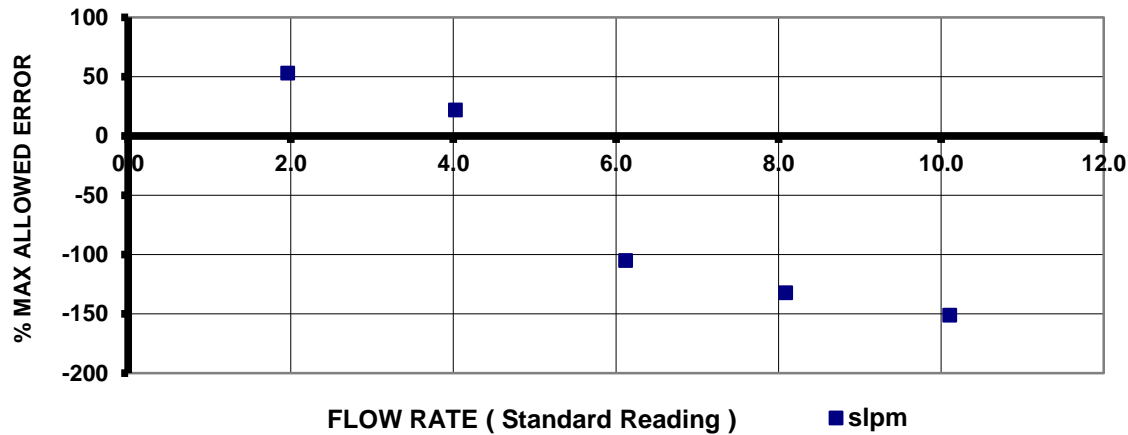
Performed By: L. Chan      Date: 8/20/2021  
Lap Chan  
Calibration Technician

Approved By: Scott Pickett      Date: 8/20/2021  
Scott Pickett  
Vice President, Lab Services

**ATTACHMENT TO CALIBRATION CERTIFICATE 92435**  
**AS FOUND DATA**  
**Page 2 of 3**

Reading From Standard, slpm	Lower Limit of Meter Reading, slpm	Measured Reading From Meter, slpm	Upper Limit of Meter Reading, slpm	Error, slpm	Measurement Uncertainty (k=2) slpm	CMC (k=2) slpm	STATUS
1.964	1.864	2.017	2.064	0.053	0.010	0.010	Pass
4.026	3.926	4.048	4.126	0.022	0.020	0.020	Pass
6.118	6.018	6.013	6.218	-0.105	0.031	0.031	Fail
8.089	7.989	7.957	8.189	-0.132	0.040	0.040	Fail
10.104	10.004	9.953	10.204	-0.151	0.051	0.051	Fail

**ERROR CHART ( Inlet Pressure = 10 psig )**



**Instrument Specifications**

Meter's Calibrated Fluid:	Air	
Test Fluid:	Air	
Meter's Standard Pressure:	14.7	psia
Meter's Standard Temperature:	70	°F
Lower Range:	0	slpm
Upper Range:	10	slpm
Resolution:	0.001	
Rated Accuracy:	1.0	% of Full Scale

**Laboratory Ambient Conditions**

Pressure:	14.36	psia
Humidity:	53.47	%RH
Temperature:	70.05	°F



WWW.GRAFTEL.COM

FLOW - TEMPERATURE - HUMIDITY - PRESSURE - DESIGN - CONSULTING - ENGINEERING

**NIST Traceable Calibration Data Sheet**

95 Chancellor Dr., Roselle, IL 60172

Phone: 847-364-2600

Fax: 847-364-3899

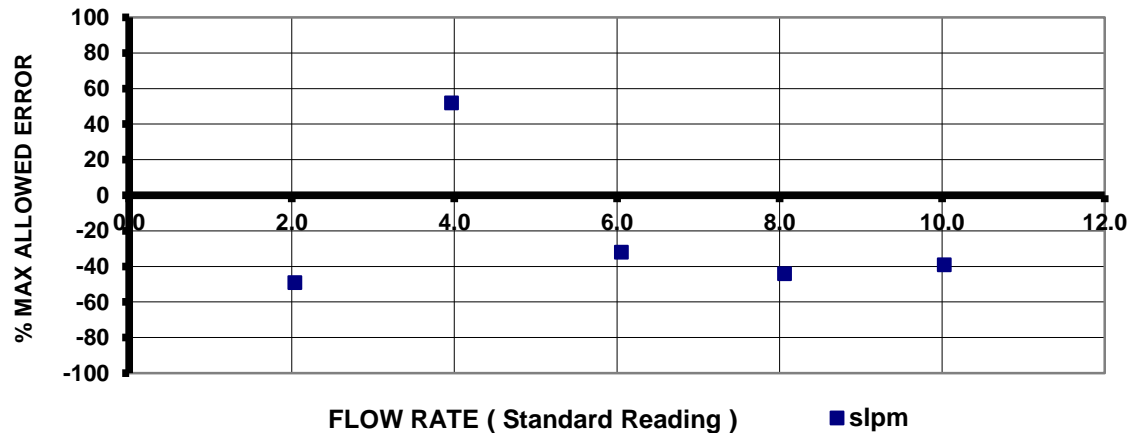
# ATTACHMENT TO CALIBRATION CERTIFICATE 92435

## AS LEFT DATA

Page 3 of 3

Reading From Standard, slpm	Lower Limit of Meter Reading, slpm	Measured Reading From Meter, slpm	Upper Limit of Meter Reading, slpm	Error, slpm	Measurement Uncertainty (k=2) slpm	CMC (k=2) slpm	STATUS
2.037	1.937	1.988	2.137	-0.049	0.010	0.010	Pass
3.964	3.864	4.016	4.064	0.052	0.020	0.020	Pass
6.053	5.953	6.021	6.153	-0.032	0.030	0.030	Pass
8.061	7.961	8.017	8.161	-0.044	0.040	0.040	Pass
10.026	9.926	9.987	10.126	-0.039	0.050	0.050	Pass

ERROR CHART ( Inlet Pressure = 10 psig )



Instrument Specifications		
Meter's Calibrated Fluid:	Air	
Test Fluid:	Air	
Meter's Standard Pressure:	14.7	psia
Meter's Standard Temperature:	70	°F
Lower Range:	0	slpm
Upper Range:	10	slpm
Resolution:	0.001	
Rated Accuracy:	1.0	% of Full Scale
Laboratory Ambient Conditions		
Pressure:	14.36	psia
Humidity:	53.61	%RH
Temperature:	70.05	°F



WWW.GRAFTEL.COM

FLOW - TEMPERATURE - HUMIDITY - PRESSURE - DESIGN - CONSULTING - ENGINEERING

**NIST Traceable Calibration Data Sheet**

95 Chancellor Dr., Roselle, IL 60172

Phone: 847-364-2600

Fax: 847-364-3899



# CAUTION ATTENTION

HOT - WHILE IN OPERATION. DO NOT TOUCH-KEEP CHILDREN, CLOTHING AND FURNISHINGS AWAY-CONTACT MAY CAUSE SKIN BURNS.SEE MANUAL FOR COMPLETE INSTRUCTIONS.  
CHAUD-DURANT LE FONCTIONNEMENT.NE PAS TOUCHER-TENIR LES ENFANTS.LES VÊTEMENTS ET LE MOBILIER À L'ÉCART-LE CONTACT PEUT PROVOQUER DES BRÛLURES CUTANÉES.VOIR LES INSTRUCTIONS COMPLÈTES DANS LE MANUEL.

MODEL,MODÈLE:HP221  
MANUFACTURER,FABRICANT:  
Ningbo Hongsheng Fireplace Co.,Ltd  
Certifié To. Certifié s pour  
ASTM E1509-2012(R2017) ULC S627-2021  
ASTM E2515-2017 ASTM E2779-2017, CSA B415.2010(R2020)

OPERATE THIS UNIT ONLY WITH THE FUEL HOPPER LID CLOSED - FAILURE TO DO SO MAY RESULT IN EMISSION OF PRODUCTS OF COMBUSTION FROM THE HOPPER UNDER CERTAIN CONDITIONS-MAINTAIN HOPPER SEAL IN GOOD CONDITION-DO NOT OVERFILL THE HOPPER.DO NOT REMOVE OR COVER THIS LABEL.

LISTED ROOM HEATERS  
FOR USE ONLY WITH PELLETTIZED WOOD.  
ROOM HEATER, PELLET FUEL-BURNING TYPE ALSO FOR USE IN MOBILE HOMES.  
WARNING: DO NOT INSTALL IN SLEEPING ROOM.

UNIT MUST BE PLACED ON A NON-COMBUSTIBLE FLOOR PROTECTOR EXTENDING 6" TO THE FRONT, 6" TO SIDES AND 3" TO REAR. EXHAUST TYPE LISTED TYPE L OR PL VENT INSTALLED TO VENT MANUFACTURER'S INSTRUCTIONS AND LOCAL BUILDING CODES. ELECTRICAL RATING: 115 VOLTS, 60 HERTZ.

INSTALL AND USE ONLY IN ACCORDANCE WITH SMG STOVES INSTALLATION AND OPERATING INSTRUCTIONS. CONTACT LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA.

DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE. REVIEW THE LOCAL BUILDING CODE AND MANUFACTURER'S INSTRUCTIONS FOR PRECAUTIONS REQUIRED FOR PASSING THROUGH A COMBUSTIBLE WALL OR CEILING.

KEEP VIEWING AND ASH REMOVAL DOORS TIGHTLY CLOSED DURING OPERATION. INSPECT AND CLEAN EXHAUST VENTING SYSTEM FREQUENTLY AND ACCORDING TO MANUFACTURER'S MANUAL.

INPUT RATING 0 TO 4.9 LBS PER HR. ROUTE POWER SUPPLY CORD AWAY FROM UNIT.  
CAUTION: MOVING PARTS MAY CAUSE INJURY-DO NOT OPERATE WITH LID OPEN.  
DANGER: RISK OF ELECTRICAL SHOCK- DISCONNECT POWER BEFORE SERVICING.

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.

U.S. ENVIRONMENTAL PROTECTION AGENCY CERTIFIED TO COMPLY WITH 2020 PARTICULATE EMISSION STANDARDS USING PELLET FUEL. PARTICULATE EMISSIONS: **1.01 g/h**  
REFER TO THE INTERTEK DIRECTORY OF BUILDING PRODUCTS (HTTPS://BPDIRECTORY.INTERTEK.COM) FOR DETAILED INFORMATION.

UTILISER CET APPAREIL UNIQUEMENT AVEC LE COUVERCLE DE TREMIE. À COMBUSTIBLE FERMÉ SOUS PEINE D'ÉMISSION DE PRODUITS DE COMBUSTION PAR LA TREMIE SOUS CERTAINES CONDITIONS-MAINTENIR LE JOINT DE LA TREMIE EN BON ÉTAT-NE PAS TROP REMPLIR LA TREMIE.NE PAS ENLEVER NI COUVRIR CETTE ÉTIQUETTE.  
APPAREILS DE CHAUFFAGE AUTONOMES HOMOLOGUÉS UTILISER UNIQUEMENT AVEC DU BOIS EN GRANULÉS.

APPAREIL DE CHAUFFAGE AUTONOME POUR COMBUSTIBLE EN GRANULÉS ÉGALEMENT UTILISABLE EN MAISON MOBILE.  
AVERTISSEMENT: NE PAS INSTALLER DANS UNE CHAMBRE À COUCHER.  
L'APPAREIL DOIT ÊTRE PLACÉ SUR UN PROTECTEUR DE PLANCHER NON COMBUSTIBLE DÉPASSANT DE 15 CM SUR L'AVANT, DE 15 CM SUR LES CÔTÉS ET DE 7,5 CM SER L'ARRIÈRE. TYPE D'ÉVACUATION: ÉVACUATION HOMOLOGUÉE DE TYPE L OU PL INSTALLÉE CONFORMÉMENT AUX INSTRUCTIONS DU FABRICANT ET AU CODE DU BÂTIMENT EN VIGUEUR. ALIMENTATION ÉLECTRIQUE: 115 VOLTS, 60 HERTZ.

INSTALLER ET UTILISER UNIQUEMENT EN CONFORMITÉ AVEC LES INSTRUCTIONS D'INSTALLATION ET D'UTILISATION DES POÊLES SMG COMMUNIQUÉES AVEC LE SERVICE DU BÂTIMENT OU D'INCENDIE LOCAL. CONCERNANT LES RESTRICTIONS ET LES INSPECTIONS D'INSTALLATION EN VIGUEUR.  
NE PAS RACCORDER CET APPAREIL À UN CONDUIT DE FUMÉE UTILISÉ POUR UN AUTRE APPAREIL. CONSULTER LE CODE DU BÂTIMENT EN VIGUEUR ET LES INSTRUCTIONS DU FABRICANT CONCERNANT LES MESURES DE PRÉCAUTION REQUISES POUR TRAVERSER UN MUR OU UN PALFOND COMBUSTIBLE.

GARDER LES PORTES D'OBSERVATION ET DE NÈVÈMENT DES CENDRES BIEN FERMÉES DURANT LA MARCHÉ. CONTRÔLER ET NETTOYER LE SYSTÈME D'ÉVACUATION FRÉQUEMMENT ET CONFORMÉMENT AU MANUEL DU FABRICANT. CONSOMMATION NOMINALE DE 0,23 kg/h. FAIRE PASSER LE CORDON ÉLECTRIQUE À L'ÉCART DE L'APPAREIL.

ATTENTION: LES PIÈCES EN MOUVEMENT PEUVENT PROVOQUER DES BLESSURES. NE PAS UTILISER AVEC LE COUVERCLE OUVERT.  
DANGER: RISQUE DE CHOC ÉLECTRIQUE- DÉBRANCHEZ L'ALIMENTATION ÉLECTRIQUE AVANT TOUT ENTRETIEN.

CE POÊLE À BOIS DOIT ÊTRE INSPECTÉ PÉRIODIQUEMENT ET LA RÉPARATION POUR UN FONCTIONNEMENT CORRECT. CONSULTEZ LE MANUEL DU PROPRIÉTAIRE POUR PLUS D'INFORMATIONS. IL EST CONTRE LES RÉGLEMENTS FÉDÉRAUX POUR FAIRE FONCTIONNER CE POÊLE À BOIS D'UNE MANIÈRE INCOMPATIBLE AVEC LES INSTRUCTIONS D'UTILISATION DANS LE MANUEL DU PROPRIÉTAIRE.  
U.S. ENVIRONMENTAL PROTECTION AGENCY CERTIFIÉ CONFORME AUX NORMES 2020 D'ÉMISSION DE PARTICULES À L'AIDE DE PASTILLES DE COMBUSTIBLE. LES ÉMISSIONS DE PARTICULES: **1.01 g/h**.

REPORTEZ-VOUS AU REPERTOIRE DES PRODUITS DE CONSTRUCTION D'INTERTEK (HTTPS://BPDIRECTORY.INTERTEK.COM) POUR OBTENIR DES INFORMATIONS DÉTAILLÉES.

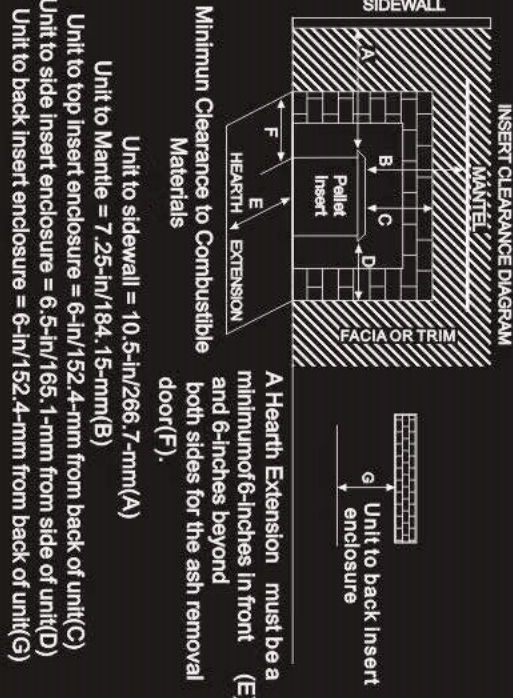


TESTED AND LISTED BY: TESTE ET HOMOLOGUE PAR:



Intertek  
WN#22060

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS  
DÉGAGEMENTS MINIMUM JUSQU' AUX MATÉRIAUX COMBUSTIBLES  
MOBILE HOME OR RESIDENTIAL INSTALLATION  
INSTALLATION EN MAISON MOBILE OU RESIDENTIELLE



SMG Hearth and Home LLC  
9241 Globe Center Drive Suite  
120 Morrisville, NC 27560  
DATE OF MANUFACTURE  
DATE DE FABRICATION

6" MINIMUM FLOOR PROTECTION REQUIREMENTS.  
PROTECTION DE PLANCHER MINIMALE REQUISE 15 CM, REQUISITOS



# CAUTION ATTENTION

HOT - WHILE IN OPERATION. DO NOT TOUCH-KEEP CHILDREN, CLOTHING AND FURNISHINGS AWAY-CONTACT MAY CAUSE SKIN BURNS.SEE MANUAL FOR COMPLETE INSTRUCTIONS.  
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MODEL,MODÈLE :HP22N  
MANUFACTURER,FABRICANT:  
Ningbo Hongsheng Fireplace Co.,Ltd  
Certifié To.Certifié s pour  
ASTM E1509-2012(R2017) ULC S627-2021  
ASTM E2515-2017 ASTM E2779-2017, CSA B415.2010(R2020)

OPERATE THIS UNIT ONLY WITH THE FUEL HOPPER LID CLOSED - FAILURE TO DO SO MAY RESULT IN EMISSION OF PRODUCTS OF COMBUSTION FROM THE HOPPER UNDER CERTAIN CONDITIONS-MAINTAIN HOPPER SEAL IN GOOD CONDITION-DO NOT OVERFILL THE HOPPER.DO NOT REMOVE OR COVER THIS LABEL.

