Research Solutions

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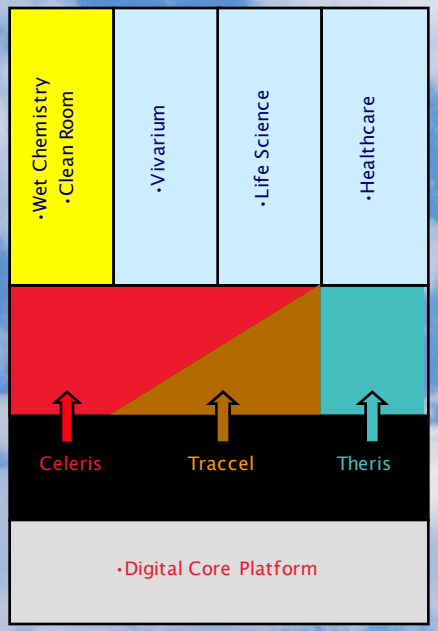


ensuring environmental integrity

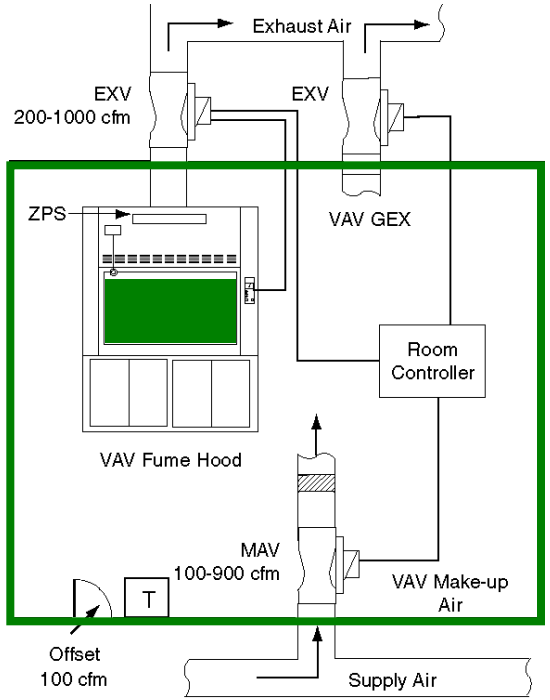
Phoenix Controls

Laboratory Controls Objectives

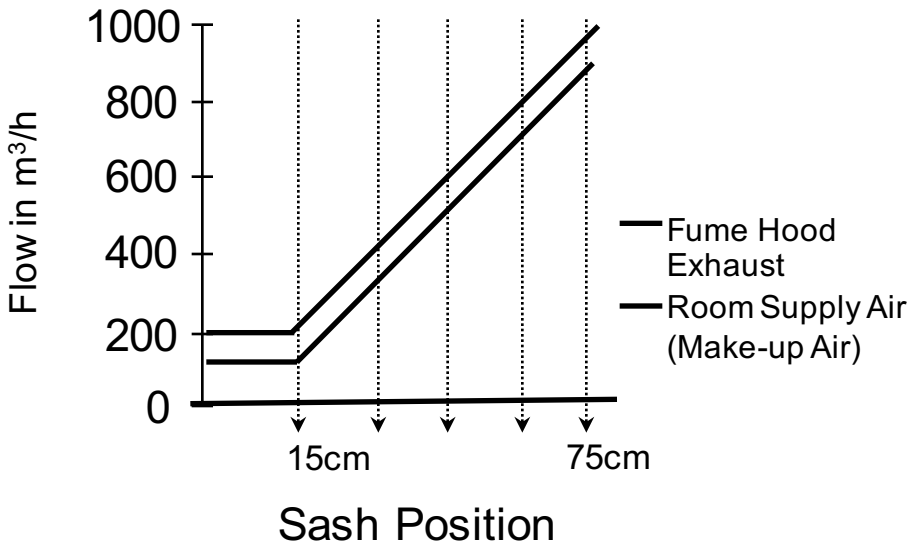
- Fume hood capture and containment
- Laboratory pressurization
- Minimum ventilation control
- Comfort control
- Local and remote monitoring

