MMN Building AHU 4 January Report

AHU Graphic | Setpoints | History | VFD Data | Supply Air Chart

AHU_4 (VAV)

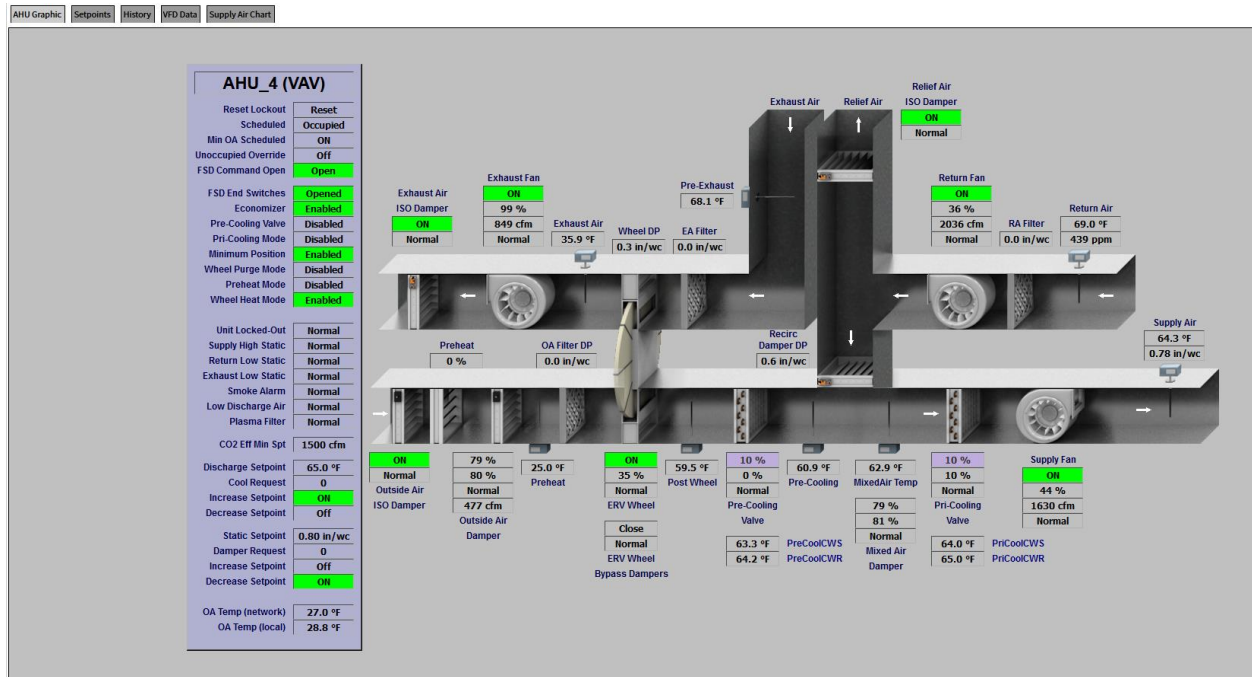|	
Reset Lockout	Reset
Scheduled	Occupied
Min OA Scheduled	ON
Unoccupied Override	Off
FSD Command Open	Open
FSD End Switches	Opened
Economizer	Enabled
Pre-Cooling Valve	Disabled
Pri-Cooling Mode	Disabled
Minimum Position	Enabled
Wheel Purge Mode	Disabled
Preheat Mode	Disabled
Wheel Heat Mode	Enabled
Unit Locked-Out	Normal
Supply High Static	Normal
Return Low Static	Normal
Exhaust Low Static	Normal
Smoke Alarm	Normal
Low Discharge Air	Normal
Plasma Filter	Normal
CO2 Eff Min Spt	1500 cfm
Discharge Setpoint	65.0 °F
Cool Request	0
Increase Setpoint	ON
Decrease Setpoint	Off
Static Setpoint	0.80 in/wc
Damper Request	0
Increase Setpoint	Off
Decrease Setpoint	ON
OA Temp (network)	27.0 °F
OA Temp (local)	28.8 °F

- Verify chiller plant doesn't run in the winter as shown in FC 8 something looks odd where it appears at time the difference between the supply and mixing temperature large like mechanical cooling is running.

