Taunton Justice Center
Taunton, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

June 22, 2021

Tighe&Bond

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Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Taunton Trial Court on February 9, 2021. While on site we inspected the air handling equipment located in various mechanical rooms and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management:*
  - Doug Loud and Tim Sampaio, Trial Court Facilities Staff
- *Tighe & Bond*
  - Todd Holland, PE, Senior Mechanical Engineer
  - Matt Mancini, Staff Mechanical Engineer

1.1 Existing Ventilation System

The Taunton Trial Court was constructed in 2011, has a full basement and four above-grade stories, and is approximately 147,000 square feet in size. There have been no significant changes or additions to the building or its systems since construction.

Ventilation air is provided by nine variable air volume (VAV) air handling units. Seven of these units serve occupied areas. Each unit consists of a mixing box with outdoor air (OA) dampers and return air (RA) dampers, 2" MERV-8 prefilters, 12" MERV-14 final filters, hot water preheat coil, chilled water cooling coil, variable-speed supply fan, and discharge damper. Differential pressure sensors monitor pressure drop across each bank of filters. Each unit has a pair of OA dampers, one opens to provide the minimum OA, and the other opens for economizer cooling or ventilation override. A dedicated variable-speed return fan serves each air handling system. Supply air is distributed to each zone via VAV boxes, with fan speed controlled by static pressure in the distribution duct. Two air handlers are constant-volume, 100% OA units, dedicated to the boiler and chiller rooms.

All units are from the original construction and appear to be in very good condition. The OA and RA dampers and actuators have airfoil-shaped blades with edge seals, appear to be in very good condition, and all were observed to at the position they were supposed to be. The heating and cooling coils also appear to be in very good condition, with a small amount of visible dirt and debris on some of them. The hot and chilled water control valves and actuators appear to be in very good condition, with all heating valves observed to be at the position controlled by the building management system (BMS). Airflow stations measure the velocity and volume of the OA, RA, and supply air (SA).

Several of the mixing boxes have baffles that were installed during commissioning to address low temperature alarms triggered by the averaging-type temperature sensors on the faces of the preheat coils. These were intended to promote turbulent mixing of the outdoor and return air streams, and also create a substantial pressure drop. They also may contribute to inaccurate readings from the OA and RA airflow stations, as several do not add up to what the SA is reading. On one of the units, the differential pressure sensor for the final filters may have been affected by the baffle as well.

Photo 1 – Representative Air Handler

According to the plans, there are 31 exhaust fans serving various areas, including the holding cells and toilet rooms. We were able to verify that all fans were operating as commanded by the BMS during our site visit.

A pair of Fulton gas-fired hydronic boilers, rated at 3.6 million Btu/hr output each, provide hot water to perimeter radiation, unit heaters, VAV reheat coils, and two heat exchangers that serve a glycol loop for the preheat coils in the air handlers. Two gas-fired 100-gallon Rheem-Ruud water heaters, rated at 199,000 Btu/hr each, provide domestic hot water to the facility.

A pair of 200-ton, water-cooled centrifugal chillers provide chilled water to all air handlers. The cooling coils are drained down in winter for freeze protection.

Table 1 summarizes the air handling units' designed airflow rates, the MERV rating of the installed filters, and the condition.

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Pre/Final Filters	Condition
AHU-1	33,000	7,500	2″ MERV-8, 12″ MERV-14	Very Good
AHU-2	4,500	4,500	2″ MERV-8	Very Good
AHU-3	14,500	4,500	2″ MERV-8, 12″ MERV-14	Very Good
AHU-4	20,500	9,500	2″ MERV-8, 12″ MERV-14	Very Good
AHU-5	13,000	4,000	2″ MERV-8, 12″ MERV-14	Very Good
AHU-6	20,000	7,000	2″ MERV-8, 12″ MERV-14	Very Good
AHU-7	17,500	6,500	2″ MERV-8, 12″ MERV-14	Very Good
AHU-8	10,000	2,500	2″ MERV-8, 12″ MERV-14	Very Good
AHU-9	4,000	4,000	2″ MERV-8	Very Good

1.2 Existing Control System

The systems are controlled by a Siemens building management system (BMS), with a typical control screen shown below.

The BMS is tied to the existing boiler & chiller systems, AHUs, VAVs, fan coils, perimeter heating, and exhaust fans. While on site, Tighe & Bond was able to observe various control system screens and setpoints.

The two air handlers that serve the courtrooms, AHU-6 and AHU-7, have demand control ventilation (DCV) sequences that will maximize ventilation air if measured CO2 levels in any of the spaces are exceeded. At the time of our visit, CO2 levels were 801 and 818 parts per million (ppm), with the threshold set at 1,000 ppm.

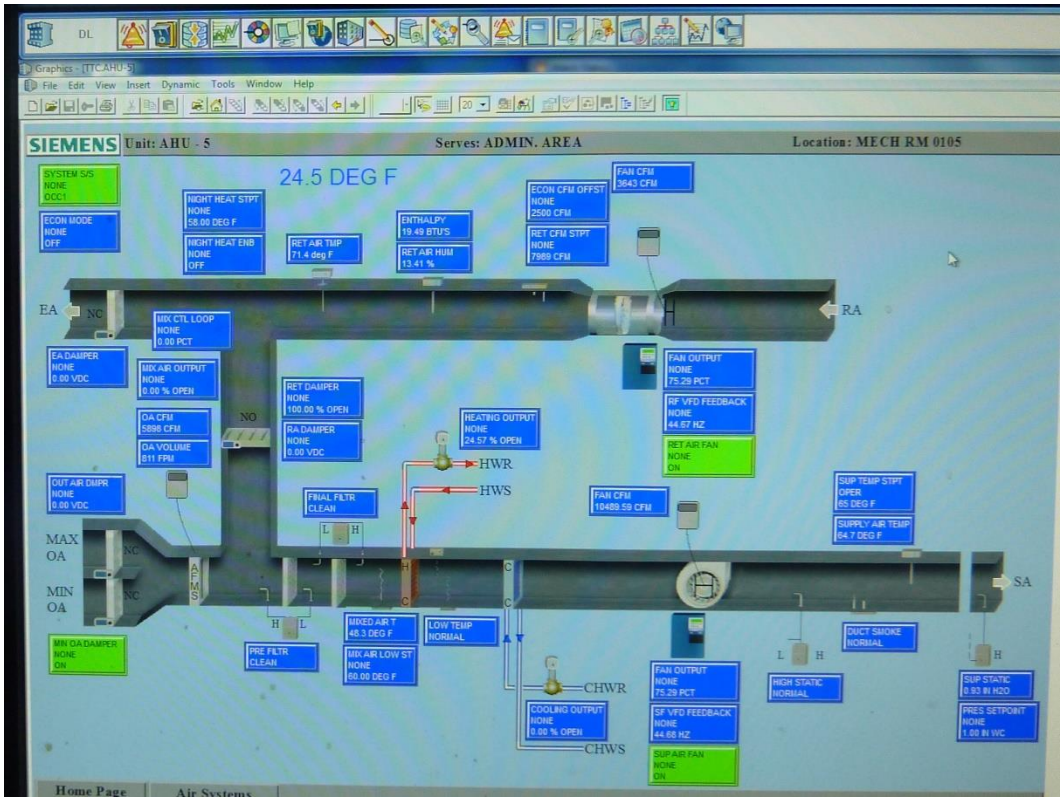

Photo 2 – Representative BMS Screen

Section 2
Recommendations

Below is a list of recommendations that we propose for the Taunton Trial Court. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

2.1 Filtration Efficiency Recommendations

We recommend the following measures be implemented for the existing air handling units that serve occupied areas:

RF-1: *Replace filters.*

We recommend the continued use of MERV-14 final filters which meet the ASHRAE recommendation of MERV-13 minimum. Existing pre-filters and final filters should be checked to ensure they are within their service lives and installed properly. The filter racks should be inspected to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass.

