DEMAND CONTROLLED KITCHEN VENTILATION (DCKV) SYSTEM

Model: **ZOE SmartHood**

Project : Chin Chin Restaurant

Client : KITOPI

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1. INTRODUCTION ON DCKV SYSTEMS

ZOE SMART ECO HOOD.

Kitchen ventilation is the largest user of energy in the average commercial service business, demand control kitchen ventilation systems can reduce restaurant ventilation energy consumption by 60% or more. Demand control kitchen ventilation systems provide automatic, continuous control over fan speed by responding to signals that are picked up by temperature, optical or infrared sensors. Those sensors work by monitoring cooking activity and smoke and steam levels or directly communicating with cooking appliances. During full load cooking, the system tells fans to run at 100% until smoke and steam are removed and the temperature is more comfortable.

Demand control kitchen ventilation uses advanced sensors and variable speed controls to offer significant reductions in commercial energy use and carbon emissions. While most restaurant ventilation systems operate at only one or two speeds, regardless of actual need, DCKV responds to real-time kitchen volume.

DCKV systems adjust the quantity of kitchen hood exhaust and incoming outdoor air, leading to energy and cost savings. Other benefits may include decreased heating and cooling energy and a reduction in HVAC and ventilation equipment deterioration. The energy and cost savings that can be achieved by installing DCKV varies between food service facilities due to site- and equipment-specific factors such as geographic location, operating hours, DCKV system features, and system cost.

1.1 How DCKV Systems work?

To control a facility's ventilation and HVAC in response to changing cooking levels, DCKV does the following:

- Detects cooking activity under the hood, using smoke and heat sensors analyzes the sensor signals to determine how much cooking is taking place, using a processor.
- Figures out the adjustment to be made to the ventilation system and sends signals to the ventilation system controls, using the processor.
- Adjusts the exhaust hood fan and outdoor air HVAC equipment, using equipment controls.
- There are many benefits of installing an DCKV system, not the least of which include significant reductions to monthly utility bills. But there are many other advantages beyond the cost savings, including:
- Automatic, continuous control over fan speed – DCKV system uses information from advanced sensors inside the kitchen to modulate fan speed according to detected cooking operations.
- A reduction in the supply and exhaust air volume, which lowers overall energy costs – just a 20% reduction in airflow volume can yield 45–50% in annual fan energy savings.
- More comfortable work environment – a restaurant kitchen can get hot, stuffy, crowded, and choked by effluent and steam.
- Demand control kitchen ventilation helps to relieve those problems, making for a more comfortable work environment for employees, which can also lead to higher productivity, accuracy, and service.

1.2 About ZOE SmartHood System

A commercial kitchen hood is designed to capture and contain all smoke and cooking effluent. ZOE smart hood mission is to accomplish this with strategic placement and superior performance of temperature and optical sensors at a cost that offers the fastest payback and optimum continual Return on Investment.

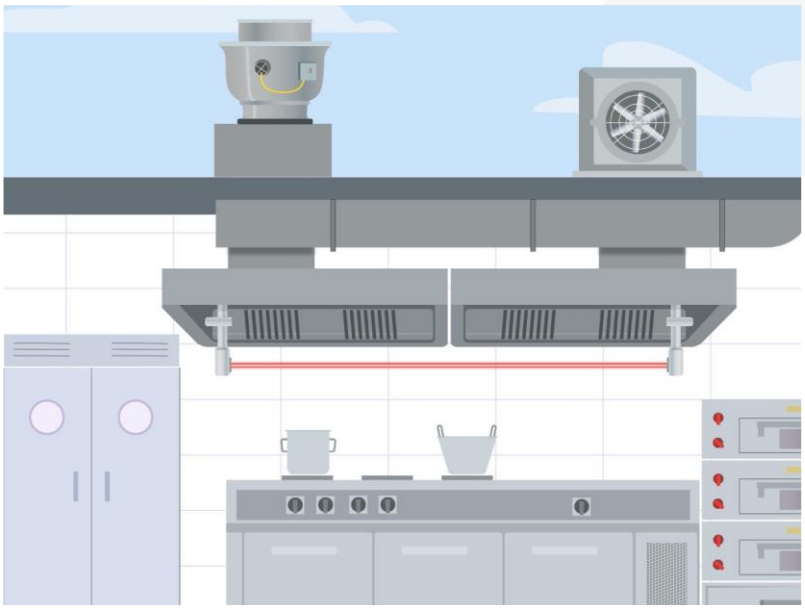
Temperature sensors alone, (especially located in the exhaust duct) must operate at exhaust levels at a much higher cfm to make sure nothing escapes the hood due to flare-ups with excessive steam or smoke. Energy savings is minimum.

