HAMPSHIRE COUNTY COURTHOUSE
HVAC SYSTEM EVALUATION SUMMARY

Visited October 8, 2020. Inspected the air handling units and toured the occupied portions of the building to determine if the spaces generally matched the expected layout and usage noted on the architectural plans. The available documentation for the mechanical systems in this facility is very limited. The Hampshire County Courthouse facility is located in a complex consisting of four three-story buildings, with a total floor area of approximately 77,000 gross square feet. The Historic Courthouse is located in the southernmost building, which was built in 1883 and is approximately 20,000 square feet in size. The Courts utilize approximately 6,500 square feet of this building. North of the Historic Courthouse is the building that houses clerks and courtrooms, built in 1930. Between 1973 and 1976, both these buildings were substantially renovated, a "Link" building was added in between, and an addition on the north side was built that houses the lockup and probation department. The 1973-1976 project also included replacing all HVAC equipment. The HVAC system includes seven constant-volume air handling units (AHUs), located in several mechanical rooms in each of the buildings.

1.0 Airflow Rate per Person (Reduced Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	*Total People*	*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Jury Pool Room	18	Unknown	Unknown	Unknown	-
District Court 3 (Basement)	17	Unknown	Unknown	750*	44
District Court 1 (1st Floor)	29	Unknown	Unknown	1,050*	36
District Court 2 (1st Floor)	19	Unknown	Unknown	850*	45
Superior Court 204 (2nd Floor)	27	Unknown	Unknown	1,050*	39
Superior Court 302 (2nd Floor)	43	Unknown	Unknown	1,500*	35

Note: If occupancy is further reduced, the airflow rate per person will increase, assuming full airflow is being delivered to the space.
*Outside airflow listed is only an estimate. Further information about the existing system distribution is required to determine the code required outdoor air flow rate.

2.0 Recommendations

Section	Recommendation/Finding	Action
2.1	**Filtration Efficiency**	
	No actionable items identified	MERV-13 in use
2.2	**Testing and Balancing**	
RTB-1	Test and rebalance AHU supply air and minimum outside air flow rates.	Complete

Hampshire County Courthouse HVAC System Evaluation Summary – Continued		
RTB-3	Increase outside air flow rate beyond minimum under non-peak conditions	Complete
RTB-5	Test and balance air inlets and outlets	N/A
RTB-6	Test and balance all air handler chilled and hot water coils	N/A
2.3	Equipment Maintenance and Upgrades	
RE-1	Test existing air handling system dampers and actuators for proper operation	Complete
RE-2	Clean air handler coils and drain pans	Complete
2.4	Control System	
RC-1	Implement a pre-occupancy flush sequence	Complete
RC-3	Install controls required to introduce outside air beyond the minimum requirement in a stepped approach	In-progress
RC-4	Confirm economizer control sequence is operational	Complete
2.5	Additional Filtration and Air Cleaning	
RFC-1	Install portable HEPA filters – *if courthouse is to operate at a high occupancy (i.e. 50% or greater), install portable HEPA filters in high traffic areas.*	In-progress
2.6	Humidity Control	
	No actionable items listed – continuous monitoring for seasonal changes	On-going
2.7	Other Recommendations	
2.7.1	Repair and Recommission HVAC-6	Deferred – included in 5-year Capital Plan
2.7.2	Replacement of Air Handling Units	Deferred – included in 5-year Capital Plan

Hampshire County Courthouse
Northampton, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

January 25, 2021

Tighe&Bond

Section 1
Existing Conditions and Site Observations

Tighe & Bond visited the Hampshire County Courthouse on October 8, 2020. While on site, we inspected the air handling units and toured the occupied portions of the building to determine if the spaces generally matched the expected layout and usage noted on the architectural plans. The available documentation for the mechanical systems in this facility is very limited.

