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ConsERV™ Application for Kitchen Makeup Air

Executive Summary

The ConsERV™ advanced fixed-plate Energy Recovery Ventilator (ERV) stands as a market leader in enhancing building ventilation efficiency globally. Central to its innovation is Aqualyte™, an advanced nonporous nanomaterial that prevents the crossover of pollutants into ventilation air while maximizing transfer of humidity. This unique material ensures improved air quality with significant energy savings, offering a payback within two years or less.

ConsERV™ proves especially beneficial in demanding commercial kitchen environments. These areas require substantial exhaust management for steam and grease, typically relying on costly and energy-intensive traditional "makeup" air systems. The ConsERV™ system, however, introduces an ingenious approach by utilizing the exhaust from the ERV as makeup air in the kitchen, leading to substantial energy savings, reducing building carbon footprint and reduced capital costs.

Key benefits of the ConsERV™ system include:

- Up to 80% reduction in ventilation energy usage by pre-conditioning the fresh air supply, verified by independent performance certification.
- Improved makeup air temperature and humidity control.
- Decreased capital and maintenance costs due to the downsizing or elimination of a dedicated system pre-conditioning the makeup air.
- Balanced pressure differentials prevent unconditioned air infiltration and associated energy penalties.
- Sustainable energy practices by eliminating reliance on fossil fuels in traditional systems.

With over twenty years of proven performance, ConsERV™ not only reduces operational costs and maintenance but also aligns with sustainability objectives through lower emissions. This system offers a solution for commercial kitchens, setting new standards for energy efficiency and environmental sustainability.

Background

ConsERV™ advanced fixed-plate Energy Recovery Ventilator (ERV) is the market leader in ventilation, vastly improving the efficiency of buildings across the world. At the heart of every ConsERV system is the Aqualyte™ nanomaterial, a nonporous barrier between the two air streams that does a superior job of preventing crossover of pollutants, odors, and contaminants

into the ventilation air. The uniquely engineered chemical properties of Aqualyte allow only pure water molecules to pass through, leaving the unselected molecules to be exhausted out of the building while improving the supply air temperature and humidity. The Aqualyte advantage makes ConsERV the best choice for most building applications, with a twenty-year track record of high performance to the field of energy recovery ventilation. This history of proven energy savings from ConsERV™ results in cost savings that typically pay back the initial expense of an ConsERV™ system within 2 years or less after installation; many installations have resulted in immediate payback.[1]

When applied to a kitchen setting in a restaurant or other institutional kitchen, a ConsERV™ system can help regulate air temperature and humidity to reduce capital costs and save energy. The kitchen environment is challenging due to the substantial exhaust required to manage steam and grease from stoves, grills, fryers, and dishwasher operations. Traditionally "makeup" air is supplied from outside the building to vents placed near the hoods to maintain pressure equilibrium.

Figure 1: N4XV ConsERV Energy Recovery System

Hoods typically exhaust 250 – 400 cfm of air per linear foot of hood. Short circuit hoods supply 80% of this hood exhaust with makeup air and 20% from other sources, usually conditioned air within the kitchen and adjoining cafeteria configured to move past workers and assure that steam, grease, smoke, and odors don't backwash into the kitchen area. This approach requires energy to condition the kitchen and cafeteria air which is then exhausted through the hoods, creating a large opportunity for savings via energy recovery.

Application of ConsERV™ to the Kitchen Environment

The grease and particulates being exhausted in the kitchen are a good reason to avoid direct use of the hood exhaust air for energy recovery, though. This can be achieved by ensuring the hood exhaust is always downstream of the ConsERV™ system, which we do by using the exhaust of the ConsERV™ system as the makeup air for the kitchen (as shown in Figure 2 below).

[1] Calculated using weather data at 12 cents per kWh. Immediate payback from equipment downsizing.

