Northern Berkshire District Court
North Adams, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

December 14, 2021

Tighe&Bond

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Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Northern Berkshire District Courthouse on February 22, 2021. While on site we inspected the air handling equipment located in the mechanical rooms and on the roof and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management:*
  - Michael Briggs, Facilities
- *Mass MoCA (Owner):*
  - Greg Eastman, Facilities Engineer
  - Zack Moulton, Facilities Staff
- *Tighe & Bond*
  - Sean Pringle, PE, Mechanical Engineer

1.1 Existing Ventilation System

The Northern Berkshire District Courthouse building was constructed in 1961. In 2002, much of the building was substantially renovated for use by the courts. In 2020, the remaining portions of the building were renovated for additional space for the courts. The courthouse is approximately 27,000 square feet in size.

AHU-1 is a constant volume dedicated outdoor air system (DOAS) air handling unit (AHU), which provides all ventilation air to the building. AHU-1 contains outdoor air dampers, 2" MERV 13 filters, a dual temperature coil with a face and bypass damper, and a supply fan. The unit is in good condition.

AHU's 2 and 3 serve the open lobby areas on the first and second floors and receive outdoor air from AHU-1. Each unit contains return and outdoor air dampers, 2" MERV 13 filters, a dual temperature coil, and a supply fan. The units are in good condition.

The packaged RTU's that serve the courtrooms appear to be from the original 2002 renovation and are in fair condition overall. Each unit contains a mixing section, 2" MERV 13 filters, a DX cooling coil, a supply fan, and a gas furnace. Outdoor air is delivered from AHU-1 into the return air ducts for each RTU. While present, the outdoor dampers are fully closed since the outdoor air is provided by AHU-1.

All other areas in the courthouse are conditioned with concealed fan coil units serving each zone. The fan coils have 1" MERV 8 filters, a dual temperature coil, and a supply fan. The outdoor air supply from AHU-1 is distributed to the spaces through different approaches in various areas. In some areas, outdoor air is provided directly into the return ductwork serving the fan coils. In other areas, the outdoor air discharges into the open ceiling return plenum near the fan coils. In the remaining areas (generally corridors and storage areas), the supply air discharges directly into the occupied spaces via supply grilles.

According to the plans, there are eight roof mounted exhaust fans, which are in fair condition. REF's 1-6 serve cells and toilet rooms, and REF 7 and 8 provide relief exhaust for the courtrooms. At the time of our site visit, REF-2 and REF-6 were not operational.

The lockup areas are served by fan coil units which provide 100% outdoor air from AHU-1. Supply air is delivered to the corridors and into each cell. Air is exhausted from each cell at greater rate than the supply (to maintain a slightly negative pressurize) via REF-5.

Hot and chilled water is provided from the Mass MoCA central heating and cooling plant.

During the walkthrough, we noted that the corridor near storage room 222 appears to be dramatically overventilated. This is a small corridor, but the drawings show it receiving 740 CFM of outdoor air. This excess air was preventing doors from automatically closing.

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

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Pre/Final Filters	Condition
AHU-1	8,100	8,100	2" MERV 13	Good
AHU-2	1,550	300*	2" MERV 13	Good
AHU-3	2,040	400*	2" MERV 13	Good
RTU-1	2,100	640**	2" MERV 13	Fair
RTU-2	3,500	400**	2" MERV 13	Fair

*OA for AHU-2 and AHU-3 is provided by AHU-1.
**The OA shown is provided by AHU-1. No OA is provided from the RTU-1 and RTU-2 outdoor air openings.

Photo 1 – AHU-1 Air Handler

1.2 Existing Control System

The HVAC equipment is controlled by a Schneider Building Management System (BMS). The AHU's, RTU's, exhaust fans, zone fan coil units, and room temperature controllers are all tied into the system. There are no demand controlled ventilation (DCV) sequences for this building. The ventilation airflow is constant during occupied periods.

The BMS sends commands for heating, cooling, and fan operation to the packaged RTU's. All other controls are self-contained within the RTU's.

