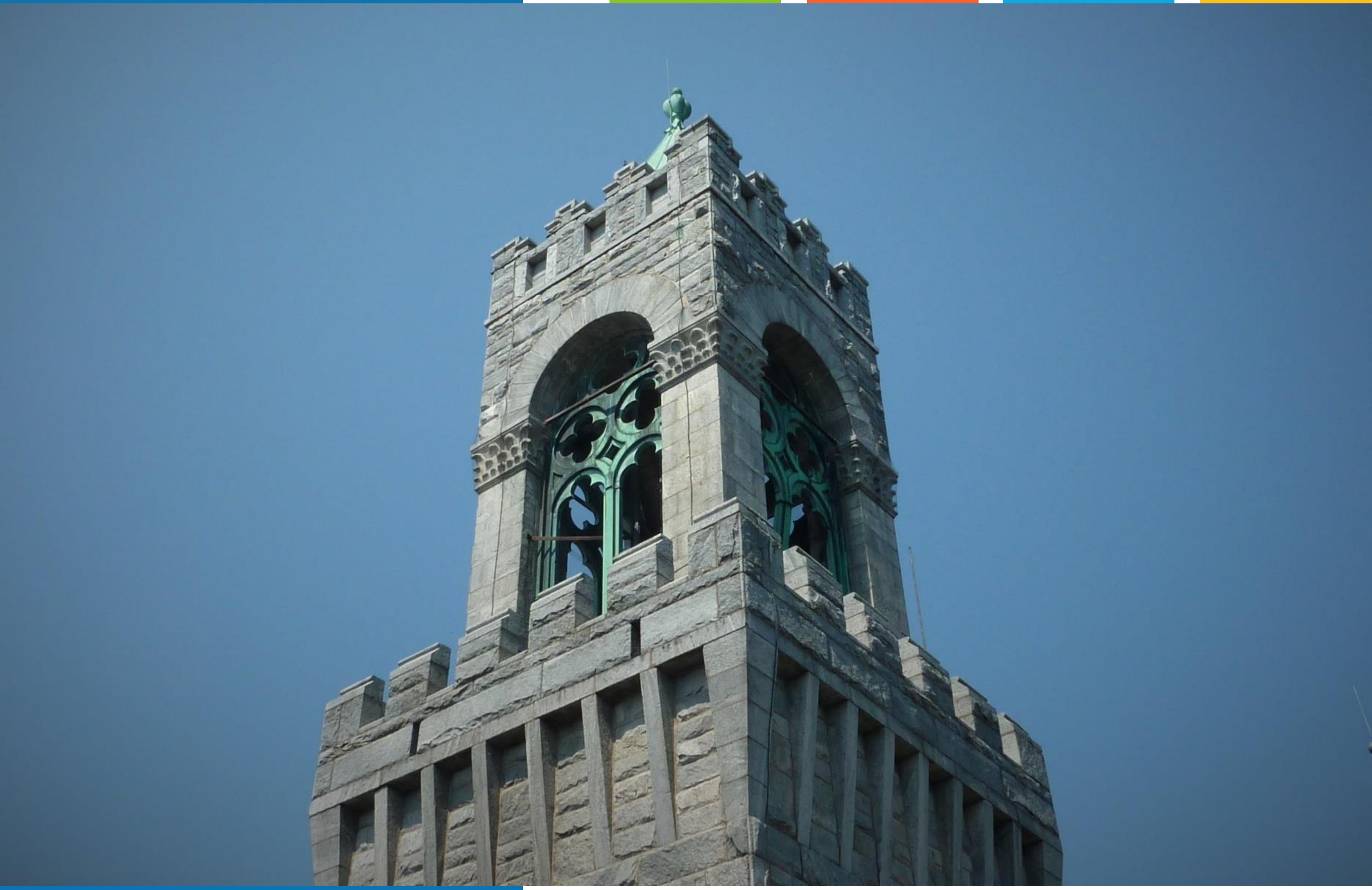

Springfield Juvenile and Family Court
Springfield, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

November 8, 2021

Tighe&Bond

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Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Springfield Housing and Juvenile Court on May 19, 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 and 2003. Our analysis is based on these drawings and our one day on site.

Site Visit Attendees:

- *Office of Court Management:*
  - Kurt Taylor, Facilities Supervisor
  - Josh Vermette, Facilities Staff
- *Tighe & Bond*
  - Todd Holland, PE, Senior Mechanical Engineer
  - Matt Mancini, Staff Mechanical Engineer

1.1 Existing Ventilation System

The Springfield Housing and Juvenile Court was constructed in 1871 and is on the National Register of Historic Places. It is approximately 48,000 square feet in size, and was renovated twice in recent history, projects that were completed in 1976 and 2005.

Fifteen water-source heat pump air handling units heat, cool, and ventilate the various spaces. These air handlers are constant volume, single zone units. The water loop is heated by four gas-fired Aerco hot water boilers in a basement mechanical room and cooled by a forced-draft closed-circuit cooling tower on the roof.

Each water-source heat pump air handler contains a supply fan, 1” or 2” thick MERV-13 filters, and a refrigerant system with an airside coil, reversing valve, waterside heat exchanger, and compressor.

Six of the air handlers are vertical style, located in two basement mechanical rooms, and draw in outdoor air through louvers and control dampers. The other nine air handlers are horizontal style, located in a very cramped attic space, and are supplied outdoor air from three packaged rooftop units.

Each rooftop unit provides 100% outdoor air with a supply fan, direct expansion (DX) refrigerant cooling coil, hot water heating coil, 2” MERV-13 filters, outdoor air intake hood, and condensing section.

According to facility staff, the air filters in the air handlers were changed to MERV-13 last August and changed again as part of a preventive maintenance (PM) program in April.

Perimeter rooms are also served by packaged water-source heat pump fan coils that are also on the water loop. The filters in the fan coils were changed to MERV-6 or MERV-7, facilities staff worked with the manufacturer to determine the highest filtration level the fan coil units could accommodate.

Photo 1 – Representative Heat Pump

All air handling units (Photo 1), rooftop units, and fan coils appear to be from the renovation in 2005 and are in fair condition. The outdoor air damper actuators are in good condition however, the outdoor air dampers are rusted (Photo 2). Facilities personnel report that the heating and cooling coils are cleaned twice a year for preventative maintenance (PM), and they appear to be in good condition.

Photo 2 – Representative Outdoor Air Damper

According to the drawings provided to Tighe & Bond, there are four exhaust fans serving toilet rooms, and the fans appear to be from the 1976 renovation. None of these exhaust fans were running at the time of our site visit. The only exhaust fan that we found to be operational was in the toilet room in the lockup area.

