

US EPA Wood Fired Appliance Test Report Deficiency Items

3/23/2023

SUBPART AAA - Wood Heaters and Pellet Heaters

The below list describes issues that have been found in the report review process. The below list is **not** a comprehensive list of all the requirements to be adhered to with respect to the rule and applicable test methods.

Test Type	Issue	Applicable Method Reference	Applicable Rule Reference
All Appliances	1st hour PM must be measured, calculated and reported for every test run . Results must be in a summary table in the report. Additionally, the 1st hour PM value must not be reported as a negative value. Zero values must be discussed and justified.		40 CFR 60.534(d)
All Appliances	The dilution tunnel used for sampling must be built per ASTM E2515 specification and the diagram of that system in the test report must reflect that the tunnel meets the method design requirements outlined in ASTM E2515 section 6.1.6.	ASTM E2515 (6.1.6) (Figure 4)	
All Appliances	For testing not being performed inside the ISO 17025 accredited laboratory, a listing of all equipment not owned by the test laboratory and used for testing, as well as calibration documentation, must be included in the test report. Additionally, the test lab must verify and provide attestation that the dilution tunnel meets ASTM E2515 section 6.1.6 design requirements, for example a photo of the appliance on the test stand with the dilution tunnel pictured.	ASTM E2515 (6.1.6) (Figure 3 and 4)	
All Appliances	Leak test information including leakage rate and any meter system volume adjustments must be documented for any filter change during the test, and for system leak check following the test run.	ASTM E2515 (9.6.5)	
All Appliances	Required proportional sampling means that filters must be changed to maintain proportional sampling should a filter plug. This is not a reason to abort the test. Filters that plug during the first hour need to be replaced and again swapped out at the 1 hr mark to measure 1st hr emissions.	ASTM E2515 (9.8.1)	
All Appliances	Negative probe weight may not be greater than 5% of particulate catch weight (excluding probe) and must be marked as an invalid run.	ASTM E2515 (10.2.2.2)	
All Appliances	Negative probe values or negative room air values not handled appropriately. Proper procedures need to be followed per the method.	ASTM E2515 (10.2.2.1), (10.2.2.2), (10.2.2.3)	
All Appliances	For filters or filter assemblies with negative tare values, present the data in the test report with the negative mass included in the sample and the negative mass counted as zero. Calculate and report the particulate matter emissions both ways.		

All Appliances	Ambient background filter information not found in report or it was not done at all. This must be in the report.	ASTM E2515 (9.5.2), (9.8.1), (9.8.5), (11.4.2)	
All Appliances	Stack pressure (P_s) – refer to EPA Method 2 for correct definition of absolute stack pressure. When calculating P_s you need to determine the local atmospheric pressure (in corresponding units, millimeters or inches of Hg) and add the duct static pressure to determine P_s . (Typically this will result in a value below atmospheric pressure, as the duct is under negative pressure).	ASTM E2515 (11.2)	
All Appliances	Dual train comparison (precision) must be calculated and both comparisons (% and g/kg) must be included in the report. The criteria for acceptance is either/or, but both must be presented in the report.	ASTM E2515 (11.7)	
All Appliances	Owner's manual must include what is required per the rule. Typically improper fuel warning is missing, proper air controls and proper operation of low burn, among other requirements. All of the owner manual requirements must be in the report per the rule.		40 CFR 60.536(g)(1) 40 CFR 60.536(g)(2) 40 CFR 60.536(g)(3) 40 CFR 60.536(g)(3)(i) 40 CFR 60.536(g)(3)(ii) 40 CFR 60.536(g)(3)(iii) 40 CFR 60.536(g)(3)(iv) 40 CFR 60.536(g)(3)(v) 40 CFR 60.536(g)(3)(vi) 40 CFR 60.536(g)(3)(vii) and (viii)
All Appliances	The report must contain all required data for all test runs, partial, incomplete, invalidated, or complete.		40 CFR 60.533(b)(5)
All Appliances	The test report must contain reported values for CO and efficiency measurement per test run, for all test run data submitted. Test runs that are incomplete due to broken sampling pieces, loss of power to the lab, or other extenuating circumstances must include the collected data for reporting these values and an explanation of why the calculations could not be performed to report those values.		40 CFR 60.534 (e)
All Appliances	Failure to document lowest burn rate. This must be included in the test report. See Rule citation.		40 CFR 60.533(b)(5)
All Appliances	Test report must include complete summary tables, individual and overall emissions, efficiencies and heat outputs.		40 CFR 60.533(b)(5)
All Appliances	Preliminary tests were conducted to "ensure that the unit reaches the limit of the standard" but no data was provided in the report. All data must be included in the report.		40 CFR 60.534(a)(1)

