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CHAPTER 45

INDUSTRIAL EXHAUST SYSTEMS

Classification of Systems, Hood Design Principles, Capture Velocity and Hood Suction, Duct System Design, Resistance of System, Efficiency of System, Air Flow Producing Equipment, Protection Against Corrosion and Abrasion

IN many industrial plants some type of exhaust system designed to collect and remove dusts, fumes, mists, vapors, and gases is essential in order to promote efficiency, economy, and safety of operation. Definitions of these various contaminants are included in Chapter 8, Air Contaminants.

The theory of air flow in an exhaust system in the following paragraphs *A* to *D* will be found in a publication[1] of the *American Foundrymen's Association.*

A. When the air flow producing equipment of an exhaust system is properly operated, it will produce a negative pressure (below atmospheric) in the exhaust side of the system sufficient to overcome all resistance, and to sustain the desired air velocity; and, further, will overcome all resistances on the discharge or positive pressure side of the system so that the air drawn through exhaust inlets will be discharged against atmospheric pressure.

B. An exhaust system is entirely dependent on a *sufficient volume* of air flowing into the exhaust inlets to catch the matter to be exhausted before such matter has an opportunity to diffuse into the general atmosphere of the work place or room.

C. The velocity of the air flowing into an exhaust inlet is usually of secondary importance, and becomes an essential factor only when a certain velocity is required to overcome some force acting on the matter to be caught. The velocity within an exhaust system is only important to the extent that it shall be sufficient to convey the entrained matter and prevent it from settling or dropping out in the piping system. Velocity in terms of velocity pressure is most essential in designing a system, because it is the basis upon which all calculations are made. In testing and checking a system the velocity, as determined from the velocity pressure reading obtained by means of a Pitot tube, is the only true indication of the exact air flow in a pipe or system.

D. The total pressure within an exhaust system is only of importance in determining the power required to operate the system. Total pressure tests do not indicate the proper functioning of an exhaust system as related to the volume and velocity of the air flowing into an exhaust inlet.

General design information is included in this chapter which is intended to relate primarily to industrial exhaust systems.

CLASSIFICATION OF SYSTEMS

In general, there are two basic layouts of exhaust systems, the central and the multiple unit system. In the central system a fan is located near the center of operations with a piping system radiating to the various machines to be served. In the multiple unit system, which is sometimes employed where the machines to be served are widely scattered, or where the operations are apt to be independent or intermittent, small individual exhaust fans are located at the center of the machine groups or at each machine. The unit arrangement has the advantage of flexibility.

Exhaust systems may be classified with respect to the nature of the material to be handled by them as (a) those handling dusts and certain fumes and mists of large particle size; and (b) those handling vapors, gases and certain fumes and mists of small particle size. Design details differ in systems serving dust producing operations and those exhausting the