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)	Pre/Final Filters	Condition
HP-1	3,200	640	1" MERV-13	Fair
HP-2	2,400	480	1" MERV-13	Fair
HP-3	2,400	480	1" MERV-13	Fair
HP-4	1,720	345	1" MERV-13	Fair
HP-5	1,120	225	1" MERV-13	Fair
HP-6	2,115	425	1" MERV-13	Fair
HP-7	2,300	860	2" MERV-13	Fair
HP-8	2,320	880	2" MERV-13	Fair
HP-9	1,915	975	1" MERV-13	Fair
HP-9A	1,915	975	1" MERV-13	Fair
HP-10	2,300	1,050	2" MERV-13	Fair
HP-10A	2,300	1,050	2" MERV-13	Fair
HP-11	1,600	555	1" MERV-13	Fair
HP-12	2,480	1,200	2" MERV-13	Fair
HP-13	1,530	580	1" MERV-13	Fair
RTU-1	2,335	2,335	2" MERV-13	Fair
RTU-2	2,715	2,715	2" MERV-13	Fair
RTU-3	3,075	3,075	2" MERV-13	Fair

1.2 Existing Control System

A hybrid of pneumatic and electronic systems controls the existing HVAC air handling equipment. The pneumatics are part of an old, obsolete system and appears to be from a renovation prior to 1976. While the air compressor and dryer appear to be newer and in good condition, the pneumatic tubing is very extensive, and many audible leaks were noted. Some of the existing control cabinets, such as for the OA dampers pictured below, were powered and pressurized but controlling systems that were no longer there.

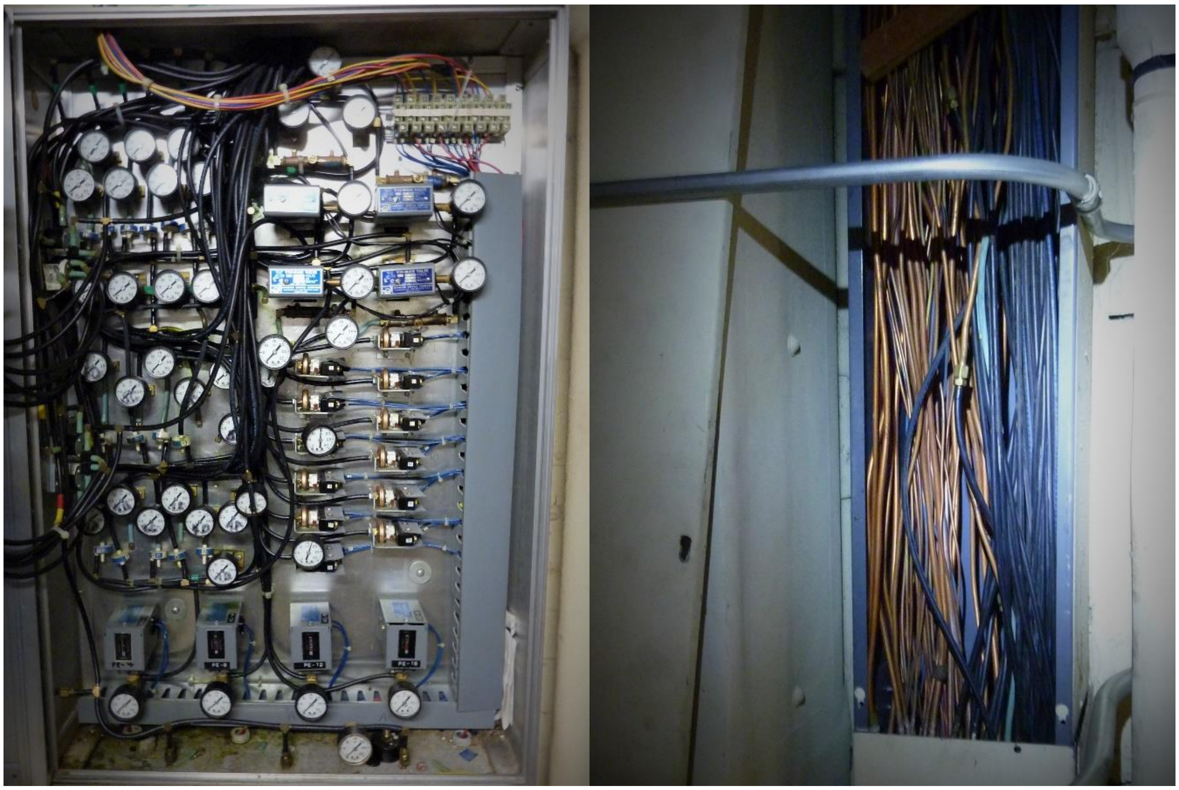

Photo 3 – Representative Pneumatic Controls

The HVAC equipment is primarily controlled by a Schneider Electric Building Management System (BMS). Air handlers, boilers, pumps, the cooling tower, etc. are all tied into the system for supervisory control. Some of the space temperature sensors, and actuators and sensors in individual air handlers are still under pneumatic control.

We are not aware of any demand control ventilation sequences in use at this facility.

Section 2 Recommendations

Below is a list of recommendations for the Springfield Housing and Juvenile Court. Please refer to the "Overview of Recommendations" report for further explanation and requirements of the stated recommendations.

2.1 Filtration Efficiency Recommendations

The filters in the air handlers were already upgraded with 1" or 2" MERV-13 filters. According to facilities personnel, the air handlers can accommodate a MERV-13 filter per the manufacturer. MERV-13 meets the minimum ASHRAE recommendations for filtration during the pandemic. However, more efficient filters will have a shorter lifespan because they will accumulate particles more quickly. This is a particular concern for 1" thick filters. PM intervals should be adjusted accordingly.

Most of the air handlers we inspected had the filter access doors and seals removed or missing, leaving the ends of the filters exposed. The doors should be replaced or repaired in order to keep unfiltered return air from bypassing the filter media, or to keep from drawing return air from the mechanical room or attic space.

We recommend that a testing and balancing contractor test and document the airflow and of all heat pumps and rooftop units, as outlined in recommendation RF-1 in the Overview of Recommendations document. This will help determine if the equipment can accommodate the increase in total static pressure associated with the addition of the MERV-13 filters without a substantial decrease in delivered airflow.

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

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

We recommend the continued use of MERV-13 filters and checking to be sure that filters are delivered as ordered since some filters we found were not marked as MERV-13. Filter racks should be inspected and adjusted to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass. This should include the filter access doors and end seals.