Site Visit Attendees:

- Office of Court Management:
  - Brian Leibinger, Facilities Systems Supervisor
- Tighe & Bond:
  - Todd Holland, PE, Senior Mechanical Engineer

1.1 Existing Ventilation System Description

The Hampshire County Courthouse is located in a complex consisting of four three-story buildings, with a total floor area of approximately 77,000 gross square feet. The Historic Superior Courthouse is located in the southernmost building, which was built in 1883 and is approximately 20,000 square feet in size. The Courts utilize approximately 6,500 square feet of this building.

North of the Historic Courthouse is the building that houses clerks and courtrooms, built in 1930. Between 1973 and 1976, both these buildings were substantially renovated, a "Link" building was added in between, and an addition on the north side was built that houses the lockup and probation department.

The 1973-1976 project also included replacing all HVAC equipment. The HVAC system includes seven constant-volume air handling units (AHUs), located in several mechanical rooms in each of the buildings.

All AHUs have a hot water heating coil; a chilled water cooling coil; supply air fan; a mixing box with return air (RA) and outdoor air (OA) dampers, and a v-bank filter section. Air handlers HVAC-1 and HVAC-2 have return air fans. Two of the AHUs have a hot water preheat coil and were initially designed to handle a higher volume of outdoor air, and possibly had the capability for a dehumidification sequence. The 2" thick air filters were recently upgraded from MERV-8 to MERV-13, in all units except HVAC-7 which still had MERV-8 filters installed.

All AHUs have newer fan motors and variable frequency drives (VFDs) to modulate fan speed. The supply fan and corresponding return fan is adjusted seasonally:

- Winter: 70% speed
- Spring: 80% speed
- Summer: 40% speed
- Fall: 70% speed (active during site visit)

The AHUs are generally in fair to poor condition, some worse than others. The units are 47 years old, well beyond their expected service lives. According to staff, the motors,

actuators, bearings, and other wear items have been replaced as they failed. The chilled water coil was replaced in HVAC-1, with the same capacity as the original. All the OA and RA dampers observed during the site visit had pneumatic actuators that appeared to be of recent vintage, in good working condition, and according to staff follow the control sequence commands.

At the time of the visit, the emergency generator was being tested, and the OA dampers were fully closed with no OA being drawn into the buildings. All cooling is provided through the AHU's for occupied spaces. Perimeter areas are heated by finned tube radiation.

HVAC-6 serving the Judge's Lobby on the third floor in the Historic Courthouse is no longer used. There is no fan belt and the heating coil is disconnected.

TABLE 1
Existing Air Handlers

Unit #	*Original Design Airflow (CFM)*	*Original Design Min. O.A. (CFM)*	*Filters*	*Condition*
HVAC-1	26,270	Unknown	2" MERV-13	Fair to Poor
HVAC-2	28,700	Unknown	2" MERV-13	Fair to Poor
HVAC-3	15,600	Unknown	2" MERV-13	Fair to Poor
HVAC-4	5,865	Unknown	2" MERV-13	Poor
HVAC-5	11,515	Unknown	2" MERV-13	Fair to Poor
HVAC-6	1,910	Unknown	2" MERV-13	Out of service
HVAC-7	8,000	Unknown	2" MERV-8	Fair to Poor

Photo 1 – Representative Coil Condition (HVAC-7)

Photo 2 – AHU-1 components, right to left, v-bank filter section, HW preheat coil, CHW cooling coil, HW reheat coil.

1.2 Existing Control System

The Courthouse has two HVAC control systems, a newer Schneider Electric SmartStruxure DDC system that is layered on top of the original Powers pneumatic control system. We understand that the DDC system provides the following:

1. Occupancy schedule
2. AHU controls:
    a. Temperatures for supply, return, and mixed air
    b. Start/Stop and Status for supply and return fans
    c. Speeds for supply and return fan VFDs
    d. Damper position for outdoor and return air
    e. Control valve position for chilled and hot water
    f. Economizer mode – 100% outdoor air when outdoor conditions permit
    g. Low-temperature mixed air (for HVAC-1 and HVAC-2 only, other AHUs have local freeze stats
3. Boiler plant sequencing (boilers and pumps)

