



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

Mr. Dale Horihan  
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Tower, Minnesota 55790

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

10/07/2022

Dear Mr.Horihan,

This letter is in response to your correspondence, dated October 6<sup>th</sup>, 2022 regarding certification testing of your Vapor-Fire 100 non-catalytic wood-fired forced-air furnace. The aim of this testing is to renew your 2020 certification for this appliance model, in the same configuration as originally tested in 2017. In your letter, you request the use of alternative testing procedures to demonstrate compliance with 40 CFR 60, Subpart QQQQ - Standards of Performance for New Residential Hydronic Heaters and Forced Air Furnaces (Subpart QQQQ), Section 60.5474(b)(6). In your letter you clarify that this appliance does not use a remote room thermostat to control the combustion air to the fire as other warm air furnaces. You further state that because of the design of the Vapor-Fire 100, and its internal computer draft controls, it cannot be operated at the less than 15% rate required by subpart QQQQ and method 28QWHH. You further state that because the Vapor-Fire has a minimum draft feature that does not allow for demonstration of a “stopped combustion condition”, CSA method 415.1-10 section 7.1 would not be an appropriate means of compliance demonstration for this model appliance, and therefore you are requesting to demonstrate compliance using the heat output rates ranges specified in CSA B415.1-10, Section 7.2.1.2. You further state that due to the computer controlled heat delivery mechanism integral to your appliance that cycling heat output during the testing, as specified in CSA B415.1-10 Section 7.2.2.2, cannot be accomplished as directed by the test method when demonstrating compliance with Category II and Category III heat output ragnes.

The Office of Air Quality Planning and Standards, as the delegated authority, must make the determination on any major alternatives to test methods and procedures required under 40 CFR parts 59, 60, 61, 63, and 65. Your proposed alternative testing procedures and our approval decisions are discussed below.

In your letter, you seek an alternative certification procedure through use of the Canadian Standards Association (CSA) B415.1-10 *Performance Testing of Solid-fuel-burning Heating Appliances* test method, which includes procedures for testing of thermostatically or electronically controlled forced-air furnaces using cord wood fuel. Specifically, you are asking to use the heat output rate categories stated in Section 7.2 of CSA Method B415.1-10 in lieu of the Method 28 WHH (40 CFR 60, Appendix A) procedures as required by 40 CFR 60.5476(e) of subpart QQQQ. In your letter you state that you

will pre-set the onboard computer controls to target heat output rates appropriate to the Category II and Category III ranges specified in CSA B415.1-10, Section 7.2.1.2.

According to the information you provided, you seek an alternative test method so you may use the heat output rate targets listed in CSA Method B415.1-10 Section 7.2.1.1 and actual category heat output ranges described in Section 7.2.1.2. Your request indicates that you would like to keep the distribution blower turned off during the Category 1 test which is contrary to instruction in CSA Method B415.1-10 Section 7.2.2.2 of the test method. You indicate that by testing in this manner, you will be ensuring that the heat from Category 1 will be as low or lower than any heat output rating that any customer or homeowner can achieve in real life.

You state that, because of the design of the Vapor-Fire 100, it cannot, due to its computer draft controls, be operated at the less than or equal to 15% heat output rate required by 40 CFR 60.5476(e) of subpart QQQQ and Method 28 WHH. In addition, the Vapor-Fire 100 has a minimum draft feature that does not allow for demonstrations of a stopped combustion condition as specified by CSA Method B415.1-10 when the forced-air furnace cannot meet the less than or equal to 15% heat output rate. You state the Vapor-Fire 100 combustion is continuous due to the computer controls and your appliance uses a thermocouple in the firebox and not a thermostat to maintain steady combustion.

To address these issues stated above, you are requesting to use the heat output rate targets described in CSA Method B415.1-10 Section 7.2.1.1 and the actual heat output ranges described in CSA Method B415.1-10 Section 7.2.1.2 in lieu of those required by 40 CFR 60.5476(e) of subpart QQQQ which states to use the burn rates in Method 28 WHH. You request the following modifications:

- Category 1: To keep the distribution blower turned off during the Category 1 test). By testing in this manner we are ensuring that the heat from category 1 will be as low, or lower than any heat output rating that any customer/homeowner can achieve in real-world use.
- Category 2: Use the low limit thermostat set between 120 and 130 degrees F and set the computer at the lowest setting. The wall thermostat will be set at the lowest setting.
- Category 3: Set the computer between 25% and 50% open and set the low limit thermostat between 95 and 125 degrees F. The wall thermostat will be again, set at the lowest setting.
- Category 4: The computer will be set at the highest setting and the low limit thermostat will be set at the lowest setting (90 degrees) and the wall thermostat set at the wide open setting.

**Based on the information provided and with the caveats set forth below**, we are approving your alternative method request for certification testing of the Vapor-Fire 100 electronically controlled forced-air furnace. As required in Subpart QQQQ, Section 60.5476(a), the manufacturer must have the approved test laboratory measure, calculate and report the efficiency, (i.e., heat output and carbon

monoxide emissions) of the tested wood heater using CSA Method B415.1-10. For particulate matter emission concentrations, ASTM E2515-11 *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel* (ASTM E2515-11) must be used; four-inch filters are acceptable. Disregard Sections 8.3.1 and 8.4 in CSA Method B415.1-10 regarding the use of Douglas fir lumber in a crib wood configuration for EPA testing. However, for cordwood, you may use Douglas fir as well as any of the other species of wood listed in CSA Method B415.1-10.