All Appliances	Appropriateness, validity, anomalies discussion must be included in report. All anomalies must be discussed in the report and explained per test run.		40 CFR 60.533(b)(5)
All Appliances	Lab technician notes, raw data sheets, calculations and test results along with calibration sheets for all calibrated equipment (in English) must be included in the report. All of the items referenced in the rule must be included in the report.		40 CFR 60.533(b)(5)
All Appliances	Manufacturer's instructions must not override the requirements of the rule or the test method. Manufacturer's instructions must be included in report. Additionally, manufacturer's instructions need to be consistent with the owner's manual and the testing must be consistent with the instructions provided to the lab and the owner's manual. If no instructions were provided to the test lab the report must state that there were no manufacturer's instructions provided to the test lab and the source of testing parameters used for certification testing (i.e., owner's manual).		40 CFR 60.534(h) 40 CFR 60.536(g)(1)
All Appliances	CO must be reported to two significant figures (0.0 has no significant figures).	CSA B415.1-10 Section 6.3	40 CFR 60.534(e)
Catalytic Appliances	Manufacturer's instructions provided to the test lab, and test lab operations of the catalyst bypass during testing, must agree with the bypass instructions described in the owner's manual. The manufacturer must provide evidence (schematic or statement) in the non-CBI test report that the wood heater is equipped with a temperature sensor that can monitor combustor gas stream temperatures within or immediately downstream [within 2.54 centimeters (1 inch)] of the catalytic combustor surface.		40 CFR 60.532(h) 40 CFR 60.536(g)(1)
ASTM E2515	Calibration frequency for the volume metering system, temperature sensors (thermocouples), barometer, and the analytical balance must be adhered to. Calibration documentation must be included in the report for all relevant equipment, it must be current for the time period that the test was conducted and must show that "as found" conditions were within specification.	ASTM E2515 (8.1), (8.2), (8.3), (8.4)	
Method 28R/ASTM E2780	Complete conditioning data with all applicable sections referenced must be included in the test report. Medium burn rate, fuel moisture and timing, flue gas temperature, catalytic combustor exit temperature (if catalyst-equipped) must be specified and reported.	M 28R (2.1.4) ASTM E2780 (9.1.3), (9.1.4), (9.1.5), (9.1.6)	40 CFR 60.533(b)(5)

