NORFOLK COUNTY SUPERIOR COURT
HVAC SYSTEM EVALUATION SUMMARY

Visited September 22, 2020. While on site, inspected the air handling equipment located in the mechanical rooms and on the roof, and toured the facility to determine if the spaces generally matched usages noted on the plans. The Norfolk County Superior Courthouse is a National Historic Landmark at 650 High Street in Dedham, Massachusetts. The building has granite walls, with two above-grade stories and an occupied basement. There are two large attic spaces and a central dome that contain many duct risers that are no longer active or functional.

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)*
Grand Jury	16	1,200	75	510	32
Jury Pool	23	Unknown	-	Unknown	-
Courtroom 3	16	Unknown	-	Unknown	-
Courtroom 8	12	Unknown	-	Unknown	-
Courtroom 10	20	Unknown	-	Unknown	-
Courtroom 20	24	Unknown	-	Unknown	-
Courtroom 25	23	Unknown	-	Unknown	-
Main Courtroom	76	Unknown	-	Unknown	-

2.0 Recommendations

Section	Recommendation/Finding	Action
2.1	**Filtration Efficiency**	
RF-1	Replace filters with a MERV-13 filter.	Complete
RE-3	Install a differential pressure sensor across the filter bank.	N/A
2.2	**Testing and Balancing**	
RTB-1	Test and rebalance air handling unit supply air and minimum outside air flow rates	N/A
RTB-3	Increase outside air flow rate beyond minimum under non-peak conditions.	N/A
2.3	**Equipment Maintenance and Upgrades**	
RE-2	Clean air handler coils.	N/A
2.4	**Control System**	
RC-1	Implement a pre and post-occupancy flush sequence	N/A
RC-2	Install controls required to introduce outside air beyond the minimum requirements.	N/A

2.5	Additional Filtration and Air Cleaning	
RFC-1	Install portable HEPA filters – *if courthouse is to operate at a high occupancy (i.e. 50-75% or greater), install portable HEPA filters in high traffic areas.*	In-progress
2.6	Humidity Control	
	Installing portable humidifiers and dehumidifiers is not recommended unless high-risk employees are present	On-going
2.7	Other Recommendations	
2.7.1	Run Ventilation Fans Continuously During Occupied Hours	On-going
2.7.2	Repair and Recommission Energy Recovery Ventilators	N/A
2.7.3	Refurbish or Replace Ventilation Systems	In-progress
2.7.4	Repair or Replace Toilet Exhaust Fans and Controls	In-progress
2.7.5	Install a Building Management System	Deferred – included in 5 year Capital Plan

Norfolk County Superior Court
Dedham, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

February 1, 2021

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Norfolk County Superior Court on September 22, 2020. While on site we inspected the air handling equipment located in the mechanical rooms and on the roof, and toured the facility to determine if the spaces generally matched usages noted on the plans.

Site Visit Attendees:

- *Office of Court Management:*
  - Mike Mullen, Scott Arneil, and Mike Ostman
- Tighe & Bond
  - Todd Holland, PE, Senior Mechanical Engineer
  - Timothy Bill, PE, Project Mechanical Engineer

1.1 Existing Ventilation System

The Norfolk County Courthouse is a National Historic Landmark at 650 High Street in Dedham, Massachusetts. The building has granite walls, with two above-grade stories and an occupied basement. There are two large attic spaces and a central dome that contain many duct risers that are no longer active or functional.

The Registry of Deeds is located directly across the street, also of granite construction, and has two above-grade stories and a basement.

The mechanical plans and other documentation available to us were minimal. Most of our observations and recommendations are based on the walk through and subsequent discussion with facilities personnel.

Courthouse:

Most spaces in the courthouse have steam perimeter convection heat and wall-mounted mini-split systems for cooling. There are no active central air or mechanical ventilation systems.

The windows have operable sashes and are in good condition. Most of the larger interior spaces have transom windows over the doors.

There are many small toilet rooms in the courthouse with dedicated exhaust fans, some of which are not in working condition. The exhaust fans are either separately switched or switched with the lights.

A project in 2002 to improve indoor air quality (IAQ) installed two energy recovery units (ERUs) to exhaust air from and supply outdoor air (OA) to occupied non-mechanical areas in the basement. Each of these systems provides approximately 1,500 cfm, has a 5-kW electric heater, 2" MERV-8 filters, and total energy wheel that recovers heat and humidity

from outgoing exhaust air. Each unit has a 4-ton cooling coil with split condensing units outside on grade. According to staff, the cooling coils are no longer functional, and the ERUs are no longer used.

The antiquated ventilation systems serving many rooms on the first and second floors consists of a pair of wall-mounted cast iron grilles, one low and one high, with a damper in the high grille with chain pulls marked "open" and "shut". In most rooms there is a third grille mounted to the side, part way up the wall. Some of these provide passive ventilation, as evidenced by dust collecting on the grille face. At least one of the three grilles has a duct that extends to the attic space, where the original ducts were capped with goosenecks and bird screens. The attic space is ventilated by louvers on the gable ends, covered by plenum boxes with manual control dampers. The goosenecks have all been removed and abandoned, leaving the ducts open to the attic space. Most of these ducts have been used to run electrical conduit, network cable, piping, or condensate piping from the mini-split systems.