4. Chilled water plant sequencing (chillers, towers, pumps)
5. Exhaust fan start/stop

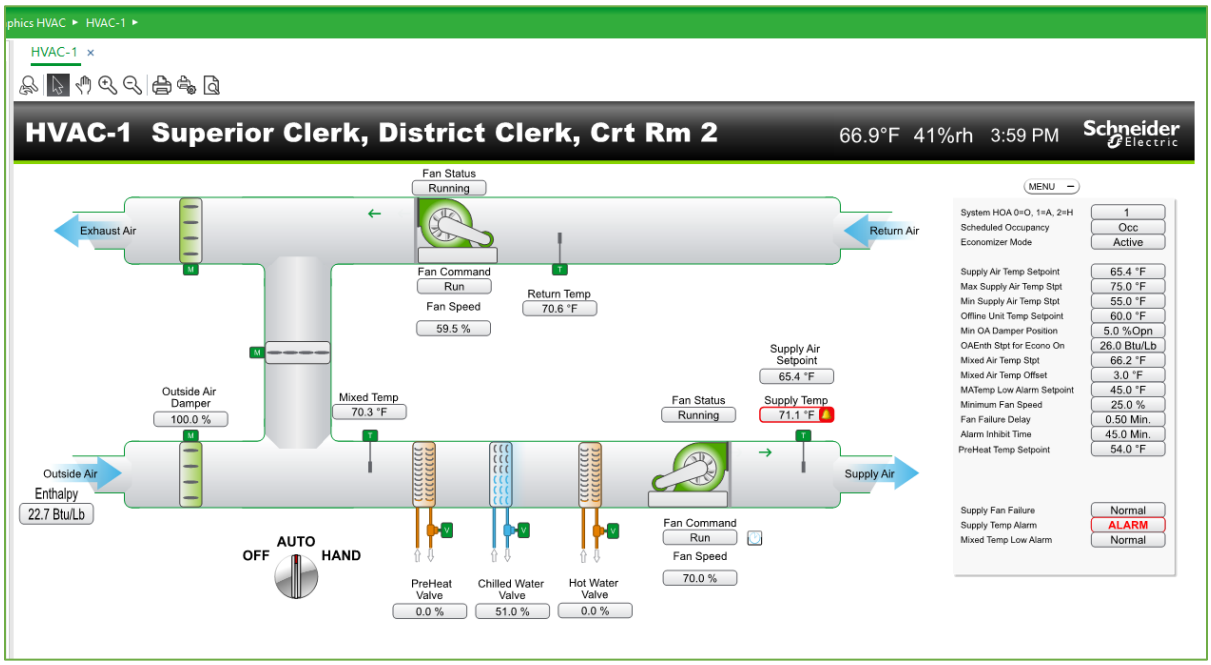

Photo 3 – HVAC-1 AHU Control Screen

Section 2
Recommendations

2.1 Filtration Efficiency Recommendations

The existing MERV-13 filters meet the ASHRAE recommendations for filtration during the pandemic. We recommend maintaining the current level of filtration and completing the changeover to MERV-13 filters in HVAC-7, which we believe was an oversight. The contractor may have confused HVAC-7 with HVAC-6, which is presently out of service.

2.2 Testing & Balancing Recommendations

We recommend the following measures:

RTB-1: *Test and rebalance AHU supply air and minimum outside air flow rates.*

> Tighe & Bond does not currently have enough information on the distribution system for each air handling unit to determine the code-required ventilation rates for any of the systems. In order for us to determine the required ventilation air for the air handlers, the ductwork distribution system would have to be traced throughout the building for each unit.
>
> We recommend testing the current airflow rates at each unit to determine the supply airflow at each of the seasonal speeds, and the return and outdoor airflow at varying damper positions. This tabulated list of measured airflow rates can then be used to estimate the allowable occupancy of each area of the building.
>
> Our calculations show that the building as a whole requires 12,000 cfm of outside air. This is approximately 30% of the total supply airflow in summer, and minimum OA damper position was 5% on BMS screens. These calculations do not take system ventilation efficiency and the primary outdoor air fraction into consideration. These variables are dependent on the specific layout for each system and may increase the quantity of outside air required for each air handler. Since we do not understand the ductwork distribution network for each air handler, we cannot determine the impact of these variables on the required outdoor air.