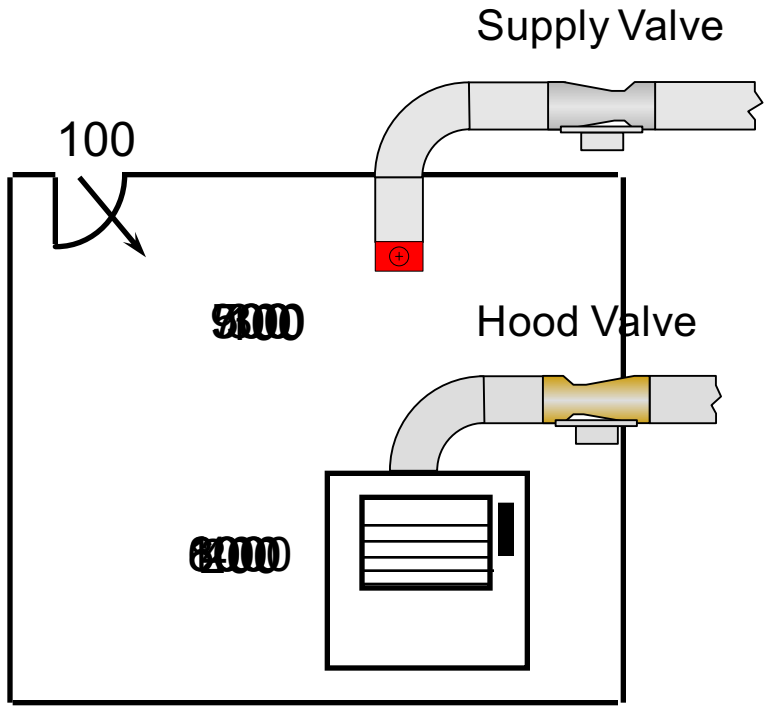
Chemistry labs

- Types of spaces
  - Fume hood labs
  - Bench labs
  - Adjacent areas
- Device level airflow control
  - Fume hoods – containment flow
  - Point exhaust - extraction
- Space pressurization
  - Supply and exhaust control



VAV Fume Hood Control System





Standards & Guidelines

- US OSHA – 60 to 100 fpm (0.3 to 0.5 m/s)
- US ANSI – 100 to 120 fpm (0.5 to 0.6 m/s)
- Canadian Nat'l Std - 0.5 m/s (100 fpm)
- Australian Standard - 0.5 m/s (100 fpm)
- British Standard - 0.5 m/s (100 fpm)
- Swedish Norm - 0.5 m/s (100 fpm)
- Japanese Standard - 0.4 m/s (80 fpm)
- DIN - 0.3 m/s (60 fpm)

60 – 120 fpm

0.3 - 0.6 m/s

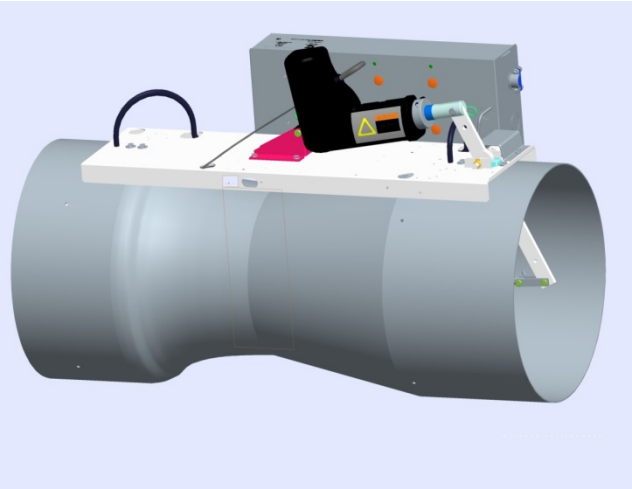
Response Time < 1 Second

- Face velocity control
  - Fast volume change to match sash movement
- Reasons for response time
  - Disruptive effect of sash movement
  - Real world dynamic challenge conditions
  - Vulnerability of a low face velocity

