Gardner District Court
Gardner, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

April 21, 2022

Tighe&Bond

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Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Gardner District Courthouse on April 22, 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. Tighe and Bond was provided with mechanical design plans from 1975. Our analysis is based on these drawings and our one day on site.

Site Visit Attendees:

- *Office of Court Management:*
  - Randen Davis, Facilities Systems Supervisor
- *Tighe & Bond*
  - Sean Pringle, PE, Project Mechanical Engineer
  - Matt Mancini, Staff Mechanical Engineer

1.1 Existing Ventilation System

The Gardner District Courthouse was constructed in 1975 and is approximately 17,000 square feet in size. Five constant volume air handlers, and sixteen packaged terminal air conditioning units provide ventilation air to the building. The entire building is electrically heated and cooled.

Air handling units (AHU) 1-4 appear to be original and are generally in poor condition. Each unit contains a supply fan, refrigerant (DX) cooling coils and an associated rooftop condenser, one or more downstream electric duct heaters (EDH), and 1" filters. AHU-1 and AHU-2 have pleated MERV 8 filters; AHU-3 and AHU-4 have mesh filters, which typically have a MERV rating of 7 or less. AHU's 1, 3, and 4 have an associated exhaust fan on the roof. Exhaust, intake and return air dampers are located in the ductwork for each unit. Generally, the electronic damper actuators appear to be in fair condition. Due to most of the dampers being located in the ductwork, we were unable to observe the condition of most dampers and their positions. According to staff, the air handlers only operate when there is a call for heating or cooling. The AHU-1 outdoor air ductwork was extremely dirty, and the outdoor air damper was barely open during operation. AHU-4 was missing the filter access cover, which was causing unfiltered air to bypass the air filter; and due to the ceiling location and nearby obstructions, the filters were extremely difficult to access. According to staff, the filters are often damaged during installation and removal.

AHU-5 appears to be original and is generally in poor condition. This unit provides makeup air to the cells. The unit contains a supply fan, as well as a preheat and downstream EDH, and 1" MERV 8 filters. An outdoor air damper with an electronic actuator is located in the outdoor air ductwork. At the time of the visit, this unit was shut off. According to staff, the unit tends to overheat the space and they often leave it off as a result. We found the preheat EDH was set to control the duct temperature to 80°F, which was likely the cause of the overheating. Air is exhausted from the cells via exhaust fan EF-3. According to the drawings, the supply and exhaust airflows in each cell are equal.

The packaged terminal air conditioning (PTAC) units generally serve the perimeter rooms on the first floor and the probation area on the ground floor. Each PTAC unit contains steel mesh filters, a fixed position outdoor air damper, electric resistance coils, and DX cooling coils with a through wall condensing unit as part of the assembly. According to staff, most of these units are original and some have been replaced over time. At the time of the visit, one of the two PTAC units serving the small courtroom was not operational.

According to the drawings provided to Tighe & Bond, there are 21 exhaust fans serving the building. Eleven fans serve the restrooms and one fan serves the lockup area. Each toilet exhaust fan is controlled by a light switch in the associated toilet room. All toilet exhaust fans appeared to be working at the time of our visit. The lockup exhaust fan EF-3 was not initially operating at the time of the visit, as it is interlocked with AHU-5, and this unit was shut off. When AHU-5 was turned on, exhaust airflow was observed in the cells.

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

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Filters	Condition
AHU-1	2,000	500	1" MERV 8	Poor
AHU-2	1,400	400	1" MERV 8	Poor
AHU-3	1,200	300	1" Mesh Filter	Poor
AHU-4	1,200	300	1" Mesh Filter	Poor
AHU-5	600	600	1" MERV 8	Poor
PTAC Types A, E, & F	320	Unknown	Steel Filter	Fair to Poor
PTAC Types B & C	380	Unknown	Steel Filter	Fair to Poor
PTAC Type D	Unknown	Unknown	Steel Filter	Fair to Poor

Note that the 1975 drawings did not identify the outdoor airflows for any of the PTAC units. In addition, the "Type D" units do not identify the supply or outdoor airflow. We were unable to locate any literature for the original units manufactured by Singer. Based on available literature for similar modern products from McQuay (Type K), it appears that the outdoor airflow is generally 25% of the supply airflow at the "high" setting. The actual airflows should be confirmed during testing and balancing.

Photo 1 – Representative Air Handler

Photo 2 – Representative PTAC unit

During our tour of the facility, we noted that room 109, which is identified as a Judge's Chamber on the plans, is currently used as a conference room. We also noted that room 101, which is identified as an employee lounge room on the plans, has been converted into a private office. The lounge is instead located in room 115, a room identified as an office on the plans. While these would changes require higher outdoor airflows, it appears

that the existing outdoor airflow provided by the PTAC units serving these areas is adequate.

In the middle of the ground floor, there is an area currently used as a break room. This break room and the nearby facilities office did not appear to have any source of ventilation.

On the first floor, there are two conference rooms, 106 and 107, that do not receive any supply air ventilation. The exhaust fan EF-6 serves these rooms and appears to operate whenever AHU-2, which serves the lobby, is operating. The use of transfer air from one space to another to meet ventilation requirements is not permitted by current codes.

1.2 Existing Control System

The existing HVAC air handlers use local electrical controls that appear to be mostly original. We did not see any evidence or components of a Building Management System (BMS) during our site visit. AHU's 1-4 appear to have economizer controls, but it is unclear if they are still functional. The PTAC units use local temperature controls. There are no demand control ventilation sequences in use at this courthouse.

Section 2
Recommendations

Below is a list of recommendations for the Gardner District Courthouse. Please refer to the "Overview of Recommendations" report for further explanation and requirements of the stated recommendations.

