Essex County Superior Courthouse
Lawrence, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

February 16, 2022

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Essex County Superior Courthouse in Lawrence, MA on December 10, 2020. While on site we inspected the air handling equipment located in the mechanical rooms and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management:*
  - Peter Andrade, Courthouse Facilities Staff
- *Tighe & Bond*
  - Jason R. Urso, PE, Mechanical Engineer

1.1 Existing Ventilation System

The Lawrence Superior Courthouse was constructed in 1856, renovated in 1990, and is approximately 30,000 square feet in size. Four York constant air volume air handling units provide ventilation air to the building. Each unit contains a supply fan, a chilled water cooling coil, and 6" MERV 15 filters. Supply air is distributed to each zone at a constant flow rate. Duct mounted hot water reheat coils serve each zone. Dedicated return fans serve each air handling unit and are also ducted to exhaust air louvers.

All air handlers appear to date back to the 1990 installation and are in fair condition. The outdoor air dampers are rusty, but appears to be in fair condition, the return air dampers are in good condition, and all actuators are in good condition. The cooling coils are dirty and the chilled water control valve actuators appear to be in fair to good condition. According to the 1990 design drawings, the air handling units were designed with 6" 60%-65% efficient filters, which is equivalent to a MERV 11 filter. The filters currently installed are MERV 15, equivalent to 95% efficiency.

The filter differential pressure sensor serving AC-1 was not working and significant air leakage from a supply air access door was noted during our site visit. The smell of burning rubber was noticeable at AC-2. Facilities staff indicated the supply fan belt burns up often. The chilled water coil in AC-2 also had a large hole and the outdoor air damper was closed during the time of our visit. A very loud high pitched noise was observed at AC-4 indicating a possible motor bearing issue and the chilled water coil is also damaged.

According to the plans, there are three toilet exhaust fans, which are in fair condition.

AC-1 supplies air to the holding cells and air is exhausted by EF-2, located on the roof. According to the drawings that were provided to Tighe & Bond, the same quantity of air that is supplied to the holding cells is exhausted, creating a neutral air pressure within the holding areas.

Two 1.5 million BTU/hr Riello hot water boilers provide hot water to duct mounted hot water coils and finned tube radiation. A 143 ton, air-cooled chiller located on grade provides chilled water to all air handlers. Both the boilers and chiller appear to be newer.

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	12,000	3,000	6" MERV 15	Fair
AC-2	8,000	800	6" MERV 15	Fair
AC-3	12,000	1,200	6" MERV 15	Fair
AC-4	11,000	1,100	6" MERV 15	Fair

Photo 1 – Representative Air Handler

1.2 Existing Control System

A pneumatic system controls the existing HVAC air handling equipment. It is an old, obsolete system and appears to be original. We did not see any evidence or components of a Building Management System (BMS) during our site visit. We are not aware of any demand control ventilation sequences in use at this courthouse. Since the air handler return fans are ducted to an exhaust air louver, we suspect an economizer sequence is available for each air handler.

Section 2
Recommendations

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

2.1 Filtration Efficiency Recommendations

We recommend the following measures be implemented for the existing air handling units:

RF-1: Maintain the current level of MERV 15 filters, pending airflow testing.

We recommend maintaining the MERV 15 filters, pending airflow testing results. MERV 15 filters impose a larger pressure drop than MERV 13 filters and may be reducing the airflow at each air handler. During the airflow testing, we recommend having MERV 13 filters on hand to test the airflow of both the existing MERV 15 filters and MERV 13 filters.

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

The filter pressure sensor for AC-1 appears to be non-functional. We recommend replacing this sensor and other sensors on the remaining air handlers if they are not functioning correctly.

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

Should the MERV 15 filters remain in place, these will require replacing much more often than MERV 13 filters. If the filters are not changed at the appropriate intervals, the dirty filters will impose a higher airflow pressure drop in the system and potentially reduce supply airflow.

2.2 Testing & Balancing Recommendations

The air handling units are approximately 31 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 were 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 rebalance 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	12,000	3,000	1,305	3,000
AC-2	8,000	800	1,090	1,100
AC-3	12,000	1,200	1,750	1,750
AC-4	11,000	1,100	1,360	1,400

Note: Although the ASHRAE Position Document on Infectious Aerosols recommends using the latest published standards and codes as a baseline for minimum ventilation, the mechanical code in effect at the time the HVAC systems were designed and constructed is what governs the required outdoor air flowrate for the HVAC equipment, if there have been no additions, renovations, alterations or changes in occupancy to the building. The 2015 International Mechanical Code does not prevent the continued use of existing systems.

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

Where we recommend increasing the outdoor air beyond the original design, it appears the cooling coils should be able to provide leaving air conditions similar to the original design under peak outdoor air conditions, assuming the coils are clean and their performance has not degraded significantly over time. Supply air temperatures during the heating and cooling season should be monitored to ensure they are not dropping below or above design values. If the supply air temperature does drop below or above design values, the outdoor airflow rate should be reduced, but not below the originally designed outdoor air flow rates.

