

Hampshire County Probate and Family Court Northampton, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

June 14, 2022

Tighe&Bond

100% Recyclable

Existing Conditions & Site Observations

Tighe & Bond visited the Hampshire County Probate and Family Court on September 17, 2021. While on site, we inspected the air handling equipment located on the roof and toured the occupied portions for the building to determine if the spaces generally matched the expected layout and usage noted on the architectural plans.

Site Visit Attendees:

- Courthouse Facilities Staff:
 - Travis Ward, Development Associates
- Tighe & Bond
 - Todd Holland, PE, Senior Mechanical Engineer

1.1 Existing Ventilation System

The Hampshire Probate and Family Court occupies the ground floor, and a small interior storage space on the second floor, for a total area of approximately 22,000 square feet of a three-story building built in 2018. This is a leased space in a privately-owned building.

This courthouse spaces are conditioned by four packaged rooftop units (RTUs) that provide heating, cooling, and ventilation air to the building. Each unit contains a supply fan, indirect-fired natural gas furnace, electric direct expansion (DX) cooling coil, 2" thick MERV-13 filter, economizer that allows 100% outdoor air "free" cooling when conditions permit, and power exhaust fans that operate with the economizer.

All four RTUs were new in 2018 and appear to be in very good condition. The OA dampers and actuators, furnaces, and DX coils appeared to be clean and fully functional. However, the outdoor air dampers on all units were fully closed, even though the units were on and the supply fans were running. The design documents do indicate, "At the start of the occupied mode the outdoor air dampers shall be open to the minimum position." However, the minimum position was not designated on the documents that we reviewed.

Each RTU has variable volume and temperature (VVT) controls, which varies airflow delivered to the space while the airflow through the unit remains constant. Zone dampers vary the airflow to individual spaces, and bypass dampers short-circuit supply air back to the return duct when supply air volume is reduced as space temperatures are satisfied. Zone dampers, which are not true variable air volume (VAV) terminals, do have minimum flow settings but do not measure airflow delivered to the space.

The minimum airflows shown on the drawings or schedules range from to 26% to 48%, averaging 30%. This is to ensure adequate room air circulation and outdoor air ventilation as zone loads are reduced.

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

TABLE 1

Existing Air H	landling Units			
Unit	Original Design Airflow (CFM)	Original Design Min. OA (CFM)	Pre/Final Filters	Condition
RTU-1	4,900	Unknown	2" MERV-13	Very Good
RTU-2	4,300	Unknown	2" MERV-13	Very Good
RTU-3	5,200	Unknown	2" MERV-13	Very Good
RTU-4	4,800	Unknown	2" MERV-13	Very Good



Photo 1 – Representative RTU

1.2 Existing Control System

The HVAC equipment is controlled by a Carrier i-Vu Building Management System (BMS). The RTUs, zone dampers, bypass dampers, and exhaust fans are all tied into the system. CO_2 sensors were shown in the return air streams of the RTUs on the control drawings, but these do not appear on the BMS control screens and were not seen in the field.

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Photo 2 - Representative BMS Control Screen - RTU-1

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Photo 3 – Representative BMS Control Screen – Zone Damper 1-3

Section 2 Recommendations

Below is a list of recommendations for the Hampshire Probate and Family 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 2" thick MERV-13 filters, and just changed at the end of August 2021. MERV-13 meets the minimum ASHRAE recommendations for filtration during the pandemic. We recommend that a testing and balancing contractor test and document the airflow and static pressure profile of all air handlers, as outlined in recommendation RF-1 in the Overview of Recommendations document. This will help determine if the equipment can accommodate the increase in system static pressure associated with the addition of the MERV-13 filters.

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

RF-1: Continue to use MERV-13 filters.

Filter racks should be inspected and adjusted to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass.

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

RF-3a: Connect the pressure sensor to the BMS system.

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 three 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 OA rates listed in Table 2.

