ASHRAE Standard Project Committee 68—1997
Cognizant TC: TC 2.6, Sound and Vibration Control
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CONTENTS

ANSI/ASHRAE 68-1997; ANSI/AMCA 330-1997
Laboratory Method of Testing to Determine the Sound Power in a Duct

(This Foreword is not part of the standard but is included for information purposes only.)

FOREWORD

This standard describes a procedure for the measurement of sound pressure levels in the inlet or outlet ducts of a fan and a method to use these sound pressure levels to calculate the sound power levels radiated by the fan to the duct system.

This standard is not meant to replace existing standards for sound power level determination of fan sound. It is an alternative method for the accurate calculation of sound power levels.

The sound power radiated into a duct by a fan depends, to some extent, on the type of duct, characterized by its acoustical impedance. For a rating method, the duct must therefore be well prescribed. In this standard, it must be of circular cross section and must be terminated nearly anechoically. The sound power obtained under these conditions is a representative value, as the anechoic termination forms an impedance between the higher and lower impedance found in practice. The sound power radiated in actual applications can be estimated from additional information on fan and duct impedances. As this information is at present insufficient, these effects are usually not considered in the acoustical layout.

To suppress the turbulent pressure fluctuation at the microphone, the use of a long, cylindrical windscreen "sampling tube" is prescribed. The microphone, with the sampling tube, is mounted at a radial position such that the sound pressure is acceptably well-related to the sound power by the plane wave formula, even in the frequency range in which radial standing waves (cross-modes) are possible.

The testing accuracy is given in terms of the standard deviation to be expected if the measurements were repeated in many different laboratories.

This foreword is not part of the standard. Appendices A and B form an integral part of this standard. Appendices C through G are for information only. This standard is technically equivalent to ISO 5136:1990, Determination of Sound Power Radiated into a Duct by Fans—In-Duct Method.

1. PURPOSE

The purpose of this standard is to determine, by test, the sound power radiated into an anechoically terminated duct on the supply and/or return side of air-handling equipment.

2. SCOPE

2.1 This standard applies to steady, broad-band, narrow band, and/or discrete frequency sound at air temperatures between −50°C and +70°C. The test duct diameter range is from 150 mm to 2 m. The maximum flow velocity in the duct is 30 m/s and the maximum swirl angle is 15°. The frequency range is from 50 Hz to 10,000 Hz.

2.2 This standard applies to sound sources connected to a duct. Examples of equipment covered by this standard are:

(a) centrifugal fans,
(b) axial-flow fans,
(c) mixed-flow fans,
(d) air-handling units,
(e) unitary equipment,
(f) furnaces,
(g) dampers, and
(h) throttling devices.

2.3 This standard does not apply to non-ducted equipment.

3. MEASUREMENT UNCERTAINTY

A single value of the sound power level of a noise source determined according to the procedures of this standard is likely to differ from the true value by an amount within the range of the measurement uncertainty. The uncertainty in determinations of the sound power level arises from several factors that affect the results, some associated with the test facilities and others with experimental techniques.

If a particular noise source were to be transported to each of a number of different laboratories, and if, at each laboratory, the sound power level of that source were to be determined in accordance with the procedures of this standard, the results would show a scatter. The standard deviation of the measured levels could be measured (see examples in ANSI S12.3, Part 4, Annex B [see Section 4 of this standard, normative reference 1]) and would vary with frequency. With few exceptions, these standard deviations would not exceed those listed in Table 1. The values given in Table 1 are standard deviations of reproducibility, σ_R, as defined in ANSI S12.3, Part 1 (see Section 4 of this standard, normative reference 1). The values of Table 1 take into account the cumulative effects of measurement uncertainty in applying the procedures of this standard, including random variations in the sound power output of the source itself but excluding variations in the sound power output caused by changes in operating conditions (e.g., rotational speed, line voltage, airflow rate) or mounting conditions.

The measurement uncertainty depends on the standard deviations of reproducibility tabulated in Table 1 and on the degree of confidence that is desired. As examples, for a normal distribution of the sound power levels, there is a 90% confidence that the true value of the sound power level of a source lies within the range of ±1.645 σ_R of the measured value and 95% confidence that it lies within the range of ±1.90 σ_R of the measured value.