CONCORD DISTRICT COURT
HVAC SYSTEM EVALUATION SUMMARY

Visited October 20, 2020. While on site, inspected the air handling units and toured the occupied portions of the building to determine if the spaces generally matched usage noted on the architectural plans. The Concord District Courthouse is a single-story building, built in 1972, with a floor area of approximately 27,800 gross square feet. Ventilation is provided by two constant-volume air handling units (AHUs), located in a penthouse mechanical room, two rooftop units (RTUs), and unit ventilators in perimeter zones.

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	15	700	47	77	5
Criminal Courtroom	24	3,500	146	503	21
Small Center Court	16	1,800	113	261	16
Civil Courtroom	30	3,500	117	503	17

2.0 Recommendations

Section	Recommendation/Finding	Action
2.1	**Filtration Efficiency**	
RF-1	Replace filters with a MERV 13 filter	Complete
RF-3	Install a differential pressure sensor (switch) across the filter banks	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-5	Test and balance all air inlets and outlets	N/A
2.3	**Equipment Maintenance and Upgrades**	
RE-1	Test existing air handling system dampers and actuators for proper operation	Complete
RE-2	Clean air handler coils and drain pans	Complete
2.4	**Control System**	
RC-1	Implement a pre-occupancy flush sequence	In-progress
RC-4	Confirm the economizer control sequence is operational	In-progress
2.5	**Additional Filtration and Air Cleaning**	
RFC-1	Install portable HEPA filters -– *if courthouse is to operate at a high occupancy (i.e. 50% or greater), install portable HEPA filters in high traffic areas.*	In-progress

2.6	Humidity Control	
	No actionable items listed – continuous monitoring for seasonal changes	On-going
2.7	Other Recommendations	
2.7.1	Replace/Reinstall missing air handling Unit “G”	Deferred – included in 5 year Capital Plan
2.7.2	Replace Rooftop Units	Deferred – included in 5 year Capital Plan
2.7.3	Replace air handling units and air-cooled condensing units	Deferred – included in 5 year Capital Plan
2.7.4	Install a building management system	Deferred – included in 5 year Capital Plan
2.7.5	Replace unit ventilators	Complete
2.7.6	Label Summer/Winter changeover switches	Complete

Concord District Court
Concord, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

April 6, 2021

Tighe&Bond

Section 1
Existing Conditions and Site Observations

Tighe & Bond visited the Concord District Courthouse located in Concord, MA on October 20, 2020. While on site, we inspected the air handling units and toured the occupied portions of the building to determine if the spaces generally matched usage noted on the architectural plans.

Site Visit Attendees:

- Office of Court Management:
  - Michael Norman
  - Raymond Nardone
- Tighe & Bond:
  - Todd Holland, PE, Senior Mechanical Engineer

1.1 Existing Ventilation System Description

The Concord District Courthouse is a single-story building, built in 1972, with a floor area of approximately 27,800 gross square feet. Ventilation is provided by two constant-volume air handling units (AHUs), located in a penthouse mechanical room, two rooftop units (RTUs), and unit ventilators in perimeter zones.

TABLE 1
Existing Air Handlers

Unit #	*Design Airflow (CFM)*	*Design Min OA (CFM)*	*Filters*	*Condition*
AH-1 ("H")	6,000	Unknown	2" MERV-8	Fair to Poor
AH-3 ("J")	6,000	Unknown	2" MERV-8	Fair to Poor
RTU-2	2,000	0	2" MERV-8	Poor
RTU-4	5,000	500	2" MERV-8	Poor
Unit "G"	3,000	Unknown	N/A	Missing

The air handlers AHU-1 and AHU-3 are called units "H" and "J" respectively on the original drawings. These units each have a direct expansion (DX) cooling coil with dual refrigerant circuits, electric resistance heating coils, a supply air fan, filter section, and mixing box with return air (RA) and outdoor air (OA) dampers. The filter section has 2" MERV-8 pleated filters. Each AHU is paired with an outdoor air-cooled condensing unit (ACU), mounted on the roof. These units serve the Criminal Courtroom and Civil Courtroom, respectively.