As noted above, there are several areas without any ventilation. Building areas without adequate ventilation and filtration significantly increase the risk of spreading viruses like Coronavirus (SARS-CoV-2), 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.*

This measure applies to the AHU's only. The TAB Contractor and/or Engineer shall verify that the existing air handlers can accommodate a 1" MERV-13 filter per Appendix A in the overview of recommendations report. Filter racks should be inspected and adjusted to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass.

It may be possible to improve the limited filtration in the PTAC units with the use of MERV 8 to MERV 11 pleated filters. However, because these units are designed to operate at a very low static pressure, this would likely negatively affect the supply and outdoor airflow. We recommend using a filter with the highest possible MERV rating while maintaining the design airflow. Because of the lack of documentation, the maximum allowable MERV rating would have to be determined by a TAB contractor.

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

This measure applies to the AHU's only.

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

Maximum differential pressure should be set per manufacturer's recommendation based on air velocity to ensure filters are within their service lives. Typically, this is not more than 1.0" w.g.

2.2 Testing & Balancing Recommendations

The air handling units are approximately 45 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 outdoor 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 outdoor 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)
AHU-1	2,000	500	750	**750**
AHU-2	1,400	400	140	**400**
AHU-3	1,200	300	80	**300**
AHU-4	1,200	300	70	**300**
AHU-5	600	600	155	**600**
PTAC Types A, E, & F	320	Unknown	Varies	**80**
PTAC Types B & C	380	Unknown	Varies	**95**
PTAC Type D	Unknown (600 est.)	Unknown	150	**150**

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.

Our ventilation air analysis discovered AHU-1, which serves the courtroom, is not providing the correct quantity of outdoor air based on today's code requirements. However, it appears the cooling and heating 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. Space temperatures during the heating and cooling season should be monitored to ensure they are being adequately maintained. If space temperatures are not being maintained, the outdoor airflow rate should be reduced, but not below the originally designed outdoor air flow rates.

For the "Type D" PTAC units, we have estimated a supply airflow of 600 CFM based on a cooling capacity of 350 CFM per ton, which is consistent with the other

scheduled selections. Based on this estimated capacity, these units can likely support an outdoor airflow of approximately 150 cfm, or 25% of supply airflow. will likely be attainable with this equipment. The actual supply and outdoor airflows should be verified during testing and balancing.

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.

TABLE 3
Average Airflow Rate per Person

	All spaces	***Courtrooms***	***Non-Courtroom Spaces***
Total Occupancy (People)	171	121	49
Total Supply Air (CFM/Person)	79	26	207
Outdoor Air (CFM/Person)	24	9	62

Note: Courtroom 2 ventilation rates are estimated, based on the Table 2 values above

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 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)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Main Courtroom C115	102	2,000	20	750	7
Small Courtroom 110	50	Unknown	Unknown	Unknown	Unknown

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)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***

Main Courtroom C115	20	2,000	100	750	38
Small Courtroom 110	8	Unknown	Unknown	Unknown	Unknown

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

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

If the airflow to each space has not been recently tested, we recommend testing the airflow rates in the holding cells, Police Room, Courtrooms, and other densely occupied areas as a minimum. These systems are very old, and the airflow rate delivered to and returned from these spaces may not match the original design intent.

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.

RTB-6: *Test DX cooling coils and condensers.*

Confirm that each AHU's and PTAC's refrigerant system is operating correctly to ensure the DX coil is receiving full refrigerant flow.

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 the dampers are located in the ductwork surrounding the AHU's, we were not able to observe the dampers during the site visits, and it was unclear if the dampers were still operational. Consider adding access panels near dampers to allow operation to be quickly checked.

RE-2: *Clean air handler DX cooling coils, electric heating coils, and drain pans.*

2.4 Control System Recommendations

We recommend the following for the control system:

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

This can likely be implemented with the existing timeclocks controlling the AHU's.

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. Refer to the "Overview of Recommendations" document for further guidance on installing portable HEPA filters.

Due to the lack of ventilation in the ground floor break room, maintenance office, and first floor conference rooms, we recommend the use of portable HEPA filters or similar air purification approaches if these areas are to be occupied in the near term, until adequate ventilation is added to these areas.

Areas without ventilation:

- Ground Floor Break Room
- Maintenance Office
- Conference Room C106
- Conference Room C107

Additionally, because of the limited filtration capability of the PTAC units, we also recommend additional air filtration in multi-occupant spaces served by these units. While all spaces benefit from additional air filtration, this measure is likely not necessary for single occupant offices.

Areas with limited filtration:

- Probation General Office G20
- Clerk's General office 114
- Employee Lounge 115
- Conference Room C107
- Library 107
- Small Courtroom 110

2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of adding active humidification is determined by the building envelope. Buildings that were not designed to operate with active humidification can potentially be damaged due to a lack of a vapor barrier, adequate insulation, and air tightness.

Duct mounted humidifiers must be engineered, integrated into the building control system, tested, and commissioned. They are available in many configurations but require substantial maintenance and additional controls. They also run the risk of adversely affecting IAQ from growing microorganisms, or leaking water through poorly sealed ductwork damaging insulation and ceilings. Portable humidifiers are easier to install and require less maintenance, but still have the potential to damage the building envelope.

While active humidification is not recommended as a whole building solution due to high installation costs, operational costs, potential to damage the building envelope and adversely affect poor IAQ, it may be warranted as a temporary solution in some areas.

2.7 Other Recommendations

Consider implementing measures 2.7.5 through 2.7.7 as a single project. This approach would likely reduce overall cost and provide more coherent systems.

2.7.1 Run Supply Fans Continuously During Occupied Hours

All AHU's and PTAC units were set to run the fan in "auto" mode, which runs the supply fan only when the unit is actively heating or cooling. When the units are off, no ventilation air is being provided. This should be changed on each of the systems to run the supply fans continuously during occupied periods to supply ventilation air to the spaces. Note that this may cause comfort issues because the supply air temperature will often fluctuate as the heating and cooling is staged on and off, and the systems may not have been originally designed to operate in this manner.

