Essex County Superior Court
Newburyport, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

September 18, 2024

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Essex County Superior Court in Newburyport, MA on February 23, 2021. 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:*
  - Courthouse Facilities Staff
- *Tighe & Bond*
  - Jason Urso, PE, Senior Mechanical Engineer
  - Ryan Ablondi, Senior Mechanical Engineer
  - Matt Mancini, Staff Mechanical Engineer

1.1 Existing Ventilation System

The Essex County Superior Court was constructed in 1805 and is approximately 8,600 square feet in size. A significant renovation of the mechanical systems for the building was completed in 2008. Ventilation air is provided to the second floor of the building by two air handling units. One larger constant volume unit serving the large courtroom on the second floor and a smaller variable air volume (VAV) air handling unit serving the four offices on the second floor. Each unit contains a supply fan, refrigerant (DX) cooling coils, hot water heating coils and 2" MERV 8 pre filters. Supply air for the smaller unit is distributed to each zone via VAV boxes. It should be noted that due to the age of the building mechanical ventilation has not been provided to any space on the first floor or the basement.

The two air handling units were installed as part of a major mechanical renovation in 2008 and are in good condition. The large AHU shows some signs of leaking at the HW heating coil and the HW has been shut off to the unit. The dampers and actuators for both units are in good condition however, the heating and cooling coils are dirty. The hot and chilled water control valves and actuators are in good condition.

There is a large exhaust fan in the attic mechanical space serving bathrooms in the Basement, the Jury Deliberation Room, and the Judge's Chambers. A small ceiling mounted bathroom fan was installed in the new bathroom off the District Attorney's Office which was installed in 2008. Both Bathroom exhaust fans are in good condition.

There is a single small detention cell on the second floor outside the courtroom. The cell currently has no ventilation air or exhaust and is not negatively pressurized.

A 1,200 million BTU/hr, oil fired hot water boiler was installed as part of the 2008 renovation in addition to an existing 400 million BTU/hr, oil fired hot water boiler. The two boilers provide hot water to both AHUs in the attic mechanical space as well as various perimeter fin tube radiation.

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
AC-1	4,000	800	MERV 8	Very Good
AC-2	1,200	200	MERV 8	Good

Photo 1 – Air Handler AC-1

1.2 Existing Control System

All of the mechanical systems in the courthouse are locally controlled and not connected to a building management system (BMS). All of the controls are electric and appear to be in good condition. AC-1 & AC-2 are not equipped with the mixed air dampers necessary for airside economizer or demand control ventilation.

Section 2
Recommendations

Below is a list of recommendations for the Essex County Superior Court. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

Building areas without adequate ventilation and filtration significantly increase the risk of spreading viruses like COVID-19, especially areas with high occupant density and where people occupy the same space for relatively long periods of time. Consider significantly reducing occupancy or relocating occupants to other areas with adequate ventilation.

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. Filter racks should be inspected and adjusted to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass.

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

2.2 Testing & Balancing Recommendations

The air handling units are approximately 13 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 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)
AC-1	4,000	800	745	**800**
AC-2	1,200	200	50	**200**

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 code minimums calculated by Tighe & Bond. Supplying more outdoor than required by 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)	84	81	3
Total Supply Air (CFM/Person)	62	44	533
Outdoor Air (CFM/Person)	12	9	93

Note: Occupancy is for spaces served with mechanical ventilation only.

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)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Courtroom	81	3,600	44	720	9

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

The airflow rate per person for each Courtroom, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 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)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Courtroom	29	3600	124	720	25

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 testing and balancing the return fan airflow rate to ensure the correct quantity of return air is being delivered to the air handler.

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

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 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 and drain pans.*

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

VAV boxes regulate the supply air delivered to each space. At a minimum, we recommend cycling the damper positions and testing the airflow to verify the maximum and minimum airflow rates are being delivered as designed. Consider cleaning the airflow stations. Any boxes not delivering the expected airflow rates should be rebalanced or replaced.

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 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 areas without mechanical ventilation and 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.