Fume Hood Containment

High-speed Electric Actuation

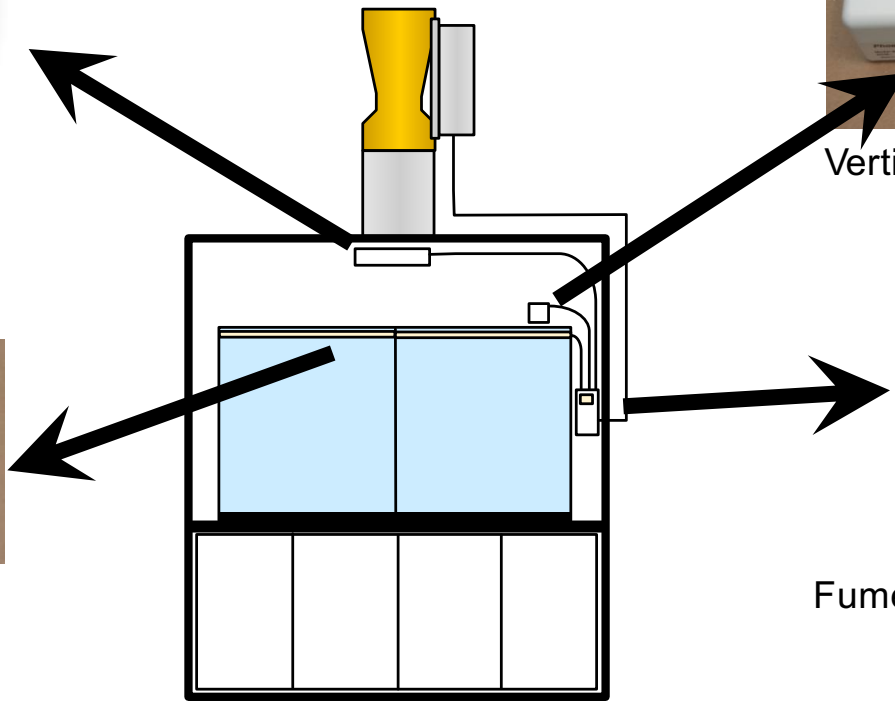
- Designed for fast speed of response with stable control– 1 second full stroke
- Fail safe (Closed, Open Last position)
- Quiet operation – Meets ASHRAE Laboratory guidelines for all types of labs
  - With suspended ceiling < RC 31
  - Without suspended ceiling < RC 54