As noted in Section 1, the lockup supply air fans were left off because the AHU supplies hot air to the space. We recommend checking and adjusting the preheat electric duct heater controls to supply no more than 65°F to the space and also confirming that the thermostat controlling the downstream duct heater is working properly.

2.7.2 Repair PTAC units

Repair PTAC units that are not operational. Once repairs are made, revise the control sequence to allow the fans to operate continuously during occupied periods.

2.7.3 Add Ventilation to All Occupied Areas

Several interior spaces did not have operable windows or any direct supply air ventilation. Consider adding supply air ventilation to the ground floor occupied areas and first floor conference rooms.

2.7.4 Replace the Filter Cover on AHU-4 and Change Filter Stock

AHU-4 was missing the filter cover. Additionally, we observed that the filters are almost impossible to remove and reinstall due to proximity to the wall and nearby utilities. The door should be replaced. Consider using multiple, smaller filters to allow the filters to checked and installed without risk of damage (e.g.: two 12x24 filters instead of a single 24x24 filter).

2.7.5 Replace Air Handling Units & Electric Duct Heaters

Indoor air handling units of the type used in the Gardner Courthouse have a life expectancy of 25-35 years. The air handlers are approximately 45 years old and are in poor condition. Additionally, these systems rely on R-22 refrigerant, which is being phased out. Consider replacing these units in the next five years. When selecting replacement units, consider the use of a split air source heat pump system to provide heating and cooling with the refrigerant coil, with the electric duct heaters as a second stage of heating to reduce energy consumption.

This recommendation is an energy saving and reliability measure and does not increase the indoor air quality of the building.

2.7.6 Replace all PTAC Units.

PTAC units of the type used in the Gardner Courthouse have a life expectancy of 25-35 years. The units are approximately 45 years old and are in poor condition. Additionally,

these systems rely on R-22 refrigerant, which is being phased out. Consider replacing any original units in the next five years. When selecting replacement units, consider the use of heat pump systems to provide heating and cooling with the refrigerant coil, with supplementary resistance heating for very cold days. Replacement units should also include automatic outdoor air dampers, rather than fixed outdoor air openings.

This recommendation is an energy saving and reliability measure and does not increase the indoor air quality of the building.

2.7.7 Update Controls and Install a Building Management System

We recommend replacing the pneumatic control system with electronic actuators and sensors and installing a building management system to control and monitor all HVAC equipment, including space temperatures, duct heater controls, AHU controls, and PTAC 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, and 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. A BMS allows settings to be quickly changed and improves visibility into how the system is operating. Parameters like filter status and outdoor air damper position can be easily viewed and system alarms can be generated to prompt corrective actions.

Disclaimer

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

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Section 3
Testing & Balancing Results

Wing's Testing & Balancing Co. visited the Gardner District Courthouse on February 8th through February 11th, 2022 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 Airflow Testing & Balancing Results

	Design			Actual		
Unit	**Supply Fan Airflow (CFM)**	**Recommended Outdoor Airflow (CFM)**	**Return Airflow (CFM)**	**Supply Fan Airflow (CFM)**	**Outdoor Airflow (CFM)**	**Return Airflow (CFM)**
AHU-1	2000	500	1500	1867	503	1364
AHU-2	1400	400	1000	950	0	950
AHU-3	1200	300	900	786	189	597
AHU-4	1200	300	900	701	0	701
AHU-5	600	600	0	746	746	0
PTAC-63 (Courtroom B)	600	150	450	698	36	662
PTAC-64 (Courtroom B)	600	150	450	0	0	0
PTAC-38 (Probation)	600	150	450	731	0	731
PTAC (Judge's Office)	320	80	240	184	0	184
PTAC (Judge's Lobby)	320	80	240	221	0	221
PTAC-70 (DA's Office)	380	95	285	439	0	439
PTAC-58 (Break Room)	320	80	240	399	0	950
PTAC-56 (Clerk's Office)	380	95	285	380	0	380

TABLE 6
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Airflow (CFM)	Actual Airflow (CFM)
EF-1	Main Courtroom (AHU-1 Relief)	500	511
EF-2	Lockup / Lobby (AHU-3 Relief)	250	240
EF-3	Cells	600	748
EF-4	Probate (AHU-4 Relief)	600	603
EF-5	Public Toilets	650	676
EF-6	Conference Rooms 106 & 107	300	305
EF-7	Courtroom B	400	384
EF's 8-17	Single Restrooms	90-100	Not Tested
EF-18	Mechanical Room	200	Not Tested
EF-19	Electric Room	200	Not Tested
EF-20	Employee Lounge	200	0
EF-21	Clerk's Office	200	Eliminated

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

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

AHU's

1. Only AHU-1 is providing acceptable supply airflow.
2. The airflows for AHU's 2, 3, and 4 are below the acceptable airflow range. The existing filters are 1" deep, MERV 10 pleated filters. These pleated filters offer higher levels of air filtration than plastic mesh filters but are often limited to a 300 FPM face velocity. The existing filter rack sizes and locations appear to only be suitable for "high velocity" mesh type filters that are rated for a 600 FPM face velocity. As a result, the current configuration is likely causing the measured reduction in total supply airflow due to increased pressure drop across the air filters.
    a. If space allows, we recommend installing larger filter racks for 2" deep pleated MERV 13 filters in the upstream ductwork, preferably at a diagonal

within the duct to allow for a greater filter area. The use of 2" deep filters will permit a slightly higher face velocity (450-500 FPM) and reduce the pressure drop across the filter and allow greater air flow through the equipment.

b. We also recommend cleaning the cooling coils and any dirty supply and return air openings that may be affecting airflow.

c. Once the filters have been modified, the units should be tested and balanced to the design airflows

3. The fan for AHU-5 is running at low speed but the supply airflow rate is well above the design value.

    a. Consider adding a balancing damper downstream of the fan to balance the airflow to the design value.