Each of the AHUs has two cold water centrifugal atomizing type humidifiers, one in the supply duct and one in the return duct. These units use a high-speed rotating wheel to sling water against copper comb to make droplets. They are mechanically simple units, but do not appear to have been used in decades.

During the site visit we noticed a third OA intake in the penthouse, disconnected from the duct drop which was capped at the floor. Copies of the original design drawings show an

air handling unit "G" serving the main lobby and corridors. We were able to verify that this unit and its accompanying ACU are no longer in place, and that there was no air movement at any of the supply diffusers or return grilles in the lobby and corridor.

Photo 1 – Typical Air Handler

The rooftop units, RTU-2 and RTU-4, each have a direct expansion (DX) cooling coil, natural gas-fired furnace, a supply air fan, and filter section with 2" pleated filters. It should be noted that neither of these units has an OA intake, and are configured to recirculate 100% of their airflow. RTU-2 serves the small center courtroom, and RTU-4 serves the probation department and lockup area.

There are 24 packaged terminal air conditioner (PTAC) unit ventilators serving office areas around the building perimeter. These units each have a direct expansion (DX) cooling coil, electric resistance heating coils, a supply air fan, OA intake louver and control damper. The filters are 1" thick "throwaway" type, rated MERV-5.

The AHUs are original to the building and in fair to poor condition, and the electric resistance heating coils were being replaced at the time of the visit. ACU-1 is in poor condition, replaced in 1993, and ACU-3 is newer but appears to be at least 10 years old. The RTUs are in poor condition, they are likely the second replacement since 1972, the first replacement happening in 1993. The existing RTUs are inexpensive, light commercial grade.

Photo 2 – Typical Rooftop Unit

Supply air is distributed from the AHUs in a multizone configuration, where each zone has a pneumatic control damper and an electric reheat coil. There are electric reheat coils in the supply air distribution for the RTUs.

The lockup area is served by RTU-4, which provides zero OA ventilation. Each of the holding cells is served by exhaust grilles over the combination toilet/lavatory fixture. This exhaust system was operational at the time of the visit.

1.2 Existing Control System

The courthouse HVAC equipment is controlled by the original Johnson Controls pneumatic control system. It is an old, obsolete system, and appears to be original although in fair condition with no major leaks noted, and a reasonably new compressor and air dryer.

There are control panels in each of the four front conference rooms with a changeover switch for winter and summer operation. Facilities staff did not know what these did.

We did not see any evidence or components of a Building Management System (BMS) during our site visit. We are not aware of any demand control ventilation sequences in use at this courthouse.

Photo 3 – Summer/Winter Changeover Switch

Section 2
Recommendations

Below is a list of recommendations that we propose for the Concord 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 the existing air handling units:

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

The 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.*

2.2 Testing & Balancing Recommendations

The AHUs are almost 50 years old and it is unknown to Tighe & Bond when the last time the units were tested and balanced. Also, the code required outside air flow rates that were used to design the system in 1972 are different than the 2015 International Mechanical Code (IMC) and ASHRAE Standard 62.1.

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)
AH-1 ("H")	6,000	unknown	1,200	1,200
AH-3 ("J")	6,000	unknown	1,200	1,200
RTU-2	2,000	unknown	500	500
RTU-4	5,000	500	500	1,000
Unit "G"	3,000	unknown	350	600

Note: Unit "G" is currently non-operational.

The airflow rates per person are shown below in Tables 3 and 4. These values are based on the original design supply and outdoor airflow rates shown in Table 2 above.