2.5 Other Recommendations

2.5.1 Mechanical Ventilation Feasibility Study

The first floor and basement of the Courthouse is not mechanically ventilated. Operable windows do exist on the first floor, and natural ventilation is acceptable per code, however windows are typically not opened during cold or hot outdoor air temperatures. We recommend a study of the Courthouse to determine how feasible it is to install mechanical ventilation in all occupied spaces.

2.5.2 Convert Chilled and Hot Water Systems to Variable Flow

The hot water pumps are constant flow systems. Constant flow pumps circulate the same volume of water to air handling units and fin tube radiation 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 water to return back to the chiller or 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. 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.

2.5.3 Add Demand-Controlled Ventilation

Consider adding demand-controlled ventilation (DCV) to the AHU serving the courtroom. The outdoor airflow rate is relatively high and the use of DCV can reduce operating costs

by reducing outdoor air when the occupancy in the space is low. This measure will require the installation of a CO2 sensor in the courtroom and new modulating damper actuators and controls in the AHU. If DCV is incorporated, per ASHRAE recommendations, it should not be enabled until the Pandemic has subsided. This recommendation is an energy saving measure and does not increase the indoor air quality of the building.

2.5.4 Add Ventilation to the Holding Cell

The existing holding cell on the second floor does not have any ventilation. Consider adding ventilation in the form of a small exhaust fan to, at a minimum, provide negative pressurization to the cell. Consideration could also be given to tying in a small duct to the large bathroom exhaust fan in the attic directly above the holding cell.

2.5.5 Add Ventilation to the Law Library

The Law Library is a 645 SF space on the second floor Mezzanine and currently does not have any mechanical ventilation or operable windows. Consider adding ventilation to the space by tapping into the 10x10 duct passing through the space from AC-1. Consideration could also be given to tying into the 18x6 exhaust duct in the wall from the bathrooms below.

Section 3
Testing & Balancing

The mechanical systems at the Newburyport Superior Courthouse were tested as part of a DCAMM energy audit. The summary of the tested airflow rates versus the design airflow rates is shown below in Table 5.

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)
AC-1	4,000	800	3,200	3,849	839	3,010
AC-2	1,200	200	1,000	1,153	203	950

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

1. All systems are operating within the design parameters.

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.

J:\M\M1671 Comm. of MA Court System\011 - COVID-19 Courthouse Evaluations\Report_Evaluation\Draft Reports\XXX Courthouse Report Templa*te*.docx

Tighe&Bond

Precision Air Testing & Balancing, Inc. TAB Report

April 19, 2022

PRECISION AIR
TESTING & BALANCING, INC.

63 South Street, Suite 292
Hopkinton, MA 01748
Phone (401) 305-8776

Test & Balance Report

Project Name: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

PA Project #: PA-21-0182

Architect:

CSS Architects, Inc.
170 Audobon Road, Suite 300
Wakefield, MA 01880

Mechanical Engineer:

SAR Engineering, Inc.
10 Granite Street
Quincy, MA 02169

General Contractor:

Ecosystem Energy
33 Arch Street, 17th Floor, Suite 110
Boston, MA 02110

Mechanical Contractor:

NL

PRECISION AIR
TESTING & BALANCING, INC.

63 South Street, Suite 292
Hopkinton, MA 01748
Phone (401) 305-8776

Certification Sheet

Project Name: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

PA Project #: PA-21-0182

This is to certify that Precision Air Testing & Balancing, Inc., has balanced the systems described herein according to their design specifications. Furthermore, the testing and balancing has been performed in compliance with the requirements and procedures of the Testing Adjusting and Balancing Bureau, and the results of these tests are recorded within this report.