4. The outdoor air damper actuators for AHU-2 and AHU-4 are not operational and as a result these units are not receiving any outdoor air. The spaces these units serve are not receiving any ventilation air.

    a. We recommend repairing or replacing the outdoor air damper actuators and/or inoperable controls and rebalancing the units to the design outdoor airflows.

PTAC Units

1. The supply airflows for the PTAC units were inconsistent, but generally within 30% of the design airflow.
2. None of the tested PTAC units are receiving the design outdoor airflow value. Only one unit was receiving any outdoor air, which was well below the recommended airflow. The remainder were not receiving any outdoor air. The areas served by these units are not receiving any ventilation air, in violation of building codes.

    a. For PTAC-63, the balancer noted that they were unable to override the factory set minimum damper position.

    b. Most of the PTAC units are not providing any outdoor air because the units have been modified and they no longer have an opening to draw outdoor air into the building.

    c. We recommend unblocking the outdoor air openings where possible or replacing the units with new PTACs in order to provide outdoor air.

3. PTAC-64 is no longer functional and should either be repaired or replaced with a new unit.

Exhaust Fans

1. EF-3 is not performing within acceptable range, it is exhausting more air than the design calls for. The balancing contractor noted that the motor sheave for this fan is seized and therefore cannot be adjusted.
    a. We recommend replacing the sheave so that the fan can be properly balanced.
2. The balancing contractor noted that EF-20 is not functional.
    a. We recommend replacing this fan.
3. EF-21 has been eliminated and no longer exists.

WING'S TESTING & BALANCING CO., INC.

Gardner District Court
HVAC / Fresh Air Ventilation Survey

* * * *

Tighe & Bond
Attn: Jason Urso
53 Southampton Road
Westfield, MA 01085

February 11th, 2022

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WING'S TESTING & BALANCING CO., INC.

February 11th, 2022

Tighe & Bond
Attn: Jason Urso
53 Southampton Road
Westfield, MA 01085

Re: Gardner District Court / HVAC Fresh Air Ventilation Survey

Dear Jason,

Wing's has completed the HVAC Fresh Air Ventilation Survey for the above referenced location. The results are as follows:

Initial observations:

- Cooling was DX and heating is electric reheats.

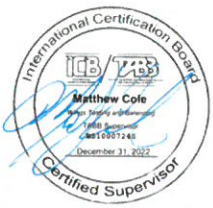
Testing observations:

- The outside air actuator for AHU-2 is not functional. This unit is wired to high speed but still below design.
- AHU-3 is wired to high speed but still below design.
- The outside air actuator for AHU-4 is not functional and is currently dismantled above the ceiling.
- AHU-5 is over design but wired to low speed.
- The PTAC units have a minimum manufacturer's O.A. set point that is part of the packaged controls. It is not adjustable and only opens further to economize.
- Many of the PTACs have had their insides replaced and no longer have an opening to drawn O.A.
- The design for EF-4 is 600 CFM and not the 300 CFM listed. It serves 6 rooms in Probation all designed for 100 CFM each.
- The motor sheave for EF-3 is seized and cannot be adjusted.
- EF-20 is not functional and needs to be replaced.
- EF-21 has been eliminated and no longer exists.

The following pages are your record of the tested conditions. If you have any questions or if we can be of further assistance, 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
CT SM-2 License 6386
MA SM-2 13595

SUPPLY FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/8/22

AREA SERVED: AHU-1, AHU-2, AHU-3 **TECH:** BS

FAN DATA						
FAN NUMBER	AHU-1		AHU-2		AHU-3	
LOCATION	Mechanical Room		2nd Floor Men's Rm		Mechanical Room	
AREA SERVED	Main Courtroom		Lobby		Lobby	
MANUFACTURER	YORK		YORK		YORK	
MODEL OR SIZE	MCBG0-6A		AHP42C3		MCB36-6A	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2000	1867	1400	950	1200	786 (1)
RETURN AIR	1500	1364	1000	950	900	597
OUTSIDE AIR	500	503	400	0 (2)	300	189
DISCH. STATIC	---	+0.55''	---	+0.32''	---	+0.23''
SUCTION STATIC	---	-0.51''	---	-0.61''	---	-0.49''
TOTAL STATIC	1.0	1.06''	N/A	0.93''	0.50	0.72"
FAN RPM	DD	DD	DD	DD	DD	DD
PULLEY O.D.	DD		DD		DD	
ESP	---		---		---	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	30%		(2)		40%	
MOTOR DATA						
MANUFACTURER	NA		NA		NA	
MODEL OR FR.	NA		48Y		NA	
HORSEPOWER	1/4	1/4	3/4	3/4	1/3	1/3
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	7.0	4.2	3.8	3.6	3.5	1.6
AMPS LEG 2	---	---	---	---	---	---
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 high speed.

(2) O.A. actuator is not functional.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

SUPPLY FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/9/22

AREA SERVED: AHU-4 and AHU-5 **TECH:** BS

FAN DATA						
FAN NUMBER	AHU-4		AHU-5			
LOCATION	Probate		Mechanical Room			
AREA SERVED	Probate		Lock-Up			
MANUFACTURER	YORK		YORK			
MODEL OR SIZE	MCB36-6A		MCB18-1A			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	1200	701	600	746		
RETURN AIR	900	701	0	0		
OUTSIDE AIR	300	(1)	600	746		
DISCH. STATIC	---	+0.20''	---	+0.24"	---	
SUCTION STATIC	---	-0.65''	---	-0.26"	---	
TOTAL STATIC	NA	0.85''	0.40	0.5"		
FAN RPM	DD	DD	DD	DD		
PULLEY O.D.	DD		DD			
ESP	---		---			
VFD SPEED	No VFD		No VFD			
O.A.D.MIN POS	(1)		100%			
MOTOR DATA						
MANUFACTURER	NA		NA			
MODEL OR FR.	NA		NA			
HORSEPOWER	1/3	1/3	1/4	1/4		
MOTOR RPM	1075	1075	1075	1075		
VOLTAGE / PH.	208/1	208/1	208/1	208/1		
AMPS LEG 1	3.5	4.2	NA	4.7		
AMPS LEG 2	---	---	---	---	---	---
AMPS LEG 3	---	---	---	---	---	---
SHEAVE O.D.	DD		DD			
BELTS - QUANTITY / SIZE	DD		DD			
SHEAVE POSITION	DD		DD			
SPEED	High		Low			