RF-3: *Check differential pressure sensors across the filter banks.*

There are existing differential pressure sensors installed for each bank of filters in each of the air handlers. We recommend reviewing the location of the pressure taps and the resulting pressure readings. We found one instance where a tap may have been relocated improperly after a baffle was installed in the mixed air plenum.

RF-3a: *Check the pressure sensors' alarms on the BMS.*

Alarm setpoints for each bank of filters should be reviewed, to ensure they are consistent with the filter manufacturer's recommendation.

2.2 Testing & Balancing Recommendations

The air handling units are approximately 10 years old and have not been tested and balanced since construction. Some of the modifications made to the OA intakes during commissioning may have affected the accuracy of the airflow measuring stations. It is not known by Tighe & Bond if these units were rebalanced after the modifications were installed.

We recommend the following testing and balancing measures be implemented:

RTB-1: *Test and balance air handling unit supply air and minimum outside air flow rates.*

We recommend testing and balancing the outdoor air flow rates for all air handling units to the recommended minimum O.A. rates listed in Table 2.

TABLE 2
Recommended Air Handler O.A. Flow Rates

Unit	Original Supply Airflow (CFM)	Original Design Min. O.A. (CFM)	Current Code Min. O.A. Requirements (CFM)	Recommended Minimum O.A. (CFM)
AHU-1	33,000	7,500	1,900	**7,500**
AHU-2	4,500	4,500	N/A	**4,500**
AHU-3	14,500	4,500	4,300	**4,500**
AHU-4	20,500	9,500	9,300	**9,500**
AHU-5	13,000	4,000	3,700	**4,300**
AHU-6	20,000	7,000	7,500	**7,600**
AHU-7	17,500	6,500	6,900	**6,900**
AHU-8	10,000	2,500	2,300	**2,500**
AHU-9	4,000	4,000	N/A	**4,000**

Note: Although the ASHRAE Position Document on Infectious Aerosols recommends using the latest published standards and codes as a baseline for minimum ventilation, the mechanical code in effect at the time the HVAC systems were designed and constructed is what governs the required outdoor air flowrate for the HVAC equipment, if there have been no additions, renovations, alterations or changes in occupancy to the building. The 2015 International Mechanical Code does not prevent the continued use of existing systems.

Our ventilation air analysis discovered a few spaces that are not receiving the correct quantity of outdoor air based on today's code requirements at full occupancy. These include courtrooms and conference rooms served by AHU-5, AHU-6, and AHU-7. Our calculations showed that the additional outdoor air required to handle full code occupancy would exceed the capacity of the heating and cooling coils. We recommend temporarily reducing the occupancy of the spaces that are not receiving the code required ventilation air. Table 3 lists the spaces that would require a reduced occupancy. The recommended outdoor air flow rates listed in Table 2 reflect the outdoor air requirements based on a reduced occupancy shown in Table 3.

TABLE 3
Recommended Occupancy During COVID-19 Pandemic

Room & Associated AHU	***2015 IMC Default Occupancy (# of People)***	***Recommended Occupancy (# of People)***
AHU-5		
Library Conference Room	8	4
Victim Witness Conference 0202	5	3
Public Conference Room 0202	7	5
AHU-6		
Pre-Trial Conference Room 3302	8	4
Pre-Trial Conference Room 3303	8	4
Pre-Trial Conference Room 3402	8	4
Pre-Trial Conference Room 3403	8	4
Pre-Trial Conference Room 3505	6	3
Pre-Trial Conference Room 3506	6	3
Off-Bench Judges Conference 1519	9	6
Juvenile Courtroom 1500	123	60
Housing Courtroom 1 3300	138	62
Probate/Family Courtroom 1 3400	139	67
Probate/Family Courtroom 2 3500	115	50
AHU-7		
Pre-Trial Conference Room 1004	5	2
Interpreter Services Room 3004	7	4
Pre-Trial Conference Room 3005	5	3
Pre-Trial Conference Room 3006	5	4
Pre-Trial Conference Room 3118	6	3
Conference Room 3122	5	2
Pre-Trial Conference Room 3202	7	3
Pre-Trial Conference Room 3203	7	3
Off-Bench Conference 3206	9	5
District Courtroom 1 1000	175	88
District Courtroom 2 3200	116	50
District Courtroom 3 3100	116	50
District Courtroom 4 3000	187	94

During the pandemic, we recommend maintaining the outdoor airflows at the original designed values where they exceed the code minimums calculated by Tighe & Bond. Supplying more outdoor than required by code will provide better indoor air quality.

Where we recommend increasing the outdoor air beyond the original design (as with AHU-5, AHU-6, and AHU-7), it appears the cooling and heating coils should be able to provide leaving air conditions similar to the original design under peak outdoor air conditions, assuming the coils are clean and their performance has not degraded over time. Supply air temperatures during the heating and cooling season should be monitored to ensure they do not significantly deviate from design values. If the supply air temperature cannot be maintained, the outdoor airflow rate should be reduced, but not below the originally designed outdoor air flow rates.

Where we do not recommend increasing outdoor air to the current code requirements, as with AHU-7, it appears the cooling and heating coils would not be able to maintain the proper leaving air temperature under peak outdoor air conditions if outdoor air were increased beyond the amount recommended.

The average airflow rate per person is shown below in Table 4. These values are based on the original full design supply airflow rate and the recommended outdoor airflow rates shown in Table 2. The airflow rate per person assumes a diversity factor of 70%, meaning the maximum number of occupants assumed to be in all zones at all times equates to 70% of the code default occupancy.

TABLE 4
Average Airflow Rate per Person

	All Spaces	***Courtrooms***	***Non-Courtroom Spaces***
Total Occupancy (People)	1,509	776	733
Total Supply Air (CFM/Person)	85	27	147
Outdoor Air (CFM/Person)	28	10	47

The airflow rate per person for each Courtroom is shown below in Table 5. These values are based on full occupancy without taking diversity into account, the original full design supply airflow rate, and the recommended outdoor airflow rate. The airflow rate per person assumes the full supply airflow is being delivered to the room. At times when the supply airflow is reduced due to the space temperature being satisfied, the airflow rate per person will also be reduced.

TABLE 5
Airflow Rate per Person (Full Occupancy)

		Total Air		***Outdoor Air***	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Juvenile Courtroom 1500	123	2,400	20	912	7
Housing Courtroom 1 3300	138	2,500	18	950	7
Probate/Family Courtroom 1 3400	139	2,500	18	950	7
Probate/Family Courtroom 2 3500	115	2,000	17	760	7
Jury Deliberation 3115	22	1,000	45	394	18
District Courtroom 1 1000	175	3,700	21	1,459	8
District Courtroom 2 3200	116	2,000	17	789	7
District Courtroom 3 3100	116	2,000	17	789	7
District Courtroom 4 4000	187	3,900	21	1,538	8
Jury Waiting Room 3525	82	3,300	40	1,254	15

Note: Courtroom occupant density is based on 70 people/1,000 square feet, per the 2015 International Mechanical Code

The airflow rate per person for each Courtroom, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 5a. The airflow rate per person assumes the full supply airflow is being delivered to the room. At times when the supply airflow is reduced due to the space temperature being satisfied, the airflow rate per person will also be reduced.

