ASME PTC 13-2018

Wire-to-Air Performance Test Code for Blower Systems

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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The next edition of this Code is scheduled for publication in 2024.

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

The American Society of Mechanical Engineers (ASME) has a long history of developing and publishing test codes for blowers and compressors. The predecessor to the Test Code for Displacement Compressors, Vacuum Pumps, and Blowers, now designated as ASME PTC 9, was originally issued in 1915. The Test Code for Compressors and Exhausters, ASME PTC 10, was originally issued in 1934, followed by several editions.

The technology of blowers, compressors, and ancillary components has advanced since the last revisions of these codes. The developments have included new types of blower and compressor mechanisms, new techniques for control and modulation, and the widespread commercialization of packages with all the mechanical and electrical components required for a fully operable system combined in an integrated factory-assembled unit. The wide application of variable speed motor control and close-coupled motors and blowers were especially problematic in the application of the earlier performance and power test codes.

The electric power industry and the wastewater treatment industry were particularly concerned by the inadequacies of the earlier codes in predicting and confirming energy consumption of the systems used to provide low-pressure air to the wastewater treatment process.

In 2010 the Consortium for Energy Efficiency (CEE) approached ASME and several individuals with the suggestion that a new performance test code be developed. This Code intends to incorporate the following features:

(a) technology neutral evaluation, to allow direct comparison of various blower systems

(b) wire-to-air power consumption, to allow convenient prediction of on-site energy requirements

(c) industry acceptance, with rigorously developed and credible procedures for the test itself and related calculation methodologies

This new Code, ASME PTC 13, Wire-to-Air Performance Test Code for Blower Systems, is the result of many hundreds of hours of dedicated work by professionals from a broad cross-section of industries involved in the manufacture and application of blowers. The needs of the wastewater treatment industry were important in the development of the Code, but it is anticipated that the Code can be used for any application of low-pressure air blowers.

The contents of this Code are comprehensive. The intent is that the required test procedures and instrumentation techniques can be implemented solely by the use of this Code. Many other ASME codes are referenced to permit examination of various test aspects in greater detail if necessary. This Code quantifies the statistical uncertainty of the measurements and provides rigorous examples to follow.

The members of the PTC 13 Committee would like to thank all of the participants in the development of this Performance Test Code. This includes many individuals outside the Committee who provided expertise and guidance, without which this work could not have been completed. Particular thanks go to Mr. John Oleyar, the founding chair of the Committee, and to Jack Karian, the ASME Staff Secretary who guided and assisted the Committee through the most critical stages.

This Standard is available for public review on a continuing basis. This provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME PTC 19.1-2018 was approved by the PTC Standards Committee on January 3, 2018, and was approved as an American National Standard by the ANSI Board of Standards Review on July 20, 2018.

ASME PTC
ASME PTC COMMITTEE

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

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard 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 Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. 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 Standard 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 Standard to which the proposed Case applies.

Interpretations. Upon request, the PTC Standards Committee will render an interpretation of any requirement of the Standard. 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 Standard 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 Standard 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

The distinction between blowers, fans, and compressors in common practice is rather vague; accordingly, machines that use any of these names may be tested under the provisions of this Code provided the gas media is air, pressure of the inlet airflow is close to local atmospheric pressure, and the pressure ratio does not exceed 3.0. The intent of this Code is to provide a means of equalizing a standard for performance testing dynamic blowers (centrifugal blowers) and positive displacement blowers (PD blowers).

The measurement methodology utilized herein for inlet and outlet conditions of the compressed air and the wire-power measurements are for PD and dynamic blowers, except as expressly noted. The driving factor for creating this Performance Test Code is expressed in the title: to provide the methodology for determining required total operating electric power of a packaged blower system. Performance testing is established in a controlled testing environment, with provisions and methodology to establish the highest accuracy and repeatable measurements to extrapolate accurate and repeatable results predicted to site conditions.

