ASME PTC 2-2001

[Revision of ASME PTC 2-1980 (R1985)]

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DEFINITIONS AND VALUES

PERFORMANCE TEST CODES

An American National Standard

The American Society of Mechanical Engineers

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[Revision of ASME PTC 2-1980 (R1985)]

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FOREWORD

Precise definitions of terms and exact values of constants employed in the various Performance Test Codes of this Society are fundamentally important. This Code is intended to provide standard definitions and values required by each respective Performance Test Code (PTC) and to supplement each of them. The principal purpose of this Code (PTC 2), *Definitions and Values*, is to provide a source for any item used by more than one of the PTC committees reporting to the Board on Performance Test Codes. This Code is an outgrowth of five previous codes concerning definitions and values issued and adopted by the Society, and it supersedes them.

A draft of the first edition was printed in the December 1921 issue of Mechanical Engineering and was presented to the Society during the spring meeting held in Atlanta, Georgia the following May. On January 21, 1926, the first such code was approved and adopted by Council as a standard practice of the Society. The second edition of this code was approved by Council on May 14, 1931.

Beginning in June 1936, a thorough review and a complete rewriting of this code was undertaken, and the fruits of this labor were adopted by Council on June 17, 1945. In June, 1969, Performance Test Code Committee No. 2, acting under instructions from the Standing Committee on Performance Test Codes, proceeded to revise this Code, the draft of which was presented to the Society as a paper during the 1970 Winter Annual Meeting in New York. It was adopted in final form by action of the Policy Board on Codes and Standards on February 26, 1971.

The last major revision of this Code began in 1972 to incorporate metrication and the use of Systeme International (SI) units. The values of many of the physical constants and conversion factors were brought up to date as well. The 1980 Code was approved by the Performance Test Codes Supervisory Committee on February 26, 1979, and it was approved as an American National Standard by the ANSI Board of Standards Review on July 21, 1980.

The Code presented herein was revised by the PTC 2 Project Team and approved by the Board on Performance Test Codes on May 29, 2001. This Performance Test Code was also approved as an American National Standard by the ANSI Board of Standards Review on October 31, 2001.

NOTICE

All Performance Test Codes **MUST** adhere to the requirements of **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 Parts I and III of PTC 1 and has read them prior to applying this Code.

ASME Performance Test Codes provide test procedures which 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. They 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.

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

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SECTION 1
OBJECT AND SCOPE

1.1 OBJECT

The purpose of this Code is to provide definition of terms and values of physical constants and conversion factors to comply with the requirements of ASME PTC 1, *General Instructions*.

1.2 SCOPE

This Code contains standards for terms, units of measure, values of constants, symbols, and technical nomenclature that are to be used in all individual test codes. The implication of the words "must," "shall," and "will" is mandatory. The use of "should," "would," and "ought" denotes recommended practice. All the information contained herein represents the state of the art at the time of its preparation. In order that the PTC may continue to be useful, any part of this Code is automatically superseded by any of the following actions:

(a) approval of new or revised units, values of physical constants, or flui properties;

(b) inclusion of equipment not covered by this Code in the PTC series; or

(c) approval by the Board on Performance Test Codes of a new Code not conforming to this document.

Such actions will be published in *Mechanical Engineering* as they occur, and this Code will be amended thereafter.

SECTION 2
MEASUREMENT OF PERFORMANCE

2.1 INTRODUCTION

The Codes provide test procedures which yield results of the highest level of accuracy consistent with the best engineering knowledge and practice, taking into account the cost of tests and monetary value of eff ciency to industry. Performance of equipment is determined in part by measurements of physical quantities. A measurement consists of sensing a physical variable and translating this result into data that is either indicated or recorded. Analog data are indicated by the position of a pointer on a dial or by a point or line on a chart. Digital data are indicated by a visual display of numbers or by a numerical printout. Devices used to make measurements are called instruments but many devices called instruments must be used with additional components to measure certain physical variables and quantities. A millivoltmeter, for example, can measure voltage but a thermocouple must be used in conjunction with the voltmeter to obtain a temperature measurement.

2.2 MEASUREMENT SYSTEM

In order to make a measurement of a physical quantity it must f rst be sensed, and the information about the energy change due to sensing must be transmitted to a component that communicates the data. The requirements for measurement are met by the system shown in Fig. 2.2.

The primary element is that part of the measurement system that f rst senses the variable to be measured. The energy change produced by the sensing must be transmitted to an information-communicating unit where it may be used directly or changed (transduced) to some other form to indicate or record data. The measurement system may be very simple or very complex but the three functions appearing in Fig. 2.2 are required to make a physical measurement. The measurement system may be a single component such as a liquid-in-glass thermometer where the sensing is done by the bulb, the transmitting by the liquid column, and the data display by the scale. On the other hand, the measurement system may be multi-component such as f ow measurement with orif ces where the primary element (the orif ce) causes f uid acceleration to produce a pressure differential which is transmitted via tubing to a manometer where the data are displayed on the scale.

2.3 UNCERTAINTY OF MEASURING SYSTEMS

Measurement of a physical quantity never continuously gives a result which is correct in an absolute sense. The numerical value determined nearly always differs by some amount from the true value, and the extent of the deviation (called error) depends upon the type of measurement system used. Code writers and test engineers must demonstrate that the test measurements used will provide results suff ciently accurate to accomplish the purposes of the test.

The accuracy obtainable for a given measurement is dependent upon the following three components:

(a) the characteristics of the measured quantity,

(b) the accuracy of the observation, and

(c) the measurement system used.

(1) The intrinsic accuracy of the measurement system.

(2) The in-situ conditions of its use.

Item (c)(1) is generally well treated by most engineers and data concerning measurement system components is given in the Instruments and Apparatus Supplements. Item (c)(2) is often responsible for gross errors of measurement. Specif c analysis is necessary for each application and installation.

ASME PTC 19.1, *Test Uncertainty*, def nes *accuracy* as the closeness of agreement between a measured value and the true value; *error* as the difference between the true value and the measured value; and *uncertainty* as a numerical estimate of the error.