TABLE 5a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		***Outdoor Air***	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Juvenile Courtroom 1500	28	2,400	86	912	33
Housing Courtroom 1 3300	28	2,500	89	950	34
Probate/Family Courtroom 1 3400	29	2,500	86	950	33
Probate/Family Courtroom 2 3500	23	2,000	87	760	33
Jury Deliberation 3115	6	1,000	167	394	66
District Courtroom 1 1000	35	3,700	106	1,459	42
District Courtroom 2 3200	28	2,000	71	789	28
District Courtroom 3 3100	28	2,000	71	789	28
District Courtroom 4 4000	42	3,900	93	1,538	37
Jury Waiting Room 3525	27	3,300	122	1,254	46

Note: If occupancy is further reduced, the airflow rate per person will increase, assuming full airflow is being delivered to the space.

RTB-2: *Rebalance system return air flow rates.*

We recommend rebalancing the return fan airflow rates to ensure the correct quantities of return air are being delivered to the air handlers.

RTB-3: *Increase outside air flow rate beyond minimum under non-peak conditions.*

We recommend increasing the outdoor air flow rate to the values in Table 6 during non-peak outdoor air conditions during the pandemic only. This may require additional controls to implement. We do not believe this create the potential for a coil to freeze given the amount of outside air as a percentage of total supply air,

however cold spots on the coil may develop due to poor mixing. This may cause nuisance freeze stat trips via the existing freeze stats.

TABLE 6
Recommended Air Handler O.A. Flow Rates During Non-Peak Conditions

Unit	Original Supply Airflow (CFM)	Recommended Min. O.A. (CFM)	Recommended Min. O.A. Under Non-Peak O.A. Conditions (CFM)
AHU-5	13,000	4,300	4,500
AHU-6	20,000	7,600	10,000
AHU-7	17,500	6,900	8,800

The return air to each air handler will also have to be adjusted to accommodate the additional outdoor air during the operation of this sequence.

RTB-6: *Test and balance all air handler chilled and hot water coils.*

Testing and balancing the air handler hot and chilled water coils will help ensure the coils are receiving the proper water flow rates. Due to the age of the coils, the coils may not perform as required to properly temper the supply air. Coils become fouled over time, which degrades the performance.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

RE-2: *Clean air handler coils and drain pans.*

According to facilities personnel, the heating and cooling coils in the air handlers have not been cleaned since they were installed. While they are in generally good condition, there was visible dirt and debris on some of the coils. These should be cleaned to maximize heat transfer and minimize pressure loss.

Photo 3 – Typical Light Accumulation of Debris on Preheat Coil

RE-4: *Inspect VAV boxes and controllers.*

VAV boxes regulate the supply air delivered to each space. At a minimum, we recommend cycling the damper positions and testing the airflow to verify the maximum and minimum airflow rates are being delivered as designed to the Courtrooms in Tables 4 and 4a and other spaced with multiple occupants such as the Jury Deliberation rooms. Any boxes not delivering the expected airflow rates should be repaired and rebalanced as required.

2.4 Control System Recommendations

We recommend the following for the control system:

RC-1: *Implement a pre-occupancy flush sequence.*

This sequence should start all air handlers and exhaust fans before the building is occupied, with the start time calculated to provide three air changes per hour (ACH) of ventilation air, or for two hours before people arrive. Systems should be run in occupied mode while cleaning staff are in the building.

RC-2: *Install controls required to introduce outside air beyond the minimum requirements.*

The existing BMS appears to be sophisticated enough to implement this type of sequence, however new control sequences must be defined.

RC-4: *Confirm the economizer control sequence is operational.*

RC-5: *Disable demand control ventilation sequences.*

For the duration of the COVID-19 pandemic, we recommend disabling any DCV sequences that may reduce the volume of outdoor air into spaces with reduced occupancy.

2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

RFC-1: *Install portable HEPA filters.*

If the Taunton Trial Court is to operate at a high capacity (i.e. 50% occupancy or greater), we recommend installing portable HEPA filters in high traffic areas, such as entrance lobbies or where people congregate outside courtrooms. They should also be considered for courtrooms, depending on the occupancy of the room and how much noise is generated from the filters. The noise levels will vary depending on the manufacturer.

2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of adding active humidification is determined by the building envelope. Buildings that were not designed to operate with active humidification can potentially be damaged due to a lack of a vapor barrier, adequate insulation, and air tightness.

Duct mounted humidifiers must be engineered, integrated into the building control system, tested, and commissioned. They are available in many configurations but require substantial maintenance and additional controls. They also run the risk of adversely affecting IAQ from growing microorganisms, or leaking water through poorly sealed ductwork damaging insulation and ceilings. Portable humidifiers are easier to install and require less maintenance, but still have the potential to damage the building envelope.

While active humidification is not recommended as a whole building solution due to high installation costs, operational costs, potential to damage the building envelope and adversely affect poor IAQ, it may be warranted as a temporary solution in some areas.

2.7 Other Recommendations

2.7.1 Repair Screens in Outdoor Air Louvers

Court personnel regularly clean the OA louvers by washing from the inside to remove leaves and other debris. The louvers are installed sufficiently above the roof level so they

do not accumulate excessive debris. There are insect screens inside the fixed louver blades, and in some cases we noted a significant number of holes. We recommend removing the louvers and replacing the screens, to prevent debris from fouling the filters and coils.

Photo 4 – Damaged Insect Screen Inside OA Louver

2.7.2 Repair, Reconfigure, Adjust, and Rebalance Airflow Stations

The Taunton Trial Court has airflow measuring stations on the supply, return, and outdoor air ducts of systems that serve occupied areas. If these are reporting accurately, the supply airflow should equal the sum of the return and outdoor airflows added together. These flow stations should be checked and repaired as needed. It is our opinion that units with a variance greater than 10% should be addressed.

The airflow readings observed while on site and deviations are tabulated below. These readings, flow stations, and sequences should be checked, adjusted, and repaired as needed to get the airflows to more closely match, within 10%.

