



**Orange District Court  
Orange, MA**

# **HVAC SYSTEM EVALUATIONS COVID-19**

Office of Court Management

July 18, 2022

# Section 1

## Existing Conditions & Site Observations

Tighe & Bond visited the Orange District Courthouse on February 18, 2021. While on site we inspected the air handling equipment located on the roof and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

### Site Visit Attendees:

- *Ownership:*
  - Matt McDonough – Building Owner
  - Ted Paul – HVAC Technician
- *Tighe & Bond*
  - Sean Pringle, PE, Mechanical Engineer
  - Tim Bill, Staff Mechanical Engineer

UPDATE: Wings Testing and Balancing visited the Orange District Courthouse on April 8th, 2022 to conduct initial testing and balancing activities, and to confirm which rooms were served by which fan coil unit. This report includes updated tables and recommendations based on the findings from that visit.

### 1.1 Existing Ventilation System

The Orange District Courthouse building was constructed around 1900 and underwent major renovations in 2000 to prepare the building for use as a courthouse. The Courthouse is approximately 22,000 square feet in size. While most of the building is leased by the state for use as a courthouse, the first floor of the building is not part of the courthouse and is occupied by several commercial tenants.

Two rooftop energy recovery ventilators (ERV's) provide all ventilation air to, and all exhaust air from the building. Each ERV unit serves roughly half of the building. The units contain 2" MERV 10 supply and exhaust filters, a supply fan, exhaust fan, and a total energy recovery (enthalpy) heat exchanger core. The south ERV unit is not operational, as the heat exchanger is damaged from a failed belt. Damage to other sections of the heat exchanger from previous belt failures was also visible, and it appeared that the three sections had been repositioned over time. Aside from the damaged heat exchanger in the south ERV, the units are in fair condition. According to the Owner, parts were on order to repair the damaged unit. A DX cooling coil and a hot water coil are located in the downstream supply air ducts to keep the outdoor air within a comfortable temperature range. According to the technician, the hot water coil serving the north ERV had burst as a result of freezing and was not operable.

Eleven fan coil units (FCU) serve the building. FCU's 3 and 4 serve the first floor commercial tenants, and the remaining nine units serve areas occupied by the courts. The two ERV's provide outdoor air to the return air ducts of the FCU's. All FCU's are mounted above drop ceilings in occupied areas.

Due to the locations of the units in the ceilings and difficulty of access, only FCU-7 was observed at the time of our site visit. The unit is in fair condition and is assumed to represent the condition of the remaining FCU's. Each FCU contains 2" MERV 10 filters, a DX cooling coil, a hot water heating coil, and supply fan.

In several areas on the third and fourth floors, the HVAC technician noted that some rooms historically had issues with poor temperature control relative to the rest of the zone served by the associated fan coil. In response, thermostatically controlled dampers were added to automatically shut off airflow to a portion of the diffusers in those rooms when those spaces were overheated or overcooled.

The lockup area is served by FCU-1. Supply air is provided to each cell and the corridor. Air is exhausted from each cell through the north ERV. At the time of the visit, the supply and exhaust airflows seemed weak, indicating a possible balancing issue.

A 1.4 million BTU/h hot water boiler plant provides hot water to the fan coils and duct mounted coils. Rooftop condensing units serve the DX cooling coils in the FCU's and ERV supply ducts. There is one condensing unit for each indoor evaporator coil.

The available drawings for this building have limited information concerning the HVAC system. The ERV outdoor air and exhaust ductwork is shown, but the supply air ductwork between the FCU's and the diffusers are not shown. The individual diffuser airflows are shown. The limited drawing data prevented us from identifying which rooms were served by each FCU. As a result of the April 8<sup>th</sup>, 2022 testing and balancing activities, we were able to determine which rooms were served by each FCU. Additionally, the ERV total airflow and outdoor airflow to each FCU unit was not indicated. The HVAC technician indicated that at some point in the past, the ERV's were balanced to 2,500 CFM each, which is consistent with the capacity tables in the manufacturer's literature. Any airflows indicated in this report for the ERV's and outdoor airflows for specific areas are estimated based on assumed FCU zoning and outdoor air duct sizes. Further engineering review is recommended. Refer to Section 2.7.2.

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

<b>Unit</b>	<b>Original Design Airflow (CFM)</b>	<b>Original Design Min. O.A. (CFM)</b>	<b>Pre/Final Filters</b>	<b>Condition</b>
ERV-N	2,500 (estimated)	2,500 (estimated)	2" MERV 10	Fair
ERV-S	2,500 (estimated)	2,500 (estimated)	2" MERV 10	Fair
FCU's 1-11	Unknown	Unknown	2" MERV 10	Fair



Photo 1 – Typical ERV

## 1.2 Existing Control System

The courthouse uses local electronic controls to control the existing HVAC air handling equipment. While some of the FCU zone thermostats are mechanical, these have mostly been replaced with programmable thermostats that include occupancy schedules. The ERV and associated heating and cooling coils use standalone local controls for scheduling and to maintain the target supply temperature.

The automatic control dampers that have been added in some areas use pneumatic actuators connected to a local control panel with integral air pump/compressor. According to the HVAC technician, there is no Building Management System (BMS) at this site.

## Section 2

# Recommendations

Below is a list of recommendations for the Orange District Courthouse. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

### 2.1 Filtration Efficiency Recommendations

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

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

The TAB Contractor and/or Engineer shall verify that the ERV's and FCU's can accommodate MERV-13 filters 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.

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

This measure is only recommended for the ERV's.

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

Provide an alarm in an area where facilities staff are likely to notice. The 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.

Alarm setpoints for each bank of filters should be reviewed, to ensure they are consistent with the filter manufacturer's recommendation.

### 2.2 Testing & Balancing Recommendations

The fan coils and ERV's are approximately 20 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)
ERV-N	2,500 (estimated)	2,500 (estimated)	2,300	2,300
ERV-S	2,500 (estimated)	2,500 (estimated)	2,400	2,400
FCU-1 (G-Lockup)	1,960*	Unknown	418	420
FCU-2 (G-South)	1,000*	Unknown	294	300
FCU-3 (1-Retail North)	2,040*	Unknown	248	250
FCU-4 (1-Retail South)	1,250*	Unknown	184	200
FCU-5 (3-North, Courtroom 321)	1,875*	Unknown	789	800
FCU-6 (2-North)	2,365*	Unknown	381	400
FCU-7 (2-South)	2,505*	Unknown	240	250
FCU-8 (3-South)	2,245*	Unknown	482	500
FCU-9 (4-Northeast, Courtroom 414)	1,865*	Unknown	849	850
FCU-10 (4-Southeast)	1,155*	Unknown	213	225
FCU-11 (4-West)	1,665*	Unknown	423	425

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.

\*Original supply airflow is based on the sum of room supply airflows shown on existing drawings.

During their April 8, 2022 visit, the TAB contractor was able to determine which spaces each FCU serves. The recommended minimum outdoor airflow for each FCU is based on the ASHRAE occupancy and ventilation rates for the spaces served by the unit.

The FCU's serving courtrooms appear to be served by outdoor air ductwork that is too small to provide the recommended minimum outdoor airflow. To obtain recommended outdoor airflows for these spaces, these portions of ductwork will need to be replaced. Refer to Other Recommendations in Section 2.7.6.

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 overall 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. Due to the limited data on the available drawings, all values are estimated.

**TABLE 3**  
Average Airflow Rate per Person - ESTIMATED

	<i><b>All spaces</b></i>	<i><b>Courtrooms</b></i>	<i><b>Non-Courtroom Spaces</b></i>
Total Occupancy (People)	279	150	129
Total Supply Air (CFM/Person)	60	22	104
Outdoor Air (CFM/Person)	15	10	21

The airflow rate per person for each Courtroom and the Jury Pool Room is shown below in Table 4. These values are based on full occupancy without taking diversity into account, the original 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. Due to the limited data on the available drawings, all values are estimated.

**TABLE 4**  
Airflow Rate per Person (Full Occupancy) - ESTIMATED

<i><b>Courtroom</b></i>	<i><b>Total People</b></i>	<i><b>Total Air</b></i>		<i><b>Outdoor Air</b></i>	
		<i><b>Supply Airflow (CFM)</b></i>	<i><b>Airflow Rate (CFM/Person)</b></i>	<i><b>Outdoor Airflow (CFM)</b></i>	<i><b>Airflow Rate (CFM/Person)</b></i>
Jury Pool Room	27	615	23	160	6
Courtroom 321	98	1,425	15	600	6
Courtroom 414	116	1,865	16	850	7

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. Due to the limited data on the available drawings, all values are estimated.

