Basic Principles of Safety – HVAC

Your Objectives:

At the end of the lesson, you should be able to understand how **HVAC**s play an important role at the workplace.

HVAC: Heating, **V**entilation and **A**ir **C**onditioning

Heating, ventilation, and air conditioning (**HVAC**) is any one of several systems of interior and vehicular environmental comfort, the goal being to provide both thermal comfort and adequate and positively superior indoor air quality.

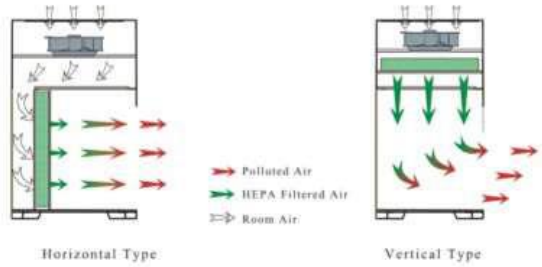
HVAC is integral to residential structures (single family homes, apartment buildings, hotels and senior-home living premises), medium to large industrial and office buildings, skyscrapers, as well as inside vehicles (cars, trains, aircraft, ships and submarines and other marine environments) and above all, in hospitals and lab facilities, where safety and health is paramount.

A proper ventilation system makes up one of the most important factors in maintaining adequate indoor air quality in buildings. Ventilating, or ventilation (the "V" in HVAC), is the process of exchanging or substituting air in a given space so as to provide high-quality indoor air. Oftentimes, ventilation refers to voluntary delivery of outside air into a building's indoor environment. Apart from introducing outside air, ventilation maintains consistent interior air circulation, preventing air stagnation. Either way, this involves temperature control, oxygen replenishment, and the removal of excess moisture and/or heat. Filtration gets rid of undesirable odours, carbon dioxide and other gases and pollutants, but also possibly smoke, dusts, and last but not least, airborne bacteria.

HEPA (High Efficiency Particulate Air) filters are filters for capturing particulates from (interior and exterior) airflow, affecting the **depth filters** and then filtering particles with an aerodynamic diameter of less than 1 μm. Particles include bacteria and viruses, pollen, mite eggs and excretion, soil and dusts, aerosols, and smoke biomass (e.g., wood, charcoal, dung, or crop residue, etc.)

Depending on the **separation efficiency**, particulate filters are divided into:

- High-performance particulate filters, or ULPA (Ultra Low Penetration Air filter)
- HEPAs (High Efficiency Particulate Air filter)
- High-performance particle filters, or EPA (Efficient Particulate Air filter).



HEPA: **H**igh **E**fficiency **P**article **A**ir filter

In Europe, particle filter classes 1 to 17 are used to classify filter effectiveness, whereby the higher the number, the higher the guaranteed degree of separation. The European standard for the classification of particulate filters is EN 1822-1: 2009.

According to the known filter effects, performance particles of approx. 0.1 to 0.3 micrometres are the hardest to separate (MPPS = most penetrating particle size). Both larger and smaller particles are separated better depending on their physical properties.

Current standards classify EPA, HEPA and ULPA according to their effectiveness for these grain sizes using a test aerosol made from di-2-ethylhexyl sebacate (DEHS). A distinction is made between the overall efficiency of the filter and the worst / weakest local point:

	Filter class	Degree of separation (total)	Degree of separation (local)
EPA	E10	> 85%	—
	E11	> 95%	—
	E12	> 99.5%	—
HEPA	H13	> 99.95%	> 99.75%
	H14	> 99.995%	> 99.975%
ULPA	U15	> 99.9995%	> 99.9975%
	U16	> 99.99995%	> 99.99975%
	U17	> 99.999995%	> 99.9999%

Particulate filter classes according to EN 1822-1: 2009

In contrast to the scope of the European standards, the United States only has the term HEPA with a fixed degree of separation. According to EN 1822-1: 1998, the degree of separation is comparable to that of filter class H13. According to DOE-STD-3020-97, it is >99.97% for particles with a size of 0.3 µm.