TABLE 7
Airflow Station Measurements at Time of Visit

Unit	Outdoor Airflow (OA CFM)	Return Airflow (RA CFM)	Sum of Airflows (CFM)	Supply Airflow (SA CFM)	Difference
AHU-1	8,554	6,487	15,041	19,599	-23%
AHU-3	2,376	6,278	8,654	13,521	-36%
AHU-4	5,420	2,939	8,359	9,061	-8%
AHU-5	5,898	3,643	9,541	10,490	-9%
AHU-6	5,259	7,897	13,156	11,324	+16%
AHU-7	4,565	3,815	8,380	9,215	-9%
AHU-8	1,607	2,735	4,342	4,701	-8%

2.8 Taunton Trial Court Recommendations Checklist

Recommended Immediate Actions

1. ☐ 2.7.2: Repair, Reconfigure, Adjust, and Rebalance Airflow Stations

Recommended Actions

2. ☐ RF-1: Continue to use MERV-8 prefilters and MERV-14 final filters
3. ☐ RF-3: Check differential pressure sensors across the filter banks
4. ☐ RF-3a: Check filter pressure sensor alarms on the BMS
5. ☐ RTB-1: Test and balance air handling unit airflow rates
6. ☐ RTB-2: Rebalance system return air flow rates
7. ☐ RTB-3: Increase OA rate beyond minimum under non-peak conditions
8. ☐ RTB-4: Test and balance zone damper airflow rates
9. ☐ RTB-6: Test and balance all air handler chilled and hot water coils
10. ☐ RE-2: Clean air handler coils and drain pans
11. ☐ RE-4: Inspect VAV boxes and controllers
12. ☐ RC-1: Implement pre-occupancy flush sequence
13. ☐ RC-2: Install controls to provide OA beyond code-required minimum
14. ☐ RC-4: Confirm the economizer control sequence is operational
15. ☐ RC-5: Disable demand control ventilation sequences
16. ☐ RFC-1: Install portable HEPA filters

Other Actions

17. ☐ 2.7.1: Repair Screens in Outdoor Air Louvers

Disclaimer

Tighe and Bond cannot in any way guarantee the effectiveness of the proposed recommendations to reduce the presence or transmission of viral infection. Our scope of work is intended to inform the Office of Court Management on recommendations for best practices based on the guidelines published by ASHRAE and the CDC. Please note that these recommendations are measures that may help reduce the risk of airborne exposure to COVID-19 but cannot eliminate the exposure or the threat of the virus. Implementing the proposed recommendations will not guarantee the safety of building occupants. Tighe & Bond will not be held responsible should building occupants contract the virus. The Office of Court Management should refer to other guidelines, published by the CDC and other governing entities, such as social distancing, wearing face masks, cleaning and disinfecting surfaces, etc. to help reduce the risk of exposure of COVID-19 to building occupants.

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Section 3
Testing & Balancing Results

Wing's Testing & Balancing Co. visited the Taunton Trial Courthouse on May 6, 2021 to test the airflow rates of the air handling units and the exhaust fans. Summaries of the tested airflow rates versus the design airflow rates are shown below in Tables 8 and 9. The full testing and balancing report is attached. The balancing report also contains the water flow rate testing results of the air handler hot and chilled water coils.

TABLE 8
Air Handler Testing & Balancing Results

	Design			Actual		
Unit	**Total Supply Fan Airflow (CFM)**	**Recommended Outdoor Airflow (CFM)**	**Return Airflow (CFM)**	**Supply Fan Airflow (CFM)**	**Outdoor Airflow (CFM)**	**Return Airflow (CFM)**
AHU-1	33,000	7,500	25,500	34,577	7,176	27,401
F-19/AHU-1 RF	N/A	N/A	27,500	N/A	N/A	**22,698**
AHU-2	4,500	4,500	N/A	4,153	4,153	N/A
AHU-3	14,500	4,500	10,000	17,308	4,576	12,832
F-20/AHU-3 RF	N/A	N/A	12,500	N/A	N/A	13,408
AHU-4	20,500	9,500	11,000	24,969	**13,987**	10,982
F-21/AHU-4 RF	N/A	N/A	11,000	N/A	N/A	10,655
AHU-5	13,000	4,300	9,000	13,680	**6,280**	7,400
F-22/AHU-5 RF	N/A	N/A	10,500	N/A	N/A	11,223
AHU-6	20,000	7,600	13,000	19,888	6,983	12,905
F-23/AHU-6 RF	N/A	N/A	16,500	N/A	N/A	17,502
AHU-7	17,500	6,900	11,000	16,042	6,240	9,802
F-24/AHU-7 RF	N/A	N/A	15,000	N/A	N/A	17,498
AHU-8	10,000	2,500	7,500	10,380	2,636	7,744
F-25/AHU-8 RF	N/A	N/A	8,000	N/A	N/A	9,428
AHU-9	4,000	4,000	N/A	4,256	4,256	N/A

TABLE 9
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Exhaust Airflow (CFM)	Actual Exhaust Airflow (CFM)
EF-9	Cells	600	643
EF-10	Cells	350	374
EF-11	Cells	600	620
EF-13	Toilets	2,900	2,924
EF-14	Toilets	4,300	4,581
EF-15	Toilets	3,525	3,802
EF-29	Toilets	4,500	4,851

Typical balancing tolerance for air systems is ±10% of the design airflow. In VAV systems, airflow issues may reside in downstream VAV boxes resulting in a total supply airflow reading at the air handler less than the designed value. Further investigation is required to determine the cause of a low airflow reading at the air handling unit.

Based on our review the TAB report, the following should be noted:

1. The AHU-1 supply fan is performing within the acceptable range, however the return fan is significantly underperforming. The return fan (F-19/AHU-1 RF) is returning approximately 5,000 CFM less airflow than specified, possibly over-pressurizing the spaces this air handler serves. We recommend that the controls contractor further investigate the operation of the return fan and make corrections to provide a return airflow rate of 27,500 CFM.
2. AHUs 2, 3, 6, 7, 8, and 9 are performing within the acceptable airflow range.
3. It appears the filters in AHU-2 and AHU-9 can be upgraded to MERV 13.
4. AHU-4 and AHU-5 have outside airflow rates that are much higher than the specified design airflow rates. The TAB contractor has noted that these units have two outdoor air dampers, the first is a two-position minimum damper and the second is a modulating min/max damper. The two-position minimum damper was open and the min/max damper was shut at the time of the testing. We recommend investigating whether these dampers are operating in accordance with the sequence of operations specified for these units, or if the two-position damper can have its maximum open position adjusted.
5. According to the TAB contractor, the Siemens hot water control valve for AHU-9 appears to be physically damaged and should be replaced. Due to the damage it is only able to open 50% of the way.
6. All tested exhaust fans are performing within acceptable range.

7. The flow rates on 6 of 9 hot water coils were adjusted to bring them within tolerance, including three AHUs that initially had flow rates as high as 2-3 times design. These units (AHU-2, AHU-3, and AHU-5) should now provide better control of supply air temperature in winter.
8. The flow rates on 3 of 6 chilled water coils were adjusted to bring them within tolerance, including one AHU that initially had only 13% of the design flow rate. We expect this unit, AHU-4, to better cool and dehumidify outdoor air in summer.
9. The TAB contractor noted a pulsation at the AHU-7 chilled water coil and could not get a reading on its flow rate. They also noted that the Nexus circuit setter for this valve does not open or close and should be replaced.

WING'S TESTING & BALANCING CO., INC.

Taunton Justice Center
HVAC/Ventilation Survey

* * * *

Tighe & Bond
Attn: Jason Urso
53 Southampton Road
Westfield, MA 01085

May 6, 2021

94 North Branford Road • Suite One • Branford, CT 06405
(203) 481-4988 • Fax (203) 488-5634 • wings@wingstesting.com
SM-1 License #6803
www.wingstesting.com

WING'S TESTING & BALANCING CO., INC.