**TABLE 4a**

Airflow Rate per Person (Reduced Occupancy) - ESTIMATED

<i>Courtroom</i>	<i>Total People</i>	<i>Total Air</i>		<i>Outdoor Air</i>	
		<i>Supply Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>	<i>Outdoor Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>
Jury Pool Room	14	615	44	160	11
Courtroom 321	27	1,425	53	600	22
Courtroom 414	26	1,865	72	850	33

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, control room, Courtrooms, Jury Pool room, and other densely occupied areas as a minimum. During the site visit, the airflow in the lockup areas appeared to be weak compared to other exhaust and supply openings in the building. If other 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. Prior to rebalancing the building, we recommend verifying the boiler plant is maintaining the correct supply water temperature, and the condensers serving the DX coils are operating properly. Incorrect water or refrigerant temperature may be contributing to the temperature control complaints instead of a lack of airflow.

**RTB-6:** *Test and balance all DX and hot water coils.*

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

Confirm each condenser is operating correctly to ensure the DX coil is receiving the correct refrigerant temperature.

## 2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

**RE-1:** *Test existing ERV dampers and actuators for proper operation.*

Replace dampers and actuators that are not functioning properly.

**RE-2:** *Clean heating and cooling coils and drain pans.***RE-5:** *Install freeze stat or confirm the existing freeze stat is working correctly on each air handling unit.*



One of the duct-mounted hot water coils downstream of the ERV had failed as a result of freezing and was not operating at the time of the visit. Verify that freeze stats are installed on both hot water coils in the supply ducts and wired to shut down the ERV's when freezing conditions occur at the coil. If freeze stats are not present, they should be installed.

**RE-7:** *Test the existing hot water control valves and actuators for proper operation.*

## 2.4 Control System Recommendations

We recommend the following for the control system:

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

This can likely be implemented with the existing programmable thermostats and ERV timer. To allow this feature to be used on the remaining zones, the remaining mechanical thermostats should be replaced with programmable units.

## 2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

**RFC-1:** *Install portable HEPA filters.*

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

## 2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of 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 Repair ERV's

As the ERV's are the sole source of outdoor air and ventilation to the building, it is important that these are well maintained. The damaged heat exchanger cores in the south ERV should be replaced. As it appears that belt failures have caused repeated damage to the cores, the pulleys should be carefully aligned, and fixed sheaves should be installed. If a root cause to the belt failures cannot be identified, consider installing a metal belt guard to prevent future damage to the cores.

The hot water coil in the north ERV supply duct should also be replaced or repaired. Ensure the freeze stat for the coil is in place and operational.

### 2.7.2 Disable Zone Dampers

During the Pandemic, we recommend that all zone dampers be disabled and kept open, to ensure all areas receive full ventilation. After the pandemic has passed these may be used, if the code-required outdoor air can be provided at the minimum airflow. Refer to Section 2.7.3 and 2.7.4.

### 2.7.3 Document As-Built Conditions and Recalculate Outdoor Air Requirements

As discussed in Section 1, the existing drawings do not indicate the fan coil duct routing or outdoor air flows to each FCU. We recommend investigating the current arrangement and developing as-built drawings confirming which FCU's serve which spaces, any revised register locations, and the locations of the added automatic dampers and associated registers. Once this is documented, revised total outdoor airflows and outdoor airflow to each FCU should be calculated by an engineer.

Update: During the April 8, 2022 balancing activities, the rooms that each FCU served were identified. Based on this information, recommended outdoor airflows were established and added to Table 2.

As-built supply air distribution and the effect of the automatic zone dampers was not assessed.

### 2.7.4 Rezone FCU's

Where dampers have been added to prevent overheating and overcooling, consider rezoning these areas with smaller FCU's or similar heating and cooling equipment to provide more accurate temperature control and eliminate the need to reduce airflow to individual spaces. If the investigation in 2.7.2 identifies spaces that are not receiving adequate ventilation at the reduced airflow when the dampers are closed, then this measure should be implemented to provide the outdoor air required by code.

If the investigation shows that adequate outdoor air can be provided with the existing arrangement, then this recommendation is primarily a comfort measure and does not affect the indoor air quality of the building.

### 2.7.5 Install a Building Management System

We recommend replacing the existing local controls with a building management system to control and monitor HVAC equipment. The use of a building management system would

allow for remote monitoring and trending of equipment and space conditions, and provide a central control point, simplifying scheduling and troubleshooting. This recommendation is an energy saving and maintenance measure and does not affect the indoor air quality of the building.

#### **2.7.6 Modify Outdoor Air Ductwork**

We recommend replacing the outdoor air ductwork for the FCU's serving the courtrooms to allow for the code required outdoor airflow rate to be delivered to the spaces served by these units. The ductwork currently serving these units is not large enough to provide the code required outdoor air.

## Section 3 Testing & Balancing Results

Wings Testing and Balancing visited the Orange District Courthouse on April 8th, 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 balancing report also contains the water flow rate testing results of the FCU hot water coils, which can be found in Table 7. The full testing and balancing report is attached.

**TABLE 5**  
Air Handler Airflow Testing & Balancing Results

Unit	Design			Actual		
	Total Supply Fan Airflow (CFM)	Recommended Outdoor Airflow (CFM)	Return Airflow (CFM)	Supply Fan Airflow (CFM)	Outdoor Airflow (CFM)	Return Airflow (CFM)
ERV-N	2,500	2,500	2,500	1,648	1,648	1,620
ERV-S	2,500	2,500	2,500	1,637	1,637	1,510
FCU-1	1,960*	420	1,540	1,541	520	1,021
FCU-2	1,000*	300	700	770	217	553
FCU-3	2,040*	250	1,790	2,343	372	1,971
FCU-4	1,250*	250	1,000	3,271	294	2,977
FCU-5	1,875*	790	1,085	2,584	419	2,164
FCU-6	2,365*	400	1,965	3,230	255	2,975
FCU-7	2,505*	240	2,265	2,630	245	2,385
FCU-8	2,245*	500	1,745	3,602	374	3,228
FCU-9	1,865*	850	1,015	1,633	100	1,533
FCU-10	1,155*	225	930	776	116	660
FCU-11	1,665*	425	1,240	1,489	122	1,367

\*Total Design Supply Fan Airflow is based on the sum of room supply airflows shown on existing drawings.

**TABLE 6**  
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Exhaust Airflow (CFM)	Actual Exhaust Airflow (CFM)
ERV-N	Restrooms & Cells	2,250*	1,620
ERV-S	Restrooms & Lockers	2,250*	1,510

\*Design Exhaust Airflow is based on the sum of room exhaust airflows shown on existing drawings.

**TABLE 7**  
Air Handler Waterflow Testing & Balancing Results

Unit	Design	Actual
	Hot Water Flow Rate (GPM)	Hot Water Flow Rate (GPM)
FCU-1	Unknown	7.9
FCU-2	Unknown	5.1
FCU-3	Unknown	8.7
FCU-4	Unknown	12.2
FCU-5	Unknown	8.3
FCU-6	Unknown	12.7
FCU-7	Unknown	13.2
FCU-8	Unknown	11.7
FCU-9	Unknown	6.6
FCU-10	Unknown	7.6
FCU-11	Unknown	6.1

The 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. ERV-N & S are not performing within the acceptable airflow range. Both units are operating at 64% of the recommended supply airflow. ERV-N is operating at 71% of the design airflow and ERV-S is operating at 67% of the design airflow.
  - a. We recommend rebalancing the ERV supply and FCU outdoor airflows to the recommended values and rebalancing the ERV exhaust and all exhaust air opening airflows to meet the design values.
2. FCU-2 & 10 are operating below the design supply airflow. FCU-5, 6, and 8 are operating well above the design supply airflow.
  - a. It is possible that there were design or room changes that are not reflected on the existing drawings available to us.
  - b. We recommend ensuring that all coils and filters are clean, and that the supply fans are working properly.
  - c. Consider rebalancing all inlets and outlets to meet the original design airflows. If there are areas where the room or supply diffuser configuration differs from the existing drawings, an engineer should establish new design supply airflows.
3. Only FCU-7 has the correct outdoor airflow.

