AYER DISTRICT COURT
HVAC SYSTEM EVALUATION SUMMARY

Visited February 4, 2021. While on site, inspected the air handling units located in the mechanical rooms and toured the facility to determine if the spaces generally matched usage noted on the architectural plans. The Ayer District Courthouse was converted to a courthouse in 1970. According to staff, the building was a town school prior to being used as a courthouse. The building is approximately 32,000 square feet in size. Four air handling units (AHU) provide ventilation air to the building.

1.0 Airflow Rate per Person (Reduced Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	*Total People*	*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Jury Pool Room	6	1,500	250	167	28
Courtroom #1	22	4,000	182	1,500	68
Courtroom #2	14	2,200	157	244	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
RF-3a	Connect the pressure sensor to the BMS system and/or a local alarm	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-4	Test and balance air inlets and outlets	Complete
RTB-5	Test and balance all air inlets and outlets	Complete
2.3	**Equipment Maintenance and Upgrades**	
RE-1	Test existing air handling system dampers and actuators for proper operation	Complete
RE-2	Clean air handler coils and drain pans	Complete
RE-3	Confirm the existing freeze stat is working correctly on each air handling unit	In progress
RE-4	Test the existing air handler control valves and actuators for proper operation	Complete
2.4	**Control System**	
RC-1	Implement a pre-occupancy flush sequence	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.*	Complete
2.6	Humidity Control	
	No actionable items listed – continuous monitoring for seasonal changes	On-going
2.7	Other Recommendations	
2.7.1	Add ventilation to all occupied areas	Deferred – included in 5 year Capital Plan
2.7.2	Upgrade controls and building management system (BMS)	Deferred – included in 5 year Capital Plan
2.7.3	Inspect reheat coils and controls	Complete
2.7.4	Replace air handling units and fan coils	Deferred – included in 5 year Capital Plan

Ayer District Court
Ayer, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

June 22, 2021

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Ayer District Courthouse on February 4, 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:*
  - Randen Davis, Courthouse Facilities Staff
  - Raymond Nardone, Courthouse Facilities Staff
  - Bob Caughlin, Courthouse Facilities Staff

- *Tighe & Bond*
  - Sean Pringle, PE, Mechanical Engineer
  - Tim Bill, Staff Mechanical Engineer

1.1 Existing Ventilation System

The Ayer District Courthouse was converted to a courthouse in 1970. According to staff, the building was a town school prior to being used as a courthouse. The building is approximately 32,000 square feet in size. Four air handling units (AHU) provide ventilation air to the building. The AHU's appear to be from the 1970 renovation and are in poor condition. Note that we were not able to inspect the dampers and coils where they were located in the ductwork.

AC-2 and AC-3 contain 2" MERV 8 filters, a chilled water cooling coil, and a supply fan. A dedicated return fan operates in conjunction with each air handling unit. AC-2 also contains a hot water coil. AC-3 does not have a hot water coil within the unit. However, duct mounted reheat coils in the supply ductwork serve each zone in the building. Each unit has return, outdoor, and relief air dampers, operated by pneumatic actuators. The outdoor air and relief dampers for AC-2, which serves Courtroom 1, were fully closed at the time of the visit. AC-3 serves the second floor.

AC-1 is a 100 percent outdoor air unit. The unit contains an outdoor air damper, 2" MERV 8 filters, a hot water coil, chilled water coil, and a supply fan. AC-1 serves the interior areas in the first floor.

HV-4 is also a 100 percent outdoor air unit. The unit contains an outdoor air damper, 2" MERV 8 filters, a hot water coil, and a supply fan. There is also a cooling coil in the downstream ductwork. HV-4 serves the lockup areas in the basement. HV-4 supplies fresh air to the corridors surrounding the holding cells. Air is exhausted through registers located in each cell.

There are 16 fan coils units serving perimeter private and open offices on the first floor. The fan coils have hot/chilled water coils and MERV 8 filters. The units are in fair condition. There are no outdoor air openings for any of these units. As a result, while these areas receive the benefit of air filtration, there is no ventilation. These areas do have operable windows.

Similarly, there is no ventilation in the first floor lobby and corridors, outside the main courtroom. There are concealed fan coils that condition this space and provide filtration, but they do not provide outdoor air.

Much of the basement, aside from the lockup area, is unventilated. Most of the basement is comprised of a large open area that has been divided with office partitions for use as a community room, maintenance offices, and a break room.

At the time of the visit, all exhaust fans serving restrooms and holding areas were operating.

A 2.7 million BTU/h hot water boiler provides hot water to air handlers, unit ventilators, duct heating coils, and radiators. A split 70 ton air cooled chiller located in the mechanical room provides chilled water to all air handlers.

Table 1 summarizes the air handling units' designed airflow rates, the MERV rating of the installed filters, and the condition.

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Pre/Final Filters	Condition
AC-1	1,210	1,210	2" MERV 8	Poor
AC-2	4,000	1,500	MERV 6 Roll Filter	Poor
AC-3	13,510	1,500	MERV 6 Roll Filter	Poor
HV-4	960	960	2" MERV 8	Poor

Photo 1 – Typical Air Handler

1.2 Existing Control System

A pneumatic system controls most of the existing HVAC air handling equipment. It is an old, obsolete system and appears to be original. There is an extremely limited Schneider SmartStruxure building management system (BMS) that enables AC's 1-3 based on a schedule, monitors supply air and space temperatures, and controls the chiller, boiler, and pumps. There is no economizer control, control of outdoor air dampers, or control of supply air or reheat temperatures through the BMS.

