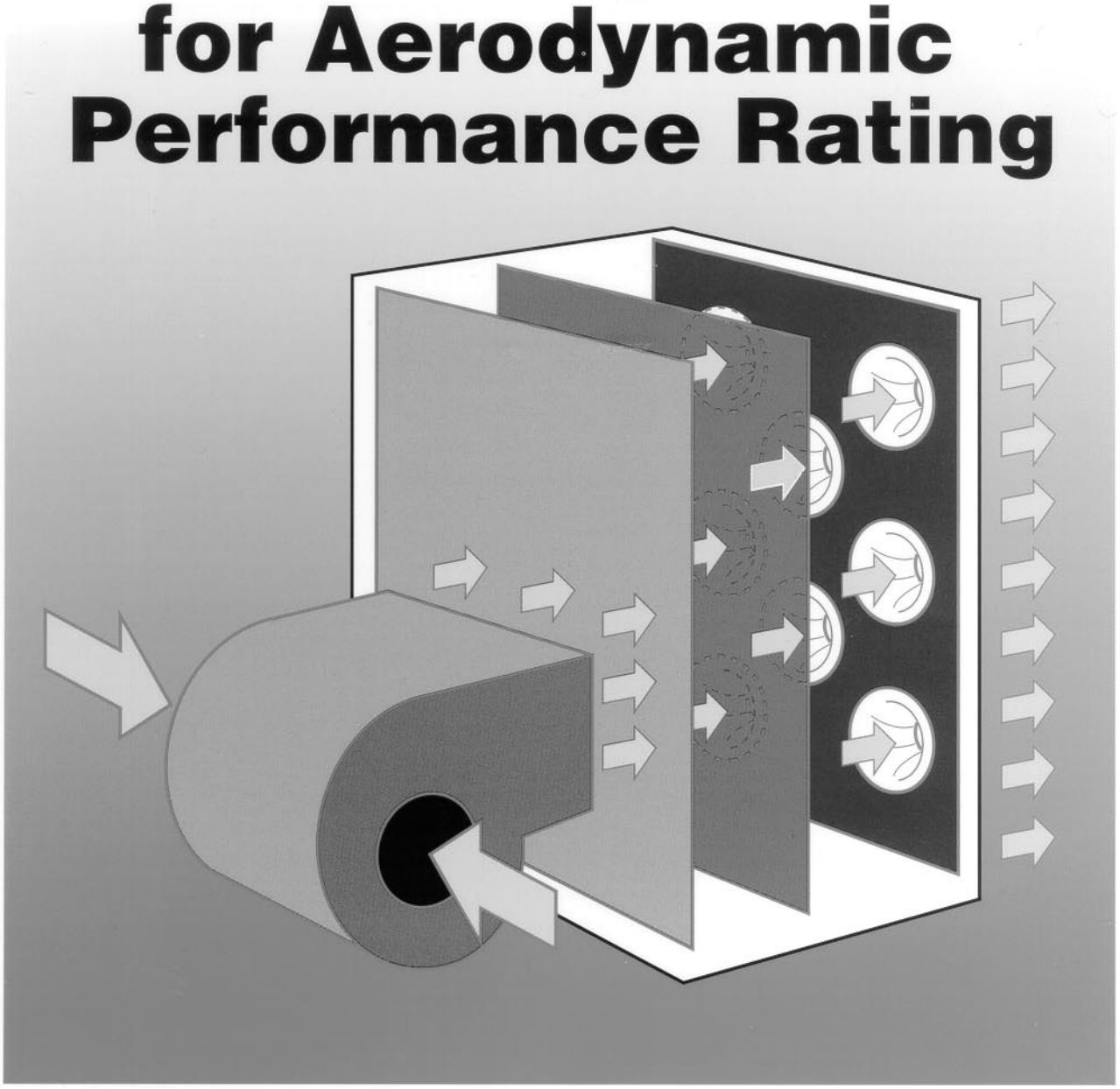
ANSI/AMCA 210-99
AN AMERICAN NATIONAL STANDARD
Approved by ANSI December 2, 1999
Approved by AMCA January 17, 1999

ANSI/ASHRAE 51-1999
AN AMERICAN NATIONAL STANDARD
Approved by ANSI December 2, 1999
Approved by ASHRAE June 23, 1999

Laboratory Methods of Testing Fans for Aerodynamic Performance Rating



ANSI/AMCA STANDARD 210 ANSI/ASHRAE STANDARD 51

LABORATORY METHOD OF TESTING FANS FOR AERODYNAMIC PERFORMANCE RATING

Published by
Air Movement and Control Association International, Inc.
and
American Society of Heating, Refrigerating
and Air Conditioning Engineers, Inc.

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SPECIAL NOTE

This National Voluntary Consensus Standard was developed under the joint auspices of the Air Movement and Control Association International, Inc. (AMCA) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). Consensus is defined as "substantial agreement reached by concerned interests according to the judgement of a duly appointed authority, after a concerted attempt at resolving objections. Consensus implies much more than the concept of a simple majority but not necessarily unanimity." This definition is according to the American National Standards Institute (ANSI) of which both AMCA and ASHRAE are members.