TABLE 3
Airflow Rate per Person

	Average for all spaces (CFM/Person)	*Courtrooms (CFM/Person)*	*Non-Courtroom Spaces (CFM/Person)*
Total Supply Air	49	32	94
Outdoor Air (design)	unknown	unknown	unknown
Outdoor Air (code)	8	6	11

TABLE 4
Airflow Rate per Person - Courtrooms

		Total Air		*Outdoor Air*	
Courtroom	*Total People*	*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Jury Pool Room	30	700	23	77	3
Criminal Courtroom	147	3,500	24	503	3
Small Center Court	58	1,800	31	261	4
Civil Courtroom	147	3,500	24	503	3

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. 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	15	700	47	77	5
Criminal Courtroom	24	3,500	146	503	21
Small Center Court	16	1,800	113	261	16
Civil Courtroom	30	3,500	117	503	17

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

We recommend testing and balancing the OA flow rate for AHU-1 and AHU-3 to the recommended minimum OA rates listed in Table 2. If RTU-2 and RTU-4 are not replaced, we recommend modifying the units with OA intakes and rebalancing the OA flow rates to the recommended minimum OA rates listed in Table 2.

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

We recommend rebalancing all air inlets and outlets throughout the building, including the unit ventilators. This will ensure that proper ventilation is provided to each individual space.

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*.

Some dampers and actuators were operational, while others were not. The OA damper for AHU-3 was scheduled for repair. We recommend testing the dampers and actuators to ensure they are functioning properly, including the OA dampers for all unit ventilators, and repairing or replacing dampers as required.

RE-2: *Clean air handler coils.*

Cooling coils and drain pans for the AHUs were noted to be clean, but we were unable to inspect the coils in the RTUs and unit ventilators, so we recommend inspecting these and cleaning them as necessary.

2.4 Control System

The Concord District Courthouse has a pneumatic control system with limited functionality. We recommend the following short-term control system strategies be implemented into the existing control system.

RC-1: *Implement a pre-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.*

These are recommended for office and library areas served by unit ventilators, which cannot have their filters upgraded to MERV-13. 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

The original atomizing humidifiers have not been used in years and their condition is unknown. The design is unusual in that the humidifiers are located in the supply and return air streams, possibly because of the relatively long distance required for absorption

of the cold atomized water. Tighe & Bond does not recommend recommissioning these; they should be removed.

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/Reinstall Missing Air Handling Unit "G"

We strongly recommend immediately reinstalling air handling unit "G" to serve the main lobby and corridors. There is no mechanical ventilation for these areas presently, and heating and cooling is provided by units that serve the surrounding areas. The original design documents show this as a 7.5-ton split system, and the replacement should be a heat pump to minimize the use of electric resistance heat for energy and cost savings.

2.7.2 Replace Rooftop Units

We strongly recommend replacing RTU-2 and RTU-4 immediately. The primary problem is that they provide no ventilation air to the spaces they serve. The secondary problem is age and reliability. Outdoor air handling units have a life expectancy of 15 years for commercial grade equipment. These units are not commercial grade. The nameplates on the units are no longer readable but they appear to be 12-15 years old.

2.7.3 Replace Air Handling Units and Air-Cooled Condensing Units

Replacing AHU-1 and AHU-3 should be considered within the next 3-5 years. Indoor air handling units have a life expectancy of 35-40 years. The units in the Concord District Court are approximately 48 years old and are in fair to poor condition. The air-cooled condensing units ACU-1 and ACU-2 should be replaced along with the AHUs. These are beyond their expected service lives of 15 years, and they use R-22 refrigerant which is no longer manufactured. This will limit repair options and increase costs should a failure occur. The replacement systems should use heat pump technology, which will generate energy and operational savings by minimizing the use of electric resistance heat.

2.7.4 Install a Building Management System

When the air handling units are replaced, we recommend replacing the Johnson Controls pneumatic control system with a BMS to control and monitor equipment. Pneumatic air systems are antiquated and do not offer the same benefits as a BMS.

2.7.5 Replace Unit Ventilators

We recommend replacing the PTAC unit ventilators. The average life of a unit ventilator is approximately 35 years. The fan coil units appear to be original and are approximately 48 years old, exceeding their expected useful life. The replacement units should be specified with MERV-13 filters, code-compliant OA volumes, and packaged terminal heat pump (PTHP) technology to minimize electric resistance heating load.

2.7.6 Label Summer/Winter Changeover Switches

Each of the front conference rooms contains a control panels with a changeover switch for winter and summer operation. Facilities staff does not know how they work. We recommend determining how they function and labeling them as such. If they are not functional, we recommend removing them.

