HOLYOKE DISTRICT COURT
HVAC SYSTEM EVALUATION SUMMARY

Visited August 10, 2020. While on site, inspected the rooftop air handling unit and toured the building to determine if the spaces generally matched usage noted on the architectural plans. The Holyoke District Courthouse was constructed in 1980 and is approximately 32,000 square feet in size. A single McQuay rooftop air handling unit (RTU-1) serves the building and contains a hot water heating coil, a direct expansion cooling coil, a supply fan, and a return fan. The Courthouse has a Schneider Electric Building Management control system that was installed in 2013.

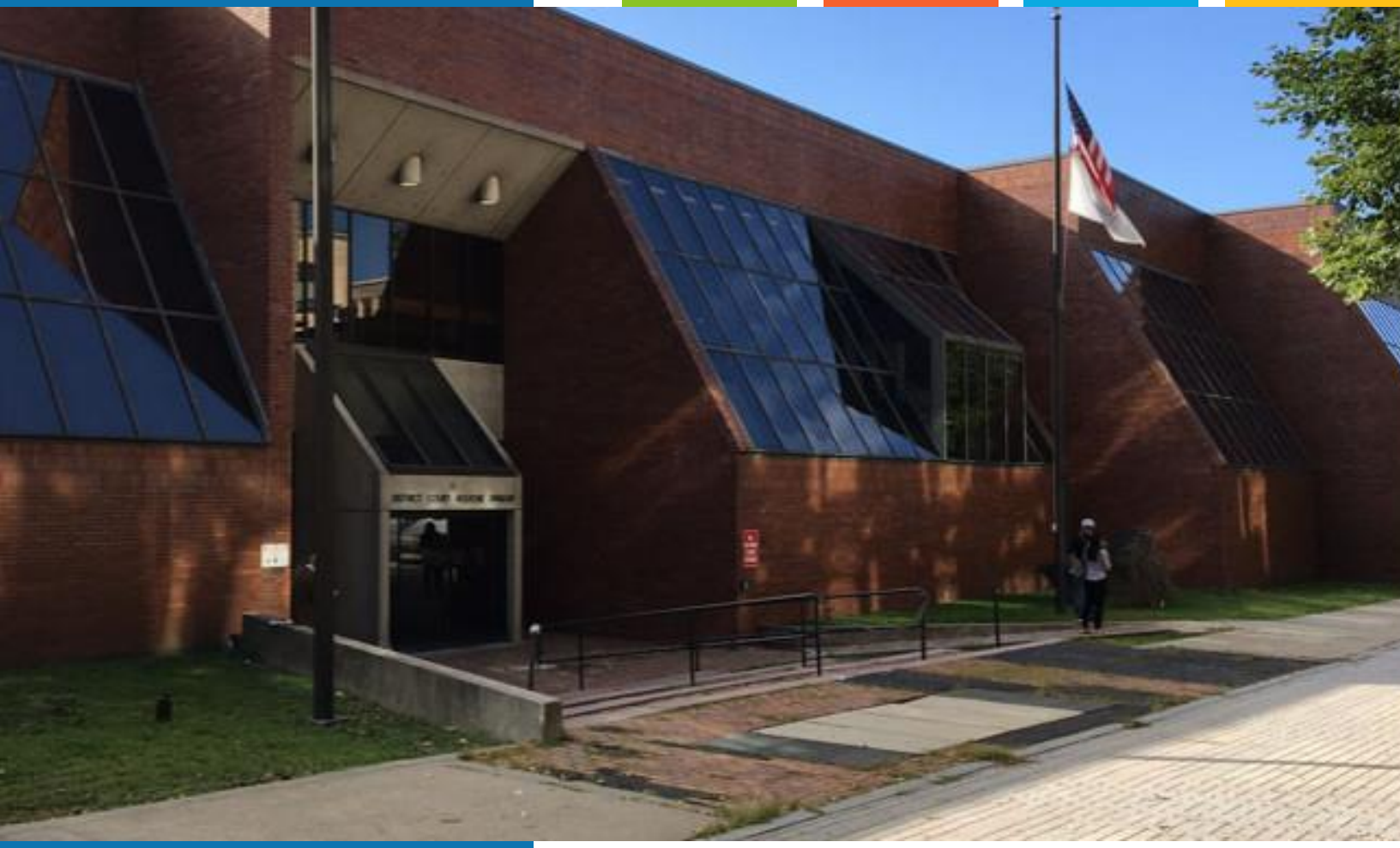
1.0 Airflow Rate per Person (Reduced Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	*Total People*	*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Jury Pool Room C213	13	1,060	82	106	8
Courtroom 1	26	3,485	134	348	13
Courtroom 2	30	4,005	134	400	13

