

# BUILDING *performance* LAB

## OA Control Using OAF

### Measure Description

In this critical measure, we seek to assure that outside air (OA) is properly controlled. Over-ventilation can cause significant energy waste. Note that under-ventilation can also cause significant occupant discomfort.

Given data for the three temperatures (i.e. OAT, MAT, RAT) in an air-handling / rooftop / packaged unit, and given knowledge of the supply fan status, occupancy, and start up schedules, this measure can be used to determine whether outdoor air is properly managed. This measure assumes that neither Demand Controlled Ventilation nor Energy / Heat Recovery Ventilation (ERV/HRV) are in use.

**Note:** It is recommended that this measure is done in conjunction with Trend Chart 1: Fan Schedule.

### Kit Contents

- (1) HOBO® waterproof temp/RH loggers: MX2301 – for OAT
- (2) HOBO® wireless temp/RH loggers: MX1101 – for MAT, RAT
- Phone or tablet with Bluetooth (e.g. iPad)
- HOBOConnect® mobile app
- The CUNY BPL Trend Chart App <<https://cunybpl.shinyapps.io/nobas-trends/>>

### HOBO® wireless temp/RH logger + waterproof temp/RH logger

1. Configure: [https://youtu.be/sbUBDB2eg\\_U](https://youtu.be/sbUBDB2eg_U)
  - a. Best practice: Configure with 15-minute time intervals and “Wrap” recording
2. Install: <https://youtu.be/R9MDkohMD-E>
3. Extract data: <https://youtu.be/-vxr8pngulQ>
4. Visualize data: <https://youtu.be/w3b48FFNeYs>



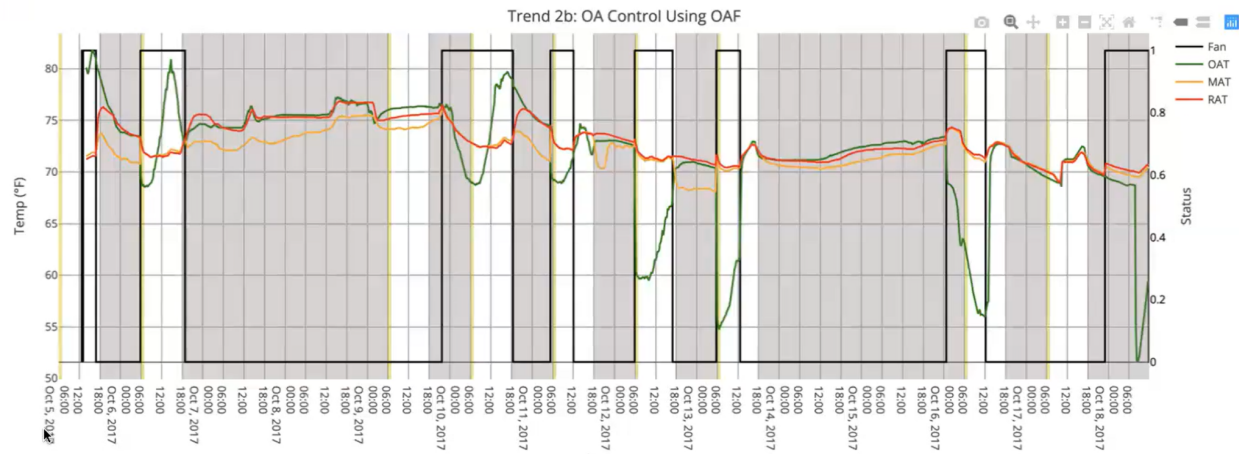
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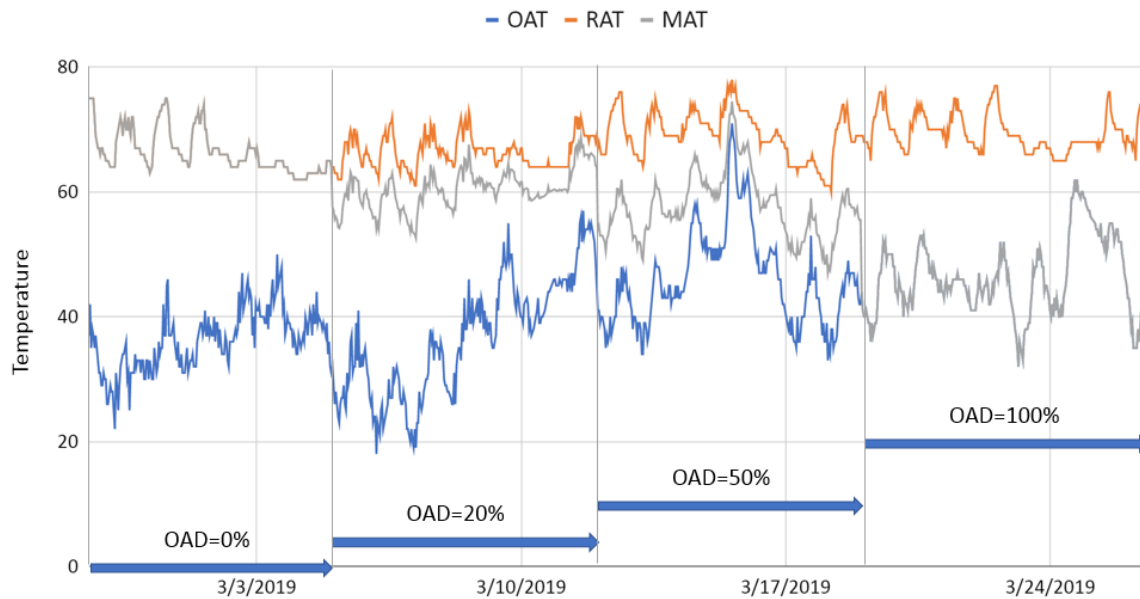
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## Trend Chart Example