REMARKS

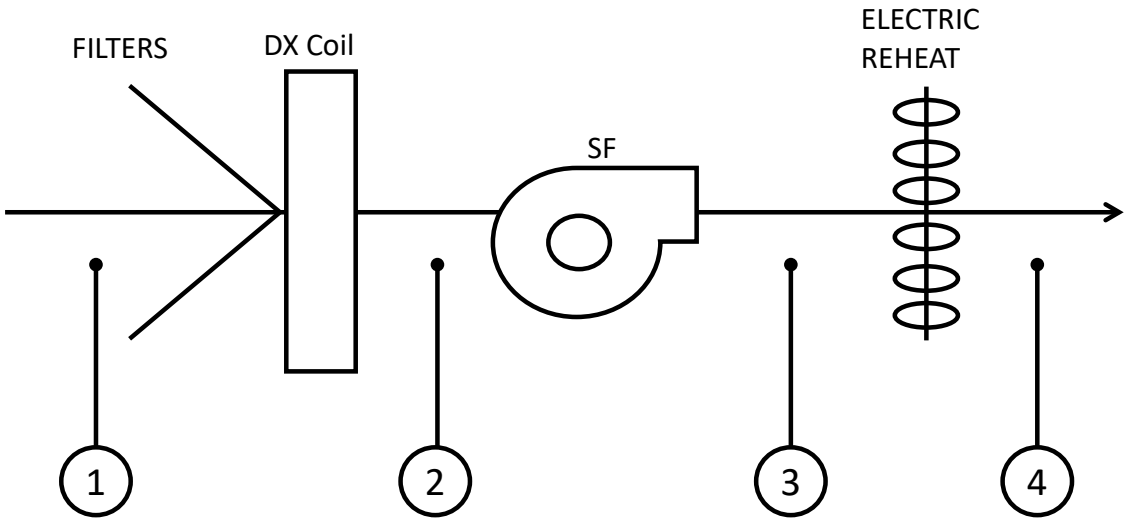
(1) Outside air actuator is not functional and is currently dismantled above the ceiling.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Gardner District Court **DATE:** 2/10/22

SYSTEM/AREA: AHUs 1-4 **TECH:** BS



STATIC PRESSURE	1	2	3	4	5	6	7	8	NOTES
AHU-1	-0.20''	-0.51''	+0.55''	+0.51''					
AHU-2	-0.50''	-0.61''	+0.32''	+0.28''					
AHU-3	-0.35''	-0.49''	+0.23''	+0.18''					
AHU-4	-0.57''	-0.65''	+0.20''	+0.16''					

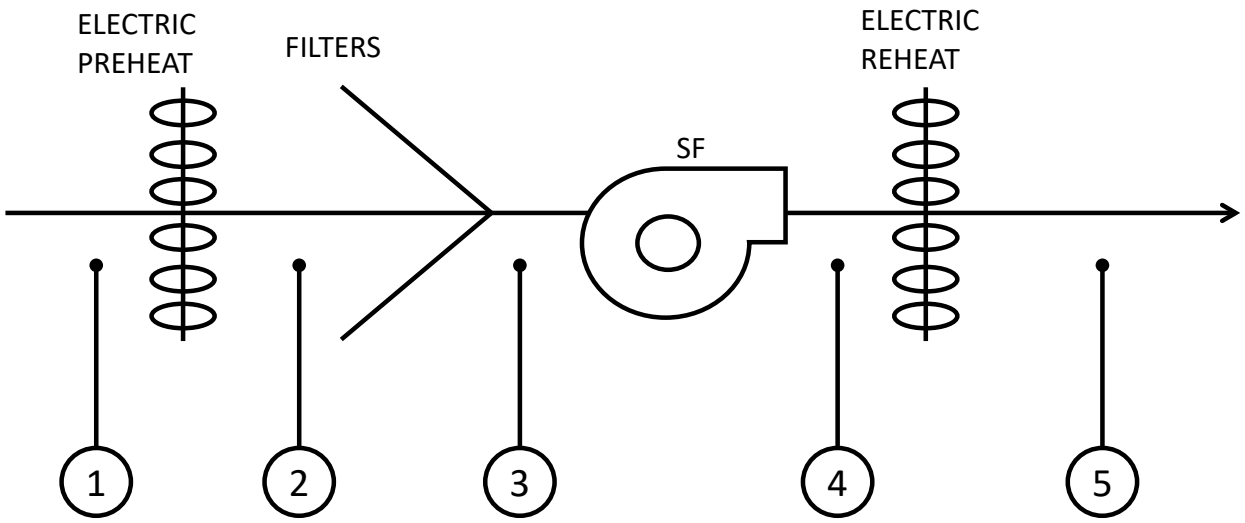
REMARKS

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Gardner District Court **DATE:** 2/11/22

SYSTEM/AREA: AHU-5 **TECH:** BS



STATIC PRESSURE	1	2	3	4	5	6	7	8	NOTES
AHU-5	-0.08''	-0.12''	-0.26''	+0.24''	+0.22''				