2.0 Recommendations

Section	Recommendation/Finding	Action
2.1	**Filtration Efficiency**	
RF-1	Replace filters with MERV-13	Complete
RF-3	Install a differential pressure sensor across the filter bank	Deferred – added to 5-year Capital Plan
RF-3b	Pressure sensor shall have a display and be connected to the BMS system and/or local alarm	Deferred – added to 5-year Capital Plan
2.2	**Testing and Balancing**	
RTB-1	Test and rebalance air handling unit minimum outside air flow rate	Complete
RTB-2	Rebalance system return and exhaust air flow rate	Complete
RTB-3	Increase outside air flow rate beyond minimum under non-peak conditions	In-progress
RTB-4	Test and balance VAV box flow rates	In-progress
RTB-5	Test and balance all air inlets and outlets	In-progress
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
RE-4	Inspect VAV boxes and controllers to ensure they are in good working condition	Complete
RE-7	Test the existing control valves and actuators for proper operation	Complete

2.4	Control System	
RC-1	Implement a pre and post-occupancy flush sequence	Complete
RC-3	Install controls to introduce outside air beyond the minimum requirements	In-progress
RC-4	Confirm the economizer control sequence is operational	Complete
2.5	Additional Filtration and Air Cleaning	
RFC-1	Install portable HEPA filters in high traffic areas – *if courthouse is to operate at a high occupancy (i.e. 50-75% 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	Design and install an air handling system to serve the basement	Deferred – added to 5-year Capital Plan



Holyoke District Court
Holyoke, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

January 25, 2021

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Holyoke District Courthouse on August 10, 2020. While on site, we inspected the rooftop air handling unit and toured the building to determine if the spaces generally matched usage noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management*:
  - Darryl MacDonald, Manager of Court Facilities – Region 1
  - Kevin Byrne, Facilities
- *Tighe & Bond:*
  - Jason Urso, PE, Senior Mechanical Engineer
  - Sean Pringle, PE, Project Mechanical Engineer

1.1 Existing Ventilation System Description

The Holyoke District Courthouse was constructed in 1980 and is approximately 32,000 square feet in size. A single McQuay rooftop air handling unit (RTU-1) serves the building and contains a hot water heating coil, a direct expansion cooling coil, a supply fan, a return fan, and 2" filters. A MERV rating was not listed on the filter and is therefore unknown. The unit is approximately 12-14 years old and was designed to provide 39,000 CFM of supply air, of which 3,900 CFM is outdoor air (OA). The remaining 35,100 CFM is return air (RA), which is returned via a return air plenum above the ceiling and is recirculated back into the building. The rooftop air handler is in good condition. The dampers, actuators, and hot water control valve were not visible. The upstream face of the adjacent heating coil appears to be slightly dirty.

According to the original design plans, the occupied spaces in the basement are not supplied with air from the rooftop air handler and are only exhausted. These areas do not comply with the requirements of the currently adopted International Mechanical Code from a ventilation standpoint.