- a. The outdoor airflows for each FCU should be rebalanced to match the recommended outdoor airflows in Table 2.
  - b. Note that FCU-5 and FCU-9 do not have large enough ducts serving the unit to provide the recommended outdoor air in Table 2. Prior to rebalancing, these duct branches should be replaced with new ductwork that is adequate to support the recommended airflow.
4. Due to the lack of hot water flow rate design data for the coils, we cannot comment on the tested water flow rates.
  - a. Wings noted that the hot water coils in the supply ductwork associated with each ERV have been valved off and disconnected in response to frozen coils. If downstream fan coils provide enough heat to maintain adequate comfort without these hot water coils, then this approach may be acceptable. Disabling these coils does not affect the ventilation airflow.
  - b. If comfort complaints arise as a result of the disabled coils, then the coils should be repaired and enabled, to temper ERV supply air. To mitigate freeze risk, we recommend further investigation to discuss viable options. Some options include verifying freeze stats are in place and operational or consider the use of a freeze pump to maintain adequate water flow through the coils whenever the ambient air temperature is below freezing.

## Disclaimer

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

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**WING'S** TESTING & BALANCING CO., INC.

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# **Orange District Court HVAC Ventilation Survey**

\* \* \* \*

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

April 8<sup>th</sup>, 2022



# WING'S TESTING & BALANCING CO., INC.

April 8<sup>th</sup>, 2022

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

Re: Orange District Court HVAC Ventilation Survey

Dear Jason,

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

**Initial Observations:**

- All filters were MERV-10.
- Hot water serving ERVs has been valved off and disconnected.
  - These units no longer receive hot water.
- FCUs 3 and 4 are served by their own pumps.
- All other units are served off the main pump.
- The water loop was read with all units 100% open to heating due to little controls.
  - These readings were taken via ultrasound.

**Testing Observations:**

- All filters are MERV-10 and in good condition.
- The ERVs are no longer served by the hot water loop.
- A print indicating served areas and a list of condenser sizes has been included below for reference.

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,

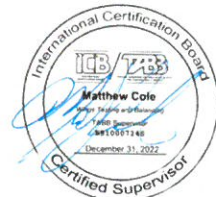
**Wing's Testing & Balancing Co., Inc.**

*ICB Certified Contractor for:*

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

**Barry Stratos**

Certified TABB Technician  
CT SM-2 License 6386  
MA SM-2 13595



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<b>Units</b>	<b>Condenser Size</b>
ERV-1	2 x 5 ton
ERV-2	2 x 5 ton
FCU-1	5 ton
FCU-2	5 ton
FCU-3	7.5 ton
FCU-4	7.5 ton
FCU-5	7.5 ton
FCU-6	7.5 ton
FCU-7	7.5 ton
FCU-8	7.5 ton
FCU-9	5 ton
FCU-10	2 ton
FCU-11	4 ton

**SUPPLY FAN REPORT****PROJECT:** Orange District Court**DATE:** 4/4/22**AREA SERVED:** Various**TECH:** BS**FAN DATA**

FAN NUMBER	ERV-N Supply		ERV-N Exhaust			
LOCATION	Roof		Roof			
AREA SERVED	North Side		North Side			
MANUFACTURER	Renew Aire		Renew Aire			
MODEL OR SIZE	HF900RTJ023515		HF900RTJ023515			
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
TOTAL CFM	2500	1648	2500	1620		
RETURN AIR	0	0	2500	1620		
OUTSIDE AIR	2500	1648	0	0		
DISCH. STATIC	---	+0.61"	---	+0.70"	---	
SUCTION STATIC	---	-0.67"	---	-0.75"	---	
TOTAL STATIC	---	1.28"	---	1.45"		
FAN RPM	---	1121	---	1122		
PULLEY O.D.	6.0" x 1"		6.0" x 1"			
ESP	0.82		0.94			
VFD SPEED	No VFD		No VFD			
O.A.D.MIN POS	100%		0%			

**MOTOR DATA**

MANUFACTURER		Century		Century			
MODEL OR FR.		S184T		S184T			
HORSEPOWER		5	5	5	5		
MOTOR RPM		1745	1745	1745	1745		
VOLTAGE / PH.		208/3	208/3	208/3	208/3		
AMPS	LEG 1	12.8	5.1	12.8	5.0		
	LEG 2	---	5.1	---	4.9	---	
	LEG 3	---	5.2	---	5.0	---	
SHEAVE O.D.		4.0" x 1 1/8"		4.0" x 1 1/8"			
BELTS - QUANTITY / SIZE		1 / B42		1 / B41			
SHEAVE POSITION		Fixed		Fixed			
C to C		14.5		14.0			

**REMARKS**

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

**SUPPLY FAN REPORT****PROJECT:** Orange District Court**DATE:** 4/4/22**AREA SERVED:** Various**TECH:** BS**FAN DATA**

FAN NUMBER	ERV-S Supply		ERV-S Exhaust			
LOCATION	Roof		Roof			
AREA SERVED	South Side		South Side			
MANUFACTURER	Renew Aire		Renew Aire			
MODEL OR SIZE	HF900RTJ023515		HF900RTJ023515			
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
TOTAL CFM	2500	1637	2500	1510		
RETURN AIR	0	0	2500	1510		
OUTSIDE AIR	2500	1637	0	0		
DISCH. STATIC	---	+0.51"	---	+0.91"	---	
SUCTION STATIC	---	-0.55"	---	-0.83"	---	
TOTAL STATIC	---	1.06"	---	1.79"		
FAN RPM	---	1130	---	1116		
PULLEY O.D.	6.0" x 1"		6.0" x 1"			
ESP	0.65		1.27			
VFD SPEED	No VFD		No VFD			
O.A.D.MIN POS	100%		0%			

**MOTOR DATA**

MANUFACTURER	Century		Century			
MODEL OR FR.	S184T		S184T			
HORSEPOWER	5	5	5	5		
MOTOR RPM	1745	1745	1745	1745		
VOLTAGE / PH.	208/3	208/3	208/3	208/3		
AMPS	LEG 1	12.8	4.9	12.8	5.4	
	LEG 2	---	4.8	---	5.4	---
	LEG 3	---	4.8	---	5.6	---
SHEAVE O.D.	4.0" x 1 1/8"		4.0" x 1 1/8"			
BELTS - QUANTITY / SIZE	1 / Bx42		1 / Bx41			
SHEAVE POSITION	Fixed		Fixed			
C to C	14.5		14.0			

**REMARKS**

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

SUPPLY FAN REPORT							
<b>PROJECT:</b> Orange District Court				<b>DATE:</b> 4/5/22			
<b>AREA SERVED:</b> Various				<b>TECH:</b> BS			
FAN DATA							
FAN NUMBER	FCU-1		FCU-2		FCU-3		
LOCATION	Women's Restroom		Ground Floor		Mediation		
AREA SERVED	Lock-Up		Probate		Mediation		
MANUFACTURER	Magic Aire		Snyder General		Snyder General		
MODEL OR SIZE	060DUX-8-3		BYMO-030		B100C3		
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL	
TOTAL CFM	ND	1541	ND	770	ND	2343	
RETURN AIR	ND	1021	ND	553	ND	1971	
OUTSIDE AIR	ND	520	ND	217	ND	372	
DISCH. STATIC	---	+0.35"	---	+0.26"	---	+0.48"	
SUCTION STATIC	---	-0.65"	---	-0.59"	---	-0.49"	
TOTAL STATIC	---	1.00"	---	0.85"	---	0.97"	
FAN RPM	---	DD	---	DD	---	938	
PULLEY O.D.	DD		DD		7.0" x 1"		
ESP	0.51		0.26		0.55		
VFD SPEED	No VFD		No VFD		No VFD		
O.A.D.MIN POS	Open		Open		Open		
MOTOR DATA							
MANUFACTURER		NA		NA		A.O. Smith	
MODEL OR FR.		NA		NA		H56Z	
HORSEPOWER		3/4	3/4	1/3	1/3	1.5	1.5
MOTOR RPM		1075	1075	1075	1075	1725	1725
VOLTAGE / PH.		115/1	115/1	115/1	115/1	203/3	203/3
AMPS	LEG 1	7.0	5.8	3.7	2.4	5.2	4.3
	LEG 2	---	---	---	---	---	4.3
	LEG 3	---	---	---	---	---	4.3
SHEAVE O.D.		DD		DD		4.75" x 3/4"	
BELTS - QUANTITY / SIZE		DD		DD		1 / A42	
SHEAVE POSITION		DD		DD		1/2 Open	
C to C		DD		DD		13.0	
REMARKS							