According to staff, AC-3 has issues with freeze stat trips during cold weather, generally when it is below 20 °F outside. Because of this, the unit is set to turn on at 10:30 am each day during the winter and has to be reset several times a day.

Section 2
Recommendations

Below is a list of recommendations that we propose for the Ayer District Courthouse. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

As noted in Section 1 above, several offices and the lobby on the first floor, and much of the basement is currently unventilated. 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.*

We recommend replacing the MERV 8 filters in AC-1 and HV-4 with MERV 13 filters.

Air handlers AC-2 and AC-3 contain roll filters and do not have traditional filter racks. To our knowledge, MERV 13 roll filters are not available. We recommend investigating if filter racks can be installed within the air handling units in place of the filter roll system. If this is not feasible, we recommend keeping the roll filters in place and installing MERV 13 filters in the supply air ductwork downstream of the unit.

The TAB Contractor and/or Engineer shall verify that the AHU's can accommodate MERV-13 filters per Appendix A in the overview of recommendations report.

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

RF-3a: *Connect the pressure sensor to the BMS system and/or a local alarm.*

If there are no controllers with available I/O in the vicinity of the AHU's, provide a local alarm.

2.2 Testing & Balancing Recommendations

The air handling units are approximately 50 years old and it is unknown to Tighe & Bond when the last time the units were tested and balanced. Also, the code requirements to determine the outside air flow rates that were used to design the original system may be different than the 2015 International Mechanical Code (IMC) and current ASHRAE Standard 62.1 requirements.

We recommend the following testing and balancing measures be implemented:

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

We recommend testing and balancing the outdoor air flow rates for all air handling units to the recommended minimum O.A. rates listed in Table 2.

TABLE 2
Recommended Air Handler O.A. Flow Rates

Unit	Original Supply Airflow (CFM)	Original Design Min. O.A. (CFM)	Current Code Min. O.A. Requirements (CFM)	Recommended Minimum O.A. (CFM)
AC-1	1,210	1,210	160	1,210
AC-2	4,000	1,500	770	1,500
AC-3	13,510	1,500	1,450	1,500
HV-4	960	960	350	960

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 as 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. Note that areas without ventilation are not included in the calculated averages.

TABLE 3
Average Airflow Rate per Person

	All spaces	***Courtrooms***	***Non-Courtroom Spaces***
Total Occupancy (People)	224	127	97
Total Supply Air (CFM/Person)	88	50	140
Outdoor Air (CFM/Person)	23	14	35

The airflow rate per person for each Courtroom and the Jury Pool Room is shown below in Table 4. These values are based on full occupancy without taking diversity into account, the original full design supply airflow rate, and the recommended outdoor airflow rate. The airflow rate per person assumes the full supply airflow is being delivered to the room.

TABLE 4
Airflow Rate per Person (Full Occupancy)

	Total Air	***Outdoor Air***

Courtroom	Total People	Supply Airflow (CFM)	Airflow Rate (CFM/Person)	Outside Airflow (CFM)	Airflow Rate (CFM/Person)
Jury Pool Room	30	1,500	50	167	6
Courtroom #1	105	4,000	38	1,500	14
Courtroom #2	77	2,200	29	244	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.

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	6	1,500	250	167	28
Courtroom #1	22	4,000	182	1,500	68
Courtroom #2	14	2,200	157	244	17

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

RTB-4: *Test and balance air inlets and outlets.*

If specific areas within the Courthouse experience regular cooling and heating comfort complaints this may be an indication of a lack of airflow to the space. We recommend testing and balancing the air inlets and outlets serving those spaces to the designed values. Prior to rebalancing the building, we recommend verifying the boiler and chilled water plants are maintaining the correct supply water temperature. Incorrect supply water temperature may be contributing to the temperature control complaints instead of a lack of airflow.

RTB-5: *Test and balance all air handler chilled and hot water coils.*

Testing and balancing the air handler hot and chilled 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.

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. As noted in Section 1, the outdoor and relief air dampers were closed on AC-2, indicating a possible pneumatic control issue.

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

RE-3: *Confirm the existing freeze stat is working correctly on each air handling unit.*

According to staff, AC-3 has had ongoing freeze stat issues. Confirm the Freeze stat is correctly adjusted and set to the correct temperature. Test the operation of all freeze stats.

RE-4: *Test the existing air handler control valves and actuators for proper operation.*

2.4 Control System Recommendations

We recommend the following for the control system:

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

While the existing BMS is limited, it does appear to have a scheduling function that would allow extended occupancy periods to be set.

2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

RFC-1: *Install portable HEPA filters.*

If the Courthouse is to operate at a high capacity (i.e. 50% occupancy or greater), we recommend installing portable HEPA filters in high traffic areas, such as entrance lobbies. They should also be considered for Courtrooms, depending on the occupancy of the room and how much noise is generated from the filters. The noise levels will vary depending on the manufacturer.

2.6 Humidity Control

Several AHU's originally contained humidifiers in the supply ductwork. According to staff, they have not been operational for some time. Before replacing these units, we recommend determining if humidification can safely be used in the building. The feasibility of using 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 Add Ventilation to All Occupied Areas

Several occupied areas in the basement and the first floor do not have any mechanical ventilation. Consider adding mechanical ventilation to serve these areas. Consider the use of an energy recovery ventilator (ERV) or a small dedicated outdoor air system (DOAS) to provide tempered outdoor air directly to the spaces. Further system analysis and improvements are required to execute this recommendation.

