NEW-TECH™

Manufacturer of Automatic Sash Positioning System,
Down Draft Tables, Custom Fume Hoods and Slot Exhausters.

THE AUTOMATIC SASH POSITIONING SYSTEM PROVIDES ENERGY AND CAPITAL SAVINGS

<u>What is the benefit of laboratory fume hood Variable Air Volume (VAV) systems when the fume hood sashes are not closed?</u> On average, a fume hood only requires the sash to be open 20 minutes per day. Normally, once a sash has been opened they rarely ever are shut. As in turning off a light, the inconvenience of closing a sash lends itself to leaving the fume hood sash open knowing you will be back soon. This habit then leads to the sash being left open as the norm, not the exception. Other factors leading to open sashes are the worry over cross contamination or exposures caused by touching the sashes or the need for using both hands to move chemicals into and out of the hood.

Just like any store entrance door that automatically opens and closes for you, a fume hood sash can be easily automated. When a fume hood sash is automated, fume hood sashes are closed whenever possible providing maximum safety and compliance with NFPA-45 6.8.3 "Laboratory Hood Sash Closure".

The Cost of Air Airflow exhausted by fume hoods first needs to be pulled from the outside, filtered, cooled and heated, and finally supplied to the laboratory. Once all of this energy is used to condition the outside air, the air is drawn into the fume hood and the contaminated air is exhausted out of the building. Typically, the industrial rate for conditioning one CFM of outside air is $3.50 per year. This cost varies by climate, utility costs and HVAC equipment efficiency. To provide year round containment within the laboratory the boilers and chillers are sized to handle the peak heating and cooling loads. Because of the cooling and dehumidification of the laboratory air, the chillers are a substantial cost of the laboratory HVAC system. Usually the peak cooling needs of outside air are about 200 CFM/ton. For a typical six foot fume hood with a 28 inch sash travel and maintaining 100 FPM capture velocity (NFPA-45 A.6.4.6), the exhaust and supply requirements are 1230 CFM with the sash open. From an HVAC system standpoint, this outside air would require 6.2 tons of cooling when at peak outside air cooling loads.

With VAV fume hoods the exhaust/supply airflow can be proportionately reduced as the sash is lowered until a minimum of 25 CFM/sq.ft. of working surface is reached (NFPA-45 A.6.4.6), a six foot fume hood requires 265 CFM. This means if the fume hood were shut at peak cooling loads the HVAC system cooling load would be reduced from 6.2 tons to 1.4 tons.

Shutting the Sash Understandably, not all fume hood sashes can be shut at all times or at peak cooling loads. With the addition of the Automatic Sash Positioning System (ASPS™), the fume hood sashes are closed when the fume hood is unattended. This automatic closure ensures that a minimum number of fume hoods will be open at any time. To determine this usage, on a random basis over several days, visually survey technicians using the fume hood to provide a statistical baseline. Figure 1 shows that the average fume hood usage at this research facility is 6 of 48 hoods open at

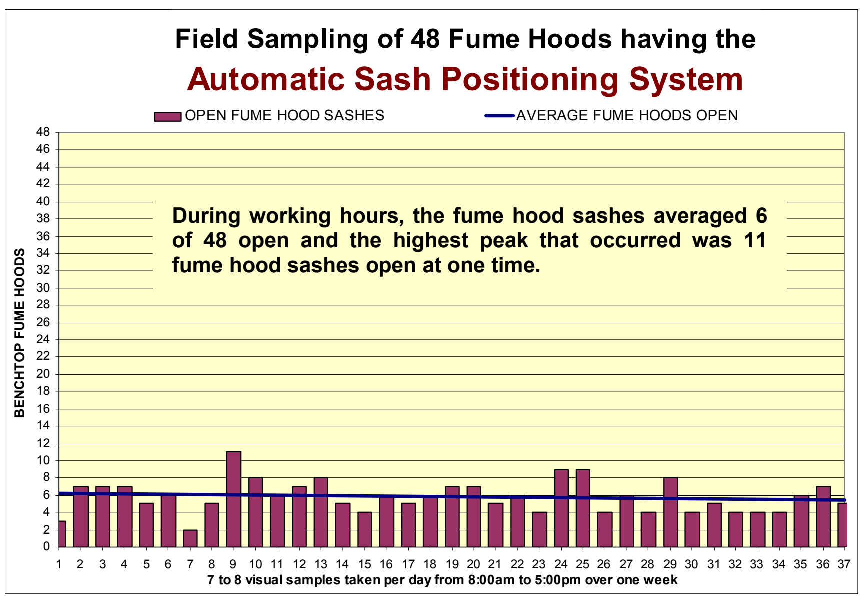

Figure 1. Research laboratory with 48-benchtop fume hoods, surveyed for open fume hood sashes. On average, at least one technician was assigned to work in one fume hood. No fume hoods were used as storage.