This ventilation system, likely original to the 1825 building, has been abandoned and compromised for decades, and it would take a very substantial effort to understand and refurbish, or to replace with a new system.

Table 1 summarizes the heat recovery units' designed airflow rates, the MERV rating of the installed filters, and the condition, based on a review of design documentation, nameplate data, and visual inspection.

TABLE 1
Existing Air Handling Units in Courthouse

Unit	Design Airflow (CFM)	Design Min. O.A. (CFM)	Filters	Condition
ERU-1	1,500	1,500	2", MERV-8	Non-functional
ERU-2	1,450	1,450	2", MERV-8	Non-functional

Registry:

Most spaces in the Registry of Deeds have steam perimeter radiation and wall-mounted mini-split systems for cooling.

There are several older ducted heating and ventilating systems with steam coils. These are abandoned in place, and there is no opportunity for refurbishing or recommissioning them. Some toilet rooms have local exhaust fans, but not all of them.

There are four air handlers in the building. One system serves the Engineering area (east wing) in the basement, is a cooling-only system, and has no outdoor air supply.

A rooftop unit (RTU) with electric DX cooling and gas heat serves the 1975 Probate Court addition. It was not running at the time of the visit, likely because space temperature was satisfied. This constant volume unit has a fixed outdoor air intake. It is a replacement for the original 5-ton Mammoth unit that had 20-kW electric heat.

Two 10-ton air handlers in an attic mechanical space serve the main records hall, and these were not running because space temperatures were satisfied. These constant volume units have fixed outdoor air volumes via 12" round ducts with dampers. Air-cooled condensing units are mounted on the adjacent roof of the Probate Court addition.

Code requires for ventilation to be provided during the periods that the room or space is occupied. The fans in these units should operate continuously during occupied hours, and not set to "auto" which turns the fans off when cooling or heating is not active.

Table 2 summarizes the air handling units' designed airflow rates, the MERV rating of the installed filters, and the condition, based on a review of design documentation, nameplate data, and visual inspection.

TABLE 2
Existing Air Handling Units in Registry

Unit	Design Airflow (CFM)	Design Min. O.A. (CFM)	Filters	Condition
Engineering	2,000	0	1", MERV unknown	Good
RTU	1,900	Unknown	2", MERV-8	Good
AHU-1	4,000	Unknown	2", MERV-8	Good
AHU-2	4,000	Unknown	2", MERV-8	Good

1.2 Existing Control System

There is no central Building Management System (BMS) or centralized controls in either building. Honeywell T7300A programmable thermostats are used as seven-day programmable timeclocks to start and stop several of the systems.

Section 2
Recommendations

Below is a list of recommendations that we propose for the Norfolk County Superior Court . 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 in both buildings:

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

TAB Contractor and/or Engineer shall verify that the rooftop unit and air handlers can accommodate MERV-13 filters.

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

2.2 Testing & Balancing Recommendations

The RTU serving the Probate Court was installed in 2016, and the AHUs serving the Records Hall were installed in 2012. It is unknown to Tighe & Bond if the units were tested and balanced, or the actual rates of the fixed outdoor air flows.

The ASHRAE climatic data for outdoor air conditions in Norwood state a summer design condition of 90.6°F/73.5°F DB/WB and a winter condition of 3.1°F. We recommend the following measures be implemented:

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

We recommend rebalancing the air handler outside airflow rates to the values shown in Tables 3 and 4. The units' cooling capacities should be able to provide adequate leaving air conditions similar to the original design under peak outdoor air conditions, assuming the cooling coils are clean and their performance has not degraded significantly over time.

TABLE 3
Courthouse - Recommended Air Handler OA Flow Rates

Unit	Supply Airflow (CFM)	Design Min. OA (CFM)	2015 IMC Min. OA Requirements (CFM)	Recommended Minimum OA (CFM)
ERU-1	1,500	1,500	296	1,500
ERU-2	1,450	1,450	184	1,450

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.

TABLE 4
Registry - Recommended Air Handler OA Flow Rates

Unit	Supply Airflow (CFM)	Design Min. OA (CFM)	2015 IMC Min. OA Requirements (CFM)	Recommended Minimum OA (CFM)
Engineering	2,000	Unknown	170	340
RTU	1,900	Unknown	510	510
AHU-1	4,000	Unknown	480	800
AHU-2	4,000	Unknown	480	800

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.

The recommended OA volume above code levels will serve as makeup air for toilet exhaust.

The unit serving Engineering is cooling-only, and will need a source of heat for winter operation to temper the air. This can be done by adding an electric resistance coil (approximately 5 kW), or by replacing the condensing unit with a heat pump unit, along with the appropriate controls, refrigerant piping, and accessories.

Although the AHUs serving the Records Hall do not have heat, the high ceilings and high capacity of the steam perimeter radiation should easily handle the heating load. Facilities personnel indicated that the space is usually too warm.

The airflow rate per person is shown below in Tables 5 and 6. These values are based on the recommended outdoor airflow and the original design supply airflow rates shown in Tables 3 and 4 above.