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Report Index

Notes:
***1**
***2**
***3**
***4**

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Symbols & Abbreviations

Adj.	Adjustable
AHU	Air Handling Unit
AV	AirVane Anomomenter
ADJ PD	Adjusted Pitch Diameter
AMP	Amperage
AVG	Average
BHP	Brake Horsepower
CB	Circuit Breaker
CD	Ceiling Diffuser
CFM	Cubic Feet Per Minute
CE	Ceiling Exhaust
CH	Chiller
CHWR	Chilled Water Return
CHW or CHWS	Chilled Water Supply
CR	Ceiling Return
CP	Circulating Pump
CC	Cooling Coil
CT	Cooling Tower
CWR	Condenser Water Return
CW or CWS	Condenser Water Supply
DB	Dry Bulb
DD	Direct Drive
DIA	Diameter
EAT	Entering Air Temperature
EDC	Electric Duct Coil
EDH	Electric Duct Heater
EF	Exhaust Fan
EWT	Entering Water Temperature
FCU	Fan Coil Unit
FH	Flow Hood
FG	Floor Grille
FE	Floor Exhaust or Return
FLA	Full Load Amperage
FPB/FPT	Fan Powered Box/Fan Terminal
FPM	Feet Per Minute
FS	Floor Supply
FSR	Floor Supply Register
FT HD	Feet of Head
FPT/FPB/FTU	Fan Powered Terminal Unit
GPM	Gallons Per Minute
HC	Heating Coil
HEATER OL	Thermal Overload for Motors
HEPA	High Eff. Particulate Arrestance
HF	HEPA Filter
HOA	Hand/Off/Auto Switch
HP	Horsepower
HPS	High Pressure Steam
HRC	Heat (Recovery or Recliam) Coil
HVAC	Heating, Ventilation & Air Cond.
HWR	Hot Water Return
HWS	Hot Water Supply
HX	Heat Exchanger
ID	Inside Diameter
LAT	Leaving Air Temperature
LD	Linear Supply Diffuser
LPS	Low Pressure Steam
LWG	Low Wall Grille
LWT	Leaving Water Temperature
MAU/MUA	Make Up Air Unit
MBH	1,000 BTU's per Hour
N/A	Not Accessible
NI	Not Installed
NL	Not listed
NA	Not Applicable
NZ	Nozzle
OD	Outside Diameter
OA Min	Outside Air Minimum
OAT	Outside Air Temperture
PHC	Preheat Coil
PMP	Circulating Pump
PSI	Pounds Per Square Inch
PT	Pitot Traverse
RA	Return Air
RF	Return Air Fan
RG	Return Grille
RHC	Reheat Coil
RPM	Revolutions per Minute
RTU	Roof Top Unit
SA	Supply Air
SAT	Supply Air Temperature
SD	Supply Diffuser
SEF	Smoke Exhaust Fan
SAF (AIR)	Supply fan
SF	Service Factors
SHC	Steam Heating Coil
S.P. "W.C."	Static Pressure in Water Column
S.W.E.	Sidewall Exhaust
S.W.R.	Sidewall Return
S.W.S.	Sidewall Supply
TAB	Testing, Adjusting, and Balancing
TSP	Total Static Pressure
UH	Unit Heater
V	Volts
VAV	Variable Air Volume
VD	Volume Damper
VFD	Variable Frequency Drive
VP	Velocity Pressure
W	Watts
WB	Wet Bulb
W.D.	Water Density
W.G.	Water Guage
W.V.	Wind Vane Anometer
F	Degrees Fahrenheit
ΔP	Differential (Delta) Pressure
ΔT	Differential (Delta) Temperature

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Instrument Calibration Sheet

This is a list of Instruments that may be used on this Project.

Model# Serial#	Manufacturer/Type or Description	Calibration Date	Calibration Due date
ADM-880C	Shortridge Multimeter	10/1/21	10/1/22
HDM-250	Shortridge Hydrodata Multimeter	10/1/21	10/1/22
CFM-886	Shortridge Flowhood	10/1/21	10/1/22
Fluke 971	Temperture/Humidity Meter	10/1/21	10/1/22
Fluke 365	Tru-RMS AC/DC 600V Amp/Volt	10/1/21	10/1/22
RV801	TSI Vane Anemometer	10/1/21	10/1/22
Complete Kit	Evergreen Telemetry Flowhood	10/1/21	10/1/22
VPC300	Extect Video Particle Counter	10/1/21	10/1/22
Fluke-922	Airflow Micromanometer	10/1/21	10/1/22
PCE-TDS-100HSH	Ultrasonic Flowmeter	10/1/21	10/1/22

All electronic instruments are calibrated using an independent calibration company. Every 3 months after the previous calibration, all equipment is tested against a controlled set of calibrated equipment in house.