LISTED ROOM HEATERS  
FOR USE ONLY WITH PELLETIZED WOOD.  
ROOM HEATER, PELLET FUEL-BURNING TYPE ALSO FOR USE IN MOBILE HOMES.  
WARNING: DO NOT INSTALL IN SLEEPING ROOM.

UNIT MUST BE PLACED ON A NON-COMBUSTIBLE FLOOR PROTECTOR EXTENDING 6" TO THE FRONT, 6" TO SIDES AND 3" TO REAR. EXHAUST TYPE LISTED TYPE L OR PL VENT INSTALLED TO VENT MANUFACTURER'S INSTRUCTIONS AND LOCAL BUILDING CODES. ELECTRICAL RATING: 115 VOLTS, 60 HERTZ.

INSTALL AND USE ONLY IN ACCORDANCE WITH SMG STOVES INSTALLATION AND OPERATING INSTRUCTIONS. CONTACT LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA.

DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE. REVIEW THE LOCAL BUILDING CODE AND MANUFACTURER'S INSTRUCTIONS FOR PRECAUTIONS REQUIRED FOR PASSING THROUGH A COMBUSTIBLE WALL OR CEILING.

KEEP VIEWING AND ASH REMOVAL DOORS TIGHTLY CLOSED DURING OPERATION. INSPECT AND CLEAN EXHAUST VENTING SYSTEM FREQUENTLY AND ACCORDING TO MANUFACTURER'S MANUAL.

INPUT RATING 0 TO 4.9 LBS PER HR. ROUTE POWER SUPPLY CORD AWAY FROM UNIT.  
CAUTION: MOVING PARTS MAY CAUSE INJURY-DO NOT OPERATE WITH LID OPEN.  
DANGER: RISK OF ELECTRICAL SHOCK- DISCONNECT POWER BEFORE SERVICING.

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GARDER LES PORTES D'OBSERVATION ET D'ENLÈVEMENT DES CENDRES BIEN FERMÉES DURANT LA MARCHÉ. CONTRÔLER ET NETTOYER LE SYSTÈME D'ÉVACUATION FRÉQUEMMENT ET CONFORMÉMENT AU MANUEL DU FABRICANT. CONSOMMATION NOMINALE DE 0 à 2.3 kg/h. FAIRE PASSER LE CORDON ÉLECTRIQUE À L'ÉCART DE L'APPAREIL.

ATTENTION: LES PIÈCES EN MOUVEMENT PEUVENT PROVOQUER DES BLESSURES. NE PAS UTILISER AVEC LE COUVERCLE OUVERT.  
DANGER: RISQUE DE CHOC ÉLECTRIQUE- DÉBRANCHEZ L'ALIMENTATION ÉLECTRIQUE AVANT TOUT ENTRETIEN.

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U.S. ENVIRONMENTAL PROTECTION AGENCY CERTIFIÉ CONFORME AUX NORMES 2020 D'ÉMISSION DE PARTICULES À L'AIDE DE PASTILLES DE COMBUSTIBLE. LES ÉMISSIONS DE PARTICULES: **1.01 G/H**.

REPORTEZ-VOUS AU REPERTOIRE DES PRODUITS DE CONSTRUCTION D'INTERTEK (HTTPS://BPDIRECTORY.INTERTEK.COM) POUR OBTENIR DES INFORMATIONS DÉTAILLÉES.



TESTED AND LISTED BY: TESTE ET HOMOLOGUE PAR:

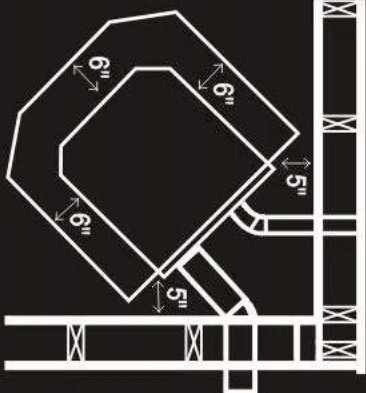
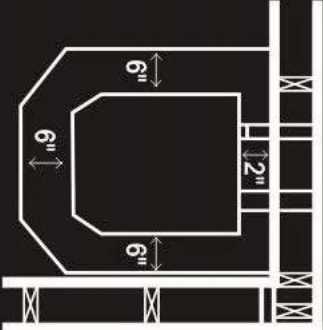


Intertek  
WN#22062

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS  
DÉGAGEMENTS MINIMUM JUSQU' AUX MATÉRIAUX COMBUSTIBLES

MOBILE HOME OR RESIDENTIAL INSTALLATION EN MAISON MOBILE OU RESIDENTIELLE

SIDE WALL TO STOVE BACKWALL TO STOVE	7" STOVE CORNER TO 2" DIAGONAL WALL	5"
MUR LATÉRAL À POÊLE MUR ARRIÈRE À POÊLE	17.8 CM COIN DU POÊLE À MUR DIAGONAL	12.7 CM
	5.1 CM	



SMG Hearth and Home LLC  
9241 Globe Center Drive Suite  
120 Morrisville, NC 27560  
DATE OF MANUFACTURE  
DATE DE FABRICATION

6" MINIMUM FLOOR PROTECTION REQUIREMENTS.  
PROTECTION DE PLANCHER MINIMALE REQUISE 15 CM, REQUISITOS



CAUTION  
ATTENTION

HOT - WHILE IN OPERATION. DO NOT TOUCH - KEEP CHILDREN, CLOTHING AND FURNISHINGS AWAY - CONTACT MAY CAUSE SKIN BURNS. SEE MANUAL FOR COMPLETE INSTRUCTIONS.  
CHAUD - DURANT LE FONCTIONNEMENT, NE PAS TOUCHER - TENIR LES ENFANTS, LES VÊTEMENTS ET LE MOBILIER À L'ÉCART - LE CONTACT PEUT PROVOQUER DES BRÛLURES CUTANÉES. VOIR LES INSTRUCTIONS COMPLÈTES DANS LE MANUEL.

MODEL, MODÈLE: HP22  
MANUFACTURER, FABRICANT:  
Ningbo Hongsheng Fireplace Co., Ltd  
Certified To, Certifié é s pour  
ASTM E1509-2012 (R2017), ULC S627-2021,  
ASTM E2515-2017, ASTM E2779-2017, CSA B415.2010 (R2020)

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FOR USE ONLY WITH PELLETTIZED WOOD.  
ROOM HEATER, PELETT FUEL-BURNING TYPE ALSO FOR USE IN MOBILE HOMES.  
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UNIT MUST BE PLACED ON A NON-COMBUSTIBLE FLOOR PROTECTOR EXTENDING 6" TO THE FRONT, 6" TO SIDES AND 3" TO REAR. EXHAUST TYPE: LISTED TYPE L OR PL VENT INSTALLED TO VENT MANUFACTURER'S INSTRUCTIONS AND LOCAL BUILDING CODES. ELECTRICAL RATING: 115 VOLTS, 60 HERTZ.

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INPUT RATING: 0 TO 6.4 LBS PER HR. ROUTE POWER SUPPLY CORD AWAY FROM UNIT.  
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APPAREIL DE CHAUFFAGE AUTONOME, POUR COMBUSTIBLE EN GRANULES ÉGALEMENT UTILISABLE EN MAISON MOBILE.  
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GARDER LES PORTES D'OBSERVATION ET D'ENLÈVEMENT DES CENDRES BIEN FERMÉES DURANT LA MARCHÉ. CONTRÔLER ET NETTOYER LE SYSTÈME D'ÉVACUATION FRÉQUEMMENT ET CONFORMÉMENT AU MANUEL DU FABRICANT. CONSOMMATION NOMINALE DE 0 à 2,86 kg/h. FAIRE PASSER LE CORDON ÉLECTRIQUE À L'ÉCART DE L'APPAREIL.  
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REPORTEZ-VOUS AU REPERTOIRE DES PRODUITS DE CONSTRUCTION D'INTERTEK (HTTPS://BPDIRECTORY.INTERTEK.COM) POUR OBTENIR DES INFORMATIONS DÉTAILLÉES.



TESTED AND LISTED BY: TESTE ET HOMOLOGUE PAR:



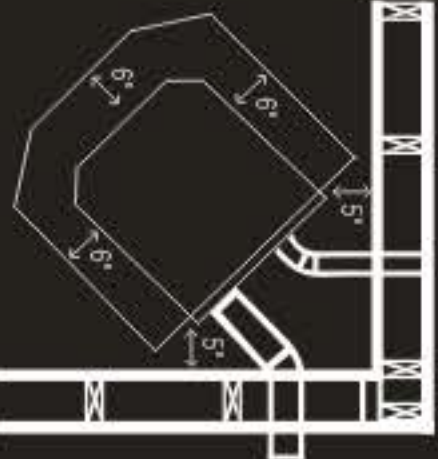
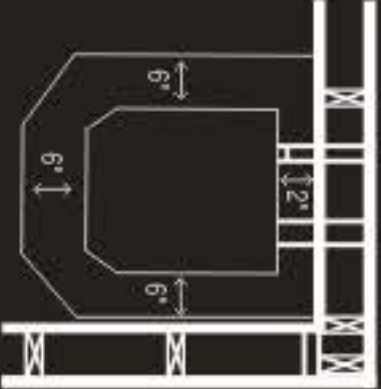
Intertek  
WN # 22061

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS  
DÉGAGEMENTS MINIMUM JUSQU'ÀUX MATÉRIAUX COMBUSTIBLES

MOBILE HOME OR RESIDENTIAL INSTALL  
INSTALLATION EN MAISON MOBILE OU RÉSIDENTIELLE

SIDEWALL TO STOVE 6" STOVE CORNER TO BACKWALL TO STOVE 2" DIAGONAL WALL 5"

MUR LATÉRAL À POÊLE 15.2 CM COIN DU POÊLE À MUR ARRIÈRE À POÊLE 5.1 CM MUR DIAGONAL 12.7 CM



SMG Hearth and Home LLC  
9241 Globe Center Drive Suite  
120 Morrisville, NC 27560

DATE OF MANUFACTURE  
DATE DE FABRICATION

6" MINIMUM FLOOR PROTECTION REQUIREMENTS.  
PROTECTION DE PLANCHER MINIMALE REQUISE 15 CM, REQUISITOS



# Fox Valley Metrology

3114 Medalist Drive

Oshkosh, WI 54902


(920) 426-5894 • Fax (920) 426-8120

http://www.FoxValleyMetrology.com

## CERTIFICATE OF CALIBRATION



Certificate No. ACT-1272

<b>CERTIFICATION NUMBER</b> CL106-36819-548  <b>FOR</b> Intertek 8431 Murphy Drive Middleton, WI 53562  <b>PURCHASE ORDER #</b> <b>TEST INSTRUMENT</b> Data Acquisition  <b>MAKE</b> Omega <b>MODEL</b> OMB-DAQ-56 (Intertek) <b>SERIAL NUMBER</b> N/A <b>IDENTIFICATION</b> 986   <b>CUSTOMER LOCATION</b> Hearth  <b>CONDITION RECEIVED</b> In Tolerance <b>CONDITION RETURNED</b> In Tolerance <b>CALIBRATED BY</b> Brandon Covington  <b>CALIBRATION LOCATION</b> FVM <b>ENVIRONMENT</b> 67.0°F, 19.4°C, 30.0%RH <b>CALIBRATION DATE</b> 04/16/2021 <b>RECALIBRATION DUE</b> 10/16/2021		<b>PROCEDURES FOLLOWED</b> FVE-006 rev. 2 FVE-011 rev. 2  <b>STANDARDS USED</b> <table border="1"> <thead> <tr> <th>INSTRUMENT</th> <th>SERIAL NUMBER</th> <th>TRACE NUMBER</th> <th>NEXT CAL</th> </tr> </thead> <tbody> <tr> <td>FVS-687</td> <td>4029719</td> <td>CK139-45952-397</td> <td>05/31/2021</td> </tr> <tr> <td>FVS-707</td> <td>N/A</td> <td>CK301-35851-397</td> <td>10/31/2021</td> </tr> </tbody> </table>  Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of (k=2). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.  The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NC SL Z540-1-1994 and ANSI/NC SL Z540.3-2006. Other standards listed upon request.	INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL	FVS-687	4029719	CK139-45952-397	05/31/2021	FVS-707	N/A	CK301-35851-397	10/31/2021
INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL											
FVS-687	4029719	CK139-45952-397	05/31/2021											
FVS-707	N/A	CK301-35851-397	10/31/2021											

## CALIBRATION RESULTS

\* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
TEMPERATURE INPUT	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)
K -Type						
CH1	1000.0	998.2	1001.8	999.8	999.8	0.6
CH2	1000.0	998.2	1001.8	1000.3	1000.3	0.7
CH3	1000.0	998.2	1001.8	1000.3	1000.3	0.6
CH4	1000.0	998.2	1001.8	998.7	998.7	0.6
CH5	1000.0	998.2	1001.8	999.9	999.9	0.6
CH6	1000.0	998.2	1001.8	999.3	999.3	0.6
CH7	1000.0	998.2	1001.8	999.7	999.7	0.7
CH8	1000.0	998.2	1001.8	999.8	999.8	0.7
CH9	1000.0	998.2	1001.8	999.7	999.7	0.7
CH11(#1 on right side of box)	5.0000	4.9989	5.0012	5.0004	5.0004	0.0006

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CALIBRATION**

ISO/IEC 17025

CALIBRATION AND TESTING  
LABORATORY

Certificate No. ACT-1272

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
	10.0000	9.9977	10.0023	10.0003	10.0003	0.0007
CH12	1000.0	998.2	1001.8	1000.1	1000.1	0.7
CH13	1000.0	998.2	1001.8	999.6	999.6	0.6
CH14	1000.0	998.2	1001.8	999.6	999.6	0.6
CH15	1000.0	998.2	1001.8	999.7	999.7	0.6
CH16	1000.0	998.2	1001.8	999.8	999.8	0.7
CH17	1000.0	998.2	1001.8	999.5	999.5	0.6
CH18	1000.0	998.2	1001.8	999.3	999.3	0.7
CH19	1000.0	998.2	1001.8	999.4	999.4	0.7
CH20	1000.0	998.2	1001.8	999.2	999.2	0.6
	(VDC)	(VDC)	(VDC)	(VDC)	(VDC)	(VDC)
CH21	5.0000	4.9989	5.0012	5.0006	5.0006	0.0007
	10.0000	9.9977	10.0023	10.0007	10.0007	0.0007
CH22	5.0000	4.9989	5.0012	5.0006	5.0006	0.0006
	10.0000	9.9977	10.0023	10.0007	10.0007	0.0007
CH23	5.0000	4.9989	5.0012	5.0006	5.0006	0.0007
	10.0000	9.9977	10.0023	10.0006	10.0006	0.0006
CH24	5.0000	4.9989	5.0012	5.0006	5.0006	0.0007
	10.0000	9.9977	10.0023	10.0006	10.0006	0.0006

**COMMENTS**

Channel 11 is actually number 1 on the right side of junction block. Channel 11 is also wired backwards.