Section 3
Testing & Balancing Results

Milharmer Associates, Inc. visited the Concord District Courthouse on January 20, 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 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)
AHU-H	6,000	1,200	4,800	4,199	1,232	2,967
AHU-J	6,000	1,200	4,800	4,259	1,109	3,150
RTU-2	2,000	500	1,500	1,253	-	1,253
RTU-4	5,000	1,000	4,000	1,076	-	1,076

Typical balancing tolerances for air systems is ±10% of the design airflow.

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

1. AHU-H and AHU-J are performing below the acceptable airflow range, about 30% less than design. New fan sheaves would be required to substantially increase the airflow of both units.
    a. The measured motor currents were approximately 80% of full load amps (FLA), and increasing airflow to design levels may be beyond the motors' capacities. Airflow should be adjusted to the maximum capacity of the fan motors but not beyond.
    b. Since the outdoor airflows for these units are within the acceptable range, increasing the total airflow would not improve ventilation but may improve temperature control.
2. RTU-2 is performing below the acceptable airflow range, almost 40% below the nominal 400 cfm per ton used for many rooftop units. A new fan sheave would be required to increase the airflow to design.
3. RTU-4 is performing well below the acceptable airflow range, almost 80% less than 400 cfm per ton. At this low flow rate, it is unlikely that the refrigeration circuit or gas furnace is operating properly. An investigation by a mechanical contractor is required to troubleshoot the low airflow.

4. No toilet exhaust fans were included in the testing and balancing report.
5. None of the unit ventilators were included in the testing and balancing report.

Disclaimer

Tighe and Bond cannot in any way guarantee the effectiveness of the proposed recommendations to reduce the presence or transmission of viral infection. Our scope of work is intended to inform the Office of Court Management on recommendations for best practices based on the guidelines published by ASHRAE and the CDC. Please note that these recommendations are measures that may help reduce the risk of airborne exposure to COVID-19 but cannot eliminate the exposure or the threat of the virus. Implementing the proposed recommendations will not guarantee the safety of building occupants. Tighe & Bond will not be held responsible should building occupants contract the virus. The Office of Court Management should refer to other guidelines, published by the CDC and other governing entities, such as social distancing, wearing face masks, cleaning and disinfecting surfaces, etc. to help reduce the risk of exposure of COVID-19 to building occupants.

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MILHARMER ASSOCIATES, INC.
534 New State Highway, Route 44, Suite 3
Raynham, MA 02767
Tel.: 508-823-8500; Facsimile: 508-823-8600

TEST AND BALANCE REPORT

Project: **Concord District Court**
Concord, MA

Project No.: **21-017** **Project Date:** **1/20/2021**

MECHANICAL CONTRACTOR
Tighe & Bond

3384

A N.E.B.B. Certified Company

Project:	Concord District Court		
Address:	Concord, MA		
Date:	1/20/2021	**Project No.**	21-017

CERTIFICATION

Submitted & Certified by:

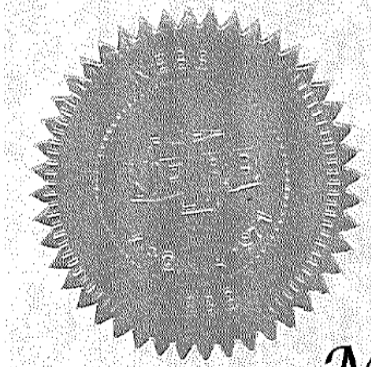
Milharmer Associates, Inc.

Certification No.: ***3384*** Certification Expiration Date: **3-31-21**

The data presented in this Report is a record of system measurements and final adjustments that have been obtained in accordance with the current edition of the ***N.E.B.B. Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.*** Any variances from design quantities which exceed N.E.B.B. tolerances, are noted in the Test-Adjust-Balance Report Project Summary.

N.E.B.B. Qualified TAB Supervisor Name: **Scott F. Miller**

N.E.B.B. Qualified TAB Supervisor Signature:_____



Certification

THIS IS TO CERTIFY THAT

Milharmer Associates, Inc.