Unit	Original Supply Airflow (CFM)	Original Design Min. OA (CFM)	Current Code Min. OA Requirements (CFM)	Recommended Minimum OA (CFM)
RTU-1	4,900	Unknown	1,090	1,100
RTU-2	4,300	Unknown	992	1,000
RTU-3	5,200	Unknown	596	1,100
RTU-4	4,800	Unknown	1,059	1,100

TABLE 2

Recommended Air Handler OA Flow Rates

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.

Our ventilation air analysis discovered that some spaces were not receiving the correct quantity of outdoor air based on today's code requirements at full occupancy. Our calculations showed that the code-required quantity of outdoor air would be likely exceed the capacity of the packaged rooftop units. We recommend temporarily reducing the occupancy of the spaces that are not receiving the coderequired ventilation air. Table 3 lists the spaces that would require a reduced occupancy. The recommended outdoor air flow rates listed in Table 2 reflect the outdoor air requirements based on a reduced occupancy shown in Table 3.

Recommended Occupancy During COVID-19 Pandemic					
Room & Associated AHU	2015 IMC Permitted Occupancy (# of People)	Recommended Occupancy (# of People)			
<u>RTU-1</u>					
Courtroom #2	84	45			
Conference Room 125	9	3			
<u>RTU-2</u>					
Staff Lunchroom 116	23	10			
Conference Room 118	35	24			
RTU-4					
Courtroom #1	81	40			
Break Room 149	8	2			
Judges' Kitchen 156A	8	1			

TABLE 3

Using our recommendations for outdoor air volumes, it appears the cooling and heating capacities are adequate to provide supply air conditions 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 TABLE 3

cooling season should be monitored to ensure they are adequate to handle the loads in the spaces.

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.

			Non-Courtroom
	All Spaces	Courtrooms	Spaces
Total Occupancy (People)	225	116	109
Total Supply Air (CFM/Person)	85	26	148
Outdoor Air (CFM/Person)	19	6	33

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 rates per person assumes the full supply and code minimum outdoor airflows are being delivered to the room. At times when the supply airflow rate per person will also be reduced.

TABLE 4

Airflow Rate per Person ((Full Occupancy)
---------------------------	------------------

		Total Air		Outdo	oor Air
Courtroom	Total People	Supply Airflow (CFM)	Airflow Rate (CFM/Person)	Outdoor Airflow (CFM)	Airflow Rate (CFM/Person)
Courtroom #1	81	1,800	22	413	5
Courtroom #2	84	1,200	14	267	3

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

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

TABLE 4a

Airflow Rate per Person (Reduced Occupancy)

		Total Air		Outdo	oor Air
Courtroom	Total People	Supply Airflow (CFM)	Airflow Rate (CFM/Person)	Outdoor Airflow (CFM)	Airflow Rate (CFM/Person)
Courtroom #1	17	1,800	106	413	24
Courtroom #2	17	1,200	71	267	16

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

RTB-4: Test and balance zone damper airflow rates.

We recommend testing and balancing the zone dampers to ensure each space is being supplied the proper quantity of air.

Upon reviewing the BMS control screens, we discovered that many of the zone dampers have had their minimum airflows reset. The total minimum airflow for zones served by RTU-1 has been reduced from 1,450 to 400 cfm, and the total minimum airflow for RTU-4 zones has been reduced from 1,385 to 550 cfm. A summary of the design minimum airflows and the actual occupied minimum airflows is shown below in Table 5.

TABLE 5

Zone Damper Minimum Airflow Settings

		Design	Occupied	Diffe	Difference	
Tag	Area Served	Min. CFM	Min. CFM	CFM	Percent	
ZD 1-1	West Offices	500	50	(450)	-90%	
ZD 1-2	Probation	475	100	(375)	-79%	
ZD 1-3	Courtroom #2	475	250	(225)	-47%	
ZD 2-4	Conference Room	360	250	(110)	-31%	
ZD 2-5	Lunchroom	250	250	-	-	
ZD 2-6	File Storage	360	360	-	-	
ZD 2-7	Probate	250	300	50	+20%	
ZD 3-8	East Offices	490	490	-	-	
ZD 3-9	Central Offices	400	400	-	-	
ZD 3-10	Lobby	450	450	-	-	
ZD 3-11	2nd Floor Storage	265	265	-	-	
ZD 4-12	Judges' Offices	360	150	(210)	-58%	
ZD 4-13	Courtroom #1	490	100	(390)	-80%	
ZD 4-14	North Offices	285	150	(135)	-47%	
ZD 4-15	Central Offices	250	150	(100)	-40%	