**Note:** OAF can be used to approximate the OAD position. You can use the following figure, which shows the relationship between OAT, MAT, RAT and OAD according to the OA fraction formula:  $OAF = (MAT - RAT) / (OAT - RAT)$ .



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## Analysis

Looking at the trend chart above, use the following Q&A to analyze the data for opportunities for energy savings.

1. Is the OAD open during unoccupied times?
  - a. If NO, then this is generally good operation.
  - b. If YES, check if OAD needs to be open for any reason, e.g., economizing for meeting a setback temperature OR purging VOCs before occupancy. If so, then this is a good operation.
  - c. Check that the programmed occupancy schedule matches the occupancy schedule for the spaces served by this unit.
    - i. If not, match the programmed occupancy schedule to the occupancy schedule for the spaces served ([1425.04](#))
  - d. Check that the OAD is programmed to close when the AHU is off.
    - i. If not, program the OAD to close when AHU is off. ([1425.11](#))
  - e. Check that the OAD closes when commanded.
    - i. If not, have controls tech program OAD to close during unoccupied times ([1425.03](#))
2. Is the OAD open during startup when conditions are not favorable for economizing?
  - a. Check if OAD needs to be open for any reason, e.g. purging VOCs before occupancy.
    - i. Otherwise, ensure dampers are programmed to remain closed until occupancy begins. ([1425.02](#))
3. Is MAT between OAT and RAT?
  - a. If YES, then this is a good operation.
  - b. If NO, the temperature sensors are not calibrated, labeled, or connected properly, or the temperature sensors may not be properly located (such as near heating/cooling coils). Recalibrate, re-label, reconnect, or move the sensor to correct the situation.
4. Does MAT = RAT when the OAD is closed during startup?
  - a. If YES, then this is a good operation.
  - b. If NO, ensure that there is no leakage at the OAD, or recalibrate / replace temperature sensors
5. Is the outside air fraction shown by RAT, MAT, OAT temps consistent with the OAD position?



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- a. If YES, then this is a good operation.
  - b. If NO, sometimes OAD position refers to an economizing damper, and there is a minimum OA damper as well. Because of this, temperatures may indicate over-ventilation, where OAD position can be misleading.
6. Ensure that OAD position indicated by BAS is accurate
  - a. If not, repair the communication to the BAS. (305.01)
7. Are you over-ventilating (e.g., OAD > 20% when not economizing)?
  - a. If NO, then this is a good operation.
  - b. If YES, check if zones require more than 20% OA due to design or other requirements. Check if DCV is in use and requires more than 20% OA. Check if zones have a high occupancy load that requires more than 20% OA (use TC#3 to check).
    - i. Otherwise, reduce to minimum OAD (usually 10–20%) when occupied. (1425.03)
8. Are you under-ventilating (OAD < 10% during occupied times)?
  - a. If NO, then this is a good operation.
  - b. If YES, Check if DCV is in use and requires less OA. Check if zones have a low occupancy load that requires less than 10% OA (use TC#3 to check). Otherwise, open up to minimum OAD (usually 10–20%) when occupied. (1425.03)
9. If you are in cooling mode and conditions are right for economizing (OAT is in the temperature range for economizing), are you economizing (OAD > minimum OAD position)?
  - a. If YES, then this is a good operation.
  - b. If NO, check if there is an OAD/actuator malfunction that prevents the OAD from opening beyond minimum OA position.
    - i. If so, have controls tech identify and repair the OAD/actuator. (1407.08)
      1. Check whether the values for economizing set points are reasonable.
    - ii. If not, have controls tech repair the economizer. (1404.03)
10. If you are in cooling mode and conditions are NOT right for economizing (OAT is NOT in the temperature range for economizing), are you economizing anyway (OAD > min)?
  - a. If NO, then this is a good operation.
  - b. If YES, Check if there is an OAD/actuator malfunction that prevents the OAD from opening beyond minimum OA position.
    - i. If so, have controls tech identify and repair the OAD/actuator. (1407.08)



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1. Check whether the values for economizing set points are reasonable.
  - ii. If not, have controls tech repair the economizer. ([1404.03](#))
11. If you are in heating mode, are you economizing anyway (OAD > min)?
  - a. If NO, then this is a good operation.
  - b. If YES, Check if there is an OAD/actuator malfunction that prevents the OAD from opening beyond minimum OA position.
    - i. If so, have controls tech identify and repair the OAD/actuator. ([1407.08](#))
    - ii. Check whether the values for economizing set points are reasonable.
    - iii. If not, have controls tech repair the economizer. ([1404.03](#))



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