May 6, 2021

Tighe & Bond
Attn: Jason Urso
53 Southampton Road
Westfield, MA 01085

Re: Taunton Justice Cener/HVAC Ventilation Survey

Dear Jason,

We have completed our HVAC/Fresh-Air survey for the above-mentioned project. Through our testing we found:

- AHU 4 & 5 are over design on their outside air.
  - The outside air louvers have a min/min and a min/max damper. The min/min dampers are only open/close. With the min/min dampers open and the min/max closed we are still achieving above design.
- The Siemens control valve for the hot water is damaged and does not open more than 50%. This valve should be replaced.
- The chilled water circuit setter for AHU-7 is not functioning properly and does not move. There is a huge pulsation of water at this unit, which needs to be investigated. This may be due to the circuit setter which is not functional.

This report includes Brake Horsepower (BHP) calculations. When a motor has a VFD, we take the amperage measurements from there. When we calculate from volts and amps, it means there has to be a nameplate on the motor. Many times, these are missing or illegible. If BHP is not listed for an individual motor, this is because we do not have enough information to calculate it. It should be noted that that the older a motor is, the less likely it is to follow the affinity laws for BHP- since the efficiency degrades over time. We have used accepted constants for efficiency and the power factor, which should result in fairly close calculations, but are not as accurate for older motors.

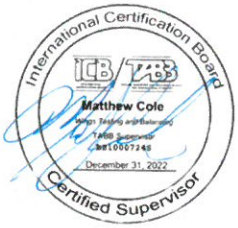
94 North Branford Road • Suite One • Branford, CT 06405
(203) 481-4988 • Fax (203) 488-5634 • wings@wingstesting.com
SM-1 License #6803
www.wingstesting.com

Taunton Justice Center
May 6, 2021

The following pages are your record of current operating conditions. If you have any questions, or if we can be of further service, please do not hesitate to call.

Very truly yours,
Wing's Testing & Balancing Co., Inc.
ICB Certified Contractor for:
TABB—Commissioning—Fire/Life Safety L1&L2—Sound & Vibration

Barry Stratos
Certified TABB Technician



PER THE DESIGN DOCUMENTS THIS VALUE IS 27,500

SUPPLY FAN REPORT

PROJECT: Taunton Justice Center	**DATE:** 5/6/21
AREA SERVED: Various	**TECH:** BS

FAN DATA						
FAN NUMBER	AHU-1		F-19/AHU-1 RF		AHU-2	
LOCATION	Basement		Basement		Boiler Room	
AREA SERVED	Lobby		Lobby		Boiler Room	
MANUFACTURER	McQuay		Cook		McQuay	
MODEL OR SIZE	FB0U100100732		490 CAS		FB0U100100714	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	33,000	34,577	ND	22,698	4500	4153
RETURN AIR	25,500	27,401	---	---	0	0
OUTSIDE AIR	7500	7176	---	---	4500	4153
DISCH. STATIC	---	+2.04"	---	+1.22"	---	0.19
SUCTION STATIC	---	-2.23"	---	-0.94"	---	-1.17
TOTAL STATIC	---	4.27	---	1.16		1.36
FAN RPM	NA	1302	NA	NA		2914
PULLEY O.D.	15 1/2" x 2 7/16"		NA		4" x 1 7/16"	
ESP	---		---		0.57	
VFD SPEED	56 Hz		60 Hz		No VFD	
O.A.D. MIN POS	35%		---		---	
MOTOR DATA						
MANUFACTURER	Baldor		Weg		Baldor	
MODEL OR FR.	326 T		254 T		213 T	
HORSEPOWER	50	50	15	15	7.5	7.5
MOTOR RPM	1775	1775	1725	1775	1770	1770
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	57.0	48.0	18.6	14.6	9.6	6.0
AMPS LEG 2	---	48.9	---	14.7	---	6.1
AMPS LEG 3	---	48.2	---	14.8	---	6.2
SHEAVE O.D.	12 1/2" x 2 1/8"		NA		7" x 1 3/8"	
BELTS - QTY / SIZE	2/5VX950		2/BX124		2/BX32	
SHEAVE POSITION	Fixed		NA		100% Open	
BHP	42.3		11.9		4.8	

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

PER THE DESIGN DOCUMENTS THIS VALUE IS 12,500

SUPPLY FAN REPORT

PROJECT: Taunton Justice Center				**DATE:** 5/6/21		
AREA SERVED: Various				**TECH:** BS		
FAN DATA						
FAN NUMBER	AHU-3		F-20/AHU-3 RF			
LOCATION	4th Fl Mechanical Rm		4th Fl Mechanical Rm			
AREA SERVED	Admin Area		AHU-3			
MANUFACTURER	McQuay		Cook			
MODEL OR SIZE	FB0U100100710		300 QMX			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	14,500	17,308	ND	13,408		
RETURN AIR	10,000	12,832	---	---		
OUTSIDE AIR	4500	4576	---	---		
DISCH. STATIC	---	+1.26"	---	+0.48"	---	
SUCTION STATIC	---	-3.93"	---	-1.18"	---	
TOTAL STATIC	NA	5.19	---	1.66		
FAN RPM	NA	1699	NA	NA		
PULLEY O.D.	6" x 2 3/16"		NA			
ESP	3.31		---			
VFD SPEED	60 Hz		60 Hz			
O.A.D. MIN POS	30%		---			
MOTOR DATA						
MANUFACTURER	Baldor		Baldor			
MODEL OR FR.	286 T		213 T			
HORSEPOWER	30	30	7.5	7.5		
MOTOR RPM	1770	1770	1770	1770		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	35.0	25.0	9.7	7.7		
AMPS LEG 2	---	25.1	---	7.6		
AMPS LEG 3	---	25.4	---	7.7		
SHEAVE O.D.	6 1/4" x 1 7/8"		NA			
BELTS - QTY / SIZE	3/5VX560		NA			
SHEAVE POSITION	Fixed		NA			
BHP	21.5		6.0			

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

PER THE DESIGN DOCUMENTS THIS VALUE IS 11,000

SUPPLY FAN REPORT

PROJECT: Taunton Justice Center	**DATE:** 4/26/21
AREA SERVED: Various	**TECH:** BS

FAN DATA

	AHU-4		F-21/AHU-4 RF		AHU-5	
FAN NUMBER	AHU-4		F-21/AHU-4 RF		AHU-5	
LOCATION	Basement Mech Rm		Basement Mech Rm		Basement	
AREA SERVED	Basement Level		Basement Level		Admin Area	
MANUFACTURER	McQuay		Cook		McQuay	
MODEL OR SIZE	FB0U100100707		270-QMX		FB0U100100719	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	20,500	24,969	ND	10,655	13,000	13,680
RETURN AIR	11,000	10,982	---	---	9000	7400
OUTSIDE AIR	9500	13,987 (1)	---	---	4000	6280 (1)
DISCH. STATIC	---	+2.57"	---	+0.29"	---	+1.84"
SUCTION STATIC	---	-2.42"	---	-0.72"	---	-3.35
TOTAL STATIC	---	4.99	---	1.01	---	---
FAN RPM	---	1241	---	NA	---	2022
PULLEY O.D.	13 1/2" x 1 15/16"		NA		7" x 2 3/16"	
ESP	3.84		---		3.54	
VFD SPEED	60 Hz		60 Hz		58 Hz	
O.A.D. MIN POS	(1)		---		(1)	