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

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

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 heat pumps and rooftop units are approximately 16 years old, and the air distribution systems are approximately 30 years old. These systems were significantly modified during the 1976 renovation and it is unknown to Tighe & Bond when the last time the air handling 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)
HP-1	3,200	640	790	**790**
HP-2	2,400	480	521	**525**
HP-3	2,400	480	520	**520**
HP-4	1,720	345	392	**395**
HP-5	1,120	225	272	**275**
HP-6	2,115	425	329	**425**
HP-7	2,300	860	537	**860**
HP-8	2,320	880	501	**880**
HP-9	1,915	975	468	**975**
HP-9A	1,915	975	468	**975**
HP-10	2,300	1,050	531	**1,050**
HP-10A	2,300	1,050	531	**1,050**
HP-11	1,600	555	611	**620**
HP-12	2,480	1,200	622	**1,200**
HP-13	1,530	580	402	**580**
RTU-1	2,335	2,335	1,635	**2,400**
RTU-2	2,715	2,715	1,506	**2,715**
RTU-3	3,075	3,075	1,529	**3,075**

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 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. Supply air temperatures during the heating and cooling season should be monitored to ensure they are not dropping below design values. If the supply air temperature does drop below design values, the outdoor airflow rate should be reduced, but not below the originally designed outdoor air flow rates.

Where we do not recommend increasing outdoor air to the current code requirements, it appears the cooling and/or heating coils cannot maintain the proper leaving air temperature under peak outdoor air conditions.

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)	524	291	232
Total Supply Air (CFM/Person)	58	42	78
Outdoor Air (CFM/Person)	21	19	24

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)

Courtroom	Total People	Total Air		Outdoor Air	
		Supply Airflow (CFM)	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Juvenile Courtroom 119	58	1,220	21	320	6
Juvenile Courtroom 222	128	3,830	30	1,950	15
Housing Courtroom 1	145	4,600	32	2,100	14
Housing Courtroom 2	85	2,480	29	1,200	14

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 full supply airflow is being delivered to the room.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy)

Courtroom	Total People	Total Air		Outdoor Air	
		Supply Airflow (CFM)	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Juvenile Courtroom 119	13	1,220	94	320	25
Juvenile Courtroom 222	21	3,830	182	1,950	93
Housing Courtroom 1	22	4,600	209	2,100	95
Housing Courtroom 2	21	2,480	118	1,200	57

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 courtrooms, jury pool room, holding cells, control room, and other densely occupied areas. The air distribution systems are 30 years 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 experiences 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 and ensure all air handler DX coils are fully charged.*

Testing the air handler coils will help ensure the coils operating at the proper cooling and heating capacities. Due to the age of the units, the coils may not perform as required to properly temper the supply air. Confirm that the heat pumps' refrigerant systems are fully charged and operating correctly to ensure the coils are receiving full refrigerant flow, and that the water sides are receiving full design 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 rusted and/or not functioning properly.

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

2.4 Control System Recommendations

We recommend the following for the control system:

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

The existing BMS appears to be sophisticated enough to implement this type of sequence, however new control sequences must be defined.

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 areas below, we recommend the use of portable HEPA filters or similar air purification devices if these areas are to be occupied in the near term, until adequate ventilation is added to these areas. While all spaces benefit from additional air filtration, this measure is likely not necessary for single occupant offices.

Offices B10 & B11	Police/Witness Waiting B58	Waiting 132
Entrance Lobby B12	Housing Court Clerical 102	Juvenile Clerical 133
Court Clinic Reception B20	Juvenile Courtroom 119	Lobby 150
Conference Room B30	Employee Lounge 126	Public Witness Waiting 151
Lobby B48	Conference Room 130	Public Waiting 152

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

2.7.1 Replace Exhaust Fans

The exhaust fans serving the toilet rooms appear to be from the 1976 renovation and were not replaced as part of the renovation completed in 2005. Exhaust fans have a life expectancy of 15-25 years. The exhaust fans are approximately 45 years old, are non-operational, and should be replaced immediately. Ventilation of toilet rooms is especially important in this pandemic, because the COVID-19 virus can be aerosolized from a toilet flush.

2.7.2 Replace Air Handling Units

ASHRAE lists the life expectancy for small indoor air handling units as 25-35 years, and 19 years for water-source heat pumps (WSHPs). The air handlers are approximately 45 years old and are in fair condition. Consider replacing these units in the next 2-4 years. This recommendation is an energy saving measure and may not increase the indoor air quality of the building. WSHPs are available with much higher efficiencies and features such as electronically commutated (EC) fan motors, multi-stage or variable-speed compressors, and advanced controls. These features can reduce energy use and noise levels while increasing reliability and thermal comfort.

2.7.3 Expand Building Management System

We recommend continuing to replace the existing pneumatic control system with a digital Building Management System (BMS) to control and monitor HVAC equipment. Pneumatic air systems are antiquated, and the existing system has many audible leaks that cycle the compressor unnecessarily. This recommendation is an energy saving and maintenance measure and does not affect the indoor air quality of the building, assuming that the same sequences are used by the digital system.

2.7.4 Replace Pneumatic Damper and Valve Actuators with Electronic Actuators

We recommend replacing pneumatic damper and valve actuators with electronic actuators and tying them into the Building Management System. Pneumatic controls are an old and obsolete technology. These systems tend to leak air, may result in poor control of the HVAC equipment, cause the air compressor to run more frequently and increase energy usage. A BMS can monitor the position of electronic valves, trend valve position data, and report alarms.

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.

2.7.5 Add Ventilation to All Occupied Areas

Several interior office spaces that do not have operable windows also do not have any mechanical ventilation. Consider adding a ventilation system to serve these areas.

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

Wings Testing & Balancing Co. visited the Springfield Housing and Juvenile Court on October 20, 2021 to test the airflow rates of the air handling units, heat pumps, and the exhaust fans. A summary of the tested airflow rates versus the design airflow rates are shown below in Tables 5 and 7. The full testing and balancing report is attached. The balancing report also contains the water flow rate testing results of the heat pump condenser water coils in Table 6. The hot water system was not operational during the time of testing, therefore hot water coil flow rates were not tested.

