ASME PTC 19.11-2008

(Revision of ASME PTC 19.11-1997)

REAFFIRMED 2018

Steam and Water Sampling, Conditioning, and Analysis in the Power Cycle

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ASME SETTING THE STANDARD

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This Code will be revised when the Society approves the issuance of a new edition. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this document. Periodically certain actions of the ASME PTC Committee will 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.

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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 included here for emphasis and the convenience of the user of this 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 with 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 methods to be used for comparing the test results with the contractual guarantees. It is beyond the scope of any Code to determine or interpret how such comparisons shall be made.

FOREWORD

The scope of Technical Committee No. 19 was to prepare Instruments and Apparatus Supplements describing the various types of instruments and methods of measurement likely to be prescribed in the ASME Performance Test Codes. Supplement Part 11, Water and Steam in the Power Cycle, presents the limits of application, treatment of interference, detailed procedure, and probable precision for selected methods of tests for determining steam purity and quality and condenser leakage.

The methods of measurement and prescribed instruments, including instructions for their use, are mandatory only when specified in the individual test codes. Other methods and instruments even though included in the Instruments and Apparatus Supplement, shall not be used for formal performance tests unless all the parties agree.

Some of the instrumentation is associated in footnotes with one or more suppliers especially in the adapted ASTM methods of test. In each instance, the reference provides information of special significance or value to the user of the document. Such citations in this and other Parts of the Performance Test Codes I and A Supplement are not to be construed as endorsements by the Society of a particular supplier's product.

Part of the material on Purity and Quality of Steam was printed in preliminary form in the June 1930 issue of *Mechanical Engineering*. A more formal draft of the first Part 11 was approved by the Standing Committee October 6, 1930 and approved and adopted by the Council of the Society on November 28, 1930. The first Part 21 on Leak Detection and Measurement was published in 1942 after similar approvals.

An updated revision of Part 11 was approved by the then Power Test Codes Committee on February 4, 1958 and approved and adopted by the Council of the Society by action of the Board on Codes and Standards on November 28, 1958. An updated revision of Part 21 was approved by the then Power Test Codes Committee on March 28, 1963 and approved and adopted by the Council of the Society by the action of the Board on Codes and Standards on February 14, 1964.

In June 1964, the PTC Committee No. 19, Part 11, was reorganized and instructed to update and rewrite the Supplement Parts on testing water and steam. The result was Supplement Part II, Water and Steam in the Power Cycle (Purity and Quality, Leak Detection and Measurement), superseding Parts 11 (1959) and 21 (1965). It was approved by the Performance Test Codes Committee on June 6, 1969 and approved and adopted by the Council of the Society by action of the Board on Codes and Standards on November 5, 1969.

The Code issued in 1997 was a revised and updated version of ASME/ANSI PTC 19.11-1970, Water and Steam in the Power Cycle (Purity and Quality, Leak Detection, and Measurement). It differed from its predecessor in a number of ways, including format and content. The format had been reorganized to follow the flow of the sample. The content had been expanded to reflect advances made since 1970, in all related areas affecting accurate measurements. The 1997 version of PTC 19.11 was approved by the ASME Board on Performance Test Codes on May 28, 1996 and adopted by the American National Standards Institute (ANSI) as an American National Standard on February 13, 1997.

Experience shows that the design, construction, and operation of sampling systems for thermal power plants have often been less than ideal. Such practices as withdrawing samples from drilled holes through the pipe or tube wall and sampling lines as large as $\frac{3}{4}$-in. pipe with numerous threaded fittings have been all too common. Ignoring the importance of maintaining proper fluid velocities in sampling lines has led to deposition of impurities on sample line surfaces so that the sample being analyzed bears little resemblance to the sample at its source. Improper sample conditioning (sample condensing and/or cooling and sample flow regulation) along with poor sampling locations and analysis methods have also taken their toll. And, finally, failure to permanently record and analyze the data taken can lead to expensive failures. The purpose of this Code is to present information on proper design, construction, and operation of steam and water sampling systems in the power cycle. The following sections are included:

(a) Section 1, Object, Scope, and Application, describes the aims, content, and limits of this Code.

