

# Fan and Air System Applications Handbook

## AMCA International



**Publication 200**  
*Air Systems*

**Publication 201**  
*Fans and Systems*

**Publication 202**  
*Troubleshooting*

**Publication 203**  
*Field Performance  
Measurements of  
Fan Systems*

## Forward

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### **Publication 200**

#### *Air Systems*

*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.

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

### **Publication 201**

#### *Fans and Systems*

*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.

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

### **Publication 202**

#### *Troubleshooting*

*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.

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

### **Publication 203**

#### *Field Performance Measurements of Fan Systems*

*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.

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

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# Air Systems

# 200

## 1. Introduction

An air system is any assembly of ducts, filters, conditioning devices, dampers, louvers, fans, etc., the main purpose of which is to move air from one place to another in a controlled fashion. Most air systems draw air from one space and discharge it into another.

Air systems are often required to operate satisfactorily in a wide range of environmental conditions. The conditions which will be encountered must be considered in the design of the ducts, pipes, etc., which will contain the airflow and constitute the boundary of the system.

### 1.1 Air system components

A typical air system may contain one or more of the following (see Figure 1):

- a) System inlet
- b) Distribution system
- c) Fan
- d) Control device
- e) Conditioning device
- f) System outlet

**1.1.1 System inlet.** An air system usually includes devices such as louvers, filters, screens, guards, grilles, etc., where the air enters the system. These are used for safety reasons as well as to inhibit the entry of rain, dust, and other unwanted matter. Their appearance may be important as they are usually visible on the exterior of a structure.

**1.1.2 Distribution system.** Most air systems are made up of ducts specially designed and constructed to convey air from the system inlet(s) to the system outlet(s). In some cases, enclosed spaces in the structure such as plenums above ceilings or holes in walls may be used to confine and direct the flow.

**1.1.3 Fan.** Understanding the design and operation of air systems begins with an understanding of the various types of fans, their performance characteristics, and their applications.

A fan is required in order to produce the pressure differential which results in the flow of air through a system. The fan must be carefully selected to meet the specified airflow and pressure for proper system operation. Different fan designs produce different pressure-volume and fan power relationships, which are critical to air system operation. Refer to Figure 4.2, AMCA Publication 201-90.

**1.1.4 Control devices.** In many air systems it is necessary to regulate and control the flow through the system in response to some monitoring signal, usually temperature or pressure. It may be also necessary to regulate the flow in the individual branches of the system. Control devices such as dampers function by controlling the amount of airflow. In some cases, the output of the fan can be varied by other methods (variable speed motor, variable inlet vanes, variable pitch impeller, etc.)

**1.1.5 Conditioning device.** Most air systems are designed to take air from the inlet and change its condition before discharging it at the outlet. Changes may include the temperature, humidity, pressure, contaminant level and cleanliness, etc., of the air. Many conditioning devices require outside energy sources, for example, heating and cooling coils; other components such as filters are passive devices and have no external energy connection. All conditioning devices increase the pressure drop across the system and this effect must be considered in the selection of the fan.

**1.1.6 System outlet.** An air system usually includes a special component at the termination of the system or at the end of each of the system's branches, such as a simple screen or louver. In many cases the distribution of the air at the outlet to the receiving space is very important, e.g., in an occupied air conditioned room. These systems require carefully selected outlets and diffusing devices to achieve desirable air motion and temperature conditions in the conditioned space. Typical devices are ceiling diffusers and grilles. In some cases these may incorporate control devices such as dampers and mixing boxes.