EXHAUST SYSTEMS

Quick removal of dust particles produced by such operations as grinding, screening, mixing, etc., is accomplished with exhaust systems. Their applications are numerous and varied, and not only prevent health hazards but eliminate product contamination. Mere discharge to the atmosphere outside of the building without collection is frequently of little effect, for incoming air redistributes the objectionable material. Information on the design of industrial exhaust systems will be found in Chapter 34. Any of the air cleaning devices previously described may be used with them depending upon the severity of the conditions and the nature and size of the material to be collected.

AIR SCRUBBERS

Air scrubbers are used extensively in exhaust systems since they provide removal of at least the coarser particles. The choice of scrubbing medium depends upon the character of the particles to be removed. The liquid medium should wet the particles, and the wetting is a surface tension phenomenon specific for each liquid-solid pair. Water effectively wets particles similar to silica, and oil wets particles similar to carbon. Combinations of oil and water, producing a froth, are effective for both and for materials of intermediate nature.

Intimate contact between the scrubbing liquid and the particles is essential, and many variations in constructions are available. Fine sprays, baffles, bubble caps, open and packed towers, and splash systems are used. Even the finest sprays are of low efficiency when used in an open chamber. Impact of the dust particles against a wetted surface is necessary for their retention, and this requires high gas velocities and well placed baffles or packing. Atomization of the liquid and air together is highly effective in removing the finest particles but makes for high power requirements.

Corrosion is frequently serious, particularly with high temperature gases containing soluble constituents. The collected material is removed as a thick sludge, and its wetted condition is a factor for consideration if it has possible recovery value.

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PROBLEMS IN PRACTICE

1 ● Assume a fan and duct system which handled 10,000 cfm through clean filters with a system resistance of 0.8 in. of water and that after the filters have become dirty the system resistance increases to 1.0 in. of water, and that the fan speed remains unchanged. Is there any way of predicting the volume of air delivered after the filter becomes dirty?

Yes. If the performance curves for the particular make of fan are available, the new volume may be determined from the resistance pressure curve. (Figs. 1, 2, 3 and 4, Chapter 27.)

2 ● What are the advantages of viscous filters?

The principal advantage of the viscous filter is its large dust holding capacity. The dust accumulation is distributed through the depth of the filtering medium rather than upon the surface as in the dry types, which makes it possible for viscous filters to handle heavy dust concentrations without excessive resistance. Since its efficiency and resistance are based on maximum air velocities of from 300 to 500 fpm through the filter, the viscous filter consumes the minimum amount of space for a given air volume.

3 ● What are the advantages of dry filters?

Dry filters are more efficient in the removal of fine dust particles from the air, and some types will eliminate even as much as 60 per cent of the smoke particles. Dry filters also are easily and conveniently maintained by vacuum cleaning, vibrating, or renewing the filtering medium.

4 ● If an air washer is used for cooling and humidity control in an air conditioning system, is a filter needed?

An air filter is desirable in conjunction with an air washer because of the large amount of soot in the air which, due to its greasy and amorphous nature, is not readily trapped in an air washer. Filters should be placed between the washer and the air intake so that all the dirt will be collected at one point to simplify maintenance and to protect all the equipment in the system.

5 ● Is an air filter needed with an extended surface type heat exchanger?

An air filter is essential with an extended surface heat exchanger in order to maintain its efficiency, for without this protection dust particles will adhere to the exposed surfaces, and gradually build up a deposit to the point where the efficiency will be impaired and the resistance increased by restricting the air passage.

6 ● What is the proper location of a filter in relation to the fan?

A filter will operate equally well whether placed on the suction or discharge side of the fan. It has become standard practice, however, to locate the filter on the fan inlet side because there it has: (1) simpler duct connections, (2) reduced static pressure losses, (3) more even air distribution over the entire filter area. Where an exceptionally high efficiency in dust removal must be maintained, it is often advisable to place the filter on the discharge side of the fan so there can be no infiltration of unclean air.