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

SUPPLY FAN REPORT							
<b>PROJECT:</b> Orange District Court				<b>DATE:</b> 4/6/22			
<b>AREA SERVED:</b> Various				<b>TECH:</b> BS			
FAN DATA							
FAN NUMBER	FCU-4		FCU-5		FCU-6		
LOCATION	Retail Space		Men's Room Ceiling		Clerk's Office		
AREA SERVED	Retail Space		3rd Floor Court		Probation		
MANUFACTURER	Snyder General		Snyder General		Snyder General		
MODEL OR SIZE	B100C3		B100C3		B100C3		
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL	
TOTAL CFM	ND	3271	ND	2584	ND	3230	
RETURN AIR	ND	2977	ND	2165	ND	2975	
OUTSIDE AIR	ND	294	ND	419	ND	255	
DISCH. STATIC	---	+0.37"	---	+0.51"	---	+0.44"	
SUCTION STATIC	---	-0.59"	---	-0.37"	---	-0.48"	
TOTAL STATIC	---	0.96"	---	0.88"	---	0.92"	
FAN RPM	---	966	---	938	---	922	
PULLEY O.D.	7.0" x 1"		7.0" x 1"		6.5" x 1"		
ESP	0.45		0.51		0.55		
VFD SPEED	No VFD		No VFD		No VFD		
O.A.D.MIN POS	Open		Open		Open		
MOTOR DATA							
MANUFACTURER		A.O. Smith		A.O. Smith		A.O. Smith	
MODEL OR FR.		NA		NA		NA	
HORSEPOWER		1.5	1.5	1.5	1.5	1.5	1.5
MOTOR RPM		1725	1725	1725	1725	1725	1725
VOLTAGE / PH.		208/3	208/3	230/3	230/3	230/3	230/3
AMPS	LEG 1	5.6	4.5	5.8	4.1	5.6	3.8
	LEG 2	---	4.5	---	4.1	---	3.8
	LEG 3	---	4.5	---	4.1	---	3.8
SHEAVE O.D.		4.5" x 3/4"		3.75" x 3/4"		4.5" x 7/8"	
BELTS - QUANTITY / SIZE		1 / Ax43		2 / Ax43		1 / Ax42	
SHEAVE POSITION		1/2 Open		Fully Closed		Fully Open	
C to C		13.5		13.5		13.5	
REMARKS							

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

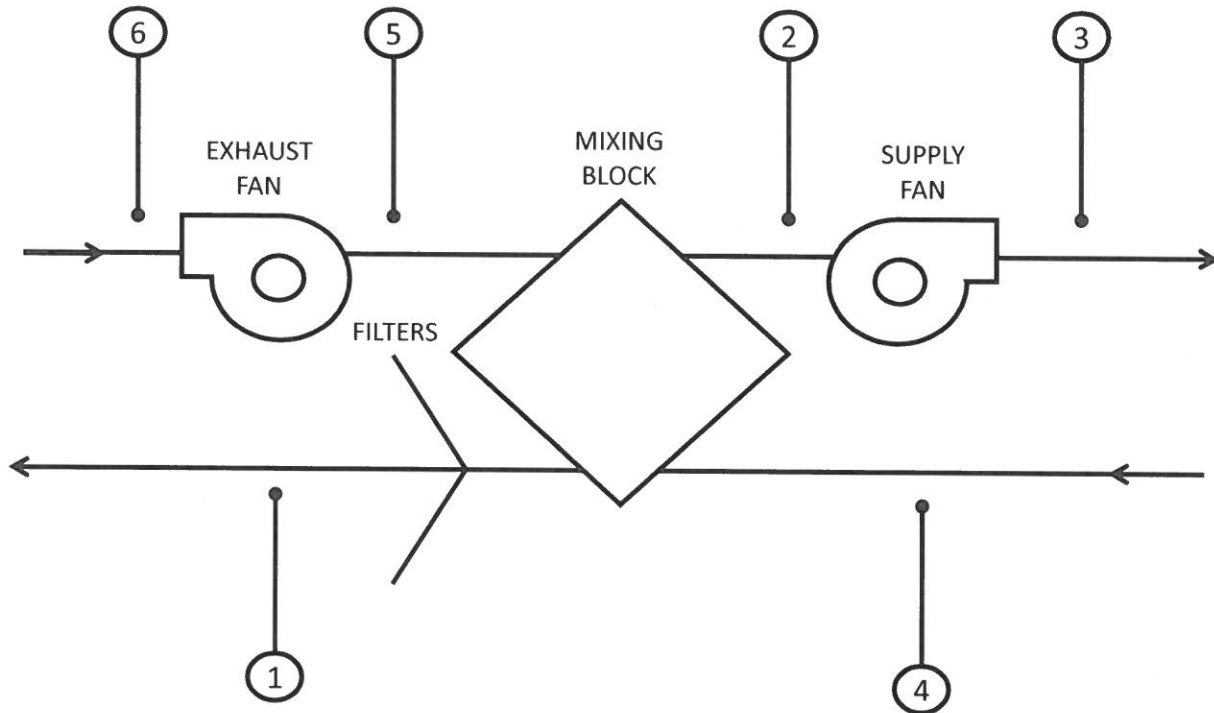
SUPPLY FAN REPORT							
<b>PROJECT:</b>		Orange District Court				<b>DATE:</b> 4/7/22	
<b>AREA SERVED:</b>		Various				<b>TECH:</b> BS	
FAN DATA							
FAN NUMBER	FCU-7		FCU-8		FCU-9		
LOCATION	Clerk's Office		3rd Floor Court Lobby		4th Floor Ceiling		
AREA SERVED	Clerk's Office		3rd Floor Court Lobby		4th Floor Courtroom		
MANUFACTURER	Snyder General		York		Magic Aire		
MODEL OR SIZE	B100C3		K4EU90A33A		060DX034W		
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL	
TOTAL CFM	ND	2630	ND	3602	ND	1633	
RETURN AIR	ND	2385	ND	3228	ND	1533	
OUTSIDE AIR	ND	245	ND	374	ND	100	
DISCH. STATIC	---	+0.51"	---	+0.44"	---	+0.06"	
SUCTION STATIC	---	-0.60"	---	-0.76"	---	-0.75"	
TOTAL STATIC	---	1.11"	---	1.20"	---	0.81"	
FAN RPM	---	981	---	966	DD	DD	
PULLEY O.D.	7.0" x 1"		7.5" x 1"		DD		
ESP	0.56		0.79		0.39		
VFD SPEED	No VFD		No VFD		No VFD		
O.A.D.MIN POS	Open		Open		Open		
MOTOR DATA							
MANUFACTURER		Dayton		A.O. Smith		Evergreen	
MODEL OR FR.		NA		56T		NA	
HORSEPOWER		1.5	1.5	1.5	1.5	1	1
MOTOR RPM		1725	1725	1725	1725	1050	1050
VOLTAGE / PH.		230/3	230/3	208/3	208/3	115/1	115/1
AMPS	LEG 1	8.0	7.8	5.0	4.0	12.8	10.8
	LEG 2	---	7.8	---	4.0	---	---
	LEG 3	---	7.8	---	4.0	---	---
SHEAVE O.D.		4.75" x 5/8"		5.0" x 7/8"		DD	
BELTS - QUANTITY / SIZE		1 / Ax42		1 / Ax36		DD	
SHEAVE POSITION		Fully Open		1/2 Open		DD	
C to C		13.0		11.0		---	
REMARKS							

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

SUPPLY FAN REPORT							
<b>PROJECT:</b>		Orange District Court				<b>DATE:</b> 3/16/22	
<b>AREA SERVED:</b>		Various				<b>TECH:</b> BS	
FAN DATA							
<b>FAN NUMBER</b>	FCU-10			FCU-11			
<b>LOCATION</b>	Attic Space			Attic			
<b>AREA SERVED</b>	D.A.'s Office			Jury Pool			
<b>MANUFACTURER</b>	SunTherm			Magic Chef			
<b>MODEL OR SIZE</b>	H41-46-26A			USA09500			
	<b>DESIGN</b>	<b>ACTUAL</b>	<b>DESIGN</b>	<b>ACTUAL</b>	<b>DESIGN</b>	<b>ACTUAL</b>	
<b>TOTAL CFM</b>	ND	776	ND	1489			
<b>RETURN AIR</b>	ND	660	ND	1367			
<b>OUTSIDE AIR</b>	ND	116	ND	122			
<b>DISCH. STATIC</b>	---	+0.31"	---	+0.18"	---		
<b>SUCTION STATIC</b>	---	-0.39"	---	-0.79"	---		
<b>TOTAL STATIC</b>	---	0.70"	---	0.98"	---		
<b>FAN RPM</b>	DD	DD	DD	DD			
<b>PULLEY O.D.</b>	DD			DD			
<b>ESP</b>	0.48			0.54			
<b>VFD SPEED</b>	No VFD			No VFD			
<b>O.A.D.MIN POS</b>	Open			Open			
MOTOR DATA							
<b>MANUFACTURER</b>		Genteq		A.O. Smith			
<b>MODEL OR FR.</b>		NA		NA			
<b>HORSEPOWER</b>		1/4	1/4	3/4	3/4		
<b>MOTOR RPM</b>		1075	1075	1075	1075		
<b>VOLTAGE / PH.</b>		120/1	120/1	208/1	208/1		
<b>AMPS</b>	<b>LEG 1</b>	2.6	3.2	4.0	3.6		
	<b>LEG 2</b>	---	---	---	---	---	---
	<b>LEG 3</b>	---	---	---	---	---	---
<b>SHEAVE O.D.</b>		DD		DD			
<b>BELTS - QUANTITY / SIZE</b>		DD		DD			
<b>SHEAVE POSITION</b>		DD		DD			
REMARKS							

