5. Electric lights should be installed in the chamber in front of and behind the air filter.

6. Air washers should, whenever possible, be installed between the tempering and heating coils to protect them from extreme cold in winter time.

7. Filters installed close to air inlet should be protected from the weather by suitable louvers, in front of which a large mesh wire screen should be provided.

8. Filters should have permanent indicators to give a warning when the filter resistance reaches too high a value.

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PROBLEMS IN PRACTICE

1 ● What is meant by air filter performance characteristics?

The factors that determine the performance of an air filter, which are:

(1) efficiency in dust removal, (2) operating resistance, (3) dust holding capacity. In a properly designed filter these factors are balanced to obtain the desired characteristics for a given application. Since the requirements vary for different kinds of air cleaning service, it is necessary to have filters of different types to meet the various conditions.

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 ft per minute 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, to protect all the equipment in the system, and to prevent contamination of the water used in the washer.

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.

7 ● What instruments and apparatus are required for determining the pollen concentration in air by means of the settling method?

A microscope with a field of know area and a glass slide coated with a viscous material.

8 ● Describe the procedure for determining the pollen concentration in air by means of the settling method.

A glass slide coated with a viscous material is placed for a period of 24 hours in a horizontal position in the atmosphere to be tested. The slide is then removed and placed under the microscope, and pollen counts are made of approximately 25 fields over the area of the glass slide. Having determined the count over a definite area, as for example, 1 sq cm, and finding the settling rate of the average particles from the chart, Fig. 1, the concentration in parts per cubic yard can be calculated.

9 ● The resistance to air flow of a unit air filter is found to be 0.4 in. of water. The volume of air passing through the filter is 1000 cfm at a velocity of 200 fpm. What would be the filter area required in order to reduce the pressure drop across the filter from 0.4 in. of water to 0.16 in. of water?

Referring to Fig. 3: The resistance is substantially proportional to the square of the velocity, or

$$\frac{R_1}{R_2} = \frac{V_1^2}{V_2^2}$$

$$\frac{0.4}{0.16} = \frac{200^2}{V_2^2}$$

$$V_2^2 = 16{,}000$$

$$V_2 = 126.5 \text{ fpm}$$

$$Q = A\,V$$

$$1000 = 126.5\,A$$

$$A = \frac{1000}{126.5} = 7.91 \text{ sq ft}$$

The filter area would be increased from 5 sq ft to 7.91 sq ft.

10 ● A ventilating system complete with filters has a fan which, when operating at 400 rpm and delivering air at 1 in. of water total static pressure, requires an input of 3 horsepower. After the system operates for a time, the pressure drop across the filter caused by the clogging action of the collected dust and dirt increases from 0.1 in. of water to 0.4 in. of water. To maintain the original