ASME B133.8-2011
[Revision of ASME B133.8-1977 (R2001)]

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Gas Turbine Installation Sound Emissions

AN AMERICAN NATIONAL STANDARD

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Gas Turbine Installation Sound Emissions

AN AMERICAN NATIONAL STANDARD

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

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The American Society of Mechanical Engineers
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FOREWORD

The purpose of this Standard is to provide format and criteria for the preparation of gas turbine procurement acoustical specifications for industrial, pipeline, and utility applications. This Standard will also be useful for response to such specifications. Field sound measurement guidelines to determine specified sound emissions compliance and to report field data are also presented.

This Standard provides essential information for the procurement of gas turbine power plants involving acoustical requirements. This Standard applies to simple-cycle gas turbines and combined-cycle gas turbines operating in simple-cycle mode with simple-cycle bypass capability, and conventional or advanced low-emissions combustion systems for industrial, marine, and electric power applications. Auxiliaries needed for proper operation are included. Gas turbines applied to earth-moving machines, agricultural and industrial-type tractors, automobiles, trucks, buses, and aeropropulsion units are not included.

For gas turbines using unconventional or special heat sources (such as chemical processes, nuclear reactors, or furnaces for supercharged boilers), this Standard may also be useful; however, appropriate modifications may be necessary.

The intent of this Standard is to cover the normal requirements of the majority of applications as determined by the consensus of the B133 Committee, recognizing that economic tradeoffs and reliability implications may differ in some applications. The user may desire to add, delete, or modify the requirements in this Standard to meet specific needs, and may do so in the procurement specification.

In the 1990s, the B133 Committee decided not to update the B133 standards, but instead to work with the ISO TC 192 Committee to prepare a series of gas turbine standards. These standards would essentially replace the B133 series of standards. As the ISO 3977 series of standards was released, the related B133 standards were withdrawn. In the first decade of this century, the B133 Committee was disbanded and all but one of the B133 standards were withdrawn. The B133.8 Standard, *Gas Turbine Installation Sound Emissions*, was considered of sufficient continuing interest in U.S. industry to merit its retention. Subsequently, it was felt that it should be updated. PTC Committee 36 on Measurement of Industrial Sound was considered to be the closest in subject matter among the ASME Standards and Certification Committees to undertake such a revision. In 2008, several former members of the B133 Committee responsible for the B133.8 Standard agreed to serve on the PTC 36 Committee.

The 2011 edition of B133.8 improves on the 1977 edition in the following aspects:

(a) addition of a near-field measurement specification along a prescribed near-field source envelope contour

(b) clarification of the gas turbine acoustical specification in the case of combined-cycle applications for both near field and far field

(c) clarification of the definition of measurement positions and distance corrections

(d) additional guidance regarding measurement methodology

(e) clarification of the treatment and evaluation of reflective surface effects

(f) additional and updated references, including Nonmandatory Appendix B on low-frequency airborne sound

Suggestions for improvement of this Standard are welcome. They should be stated as specifically as possible, and sent to the Secretary, PTC 36 Committee, The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016.

This edition of the B133.8 Standard was approved by the PTC Standards Committee on April 18, 2011, and was approved as an American National Standard by the American National Standards Institute on August 17, 2011.

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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 Standards Committee
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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 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.

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 Standards Committee and PTC Committees hold meetings regularly, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the PTC Committee.

INTRODUCTION

This Standard is intended to be primarily a sound emissions procurement specification for gas turbines, as opposed to a standardized test procedure. The PTC 36 Committee believes that although there are many test procedures available to users of this Standard, procurement and testing are inextricably and unavoidably connected.

Whether the specification calls for measured airborne sound levels at particular positions, or for source sound power levels from components, a significant degree of measurement methodology is absolutely necessary.

Whenever sound levels at particular positions are called out, requirements are also specified for controlling the operating conditions, the instrumentation, the definition of locations, the averaging methodology, the meteorological constraints, the measurement duration, the test tolerances permitted, the environmental corrections to be applied, and the manner and methodologies used in any such corrections. Without such defined constraints, similar to test procedures, the sound emissions specification will be deficient.

Sound power level specifications require even more explicit details to adapt and apply any of the several possible sound power test procedures for gas turbine installations. Failure to provide detailed qualifications to sufficiently control and limit the range of possible interpretations on the specification or commitments can have adverse effects. These qualifications should be provided at the earliest possible stage in the specification (and by extension, in the contract documents and vendor guarantees) to avoid disagreements regarding the limitations and constraints of any specified sound emissions. Sound emissions must be considered in any gas turbine installation, as they are central to declarations of provisional acceptance, final acceptance, etc. Furthermore, the degree of financial exposure as a result of disagreements as to whether acoustical compliance has been achieved, or the degree to which some shortfall has occurred, is always a function of the precision of the definition of measurement methodology. In turn, any such disagreements affect the cost of both retrofit corrections or liquidated damages involved.

While contractual considerations are beyond the scope of this Standard, an awareness of the context within which the specification will be implemented is needed. This awareness influences the work of PTC 36 on this Standard, since it bears directly on the revisions contained herein.

The gas turbine literature often uses “gas turbine” and “combustion turbine” interchangeably. PTC 36 regards the use of “gas turbine” herein to be synonymous with “combustion turbine.”