TABLE 5
Air Handler and Heat Pump Airflow 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)**
HP-1	3,200	790	2,410	**1,969**	**540**	**1,429**
HP-2	2,400	525	1,875	**1,534**	**350**	**1,184**
HP-3	2,400	520	1,880	**1,863**	481	**1,382**
HP-4	1,720	395	1,325	1,664	**232**	1,432
HP-5	1,120	275	845	**1,323**	**122**	**1,201**
HP-6	2,115	425	1,690	**1,442**	**209**	**1,233**
HP-7	2,300	860	1,440	2,116	804	1,312
HP-8	2,320	880	1,440	2,100	874	**1,226**
HP-9	1,915	975	940	1,756	969	**787**
HP-9A	1,915	975	940	1,799	986	**815**
HP-10	2,300	1,050	1,250	2,237	957	1,280
HP-10A	2,300	1,050	1,250	2,417	1,095	1,322
HP-11	1,600	620	980	1,466	611	**855**
HP-12	2,480	1,200	1,280	2,348	1,132	1,216
HP-13	1,530	580	950	1,689	578	**1,111**
RTU-1	2,335	2,400	0	2,190	2,190	0
RTU-2	2,715	2,715	0	2,609	2,609	0
RTU-3	3,075	3,075	0	2,786	2,786	0

TABLE 6
Heat Pump Water Flow Testing & Balancing Results

	Design Condenser Water Flow Rate (GPM)	Actual Condenser Water Flow Rate (GPM)
HP-1	30	X
HP-2	18	X
HP-3	30	X
HP-4	10	10
HP-5	15	X
HP-6	13	X
HP-7	18	18
HP-8	18	X
HP-9	16	X
HP-9A	16	X
HP-10	18	18
HP-10A	18	X
HP-11	13	X
HP-12	24	24
HP-13	16	X

“X” indicates that the unit does not meet the required 2-psi minimum at the control valve and could not be tested.

TABLE 7
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Return/Exhaust Airflow (CFM)	Actual Return/Exhaust Airflow (CFM)
EF-1	Toilet Rooms	60	58
EF-2	Toilet Rooms	110	102
EF-3	Toilet Rooms	610	N/A
EF-4	Toilet Rooms	1,660	N/A

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. Heat pumps HP-1 through 6, 8, 9, 9A, 11, and 13 have supply, return, and/or outdoor airflow rates that are significantly below the typical ±10% tolerance for airside systems. Readings more than 10% outside the design values are shown in boldface in Table 5. We recommend rebalancing these units to match the design airflow rates.
2. HP-1 originally had a 2-HP motor which has since been replaced with a 1.5-HP motor. The new motor current was measured at 2.5 amps which is within the FLA of a typical 1.5-HP motor which is 3.0 amps. The motor’s nameplate FLA was not listed in the TAB report.
3. The motor for HP-2 is appears to be failing, as observed by the TAB contractor, and should be replaced.
4. The outside air louver serving HP-3 through HP-6 is clogged and should be cleaned. The units connected to this louver are not achieving their design outside airflow rates, and HP-4 and 5 have their outside air dampers 100% open. These units are likely not getting the required outside air due to the louver blockage. There is unsanitary debris on the ground outside the louver that should be cleaned for IAQ reasons.
5. HP-6 is running at medium speed because running the unit at high speed would exceed the rated amperage of the motor (3.5 amps required, but motor FLA=2.8). This unit also has a high discharge static pressure which is likely caused by a downstream blockage such as closed volume dampers or supply grilles.
6. EF-1 was not accessible. EF-3 and EF-4 have not been in operation for years and therefore were not tested by the TAB contractor.
7. The hot water system was not operational, therefore hot water coil flow rates could not be measured.
8. The TAB contractor noted that the condenser water piping loop seems too small for the flow rates required by the units. Flow is restricted because pipe diameters are reduced just upstream of the unit coils and then increased downstream in order to meet the control valve sizes. This should not be a concern if the units are getting the design condenser water flow. Further investigation by an engineer would be required to evaluate this concern.
9. All units have been fitted out with Hayes autoflow circuit setter control valves, which operate with a pressure range of 2-32 psi. Some units do not reach the 2-psi minimum at the control valve, and therefore could not be tested. Those units have an “X” in the Actual Condenser Water Flow Rate column in Table 6.
10. HP-4 has a design flow rate of 15.9 gpm but the autoflow circuit setter is set for 10 gpm. Conversely, HP-5 has a design flowrate of 9.5 gpm but the autoflow circuit setter is set for 15 gpm. These valves were likely switched during

installation, we recommend switching them back so that the valves match the design gpm for each heat pump.

11. HP-13 is piped such that the multi-row coil is not in a counterflow arrangement, reducing its capacity. The design condenser water flow rate is 12.6 gpm but the circuit setter was set for 16 gpm. This coil should be re-piped so the supply is to the aft end of the coil, and the flow reset.

Springfield Juvenile and Family Court

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

October 20th, 2021

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WING'S TESTING & BALANCING CO., INC.

October 20th, 2021

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

Re: Springfield Juvenile and Family Court

Dear, Jason

Wing's has completed the HVAC/fresh air ventilation survey for the above referenced location. Upon arriving on site, it was discovered that HP-1 through HP-4 had to have new belts installed. In-house personnel took care of this issue. In-house staff had also already installed new MERV-13 filters on all units. The results of our testing are as follows:

- HP-1 was originally installed with a 2HP motor. It currently has a 1 ½ HP motor in it. A 2HP motor should be installed.
- The motor on HP-2 is dying and should be replaced. It is a 1 ½ HP motor. It would be cost effective to make current motor installed in HP-1 work for HP-2
- The outside air louver serving HP-3 through HP-6 is clogged and needs to be cleaned. All these HPs should be powered down to be cleaned. There are also large amounts of human waste on the ground directly below this louver. This area needs to be cleaned and fenced off to prevent foul odors from being drawn into the building.
- HP-6 is on medium speeding during 2.5 amps out of a FLA of 2.8 high speed over-amps the motor to 3.5 amps.
- EF-3 and EF-4 do not operate and have not operated in years.
- EF-1 is located above a sheetrock ceiling with no access to the fan.
- EF-4 has no motor nameplate.
- The hot water loop was not operational yet due to seasonal change-over. Furthermore, the hot water has no circuit setters and has no clear place to take ultrasound readings.

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- The chilled water loop has several issues. First, the piping gets downsized just prior to and after the unit coils. This makes it impossible to achieve design GPM on most units. Secondly, HP-13 is piped backwards. Thirdly, per design, this circuit setters for HP-4 and HP-5 were switched with one another during install. The units need their circuit setters swapped. Finally, HP-13 has a circuit setter of 16 GPM installed whereas the design is only 12.6 GPM. The engineer should review the field conditions of the CHW.

