

Commissioning Commercial Kitchen Ventilation Systems

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Modern Commercial Kitchen Ventilation System (CKV) manufacturers employ numerous new technologies and solutions to increase indoor air quality (IAQ), decrease hood exhaust requirements, and offer an economical and reliable hood system that will last the life of the restaurant. This article will discuss many of the newest technologies and commissioning methods for ensuring the best possible outcome for the end user.

Modern Design Features

Let's face it, historically hoods have been dirty, greasy, smoky, and a nuisance to restaurant owners and operators. They are energy hogs and maintenance burdens.

Modern manufacturers of CKV products have come out with many innovations in the past decade to resolve, if not eliminate altogether, many common failure points and frustrations in the standard commercial kitchen. Knowing how to implement these solutions correctly is imperative to obtain the optimal outcome.

In discussing equipment, the heart of the CKV system is the exhaust fan. A recent trend has been the use of direct drive fans. One major failure point historically has been the fan belts themselves, and the fact that as a belt wears, the fan RPM, and therefore the overall Cubic Feet per Minute (CFM), decreases. This results in an over-pressurized building which may have a hot or smoky kitchen. To resolve this issue, modern manufacturers are turning to direct drive exhaust fans. Direct drive fans are those which have the fan wheel directly coupled to the motor shaft, eliminating the need for belts, pulleys, and bearings. Direct drive fans come in many forms, from smaller permanent split capacitor motors (PSC) and electronically commutated motors (ECM) for 2 HP and below, to variable speed 3 phase motors for higher HP applications.

Exhaust fans exist to pull out the necessary air for a given set of appliances underneath a hood. What if the total CFM requirements could be reduced? One of the best methods for reducing the required airflow is to use a listed, engineered hood that is tested and labeled for much lower CFM than code requires. Additionally, the use of mechanical end panels can allow upwards of a 20% airflow reduction. These simple and economical design features can vastly

reduce the total air required, eliminating roof top equipment and making the system economical, sustainable, and easier to setup.

On the hood controls front, Demand Controls (DCKV) for exhaust hoods and make up air systems are becoming increasingly more common, now over 1/3 of all packages sold by one of the leading manufacturers in the US. These systems offer the advantage of having a higher airflow capacity for peak times, with a turndown during off peak periods for energy savings. When coupled with direct drive fans, DCKV systems offer a major advantage for commissioning, allowing for all tuning of airflows to be performed in the space, a welcome feature during the extreme months of winter and summer. Many jurisdictions are now requiring the use of DCKV for jobsites with over 5000 CFM of exhaust, following the requirements set forth in ASHRAE 90.1.

On the fire prevention front, there has been an uptick in the use of self-cleaning and water-based fire suppression systems, which offer the advantage of cleaning the plenum and a portion of the ductwork on a daily basis. Although this does not directly impact the commissioning process, it does work to ensure that the system stays in clean, safe, and like-new condition. This is particularly critical for solid fuel hoods, which use wood or charcoal for their fuel source, as these appliances produce creosote which is a major fire hazard.

Ductwork design is moving toward the use of listed, factory-built ductwork systems. These systems offer the advantage of being significantly less prone to leaking. The ability to accurately know, during the design stage, what the static pressure will be is another major benefit. They offer a weld-free and fire wrap free installation process when ordered for zero clearance to combustibles.

Lastly, the most recent trend has been the use of remote cloud-based monitoring systems for real-time hood operation, amperage, speed and functionality verification. As sensors become less expensive, the economics of monitoring all aspects of the CKV system in real time are so favorable that it simply doesn't make financial sense to not have it. Using these modern systems one can set up the

kitchen during commissioning, and then check up on the kitchen remotely over the long term. When an issue arises, the technician can be the first to know and the first to solve, leading to higher customer satisfaction.

As described above, there have been many innovations on the CKV market in recent years. When used together as an integrated system, the entire operation can be expected to provide ideal indoor air quality with significantly improved energy consumption.

Commissioning

Before any measurements are taken, the first steps should be to ensure that all control wiring and the engineer's sequence of operation for the kitchen are in place. It is common for engineers to specify items such as Roof Top Units (RTU) to provide a sizable portion, if not all, make up air requirements for a commercial kitchen hood. Unfortunately it is also common for the same equipment to be set up on a wall thermostat and not electrically interlocked with the hood system. It is not hard to see that a hood will not perform as intended if it doesn't have the air available for exhausting. RTU thermostats are often set in blower "ON" mode, thinking that this is sufficient. The reality is that the user will think that switching to blower "AUTO" mode will save them energy, not realizing that this will instead result in a severely negative building and poor IAQ. It is highly recommended that all RTUs be electrically interlocked, via physical wiring, with the hood control panels to ensure that all available air will be there when the hoods need it.

Assuming controls are in place and wired properly, the next step is to make sure that all filters are in place and clean. A common failure point in the test and balance process is to take measurements with dirty hood or make up air filters. All building filters should be as-new, including the RTUs. Additionally, if the hood was engineered for the use of mechanical end panels, these must be installed prior to airflow measurement.

If the jobsite has dedicated direct fired make up air units, startup of their natural gas systems should be performed prior to test and balance. Although the equipment is set up from the factory for most models, jobsite specific gas pressure, elevation, and other factors can result in poor performance out of the box. Setting of the pilot flame, low fire, and high fire are all critical items for long term customer satisfaction.

