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QUESTION:

Explain Recirculation of air in the ventilation system

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**Introduction**

Ventilation systems play a crucial role in maintaining indoor air quality and ensuring a healthy and comfortable environment. One essential aspect of ventilation systems is the recirculation of air, a process that involves the reusing of conditioned air within a building. This mechanism allows for energy conservation and effective temperature control. In this essay, we will delve into the concept of air recirculation in ventilation systems, examining its advantages, potential drawbacks, and its impact on energy efficiency and indoor air quality.

Ventilation systems are vital components of modern buildings, ensuring the circulation of air to maintain a healthy and comfortable indoor environment. The quality of indoor air has a direct impact on occupants' health, well-being, and productivity. It is crucial to strike a balance between providing a continuous supply of fresh outdoor air and conserving energy. This is where the concept of air recirculation in ventilation systems becomes significant.

In traditional ventilation systems, outdoor air is constantly introduced to dilute indoor pollutants and maintain acceptable indoor air quality. However, this process can be energy-intensive, especially in extreme weather conditions. The constant heating or cooling of large volumes of fresh air consumes substantial amounts of energy, leading to increased operational costs and higher carbon footprints.

To address these challenges and promote energy efficiency, building designers and engineers have turned to the innovative approach of air recirculation. The recirculation process involves reusing the already conditioned indoor air within the building, instead of solely relying on fresh outdoor air for ventilation. By doing so, ventilation systems can achieve a delicate balance between indoor air quality and energy conservation.

**Recirculation Process**

The rate at which fresh air is introduced varies depending on factors such as building occupancy, ventilation standards, and outdoor air quality. Sophisticated ventilation systems can dynamically adjust the ratio of recirculated air to fresh air intake based on real-time data, ensuring optimal energy efficiency and indoor air quality. In a typical ventilation system, fresh air is introduced into the building from the outside to replace stale air and maintain a healthy environment. However, constantly bringing in outdoor air can be energy-intensive, especially in extreme weather conditions. To tackle this challenge, modern ventilation systems are designed with recirculation capabilities.

The recirculation process in ventilation systems involves the controlled re-circulation of indoor air back into the building, rather than continuously introducing large volumes of fresh outdoor air. This process is facilitated by a combination of strategically placed intake and exhaust vents, air handlers, fans, and advanced controls.

**Intake and Exhaust Vents:** The ventilation system is equipped with intake and exhaust vents distributed strategically throughout the building. The intake vents are responsible for drawing in the indoor air, which has already been conditioned, from various occupied spaces. On the other hand, exhaust vents expel a portion of the indoor air from the building. The recirculation process typically takes place within the HVAC unit.

**Air Handlers and Fans:** Air handlers, also known as air-handling units (AHUs), are key components of the recirculation process. They are responsible for conditioning the air before it is reintroduced into the building. The air passes through filters to remove dust, allergens, and other particles, improving indoor air quality.

After passing through the filters, the air may be heated or cooled by the HVAC system, depending on the desired indoor temperature. In colder climates, the air may be heated to maintain comfort, while in hotter climates, the air may be cooled to provide relief from high temperatures. Fans within the ventilation system play a crucial role in facilitating air movement. They ensure that the recirculated air is distributed evenly throughout the building, reaching all occupied spaces and maintaining a consistent indoor temperature.

**Advanced Controls and Sensors:** The effectiveness of the recirculation process heavily relies on sophisticated controls and sensors. Modern ventilation systems are equipped with advanced technologies that can monitor indoor air quality, temperature, humidity, and occupancy levels. By utilizing data from these sensors, the system can determine the appropriate times for air recirculation and fresh air intake. For example, during periods of high occupancy or increased indoor pollutant levels, the ventilation system may increase fresh air intake to maintain acceptable indoor air quality. Conversely, during periods of low occupancy or favorable outdoor conditions, the system may optimize recirculation to conserve energy.

**Balancing Fresh Air Intake and Recirculation:** While the recirculation process offers significant energy-saving benefits, it is essential to strike a balance between recirculation and fresh air intake. Complete reliance on recirculated air can lead to the accumulation of indoor pollutants, including carbon dioxide (CO2), volatile organic compounds (VOCs), and other contaminants. To avoid this, the system must periodically introduce fresh outdoor air to dilute indoor pollutants and maintain healthy indoor air quality.

**Advantages of Air Recirculation**

**Energy Conservation:** Recirculating air allows the system to reuse conditioned air, reducing the need to heat or cool large volumes of fresh outdoor air. As a result, the overall energy consumption of the HVAC (Heating, Ventilation, and Air Conditioning) system decreases, leading to cost savings and lower environmental impact.

**Temperature Regulation:** By recirculating air, the ventilation system can maintain a more consistent indoor temperature. This is particularly useful in spaces with varying occupancy levels or areas that require precise temperature control, such as data centers or laboratories.

**Air Filtration Efficiency:** Recirculation enables the ventilation system to pass the air through filters multiple times. This process improves air filtration efficiency, as airborne pollutants and contaminants get trapped more effectively, enhancing indoor air quality.

**CONCLUSION**

In conclusion, air recirculation is a valuable feature in ventilation systems that offers several advantages, including energy conservation, temperature regulation, and improved air filtration efficiency. However, it also poses challenges related to indoor air quality and humidity control. To ensure the effectiveness of air recirculation, proper maintenance, regular filter replacement, and appropriate system design are crucial. By striking the right balance between recirculation and introducing fresh air, buildings can achieve optimal energy efficiency while maintaining a healthy and comfortable indoor environment. The recirculation process in ventilation systems is a well-designed and controlled mechanism that allows for the reuse of conditioned indoor air. By strategically re-circulating air through the HVAC system, buildings can achieve a balance between energy conservation and maintaining a healthy indoor environment. With the aid of advanced controls and sensors, the ventilation system can adapt to changing indoor conditions, optimizing the ratio of recirculated air and fresh air intake. However, it is crucial to strike the right balance to avoid stagnation and ensure indoor air quality remains at acceptable levels. By embracing air recirculation and employing cutting-edge technologies, building owners and facility managers can create sustainable, energy-efficient, and healthy indoor spaces for occupants.

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