TABLE 5
Courthouse Basement - Airflow Rate per Person

	Average for all spaces (CFM/Person)	***Courtrooms (CFM/Person)***	***Non-Courtroom Spaces (CFM/Person)***
Total Supply Air	0-48	N/A	0-60
Outdoor Air	0-48	N/A	0-60

The airflow rate per person for each Courtroom and the Jury Pool Room is shown below in Table 6. 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. Note that the Grand Jury and Jury Pool Rooms are located in the Registry Building.

TABLE 6
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)***
Grand Jury	29	1,200	42	510	18
Jury Pool Room	36	Unknown	-	Unknown	-
Courtroom 3	93	Unknown	-	Unknown	-
Courtroom 8	41	Unknown	-	Unknown	-
Courtroom 10	109	Unknown	-	Unknown	-
Courtroom 20	56	Unknown	-	Unknown	-
Courtroom 25	78	Unknown	-	Unknown	-
Main Courtroom	181	Unknown	-	Unknown	-

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 6a. 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 6a
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)*
Grand Jury	16	1,200	75	510	32
Jury Pool Room	23	Unknown	-	Unknown	-
Courtroom 3	16	Unknown	-	Unknown	-
Courtroom 8	12	Unknown	-	Unknown	-
Courtroom 10	20	Unknown	-	Unknown	-
Courtroom 20	24	Unknown	-	Unknown	-
Courtroom 25	23	Unknown	-	Unknown	-
Main Courtroom	76	Unknown	-	Unknown	-

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

RTB-3: *Increase outside air flow rate beyond minimum under non-peak conditions.* We recommend increasing the outdoor air flow rate per Table 3. We do not believe this would run the risk of high humidity in summer or cold temperatures in winter, based on our calculation of discharge air temperatures.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades for the units in both buildings:

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

2.4 Control System

The Norfolk County Superior Court buildings have local control systems with limited functionality. We recommend the following control system strategies be implemented into the existing control systems:

Run supply fans continuously during occupied hours to provide mechanical ventilation, per Section 2.7, Other Recommendations.

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

RC-2: *Install controls required to introduce outside air beyond the minimum requirements.*

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, and occupied spaces that do not have mechanical ventilation systems. They should be considered for courtrooms, jury rooms, offices, and the holding cells. Noise levels will be a concern in the courtrooms, and will vary depending on the manufacturer, size of the unit, and whether it can be run at low or medium speed.

2.6 Humidity Control

Installing portable humidifiers and dehumidifiers is not recommended unless there are high risk employees who cannot work remotely and are required to be in the courthouse.

2.7 Other Recommendations

2.7.1 Run Ventilation Fans Continuously During Occupied Hours

The systems that provide ventilation air to the Registry were not operating during our visit, presumably because the weather was mild, occupancy was low, and space temperatures were satisfied. We strongly recommend running the supply fans continuously during occupied hours to provide mechanical ventilation, as code requires. Further system analysis and improvements are required to execute this recommendation.

2.7.2 Repair and Recommission Energy Recovery Ventilators

The non-operational ERUs serving the courthouse basement areas should be repaired, refurbished, cleaned, and recommissioned. The DX coils and/or condensing units should be repaired or replaced as required. If these units are replaced, heat pumps should be considered to provide heat with much greater efficiency than the existing electric resistance coils, which could remain as backup.

2.7.3 Refurbish or Replace Ventilation Systems

The decommissioned and abandoned courthouse ventilation systems should be refurbished, enhanced, and recommissioned. It is possible that the existing grilles and duct risers could be reused, with the attic space housing direct outdoor air systems (DOAS) with heat recovery for efficiency and MERV-13 filters for IAQ.

This effort would start with understanding how the original systems were designed and operated, and would then require a substantial and invasive construction project. The existing ducts would have to be cleared of electrical, data, telephone, plumbing, and other utilities that have been routed through them over the decades. The ducts would also need to be cleaned and sealed. These utilities would have to be rerouted elsewhere or new duct systems would have to be installed. Due to the constraints of the existing building construction, adding new ductwork may be difficult. New ducts may need to be run to ensure adequate ventilation effectiveness, so that inlets and outlets are not too close together.

2.7.4 Repair or Replace Toilet Exhaust Fans and Controls

All of the toilet rooms in both buildings should have dedicated working exhaust fans, properly sized, with suitable controls. Toilet exhaust fans should be sized at 70 cfm per fixture in heavy use areas, such as those with public access. They can be sized at 50 cfm for single-person occupancy if they are run continuously during occupied hours. If toilet exhaust fans are controlled with the lights, we recommend using a switch with auxiliary contacts for the fan and a time delay, to run the fan for an interval, 10 minutes for example, after the lights are shut off.

If new ventilation systems are considered for the Courthouse, it would be ideal if toilet exhaust was routed through the heat recovery systems. However, because of the number and location of small toilet rooms, it may not be practical to route all toilet exhaust to a few central locations.

2.7.5 Install a Building Management System

We recommend installing a BMS to schedule, control, and monitor equipment. The local control systems are antiquated and do not offer the same benefits as a BMS.