Fume Hood Components

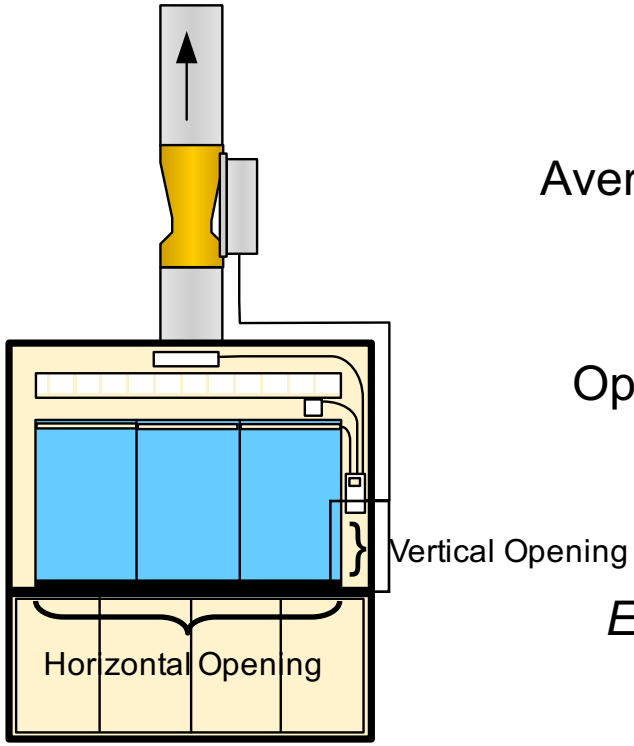
Vertical Sash Sensor

Horizontal Sash Sensor



Fume Hood Monitors

Sash Sensing



$$\text{Average Face Velocity} = \frac{\text{Volume } (m^3/h)}{\text{Open Sash Area } (m^2)}$$

$$\text{Volume } (m^3/h) = \text{Open Sash Area } (m^2) \times \text{Face Velocity } (m/s) \times 3600\ s/h$$