Fault Condition One Report

Fault condition one of ASHRAE Guideline 36 is related to flagging poor performance of a AHU variable supply fan attempting to control to a duct pressure setpoint. Fault condition equation as defined by ASHRAE:

FC#1	Equation	DSP < DSPSP − εDSP **AND** VFDSPD ≥ 99% − εVFDSPD	Applies to OS#1 through OS#5
	Description	Duct static pressure too low with fan at full speed	
	Possible Diagnosis	• Problem with VFD • Mechanical problem with fan • Fan undersized • SAT set point too high (too much zone demand)	

Dataset Plot
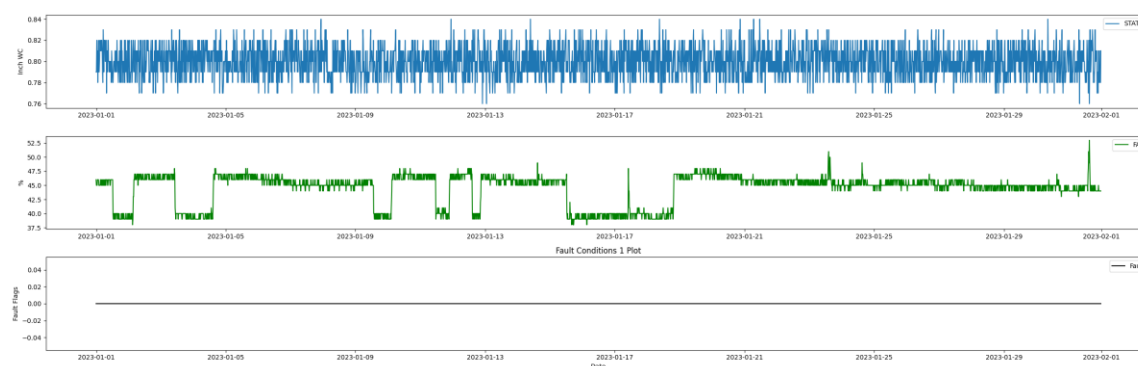
Dataset Statistics

- Total time in days calculated in dataset: 30.99
- Total time in hours calculated in dataset: 743.75
- Total time in hours for when fault flag is True: 0.0
- Percent of time in the dataset when the fault flag is True: 0.0%
- Percent of time in the dataset when the fault flag is False: 100.0%
- Calculated motor runtime in hours based off of VFD signal > zero: 743.75
- This fan system appears to run 24/7 consider implementing occupancy schedules to reduce building fuel use through HVAC
- No faults were found in this given dataset for the equation defined by ASHRAE.

Summary Statistics filtered for when the AHU is running

VFD Speed

- count   2976.000000
  mean   44.430444
  std   2.617434

```
min      38.000000
25%      44.000000
50%      45.000000
75%      46.000000
max      53.000000
Name: AHU4_SaFanSpeedAO_value, dtype: float64
```

Duct Pressure

- ```
  count   2976.000000
  mean       0.799896
  std        0.014909
  min        0.760000
  25%        0.790000
  50%        0.800000
  75%        0.810000
  max        0.840000
  Name: AHU4_SaStatic_value, dtype: float64
  ```

Duct Pressure Setpoint

- ```
  count   2.976000e+03
  mean    8.000000e-01
  std     1.110410e-16
  min     8.000000e-01
  25%     8.000000e-01
  50%     8.000000e-01
  75%     8.000000e-01
  max     8.000000e-01
  Name: duct_static_setpoint, dtype: float64
  ```

Suggestions based on data analysis

- The percent True metric that represents the amount of time for when the fault flag is True is low inidicating the fan appears to generate good duct static pressure
- No duct static pressure setpoint reset detected consider implementing a reset strategy to save AHU fan energy
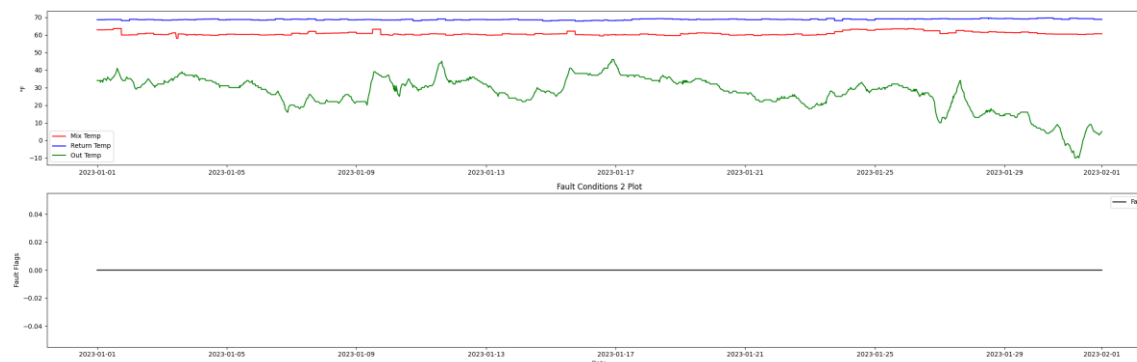
Report generated: Mon Feb 27 13:09:54 2023

