

# AMCA Publication 201-02 (R2007)

## Fans and Systems



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

The International Authority on Air System Components

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## 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.

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## 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.

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# Fans and Systems

## 1. Introduction

ANSI/AMCA 210 *Laboratory Methods of Testing Fans For Aerodynamic Performance Rating*, offers the system design engineer guidance as to how the fan was tested and rated. AMCA Publication 201 *Fans and Systems*, helps provide guidance as to what effect the system and its connections to the fan have on fan performance.

Recognizing and accounting for losses that affect the fan's performance, in the design stage, will allow the designer to predict with reasonable accuracy, the installed performance of the fan.

### 1.1 Purpose

This part of the AMCA *Fan Application Manual* includes general information about how fans are tested in the laboratory, and how their performance ratings are calculated and published. It also reviews some of the more important reasons for the "loss" of fan performance that may occur when the fan is installed in an actual system.

Allowances, called *System Effect Factors (SEF)*, are also given in this part of the manual. *SEF* must be taken into account by the system design engineer if a reasonable estimate of fan/system performance is to be determined.

### 1.2 Some limitations

It must be appreciated that the *System Effect Factors* given in this manual are intended as guidelines and are, in general, approximations. Some have been obtained from research studies, others have been published previously by individual fan manufacturers, and many represent the consensus of engineers with considerable experience in the application of fans.

Fans of different types and even fans of the same type, but supplied by different manufacturers, will not necessarily react with the system in exactly the same way. It will be necessary, therefore, to apply judgment based on actual experience in applying the *SEF*.

The *SEF* represented in this manual assume that the fan application is generally consistent with the method of testing and rating by the manufacturer. Inappropriate application of the fan will result in *SEF*

values inconsistent with the values presented.

Mechanical design of the fan is not within the scope of this publication.

## 2. Symbols and Subscripts

For symbols and subscripted symbols, see Table 2.1. For subscripts, see Table 2.2.

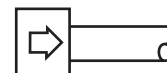
## 3. Fan Testing

Fans are tested in setups that simulate installations. The four standard installation types are as shown in Figure 3.1.

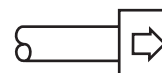
AMCA INSTALLATION TYPE A:  
Free Inlet, Free Outlet



AMCA INSTALLATION TYPE B:  
Free Inlet, Ducted Outlet



AMCA INSTALLATION TYPE C:  
Ducted Inlet, Free Outlet



AMCA INSTALLATION TYPE D:  
Ducted Inlet, Ducted Outlet



Figure 3.1 - Standard Fan Installation Types

### 3.1 ANSI/AMCA Standard 210

Most fan manufacturers rate the performance of their products from tests made in accordance with ANSI/AMCA 210 *Laboratory Methods of Testing Fans for Aerodynamic Performance Rating*. The purpose