It is likely that these minimum settings were revised to address comfort complaints, from overheating or overcooling when space temperatures are satisfied. However, a major reduction in the minimum occupied airflow also reduces ventilation air. Tighe & Bond strongly recommends resetting these minimums to the design values, and addressing comfort complaints in a manner that does not reduce ventilation air.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

RE-1: Test existing rooftop unit dampers and actuators for proper operation.

Repair or replace dampers and actuators that are not functioning properly.

2.4 Control System Recommendations

We recommend the following for the control system:

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

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 Hampshire Probate and Family Court 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 high occupancy in the areas below, we recommend the use of portable HEPA filters or similar air purification approaches if these areas are to be occupied in the near term. While all spaces benefit from additional air filtration, this measure is likely not necessary for single occupant offices.

- Courtroom #1
- Probate Workstations 107
- Judges' Workstations 156
- Conference Rm. 125

- Courtroom #2
- Probation Workstations 122
- Conference Rm. 118
- Lobby 101

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

Tighe & Bond has no other recommendations for this facility at this time.

2.8 Hampshire Probate and Family Court Recommendations Checklist

Recommended Immediate Actions

1.
□ Reset all zone damper minimum airflows based on code minimum ventilation

Recommended Actions

- 2.
 □ RF-1: Continue to use MERV-13 filters
- 3. □ RF-3: Install a differential pressure sensor across filter banks
- 4.
 □ RF-3a: Connect filter pressure sensor to BMS
- 5. ✓ RTB-1: Test and balance air handling unit airflow rates
- 6. □ RTB-4: Test and balance zone damper airflow rates
- 7. □ RE-1: Test rooftop unit dampers and actuators for proper operation
- 8.
 □ RC-1: Implement pre-occupancy flush sequence
- 9.
 □ RC-4: Confirm economizer control sequence is operational
- 10. □ RFC-1: Install portable HEPA filters

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 and Balancing Co. visited the Hampshire Probate Courthouse on February 28 to March 2, 2022 to test the airflow rates of the air handling units and exhaust fans. Summaries of the tested airflow rates versus the design airflow rates are shown below in Tables 6 and 7. The full testing and balancing report is attached.

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)			
RTU-1	4,900	1,100	3,800	5,201	1,102	4,099			
RTU-2	4,300	1,000	3,300	4,407	1,038	3,369			
RTU-3	5,200	1,100	4,100	5,355	1,111	4,244			
RTU-4	4,800	1,100	3,700	4,696	1,165	3,531			

TABLE 6

TABLE 7

Exhaust Fan Testing & Balancing Results							
		Design Return/Exhaust Airflow	Actual Return/Exhaust Airflow				
Unit	Serving	(CFM)	(CFM)				
EF-2	Toilet Rooms	400	636				
EF-3	Toilet Rooms and Holding Cells	700	639				

Typical balancing tolerance for air systems is $\pm 10\%$ of the design airflow. In reviewing the airflow report data, the following should be noted:

- 1. RTUs 1-4 are performing within the acceptable airflow range.
- Toilet exhaust fan EF-2 is performing outside the acceptable range, roughly 60% greater than design airflow. This unit serves six toilet rooms with one or two fixtures each. Two of these rooms, 113 and 118, have more than double the design flow. We recommend reducing the exhaust airflow down closer to the design rate of 400 CFM.
- 3. Two rooms served by EF-3, Holding Cells 142 and 144, are receiving 50% to 60% less than design exhaust airflow. Toilet Rooms 147 and 148 are running at 16% to 18% over design values. We recommend rebalancing the system to bring the holding cells up to the acceptable range.