Fault Condition Two Report

Fault condition two and three of ASHRAE Guideline 36 is related to flagging mixing air temperatures of the AHU that are out of acceptable ranges. Fault condition 2 flags mixing air temperatures that are too low and fault condition 3 flags mixing temperatures that are too high when in comparision to return and outside air data. The mixing air temperatures in theory should always be in between the return and outside air temperatures ranges. Fault condition two equation as defined by ASHRAE:

Snip of ASHRAE Fault Condition 2

FC#2 (omit if no MAT sensor)	Equation	$MAT_{avg} + \varepsilon MAT < \min[(RAT_{avg} - \varepsilon RAT), (OAT_{avg} - \varepsilon OAT)]$	Applies to OS#1 through OS#5
	Description	MAT too low; should be between OAT and RAT	
	Possible Diagnosis	• RAT sensor error • MAT sensor error • OAT sensor error	

Dataset Plot

Dataset Statistics

- Total time in days calculated in dataset: 31.0
- Total time in hours calculated in dataset: 743.8833333333333
- Total time in hours for when fault flag is True: 0.0
- Percent of time in the dataset when the fault flag is True: 0.0%
- Percent of time in the dataset when the fault flag is False: 100.0%
- Calculated motor runtime in hours based off of VFD signal > zero: 743.88
- This fan system appears to run 24/7 consider implementing occupancy schedules to reduce building fuel use through HVAC
- No faults were found in this given dataset for the equation defined by ASHRAE.

Summary Statistics filtered for when the AHU is running

Mix Temp

- count   1369.000000
  mean   60.848868
  std   1.102967
  min   58.100000
  25%   60.100000
  50%   60.500000
  75%   61.300000
  max   63.600000
  Name: AHU4_MATemp, dtype: float64

Return Temp

- count   1369.000000
  mean   68.739445
  std   0.347348
  min   67.800000
  25%   68.500000
  50%   68.700000
  75%   69.000000
  max   69.600000
  Name: AHU4_RATemp_value, dtype: float64

Outside Temp

- count   1369.000000
  mean   27.661432
  std   8.729501
  min   -10.000000
  25%   23.000000
  50%   30.000000
  75%   34.000000
  max   46.000000
  Name: HourlyDryBulbTemp, dtype: float64

Suggestions based on data analysis

- The percent True of time in fault condition 2 is high indicating the AHU temperature temp sensors are out of calibration

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Fault Condition Five Report

Fault condition five of ASHRAE Guideline 36 is (an AHU heating mode or winter time conditions only fault equation) related to flagging supply air temperatures that are out of acceptable ranges based on the mix air temperature and an assumption for heat created by the AHU supply fan in the air stream. Fault condition five equation as defined by ASHRAE:

FC#5 (omit if no MAT sensor)	Equation	$SATavg + \varepsilon SAT \leq MATavg - \varepsilon MAT + \Delta TSF$	Applies to OS#1
	Description	SAT too low; should be higher than MAT	(heating mode)
	Possible Diagnosis	• SAT sensor error • MAT sensor error • Cooling-coil valve leaking or stuck open • Heating-coil valve stuck closed or actuator failure • Fouled or undersized heating coil • HW temperature too low or HW unavailable • Gas or electric heat unavailable • DX cooling stuck ON	