This Code provides procedures for testing the performance of wire-to-air blower systems. It also provides methods for converting the resulting performance data from test conditions to alternate inlet and discharge thermodynamic conditions, and identifies the information to be included in the report of test results. The information to be provided in the report includes blower system performance data, the thermodynamic properties of the inlet and discharge process airflow, and the physical configuration and significant components included in the blower system as tested.

The reported data and the procedures defined herein may be used by manufacturers or designers prior to equipment purchase to project performance at inlet air conditions differing from tested or standard conditions.

The reported data and the procedures as defined herein or as modified by agreement between parties may be used to verify performance at specified inlet air conditions differing from the tested conditions.

It is incumbent on the parties conducting the test and using the reported test results to

(a) identify differences between the tested and specified inlet and discharge air conditions

(b) identify differences between tested and proposed or purchased equipment configurations

(c) verify that any variations between test and installed configurations fall within the limits of the methodology for converting performance data to predicted conditions

(d) evaluate the performance impact of differences in configuration or components between the tested blower system and the installed configurations of the blower system

Section 1
Object and Scope

1-1 OBJECT

The purpose of this Code is to measure the electric power consumption associated with a specified performance condition of a blower package referred to as wire-to-air performance.

Blower packages shall include but not be limited to dynamic and rotary positive displacement (PD) types and the ancillary devices required for operational service. This Code determines total input electric power consumption (herein referred to as wire power) and delivery of compressed air from the blower package to the defined system boundary.

1-1.1 Objectives

The objectives of this Code are to

(a) provide the rules for testing blower packages to determine wire-to-air performance using ambient air

(b) provide methods for comparing measured or converted wire-to-air performance to specified performance

(c) account for parasitic losses from mechanical and electrical components as required for a complete operational blower package

1-1.2 Performance Parameters

The principal parameters to be determined in a test are

(a) blower system volumetric flow rate

(b) blower system isentropic head or, alternatively, blower system pressure rise

(c) blower system electric active power (i.e., kilowatt) measured for all power-consuming devices that form the blower system

Henceforth, the term “performance” shall encompass these parameters.

1-1.3 Operating Conditions

Additional quantities that can be determined are

(a) properties of gases at the blower inlet

(b) blower speed

(c) relative set positions of inlet or discharge flow-modulating devices (e.g., valves, vanes, etc.)

Henceforth, the term “operating conditions” shall encompass these conditions.

1-2 SCOPE

The scope of this Code is limited to wire-to-air performance testing of blowers in a controlled environment and does not include field testing. The term “blower” implies that the machine is used primarily for delivery of air at pressure ratios equal to or less than 3.0. This Code does not include procedures for determining the blower system’s mechanical and acoustical characteristics, nor is it applicable to machines employing forced interstage cooling.

1-3 APPLICABILITY

A blower test shall be considered an ASME Code test only if the test procedures comply with the procedures and allowed variations specified by this Code.

1-4 TEST UNCERTAINTY

The uncertainties of blower package test results depend on features of the installation and on parameters of the performance test such as the instruments selected, their locations, and the number and frequency of readings. This Code requires an agreement between parties for a pretest and/or a post-test uncertainty analysis. The pretest analysis is required to effectively plan the test. It allows corrective action to be taken prior to the test, either to decrease the uncertainty to a level consistent with the overall objective of the test or to reduce the cost of the test while still attaining the objective. The post-test uncertainty analysis shall be used to determine the uncertainty intervals for the actual test. This analysis should confirm the pretest systematic and random uncertainty estimates. It serves either to validate the quality of the test results or to expose problems.

For a blower package, the following independent items shall be the typical uncertainties when a test is performed in accordance with this Code:

Parameter	Typical Uncertainty
Inlet volumetric flow rate	±1.0% (±1.5%) (refer to subsection 4-5)
Pressure ratio (PD blowers)	±0.5%
Isentropic head (dynamic blowers)	±0.5%
Total wire-power measurement	±0.9%