MOTOR DATA

MANUFACTURER	Baldor		Teco		Baldor	
MODEL OR FR.	324 T		213 T		284 T	
HORSEPOWER	40	40	7.5	7.5	25	25
MOTOR RPM	1775	1775	1775	1775	1770	1770
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	46	32.2	9.55	5.8	30	24.6
AMPS LEG 2	---	32.5	---	5.8	---	23.6
AMPS LEG 3	---	32.8	---	5.9	---	24.9
SHEAVE O.D.	9 1/2" x 2 1/8"		NA		8" x 1 7/8"	
BELTS - QTY / SIZE	2/5VX1230		NA		2/5VX490	
SHEAVE POSITION	Fixed		NA		Fixed	
BHP	28.3		4.6		19.7	

REMARKS

(1) This unit has two OA dampers. One is a min/min and the other is a min/max OA damper. The min/min damper is only 2 position. OA was set with min/min open and min/max shut.
NA-Not Available
ND-No Design DD-Direct Drive

PER THE DESIGN DOCUMENTS THIS VALUE IS 10,500

PER THE DESIGN DOCUMENTS THIS VALUE IS 16,500

SUPPLY FAN REPORT

PROJECT: Taunton Justice Center | **DATE:** 5/6/21

AREA SERVED: Various | **TECH:** BS

FAN DATA

	F-22 (AHU-5 RF)		AHU-6		F-23 (AHU-6 RF)	
FAN NUMBER						
LOCATION	Basement		4th Floor Mech Rm		4th Floor Mech Rm	
AREA SERVED	AHU-5		Court Offices		AHU-6	
MANUFACTURER	Cook		McQuay		Cook	
MODEL OR SIZE	270 QMX		FB0U100100705		365 QMX	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	ND	11,223	20,000	19,888	ND	17,502
RETURN AIR	---	---	13,000	12,905	---	---
OUTSIDE AIR	---	---	7000	6983	---	---
DISCH. STATIC	---	+0.34"	---	2.25"	---	+0.98"
SUCTION STATIC	---	-0.82"	---	-1.66"	---	-1.06"
TOTAL STATIC	---	1.16	NA	3.91	---	2.04
FAN RPM	---	NA	NA	1010	---	NA
PULLEY O.D.	NA		13 1/2" x 1 15/16"		NA	
ESP	---		2.99		---	
VFD SPEED	60 Hz		49 Hz		60 Hz	
O.A.D. MIN POS	---		55%		---	

MOTOR DATA

MANUFACTURER	Teco		Baldor		Watt Saver	
MODEL OR FR.	213 T		324 T		215 T	
HORSEPOWER	7.5	7.5	40	40	10	10
MOTOR RPM	1775	1775	1775	1775	1765	1765
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	9.55	5.8	46.0	26.8	13.4	9.7
AMPS LEG 2	---	5.6	---	26.7	---	9.4
AMPS LEG 3	---	5.8	---	27.4	---	8.8
SHEAVE O.D.	NA		9 1/2" x 2 1/8"		NA	
BELTS - QTY / SIZE	NA		2/5VX1230		NA	
SHEAVE POSITION	NA		Fixed		NA	
BHP	4.6		23.2		7.0	

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

PER THE DESIGN DOCUMENTS THIS VALUE IS 15,000

SUPPLY FAN REPORT

PROJECT: Taunton Justice Center	**DATE:** 5/6/21
AREA SERVED: Various	**TECH:** BS

FAN DATA						
FAN NUMBER	AHU-7		F-24 (AHU-7 RF)		AHU-8	
LOCATION	4th Floor Mech Rm		4th Floor Mech Rm		4th Floor Mech Rm	
AREA SERVED	Court Rooms		AHU-7		4th Floor	
MANUFACTURER	McQuay		Cook		McQuay	
MODEL OR SIZE	FB0U100100706		365 QMX		FB0U100100720	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	17,500	16,042	ND	17,498	10,000	10,380
RETURN AIR	11,000	9802	---	---	7500	7744
OUTSIDE AIR	6500	6240	---	---	2500	2636
DISCH. STATIC	---	+1.98"	---	+0.88"	---	1.91"
SUCTION STATIC	---	-0.99"	---	-0.99"	---	-2.21"
TOTAL STATIC	NA	2.97	---	1.87	NA	4.12
FAN RPM	NA	1272	NA	NA	NA	1972
PULLEY O.D.	14"x 1 15/16"		NA		5" x 1 11/16"	
ESP	2.15		---		2.13	
VFD SPEED	39 Hz		60 Hz		60 Hz	
O.A.D. MIN POS	45%		---		15%	
MOTOR DATA						
MANUFACTURER	Baldor		Teco		Baldor	
MODEL OR FR.	324 T		213 T		256 T	
HORSEPOWER	40	40	7.5	7.5	20	20
MOTOR RPM	1770	1770	1750	1750	1765	1765
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	46.0	25.2	8.97	6.3	23.5	16.1
AMPS LEG 2	---	25.1	---	6.6	---	16.0
AMPS LEG 3	---	25.5	---	6.7	---	16.2
SHEAVE O.D.	12 1/2" x 2 1/8"		NA		5 1/2" x 1 5/8"	
BELTS - QTY / SIZE	2/BX115		NA		3/5VX780	
SHEAVE POSITION	Fixed		NA		Fixed	
BHP	21.8		5.5		13.6	