Dataset Plot
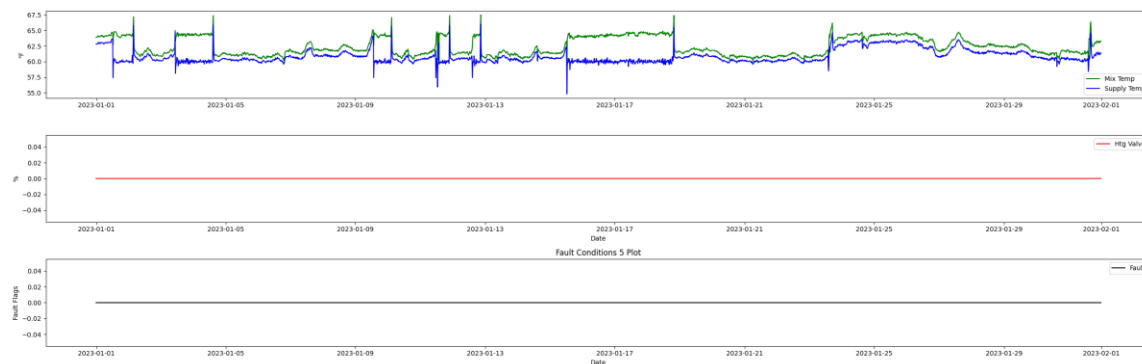
Dataset Statistics

- Total time in days calculated in dataset: 30.99
- Total time in hours calculated in dataset: 743.75
- Total time in hours for when fault flag is True: 0.0
- Percent of time in the dataset when the fault flag is True: 0.0%
- Percent of time in the dataset when the fault flag is False: 100.0%
- Calculated motor runtime in hours based off of VFD signal > zero: 743.75
- This fan system appears to run 24/7 consider implementing occupancy schedules to reduce building fuel use through HVAC
- No faults were found in this given dataset for the equation defined by ASHRAE.

Summary Statistics filtered for when the AHU is running

Mix Temp

- count   2976.000000
  mean   62.440087
  std   1.438272
  min   57.000000
  25%   61.200000
  50%   61.900000
  75%   64.100000
  max   67.500000
  Name: AHU4_DAT, dtype: float64

Supply Temp

- count   2976.000000
  mean   60.814684
  std   1.062540
  min   54.800000
  25%   60.100000
  50%   60.500000
  75%   61.125000
  max   66.000000
  Name: AHU4_MATemp, dtype: float64

Suggestions based on data analysis

- The percent True metric that represents the amount of time for when the fault flag is True is low inidicating the AHU temperature sensors are within calibration
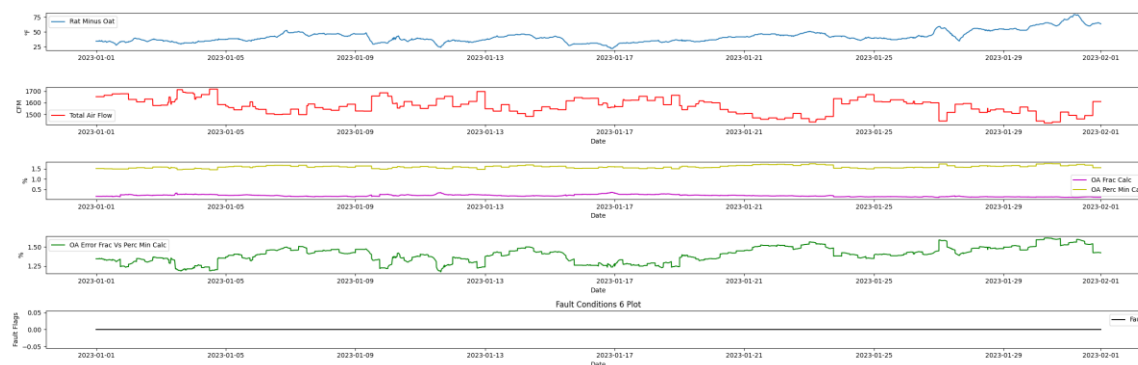
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Fault Condition Six Report

Fault condition six of ASHRAE Guideline 36 is an attempt at verifying that AHU design minimum outside air is close to the calculated outside air fraction through the outside, mix, and return air temperature sensors. A fault will get flagged in an AHU heating or mechanical cooling mode only if the calculated OA fraction is too low or too high as to compared to percent Min calculation which is the AHU total air flow divided by the design minimum outdoor air expressed as a percent. Fault condition six equation as defined by ASHRAE:

FC#6	Equation	$\lvert RATavg - OATavg \rvert \geq \Delta Tmin$ **AND** $\lvert \%OA - \%OAmin \rvert > \varepsilon F$	Applies to OS#1 and OS#4
	Description	OA fraction too low or too high; should equal %OAmin	
	Possible Diagnosis	• RAT sensor error • MAT sensor error • OAT sensor error • Leaking or stuck economizer damper or actuator	

Dataset Plot

Dataset Statistics

- Total time in days calculated in dataset: 31.0
- Total time in hours calculated in dataset: 743.8833333333333
- Total time in hours for when fault flag is True: 0.0
- Percent of time in the dataset when the fault flag is True: 0.0%
- Percent of time in the dataset when the fault flag is False: 100.0%
- Calculated motor runtime in hours based off of VFD signal > zero: 743.88
- This fan system appears to run 24/7 consider implementing occupancy schedules to reduce building fuel use through HVAC
- No faults were found in this given dataset for the equation defined by ASHRAE.