Supply air is regulated to each zone by variable air volume (VAV) boxes. According to the original design drawings, it appears no VAV boxes have hot water reheat coils. We assume the VAV boxes are original and have not been replaced. VAV boxes typically operate between a maximum and minimum position. The minimum position prevents the VAV box damper from fully closing, which allows airflow to be supplied the space when occupied to the space when occupied, which is a code requirement for ventilation purposes. The design drawings do not list a minimum supply airflow, so it is unknown if supply air is always being provided. The working condition of these boxes is also unknown.

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 Unit

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Pre/Final Filters	Condition
RTU-1	39,000	3,900	2" MERV Unknown	Good

Photo 1 – RTU-1

1.2 Existing Control System

The Courthouse has a Schneider Electric Building Management control system that was installed in 2013. It is tied to the existing heating plant, rooftop air handling unit, VAV boxes, and provides basic controls. Tighe & Bond spoke to a representative from Schneider Electric regarding the existing controls at the Courthouse. This representative provided as-built control system information from the 2013 project. We understand that the system provides the following controls for the rooftop air handler:

1. Start/stop based on an occupancy schedule
2. Economizer mode – 100% outdoor air
3. Modulation of fan speed via a VFD and duct static pressure sensor
4. Supply air temperature control and supply temperature reset
5. Humidification controls
6. Freeze stat
7. Other safeties and alarms

VAV boxes and space temperature sensors are also tied into the control system.

Section 2
Recommendations

Below is a list of recommendations that we propose for the Palmer District Courthouse. 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 rooftop air handling unit, RTU-1, at the Palmer Courthouse:

RF-1: *Replace filters with a MERV-13 filter.*

TAB Contractor and/or Engineer shall verify that the air handlers can accommodate a MERV-13 filter.

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

RF-3b: *Pressure sensor shall have a display and be connected to the BMS system and/or a local alarm.*

Since the unit is located on the roof, we recommend a differential pressure sensor be installed across the filter bank and be tied to the existing BMS to allow facility personal to check the status of the filter condition without having to travel up to the roof.

2.2 Testing & Balancing Recommendations

According to the original design documents, RTU-1 was designed with an outdoor airflow rate of 3,900 CFM. According to our calculations, the minimum outdoor air flow rate for this air handing unit per the 2015 International Mechanical Code (IMC) is 4,100 CFM, not including the areas in the basement. In reviewing the originally designed entering air temperature for the cooling and heating coils, 80°F/67°F DB/WB and 63°F DB, respectively, we have determined the air handler coils can accommodate the 2015 code required ventilation air. Prior to rebalancing efforts, dampers and actuators should be tested to ensure they are operating correctly. We recommend the following measures for RTU-1:

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 Rate

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	39,000	3,900	4,700	**3,900**

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.

According to the performance information of the heating coil in the rooftop unit schedule in the 2004 design drawings, the unit cannot handling increasing the outdoor air flowrate beyond 3,900 CFM when operating under peak conditions.

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 air flow 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)	464	250	214
Total Supply Air (CFM/Person)	120	43	210
Outdoor Air (CFM/Person)	12	4	21

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 design full 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 4
Airflow Rate per Person (Full 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 C213	24	1,060	44	106	4.4
Courtroom 1	124	3,485	28	348	2.8
Courtroom 2	126	4,005	32	400	3.2

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 4a
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 C213	13	1,060	82	106	8
Courtroom 1	26	3,485	134	348	13
Courtroom 2	30	4,005	134	400	13

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

We recommend increasing the outdoor air flow rate up to 8,700. We do not believe this would cause a threat of a potential coil to freeze based on the total percentage of outside air vs. the total amount of 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 stat.

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-4: *Test and balance VAV box flow rates.*

We recommend testing and balancing the VAV boxes to ensure each space is being supplied the proper quantity of air.

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

If the Courthouse experiences regular cooling and heating comfort complaints, we recommend rebalancing all air inlets and outlets throughout the building. Prior to rebalancing the building, we recommend verifying the boiler plant is maintaining the correct supply water temperature. Incorrect supply water temperature may be contributing to the temperature control complaints instead of a lack of airflow.