Based upon the occupant densities outlined in the 2015 International Mechanical Code, the occupancy for the entire building is approximately 1,200 people, assuming all spaces are fully occupied. Using an occupant diversity factor of 70%, the occupant density is 840 people for the building.

The airflow rate per person for each courtroom is shown below in Table 2. These values are based on the code required outdoor air flow rate and assume each Courtroom is fully occupied. However, the outside air flow rate and airflow rate per person listed do not consider ventilation efficiency and the primary outdoor air fraction, which is dependent on the layout of each system. The actual outdoor air flow rate and flow rate per person can be updated upon confirming the ductwork distribution system for each air handler.

TABLE 2
Airflow Rate per Person

		Total Air		Outdoor Air	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Estimated Outside Airflow (CFM)***	***Estimated Airflow Rate (CFM/Person)***
Jury Pool Room	55	Unknown	Unknown	Unknown	-
District Court 3 (Basement)	102	Unknown	Unknown	750[2]	7
District Court 1 (1st Floor)	143	Unknown	Unknown	1,050[2]	7
District Court 2 (1st Floor)	115	Unknown	Unknown	850[2]	7
Superior Court 204 (2nd Floor)	142	Unknown	Unknown	1,050[2]	7
Superior Court 302 (2nd Floor)	205	Unknown	Unknown	1,500[2]	7

1. Courtroom occupant density is based on 70 people/1,000 square feet, per the 2015 International Mechanical Code.
2. Outside airflow listed is only an estimate. Further information about the existing system distribution is required to determine the code required outdoor air flow rate.

The airflow rate per person for each Courtroom and the Jury Pool Room, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 4a. 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 2a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		Outdoor Air	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outside Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Jury Pool Room	18	Unknown	Unknown	Unknown	-
District Court 3 (Basement)	17	Unknown	Unknown	750[1]	44
District Court 1 (1st Floor)	29	Unknown	Unknown	1,050[1]	36
District Court 2 (1st Floor)	19	Unknown	Unknown	850[1]	45
Superior Court 204 (2nd Floor)	27	Unknown	Unknown	1,050[1]	39
Superior Court 302 (2nd Floor)	43	Unknown	Unknown	1,500[1]	35

Note: If occupancy is further reduced, the airflow rate per person will increase, assuming full airflow is being delivered to the space.
1. Outside airflow listed is only an estimate. Further information about the existing system distribution is required to determine the code required outdoor air flow rate.

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

We recommend this strategy for AHU-1, AHU-2, and AHU-7. According to the data received from the manufacturer, these units were originally designed to operate at relatively high OA volumes. The coils generally appear to be in good condition. If this measure is implemented the AHU supply air temperatures should be monitored, as well as indoor humidity levels in representative locations.

RTB-5: *Test and balance air inlets and outlets.*

Lockup areas
The lockup ventilation strategy is based on maintaining a slight airflow deficit in the cells relative to the corridors in the lockup area. To minimize the risk of one prisoner infecting others, it is important that the air balance is correct. If any vents have been accidently closed or if the supply air flow is too high in these areas, the likelihood of cross contamination is increased. Both prisoners and guards are at increased risk in the lockup areas due to the risk profile of prisoners and extended time within these spaces.

Whole building
Tighe & Bond does not currently have enough information on the distribution system to determine the code-required ventilation rates for any of the systems. In order to calculate these values, we also need the airflows tested at all air inlets and outlets throughout the building by a Testing and Balancing Contractor.

To help determine which spaces each air handling unit serves, one possible solution is to run only one air handler at a time while testing the airflows at each inlet and outlet in each room. This will be a time-consuming process and would shut down the ventilation air to most of the spaces during the testing procedure. If this is pursued, we recommend the testing be performed while the building is unoccupied.

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. The current flow rates are also required for Tighe & Bond to calculate the allowable OA fraction for each of the systems. Prior to rebalancing the coils, we recommend verifying the chiller and boiler plants are maintaining the correct supply water temperatures.

