EXPERIENCE OPERATIONAL & ENERGY SAVINGS WITH MAKE-UP AIR UNITS

Commercial kitchen ventilation systems include numerous components that must simultaneously work together to provide restaurants and other foodservice facilities with a properly ventilated environment. The system design is contingent on application needs and various products such as exhaust hoods and make-up air units. Each product uses different fan types to move air throughout commercial cooking areas. Make-up air units, in particular, take on the task of providing fresh outdoor air with heating and cooling options depending on the geographic location. The energy consumed by a building's ventilation system accounts for roughly 28% of the building's overall energy usage, depending on the kitchen, this can be due to the make-up air unit's tempering functionality, and the type of fan used within. Because of this, significant energy and cost savings are possible by applying high-efficiency fans in make-up air system designs.

Comparing Common Fan Types in Make-Up Air Units

Forward-curved fans are one proven option for use in commercial kitchen ventilation systems and are an economical and readily available solution for moving air. These fans are well suited for handling high flow rates at low pressures. Forward-curved fans feature blades that curve in the direction of rotation, which pull air through one or both sides of the fan housing. This fan type has relatively low efficiency, ranging between 55% and 65%. In addition, forward-curved fans can be problematic as they often experience horsepower overloading in which the fan's required electrical power steadily increases from shut-off to free air delivery. This challenging trait can occur during start-up if the fan is oversized, causing the electrical overloads to trip if system losses are overestimated. Overloading can be avoided if the ventilation system is properly designed, and the fan's experienced static pressure is held relatively stable.

Backward-inclined plenum fans, often use in high-pressure applicatgions, are another common fan type. This fan type features a single inlet and blades that slant away or are "backward" from the direction of rotation. Backward-inclined fans may use different blade styles including flat, curved, and airfoil. The spinning blades compress the air, forcing airflow in a radial direction, pressurizing the fan compartment, rather than throwing the air out the discharge like forward-curved fans. These fans are typically more efficient than forward-curved options with peak efficiencies of up to 75%. Unlike forward-curved fans, the backward-inclined fan is non-overloading, meaning the maximum required power occurs somewhere between shut-off and free air delivery. This feature makes the backward-inclined plenum fan less susceptible to electrical overloading if oversized or if system resistance is less than expected. However, the fan's robust construction for higher pressure applications often makes it the most expensive of the fan types being compared.

Mixed flow fans are a unique hybrid design between an axial flow fan and a centrifugal fan, where airflow is directed both in axial and radial directions. This design benefits from the high airflow characteristic of axial fans, as well as the non-overloading feature of backward-inclined fans. While their pressure capabilities are slightly less than backward-inclined fans, mixed-flow fans operate at efficiencies as high as 70% and at lower sound levels than forward-curved fans. When there are lower pressure requirements, mixed flow fans are an economical alternative to backward-inclined plenum fans and their higher efficiencies make them superior to forward-curved fans.

Mixed Flow Fans Transform Make-Up Air Proficiencies

Mixed flow fan technology is revolutionizing the industry. Designers, dealers, contractors, and restaurant owners can leverage the benefits when designing commercial kitchen spaces and experience the overall operational efficiencies that can be gained from considering mixed flow fans in make-up air units.

Low First Cost and Operating Costs

Mixed flow fans have a similar first cost and offer as much as 55% energy savings when compared to forward-curved fans. These savings are a result of the high operating efficiency of mixed flow fans, especially notable when applied in moderate static applications, like commercial kitchen make-up air units. Due to their higher operating efficiencies, mixed flow fans use motors that are half the size of equivalent forward-curved fans, which reduce both upfront and operational costs.

The savings are substantial, especially for intensive make-up air applications such as managing and balancing fluctuating air temperatures in foodservice kitchen spaces. For example, see Table 1, which compares two groups of 18 direct-fired make-up air units. The first group of 18 uses a forward-curved supply fan. The second group utilizes mixed flow fans. The results show how the mixed flow fans lower annual operating costs by over $28,000 due to lower motor sizes and operating power.

Table 1

	18 Direct Gas-fired Make-up Air Units at 18,000 cfm each	
Supply Fan Type	Forward-Curved	Mixed Flow
Operating Power	14.86 hp	7.83 hp
Fan Motor Size	20 hp	10 hp
Unit Relative Cost	1.00	0.95
Estimated Annual Electric Cost	$59,616	$31,413

Reduced Maintenance Costs

Mixed flow fans are direct drive, meaning the impeller is directly connected to the motor shaft, eliminating the cost and maintenance requirements of belts, pulleys, and bearings found on forward-curved fans. Belt drive fans require inspections for wear and tear several times throughout the year, which may necessitate adjustments or the replacement of belts, pulleys, or bearings. Costs to repair or replace these components can vary greatly depending on the fan and motor size. Mixed flow fan-equipped units have no belts, pulleys, or bearings, eliminating these recurring expenses.

Enhanced Turndown Capabilities

Make-up air units equipped with mixed flow fans typically utilize a variable frequency drive (VFD) to control and automatically vary the speed of the motor and fan. The VFD allows for soft starts and stops, near-infinite speed adjustment, motor protection, and the ability to operate in demand-controlled kitchen ventilation (DCKV) applications often needed with commercial kitchen make-up air units. In DCKV applications, the variable exhaust fan and make-up air unit reduce their airflow by up to 50% during reduced cooking loads. While reduced airflow leads to up to 88% electrical savings on fan operation alone, further savings can be realized on units with tempering functionality, as this reduced airflow results in significant savings on gas and electric costs used to heat or cool the air. The use of VFDs in make-up air units provides precise airflow control and balances the fresh air supply in cooking spaces.

Look to the Accurex team of qualified ventilation experts to help with selecting the right supply fan for your make-up air unit and one that meets the requirements of your commercial kitchen cooking needs.