Competitors with optical sensors, (often limited in range, usually max out at 20 feet), mount them inside the center of the hood, which needlessly ramps up exhaust speed when the effluent is already captured inside the hood. Again, minimizing potential savings of a DCKV. ZOE optical sensors are place at near the outer edge of the hood. They are designed to detect the effluent when it may start to escape, and only then instantly ramps the hood exhaust up to maximum for a period, (which is programmable), to capture and contain.

We does not believe in dampers in the exhaust ducts. They increase costs, and make installation more complex which takes longer, increases expense, which extends ROI. Not to mention additional mechanical operations in a greasy environment, subject to increased maintenance costs and risk of failure.

1.3 Benefits

- Stand-alone System Automatically begins exhaust (wakes up) at a preset temperature setting or upon smoke/steam detection. Initial start up by optical sensors is at 100% for preset time – usually 10 seconds.
- After assessing degree of opacity blockage – it automatically reduces to a preset minimum exhaust percentage or modulates to the amount of exhaust according to temperature setting or degree of opacity blockage.
- System will automatically stop after preset time after reaching sleep temp without increase or change in optical signal.
- Stainless Steel –design to shed water and oil and minimize dust and grease accumulation.
- 100% sealed – impervious to water and oil and all vapours – Easy to wipe clean in seconds – No Air Purge Required
- Fast and easy installation inside or outside of the new hood or easily retrofit to an existing hood.
- Re-zeros automatically to adjust for any accumulation of grease for constant accurate readings for modulation.
- Easily adjustable for hoods from 3 to 45 feet



2. ENERGY USAGE WITHOUT DEMAND CONTROL SYSTEM

Current system is running with constant speed when the hoods switches are turned on. Fan speed doesn't change when all the hood switches are on. Energy consumption of Ecology, FAHU and MAHU when running in hand mode.

Item Description	Flow Rate	Fan power kW	% of Operation	Operation hours (Hrs)	Power Consumption (kWh)	KWh Month	Per Year Kw/Hr	Electricity Tarif 0.25 AED
KEF	3400 L/s	7.5 Kw	100%	18	114.75	3,557.25	42,687	10,671.75
FAHU	2900 L/s	4 Kw	100%	18	72	2,232.00	26,784	6,696.00
Total Power Consumption _ A					**186.75**	**5,789.25**	**69,471**	**17,367.75**

3. ENERGY USAGE WITH DEMAND CONTROL SYSTEM

When the system works w/ ZOE smart system, all the system works based on demand only. That means, fans speed keeps on modulating from 20% to 100%. Cooking activity is being monitored by ZOE smart sensors and send commands to VFD to control the fan speed on the requirements.

When FAHU is modulating, chilled water requirements is keep changing to maintain the off coil temperature. So about 40% of chilled water will be saved.

KEF

Item Description	Flow Rate	Fan power kW	% of Operation	Operation Hours (Hrs)	Power Consumption (kWh)	KWh / Month	KWh / Year	Electricity Tarif 0.25 AED
Exhaust Fan	3400 L/s	7.5	100%	2	12.75	395.25	4743	1,185.75
		7.5	80%	2	10.2	316.2	3794.4	948.60
		7.5	60%	3	11.475	355.725	4268.7	1,067.18
		7.5	50%	2	6.375	197.625	2371.5	592.88
		7.5	40%	4	10.2	316.2	3794.4	948.60
		7.5	30%	5	9.5625	296.4375	3557.25	889.31
Total Electricity Consumption _ B				**18**	**60.5625**	**1877.4375**	**22529.25**	**5,632.31**

FAHU

Item Description	Flow Rate	Fan power kW	% of Operation	Operation Hours (Hrs)	Power Consumption (kWh)	KWh / Month	KWh / Year	Electricity Tarif 0.25 AED
Exhaust Fan	2800 L/s	4	100%	2	6.8	210.8	2529.6	632.40
		4	80%	2	5.44	168.64	2023.68	505.92
		4	60%	3	6.12	189.72	2276.64	569.16
		4	50%	2	3.4	105.4	1264.8	316.20
		4	40%	4	5.44	168.64	2023.68	505.92
		4	30%	5	5.1	158.1	1897.2	474.30
Total Electricity Consumption _ C				**18**	**32.3**	**1001.3**	**12015.6**	**3,003.90**

4. SUMMARY

Total Running cost per year without DCKV			**AED**	**17,367.75**
Total Running cost per year with DCKV _ D	**B+C**		**AED**	**8,636.21**
Total Savings per year _ E	**A-D**		**AED**	**8,731.54**
FAHU chilled water savings _ F	**400 AED / Month**		**AED**	**4,800.00**
Total Savings per year	**E+F**		**AED**	**13,531.54**
Investment cost on DCKV			**AED**	**26,000.00**

Return on Investment will be 2 Years.

Notes:

- Total air conditioning load will be reduced with Demand control system since total fresh air and exhaust is modulating all the time. However, these savings cannot be monitored.
- Above mentioned Chilled water savings are tentative, this would be even more during summer. Would recommend to have Energy meter to be installed on the FAHU chilled water line.