This Foreword is not a part of ANSI/AMCA Standard 210 or ANSI/ASHRAE Standard 51 but is included for information purposes only. See also Appendix I for the History and Authority.

FOREWORD

This standard provides rules for testing fans, under laboratory conditions, to provide rating information. It was prepared by a joint committee consisting of the Air Movement and Control Association International, Inc. (AMCA) 210 Review Committee and the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) Standard 51-85R Committee.

The joint committee debated whether the International Standard for laboratory testing of industrial fans, ISO 5801 *Industrial fans: Performance testing using standardised airways*, should be adopted in lieu of preparing a new edition of this standard. The decision to proceed with a ninth edition was based on the conclusion that ISO 5801 allowed the use of measurements that did not meet the uncertainties requirements of this standard. However, certain features of ISO 5801 have been included, most of which were anticipated in the 1985 edition.

The principal changes compared to ANSI/AMCA 210-85//ANSI/ASHRAE 51-85 *Laboratory Methods of Testing Fans for Rating* are:

1) Incorporation of SI units in the text. SI units are primary, I-P units are secondary.
2) Addition of SI equations.
3) Numbering of equations for easier reference.
4) Deletion of tabular and graphical data as unnecessary, since equations are definitive and universal use of computers is anticipated.
5) Addition of Appendix F, giving an example of the iterative solution of Re and C.
6) Addition of Appendix I, giving the history of fan test codes in North America.

Suggestions for improvement of this standard will be welcome. They should be sent to either the Air Movement and Control Association International, Inc., 30 West University Drive, Arlington Heights, Illinois 60004-1893 U.S.A. or the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329 U.S.A.

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CONTENTS

Laboratory Methods of Testing Fans For Aerodynamic Performance Rating

1. Purpose

This standard establishes uniform methods for laboratory testing of fans and other air moving devices to determine aerodynamic performance for rating or guarantee purposes in terms of airflow rate, pressure, power, air density, speed of rotation, and efficiency.

It is not the purpose of this standard to specify the testing procedures to be used for design, production, or field testing.

2. Scope

2.1 This standard may be used as the basis for testing fans, blowers, exhausters, compressors, or other air moving devices when air is used as the test gas.

2.2 The scope of this standard does not cover:
(a) circulating fans such as ceiling fans, desk fans and jet fans.
(b) compressors with interstage cooling.
(c) positive displacement machines.
(d) testing procedures to be used for design, production, or field testing.

2.3 The parties to a test for guarantee purposes may agree on exceptions to this standard in writing prior to the test. However, only tests which do not violate any mandatory requirements of this standard shall be designated as tests conducted in accordance with this standard.

3. Definitions

3.1 Fans

3.1.1 Fan: A device for moving air which utilizes a power driven rotating impeller. A fan shall have at least one inlet opening and at least one outlet opening. The openings may or may not have elements for connection to ductwork.

3.1.2 Boundaries.

3.1.2.1 Fan Inlet and Outlet Boundaries. Fan inlet and outlet boundaries are defined as the interfaces between the fan and the remainder of the system, and are at a plane perpendicular to the air stream where it enters or leaves the fan. Various appurtenances, such as inlet boxes, inlet vanes, inlet cones, silencers, screens, rain hoods, dampers, discharge cones, evasé, etc., may be included as a part of the fan between the inlet and outlet boundaries.

3.1.2.2 Fan Input Power Boundary. The interface between the fan and its driver. Drive or coupling losses may be included as a part of the input power.

3.1.3 Fan Outlet Area. Fan outlet area is the gross inside area measured in the plane(s) of the outlet opening(s). For roof ventilators and unhoused fans, the area shall be considered the gross impeller outlet area for centrifugal types or the gross casing area at the impeller for axial types.

3.1.4 Fan Inlet Area. Fan inlet area is the gross inside area measured in the plane(s) of the inlet connection(s). For converging inlets without connection elements, the inlet area shall be considered to be that where a plane, perpendicular to the airstream, first meets the bell mouth or cone.

3.2 Psychrometrics

3.2.1 Dry-Bulb Temperature. Dry-bulb temperature is the air temperature measured by a dry temperature sensor.

3.2.2 Wet-Bulb Temperature. Wet-bulb temperature is the temperature measured by a temperature sensor covered by a water-moistened wick and exposed to air in motion. When properly measured, it is a close approximation of the temperature of adiabatic saturation.

3.2.3 Wet-Bulb Depression. Wet-bulb depression is the difference between the dry-bulb and wet-bulb temperatures at the same location.

3.2.4 Stagnation (Total) Temperature. Stagnation (total) temperature is the temperature which exists by virtue of the internal and kinetic energy of the air. If the air is at rest, the stagnation (total) temperature will equal the static temperature.

3.2.5 Static Temperature. Static temperature is the temperature which exists by virtue of the internal energy of the air only. If a portion of the internal energy is converted into kinetic energy, the static temperature will be decreased accordingly.

3.2.6 Air Density. Air density is the mass per unit volume of the air.

Note: References which are enclosed in { } are normative for this standard, while those enclosed in [ ] are to be considered informative.