2.7.2 Upgrade Controls and Building Management System

We recommend replacing the pneumatic control system with electronic actuators and sensors, and upgrading the building management system to control and monitor all HVAC equipment, including space temperatures, reheat controls, AHU controls, and fan coil controls. Pneumatic air systems are antiquated and do not offer the same benefits as a BMS. A BMS can monitor the position of electronic valves, trend valve position data, and report alarms. Pneumatic actuators also tend to leak air, may result in poor control of the HVAC equipment, cause the air compressor to run more frequently and increase energy usage.

If the existing pneumatic system can cycle damper and valve actuators and position the valves and dampers in their correct position repeatedly, then immediate replacement is not necessary. If the system cannot cycle the actuators to correct damper or valve positions, this may cause too little or too much outdoor air flow and water flow through the units, affecting the quantity of ventilation air and heating and cooling capacity of the coils.

This recommendation is primarily an energy saving and maintenance measure and does not affect the indoor air quality of the building, although it would make some of the recommended measures easier to implement.

If possible, installing a BMS should be implemented at the same time as measure 2.7.1 and 2.7.4 as a single project.

2.7.3 Inspect Reheat Coils and Controls

If specific area experience temperature complaints, the reheat coils may be clogged or there may be a control issue with the pneumatic control valve. For these areas, we recommend adjusting the thermostats and verifying that the supply air temperature changes in response to the thermostat setpoint. Consider cleaning the reheat coils. Any reheat coils not providing the required temperature control should be repaired or replaced.

2.7.4 Replace Air Handling Units and Fan Coils

We recommend replacing all air handling units and fan coils within the next three years. The units are approximately 50 years old and are beyond their expected life span of 30 to 40 years. This recommendation does not affect the indoor air quality of the building, assuming the existing air handling units can deliver the proper quantity of supply and

outdoor air and temper the air adequately. Consider converting the existing duct systems to VAV by replacing the reheat coils with VAV boxes with reheat to improve temperature and humidity control.

Section 3
Testing & Balancing Results

Milharmer Associates, Inc. visited the Ayer District Courthouse on May 11, 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 Tables 5 and 6. The full testing and balancing report is attached.

TABLE 5
Air Handler Testing & Balancing Results

	Design			Actual		
Unit	Total Supply Fan Airflow (CFM)	Recommended Outdoor Airflow (CFM)	Return Airflow (CFM)	Supply Fan Airflow (CFM)	Outdoor Airflow (CFM)	Return Airflow (CFM)
AC-1	1,220	1,220	N/A	1,340	1,340	N/A
AC-2	4,000	1,500	4,000	2,080	1,311	769
AC-3	13,520	1,500	13,520	12,240	1,629	10,611
HV-4	960	960	0	202	202	0

TABLE 6
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Return/Exhaust Airflow (CFM)	Actual Return/Exhaust Airflow (CFM)
EF-4	Bathrooms	1,180	1,375
EF-5	Bathrooms	800	628
EF-6	Basement Toilets	960	870

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

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

1. AC-1 and 3 are performing within the acceptable airflow range.
2. The AC-2 supply airflow is performing at approximately 50% of the design airflow. The Milharmer report notes that a sheave change is required to increase the airflow. However, changing the sheaves with the existing 3HP motor would only allow the airflow to be increased to approximately 65% of design. We recommend investigating the unit further to determine the cause of the issue.
3. HV-4 is operating at 20% of the design value. We recommend investigating the unit further to determine the cause of the issue. The technician indicated the low

airflow may have been a result of dirty coils. These should be cleaned prior to any retest, including the duct mounted coils.

4. The technician noted that a new belt is needed in AC-1 as the existing belt is worn.
5. Toilet exhaust fan EF-5 is not performing within acceptable range. We recommend investigating the cause of the low airflow. If no obvious obstructions or balancing issues are found, larger capacity fan should be selected by an engineer.
6. The building appears to be negatively pressurized overall, operating at a deficit of approximately 2,000 CFM over the entire building. Generally, buildings should be positively pressurized to limit drafts and moisture infiltration. The current pressurization appears consistent with the original design airflows. We recommend that an engineer review the airflow throughout the building and develop a revised airflow plan. Note that while there may be long term building envelope, energy use, environmental air quality, and comfort impacts as a result of negative pressurization, this issue does not directly affect short term IAQ or ventilation rates.

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.

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: **Ayer District Court**
Ayer, MA

Project No.: **21-209** **Project Date:** **5/11/2021**

MECHANICAL CONTRACTOR
Tighe & Bond

3384

A N.E.B.B. Certified Company

Project:	Ayer District Court		
Address:	Ayer, MA		
Date:	5/11/2021	**Project No.**	21-209

CERTIFICATION

Submitted & Certified by:

Milharmer Associates, Inc.

Certification No.: ***3384*** Certification Expiration Date: **3-31-23**

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

SCOTT F. MILLER

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

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

CP-23541

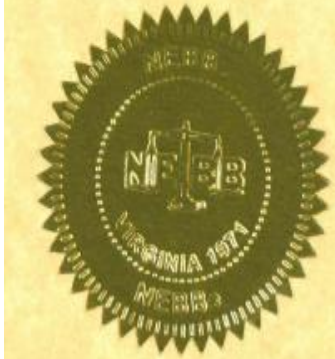
NEBB Certification Number

March 31, 2023

Expiration Date

NEBB President

NEBB President-Elect



Firm Certification

MILHARMER ASSOCIATES, INC.

