

AMCA Publication 201-02 (R2007)

Fans and Systems



**AIR MOVEMENT AND CONTROL
ASSOCIATION INTERNATIONAL, INC.**

The International Authority on Air System Components

This is a preview. [Click here to purchase the full publication.](#)

AMCA PUBLICATION 201-02 (R2007)

Fans and Systems



**Air Movement and Control Association International, Inc.
30 West University Drive
Arlington Heights, IL 60004-1893**

This is a preview. [Click here to purchase the full publication.](#)

© 2007 by Air Movement and Control Association International, Inc.

All rights reserved. Reproduction or translation of any part of this work beyond that permitted by Sections 107 and 108 of the United States Copyright Act without the permission of the copyright owner is unlawful. Requests for permission or further information should be addressed to the Executive Director, Air Movement and Control Association International, Inc. at 30 West University Drive, Arlington Heights, IL 60004-1893 U.S.A.

[This is a preview. Click here to purchase the full publication.](#)

Forward

ANSI/AMCA Standard 210 *Laboratory Methods of Testing Fans for Aerodynamic Performance Rating*, provides a basis for accurately rating the performance of fans when tested under standardized laboratory conditions. The actual performance of a fan when installed in an air moving system will sometimes be different from the fan performance as measured in the laboratory. The difference in performance between the laboratory and the field installation can sometimes be attributed to the interaction of the fan and the duct system, i.e., duct system design can diminish the usable output of the fan.

AMCA Publication 201 *Fans and Systems*, introduced the concept of *System Effect Factor* to the air moving industry. The *System Effect Factor* quantifies the duct system design effect on performance. The *System Effect Factor* has been widely accepted since its inception in 1973. It must be remembered, however, that the "factors" provided are approximations as it is prohibitive to test all fan types and all duct system configurations. The major revision to this edition of AMCA Publication 201 *Fans and Systems*, is a change to the use of SI units of measure, with Inch-Pound units being given secondary consideration.

AMCA 201 Review Committee

Bill Smiley	The Trane Company / LaCrosse
James L. Smith	Aerovent, A Twin City Fan Company
Tung Nguyen	Emerson Ventilation Products
Patrick Chinoda	Hartzell Fan, Inc.
Rick Bursh	Illinois Blower, Inc.
Sutton G. Page	Austin Air Balancing Corp.
Paul R. Saxon	AMCA Staff

Disclaimer

AMCA International uses its best efforts to produce standards for the benefit of the industry and the public in light of available information and accepted industry practices. However, AMCA International does not guarantee, certify or assure the safety or performance of any products, components or systems tested, designed, installed or operated in accordance with AMCA International standards or that any tests conducted under its standards will be non-hazardous or free from risk.

Objections to AMCA Standards and Certifications Programs

Air Movement and Control Association International, Inc. will consider and decide all written complaints regarding its standards, certification programs, or interpretations thereof. For information on procedures for submitting and handling complaints, write to:

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004-1893 U.S.A.

or

AMCA International, Incorporated
c/o Federation of Environmental Trade Associations
2 Waltham Court, Milley Lane, Hare Hatch
Reading, Berkshire
RG10 9TH United Kingdom

[This is a preview. Click here to purchase the full publication.](#)

Related AMCA Standards and Publications

Publication 200 ***AIR SYSTEMS***

- System Pressure Losses
- Fan Performance Characteristics
- System Effect
- System Design Tolerances

Air Systems is intended to provide basic information needed to design effective and energy efficient air systems. Discussion is limited to systems where there is a clear separation of the fan inlet and outlet and does not cover applications in which fans are used only to circulate air in an open space.

Publication 201 ***FANS AND SYSTEMS***

- Fan Testing and Rating
- The Fan "Laws"
- Air Systems
- Fan and System Interaction
- System Effect Factors

Fans and Systems is aimed primarily at the designer of the air moving system and discusses the effect on inlet and outlet connections of the fan's performance. System Effect Factors, which must be included in the basic design calculations, are listed for various configurations. AMCA 202 and AMCA 203 are companion documents.