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:	Springfield Juvenile and Family Court	**DATE:**	10/7/2021
AREA SERVED:	Heat Pumps	**TECH:**	BS

FAN DATA						
FAN NUMBER	RTU-1		RTU-2		RTU-3	
LOCATION	Roof		Roof		Roof	
AREA SERVED	Heat Pumps		Heat Pumps		Heat Pumps	
MANUFACTURER	AAON		AAON		AAON	
MODEL OR SIZE	RM-010-8-1		RM-010-8-1		RM-010-8-1	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2335	2190	2715	2609	3075	2786
RETURN AIR	0	0	0	0	0	0
OUTSIDE AIR	2335	2190	2715	2609	3075	2786
DISCH. STATIC	---	+0.12"	---	+0.14"	---	+0.20"
SUCTION STATIC	---	-0.16"	---	-0.35"	---	-0.43"
TOTAL STATIC	---	0.28"	---	0.54"	---	0.63"
FAN RPM	---	892	---		---	1288
PULLEY O.D.	5.0" x 1.0		6.0" x 1.0		6.0" x 1.0"	
ESP	0.28		0.40		0.41	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	100%		100%		100%	

MOTOR DATA							
MANUFACTURER		AO Smith		AO Smith		AO Smith	
MODEL OR FR.		P145T		P145T		P145T	
HORSEPOWER		2.0	2.0	2.0	2.0	2.0	2.0
MOTOR RPM		1745	1745	1745	1745	1745	1745
VOLTAGE / PH.		460/3	460/3	460/3	460/3	460/3	460/3
AMPS	**LEG 1**	2.8	---	2.8	---	2.8	---
	LEG 2	---	1.6	---	1.9	---	2.0
	LEG 3	---	---	---	---	---	---
SHEAVE O.D.		4.25" x 5/8		4.0" x 5/8		4.25" x 5/8	
BELTS - QUANTITY / SIZE		1/BX59		1/BX61		1/	
SHEAVE POSITION		Fully open		1/2 Open		3/4 Closed	
C to C		24.5		24.5		24.0	

REMARKS

NA Not Available
ND No Design
DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/8/2021
AREA SERVED:	Mechanical Rooms	**TECH:**	BS

FAN DATA

FAN NUMBER	HP-1		HP-2		HP-3	
LOCATION	Mech Rm B47		Mech Rm B47		Mech Rm B17	
AREA SERVED	Holding Rooms		Court #2		Juvenile Clerks	
MANUFACTURER	McQuay		McQuay		McQuay	
MODEL OR SIZE	WL-108-MS2		WL-070-MSI		WL-108-MS2	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	3200	1969 (1)	2400	1534	2400	1863
RETURN AIR	2410	1429	1875	1184	1880	1382
OUTSIDE AIR	790	540	525	350	520	481
DISCH. STATIC	---	+0.50	---	+0.72"	---	+0.43"
SUCTION STATIC	---	-0.50	---	-0.41"	---	-0.50"
TOTAL STATIC	---	1.00"	---	1.13"	---	0.93"
FAN RPM	1170	923	1000	949	980	905
PULLEY O.D.	6.25" x 1		5.5" x 1		6.5" x 1	
ESP	0.65		0.89		0.64	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	40%		40%		50%	

MOTOR DATA

MANUFACTURER	AO Smith		Emerson (2)		AO Smith	
MODEL OR FR.	UA56H		NA		UA56H	
HORSEPOWER	2	1/2	1/2	1/2	1/2	1/2
MOTOR RPM	1725	1725	1725	1725	1725	1725
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	2.8	2.5	2.2	1.5	2.8	2.4
AMPS LEG 2	---	2.5	---	1.5	---	2.4
AMPS LEG 3	---	2.5	---	2.4	---	2.3
SHEAVE O.D.	3.75" x 5/8		3.75" x 5/8		3.75" x 5/8	
BELTS - QUANTITY / SIZE	1/A47		1/A47		1/A47	
SHEAVE POSITION	1/2 Open		3/4 Closed		Fully closed	
C to C	16.5		18.0		17.0	

REMARKS

(1) This unit originally had a two HP motor. There is a 1 1/2 HP motor currently in this unit.
(2) It appears according o the amparage readings that this motor needs replacing.

NA Not Available
ND No Design
DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/12/2021
AREA SERVED:	Various	**TECH:**	BS

FAN DATA

FAN NUMBER	HP-4		HP-5		HP-6	
LOCATION	Mech Rm B17		Mech Rm B17		Mech Rm B17	
AREA SERVED	Clerk's Office		Basement Offices		Housing Clerks	
MANUFACTURER	McQuay		McQuay		McQuay	
MODEL OR SIZE	WF-060-MS2		WF-036-MS1		WF-060-MS2	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	1720	1664	1120	1323 (2)	2115	1442 (3)
RETURN AIR	1325	1432	845	1201	1690	1233
OUTSIDE AIR	395	232 (1)	275	122 (1)	425	209
DISCH. STATIC	---	+0.33"	---	+0.30"	---	+0.73" (4)
SUCTION STATIC	---	-0.68"	---	-0.63"	---	-0.43"
TOTAL STATIC	---	1.01"	---	0.93"	---	1.16"
FAN RPM	DD	DD	DD	DD	DD	DD
PULLEY O.D.	DD		DD		DD	
ESP	0.43		0.46		0.84	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	100%		100%		100%	

MOTOR DATA

MANUFACTURER	Fasco		Fasco		Fasco	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	3/4	3/4	1/2	1/2	3/4	3/4
MOTOR RPM	1050	1050	1050	1050	1050	1050
VOLTAGE / PH.	460/1	460/1	460/1	460/1	460/1	460/1
AMPS LEG 1	2.8	---	1.6	---	2.8	---
AMPS LEG 2	---	2.0	---	1.0	---	2.5
AMPS LEG 3	---	---	---	---	---	---
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	
C to C	Low		Low		Medium	

REMARKS

(1) The outside air damper is 100% open, but still below design.

(2) Unit is direct drive.

(3) Unit is on medium speed drawing 2.5 amps. High speed over-amps the motor to 3.5 amps with a FLA rating at 2.8.

(4) This high discharge static would indicate that there is either blockage or supply grills are closed down the line.