REMARKS

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

VELOCITY PRESSURE READINGS

PROJECT: Gardner District Court **DATE:** 2/11/22

AREA SERVED: AHUs 1-5 **TECH:** BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN FPM	DESIGN CFM	CENT. STAT. PRESS.''	TEST FPM	TEST CFM	NOTES
AHU-1 Total	20'' x 20''	2.77	---	2000	+0.55''	672	1867	
AHU-1 O.A.	20'' x 17''	1.67	---	500	-0.20''	301	503	
AHU-1 Return				1500	Calculated		1364	
AHU-2 Total	18'' x 36''	4.5	---	1400	w/ Velgrid	211	950	
AHU-3 Total	10'' x 12''	1.33	---	1200	950	591	786	
AHU-3 O.A.	12'' x 12''	1.0	---	300	-0.01''	189	189	
AHU-3 Return				900	Calculated		597	
AHU-4	12'' x 12''	1.0	---	1200	+0.16''	701	701	
AHU-5	12'' x 12''	1.0	---	600	+0.08''	746	746	

REMARKS

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

SUPPLY FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/16/22

AREA SERVED: PTAC 63-64 **TECH:** BS

FAN DATA						
FAN NUMBER	PTAC-63		PTAC-64			
LOCATION	Courtroom B		Courtroom B			
AREA SERVED	Courtroom B		Courtroom B			
MANUFACTURER	Singer		Singer			
MODEL OR SIZE	D		D			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	600	698	600	(1)		
RETURN AIR	450	662	450	(1)		
OUTSIDE AIR	150	36 (2)	150	(1)		
DISCH. STATIC	---	+0.09''	---	(1)	---	
SUCTION STATIC	---	-0.07''	---	(1)	---	
TOTAL STATIC	---	0.16''	NA	(1)		
FAN RPM	DD	DD	DD	DD		
PULLEY O.D.	DD		DD			
ESP	---		---			
VFD SPEED	No VFD		No VFD			
O.A.D.MIN POS	---		---			
MOTOR DATA						
MANUFACTURER	NA		NA			
MODEL OR FR.	NA		NA			
HORSEPOWER	1/3	1/3	1/3	1/3		
MOTOR RPM	1075	1075	1075	1075		
VOLTAGE / PH.	208/1	208/1	208/1	208/1		
AMPS LEG 1	2.2	4.2	2.2	(1)		
AMPS LEG 2	---	---	---	---	---	
AMPS LEG 3	---	---	---	---	---	---
SHEAVE O.D.	DD		DD			
BELTS - QUANTITY / SIZE	DD		DD			
SHEAVE POSITION	DD		DD			
SPEED	Low		---			

REMARKS

(1) Unit is not functional.

(2) Unit has a packaged controls sequence that opens O.A. to a minimum and then only opens further to economize. Not able to set minimum O.A.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

SUPPLY FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/10/22

AREA SERVED: PTACs **TECH:** BS

FAN DATA						
FAN NUMBER	PTAC-38		PTAC		PTAC	
LOCATION	Probate		Judge's Office		Judge's Lobby	
AREA SERVED	Probate		Judge's Office		Judge's Lobby	
MANUFACTURER	Singer		Singer		Singer	
MODEL OR SIZE	D		F		E	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	600	731 (1)	320	184	320	221
RETURN AIR	450	731	240	184	240	221
OUTSIDE AIR	150	0	80	0 (2)	80	0 (2)
DISCH. STATIC	---	+0.07''	---	+0.04''	---	+0.04''
SUCTION STATIC	---	-0.05''	---	-0.03''	---	-0.03''
TOTAL STATIC	---	0.12''	---	0.07''	---	0.07''
FAN RPM	DD	DD	DD	DD	DD	DD
PULLEY O.D.	DD		DD		DD	
ESP	---		---		---	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	10% ?		No O.A.		No O.A.	
MOTOR DATA						
MANUFACTURER	NA		NA		NA	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	NA	NA	NA	NA	NA	NA
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	1.6	4.2	0.5	0.4	0.5	0.4
AMPS LEG 2	---	---	---	---	---	---
AMPS LEG 3	---	---	---	---	---	---
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	

REMARKS

(1) One of the two motor relays is blown. Only one of the two blowers runs.

(2) There is no O.A. ducted to this unit.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

SUPPLY FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/11/22

AREA SERVED: PTACs **TECH:** BS

FAN DATA						
FAN NUMBER	PTAC-70		PTAC-58		PTAC-56	
LOCATION	DA's Office		Break Room		Clerk's Office	
AREA SERVED	DA's Office		Break Room		Clerk's Office	
MANUFACTURER	Singer		Singer		Singer	
MODEL OR SIZE	C		A		B	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	380	439	320	399	380	380
RETURN AIR	285	439	240	950	285	380
OUTSIDE AIR	95	0 (1)	80	0 (1)	95	0 (1)
DISCH. STATIC	---	+0.08''	---	+0.08''	---	+0.07''
SUCTION STATIC	---	-0.04''	---	-0.08''	---	-0.05''
TOTAL STATIC	---	0.12''		0.16"		0.12''
FAN RPM	DD	DD	DD	DD	DD	DD
PULLEY O.D.	DD		DD		DD	
ESP	---		---		---	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	No O.A.		No O.A.		No O.A.	
MOTOR DATA						
MANUFACTURER	NA		NA		NA	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	NA	NA	NA	NA	NA	NA
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	NA	4.2	NA	0.5	NA	0.5
AMPS LEG 2	---	---	---	---	---	---
AMPS LEG 3	---	---	---	---	---	---
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	

REMARKS

(1) This unit does not have O.A. ducted to it.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