Example: 2 meter wide sash, open 18 cm

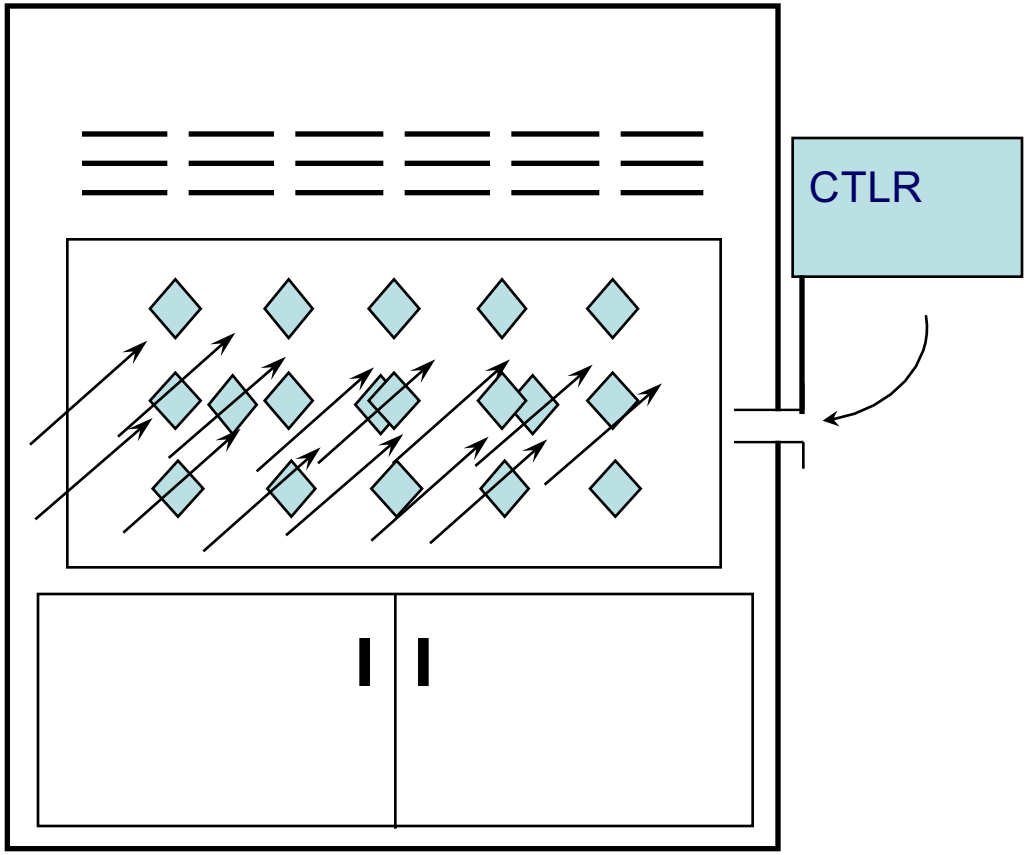
Volume = 2m x .18m x 0.5m/s x 3600m/s

Volume = 0.36m² x 0.5m/2 x 3600m/s

Volume = 648 m^3/h

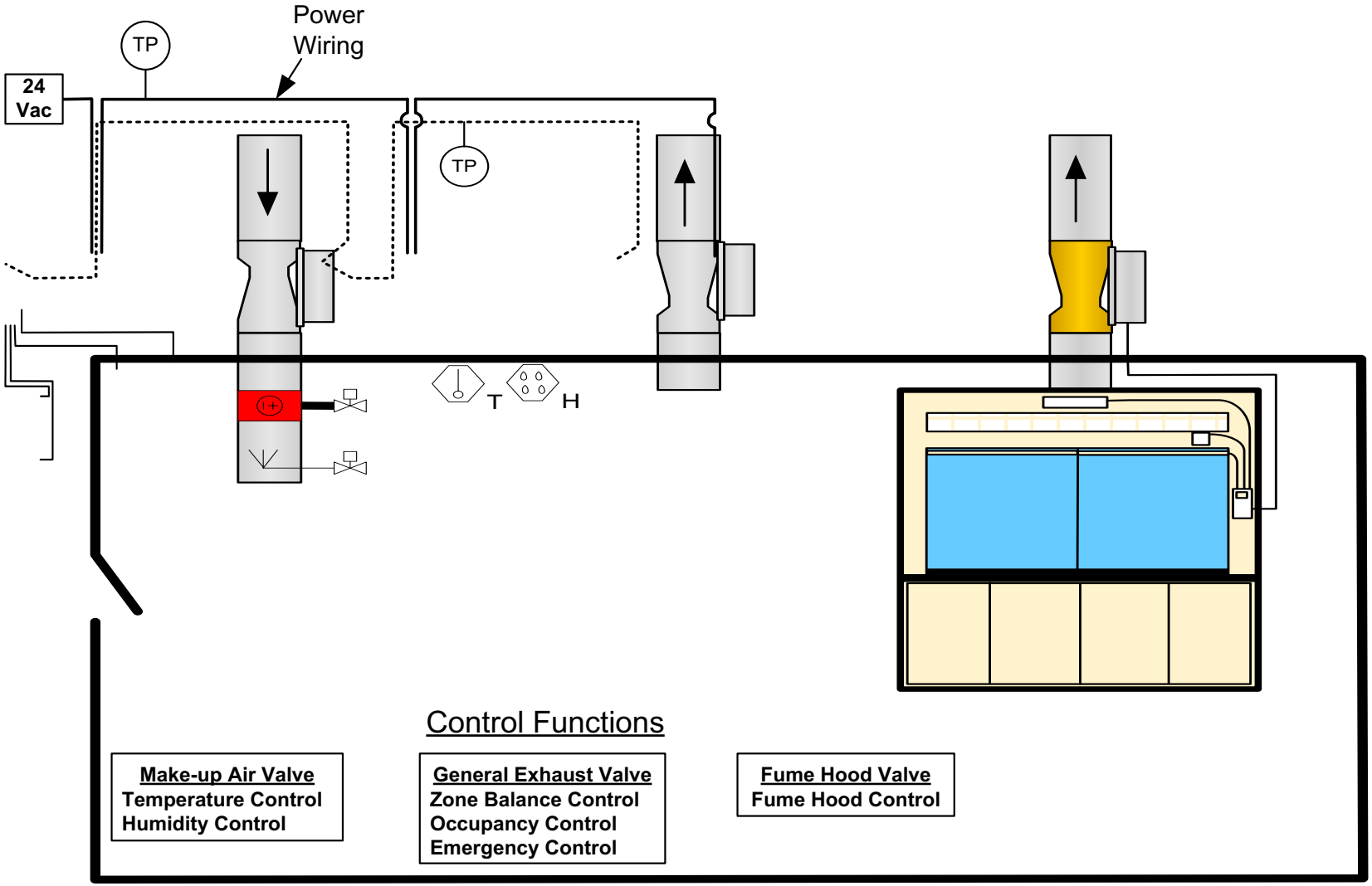
Side Wall Sensing

The sensor measures velocity and sends its signal to a controller that decides the appropriate volume adjustment for the exhaust