Method 28R/ASTM E2780	Overall firebox calculations and dimensions as well as usable firebox dimensions and calculations that result in the listed firebox volume used for certification testing must be calculated and shown in the report. These must not conflict with diagrams, drawings or firebox descriptions elsewhere in the report or user manual.	ASTM E2780 (9.3)	40 CFR 60.533(b)(3) 40 CFR 60.533(b)(5)
Method 28R/ASTM E2780	Fuel moisture content must be per the method.	ASTM E2780 (9.4.1.2.(1))	
Method 28R/ASTM E2780	Failure to document lowest burn rate. This must be included in the test report. See Rule citation.	M28 (8.1.1) via M28R (2.1.1)	40 CFR 60.537(a)(2)
Method 28R/ASTM E2780	Fuel type must be specified in the report. Douglas fir for this method.	ASTM E2780 (9.4.1.1)	40 CFR 60.533(b)(5)
Method 28R/ASTM E2780	Test fuel density and test fuel crib loading density must fall within the range specified in the test method.	ASTM E2780 (9.4.1.3), (9.4.1.5)	
Method 28R/ASTM E2780	For square or rectangular fireboxes, the test fuel length targets 5/6ths of the defined firebox length (section 3.2.8) and may be shorter only to meet the test fuel crib loading density range requirements. Fireboxes that are not square or rectangular (i.e., trapezoidal) are best tested with a crib design that matches the geometry of the firebox and includes one or more firebox lengths (section 3.2.8) to determine the appropriate crib geometry.	ASTM E2780 (9.4.1.6)	
Method 28R/ASTM E2780	Calibration frequency for the wood moisture meter, platform scale, test fuel scale, and temperature sensors (thermocouples) must be adhered to. Calibration documentation must be included in the report for all relevant equipment, it must be current for the time period that the test was conducted and must show that "as found" conditions were within specification.	ASTM E2780 (8.1), (8.2), (8.3), (8.4)	
ASTM E3053	Cordwood fuel shape not per the method. Fuel shape must be consistent with the method definition.	ASTM E3053 (3.2.3)	
ASTM E3053	Test fuel length used must be per the method. Usually, the manual gives the max log length, but the length used for testing is significantly smaller. Test fuel length must be in accordance with the manufacturer's instructions and shall be a nominal length of +/- 1 inch. 1 nominal fuel length per appliance is allowed. ASTM 3053 allows a single nominal fuel length.	ASTM E3053 (8.4.2.8)	
ASTM E3053	Type of cord wood fuel burned must meet fuel density requirements and fuel species must be documented in the test report.	ASTM E3053 (8.4.2.1)	
ASTM E3053	Complete conditioning data with all applicable sections referenced must be included in the test report. Combustion air setting, time, weight and moisture content for fuel added must be reported, flue gas temperature, catalytic combustor exit temperature (if catalyst-equipped) must be specified and reported.	ASTM E3053 (8.1.4), (8.1.5), (8.1.6), (8.1.7)	

ASTM E3053	Failure to document lowest burn rate. This needs to be included in the test report. See rule citation.	ASTM E3053 (8.7.1)	40 CFR 60.537(a)(2)
ASTM E3053	Overall firebox calculations and dimensions as well as usable firebox dimensions and calculations that result in the listed firebox volume used for certification testing must be calculated and shown in the report. These must not conflict with diagrams, drawings or firebox descriptions elsewhere in the report or user manual.	ASTM E3053 (3.2.5), (3.2.6), (3.2.7), (8.3)	40 CFR 60.533(b)(3) 40 CFR 60.533(b)(5)
ASTM E3053	Filter media must be teflon coated glass fiber and all filters must be weighed in pairs .	EPA ALT-125 & EPA ALT-127	
ASTM E3053	Clear and representative (close-up) photos must be in the report (not photos from across the room or signs that are illegible).	ASTM E3053 (8.2.7), (8.5.9.2), (8.5.9.3), (8.5.9.5), (8.6.8), (8.6.9.1) among other references in the method	40 CFR 60.533(b)(5)
ASTM E3053	Medium burn rate must be greater than the low burn rate. Documentation must be provided in the report for the primary air settings used.	ASTM E3053 (8.7.1), (8.7.1.1), (8.8.1), (8.8.1.1)	40 CFR 60.537(a)(2)
ASTM E3053	Calibration frequency for the wood moisture meter, platform scale, test fuel scale, and temperature sensors (thermocouples) must be adhered to. Calibration documentation must be included in the report for all relevant equipment, it must be current for the time period that the test was conducted and must show that "as found" conditions were within specification.	ASTM E3053 (7.1), (7.2), (7.3), (7.4)	
ASTM E3053	For the high fire test the average heater surface temperature and the flue-gas temperature at the start of the test run shall be less than 10 °F (5°C) above ambient.	ASTM E3053 (8.5), (8.5.1)	
ASTM E2779	Complete conditioning data with all applicable sections referenced must be included in the test report. Run hours at medium burn rate, time and weight of all fuel added and flue gas temperature.	ASTM E2779 (9.1.3), (9.1.4), (9.1.5)	
ASTM E2779	Report must include assay of pellet fuel analysis by certified 3rd party laboratory.		40 CFR 60.532(e)
ASTM E2779	Maximum burn rate criteria must be documented in the test report, showing that the unit was operated per manufacturers rating for maximum output (highest feed rate).	ASTM E2779 (9.4.1.1)	
ASTM E2779	Per ASTM E2779, the medium burn rate must be <50% of the maximum burn rating. Per EPA ALT-146, the Medium Burn Rate Category may be determined as the level below 50% of the span between the Maximum Burn Rate and the Low Burn Rate (a non-zero value).	ASTM E2779 (9.4.1.2) EPA ALT-146	