Technician: Peter Bouchard

Notes:
***1**
***2**
***3**
***4**

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Report Summary

All Systems are calibrated and balanced to within design specifications.

AC-1: All diffusers balanced, confirmed OA and mixed air dampers are now working properly and set.
Supply air design from schedule says 4,000CFM. Diffusers add up to 3,800CFM. 800 CFM minimum Outside Air equals 3,000CFM.

AC-2: By pass set to run off of static pressure (VAV-5) set to 1.0".
VAVs calibrated, Mins and Max CFMs set.

Technician: Peter Bouchard

TABB Supervisor: Peter Medeiros

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Fan Data

SYSTEM:	Fan No. #	AC-1	Fan No. #	
Serves	Court Room Offices			
Location	Attic			
Manufacturer	Trane			
Model No. #	MCCB008UA0C0UA			
Serial No. #	K07B13704			
MOTOR DATA:	**Listed**	**Tested**	**Listed**	**Tested**
Manufacturer	~~NA~~	Century	~~NA~~	
Frame Size	~~NA~~	S184T	~~NA~~	
Horsepower-HP	2	5		
Break Horsepower-BHP	1.6	3.69		
Service Factor / Pf / Eff.	~~NA~~	1.15/83.3/87.5	~~NA~~	
Volts/Phase/Hertz	208/3/60	208/3/60		
Motor-Full Load Amperage	14.8	13.1		
Motor-RPM	1745	1745		
Speed Control/VFD Setting	Single	1		
Overload Heater Size/VFD	~~NA~~	Adj @	~~NA~~	
Overload Heater Amps/VFD	~~NA~~	17.5	~~NA~~	
FAN PERFORMANCE:	**Listed**	**Tested**	**Listed**	**Tested**
Supply-CFM	4,000	3,849		
Return-CFM	3,200	3,010		
Exhaust-CFM	-	-		
Outside Air/Fresh Air-CFM	800	839		
Fan Suction Pressure-WC"	~~NA~~	-1.98	~~NA~~	
Fan Discharge Pressure-WC"	~~NA~~	0.56	~~NA~~	
Fan Total Static Press.-WC"	2.5	2.54		
External Static Pressure-WC"	1.5	0.8		
OA/EA Damper %/Exh Offset	~~NA~~	15%	~~NA~~	
Static Pressure Setpoint-WC"	~~NA~~	NA	~~NA~~	
DRIVE COMPONENT:	**Listed**	**Tested**	**Listed**	**Tested**
Fan RPM	NL	2879		
Motor Sheave"/Bore"	~~NA~~	1BK70-1 1/8	~~NA~~	
Fan Sheave"/Bore"	~~NA~~	1BK40-1	~~NA~~	
Belt Quantity/Belt Size	~~NA~~	1-BX51	~~NA~~	
Shaft Center Line-Inches"	~~NA~~	18.5	~~NA~~	
Sheave Turns Open	~~NA~~	Fixed	~~NA~~	

Notes: ***1** Supply air design says 4,000CFM. Diffusers add up to 3,800CFM.

