PITTSFIELD PROBATE AND FAMILY COURTHOUSE
HVAC SYSTEM EVALUATION SUMMARY

Visited October 14, 2020. While on site, inspected the air handling equipment located in the mechanical rooms and toured the facility to determine if the spaces generally matched usages noted on the architectural plans. The Pittsfield Probate and Family Courthouse was constructed in 1876 and is approximately 25,000 square feet in size. Two constant volume air handling units provide ventilation air to the building.

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)*
Probate Court	17	2919	172	730	43
County Commissioners Office	6	1680	280	420	70

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 banks	In-progress
RF-3a	Connect the pressure sensor to a local alarm in the boiler room	In-progress
2.2	**Testing and Balancing**	
RTB-1	Test and rebalance air handling unit supply air and minimum outside air flow rates	Complete
RTB-2	Rebalance system return air flow rate.	Complete
RTB-5	Test and balance all air inlets and outlets	Deferred – added to the 5-year Capital Plan
RTB-6	Test and balance all air handler hot water coils	Complete
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	Complete
RE-5	Install freeze stat or confirm the existing freeze status working correctly on each air handling unit	In-progress
RE-7	Test the existing air handler control valves and actuators for proper operation	Complete
2.4	**Control System**	
RC-1	Implement a pre and post-occupancy flush sequence	In-progress
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% occupancy or greater), install portable HEPA filters in high traffic areas.*	In-progress
2.6	Humidity Control	
	No actionable items listed	
2.7	Other Recommendations	
2.7.1	Replace air handlers and return fans	Deferred – added to the 5-year Capital Plan
2.7.2	Replace toilet exhaust fans	In-progress
2.7.3	Install a building management system	Deferred – added to the 5-year Capital Plan
2.7.4	Convert hot water systems to variable flow	Deferred – added to the 5-year Capital Plan

Pittsfield Probate & Family Courthouse
Pittsfield, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

March 22, 2021

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Pittsfield Family & Probate Courthouse on October 14, 2020. While on site we inspected the air handling equipment located in the 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:*
  - Marc Latimer, Courthouse Facilities Staff
- *Tighe & Bond*
  - Jason Urso, PE, Senior Mechanical Engineer

1.1 Existing Ventilation System

The Pittsfield Family & Probate Courthouse was constructed in 1876 and is approximately 25,000 square feet in size. Two constant volume air handling units (HVAC-1 and HVAC-2) provide ventilation air to the building. Each unit contains a supply fan, refrigerant (DX) cooling coil, and hot water heating coil. A 2", MERV 10 filter is installed in the outdoor intake plenum serving HVAC-1 only. To our knowledge, the return air is unfiltered. HVAC-2 contains a 2", MERV 10 filter inside the cabinet of the unit. A dedicated return fan serves each air handling unit (EF-1 and EF-2), which are also ducted to exhaust air louvers indicating these units may operate under an economizer sequence. A variable frequency drive was observed operating return fan EF-2. To our knowledge, variable frequency drives (VFDs) do not operate either of the air handlers or return fan EF-1. Supply air is distributed to each zone and each zone contains a duct mounted hot water reheat coil.

A heat reclaim piping loop is installed on the exhaust air and outdoor air ductwork serving EF-1 and AHU-1. The intent of this system is to preheat the outside air by transferring heat from the exhaust air to the outdoor air via a piping loop and glycol water coils in the ductwork. According to facilities staff, this system does not operate. The coil in the outdoor air duct is dirty.

Both air handling units and the return fans appear to be from the 1978 renovation project, are in fair to poor condition, and are past their useful life expectancy. The outdoor air and return air dampers are in fair condition. The damper actuators serving HVAC-1 appear to be new and are in good condition, and the damper actuators serving HVAC-2 are in fair condition. At the time of our site visit, the outdoor air damper serving HVAC-1 was closed, while the outdoor air damper serving HVAC-2 was open. The 3-way hot water coil control valves appear to be in fair condition and actuators are in good condition. The heating and cooling coils for both air handling units were dirty as well as the intake air louver screens.

According to the plans, there is one toilet exhaust fan (EF-3) that serves the building, which appears to be from the 1978 renovation and in fair condition. This fan was running during the time of our site visit.

A new 2.1 million BTU/hr Buderus Logano GE515 hot water boiler provides hot water to air handlers and duct mounted reheat coils. Two condensing units are located outside, which supply refrigerant to the cooling coils in the air handling units. Each condensing unit is dedicated to one air handler.