A BMS for each building could also be used to control and schedule other pieces of equipment such as boilers and mini-split systems. If it is desired to control only the air handling systems, less complex programmable controllers that are web-accessible may be able to provide the benefits of a BMS at a lower cost.

Section 3
Testing & Balancing Results

On November 10, 2020 Milharmer Associates, Inc. visited the Norfolk County Superior Court to test the airflow rates of the air handling units. The Office of Court Management's Automatic Temperature Controls (ATC) Contractor was also on site to assist in the balancing process. A summary of the tested airflow rates versus the design airflow rates are shown below in Table 7. Their full testing and balancing report is attached.

TABLE 7
Air Handler Testing & Balancing Results (Courthouse)

	Design			Actual		
Unit	Total Supply Fan Airflow (CFM)	Recommended Outdoor Airflow (CFM)	Exhaust Fan Airflow (CFM)	Supply Fan Airflow (CFM)	Outdoor Airflow (CFM)	Exhaust Fan Airflow (CFM)
ERU-1	1,500	1,500	1,500	1,599	1,599	1,623
ERU-2	1,500	1,500	1,500	1,384	1,384	1,505

Both energy recovery units are operating with acceptable airflow ranges for both the supply and exhaust fans. According to the TAB report, these units have adequate capacity to increase the efficiency of the air filters, as the motors are approximately 62% loaded. It should be noted that the cooling coils for these units are no longer functional, and the ERUs are no longer used.

TABLE 8
Air Handler Testing & Balancing Results (Registry of Deeds)

	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	1,900	510	1,390	1,108	413	695
AHU-1	4,000	800	3,200	3,761	255	3,506
AHU-2	4,000	800	3,200	3,955	234	3,721

The rooftop unit serving the Probate Court is operating at only a fraction of the design supply airflow. The outdoor air (OA) flow rate is below the 2015 IMC minimum requirements and recommended minimum in Table 4. These airflow shortfalls are significant, more than 40% on supply and about 20% for OA. Not only does that affect ventilation rates, it likely adversely affects the performance and reliability of the cooling and heating equipment from short cycling.

Both air handlers serving the Records Hall are operating with acceptable airflow ranges for both the supply and return fans. However, OA flow rates are significantly below the 2015 IMC minimum requirements and recommended minimums in Table 4. The TAB report states that the OA could be increased slightly because the OA dampers were not 100% open during the test.

According to the TAB report, these units have adequate capacity to increase the efficiency of the air filters, as the motors are approximately 72% loaded.

The Engineering air handling unit was not tested since it does not provide any outdoor air.

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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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: **Norfolk Superior Court House**
650 High St Dedham, MA

Project No.: **20-549** **Project Date:** **11/10/2020**

MECHANICAL CONTRACTOR
Tighe & Bond

3384

A N.E.B.B. Certified Company

Project:	Norfolk Superior Court House		
Address:	650 High St Dedham, MA		
Date:	11/10/2020	**Project No.**	20-549

CERTIFICATION

Submitted & Certified by:

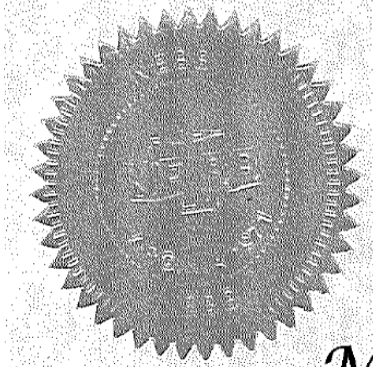
Milharmer Associates, Inc.

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 Farrell

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:	Norfolk Superior Court House		
Address:	650 High St Dedham, MA		
Date:	11/10/2020	**Project No.**	20-549

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Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

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 Protection For Motors Located at Starter Motor
AC or ACU	Air Conditioner Unit		
ACCU	Air Cooled Condensing Unit		
ADJ P.D.	Adjusted Pitch Diameter		
AMP	Amperage	HEPA	High Efficiency Particulate Arrestance
AVG	Average		
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 Air Conditioning
CH	Chiller		
CHWR	Chilled Water Return	HWR	Hot Water Return or Heating Water Return
CHW or CHWS	Chilled Water Supply		
CT	Cooling Tower	HWS	Hot Water Supply or Heating Water Supply
CWR	Condenser Water Return		
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:	Norfolk Superior Court House		
Address:	650 High St Dedham, MA		
Date:	11/10/2020	**Project No.**	20-549

REPORT SUMMARY

The ventilation for Norfolk Superior Courthouse is provided by two Energy Recovery Units both of which are operating at design airflow. The units have available capacity to increase Outside Air or Exhaust Air flows if required. There is also sufficient capacity to increase the filter efficiency on both units.