RTB-6: *Test and balance the air handler hot water coil and ensure the refrigerant system is operating correctly.*

Testing and balancing the air handler hot water coil will help ensure the coil is receiving the proper water flow rate. Confirm that the air handler's refrigerant system is operating correctly to ensure the DX coil is receiving full refrigerant flow. Due to the age of the coil, they 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 maintenance and upgrades to RTU-1:

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

Replace dampers and actuators that are not functioning.

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

RE-4: *Inspect VAV boxes and controllers* to ensure they are in good working condition.

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

We were not able to inspect the control valves during out site visit, but we suspect they may be original and need replacement. The new valves should be tested and balanced to the original flow rates.

2.4 Control System

The Palmer District Courthouse has a BMS. We recommend the following control system strategies be implemented into the existing control system:

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

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

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

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%-75% 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 using duct mounted humidification or portable humidifiers 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. We are not aware if this building was constructed to accommodate a humidification system.

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 Provide ventilation air to the basement

We recommend an air handling system be designed and installed to serve the basement. This will provide a means to introduce ventilation air to these spaces.

Section 3
Testing & Balancing Results

Wings Testing & Balancing visited the Holyoke District Courthouse on October 5, 2020 to test the airflow rates of the air handling unit and exhaust fans. A summary of the tested airflow rates versus the design airflow rates are shown below in Table 5. The full testing and balancing report is attached.

TABLE 5
Air Handler Testing & Balancing Results

	Design			Actual		
Unit	Total Supply Fan Airflow (CFM)	Recommended Outdoor Airflow (CFM)	Return Fan Airflow (CFM)	Supply Fan Airflow (CFM)	Outdoor Airflow (CFM)	Return Fan Airflow (CFM)
RTU-1	39,000	3,900	35,100	35,541	3,564	31,977

Typical balancing tolerances for air systems is ±10% of the design airflow. In reviewing the airflow report data, the following should be noted:

1. RTU-1 supply fan is performing within acceptable range of ±10%, however this is causing a shortage in code required outdoor air. We recommend investigating the possibly of increasing the total supply air through a sheave change or motor replacement. If that is not possible, the unit's heating and cooling coils can accommodate increasing the outdoor air to 3,900 CFM. Considering the unit is not supplying the full airflow, the addition of adding a MERV 13 filter may decrease the total supplied air.
2. The exhaust fans were not operating at the time of testing. We recommend repairing or replacing the exhaust fans and balancing them to the correct airflows.

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.

Holyoke Courthouse
HVAC Survey
Holyoke, MA

* * * *

Tighe & Bond Engineering
Attn: Jason R. Urso
53 South Hampton Road
Westfield, MA 01085

October 12, 2020

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SM-1 License #6803
www.wingstesting.com

WING'S TESTING & BALANCING CO., INC.

October 12, 2020

Tighe & Bond Engineering
Attn: Jason R. Urso
53 South Hampton Road
Westfield, MA 01085

Re: Holyoke Courthouse

Dear Jason,

The HVAC Survey of Roof Top Units, Return Fans, Outside Air and Exhaust Air has been completed. While onsite, we worked with the in-house technicians. Our findings are as follows:

- All supply boxes were forced to full flow for testing.
  - Total air, return air, and fresh air were measured at the unit.
  - Fresh air was measured 100% proportional to design
    - The unit was running at 91% of total design
    - OA was 91% of design
    - If total increases to 100%, so will the OA.
- None of the exhaust fans were running at the time of testing.
  - The in-house technician said these fans have not run in a long time.
  - *We recommend considering replacing all exhaust fans.*
- There is not a location or circuit setter to measure the water flow to the units.
  - These are closed loops serving only the unit.