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GAS TURBINE INSTALLATION SOUND EMISSIONS

Section 1
Object and Scope

1-1 OBJECT

The object of this Standard is to provide methods and procedures for specifying the sound emissions of gas turbine installations for industrial, pipeline, and utility applications. Included are guidelines for making field sound measurements and for reporting field data. This Standard may be used by users and manufacturers to write specifications and to determine compliance with a specification after installation. Information is included in Nonmandatory Appendices A and B for guidance in estimating expected community reaction to noise.

These methods and procedures are intended to be used by gas turbine users and manufacturers. The procedure may be used to specify sound emissions levels in accordance with local, state, or federal noise control requirements. A methodology is suggested in Nonmandatory Appendices A and B to determine gas turbine installation sound emissions levels that are generally compatible with the sound environment of a neighboring sensitive receiver, such as a residential community.

1-2 SCOPE

This Standard is applicable to land-based, or shoreside, barge-mounted gas turbines in single or multiple arrangements, for indoor or outdoor stationary installations. Applications may include, but are not limited to, gas turbine-driven generators, compressors, or pumps, in simple-cycle gas turbines or combined-cycle gas turbines with simple-cycle bypass capabilities.

Gas turbines used for the primary or auxiliary propulsion source in transportation vehicles (airplanes, automobiles, off-road vehicles, ships, etc.) are excluded from this Standard.

Procedures outlined in Section 2 may be used to specify either the sound emissions from the gas turbine only, or the total sound emissions from the site, including, but not limited to, gas turbine-driven equipment and auxiliary equipment. The user's specification must clearly define the equipment for which the noise specification is applicable, especially for combined-cycle plants, where all equipment may not be furnished by the gas turbine manufacturer on a turnkey basis. Unless otherwise stated, the specified noise emissions limits shall include all equipment at the site provided by the gas turbine manufacturer on a turnkey basis.

This Standard does not include specifications addressing exhaust stack exit sound pressure levels, exhaust stack exit sound power levels, or either the presence or absence of tonal components in the emitted acoustic spectrum.

Section 2
Sound Emissions Specification

2-1 INTRODUCTION

This Section provides standard methods to specify gas turbine installation sound emissions to comply with applicable environmental sound emissions limits[1] or company standards, or to avoid unreasonable sound intrusions into the surrounding neighborhoods, or to conserve employee hearing.

2-2 ENVIRONMENTAL SOUND EMISSIONS SPECIFICATION PROCEDURES

Gas turbine installation environmental sound emissions, at the specified steady-state load condition (up to and including full load as defined by the performance specification), are specified by one of two alternate procedures: specifying the A-weighted and, optionally, the C-weighted sound levels, or specifying the octave-band sound pressure level spectrum at a standard distance of 400 ft (120 m) from the perimeter of the gas turbine(s) sound source envelope. The gas turbine sound emissions level can be estimated for other far-field locations using Fig. 2-2-1 [refer to para. 3-6(c)].

2-2.1 Procedure A

This procedure requires specifying either the maximum[2] or the average[3] A-weighted sound levels. One suggested method to determine gas turbine installation sound emissions that are expected to be acceptable in a neighboring community is presented in Nonmandatory Appendix A. Also, for some installations, such as simple-cycle installations, where sensitive receivers consisting of frame structures occupied by people are nearby, the A-weighted sound level alone does not adequately define permissible low-frequency sound emissions. Thus, when using this procedure, the permissible C-weighted level may also be specified. Suggestions for specifying the C-weighted sound level limit are given in Nonmandatory Appendix B. A specification format is given in Form 2-2.1-1.

[1] Applicable limits may include local, state, or national regulatory requirements.

[2] Maximum sound level in this context means the highest measured sound level at any defined measurement position, nominally 400 ft (120 m) from the gas turbine sound source envelope.

[3] Average sound level is defined in para. 3-9.

2-2.2 Procedure B

This procedure requires specifying the maximum or average sound emissions levels in each of nine specified octave bands. This procedure should be used when local or state regulations or user procedures set octave band sound limits. A specification format is shown in Form 2-2.2-1.

2-3 ENVIRONMENTAL SOUND EMISSIONS SPECIFICATION FORMAT

Where the gas turbine manufacturer or the engineering, procurement, and construction (EPC) contractor provides all the equipment in the gas turbine installation, a typical gas turbine installation environmental sound emissions specification can be stated as follows: "Sound emissions from the total gas turbine site, including auxiliary equipment, when operated at specified megawatt or horsepower load in accordance with the contract specifications and ASME B133.8 procedures, shall not exceed the spatial average[4] or maximum (choose one) A-weighted and C-weighted sound level, or any octave band sound level listed in Form 2-2.1-1 or 2-2.2-1, when measured at a distance of 400 ft (120 m) or other specified positions from the sound source envelope of the nearest gas turbine. If the manufacturer does not provide all of the equipment, the user shall specify the maximum or average permissible sound level emitted from all sources other than the manufacturer's equipment." Note that in the latter circumstance, the owner accepts responsibility for achieving site acoustical goals due to the total operating facility. The requester should ensure that the noise specifications are for environmental conditions (humidity, temperature, cloud cover) that are typical of those in the installation area. The requester may also specify that the noise level requirements are for worst-case conditions.

When specifying sound levels in either the nine specified octave bands or the A-weighted and C-weighted format, the following information should be contained within the purchase specification:

(a) physical description and topographical plots of the ground surface.

(b) dimensioned sketch showing gas turbine, measurement points, and significant building structures, or other sound-reflecting objects [see para. 3-4(b)].

[4] Refer to para. 3-9.6 Footnote (1).