The average airflow rate per person is shown below in Table 3. These values are based on the original design supply airflow rate and the recommended outdoor air flow rates shown in Table 2. The airflow rate per person assumes a diversity factor of 70%, meaning the maximum number of occupants assumed to be in all zones at all times equates to 70% of the code required occupancy.

TABLE 3
Average Airflow Rate per Person

	All spaces	***Courtrooms***	***Non-Courtroom Spaces***
Total Occupancy (People)	524	323	200
Total Supply Air (CFM/Person)	82	31	164
Outdoor Air (CFM/Person)	14	4	29

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 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. 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 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 201	65	2,400	37	330	5
Courtroom No.1 128	103	2,520	24	368	3
Courtroom No.2 226	103	2,520	24	368	3
Courtroom No.3 208	96	2,520	26	321	3
Courtroom No.4 306	95	2,520	27	321	3

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

The airflow rate per person for each Courtroom and the Jury Pool Room, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 4a. The airflow rate per person assumes the full supply airflow is being delivered to the room. At times when the supply airflow is reduced due to the space temperature being satisfied, the airflow rate per person will also be reduced.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outside Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Jury Pool Room 201	23	2,400	104	330	14
Courtroom No.1 128	22	2,520	115	368	17
Courtroom No.2 226	23	2,520	110	368	16
Courtroom No.3 208	28	2,520	90	321	11
Courtroom No.4 306	26	2,520	97	321	12

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

RTB-2: *Rebalance system return air flow rate.*

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

RTB-6: *Test and balance air handler chilled water cooling coils and duct mounted hot water reheat coils.*

Testing and balancing the air handler chilled water coils and duct mounted hot water coils will help ensure the coils are receiving the proper water flow rates. Due to the age of the coils, the coils may not perform as required to properly temper the supply air. Coils become fouled over time, which degrades the performance.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

RE-1: *Test existing air handling system dampers and actuators for proper operation*.

Replace dampers and actuators that are not functioning properly.

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

RE-7: Test the existing air handler control valves and actuators for proper operation.

2.4 Control System Recommendations

We recommend the following for the control system:

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

Additional controls will be required in order to implement this recommendation.

RC-4: *Confirm the economizer control sequence is operational.*

2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

RFC-1: *Install portable HEPA filters.*

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

2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of using duct mounted humidification or portable humidifiers 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. We are not aware if this building was constructed to accommodate a humidification system.

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 Install a Building Management System

We recommend replacing the pneumatic control system with a Building Management System to control and monitor HVAC equipment. Pneumatic air systems are antiquated and do not offer the same benefits as a BMS. This recommendation is an energy saving and maintenance measure and does not affect the indoor air quality of the building, however a BMS does give insight into how the system is operating. Things like filter status and outdoor air damper position can be easily viewed and system alarms can be generated to prompt corrective actions.

2.7.2 Convert Chilled and Hot Water Systems to Variable Flow

According to the design drawings, the hot and chilled water systems are constant flow systems. Constant flow pumps circulate the same volume of water to air handling units regardless of whether the water is required or not. If air handlers do not require this water, the three-way valves serving the air handler coils bypass the coil and is pumped back to the chiller or boiler plant. We recommend investigating the possibility of converting these systems to variable flow. The three-way air handler valves and 3-way hot water valves serving the duct mounted reheat coils would have to be replaced with two-way valves, as well as any other three-way valves that are in the system. Variable frequency drives (VFD) may be able to be connected to the existing hot and chilled water pumps, allowing the pumps to vary the flow rate to match the demand. This recommendation is an energy saving measure and does not affect the indoor air quality of the building.

Section 3
Testing & Balancing Results

Milharmer Associates visited the Essex Superior Courthouse on January 12, 2021 to test the airflow rates of the air handling units and the exhaust fans. Milharmer return on December 17, 2021 to test 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 Fan Airflow (CFM)	Supply Fan Airflow (CFM)	Outdoor Airflow (CFM)	Return Fan Airflow (CFM)
AC-1	12,000	3,000	9,000	12,760	3,233	8,585
AC-2	8,000	1,100	6,900	8,566	1,095	7,440
AC-3	12,000	1,750	10,250	11,747	1,629	9,942
AC-4	11,000	1,400	9,600	9,917	1,033	8,849

TABLE 6
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Return/Exhaust Airflow (CFM)	Actual Return/Exhaust Airflow (CFM)
EF-1	1st flr. Toilets	300	61
EF-2	1st, 2nd, 3rd flr. Toilets	2,375	1,296[1]
EF-3	2nd & 3rd flr. Toilets	150	137

Note 1: The contractor did not have access to the fan, test data is from the air outlets. Contractor was unsure if all air outlets for EF-2 were identified and tested.

