From a hygienic viewpoint where air is to be recirculated, only the contaminant concentration in the recirculated air stream, rather than the collection efficiency, should be considered.

Correlation between the various efficiencies is poor due to the wide variation in particle size, size distribution, and shape.

Resistance or pressure drop through any given collector is related to the operating principle, and varies about as follows: low resistance collectors—up to 2 in. water; medium resistance collectors—2 to 8 in. water; high resistance collectors—8 to 25 in. water.

In mechanical centrifugal collectors of the wet or dry type (power driven impellers or rotors) resistance alone is not of significance since these devices are also air movers and therefore the factor of paramount importance is the overall power consumption of the unit. This is also true of certain types of wet collectors which require auxiliary pumping power.

The ability of any unit to maintain specified air or gas flow during its operating cycle is also a function of its operating principle. For example, inertial collectors of the simple and centrifugal type are able to maintain constant resistance regardless of concentration and particle size. However, adhesive materials may collect at the entry, throughout the unit, and at the exit, and thus cause a reduction in air flow and serious maintenance problems. With the exception of packed towers and wet filters, wet collectors operate at constant resistance throughout their operating cycles. However they may also be adversely affected by adhesive or corrosive materials. Wet filters or packed towers will eventually become clogged because of retention of inert dusts. Units employing fabric or other filter media will have resistance influenced by the concentration, particle size, shape, and packing characteristics of the aerosol. Their overall resistance during the operating cycle may increase gradually over a known or determined period. Auxiliary cleaning devices such as separate compartments, alternately shaken, reverse air flow, or reverse jet air flow may maintain constant or nearly constant resistance or insure only small fluctuations in air or gas flow. Electrostatic precipitators have the outstanding characteristic of maintaining a constant air flow with an accompanying low resistance. Adsorbers behave similarly to packed towers in that they provide constant resistance until the voids become seriously plugged with inert dusts. This generally requires a matter of several months on normal applications.

It has been found that inertial separators require the least maintenance. Simple wet collectors rank next in this respect. Complex wet collectors and fabric arrestors require maintenance on a definitely scheduled basis. Electrostatic precipitators require the usual maintenance connected with high-voltage equipment and may vary widely. The maintenance of adsorber type units is minimal and is based primarily on the amount of inert material encountered.

INERTIAL SEPARATORS

There are many types in this group. These range from simple settling chambers utilizing gravitational forces, to complex centrifugal devices using abrupt directional changes or motor driven rotors. They all have the desirable features of constant resistance during their operating cycle and do not require any special construction for temperatures under 750 F. Usually they require less maintenance than other types of collectors.

Table 1 . . . . Inertial Separator Characteristics

Kind	Efficiency Particle Size Range In Microns			Resistance (Pressure Drop)	Description and Remarks
	>100	100–10	<10		
Settling and baffle chambers	Medium	Low	Low	Low	A large chamber to reduce velocity to permit settling. Auxiliary baffles are sometimes used to improve performance. Requires large space.
Large diameter cyclones	High	Medium to low	Low	Low	Considered as single body over 3 ft in diameter. Gases and material must be dry. Air-tight dust bins or continuous removal of material must be provided. Space requirements moderate.
Refined design centrifugals	High	High	Medium to low	Medium	Available as multiple small-diameter tubes, scroll-shaped bodies, and multiple louvers. Gases and material must be dry. Air-tight dust bins or continuous removal of material must be provided. Space requirements moderate.
Integral rotor type	High	High	Medium to low	See remarks	Rotor acts as air mover and separating element. Usually limited to dry granular materials and dry gases. Low space requirements. No external pressure loss involved but power requirements are higher than usual exhauster.
Slotted scroll fan	High	Medium to low	Low	See remarks	Separation takes place in in fan scroll. No external loss involved but power requirements are higher than usual exhauster.

On the basis of their important characteristics inertial separators may be classified according to Table 1.

SCRUBBERS AND OTHER WET COLLECTORS

In these collectors many methods are used to wet the contaminant and remove it from the air stream. A number of wet collectors are similar in design to dry collectors with the addition of sprays or liquid contactors. The mechanism of separation in wet collectors depends on inertial forces such as impaction and impingement, and in some cases, diffusion.

Wet collectors do not require any special construction for high temperatures. They are suitable for use on mixed contaminants such as gases and solid or liquid particles. The collection of dust in a wetted form eliminates a secondary dust problem in disposal of collected material. Protection against corrosion and freezing may be necessary and disposal of waste liquids may become a problem. With the exception of the packed towers and wetted filters they all have a constant resistance during their operation.

Table 2 . . . . Characteristics of Wet Collectors

Kind	Efficiency Particle size range in microns			Resistance In. Water	Water Rate In Gallons Per 1000 Cu Ft Gas	Maintenance	Description and Remarks
	>10	10–1	<1				
Air washers	High	Medium	Low	Low (less than 1)	5–15	Medium	Composed of one or more banks of low-pressure sprays and flooded eliminator plates. Space requirements are large. Water is usually recirculated.
Wet filters	High	High	Medium	Low (less than 1)	3–8	Medium	Composed of one or more banks of low-pressure sprays flooding packed cells of glass or other fibers. Space requirements are large. Limited to low loadings of solid particles.
Packed towers	High	High	Medium	High	5–10	High	Composed of granular or ceramic packing. Space requirements large. Generally limited to gas absorption.
Spray towers	High	Medium	Low	Low	5–10	Low	Usually a vertical chamber equipped with low-pressure water sprays at the top or along the walls. Baffle plates may be provided for contacting. Space requirements medium. Usually applied for hot gases.
Centrifugal or inertial scrubbers	High	High	Medium to high	Medium (see remarks)	½–40	See remarks	This classification includes most of the commercial wet collectors. They may utilize singly or in combination, low- or high-pressure sprays, wetted plates, rotating members, liquid gas contact by induction or centrifugal action. Some of these units (disintegrators) have high overall power requirements for driving the rotor while others have high power consumption for raising water pressures for spray nozzles. Maintenance varies from low to high depending on component parts. Simple gas liquid contact units would be classified as low. Units having rotating members may vary from medium to high depending on the type of service.
Venturi scrubber	High	High	High	High (12–25)	5–10	Medium	Consists of a simple venturi with low-pressure sprays at throat followed by a cyclonic type separator. Space requirements are low. Unit functions independent of grain loadings. High velocity at venturi throat may cause erosion problems.

On the basis of their important characteristics wet collectors may be classified according to Table 2.

FILTERS

Filters for industrial air and gas cleaning consist primarily of cloth dust collectors and the ultra or absolute type of filter.

Cloth dust collectors are generally constructed in the form of housings with cloth envelopes drawn over wire screen frames or with vertical cloth bags or tubes. Cloth filters depend to a great extent on the accumulated dust