***2**

***3**

***4**

***5**

***6**

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

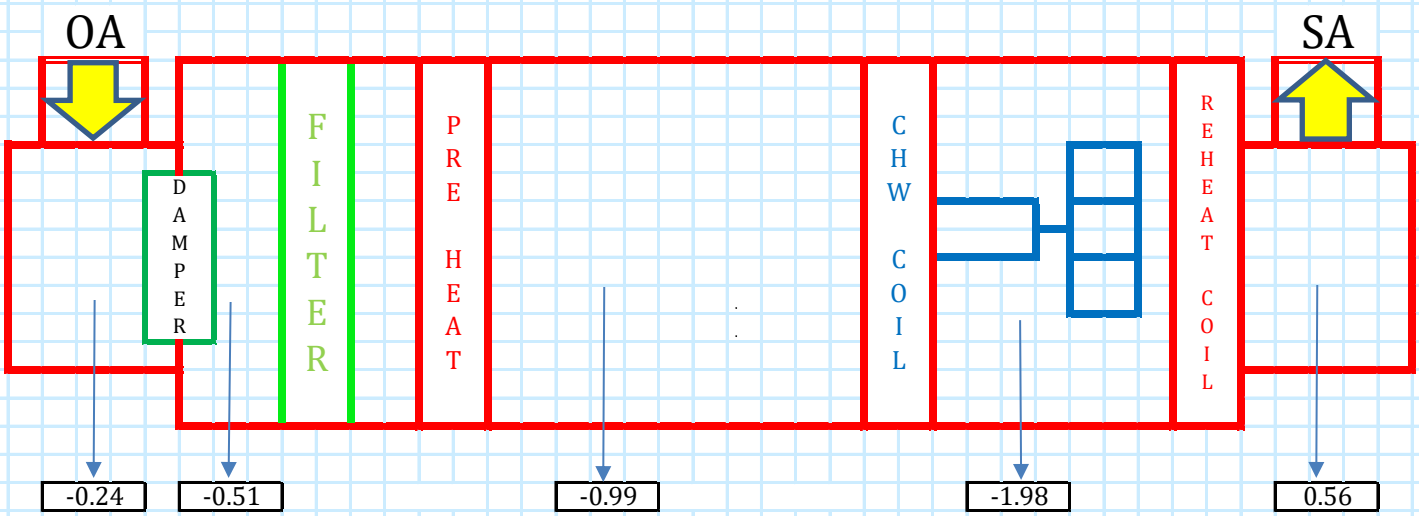
Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

AHU Fan Static Profile

System:	AC-1	Location:	Attic	Type/Size:	Horizontal



	Static Pressure			Temp			
COMPONENT:	IN	OUT	PD	IN	OUT	ΔT	Note
External Press.							
Total Fan Press.							
CHW/DX Coil							
Hot Water Coil							
Pre-Heat Coil							
Heat Rec. Wheel							

	Static Pressure			Temp			
COMPONENT:	IN	OUT	PD	IN	OUT	ΔT	Note
Supply Duct Press.							
Return Duct Press.							
Mixed Air Press.							
Outside Air Press.							
Pre-Filter Press.							
Final Filter Press.							

Notes: *1

*2

*3

*4

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Air Distribution

System:	AC-1	Supply:	X	Ret./Exh:	X	OA:	

Room or Location	Unit Number	Unit Size"/Type	Area/Ak' or FH/AV	FPM (=cfm/areaAk)		CFM (=fpm*areaAk)		Notes
				Design	Actual	Design	Actual	
	Supply							
Court Room	1	12x10	0.83	482	492	400	408	
Court Room	2	12x10	0.83	482	488	400	406	
Court Room	3	12x10	0.83	482	497	400	413	
Court Room	4	12x10	0.83	482	480	400	398	
Court Room	5	12x10	0.83	482	495	400	411	
Court Room	6	12x10	0.83	482	483	400	401	
Court Room	7	12x10	0.83	482	496	400	412	
Court Room	8	12x10	0.83	482	469	400	389	
Court Room	9	12x10	0.83	482	489	400	406	
Corridor	10	10x8	0.56	357	366	200	205	
					Total	**3,800**	**3,849**	
	Return							
Court Room	1	36x12	FH	NA	NA	900	644	
Court Room	2	36x12	FH	NA	NA	900	653	
Court Room	3	36x12	FH	NA	NA	900	638	
Court Room	4	36x12	FH	NA	NA	900	642	
Corridor	5	24X6	FH	NA	NA	600	433	
					Total	**4,200**	**3,010**	

Notes:
***1** Reduced Return Air design values 71% to compensate for OA.
***2**
***3**
***4**