HAS MET ALL REQUIREMENTS FOR NEBB CERTIFICATION IN THE FOLLOWING DISCIPLINE

Testing, Adjusting and Balancing of Environmental Systems

FOR THE NEBB BOARD OF DIRECTORS

March 31, 2021

Expiration Date

NEBB President

3384

NEBB Certification Number

NEBB President-Elect

NEBB Certification Board

NEBB Certified Professional

Scott F. Miller

HAS MET ALL THE NEBB REQUIREMENTS FOR NEBB CERTIFIED PROFESSIONAL STATUS IN

Testing, Adjusting and Balancing of Environmental Systems

This Certificate, as well as individual affiliation with a NEBB Certified Firm and associated NEBB Certification Stamp are REQUIRED to provide a NEBB Certified Report. Participation in the NEBB Quality Assurance Program requires the Certificant be affiliated with a NEBB Certified Firm.

March 31, 2021

Expiration Date

23541

NEBB Certificant Number

Richard Fant

NEBB Certification Board Chairman

Cynthia Heath

NEBB Certification Director

The NEBB Certification Board retains sole ownership of all certificates. The NEBB Certification Board Policy Manual governs use of this certificate.

Project:	Concord District Court		
Address:	Concord, MA		
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Project: Concord District Court
Address: Concord, MA
Date: 1/20/2021 **Project No.** 21-017

INSTRUMENT SHEET

The following is a list of Instruments owned and operated by Milharmer Associates, Inc. and used on this project.

Instrument ID Number	Instrument	Calibration Date	Calibration Due Date
1	ADM-870 Digital Multimeter	8-20-20	8-20-21
2	Shortridge Flow Hood	8-20-20	8-20-21
3	Ampmeter	8-20-20	8-20-21
4	Tachometer	8-20-20	8-20-21
5	Airflow Anemometer	8-20-20	8-20-21
6	Digital Thermometers	8-20-20	8-20-21
7	Shortridge Water Meter	8-20-20	8-20-21
8	Sound Meter	8-20-20	8-20-21
9	Vibration Meter	8-20-20	8-20-21

Please Note: Instruments are tested annually at the M.A.I. Lab. and sent back to the factory if deviation exceeds manufacturing tolerance.

Technician:

SYMBOL SHEET

AHU	Air Handling Unit	HEATER O.L.	Thermal Overload
AC or ACU	Air Conditioner Unit		Protection For Motors
ACCU	Air Cooled Condensing Unit		Located at Starter Motor
ADJ P.D.	Adjusted Pitch Diameter		
AMP	Amperage	HEPA	High Efficiency Particulate
AVG	Average		Arrestance
A.D.	Air Density	HOA	Hand/Off/Auto Switch
		H.P.	Horsepower
B.H.P.	Brake Horsepower	HPS	High Pressure Steam
		HRC	Heat (Recovery or Recliam) Coil
CFM	Cubic Feet Per Minute	HVAC	Heating, Ventilation and
CH	Chiller		Air Conditioning
CHWR	Chilled Water Return	HWR	Hot Water Return or
CHW or CHWS	Chilled Water Supply		Heating Water Return
CT	Cooling Tower	HWS	Hot Water Supply or
CWR	Condenser Water Return		Heating Water Supply
CW or CWS	Condenser Water Supply	HX	Heat Exchanger
DB	Dry Bulb	I.D.	Inside Diameter
D.D.	Direct Drive		
DIA	Diameter	LAT	Leaving Air Temperature
		L.D.	Linear Supply Diffuser
EAT	Entering Air Temperature	LPS	Low Pressure Steam
EDC	Electric Duct Coil	L.T.	Light Troffer
EDH	Electric Duct Heater	LWT	Leaving Water Temperature
EF	Exhaust Fan		
EMS	Energy Mgt System	MAU/MUA	Make Up Air Unit
EWT	Entering Water Temperature	MBH	1,000 BTU's per Hour
FCU	Fan Coil Unit	N.A.	Not Accessible
FH	Fume Hood	N/A	Not Applicable
F.L.A.	Full Load Amperage	N.I.	Not Installed
FPB	Fan Powered Box	N.L.	Not Listed
FPM	Feet Per Minute		
FT. HD.	Feet of Head		
GPM	Gallons Per Minute		

