# DEMAND CONTROL VENTILATION SYSTEMS FOR COMMERCIAL KITCHENS

## HOW DO THEY DIFFER, HOW ARE THEY THE SAME?

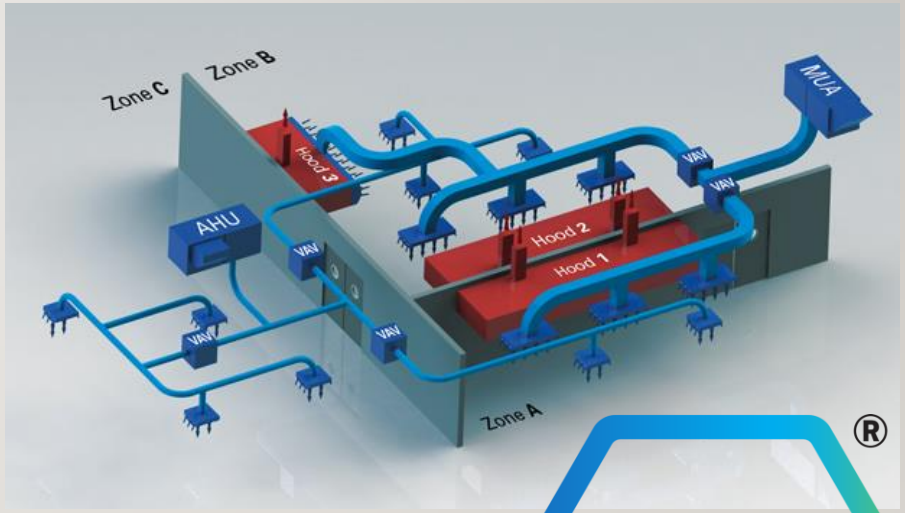
KITCHENVENTILATION.COM

KNOWLEDGE BY Halton

HTTP://WWW.TECHNICALAIR.COM/

# BACKGROUND

- The number and type of Demand Control Ventilation (DCV) systems have grown significantly in recent years.
- ASHRAE 90.1-On exhaust systems greater than 5000 cfm, one of three energy conservation measures are needed.
    1. **At least 50% of all replacement air is transferred air**
        1. Air that would otherwise be exhausted
    2. **Demand Control Ventilation system(s) on at least 75% of exhaust air.**
        1. Systems shall be capable of at least a 50% reduction in the exhaust and replacement airflow rates
        2. Include controls necessary to modulate airflow in response to appliance operation
        3. Maintain full capture and containment of smoke, effluent, and combustion products during cooking and idle.
    3. **Use of a listed energy recovery device**
        1. Requires sensible heat recovery effectiveness of no less than 40% on at least 50% of the total exhaust airflow.

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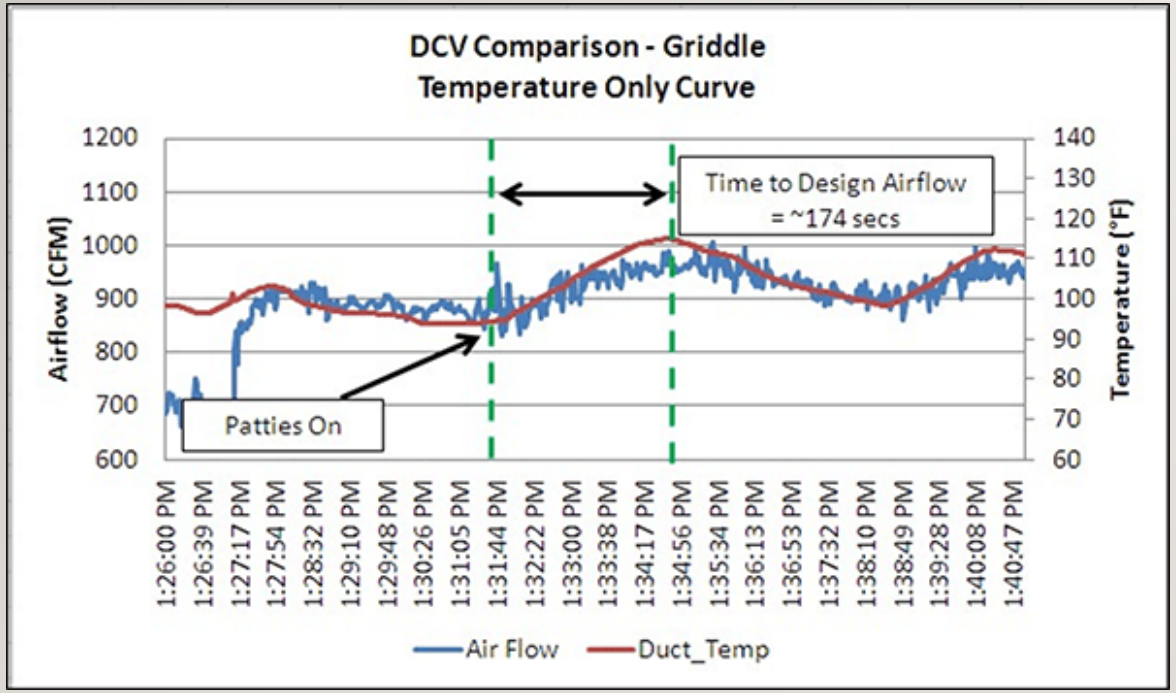
# THE THREE TYPES OF DCV