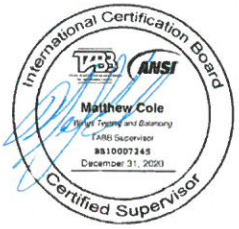
This report has been updated to include Brake Horsepower (BHP) calculations. When a motor has a VFD, we take the amperage measurements from there. When we calculate from volts and amps, it means there has to be a nameplate on the motor. Many times, these are missing or illegible. If BHP is not listed 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.

Holyoke Courthouse
October 12, 2020

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 BB996928T



SUPPLY FAN REPORT

PROJECT: Holyoke Courthouse					**DATE:** 10/6/20	
AREA SERVED: Courthouse					**TECH:** BS	
FAN DATA						
FAN NUMBER	RTU-1					
LOCATION	Roof					
AREA SERVED	Courthouse					
MANUFACTURER	McQuay					
MODEL OR SIZE	FB0U05040784					
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	39,000	35,541				
RETURN AIR	35,100	31,977				
OUTSIDE AIR	3900	3564				
DISCH. STATIC	---	2.43	---		---	
SUCTION STATIC	---	-1.96	---		---	
TOTAL STATIC	5.25	4.39				
FAN RPM	832	624				
PULLEY O.D.	18 3/4"					
ESP	---					
VFD SPEED	60 Hz					
O.A.D.MIN POS	5%					
MOTOR DATA						
MANUFACTURER	A.O. Smith					
MODEL OR FR.	364T					
HORSEPOWER	60	60				
MOTOR RPM	NA	1780				
VOLTAGE / PH.	208/3	208/3				
AMPS LEG 1	165	117.9				
AMPS LEG 2	---	117.2	---		---	
AMPS LEG 3	---	116.1	---		---	
SHEAVE O.D.	12 1/2"					
BELTS - QTY / SIZE	4/B144					
SHEAVE POSITION	Fixed					
Filters/QTY/Size	44/16" x 20" x 2"					
BHP	42.6					
REMARKS						