2.3 Equipment Maintenance & Upgrades

RE-1: *Test existing air handling system dampers and actuators for proper operation*.

Repair or replace dampers and actuators that are not opening and closing fully, or not going to the position commanded by the BMS.

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

Several coils were noted as being dirty (see Photos 1 and 4). These should be cleaned. All accessible pre-heating, cooling, and heating coils should be inspected and cleaned as necessary.

2.4 Control System

The Hampshire County Courthouse has a BMS. We recommend implementing the following control system strategies into the existing control system:

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

RC-3: *Install controls required to introduce outside air beyond the minimum requirement in a stepped approach.*

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

The screens from the BMS showed inconsistent OA damper position among the air handlers. HVAC-1, HVAC-3, and HVAC-7 were in economizer mode, while HVAC-2, HVAC-4, and HVAC-5 were at minimum OA position. It appears the economizer sequence for HVAC-2, 4, and 5 may not be operating correctly or these systems are not capable of implementing an economizer sequence.

2.5 Additional Filtration and Air Cleaning

Based on conversations with the client, we understand that they would prefer to prioritize improving existing ventilation systems to the extent possible over portable filtration or air cleaning devices such as bipolar ionization or UVGI.

RFC-1: *Install portable HEPA filters.*

If the Courthouse 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. 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. It is also likely that multiple units would be needed for proper air turnover in these high-volume spaces.

2.6 Humidity Control

ASHRAE recommends maintaining indoor humidity between 40% and 60% RH to minimize the risk of airborne virus transmission. If high humidity is a concern for this facility in summer, a dehumidification sequence could be implemented for HVAC-1 and HVAC-2. The sequence would sub-cool the air coming off the cooling coil, and then reheat the supply air to setpoint.

In winter, 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 and Recommission HVAC-6

The non-operational air handler serving the Judges' Lobby should be repaired, refurbished, cleaned, and recommissioned or replaced in full so that ventilation air is provided to this space. The cooling coil and drain pan must be cleaned. The heating coil may need to be replaced. This unit will have to provide code-required ventilation air to the space it serves, even if other systems are presently providing temperature control.

2.7.2 Replacement of Air Handling Units

Replacing all air handlers should be considered within 1-3 years. An indoor central station air handling unit has a life expectancy of approximately 35-40 years. These units are 47 years old and have components that are in poor condition, thus subject to imminent failure, which will result in immediate interruption to Court activities.

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Photo 4 – HVAC-6 cooling coil

Section 3
Testing & Balancing Results

On November 18, 2020, Wings Testing & Balancing Co., Inc. visited the Hampshire County Courthouse to test the airflow rates of the air handling units and the exhaust fans. The Office of Court Management's Automatic Temperature Controls (ATC) Contractor was also on site to assist in the balancing process. A summary of the tested airflow rates versus the design airflow rates are shown below in Tables 3 and 4. Their full testing and balancing report is attached.

TABLE 3
Air Handler Testing & Balancing Results

	Design			Actual		
Unit	**Total Supply Fan Airflow (CFM)**	**Expected* Outdoor Airflow (CFM)**	**Return Fan Airflow (CFM)**	**Supply Fan Airflow (CFM)**	**Outdoor Airflow (CFM)**	**Return Fan Airflow (CFM)**
AHU-1	26,270	2,625	23,645	20,355	Not tested	24,136
AHU-2	28,700	2,870	25,830	21,024	2,001	19,023
AHU-3	15,600	1,560	14,040	11,809	1,156	10,653
AHU-4	5,865	590	5,275	7,297	723	6,574
AHU-5	11,515	1,150	10,365	7,023	720	6,303
AHU-6	1,910	Unknown	Unknown	Not tested	Not tested	Not tested
AHU-7	8,000	800	7,200	7,720	786	6,934

* Expected outdoor airflows are 10% of supply

TABLE 4
Exhaust Fan Testing & Balancing Results

Unit	**Serving**	**Design Return/Exhaust Airflow (CFM)**	**Actual Return/Exhaust Airflow (CFM)**
RF-1	AHU-1	23,645	24,136
RF-2	AHU-2	25,830	19,023

In reviewing the airflow report data, the following should be noted:

1. AHU-6 was not tested because it is not operational.
2. All supply fans were tested at 100% speed (60 Hz), although they run between 40% and 80% speed (24 to 48 Hz), adjusted seasonally.
3. All fan motors are running under their rated full load amperage, 24% to 84% loaded, at full speed.