# Fox Valley Metrology

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## CERTIFICATE OF CALIBRATION



ISO/IEC 17025  
CALIBRATION AND TESTING  
LABORATORY

Certificate No. ACT-1272

<b>CERTIFICATION NUMBER</b>	CL284-37923-679	<b>IDENTIFICATION</b>	713
<b>FOR</b>	Intertek 8431 Murphy Drive Middleton, WI 53562	<b>SERIAL NUMBER</b>	B258010639
<b>TEST INSTRUMENT</b>	Scales Analytical Balance	<b>PURCHASE ORDER #</b>	
<b>MAKE</b>	Ohaus	<b>PROCEDURES FOLLOWED</b>	FVE-020 rev. 2
<b>MODEL</b>	Explorer E12140	<b>STANDARDS USED</b>	
<b>CUSTOMER LOCATION</b>		<b>INSTRUMENT</b>	<b>SERIAL NUMBER</b>
		FVS-019J	4MMU
		FVS-469	N/A
		<b>TRACE NUMBER</b>	<b>NEXT CAL</b>
		CK119-54752-522	04/30/2022
		CL084-50197-397	03/31/2022
<b>CONDITION RECEIVED</b>	<b>Out Of Tolerance</b>		
<b>CONDITION RETURNED</b>	In Tolerance		
<b>CALIBRATED BY</b>	Danny Scherr		
<b>CALIBRATION LOCATION</b>	On Site		
<b>ENVIRONMENT</b>	70.0°F, 21.1°C, 53.0%RH		
<b>CALIBRATION DATE</b>	10/11/2021		
<b>RECALIBRATION DUE</b>	04/11/2022		

## CALIBRATION RESULTS

\* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
Increasing Load	(g)	(g)	(g)	(g)	(g)	(g)
	0.0000	-0.0002	0.0002	0.0000	0.0000	0.00007
	5.0000	4.9998	5.0002	5.0000	5.0000	0.00007
	10.0000	9.9998	10.0002	10.0000	10.0000	0.00006
	20.0000	19.9996	20.0004	19.9996	20.0000	0.00006
	50.0000	49.9994	50.0006	49.9976*	50.0000	0.00007
	100.0000	99.9994	100.0006	99.9960*	99.9999	0.00007
	200.0000	199.9994	200.0006	199.9928*	200.0000	0.00006
	210.0000	209.9994	210.0006	209.9926*	210.0000	0.00006
Decreasing Load	(g)	(g)	(g)	(g)	(g)	(g)
	40.0000	39.9996	40.0004	39.9979*	40.0000	0.00006
	10.0000	9.9998	10.0002	9.9998	10.0000	0.00006
Shift Test	(g)	(g)	(g)	(g)	(g)	(g)
Front	70.0000	69.9994	70.0006	69.9973*	70.0000	0.00007
Left	70.0000	69.9994	70.0006	69.9975*	69.9999	0.00006
Right	70.0000	69.9994	70.0006	69.9974*	69.9999	0.00006
Back	70.0000	69.9994	70.0006	69.9972*	69.9999	0.00006

## ADJUSTMENT NOTES

int cal done to bring in to tolernace

## COMMENTS

Scale Capacity = 210 g; Precision = .0002 g; Class = I; Total Divisions = 1050000

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## CERTIFICATE OF CALIBRATION



ISO/IEC 17025

CALIBRATION AND TESTING  
LABORATORY

Certificate No. ACT-1272

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• This certificate shall not be altered in any form or reproduced, except in full, without prior written approval from originating lab. These results relate only to the item(s) calibrated. Form Revision 8: 08/19/2021

• Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of ( $k=2$ ). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.

• The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006. Other standards listed upon request.

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# Fox Valley Metrology

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Oshkosh, WI 54902

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## CERTIFICATE OF CALIBRATION



Certificate No. ACT-1272

**CERTIFICATION NUMBER** CL095-41671-502

**FOR** Intertek  
8431 Murphy Drive  
Middleton, WI 53562

**PURCHASE ORDER #**

**TEST INSTRUMENT** Timer

**MAKE** Cole-Parmer

**MODEL** 94440-10

**SERIAL NUMBER** N/A

**IDENTIFICATION** 646



**CUSTOMER LOCATION** Hearth

**CONDITION RECEIVED** In Tolerance

**CONDITION RETURNED** In Tolerance

**CALIBRATED BY** Christopher Moore

**CALIBRATION LOCATION** On Site

**ENVIRONMENT** 72.0°F, 22.2°C, 21.0%RH

**CALIBRATION DATE** 04/05/2021

**RECALIBRATION DUE** 04/05/2022

### PROCEDURES FOLLOWED

FVE-033 rev. 1

This certificate shall not be altered in any form or reproduced, except in full, without prior written approval from originating lab. These results relate only to the item(s) calibrated.

Form Revision 7: 07/14/2020

### STANDARDS USED

INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL
FVS-553	N/A	CL022-19908-397	01/31/2022
FVS-811B	N/A	CK281-24359-397	10/31/2021

Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of (k=2). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.

The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006. Other standards listed upon request.

## CALIBRATION RESULTS

\* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
Timer	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
	60.0	59.5	60.5	60.0	60.0	0.06
	60.0	59.5	60.5	60.1	60.1	0.07
	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
	300.0	299.5	300.5	300.1	300.1	0.06
	300.0	299.5	300.5	300.0	300.0	0.07
	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
	1800.0	1799.5	1800.5	1800.2	1800.2	0.06
	1800.0	1799.5	1800.5	1800.1	1800.1	0.07



# CERTIFICATE OF NIST TRACEABLE CALIBRATION

## Calibration Certificate No: 90275

### Customer Information

Customer: Intertek  
Address : 8431 Murphy Drive  
Middleton WI 53562



Customer PO #: Verbal - Christine Schultze

### Calibration Procedure Information

Procedure ID: GTP AIRVEL

Revision #: 7

Revision Date: 10/17/2018

### Calibration Standards Information

<u>Graftel ID</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Description</u>	<u>CAL Due</u>
10086	Furness Controls	FC0332	DP Transmitter	5/7/2022
10100	Graftel	n/a	Temperature	10/18/2022
10171	Furness	FC0332-2W	0 - .4" H2O	5/7/2022
10187	Vaisala	PTB210	Barometric Pressure Gauge	12/1/2021
10157	HOBO	UX100-011	RH/Temp logger	10/15/2021
10017	Hart Scientific/Burns	1502A/3925	PRT, Temperature	8/3/2021

### Sensor Information

Manufacturer: Lutron      Description: Anemometer      Method Used: Pitot Tube  
Model #: LM-81AM      Rated Accuracy:  $\pm$       See Attachment      Accuracy Specified By: Lutron  
Instrument ID#: 001457      Range: 80 to 5910 fpm      Condition: Functional  
Serial #: AB.50584

Comments: Calibration Date: 05/14/2021  
Calibration Due: 05/14/2022

*The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). The reported calibration uncertainty has a confidence level of 95% ( $k=2$ ). A calibration uncertainty ratio of 4:1 was maintained unless required uncertainty is supported by analysis. Graftel Quality Assurance System complies with applicable requirements of ISO/IEC-17025-2017, ANSI/NCSL Z540-I-1994 and ISO 9001. All results contained within this certificate relate only to item(s) calibrated. This certificate shall not be reproduced except in full and with the written consent of Graftel. Acceptance Criteria per Simple Acceptance Rule: Measurement Uncertainty is not applied to the measured value when in/out of tolerance statement is made.*

Performed By:

Kevin Garcia  
Calibration Technician

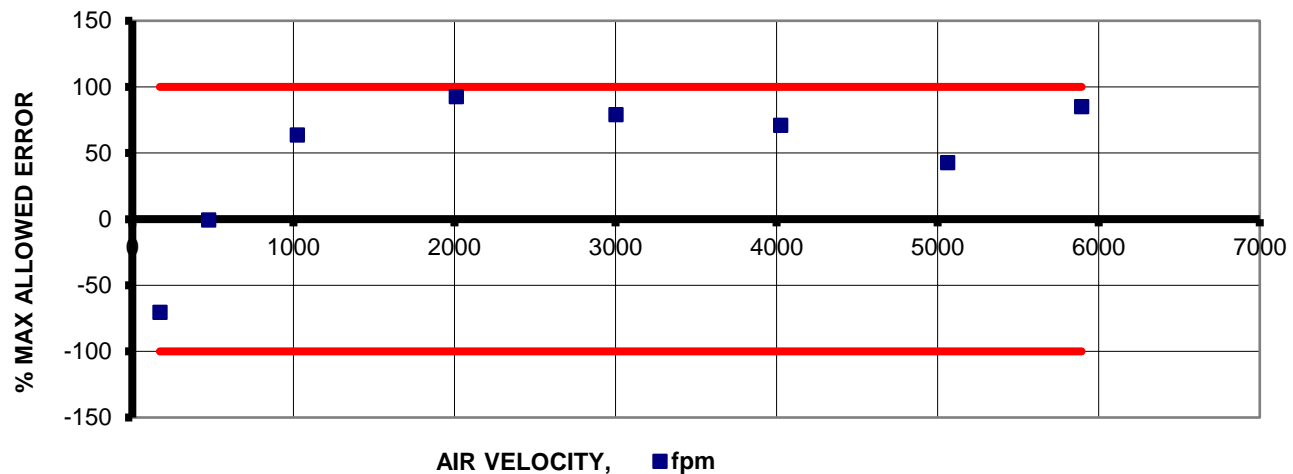
Date: 5/14/2021



**ATTACHMENT TO CALIBRATION CERTIFICATE 90275**  
**AS FOUND / AS LEFT DATA**  
**Page 2 of 2**

Reading From Standard,	Lower Limit of Meter Reading,	Measured Reading From Meter,	Upper Limit of Meter Reading,	Error,	Measurement Uncertainty (k=2)	CMC (k=2)	STATUS
Actual Air Velocity							
fpm	fpm	fpm	fpm	fpm	fpm	fpm	STATUS
171	-6	46	348	-125	4	4	Pass
473	296	472	650	-1	8	8	Pass
1025	848	1138	1202	113	15	15	Pass
2011	1834	2175	2188	164	28	28	Pass
3002	2825	3142	3179	140	41	41	Pass
4025	3789	4193	4261	168	54	54	Pass
5062	4826	5163	5298	101	68	68	Pass
5894	5658	6095	6130	201	79	79	Pass

**ERROR CHART**



**Instrument Specifications**

Test Fluid:	Air	
Lower Velocity Range:	80	fpm
Upper Velocity Range:	5910	fpm
Velocity Resolution:	1	
Velocity Accuracy:	+/- (3%FS <=3937) (4%FS >3937)	

**Laboratory Ambient Conditions**

Pressure:	14.46	psia
Humidity:	22.60	%RH
Temperature:	75.90	°F



WWW.GRAFTEL.COM

FLOW - TEMPERATURE - HUMIDITY - PRESSURE - DESIGN - CONSULTING - ENGINEERING

**NIST Traceable Calibration Data Sheet**

95 Chancellor Dr., Roselle, IL 60172

Phone: 847-364-2600

Fax: 847-364-3899

**Fox Valley Metrology**

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<http://www.FoxValleyMetrology.com>**CERTIFICATE OF  
CALIBRATION**

Certificate No. ACT-1272

**CERTIFICATION NUMBER** CL194-30656-679**FOR** Intertek  
8431 Murphy Drive  
Middleton, WI 53562**PURCHASE ORDER #****TEST INSTRUMENT** Pressure Transducer  
Differential Pressure Transducer**MAKE** Omega**MODEL** PX263-01D5V (Intertek)**SERIAL NUMBER** X15160229**IDENTIFICATION** 1406 **CUSTOMER LOCATION****CONDITION RECEIVED** In Tolerance**CONDITION RETURNED** In Tolerance**CALIBRATED BY** Danny Scherr**CALIBRATION LOCATION** On Site**ENVIRONMENT** 70.0°F, 21.1°C, 48.0%RH**CALIBRATION DATE** 07/13/2021**RECALIBRATION DUE** 01/13/2022**PROCEDURES FOLLOWED**

FVE-060 rev. 0

This certificate shall not be altered in any form or reproduced, except in full, without prior written approval from originating lab. These results relate only to the item(s) calibrated.

Form Revision 7: 07/14/2020

**STANDARDS USED**

INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL
FVS-469	N/A	CL084-50197-397	03/31/2022
FVS-789	7543203	CL138-51841-614	05/31/2022
FVS-789A	7461971	CL138-52996-466	05/31/2022

Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of (k=2). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.

The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NC SL Z540-1-1994 and ANSI/NC SL Z540.3-2006. Other standards listed upon request.

**CALIBRATION RESULTS**

\* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
Pressure/Vacuum	(inH20)	(inH20)	(inH20)	(inH20)	(inH20)	(inH20)
Low	-0.0000	-0.0025	0.0025	0.0002	0.0002	0.7
Vacuum	-0.0500	-0.0525	-0.0475	-0.0501	-0.0501	0.7
	-0.1000	-0.1025	-0.0975	-0.1003	-0.1003	0.7
	-0.5000	-0.5025	-0.4975	-0.4998	-0.4998	0.6
	-1.0000	-1.0025	-0.9975	-0.9989	-0.9989	0.7
High	0.0000	-0.0025	0.0025	0.0002	0.0002	0.6
pressure	0.0500	0.0475	0.0525	0.0500	0.0500	0.7
	0.1000	0.0975	0.1025	0.0996	0.0996	0.6
	0.5000	0.4975	0.5025	0.4999	0.4999	0.6
	1.0000	0.9975	1.0025	0.9990	0.9990	0.7



## Certificate of Calibration

**Customer:** Intertek Testing Services  
**Address:** 8431 Murphy Drive  
**City, State Zip:** Middleton, WISCONSIN 53562

**Certificate ID:** 1134210610\_286292  
**ISO Number:** ISO/IEC 17025 82374  
**Date:** 10/6/2021

**Indicator Mfg.**  
Rice Lake  
**Indicator Model**  
520  
**Indicator Serial**  
1494600044  
**Test Interval**  
6 Months

**Base Mfg.**  
Rice Lake  
**Base Model**  
4x4 HP-1K  
**Base Serial**  
C42769

**Cal Date**  
10/6/2021  
**Due Date**  
4/6/2022  
**Procedure**  
QWI 6.4.2

**Scale ID**  
1134  
**Scale Class**  
III  
**Scale Status**  
In Service

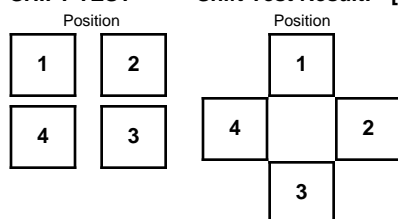
**Scale Location**  
Hearth  
**Scale Range**  
0 - 1000 lb x 0.1 lb

### EQUIPMENT CONDITIONS

[Working] Non-Working [Clean] Dirty Out Of Level

### SHIFT TEST

Shift Test Result: [Pass] Fail Adjust Not Applicable



All tolerances calculated in conformance with Handbook 44 Table 6.

### LOAD TEST

Preliminary Load Test		
Test Wt.	Reading	Error
0.0 lb	0.0 lb	0.0 lb
100.0 lb	100.0 lb	0.0 lb
250.0 lb	250.0 lb	0.0 lb
500.0 lb	500.0 lb	0.0 lb
1000.0 lb	1000.0 lb	0.0 lb

In maintenance tolerance? [Yes] No N/A

Final Load Test		
Test Wt.	Reading	Error
0.0 lb	0.0 lb	0.0 lb
100.0 lb	100.0 lb	0.0 lb
250.0 lb	250.0 lb	0.0 lb
500.0 lb	500.0 lb	0.0 lb
1000.0 lb	1000.0 lb	0.0 lb

In acceptance tolerance? [Yes] No N/A

### TEST INFORMATION

**Test Weight Classification:**

**Traceability Certificate Number(s):**

**Standards Used:**

**Expanded Uncertainty:**

**Test Location:**

**Overall Result:**

**Was the scale within customers required accuracy?**

**Environmental Conditions:**

**Temperature:**

**Humidity:**

**Comments / Notes:**

**Technician:**

F

W20-004A Cal Date: 1/6/2020 Recal Date: 1/6/2022, W20-004B Cal Date: 1/6/2020  
Recal Date: 1/6/2022

1000 lb #81; 50 lb #81, 82, 83, 84, 85, 86, 87, 88, 89, 90

See Comments

[Onsite] Offsite

[Pass] Fail Adjust

[Yes] No N/A

[Acceptable] Unacceptable

71°F

46%

Scale is accurate and correct. Measurement of Uncertainty: 100 lbs.= .0118 lb./ 250  
lbs.= .0295 lb./ 500 lbs.= .059 lb./ 1000 lbs.= .118 lb.

Mark Baker

Scales were calibrated with certified test weights. Adjustments made to restore and/or maintain the accuracy of the scale conform to the tolerances established by the National Institute of Standards and Technology as specified in Handbook 44 Section 2.20, manufacturers specifications or other written agreement with customer. Best measurement of uncertainty calculated using a coverage factor of K=2. This provides confidence level of 95%. Acceptance rule w=0. Overall result of PASS or ADJUST indicates measurement below or equal to the acceptance limit: AL=TL. Overall result of FAIL indicates measurement result above acceptance limit AL=TL. This certificate shall not be reproduced, except in full, without the written approval of the laboratory. Measurement uncertainty available upon request. This calibration test is accredited and meets the requirements of ISO/IEC 17025:2017 & ANSI/NCSL Z540-1-1994 as verified by Perry Johnson Laboratory Accreditation. Refer to certificate and scope of accreditation 82374.

# Fox Valley Metrology

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Oshkosh, WI 54902

(920) 426-5894 • Fax (920) 426-8120

<http://www.FoxValleyMetrology.com>

## CERTIFICATE OF CALIBRATION



Certificate No. ACT-1272

**CERTIFICATION NUMBER** CL095-41794-502

**FOR** Intertek  
8431 Murphy Drive  
Middleton, WI 53562

**PURCHASE ORDER #**

**TEST INSTRUMENT** Timer

**MAKE** Cole-Parmer

**MODEL** 94440-10

**SERIAL NUMBER** 101587800

**IDENTIFICATION** 1212



**CUSTOMER LOCATION** Hearth

**CONDITION RECEIVED** In Tolerance

**CONDITION RETURNED** In Tolerance

**CALIBRATED BY** Christopher Moore

**CALIBRATION LOCATION** On Site

**ENVIRONMENT** 72.0°F, 22.2°C, 21.0%RH

**CALIBRATION DATE** 04/05/2021

**RECALIBRATION DUE** 04/05/2022

### PROCEDURES FOLLOWED

FVE-033 rev. 1

This certificate shall not be altered in any form or reproduced, except in full, without prior written approval from originating lab. These results relate only to the item(s) calibrated.  
Form Revision 7: 07/14/2020

### STANDARDS USED

INSTRUMENT	SERIAL NUMBER	TRACE NUMBER	NEXT CAL
FVS-553	N/A	CL022-19908-397	01/31/2022
FVS-811B	N/A	CK281-24359-397	10/31/2021

Total expanded measurement uncertainties expressed are based on a confidence level of 95%; coverage factor of (k=2). The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration. The customer shall assess the results and uncertainty when determining if the results meet their needs. (This is considered "shared responsibility.") Uncertainties expressed in nominal units.