Summary Statistics filtered for when the AHU is running

Mix Temp

- count   1369.000000
  mean   60.848868
  std   1.102967
  min   58.100000
  25%   60.100000
  50%   60.500000
  75%   61.300000
  max   63.600000
  Name: AHU4_MATemp, dtype: float64

Outside Temp

- count   1369.000000
  mean   27.661432
  std   8.729501
  min   -10.000000
  25%   23.000000
  50%   30.000000
  75%   34.000000
  max   46.000000
  Name: HourlyDryBulbTemp, dtype: float64

Return Temp

- count   1369.000000
  mean   68.739445
  std   0.347348
  min   67.800000
  25%   68.500000
  50%   68.700000
  75%   69.000000
  max   69.600000
  Name: AHU4_RATemp_value, dtype: float64

Total Air Flow

- count   1369.000000
  mean   1574.639153
  std   63.777252
  min   1427.000000
  25%   1530.000000
  50%   1579.000000
  75%   1617.000000

max   1718.000000
Name: AHU4_SaFanFlow_value, dtype: float64

Suggestions based on data analysis

- The percent True metric that represents the amount of time for when the fault flag is True is low inidicating the sensors are within calibration

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Fault Condition Eight Report

Fault condition Eight of ASHRAE Guideline 36 is an AHU economizer free cooling mode only with an attempt at flagging conditions when the AHU mixing air temperature the supply air temperature are not approximately equal. Fault condition eight equation as defined by ASHRAE:

FC#8 (omit if no MAT sensor)	Equation	$|SAT_{avg} - \Delta TSF - MAT_{avg}| > \sqrt{\varepsilon SAT^2 + \varepsilon MAT^2}$	Applies to OS#2
	Description	SAT and MAT should be approximately equal	
	Possible Diagnosis	• SAT sensor error • MAT sensor error • Cooling-coil valve leaking or stuck open • Heating-coil valve leaking or stuck open	

Dataset Plot
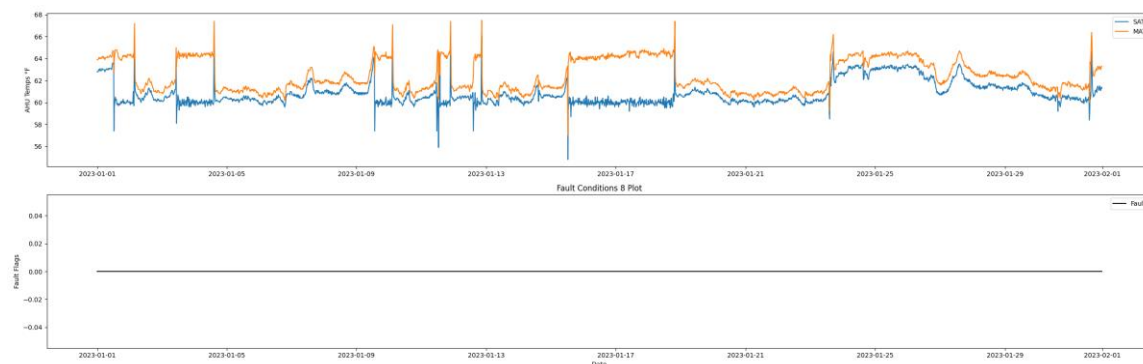
Dataset Statistics

- Total time in days calculated in dataset: 30.99
- Total time in hours calculated in dataset: 743.75
- Total time in hours for when fault flag is True: 0.0
- Percent of time in the dataset when the fault flag is True: 0.0%
- Percent of time in the dataset when the fault flag is False: 100.0%
- Calculated motor runtime in hours based off of VFD signal > zero: 743.75
- This fan system appears to run 24/7 consider implementing occupancy schedules to reduce building fuel use through HVAC
- No faults were found in this given dataset for the equation defined by ASHRAE.

Summary Statistics filtered for when the AHU is running

Supply Air Temp

- count   2976.000000
  mean   60.814684
  std   1.062540
  min   54.800000

25%   60.100000
50%   60.500000
75%   61.125000
max   66.000000
Name: AHU4_MATemp, dtype: float64

Mix Air Temp

- count   2976.000000
  mean   62.440087
  std   1.438272
  min   57.000000
  25%   61.200000
  50%   61.900000
  75%   64.100000
  max   67.500000
  Name: AHU4_DAT, dtype: float64

Suggestions based on data analysis

- The percent True metric that represents the amount of time for when the fault flag is True is low inidicating the AHU components are within calibration for this fault equation Ok.

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