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

1. All air handlers are delivering a total supply airflow within acceptable tolerances.
2. The outdoor airflow for AC-4 is approximately 25% below the recommended flow rate and should be rebalanced.
3. Exhaust fan EF-2 itself could not be accessed and therefore could not be tested. Instead, the exhaust grilles connected to EF-2 were tested in order to get an actual exhaust airflow rate.

However, the contractor was unsure that they identified tested all grilles associated with EF-2.

4. EF-1 and EF-2 are performing significantly below their design airflow rates. Areas that are not receiving their design exhaust airflow rates may not be exhausting the code required airflow rate. Spaces such as holding cells and restrooms are required to have a minimum exhaust airflow rates. We recommend investigating if rebalancing the exhaust fans to their design airflow rates is possible or replacing the fan.
5. The AC units do not have hot water coils.

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: **Essex Superior Court**
Lawrence, MA

Project No.: **21-016** **Project Date:** **12/17/2021**

MECHANICAL CONTRACTOR
Tighe & Bond

3384

A N.E.B.B. Certified Company

Project:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	12/17/2021	**Project No.**	21-016

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:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	12/17/2021	**Project No.**	21-016

TABLE OF CONTENTS

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

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	8-20-21	8-20-22
2	Shortridge Flow Hood	8-20-21	8-20-22
3	Ampmeter	8-20-21	8-20-22
4	Tachometer	8-20-21	8-20-22
5	Airflow Anemometer	8-20-21	8-20-22
6	Digital Thermometers	8-20-21	8-20-22
7	Shortridge Water Meter	8-20-21	8-20-22
8	Sound Meter	8-20-21	8-20-22
9	Vibration Meter	8-20-21	8-20-22

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:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	1/12/2021	**Project No.**	21-016

REPORT SUMMARY

The following is the report for the Essex Superior Court. A survey was performed on AC-1 thru AC-4 and all units tested within design parameters.

There are no hot water coils for the AC units. The source of HTW / heat is individual reheat coils in the supply zones.

Project:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	1/12/2021	**Project No.**	21-016

REPORT SUMMARY

AIR HANDLING UNITS

UNIT	SUPPLY	RETURN	OUTSIDE AIR
AC-1	12,760 CFM	8,585 CFM	3,233 CFM
AC-2	8,566 CFM	7,440 CFM	1,095 CFM
AC-3	11,747 CFM	9,942 CFM	1,629 CFM
AC-4	9,917 CFM	8,849 CFM	1,033 CFM