NA Not Available

ND No Design

DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/13/2021
AREA SERVED:	Various	**TECH:**	BS

FAN DATA

FAN NUMBER	HP-7		HP-8		HP-9	
LOCATION	Attic		Attic		Attic	
AREA SERVED	Probate #2		Probate #3		Juvenile Court #1	
MANUFACTURER	McQuay		McQuay		McQuay	
MODEL OR SIZE	W.CMS.1.070		W.CMS.1.070		W.CMS.2.060	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2300	2116	2320	2100	1915	1756
RETURN AIR	1440	1312	1440	1226	940	787
OUTSIDE AIR	860	804	880	874	975	969
DISCH. STATIC	---	+0.65"	---	+0.62"	---	+0.28"
SUCTION STATIC	---	-0.36"	---	-0.41"	---	-0.58"
TOTAL STATIC	---	1.01"	---	1.03"	---	0.86"
FAN RPM	---	729	---	749	DD	DD
PULLEY O.D.	6.0" X 5/8		6.0" X 5/8		DD	
ESP	0.77		0.67		0.36	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	100%		100%		50%	

MOTOR DATA

MANUFACTURER	Dayotn		Emerson		NA	
MODEL OR FR.	56H		NA		NA	
HORSEPOWER	1.5	1.5	1.5	1.5	3/4	3/4
MOTOR RPM	1725	1725	1725	1725	1050	1050
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/1	460/1
AMPS LEG 1	2.8	2.4	2.4	---	2.8	---
AMPS LEG 2	---	2.4	---	1.9	---	2.0
AMPS LEG 3	---	2.4	---	---	---	---
SHEAVE O.D.	12.0" x 1		12.0" x 1		DD	
BELTS - QUANTITY / SIZE	1/A60		1/A60		DD	
SHEAVE POSITION	1/2 Open		1/2 Open		DD	
C to C	17.0		17.0		DD	

REMARKS

NA Not Available
ND No Design
DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/14/2021
AREA SERVED:	Various	**TECH:**	BS

FAN DATA

FAN NUMBER	HP-9A		HP-10		HP-10A	
LOCATION	Attic		Attic		Attic	
AREA SERVED	Court #1		Housing Court		Housing Court	
MANUFACTURER	McQuay		McQuay		McQuay	
MODEL OR SIZE	W.CMS.2.060		W.CMS.1.070		W.CMS.1.070	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	1915	1799	2300	2237	2300	2417
RETURN AIR	940	815	1250	1280	1250	132
OUTSIDE AIR	975	986	1050	957	1050	1095
DISCH. STATIC	---	+0.24"	---	+0.38"	---	+0.38"
SUCTION STATIC	---	-0.49"	---	-0.41"	---	-0.29"
TOTAL STATIC	---	0.73"	---	0.79"	---	0.68"
FAN RPM	DD	DD	---	754		816
PULLEY O.D.	DD		6.0" x 5/8		6.0" x 5/8	
ESP	0.32		0.53		0.48	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	100%		100%		100%	

MOTOR DATA

MANUFACTURER	NA		AO Smith		Dayton	
MODEL OR FR.	NA		UA56H		56H	
HORSEPOWER	3/4	3/4	1.5	1.5	1.5	1.5
MOTOR RPM	1050	1050	1725	1725	1725	1725
VOLTAGE / PH.	460/1	460/1	460/3	460/3	460/3	460/3
AMPS LEG 1	2.8	---	2.8	2.4	2.8	2.6
AMPS LEG 2	---	2.1	---	2.5	---	2.5
AMPS LEG 3	---	---	---	2.5	---	2.6
SHEAVE O.D.	DD		12.0" x 1		12.0" x 1	
BELTS - QUANTITY / SIZE	DD		1/A60		1/A60	
SHEAVE POSITION	DD		1/2 Open		1/2 Open	
C to C	DD		17.0		17.0	

REMARKS

NA Not Available
ND No Design
DD Direct Drive

SUPPLY FAN REPORT

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/14/2021
AREA SERVED:	Various	**TECH:**	BS

FAN DATA

FAN NUMBER	HP-11		HP-12		HP-13	
LOCATION	Bell Tower		Bell Tower		Attic	
AREA SERVED	Housing Offices		Housing Court#2		Housing Clinic	
MANUFACTURER	McQuay		McQuay		McQuay	
MODEL OR SIZE	W.CMS.1.048		W.CMS.1.090		W.CMS.1.048	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	1600	1466	2480	2348	1530	1689
RETURN AIR	980	855	1280	1216	950	1111
OUTSIDE AIR	620	611	1200	1132	580	578
DISCH. STATIC	---	+0.61"	---	+0.62"	---	+0.68"
SUCTION STATIC	---	-0.45'	---	-0.32"	---	-0.60"
TOTAL STATIC	---	1.00"	---	0.94"	---	---
FAN RPM	DD	DD	---	849	DD	DD
PULLEY O.D.	DD		12.0" x 1		DD	
ESP	0.78		0.72		0.81	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	50%		100%		50%	

MOTOR DATA

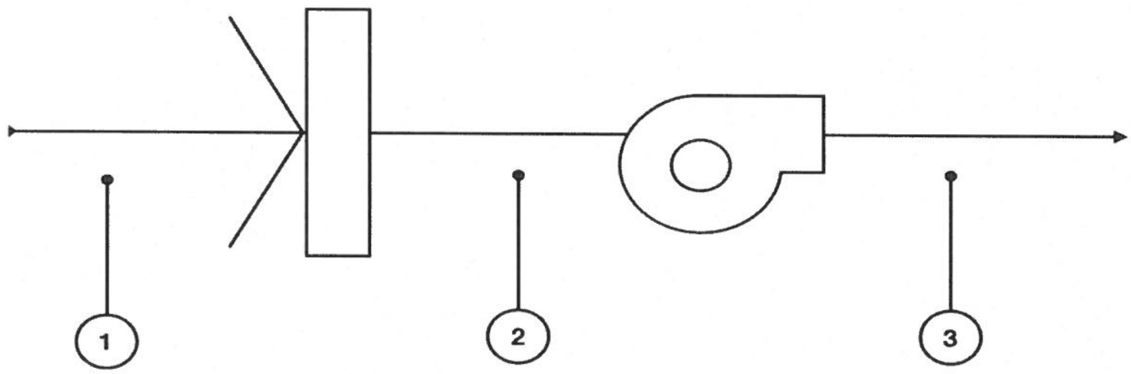
MANUFACTURER	Tasco		Emerson		NA	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	3/4	3/4	1.5	1.5	3/4	3/4
MOTOR RPM	1050	1050	1725	1725	1050	1050
VOLTAGE / PH.	460/1	460/1	460/3	460/3	460/1	460/1
AMPS LEG 1	2.8	---	2.8	---	2.8	---
AMPS LEG 2	---	2.5	---	1.6	---	2.5
AMPS LEG 3	---	---	---	---	---	---
SHEAVE O.D.	DD		6.5" x 5/8		DD	
BELTS - QUANTITY / SIZE	DD		1/A60		DD	
SHEAVE POSITION	DD		1/2 Closed		DD	
C to C	DD		16.0		DD	
SPEED	High				High	

REMARKS

NA Not Available
ND No Design
DD Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/20/2021
SYSTEM/AREA:	Various	**TECH:**	BS