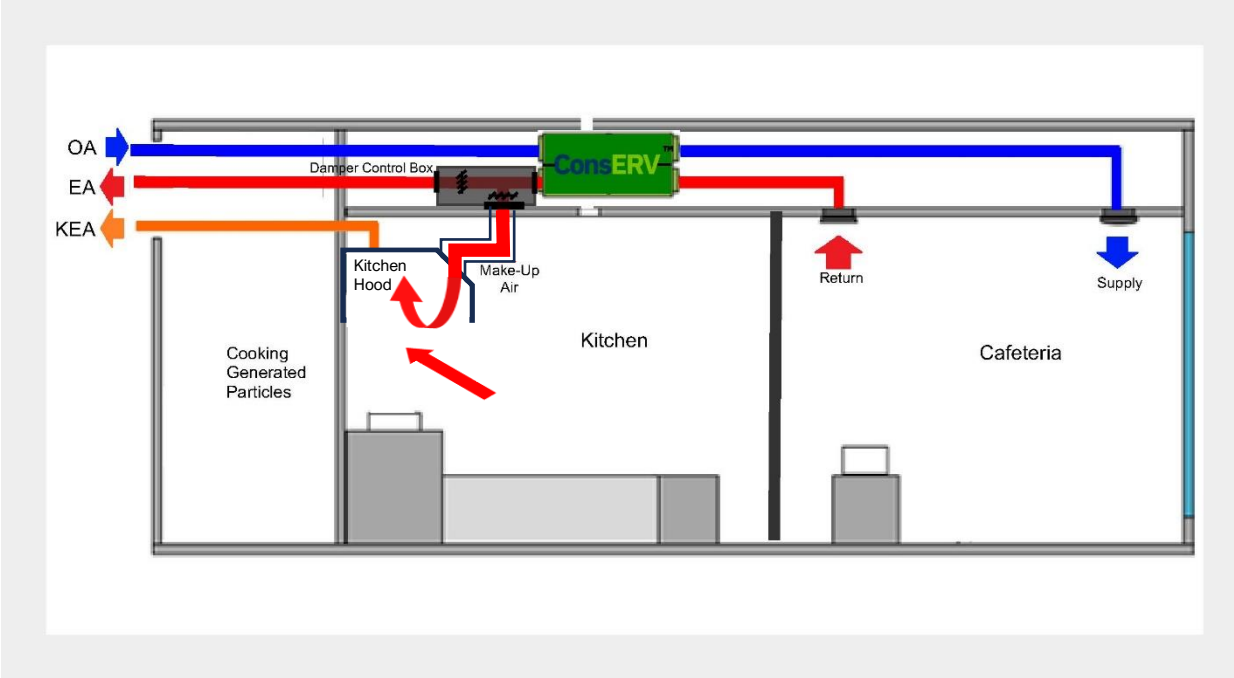

Figure 2. Kitchen makeup air via ConsERV.

The ConsERV™ unit transfers energy in the form or temperature and humidity between the supply and return air to the cafeteria. When the outside air is hot and humid the return air becomes ERV exhaust air carrying approximately 70% of the excess heat and humidity to the outside air; when the outside is cold and dry that ERV exhaust air has transferred approximately 70% of the surplus heat and humidity that was in the cafeteria back to the supply air. The ERV exhaust air will always be closer to the outside conditions than the cafeteria conditions, but it is somewhat moderated by virtue of the 30% of the heat and humidity that is not transferred. In addition, the ability of the Aqualyte™ membrane separating the airstreams in ConsERV™ to selectively transfer water molecules while 100% rejecting odor and gas molecules ensures that the fresh outside air entering the cafeteria remains uncontaminated by odors from building.

The addition of the Damper Control Box shown next to the ConsERV™ in Figure 2 transforms the ERV exhaust into a potential source of makeup air to the kitchen hoods. When the kitchen exhaust hood(s) are operating, the Damper Control Box diverts enough ERV exhaust air to supply the 80% makeup air required by the hood system, with the remainder exhausted directly outside. When the kitchen ventilation system shuts down, the Damper Control Box returns the ERV exhaust air to the outside instead of acting as a makeup air unit. Demand-controlled ventilation (DCV) can be used with the ConsERV™ unit moderating its flow rate in response to the needs of the cafeteria, as long as the unit cycles to a high enough capacity to supply the makeup air when the kitchen demands it.

Benefits of ConsERV™

A ConsERV™ system can reduce ventilation energy usage up to 80% while improving make-up air temperature[2] and humidity. By installing a ConsERV™ system with the capacity to supply ASHRAE-recommended ventilation for the cafeteria plus makeup air for the kitchen ventilation system, the building can be engineered to maximize energy performance:

- Fresh air supply to the cafeteria is pre-conditioned before further HVAC conditioning is applied, saving up to 80% versus direct introduction of outside air.
- Using the ERV exhaust air to supply makeup air instead of outside air results in more moderate conditions. Short circuit kitchen hoods are not required to pre-condition makeup air to meet code, but there are practical limits on the temperature extremes allowable before workers are unbearably warm in the summer or cold air causes condensation to rain out of the makeup air duct into the kitchen. This can force the installation of makeup air systems to blunt the worst differentials. Because ERV exhaust air is not as cold and dry in winter or warm in summer, this extra energy expenditure can be avoided. are based on occupancy driving the amount of fresh outside air that must be supplied to control CO_2 within the cafeteria.
- Eliminating a dedicated make-up air unit reduces capital and maintenance costs. ConsERV™ merely requires periodic filter replacements and annual core cleaning, whereas conventional kitchen make-up air units often entail servicing gas furnaces.
- Maintaining a correctly balanced pressure differential between the kitchen, the cafeteria, and the outdoors prevents the infiltration of unconditioned outdoor air and its associated energy penalties.

Unlike traditional kitchen make-up air systems that heavily rely on natural gas for heating, particularly in colder periods, using ConsERV™ as the designated make-up air unit eliminates the need for a second system and the use of fossil fuels. This transition represents a significant stride toward sustainable energy practices. Furthermore, the ConsERV™ solution benefits the kitchen and the cafeteria, conserving energy and reducing the building's overall carbon footprint. This dual impact underscores the comprehensive advantages of ConsERV™, encompassing energy efficiency and a greener, more environmentally conscious solution.

With a distinguished track record of more than twenty years, ConsERV™ embodies innovation towards more sustainable and energy efficient applications. It enhances energy

[2] Direct energy savings provided from the customer facility management.

efficiency and establishes a stable and comfortable environment for kitchen operations, while also reducing energy usage, lowering operational cost and maintenance. By reevaluating conventional kitchen system installations and embracing a ConsERV-based approach, commercial kitchens can simultaneously achieve operational efficiency and sustainability objectives (through lower costs and emissions).