SYMBOL SHEET CONTINUED

O.D.	Outside Diameter	TAB	Testing, Adjusting, and Balancing
OA Min	Outside Air Minimum	TSP	Total Static Pressure
OAT	Outside Air Total	TP	Thermally Protected
PF	Power Factor	UH	Unit Heater
PHC	Preheat Coil		
PH	Phase(s)	V	Volts
PSI	Pounds Per Square Inch	VAV	Variable Air Volume
P.T.	Pitot Traverse	VD	Volume Damper
		VFD	Variable Frequency Drive
RA	Return Air	VP	Velocity Pressure
RF	Return Air Fan		
R.G.	Return Grille	W	Watts
RHC	Reheat Coil	WB	Wet Bulb
RPM	Revolutions per Minute	W.D.	Water Density
		W.G.	Water Guage
SA	Supply Air		
SAT	Supply Air Temperature	F	Degrees Fahrenheit
S.D.	Supply Diffuser		
SEF	Smoke Exhaust Fan	ΔP	Differential (Delta) Pressure or Pressure Drop
SF (AIR)	Supply Fan		
S.F.(Elect)	Service Factors		
SHC	Steam Heating Coil	ΔT	Differential (Delta) Temperature, Net Temperature Decrease or Increase
S.P. "W.C."	Static Pressure Measured in Inches of Water Column	#	PSI or Pounds Per Square Inch Decrease or Increase

Project:	Concord District Court		
Address:	Concord, MA		
Date:	1/20/2021	**Project No.**	21-017

REPORT SUMMARY

The following is the report for the Concord District Court. A survey was performed on AHU-H, AHU-J, RTU-2 & RTU-4 with the following comments:

1. AHU-H was tested at 4,199 CFM and is designed for 6,000 CFM. A fan sheave change would be required in order to increase the airflow to design. The new fan sheave would need to be a BK110 x 1 1/4" with an A62 Belt.

2. AHU-J was tested at 4,259 CFM and is designed for 6,000 CFM. A fan sheave change would be required in order to increase the airflow to design. The new fan sheave would need to be a BK110 x 1 1/4" with an A62 Belt.

3. RTU-2 was tested at 1,253 CFM and is designed for 2,000 CFM. A motor sheave change would be required in order to increase the airflow to design. The new motor sheave would need to be a 1VP56 x 7/8" with an AX54 Belt.

3. RTU-4 was tested at 1,076 CFM and is designed for 5,000 CFM. This unit requires additional troubleshooting by a mechanical contractor due to the very low airflow.

Project:	Concord District Court		
Address:	Concord, MA		
Date:	1/20/2021	**Project No.**	21-017

REPORT SUMMARY

AIR HANDLING UNITS

UNIT	SUPPLY	RETURN	OUTSIDE AIR
AHU-H	4,199 CFM	2,967 CFM	1,232 CFM
AHU-J	4,259 CFM	3,150 CFM	1,109 CFM
RTU-2	1,253 CFM	1,253 CFM	NA
RTU-4	1.076 CFM	1,076 CFM	NA

Project: Concord District Court
Address: Concord, MA
Date: 1/20/2021 **Project No.** 21-017