After confirmation of the above, the building should be brought to operating temperature. A building tested at the wrong overall temperature will give false readings. Bringing equipment up to operational temperature is a major element in this process. Hood readings without appliances running can result in significant differences in actual exhaust airflow. Hot air is less dense, and therefore an exhaust fan will move

more air than necessary when adjusted without the appliances on. Obviously safety is a concern when attempting to measure a hood with appliances running, therefore caution and common sense should be taken into account.

With all of the above in place, proceed to measure the hood and make up air system. Modern hoods use filters of various sizes and shapes. Each filter will have its own K-factor, or adjustment, for the measurement device utilized. If you are unsure of the K-factor for your hood filters and the measurement device, consult the manufacturer of the measurement equipment or the hood supplier for guidance. When taking measurements with a vel-grid style device, be certain to adjust your numbers for the actual exposed filter size, not the nominal filter size.

If the hood filters are not of a high efficiency type, and the hood has more than one exhaust riser or more than one hood is sharing a single fan, balance dampers may be required in the exhaust ductwork.

Measuring modern make up air delivery devices can be a bit more challenging. The delivery devices themselves vary by manufacturer, however the most common type are the perforated supply plenum (PSP) variety, which vary significantly in overall dimension. The delivery velocity, in feet per minute (FPM), from these devices is critical. Too high or too low of a velocity and the make up air will disperse through the space, resulting in higher utility bills for the end-user. For common 24" tall canopy hoods, the velocity target should be 140 to 160 FPM. For taller 30" hoods, a target of 165 to 185 FPM is ideal. Note that readings will vary summer to winter as the temperature of the air affects how it falls. Tuning the individual dampers on a PSP is critical to ensure that no one section of the make up air device delivers air at a higher velocity than the other sections. A make up air duct traverse is also a valid method of measurement of total airflow, however setting the individual velocities at the PSP is still a requirement for proper operation. This is even truer when a single make up air device is delivering air for more than one hood system.

Roof Top Unit outside air dampers are another critical element in the air balancing process. Although each manufacturer will have a unique method for setting the outside air damper, either on an economizer controller, through integral controls, or through a 0-10v damper, under all circumstances it should be confirmed that when the hood is on, the RTU is also on and the damper is open to the appropriate position. This is the most common failure when balancing a commercial kitchen. Additionally, RTU air delivery, if through four-way diffusers or similar, should be kept as far away from the hoods as possible. RTU returns should also be far away from the hoods, and ideally not in the kitchen space at all as that makes them prone to collecting the

odors and effluents of the kitchen and distributing them through the space.

RTU economizers should be avoided if possible for RTUs dedicated to the kitchen space, as they impact the localized balance of the kitchen. Some jurisdictions will not allow the removal of economizers, making the placement of the diffusers even more critical.

The velocity of individual RTU diffusers in the kitchen space is critical. The diffusers should have a flow that does not exceed 50 FPM velocity at the height of the bottom of the hood. For most diffusers, this means 250 CFM or less.

After taking your measurements, proceed to adjust to design conditions. If using direct drive fans, adjustments can be made in the space directly on the hood controls, or using dials on the fans. Re-measure and adjust as necessary, making note of the fact that a major adjustment in the building pressure, such as a swing from highly negative to slightly positive, will shift the readings significantly. It is wise to take a final set of readings after all adjustments have been made to confirm that the original measurements are still valid.

After all adjustments have been made to meet the specifications of the client, log and report the information to all necessary parties. It is important to bring any deficiencies to the attention of the general contractor or jobsite supervisor for immediate remedy, as most issues that exist when the building turns over to the end-user are never resolved. Solving them now will save numerous headaches down the road.

Future Challenges

As technologies evolve, energy codes become increasingly complex, and manufacturers are shooting for ever more efficient systems, the integration of equipment from the factory becomes ever more important. Just as an old shade tree mechanic has been replaced by modern factory dealership maintenance systems in the automotive world, in the CKV world, factory certified and trained technicians, building management integrators, and knowledgeable test and balancing firms will become increasingly more critical to ensuring a proper outcome. Monitoring of these systems will weed out players who cut corners, leaving only those with attention for detail and a focus on the end-user.



Commercial Kitchen Hoods

By Olaf Zwickau, Air Solutions & Balancing

As a TAB Professional, having been involved in the commercial kitchen ventilation industry for 25 years, I have seen the industry change dramatically on the balancing side as well. With the introduction of high tech kitchen hood energy management

systems and the increasing use of variable frequency drives for both hood fans and the HVAC roof top units, the process of testing, adjusting and balancing is no longer a walk in the park that can be done by an inexperienced TAB technician. The proper balance of air pressure within the restaurant or commercial kitchen has become a science that cannot be taken lightly. When considering the many variables of keeping a proper building pressure during the ever changing restaurant environment, such as after hour unoccupied times compared with occupied times and varying speed of the kitchen hood fans, the overall store balance has to be well engineered and executed by both the design team and the TAB Professional. Today's retail and restaurant owners are energy and technology savvy and expect perfection in all areas. When their space is not perfectly balanced all the time, it will most certainly affect their customer's comfort, which in turn affects their bottom line. We as the NEBB Certified TAB community must be vigilant in performing top notch service using technicians who understand not only the engineering behind the space, but can properly adjust the balancing of a facility with a commercial kitchen hood. ■



25-2500 cfm Range
Fast, Accurate, Easy, Auto-Range and Zero
Backpressure Compensated Air Balance System
Automatic Density Correction
Custom Tops Made to Order



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