Hampshire Probate Court HVAC Survey

* * * *

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

February 28th, 2022

94 North Branford Road • Suite One • Branford, CT 06405 (203) 481-4988 • Fax (203) 488-5634 • wings@wingstesting.com



February 28th, 2022

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

Re: Hampshire Probate Court / HVAC Ventilation Study

Dear Jason,

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

Initial Observations:

Heating is electric reheat and cooling is DX.

Testing Observations:

- EF-2 is over its design of 400 CFM. This fan is direct drive with no speed control.
- The RTU control static pressures are the following:
 - RTU-1 = 1.20"wg
 - RTU-2 = 0.75"wg
 - RTU-3 = 1.0"wg
 - RTU-4 = 1.20"wg

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



94 North Branford Road • Suite One • Branford, CT 06405 (203) 481-4988 • Fax (203) 488-5634 • wings@wingstesting.com

			S	UPPLY FA	AN REPOI	RT			
PROJECT:	Hamps	hire Probate	e Court					DATE:	2/28/22
AREA SERVED	: RTU-1,	, RTU-2, RTU-3						TECH: BS	
				FAN	DATA				
FAN NUM	BER	RT	U-1	RT	U-2	RT	U-3	RT	U-4
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MANUFACT	URER	Car	rier	Car	rier	Car	rier	Car	rier
MODEL OR	SIZE	48HC	EG14B	48HC	EG14B	48HC	EG14B	48HC	EG14B
		DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
TOTAL C	FM	4900	5201	4300	4407	5200	5355	4800	4696
RETURN	AIR	3800	4099	3300	3369	4100	4244	3700	3531
OUTSIDE	AIR	1100	1102	1000	1038	1100	1111	1100	1165
DISCH. ST	ATIC		+1.63"		+1.15"		+1.11"		+1.09
SUCTION ST	ΓΑΤΙΟ		-0.89"		-0.75"		-0.72"		-0.67
TOTAL ST	ATIC		2.52"		1.90"		1.83"		1.76
FAN RP	M	ND	944	ND	816	ND	949	ND	870
PULLEY C).D.	11.5" x	1 3/16	11.5" ×	1 3/16	11.5" >	1 3/16	11.5">	13/16
ESP		2.	19	1.	62	1.	57	1.	43
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MOTOR F	RPM	1755	1755	1755	1755	1755	1755	1755	1755
VOLTAGE	/ PH.	208/3	208/3	208/3	208/3	208/3	208/3	208/3	208/3
	LEG 1	12.6	11.8	12.6	11.2	12.6	12.0	12.6	11.5
AMPS	LEG 2		11.9		11.1		12.1		11.4
	LEG 3		11.8		11.0		12.1		11.5
SHEAVE C	D.D.	6.5" x	1 1/8	6.5" x	1 1/8	6.5" x	1 1/8	6.5">	11/8
BELTS - QTY	/ SIZE	1/B	X67	1/B	X67	1/B	X67	1/B	X67
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AND PROPERTY				REM	IARKS				