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

PER THE DESIGN DOCUMENTS THIS VALUE IS 8,000

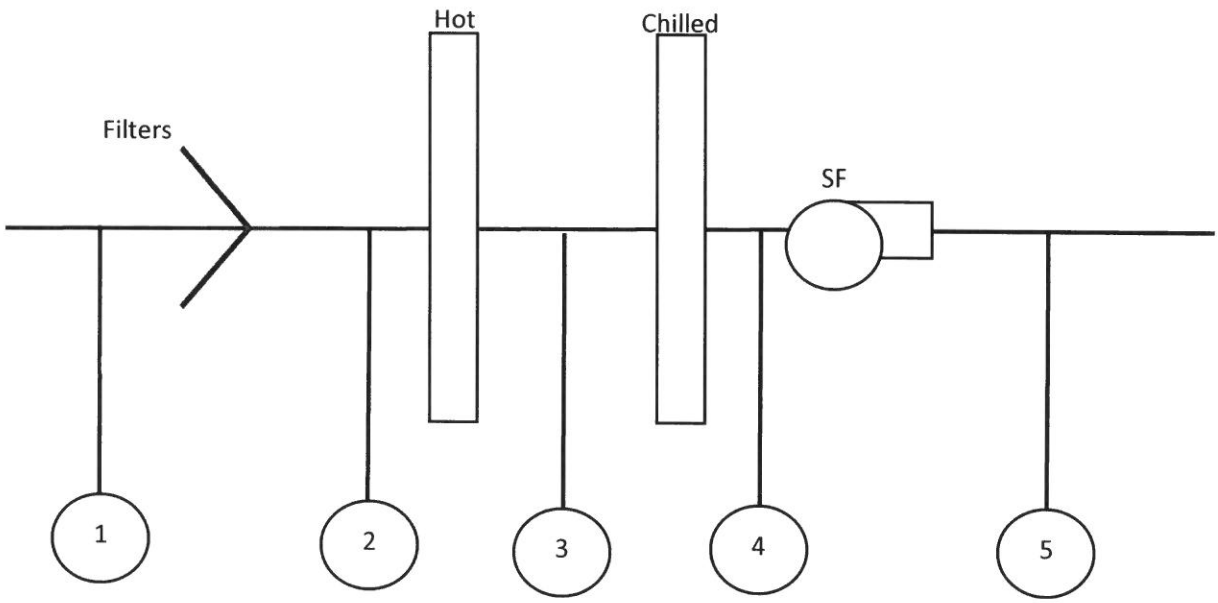
SUPPLY FAN REPORT

PROJECT: Taunton Justice Center				**DATE:** 5/6/21		
AREA SERVED: Various				**TECH:** BS		
FAN DATA						
FAN NUMBER	F-25 (AHU-8 RF)		AHU-9			
LOCATION	4th Floor Mech Rm		Pump Room			
AREA SERVED	AHU-8		Pump Room			
MANUFACTURER	Cook		McQuay			
MODEL OR SIZE	NA		FB0U100100709			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	ND	9428	4000	4256		
RETURN AIR	---	---	0	0		
OUTSIDE AIR	---	---	4000	4256		
DISCH. STATIC	---	+0.18"	---	+0.20"	---	
SUCTION STATIC	---	-1.06"	---	-1.04"	---	
TOTAL STATIC	---	1.24	---	1.24		
FAN RPM	---	NA	NA	2802		
PULLEY O.D.	NA		3" x 1 7/16"			
ESP	1.24		0.51			
VFD SPEED	No VFD		No VFD			
O.A.D. MIN POS	---		100%			
MOTOR DATA						
MANUFACTURER	Teco		Baldor			
MODEL OR FR.	184 T		184 T			
HORSEPOWER	5	5	5	5		
MOTOR RPM	1750	1750	1750	1750		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	6.8	5.0	6.6	4.8		
AMPS LEG 2	---	5.0	---	4.9		
AMPS LEG 3	---	5.1	---	4.8		
SHEAVE O.D.	NA		6" x 1 1/8"			
BELTS - QTY / SIZE	NA		2/AX32			
SHEAVE POSITION	NA		100% Open			
BHP	3.7		3.6			
REMARKS						
NA-Not Available ND-No Design DD-Direct Drive						

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Taunton Justice Center | **DATE:** 5/6/21

SYSTEM/AREA SERV: Various | **TECH:** BS



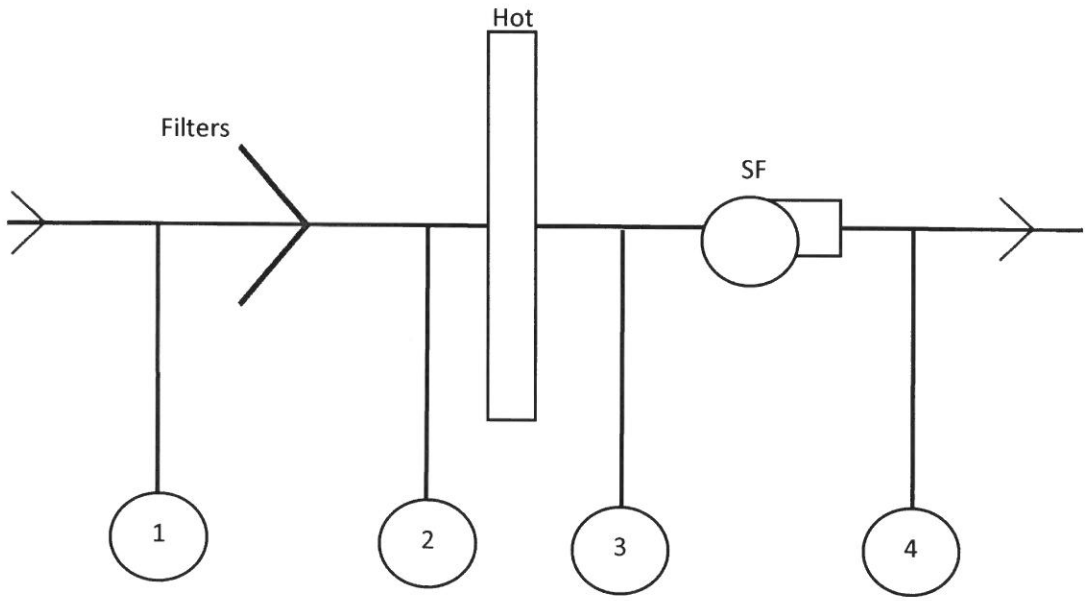
STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	NOTES
AHU-1	-0.74"	-1.38"	-1.71"	-2.23"	+2.04"			
AHU-3	-2.05"	-3.05"	-3.47"	-3.93"	+1.26"			
AHU-4	-1.27"	-1.59"	-1.84"	-2.42"	+2.57"			
AHU-5	-1.70"	-2.21"	-2.60"	-3.35"	+1.84"			
AHU-6	-0.71"	-1.13"	-1.32"	-1.66"	+2.28"			
AHU-7	-0.17"	-0.61"	-0.75"	-0.99"	+1.98"			
AHU-8	-0.22"	-1.26"	-1.69"	-2.21"	+1.91"			

REMARKS

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Taunton Justice Center	**DATE:** 5/6/21
SYSTEM/AREA SERV: Various	**TECH:** BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	NOTES
AHU-2	-0.38"	-0.44"	-1.17"	+0.19"				
AHU-9	-0.31"	-0.38"	-1.04"	+0.20"				

REMARKS

EXHAUST FAN REPORT

PROJECT: Taunton Justice Center | **DATE:** 5/6/21

AREA SERVED: Various | **TECH:** BS

FAN DATA						
FAN NUMBER		EF-9	EF-10	EF-11	EF-13	EF-14
LOCATION		Roof	Roof	Roof	Roof	Roof
AREA SERVED		Cells	Cells	Cells	Toilets	Toilets
MANUFACTURER		Cook	Cook	Cook	Cook	Cook
MODEL OR SIZE		100 CPS	70 CPS	100 CPS	180 CPS	210 CPS
TOTAL CFM	DESIGN	600	350	600	2900	4300
	ACTUAL	643	374	620	2924	4581
FAN RPM	DESIGN	1750	1482	1750	1157	948
	ACTUAL	1916	2020	1901	1202	1124
PULLEY	O.D.	3" x 1"	3" x 1"	3" x 1"	4" x 1 3/16"	6" x 1 7/16"
SERVICE		1.25	1.25	1.25	1.15	1.15
MOTOR DATA						
MANUFACTURER		Marathon	Marathon	Marathon	Baldor	Baldor
MODEL NUMBER		48 Z	48 Y	48 Z	145 T	145 T
MOTOR HP	DESIGN	1/3	1/4	1/3	1.5	2
	ACTUAL	1/2	1/2	1/2	1.5	2
MOTOR RPM		1725	1725	1725	1740	1755
VOLTAGE/PHASE		115/1	115/1	115/1	460/3	460/3
MOTOR AMPS	DESIGN	7.5	7.5	7.5	2.1	2.75
	ACT. LEG 1	---	---	---	1.9	2.2
	ACT. LEG 2	7.3	6.7	7.1	1.8	2.3
	ACT. LEG 3	---	---	---	1.9	2.5
SHEAVE		3 1/2" x 5/8"	4" x 5/8"	3 1/2" x 5/8"	3 1/4" x 7/8"	4" x 7/8"
BELTS-QTY/SIZE		1/4L360	1/4L350	1/4L360	1/A44	1/4L530H
SHEAVE POSITION		50% Closed	50% Open	50% Closed	100% Open	100% Open
BHP		0.5	0.4	0.5	1.3	1.6