HAS MET ALL REQUIREMENTS FOR NEBB CERTIFIED STATUS IN THE FOLLOWING DISCIPLINE

Testing, Adjusting and Balancing of Environmental Systems

3384

NEBB Certification Number

March 31, 2023

Expiration Date

NEBB President

NEBB President-Elect

Project:	Ayer District Court		
Address:	Ayer, MA		
Date:	5/11/2021	**Project No.**	21-209

TABLE OF CONTENTS

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

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:	Ayer District Court		
Address:	Ayer, MA		
Date:	1/0/1900	**Project No.**	21-209

REPORT SUMMARY

The following is the report for the Ayer District Court. A survey was performed on AC-1 thru 3, HV-1 and the toilet exhaust fans with the following comments:

1. Chilled water was not running during testing.

2. AC-1 - Unit needs a new belt.

3. AC-2 - The unit is operating at 52% of design airflow and would require a sheave change to increase airflow to design.

4. Toilet exhaust fans have been tested and some are below design with no adjustment as they are direct drive fans.

Project:	Ayer District Court		
Address:	Ayer, MA		
Date:	1/0/1900	**Project No.**	21-209

REPORT SUMMARY

AIR HANDLING UNITS

UNIT	SUPPLY	RETURN	OUTSIDE AIR
AC-1	1,340 CFM	NA	1,340 CFM
AC-2	2,080 CFM	769 CFM	1,311 CFM
AC-3	12,240 CFM	10,611 CFM	1,629 CFM
HV-1	202 CFM	NA	202 CFM

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

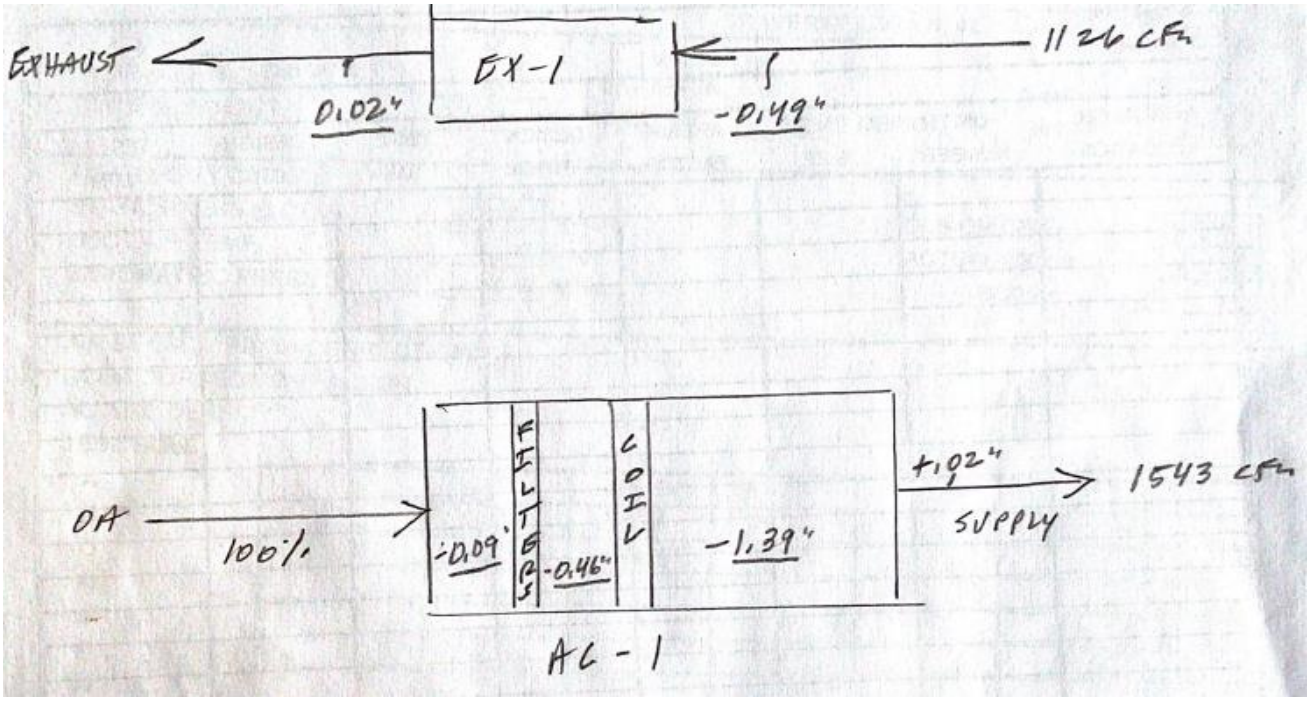
FAN DATA SHEET

	FAN NO. AC-1		FAN NO. EX-1	
Serves / Location:	Judges Lobby 1st fl.	Mech. Rm.	Judges Lobby 1st fl.	Mech. Rm.
Manufacturer:	McQuay		Barry Blower Co.	
Model Number:	No Tag		No Tag	
Size:	No Tag		No Tag	
Serial Number:	No Tag		21105	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	BALDOR	NL	G.E.
Frame Number:	NL	143T	NL	48Y
Horsepower:	1	1	NL	1/3
Brake Horsepower:	NL	0.83	NL	NA
Safety Factor:	NL	1.15	NL	1.35
Volts/Phase:	208/3	208	115	NA
Motor Amperage:	4	3.3/3.3/3.1	6.6	NA
Motor RPM:	1725	1725	1725	1725
Speeds:	NL	1	NL	NA
Heater Size:	NL	NA	NL	NA
Heater Amps.:	NL	NA	NL	NA
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	1220	1340		
Return Air CFM:				
Exhaust Air CFM:			1220	1129
Outside Air CFM:	1220	1340		
Suction Pressure:	NL	1.39	NL	-0.49
Discharge Pressure:	NL	0.02	NL	0.31
Fan Static Pressure:	NL	1.41	NL	0.8
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	NA	NL	NA
Motor Drive:	NL	1VP40	NL	VP25
Motor Size/Bore:	NL	7/8"	NL	1/2"
Fan Drive:	NL	AK35	NL	AK38
Fan Size/Bore:	NL	1"	NL	1"
Belt Size / Number:	NL	4L420/1	NL	4L290H/1
Shafts C-C:	NL	15"	NL	9"
Turns Open:	NL	2	NL	0