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



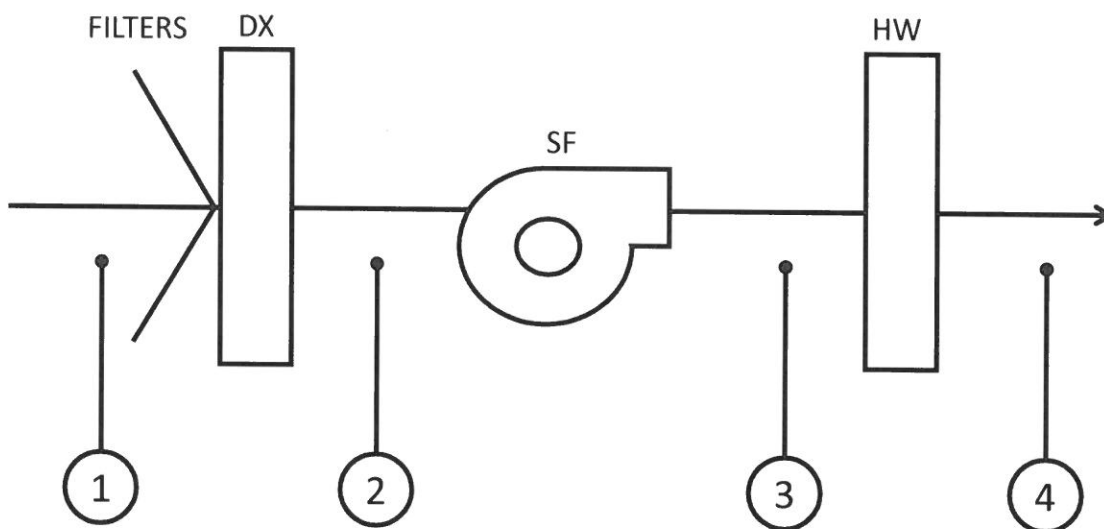
**SYSTEM STATIC PRESSURE PROFILE****PROJECT:** Orange District Court**DATE:** 4/4/22**SYSTEM/AREA:** ERVs**TECH:** BS

UNIT	1	2	3	4	5	6	7	8	NOTES
ERV-N Supply	-0.21"	-0.67"	+0.61"						
ERV-N Exhaust	-0.24"	-0.75"	+0.70"						
ERV-S Supply	-0.14"	-0.55"	+0.51"						
ERV-S Exhaust	-0.36"	-0.83"	+0.91"						

**REMARKS**

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



**SYSTEM STATIC PRESSURE PROFILE****PROJECT:** Orange District Court**DATE:** 4/7/22**SYSTEM/AREA:** FCUs**TECH:** BS

UNIT	1	2	3	4	5	6	7	8	NOTES
FCU-1	-0.16"	-0.65"	+0.44	+0.35"					
FCU-2	-0.05"	-0.59"	+0.26"	+0.21"					
FCU-3	-0.14"	-0.49"	+0.48"	+0.41"					
FCU-4	-0.18"	-0.59"	+0.37"	+0.27"					
FCU-5	-0.09"	-0.37"	+0.51"	+0.42"					
FCU-6	-0.21"	-0.48"	+0.44"	+0.35"					
FCU-7	-0.13"	-0.60"	+0.51"	+0.43"					
FCU-8	-0.11"	-0.76"	+0.44"	+0.32"					
FCU-10	-0.22"	-0.39"	+0.31"	+0.26"					
FCU-11	-0.36"	-0.79"	+0.31"	+0.18"					

**REMARKS**

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

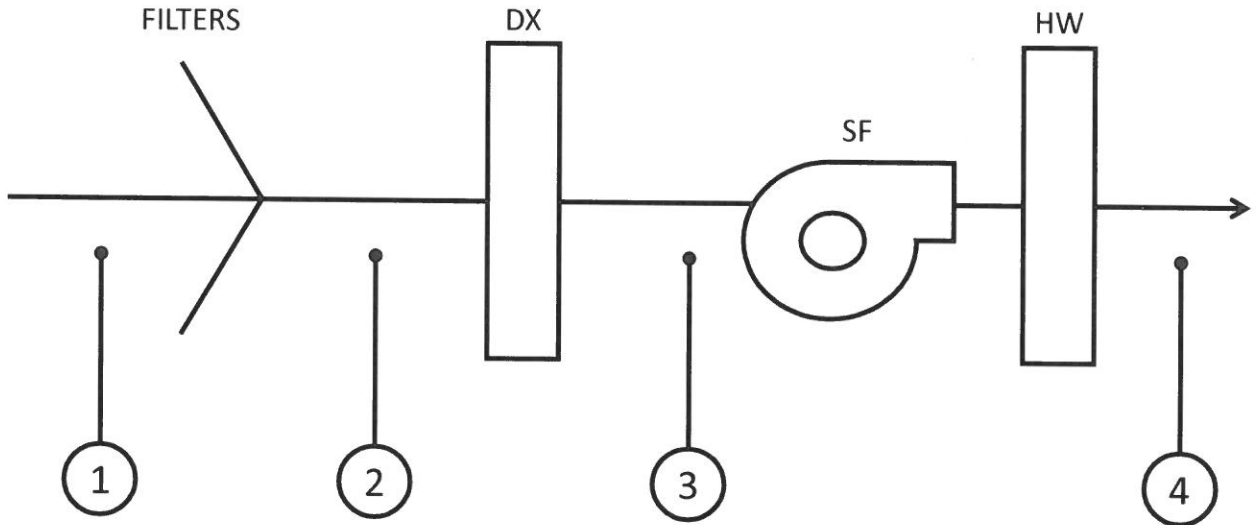
## SYSTEM STATIC PRESSURE PROFILE

**PROJECT:** Orange District Court

**DATE:** 4/5/22

**SYSTEM/AREA:** FCUs

**TECH:** BS



UNIT	1	2	3	4	5	6	7	8	NOTES
FCU-9	-0.33"	-0.58"	-0.75"	+0.06"					

### REMARKS

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

## AIR DEVICE REPORT

<b>PROJECT:</b>	Orange District Court
-----------------	-----------------------

**DATE:** 4/7/22

SYSTEM / AREA: FCU-7

TECH: BS

[illegible]

## REMARKS

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

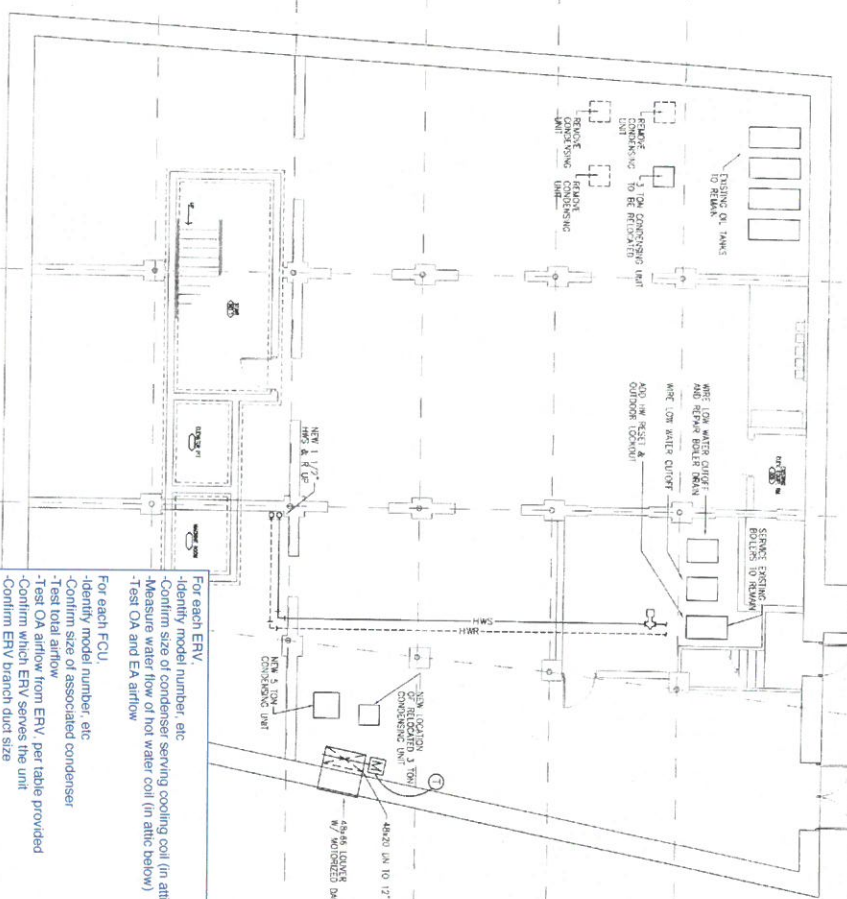
[illegible]