Publication 202 ***TROUBLESHOOTING***

- System Checklist
- Fan Manufacturer's Analysis
- Master Troubleshooting Appendices

Troubleshooting is intended to help identify and correct problems with the performance and operation of the air moving system after installation. AMCA 201 and AMCA 203 are companion documents.

Publication 203 ***FIELD PERFORMANCE MEASUREMENTS OF FAN SYSTEMS***

- Acceptance Tests
- Test Methods and Instruments
- Precautions
- Limitations and Expected Accuracies
- Calculations

Field Performance Measurements of Fan Systems reviews the various problems of making field measurements and calculating the actual performance of the fan and system. AMCA 201 and AMCA 202 are companion documents.

[This is a preview. Click here to purchase the full publication.](#)

TABLE OF CONTENTS

1. Introduction	1
1.1 Purpose	1
1.2 Some limitations	1
2. Symbols and Subscripts	1
2.1 Symbols and subscripted symbols	1
2.2 Subscripts	1
3. Fan Testing	1
3.1 ANSI/AMCA Standard 210	1
3.2 Ducted outlet fan tests	3
3.3 Free inlet, free outlet fan tests	4
3.4 Obstructed inlets and outlets	4
4. Fan Ratings	4
4.1 The Fan Laws	4
4.2 Limitations	4
4.3 Fan performance curves	9
5. Catalog Performance Tables	13
5.1 Type A: Free inlet, free outlet fans	13
5.2 Ducted fans	13
6. Air Systems	16
6.1 The system	16
6.2 Component losses	16
6.3 The system curve	17
6.4 Interaction of system curve and fan performance curve	18
6.5 Effect of changes in speed	18
6.6 Effect of density on system resistance	19
6.7 Fan and system interaction	21
6.8 Effects of errors in estimating system resistance	21

[This is a preview. Click here to purchase the full publication.](#)

6.9	Safety factors	22
6.10	Deficient fan/system performance	23
6.11	Precautions to prevent deficient performance	23
6.12	System effect	23
7.	System Effect Factor (SEF)	24
7.1	System Effect Curves	24
7.2	Power determination	29
8.	Outlet System Effect Factors	29
8.1	Outlet ducts	29
8.2	Outlet diffusers	30
8.3	Outlet duct elbows	31
8.4	Turning vanes	35
8.5	Volume control dampers	35
8.6	Duct branches	37
9.	Inlet System Effect Factors	38
9.1	Inlet ducts	38
9.2	Inlet duct elbows	38
9.3	Inlet vortex (spin or swirl)	40
9.4	Inlet turning vanes	44
9.5	Airflow straighteners	44
9.6	Enclosures (plenum and cabinet effects)	46
9.7	Obstructed inlets	47
10.	Effects of Factory Supplied Accessories	49
10.1	Bearing and supports in fan inlet	50
10.2	Drive guards obstructing fan inlet	50
10.3	Belt tube in axial fan inlet or outlet	50
10.4	Inlet box	50
10.5	Inlet box dampers	50
10.6	Variable inlet vane (VIV)	51

Annex A. SI / I-P Conversion Table (Informative)	52
Annex B. Dual Fan Systems - Series and Parallel	53
B.1 Fans operating in series	53
B.2 Fans operating in parallel	53
Annex C. Definitions and Terminology	55
C.1 The air	55
C.2 The fan	55
C.3 The system	58
Annex D. Examples of the Convertibility of Energy from Velocity Pressure to Static Pressure	62
D.1 Example of fan (tested with free inlet, ducted outlet) applied to a duct system	62
D.2 Example of fan (tested with free inlet, ducted outlet), connected to a duct system and then a plenum	63
D.3 Example of fan with free inlet, free outlet - fan discharges directly into plenum and then to duct system (abrupt expansion at fan outlet)	65
D.4 Example of fan used to exhaust with obstruction in inlet, inlet elbow, inlet duct, free outlet	66
Annex E. References	69

This is a preview. [Click here to purchase the full publication.](#)