Comments:

Project:	Ayer District Court		
Address:	Ayer, MA		
Date:	5/11/2021	**Project No.**	21-209

STATIC PRESSURE PROFILE



Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: AC-1 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	22	" WIDTH x	12	" DEPTH	Sq Ft =	1.83

AIR DENSITY DATA

STATIC PRESS @ CL:	0.29	InWg.	DESIGN CFM =	1220
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	1340
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**1342**

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	717	708	722	675			
B	706	729	783	754			
C	758	753	755	714			
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 12 AVERAGE FPM = 731

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: EX-1 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	24	" WIDTH x	8 " DEPTH	Sq Ft =	1.33

AIR DENSITY DATA

STATIC PRESS @ CL:	0.35	InWg.	DESIGN CFM =	1220
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	1129
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**1131**

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	888	893	833	837	799		
B	867	841	855	900	844		
C	773	811	898	882	781		
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 15 AVERAGE FPM = 847

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

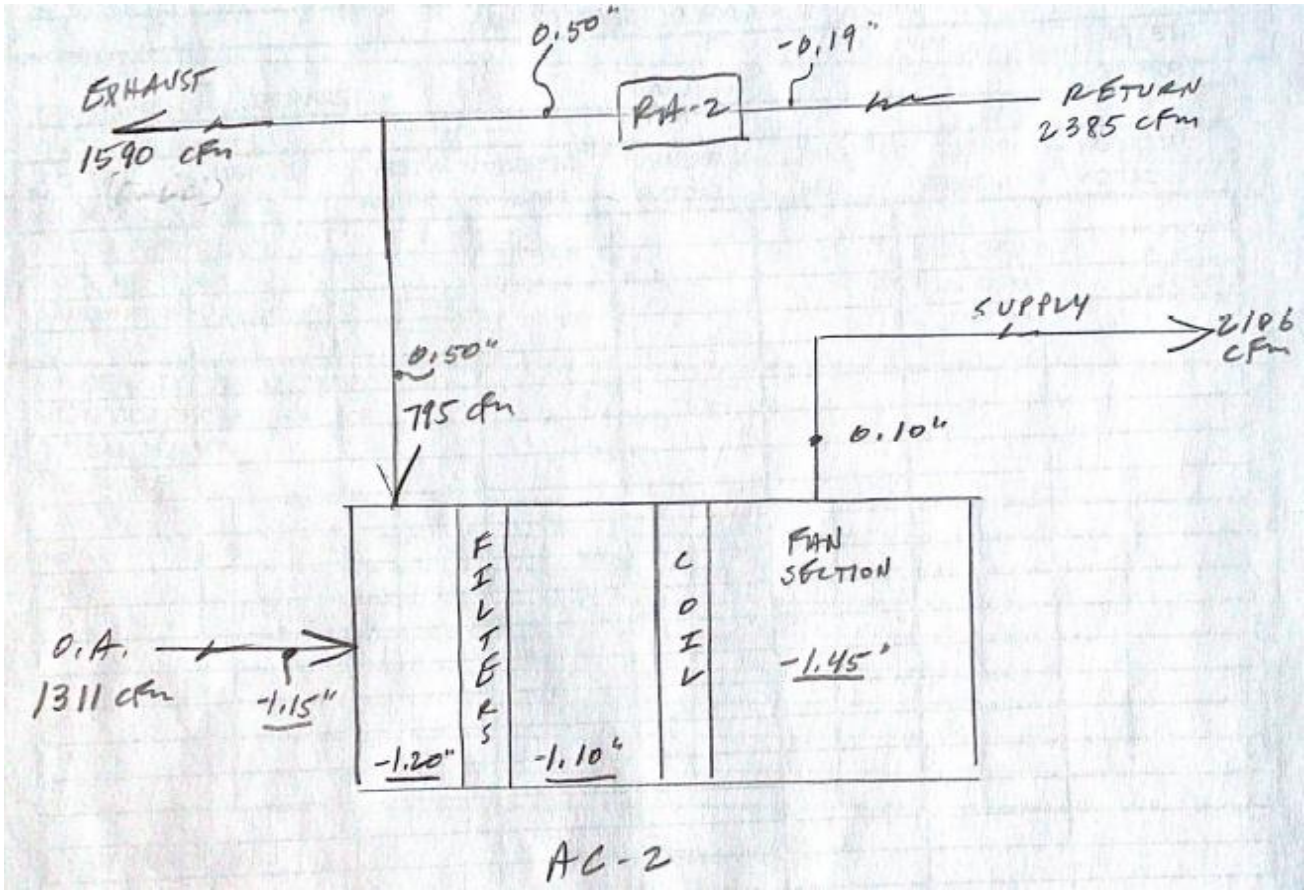
FAN DATA SHEET

	FAN NO. AC-2		FAN NO. RA-2	
Serves / Location:	Main Court Rm.	Mech. Rm.	Main Court Rm.	Mech. Rm.
Manufacturer:	McQuay		Barry Blower Co.	
Model Number:	No Tag		NL	
Size:	No Tag		NL	
Serial Number:	No Tag		21106	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	DAYTON	NL	DAYTON
Frame Number:	NL	182T	NL	NA
Horsepower:	NL	3	NL	1/2
Brake Horsepower:	NL	1.64	NL	NA
Safety Factor:	NL	1.15	NL	1.25
Volts/Phase:	208/3	208	208/3	NA
Motor Amperage:	9.7	5.2/5.3/5.1	4.4	NA
Motor RPM:	1755	1755	1725	NA
Speeds:	NL	1	NL	1
Heater Size:	NL	NA	NL	NA
Heater Amps.:	NL	NA	NL	NA
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	4000	2080		
Return Air CFM:				
Exhaust Air CFM:			4000	2386
Outside Air CFM:	1500	1311		
Suction Pressure:	NL	1.45	NL	0.19
Discharge Pressure:	NL	0.1	NL	0.5
Fan Static Pressure:	0.75	1.55	NL	0.69
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	1039	NL	NA
Motor Drive:	NL	1VP52	NL	VP40
Motor Size/Bore:	NL	1 1/8"	NL	5/8
Fan Drive:	NL	BK90	NL	AK104
Fan Size/Bore:	NL	1 3/8"	NL	1 1/2"
Belt Size / Number:	NL	B77/1	NL	4L540H/1
Shafts C-C:	NL	29"	NL	16"
Turns Open:	NL	1 1/2	NL	1

Comments:

Project:	Ayer District Court		
Address:	Ayer, MA		
Date:	5/11/2021	**Project No.**	21-209

STATIC PRESSURE PROFILE



Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: AC-2 TRAVERSE NUMBER : T1
Zone 1 TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	24	" WIDTH x	16 " DEPTH	Sq Ft =	2.67

AIR DENSITY DATA

STATIC PRESS @ CL:	0.04	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	1206
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**1206**

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	617	474	279	160			
B	587	495	266	315			
C	624	468	468	458			
D	590	526	455	452			
E							
F							
G							
H							
I							

NO. OF READINGS = 16 AVERAGE FPM = 452

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: AC-2 TRAVERSE NUMBER : T2
Zone 2 TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	24	" WIDTH x	16 " DEPTH	Sq Ft =	2.67

AIR DENSITY DATA

STATIC PRESS @ CL:	0.03	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	874
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**874**

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	339	331	311	258			
B	348	377	347	323			
C	304	397	351	299			
D	259	353	347	297			
E							
F							
G							
H							
I							

NO. OF READINGS = 16 AVERAGE FPM = 328

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: RA-2 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	30	" WIDTH x	18 " DEPTH	Sq Ft =	3.75

AIR DENSITY DATA

STATIC PRESS @ CL:	0.5	InWg.	DESIGN CFM =	4000
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	2386
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**2391**

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	614	641	604				
B	624	668	633				
C	667	592	707				
D	673	602	715				
E	636	555	614				
F							
G							
H							
I							

NO. OF READINGS = 15 AVERAGE FPM = 636

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: RA-2 TRAVERSE NUMBER : T2
Return to AC-2 TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	30	" WIDTH x	18 " DEPTH	Sq Ft =	3.75

AIR DENSITY DATA

STATIC PRESS @ CL:	0.5	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	795
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**796**

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	168	135	125				
B	210	101	130				
C	267	151	156				
D	318	222	268				
E	369	284	274				
F							
G							
H							
I							