The calibrations within the certificate/report are traceable through NIST or another National Metrology Institute to the International System of Units (SI). Calibration was completed in accordance with ISO/IEC 17025:2017, ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006. Other standards listed upon request.

## CALIBRATION RESULTS

\* DENOTES "OUT OF TOLERANCE"

FEATURE	NOMINAL	LOWER LIMIT	UPPER LIMIT	AS FOUND	AS LEFT	UNCERTAINTY
Timer	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
	60.0	59.5	60.5	60.0	60.0	0.06
	60.0	59.5	60.5	59.9	59.9	0.07
	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
	300.0	299.5	300.5	300.0	300.0	0.06
	300.0	299.5	300.5	300.0	300.0	0.06
	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
	1800.0	1799.5	1800.5	1800.0	1800.0	0.07
	1800.0	1799.5	1800.5	1799.9	1799.9	0.06

This Excel spreadsheet calculates solid fuel appliance efficiency and heat output in accordance with the procedure specified in CSA B415.1-09. In general the column headings correspond to the variables used in the Standard.

All data from a test run are entered on the "Data" sheet. The cells requiring data entry are highlighted. Please note that input data can be entered in either yard/pound or SI units. Select the units in cells F4 and F5 of the "Data" sheet.

Particulate emissions determined using the dilution tunnel method should be entered in cell C13 of the "Data" sheet as total grams of emissions.

Since oxygen concentrations are calculated for the efficiency determination, entry of measured oxygen data is optional. However, it might be useful to include the measured oxygen values for comparison to the calculated values for diagnostic purposes. A deviation of more than 1 or 2 percentage points can indicate inaccurate CO, CO<sub>2</sub>, or fuel composition input data.

Selection of an appliance type in cell F2 of the "Data" sheet is needed for the air/fuel ratio calculation in accordance with Clause 16.3.5 of the Standard.

The "CSA B415.1 Calculations" and "Report" sheets include calculation of efficiencies based on the Lower Heating Value (LHV) of the fuel, which is not required in CSA B415.1-09. The LHV is calculated from the Higher Heating Value (HHV) and fuel composition data in accordance with ASTM E711.

The "CSA B415.1 Calculations" sheet is locked and password protected to prevent inadvertent modifications.

The "Chart" sheet includes a chart of flue gas composition data and fuel consumption. The range of cells in the "CSA B415.1 Calculations" sheet to be charted or plotted might need to be adjusted to correspond to the number of data points entered.

Please report any errors or problems to Tony Joseph at CSA.

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Spreadsheet created by: Rick Curkeet, PE, Intertek Testing Services, NA Inc.  
Version 2.2 14 December 2009

**12/14/2009**

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

<b>Temp. Units</b>	F	(F or C)
<b>Weight Units</b>	lb	(kg or lb)

## Default Fuel Values

D. Fir	Oak
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36
37	37
38	38
39	39
40	40
41	41
42	42
43	43
44	44
45	45
46	46
47	47
48	48
49	49
50	50
51	51
52	52
53	53
54	54
55	55
56	56
57	57
58	58
59	59
60	60
61	61
62	62
63	63
64	64
65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

HHV (kJ/kg)	19,810	19,887
-------------	--------	--------

%C	48.73	50
----	-------	----

%H	6.87	6.6
----	------	-----

## Fuel Data

## Marth

**HHV** 18,967 kJ/kg

%C	46.87
----	-------

%C	46.87
----	-------

%C	46.87
----	-------

%Ash	0.5	0.5
------	-----	-----

%Ash	0.5	0.5
------	-----	-----

Temp. (°F)

<b>Flue</b>	<b>Room</b>
<b>Gas</b>	<b>Temp</b>

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

2 of 8

Manufacturer: MG Hearth & Home

Model: HP22

Date: 10/21/21

Run: 1

Control #: G104780922

Test Duration: 60 min

	HHV	LHV
Eff	79.13%	85.35%
Comb Eff	99.50%	99.50%
HT Eff	79.53%	85.78%
Output	42,894	kJ/h
Burn Rate	2.86	kg/h
Grams CO	0	g
Input	54,208	kJ/h
MC wet	3.25	
Averages	0.00	8.52

Note: In the "Input data", "Calc. % O<sub>2</sub>", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a], [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses 13.7.3 to 13.7.5.

Ultimate CO<sub>2</sub>  
CO<sub>2-ult</sub> 20.36  
F<sub>0</sub>  
1.024

Overall Heating Efficiency: 79.13%  
Combustion Efficiency: 99.50%  
Heat Transfer Efficiency: 79.53%

Air Fuel Ratio (A/F)	
Dry Molecular Weight (M <sub>d</sub> )	29.85
Dry Moles Exhaust Gas (N <sub>r</sub> ):	498.75
Air Fuel Ratio (A/F)	14.38

%HC  
0.8

Heat Output: 40,689 Btu/h 42,894 kJ/h  
Heat Input: 51,422 Btu/h 54,208 kJ/h

Burn Duration: 1.00 h

Burn Rate: 6.30 lb/h 2.858 kg/h

Stack Temp: 323.2 Deg. F 161.8 Deg. C

	Averages	0.00	8.52	1.39	20.70	12.18	161.64	23.29	100.4%	81.2%	81.6%	13.31	1.48	49.83	1.43	49.83	58822	3.91	6.41
INPUT DATA				Oxygen Calculation			Input Data		Combust Eff %	Heat Transfer %	Net Eff %	Air Fuel Ratio	Wet Wt	% Wet	Dry Wt.	% Dry	Fuel I		
Elapsed Time	Weight	%	%	Excess Air EA	Total O <sub>2</sub>	Calc. % O <sub>2</sub> [g]	Flue Gas (°C)	Room Temp (°C)					Now	Consumed	Now	Comsumed	Total Input	Carbon /12= [a]	Hydrogen /1= [b]
	Remaining (kg)	CO [e]	CO <sub>2</sub> [d]																
0	2.95	0.00	8.34	144.1%	20.70	12.36	160.8	23.3	100.4%	81.1%	81.4%	13.6	2.95	0.00	2.86	0.00	0	3.91	6.41
10	2.46	0.00	8.66	135.2%	20.70	12.04	163.6	23.4	100.4%	81.2%	81.6%	13.1	2.46	16.87	2.38	16.87	13765	3.91	6.41
20	1.95	0.00	8.79	131.8%	20.69	11.91	160.9	23.3	100.4%	81.6%	81.9%	12.9	1.95	33.91	1.89	33.91	8710	3.91	6.41
30	1.51	0.00	8.40	142.6%	20.70	12.31	160.9	23.6	100.4%	81.2%	81.5%	13.5	1.51	49.01	1.46	49.01	8705	3.91	6.41
40	1.00	0.00	8.36	143.7%	20.70	12.35	162.7	23.1	100.4%	80.9%	81.3%	13.6	1.00	66.03	0.97	66.03	9207	3.91	6.41
50	0.50	0.00	8.76	132.5%	20.69	11.93	160.4	23.3	100.4%	81.6%	81.9%	12.9	0.50	82.98	0.49	82.98	13821	3.91	6.41



Moisture Content  $M_{Cwb}$ : 3.25

Combustion Efficiency:	99.50%		Moisture of Wood (wet basis):	3.25	Dry kg :	2.86
Total Input (kJ):	54,208	51,413 (Btu)	Initial Dry Weight $W_{t_{do}}$ (kg):	2.86	CA:	46.87
Total Output (kJ):	42,894	40,683 (Btu)	Moisture Content Dry	3.36	HY:	6.41
Efficiency:	79.13%				OX:	46.62
Total CO (g):	0.05					

Load Weight (kg):	2.95			
Fuel Heating	HHV	LHV	HHV	LHV
Value in kJ/kg - CV:	18,967	17,585	Btu/lb	8159.8 7565.2

2.91	18967.00	3.25	79.30	21.03	2.18	7.01	-0.02	0.22	39.18	56.04	0.00	-0.09	364.82	32.25	1.87	434.79	5553.78	4160.55	4041.14	3997.33	5388.12
Properties		Mw	Mass Balance					kg Wood per 100 mole dfp							Stack Temp	Heat Content Change - Ambient to Stack Temperature					
Oxygen	Calorific	Moisture	(moles/100 mole dry flue gas)				Moles per kg of Dry Wood					Moisture	Flue Gas Constituent								
/16= [c]	Value	Fuel Burnt	[h]	[u]	[w]	[j]	[k]		Nk	CO <sub>2</sub>	O <sub>2</sub>	CO	HC	N <sub>2</sub>		H <sub>2</sub> O	Present	K	CO <sub>2</sub>	O <sub>2</sub>	CO
2.91	18967.00	3.25	79.30	21.03	2.13	6.87	-0.02	0.21	39.19	58.06	0.00	-0.09	372.44	32.26	1.87	433.96	5519.19	4135.38	4016.88	3973.29	5352.93
2.91	18967.00	3.25	79.30	21.04	2.21	7.13	-0.02	0.22	39.18	54.47	0.00	-0.08	358.86	32.25	1.87	436.71	5631.52	4217.00	4095.53	4051.23	5467.46
2.91	18967.00	3.25	79.31	21.04	2.24	7.23	-0.02	0.22	39.18	53.09	0.00	-0.08	353.65	32.24	1.87	434.04	5520.59	4136.31	4017.75	3974.16	5354.57
2.91	18967.00	3.25	79.30	21.03	2.14	6.91	-0.02	0.21	39.18	57.44	0.00	-0.09	370.10	32.26	1.87	434.08	5513.14	4130.47	4012.02	3968.51	5347.88
2.91	18967.00	3.25	79.30	21.03	2.13	6.88	-0.02	0.21	39.19	57.90	0.00	-0.09	371.85	32.26	1.87	435.83	5603.79	4197.23	4076.57	4032.42	5438.36
2.91	18967.00	3.25	79.31	21.04	2.24	7.21	-0.02	0.22	39.18	53.39	0.00	-0.08	354.77	32.25	1.87	433.59	5504.65	4124.82	4006.70	3963.21	5338.11

		SUMS							AVERAGE	SUMS						
4834.38	296.44	1523.28	1632.32	1.06	10208.60	-536.71	11018.49	637.55	3497.80	10810.40	-232.54	11042.9	48011.1	-232.5	0.0	-4.2
re	Room Temp K	Energy Losses (kJ/kg of Dry Fuel) Flue Gas Constituent							Total Loss Rate							
		CO <sub>2</sub>	O <sub>2</sub>	CO	N <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub> O Comb	H <sub>2</sub> O Fuel MC		Total Loss	Chemical Loss 1	Sensible and Latent Loss	Total Output	Chem Loss 2	Grams Produced	
H <sub>2</sub> O															CO	HC
4805.41	296.42	216.27	240.09	0.16	1479.80	-79.42	1573.44	91.02	3521.36	0.00	0	0.00	0	0	0.00	0.00
4899.30	296.53	220.64	229.69	0.21	1453.84	-74.50	1575.93	91.20	3497.01	2537.92	-54	2591.51	11227	-54	0.01	-0.97
4806.45	296.48	216.28	219.59	0.20	1405.46	-72.60	1572.73	91.03	3432.69	1576.32	-33	1609.37	7133	-33	0.01	-0.60
4799.57	296.72	216.03	237.25	0.13	1468.74	-78.59	1573.16	91.01	3507.74	1609.84	-36	1645.63	7095	-36	0.01	-0.64
4876.70	296.28	219.59	243.02	0.11	1499.44	-79.23	1575.71	91.16	3549.80	1723.19	-38	1761.36	7484	-38	0.01	-0.69
4793.26	296.41	215.66	220.21	0.17	1406.04	-73.02	1572.35	91.00	3432.41	2501.14	-53	2553.91	11320	-53	0.01	-0.95

Run: 1  
Test Duration: 60  
Output Category: High

	HHV Basis	LHV Basis
Overall Efficiency	79.1%	85.3%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	80%	85.8%

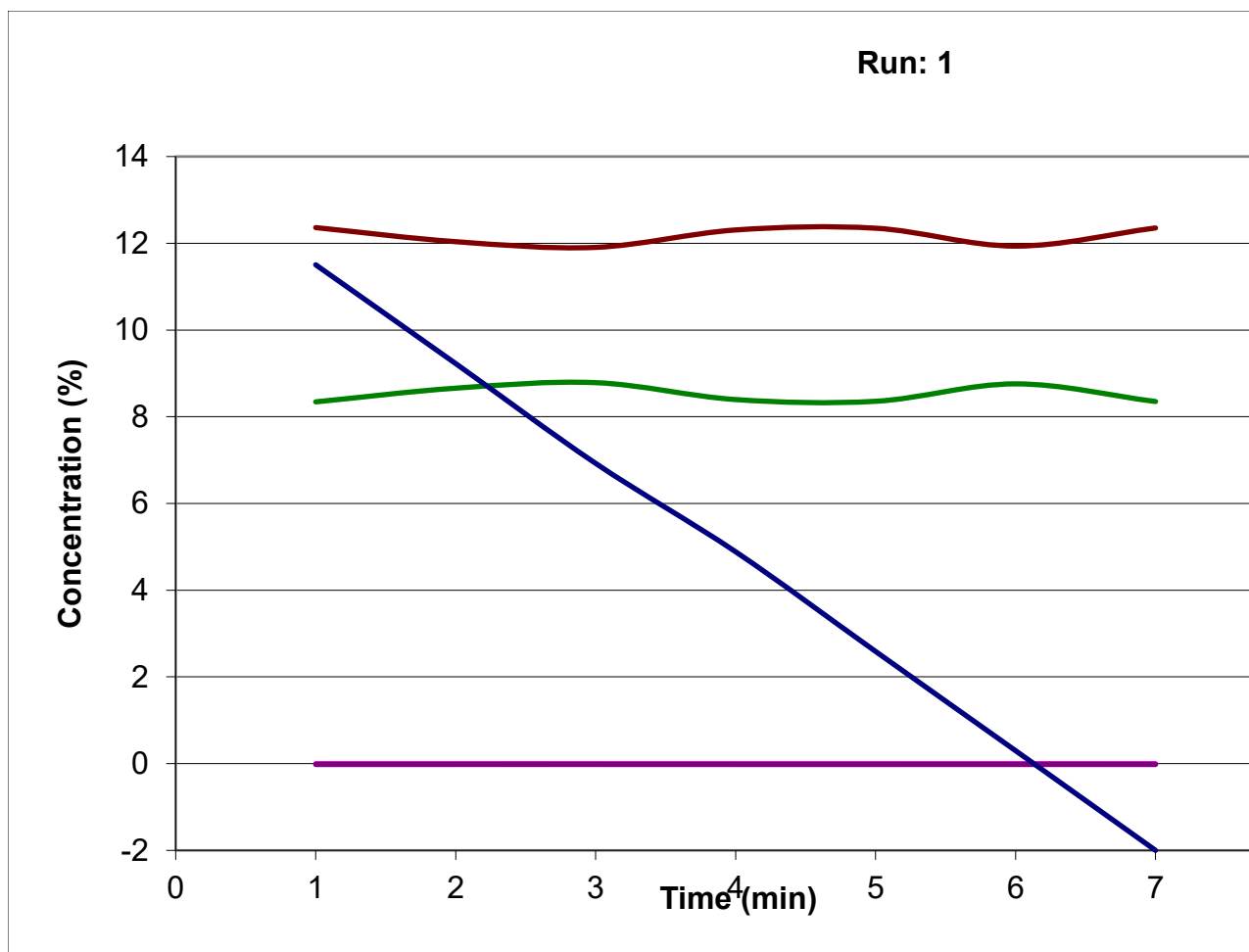
Output Rate (kJ/h)	42,894	40,689	(Btu/h)
Burn Rate (kg/h)	2.86	6.30	(lb/h)
Input (kJ/h)	54,208	51,422	(Btu/h)

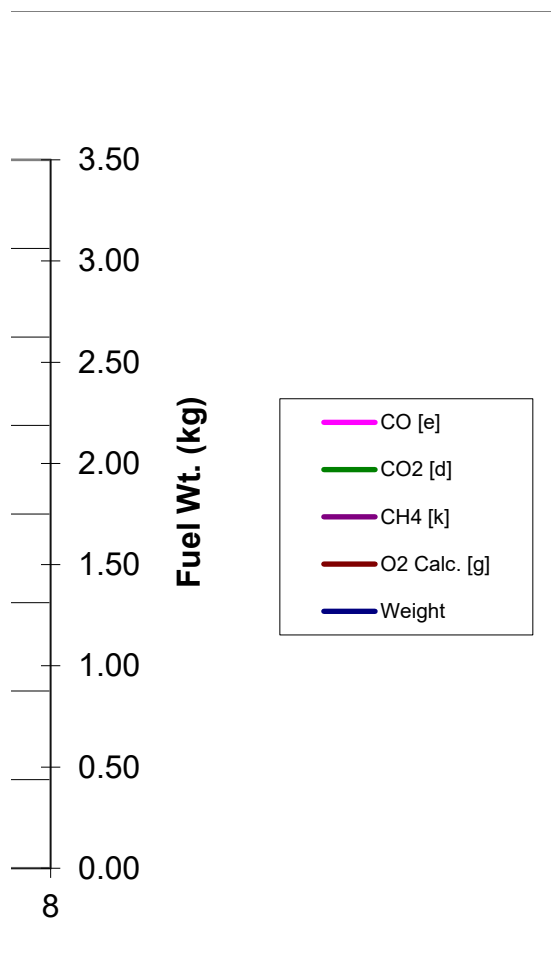
Test Load Weight (dry kg)	2.86	6.30	dry lb
MC wet (%)	3.25		
MC dry (%)	3.36		
Particulate (g )	1.53		
CO (g)	0		
Test Duration (h)	1.00		

Emissions	Particulate	CO
g/MJ Output	0.04	0.00
g/kg Dry Fuel	0.54	0.02
g/h	1.53	0.05
lb/MM Btu Output	0.08	0.00

0.00081

Air/Fuel Ratio (A/F)	14.38
----------------------	-------





Note: In the legend, [d], [e], [g], and [k] refer to their respective variables in Clauses 13.7.3 and 13.7.5

This Excel spreadsheet calculates solid fuel appliance efficiency and heat output in accordance with the procedure specified in CSA B415.1-09. In general the column headings correspond to the variables used in the Standard.

