

DRY AIR FILTERS

The media in such filters are usually fabrics or fabric-like materials. Media of wool felt, cotton batting (both glazed and unglazed), cellulose fiber and other materials have been used commercially. The medium in a filter of this class is usually supported by a wire frame in the form of pockets or V-shaped pleats in order to increase the area exposed to the passage of air. A 2-ft square unit may contain from 15 to 30 sq ft of medium.

Dry air filters are likely to have a comparatively high lint-holding capacity on account of the large area of medium used. Wool felt media are troublesome to clean when impregnated with greasy dust, and they are too expensive to discard frequently. Both vacuum cleaning and dry cleaning have been used for reconditioning wool felt filters.

ELECTRIC PRECIPITATORS

The fact that a particle exposed to an electric field will assume a charge

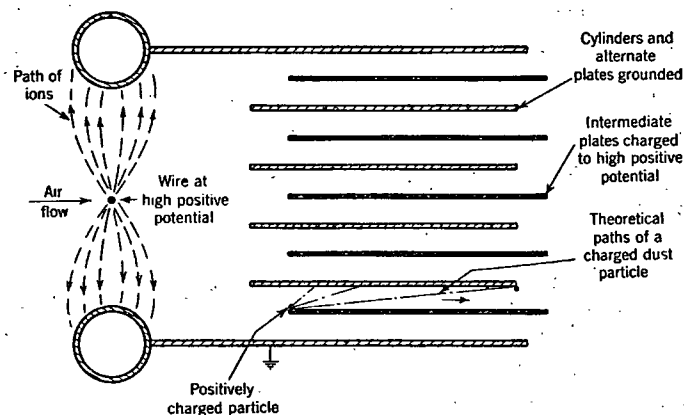


FIG. 1. DIAGRAMMATIC CROSS-SECTION OF ELECTROSTATIC PRECIPITATOR

and migrate toward one of the electrodes, has been utilized for some years in boiler plants as a means of smoke abatement. The same principle has been used in equipment developed for air cleaning in air conditioning without generating ozone in intolerable quantities. The air stream in a precipitator passes first through a relatively high-tension electric field, known as the ionizing field, and then through a secondary field where the precipitation of the dust occurs. The arrangement is as shown in Fig. 1.

In a typical case, a potential of 12,000 volts may be used to create the ionizing field, and some 5000 volts between the plates upon which the precipitation of dust occurs. These voltages, which are capable of shock to personnel similar to that of a spark plug, necessitate some safety measures. A typical arrangement provides means for automatically making the unit inoperative when a door to the precipitator is opened. To resume operation the procedure necessitates closing the door and turning an electric switch, the latter of which should be located at a reasonable distance from the equipment. The voltages necessary for the operation of the precipitator are usually obtained from an alternating current building service line

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by means of a step-up transformer. Precipitation with alternating current is possible, but is not nearly so effective, so the current is usually rectified by means of vacuum tubes. The transformer and tubes are collectively termed the power pack.

Only a very small amount of electric energy is necessary to operate an electric precipitator, and the resistance to air flow through the device is practically negligible. Some care is necessary in arranging the duct approaches on the entering and leaving sides of precipitators to assure that the air flow is distributed uniformly over the cross-sectional area. The efficiency of the precipitator is sensitive to air velocity, and the device itself has much less tendency to rectify the air stream than filters, which have much higher resistances.

Electric precipitators are available in both automatic and non-automatic types. The plates of non-automatic precipitators are commonly coated with a light oil as an adhesive. Cleaning is accomplished with a water hose and, for this reason, the bottom of the equipment is made water tight and provided with a drain. In one automatic type, precipitation units are mounted on chains, and are alternately dipped in oil and exposed to the air stream with an action similar to that of an automatic impingement filter. An arrangement of sliding contacts maintains the necessary electric circuits.

AIR FILTER PERFORMANCE AND TESTING

Air filters are generally rated in terms of the total air flow for which they are designed, expressed in cubic feet per minute. Face velocity is defined as the average velocity of the air entering the filter, and it is determined by taking the air flow and dividing it by the area of the duct connection to the cleaner in square feet. Filters are often rated at a face velocity in the range of 250 to 500 fpm. Resistance to air flow is usually measured in inches of water column. The resistances of filters when new and clean, and when operated at rated capacity, are generally available from the manufacturer (see *Catalog Data Section*).

The ability of air cleaners to clean air is called the efficiency or the arrestance, and may be denoted by the symbol E . The efficiency of an air cleaner differs with the size and nature of the dust on which the cleaner operates. The efficiency of an air cleaner, algebraically expressed, is:

$$E = \frac{D_1 - D_2}{D_1} \quad (1)$$

where

D_1 = amount of dust per unit volume in uncleaned air.

D_2 = amount of dust per unit volume in cleaned air.

Several methods have been investigated for evaluating D_1 and D_2 . The particle count method is not used for efficiency evaluation, except in investigation of filter performance on specific particles such as pollen, or on certain industrial dusts harmful to health. Dust particles can be captured on microscope slides by means of one of the various kinds of impingement devices. The process is useful if inspection and analysis of dust are desired, but particle counting is not sufficiently precise for evaluating the efficiency of a cleaner operating on a heterogeneous dust.

The weight method of evaluating efficiency has found wide utility, and was recognized by the AMERICAN SOCIETY OF HEATING AND VENTILATING