Project:	Norfolk Superior Court House		
Address:	650 High St Dedham, MA		
Date:	1/0/1900	**Project No.**	20-549

REPORT SUMMARY

ERU's

UNIT	SUPPLY	EXHAUST	OUTSIDE AIR
ERU-1	1,599 CFM	1,623 CFM	1,599 CFM
ERU-2	1,384 CFM	1,505 CFM	1,384 CFM

Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

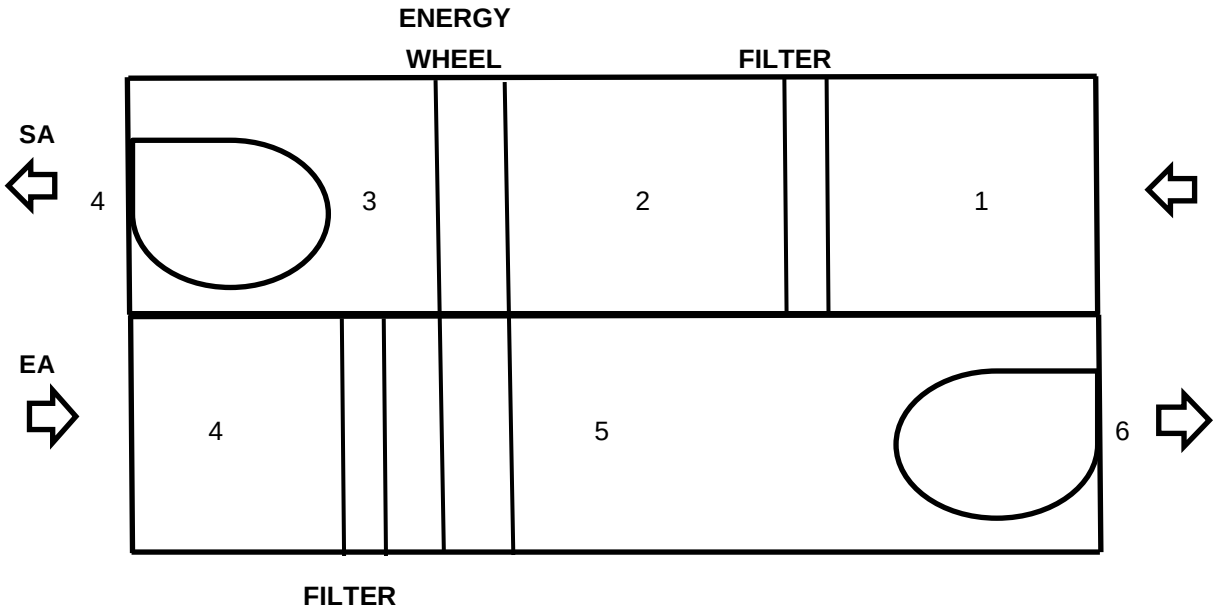
FAN DATA SHEET

	FAN NO. ERU-1(SUPPLY)		FAN NO. ERU-1(EXHAUST)	
Serves / Location:	Bsmt & 1st Fl / Mech Rm		Bsmt & 1st Fl / Mech Rm	
Manufacturer:	Greenheck		Greenheck	
Model Number:	ERV-361S-15-A-ES		ERV-361S-15-A-ES	
Size:	NL		NL	
Serial Number:	03D17306		03D17306	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	Marathon	NL	Marathon
Frame Number:	NL	56H-70	NL	56H-70
Horsepower:	1 1/2	1 1/2	1	1 1/2
Brake Horsepower:	NL	NA	NL	NA
Safety Factor:	NL	1.15	NL	1.15
Volts/Phase:	208/3	200	208/3	200
Motor Amperage:	5.7	3.6	5.7	3.5
Motor RPM:	1725	1744	1725	1742
Speeds:	1	1	1	1
Heater Size:	NL	EA	NL	EA
Heater Amps.:	NL	Set @ 6.0	NL	Set @ 6.0
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	1500	1599		
Return Air CFM:				
Exhaust Air CFM:			1500	1623
Outside Air CFM:	1500	1599		
Suction Pressure:	NL	-1.53	NL	-1.46
Discharge Pressure:	NL	0.63	NL	0.34
Fan Static Pressure:	NL	2.16	NL	1.8
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	NA	NL	NA
Motor Drive:	NL	1VL40	NL	1VL40
Motor Size/Bore:	NL	5/8	NL	5/8
Fan Drive:	NL	AK39	NL	AK39
Fan Size/Bore:	NL	3/4	NL	3/4
Belt Size / Number:	NL	A40 / 1	NL	A40 / 1
Shafts C-C:	NL	15 1/2"	NL	15 1/2"
Turns Open:	NL	1	NL	1

Comments:

Project:	Plymouth Trial Court		
Address:	52 Obery St., Plymouth, MA		
Date:	10/30/2020	**Project No.**	20-547

ERU-1 STATIC PROFILE



LOCATION	STATIC
1	-.33"
2	-.55"
3	-1.53"
4	-.20"
5	-1.46"
6	+.34"

Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: ERU-1 Supply
TRAVERSE NUMBER : T-1
TRAVERSE LOCATION: OSA

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	20	" WIDTH x	17	" DEPTH	Sq Ft =	2.36

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.05	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	1598
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**1599**

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	601	724	677	488			
B	686	687	657	591			
C	776	826	521	569			
D	696	860	730	603			
E	552	860	835	601			
F							
G							
H							
I							

NO. OF READINGS = 20 AVERAGE FPM = 677

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller

Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: ERU-1 Exhaust
TRAVERSE NUMBER : T-1
TRAVERSE LOCATION: Exhaust