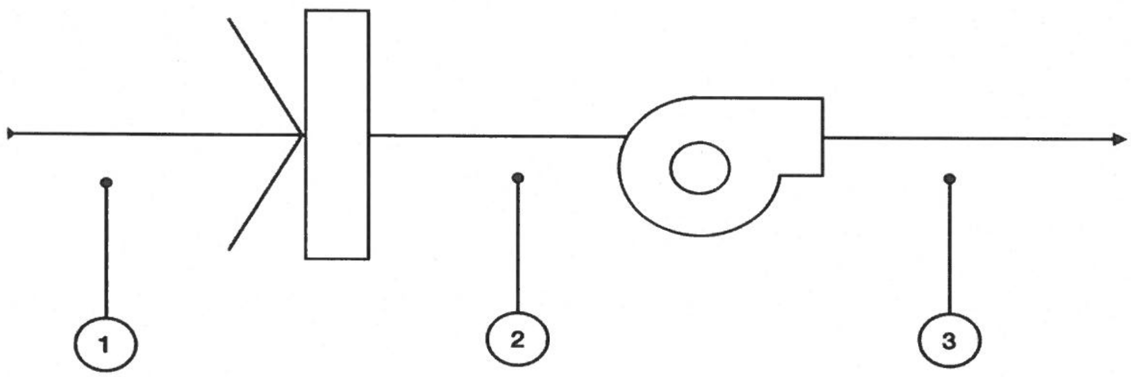
STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	9
RTU-1	-0.12"	-0.16"	+0.12"						
RTU-2	-0.21"	-0.35"	+0.19"						
RTU-3	-0.21"	-0.43"	+0.20"						
HP-1	-0.19"	-0.50"	+0.50"						
HP-2	-0.23"	-0.41"	+0.72"						
HP-3	-0.23"	-0.50"	+0.43"						
HP-4	-0.12"	-0.68"	+0.33"						

REMARKS

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/20/2021
SYSTEM/AREA:	Various	**TECH:**	BS



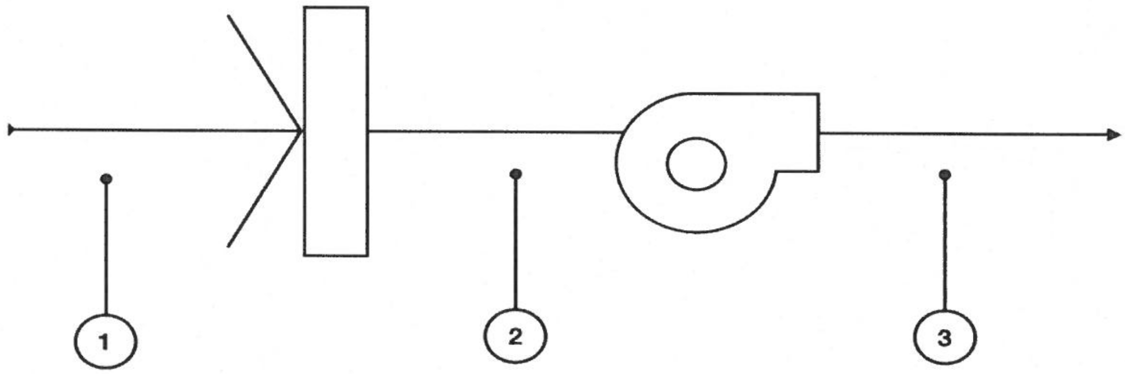
STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	9
HP-5	-0.18'	-0.63"	+0.30"						
HP-6	-0.15"	-0.43"	+0.71"						
HP-7	-0.14"	-0.36"	+0.65"						
HP-8	-0.16'	-0.41"	+0.62"						
HP-9	-0.10"	-0.58"	+0.28"						
HP-9A	-0.10"	-0.49"	+0.24"						
HP-10	-0.17"	-0.41"	+0.38"						

REMARKS

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/20/2021
SYSTEM/AREA:	Various	**TECH:**	BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	9
HP-10A	-0.11"	-0.29"	+0.39"						
HP-11	-0.19"	-0.45"	+0.61"						
HP-12	-0.12"	-0.32"	+0.62"						
HP-13	-0.15"	-0.60"	+0.68"						

REMARKS

VELOCITY PRESSURE READINGS

PROJECT:	Springfield Juvenile and Family Court	DATE:	10/20/2021
AREA SERVED:	Various	TECH:	BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN FPM	DESIGN CFM	CENT. STAT. PRESS."	TEST FPM	TEST CFM	NOTES
RTU-1	38" x 12"	3.17	---	2335	w/ Velgrid	691	2190	
RTU-2	38" x 12"	3.17	---	2715	w/ Velgrid	823	2609	
RTU-3	38" x 12"	3.17	---	3075	w/ Velgrid	879	2786	
HP-1 Supply	16" x 12"	1.33	---	3200	+0.50"	1477	1969	
HP-1 OA	30" x 12"	2.5	---	790	-0.19"	216	540	
HP-1 Return			---	2410	(1)		1429	
HP-2 Supply	16" x 16" ID	1.78	---	2400	+0.72"	863	1534	
HP-2 OA	22" x 12"	1.83	---	525	-0.23"	191	350	
HP-2 Return			---	1875	(1)		1184	
HP-3 Supply	28" x 10"	1.94	---	2400	+0.43"	960	1863	
HP-3 OA	24" x 10"	1.67	---	520	-0.15"	288	481	
HP-3 Return			---	1880	(1)		1382	
HP-4 Supply	18" x 12"	1.5	---	1720	+0.35"	1109	1664	
HP-4 OA	19" x 11"	1.45	---	395	-0.11"	160	232	
HP-4 Return			---	1325	(1)		1432	
HP-5 Supply	28" x 10"	1.94	---	1120	+0.30"	682	1323	
HP-5 OA	20" x 12"	1.67	---	275	-0.15"	73	122	
HP-5 Return			---	845	(1)		1201	
HP-6 Supply	28" x 12"	2.33	---	2115	+0.71"	619	1442	
HP-6 OA	23" x 9"	1.44	---	425	-0.13"	145	209	
HP-6 Return			---	1690	(1)		1233	

REMARKS

(1) Calculated.