**VELOCITY PRESSURE READINGS**

<b>PROJECT:</b>		Orange District Court				<b>DATE:</b> 4/5/22		
<b>AREA SERVED:</b>		FCUs				<b>TECH:</b> BS		
TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENT. STAT. PRESS."	TEST		NOTES
			FPM	CFM		FPM	CFM	
FCU-1 Total	24" x 16"	2.66	---	ND	+0.34"	578	1541	
FCU-1 O.A.	12"Ø	0.79	---	ND	-0.07"	658	520	
FCU-1 Return			---	ND	Calculated		1021	
FCU-2 Total	16" x 12"	1.33	---	ND	+0.21"	579	770	
FCU-2 O.A.	12"Ø	0.79	---	ND	-0.02"	275	217	
FCU-2 Return			---	ND	Calculated		553	
FCU-3 Total	30" x 16"	3.33	---	ND	+0.41"	703	2343	
FCU-3 O.A.	12"Ø	0.79	---	ND	-0.07"	471	372	
FCU-3 Return			---	ND	Calculated		1971	
FCU-4 Total	30" x 21"	5.25	---	ND	+0.27"	623	3271	
FCU-4 O.A.	12"Ø	0.79	---	ND	-0.02"	372	294	
FCU-4 Return			---	ND	Calculated		2977	
FCU-5 Total	30" x 16"	4.0	---	ND	+0.42"	646	2584	
FCU-5 O.A.	10"Ø	0.55	---	ND	-0.01"	761	419	
FCU-5 Return			---	ND	Calculated		2465	
FCU-6 Total	30" x 14"	3.5	---	ND	+0.44"	923	3230	
FCU-6 O.A.	10"Ø	0.55	---	ND	-0.10"	464	255	
FCU-6 Return			---	ND	Calculated		2975	
FCU-7 Total	---	---	---	ND	---	---	2630	(1)
FCU-7 O.A.	10"Ø	0.55	---	ND	-0.10"	446	245	
FCU-7 Return			---	ND	Calculated		2385	
FCU-8 Total	24" x 14"	2.33	---	ND	+0.32"	1544	3602	
FCU-8 O.A.	12"Ø	0.79	---	ND	-0.04"	473	374	
FCU-8 Return			---	ND	Calculated		3228	
FCU-9 Total	18"Ø	1.77	---	ND	+0.11	868	1533	
FCU-9 O.A.	8"Ø	0.35	---	ND	-0.26"	285	100	
FCU-9 Return			---	ND	Calculated		1433	
FCU-10 Total	14"Ø	1.07	---	ND	+0.26"	727	776	
FCU-10 O.A.	8"Ø	0.35	---	ND	-0.19"	329	116	
FCU-10 Return					Calculated		660	
FCU-11 Total	30" x 18"	3.75	---	ND	+0.17"	397	1489	
FCU-11 O.A.	10"Ø	0.55	---	ND	-0.11"	222	122	
FCU-11 Return					Calculated		1367	
<b>REMARKS</b>								
(1) This unit had no place to get a traverse total. Grille readings were taken instead.								

[illegible]





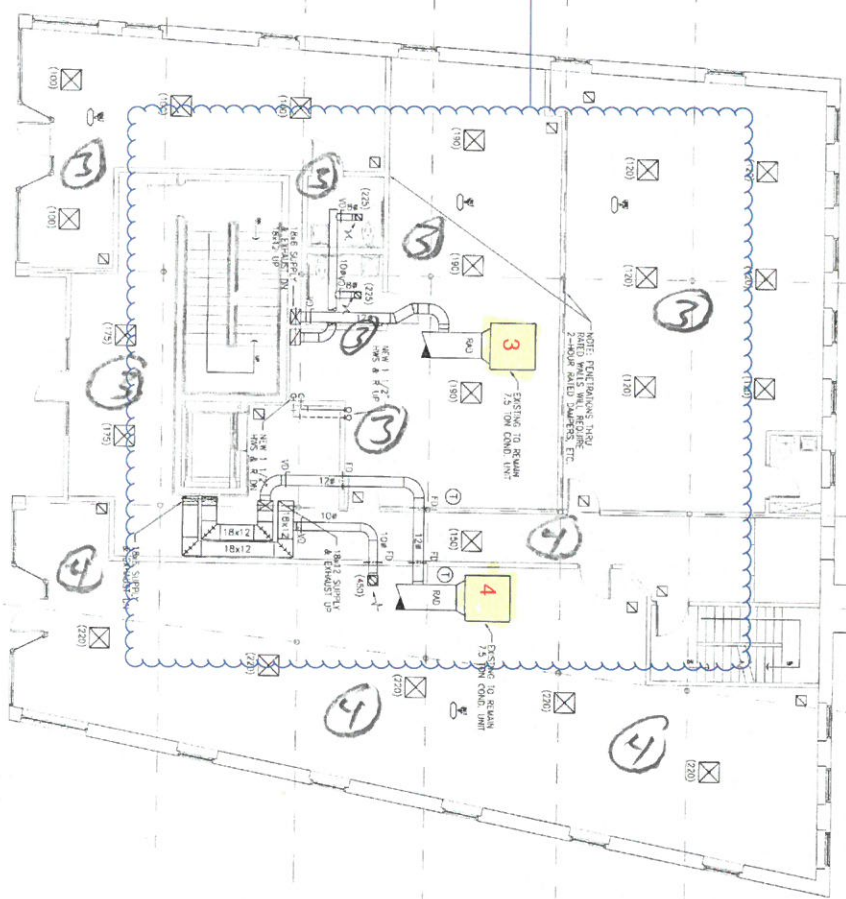
- Identify model number, etc.
- Confirm size of condenser serving cooling coil (in attic below)
- Measure water flow of hot water coil (in attic below)
- Test OA and EA airflows

For each FCU:

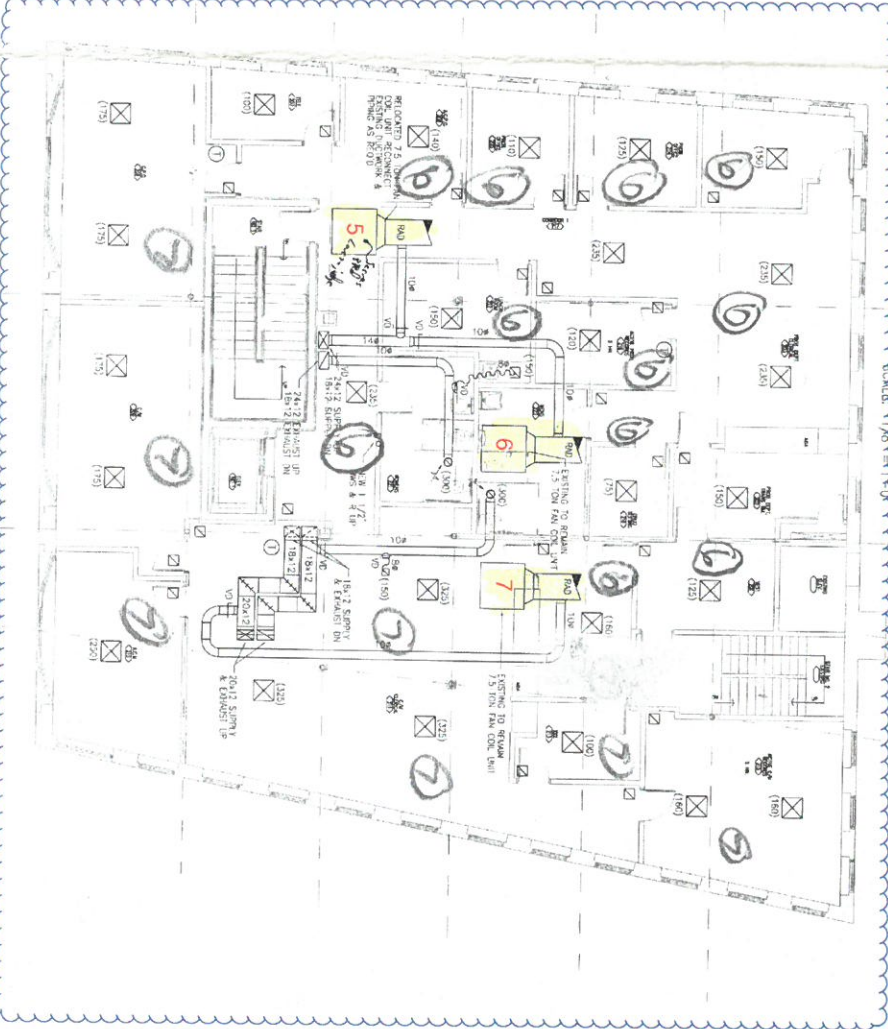
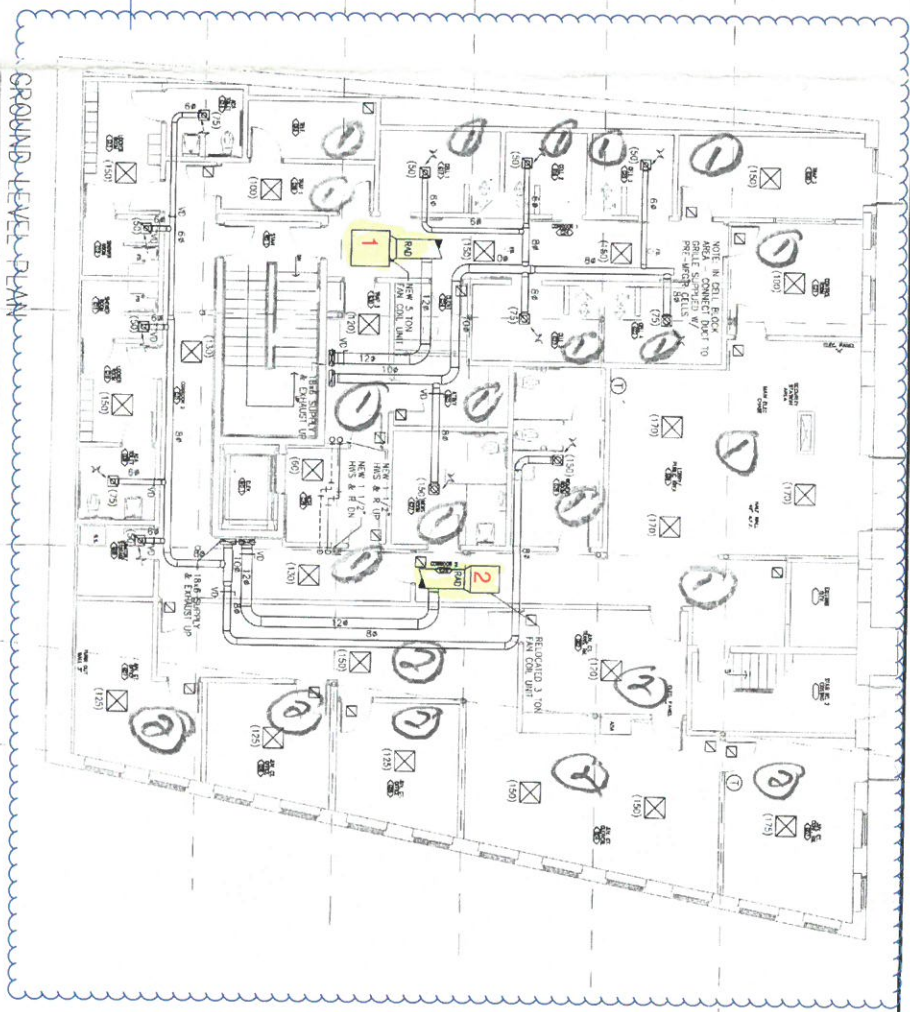
- Identify model number, etc.
- Confirm size of associated condenser
- Test OA airflow from EVF, per table provided
- Confirm which EVF serves the unit
- Confirm EVF branch duct size


For each Room:

- Confirm which FCU serves it
- Mark each room with the FCU#



commercial areas -  
(test ERV airflows only)