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	22	" WIDTH x	14 " DEPTH	Sq Ft =	2.14

Actual Size is 24 X 16 with 1" insulation

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.04	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	1622
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**1623**

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	562	829	928	628			
B	762	868	964	747			
C	817	944	886	751			
D	810	919	739	655			
E	727	719	482	429			
F							
G							
H							
I							

NO. OF READINGS = 20 AVERAGE FPM = 758

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller

Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

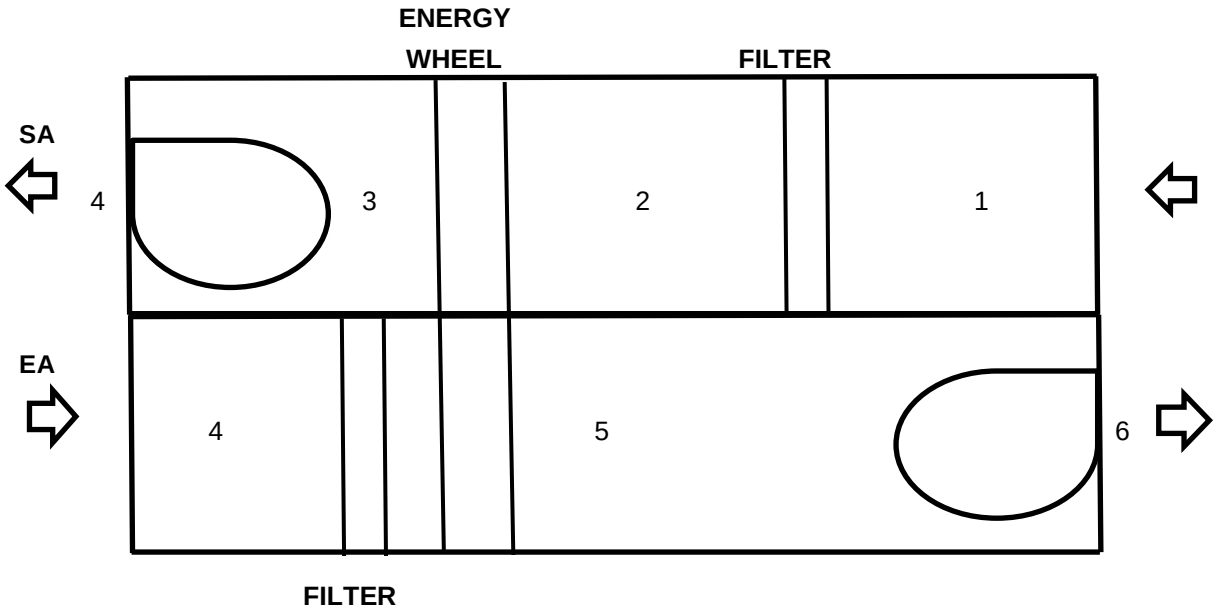
FAN DATA SHEET

	FAN NO. ERU-2(SUPPLY)		FAN NO. ERU-2(EXHAUST)	
Serves / Location:	Bsmt & Upper flrs / File rm Mech		Bsmt & Upper flrs / File rm Mech	
Manufacturer:	Greenheck		Greenheck	
Model Number:	ERV-361S-15-A-ES		ERV-361S-15-A-ES	
Size:	NL		NL	
Serial Number:	03D17307		03D17307	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	Marathon	NL	Marathon
Frame Number:	NL	NA	NL	56
Horsepower:	1 1/2	1 1/2	1	1
Brake Horsepower:	NL	NA	NL	NA
Safety Factor:	NL	1.15	NL	1.15
Volts/Phase:	208/3	200	208/3	200
Motor Amperage:	5.7	3.3	4	2.9
Motor RPM:	1725	1752	1725	1733
Speeds:	1	1	1	1
Heater Size:	NL	EA	NL	EA
Heater Amps.:	NL	Set @ 6.0	NL	Set @ 5
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	1450	1384		
Return Air CFM:				
Exhaust Air CFM:			1450	1505
Outside Air CFM:	1450	1384		
Suction Pressure:	NL	-1.53	NL	-1.34
Discharge Pressure:	NL	0.49	NL	0.48
Fan Static Pressure:	NL	2.02	NL	1.82
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	NA	NL	NA
Motor Drive:	NL	1VL40	NL	1VL34
Motor Size/Bore:	NL	5/8	NL	5/8
Fan Drive:	NL	AK39	NL	AK32
Fan Size/Bore:	NL	3/4	NL	3/4
Belt Size / Number:	NL	A40 / 1	NL	A38 / 1
Shafts C-C:	NL	15 1/2"	NL	15 1/4"
Turns Open:	NL	1	NL	1

Comments:

Project:	Plymouth Trial Court		
Address:	52 Obery St., Plymouth, MA		
Date:	10/30/2020	**Project No.**	20-547

ERU-2 STATIC PROFILE



LOCATION	STATIC
1	-.48"
2	-.77"
3	-1.53"
4	-.48"
5	-1.34"
6	+.48"

Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: ERU-1 Supply TRAVERSE NUMBER : T-1
TRAVERSE LOCATION: OSA

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	24	" WIDTH x	10	" DEPTH	Sq Ft =	1.67