EXHAUST FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/10/22

AREA SERVED: EFs 1-3 **TECH:** BS

FAN DATA				
FAN NUMBER		EF-1	EF-2	EF-3
LOCATION		Roof	Roof	Roof
AREA SERVED		Main Court Room	Court Office	Cell Break
MANUFACTURER		CentriMaster	CentriMaster	CentriMaster
MODEL OR SIZE		NA	NA	NA
TOTAL CFM	**DESIGN**	500	250	600
	ACTUAL	511	240	748
FAN RPM	**DESIGN**	---	---	---
	ACTUAL	1033	DD	1440
PULLEY	**O.D.**	4.5'' x 3/8	DD	3.0 x 5/8
SERVICE		1.35	---	1.35
MOTOR DATA				
MANUFACTURER		Century	AO Smith	Marathon
MODEL NUMBER		48	NA	48Y
MOTOR HP	**DESIGN**	1/6	1/12	1/6
	ACTUAL	1/4	1/15	1/4
MOTOR RPM		1725	1550	1725
VOLTAGE/PHASE		115/1	115/1	115/1
MOTOR AMPS	**DESIGN**	5.0	2.3	5.0
	ACT. LEG 1	4.4	1.6	4.7
	ACT. LEG 2	---	---	---
	ACT. LEG 3	---	---	---
SHEAVE		2.5'' x 1/2	DD	2.5'' x 1/2 (1)
BELTS - QUANTITY/SIZE		1/A18	DD	1/3L200
SHEAVE POSITION		Fully Closed	DD	Fully Closed
C to C		5.5	5.5	5.5

REMARKS

(1) Motor sheave seized and cant be adjusted.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

EXHAUST FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/10/22

AREA SERVED: EFs 4-6 **TECH:** BS

FAN DATA				
FAN NUMBER		EF-4	EF-5	EF-6
LOCATION		Roof	Roof	Roof
AREA SERVED		Probate	Toilets	Conference 106+107
MANUFACTURER		CentriMaster	Greenheck	CentriMaster
MODEL OR SIZE		NA	GB-081-4	NA
TOTAL CFM	**DESIGN**	300 (1)	650	300
	ACTUAL	603	676	305
FAN RPM	**DESIGN**	NL	NL	NL
	ACTUAL	DD	1449	DD
PULLEY	**O.D.**	DD	3'' x 1/2''	DD
SERVICE		---	1.0	---
MOTOR DATA				
MANUFACTURER		Century	Marathon	Century
MODEL NUMBER		NA	48	NA
MOTOR HP	**DESIGN**	1/10	1/6	1/20
	ACTUAL	1/15	1/4	1/15
MOTOR RPM		1550	1725	1550
VOLTAGE/PHASE		115/1	115/1	115/1
MOTOR AMPS	**DESIGN**	2.5	4.6	2.3
	ACT. LEG 1	2.5	---	1.8
	ACT. LEG 2	---	---	---
	ACT. LEG 3	---	---	---
SHEAVE		DD	3.5'' x 3/4''	DD
BELTS - QUANTITY/SIZE		DD	4/L220	DD
SHEAVE POSITION		DD	50% open	DD
C to C		---	5.5	---

REMARKS

(1) The design for this fan is 600 CFM and not the 300 CFM on the schedule. It served 6 rooms in probation, all for 100 CFM each.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

EXHAUST FAN REPORT

PROJECT: Gardner District Court **DATE:** 2/10/22

AREA SERVED: EFs **TECH:** BS

FAN DATA				
FAN NUMBER		EF-7	EF-20	EF-21
LOCATION		Roof	Ceiling	Ceiling
AREA SERVED		Courtroom B	Employee Lounge	Clerk's
MANUFACTURER		Dayton	(1)	(2)
MODEL OR SIZE		4YU94	(1)	(2)
TOTAL CFM	**DESIGN**	400	200 (1)	200 (2)
	ACTUAL	384	(1)	(2)
FAN RPM	**DESIGN**	---	(1)	(2)
	ACTUAL	1116	(1)	(2)
PULLEY	**O.D.**	4.0'' x 3/4''	(1)	(2)
SERVICE		1.35	(1)	(2)
MOTOR DATA				
MANUFACTURER		Dayton	(1)	(2)
MODEL NUMBER		48Y	(1)	(2)
MOTOR HP	**DESIGN**	1/6	1/10	1/10
	ACTUAL	1/4	(1)	(2)
MOTOR RPM		1725	(1)	(2)
VOLTAGE/PHASE		115/1	(1)	(2)
MOTOR AMPS	**DESIGN**	4.6	(1)	(2)
	ACT. LEG 1	4.0	(1)	(2)
	ACT. LEG 2	---	(1)	(2)
	ACT. LEG 3	---	(1)	(2)
SHEAVE		3.0'' x 1/2''	(1)	(2)
BELTS - QUANTITY/SIZE		1/3L200	(1)	(2)
SHEAVE POSITION		50% open	(1)	(2)
C to C		6.0	(1)	(2)

REMARKS

(1) Fan is not functional and needs replacing.

(2) Fan has been eliminated.

