ASME PTC 34-2007

Waste Combustors With Energy Recovery

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Three Park Avenue • New York, NY 10016

Date of Issuance: February 29, 2008

This Code will be revised when the Society approves the issuance of a new edition. There will be no addenda issued to ASME PTC 34-2007.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this document. Periodically certain actions of the ASME PTC Committee may be published as Code Cases. Code Cases and interpretations are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

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NOTICE

All Performance Test Codes must adhere to the requirements of ASME PTC 1, General Instructions. The following information is based on that document and is included here for emphasis and for the convenience of the user of the Code. It is expected that the Code user is fully cognizant of Sections 1 and 3 of ASME PTC 1 and has read them prior to applying this Code.

ASME Performance Test Codes provide test procedures that yield results of the highest level of accuracy consistent with the best engineering knowledge and practice currently available. They were developed by balanced committees representing all concerned interests and specify procedures, instrumentation, equipment-operating requirements, calculation methods, and uncertainty analysis.

When tests are run in accordance with a Code, the test results themselves, without adjustment for uncertainty, yield the best available indication of the actual performance of the tested equipment. ASME Performance Test Codes do not specify means to compare those results to contractual guarantees. Therefore, it is recommended that the parties to a commercial test agree before starting the test and preferably before signing the contract on the method to be used for comparing the test results to the contractual guarantees. It is beyond the scope of any Code to determine or interpret how such comparisons shall be made.

FOREWORD

In 1966, the ASME Performance Test Code committee recognized the need for a Performance Test Code for Large Incinerators. A Committee was formed in 1967 and charged with the task of developing a comprehensive Test Code for Large Incinerators; a task to be followed by a Short Form Test Procedure. This Committee was officially designated as PTC Committee 33 Large Incinerators. At the time of its issue, PTC 33 represented the highest state of the art in incinerator testing. It was submitted to industry for trial use and comment in 1977. PTC 33 was approved by the Performance Test Codes Supervisory Committee on June 30, 1978 and was approved as an American National Standard by the ANSI Board of Standards Review on December 6, 1978.

PTC 34 was formed in 1988 as a follow-up to PTC 33. PTC 33 was essentially a procedure for determining combustion efficiency and waste capacity and did not address units with energy recovery. At that time, it was recognized that the procedures for sampling tons of a heterogeneous material was unrealistic and impractical as a key element of a waste combustion performance test. At the urging of the ASME Research Committee on Industrial and Municipal Waste, the U.S. Bureau of Standards [now the National Institute Standards and Technology (NIST)] developed, over a period of about 10 years, a larger calorimeter but concluded that the larger one was not much better than the smaller one because of the sampling dilemma. This provided the incentive to pursue the Boiler-Calorimeter Method covered by this test code.

This Code was approved by the PTC 34 Committee on January 9, 2007 and by the Performance Test Codes Standards Committee on January 9, 2007. It was then approved and adopted by the Council as a Standard practice of the Society by action of the Board on Standardization and Testing on February 20, 2007. This Performance Test Code was approved by ANSI as an American National Standard on April 12, 2007.

ASME PTC COMMITTEE
Performance Test Codes

(The following is the roster of the Committee at the time of approval of this Standard.)

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SPECIAL NOTE

The Committee acknowledges, with appreciation, the contribution to the development of this Code by former members Roger S. Hecklinger, who chaired the Committee during most of its existence, Frank Hamlyn, and Robert E. Sommerlad (Member Emeritus of the PTC Standards Committee).

CORRESPONDENCE WITH THE PTC 34 COMMITTEE

General. ASME Codes are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Code may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to

Secretary, PTC 34 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to the Code to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Code. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Code. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Code, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Code to which the proposed Case applies.

Interpretations. Upon request, the PTC 34 Committee will render an interpretation of any requirement of the Code. Interpretations can only be rendered in response to a written request sent to the Secretary of the PTC 34 Standards Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Code for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The PTC 34 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the PTC 34 Standards Committee.

INTRODUCTION

This Code contains instructions for testing waste fuel combustion systems with energy recovery. These facilities are defined as combinations of apparatus for consuming the organic content of waste by releasing its chemical energy. For the purpose of this Code, performance will be a measurement of the available heat energy released during the process. The recovery of useful energy in the form of steam is considered to be the measure of performance in this Code. It is not the intent of these testing procedures to obtain data on specific components of the system or to establish design criteria for these components or the process. Testing of individual components such as fans shall be conducted in accordance with their respective test codes. See PTC 11.

It is intended that in using this Code a detailed examination will be made of the Code of General Instructions, PTC 1 and all other codes herein referenced before starting preparations for the tests. Such study is for the purpose of assuring an orderly and thorough testing procedure since it provides the user with an overall understanding of the ASME Performance Test Code requirements and enables the tester to understand readily the interrelationship of the various codes. Care should be exercised to obtain and use the latest revision of the Codes.