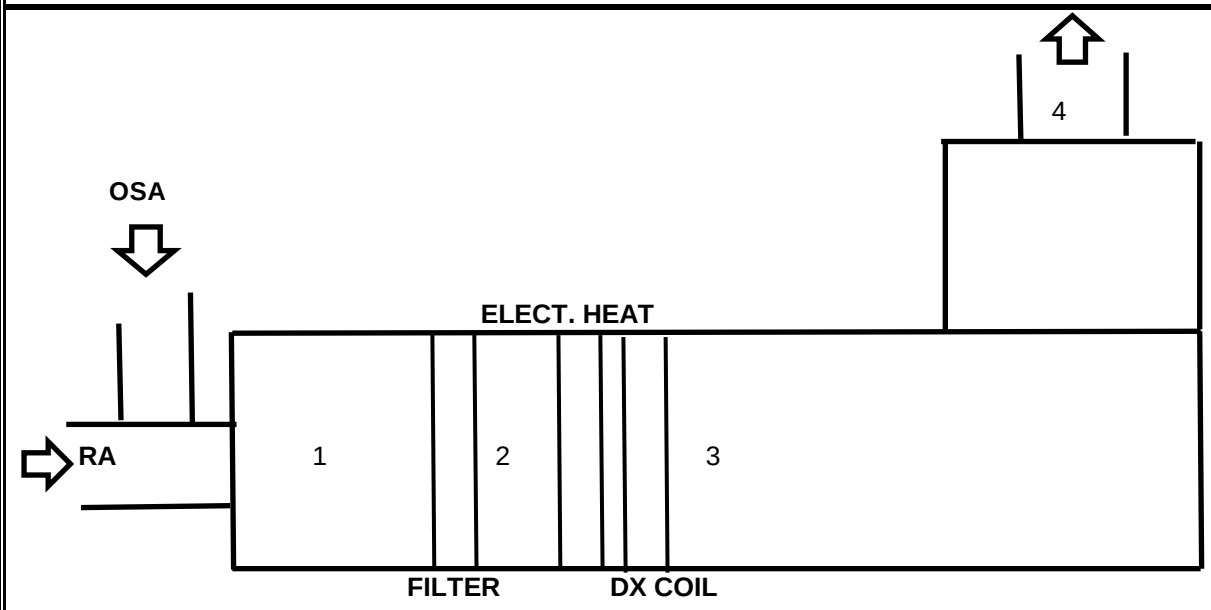
FAN DATA SHEET

	FAN NO.	AHU-H (1)	FAN NO.	
Serves / Location:	Courtroom 1	Penthouse		
Manufacturer:	TRANE			
Model Number:	L-10			
Size:	NL			
Serial Number:	K1H204763			
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	DAYTON		
Frame Number:	NL	145T		
Horsepower:	NL	2		
Brake Horsepower:	NL	NA		
Safety Factor:	NL	1.15		
Volts/Phase:	460/3	460		
Motor Amperage:	3.1	2.6/3.0/2.7		
Motor RPM:	1740	1740		
Speeds:	1	1		
Heater Size:	NL	CB		
Heater Amps.:	NL	CB		
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	6000	4199		
Return Air CFM:	NL	2967		
Exhaust Air CFM:				
Outside Air CFM:	1200	1232		
Suction Pressure:	NL	0.85		
Discharge Pressure:	NL	0.22		
Fan Static Pressure:	NL	1.1		
External Pressure:	NL	NA		
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	869		
Motor Drive:	NL	1VP62		
Motor Size/Bore:	NL	7/8"		
Fan Drive:	NL	12" OD		
Fan Size/Bore:	NL	1 1/4"		
Belt Size / Number:	NL	A64/1		
Shafts C-C:	NL	19"		
Turns Open:	NL	2.5		

Comments:

Project:	Concord District Court		
Address:	Concord, MA		
Date:	1/20/2021	**Project No.**	21-017

AHU-H(1) STATIC PROFILE



LOCATION	STATIC
1	-0.41"
2	-.67"
3	-.85"
4	+.22"

** Pressures measured wiith VAV Boxes at full cooling position.

Project: Concord District Court
Address: Concord, MA
Date: 1/20/2021 **Project No.** 21-017

TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T1
Supply Zone 1 TRAVERSE LOCATION: Penthouse

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	56	" WIDTH x	16	" DEPTH	Sq Ft =	6.22

AIR DENSITY DATA

STATIC PRESS @ CL:	0.29	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	3624
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**3629**

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

TEST HOLE	1	2	3	4	5	6	7
A	494	584	452	456	463	628	695
B	766	672	490	424	462	606	662
C	828	746	560	476	414	458	606
D	764	666	538	502	384	414	538
E							
F							
G							
H							
I							