ASTM E2779	Verify that additional test runs use proper averaging per the test method. If 2 tests are done then both need to be included in the average but if 3 tests are done then 2/3 need to be included in the average and all of the data must be reported.	ASTM E2779 (9.4.8)	
ASTM E2779	Pre-ignition data must be included in the report.	ASTM E2779 (9.4.2)	
ASTM E2779	If another fuel is listed in the manual (i.e., corn pellets) then one test run with each alternate fuel must be conducted and the data must be included in the test report.	ASTM E2779 (9.4.9)	40 CFR 60.532(f)(14)
ASTM E2779	Calibration frequency for the platform scale and the temperature sensors (thermocouples) must be adhered to. Calibration documentation must be included in the report for all relevant equipment, it must be current for the time period that the test was conducted and must show that "as found" conditions were within specification.	ASTM E2779 (8.1), (8.2)	

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SUBPART QQQQ - Hydronic Heaters and Forced Air Furnaces

The below list shows issues that have been found in the report review process. The below list is **not** a comprehensive list of all the requirements to be adhered to with respect to the rule and applicable test methods.

Test Type	Issue	Applicable Method Reference	Applicable Rule Reference
All Appliances	1st hour PM must be measured, calculated and reported for every test run . Results must be in a summary table in the report. Additionally, the 1st hour PM value must not be reported as a negative value. Zero values must be discussed and justified.		40 CFR 60.5476(c)(6)
All Appliances	The dilution tunnel used for sampling must be built per ASTM E2515 specification and the diagram of that system in the test report must reflect that the tunnel meets the method design requirements outlined in ASTM E2515 section 6.1.6.	ASTM E 2515 (6.1.6) (Figure 4)	
All Appliances	For testing not being performed inside the ISO 17025 accredited laboratory, a listing of all equipment not owned by the test laboratory and used for testing, as well as calibration documentation, must be included in the test report. Additionally, the test lab must verify and provide attestation that the dilution tunnel meets ASTM E2515 section 6.1.6 design requirements and a photo of the appliance on the test stand with the dilution tunnel must be included in the test report.	ASTM E 2515 (6.1.6) (Figure 4)	
All Appliances	Leak test information including leakage rate and any meter system volume adjustments must be documented for any filter change during the test, and for system leak check following the test run.	ASTM E2515 (9.6.5)	
All Appliances	Required proportional sampling means that filters must be changed to maintain proportional sampling should a filter plug. This is not a reason to abort the test. Filters that plug during the first hour need to be replaced and again swapped out at the 1 hr mark to measure 1st hr emissions.	ASTM E2515 (9.8.1)	
All Appliances	Failure to document lowest burn rate. This must be included in the test report. See Rule citation.		40 CFR 60.5475(b)(5)
All Appliances	Negative probe weight greater than 5% of particulate catch weight (excluding probe) must be marked as an invalid run.	ASTM E2515 (10.2.2.2)	
All Appliances	Negative probe values or negative room air values must be handled appropriately, per procedures in the method.	ASTM E2515 (10.2.2.1), (10.2.2.2), (10.2.2.3)	