4. AHU-1, AHU-2, AHU-3, and AHU-5 supply airflows fall well short of design, between 23% and 39% below design values.
5. AHU-4 supply airflow is 24% above the design value.
6. Expected outdoor airflows in Table 3 were calculated using the nominal minimum OA damper position of 10%. The actual code required outdoor airflow rate could not be determined based on the information we have.

Wings Testing and Balancing also noted the following findings in their report:

1. The mixed air damper for AHU-1 is not functioning properly and should be repaired or replaced.
2. AHU-3 and AHU-5 supply airflows fall well short of design.
3. There was no access to the ductwork for the four exhaust fans serving public spaces.
4. There are no balancing valves with test ports to test water flows through the chilled and hot water coils.

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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WING'S TESTING & BALANCING CO., INC.

Hampshire Superior Court
HVAC/Ventilation Survey

* * * *

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

November 18, 2020

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WING'S TESTING & BALANCING CO., INC.

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

November 18, 2020

Re: Hampshire Superior Court/HVAC Ventilation Survey

Dear Jason,

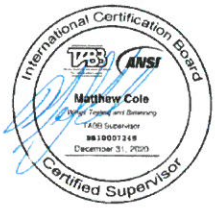
Our HVAC survey of the above referenced is complete. While onsite, we worked with Brian Leibinger, the Controls Contractor. Through our testing we found that the mixed air damper for AHU-1 is not functioning properly and needs to be fixed or replaced. AHU-3 & 5 do not meet design air flow. Also, there is no access to the ductwork for the four exhaust fans that serve public spaces. We would need to do a complete system check of these fans with all the grille readings to all the spaces they serve. Additionally, there are no circuit setters on the hot or chilled water to test flow.

This report has been updated to include 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.

The following pages are your record of the tested conditions. If you have any questions or if we can be of further assistance, 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 BB996928T



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SUPPLY FAN REPORT

PROJECT: Hampshire Superior Court	**DATE:** 11/18/20
AREA SERVED: AHU's	**TECH:** BS

FAN DATA

FAN NUMBER	AHU-1		AHU-2		AHU-3	
LOCATION	Chiller Room		Penthouse		Mech Room	
AREA SERVED	Main Buidling		Main Building		1st Floor	
MANUFACTURER	Trane		Trane		Trane	
MODEL OR SIZE	M-41		M-50		L-31	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	26270	20355 (1)	28700	21024	15600	11809
RETURN AIR	23645	NA	25830	19023	14040	10653
OUTSIDE AIR	2625	NA	2870	2001	1560	1156
DISCH. STATIC	---	+0.99"	---	+0.62"	---	+0.28
SUCTION STATIC	---	-2.82"	---	-1.14"	---	1.33"
TOTAL STATIC	4.2	3.81	3.5	1.76	1.8	1.61
FAN RPM	1335	1148	1104	789	756	741
PULLEY O.D.	10" x 1 7/8"		13" x 2 3/16"		14" x 1 7/16"	
ESP	1.99"		0.82"		0.50"	
VFD SPEED	60Hz		60Hz		60Hz	
O.A.D.MIN POS	NA		10%		10%	

MOTOR DATA

MANUFACTURER	Baldor		Baldor		Siemens	
MODEL OR FR.	286T		286T		254T	
HORSEPOWER	30	30	30	30	15	15
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	36	27.9	36	18.7	19.0	10.4
AMPS LEG 2	---	27.2	---	18.7	---	10.7
AMPS LEG 3	---	25.3	---	18.9	---	10.7
SHEAVE O.D.	6" x 1/18"		5 1/2" x 1 7/8"		7 1/2" x 1 5/8"	
BELTS - QTY / SIZE	3/B95		3/B100		2/B78	
SHEAVE POSITION	Fixed		Fixed		100% Open	
BHP	22.3		15.6		8.4	

REMARKS

(1) Total not full total. Mixed air damper leaking air.