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



PROJECT: Hampshire Probate Court DATE: 2/26/22 AREA SERVED: RTUS CENT. STAT. PRM CFM PRES." FM CFM NC RTAVERSE DUCT SIZE " AREA SQ.FT. FPM CFM PRESS." FPM CFM NC RTUT AREA SQ.FT. FPM CFM PRESS." FPM CFM NC O.A. 50" x 26" 9.03 1000 w/ Velgrid 122 1102 1002 4099 409 409 <th></th> <th></th> <th>VELOCITY F</th> <th>PRESSU</th> <th>RE REA</th> <th>DINGS</th> <th></th> <th></th> <th></th>			VELOCITY F	PRESSU	RE REA	DINGS			
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LOCATIONS DUCT SIZE " AREA SQ.FT. FPM CFM PRESS." FPM CFM NC RTU-1	TRAVERSE			DES	SIGN	CENT. STAT.	TE	ST	
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Total 50" x 26" 9.03 4900 w/ Velgrid 122 1102 Return 380 Calculated 100 Return 380 Calculated 100 RTU-2 380 w/ Velgrid 488 4407 O.A. 50" x 26" 9.03 4300 w/ Velgrid 488 4407 O.A. 50" x 26" 9.03 1000 w/ Velgrid 115 1038 Return 3300 Calculated Total 50" x 26" 9.03 1100 w/ Velgrid 593 5355 O.A. 50" x 26" 9.03 1100 w/ Velgrid 123 1111 Return 4100 Calculated 4244 4244 RTU-4 4800 w/ Velgrid 129 1165 Return	RTU-1								
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PROJECT: Hampshire Probate Court DATE: 2/27/22 AREA SERVED: F-2 and EF-3 TECH: BS FAN NUMBER EF-2 EF-2 EF-3 LOCATION Roof Roof Roof AREA SERVED Restrooms Restrooms Restrooms MANUFACTURER Cook Cook Cook TOTAL CFM DESIGN 400 700 ACTUAL G36 (1) 639 D COTAL CFM DESIGN DD DD PULEY O.D. DD DD DD VULEY O.D. DD DD DD SERVICE NA NA NA MOTOR DATA MOTOR DATA MOTOR DATA MOTOR RPM DESIGN 1/4 1/4 MOTOR RPM DESIGN 1/4 1/4 MOTOR RPM 1725 1725 OUTAGE/PHASE MOTOR RPM 3.4 3.4 ACT. LEG 1 3.0 ACT. LEG 2 SHEAVE			Enthosith	IN NEFORT		
AREA SERVED: EF-2 and EF-3 TECH: BS FAN NUMBER EF-2 EF-3	PROJECT:	Hampshire Proba	te Court	DATE: 2/27/22		
FAN NUMBER EF-2 EF-3 LOCATION Roof Roof Roof AREA SERVED Restrooms Restrooms Restrooms MANUFACTURER Cook Cook Cook MODEL OR SIZE 1405H756 1405H756 1405H756 TOTAL CFM DESIGN 400 700 ACTUAL 636 (1) 639 639 FAN RPM DESIGN DD DD PULLEY O.D. DD DD SERVICE NA NA NA MANUFACTURER Cook Cook MANUFACTURER Cook Cook MOTOR DATA MANUFACTURER Cook MOTOR RPM 1725 1725 MOTOR RPM 1725 1725 MOTOR RPM 3.4 3.4 ACT. LEG 1 3.0 3.0 ACT. LEG 3	AREA SERVED:	EF-2 and EF-3		TECH: BS		
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MANUFACTURER Cook Cook MODEL OR SIZE 1405H756 1405H756 TOTAL CFM DESIGN 400 700 ACTUAL 636 (1) 639	AREA SE	RVED	Restrooms	Restrooms		
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TOTAL CFM DESIGN 400 700 FAN RPM DESIGN DD DD ACTUAL DD DD DD PULLEY O.D. DD DD DD SERVICE NA NA NA NA MANUFACTURE Cook Cook Cook MANUFACTURER Cook Cook Cook MOTOR HP DESIGN 1/4 1/4 MOTOR RPM 1725 1725 VOLTAGE/PHASE MOTOR AMPS ACT. LEG 1 3.0 3.0 ACT. LEG 2 SHEAVE DD DD DD BELTS - QUANTITY/SIZE DD DD DD SHEAVE POSITION DD DD DD	MODEL	DR SIZE	140SH756	140SH756		
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MOTOR RPM 1725 1725 VOLTAGE/PHASE 115/1 115/1 MOTOR AMPS DESIGN 3.4 3.4 ACT. LEG 1 3.0 3.0 3.0 ACT. LEG 2 ACT. LEG 3 SHEAVE DD DD BELTS - QUANTITY/SIZE DD DD SHEAVE POSITION DD DD MOTOR MOD DD REMARKS Control of the state of the speed controller. REMARKS	MOTOR HP		1/4	1/4		
Interview Interview <thinterview< th=""> Interview <th< td=""><td>MOTOR</td><td>RPM</td><td>1725</td><td>1725</td><td></td></th<></thinterview<>	MOTOR	RPM	1725	1725		
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ACT. LEG 2 ACT. LEG 3 SHEAVE DD BELTS - QUANTITY/SIZE DD SHEAVE POSITION DD SHEAVE POSITION DD Image: Control of the speed control ler.		ACT. LEG 1	5.0	5.0		
Image: New Year of the speed controller. Image: New Year of the speed controller.		ACT. LEG 2				
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Image: Controller.	SHEAVE P	USITION	DD	DD		
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Image: Controller in the speed controller.						
REMARKS (1) This fan is direct drive with no speed controller.			er en skielen in er en skie			
(1) This fan is direct drive with no speed controller.						
(1) This fan is direct drive with no speed controller.						
REMARKS (1) This fan is direct drive with no speed controller.						
(1) This fan is direct drive with no speed controller.						
(1) This fan is direct drive with no speed controller.			REMA	RKS		
	(1) This fan is dire	ct drive with no sp	eed controller.			