FANS

UNIT	EXHAUST
EF-1	61 CFM
EF-2	1,296 CFM
EF-3	137 CFM

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

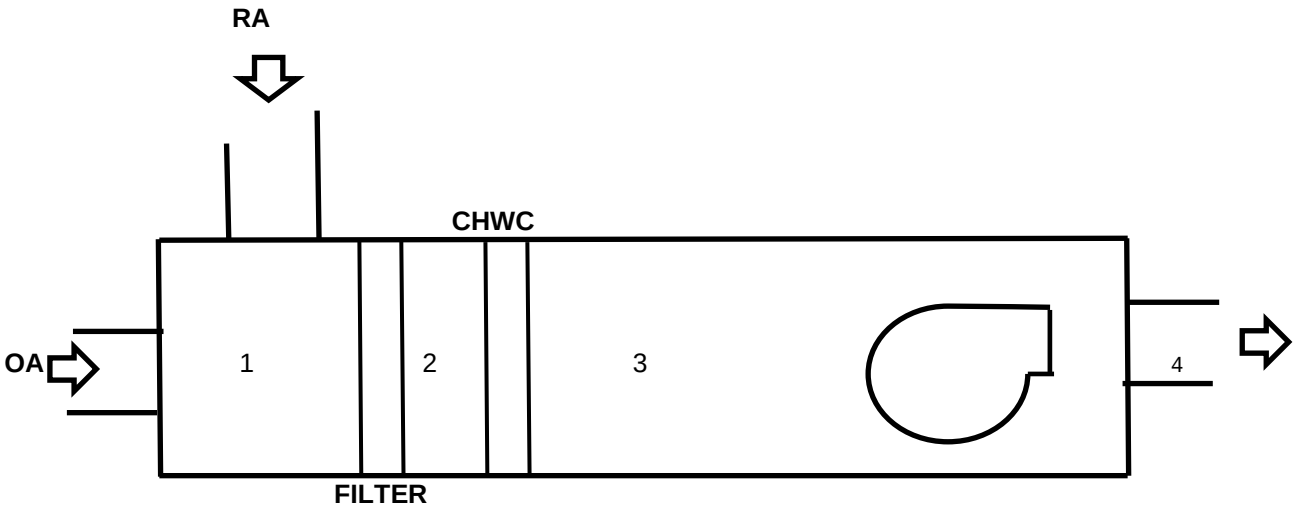
FAN DATA SHEET

	FAN NO. AC-1		FAN NO. RF-1	
Serves / Location:	Ground, 1st fl.		Ground, 1st fl.	
Manufacturer:	YORK		PENN VENT	
Model Number:	05217FOMP D AC-1		SX	
Size:	NL		NL	
Serial Number:	90-802989A		No Tag	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	BALDOR	NL	BALDOR
Frame Number:	NL	256T	NL	145T
Horsepower:	20	20	3	3
Brake Horsepower:	NL	18.9	NL	2.3
Safety Factor:	NL	1.15	NL	1.15
Volts/Phase:	208/3	206	208/3	206
Motor Amperage:	55	53/52/52	8.5	6.6/6.6/6.0
Motor RPM:	1765	1765	1725	1725
Speeds:	NL	1	NL	1
Heater Size:	NL	TR70R	NL	NA
Heater Amps.:	NL	TR70R	NL	NA
FAN	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Supply Air CFM:	12000	12760		
Return Air CFM:			9000	8585
Exhaust Air CFM:				
Outside Air CFM:	3000	3233		
Suction Pressure:	NL	1.97	NL	NA
Discharge Pressure:	NL	2.62	NL	NA
Fan Static Pressure:	4	4.59	NL	NA
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	1074	973	NL	INLINE
Motor Drive:	NL	3B5V48	NL	2VP45
Motor Size/Bore:	NL	B1 5/8	NL	7/8
Fan Drive:	NL	3BK858	NL	INLINE
Fan Size/Bore:	NL	Q1 11/16	NL	INLINE
Belt Size / Number:	NL	B93/3	NL	B80/2
Shafts C-C:	NL	38"	NL	30"
Turns Open:	NL	FIXED	NL	2

Comments:

Project:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	12/17/2021	**Project No.**	21-016

AC-1 STATIC PROFILE



LOCATION	STATIC
1	-0.22"
2	-1.8"
3	-1.9"
4	+2.62"

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

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-1 TRAVERSE NUMBER : T1
Supply Zone 1 TRAVERSE LOCATION: Basement Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	24	" WIDTH x	31	" DEPTH	Sq Ft =	5.17

AIR DENSITY DATA

STATIC PRESS @ CL:	2.49	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	7093
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**7141**

AIR DENSITY RATIO CORRECTION =	1.01
SCFM CORRECTION FACTOR	1.01
ACTUAL DENSITY	0.076

TEST HOLE	1	2	3	4	5	6	7
A	1976	1887	1412	1085			
B	1956	1988	1219	811			
C	1936	1797	1191	884			
D	1865	1746	1135	901			
E	1667	1581	889	578			
F	1735	1635	482	593			
G							
H							
I							

NO. OF READINGS = 24 AVERAGE FPM = 1373

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-1 TRAVERSE NUMBER : T2
Supply Zone 2 TRAVERSE LOCATION: Basement Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	38	" WIDTH x	18	" DEPTH	Sq Ft =	4.75

AIR DENSITY DATA

STATIC PRESS @ CL:	2.65	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	5667
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**5708**

AIR DENSITY RATIO CORRECTION = 1.01
SCFM CORRECTION FACTOR 1.01
ACTUAL DENSITY 0.076

TEST HOLE	1	2	3	4	5	6	7
A	1001	1181	1633	1941	1897		
B	906	1191	1606	1692	1864		
C	404	643	1187	1254	1614		
D	472	309	773	1116	1179		
E							
F							
G							
H							
I							

NO. OF READINGS = 20 AVERAGE FPM = 1193

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: RF-1, AC-1 Return TRAVERSE NUMBER : T1
Zone 1 TRAVERSE LOCATION: Basement Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	40	" WIDTH x	14	" DEPTH	Sq Ft =	3.89

AIR DENSITY DATA

STATIC PRESS @ CL:	0.22	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	5009
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**5014**

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	1215	1310	1081				
B	1174	1301	1208				
C	1376	1274	1345				
D	1272	1275	1437				
E	1294	1283	1466				
F	1208	1245	1420				
G							
H							
I							

NO. OF READINGS = 18 AVERAGE FPM = 1288

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: RF-1, AC-1 Return TRAVERSE NUMBER : T2
Zone 2 TRAVERSE LOCATION: Basement Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	22	" WIDTH x	24	" DEPTH	Sq Ft =	3.67

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.37	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	3576
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**3575**

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	1333	1060	1037	0			
B	1292	1259	1047	0			
C	1381	1326	1062	0			
D	1361	1254	1042	555			
E	1395	1262	1193	645			
F							
G							
H							
I							