- Categories are derived from the method used to detect heat and/or cooking.
- Each type of system has its benefits and drawbacks.
- Choosing the system of most value depends on a number of factors. Those may include:
  - Complexity of the ventilation system
  - Need for expandability,
  - Capital investment
  - ROI
- **The three primary types of DCV systems are:**
  1. **Temperature Only**
  2. **Temperature and Opacity Sensor**
  3. **Infrared Cooking Activity Sensor**

# TEMPERATURE ONLY SYSTEMS

- Simplest of systems
- Uses a Resistance Temperature Detector (RTD).
  - Device with a significant temperature coefficient
  - Resistance varies with temperature.
  - Used as a temperature measurement device
  - Passes low-level current and measures voltage drop.
  - Thermistor- common type of RTD.
- The RTD is typically located in the exhaust collar of the hood.
- Some manufacturers have multiple RTD's within the canopy
  - Detects heat over the entire length of the hood.
- The RTD has a temperature set point
  - Once reached, signals the exhaust fan VFD to exhaust a percentage of air.
  - Amount of air is dependent on the system setpoints for idle and actual cooking.
    - Idle- a non-cooking period is when appliances are turned on

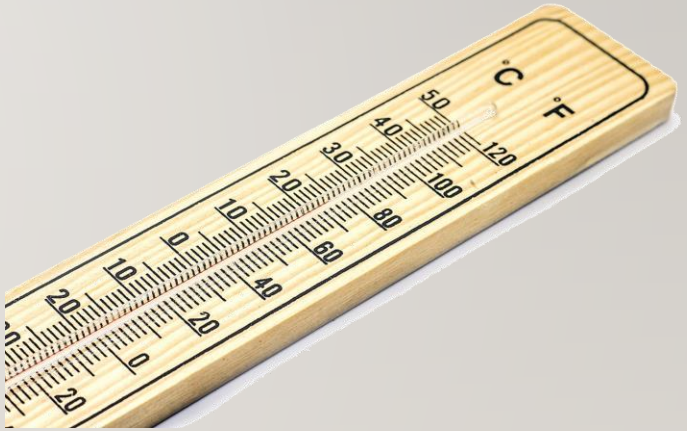
# TEMPERATURE ONLY SYSTEMS




- On these systems that don't measure the airflow in the hood:
  - signal that is proportional to the exhaust frequency is sent to the corresponding supply air unit.
- Example:
  - **IF** Exhaust is at idle or 48Hz on a 60Hz motor,
    - **THEN** a 48Htz signal is sent to the supply air to keep the system balanced.
  - Caution should be used in determining this output signal because it assumes a one to one relationship of exhaust to supply air.
  - Should transfer air be used or other means of make-up air used, then that must be taken into account when estimating the supply air signal.