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)	Filters	Condition
HVAC-1	13,200	3,300	2" MERV 10 in OA duct only	Poor
HVAC-2	9,200	2,300	2" MERV 10	Poor

Photo 1 – Air Handler HVAC-2

1.2 Existing Control System

A pneumatic Barber-Colman system controls the existing HVAC air handling equipment. It is an old, obsolete system and appears to be original. We do not know if the system is fully functional. According to staff, a limited Building Management System (BMS) controls the air handlers' outdoor air dampers, the return fans, and operates the economizer sequence. We are not aware of any demand control ventilation sequences in use at this courthouse.

Section 2
Recommendations

Below is a list of recommendations for the Pittsfield Family & Probate 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 the existing air handling units:

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

The TAB Contractor and/or Engineer shall verify that the air handlers can accommodate a MERV-13 filter per Appendix A in the overview of recommendations report.

HVAC-1 only contains a filter in the outdoor air plenum. We did not observe a filter inside the unit that would filter both outdoor air and return air. We recommend installing a MERV 13 filter in the return air duct, unless there is space inside the unit to install a filter that will capture both the outdoor and return air. If there is space inside HVAC-1 to install a filter, the filter in the OA intake air plenum does not have to be upgraded to MERV 13.

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

RF-3a: *Connect the pressure sensor to a local alarm.*

A pressure sensor and a local alarm will provide a reminder to facilities staff to change filters. As filters become dirtier, they restrict airflow.

2.2 Testing & Balancing Recommendations

The air handling units are over 40 years old and it is unknown to Tighe & Bond when the last time the units were tested and balanced. Also, the code requirements to determine the outside 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 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)
HVAC-1	13,200	3,300	2,800	3,300
HVAC-2	9,200	2,300	600	2,300

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.

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

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)	185	116	69
Total Supply Air (CFM/Person)	121	40	257
Outdoor Air (CFM/Person)	30	10	64

The airflow rate per person for each Courtroom 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)***	***Outside Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Probate Court	105	2,904	28	730	7
County Commissioners Court	60	1,680	28	420	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.

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)***
Probate Court	17	2,919	172	730	43
County Commissioners Court	6	1,680	280	420	70

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 rate.*

We recommend rebalancing the return fans airflow rate to ensure the correct quantity of return air is being delivered to the air handler.

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

Considering the age of these systems, at a minimum, we recommend testing the supply and return air flow rates to the Courtrooms and other spaces occupied by more than one person to ensure the proper airflow is being delivered to each space.

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

Testing and balancing the air handler hot 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 that the air handler's refrigerant system is operating correctly to ensure the refrigerant piping is fully charged and the DX coil is receiving full refrigerant flow.

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 air handler coils.*

RE-5: *Install freeze stat or 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.*

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% 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 Replace Air Handlers and Return Fans

Indoor air handling units have a life expectancy of 35-45 years. The air handlers are approximately 42 years old and should be considered for replacement within the next 5 years. Replacing the return fans should also occur in conjunction with the replacement of the air handling units and should be sized correctly to provide an overall positive building pressure to reduce infiltration.

2.7.2 Replace Toilet Exhaust Fan

Utility set exhaust fans have a life expectancy of 35-50 years. The toilet exhaust fan is approximately 42 years and should be considered for replacement when the air handlers are replaced.

2.7.3 Install a Building Management System

We recommend replacing the pneumatic control system with a more sophisticated Building Management System than what exists to control and monitor HVAC equipment. Pneumatic air systems are antiquated and do not offer the same benefits as a BMS. This recommendation is an energy saving and maintenance measure and does not affect the indoor air quality of the building.

2.7.4 Convert Hot Water Systems to Variable Flow

The hot water pumps appear to be constant flow systems. Constant flow pumps circulate the same volume of water to air handling units regardless of whether the water is required or not. If air handlers do not require this water, the three-way valves serving the air handler coils bypass the coil, which allows the hot water to return to the boiler plant. We recommend investigating the possibility of converting these systems to variable flow. The three-way air handler valves would have to be replaced with two-way valves, as well as any other three-way valves that are in the system. According to the HVAC details in the 1978 drawings, two-way valves serve the duct mounted reheat coils. These valves would not have to be replaced, assuming they are in good working condition. Variable frequency drives (VFD) may be able to be connected to the existing hot water pumps, allowing the pumps to vary the flow rate to match the demand.

This recommendation is an energy saving measure and does not affect the indoor air quality of the building.