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Fan Data

SYSTEM:	Fan No. #	AC-2	Fan No. #	
Serves	Court House Offices/VAVs			
Location	Attic			
Manufacturer	Johnson Controls			
Model No. #	AHJ080408-03P20			
Serial No. #	NL			
MOTOR DATA:	**Listed**	**Tested**	**Listed**	**Tested**
Manufacturer	~~NA~~	Weg	~~NA~~	
Frame Size	~~NA~~	E56	~~NA~~	
Horsepower-HP	0.75	0.75		
Break Horsepower-BHP	NL	0.37		
Service Factor / Pf / Eff.	~~NA~~	1.25/0.72/72.0	~~NA~~	
Volts/Phase/Hertz	208/3/60	208/3/60		
Motor-Full Load Amperage	2.65	1.8		
Motor-RPM	1735	1735		
Speed Control/VFD Setting	Single	1		
Overload Heater Size/VFD	~~NA~~	Fuse	~~NA~~	
Overload Heater Amps/VFD	~~NA~~	3 @ 5.0A	~~NA~~	
FAN PERFORMANCE:	**Listed**	**Tested**	**Listed**	**Tested**
Supply-CFM	1,200	1,153		
Return-CFM	1,000	950		
Exhaust-CFM	-	-		
Outside Air/Fresh Air-CFM	200	203		
Fan Suction Pressure-WC"	~~NA~~	-0.18	~~NA~~	
Fan Discharge Pressure-WC"	~~NA~~	0.94	~~NA~~	
Fan Total Static Press.-WC"	NL	1.12		
External Static Pressure-WC"	0.5	0.96		
OA/EA Damper %/Exh Offset	~~NA~~	15%	~~NA~~	
Static Pressure Setpoint-WC"	~~NA~~	1	~~NA~~	
DRIVE COMPONENT:	**Listed**	**Tested**	**Listed**	**Tested**
Fan RPM	NL	1381		
Motor Sheave"/Bore"	~~NA~~	1VP40-5/8	~~NA~~	
Fan Sheave"/Bore"	~~NA~~	1AK49-3/4	~~NA~~	
Belt Quantity/Belt Size	~~NA~~	1-AX37	~~NA~~	
Shaft Center Line-Inches"	~~NA~~	13	~~NA~~	
Sheave Turns Open	~~NA~~	2	~~NA~~	

Notes: ***1** Bypass set to static pressure set point.
***2**
***3**
***4**
***5**
***6**

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

VAV Air Distribution

System:	AC-2	Supply:	X	Return:		Exhaust:	

Control Address# / Room Serves	VAV # / Outlet #	Inlet Size" / Outlet Size	K-Factor / FH/AV	MIN CFM Design	MIN CFM Actual	MAX CFM Design	MAX CFM Actual	Notes
Add #1	**VAV-1**	8"	Kf=0.95					
Judges Office	1	12x5	FH/AV	200	202	680	678	
Add #2	**VAV-2**	4"	KF=1.35					
Secretary	1	12x12	FH	60	62	220	224	
Add #3	**VAV-3**	4"	KF=0.87					
Stenographer	1	12x12	FH	50	51	95	98	
Add #4	**VAV-4**	4"	Kf=1.06					
Clerk of the Courts	1	12x12	FH	50	52	150	153	
					Total	**1,145**	**1,153**	

Notes:
***1**
***2**
***3**
***4**

PRECISION AIR
TESTING & BALANCING, INC.

Project: Newburyport Superior Court

Address: 145 High Street
Newburyport, MA 01950

Date: 4/19/22

Project #: PA-21-0182

Air Distribution

System:	AC-2	Supply:		Ret./Exh:	X	OA:	

Room or Location	Unit Number	Unit Size"/Type	Area/Ak' or FH/AV	FPM (=cfm/areaAk)		CFM (=fpm*areaAk)		Notes
				Design	Actual	Design	Actual	
	Return							
Judges Chamber	1	12x12	FH	NA	NA	640	580	
Stenographer	2	12x12	FH	NA	NA	75	69	
Secretary	3	12x12	FH	NA	NA	200	183	
Clerk of the Courts	4	12x12	FH	NA	NA	130	118	
					Total	**1,045**	**950**	

Notes:
***1**
***2**
***3**
***4**