Sash vs. Side Wall Sensing

- Sash Sensing
  - 100% repeatable, immediate command
  - Reliable components
  - Insensitive to equipment in hood
- Side Wall (Thru-the-wall)
  - Slow to react
  - Produces false readings
  - Sensitive to equipment in hood
  - Maintenance required



Control Functions

Make-up Air Valve
Temperature Control
Humidity Control

General Exhaust Valve
Zone Balance Control
Occupancy Control
Emergency Control

Fume Hood Valve
Fume Hood Control

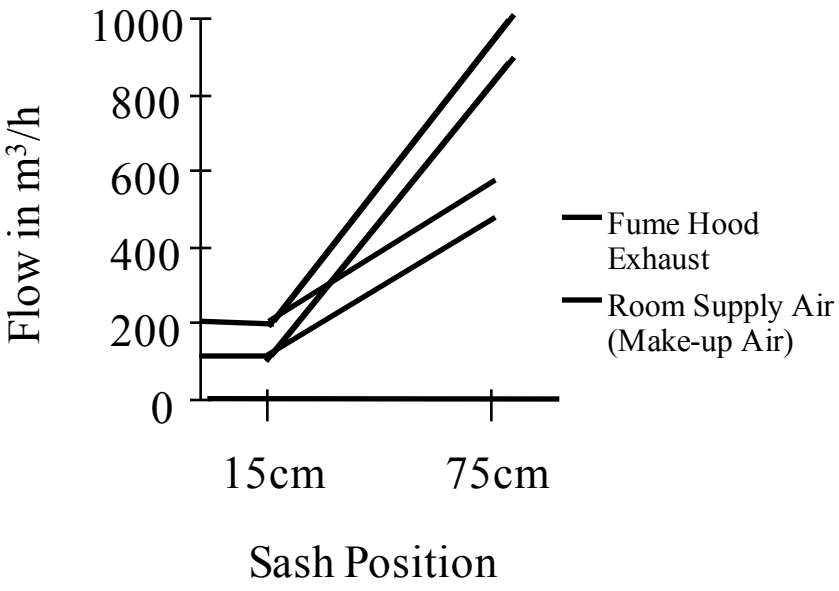
Energy Conservation Opportunities

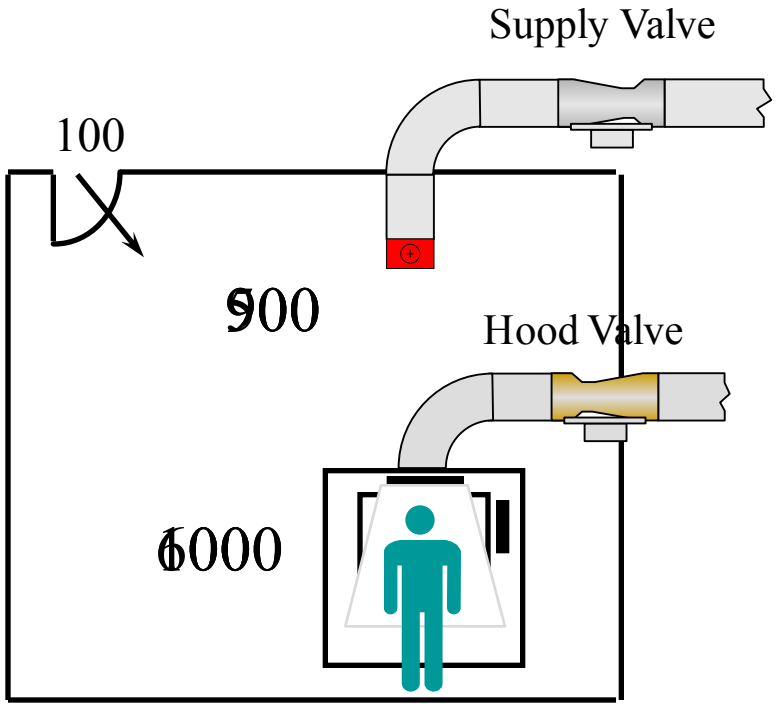
- Usage Based Controls (UBC)
- Fume Hood Decommissioning
- Energy Waste Alert
- IAQ and Occupancy Control