NO. OF READINGS = 20 AVERAGE FPM = 975

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

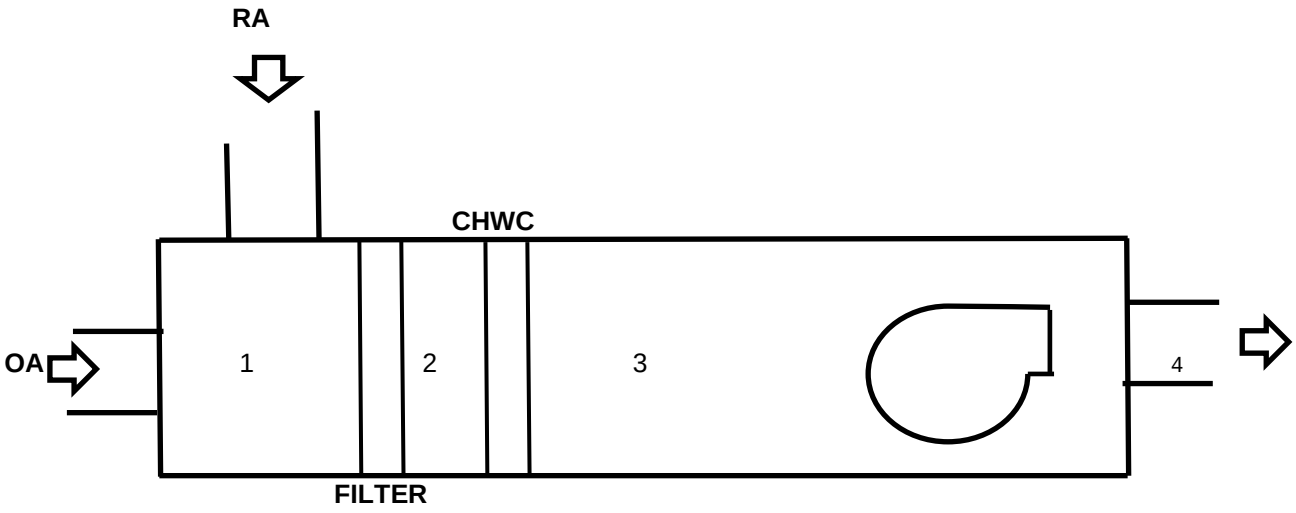
FAN DATA SHEET

	FAN NO. AC-2		FAN NO. RF-2	
Serves / Location:	Probate & Jury Pool		Probate & Jury Pool	
Manufacturer:	YORK		PENN VENT	
Model Number:	CS156SHMP D AC2		No Tag	
Size:	NL		NL	
Serial Number:	90-802989A		No Tag	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	MARATHON	NL	BALDOR
Frame Number:	NL	254T	NL	145T
Horsepower:	15	15	2	2
Brake Horsepower:	NL	8.71	NL	1.56
Safety Factor:	NL	1.15	NL	1.15
Volts/Phase:	208/3	203/3	208/3	202/3
Motor Amperage:	44.9	19.5/18.9/18.9	6.8	5.1/5.3/5.2
Motor RPM:	1745	1745	1725	1725
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:	8000	8566		
Return Air CFM:			6900	7440
Exhaust Air CFM:				
Outside Air CFM:	1100	1095		
Suction Pressure:	NL	0.52	NL	0.61
Discharge Pressure:	NL	0.33	NL	0.09
Fan Static Pressure:	4	0.85	NL	0.7
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	1074	NA	NL	INLINE
Motor Drive:	NL	2VP58	NL	2VP42
Motor Size/Bore:	NL	1 1/4"	NL	7/8
Fan Drive:	NL	2AK100	NL	INLINE
Fan Size/Bore:	NL	1 1/2"	NL	INLINE
Belt Size / Number:	NL	B91/2	NL	A76/2
Shafts C-C:	NL	35 3/4"	NL	30"
Turns Open:	NL	3	NL	3

Comments:

Project:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	12/17/2021	**Project No.**	21-016

AC-2 STATIC PROFILE



LOCATION	STATIC
1	-0.20"
2	-.44"
3	-.49"
4	+.32"

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

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-2 TRAVERSE NUMBER : T1
Supply TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	54	" WIDTH x	20	" DEPTH	Sq Ft =	7.50

AIR DENSITY DATA

STATIC PRESS @ CL:	1.04	InWg.	DESIGN CFM =	8000
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	8566
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**8593**

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	616	708	724	1289	1217	1295	1054
B	569	843	805	1164	1271	1483	1400
C	808	897	974	1042	1243	1432	1488
D	831	925	930	1604	1714	1532	2123
E							
F							
G							
H							
I							

NO. OF READINGS = 28 AVERAGE FPM = 1142

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: RF-2 TRAVERSE NUMBER : T1
AC-2 Return TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	48	" WIDTH x	18	" DEPTH	Sq Ft =	6.00

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.04	InWg.	DESIGN CFM =	7200
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	7440
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**7444**

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	1460	1453	1521	1605			
B	1494	1414	1500	1575			
C	1511	1592	1611	1702			
D	1468	1599	1621	1637			
E	1566	1721	1646	1836			
F	1421	588	1659	1847			
G	387	0	505	1663			
H	0	1077	1233	1575			
I	0	1009	0	145			

NO. OF READINGS = 36 AVERAGE FPM = 1240

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

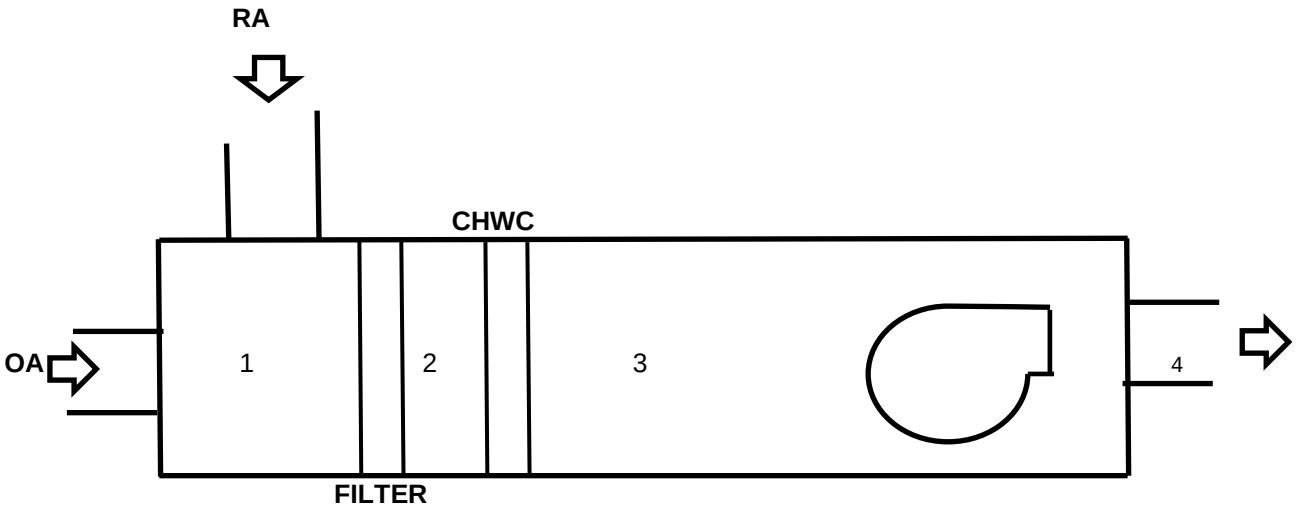
FAN DATA SHEET

	FAN NO. AC-3		FAN NO. RF-3	
Serves / Location:	Courtroom #2 & Assoc Rms.		Courtroom #2 & Assoc Rms.	
Manufacturer:	YORK		PENN VENT	
Model Number:	CS217FOMP D-AC3		SX	
Size:	NL		NL	
Serial Number:	90-802989C		No Tag	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	MAGNETEK	NL	BALDOR
Frame Number:	NL	256T	NL	213T
Horsepower:	20	20	7.5	7.5
Brake Horsepower:	NL	13.8	NL	5.1
Safety Factor:	NL	1.15	NL	1.15
Volts/Phase:	208/3	203	208/3	201
Motor Amperage:	58	29.3/30.2/30.1	23	13.7/13.7/12.7
Motor RPM:	1750	1750	1725	1725
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:	12000	11747		
Return Air CFM:			10250	9942
Exhaust Air CFM:				
Outside Air CFM:	1750	1629		
Suction Pressure:	NL	1.36	NL	-0.87
Discharge Pressure:	NL	1.39	NL	0.08
Fan Static Pressure:	4	2.75	NL	NA
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	1074	833	NL	INLINE
Motor Drive:	NL	VP53	NL	2VP54
Motor Size/Bore:	NL	1 5/8"	NL	1 3/8"
Fan Drive:	NL	2B110	NL	INLINE
Fan Size/Bore:	NL	SK 1 11/16	NL	INLINE
Belt Size / Number:	NL	B91/3	NL	B96/2
Shafts C-C:	NL	33 3/4"	NL	37"
Turns Open:	NL	2	NL	4

Comments:

Project:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	12/17/2021	**Project No.**	21-016

AC-3 STATIC PROFILE



LOCATION	STATIC
1	-0.21"
2	-1.32"
3	-1.36"
4	+1.39"

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

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-3 TRAVERSE NUMBER : T1
Supply Zone 1 TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	30	" WIDTH x	24	" DEPTH	Sq Ft =	5.00

AIR DENSITY DATA

STATIC PRESS @ CL:	1.76	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	2750
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**2763**

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	1522	879	806	668			
B	1313	828	575	0			
C	985	527	0	0			
D	697	0	0	0			
E							
F							
G							
H							
I							

NO. OF READINGS = 16 AVERAGE FPM = 550

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-3 TRAVERSE NUMBER : T2
Supply Zone 2 TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	30	" WIDTH x	20	" DEPTH	Sq Ft =	4.17

AIR DENSITY DATA

STATIC PRESS @ CL:	1.43	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	5039
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**5060**

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	796	859	1091	1241	1501	1626	
B	811	909	999	1319	1484	1643	
C	987	1017	1067	1290	1478	1565	
D	1003	1039	1224	1285	1378	1586	
E	668	1004	1284	1330	1455	1344	
F							
G							
H							
I							

NO. OF READINGS = 30 AVERAGE FPM = 1209

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-3 TRAVERSE NUMBER : T3
Supply Zone 3 TRAVERSE LOCATION: Penthouse Mech.

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:	1.48	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	3958
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**3974**

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	835	1113	1149	1119	1461		
B	895	1073	1028	953	1360		
C	1201	1170	959	478	1037		
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 15 AVERAGE FPM = 1055

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: RF-3 TRAVERSE NUMBER : T1
AC-3 Return TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	36	" WIDTH x	36	" DEPTH	Sq Ft =	9.00

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.93	InWg.	DESIGN CFM =	NL
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	9942
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**9925**

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	784	908	1228	1397	1402		
B	394	965	1257	1371	1474		
C	757	851	1240	1371	1463		
D	651	929	1029	1378	1415		
E	749	732	1021	1285	1473		
F	800	899	1199	1320	1398		
G							
H							
I							

NO. OF READINGS = 30 AVERAGE FPM = 1105

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

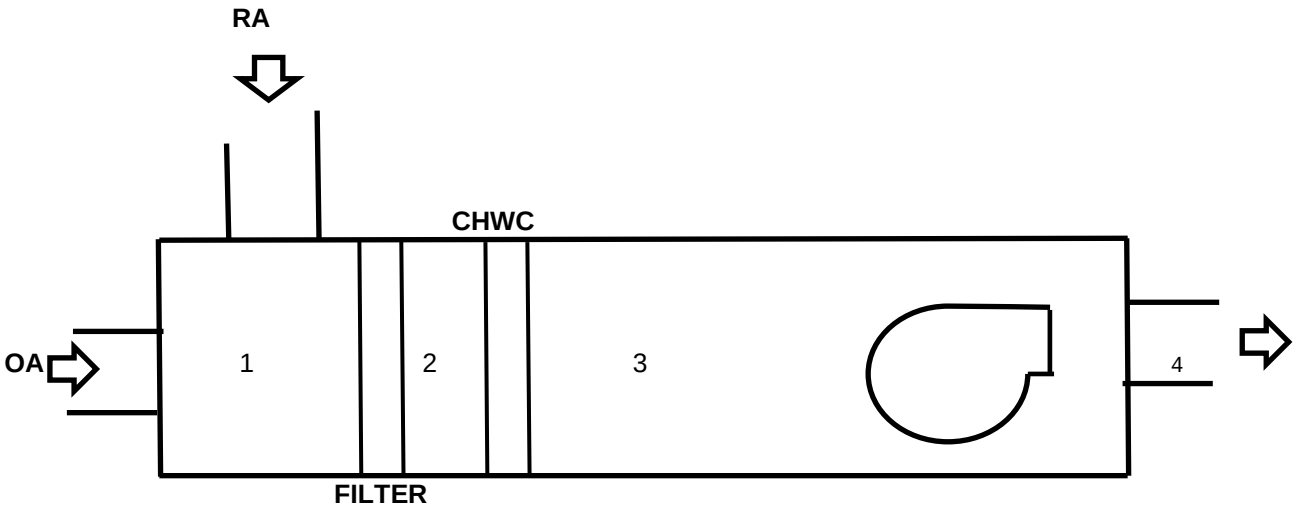
FAN DATA SHEET

	FAN NO. AC-4		FAN NO. RF-4	
Serves / Location:	2nd & 3rd Fl. New Bldgs.		2nd & 3rd Fl. New Bldgs.	
Manufacturer:	YORK		PENN VENT	
Model Number:	CS217SHMP D-AC4		75797	
Size:	NL		NL	
Serial Number:	90-802989D		NA	
MOTOR	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Manufacturer:	NL	AO SMITH	NL	*1
Frame Number:	NL	256T	NL	*1
Horsepower:	20	20	5	*1
Brake Horsepower:	NL	18.1	NL	*1
Safety Factor:	NL	1.15	NL	*1
Volts/Phase:	208/3	208/3	208/3	208
Motor Amperage:	61.6	43/43/41	*1	9.4/9.7/9.7
Motor RPM:	1745	1745	*1	1725
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:	11000	9917		
Return Air CFM:			9900	8949
Exhaust Air CFM:				
Outside Air CFM:	1100	1033		
Suction Pressure:	NL	0.42	NL	0.59
Discharge Pressure:	NL	0.88	NL	0.2
Fan Static Pressure:	3.5	1.3	NL	0.79
External Pressure:	NL	NA	NL	NA
RPM	**DESIGN**	**TESTED**	**DESIGN**	**TESTED**
Fan RPM:	1000	662	NL	INLINE
Motor Drive:	NL	2VP52	NL	2VP54
Motor Size/Bore:	NL	1 5/8"	NL	1 3/8"
Fan Drive:	NL	2T0160	NL	INLINE
Fan Size/Bore:	NL	H1 3/4"	NL	INLINE
Belt Size / Number:	NL	B96/2	NL	B96/2
Shafts C-C:	NL	32"	NL	38"
Turns Open:	NL	1 1/2	NL	3

Comments: ***1 No access to motor tag.**

Project:	Essex Superior Court		
Address:	Lawrence, MA		
Date:	12/17/2021	**Project No.**	21-016

AC-4 STATIC PROFILE



LOCATION	STATIC
1	-0.24"
2	-.39"
3	-.44"
4	+.88"

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

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-4 TRAVERSE NUMBER : T1
Supply Zone 1 TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)		" DIAMETER			Sq Ft =	0.00
DUCT SIZE (RECT.)	36	" WIDTH x	36	" DEPTH	Sq Ft =	9.00

AIR DENSITY DATA

STATIC PRESS @ CL:	0.78	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	7503
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**7522**

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	670	714	499	718	806		
B	746	856	697	888	858		
C	709	595	619	844	819		
D	708	719	724	909	934		
E	983	757	927	904	966		
F	1053	1362	1217	997	812		
G							
H							
I							

NO. OF READINGS = 30 AVERAGE FPM = 834

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: AC-4 TRAVERSE NUMBER : T1
Supply Zone 2 TRAVERSE LOCATION: Penthouse Mech.

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:	0.22	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	2414
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**2416**

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	1132	1118	919	775	537		
B	1059	1189	900	736	560		
C	1281	1135	1007	740	488		
D							
E							
F							
G							
H							
I							

NO. OF READINGS = 15 AVERAGE FPM = 905

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: RF-4 TRAVERSE NUMBER : T1
Return Zone 4 TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)		" DIAMETER		Sq Ft =	0.00
DUCT SIZE (RECT.)	36	" WIDTH x	28 " DEPTH	Sq Ft =	7.00

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.47	InWg.	DESIGN CFM =	NA
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	8949
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**8944**

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	1095	1245	853	852	1224		
B	1012	1258	1115	1378	1491		
C	1076	1371	1420	1718	1428		
D	1037	1063	1578	1680	1482		
E	907	1026	1478	1672	1502		
F							
G							
H							
I							

NO. OF READINGS = 25 AVERAGE FPM = 1278

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: EF-1 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)	8	" DIAMETER		Sq Ft =	0.35
DUCT SIZE (RECT.)		" WIDTH x	" DEPTH	Sq Ft =	0.00

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.01	InWg.	DESIGN CFM =	300
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	61
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**61**

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	173	154					
B	167	175					
C	188	179					
D	205	167					
E							
F							
G							
H							
I							

NO. OF READINGS = 8 AVERAGE FPM = 176

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

No access to get fan data for EF-1

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

AIR DISTRIBUTION

SYSTEM: EF-2

SUPPLY [ ] RETURN [ ] EXHAUST [X]

ROOM OR LOCATION	UNIT NUMBER	UNIT SIZE	AREAxK FACTOR	DESIGN FT/MIN	TEST FT/MIN	DESIGN CFM	TESTED CFM
313	1	6X6	FH	NA	NA	NL	105
318	2	6X6	FH	NA	NA	NL	92
308	3	6X6	FH	NA	NA	NL	45
319	4	6X6	FH	NA	NA	NL	57
312	5	6"	FH	NA	NA	NL	145
215	6	6X6	FH	NA	NA	NL	143
220	7	6X6	FH	NA	NA	NL	96
210	8	6X6	FH	NA	NA	NL	86
214	9	6X6	FH	NA	NA	NL	43
120	10	6X6	FH	NA	NA	NL	40
1ST Fl. Men	11	8X8	FH	NA	NA	NL	232
1ST Fl. Women	12	8X8	FH	NA	NA	NL	212
						TOTALS:	NL	1296 *1

Comments: ***1 Not sure if anything else is off EF-2.**

No access to get fan data for EF-2

Project: Essex Superior Court
Address: Lawrence, MA
Date: 12/17/2021 **Project No.** 21-016

TRAVERSE DATA

SYSTEM: EF-3 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: Penthouse Mech.

DUCT SIZE (ROUND)	8	" DIAMETER		Sq Ft =	0.35
DUCT SIZE (RECT.)		" WIDTH x	" DEPTH	Sq Ft =	0.00

AIR DENSITY DATA

STATIC PRESS @ CL:	-0.18	InWg.	DESIGN CFM =	150
DUCT AIR TEMP :	70	Deg F	ACTUAL CFM =	137
BAROMETRIC PRESS :	29.92	In Hg.	SCFM=	**137**

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	415	415					
B	410	381					
C	364	387					
D	378	386					
E							
F							
G							
H							
I							

NO. OF READINGS = 8 AVERAGE FPM = 392

J							
K							
L							
M							
N							
O							
P							
Q							
R							

TECHNICIAN: Dan Abbett

No Access to get fan data for EF-3.