REMARKS

EXHAUST FAN REPORT

PROJECT: Taunton Justice Center | **DATE:** 5/6/21

AREA SERVED: Various | **TECH:** BS

FAN DATA						
FAN NUMBER		EF-15	EF-29			
LOCATION		Roof	Roof			
AREA SERVED		Toilet	Cells			
MANUFACTURER		Cook	Cook			
MODEL OR SIZE		195 CPS	245 CPS			
TOTAL CFM	DESIGN	3525	4500			
	ACTUAL	3802	4851			
FAN RPM	DESIGN	1061	815			
	ACTUAL	1291	874			
PULLEY	O.D.	5" x 1 3/16"	7" x 1 1/16"			
SERVICE		1.15	1.15			
MOTOR DATA						
MANUFACTURER		Baldor	Baldor			
MODEL NUMBER		145 T	145 T			
MOTOR HP	DESIGN	1.5	2			
	ACTUAL	1.5	2			
MOTOR RPM		1755	1755			
VOLTAGE/PHASE		460/3	460/3			
MOTOR AMPS	DESIGN	2.2	2.75			
	ACT. LEG 1	1.9	2.5			
	ACT. LEG 2	1.9	2.4			
	ACT. LEG 3	1.9	2.5			
SHEAVE		4" x 7/8"	3 1/4" x 7/8"			
BELTS-QTY/SIZE		1/4L470	1/AX60			
SHEAVE POSITION		75% Open	100% Closed			
BHP		1.3	1.7			

REMARKS

VELOCITY PRESSURE READINGS

PROJECT: Taunton Justice Center | **DATE:** 5/6/21

AREA SERVED: Various | **TECH:** BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
AHU-1 Total	120" x 82"	68.33	---	33,000	w/velgrid	506	34,577	
AHU-1 Return	---	---	---	25,500	Calc	---	27,401	
AHU-1 O.A.	72" x 48"	24.0	---	7500	w/velgrid	299	7176	
AHU-2 Total	28" x 20" ID	3.89	---	4500	+0.18	1068	4153	
AHU-3 Total	82" x 49"	27.9	---	14,500	w/velgrid	621	17,328	
AHU-3 Return	---	---	---	10,000	Calc	---	12,852	
AHU-3 O.A.	36" x 48"	12.0	---	4500	-0.14	373	4476	
AHU-4 Total	104" x 67"	48.39	---	20,500	w/velgrid	516	24,969	
AHU-4 Return	---	---	---	11,000	Calc	---	10,982	
AHU-4 O.A.	84" x 26"	15.17	---	9500	-0.45	922	13,987	(1)
AHU-5 Total	48" x 20" ID	6.67	---	13,000	1.81	2051	13,680	
AHU-5 Return	---	---	---	9000	Calc	---	7400	
AHU-5 O.A.	48" x 30"	10.0	---	4000	w/velgrid	628	6280	(1)
	---	---						
AHU-6 Total	104" x 67"	48.36	---	20,000	w/velgrid	411	19,888	
AHU-6 Return	---	---	---	13,000	Calc	---	12,905	
AHU-6 O.A.	84" x 26"	16.3	---	7000	w/velgrid	428	6983	
	---	---						
AHU-7 Total	100" x 55"	38.2	---	17,500	w/velgrid	420	16,042	
AHU-7 Return	---	---	---	11,000	Calc	---	9802	
AHU-7 O.A.	62.5" x 48"	20.8	---	6500	w/velgrid	300	6240	

REMARKS

(1)The minimum damper is open with the min/max damper fully closed. The min/min dampers are only 2 position, either open or closed.

VELOCITY PRESSURE READINGS

PROJECT: Taunton Justice Center | **DATE:** 5/6/21

AREA SERVED: Various | **TECH:** BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
AHU-8 Total	40" x 18" ID	5.0	---	10,000	+1.91	2076	10,380	
AHU-8 Return	---	---	---	7500	Calc	---	7744	
AHU-8 O.A.	86" x 59"	35.24	---	2500	w/velgrid	77	2636	
AHU-9 Total	36" x 14" ID	3.5	---	4000	+0.18	1216	4256	
EF-9	15 1/2" x 7 1/2"	0.58	---	600	Anomometer	1109	643	
EF-10	15 1/2" x 7 1/2"	0.56	---	350	Anomometer	668	374	
EF-11	15 1/2" x 7 1/2"	0.58	---	600	Anomometer	1069	620	
EF-13	20" x 14"	1.94	---	2900	w/velgrid	1504	2924	
EF-14	16" x 32 1/5" ID	3.61	---	4300	w/velgrid	1269	4581	
EF-15	14" x 30"	2.92	---	3525	w/velgrid	1302	3802	
EF-29	18 1/2" x 38"	4.88	---	4500	w/velgrid	994	4851	

REMARKS

HYDRONIC FLOW ELEMENTS

PROJECT: Taunton Justice Center | **DATE:** 5/6/21

AREA SERVED: Various | **TECH:** BS

LOCATION	NO.	ELEMENT	MFG.	SIZE	DESIGN GPM	TEST I			FINAL			NOTES
						POS.	PR.DIF	GPM	POS.	PR.DIF	GPM	
Hot Water												
AHU-1	1	---	Nexus	6A	54	Open	36.9	58.0	---	---	---	
AHU-2	2	---	Nexus	6B	30	Open	50.5	82.0	60	29.8	30.0	
AHU-3	3	---	Nexus	6B	31	80	57.0	46.0	70	30.1	31.0	
AHU-4	4	---	Nexus	6A	71	Open	62.3	90	80	51.6	72.0	
AHU-5	5	---	Nexus	6B	25	Open	68.3	80.0	60	26.9	26.0	
AHU-6	6	---	Nexus	6A	46	Open	34.9	55.0	80	21.4	46.0	
AHU-7	7	---	Nexus	6A	45	Open	51.4	60.0	80	22.1	47.0	
AHU-8	8	---	Nexus	4A	19	Open	42.1	20.0	---	---	---	
AHU-9	9	---	Nexus	6B	27	Open	23.2	28.0	---	---	---	(1)
Chilled Water												
AHU-1	1	---	Nexus	4"	220	Open	13.1	230	---	---	---	
AHU-3	2	---	Nexus	3"	105	Open	10.1	105	---	---	---	
AHU-4	3	---	Nexus	4"	171	Open	13.0	23.0	80	9.1	170.0	
AHU-5	4	---	Nexus	3"	97	Open	10.2	105				
AHU-6	5	---	Nexus	4"	157	Open	9.9	180	80	8.0	160.0	
AHU-7	6	---	Nexus	4"	140	Open	---	---	---	---	---	(2)
AHU-8	7	---	Nexus	3"	72	Open	9.4	100	70	6.4	75.0	

REMARKS

(1) The Siemens control valve for AHU-9 is damaged and needs to be replaced. It looks like someone smashed it with a hammer & now only opens 50%.

(2) There is huge pulsation of chilled water at this unit making it unreadable. The Nexus curcuit setter does not open or close & should be replaced.