All Appliances	For filters or filter assemblies with negative tare values, present the data in the test report with the negative mass included in the sample and the negative mass counted as zero. Calculate and report the particulate matter emissions both ways.		
All Appliances	Ambient background filter information must be in the report. Ambient background sampling is required, per the method.	ASTM E2515 (9.5.2), (9.8.1), (9.8.5), (11.4.2)	
All Appliances	Stack pressure (Ps) – refer to EPA Method 2 for correct definition of absolute stack pressure. When calculating Ps you need to determine the local atmospheric pressure (in corresponding units, millimeters or inches of Hg) and add the duct static pressure to determine Ps. (Typically this will result in a value below atmospheric pressure, as the duct is under negative pressure).		
All Appliances	Dual train comparison (precision) must be calculated and both comparisons (% and g/kg) must be included in the report. The criteria for acceptance is either/or, but both must be presented in the report.	ASTM E2515 (11.7)	
All Appliances	Owner's manual must include what is required per the rule. Typically, the improper fuel warning is missing, proper air controls and proper operation of lowest burn rate, among other requirements. All of the owner manual requirements must be in the report per the rule.		40 CFR 60.5478(f)(1) 40 CFR 60.5478(f)(2) 40 CFR 60.5478(f)(3) 40 CFR 60.5478(f)(3)(i) 40 CFR 60.5478(f)(3)(ii) 40 CFR 60.5478(f)(3)(iii) 40 CFR 60.5478(f)(3)(iv) 40 CFR 60.5478(f)(3)(v) 40 CFR 60.5478(f)(3)(vi) 40 CFR 60.5478(f)(3)(vii) and (viii)
All Appliances	The report must contain a discussion of each test run and its appropriateness and validity as well as a discussion of anomalies observed. Additionally, whether all burn rate categories were achieved and discussion on any test runs not completed.		40 CFR 60.5475(b)(5)
All Appliances	The report must contain all required data for all test runs, partial, incomplete, invalidated, or complete.		40 CFR 60.5475(b)(5)
All Appliances	Each output rate category must be below the PM emission limit for the applicable appliance type. No weighted averaging is needed for compliance with this subpart.		40 CFR 60.5474(b)(2) 40 CFR 60.5474(b)(3) 40 CFR 60.5474(b)(6)
All Appliances	Preliminary tests that are conducted once the heater is in the lab generate data that must be included in the report.		40 CFR 60.5475(b)(5)

All Appliances	Test report must include complete summary tables, individual and overall emissions, efficiencies and heat outputs.		40 CFR 60.5475(b)(5)
All Appliances	Lab technician notes, raw data sheets, calculations and test results along with calibration sheets for all calibrated equipment must be included in the report. All of the items referenced in the rule must be included in the report.		40 CFR 60.5475(b)(5)
All Appliances	Manufacturer's instructions must not override the requirements of the rule or the test method. Manufacturer's instructions must be included in report. Additionally, manufacturer's instructions need to be consistent with the owner's manual and the testing must be consistent with the instructions provided to the lab and the owner's manual. If no instructions were provided to the test lab the report must state that there were no manufacturer's instructions provided to the test lab and the source of testing parameters used for certification testing (i.e., owner's manual).		40 CFR 60.6476(i) 40 CFR 60.5478(f)(1)
All Appliances	CO must be reported to two significant figures (0.0 has no significant figures).	CSA B415.1-10 Section 6.3	40 CFR 60.5476(a)
Catalytic Appliances	Manufacturer's instructions provided to the test lab, and test lab operations of the catalyst bypass during testing, must agree with the bypass instructions described in the owner's manual. The manufacturer must provide evidence (schematic or statement) in the non-CBI test report that the wood heater is equipped with a temperature sensor that can monitor combustor gas stream temperatures within or immediately downstream [within 2.54 centimeters (1 inch)] of the catalytic combustor surface.		40 CFR 60.5474(h) 40 CFR 60.5478(f)(1)
Hydronic Heaters & Forced Air Furnaces	Operation software settings for hydronic heaters for the low burn category must not change after the certification test and the testing must be conducted while operating the appliance at the lowest test setting available to any user.		40 CFR 60.5479(a)(2)
EPA Method 28 WHH	When the CSA B415.1-10 efficiency is found to be lower than the overall efficiency based on load side measurements an explanation and discussion of reasons for this result must be provided in the test report.	Method 28WHH (13.5.5.1)	
EPA Method 28 WHH	Calibration frequency for the water temperature sensors (thermocouples), heat exchanger load side water flow meter, scales, and flue gas analyzers must be adhered to. Calibration documentation must be provided in the test report.	Method 28WHH (10.1), (10.2.1), (10.3), (10.4), (10.5)	

