

EXHAUST & VENTILATIONS



Local Exhaust Ventilation (LEV) Systems

Definition and Purpose:

A Local Exhaust Ventilation (LEV) system is an engineering control designed to minimize exposure to airborne contaminants in the workplace. These contaminants may include dust, mist, fumes, vapors, or gases that can pose health risks to employees. The primary function of an LEV system is to capture and remove these airborne pollutants at their source before they disperse into the broader work environment.

Operation:

- **Capture:** The LEV system uses hoods or capture devices placed near the source of contamination to effectively capture airborne pollutants. The design of these capture devices is critical to ensure efficient extraction of contaminants.
- **Transport:** Once captured, the contaminated air is transported through a duct system to an extraction point. This system is designed to minimize air resistance and ensure the contaminants are efficiently carried away from the work area.
- **Filtration and Exhaust:** The extracted air is then passed through filters or scrubbers to remove the contaminants. After filtration, the clean air is either returned to the workplace or expelled to the outside environment, depending on the system's design.

Components:

1. **Hoods:** Devices designed to capture airborne contaminants at or near the source. Types include face shields, canopy hoods, and slot hoods.
2. **Ducts:** Conduits that transport the contaminated air from the capture point to the filtration system. Proper duct design ensures efficient airflow and minimizes energy losses.
3. **Filters:** Equipment that removes contaminants from the air. Types of filters include particulate filters, activated carbon filters, and electrostatic precipitators.



4. **Fans:** Devices that create airflow through the LEV system. Fans are selected based on the required airflow rate and pressure.
5. **Discharge Points:** Locations where the clean air is either released back into the environment or exhausted to the outside.

Benefits:

- **Health Protection:** Reduces the risk of respiratory illnesses and other health issues associated with airborne contaminants.
- **Enhanced Safety:** Helps prevent fires and explosions by removing flammable vapors and gases from the workplace.
- **Compliance:** Ensures adherence to occupational health and safety regulations and standards.

Supply Air Mechanisms

Definition and Function:

Supply air mechanisms are components of HVAC systems responsible for introducing fresh outdoor air into indoor spaces. Proper supply air distribution is essential for maintaining indoor air quality, comfort, and energy efficiency.

Operation:

- **Outdoor Air Registers:** Supply air is introduced through registers installed in window frames, walls, or other strategic locations. These registers allow fresh air to enter the building and mix with the indoor air.
- **Self-Regulating Registers:** Some outdoor air registers are equipped with self-regulating mechanisms that adjust the airflow based on outdoor temperature. This feature prevents excessive cold air from entering the building during low temperatures, thus enhancing energy efficiency and comfort.

Air Circulation:

- **Gaps and Openings:** To ensure effective air circulation, supply air must be able to flow through gaps at the bottom or top of doors. This allows the fresh air to distribute evenly throughout the indoor space and prevents stagnation.

Benefits:

- **Improved Air Quality:** Introduces fresh outdoor air to replace stale indoor air, reducing the concentration of indoor pollutants.
- **Enhanced Comfort:** Helps maintain a comfortable indoor temperature and humidity level by ensuring proper ventilation.
- **Energy Efficiency:** Properly designed supply air systems can improve energy efficiency by optimizing the use of conditioned air and reducing the load on heating and cooling systems.



Summary:

Local Exhaust Ventilation (LEV) systems and supply air mechanisms are integral to maintaining a healthy and comfortable indoor environment. LEV systems are engineered to capture and remove airborne contaminants at their source, protecting workers' health and ensuring compliance with safety standards. Meanwhile, supply air mechanisms facilitate the introduction and circulation of fresh air, enhancing indoor air quality and overall comfort. Both systems play crucial roles in effective workplace and building ventilation.



EXHAUSTER & AIR CLEANER



Air Cleaners and Air Filters: Overview and Function

Definition and Purpose:

An air cleaner or air filter is a device designed to capture and remove airborne particles and contaminants from the air before it enters air-breathing machinery or building ventilation systems. The primary objective is to ensure that only clean air reaches sensitive components or living spaces, thereby enhancing performance, efficiency, and air quality.

Types of Air Filters:

1. Particle Filters:

- **Mechanism:** These filters use physical barriers to trap particulate matter such as dust, pollen, and soot. Common types include HEPA (High-Efficiency Particulate Air) filters, which can capture particles as small as 0.3 micrometers with high efficiency.
- **Applications:** Particle filters are widely used in residential and commercial building ventilation systems to improve indoor air quality. They are also used in various machinery and industrial processes to prevent the ingress of particulates that could cause wear or damage.

2. Adsorbent Filters:

- **Mechanism:** These filters contain materials like activated charcoal (carbon) that adsorb and neutralize gaseous pollutants and odors. Activated carbon filters work by attracting and holding molecules of gases and odors onto their surface.
- **Applications:** Adsorbent filters are commonly used in applications where the removal of odors and volatile organic compounds (VOCs) is necessary. They are frequently found in building HVAC systems, air purifiers, and certain industrial processes.

3. Catalytic Filters:

- **Mechanism:** Catalytic filters use a chemical catalyst to facilitate reactions that break down harmful gases into less harmful substances. This process can neutralize gases like ozone and certain VOCs.



- **Applications:** Catalytic filters are employed in settings where both particulate and gaseous contaminant removal is crucial. They are often used in automotive exhaust systems and advanced air purification systems.

Applications:

1. Engines:

- **Function:** In engines, air filters prevent dust, dirt, and other particulates from entering the combustion chamber. Clean air improves engine efficiency, performance, and longevity while reducing wear and tear on internal components.
- **Types:** Engine air filters are typically made from pleated paper, foam, or synthetic materials. They are designed to handle large volumes of air and can be either replaceable or washable.

2. Building Ventilation Systems:

- **Function:** In HVAC (Heating, Ventilation, and Air Conditioning) systems, air filters improve indoor air quality by removing dust, allergens, and other airborne particles. They also help in maintaining the efficiency of the system by preventing dust accumulation on components.
- **Types:** Building air filters range from basic fiberglass filters to high-efficiency HEPA filters, depending on the required level of air purification and the specific application.

Benefits:

- **Improved Air Quality:** Air filters enhance air quality by removing harmful particles and contaminants, contributing to a healthier and more comfortable environment.
- **Enhanced Equipment Performance:** In engines and machinery, filters prevent the ingress of particulates that could impair performance and cause damage. Clean air ensures smooth operation and extends the lifespan of components.
- **Energy Efficiency:** Clean air filters contribute to the efficiency of HVAC systems by preventing dust buildup on coils and fans. This reduces energy consumption and maintenance costs.
- **Odor and Gas Removal:** Adsorbent and catalytic filters address issues related to unpleasant odors and gaseous pollutants, improving the overall air quality.

Summary:

Air cleaners and air filters play a critical role in maintaining air quality and protecting machinery in various applications. By filtering out particles, odors, and gaseous pollutants, they ensure that only clean air reaches sensitive components and living spaces. From enhancing engine performance to improving indoor air quality in building ventilation systems, air filters are essential for efficient and effective operation in numerous environments.