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

SUPPLY FAN REPORT

PROJECT: Hampshire Superior Court	**DATE:** 11/18/20
AREA SERVED: AHU's	**TECH:** BS

FAN DATA

FAN NUMBER	AHU-4		AHU-5		AHU-7	
LOCATION	Law Library		Attic		Attic	
AREA SERVED	Law Library		Jury Court		Old Superior Court	
MANUFACTURER	Trane		Trane		Trane	
MODEL OR SIZE	M-12		M-25		L-17	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	5865	7297	11515	7023	8000	7720
RETURN AIR	5275	6574	10365	6303	7200	6934
OUTSIDE AIR	590	723	1150	720	800	786
DISCH. STATIC	---	+0.80"	---	+0.50"	---	+0.20"
SUCTION STATIC	---	-1.53"	---	-0.48"	---	-0.88"
TOTAL STATIC	2.5	2.33	2.3	0.98	1.5	1.08
FAN RPM	992	974	960	699	873	803
PULLEY O.D.	9 1/2" x 1 7/16"		11 1/2" x 1 7/8"		12" x 1 3/16"	
ESP	1.57"		0.74"		0.35"	
VFD SPEED	60Hz		60Hz		60Hz	
O.A.D.MIN POS	25%		10%		20%	

MOTOR DATA

MANUFACTURER	Techtop		Siemens		Siemens	
MODEL OR FR.	184T		254T		213T	
HORSEPOWER	5	5	15	15	7.5	7.5
MOTOR RPM	1745	1745	1770	1770	1765	1765
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	6.3	4.6	19.0	8.0	9.7	5.0
AMPS LEG 2	---	4.8	---	8.0	---	5.0
AMPS LEG 3	---	4.8	---	8.0	---	5.0
SHEAVE O.D.	6" x 1 3/8"		4 1/2" x 1 5/8"		6" x 1 3/8"	
BELTS - QTY / SIZE	2/A60		2/B71		2/B65	
SHEAVE POSITION	50% Open		Fixed		50% Open	
BHP	3.8		6.3		3.9	