NO. OF READINGS = 15 AVERAGE FPM = 212

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

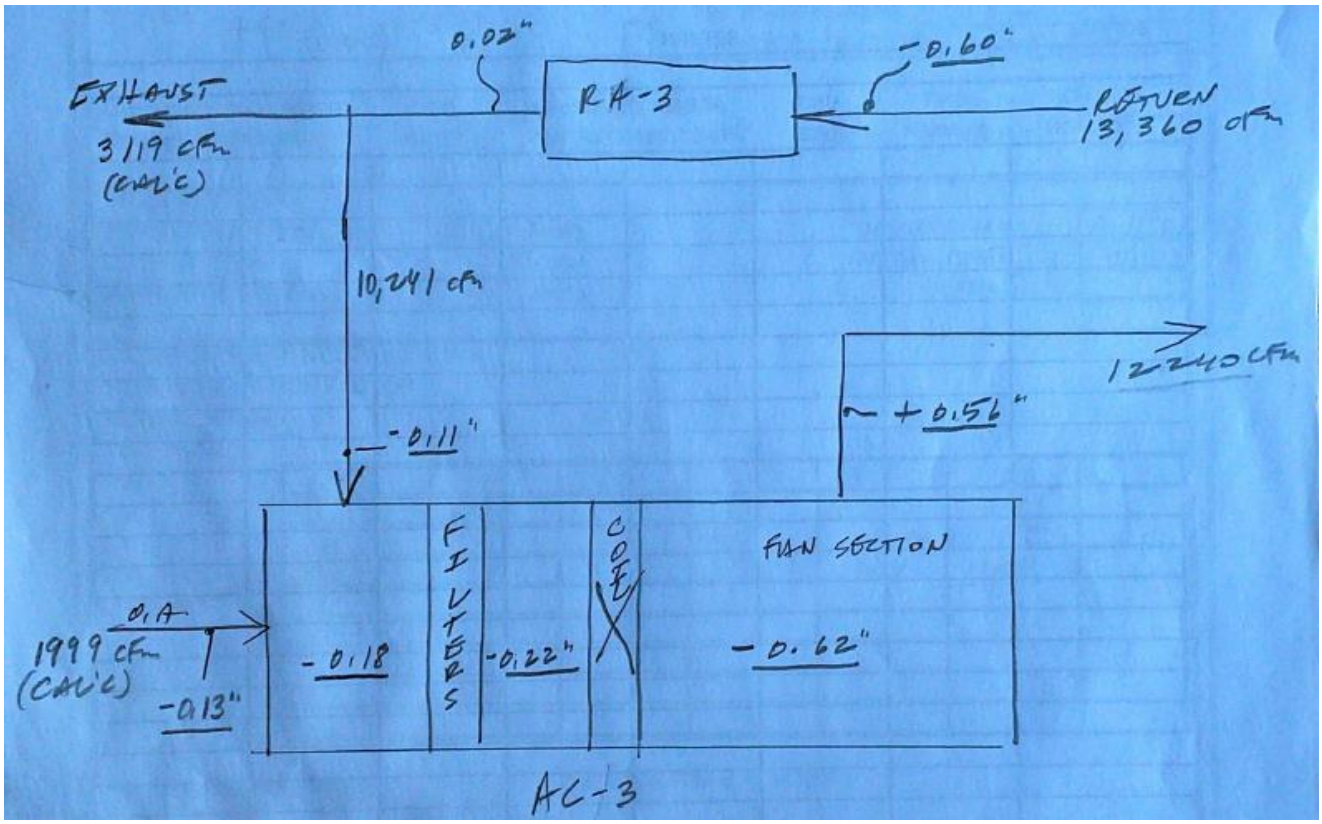
FAN DATA SHEET

	FAN NO. AC-3		FAN NO. RA-3	
Serves / Location:	Top Floor	Mech. Rm.	Top Floor	Mech. Rm.
Manufacturer:	McQuay		Barry Blower Co.	
Model Number:	TS-228H		402-SWSI	
Size:	NA		NL	
Serial Number:	0.0.82155H-090		70-1022	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	DAYTON	NL	LINCOLN
Frame Number:	NL	213T	NL	182T
Horsepower:	NL	7.5	NL	3
Brake Horsepower:	NL	4.6	NL	2.8
Safety Factor:	NL	1.15	NL	NA
Volts/Phase:	208/3	208	208/3	208
Motor Amperage:	22.5	13.4/13.9/13.9	10.8	9.8/9.9/9.9
Motor RPM:	1740	1740	1755	1755
Speeds:	NL	1	NL	1
Heater Size:	NL	NA	NL	NA
Heater Amps.:	NL	NA	NL	NA
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	13520	12240		
Return Air CFM:				
Exhaust Air CFM:			13520	13362
Outside Air CFM:	1500	1629		
Suction Pressure:	NL	0.62	NL	0.6
Discharge Pressure:	NL	0.56	NL	0.02
Fan Static Pressure:	0.85	1.18	NL	0.62
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	NA	NL	562
Motor Drive:	NL	1VP60	NL	2VP58
Motor Size/Bore:	NL	1 3/8"	NL	1 1/8"
Fan Drive:	NL	2B1460	NL	2TB184
Fan Size/Bore:	NL	2 1/4"	NL	2 1/4
Belt Size / Number:	NL	B85/2	NL	A128/2
Shafts C-C:	NL	28 1/2"	NL	45 1/2"
Turns Open:	NL	2	NL	1

Comments:

Project:	Ayer District Court		
Address:	Ayer, MA		
Date:	5/11/2021	**Project No.**	21-209

STATIC PRESSURE PROFILE



Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: AC-3 TRAVERSE NUMBER : T1
Supply TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	60	" WIDTH x	24 " DEPTH	Sq Ft =	10.00

AIR DENSITY DATA

STATIC PRESS @ CL:	0.53	InWg.	DESIGN CFM =	13520
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	12240
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**12262**

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	1271	1307	1440	1307	1356	1186	
B	1355	1339	1258	1367	1321	1283	
C	1272	967	935	1151	1262	1318	
D	1362	983	980	847	1214	1294	
E							
F							
G							
H							
I							

NO. OF READINGS = 24 AVERAGE FPM = 1224

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: RA-3 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	60	" WIDTH x	24	" DEPTH Sq Ft =	10.00