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

PROJECT:HampshiSYSTEM / AREA:ExhaustLOCATIONNO.EF-2Toilet 1131Toilet 1112Toilet 1112Toilet 1123Toilet 1144Toilet 1185Toilet 1185Toilet 1186EF-3Toilet 1541Toilet 1552JC 1533Toilet 1484Toilet 1475Drug Test 1446Toilet 1278Cell 14210	ire Probate Fans SIZE 10" × 10" 16" × 16" 16" × 16" 10" × 10" 8" × 8" 10" × 10" 10" × 10"	Court A K FH FH FH FH 0.83 FH 0.83 FH FH FH FH FH FH FH	DES FPM	IGN CFM 50 100 50 50 50 50 50 50 50 50 50 50	TE FPM	ST CFM 106 147 149 83 106 45 636 48 48	DATE: TECH: FIN FPM	2/28/22 BS VAL CFM	NOTES
SYSTEM / AREA: Exhaust LOCATION NO. EF-2	Fans SIZE 10" × 10" 16" × 16" 16" × 16" 10" × 10" 8" × 8" 10" × 10" 10" × 10"	A K FH FH FH FH 0.83 FH FH FH FH FH FH FH	DES FPM	IGN CFM 50 100 100 50 50 <u>50</u> 400 50 50 50 50 50 50	TE FPM	ST CFM 106 147 149 83 106 <u>45</u> 636 48 48 48	TECH: FIN FPM	BS IAL CFM	NOTES
LOCATION NO. EF-2 Toilet 113 1 Toilet 111 2 Toilet 111 2 Toilet 111 2 Toilet 112 3 Toilet 114 4 Toilet 118 5 Toilet 121 6 Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 147 5 Drug Test 144 6 Toilet 127 8 Cell 144 9	SIZE 10" × 10" 16" × 16" 16" × 16" 10" × 10" 8" × 8" 10" × 10" 10" × 10"	A K FH FH FH FH 0.83 FH 0.83 FH FH FH FH FH FH FH	DES FPM	IGN CFM 50 100 100 50 50 50 400 50 50 50 50	TE FPM	ST CFM 106 147 149 83 106 <u>45</u> 636 48 48	FPM		NOTES
LOCATION NO. EF-2 Toilet 113 1 Toilet 111 2 Toilet 112 3 Toilet 114 4 Toilet 118 5 Toilet 118 5 Toilet 118 5 Toilet 118 5 Toilet 121 6 EF-3 Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 147 5 Drug Test 144 6 Toilet 127 8 Cell 144 9 Cell 142 10	SIZE 10" × 10" 16" × 16" 16" × 16" 10" × 10" 8" × 8" 10" × 10" 10" × 10"	A K FH FH FH 0.83 FH 0.83 FH FH FH FH FH FH FH	FPM	CFM 50 100 50 50 50 50 400 50 50 50 50	FPM	CFM 106 147 149 83 106 <u>45</u> 636 	FPM	CFM	NOTES
EF-2 Toilet 113 1 Toilet 111 2 Toilet 112 3 Toilet 114 4 Toilet 118 5 Toilet 118 5 Toilet 112 6 Toilet 114 4 Toilet 114 4 Toilet 114 4 Toilet 118 5 Toilet 121 6 EF-3	10" x 10" 16" x 16" 16" x 16" 10" x 10" 8" x 8" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH FH 0.83 FH FH FH FH FH FH FH	 60 	50 100 50 50 50 400 50 50 50 50 50	 128 	106 147 149 83 106 <u>45</u> 636 48 48			
Toilet 113 1 Toilet 111 2 Toilet 112 3 Toilet 114 4 Toilet 114 4 Toilet 118 5 Toilet 118 5 Toilet 121 6 EF-3	10" x 10" 16" x 16" 16" x 16" 10" x 10" 8" x 8" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 16" x 10" 10" x 10"	FH FH FH 0.83 FH 0.83 FH FH	 60 	50 100 50 50 <u>50</u> 400 50 50 50	 128 	106 147 149 83 106 <u>45</u> 636 			
