ASME PTC 6.2-2011
(Revision of ASME PTC 6.2-2004)

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Steam Turbines in Combined Cycles

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers
Three Park Avenue • New York, NY • 10016 USA

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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 levelof 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

ASME Performance Test Code 6 on Steam Turbines is most directly targeted for application to steam turbines in regenerative feedwater heater cycles. A Performance Test Code has heretofore not existed to provide procedures for the accurate testing of steam turbines in a Combined Cycle application. The procedures for testing a steam turbine in a Combined Cycle differ from those used to test a steam turbine in a regenerative feedwater heater cycle because of differences in cycle configuration and test objectives.

In recognition of these differences and to facilitate testing of Steam Turbines in Combined Cycle Applications, the ASME Board on Performance Test Codes approved the formation of a committee (PTC 6.2) on June 7, 2000, with the charter of developing a code for testing of Steam Turbines in Combined Cycle Applications. The resulting committee included experienced and qualified users, manufacturers, and general interest category personnel from the domestic regulated, the domestic nonregulated, and the international electric power generating industry. The organizational meeting of this committee was held on August 15 and 16, 2000.

In developing the first edition of this Code, the Committee reviewed industry practices with regard to determining the performance of a steam turbine in a combined cycle application. The Committee strived to develop an objective code that addresses the need for explicit testing methods and procedures while providing maximum flexibility in recognition of the wide range of combined cycle applications and testing methodologies.

The first edition of this Code was approved by the PTC 6.2 Committee on October 24, 2003. It was then approved and adopted by the Council as a Standard practice of the Society by action of the Board on Performance Test Codes on January 13, 2004. It was also approved as an American National Standard by the ANSI Board of Standards Review on August 6, 2004.

This revision was undertaken at the Committee meeting on March 6 and 7, 2006. This revision accomplishes the following changes:

(a) it amplifies the section on degradation thus providing more useful guidance

(b) provides more guidance on correlated and uncorrelated uncertainty

(c) addresses stability criteria — such as off-design limits of pressure and temperature

(d) adds references to relevant Codes such as PTC 19.5 and PTC 19.6

(e) complies with PTC 1 and the PTC 1 Template

(f) provides an expanded Nonmandatory Appendix C (formerly D) on the procedure for determining N2 packing leakage flow

(g) revises many recommendations in Section 3 to requirements, i.e., use of *shall* instead of *should*

This revision does not include Mandatory Appendix II, Procedure for Fitting a Calibration Curve of an Orifice-Metering Run and Nonmandatory Appendix C, Sample Flow Calculations for Differential Pressure Meter. It was reasoned that the issuance of the revised PTC 19.5, Flow Measurement, provided much of the corresponding information found in these deleted appendices.

This revision was approved by the Council as a Standard practice of the Society by action of the Board on Standardization and Testing on April 1, 2011. It was also approved as an American National Standard by the ANSI Board of Standards Review on June 28, 2011.

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Performance Test Codes

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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 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 which 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 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.

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

Subject:	Cite the applicable paragraph number(s) and a concise description.
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. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The PTC Committee holds meetings or telephone conferences, which are open to the public. Persons wishing to attend any meeting or telephone conference should contact the Secretary of the PTC Standards Committee or check our Web site http://www.asme.org/codes/.

STEAM TURBINES IN COMBINED CYCLES

Section 1
Object and Scope

1-1 OBJECT

This Code provides procedures for the accurate testing of steam turbines in combined cycles. It is the intent of this Code that accurate instrumentation and measurement techniques be used to determine performance. In planning and running the test, the Code user must strive to follow the procedures in this Code to meet the uncertainty requirements.

1-2 SCOPE

This Code may be used for testing steam turbines in combined cycles with or without supplementary firing and in cogeneration applications. Within these categories of combined and cogeneration cycles, this Code is applicable to condensing and noncondensing steam turbines, to reheat and nonreheat steam turbines, and to induction/extraction steam turbines. The variety of cycles presents challenges in writing a code that addresses all issues encountered for all cycle configurations. ASME PTC 6 is the appropriate code for testing steam turbines in nuclear and fossil-fired regenerative feedwater heater cycles. This Code is applicable only to turbines in cycles in which steam is the working fluid.

This Code provides procedures for testing and calculating turbine-generator *output performance* corrected to reference conditions as a measure of overall turbine performance. This Code contains rules and procedures for the conduct and reporting of steam turbine testing, including requirements for pretest arrangements, testing techniques, instrumentation, methods of measurement, and methods for calculating test results and uncertainty.

1-3 UNCERTAINTY

The underlying philosophy of this Code is to achieve test results of the lowest uncertainty based on current technology and knowledge, taking into account test cost and value of the information obtained. To accomplish this and because of the various configurations covered by this Code, an upper limit for the uncertainty of each parameter is established. Exceeding the upper limit of any parameter's uncertainty requirement is allowable only if it is demonstrated that the selection of all instrumentation will result in an overall test uncertainty equal to or less than what it would have been had all parameters' uncertainty requirements been followed.

A pretest uncertainty analysis is required. It serves to establish the expected level of uncertainty for the test. The test uncertainty shall be calculated in accordance with the procedures defined herein and by ASME PTC 19.1, Test Uncertainty.

A post-test uncertainty analysis is also required. It is used to determine the uncertainty for the actual test. This analysis should confirm the pretest systematic and random uncertainty estimates and validate the quality of the test results.

The maximum uncertainty permitted by the Code will be influenced by the actual turbine cycle and the sensitivity of the corrected results to cycle variables. The combination of the applicable test uncertainty limits of each of the measurements shown in Table 3-6.4.1 and Section 4 shall be used to determine the maximum allowable test uncertainty for that particular configuration and test. For example, the maximum allowable test uncertainty for a typical reheat cycle derived using the limiting uncertainties of all components is 0.5%, as given in Nonmandatory Appendix B.