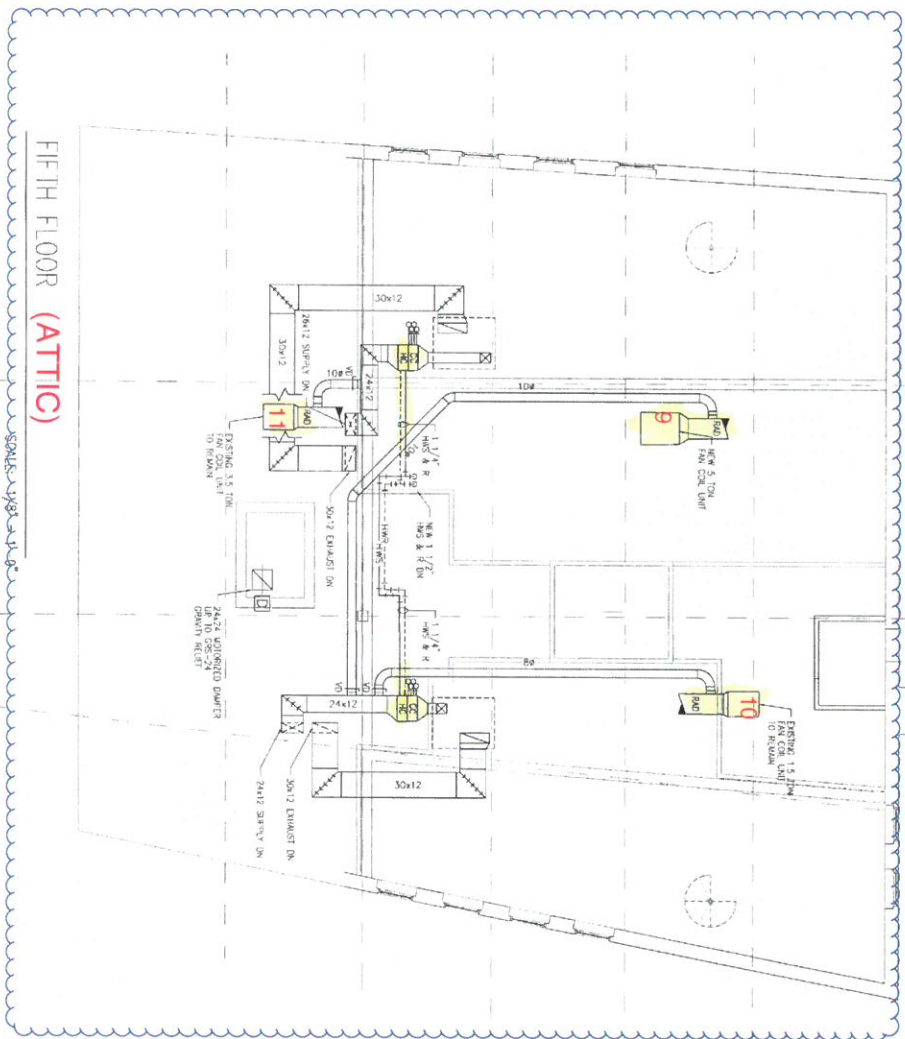
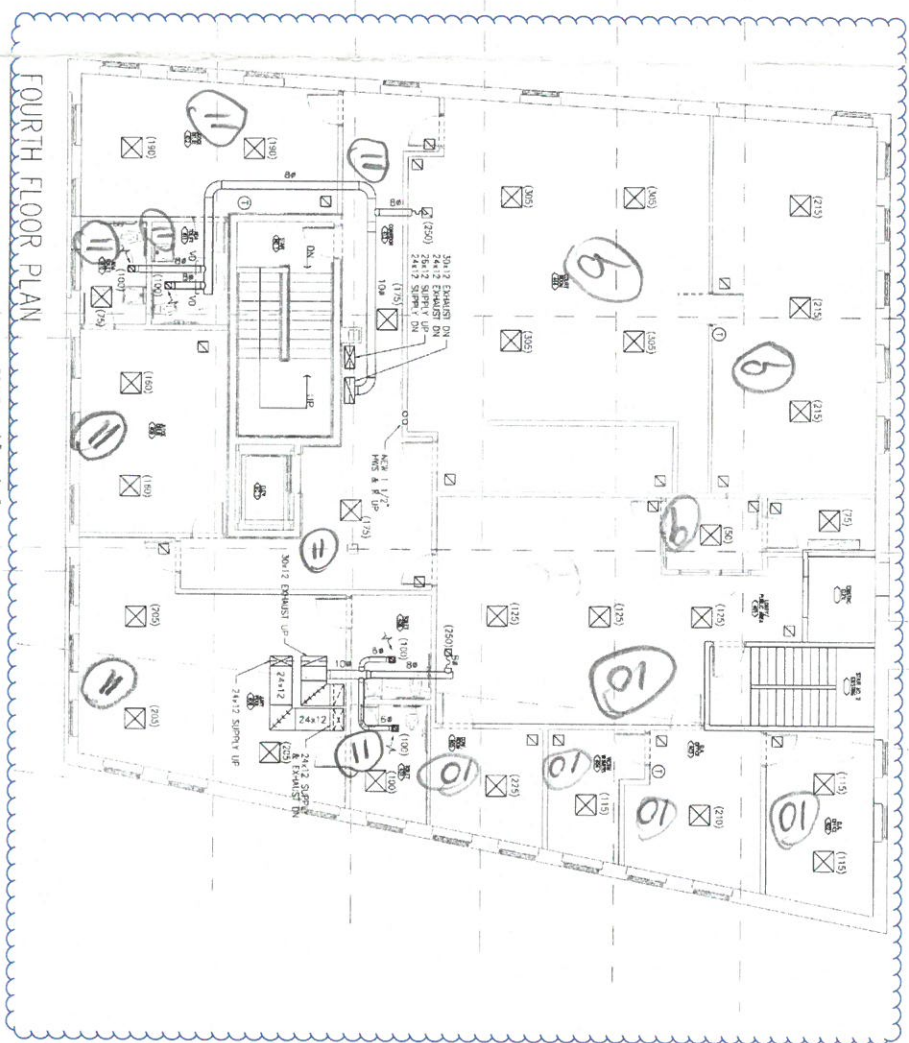
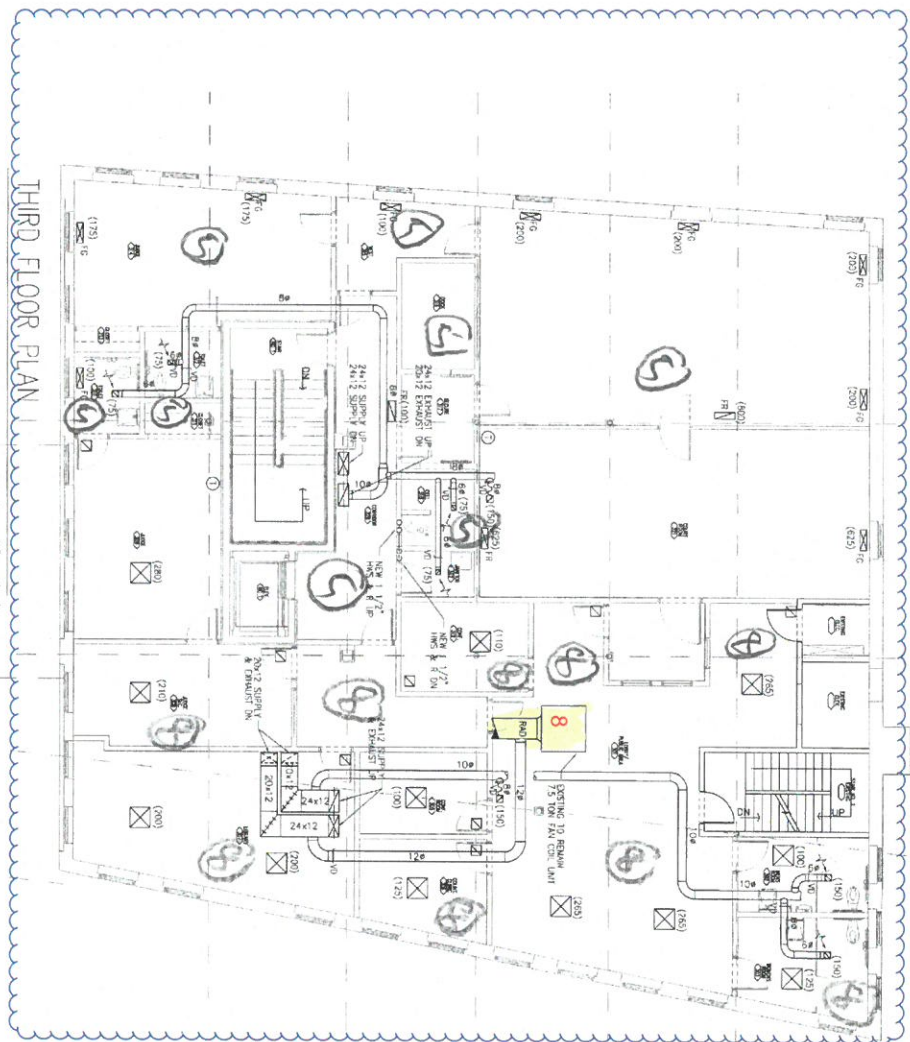
				 <p><b>Hurley &amp; David Inc.</b> AIR CONDITIONING • HEATING • VENTILATION</p> <p>90 FISK AVENUE      TELEPHONE: 413-732-3141 SPRINGFIELD, MA 01107      FAX: 413-736-2193</p>			
A	07/11/02	M.E.E.		CLIENT REVISIONS			
ACTION	DATE	BY	APP	DESCRIPTION			
				<p><b>BERNARD M. SCHENKELBERG</b>      A R C H I T E C T</p> <p>ONE MONARCH PLACE - SUITE 2540 SUITE 2540 SPRINGFIELD, MA 01144 PHONE: 413-739-0162 FAX: 413-739-0163</p> <p>CONNECTICUT    ILLINOIS    MASSACHUSETTS MINNESOTA    WISCONSIN</p> <p>3309 SPUR LANE GREEN BAY, WI 54313 PHONE: 920-434-3277 FAX: 920-434-3301</p>			

H-1

DRAWN BY: RED  
DATE: 09/16/02  
SCALE: 1/8" = 1'-0"

BASEMENT THROUGH SECOND FLOOR  
ORANGE COURTHOUSE  
9-13 SOUTH MAIN STREET  
ORANGE, MASSACHUSETTS





**HDAIR**  
Hurley & David Inc.  
AIR CONDITIONING • HEATING • VENTILATION  
90 FISK AVENUE SPRINGFIELD, MA 01107  
TELEPHONE 413-732-3141  
FAX 413-736-2193

ACTION	DATE	BY	APP	DESCRIPTION
1	07/11/02	M.E.E.		CLIENT REVISIONS
2	07/11/02	M.E.E.		CLIENT REVISIONS
3	07/11/02	M.E.E.		CLIENT REVISIONS
4	07/11/02	M.E.E.		CLIENT REVISIONS
5	07/11/02	M.E.E.		CLIENT REVISIONS
6	07/11/02	M.E.E.		CLIENT REVISIONS
7	07/11/02	M.E.E.		CLIENT REVISIONS
8	07/11/02	M.E.E.		CLIENT REVISIONS
9	07/11/02	M.E.E.		CLIENT REVISIONS
10	07/11/02	M.E.E.		CLIENT REVISIONS
11	07/11/02	M.E.E.		CLIENT REVISIONS
12	07/11/02	M.E.E.		CLIENT REVISIONS
13	07/11/02	M.E.E.		CLIENT REVISIONS
14	07/11/02	M.E.E.		CLIENT REVISIONS
15	07/11/02	M.E.E.		CLIENT REVISIONS
16	07/11/02	M.E.E.		CLIENT REVISIONS
17	07/11/02	M.E.E.		CLIENT REVISIONS
18	07/11/02	M.E.E.		CLIENT REVISIONS
19	07/11/02	M.E.E.		CLIENT REVISIONS
20	07/11/02	M.E.E.		CLIENT REVISIONS

**BERNARD M. SCHENKELBERG** ARCHITECT

ONE MONARCH PLACE - SUITE 2540  
SUITE 2540 SPRINGFIELD, MA 01144  
PHONE: 413-739-0162  
FAX: 413-739-0163

CONNECTICUT ILLINOIS MASSACHUSETTS  
MINNESOTA WISCONSIN

3309 SPUR LANE  
GREEN BAY, WI 54313  
PHONE: 920-434-3277  
FAX: 920-434-3301

**THIRD THROUGH FIFTH FLOOR  
ORANGE COURTHOUSE  
9-13 SOUTH MAIN STREET  
ORANGE, MASSACHUSETTS**