According to staff, the building is currently set to a 24/7 occupancy schedule in response to the COVID-19 pandemic to provide as many air changes as possible overnight.

Section 2
Recommendations

Below is a list of recommendations for the Northern Berkshire District Courthouse. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

2.1 Filtration Efficiency Recommendations

The filters in the air handlers and rooftop units were recently upgraded to use 2" MERV 13 filters. The use of 2" MERV 13 meets the minimum ASHRAE recommendations for filtration during the pandemic. We recommend that a testing and balancing contractor test and document the airflow and static pressure profile of all AHU's and RTU's, as outlined in recommendation RF-1 in the Overview of Recommendations document. This will help determine if the equipment can accommodate the increase in system static pressure associated with the addition of the MERV 13 filters.

We recommend the following measures be implemented for the existing air handling units:

RF-1: *Replace fan coil filters with 1" MERV 13 filters.*

The TAB Contractor and/or Engineer shall verify that the existing fan coils can accommodate a 1" MERV-13 filter while maintaining the design supply airflow. per Appendix A in the overview of recommendations report. Filter racks should be inspected and adjusted to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass.

Note that because 1" MERV 13 filters have a higher pressure drop than 2" MERV 13 filters, the fan coils may not be able to maintain supply airflows with the added restriction of a MERV-13 filter. If airflow cannot be maintained, install a filter with the highest possible MERV rating while maintaining airflow.

RF-3: *Install a differential pressure sensor with a display across the filter bank.*

This measure applies to the AHU's, and if possible, the RTU's. This is likely not practical for the fan coils.

RF-3a: *Connect the pressure sensor to the BMS system.*

Maximum differential pressure should be set per manufacturer's recommendation based on air velocity to ensure filters are within their service lives. Typically, this is not more than 1.0" w.g.

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 20 years old. The whole building was balanced in 2015, and the renovated areas were balanced in March 2021. The code requirements to determine the outdoor air flow rates that were used to design the original system may be different than the 2015 International Mechanical Code (IMC) and current ASHRAE Standard 62.1 requirements.

We recommend the following testing and balancing measures be implemented:

RTB-1: *Test and balance air handling unit supply air and minimum outdoor 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	8,100	8,100	5,000	8,100
AHU-2	1,550	300	150	300*
AHU-3	2,040	400	220	400*
RTU-1	2,100	640	820	820*
RTU-2	3,500	400	920	920*

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.

*Outdoor air provided through AHU-1.

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. For AHU-1, the recommended outdoor air quantity the scheduled capacity. This is slightly higher than the apparent connected load after implementing the recommended changes in this section of 7,700 CFM. During the Covid pandemic, we recommend balancing all supplies to the values shown on the drawings and in this section, and then increasing the fan speed of AHU-1 to obtain approximately 8,100 CFM if possible. After the pandemic has passed, the AHU-1 airflow can be reduced to connected airflow.

Our ventilation air analysis discovered that the design outdoor airflow for the Jury pool room is not adequate based on current code requirements at full occupancy. We recommend increasing the outdoor air delivered to the space to 350 CFM, from the current 200 CFM indicated on the design drawings. This may require an additional duct branch from the AHU-1 supply ductwork which runs above the space. Also, as noted above, it appears that the corridor near room 222 is dramatically overventilated. The airflow to this corridor should be reduced to approximately 100 CFM. We recommend coordinating the response to these issues with the engineer of record for the 2020 project.

We believe the outdoor air for RTU's 1 and 2 can be increased to the recommended values with the current building operation, as the connected load of AHU-1 is currently less than the scheduled capacity. This may require minor changes in

ductwork to accommodate the higher airflow. (see Section 2.7.1 for additional recommendations.)

The average airflow rate per person is shown below in Table 3. 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 required occupancy.

TABLE 3
Average Airflow Rate per Person

	All spaces	***Courtrooms***	***Non-Courtroom Spaces***
Total Occupancy (People)	338	166	172
Total Supply Air (CFM/Person)	68	34	100
Outdoor Air (CFM/Person)	24	11	37

The airflow rate per person for each Courtroom and the Jury Pool Room is shown below in Table 4. 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.

