

Air pollution control devices

The air pollution control equipment refers to systems that stop a range of solid and gaseous pollutants from entering the atmosphere, primarily through industrial exhaust stacks (chimneys).

These controls are divided into two categories:

- limit the emissions of acidic gasses
- limit the emissions of particulate matter

Name of mechanical devices	Minimum particle size that can be removed	Efficiency	Merits	Demerits	Principle of working and uses
Cyclone collectors and separators	5-25µm	50-90%	<p>Low capital cost.</p> <p>Ability to operate at high temperatures.</p> <p>Can handle liquid mists or dry materials.</p> <p>Low maintenance requirements (no moving parts).</p> <p>Small footprint - requires relatively small space.</p>	<p>High operating costs (due to pressure drop).</p> <p>Low efficiencies (particularly for small particles).</p> <p>Unable to process "sticky" materials.</p>	<p>Cyclone separators operate by incorporating centrifugal, gravitational, and inertial forces to remove fine particles suspended in air or gas. These types of separators use cyclonic action to separate particulates from a gas stream. Typically, PM enters the cyclone separator at an angle (perpendicular to the flow stream, tangentially, or from the side), and is then spun rapidly. A centrifugal force is created by the circular airflow that throws the particulate towards the wall of the cyclone. Once the PM hits the wall, it falls into a hopper below. "Clean" exhaust is then either blown through or recirculated to be filtered again</p>

Scrubbers					
Wet scrubber	>10 µm	<80%	<p>Safely handle combustible dust.</p> <p>Save space and minimize maintenance.</p> <p>Handle sticky or abrasive dust.</p> <p>Remove unwanted soluble gases, fine particulate and mists.</p>	<p>Minimize maintenance.</p> <p>Difficulty of wet waste disposal.</p> <p>Pay higher energy costs.</p>	<p>Wet scrubbers trap suspended particles by direct contact with a spray of water or other liquid. In effect, a scrubber washes the particulates out of the dirty airstream as they collide with and are entrained by the countless tiny droplets in the spray.</p>
Dry scrubber		>95%	<p>Lower capital and operating costs.</p> <p>Capable of controlling very acidic waste streams.</p> <p>Handles high temperature waste streams.</p> <p>Low water consumption. No wastewater treatment.</p>	<p>SO₂ removal efficiency typically lower than wet scrubbers.</p> <p>Disposal of waste can incur higher costs.</p>	<p>Dry air scrubbers quickly spray chemicals into the exhaust stream. Pollutants fall out of the air stream due to the reaction between the reagent and the pollutants. A dry air scrubber is environmentally benign since the collected particles and spray are either burned off in the heat of the air stream or caught in a filter.</p>
Electro Static Precipitators (ESP)	>1 µm	95-99%	<p>ESPs remove the soot, ashes, and unburned carbon dioxide from the smoke and release clean air or smoke into the sky.</p> <p>Could collect dry as well as wet pollutants.</p> <p>Low operating costs</p>	<p>High initial cost.</p> <p>Requires high voltage power supply.</p> <p>May generate ozone emissions:</p> <p>May not be effective in removing certain types heavy metals such as and organic compounds of particles.</p>	<p>The transformers of ESPs create high static electrical potential difference between charging electrodes and collecting plates. As gas streams pass between the two components, an electrical charge is introduced to the particulates, which attracts the particulate matter to the collecting plates.</p>

<p>Bag filters</p>	<p><1 μm</p>	<p>>99%</p>	<p>A filter bag is the best method amongst all for removing fines from the air.</p> <p>Electricity consumption is low.</p> <p>It helps to maintain and protect a healthy environment.</p> <p>They are simple in construction and operation.</p>	<p>It has limitations for its operation due to high gas temperature and high humidity.</p> <p>The maintenance cost is high as the fabric used is costly.</p> <p>The characteristics of fabric change with operating parameters.</p> <p>Comparatively, it is large.</p>	<p>The dust layer is deposited on the surface of the filter bag and the inner side of the filter cloth (the primary dust layer), the dust that contained in the processed gas. The fabric provides a surface for dust particles to get accumulated by inertial or electrostatic interaction, interception, and Brownian movement.</p>
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