All data from a test run are entered on the "Data" sheet. The cells requiring data entry are highlighted. Please note that input data can be entered in either yard/pound or SI units. Select the units in cells F4 and F5 of the "Data" sheet.

Particulate emissions determined using the dilution tunnel method should be entered in cell C13 of the "Data" sheet as total grams of emissions.

Since oxygen concentrations are calculated for the efficiency determination, entry of measured oxygen data is optional. However, it might be useful to include the measured oxygen values for comparison to the calculated values for diagnostic purposes. A deviation of more than 1 or 2 percentage points can indicate inaccurate CO, CO<sub>2</sub>, or fuel composition input data.

Selection of an appliance type in cell F2 of the "Data" sheet is needed for the air/fuel ratio calculation in accordance with Clause 16.3.5 of the Standard.

The "CSA B415.1 Calculations" and "Report" sheets include calculation of efficiencies based on the Lower Heating Value (LHV) of the fuel, which is not required in CSA B415.1-09. The LHV is calculated from the Higher Heating Value (HHV) and fuel composition data in accordance with ASTM E711.

The "CSA B415.1 Calculations" sheet is locked and password protected to prevent inadvertent modifications.

The "Chart" sheet includes a chart of flue gas composition data and fuel consumption. The range of cells in the "CSA B415.1 Calculations" sheet to be charted or plotted might need to be adjusted to correspond to the number of data points entered.

Please report any errors or problems to Tony Joseph at CSA.

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Spreadsheet created by: Rick Curkeet, PE, Intertek Testing Services, NA Inc.  
Version 2.2 14 December 2009

VERSION: 2.2

12/14/2009

Manufacturer: SMG Hearth &amp; Home

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

Model: HP22

Date: 10/21/2021

Run: 1

Control #: G104780922

Test Duration: 180

Output Category: Low

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

## Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

## Fuel Data

## Marth

HHV	18,967	kJ/kg
%C	46.87	
%H	6.41	
%O	46.62	
%Ash	0.1	

Wood Moisture (% wet): 3.25  
 Load Weight (lb wet): 6.10  
 Burn Rate (dry kg/h): 0.89  
 Total Particulate Emissions: 6.06 g

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

Averages 0.00 3.52 17.28 182.84 71.87

Temp. (°F)

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Flue Gas Temp	Room Temp
		CO	CO <sub>2</sub>	O <sub>2</sub>		

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

0	6.10	0.00	4.03	16.62	192.3	71.8
10	5.71	0.00	4.06	16.91	188.5	72.0
20	5.40	0.00	3.73	17.63	184.6	72.0
30	4.99	0.00	3.47	17.57	183.4	72.2
40	4.71	0.00	3.52	18.01	182.4	72.2
50	4.40	0.00	3.61	17.22	183.2	71.9
60	4.01	0.00	3.35	17.01	182.7	71.7
70	3.69	0.00	3.63	16.73	182.4	72.2
80	3.31	0.00	3.90	16.80	185.5	71.8
90	2.99	0.00	3.29	17.28	183.7	71.8
100	2.59	0.00	3.49	17.41	182.1	71.9
110	2.30	0.00	3.06	17.31	182.9	72.1
120	1.99	0.00	3.47	18.15	176.4	71.9
130	1.70	0.00	3.33	17.46	178.7	71.6
140	1.29	0.00	3.57	17.38	179.7	71.5
150	1.00	0.00	3.39	16.97	181.2	71.6
160	0.69	0.00	3.14	17.69	178.2	71.7
170	0.40	0.00	3.29	16.82	182.8	72.0
180	0.00	0.00	3.51	17.43	183.1	71.8



Manufacturer: MG Hearth & Home

Model: HP22

Date: 10/21/21

Run: 1

Control #: G104780922

Test Duration: 180 min

	HHV	LHV
Eff	79.80%	86.07%
Comb Eff	99.50%	99.50%
HT Eff	80.20%	86.51%
Output	13,515	kJ/h
Burn Rate	0.89	kg/h
Grams CO	0	g
Input	16,936	kJ/h
MC wet	3.25	
Averages	0.00	3.52

Note: In the "Input data", "Calc. % O<sub>2</sub>", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a], [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses 13.7.3 to 13.7.5.

Ultimate CO<sub>2</sub>  
CO<sub>2-ult</sub> 20.36  
F<sub>0</sub>  
1.017

		Air Fuel Ratio (A/F)	
Overall Heating Efficiency:	79.80%	Dry Molecular Weight (M <sub>d</sub> )	29.26
Combustion Efficiency:	99.50%	Dry Moles Exhaust Gas (N <sub>r</sub> ):	1207.75
Heat Transfer Efficiency:	80.20%	Air Fuel Ratio (A/F)	34.82

%HC  
0.8

Heat Output: 12,820 Btu/h 13,515 kJ/h  
Heat Input: 16,065 Btu/h 16,936 kJ/h

Burn Duration: 3.00 h

Burn Rate: 1.97 lb/h 0.893 kg/h

Stack Temp: 182.3 Deg. F 83.5 Deg. C

INPUT DATA				4.82	20.84	17.32	83.80	22.15	101.4%	81.2%	82.3%	32.51	1.37	50.59	1.32	50.59	52487	3.91	6.41
				Oxygen Calculation			Input Data		Combust Eff %	Heat Transfer %	Net Eff %	Air Fuel Ratio	Wet Wt Now	% Wet Consumed	Dry Wt. Now	% Dry Comsumed	Total Input	Fuel I	
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO <sub>2</sub> [d]	Excess Air EA	Total O <sub>2</sub>	Calc. % O <sub>2</sub> [g]	Flue Gas (°C)	Room Temp (°C)					Wt	x	Wt <sub>dn</sub>	y		Carbon /12= [a]	Hydrogen /1= [b]
0	2.77	0.00	4.03	404.7%	20.83	16.79	89.1	22.1	101.2%	81.7%	82.7%	28.2	2.77	0.00	2.68	0.00	0	3.91	6.41
10	2.59	0.00	4.06	401.9%	20.83	16.77	86.9	22.2	101.2%	82.1%	83.1%	28.0	2.59	6.49	2.50	6.49	4578	3.91	6.41
20	2.45	0.00	3.73	445.3%	20.83	17.10	84.8	22.2	101.3%	81.7%	82.7%	30.5	2.45	11.53	2.37	11.53	2979	3.91	6.41
30	2.26	0.00	3.47	486.3%	20.84	17.37	84.1	22.3	101.4%	81.1%	82.2%	32.8	2.26	18.22	2.19	18.22	2883	3.91	6.41
40	2.14	0.00	3.52	477.8%	20.84	17.32	83.5	22.3	101.4%	81.3%	82.5%	32.3	2.14	22.88	2.07	22.88	2467	3.91	6.41
50	2.00	0.00	3.61	464.6%	20.84	17.23	84.0	22.2	101.3%	81.5%	82.6%	31.5	2.00	27.93	1.93	27.93	2903	3.91	6.41

Moisture Content  $M_{Cwb}$ : 3.25

Combustion Efficiency:	99.50%		Moisture of Wood (wet basis):	3.25	Dry kg :	2.68
Total Input (kJ):	50,807	48,188 (Btu)	Initial Dry Weight $W_{t_{do}}$ (kg):	2.68	CA:	46.87
Total Output (kJ):	40,545	38,455 (Btu)	Moisture Content Dry	3.36	HY:	6.41
Efficiency:	79.80%				OX:	46.62
Total CO (g):	0.03					

Load Weight (kg):	2.77			
Fuel Heating	HHV	LHV	HHV	LHV
Value in kJ/kg - CV:	18,967	17,585	Btu/lb	8159.8 7565.2

2.91	18967.00	3.25	79.16	21.00	0.89	2.92	-0.03	0.09	39.40	195.21	0.00	-0.30	891.07	32.68	1.87	356.95	2404.24	1832.06	1787.12	1766.14	2264.74
Properties		Mw	Mass Balance					kg Wood per 100 mole dfp							Stack Temp	Heat Content Change - Ambient to Stack Temperature					
Oxygen	Calorific	Moisture	(moles/100 mole dry flue gas)						Moles per kg of Dry Wood					Moisture		Flue Gas Constituent					
/16= [c]	Value	Fuel Burnt	[h]	[u]	[w]	[j]	[k]		Nk	CO <sub>2</sub>	O <sub>2</sub>	CO	HC	N <sub>2</sub>		H <sub>2</sub> O	Present	K	CO <sub>2</sub>	O <sub>2</sub>	CO
2.91	18967.00	3.25	79.17	21.00	1.03	3.34	-0.03	0.10	39.35	163.74	0.00	-0.25	772.07	32.58	1.87	362.21	2616.45	1991.51	1942.11	1919.43	2469.59
2.91	18967.00	3.25	79.17	21.00	1.03	3.36	-0.03	0.10	39.35	162.62	0.00	-0.25	767.84	32.58	1.87	360.08	2526.26	1923.71	1876.20	1854.25	2382.60
2.91	18967.00	3.25	79.17	21.00	0.95	3.10	-0.03	0.09	39.37	180.27	0.00	-0.28	834.57	32.63	1.87	357.95	2442.17	1860.56	1814.82	1793.54	2301.37
2.91	18967.00	3.25	79.16	21.00	0.88	2.88	-0.03	0.09	39.40	196.99	0.00	-0.30	897.83	32.68	1.87	357.23	2408.47	1835.12	1790.07	1769.06	2269.09
2.91	18967.00	3.25	79.16	21.00	0.90	2.92	-0.03	0.09	39.39	193.55	0.00	-0.30	884.82	32.67	1.87	356.69	2386.42	1818.53	1773.94	1753.11	2247.84
2.91	18967.00	3.25	79.16	21.00	0.92	2.99	-0.03	0.09	39.38	188.16	0.00	-0.29	864.43	32.66	1.87	357.16	2412.40	1838.22	1793.11	1772.07	2272.57

		SUMS							AVERAGE	SUMS						
2140.35	295.30	1799.58	6782.73	1.66	29856.89	-5059.94	28629.22	1634.96	3349.74	9270.98	-737.25	10008.2	43216.2	-737.3	0.0	-13.3
re	Room Temp	Energy Losses (kJ/kg of Dry Fuel) Flue Gas Constituent							Total Loss Rate							
	K	CO <sub>2</sub>	O <sub>2</sub>	CO	N <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub> O Comb	H <sub>2</sub> O Fuel MC		Total Loss	Chemical Loss 1	Sensible and Latent Loss	Total Output	Chem Loss 2	Grams Produced	
H <sub>2</sub> O																
2325.80	295.25	102.95	326.09	0.07	1481.94	-223.44	1508.41	86.40	3282.42	0.00	0	0.00	0	0	0.00	0.00
2246.94	295.38	99.40	312.83	0.17	1423.77	-221.84	1505.68	86.25	3206.25	773.92	-53	827.29	3804	-53	0.00	-0.96
2173.49	295.35	96.16	335.39	0.07	1496.84	-245.94	1505.78	86.11	3274.41	514.35	-39	552.88	2465	-39	0.00	-0.69
2143.87	295.49	94.89	361.51	0.08	1588.32	-268.76	1507.17	86.06	3369.27	512.12	-41	552.86	2371	-41	0.00	-0.73
2124.56	295.49	94.01	351.98	0.08	1551.18	-264.05	1506.05	86.02	3325.27	432.47	-34	466.71	2034	-34	0.00	-0.62
2147.52	295.31	95.01	345.88	0.04	1531.83	-256.72	1506.05	86.06	3308.14	506.38	-39	545.57	2397	-39	0.00	-0.70

Run: 1  
Test Duration: 180  
Output Category: Low

	HHV Basis	LHV Basis
Overall Efficiency	79.8%	86.1%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	80%	86.5%

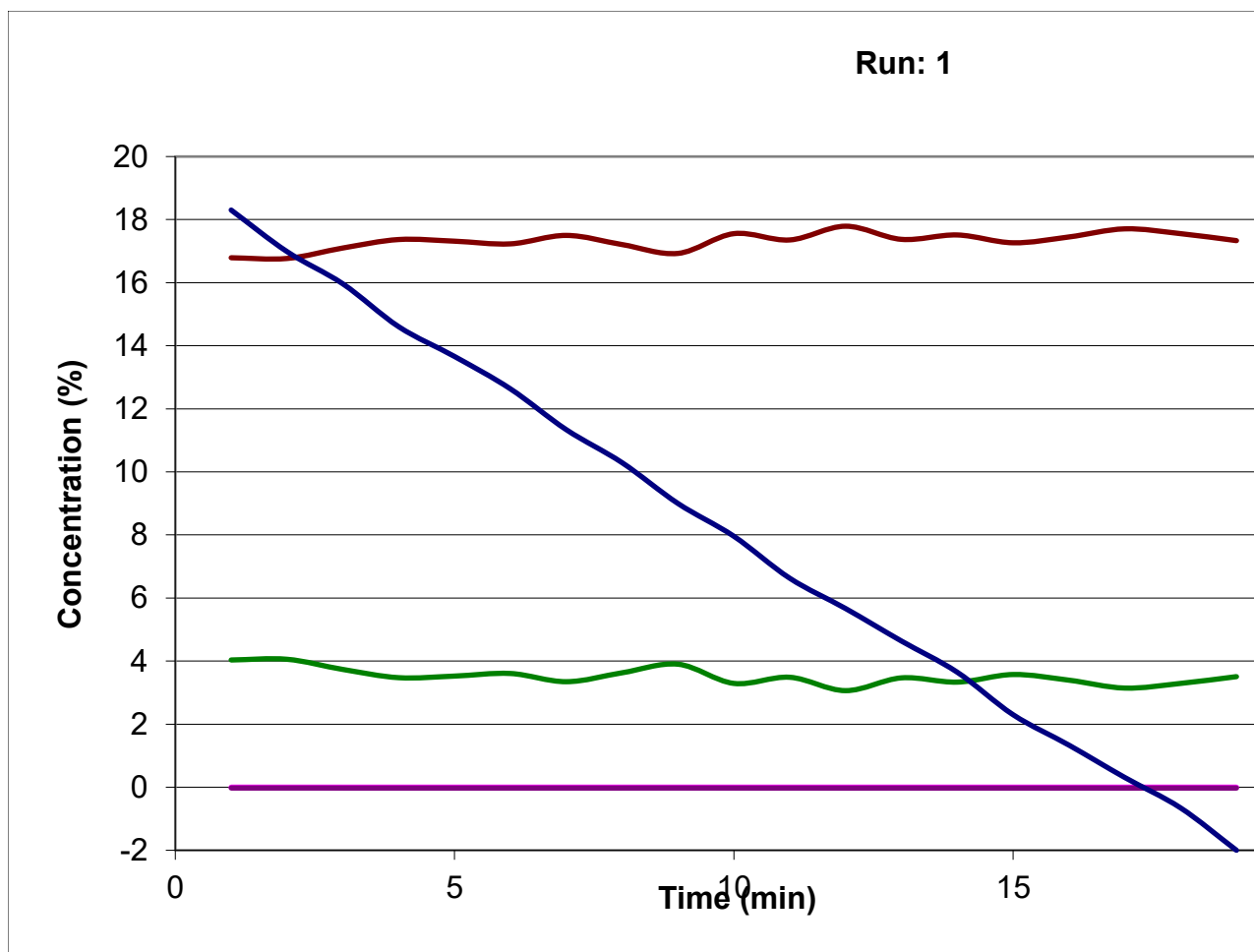
Output Rate (kJ/h)	13,515	12,820	(Btu/h)
Burn Rate (kg/h)	0.89	1.97	(lb/h)
Input (kJ/h)	16,936	16,065	(Btu/h)