NO. OF READINGS = 36 AVERAGE FPM = 582

J	690	606					
K	637	664					
L	649	683					
M	677	614					
N							
O							
P							
Q							
R							

TECHNICIAN: Nick Cifelli / Brian Murphy

Project: Concord District Court
Address: Concord, MA
Date: 1/20/2021 **Project No.** 21-017

TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T2
Supply Zone 2 TRAVERSE LOCATION: Penthouse

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	10	" WIDTH x	6	" DEPTH	Sq Ft =	0.42

AIR DENSITY DATA

STATIC PRESS @ CL:	0.17	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	313
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**314**

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

TEST HOLE	1	2	3	4	5	6	7
A	760	685					
B	744	769					
C	774	782					
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 6 AVERAGE FPM = 752

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Nick Cifelli / Brian Murphy

Project: Concord District Court
Address: Concord, MA
Date: 1/20/2021 **Project No.** 21-017

TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T3
Supply Zone 3 TRAVERSE LOCATION: Penthouse

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	10	" WIDTH x	6	" DEPTH Sq Ft =	0.42

AIR DENSITY DATA

STATIC PRESS @ CL:	0.16	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	262
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**262**

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

TEST HOLE	1	2	3	4	5	6	7
A	512	690					
B	682	670					
C	723	490					
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 6 AVERAGE FPM = 628

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Nick Cifelli / Brian Murphy

Project: Concord District Court
Address: Concord, MA
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TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T1
Return TRAVERSE LOCATION: Penthouse

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	24	" WIDTH x	20	" DEPTH	Sq Ft =	3.33

AIR DENSITY DATA

STATIC PRESS @ CL:	0.15	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	2647
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**2649**

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

TEST HOLE	1	2	3	4	5	6	7
A	805	808	812				
B	843	810	854				
C	824	855	838				
D	642	659	886				
E	798	715	846				
F	640	808	850				
G							
H							
I							

NO. OF READINGS = 18 AVERAGE FPM = 794

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Nick Cifelli / Brian Murphy

Project: Concord District Court
Address: Concord, MA
Date: 1/20/2021 **Project No.** 21-017

TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T2
Return TRAVERSE LOCATION: Penthouse

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	10	" WIDTH x	6	" DEPTH Sq Ft =	0.42

AIR DENSITY DATA

STATIC PRESS @ CL:	0.17	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	320
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**320**

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

TEST HOLE	1	2	3	4	5	6	7
A	574	861					
B	716	826					
C	818	814					
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 6 AVERAGE FPM = 768

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Nick Cifelli / Brian Murphy

Project: Concord District Court
Address: Concord, MA
Date: 1/20/2021 **Project No.** 21-017

FAN DATA SHEET

	FAN NO.	AHU-J (3)	FAN NO.	
Serves / Location:	Courtroom 3	Penthouse		
Manufacturer:	TRANE			
Model Number:	L-10			
Size:	NL			
Serial Number:	K1H204764			
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	DAYTON		
Frame Number:	NL	145T		
Horsepower:	NL	2		
Brake Horsepower:	NL	1.7		
Safety Factor:	NL	1.15		
Volts/Phase:	460/3	460		
Motor Amperage:	2.7	2.1/2.2/2.2		
Motor RPM:	1735	1735		
Speeds:	1	1		
Heater Size:	NL	CB		
Heater Amps.:	NL	CB		
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	6000	4259		
Return Air CFM:	NL	3150		
Exhaust Air CFM:				
Outside Air CFM:	1200	1109		
Suction Pressure:	NL	0.86		
Discharge Pressure:	NL	0.18		
Fan Static Pressure:	NL	1.04		
External Pressure:	NL	NA		
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	859		
Motor Drive:	NL	1VP62		
Motor Size/Bore:	NL	7/8"		
Fan Drive:	NL	12" OD		
Fan Size/Bore:	NL	1 1/4"		
Belt Size / Number:	NL	A64/1		
Shafts C-C:	NL	19"		
Turns Open:	NL	2.5		

Comments: