New Bedford Probate & Family Court
New Bedford, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

November 11, 2021

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the New Bedford Probate and Family Courthouse on November 5, 2020. While on site we inspected the air handling equipment located in ceilings and the attic and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management:*
  - Doug Firth, Courthouse Facilities Staff
- *Tighe & Bond*
  - Sean Pringle, PE, Mechanical Engineer
  - Caitlin DeWolfe, Staff Engineer

1.1 Existing Ventilation System

The New Bedford Probate and Family Courthouse is a two story building constructed in 1909, with significant HVAC improvements in 1987. The courthouse is approximately 16,200 square feet in size. Fourteen air handling units (AHU) provide ventilation air to the building.

The AHU's are light commercial / residential style constant volume air handlers. Each unit has a DX cooling coil, and supply fan. AC's 1-10 have an outdoor air (O.A.) duct and outdoor air. Several of the attic AHUS also have standalone economizer controllers and return air dampers. The AHU's do not provide heat. The AHU serving Courtroom 1 has a duct-mounted hot water coil to temper the supply air in the winter. Heating in the areas served by each AHU is provided by hot water perimeter baseboard. The AHU's have historically been configured to cycle the fan with calls for cooling and did not operate in the heating season. However, staff have indicated that they have been encouraging occupants to leave the systems in "fan on" at the thermostat and plan to continue to do so through the heating season. Due to the locations of the AHU's in the ceiling and attic and difficulty of access, not all units were observed. The units that were observed all appeared similar in age and were generally in fair condition.

AC's 11-14 do not have any outdoor air ductwork, and as a result the basement areas served by these units do not have any ventilation. This includes the following occupied areas:

- Room 005 (Library / Conference)
- Room 019 (Staff Lounge)
- Room 020 (Conference)
- Rooms 014 & 015 (Office)
- Room 013 (Reception)

In addition to the areas served by these AHU's, Rooms 007 and 008, which are being used by facilities staff, do not have any mechanical ventilation. Heat in this area is provided by a ceiling mounted unit heater.

Building areas without ventilation 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.

The basement rooms noted above generally have windows with operable sashes.

At the time of the visit, all toilet exhaust fans appeared to be operational. The fans generally serve one or two restrooms each and are interlocked with the light switch in each restroom.

Two 690 MBtu/Hr hot water boilers provide hot water to the perimeter baseboard heating and duct mounted coil. Cooling for each AC unit is provided by separate condenser on the roof.

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)	Filters	Condition
AC-1	1,600	Unknown	1" MERV 10	Fair
AC-2	1,400	Unknown	1" MERV 10	Fair
AC-3	1,400	Unknown	1" MERV 10	Fair
AC-4	1,200	Unknown	1" MERV 10	Fair
AC-5	2,500	Unknown	1" MERV 10	Fair
AC-6	1,400	Unknown	1" MERV 10	Fair
AC-7	1,600	Unknown	1" MERV 10	Fair
AC-8	1,400	Unknown	1" MERV 10	Fair
AC-9	800	Unknown	1" MERV 10	Fair
AC-10	800	Unknown	1" MERV 10	Fair
AC-11*	500	0	1" MERV 10	Fair
AC-12*	800	0	1" MERV 10	Fair
AC-13*	600	0	1" MERV 10	Fair
AC-14*	600	0	1" MERV 10	Fair

*AHU has no outdoor air ductwork.

Photo 1 – Representative Air Handler

1.2 Existing Control System

The Courthouse does not have a building-wide control system. Each AHU has local thermostatic controls in the space. Some are 7 day programmable thermostats, while the others are non-programmable. Next to each thermostat is a switch to enable outdoor air for that AHU, and also a speed selector switch. Standalone economizer controllers were observed on several of the AHU's in the attic. It is unclear if these are present on all of the AHU's with outdoor air provisions, or only some units, as we were not able to observe every unit.

The perimeter baseboard heating units are controlled via thermostatic valves and return temperature sensor bulbs located within the heaters.

Section 2
Recommendations

Below is a list of recommendations that we propose for the New Bedford Probate and Family 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: *Replace 1" MERV-10 filters with MERV-13 filters.*

The existing MERV filters have relatively high removal efficiency. However, we recommend replacing the MERV 10 filters with MERV 13 filters if supply airflows can be maintained. The TAB contractor and/or Engineer shall verify that the air handlers can accommodate a MERV 13 filter per Appendix A in the overview of recommendations report. Note that the increased pressure drop associated with upgrading to MERV 13 filters is generally higher with 1" filters than with 2" filters. The filters will also require more frequent replacement.

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

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

Provide a local alarm. As many AHU's are in difficult to reach areas, provide a local alarm in an area that will be noticed by staff.

2.2 Testing & Balancing Recommendations

The air handling units are approximately 34 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.

The original design drawings do not indicate the intended outdoor air percentage for the AHU's, only the cooling capacities and total airflow. Based on the design cooling capacities of the equipment, we verified that the recommended outdoor air percentage would allow a supply air of 54-57°F in cooling to be maintained.

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	1,600	Unknown	110	150
AC-2	1,400	Unknown	40	150
AC-3	1,400	Unknown	60	150
AC-4	1,200	Unknown	90	150
AC-5	2,500	Unknown	720	750
AC-6	1,400	Unknown	60	100
AC-7	1,600	Unknown	300	300
AC-8	1,400	Unknown	40	150
AC-9	800	Unknown	140	150
AC-10	800	Unknown	60	150
AC-11*	500	0	150	0
AC-12*	800	0	100	0
AC-13*	600	0	190	0
AC-14*	600	0	160	0

*AHU has no outdoor air ductwork.

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

The 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. Note this includes the supply air for AHU systems that do not provide outdoor air. The outdoor air CFM/person only includes areas that are mechanically ventilated.

TABLE 3
Average Airflow Rate per Person

	Spaces Mechanically Ventilated	*Courtrooms*	*Non-Courtroom Spaces*
Total Occupancy (People)	209	122	88
Total Supply Air (CFM/Person)	80	34	144
Outdoor Air (CFM/Person)	11	9	13

The airflow rate per person for each Courtroom is shown below in Table 4. These values are based on full occupancy without taking diversity into account, the original design supply airflow rate, and the recommended outdoor airflow rate. The airflow rate per person assumes the fan operates continuously.

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)*
Courtroom 1	123	2,500	20	750	6
Courtroom 3	51	1,600	31	300	6

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

The airflow rate per person for each Courtroom, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 4a. The airflow rate per person assumes the fan operates continuously.

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)*
Courtroom 1	37	2,500	68	750	20
Courtroom 3	16	1,600	100	300	19

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

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

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

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.*

Adjust schedules in thermostats and local controls where possible. For manually operated equipment, turn on three hours prior to occupancy, and off three hours after occupancy. This includes AHU ventilation and exhaust fans.

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

Verify the operation of any standalone economizers on present AC's 1-10. Replace or adjust any economizers that are not functioning properly.

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.

Because several basement rooms do not provide outdoor air, we recommend the use of portable HEPA filters in these areas if they will be occupied.

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 Run Ventilation Fans Continuously During Occupied Hours

We strongly recommend running the supply fans continuously during occupied hours, to provide mechanical ventilation at all times, as code requires. According to staff, this measure is already being implemented.

Implementing this strategy may cause comfort issues. When the fan continuously runs, the cooling coils will turn on and off based on the space temperature. Comfort issues may arise if the existing units do not have multiple stages of cooling that would otherwise handle load fluctuations better. During the winter, AHU's without heating coils in the ductwork will supply air below room temperature. Further system analysis and improvements are required to address these issues.

Consider adding a single electronic time clock to control AHU fans and exhaust fans from a single location in the Courthouse to simplify scheduling and operation. Alternately, the existing individual thermostats serving the AHU's could be replaced with new thermostats that include a programmable fan or an occupancy schedule function. Depending on the current wiring, new control wiring may be required between the thermostats and AHU's.

2.7.2 Add Ventilation to All Occupied Areas

Several occupied areas in the basement do not have any mechanical ventilation. Consider adding outdoor air to serve these areas. At minimum, this would include installing outdoor air ductwork to the AHU from either the existing shafts providing outdoor air, a wall opening, or a window opening. Consider the use of an energy recovery ventilator (ERV) to temper the outdoor air. Further system analysis and improvements are required to execute this recommendation.

2.7.3 Add Heat to AHU's

The only system that provides heat via a duct mounted heating coil is AC-5. As mentioned in section 2.7.1, occupants may feel cold with the low supply air temperature in the winter without heat to temper supply air. Consider providing duct mounted hot water heating coils or replace the AC unit and condenser with a split air source heat pump system to provide heating and cooling with the refrigerant coil.

This recommendation is a comfort and energy saving measure and does not affect the indoor air quality of the building.

Section 3
Testing & Balancing Results

Wing's Testing & Balancing visited the New Bedford Probate and family Courthouse from September 27 to October 5, 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. Note that all air handlers provide cooling via DX (refrigerant) coils only, and do provide heat, so no there was no water balancing to perform.

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	1,600	150	1,450	1,318	360	958
AC-2	1,400	150	1,250	1,283	0	1,283
AC-3	1,400	150	1,250	1,308	0	1,308
AC-4	1,200	150	1,050	1,247	0	1,247
AC-5	2,500	750	1,750	2,293	0	2,293
AC-6	1,400	100	1,300	1,298	0	1,298
AC-7	1,600	300	1,300	1,460	0	1,460
AC-8	1,400	150	1,250	1,086	0	1,086
AC-9	800	150	650	743	154	589
AC-10	800	150	650	780	146	634
AC-11	500	0	500	591	0	591
AC-12	800	0	800	752	0	752
AC-13	600	0	600	545	0	545
AC-14	600	0	600	584	0	584

TABLE 6
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Exhaust Airflow (CFM)	Actual Exhaust Airflow (CFM)
RF-1	Building Relief Air	2,500	0
EF-1	Rm 105 Toilet	146	160
EF-2	Rm 115 Toilet	146	163
EF-3	Rm 110 Toilet	146	101
EF-4	Rm 123 Toilet	146	182
EF-5	Rm 118 & 119 Toilet	300	174
EF-7	Rm 101 Toilet	146	160
EF-10	Rm 021 Toilet	55	82
EF-11	Rm 011 Toilet	300	174
EF-12	Rm 016 Toilet	125	160
EF-13	Rm 018 Toilet	125	174

The typical balancing tolerance for air systems is ±10% of the design airflow

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

1. The filters for all AC units at the time of testing were 1" MERV 10. Based on the measured airflows (generally within tolerances, but low), 1" MERV 13 filters could likely be installed without substantially impacting unit airflow.
    a. However, MERV 13 filters will become dirty and begin to impact airflow much more quickly because both of the reduced filter area in 1" filters, and the increased filtration efficiency of MERV 13 filters. At a minimum, the filters will need to be regularly checked and any scheduled replacement intervals adjusted to accommodate the new filters.
    b. Consider adding local dirty filter alarms and/or differential pressure gauges to the AC units.
2. The total supply airflows of all units except AC-1, AC-8, and AC-11 are within the acceptable airflow range.
3. The supply airflows of AC-1 and AC-8 are slightly below design (80% of design) at the highest fan speed. The cause of the low airflow should be investigated.
    a. Possible causes include dirty return ducts, dirty filters, dirty cooling coils, misadjusted return and outdoor air dampers, or worn out fan motors.
    b. If no obvious issues are identified, consider rebalancing all inlets and outlets to minimize pressure drop over balancing dampers.

4. The supply airflow of AC-11 is slightly above design (120% of design) at the lowest fan speed.
    a. Consider rebalancing the supply outlets to match the design airflow.
5. The outdoor airflow of AC-1 was well above design.
    a. Once the low supply airflow is resolved, this should be adjusted to match the design outdoor airflow.
6. Most outdoor air damper and return air damper actuators were inoperable resulting in air handlers AC-2 through AC-8 providing no ventilation air. The dampers for AC-9 and AC-10 were set manually, resulting in wasted energy due to ventilation air being provided during both occupied and unoccupied periods.
    a. The dampers and actuators for all units should be tested, and repaired or replaced as appropriate. Once operation is restored, the outdoor airflows should be rebalanced. As many of these units also include standalone economizer controls, these should also be repaired and calibrated.
7. Toilet exhaust fans EF-3, EF-5, and EF-11 are not performing within the acceptable range (60-70% of design) at the highest speed setting.
    a. As these are small direct drive units, we recommend replacing these fans.
    b. Also consider cleaning the associated exhaust registers and ductwork to maximize airflow.
8. The airflows of EF-4, EF-12, and EF-13 are well over design, but make noises when the speed is reduced via the speed controllers.
    a. We recommend confirming that the speed controllers are wired and operating properly.
    b. Also consider replacing the existing fans with equivalent units with direct drive ECM motors for improved speed control.

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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WING'S TESTING & BALANCING CO., INC.

New Bedford
Probate and Family Court

* * * *

Tighe & Bond
Attn: Jason Urso
1 University Ave #100
Westwood, MA 02090

October 6th, 2021

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WING'S TESTING & BALANCING CO., INC.

October 6th, 2021

Tighe & Bond
Attn: Jason Urso
1 University Ave #100
Westwood, MA 02090

Re: New Bedford Probate and Family Court

Dear Jason,

We have completed our HVAC/fresh air testing for the above-mentioned site. The results are as follows:

- The outside air dampers do not modulate open when the units are running on units AC-2, AC-3, AC-, AC-5, AC-6, AC-7 and AC-8.
- AC-1 and A-8 are below design but on their highest speeds.
- The outside air damper linkage has been removed from the dampers on units AC-9 and AC-10. These outside airs were manually set.
- AC-11 is on its lowest speed but still over design.
- AC-11, AC-12, AC-13 and AC-14 do not have outside air ducted to them.
- There is a fan labeled RF-1 that is interlocked with AC-5. This fan never runs, and our team is unsure what the sequence of operations is for this fan. The in-house staff were unaware that this fan even existed. The fan is located in the attic with no access to the motor and sheaves.
- EF-3, EF-5 and EF-11 are all on their highest speeds but still well below design. These fans should be replaced.
- EF-4, EF-12 and EF-13 are all over design. However, if their speed controllers are lowered, the fans emit loud noises. We assume that the speed controllers are not wired properly.
- There is no access to EF-6 or the ductwork it serves. It is in the attic crawl space behind units AC-5 and AC-6. EF-6 serves room 109. We did not have access to this space at the time as we were only in mechanical spaces.
- All filters on the job were MERV-10.
- All of the OA toggle switches were turned on during testing of those units.

The following pages are your record of current operating conditions. If you have any questions, or if we can be of further service, please do not hesitate to call.

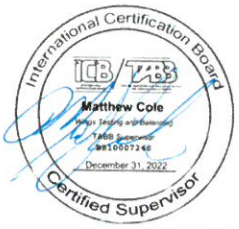
Very truly yours,

Wing's Testing & Balancing Co., Inc.

ICB Certified Contractor for:

TABB—Commissioning—Fire/Life Safety L1&L2—Sound & Vibration

Barry Stratos
Certified TABB Technician



SUPPLY FAN REPORT

PROJECT:	New Bedford Probate and Family Court	**DATE:**	9/27/2021
AREA SERVED:		**TECH:**	BS

FAN DATA

	AC-1		AC-2		AC-3	
FAN NUMBER						
LOCATION	Attic		Attic		Attic	
AREA SERVED	Probation		Register's Office		Registry	
MANUFACTURER	Goodman		Carrier		Carrier	
MODEL OR SIZE	ARUF49C14		40QH042		40QH042	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	1600	1318 (1)	1400	1283	1400	1308
RETURN AIR	1450	958	1250	1283		1308
OUTSIDE AIR	150	360	150	0 (2)	150	0 (2)
DISCH. STATIC	---	+0.22"	---	+0.14"	---	+0.14"
SUCTION STATIC	---	-0.79"	---	-0.56"	---	-0.51"
TOTAL STATIC	---	1.01"	---	0.70"	---	
FAN RPM	DD	DD	DD	DD	DD	DD
PULLEY O.D.	DD		DD		DD	
ESP	0.28		0.24		0.25	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	100%		0%		0%	

MOTOR DATA

MANUFACTURER	NA		NA		NA	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	1/2	1/2	1/2	1/2	1/2	1/2
MOTOR RPM	1075	1075	1075	1075	1075	1075
VOLTAGE / PH.	208/1	208/1	208/1	208/1	208/1	208/1
AMPS LEG 1	3.1		3.8		3.8	
AMPS LEG 2	---	2.9	---	3.1	---	3.1
AMPS LEG 3	---		---		---	
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	
SPEED	High		High		High	

REMARKS

(1) Fan on its highest speed.

(2) The outside air damper does not modulate.

NA Not Available

ND No Design

DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	New Bedford Probate and Family Court	**DATE:**	9/28/2021
AREA SERVED:		**TECH:**	BS

FAN DATA

	AC-4		AC-5		AC-6	
FAN NUMBER						
LOCATION	Attic		Attic		Attic	
AREA SERVED	Main Hall		Court 1		Lobby	
MANUFACTURER	Carrier		Carrier		Carrier	
MODEL OR SIZE	40AQ036		10BA0093		40QH042	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	1200	1247	2500	2293	1400	1298
RETURN AIR		1247		2293		1280
OUTSIDE AIR	150	0 (1)	750	0 (1)	100	0 (1)
DISCH. STATIC	---	+0.20"	---	+0.17"	---	+0.16'
SUCTION STATIC	---	-0.46"	---	-0.93"	---	-0.63"
TOTAL STATIC	---	0.66"	---	1.10"	---	0.79"
FAN RPM	DD	DD	---	788	DD	DD
PULLEY O.D.	DD		14.0 x 3/4		DD	
ESP	0.33		0.79		0.40	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	0%		0%		0%	

MOTOR DATA

MANUFACTURER	NA		Balder		NA	
MODEL OR FR.	NA		56/56 H		NA	
HORSEPOWER	1/3	1/3	1.5	1.5	1/2	1/2
MOTOR RPM	1075	1075	3450	3450	1075	1075
VOLTAGE / PH.	208/1	208/1	208/3	208/3	208/1	208/1
AMPS LEG 1	3.6		9.0	7.8	3.8	
AMPS LEG 2	---	2.9	---	7.7	---	3.1
AMPS LEG 3	---		---	7.7	---	
SHEAVE O.D.	DD		3.5 x 5/8		DD	
BELTS - QUANTITY / SIZE	DD		1/A61		DD	
SHEAVE POSITION	DD		Fully open		DD	
SPEED	High		High		Low	

REMARKS

(1) The outside air damper does not modulate.

NA Not Available
ND No Design
DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	New Bedford Probate and Family Court	**DATE:**	9/29/2021
AREA SERVED:		**TECH:**	BS

FAN DATA

	AC-7		AC-8		AC-9	
FAN NUMBER						
LOCATION	Attic		Attic		Boiler Room	
AREA SERVED	Main Hall		Court 1		Offices	
MANUFACTURER	Carrier		Carrier		Carrier	
MODEL OR SIZE	40QH048		42QH042		40AQ024	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	1600	1460	1400	1086	800	743
RETURN AIR		1460		1086		589
OUTSIDE AIR	300	0 (2)	150	0 (2)	150	154 (1)
DISCH. STATIC	---	+0.36"	---	+0.07"	---	+0.30"
SUCTION STATIC	---	-0.58"	---	-0.47"	---	-0.49"
TOTAL STATIC	---	0.94"	---	0.54"	---	0.79"
FAN RPM	DD	DD	---	DD	DD	DD
PULLEY O.D.	DD		DD		DD	
ESP	0.59		0.18			
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	0%		0%		50%	

MOTOR DATA

MANUFACTURER	NA		Balder		NA	
MODEL OR FR.	NA		56/56 H		NA	
HORSEPOWER	1/2	1/2	1/2	1/2	1/4	1/4
MOTOR RPM	1075	1075	1075	1075	1075	1075
VOLTAGE / PH.	208/1	208/1	208/1	208/1	208/1	208/1
AMPS LEG 1	4.8		3.8		2.9	
AMPS LEG 2	---	4.2	---	2.4	---	1.6
AMPS LEG 3	---		---		---	
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	
SPEED	Low		High		Low	

REMARKS

(1) The linkage to the outside air damper has been removed and is missing. The damper was set manually.
(2) The outside air damper does not modulate and needs replacing.

NA Not Available
ND No Design
DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	New Bedford Probate and Family Court	**DATE:**	9/30/2021
AREA SERVED:		**TECH:**	BS

FAN DATA

	AC-10		AC-11		AC-12	
FAN NUMBER						
LOCATION	Boiler Room		Boiler Room		Boiler Room	
AREA SERVED	Offices		Library		Corridor	
MANUFACTURER	Carrier		Carrier		Carrier	
MODEL OR SIZE	40AQ024		40AQ018		40AQ024	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	800	780	500	591 (1)	800	752
RETURN AIR	650	634	500	591	800	752
OUTSIDE AIR	150	146 (2)	0	0 (3)	0	0 (3)
DISCH. STATIC	---	+0.17"	---	+0.13"	---	+0.26"
SUCTION STATIC	---	-0.45"	---	-0.60"	---	-0.48"
TOTAL STATIC	---	0.62"	---	0.73"	---	0.72"
FAN RPM	DD	DD	---	DD	DD	DD
PULLEY O.D.	DD		DD		DD	
ESP	0.32		0.32		0.48	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	40%		0%		0%	

MOTOR DATA

MANUFACTURER	NA		NA		NA	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	1/4	1/4	1/8	1/8	1/4	1/4
MOTOR RPM	1075	1075	1075	1075	1075	1075
VOLTAGE / PH.	208/1	208/1	208/1	208/1	208/1	208/1
AMPS LEG 1	2.9		1.5		2.9	
AMPS LEG 2	---	1.6	---	1.1	---	1.6
AMPS LEG 3	---		---		---	
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	
SPEED	Low		Low		Low	

REMARKS

(1) Fan is on it's lowest speed but still over design.

(2) The linkage to the outside air damper has been removed and is missing. The damper was set manually.

(3) These units do not have outside air ducted to them.

NA Not Available

ND No Design

DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	New Bedford Probate and Family Court	**DATE:**	9/30/2021
AREA SERVED:		**TECH:**	BS

FAN DATA

FAN NUMBER	AC-13		AC-14			
LOCATION	Basement		Basement			
AREA SERVED	Kitchen		Locker Up			
MANUFACTURER	Carrier		Carrier			
MODEL OR SIZE	40AQ018		40AQ018			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	600	545	600	584		
RETURN AIR	600	545	600	584		
OUTSIDE AIR	0	0 (1)	0	0 (1)		
DISCH. STATIC	---	+0.17"	---	+0.10"		
SUCTION STATIC	---	-0.61"	---	-0.63"		
TOTAL STATIC	---	0.73"	---	0.73"		
FAN RPM	DD	DD	---	DD		
PULLEY O.D.	DD		DD			
ESP	0.32		0.31			
VFD SPEED	No VFD		No VFD			
O.A.D.MIN POS	0%		0%			

MOTOR DATA

MANUFACTURER	NA		NA			
MODEL OR FR.	NA		NA			
HORSEPOWER	1/8	1/8	1/8	1/8		
MOTOR RPM	1075	1075	1075	1075		
VOLTAGE / PH.	208/1	208/1	208/1	208/1		
AMPS LEG 1	1.5		1.5			
AMPS LEG 2	---	1.1	---	1.1		
AMPS LEG 3	---		---			
SHEAVE O.D.	DD		DD			
BELTS - QUANTITY / SIZE	DD		DD			
SHEAVE POSITION	DD		DD			
SPEED	Low		Low			

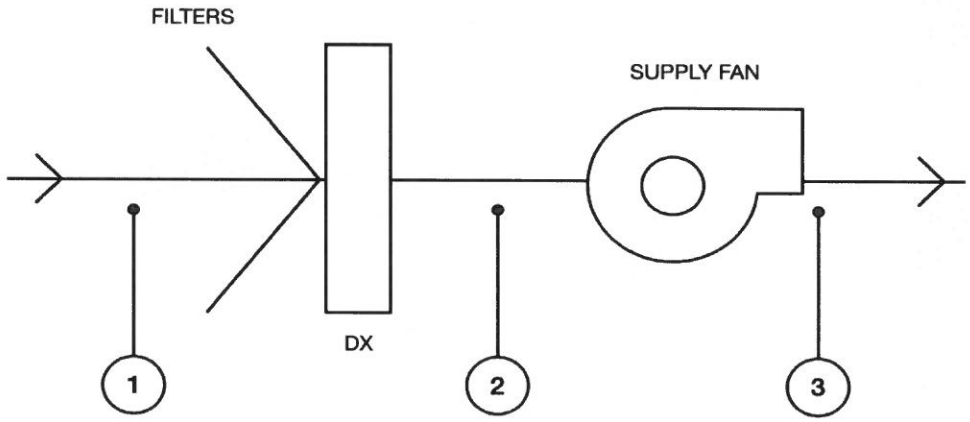
REMARKS

(1) These units do not have outside air ducted to them.

NA Not Available
ND No Design
DD Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	New Bedford Probate and Family Court	**DATE:**	10/6/2021
SYSTEM/AREA:		**TECH:**	BS



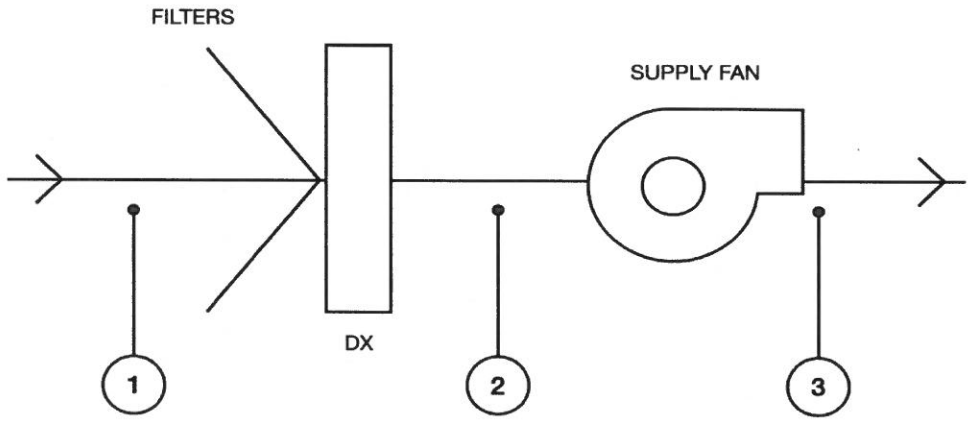
STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	9
AC-1	-0.06"	-0.79"	+0.22"						
AC-2	-0.10"	-0.56"	+0.14"						
AC-3	-0.12"	-0.51"	+0.14"						
AC-4	-0.13"	-.46"	+0.20"						
AC-5	-0.62"	-0.93"	+0.17"						
AC-6	-0.24"	-0.63"	+0.16"						
AC-7	-0.23"	-0.58"	+0.36"						

REMARKS

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	New Bedford Probate and Family Court	**DATE:**	10/5/2021
SYSTEM/AREA:		**TECH:**	BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	9
AC-8	-0.11"	-0.47"	+0.07"						
AC-9	-0.22"	-0.49"	+0.30"						
AC-10	-0.15"	-0.45"	+0.17"						
AC-11	-0.19"	-0.60"	+0.13"						
AC-12	-0.22"	-0.48"	+0.26"						
AC-13	-0.20"	-0.61"	+0.12"						
AC-14	-0.21"	-0.63"	+0.10"						

REMARKS

VELOCITY PRESSURE READINGS

PROJECT:	New Bedford Probate and Family Court					DATE:	9/30/2021	
AREA SERVED:						TECH:	BS	
TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN FPM	DESIGN CFM	CENT. STAT. PRESS."	TEST FPM	TEST CFM	NOTES
AC-1 Total	24x12	2.0		1600	+0.29"	659	1318	(1)
AC-1 OA	18x6	0.75		150	-0.05"	479	360	(2)
AC-1 Return				1450	(3)			
AC-2 Total	21x19	2.77		1400	-0.09"	463	1283	
AC-2 OA	20x13	1.81		150	0.00	0	0	(2)
AC-2 Return				1250	(3)	---	1283	
AC-3 Total	20x12	1.66		1400	+0.13	788	1308	
AC-3 OA	20x12	1.66		150	0.00	0	0	(2)
AC-3 Return				1250	(3)	---	1308	
AC-4 Total	20x6	0.83		1200	+0.20"	897	1247	
AC-4 OA	20x6	0.83		150	0.00	0	0	(2)
AC-4 Return				1050	(3)		1247	
AC-5 Total	28x14	2.72		2500	+0.17"	843	2293	
AC-5 OA	24x16	2.67		750	0.00	0	0	(2)
AC-5 Return				1750	(3)		2293	
AC-6 Total	20x12	1.67		1400	+0.16"	772	1289	
AC-6 OA	18x18			100	0.00	0	0	(2)
AC-6 Return				1300	(3)		1289	
AC-7 Total	24x12	2.0		1600	+0.36"	730	1460	
AC-7 OA	20x12	1.66		300	0.00	0	0	(2)
AC-7 Return				1300	(3)		1460	

REMARKS

(1) Fan is on its highest speed.

(2) Outside air damper does not modulate.

(3) Calculated.

VELOCITY PRESSURE READINGS

PROJECT:	New Bedford Probate and Family Court					**DATE:**	9/30/2021	
AREA SERVED:						**TECH:**	BS	
TRAVERSE		**AREA**	**DESIGN**		**CENT. STAT.**	**TEST**		
LOCATIONS	**DUCT SIZE "**	**SQ.FT.**	**FPM**	**CFM**	**PRESS."**	**FPM**	**CFM**	**NOTES**
AC-8 Total	20x12	1.67		1400	+0.07"	650	1086	(1)
AC-8 OA	20x12	1.67		150	0.00	0	0	
AC-8 Return				1250	(2)			
AC-9 Total	16x10	1.11		800	+0.30"	669	743	
AC-9 OA	16x10	1.11		150	-0.20"	139	154	
AC-9 Return				650	(2)			
AC-10 Total	16x10	1.11		800	+0.17"	702	780	
AC-10 OA	12x12	1.0		150	-0.06"	146	146	
AC-10 Return				650	(2)		634	
AC-11 Total	14x10	0.97		500	+0.13"	608	591	
AC-12 Total	14x10	1.11		800	+0.14"	677	752	
AC-13 Total	14x10	0.97		600	+0.12"	561	545	
AC-14 Total	14x10	0.97		600	+0.096"	601	584	

REMARKS

(1) Units are wired to its highest speed. Motor should be replaced.

(2) Calculated.

EXHAUST FAN REPORT

PROJECT:	New Bedford Probate and Family Court				**DATE:**	10/4/2021
AREA SERVED:					**TECH:**	BS
FAN DATA						
FAN NUMBER		RF-1	EF-1	EF-2	EF-3	EF-4
LOCATION		Attic	Attic	Attic	Attic	Attic
AREA SERVED		Whole Bldg	Rm 105	Rm 115	Rm 110	Rm 123
MANUFACTURER		Acme	Acme	Acme	Acme	Acme
MODEL OR SIZE		XB-161J	V-150	V-150	V-150	V-150
TOTAL CFM	**DESIGN**	2500 (1)	146	146	146	146
	ACTUAL		160	163	101 (2)	182
FAN RPM	**DESIGN**		DD	DD	DD	DD
	ACTUAL		DD	DD	DD	DD
PULLEY	**O.D.**	DD	DD	DD	DD	DD
SERVICE			---	---	---	---
MOTOR DATA						
MANUFACTURER		NA	NA	NA	NA	NA
MODEL NUMBER		NA	NA	NA	NA	NA
MOTOR HP	**DESIGN**	1	100 Watt	100 Watt	100 Watt	100 Watt
	ACTUAL	1	100 Watt	100 Watt	100 Watt	100 Watt
MOTOR RPM		1200	1550	1550	1550	1550
VOLTAGE/PHASE		208/3	120/1	120/1	120/1	120/1
MOTOR AMPS	**DESIGN**	NA	NA	NA	NA	NA
	ACT. LEG 1					
	ACT. LEG 2		0.6	0.6	0.4	0.6
	ACT. LEG 3					
SHEAVE		DD	DD	DD	DD	DD
BELTS - QUANTITY/SIZE		DD	DD	DD	DD	DD
SHEAVE POSITION		DD	DD	DD	DD	DD

REMARKS

(1) This fan is interlocked with AC-5. However the fan never runs and it's unsure what this fan's sequence of operations is.

(2) Fan is on its highest speed but well below design CFM. This fan should be replaced.

NA Not Available
ND No Design
DD Direct Drive

EXHAUST FAN REPORT

PROJECT:	New Bedford Probate and Family Court				**DATE:**	10/6/2021
AREA SERVED:					**TECH:**	BS
FAN DATA						
FAN NUMBER		EF-5	EF-6	EF-7	EF-10	EF-11
LOCATION		Attic	Attic	Attic	Attic	Attic
AREA SERVED		Rm 118 + 119	Rm 109	Rm 101	Rm 021	Rm 011
MANUFACTURER		Acme	Acme	Acme	Acme	Acme
MODEL OR SIZE		V-400	FQ121OLO	V-10	V-100	V-400
TOTAL CFM	**DESIGN**	300	565	146	55	300
	ACTUAL	174 (1)	(2)	160	82	174 (1)
FAN RPM	**DESIGN**	DD	DD	DD	DD	DD
	ACTUAL	DD	DD	DD	DD	DD
PULLEY	**O.D.**	DD	DD	DD	DD	DD
SERVICE		---	---	---	---	---
MOTOR DATA						
MANUFACTURER		NA	NA	NA	NA	NA
MODEL NUMBER		NA	NA	NA	NA	NA
MOTOR HP	**DESIGN**	255 Watt	1/29	100 Watt	80 Watt	255 Watt
	ACTUAL	255 Watt	1/29	100 Watt	80 Watt	255 Watt
MOTOR RPM						
VOLTAGE/PHASE		120/1	120/1	120/1	120/1	120/1
MOTOR AMPS	**DESIGN**	NA	NA	NA	NA	NA
	ACT. LEG 1					
	ACT. LEG 2	0.6		0.6	0.4	0.6
	ACT. LEG 3					
SHEAVE		DD	DD	DD	DD	DD
BELTS - QUANTITY/SIZE		DD	DD	DD	DD	DD
SHEAVE POSITION		DD	DD	DD	DD	DD

REMARKS

(1) These fans are on their highest speed but still far below design CFM. These fans should be replaced.

(2) There is no access to this fan or ductwork. It is located behind AC-5 and AC-6 in the attic.

NA Not Available
ND No Design
DD Direct Drive

EXHAUST FAN REPORT

PROJECT:	New Bedford Probate and Family Court				**DATE:**	10/5/2021
AREA SERVED:					**TECH:**	BS
FAN DATA						
FAN NUMBER		EF-12	EF-13	EF-14A	EF-15A	
LOCATION		Attic	Attic	Conf. Rm	Conf. Rm	
AREA SERVED		Rm 016	Rm 018	Rm 002	Rm 006	
MANUFACTURER		Acme	Acme	Acme	Acme	
MODEL OR SIZE		V-150	V-150	V-150	V-150	
TOTAL CFM	**DESIGN**	125	125	125	125	
	ACTUAL	160	174	136	122	
FAN RPM	**DESIGN**	DD	DD	DD	DD	
	ACTUAL	DD	DD	DD	DD	
PULLEY	**O.D.**	DD	DD	DD	DD	
SERVICE		---	---	---	---	
MOTOR DATA						
MANUFACTURER		NA	NA	NA	NA	
MODEL NUMBER		NA	NA	NA	NA	
MOTOR HP	**DESIGN**	100 Watt	100 Watt	100 Watt	100 Watt	
	ACTUAL	100 Watt	100 Watt	70 Watt	70 Watt	
MOTOR RPM		1550	1550	675	675	
VOLTAGE/PHASE		120/1	120/1	120/1	120/1	
MOTOR AMPS	**DESIGN**	NA	NA	0.6	0.6	
	ACT. LEG 1					
	ACT. LEG 2	0.6	0.6	0.6	0.6	
	ACT. LEG 3					
SHEAVE		DD	DD	DD	DD	
BELTS - QUANTITY/SIZE		DD	DD	DD	DD	
SHEAVE POSITION		DD	DD	DD	DD	
REMARKS						

NA Not Available
ND No Design
DD Direct Drive

VELOCITY PRESSURE READINGS

PROJECT:	New Bedford Probate and Family Court	**DATE:**	9/30/2021
AREA SERVED:		**TECH:**	BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENT. STAT. PRESS."	TEST		NOTES
			FPM	CFM		FPM	CFM	
EF-1 Total	8"R	0.35		146	+0.05"	427	148	
EF-2 Total	8"R	0.35		146	+0.05"	466	163	
EF-3 Total	8"R	0.35		146	+0.04"	289	101	
EF-4 Total	8"R	0.35		146	+0.06"	520	182	(1)
EF-5 Total	10"R	0.55		300	+0.03"	317	174	(2)
EF-6 Total								(3)
EF-7 Total	8"R	0.35		146	+0.07"	456	160	
EF-10 Total	8"R	0.35		55	+0.03"	233	82	(1)
EF-11 Total	10"R	0.55		300	+0.05"	318	175	(2)
EF-12 Total	8"R	0.35		125	+0.06"	457	160	(4)
EF-13 Total	8"R	0.35		125	+0.06"	497	174	(4)
EF-14 Total	12x10	0.60		125	Anomometer	227	136	
EF-15 Total	12x10	0.60		125	Anomometer	203	122	

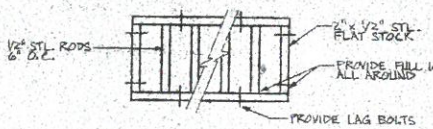
REMARKS

(1) Fan is on its lowest speed.

(2) Fan is on its highest speed but well below design. Fan should be replaced.

(3) There is no access to this fan or duct work.

(4) Fan makes loud noise when speed control is turned down.



COAL BIN SECURITY GRILLE DETAIL

NO SCALE

NOTES:

1. LOWER LEVEL SYSTEMS FOR CONFERENCE ROOMS TO BE BALANCED FOR CFM QUANTITIES INDICATED WITH NO VENTILATION AIR. FINAL AIR SYSTEM WITH OUTSIDE AIR SUPPLIED WITH TOILETS TO PROVIDE NECESSARY EXHAUST CFM. ADJUST RETURN, EXHAUST & OUTSIDE AIR DUCTWORK PROPORTION EACH ROOM RETURN FLOW ACCORDINGLY.

NOTE:

ALL PIPING RUNOUTS & STUB-UPS TO BE 3/4" UNLESS NOTED OTHERWISE

REVISIONS		
NO.	DESCRIPTION	DATE

PROJECT NO. 384-4 — RENOVATION & REUSE OF THE THIRD BRISTOL CONTRACT NO. 1 — DIVISION COURTHOUSE, NEW BEDFORD MASS.

THE COMMONWEALTH OF MASSACHUSETTS
DIVISION OF CAPITAL PLANNING AND OPERATIONS

HOFFER FINEGOLD & ALEXANDER INC. — ARCHITECTS
BOSTON BUILDING CONSULTANTS — STRUCTURAL ENGINEERS
THOMPSON CONSULTANTS INC. — MECHANICAL & ELECTRICAL

LOWER LEVEL HVAC PLAN PHASE 1

DRAWN LNM
TRACED
CHECKED JKP

SCALE: 1/4" = 1'-0"
DATE:

SHEET NO. M-5

108-110 HVAC

THE COMMONWEALTH OF MASSACHUSETTS
DIVISION OF CAPITAL PLANNING AND OPERATIONS

PROJECT: J04-6 RENOVATION & REUSE OF THE THIRD ARTICLE
CONTRACT: NO. 1 DIVISION COURTHOUSE, NEW ASHFORD AREA

ARCHITECT: BOSTON PREVOLOS & LIVERMORE INC.
CONSULTANTS: THORNDIKE CONSULTANTS INC. STRUCTURAL ENGINEERS
MECHANICAL & ELECTRICAL

NO.	DESCRIPTION	DATE
REVISIONS		

MAIN LEVEL HVAC PLAN
PHASE 1
DRAWN: LMM SCALE: 1/4"=1'-0" DATE:
CHECKED: JCD

M-4

SHEET NO

now a registrar's area with reception