



Project Summary

Quality Assurance Procedures: Method 28A Measurement of Air to Fuel Ratio and Minimum Burn Rate for Wood-Fired Appliances

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The full report is a comprehensive document intended to be used as an aid for wood heater manufacturers and testing laboratories in performing measurement of air-to-fuel ratio and minimum burn rate determinations according to EPA protocol, Method 28A. These procedures may be used in research and development, and as an aid in auditing and certification applicability testing. A detailed, step-by-step quality assurance guide is provided to aid in the procurement and assembly of testing apparatus, to clearly describe the procedures, and to facilitate data collection and reporting. Suggested data sheets are supplied that can be used as an aid for both recordkeeping and certification applications. Throughout the document, activity matrices are provided to serve as a summary reference. Checklists are also supplied that can be used by testing personnel. Finally, for the purposes of ensuring data quality, procedures are outlined for apparatus operation, maintenance, and traceability. These procedures combined with the detailed description of the sampling and analysis protocol will help ensure the accuracy and reliability of Method 28A testing results.

This Project Summary was developed by EPA's Atmospheric Research

and Exposure Assessment Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Quality Assurance Procedures: Method 28A, Measurement of Air to Fuel Ratio and Minimum Burn Rate for Wood-Fired Appliances has been prepared as an aid for wood heater manufacturers and testing laboratories in performing wood heater procedures specified in Method 28A and in ensuring data quality and reliability. This manual may be used in combination with Method 28A for designing an individualized quality assurance program.

Method Highlights

EPA Method 28A contains all the requirements and describes the apparatus and procedures for measuring minimum burn rate and air-to-fuel ratio for wood heaters. The apparatus and procedures used are similar to those used for Method 28, "Certification and Auditing of Wood Heaters." Method 28A is unique in that its purpose is to determine whether further particulate emissions testing is required. Thus, Method 28A focuses on wood heater

process characteristics rather than emissions. However, stack gas analysis (for CO₂, O₂, and CO) is used to calculate process parameters (i.e., air-to-fuel ratios). To get accurate and repeatable results, it is extremely important to follow the procedures described in Method 28A closely. Following the test procedures closely is ultimately to the advantage of both the wood heater manufacturer and the test laboratory.

Quality Assurance Procedures Highlights

These procedures, *Quality Assurance Procedures: Method 28A, Measurement of Air to Fuel Ratio and Minimum Burn Rate for Wood-Fired Appliances*, are to be used as an aid in assembling the testing apparatus, to list and describe the required procedures, and to facilitate the data recording. Activity matrices are provided at the end of the appropriate sections. Section 12.0 contains blank data sheets which can be reproduced and used as an aid in data collection and recording. Examples of the use of these sheets are given in the appropriate sections of this Manual.

Section 1.0 presents the specifications, criteria, and design features for the equipment and materials that are required to set up and operate a wood heater according to Method 28A. This section is intended to inform the user of the apparatus selection options and the rationale for selecting a particular piece of equipment or analytical method. The activity matrix given at the end of Section 1.0 can be used as a convenient checklist for equipment procurement and initial acceptance check procedures.

Section 2.0 provides an item-by-item, step-by-step guide to the required calibration procedures and frequencies. Some of the apparatus (e.g., platform scale, moisture content meter, and instrumental analyzers) require calibrations before each test run while other pieces of

apparatus require calibration semianually.

Section 3.0 describes procedures that are conducted before gas sampling begins. These procedures include firebox volume measurements, wood heater installation, apparatus check and calibration, test fuel measurements and crib construction, measurement of the facility conditions, and presampling burn activities. Illustrations, examples, and an activity checklist are provided to assist testing personnel in performing and documenting pretest procedures. An activity matrix provides a summary of the purpose, specifications, and time and frequency of each pretest activity.

Section 4.0 lists and describes the activities performed during the test run. These activities include beginning the test run, measurement of test run data at 10-minute intervals, adjustment of fuel and air supply settings, test run completion, and recording of data. An activity matrix is provided listing in chronological order each activity performed during the test run.

Illustrations and examples are provided to assist testing personnel in performing and documenting test run activities.

Section 5.0 describes the activities required at the end of the certification test. These include: the measurement of test facility condition parameters, sampling train and equipment leak checks, and either determination of gas concentration using an Orsat analyzer or data verification by span and zero drift determination for Continuous Emission Monitoring Systems (CEMS). Recommended procedures also include performing a calibration check on the platform scale and measurement of the fluid level in the liquid seal.

Section 6.0 describes calculations necessary for interpreting the data obtained. Calculations for determining dry burn rate and air-to-fuel ratio are provided. Also, calculations required to

determine F_o, a fuel factor data quality indicator, are described. Examples are included. Section 7.0 summarizes recommendations on maintenance of equipment. Section 8.0 describes recommended audit procedures, including both performance audits and system audits. A table is provided that summarizes these procedures. Section 9.0 recommends the primary standards to which the wood heater operation and sample analysis measurements are traceable.

Section 10.0 contains a copy of Method 28A as published in the Federal Register (40 CFR 60.530). Copies of Methods 28 and 5H are also included since these are often referenced in Method 28A. Section 11.0 provides the reader with a list of the references used in the preparation of this manual. Section 12.0 provides sheets that can be used for calculations, recordkeeping, and data reporting. These sheets may be removed and duplicated.

Conclusions and Recommendations

It is concluded that these procedures will be helpful in ensuring and establishing the quality of the data when sampling according to the requirements of Method 28A. This will be beneficial for data producing activities including research and development, and as an aid for certification applicability determination.

These quality assurance procedures may be used in the individualized quality assurance program established by each user. Copies of the checklists and summary activity matrices provided herein may be supplied to testing personnel to ensure that the desired quality assurance procedures are followed. Also, copies of blank data sheets can aid the user in ensuring and establishing data quality in sampling activities.

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The complete report, entitled "Quality Assurance Procedures: Method 28A Measurement of Air to Fuel Ratio and Minimum Burn Rate for Wood-Fired Appliances," (Order No. PB 89-214 027AS; Cost: \$28.95, subject to change) will be available only from:

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