The Vapor-Fire 100 forced-air furnace design incorporates a low setting on its controller which is the lowest heat output (Btu/hr) setting available to the user and corresponds to the lowest burn rate to be evaluated during certification testing; this is consistent with 40 CFR part 60, Subpart QQQQ, Section 60.5476, which states “*The burn rate for the low burn category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer.*” For the purposes of your testing, you have determined that the the heat delivery blower will be turned off for the duration of your low fire testing, thereby providing a test condition that is representative of a full idle mode for this appliance as your Category I appliance operating mode.

**This letter supersedes the Alternate Test Method for the Vapor-Fire 100 that was sent to you on August 1, 2017, the Alternate Test Method approved on October 3, 2022 and the Alternate Test Method approved on October 5<sup>th</sup>, 2022. Additionally, a full copy of this letter must be included in the certification test report.** The emission limit in the rule remains intact for each heat output category. This alternative method approval is valid until such time that Subpart QQQQ is revised or replaced to require a different certification test method for these units, and at such time, this alternative will be reconsidered and possibly withdrawn.

When conducting the certification test of the Vapor-Fire 100, the heat output rate requirements in Section 7.2.1.2 of CSA Method B415.1-10 must be followed in conjunction with the caveats below:

- **Category 1:** Operate at the lowest delivered heat output that the unit is capable of operating which must be below 35% of the **actual maximum measured** heat output of the furnace as achieved in the Category 4 test and not using the manufacturer’s rated heat output. The low limit thermostat switch must be in the **OFF** position for the entire Category 1 test and **NOT** manually turned on and off (cycled) as required in Section 7.2.2.2 of CSA Method B415.1-10. This operation is intended to minimize the heat output from the appliance during the test.
- **Category 2:** Heat output must be between 35 and 53% of the **actual maximum measured** heat output of furnace as determined by the Category 4 test. You must use the low limit thermostat set between 120 and 130 degrees F and set the computer at the lowest setting. The wall thermostat will be set at the lowest setting in order to meet the heat output range requirements in Section 7.2.1.2 of CSA Method B415.1-10.
- **Category 3:** Heat output must be between 53 and 76% of the **actual maximum measured** heat output of furnace as determined by the Category 4 test. You will set the computer between 25%

and 50% open and set the low limit thermostat between 95 and 125 degrees F. The wall thermostat will be set at the lowest setting for this test.

- **Category 4:** Operate at the highest delivered heat output that the unit is capable of operating. The resultant heat output is the **actual maximum measured** heat output of the furnace. The computer will be set at the highest setting and the low limit thermostat will be set at the lowest setting (90 degrees) and the wall thermostat will be set at the wide open setting.

The target and cycling procedures in Section 7.2.2.2 of CSA Method B415.1-10 do not apply for this test method. Heat output cycling will be achieved through normal appliance operation, coupled with specific thermostat and control settings, in the case of Category II and Category III tests, while heat output will be forced to a minimum (heat distribution blower off) for Category I testing.

**The specified settings and control configurations listed above for the 4 heat output category tests constitute “operation as intended by the manufacturer” as allowed in CSA B415.1-10, Section 7.2.2.4. Changes to these configurations may not be made during the test, such that the control settings then reside outside of the stated parameters. Changes such as this will invalidate the test run for the operational settings would no longer conform to the settings stipulated above.**

Photo documentation of the control settings specified for each category test is required. Your test report must document all settings described above with respect to operation of the appliance during each category test.

Additionally, per section 8.5.6 of CSA B415.1-10, the **maximum start time for each test run is limited to 5 minutes**. There is no additional time allotted as suggested in Sections 8.5.4 and 8.5.5.

As required in Subpart QQQQ, Section 60.5476(c)(6), the manufacturer or approved test lab must also measure the first hour of particulate matter emissions for each test run. When using ASTM E2515-11 to conduct first hour PM sampling as required by 60.5476(c)(6), the following changes and modifications must be made:

1. To determine the first hour PM emissions as required by 60.534(d), the manufacturer and approved test laboratory must measure the first hour of PM emissions for each test run by sampling with a third, identical and independent sampling train operated concurrently for the first hour of PM paired train compliance testing. The manufacturer and approved test laboratory must report the test results from this third train separately as the first hour emissions. Filters must be recovered and weighed as a paired set.

Additionally the following changes to ASTM E2515-11 must be followed for the certification testing for all particulate matter sampling:

1. Filters must be weighed in pairs to reduce weighing error propagation. See ASTM E2515-11, Section 10.2.1, Analytical Procedure.
2. Sample filters must be Pall TX-40 or equivalent Teflon-coated glass fiber filters, and 47 mm, 90 mm, 100 mm, or 110 mm in diameter.
3. Only one point is allowed outside the  $\pm 10$  percent proportionality range per test run.
4. Sample filter temperature must be maintained between 80°F and 90°F at all times, for each test run.

If you have additional questions regarding this approval, please contact Michael Toney of my staff at 919-541-5247 or [toney.mike@epa.gov](mailto:toney.mike@epa.gov).

Sincerely,

Steffan M. Johnson  
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Measurement Technology Group

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