TABLE 4
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)***
Jury Pool Room	40	400	10	350	9
Courtroom #1	112	2,100	19	820	7
Courtroom #2	125	3,500	28	920	7

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 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.

TABLE 4a
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)
Jury Pool Room	9	400	45	350	39
Courtroom #1	15	2,100	140	820	55
Courtroom #2	23	3,500	150	920	40

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

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

Confirm each condenser is operating correctly to ensure the DX coil is receiving the correct refrigerant temperature.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

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

Replace dampers and actuators that are not functioning properly.

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

RE-5: *Confirm the existing freeze stat is working correctly on each air handling unit.*

RE-7: *Test the existing air handler control valves and actuators for proper operation.*

2.4 Control System Recommendations

We recommend the following for the control system:

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

It is our understanding based on conversations with staff that the building is currently being operated in an occupied mode 24/7, possibly including using daytime occupied temperature setpoints. This exceeds the three air change flush sequence recommended by ASHRAE. This likely results in more air changes and energy cost than necessary. If the current strategy is continued, it is recommended that the nighttime temperature setpoints be used instead of the daytime setpoints to reduce energy use.

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

This applies to AHU 2 and 3, and RTU 1 and 2.

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 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.

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 or Replace Holding Cell and Toilet Exhaust Fans

We recommend repairing or replacing the exhaust fans REF-2 and REF-6 that were not working at the time of the visit.

2.7.2 Replace RTU's

While generally in fair condition and well maintained, the RTU's are nearing the end of their expected service life of 20-25 years. Plan to replace the RTU's over the next five years.

Consider selecting RTU's that can provide outdoor air through the RTU, rather than through AHU-1. This would provide some additional capacity margin in AHU-1 and would allow for economizer operation and demand controlled ventilation in the courtrooms (after the pandemic has passed). To allow for this, the replacement units should have modulating or multi-stage heating and preferably modulating or multi-stage cooling as well. This will improve thermal comfort when operating the fans continuously. With a single stage furnace, occupants may feel cold in the winter as the supply air temperature would be very low (approximately 50°F) if the furnace cycles on cold days. Note that the RTU

heating and cooling capacities will also have to be reviewed in order to allow the unit to adequately heat and cool the space with the code-required outdoor air.

Note that there is an exhaust fan within a few feet of the current outdoor air intake for RTU-1. If the outdoor air on the replacement unit is in the same area, the exhaust discharge will need to be relocated to comply with the mechanical code.

This recommendation is a primarily an energy saving measure and does not impact indoor air quality.

2.7.3 Connect Outdoor Air Ductwork to Fan Coils

In many locations, the outdoor air ductwork discharges into ceiling return plenums near the fan coils serving the spaces. This practice is not acceptable, as it does not guarantee that the OA being provided to the plenum will be drawn into the intended unit, especially where several FCU's exist within the same plenum. We recommend connecting the outdoor air ductwork to the return air ductwork. Once completed, the OA to the fan coils should be rebalanced.

Section 3
Testing & Balancing Results

Wing's Testing & Balancing Co., Inc. visited the Northern Berkshire District Court Courthouse on October 24th through October 29th, 2021 to test the airflow rates of the air handling units and the exhaust fans. A summary of the tested airflow rates versus the design airflow rates are shown below in Tables 5 and 7. The full testing and balancing report is attached. The balancing report also contains the water flow rate testing results of the air handler hot water coils. The hot water system flow rates are shown in Table 6. The chilled water coil flow rates were not gathered as the building uses a dual temperature (hot/chilled) water distribution system. The system was operating in heating mode at the time of the test.