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement

AIR DEVICE REPORT

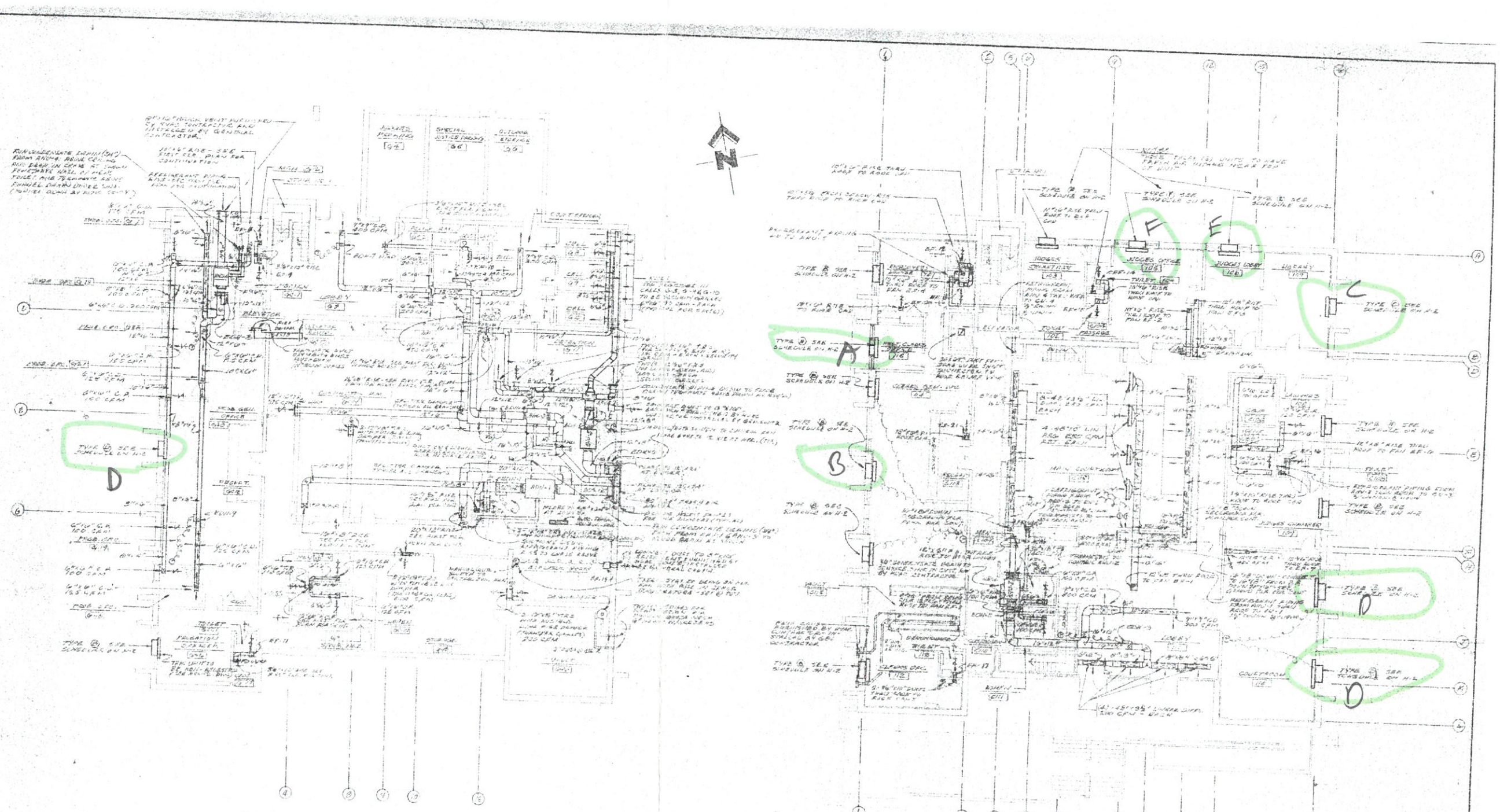
PROJECT: Gardner District Court **DATE:** 2/11/22

SYSTEM / AREA: EF 1-7 **TECH:** BS

LOCATION	NO.	SIZE	A K	DESIGN		TEST		FINAL		NOTES
				FPM	CFM	FPM	CFM	FPM	CFM	
EF-1										
Main Court	1	48'' x 5''	FH	---	250	---	119			
Main Court	2	48'' x 5''	FH	---	250	---	126			
Main Court	3	48'' x 5''	FH	---	250	---	179			
Main Court	4	48'' x 5''	FH	---	250	---	213			
					1000		637			
EF-3										
Cell 1	1	6'' x 6''	0.18	556	100	784	141			
Cell 2	2	12'' x 6''	0.36	556	200	618	222			
Cell 3	3	6'' x 6''	0.18	500	90	766	137			
Cell 4	4	6'' x 6''	0.18	500	90	742	134			
Cell 5	5	6'' x 6''	0.18	500	90	634	114			
					570		748			
EF-4										
P.O. Office	1	6'' x 6''	0.18	ND	ND	868	156			
G23	2	6'' x 6''	0.18	ND	ND	767	138			
G22	3	6'' x 6''	0.18	ND	ND	435	78			
G21	4	6'' x 6''	0.18	ND	ND	490	88			
G19	5	6'' x 6''	0.18	ND	ND	478	86			
G18	6	6'' x 6''	0.18	ND	ND	318	57			
					ND		603			
EF-5										
1F Men's Rm	1	6'' x 6''	0.18	556	100	609	110			
1F Women's Rm	2	6'' x 6''	0.18	556	100	684	123			
1F JC	3	6'' x 6''	0.18	556	100	815	147			
GF Men's Rm	4	6'' x 6''	0.18	694	125	486	87			
GF Women's Rm	5	6'' x 6''	0.18	694	125	532	96			
GF JC	6	6'' x 6''	0.18	556	100	629	113			
					650		676			
EF-6										
Conference 106	1	6'' x 6''	0.18	556	100	547	98			
Conference 107	2	6'' x 6''	0.18	556	100	551	99			
Lawyers 108	3	10'' x 6''	0.30	400	120	361	108			
					320		305			
EF-7										
Court B	1	12'' x 12''	FH	---	400	---	384			

REMARKS

NA Not Available | **ND** No Design | **DD** Direct Drive | **N/R** No Requirement



PROJECT CVIO-TS-2ND FIRST DISTRICT COURT
GARDNER, MASS. NORTHERN WORCESTER COUNTY

THE COMMONWEALTH OF MASSACHUSETTS
BUREAU OF BUILDING CONSTRUCTION

REVISIONS		
NO	DESCRIPTION	DATE

GROUND AND FIRST FLOOR PLANS — PLAN NO. HVAC-1

MASIELLO & ASSOC ARCHITECTS, INC.
WORCESTER, MASSACHUSETTS

DRAWN BAN
TRACED
CHECKED

SCALE 1/8" = 1'-0"
DATE MARCH 13, 1975