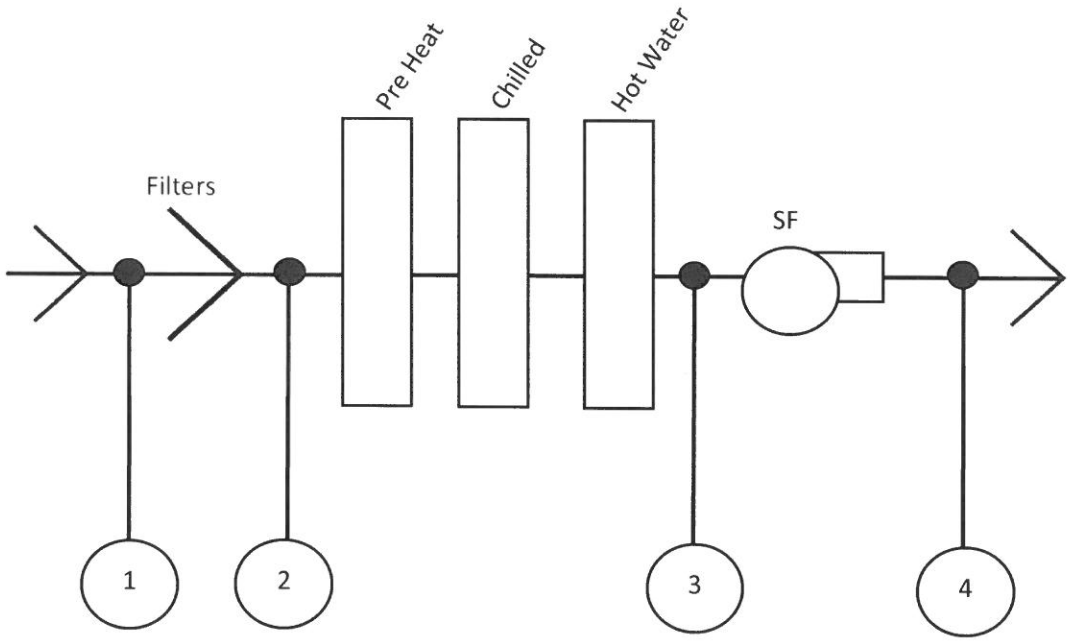
REMARKS

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

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Hampshire Superior Court | **DATE:** 11/18/20

SYSTEM/AREA SERV: AHU's | **TECH:** BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	NOTES
AHU-1	-1.00"	-1.34"	-2.82"	+0.99"				
AHU-2	-0.25"	-0.38"	-1.14"	+0.62"				
AHU-3	-0.22"	-0.44"	-1.33"	+0.28"				
AHU-4	-0.77"	-0.95"	-1.53"	+0.80"				
AHU-5	-0.24"	-0.31"	-0.48"	+0.50"				
AHU-7	-0.15"	-0.25"	-0.88"	+0.20"				

REMARKS

EXHAUST FAN REPORT

PROJECT: Hampshire Superior Court					**DATE:** 11/28/20	
AREA SERVED: Various					**TECH:** BS	
FAN DATA						
FAN NUMBER		RF-1	RF-2			
LOCATION		Boiler Room	Penthouse			
AREA SERVED		Main Building	Main Building			
MANUFACTURER		Cook	Cook			
MODEL OR SIZE		420-ED	430-ED			
TOTAL CFM	DESIGN	23640	25830			
	ACTUAL	24136	19023			
FAN RPM	DESIGN	NA	NA			
	ACTUAL	NA	NA			
PULLEY	O.D.	7.0"	NA			
SERVICE		1.15	1.15			
MOTOR DATA						
MANUFACTURER		Weg	Weg			
MODEL NUMBER		21315T	21315T			
MOTOR HP	DESIGN	10	10			
	ACTUAL	10	10			
MOTOR RPM		1760	1760			
VOLTAGE/PHASE		460/3	460/3			
MOTOR AMPS	DESIGN	12.2	12.2			
	ACT. LEG 1	10.3	8.5			
	ACT. LEG 2	10.3	8.7			
	ACT. LEG 3	10.3	8.6			
SHEAVE		4.5"	4.5"			
BELTS-QTY/SIZE		2/5x480	2/Bx85			
SHEAVE POSITION		Fixed	Fixed			
BHP		8.4	7.0			
REMARKS						

VELOCITY PRESSURE READINGS

PROJECT: Hampshire Superior Court | **DATE:** 11/18/20

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

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
AHU-1 Supply	56" x 36"	14.0	1873	26220	-0.08	1454	20355	
RF-1	42" x 48"	14.0	1689	23640	-0.59	1724	24136	
AHU-2 Supply	50" x 50"	17.36	1653	28200	+0.59	1211	21024	
AHU-2 OA	52" x 42"	15.17	189	2870	-0.037	84	2001	
AHU-3 Supply	36" x 22"	5.50	2836	15600	+0.28	2147	11809	
AHU-3 OA	42" x 22"	6.42	184	1180	w/velgrid	180	1156	
AHU-4 Supply	44" x 24"	7.33	800	5865	+0.77	995	7297	
AHU-4 OA	52" x 8"	2.89	204	590	-0.60	250	723	
AHU-5 Supply	60" x 28"	11.67	987	11515	+0.47	602	7023	
AHU-5 OA	36" x 18"	4.5	256	1150	+0.23	160	720	
AHU-7 Supply	48" x 24"	8.0	1000	8000	+0.18	965	7320	
AHU-7 OA	36" x 24"	6.0	133	800	-0.27	131	786	

REMARKS