ASME PTC 34-2017
(Revision of ASME PTC 34-2007)

REAFFIRMED 2022

Waste Combustors With Energy Recovery

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of
Mechanical Engineers

ASME PTC 34-2017
(Revision of ASME PTC 34-2007)

Waste Combustors With Energy Recovery

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: March 20, 2017

This Code will be revised when the Society approves the issuance of a new edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Code. Interpretations are published on the Committee Web page and under go.asme.org/InterpsDatabase. Periodically certain actions of the ASME PTC Committee may be published as Cases. Cases are published on the ASME Web site under the PTC Committee Page at go.asme.org/PTCcommittee as they are issued.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The PTC Committee Page can be found at go.asme.org/PTCcommittee. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting “Errata” in the “Publication Information” section.

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

CONTENTS

Figures

Tables

Mandatory Appendix

Nonmandatory Appendices

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 before starting the test, and preferably before signing the contract, the parties to a commercial test agree 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 American National Standards Institute (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 were 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 of 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-as-a-calorimeter method covered by this test Code.

The 2007 edition of the 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. It was approved by ANSI as an American National Standard on April 12, 2007.

This update of PTC 34 does not include any significant philosophical or computational changes. It is more a clarification (i.e., we fixed typographical errors) of previously established procedures, and we added clarity and detail to aid the user in the determination of test uncertainty. It was approved by ANSI as an American National Standard on January 6, 2017.

ASME PTC COMMITTEE
Performance Test Codes

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

CORRESPONDENCE WITH THE PTC 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 or a case, and attending Committee meetings. Correspondence should be addressed to:

Secretary, PTC Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

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 to provide 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 and 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 Standards 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 Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the Secretary of the PTC Standards Committee at the above address. The request for an 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 in one or two words.
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. Please provide a condensed and precise question, composed in such a way that a "yes" or "no" reply is acceptable.
Proposed Reply(ies):	Provide a proposed reply(ies) in the form of "Yes" or "No," with explanation as needed. If entering replies to more than one question, please number the questions and replies.
Background Information:	Provide the Committee with any background information that will assist the Committee in understanding the inquiry. 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 the format described above may be rewritten in the appropriate 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 Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the PTC Standards Committee. Future Committee meeting dates and locations can be found on the Committee Page at go.asme.org/PTCcommittee.

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 ASME PTC 11.

It is intended that in using this Code a detailed examination will be made of the Code of General Instructions, ASME PTC 1, and all other Codes herein referenced before starting preparations for the tests. Such study is for the purpose of ensuring 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 used in earlier Codes in an attempt to make the symbols compatible with current word processors, personal computer spreadsheets, 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 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, ASME 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 ASME PTC 4 and ASME PTC 34.

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

WASTE COMBUSTORS WITH ENERGY RECOVERY

Section 1
Object and Scope

1-1 OBJECT

1-1.1 Introduction

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 result in a lack of confidence in obtaining representative samples for laboratory analysis.

This Code is used to determine

(a) the thermal efficiency of systems 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

1-1.2 Other Applications

A determination of the items specified in subsection 1-1.1 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 the optimal 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 that 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. 2-4-1 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 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 ASME 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 are 1.2% to 2.0%

(2) thermal capacity are 1.2% to 2.0%

(3) waste fuel HHV are 2.3% to 5.0%

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 mass flow rate of the waste fuel accurately.