Subsection 5-20 of this Code is concerned with symbols and their description, relating specifically to testing of waste combustion systems. This Code has departed from the use of symbols previously used in earlier codes in an attempt to make the symbols compatible with present-day word processors, personal computer spread sheets, and computer code. Hence a symbol set was adopted that does not use superscripts, subscripts, hyphens, or Greek letters.

The ASME Supplements on Instruments and Apparatus PTC 19 series referenced herein should be studied thoroughly, because the value of the test results depends on the selection and application of the instruments, their calibration, and the accuracy of the readings.

Other items of vital importance to the value of the test are the proper determination of the characteristics of the effluent gas and water streams. The appropriate procedures for test and analysis procedures as listed herein should be followed carefully.

This Code is intended as a test guide for all waste combustor systems with energy recovery, but it could not possibly detail a test applicable to every variation in the design of waste combustion systems. In every case, a competent engineer must study the particular facility and develop test procedures that are in agreement with the intent, guiding principles and required accuracy of this Code. Examples of the system variations at the time of preparation of this Code include rotary kilns, refractory and waterwall furnaces, rotary combustors, mechanical grates, semi-suspension and suspension burning, multiple chamber solid hearth units, and two-stage combustion systems. Such systems were considered as the Code was being prepared.

Portions of this Code may be used for waste combustors without energy recovery in the area of unburned combustibles in residue.

For systems fired either by waste, or by waste in combination with other fuels in which heat recovery is a major portion of the heat output, PTC 4 may be used along with appropriate sections of this Code. The user is cautioned to note the difference between capacity and efficiency as defined in PTC 4 and PTC 34.

Advanced instrument systems such as those using electronic devices or mass flow techniques, may, by mutual agreement, be used as alternates to the specified Code instruments, provided that applications of such instruments have been demonstrated to be no less accurate than required by the Code.

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WASTE COMBUSTORS WITH ENERGY RECOVERY

Section 1
Object and Scope

1-1 OBJECT

The object of this Code is to provide a test procedure for evaluating the performance of waste fuel combustors with energy recovery using the boiler as a calorimeter. These procedures apply when the variability and waste fuel composition results in a lack of confidence in obtaining representative samples for laboratory analysis.

This Code is used to determine

(a) the thermal efficiency of system combusting waste fuels

(b) the thermal capacity (heat input per unit time) of systems combusting waste fuels

(c) the higher heating value (HHV) of waste fuels

1-1.1 Other Applications

A determination of the items specified above may be used for other purposes such as

(a) comparing the actual performance with guaranteed performance

(b) determining performance of system components

(c) evaluating performance when firing any fuel

(d) determining optimum method of operation

1-2 SCOPE

The rules and instructions given in this Code apply to all waste combustor systems with energy recovery, but the code cannot detail a test applicable to every variation in the design of waste combustor systems. In every case, a qualified engineer must study the particular facility and develop a test procedure, which is in agreement with the intent, guiding principles, and required accuracy of this Code. Examples of systems considered at the time of preparation of this Code include rotary kilns, refractory and waterwall furnaces, rotary combustors, mechanical grates, semi-suspension and suspension burning, multiple chamber solid hearth, and two-stage combustion systems. Portions of this Code may be used for waste combustors without energy recovery in the area of unburned combustibles in residue.

Testing of accessory equipment shall be performed using the applicable performance test code. Refer to Fig. 2-1 in Section 2 for a typical system boundary. Test methods of this Code apply to solid, liquid, or gaseous waste fuels.

Instructions are given to determine the thermal capacity and thermal efficiency of waste combustor systems by applying the concept of using the boiler as a calorimeter. In addition, the HHV of the waste fuel can be determined by weighing the waste fuel that has been consumed during the test.

1-3 UNCERTAINTY

The uncertainty values are used to determine the quality of the test and have no relationship to the expected performance of the equipment. The uncertainty values reflect the accuracy of the test instrumentation and stability of the test conditions.

This Code provides standard test procedures that can yield results giving the highest level of accuracy consistent with the current engineering knowledge and practice. A test may be considered an ASME Code test only if the following conditions are met:

(a) Test procedures (and allowed variations) comply with this Code.

(b) The uncertainty of test results is determined in accordance with Section 7 of this Code and PTC 19.1.

(c) Pretest uncertainty analysis and post-test confirmation of uncertainty values are conducted. The parties to the test shall agree to a target test uncertainty prior to the start of the test.

Typical values of the test uncertainties for

(1) thermal efficiency is 1.2% to 2.0%

(2) thermal capacity is 2.4% to 3.6%

(3) waste fuel HHV is 5.0% to 9.6%

These numbers reflect the Committee's experience considering the variation in unit design. The large uncertainty for the waste fuel HHV is the result of the inability to measure the weight of the waste fuel accurately.