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one time. From an energy usage standpoint, the average for an eight-hour day is 6 fume hood sashes open and the other 42 fume hood sashes closed for one-third of a day. For the other two-thirds of a day all 48 fume hoods will be closed. Using six foot fume hoods, the average airflow per hood is:

$$\frac{1/3(6\times 1230\ CFM\ + 42\times 265\ CFM) + 2/3(48\times 265\ CFM)}{48\ hoods} = 305\ CFM$$

Knowing that the average fume hood airflow is 305 CFM using the ASPS™ and VAV the average energy savings compared to a 1230 CFM constant volume fume hood is:

$$(1230\ CFM - 305\ CFM) \times \$3.50 / CFM / year = \$3{,}237 / year$$

This energy savings assumes that the minimum airflow of the fume hood is greater than the minimum air change rate of the laboratory and no extra cooling airflow is needed for equipment.

HVAC Equipment Sizing What can be even more important than yearly energy savings is an HVAC system capacity reduction. Fume hood usage can be calculated using mathematical probability equations similar to the "Hunter's Curves" used for plumbing fixtures. HVAC system sizing can be calculated using probability and safety factors to account for the importance of the HVAC equipment relative to the containment of the fume hood.

When the average of 6 of 48 fume hoods open is applied to the "Probability of Use" a 5% probability is found, see Table 1, Column 3. Using a 3 times safety factor, or 15% probability, can be used to find the load for Chillers and Boilers. Table 1, Column 2 shows that 13 of 48 fume hoods would be open. As in Figure 1, a peak of 11 of 48 fume hoods was seen open. Sizing the chiller for 13 fume hoods open produces:

$$\frac{(13\times 1230\ CFM\ + 35\times 265\ CFM)}{200\ CFM / ton} = 126\ tons$$

In comparison if the chiller were sized for all 48 fume hoods at maximum airflow the required chiller size would be:

$$\frac{48\times 1230\ CFM}{200\ CFM / ton} = 295\ tons \qquad \text{Total Reduction} = 169 \text{ tons } (57\%)$$

<u>At a capital cost of $ 2,000/ton installed, the 169 ton reduction would equate to a $338,000 capital cost savings on the chiller system alone.</u> This savings could pay for the ASPS™ and VAV fume hood systems. The $3,237/hood/year energy savings is additional the capital cost reduction. This equates to an average 3.5 ton/hood reduction in peak load to the chiller system would be achived.

Simularly, appling a safety factor of 5 times to a single ganged exhaust and single supply fan system will find that these systems can be be sized for 19 of 48 hoods open. (see Table 1, Column 1)

$$19\times 1230\ CFM\ + 29\times 265\ CFM\ = 31{,}055\ CFM$$

In comparison if the exhaust and supply were sized for all 48 fume hoods at maximum airflow the required fan sizes would be:

$$48\times 1230\ CFM\ = 59{,}040\ CFM \qquad \text{Total Reduction} = 27{,}985 \text{ CFM } (47\%)$$

Improving Safety while Saving Energy A laboratory is not built to save energy, it is built to provide maximum safety for the people using the facility. The ASPS™ not only provides maximum safety but when combined with any VAV system provides maximum energy savings and minimum HVAC system costs.

1 Exhaust & Supply		2 Chiller & Boiler		3 Average Use	
Using a 5X Safety Factor These system can be sized for a 25% Probability		Using a 3X Safety Factor These system can be sized for a 15% Probability		5% Probability of Used for Energy Analysis	
Number Of Hoods	Hoods Open	Number Of Hoods	Hoods Open	Number Of Hoods	Hoods Open
1	1	1	1	1 – 3	1
2	2	2 – 3	2	4 – 9	2
3 – 4	3	4 – 6	3	10 – 17	3
5 – 6	4	7 – 10	4	18 – 26	4
7 – 9	5	11 – 13	5	27 – 38	5
10 – 11	6	14 – 17	6	**38 – 48**	**6**
12 – 13	7	18 – 21	7	49 – 66	7
14 – 16	8	22 – 25	8	67 – 81	8
17 – 19	9	26 – 30	9	82 – 97	9
20 – 22	10	31 – 34	10	98 – 112	10
23 – 24	11	35 – 39	11	113 – 128	11
25 – 27	12	40 – 43	12	129 – 143	12
28 – 30	13	**44 – 48**	**13**	144 – 159	13
31 – 33	14	49 – 55	14	160 – 175	14
34 – 36	15	56 – 60	15	176 – 191	15
37 – 39	16	61 – 65	16	192 – 207	16
40 – 42	17	66 – 70	17	208 – 223	17
43 – 45	18	71 – 75	18	224 – 239	18
46 – 48	**19**	76 – 80	19	240 – 255	19

TABLE 1, Probability of Use for Fume Hood Systems using the ASPS™.

The ASPS™ product is covered by one or more of the following New-Tech™ patents: 6,024,638; 5,759,096; 5,303,659; 4,774,878; 4,667,353; 4,594,742; 4,502,375 and other U.S./Foreign Patents Pending.