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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Section 3
Testing & Balancing Results

Wings Testing & Balancing Co. visited the Pittsfield Probate and Family Courthouse on January 21, 2021 to test the airflow rates of the air handling units and the toilet exhaust fans. A summary of the tested airflow rates versus the design airflow rates are shown below in Tables 5 and 6. 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)
HVAC-1	13,200	3,300	9,900	13,806	3,334	10,472
HVAC-2	9,200	2,300	6,900	7,174	1,779	5,395

TABLE 6
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Return/Exhaust Airflow (CFM)	Actual Return/Exhaust Airflow (CFM)
EF-3	Toilet Rooms	950	1,088

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

1. HVAC-1 is delivering the proper quantity of supply and outdoor air to the building.
2. HVAC-2 is underperforming. It is delivering 22% less supply air and outdoor air than design. We recommend further investigation to determine if a belt replacement, sheave change, or motor replacement is required to deliver the proper quantity of supply air.
3. Return fan EF-2 serving HVAC-2 is underperforming. It is delivering 22% less return air than design. We recommend further investigation to determine if the VFD can be adjusted to balance the fan to the proper return air flow rate.
4. Toilet exhaust fan EF-3 is not performing within acceptable range.
5. It appears there may be an issue with the hot water heating systems. The TAB Contractor could not verify any flow, despite the pumps being on.

WING'S TESTING & BALANCING CO., INC.

Pittsfield Probate & Family Court
HVAC/Ventilation Survey

* * * *

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

January 21, 2021

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WING'S TESTING & BALANCING CO., INC.

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

January 21, 2021

Re: Pittsfield Probate & Family Court/HVAC Ventilation Survey

Dear Jason,

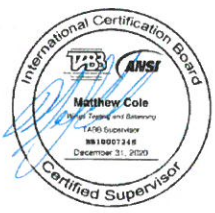
We have completed our HVAC/Fresh Air Survey for the above-mentioned project. Through our testing we found that the hot water loop that serves just HVAC-1 and HVAC-2, located in the basement, is not operating properly. The pump is on, but we still do not see any flow or temperature at the coils of these two units. This should be investigated.

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.

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



HYDRONIC FLOW ELEMENTS

PROJECT: Pittsfield Probate & Family Court | **DATE:** 1/20/21

AREA SERVED: HVAC-1 & 2 | **TECH:** BS

LOCATION	NO.	ELEMENT	MFG.	SIZE	DESIGN GPM	TEST I			FINAL			NOTES
						POS.	PR.DIF	GPM	POS.	PR.DIF	GPM	
HVAC-1	1	C/S	B & G	1 1/4	8.91							(1)
HVAC-2	2	C/S	B & G	1	6.21							(1)

REMARKS

(1) HVAC-1 & HVAC-2 are both off of one pump and are on their own loop. We are unable to get any flow or temp at these units with the pump running.

SUPPLY FAN REPORT

PROJECT: Pittsfield DistrictProbate & Family Court				**DATE:** 1/20/21		
AREA SERVED: Various				**TECH:** BS		
FAN DATA						
FAN NUMBER	HVAC-1		HVAC-2			
LOCATION	Basement		Basement			
AREA SERVED	1st Fl & Basement		2nd Floor			
MANUFACTURER	McQuay		McQuay			
MODEL OR SIZE	L3L-222CH		L3L-217CV			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	13,200	13,806	9,200	7,174		
RETURN AIR	9,900	10,472	6,900	5,395		
OUTSIDE AIR	3,300	3,334	2,300	1,779		
DISCH. STATIC	---	+0.71"	---	+1.11"	---	
SUCTION STATIC	---	-1.77"	---	-1.18"	---	
TOTAL STATIC	2.3	2.48	---	2.29		
FAN RPM	---	1076	---	1096		
PULLEY O.D.	9 3/4" x 1 7/16"		8 1/2" x 1 7/16"			
ESP	1.13		1.41			
VFD SPEED	60 Hz		60 Hz			
O.A.D. MIN POS	20%		40%			
MOTOR DATA						
MANUFACTURER	Baldor		Baldor			
MODEL OR FR.	215T		213T			
HORSEPOWER	10	10	7.5	7.5		
MOTOR RPM	1725	1725	1725	1725		
VOLTAGE / PH.	208/3	208/3	208/3	208/3		
AMPS LEG 1	33.0	18.4	25.0	13.9		
AMPS LEG 2	---	18.6	---	13.8	---	
AMPS LEG 3	---	18.5	---	13.9	---	
SHEAVE O.D.	6.0" x 1 3/8"		6.0" x 1 3/8"			
BELTS - QTY / SIZE	2/B78		2/Ax75			
SHEAVE POSITION	Fixed		50% Open			
BHP	5.6		4.2			
FILTERS	12/16"x25"x2"		8/20"x25"x2"			