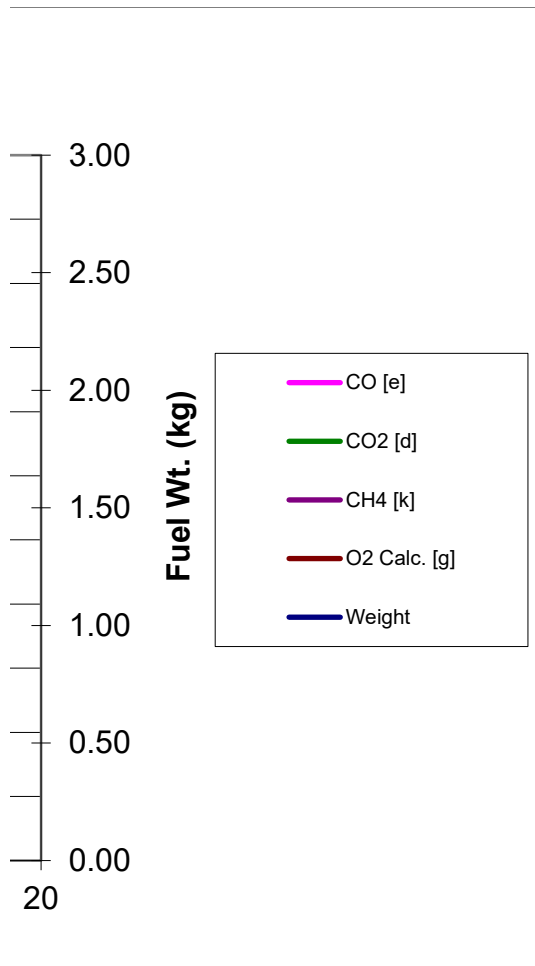
Test Load Weight (dry kg)	2.68	5.90	dry lb
MC wet (%)	3.25		
MC dry (%)	3.36		
Particulate (g )	6.06		
CO (g)	0		
Test Duration (h)	3.00		

Emissions	Particulate	CO
g/MJ Output	0.15	0.00
g/kg Dry Fuel	2.26	0.01
g/h	2.02	0.01
lb/MM Btu Output	0.35	0.00

0.00015

Air/Fuel Ratio (A/F)	34.82
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Note: In the legend, [d], [e], [g], and [k] refer to their respective variables in Clauses 13.7.3 and 13.7.5



This Excel spreadsheet calculates solid fuel appliance efficiency and heat output in accordance with the procedure specified in CSA B415.1-09. In general the column headings correspond to the variables used in the Standard.

All data from a test run are entered on the "Data" sheet. The cells requiring data entry are highlighted. Please note that input data can be entered in either yard/pound or SI units. Select the units in cells F4 and F5 of the "Data" sheet.

Particulate emissions determined using the dilution tunnel method should be entered in cell C13 of the "Data" sheet as total grams of emissions.

Since oxygen concentrations are calculated for the efficiency determination, entry of measured oxygen data is optional. However, it might be useful to include the measured oxygen values for comparison to the calculated values for diagnostic purposes. A deviation of more than 1 or 2 percentage points can indicate inaccurate CO, CO<sub>2</sub>, or fuel composition input data.

Selection of an appliance type in cell F2 of the "Data" sheet is needed for the air/fuel ratio calculation in accordance with Clause 16.3.5 of the Standard.

The "CSA B415.1 Calculations" and "Report" sheets include calculation of efficiencies based on the Lower Heating Value (LHV) of the fuel, which is not required in CSA B415.1-09. The LHV is calculated from the Higher Heating Value (HHV) and fuel composition data in accordance with ASTM E711.

The "CSA B415.1 Calculations" sheet is locked and password protected to prevent inadvertent modifications.

The "Chart" sheet includes a chart of flue gas composition data and fuel consumption. The range of cells in the "CSA B415.1 Calculations" sheet to be charted or plotted might need to be adjusted to correspond to the number of data points entered.

Please report any errors or problems to Tony Joseph at CSA.

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Spreadsheet created by: Rick Curkeet, PE, Intertek Testing Services, NA Inc.  
Version 2.2 14 December 2009

VERSION: 2.2

12/14/2009

Manufacturer: SMG Hearth &amp; Home

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

Model: HP22

Date: 10/21/2021

Run: 1

Control #: G104780922

Test Duration: 360

Output Category: Overall

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

## Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

## Fuel Data

## Marth

HHV	18,967	kJ/kg
%C	46.87	
%H	6.41	
%O	46.62	
%Ash	0.1	

Wood Moisture (% wet): 3.25

Load Weight (lb wet): 17.73

Burn Rate (dry kg/h): 1.30

Total Particulate Emissions: 6.06 g

Averages 0.00 4.78 15.97 216.57 72.44

Temp. (°F)

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Flue Gas Temp	Room Temp
		CO	CO <sub>2</sub>	O <sub>2</sub>		

0	17.73	0.00	8.34	12.27	321.4	73.9
10	16.63	0.00	8.66	11.79	326.4	74.1
20	15.52	0.00	8.79	12.02	321.6	74.0
30	14.54	0.00	8.40	12.07	321.7	74.4
40	13.43	0.00	8.36	11.79	324.8	73.6
50	12.33	0.00	8.76	11.65	320.8	73.9
60	11.22	0.00	8.35	11.39	323.8	73.5
70	10.71	0.00	6.85	15.18	235.5	73.2
80	10.21	0.00	5.85	15.37	223.1	72.9
90	9.71	0.00	4.79	15.54	215.8	72.7
100	9.31	0.00	4.53	16.26	209.0	72.8
110	8.81	0.00	4.08	16.82	207.1	72.5
120	8.41	0.00	4.27	16.40	202.9	72.3
130	8.03	0.00	4.37	16.50	201.8	72.0
140	7.61	0.00	4.00	16.91	194.7	72.4
150	7.20	0.00	3.95	16.69	195.6	72.3
160	6.81	0.00	3.86	16.52	197.5	72.2
170	6.41	0.00	3.97	17.31	195.3	72.0
180	6.10	0.00	4.03	16.62	192.3	71.8

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

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

Manufacturer: MG Hearth & Home

Model: HP22

Date: 10/21/21

Run: 1

Control #: G104780922

Test Duration: 360 min

	HHV	LHV
Eff	80.48%	86.80%
Comb Eff	99.50%	99.50%
HT Eff	80.88%	87.24%
Output	19,798	kJ/h
Burn Rate	1.30	kg/h
Grams CO	0	g
Input	24,600	kJ/h
MC wet	3.25	
Averages	0.00	4.78

Note: In the "Input data", "Calc. % O<sub>2</sub>", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a], [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses 13.7.3 to 13.7.5.

Ultimate CO<sub>2</sub>  
CO<sub>2-ult</sub> 20.36  
F<sub>0</sub>  
1.020

Overall Heating Efficiency: 80.48%  
Combustion Efficiency: 99.50%  
Heat Transfer Efficiency: 80.88%

Air Fuel Ratio (A/F)	
Dry Molecular Weight (M <sub>d</sub> )	29.41
Dry Moles Exhaust Gas (N <sub>r</sub> ):	888.21
Air Fuel Ratio (A/F)	25.61

%HC  
0.8

Heat Output: 18,780 Btu/h 19,798 kJ/h  
Heat Input: 23,336 Btu/h 24,600 kJ/h

Burn Duration: 6.00 h

Burn Rate: 2.86 lb/h 1.297 kg/h

Stack Temp: 213.7 Deg. F 100.9 Deg. C

	Averages	0.00	4.78	3.80	20.80	16.02	102.54	22.47	101.1%	81.3%	82.2%	26.79	3.09	61.60	2.99	61.60	149280	3.91	6.41
INPUT DATA				Oxygen Calculation			Input Data		Combust Eff	Heat Transfer	Net Eff	Air Fuel Ratio	Wet Wt Now	% Wet Consumed	Dry Wt. Now	% Dry Comsumed	Total Input	Fuel I	
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO <sub>2</sub> [d]	Excess Air EA	Total O <sub>2</sub>	Calc. % O <sub>2</sub> [g]	Flue Gas (°C)	Room Temp (°C)										Carbon /12= [a]	Hydrogen /1= [b]
0	8.04	0.00	8.34	144.1%	20.70	12.36	160.8	23.3	100.4%	81.1%	81.4%	13.6	8.04	0.00	7.78	0.00	0	3.91	6.41
10	7.54	0.00	8.66	135.2%	20.70	12.04	163.6	23.4	100.4%	81.2%	81.6%	13.1	7.54	6.20	7.30	6.20	13765	3.91	6.41
20	7.04	0.00	8.79	131.8%	20.69	11.91	160.9	23.3	100.4%	81.6%	81.9%	12.9	7.04	12.46	6.81	12.46	8710	3.91	6.41
30	6.60	0.00	8.40	142.6%	20.70	12.31	160.9	23.6	100.4%	81.2%	81.5%	13.5	6.60	18.00	6.38	18.00	8705	3.91	6.41
40	6.09	0.00	8.36	143.7%	20.70	12.35	162.7	23.1	100.4%	80.9%	81.3%	13.6	6.09	24.25	5.89	24.25	9207	3.91	6.41
50	5.59	0.00	8.76	132.5%	20.69	11.93	160.4	23.3	100.4%	81.6%	81.9%	12.9	5.59	30.47	5.41	30.47	9207	3.91	6.41

Moisture Content  $M_{Cwb}$ :3.25

Combustion Efficiency:99.50%

Total Input (kJ):147,599139,991 (Btu)

Total Output (kJ):118,785112,662 (Btu)

Efficiency:80.48%

Total CO (g):0.08

Moisture of Wood (wet basis):3.25

Initial Dry Weight  $W_{t_{do}}$  (kg):7.78

Moisture Content Dry3.36

Dry kg :7.78

CA:46.87

HY:6.41

OX:46.62

Load Weight (kg):8.04

Fuel HeatingHHVLHV

Value in kJ/kg - CV:18,96717,585

Btu/lbHHVLHV

8159.87565.2

2.91	18967.00	3.25	79.20	21.01	1.22	3.96	-0.02	0.12	39.33	153.76	0.00	-0.24	734.33	32.55	1.87	375.69	3157.25	2390.24	2327.82	2301.28	3008.28
Properties		Mw	Mass Balance					kg Wood per 100 mole dfp								Stack Temp K	Heat Content Change - Ambient to Stack Temperature				
Oxygen	Calorific	Moisture	(moles/100 mole dry flue gas)						Moles per kg of Dry Wood						Moisture		Flue Gas Constituent				
/16= [c]	Value	Fuel Burnt	[h]	[u]	[w]	[j]	[k]		Nk	CO <sub>2</sub>	O <sub>2</sub>	CO	HC	N <sub>2</sub>	H <sub>2</sub> O		Present	CO <sub>2</sub>	O <sub>2</sub>	CO	N <sub>2</sub>
2.91	18967.00	3.25	79.30	21.03	2.13	6.87	-0.02	0.21	39.19	58.06	0.00	-0.09	372.44	32.26	1.87	433.96	5519.19	4135.38	4016.88	3973.29	5352.93
2.91	18967.00	3.25	79.30	21.04	2.21	7.13	-0.02	0.22	39.18	54.47	0.00	-0.08	358.86	32.25	1.87	436.71	5631.52	4217.00	4095.53	4051.23	5467.46
2.91	18967.00	3.25	79.31	21.04	2.24	7.23	-0.02	0.22	39.18	53.09	0.00	-0.08	353.65	32.24	1.87	434.04	5520.59	4136.31	4017.75	3974.16	5354.57
2.91	18967.00	3.25	79.30	21.03	2.14	6.91	-0.02	0.21	39.18	57.44	0.00	-0.09	370.10	32.26	1.87	434.08	5513.14	4130.47	4012.02	3968.51	5347.88
2.91	18967.00	3.25	79.30	21.03	2.13	6.88	-0.02	0.21	39.19	57.90	0.00	-0.09	371.85	32.26	1.87	435.83	5603.79	4197.23	4076.57	4032.42	5438.36
2.91	18967.00	3.25	79.31	21.04	2.24	7.21	-0.02	0.22	39.18	53.39	0.00	-0.08	354.77	32.25	1.87	433.59	5504.65	4124.82	4006.70	3963.21	5338.11

		SUMS							AVERAGE	SUMS						
2786.71	295.62	4591.18	11890.27	3.42	56336.99	-7763.93	56307.94	3228.49	3367.42	26701.54	-1374.71	28076.3	122578.0	-1374.7	0.1	-24.7
re	Room Temp K	Energy Losses (kJ/kg of Dry Fuel) Flue Gas Constituent							Total Loss Rate							
		CO <sub>2</sub>	O <sub>2</sub>	CO	N <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub> O Comb	H <sub>2</sub> O Fuel MC		Total Loss	Chemical Loss 1	Sensible and Latent Loss	Total Output	Chem Loss 2	Grams Produced	
H <sub>2</sub> O															CO	HC
4805.41	296.42	216.27	240.09	0.16	1479.80	-79.42	1573.44	91.02	3521.36	0.00	0	0.00	0	0	0.00	0.00
4899.30	296.53	220.64	229.69	0.21	1453.84	-74.50	1575.93	91.20	3497.01	2537.92	-54	2591.51	11227	-54	0.01	-0.97
4806.45	296.48	216.28	219.59	0.20	1405.46	-72.60	1572.73	91.03	3432.69	1576.32	-33	1609.37	7133	-33	0.01	-0.60
4799.57	296.72	216.03	237.25	0.13	1468.74	-78.59	1573.16	91.01	3507.74	1609.84	-36	1645.63	7095	-36	0.01	-0.64
4876.70	296.28	219.59	243.02	0.11	1499.44	-79.23	1575.71	91.16	3549.80	1723.19	-38	1761.36	7484	-38	0.01	-0.69
4793.26	296.41	215.66	220.21	0.17	1406.04	-73.02	1572.35	91.00	3432.41	1666.21	-35	1701.36	7541	-35	0.01	-0.63

Run: 1  
Test Duration: 360  
Output Category: Overall

	HHV Basis	LHV Basis
Overall Efficiency	80.5%	86.8%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	81%	87.2%

Output Rate (kJ/h)	19,798	18,780	(Btu/h)
Burn Rate (kg/h)	1.30	2.86	(lb/h)
Input (kJ/h)	24,600	23,336	(Btu/h)

Test Load Weight (dry kg)	7.78	17.15	dry lb
MC wet (%)	3.25		
MC dry (%)	3.36		
Particulate (g )	6.06		
CO (g)	0		
Test Duration (h)	6.00		

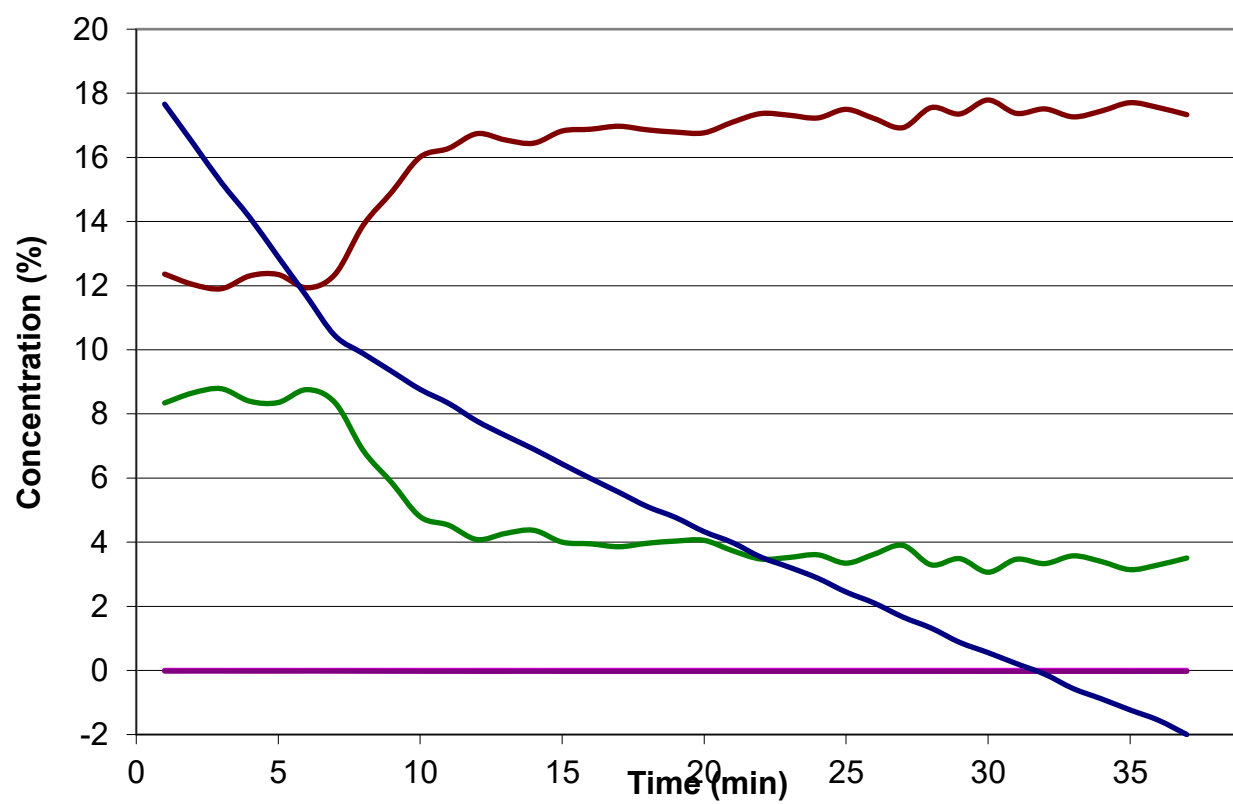
Emissions	Particulate	CO
g/MJ Output	0.05	0.00
g/kg Dry Fuel	0.78	0.01
g/h	1.01	0.01
lb/MM Btu Output	0.12	0.00