# TEMPERATURE ONLY SYSTEMS

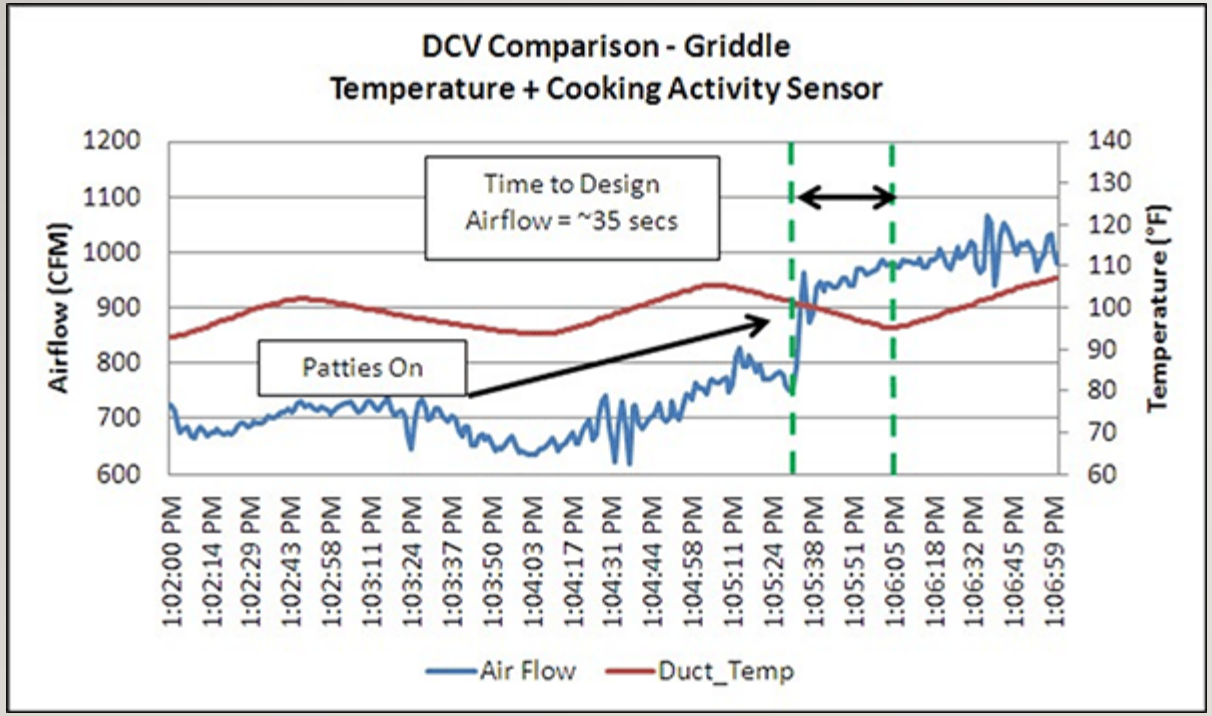
- Temp only systems tend to be less expensive
  - However, may not capture all potential savings due to a limited turndown ratio.
    - Difference between full airflow and idle airflow
- Reaction time tends to be slower due to:
  - Signal for appliance start-up and/or the onset of cooking is measured in the exhaust collar or hood canopy
  - Time to heat the thermal mass of the RTD.
- This delay may create conditions where heat and/or smoke may escape the hood.
- System increases airflow with higher sensed temperatures and lower airflow with lower sensed temperatures.
  - When cooking starts, however, temperature often drops (think cold burgers covering a hot griddle)
  - Erroneously results in  reduced cfm when design cfm would be required.



# TEMPERATURE ONLY W/ OPACITY SENSOR

- It is difficult to gather accurate information about the cooking activity on temperature sensing alone
  - Known lag in response to heat generation by the appliances
- As a result, some manufacturers have put an **opacity sensor** in their DCV systems.
  - Opacity Sensor: A reflective beam in the canopy/exhaust hood.
  - Steam and or smoke can be generated before the temperature setpoint is reached.
  - If the smoke and steam block and break “beam”, it will automatically ramp the exhaust system to design airflow.

# INFRARED COOKING ACTIVITY SENSORS




- More sophisticated systems use a variety of sensors,
  - duct temperature
  - space temperature
  - infrared sensors directed at the appliance surface.
- These types of systems compare the signals from all the sensors to determine cooking status.
- EXAMPLE: Frozen Fries placed into hot oil:
  - Temperature is at a steady-state and the infrared sensor detects a sudden drop in temperature at the cooking surface ( cold fries in hot oil drops temperature)
  - Interpreted as a cooking signal and the system responds instantaneously.
  - Only lag time is associated with the ramp speed of the VFD.

# INFRARED COOKING ACTIVITY SENSORS

- Systems measure actual exhaust rate
- Rather than drive to a specific frequency on the VFD; they send a signal to achieve a given CFM at the hood.
  - Based on this signal, a proportional low voltage signal is sent to the make-up air system or Building Management System to adjust the make-up air volume.
- In addition, customizable algorithms are available for project-specific requirements.
- There are systems that can provide zone control over make-up air volume or output a split signal for multiple supply air units.

Infrared Sensor

Space Temperature Sensor

# INFRARED COOKING ACTIVITY SENSORS

- Further differentiation comes from the ability of the systems to modulate and control exhaust hoods independently of each other on a common fan and duct system.
- Most manufacturers can provide a detailed analysis and report on the energy savings associated with their respective systems.
- Consideration should be given to budget, potential energy savings, expandability, remote monitoring capability, and algorithm changeability.

# CONTACT THE EXPERTS

- Learn more about Halton Group's M.A.R.V.E.L. Demand Control Ventilation Solution along with their complete commercial kitchen line by going to https://www.halton.com/products/mrv-energy-saving-technology-en/
- Contact the Technical Air Systems' Sales Engineering Team at 973-285-0333 or by email at solutions@technicalair.com
- Learn more about Technical Air Systems, Inc at http://www.technicalair.com/
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