ASME PTC 19.6-2018

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Electrical Power Measurements

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers

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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 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 method 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

At the suggestion of members of the Rotating Machinery Committee of the American Institute of Electrical Engineers (AIEE), the Instruments and Measurements Committee voted, in 1950, the appointment of a subcommittee for preparing a master Test Code for electrical measurements in power circuits.

Material was gathered from Part 6 of the ASME Power Test Code Supplement on instruments and apparatuses of 1934, AIEE Test Code 502 on single-phase motors, and Test Code 503 on synchronous machines. Other codes of the AIEE were reviewed, and much new material was added. All of this information was compiled and revised for the 1955 edition of ASME PTC 19.6 on electrical measurements in power circuits.

Since 1955, many ASME Performance Test Codes have been written or revised that require the accurate determination of power. Due to advances in power metering technology, these newer codes include many additional metering requirements not included in ASME PTC 19.6-1955. In addition, many fundamental techniques of power metering, use of instrument transformers, and methods for correcting for installation effects had lost emphasis or were not well understood by the more recent generation of Performance Test Code users and committee members.

Therefore, in 2002, a new ASME PTC 19.6 Committee was formed, and an initial organizational meeting was held on July 30, 2002, at ASME headquarters in New York with the intent to modernize the Supplement while simplifying, illustrating, and emphasizing techniques that are required primarily in the measurement of electrical power.

The intent of the reactivated PTC 19.6 Committee was to produce an instrument and apparatus supplement that could be wholly referenced by the equipment/system PTCs and reduce the need for the other ASME Performance Test Code committees to develop unique sections on electrical power measurement. However, it is not the intent of this revised Supplement to supersede the guidance or requirements of any IEEE code. Rather, this revised edition of ASME PTC 19.6 is intended solely to provide assistance and guidance for the accurate measurement and determination of electrical power as it applies to ASME PTC tests.

The ASME Board on Standardization and Testing approved this Code on November 20, 2017, and the ANSI Board of Standards Review approved it as an American National Standard on February 27, 2018.

ACKNOWLEDGMENT: The preparation of this Supplement required several years, and some previous members of the committee were not active at the time of its publication. The committee chair would therefore like to recognize and thank the following individuals for their significant contributions to the development of this Supplement:

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Secretary, PTC Standards Committee
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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.

Moreover, ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Code requirements. If, based on the inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

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 http://go.asme.org/PTCcommittee.

INTRODUCTION

Many ASME Performance Test Codes require the determination of electrical power in order to evaluate the performance of a power generating system, the power produced by a large piece of mechanical equipment, or the power consumed by auxiliary equipment. IEEE 120 and C57.13 contain details for measurement of electrical properties and the application of instrument transformers. These IEEE standards are very thorough and cover measurements of voltage, current, power, power factor, frequency, impedance, magnetic quantities, and ancillary equipment. However, during many ASME performance tests, power is the main quantity of interest. In addition, specific corrections for electrical generator power output to reference operating conditions are necessary for many ASME performance tests.

It is not the intent of this Supplement to supersede the guidance or requirements of any IEEE standard. The intent is simply to emphasize and simplify the requirements for these measurements as they apply to ASME Performance Test Code tests and to provide a common document that can be referred to by all ASME Performance Test Codes.

Section 1
Object and Scope

1-1 OBJECT

It is the purpose of this Supplement to give instructions and guidance for the accurate determination of electrical power quantities that are commonly needed in support of ASME Performance Test Codes. The choice of method and instruments to be used, required calculations, and corrections to be applied in any given case depend on the requirements of the PTC referencing this Supplement, considering the purpose of the measurement, uncertainty required, and nature of the circuit to be measured.

1-2 SCOPE

The methods given herein include direct and indirect determinations of active power (watts), reactive power (vars), and power factor produced or consumed in alternating-current single-phase and polyphase electrical circuits, electrical generators, power transformers, and motors. This Supplement does not include such measurements of fundamental electrical properties as voltage, current, frequency, resistance, and impedance, except as needed to support the objectives of this Supplement.

1-3 TEST UNCERTAINTY

This Supplement emphasizes the methods and instrumentation required to obtain measurement results with the lowest practical uncertainty based on current engineering knowledge, taking into account measurement costs and the value of information obtained from the measurement. Test uncertainty is principally influenced by the quality and calibration of the instruments, experience and judgment of the test personnel, and stability and characteristics of the power system. When estimating the systematic uncertainty of a power measurement, an uncertainty analysis shall be conducted to identify the potential sources of uncertainty, how these were estimated, and a list of all assumptions made that support the estimates presented.

Table 1-3-1 presents the requirements for the active power measurement uncertainty for three classes of measurements designated as Class A, B, or C. For the Class A measurements (high quality, minimum uncertainty), the uncertainty can be restricted to a narrow band. For the Classes B and C, a range of uncertainties can occur depending on the instrumentation selected and the other factors mentioned above. Class B has two options, depending on the calibration and burden data available. Other options may be applicable for exceptions to best practices, provided the uncertainty requirements are met for Class B.

Table 1-3-1 Class Requirements for Active Power Measurement Uncertainty

Class/Purpose	Requirements	Uncertainty, %
A (best practices)	Calibrated watt or watt-hour meter, VTs, and CTs with corrections	0.2 or better
B	Calibrated watt or watt-hour meter, with exceptions to best practices for burden correction, and VTs and CTs calibration as shown in B1 and B2	0.2–0.35
B1	Exception: type test information on CTs	0.2–0.3
B2	Exception: type test information on CTs, VTs, and estimated burden	0.25–0.35
C (low-voltage)	Clamp-on and direct metering	2–5

GENERAL NOTE: VT = voltage transformer; CT = current transformer.