AIR DENSITY DATA

STATIC PRESS @ CL:	0.02	InWg.	DESIGN CFM =	13520
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	13362
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**13370**

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	1313	1330	1437	1329	1337		
B	1366	1423	1400	1331	1301		
C	1331	1443	1314	1213	1242		
D	1418	1371	1400	1226	1198		
E							
F							
G							
H							
I							

NO. OF READINGS = 20 AVERAGE FPM = 1336

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: RA-3 TRAVERSE NUMBER : T2
Return to AC-3 TRAVERSE LOCATION: MECH ROOM

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	32	" WIDTH x	44	" DEPTH Sq Ft =	9.78

AIR DENSITY DATA

STATIC PRESS @ CL:	0.11	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	10221
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**10230**

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	960	1036	1228	1100			
B	927	644	915	1299			
C	621	636	710	1182			
D	659	802	631	1300			
E	956	1148	1194	1441			
F	1265	1389	1526	1520			
G							
H							
I							

NO. OF READINGS = 24 AVERAGE FPM = 1045

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

FAN DATA SHEET

	FAN NO. HV-1		FAN NO.	
Serves / Location:	Holding Rooms	Basement Mech.		
Manufacturer:	McQuay			
Model Number:	No Tag			
Size:	No Tag			
Serial Number:	No Tag			
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	GE MOTORS		
Frame Number:	NL	56		
Horsepower:	NL	1		
Brake Horsepower:	NL	NA		
Safety Factor:	NL	1.15		
Volts/Phase:	208/3	NA		
Motor Amperage:	3.4	NA		
Motor RPM:	1725	NA		
Speeds:	NL	NA		
Heater Size:	NL	NA		
Heater Amps.:	NL	NA		
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	960	202 *1		
Return Air CFM:				
Exhaust Air CFM:				
Outside Air CFM:	960	202		
Suction Pressure:				
Discharge Pressure:				
Fan Static Pressure:				
External Pressure:				
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	1380		
Motor Drive:	NL	1VP40		
Motor Size/Bore:	NL	5/8"		
Fan Drive:	NL	A52		
Fan Size/Bore:	NL	1"		
Belt Size / Number:	NL	4L420/1		
Shafts C-C:	NL	15"		
Turns Open:	NL	3		