TABLE 5
Air Handler Airflow 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	8,100	8,100	0	8,608	8,608	0
AHU-2	1,550	300	1,205	2,081	523*	1,558
AHU-3	2,040	400	1,640	3,071	523*	2,548
RTU-1	2,100	820	1,280	1,938	Not Measured	Not Measured
RTU-2	3,500	920	2,580	3,168	Not Measured	Not Measured

*Only the combined AHU-2/3 outdoor air flow could be measured due to the duct configuration. The individual airflows to each could not be measured. The values shown assume half of the outdoor air is provided to each unit.

TABLE 6
Air Handler Waterflow Testing & Balancing Results

	Design		Actual	
Unit	Chilled Water Flow Rate (GPM)	Hot Water Flow Rate (GPM)	Chilled Water Flow Rate (GPM)	Hot Water Flow Rate (GPM)
AHU-1	80	131	NA	82
AHU-2	15	7	NA	6.3
AHU-3	20	5.5	NA	5

TABLE 7
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Return/ Exhaust Airflow (CFM)	Actual Return/ Exhaust Airflow (CFM)
REF-1	2nd Floor Bathroom	425	85
REF-2	Jan. Closet	125	223
REF-3	NA	200	220
REF-4	Restrooms	880	903
REF-5	NA	1,645	1,483
REF-6	2nd Floor Restroom	75	88
REF-7	NA	1900	NA
REF-8	Court Room	3400	NA

The typical balancing tolerance for air systems is ±10% of the design airflow. Further investigation is required to determine the cause of a low airflow reading at the air handling unit.

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

1. AHU-1 is performing within the acceptable airflow range. It appears the MERV 13 filters are not impacting airflow.
2. AHU-2 and AHU-3 are performing within the acceptable supply airflow range. It appears the MERV 13 filters are not impacting airflow. Although the outdoor airflow to each could not be determined, the total outdoor air being supplied to the units is 140% of design.
    a. Consider reducing outdoor the outdoor airflow to the design airflows after COVID has passed to conserve energy.
    b. Consider balancing the outdoor airflow to each individual unit by measuring outdoor, return, and mixed air temperature as part of any future balancing activities. This should be done during moderate winter weather (35-50°F) and will require temporarily disabling the AHU-1 heating coil to establish a greater temperature difference between the return and outdoor air. Do not conduct this test when outdoor air conditions are near or below freezing. This may cause comfort issues during testing.
3. RTU-1 and RTU-2 are performing within the acceptable supply airflow range. It appears the MERV 13 filters are not impacting airflow. The outdoor airflow from AHU-1 was not measured. The RTU's are not designed to supply any outdoor air directly. The plans show that these units receive outdoor air from AHU-1. The outdoor air is supplied to the return air ductwork within the building, which was not measured.

   a. Consider balancing the outdoor airflow ducts for each of these systems as part of any future balancing activity.
4. The hot water flow through the dual temperature coil of AHU-1 is approximately 60% of the design hot water flow. However, this flow matches the design chilled water flow. The balancer indicated in the report that the hot and chilled flows appeared backwards. However, the scheduled flows are consistent with the design heating / cooling performance requirements and appear to be correct.
   a. If possible, we recommend increasing the flow during hot water operation to the design flow.
   b. If the system is able to maintain the supply air temperature during design outdoor air conditions, then the lower flow may be maintained.
5. REF-1 is operating well below the original design airflow. However, according to staff, this unit now only serves a single private restroom. The measured exhaust airflow is appropriate for this use.
6. REF-2 is operating at 180% of the design airflow.
   a. We recommend rebalancing this fan to meet the design airflow or investigate if the fan was connected to another space, resulting in the increased airflow.
7. REF's 3, 4, 5, and 6 are operating within acceptable tolerances.
8. REF-7 was inoperable. Staff indicated that a replacement had been ordered.
9. The motor operated damper for REF-8 would not open.
   a. The damper and actuator should be replaced or repaired. Once repaired, the fan should be rebalanced.

Disclaimer

Tighe and Bond cannot in anyway 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.

Northern Berkshire District Court

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

November 1st, 2021

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WING'S TESTING & BALANCING CO., INC.