VELOCITY PRESSURE READINGS

PROJECT:	Springfield Juvenile and Family Court					**DATE:**	10/20/2021	
AREA SERVED:	Various					**TECH:**	BS	

TRAVERSE			DESIGN		CENT. STAT.	TEST		
LOCATIONS	DUCT SIZE "	AREA SQ.FT.	FPM	CFM	PRESS."	FPM	CFM	NOTES
HP-7 Supply	24" x 24"	4.0	---	2300	+0.65"	529	2116	
HP-7 OA	12" x 12"	1.0	---	860	-0.14"	804	804	
HP-7 Return			---	1440	(1)		1312	
HP-8 Supply	24" x 24"	4.0	---	2300	+0.84"	525	2100	
HP-8 OA	14" x 12"	1.67	---	880	-0.16"	749	874	
HP-8 Return			---	1420	(1)		1226	
HP-9 Supply	22" x 12"	1.83	---	1915	+0.28"	958	1756	
HP-9 OA	14" x 12"	1.17	---	975	+0.09"	828	969	
HP-9 Return			---	940	(1)		787	
HP-9A Supply	22" x 12"	1.83	---	1915	+0.24"	983	1799	
HP-9A OA	24" x 14"	2.33	---	975	-0.07"	423	986	
HP-9A Return			---	940	(1)		813	
HP-10 Supply	18" x 19"	2.375	---	2300	+0.38"	942	2237	
HP-10 OA	14" x 12"	1.17	---	1050	+0.13"	818	957	
HP-10 Return			---	1250	(1)		1280	
HP-10A Supply	30" x 16"	3.37	---	2300	+0.38"	726	2417	
HP-10A OA	12" x 14"	1.17	---	1050	-0.14"	936	1095	
HP-10A Return			---	1250	(1)		1322	
HP-11 Supply	12" x 15"	1.25	---	1600	+0.61"	1173	1466	
HP-11 OA	14" x 12"	1.17	---	620	+0.11"	522	611	
HP-11 Return			---	980	(1)		855	

REMARKS

(1) Calculated.

VELOCITY PRESSURE READINGS

PROJECT:	Springfield Juvenile and Family Court	DATE:	10/20/2021
AREA SERVED:	Various	TECH:	BS

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN FPM	DESIGN CFM	CENT. STAT. PRESS."	TEST FPM	TEST CFM	NOTES
HP-12 Supply	24" x 24"	4.0	---	2480	+0.62"	587	2348	
HP-12 OA	14" x 12"	1.67	---	1200	+0.16"	967	1132	
HP-12 Return			---	1280	(1)			
HP-13 Supply	22" x 10"	1.52	---	1530	+0.68"	1111	1689	
HP-13 OA	20" x 8"	1.11	---	580	+0.03"	521	578	
HP-13 Return			---	950	(1)		1111	

REMARKS

(1) Calculated.

EXHAUST FAN REPORT

PROJECT:	Springfield Juvenile and Family Court	**DATE:**	10/15/2021
AREA SERVED:	Toilets	**TECH:**	BS

FAN DATA

FAN NUMBER		EF-1 (2)	EF-2	EF-3 (3)	EF-4 (3)	
LOCATION		Basement	1st Floor	2nd Floor	Attic	
AREA SERVED		Basement Toilet	1st Fl toilet	2nd Fl Toilet	Toilets	
MANUFACTURER		Baby Vent	Nutone	Baby Vent	ILG Industries	
MODEL OR SIZE		A	QTRN110B	EF-3 (3)	BCL-1500	
TOTAL CFM	**DESIGN**	60	110	610	1660	
	ACTUAL	58	102	---	---	
FAN RPM	**DESIGN**	DD	DD	DD	1245	
	ACTUAL	DD	DD	DD	---	
PULLEY	**O.D.**	DD	DD	DD	6.5" x 1	
SERVICE		---	---	---	---	

MOTOR DATA

MANUFACTURER		Nutone	Nutone	---	NA (1)	
MODEL NUMBER		---	---	---	NA (1)	
MOTOR HP	**DESIGN**	1/20	1/20	1/3	1/2	
	ACTUAL	1/20	1/20	1/3	1/2	
MOTOR RPM		NA	NA	NA	1725	
VOLTAGE/PHASE		120/1	120/1	---	460/1	
MOTOR AMPS	**DESIGN**	0.9	0.9	---	NA (1)	
	ACT. LEG 1	---	---	---	---	
	ACT. LEG 2	(2)	0.8	---	---	
	ACT. LEG 3	---	---	---	---	
SHEAVE		DD	DD	DD	5.0" x 5/8	
BELTS - QUANTITY/SIZE		DD	DD	DD	1/AX37	
SHEAVE POSITION		DD	DD	DD	Fully open	

REMARKS

(1) Motor has no nameplate on it.
(2) Fan not accessible, located above sheetrock in lock-up.
(3) This fan has not operated in years.

NA Not Available
ND No Design
DD Direct Drive

HYDRONIC FLOW ELEMENTS

PROJECT:	Springfield Juvenile and Family Court								**DATE:**	10/8/2021		
AREA SERVED:	Chilled Water								**TECH:**	BS		

LOCATION	NO.	ELEMENT	MFG.	SIZE	DESIGN GPM	TEST I POS.	TEST I PR.DIF	TEST I GPM	FINAL POS.	FINAL PR.DIF	FINAL GPM	NOTES
Chilled												(4)
HP-1	1	CS	HAYES	1 1/4	30	Open	1.3					(1)
HP-2	2	CS	HAYES	1 1/4	18	Open	0.7					(1)
HP-3	3	CS	HAYES	1 1/4	30	Open	1.5					(1)
HP-4	4	CS	HAYES	3/4	10	Open	3.1	10				(2)
HP-5	5	CS	HAYES	3/4	15	Open	1.0					(1,2)
HP-6	6	CS	HAYES	3/4	13	Open	1.6					(1)
HP-7	7	CS	HAYES	1 1/4	18	Open	1.9					(1)
HP-8	8	CS	HAYES	1 1/4	18	Open	2.0	18				
HP-9	9	CS	HAYES	3/4	16	Open	1.4					(1)
HP-9A	10	CS	HAYES	3/4	16	Open	1.4					(1)
HP-10	11	CS	HAYES	1 1/4	18	Open	2.4	18				
HP-10A	12	CS	HAYES	1 1/4	18	Open	1.6					(1)
HP-11	13	CS	HAYES	3/4	13	Open	1.0					(1)
HP-12	14	CS	HAYES	1 1/4	24	Open	3.1	24				
HP-13	15	CS	HAYES	3/4	16	Open	-1.8					(3)

REMARKS

(1) These are Hayes autoflow curcuit setters with a range of 2-32 PSI. Therefore, we are unable to determine what GPM they are doing if they do not meet minimum pressure of 2psi.

(2) HP-4 has a design of 15.9 GPM but has an autoflow curciut setter for 10 GPM. HP-5 has a design of 9.5 GPM but a circuit setter for 15 GPM.

(3) HP-13 is piped backwards.

(4) The piping on this loop seems too small for the design GPM for some of these units. Also, the pipe sizing reduces down to smaller piping just before each unit and then is sized back up to meet the circuit setter sizes. This restricts flow.