Comments: ***1 Possible dirty coils resulting in low airflows.**

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

FAN DATA SHEET

	FAN NO. RF-4		FAN NO. RF-5	
Serves / Location:	Toilets (SE)	Roof	Toilets (NW)	Roof
Manufacturer:	EMERSON CLIMATE		No Tag	
Model Number:	5BDD15D8		No Tag	
Size:	NL		No Tag	
Serial Number:	NL		No Tag	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	EMERSON	NL	No Tag
Frame Number:	NL	NL	NL	No Tag
Horsepower:	NL	1/2	NL	No Tag
Brake Horsepower:	NL	NA	NL	No Tag
Safety Factor:	NL	1	NL	No Tag
Volts/Phase:	115	NA	No Tag	NA
Motor Amperage:	8.4	NA	No Tag	NA
Motor RPM:	1725	1725	No Tag	NA
Speeds:	NL	NA	NL	NA
Heater Size:	NL	NA	NL	NA
Heater Amps.:	NL	NA	NL	NA
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:				
Return Air CFM:				
Exhaust Air CFM:	1180	1375	800	628
Outside Air CFM:				
Suction Pressure:				
Discharge Pressure:				
Fan Static Pressure:				
External Pressure:				
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	NL	1380	NL	DIRECT DRIVE
Motor Drive:	NL	1VL40	NL	DIRECT DRIVE
Motor Size/Bore:	NL	1/2	NL	DIRECT DRIVE
Fan Drive:	NL	A50	NL	DIRECT DRIVE
Fan Size/Bore:	NL	7/8"	NL	DIRECT DRIVE
Belt Size / Number:	NL	4L240/1	NL	DIRECT DRIVE
Shafts C-C:	NL	5 1/2	NL	DIRECT DRIVE
Turns Open:	NL	CLOSED	NL	DIRECT DRIVE

Comments:

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

AIR DISTRIBUTION

SYSTEM: RF-4

SUPPLY [ ] RETURN [ ] EXHAUST [X]

ROOM OR LOCATION	UNIT NUMBER	UNIT SIZE	AREAxK FACTOR	DESIGN FT/MIN	TEST FT/MIN	DESIGN CFM	TESTED CFM
Men 229	1	8x8	FH	NA	NA	NL	126
Women 230	2	8x8	FH	NA	NA	NL	143
Women 129	3	12x8	FH	NA	NA	NL	329
Janitor 130	4	12x8	FH	NA	NA	NL	292
Men 131	5	8x8	FH	NA	NA	NL	182
Men 136	6	8x8	FH	NA	NA	NL	142
Women 137	7	8x8	FH	NA	NA	NL	161
					TOTALS:	1180	1375

Comments:

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

AIR DISTRIBUTION

SYSTEM: RF-5

SUPPLY [ ] RETURN [ ] EXHAUST [X]

ROOM OR LOCATION	UNIT NUMBER	UNIT SIZE	AREAxK FACTOR	DESIGN FT/MIN	TEST FT/MIN	DESIGN CFM	TESTED CFM
Janitor 218	1	6x6	FH	NA	NA	NL	0
Men 213	2	8x8	FH	NA	NA	NL	62
Women 214	3	8x8	FH	NA	NA	NL	71
Toilet 217	4	8x8	FH	NA	NA	NL	60
Toilet 221	5	8x8	FH	NA	NA	NL	40
Toilet 210	6	8x8	FH	NA	NA	NL	52
Toilet 204	7	8x8	FH	NA	NA	NL	49
Toilet 118	8	8x8	FH	NA	NA	NL	57
Toilet 120	9	8x8	FH	NA	NA	NL	67
Toilet 121	10	8x8	FH	NA	NA	NL	78
Women 107	11	8x8	FH	NA	NA	NL	45
Men 108	12	8x8	FH	NA	NA	NL	47
					TOTALS:	800	628

Comments:

Project: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

FAN DATA SHEET

	FAN NO. RF-6		FAN NO.	
Serves / Location:	Toilets Basement	Roof		
Manufacturer:	No Tag			
Model Number:	No Tag			
Size:	No Tag			
Serial Number:	No Tag			
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	No Tag		
Frame Number:	NL	No Tag		
Horsepower:	NL	No Tag		
Brake Horsepower:	NL	No Tag		
Safety Factor:	NL	No Tag		
Volts/Phase:	No Tag	NA		
Motor Amperage:	No Tag	NA		
Motor RPM:	No Tag	NA		
Speeds:	NL	NA		
Heater Size:	NL	NA		
Heater Amps.:	NL	NA		
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:				
Return Air CFM:				
Exhaust Air CFM:	960	870		
Outside Air CFM:				
Suction Pressure:				
Discharge Pressure:				
Fan Static Pressure:				
External Pressure:				
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: Ayer District Court
Address: Ayer, MA
Date: 5/11/2021 **Project No.** 21-209

TRAVERSE DATA

SYSTEM: RF-6 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: Basement Mech

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	20	" WIDTH x	10	" DEPTH	Sq Ft =	1.39

AIR DENSITY DATA

STATIC PRESS @ CL:	0.18	InWg.	DESIGN CFM =	960
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	870
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**871**

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	573	560	607	556			
B	681	673	669	619			
C	631	675	654	623			
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 12 AVERAGE FPM = 627

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Brian Murphy