EPA Method 28 WHH PTS	If the CSA B415.1-10 overall efficiency is found to be lower than the overall efficiency based on the load side measurements, the test report must include a discussion of the reasons for this result. If a test has a CSA B415.1-10 overall efficiency (SLM) that is less than 2 percentage points lower than the overall efficiency based on load side measurements, the efficiency based on load side measurements shall be considered invalid.	Method 28WHH - PTS (13.6.5.1)	
EPA Method 28 WHH PTS	Calibration frequency for the water temperature sensors (thermocouples), heat exchanger load side water flow meter, scales, and flue gas analyzers must be adhered to. Calibration documentation must be included in the report for all relevant equipment, it must be current for the time period that the test was conducted and must show that "as found" conditions were within specification.	Method 28WHH - PTS (10.1), (10.2.1), (10.3), (10.4)	
ASTM E2618	Complete conditioning data with all applicable sections referenced must be included in the test report. Usually, the duration is not long enough or medium heat draw rate is not specified. Fuel moisture must be specified and reported also.	ASTM E2618 (11.1)	
ASTM E2618	Cordwood fueled appliances - Overall firebox calculations and dimensions as well as usable firebox dimensions and calculations that result in the listed firebox volume used for certification testing must be calculated and shown in the report. These must not conflict with diagrams, drawings or firebox descriptions elsewhere in the report or user manual.	ASTM E2618 (12.2.2)	40 CFR 60.5475(b)(3)
ASTM E2618	Fuel loading density (wet basis) to meet 10.0 lb/ft ³ or greater for the volume of firebox used. Fuel loading density must be provided in the test report.	ASTM E2618 (12.2.3)	
ASTM E2618	A full compliance test is only needed for wood fuels, however other fuels listed and intended to be used in the unit as sold (corn, nut hulls, etc.) must be burned in the test lab, and particulate measurements made, and those test data submitted with the compliance test report.	ASTM E2618 (12.3.3)	
ASTM E2618	Cordwood fueled appliances - the pre-burn must meet the method specification and that documentation must be included in the test report.	ASTM E2618 (12.2.6)	
ASTM E2618	Pellet fueled appliances - the pre-burn must meet the method specification and that documentation must be included in the test report.	ASTM E2618 (12.3.2)	
ASTM E2618	Calibration frequency for the temperature sensors (thermocouples), water flow meter, scales, and moisture meter must be adhered to. Calibration documentation must be included in the report for all relevant equipment, it must be current for the time period that the test was conducted and must show that "as found" conditions were within specification.	ASTM E2618 (10.1), (10.2), (10.3), (10.4)	

ASTM E2618	When the CSA B415.1-10 overall efficiency (SLM) is found to be lower than the delivered efficiency, the test report must include a discussion of the reasons for this result.	ASTM E2618 (13.4.5.1)	
CSA B415	Overall firebox calculations and dimensions as well as usable firebox dimensions and calculations that result in the listed firebox volume used for certification testing must be calculated and shown in the report. These must not conflict with diagrams, drawings or firebox descriptions elsewhere in the report or user manual.	CSA B415.1-10 Section 8.2	40 CFR 60.5475(b)(3)
CSA B415	The test fuel loading density must adhere to the requirements described in CSA Method B415.1-10 section 8.3.4. The test fuel loading density must be equal to or greater than 10.0 lb/ft ³ .	CSA B415.1-10 Section 8.3.4	
CSA B415	Preliminary tests conducted to "ensure that the unit reaches the limit of the standard" but no data was provided in the report. This data must be included in the report.		40 CFR 60.5475(b)(5)
CSA B415	Pre-burn fuel load must meet method specification and must be documented.	CSA B415.1-10 Section 8.5.1	
CSA B415	For forced air furnaces with thermostatic or electronic controls use CSA B415.1-10 section 7.2 to determine burn rate settings and operation of the appliance during the test. Must meet the requirements in ALT-134 on EPA website and the applicable sections in CSA B415.	EPA ALT-134	
CSA B415	Calibration frequency must be adhered to. Calibration documentation must be included in the report for all relevant equipment, it must be current for the time period that the test was conducted and must show that "as found" conditions were within specification.	CSA B415.1-10 Section 6.8 and Section B.8	