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

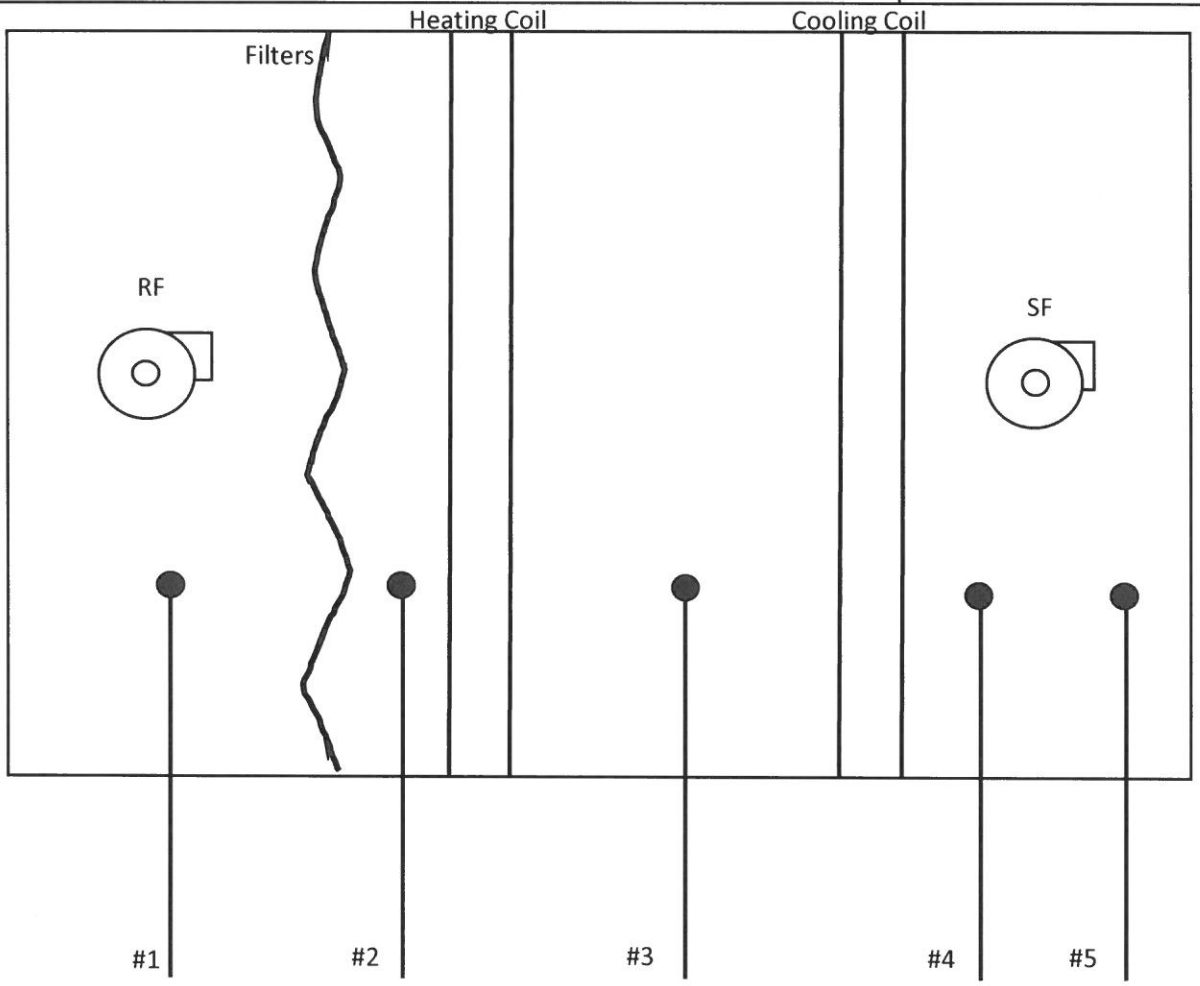
EXHAUST FAN REPORT

PROJECT: Holyoke Courthouse					**DATE:** 10/6/20	
AREA SERVED: Courthouse					**TECH:** BS	
FAN DATA						
FAN NUMBER		RF-1				
LOCATION		RTU-1				
AREA SERVED		Courthouse				
MANUFACTURER		McQuay				
MODEL OR SIZE		FB0U05040784				
TOTAL CFM	DESIGN	35,100				
	ACTUAL	30,270				
FAN RPM	DESIGN	836				
	ACTUAL	861				
PULLEY	O.D.	14 1/2"				
SERVICE		1.15				
MOTOR DATA						
MANUFACTURER		Baldor				
MODEL NUMBER		284 T				
MOTOR HP	DESIGN	25				
	ACTUAL	25				
MOTOR RPM		1770				
VOLTAGE/PHASE		208/3				
MOTOR AMPS	DESIGN	69.5				
	ACT. LEG 1	56.0				
	ACT. LEG 2	55.2				
	ACT. LEG 3	56.2				
SHEAVE		7.0"				
BELTS-QTY/SIZE		3/BX-74				
SHEAVE POSITION		Fixed				
BHP		20.1				
REMARKS						

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Holyoke Courthouse | **DATE:** 10/6/20

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



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	NOTES
	-0.67"	-0.87"	-1.17"	-1.96"	+2.43"			

REMARKS

VELOCITY PRESSURE READINGS

PROJECT: Holyoke Courthouse | **DATE:** 10/6/20

AREA SERVED: Courthouse | **TECH:** BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN FPM	DESIGN CFM	CENTERLINE STATIC PRES."	TEST FPM	TEST CFM	NOTES
RTU-1								
Coil	80 1/2" x 75 1/2"	42.21	924	39000	w/velgrid	842	35,541	
RF-1	78" X 42"	22.75	1543	35,100	w/velgrid	1405	31,971	
OA	77" X 119"	63.63	61	3900	w/velgrid	56	3564	

REMARKS