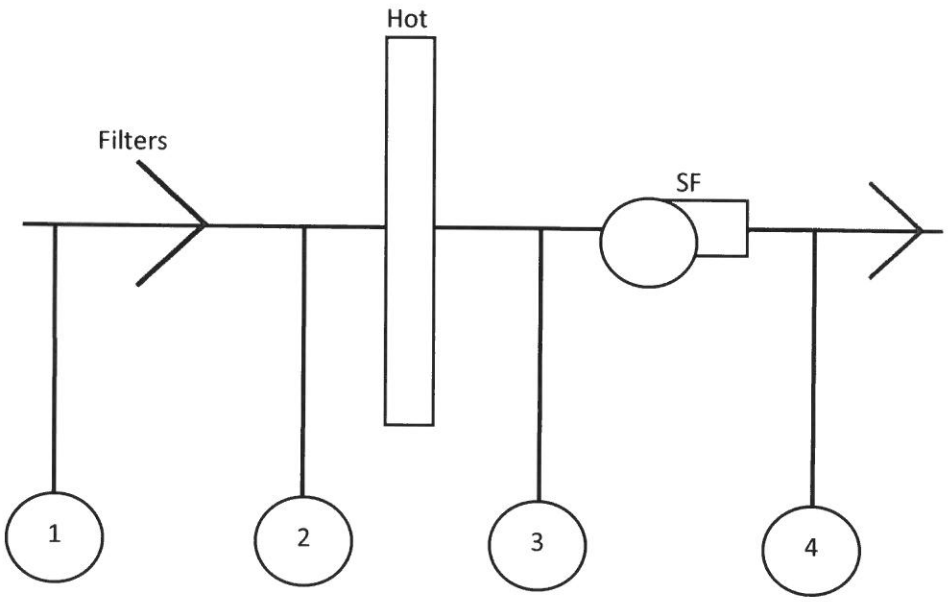
REMARKS

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

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Pittsfield Probate & Family Court | **DATE:** 1/20/21

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



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	NOTES
HVAC-1	-0.42"	-0.60"	-1.77"	+0.71"				
HVAC-2	-0.30"	-0.47"	-1.18"	+1.11"				

REMARKS

VELOCITY PRESSURE READINGS

PROJECT: Pittsfield Probate & Family Court | **DATE:** 1/20/21

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

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
HVAC-1								
Supply	26" x 56"	10.11	1306	13,200	+0.70	1366	13,806	
Return	48" x 24"	8.0	1238	9900	-0.17	1309	10,472	
HVAC-2								
Supply	34" x 20" ID	4.72	975	4600	+1.05	838	3955	
Supply	34" x 20" ID	4.72	975	4600	+0.20	682	3219	
Return	44" x 24"	7.33	941	6900	+0.13	736	5315	
EF-13	12" x 13"	1.08	880	950	+0.07	1004	1088	

REMARKS

(1) The outside air set up for this unit is packaged and not able to be controlled by the maintenance crew

EXHAUST FAN REPORT

PROJECT: Pittsfield Probate & Family Court | **DATE:** 1/20/21

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

FAN DATA						
FAN NUMBER		EF-3				
LOCATION		Basement				
AREA SERVED		All Restrooms				
MANUFACTURER		Barry Blouer				
MODEL OR SIZE		BVF-122				
TOTAL CFM	DESIGN	950				
	ACTUAL	1088				
FAN RPM	DESIGN	925				
	ACTUAL	980				
PULLEY	O.D.	6.0" x 1"				
SERVICE		NA				
MOTOR DATA						
MANUFACTURER		Baldor				
MODEL NUMBER		143T				
MOTOR HP	DESIGN	1				
	ACTUAL	1				
MOTOR RPM		1725				
VOLTAGE/PHASE		208/3				
MOTOR AMPS	DESIGN	3.6				
	ACT. LEG 1	2.2				
	ACT. LEG 2	2.4				
	ACT. LEG 3	2.6				
SHEAVE		3 3/4" x 7/8"				
BELTS-QTY/SIZE		1/A28				
SHEAVE POSITION		100% Closed				
BHP		0.7				

REMARKS