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.44	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	1385
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**1384**

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	267	127	194	173			
B	1221	878	798	529			
C	1474	1167	1053	1258			
D	834	1169	1092	1059			
E							
F							
G							
H							
I							

NO. OF READINGS = 16 AVERAGE FPM = 831

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller

Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: ERU-2 Exhaust
TRAVERSE NUMBER : T-1
TRAVERSE LOCATION: Exhaust

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	16	" WIDTH x	16 " DEPTH	Sq Ft =	1.78

Actual Size is 18X18 with 1" insulation

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.48	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	1506
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**1505**

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	870	973	876	608			
B	978	948	998	744			
C	1009	974	916	736			
D	969	951	743	655			
E	843	907	602	643			
F							
G							
H							
I							

NO. OF READINGS = 20 AVERAGE FPM = 847

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller

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: **Norfolk County Registry of Deeds**
649 High Street Dedham, MA

Project No.: **20-549** **Project Date:** **1/4/2021**

MECHANICAL CONTRACTOR
TIGHE & Bond

3384

A N.E.B.B. Certified Company

Project:	Norfolk County Registry of Deeds		
Address:	649 High Street Dedham, MA		
Date:	1/4/2021	**Project No.**	20-549

CERTIFICATION

Submitted & Certified by:

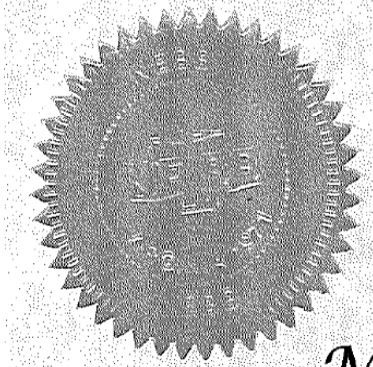
Milharmer Associates, Inc.

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 Farrell

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:	Norfolk County Registry of Deeds		
Address:	649 High Street Dedham, MA		
Date:	1/4/2021	**Project No.**	20-549

TABLE OF CONTENTS

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 1/4/2021 **Project No.** 20-549

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 Protection For Motors Located at Starter Motor
AC or ACU	Air Conditioner Unit		
ACCU	Air Cooled Condensing Unit		
ADJ P.D.	Adjusted Pitch Diameter		
AMP	Amperage	HEPA	High Efficiency Particulate Arrestance
AVG	Average		
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 Air Conditioning
CH	Chiller		
CHWR	Chilled Water Return	HWR	Hot Water Return or Heating Water Return
CHW or CHWS	Chilled Water Supply		
CT	Cooling Tower	HWS	Hot Water Supply or Heating Water Supply
CWR	Condenser Water Return		
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:	Norfolk County Registry of Deeds		
Address:	649 High Street Dedham, MA		
Date:	1/4/2021	**Project No.**	20-549

REPORT SUMMARY

The ventilation for the Norfolk County Registry of Deeds is provided by two small Air Handling Units Located in the Mezzanine of the building. The units bring in a continuous minimum amount of outside air to the building. The minimum outside air could be slightly increased as the outside air dampers were not 100% open at the time of testing. The units have sufficient capacity to increase the filter efficiency.

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 1/4/2021 **Project No.** 20-549

FAN DATA SHEET

	FAN NO. RTU-1		FAN NO.	
Serves / Location:	Probation Annex / Roof			
Manufacturer:	Trane			
Model Number:	YSC063G3RHAO			
Size:	NL			
Serial Number:	160912541L			
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	Selectech		
Frame Number:	NL	56		
Horsepower:	1	1		
Brake Horsepower:	NL	0.75		
Safety Factor:	NL	1.15		
Volts/Phase:	208/1	200		
Motor Amperage:	6.9	5.2		
Motor RPM:	NL	Direct Drive		
Speeds:	ECM	High		
Heater Size:	NL	CB		
Heater Amps.:	NL	CB		
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	Not Listed	1108		
Return Air CFM:		695		
Exhaust Air CFM:				
Outside Air CFM:	Not Listed	413		
Suction Pressure:	NL	-0.68		
Discharge Pressure:	NL	0.56		
Fan Static Pressure:	NL	1.24		
External Pressure:	NL	NA		
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	Direct Drive		
Motor Drive:	NL	Direct Drive		
Motor Size/Bore:	NL	Direct Drive		
Fan Drive:	NL	Direct Drive		
Fan Size/Bore:	NL	Direct Drive		
Belt Size / Number:	NL	Direct Drive		
Shafts C-C:	NL	Direct Drive		
Turns Open:	NL	Direct Drive		

Comments:

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

AIR DISTRIBUTION

SYSTEM: RTU-1
SUPPLY [X] RETURN [ ] EXHAUST [ ]

ROOM OR LOCATION	UNIT NUMBER	UNIT SIZE	AREAxK FACTOR	DESIGN FT/MIN	TEST FT/MIN	DESIGN CFM	TESTED CFM
Probation Annex	1	12x12	F.H.	NA	NA	NL	190
Probation Annex	2	12x12	F.H.	NA	NA	NL	233
Probation Annex	3	12x12	F.H.	NA	NA	NL	71
Probation Annex	4	12x12	F.H.	NA	NA	NL	100
Probation Annex	5	12x12	F.H.	NA	NA	NL	280
Probation Annex	6	12x12	F.H.	NA	NA	NL	234
					TOTALS:	NL	1108