(b) Section 2, Sample Selection Criteria, describes the components of a thermal power plant and what sample locations might be selected.

(c) Section 3, Obtaining the Sample, describes equipment design and operation for taking samples of saturated steam, superheated steam, and water.

(d) Section 4, Transporting the Sample, deals with proper sampling line design and operation. A table of satisfactory sample line sizes for various pressures and line lengths is presented.

(e) Section 5, Sample Conditioning, describes the recommended design and operation so as to provide proper sample flow, pressure, and temperature control, which is required for manual or automatic analysis.

(f) Section 6, Sample Analysis and Instrumentation, describes analyses that are usually made of samples. Principles of operation, precision, and literature references for analysis methods are also given.

(g) Section 7, Data Collection, Analysis, and Control, describes automatic instrumentation for collecting and storing data, means for retrieving and analyzing stored data (e.g., short- and long-term trends), and automated control purposes.

(h) Nonmandatory Appendices

(1) Nonmandatory Appendix A, Leakage Detection and Measurement

(2) Nonmandatory Appendix B, Throttling Calorimeter

This revision adds information on new sampling methods and instrumentation related to combined cycle plants using Heat Recovery Steam Generators (HRSG), new analytical instruments that aid in sample analysis, and other updates and advances in sampling methods and concepts developed since the last revision.

This edition was approved by the Board on Standardization and Testing on December 10, 2007 and by the ANSI Board of Standards Review as an American National Standard on January 15, 2008.

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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CORRESPONDENCE WITH THE PTC 19.11 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 19.11 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 19.11 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 19.11 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 19.11 Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the PTC 19.11 Committee.

STEAM AND WATER SAMPLING, CONDITIONING, AND ANALYSIS IN THE POWER CYCLE

Section 1
Object, Scope, and Application

1-1 OBJECT

The object of this Code is to specify and discuss the methods and instrumentation for testing boiler makeup and feedwater, steam, and condensate in relation to performance testing as may be required in Performance Test Codes in one-time acceptance testing and continuous performance monitoring.

This Code also provides guidance to power-plant management, engineers, chemists, and operators in the design and operation of sampling systems for monitoring of cycle chemistry. The methods and equipment recommended herein may be useful for monitoring other influent and effluent streams of the power plant.

Contamination of the steam and water cycle must be at or less than the maximum specified for the performance test before a turbine, condenser, or deaerator performance test is made.

1-2 SCOPE

This Code includes
(a) sample selection
(b) sample collection and conditioning
(c) sample analysis
(d) data analysis

1-3 APPLICATION

The procedures, methods, and component information described in this Code are provided for guidance in obtaining, transporting, conditioning, and analyzing samples and detecting leaks in steam power cycles. A brief discussion of water treatment schemes is included but should not be interpreted as a recommendation of any particular method(s) or procedure(s). Application of these techniques should help ensure the performance determination (testing and operation) of significant components and of the steam cycle system in general. Additional sampling points and/or analysis, redundancy, etc., are considerations for specific steam cycles but do not degrade the fundamental techniques detailed in the Code. This Code is applicable to any thermal power plant that involves water as a working fluid including, but not limited to, the following steam power cycles:

(a) fossil (utility/industrial base load and cycling)
  (1) combined cycle
  (2) bottoming cycle
  (3) topping cycle
  (4) utility nuclear[1]
  (5) solar
(b) specific areas not covered include the following:
  (1) makeup water treatment plant
  (2) service water cycle
  (3) cooling tower cycle
  (4) geothermal
  (5) techniques specific to handling radioactive fluids

1-4 UNCERTAINTY

Measurement uncertainty is not applicable to this Code. As stated in the object, this Code primarily provides guidance in the design and operation of sampling systems for monitoring cycle steam and water chemistry. Section 6 is included to provide a general overview of the analytical methods typically used in steam cycle water chemistry. Published analytical methods noted should be consulted for parameter uncertainty determination. Other noted analytical methodology should have parameter uncertainty determined and agreed to by the relevant parties prior to its acceptance for use in performance testing.

[1] The handling and disposal of radioactive water and other hazardous materials require procedures beyond the scope of this Code. It is the user's responsibility to determine and comply with all applicable codes and regulations.