November 1st, 2021

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

Re: Northern Berkshire District Court

Dear, Jason

Wing's has completed the testing and balancing for the above referenced location. Upon arriving onsite, it was noted that all filters are MERV-13 rated. The coils in the units were clean. The water is a dual temp system in heating mode. The results found through our testing are as follows:

- The water is a dual temp system with seasonal change-over bid with different hot and chilled water values.
- The water loop is fed from a different building which serves several other buildings as well.
- AHU-3 requires a sheave change in order to meet design.
- The sheave on AHU-2 is seized up and cannot be adjusted.
- AHU-2 and AHU-3 are served by one common outside air duct.

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
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SUPPLY FAN REPORT

PROJECT:	Northern Berkshire District Court	**DATE:**	10/25/2021
AREA SERVED:	AHU-1, AHU-2, AHU-3	**TECH:**	BS

FAN DATA

FAN NUMBER	AHU-1		AHU-2 (1)		AHU-3 (1)	
LOCATION	Basement		Basement		Basement	
AREA SERVED	Fresh Air ECUs		Lobby		Lobby	
MANUFACTURER	Trane		Trane		Trane	
MODEL OR SIZE	MCCB021		MCCB006		MCCB006	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	8100	8608	2040	3071	1550	2081
RETURN AIR	0	0	1640	2548	1250	1558
OUTSIDE AIR	8100	8608	400	523 (2)	300	523(2)
DISCH. STATIC	---	+0.36"	---	+0.66"	---	+0.44"
SUCTION STATIC	---	-0.61"	---	-1.36"	---	-1.71"
TOTAL STATIC	---	0.97"	---	2.02"	---	2.15"
FAN RPM	---	575	---	1467	---	1460
PULLEY O.D.	12.5" x 1 11/16		6.5" x 1		6.5" x 1	
ESP	0.42		1.40		1.15	
VFD SPEED	42Hz		No VFD		No VFD	
O.A.D.MIN POS	100%		30%		30%	

MOTOR DATA

MANUFACTURER	A.O. Smith		A.O. Smith		A.O. Smith	
MODEL OR FR.	S213T		S184T		S184T	
HORSEPOWER	7.5	7.5	5	5	5	5
MOTOR RPM	1760	1760	1745	1745	1745	1745
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	9.6	6.8	7.0	4.0	2.0	3.6
AMPS LEG 2	---	6.6	---	4.1	---	3.6
AMPS LEG 3	---	6.6	---	4.2	---	3.5
SHEAVE O.D.	6.5" X 1 3/8		6.0" X 1 1/8		6.0" X 1 1/8	
BELTS - QUANTITY / SIZE	1/BX64		1/B51		1/B51	
SHEAVE POSITION	Fixed		Fully closed		Fully closed	
C to C	17.0		16.5		16.0	

REMARKS

(1) Sheave change needed.

(2) AHU-2 and AHU-3 are both served by one outside air duct.