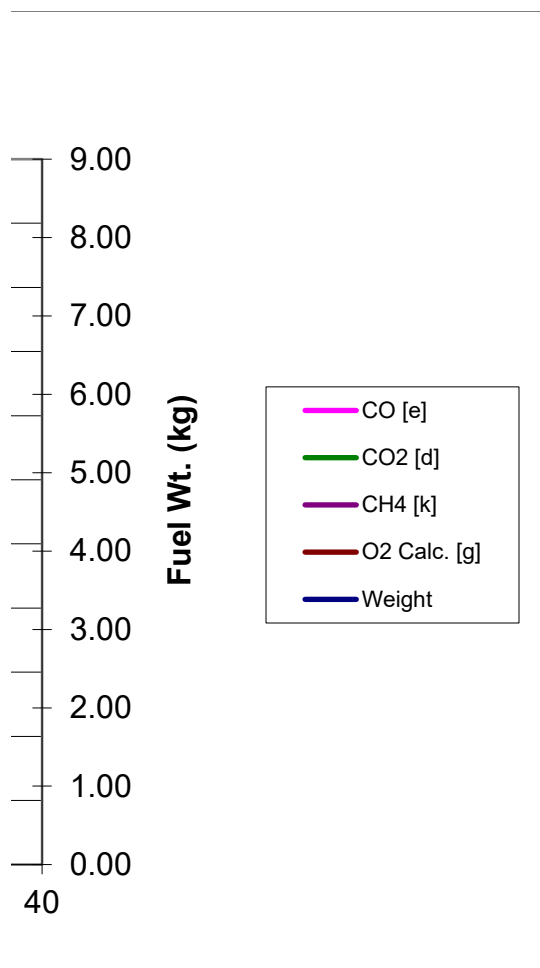
0.00024

Air/Fuel Ratio (A/F)	25.61
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Run: 1





Note: In the legend, [d], [e], [g], and [k] refer to their respective variables in Clauses 13.7.3 and 13.7.5



## Analytical Report

Report Number: 186096

Report Status: *Interim*

Brian Ziegler  
Intertek  
8431 Murphy Dr.  
Middleton, WI 53562

Sample: Marth wood pellets

C	H	N	O
46.87 %	6.41 %	0.06 %	To Follow.
ROI	LOD		
< 0.1 %	4.32 %		



**Analytical Report**  
Report Number: 186096  
Report Status: *Interim*

Brian Ziegler  
Intertek  
8431 Murphy Dr.  
Middleton, WI 53562

**non-GMP Statement**

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

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

This Excel spreadsheet calculates solid fuel appliance efficiency and heat output in accordance with the procedure specified in CSA B415.1-09. In general the column headings correspond to the variables used in the Standard.

All data from a test run are entered on the "Data" sheet. The cells requiring data entry are highlighted. Please note that input data can be entered in either yard/pound or SI units. Select the units in cells F4 and F5 of the "Data" sheet.

Particulate emissions determined using the dilution tunnel method should be entered in cell C13 of the "Data" sheet as total grams of emissions.

Since oxygen concentrations are calculated for the efficiency determination, entry of measured oxygen data is optional. However, it might be useful to include the measured oxygen values for comparison to the calculated values for diagnostic purposes. A deviation of more than 1 or 2 percentage points can indicate inaccurate CO, CO<sub>2</sub>, or fuel composition input data.

Selection of an appliance type in cell F2 of the "Data" sheet is needed for the air/fuel ratio calculation in accordance with Clause 16.3.5 of the Standard.

The "CSA B415.1 Calculations" and "Report" sheets include calculation of efficiencies based on the Lower Heating Value (LHV) of the fuel, which is not required in CSA B415.1-09. The LHV is calculated from the Higher Heating Value (HHV) and fuel composition data in accordance with ASTM E711.

The "CSA B415.1 Calculations" sheet is locked and password protected to prevent inadvertent modifications.

The "Chart" sheet includes a chart of flue gas composition data and fuel consumption. The range of cells in the "CSA B415.1 Calculations" sheet to be charted or plotted might need to be adjusted to correspond to the number of data points entered.

Please report any errors or problems to Tony Joseph at CSA.

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Spreadsheet created by: Rick Curkeet, PE, Intertek Testing Services, NA Inc.  
Version 2.2 14 December 2009

VERSION: 2.2

12/14/2009

Manufacturer: SMG Hearth &amp; Home

Model: HP22

Date: 10/21/2021

Run: 1

Control #: G104780922

Test Duration: 120

Output Category: Medium

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

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

## Default Fuel Values

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

## Fuel Data

## Marth

HHV	18,967	kJ/kg
%C	46.87	
%H	6.41	
%O	46.62	
%Ash	0.1	

Wood Moisture (% wet): 3.25

Load Weight (lb wet): 5.11

Burn Rate (dry kg/h): 1.12

Total Particulate Emissions: 6.06 g

Averages 0.00 4.84 15.96 214.97 72.51

Temp. (°F)

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Flue Gas Temp	Room Temp
		CO	CO <sub>2</sub>	O <sub>2</sub>		

0	5.11	0.00	8.35	11.39	323.8	73.5
10	4.61	0.00	6.85	15.18	235.5	73.2
20	4.11	0.00	5.85	15.37	223.1	72.9
30	3.60	0.00	4.79	15.54	215.8	72.7
40	3.21	0.00	4.53	16.26	209.0	72.8
50	2.71	0.00	4.08	16.82	207.1	72.5
60	2.31	0.00	4.27	16.40	202.9	72.3
70	1.92	0.00	4.37	16.50	201.8	72.0
80	1.51	0.00	4.00	16.91	194.7	72.4
90	1.10	0.00	3.95	16.69	195.6	72.3
100	0.71	0.00	3.86	16.52	197.5	72.2
110	0.31	0.00	3.97	17.31	195.3	72.0
120	0.00	0.00	4.03	16.62	192.3	71.8

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

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



Manufacturer: MG Hearth & Home

Model: HP22

Date: 10/21/21

Run: 1

Control #: G104780922

Test Duration: 120 min

	HHV	LHV
Eff	80.57%	86.91%
Comb Eff	99.50%	99.50%
HT Eff	80.98%	87.34%
Output	17,156	kJ/h
Burn Rate	1.12	kg/h
Grams CO	0	g
Input	21,292	kJ/h
MC wet	3.25	
Averages	0.00	4.84

Note: In the "Input data", "Calc. % O<sub>2</sub>", "Fuel Properties", and "Mass Balance" columns, [e], [d], [g], [a], [b], [c], [h], [u], [w], [j], and [k] refer to their respective variables in Clauses 13.7.3 to 13.7.5.

Ultimate CO<sub>2</sub>  
CO<sub>2-ult</sub> 20.36  
F<sub>0</sub>  
1.020

		Air Fuel Ratio (A/F)	
Overall Heating Efficiency:	80.57%	Dry Molecular Weight (M <sub>d</sub> )	29.41
Combustion Efficiency:	99.50%	Dry Moles Exhaust Gas (N <sub>r</sub> ):	878.13
Heat Transfer Efficiency:	80.98%	Air Fuel Ratio (A/F)	25.32

%HC  
0.8

Heat Output: 16,274 Btu/h 17,156 kJ/h  
Heat Input: 20,198 Btu/h 21,292 kJ/h

Burn Duration: 2.00 h

Burn Rate: 2.47 lb/h 1.123 kg/h

Stack Temp: 205.9 Deg. F 96.6 Deg. C

INPUT DATA				Oxygen Calculation			Input Data		Combust Eff %	Heat Transfer %	Net Eff %	Air Fuel Ratio	Wet Wt Now	% Wet Consumed	Dry Wt. Now	% Dry Comsumed	Total Input	Carbon /12= [a]	Fuel I Hydrogen /1= [b]
Elapsed Time	Weight Remaining (kg)	% CO [e]	% CO <sub>2</sub> [d]	Excess Air EA	Total O <sub>2</sub>	Calc. % O <sub>2</sub> [g]	Flue Gas (°C)	Room Temp (°C)						x	Wt <sub>dn</sub>	y			
0	2.32	0.00	8.35	143.9%	20.70	12.35	162.1	23.1	100.4%	81.0%	81.3%	13.6	2.32	0.00	2.25	0.00	0	3.91	6.41
10	2.09	0.00	6.85	197.2%	20.75	13.89	113.0	22.9	100.6%	83.5%	84.0%	16.6	2.09	9.89	2.02	9.89	6294	3.91	6.41
20	1.86	0.00	5.85	247.9%	20.77	14.92	106.2	22.7	100.7%	83.0%	83.5%	19.4	1.86	19.67	1.80	19.67	4182	3.91	6.41
30	1.64	0.00	4.79	324.9%	20.80	16.01	102.1	22.6	100.9%	81.6%	82.4%	23.7	1.64	29.54	1.58	29.54	3731	3.91	6.41
40	1.46	0.00	4.53	349.5%	20.81	16.28	98.3	22.7	101.0%	81.6%	82.4%	25.1	1.46	37.19	1.41	37.19	3710	3.91	6.41
50	1.23	0.00	4.08	398.8%	20.82	16.74	97.3	22.5	101.2%	80.6%	81.6%	27.8	1.23	46.96	1.19	46.96	3771	3.91	6.41

Moisture Content  $M_{Cwb}$ :3.25

Combustion Efficiency:99.50%

Total Input (kJ):42,58540,389 (Btu)

Total Output (kJ):34,31232,543 (Btu)

Efficiency:80.57%

Total CO (g):0.01

Moisture of Wood (wet basis):3.25

Initial Dry Weight  $W_{t_{do}}$  (kg):2.25

Moisture Content Dry3.36

Dry kg :2.25

CA:46.87

HY:6.41

OX:46.62

Load Weight (kg):2.32

Fuel HeatingHHVLHV

Value in kJ/kg - CV:18,96717,585

Btu/lb

HHV8159.8

LHV7565.2

2.91	18967.00	3.25	79.20	21.01	1.23	4.00	-0.02	0.12	39.31	139.19	0.00	-0.21	679.25	32.51	1.87	374.80	3112.41	2360.00	2299.28	2272.88	2957.43
Properties		Mw	Mass Balance					kg Wood per 100 mole dfp								Stack Temp K	Heat Content Change - Ambient to Stack Temperature				
Oxygen	Calorific	Moisture	(moles/100 mole dry flue gas)						Moles per kg of Dry Wood						Moisture		Flue Gas Constituent				
/16= [c]	Value	Fuel Burnt	[h]	[u]	[w]	[j]	[k]		Nk	CO <sub>2</sub>	O <sub>2</sub>	CO	HC	N <sub>2</sub>	H <sub>2</sub> O		Present	CO <sub>2</sub>	O <sub>2</sub>	CO	N <sub>2</sub>
2.91	18967.00	3.25	79.30	21.03	2.13	6.87	-0.02	0.21	39.19	57.97	0.00	-0.09	372.10	32.26	1.87	435.29	5583.55	4182.62	4062.52	4018.49	5417.52
2.91	18967.00	3.25	79.25	21.02	1.75	5.65	-0.02	0.17	39.22	79.52	0.00	-0.12	453.61	32.33	1.87	386.19	3554.17	2690.65	2620.36	2590.50	3386.66
2.91	18967.00	3.25	79.23	21.01	1.49	4.83	-0.02	0.15	39.25	100.05	0.00	-0.15	531.24	32.39	1.87	379.33	3283.28	2489.39	2425.30	2397.46	3120.16
2.91	18967.00	3.25	79.20	21.01	1.22	3.96	-0.02	0.12	39.30	131.29	0.00	-0.20	649.35	32.48	1.87	375.27	3121.40	2368.79	2308.32	2281.72	2961.65
2.91	18967.00	3.25	79.19	21.00	1.15	3.75	-0.02	0.12	39.31	141.27	0.00	-0.22	687.13	32.51	1.87	371.48	2967.38	2253.75	2196.67	2171.26	2811.47
2.91	18967.00	3.25	79.18	21.00	1.04	3.38	-0.03	0.10	39.34	161.36	0.00	-0.25	763.07	32.58	1.87	370.44	2931.53	2227.12	2170.86	2145.71	2776.21

		SUMS							AVERAGE	SUMS						
2752.83	295.65	1590.07	4043.78	0.83	19248.73	-2470.07	19743.82	1133.51	3330.05	7618.75	-441.06	8059.8	36250.0	-441.1	0.0	-7.9
re	Room Temp	Energy Losses (kJ/kg of Dry Fuel) Flue Gas Constituent							Total Loss Rate							
	K	CO <sub>2</sub>	O <sub>2</sub>	CO	N <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub> O Comb	H <sub>2</sub> O Fuel MC		Total Loss	Chemical Loss 1	Sensible and Latent Loss	Total Output	Chem Loss 2	Grams Produced	
H <sub>2</sub> O																
4859.94	296.21	218.80	242.46	0.07	1495.29	-79.35	1575.19	91.13	3543.58	0.00	0	0.00	0	0	0.00	0.00
3136.92	296.06	139.39	213.97	0.06	1175.08	-108.62	1522.71	87.91	3030.50	1005.60	-36	1041.49	5288	-36	0.00	-0.65
2903.70	295.86	128.87	249.07	0.21	1273.64	-136.56	1518.10	87.47	3120.81	688.15	-30	718.12	3494	-30	0.00	-0.54
2763.81	295.78	122.66	310.99	0.09	1481.64	-179.24	1518.04	87.21	3341.40	657.21	-35	692.33	3073	-35	0.00	-0.63
2630.27	295.82	116.66	318.40	0.00	1491.93	-192.88	1515.13	86.96	3336.20	652.62	-38	690.23	3058	-38	0.00	-0.68
2599.41	295.65	115.34	359.36	0.03	1637.33	-220.28	1516.99	86.91	3495.68	695.05	-44	738.70	3076	-44	0.00	-0.78

Run: 1  
Test Duration: 120  
Output Category: Medium

	HHV Basis	LHV Basis
Overall Efficiency	80.6%	86.9%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	81%	87.3%

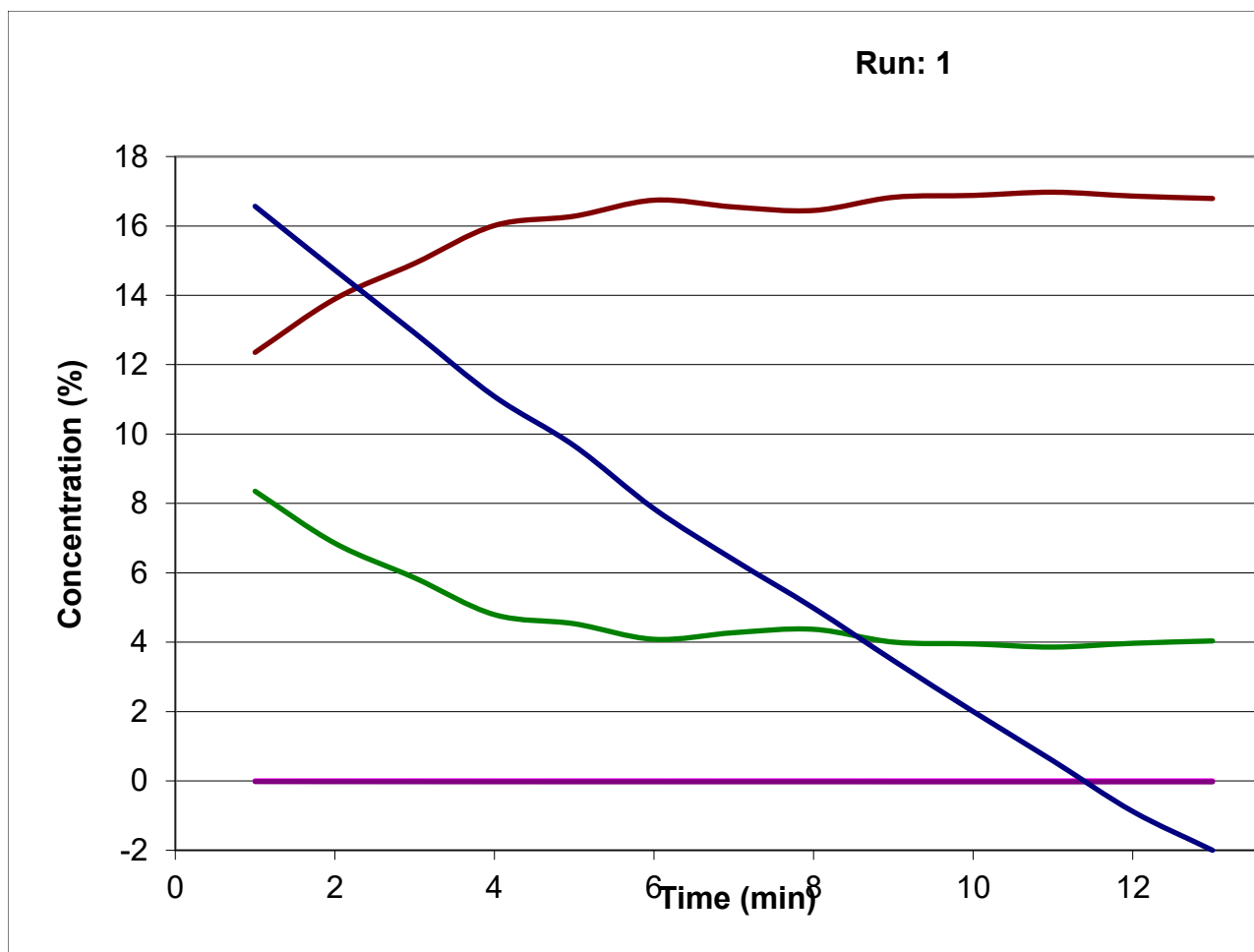
Output Rate (kJ/h)	17,156	16,274	(Btu/h)
Burn Rate (kg/h)	1.12	2.47	(lb/h)
Input (kJ/h)	21,292	20,198	(Btu/h)

