percentage relationship expressing dust removal efficiency at rated capacity, (4) reconditioning power, the energy necessary to operate the mechanism of an automatic air cleaning device, and (5) dust-holding capacity, the amount by weight of standard dust which a non-automatic air cleaning device will retain before reconditioning is necessary.

## CLASSIFICATION OF AIR CLEANERS

According to the Code, the following four classifications are given the devices:

*Class A. Automatic Type:* In general all air cleaning devices which use power to automatically recondition the filter medium and maintain a non-varying resistance to air flow.

*Class B. Low Resistance Non-Automatic Type:* Air cleaning devices for warm-air furnaces, unit ventilating machines and similar apparatus and installations in which a maximum of not more than 0.18 in. water gage is available to move air through the air cleaning device.

*Class C. Medium Resistance Non-Automatic Type:* Air cleaning devices for systems in which a maximum of not more than 0.5 in. water gage is available to move air through the air cleaning device.

*Class D. High Resistance Non-Automatic Type:* Air cleaning devices for the air intake of compressors, internal combustion engines, and the like, where a pressure of 1.0 in. or more water gage is available to move air through the air cleaning device.

Air cleaners may also be classified as follows:

1. According to principle of air cleaning.
   a. Viscous air filters.
      (1) Unit type.
      (2) Automatic type.
   b. Dry air filters.
   c. Air washers.
   d. Electrical precipitators.
2. According to application.
   a. For central fan systems of ventilation and air conditioning. Filters of the automatic or semi-automatic type, as well as the non-automatic viscous unit or dry type are usually recommended and are installed in a central plenum chamber.
   b. For unit ventilators. Filters of viscous unit or dry type, installed at inlet of individual units.
   c. For window installations. Self-contained units consisting of fan and filter, usually dry or viscous type, adapted to be placed in the ordinary window.
   d. For warm-air furnaces. Unit type viscous or dry filters placed in small plenum chamber of warm-air house heating systems.
   e. For compressors and Diesel engines. Unit or automatic type viscous or dry filters, installed at air intake of compressors and Diesel engines.
   f. For compressed air lines. Unit type viscous or dry filters.
   g. For stack gases. Settling chambers, dynamic or electrical precipitators.
   h. For exhaust systems. All types.

Air cleaners may be classified further as follows:

1. For general air conditioning. With the growing congestion of large cities and an industrial growth throughout the entire country, the percentages of foreign material in the air, such as soot or carbon, which are unaffected by an air washer type of air cleaner, have increased. This has brought about the development of the viscous and dry type air filters which are part of many ventilating and air conditioning systems.
2. For removal of dusts, smokes and fumes from stack gases. Prevention of atmospheric pollution from this source is of ever increasing importance, sometimes forced legally and frequently used in order to obtain increased efficiency.
3. For removal and collection of industrial dusts from the point of their production through exhaust systems.





## VISCOUS TYPE FILTERS

The principle of air cleaning used in viscous filters is that of *adhesive impingement.* Dust and dirt in the air, especially soot and carbons, are trapped and retained by successive impingements on coated surfaces. While the arrangements of filtering media and the kind of materials used are almost unlimited, there are certain rather definite requirements for a practical commercial filter.

Investigations in this country and abroad demonstrate that the first impingement of dust laden air on a viscous coated surface removes about 60 per cent of the dust, the next impingement takes 60 per cent of what then remains—that is, 24 per cent—and the next impingement removes 9.6 per cent. To secure maximum efficiency, it is necessary to divide the air into innumerable fine streams, as the more intimately and freely the air is brought into contact with the viscous-coated media the better will be the cleaning.

The binding liquid used with viscous filters should have the following properties:

1. Its surface tension should be such as to produce a homogeneous film-like coating on the filter medium.
2. The viscosity should vary only slightly with normal changes of temperature.
3. It should be germicidal in its action to prevent the development of mold spores and bacteria on the filter media.
4. The liquid should have a high affinity for dust at low temperatures.
5. The liquid should have high capilarity, or ability to wet and retain the dust.
6. Evaporation should not exceed 1 per cent.
7. It should be fireproof.
8. It should be odorless.

### Viscous Unit Filters

In the unit type viscous filter, the filtering media are arranged in units of convenient size to facilitate installation, maintenance, and cleaning. Each unit consists of an interchangeable cell or replaceable filter pad and a substantial frame which may be bolted to the frames of other like units to form a partition between the source of dusty air and the fan inlet. Where necessary reconditioning equipment should be installed near each group of unit filters, with hot water and sewer connections provided.

To secure greater dust holding capacity and a practically constant resistance and air volume, the filter media are usually placed in the direction of air flow, with progressively finer filter densities determined by the percentage of dust impinged. This arrangement provides relatively large spaces for the collection of dirt in the front of the filter where the bulk of the dust is taken out without undue increase in resistance, while at the back of the filter the openings are smaller to secure high efficiency in the removal of the finer dust particles.