Toilet 111 2 Toilet 112 3 Toilet 114 4 Toilet 118 5 Toilet 118 5 Toilet 121 6 EF-3	16" x 16" 16" x 16" 10" x 10" 8" x 8" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH 0.83 FH 0.84 FH FH	 60 	100 100 50 50 400 50 50 50 50	 128 	147 149 83 106 <u>45</u> 636 			
Toilet 112 3 Toilet 114 4 Toilet 118 5 Toilet 118 5 Toilet 121 6 EF-3 Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 127 8 Cell 144 9 Cell 142 10	16" x 16" 10" x 10" 8" x 8" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH 0.83 FH	 60 	100 50 50 400 50 50 50 50	 128 	149 83 106 45 636 48 48			
Toilet 114 4 Toilet 118 5 Toilet 121 6 EF-3 - Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 127 8 Cell 142 10	10" x 10" 8" x 8" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 16" x 10" 10" x 10" 10" x 10"	FH 0.83 FH	 60 	50 50 <u>50</u> 400 50 50 50	 128 	83 106 <u>45</u> 636 48 48			
Toilet 118 5 Toilet 121 6 EF-3 - Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 142 10	8" x 8" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	0.83 FH FH FH FH FH FH FH	60 	50 <u>50</u> 400 50 50 50	128 	106 <u>45</u> 636 			
Toilet 121 6 EF-3 Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 142 10	10" x 10" 10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH FH FH FH FH FH		<u>50</u> 400 50 50 50		<u>45</u> 636 48 48			
EF-3 Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH FH FH FH		400 50 50 50		636 48 48			
EF-3 Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 142 10	10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH FH FH FH		50 50 50		48			
Toilet 154 1 Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	10" x 10" 10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH FH FH FH		50 50 50		48 48			
Toilet 155 2 JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	10" x 10" 10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH FH FH		50 50 50		48			1
JC 153 3 Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	10" x 10" 16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH FH		50		10			
Toilet 148 4 Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	16" x 16" 16" x 16" 10" x 10" 10" x 10"	FH FH		50		51			
Toilet 147 5 Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	16" x 16" 10" x 10" 10" x 10"	FH	and the second se	100		118			
Drug Test 144 6 Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	10" x 10" 10" x 10"			100		116			
Toilet 126 7 Toilet 127 8 Cell 144 9 Cell 142 10	10" x 10"	FH		50		46			
Toilet 127 8 Cell 144 9 Cell 142 10		FH		50		53			
Cell 144 9	10" x 10"	FH		50		46			
Cell 142 10	8" x 8"	FH		75		38			
	8" x 8"	FH		75		31			
Storage 132 11	10" x 10"	FH		50		44			
				700		639			
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				ANKJ					