Comments:

Project: Norfolk Superior Court House
Address: 650 High St Dedham, MA
Date: 11/10/2020 **Project No.** 20-549

AIR DISTRIBUTION

SYSTEM: RTU-1

SUPPLY [ ] RETURN [X] EXHAUST [ ]

ROOM OR LOCATION	UNIT NUMBER	UNIT SIZE	AREAxK FACTOR	DESIGN FT/MIN	TEST FT/MIN	DESIGN CFM	TESTED CFM
Probation Annex	1	12x12	F.H.	NA	NA	NL	795
					TOTALS:	NL	795

Comments:

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 1/4/2021 **Project No.** 20-549

FAN DATA SHEET

	FAN NO. AHU-1		FAN NO. AHU-2	
Serves / Location:	Main Records / Mezzanine		Main Records / Mezzanine	
Manufacturer:	Trane		Trane	
Model Number:	TWE120E300AB		TWE120E300AB	
Size:	NL		NL	
Serial Number:	12083KAPBA		12102MSSBA	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	Marathon	NL	Marathon
Frame Number:	NL	145T	NL	145T
Horsepower:	NL	2	NL	2
Brake Horsepower:	NL	1.4	NL	1.45
Safety Factor:	NL	1.15	NL	1.15
Volts/Phase:	208/3	200	208/3	200
Motor Amperage:	6.2	4.3	6.2	4.7
Motor RPM:	1725	1733	1725	1740
Speeds:	1	1	1	1
Heater Size:	NL	CB	NL	CB
Heater Amps.:	NL	CB	NL	CB
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	NL	3761	NL	3955
Return Air CFM:	NL	3506	NL	3721
Exhaust Air CFM:				
Outside Air CFM:	NL	255	NL	234
Suction Pressure:	NL	-0.77	NL	-0.74
Discharge Pressure:	NL	0.26	NL	0.12
Fan Static Pressure:	NL	1.03	NL	0.86
External Pressure:	NL	-0.26	NL	-0.24
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	NA	NL	NA
Motor Drive:	NL	1VL40	NL	1VL40
Motor Size/Bore:	NL	7/8"	NL	7/8"
Fan Drive:	NL	AK79	NL	AK79
Fan Size/Bore:	NL	1"	NL	1"
Belt Size / Number:	NL	A50 / 1	NL	A50 / 1
Shafts C-C:	NL	17"	NL	17"
Turns Open:	NL	2	NL	2

Comments:

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 1/4/2021 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: AHU-1 TRAVERSE NUMBER : T-1
TRAVERSE LOCATION: RETURN

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	34	" WIDTH x	18 " DEPTH	Sq Ft =	4.25

Actual is 36X20 with 1" Insulation

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.15	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	3506
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**3507**

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	378	462	646	617	801	796	
B	353	682	754	765	813	906	
C	693	660	1084	819	826	1087	
D	1036	942	1176	1149	946	1094	
E	780	1229	1161	916		353	
F							
G							
H							
I							

NO. OF READINGS = 29 AVERAGE FPM = 825

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 1/4/2021 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: AHU-1 TRAVERSE NUMBER : T-1
TRAVERSE LOCATION: OSA

DUCT SIZE (ROUND)	10	" DIAMETER		Sq Ft =	0.55
DUCT SIZE (RECT.)		" WIDTH x	" DEPTH	Sq Ft =	0.00

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.07	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	255
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**255**

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	511	434					
B	454	376					
C	424	583					
D	480	473					
E							
F							
G							
H							
I							

NO. OF READINGS = 8 AVERAGE FPM = 467

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 1/4/2021 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: AHU-2 TRAVERSE NUMBER : T-1
TRAVERSE LOCATION: RETURN

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	34	" WIDTH x	18 " DEPTH	Sq Ft =	4.25

Actual is 36X20 with 1" Insulation

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.18	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	3721
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**3721**

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	515	564	505	607	588	889	
B	763	1052	945	848	705	1143	
C	1309	1315	1178	902	838	1385	
D	1324	1344	1252	1115	780	1445	
E	608	421	288	344	777	515	
F							
G							
H							
I							

NO. OF READINGS = 30 AVERAGE FPM = 875

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller

Project: Norfolk County Registry of Deeds
Address: 649 High Street Dedham, MA
Date: 1/4/2021 **Project No.** 20-549

TRAVERSE DATA

SYSTEM: AHU-2 TRAVERSE NUMBER : T-2
TRAVERSE LOCATION: OSA

DUCT SIZE (ROUND)	10	" DIAMETER		Sq Ft =	0.55
DUCT SIZE (RECT.)		" WIDTH x	" DEPTH	Sq Ft =	0.00

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.06	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	234
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**234**

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	491	382					
B	451	350					
C	370	503					
D	406	483					
E							
F							
G							
H							
I							

NO. OF READINGS = 8 AVERAGE FPM = 430

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Greg Miller