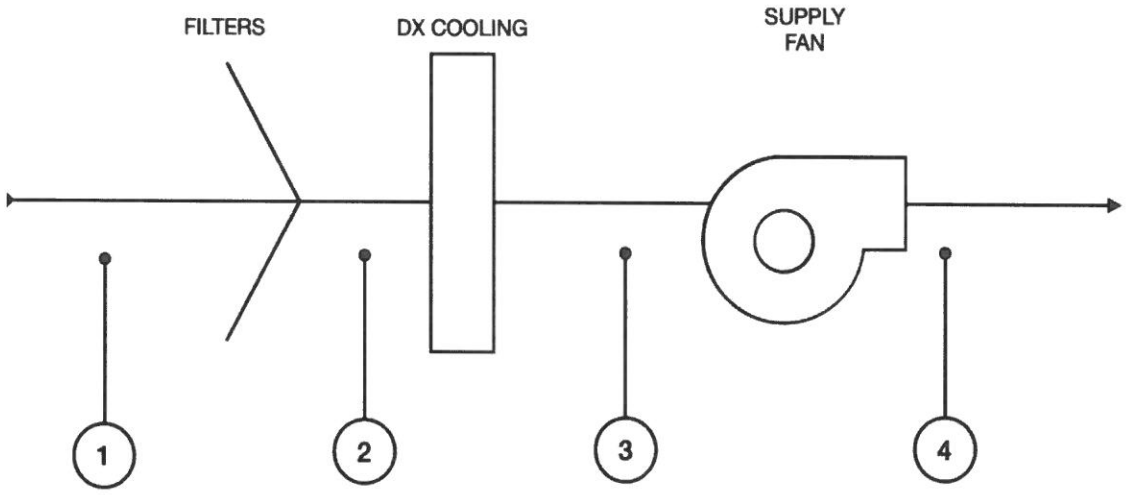
NA Not Available

ND No Design

DD Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Northern Berkshire District Court	**DATE:**	10/24/2021
SYSTEM/AREA:	AHU-1, AHU-2, AHU-3	**TECH:**	BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	NOTES
AHU-1	-0.06"	-0.21"	-0.61"	+0.36"					
AHU-2	-0.74"	-0.91"	-1.36"	+0.66"					
AHU-3	-0.71"	-1.06"	-1.71"	+0.44"					

REMARKS

SUPPLY FAN REPORT

PROJECT:	Northern Berkshire District Court	**DATE:**	10/26/2021
AREA SERVED:	RTU-1, RTU-2	**TECH:**	BS

FAN DATA

	RTU-1		RTU-2			
FAN NUMBER						
LOCATION	Roof		Roof			
AREA SERVED	Court Room		Court Room			
MANUFACTURER	Lennox		NA			
MODEL OR SIZE	LGA060		NA			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2100	1938	3500	3168		
RETURN AIR	1460	1938	3100	3168		
OUTSIDE AIR	640	0 (1)	400	0 (1)		
DISCH. STATIC	---	+0.27"	---	+0.35"	---	
SUCTION STATIC	---	-0.37"	---	-0.80"	---	
TOTAL STATIC	---	0.64"	---	1.15"	---	
FAN RPM	---	898	---	865	---	
PULLEY O.D.	5.5" x 1		6.5" x 1			
ESP	0.31		0.69			
VFD SPEED	No VFD		No VFD			
O.A.D.MIN POS	0		0			

MOTOR DATA

MANUFACTURER	NA (2)		Emerson			
MODEL OR FR.	NA (2)		NA			
HORSEPOWER	NA	NA (2)	3	3		
MOTOR RPM	NA	NA	1725	1725		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	2.8	1.8	4.6	3.8		
AMPS LEG 2	---	1.8	---	3.9	---	
AMPS LEG 3	---	1.8	---	3.6	---	
SHEAVE O.D.	3.5" x 5/8		3.5" x 7/8			
BELTS - QUANTITY / SIZE	1/AX43		1/AX			
SHEAVE POSITION	1/2 Open		1/2 Open			
C to C	16.0		16.0			

REMARKS

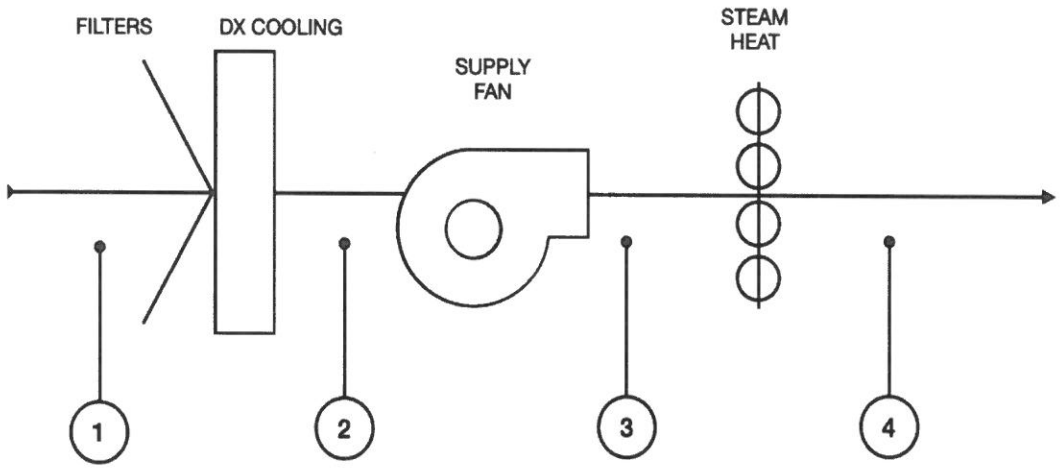
(1) The outside air for these units has been permanently capped.

(2) No access to the motor of this fan. The electrical disconnect is mount on the access door to the motor of this unit.

NA Not Available
ND No Design
DD Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Northern Berkshire District Court	**DATE:**	10/24/2021
SYSTEM/AREA:	RTU-1, RTU-2	**TECH:**	BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	NOTES
RTU-1	-0.08"	-0.37"	+0.27"	+0.23"					
RTU-2	-0.37"	-0.80"	+0.35"	+0.32"					

REMARKS

EXHAUST FAN REPORT

PROJECT:	Northern Berkshire District Court	**DATE:**	10/27/2021
AREA SERVED:	REFs	**TECH:**	BS

FAN DATA						
FAN NUMBER		REF-1 (1)	REF-2	REF-3	REF-4	REF-5
LOCATION		Roof	Roof	Roof	Roof	Roof
AREA SERVED		2nd Fl Restrm	Jan. closet	NA	Restrooms	NA
MANUFACTURER		Greenhack	Greenhack	Greenhack	Greenhack	Greenhack
MODEL OR SIZE		GB-091-4X	GB-071-4X	GB-011-6	GB-121-9X	GB-121-4X
TOTAL CFM	**DESIGN**	425	125	200	880	1645
	ACTUAL	85	223	220	903	1483
FAN RPM	**DESIGN**	1660	1860	1560	1365	NA
	ACTUAL	1233		1285	1385	1342
PULLEY	**O.D.**	3.0" x 3/4	3.0" x 3/4	3.0" x 3/4	3.25" x 3/4	3.25" x 3/4
SERVICE						
MOTOR DATA						
MANUFACTURER		Fasco	Fasco	Marathon	Fasco	Fasco
MODEL NUMBER		NA	NA	482	NA	NA
MOTOR HP	**DESIGN**	1/4	1/4	1/6	1/4	1/4
	ACTUAL	1/4	1/4	1/6	1/4	1/4
MOTOR RPM		1725	1725	1725	1725	1725
VOLTAGE/PHASE		115/1	115/1	115/1	115/1	115/1
MOTOR AMPS	**DESIGN**	4.1	4.1	3.6	4.1	4.1
	ACT. LEG 1					
	ACT. LEG 2	4.1	4.0	3.4	4.3	4.3
	ACT. LEG 3					
SHEAVE		2.5" x 1/2	2.5" x 1/2	2.5" x 1/2	2.5" x 1/2	2.5" x 1/2
BELTS - QUANTITY/SIZE		4L220/1	3L190/1	3L190/1	3L190/1	3L190/1
SHEAVE POSITION		1/2 Open	Fully Open	1/2 Open	Open	Fully Open

REMARKS

(1) The area this fan serves has been renovated and now only serves one restroom.

NA Not Available
ND No Design
DD Direct Drive

EXHAUST FAN REPORT

PROJECT:	Northern Berkshire District Court				**DATE:**	10/27/2021
AREA SERVED:	REFs				**TECH:**	BS
FAN DATA						
FAN NUMBER		REF-6	REF-7 (1)	REF-8 (2)		
LOCATION		Roof	Roof	Roof		
AREA SERVED		2nd Fl Restrm		Court Rm		
MANUFACTURER		Greenhack	Greenhack	Greenhack		
MODEL OR SIZE		GB-071-6				
TOTAL CFM	**DESIGN**	75	1900	3400		
	ACTUAL	88				
FAN RPM	**DESIGN**	1460		NA		
	ACTUAL	1414		406		
PULLEY	**O.D.**	3.75" x 3/4		9.0" x 1		
SERVICE						
MOTOR DATA						
MANUFACTURER		Marathon		Marathon		
MODEL NUMBER		487		56		
MOTOR HP	**DESIGN**	1/6		1/2		
	ACTUAL	1/6		1/2		
MOTOR RPM		1725		1725		
VOLTAGE/PHASE		115/1		460/3		
MOTOR AMPS	**DESIGN**	3.6		1.1		
	ACT. LEG 1					
	ACT. LEG 2	3.0		1.1		
	ACT. LEG 3					
SHEAVE		2.5" x 1/2		3.25" x 5/8		
BELTS - QUANTITY/SIZE		1/3L270		1/AP34		
SHEAVE POSITION		Fully Open		Fully Closed		

REMARKS

(1) Fan not running. New fan has already been oredered.

(2) This fan has a motorized backdraft damper that is pinned shut and does not function.

NA Not Available
ND No Design
DD Direct Drive

AIR DEVICE REPORT

PROJECT:	Northern Berkshire District Court	**DATE:**	10/29/21
SYSTEM / AREA:	REF-4	**TECH:**	BS

LOCATION	NO.	SIZE	A K	DESIGN		TEST		FINAL		NOTES
				FPM	CFM	FPM	CFM	FPM	CFM	
REF-4										
Men's 2nd Fl	1	10"x10"	0.50		ND	421	211			
Women's 2nd Fl	2	10"x10"	0.50		ND	417	209			
Men's 1st Fl	3	10"x10"	0.50		ND	487	244			
Women's 1st Fl	4	10"x10"	0.50		ND	478	239			
							903			

REMARKS

VELOCITY PRESSURE READINGS

PROJECT:	Northern Berkshire District Court	**DATE:**	10/29/2021
AREA SERVED:	AHUs, RTUs and REFs	**TECH:**	BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN FPM	DESIGN CFM	CENT. STAT. PRESS."	TEST FPM	TEST CFM	NOTES
AHU-1 Partial	60" x 18'	7.5		ND	+0.35"	671	6352	
AHU-1 Partial	26" x 14"	2.53		ND	+0.33"	891	2256	
AHU-1 Total				8100			8608	
AHU-2 Supply	18" x 18"	2.25		2040	+0.66"	1365	3071	
AHU-3 Supply	20" x 12"	1.66		1550	+0.44"	1249	2081	
AHU-2+3 OA	40" x 12"	3.33		1005	-0.31"	314	1046	
RTU-1 Total	24" x 12"	2.0		2100	Velgird	969	1938	
RTU-2 Total	36" x 12"	3.0		3500	Velgrid	1056	3168	
REF-1	6"Ø	0.19		ND	-0.06"	435	85	
REF-2	12" x 12"	1.0		ND	-0.09"	223	223	
REF-3	8" x 8"	0.44		ND	-0.06"	499	220	
REF-5	12" x 12"	1.0		1645	-0.24"	1483	1483	
REF-6	6"Ø	0.20		ND	-0.04"	441	88	

REMARKS

HYDRONIC FLOW ELEMENTS

PROJECT: Northern Berkshire District Court **DATE:** 10/29/2021

AREA SERVED: Hot Water **TECH:** BS

LOCATION	NO.	ELEMENT	MFG.	SIZE	DESIGN GPM	TEST I			FINAL			NOTES
						POS.	PR.DIF	GPM	POS.	PR.DIF	GPM	
Hot Water												(1)
AHU-1	1	US			131 (2)			82.0				
AHU-2	2	CS	TA	1.25	7.0	4.0	0.8	6.3				
AHU-3	3	CS	TA	1.25	5.5	4.0	0.6	5.0				

REMARKS

(1) Loop is dual temp and currently in heating.

(2) The hot and chilled water values for AHU-1 appear to be backwards on the schedule. It lists the hot value at 131 GPM and the chilled value at 80 GPM.