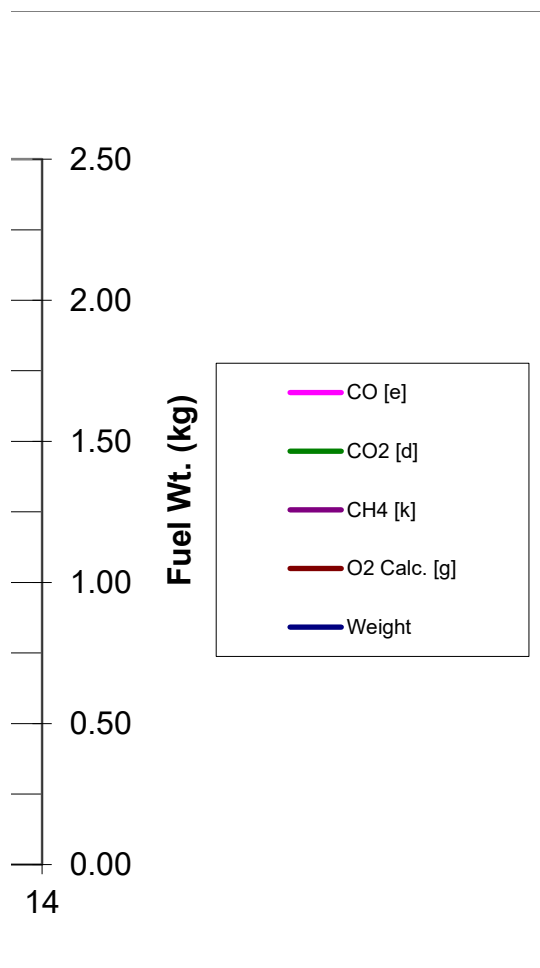
Test Load Weight (dry kg)	2.25	4.95	dry lb
MC wet (%)	3.25		
MC dry (%)	3.36		
Particulate (g )	6.06		
CO (g)	0		
Test Duration (h)	2.00		

Emissions	Particulate	CO
g/MJ Output	0.18	0.00
g/kg Dry Fuel	2.70	0.01
g/h	3.03	0.01
lb/MM Btu Output	0.41	0.00

0.00012

Air/Fuel Ratio (A/F)	25.32
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Note: In the legend, [d], [e], [g], and [k] refer to their respective variables in Clauses 13.7.3 and 13.7.5



Manufacturer: *Smc Heath & Horne*  
Job #: *GI 104780922*

Model: *HP22*  
Run: *1*

Page *1* of *1*  
Date: *10-21-21*  
Tech: *for Station*

## 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	<i>10</i>	<i>31</i>	<i>32</i>	<i>A</i>	<i>33</i>	<i>34</i>	<i>B</i>	<i>35</i>	<i>36</i>	°F	%
<i>10/20/21</i>	<i>7:00A</i>	<i>92.0013</i>	<i>1.8472</i>	<i>1.8017</i>	<i>92.4454</i>	<i>1.8419</i>	<i>1.8332</i>	<i>92.3730</i>	<i>1.8584</i>	<i>1.8254</i>	<i>71.0</i>	<i>42.8</i>
<i>10/21/21</i>	<i>7:30A</i>	<i>92.0012</i>	<i>1.8471</i>	<i>1.8016</i>	<i>92.4453</i>	<i>1.8419</i>	<i>1.8331</i>	<i>92.3329</i>	<i>1.8584</i>	<i>1.8254</i>	<i>71.7</i>	<i>44.9</i>
<i>NA</i>												
<i>NA</i>												
<i>NA</i>												
<i>NA</i>												
<i>NA</i>		Total:	<i>3.6487</i>		Total:	<i>3.675</i>		Total:	<i>3.6838</i>		<i>NA</i>	<i>NA</i>

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	<i>A</i>	<i>31+32</i>	<i>B</i>	<i>33+34</i>	<i>C</i>	<i>35+36</i>	°F	%
<i>10/21/21</i>	<i>3:10P</i>	<i>92.0012</i>	<i>3.6555</i>	<i>92.4454</i>	<i>3.6814</i>	<i>92.3329</i>	<i>3.6878</i>	<i>75.2</i>	<i>39.2</i>
<i>10/22/21</i>	<i>7:30A</i>	<i>92.0012</i>	<i>3.6554</i>	<i>92.4453</i>	<i>3.6797</i>	<i>92.3329</i>	<i>3.6857</i>	<i>67.8</i>	<i>40.2</i>
<i>10/25/21</i>	<i>7:30A</i>	<i>92.0012</i>	<i>3.6521</i>	<i>92.4453</i>	<i>3.6786</i>	<i>92.3329</i>	<i>3.6849</i>	<i>65.5</i>	<i>42.1</i>
<i>10/26/21</i>	<i>7:00A</i>	<i>92.0012</i>	<i>3.6521</i>	<i>92.4453</i>	<i>3.6786</i>	<i>92.3329</i>	<i>3.6847</i>	<i>64.6</i>	<i>40.2</i>
<i>NA</i>									
<i>NA</i>									

### Dry Down Weight

Date	Time	P1	F1	P2	F2	P3	F3	Gr/hr	Lb/MMbtu	Btu
<i>10/21/21</i>	<i>3:10P</i>	<i>0</i>	<i>6.8</i>	<i>0.1</i>	<i>6.4</i>	<i>0</i>	<i>4.0</i>	<i>1.921</i>	<i>NA</i>	<i>NA</i>
<i>10/22/21</i>	<i>7:30A</i>	<i>0</i>	<i>4.7</i>	<i>0</i>	<i>4.7</i>	<i>0</i>	<i>1.9</i>	<i>1.356</i>	<i>1</i>	<i>1</i>
<i>10/25/21</i>	<i>7:30A</i>	<i>0</i>	<i>3.4</i>	<i>0</i>	<i>3.6</i>	<i>0</i>	<i>1.1</i>	<i>1.010</i>		
<i>10/26/21</i>	<i>7:00A</i>	<i>0</i>	<i>3.4</i>	<i>0</i>	<i>3.6</i>	<i>0</i>	<i>0.9</i>	<i>1.010</i>		
<i>NA</i>										
<i>NA</i>										

*1 hr - 1.335*

*AVC/Te 6.06*

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

pg. 1 of 8

## INTRODUCTION

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

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

### I. APPLIANCE INSPECTION AND SET-UP

- A. Incoming Inspection
- B. Unit Set-Up

### II. SAMPLING SYSTEMS - SET-UP

- A. Gas Analysis
- B. Dilution Tunnel

### III. TEST CONDUCT

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

### IV. POST TEST PROCEDURE

- A. Leak Checks
- B. Particulate Sample Recovery

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

- 1. ASTM E2779
- 2. ASTM E2515

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

pg. 2 of 8

I. APPLIANCE INSPECTION AND SET-UP

A. Incoming Inspection

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

B. Unit Set-Up

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

II. SAMPLING SYSTEMS SET-UP

A. Gas Analysis

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

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

pg. 3 of 8

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

The gas analyzer ( $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{O}_2$ ) is zeroed on nitrogen. The  $\text{O}_2$ ,  $\text{CO}_2$  and  $\text{CO}$  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 ( $\text{O}_2$  analyzer should read 20.93,  $\text{CO}$  and  $\text{CO}_2$  should read 0.00).
- b. Switch to "CAL" setting and start the stopwatch. Note the time required for each unit to reach the calibration gas bottle value. If all three analyzers reach this value within 5 seconds of each other, synchronization is adequate. If not, contact the laboratory manager. Synchronization is adjusted by either internal instrument setting or adjustment of sample line length.
- c. Use EPA Method 5H 6.7-6.9 procedures to check calibration of instruments.

4. Sample clean-up train.

- a. Load a new filter in 4-inch glass filter holder.
- b. Load four Impingers as follows:
  - #1: 100 ml. distilled water
  - #2: 100 ml. distilled water
  - #3: Empty
  - #4: 200-300 grams Drierite.
- c. Place Impingers in container and connect with greased "U TUBES". (Grease carefully on bottom half of ball joint so that grease will not get into tubes.)
- d. Connect filter to impinger #1 and sample line to impinger #4.
- e. Connect stack probe to filter.
- f. Leak check system as follows:

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

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

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

B. Dilution Tunnel Sample Train Set-Up:

1. Filters and holders.
  - a. Clean probes and filter holder front housings carefully and desiccate to a constant weight prior to use.
  - b. Filters and filter probe combinations should be numbered and labeled prior to use.
  - c. Weigh desiccated filters and probe filter units on analytical balance. Record the weights on the appropriate form. Note that the probe and front half of the front filter holder is to be weighed as a unit.
  - d. Carefully assemble the filter holder units and connect to sampling systems.
  - e. System #1 (Filter set #1) will have one filter set and System #2 (Filter set #2 and #3) will have two filter sets. Filter set #2 will be changed 1-hour into the test.
  - e. Change desiccate columns with dry absorbent before each test series.
2. Leak checking.
  - a. Each sample system is to be checked for leakage prior to inserting probes in tunnel.
  - b. Plug probes and start the samplers. Adjust pump bypass valve to produce a vacuum reading of 10 inches mercury. NOTE: During test, highest vacuum recorded is required for posttest leak check.
  - c. Allow vacuum indication to stabilize at 10" mercury, record dry gas meter readings, (DGM<sub>1</sub>, DGM<sub>2</sub>). At a convenient DGM value start stopwatch. Time for 1 minute then stop vacuum pumps. Record dry gas meter readings again, (DGM<sub>3</sub>, DGM<sub>4</sub>). NOTE: If rotometer ball is floating above the 5-mm mark, system is leaking too much and all seals should be checked.

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- d. Calculate leakage rate as follows.

System 1:  $DGM3 - DGM_1 = CFM_1$

System 2:  $DGM4 - DGM_2 = CFM_2$

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

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

### III. TEST CONDUCT

#### A. Pre-Test Fuel Load

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

#### B. Test Fuel Load

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

#### C. Unit Start-Up

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



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

D. Test Run

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

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#### IV. POST TEST PROCEDURES

##### A. Leak Checks

1. Dilution Tunnel
  - a. Remove sample probes from tunnel and plug with rubber stopper.
  - b. Turn on sample system and set vacuum to 10" mercury or to the highest value reached during the test.
  - c. At a convenient value start stopwatch and record the DGM starting value.
  - d. After 1 minute stop sample system and record ending DGM value.
  - e. Calculate leakage rate per pre-test description (see II.B.2.c.).
2. Gas Analyzers
  - a. Set stack sample flow to about 75 mm on the rotometer.
  - b. Plug with rubber stopper.
  - c. Adjust vacuum to 10" mercury.
  - d. Let system stabilize then record rotometer readings.
  - e. If the rotometer readings do not equal zero, check with the laboratory manager.
  - f. SLOWLY unplug probe and decrease flow rate to zero.
  - g. Turn off stack sampling system.
  - h. Zero, span and calibrate the analyzers (see Gas Analysis). **RECORD ONLY** these meter values.

##### B. Particulate Sample Recovery

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

#### V. DISPOSITION OF TESTED UNIT.

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

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

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- 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.

# 48hr Preburn

Model: HP50

Date	Time	Flue Temp	Room Temp	Pellets Added	Notes
10-5	10 AM	77	77	40 #	
10-5	11 AM	464	81		
10-5	12 N	482	82		
10-5	1 PM	483	84		
10-5	2 PM	480	84		
10-5	3 PM	472	91		
10-5	4 PM	481	89		7 hrs
10-5	5 PM	457	94	21 #	
10-6	6 AM	73	75		
10-6	7 AM	386	77		
10-6	8 AM	419	81		
10-6	9 AM	447	82		
10-6	10 AM	440	78		
10-6	11 AM	432	84	40 #	
10-6	12 N	411	83		
10-6	1 PM	458	86		
10-6	2 PM	487	86		
10-6	3 PM	485	87		
10-6	4 PM	478	92		12 hrs
10-6	5 PM	482	88		
10-6	6 PM	474	89	40 #	
10-7	630 AM	76	74		
10-7	730 AM	448	83		
10-7	830 AM	467	80		
10-7	930 AM	441	83		
10-7	1030 AM	456	82		
10-7	1130 AM	476	82		
10-7	1230 PM	452	87	40 #	
10-7	130 PM	447	86		
10-7	230 PM	461	86		
10-7	330 PM	460	84		
10-7	430 PM	460	84		
10-7	530 PM	456	84		11 hrs
10-8	630 AM	77	72		
10-8	730 AM	410	73		
10-8	830 AM	428	78		
10-8	930 AM	433	78	40 #	
10-8	1030 AM	444	81		

Model: HP50

Date	Time	Flue Temp	Room Temp	Pellets Added	Notes
10-8	1130A	449	81		
10-8	1230P	441	83		
10-8	130P	451	81		
10-8	230P	457	79		
10-8	330P	442	82		
10-8	430P	459	81	40 #	
10-8	530P	473	82		11 hrs
10-9	630A	72	64		
10-9	730A	474	72		
10-9	830A	488	75		
10-9	930A	476	80		
10-9	1030A	463	79	40 #	
10-9	1130A	472	81		5 hrs
10-9	930A	72	70		
10-9	1030A	467	72		
10-9	1130A	464	73		

2hr  
Total 48

Model: HP22

Date	Time	Flue Temp	Room Temp	Pellets Added	Notes
10-5	9 AM	73	76	40 #	
10-5	10 AM	464	81		
10-5	11 AM	504	85		
10-5	Noon	493	85		
10-5	1 PM	496	83		
10-5	2 PM	472	87	25 #	
10-5	3 PM	454	90		8 hrs
10-5	4 PM	471	90		
10-5	5 PM	476	91		
10-6	6 AM	73	75		
10-6	7 AM	394	77		
10-6	8 AM	458	84		
10-6	9 AM	482	84	27 #	
10-6	10 AM	483	83		
10-6	11 AM	489	86		
10-6	Noon	454	85		
10-6	1 PM	476	90		
10-6	2 PM	472	94		
10-6	3 PM	465	92	40 #	
10-6	4 PM	479	94		12 hrs
10-6	5 PM	473	95	12 #	
10-6	6 PM	476	102		
10-7	630 AM	75	79		
10-7	730 AM	457	79		
10-7	830 AM	468	86		
10-7	930 AM	480	85		
10-7	1030 AM	472	84	40 #	
10-7	1130 AM	473	83		
10-7	1230 PM	462	84		
10-7	130 PM	463	85		
10-7	230 PM	465	86	40 #	
10-7	330 PM	473	86		
10-7	430 PM	483	86		
10-7	530 PM	465	85		11 hrs
10-8	630 AM	78	75		
10-8	730 AM	463	84		
10-8	830 AM	478	85		
10-8	930 AM	477	85		

Model: HP22

Date	Time	Flue Temp	Room Temp	Pellets Added	Notes
10-8	10:30A	482	84	40 #	
10-8	1130A	473	83		
10-8	1230P	476	83		
10-8	130PM	480	84		
10-8	230P	472	85		
10-8	330P	488	85		
10-8	430P	485	86	40 #	11 hrs
10-8	530P	476	85		
10-9	630A	66	72		
10-9	730A	478	79		
10-9	830A	481	82		
10-9	930A	476	82		
10-9	1030A	484	84	40 #	5 hrs
10-9	1130A	476	83		
10-11	930A	70	71		
10-11	1030A	482	78		2 hrs
10-11	1130A	490	78		
					49 TOTAL