Lab Usage Patterns

- 24-hour operation
- 100% outside air (no recirculation)
- Hood occupancy in short segments
- Total hood usage typically one hour per day and independent
- Sash management varies widely

Usage Based Controls





Zone Presence Sensor®

- One ZPS® per 2 meter hood
  - Can be used in series for wider hoods
- Field programmable via a USB port
  - Detection zone
  - Setback times and values
  - Lighting adjustments
  - Motion sensitivity

Hood Hibernation Mode

- Ability to turn off fume hood exhaust when not in use
- Valve options:
  - Valve minimum (i.e. 60, 85, 155 or 340 m^3/h)
  - Shut-off Valve (i.e. 8.5 m^3/h)
- Savings: @ \$4.5 m^3/h /yr = US\$375/hood/3-month break
  - Teaching labs or hoods rarely used
  - Unoccupied Buildings
  - Understaffed research facilities

Energy Waste Alert

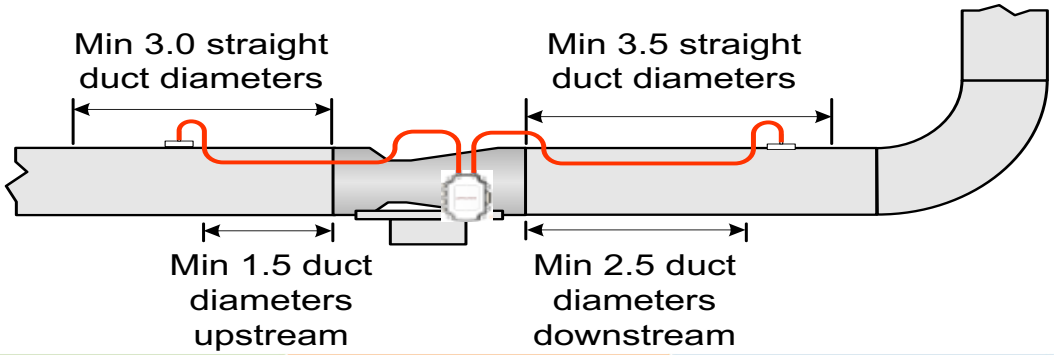
- Notification when sash is left open and lab lights are turned off
- Features
  - Light sensor incorporated in monitor
  - Provides audible alarm
  - Displays "EnrG" on monitor
- Example: 1.5m hood, Sash @ 50%, $4.5 m^3/h = US$ 1,670 savings

IAQ and Occupancy Control

- Occupancy driven Air Change Rates
  - Lower ACH when labs are unoccupied
    - Relaxed temperature control
  - Triggered locally or via BMS schedule
- IAQ driven Air Change Rates
  - Reduce minimum ACH when air is "clean"
  - Drive to higher ACH when contamination is detected

Fan Static Reset Kit

- Measures static pressure across valves
  - Locate on valves furthest from fan or on all valves in an area
- Pass value across network to BMS
  - Dynamically trim fan static as flow conditions vary
- Maximize energy savings
  - System can be operated at lowest possible static



Lab System Benefits

- **Safest most comfortable lab environment**
- Reduced cost for mechanical systems
- Lowest installation & commissioning costs
- **Lowest energy costs**
- **Minimizes maintenance**
- Quietest laboratories
- Integration with all BMS
- More expertise than any other supplier

Thank you

Question