Waltham District / Juvenile Court
Waltham, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

February 16, 2022

Tighe&Bond

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Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the Waltham District Courthouse on May 26th, 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. \Tighe & Bond did not receive adequate mechanical drawings to be able to perform analysis of ventilation systems for this building. During the site visit, Tighe & Bond learned that each of the three courtrooms has a dedicated rooftop unit (RTU), and the lockup area has a dedicated 100% outside air make-up air handling unit (AHU)and exhaust fan. Therefore, while we do not have design information for the existing equipment, we were able to calculate the code required amount of outside air that each unit should be providing. Our analysis in this report is based solely on information gathered during our site visit.

Tighe & Bond visited for a second time on November 23rd, 2021 after the initial TAB work was performed to verify areas served by each RTU and the AHU in the basement. During this site visit we learned that the RTUs were serving more than just the Courtrooms and our ventilation calc and this report have been updated accordingly.

Site Visit Attendees:

- *Office of Court Management:*
  - Michael Stack, Courthouse Facilities Staff
- *Tighe & Bond*
  - Ryan Ablondi, Senior Mechanical Engineer
  - Matt Mancini, Staff Mechanical Engineer
  - Olivia Robillard, Staff Intern

1.1 Existing Ventilation System

The Waltham District Courthouse was constructed in 1941, renovated in 1996 and is approximately 27,000 square feet in size. Three constant volume RTUs provide ventilation and cooling to the three courtrooms. A 100% outside air make-up AHU and exhaust fan provide ventilation to the lockup area. Perimeter steam radiators provide heat to the building. There does not appear to be any mechanical ventilation provided to the building outside of the three courtrooms and the lock-up area. There are what appear to be some very old unit ventilators in some spaces however, during the site visit it was noted that the outside air louvers for these units had been sealed.

Each rooftop unit contains a supply fan, refrigerant (DX) cooling coils, and 2" MERV 13 filter. These units are all cooling only units and therefore do not operate during the winter when there is no call for cooling. The rooftop units were installed in 1996 and appear to be in poor condition. The DX cooling coil for each unit is dirty. The outdoor air dampers are old and rusting but appear to be operational. Each RTU is believed to be a single zone unit that serves a dedicated courtroom. Due to lack of mechanical plans, Tighe & Bond has made assumptions as to which courtroom is served by each unit based on the unit's location, size, and the size of the courtrooms.

A 100% outside air make-up air handling unit, installed in 1996, located on the ground floor provides ventilation air to the lockup area. This unit contains a steam heating coil,

and a 2" MERV 13 filter. The damper actuator for this unit is not currently operational, but the unit looks to be in good condition overall.

As noted above, Tighe & Bond did not receive mechanical drawings for the building, therefore, the total number of toilet exhaust fans in this building is unknown. There is one exhaust fan serving the lockup area. There are two additional exhaust fans on the roof that were observed during the site visit and appeared to be operational.

The various unit ventilators and steam radiators throughout the building appear to be very old if not original to the building. The unit ventilators have steam heating coils and no cooling and as noted above, the outside air openings for these units have been sealed so that they no longer provide ventilation to the areas served.

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
RTU-1	Unknown	Unknown	2" MERV 13	Poor
RTU-2	Unknown	Unknown	2" MERV 13	Poor
RTU-3	Unknown	Unknown	2" MERV 13	Poor
AHU-1	Unknown	Unknown	2" MERV 13	Good

Photo 1 – Representative Air Handler

1.2 Existing Control System

The RTUs, AHU and perimeter heating all operates with local electric thermostats. We are not aware of any existing building management system (BMS) or demand control ventilation sequences in use at this courthouse.

Section 2
Recommendations

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

Building areas without adequate ventilation and filtration significantly increase the risk of spreading viruses like Coronavirus (SARS-CoV-2), especially areas with high occupant density and where people occupy the same space for relatively long periods of time. Consider significantly reducing occupancy or relocating occupants to other areas with adequate ventilation.

2.1 Filtration Efficiency Recommendations

The filters in the air handlers were already upgraded with 2" MERV 13 filters. The use of 2" 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-3: *Install a differential pressure sensor with a display across each filter bank.*

2.2 Testing & Balancing Recommendations

The air handling units are approximately 25 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 rooftop units to the recommended minimum O.A. rates listed in Table 2. Because the RTUs are all presumed to be single zone systems Tighe & Bond was able to calculate the code required O.A rate for those units. However, the original design supply and outside air flow rates were not provided to Tighe & Bond. The indoor AHU serves multiple spaces which the mechanical plans do not provide information for, and therefore the code required O.A. rate for that unit cannot be calculated.

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)
RTU-1 (First Session Courtroom)	Unknown	Unknown	1,125	**1,125**
RTU-2 (Second Session Courtroom)	Unknown	Unknown	800	**800**
RTU-3 (Third Session Courtroom)	Unknown	Unknown	390	**390**
AHU-1 (Lockup Area)	Unknown	Unknown	255	**255**

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.

If it is determined that the original design outside air values exceed the code requirements, we recommend maintaining these elevated outside airflows during the pandemic. Supplying more outdoor than required by code will provide better indoor air quality.

The average airflow rate per person is shown below in Table 3. The values for total occupancy and outdoor air per person are determined from outdoor air calculations for areas served with ventilation air and based on the architectural drawings received by Tighe & Bond. The occupancy numbers are based on theoretical data provided by ASHRAE based on the type of space usage. 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)	245	214	16
Total Supply Air (CFM/Person)	Unknown	Unknown	Unknown
Outdoor Air (CFM/Person)	10	9	36

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, and the recommended outdoor airflow rate. The supply airflow rates for these courtrooms

were not provided to Tighe & Bond, therefore, they are listed as "unknown". The airflow rate per person assumes the full supply airflow is being delivered to the room.

TABLE 4
Airflow Rate per Person (Full Occupancy)

		Total Air		Outdoor Air	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
First Session Courtroom	140	Unknown	Unknown	884	6
Second Session Courtroom	112	Unknown	Unknown	765	7
Third Session Courtroom	53	Unknown	Unknown	365	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, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 4a. The airflow rate per person assumes the full supply airflow is being delivered to the room.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		Outdoor Air	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
First Session Courtroom	26	Unknown	Unknown	884	34
Second Session Courtroom	21	Unknown	Unknown	765	37
Third Session Courtroom	12	Unknown	Unknown	365	30

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. These systems are very old and the airflow rate delivered to and returned from these spaces may not match the original design intent.

If specific areas within the Courthouse experience regular cooling and heating comfort complaints this may be an indication of a lack of airflow to the space. We recommend testing and balancing the air inlets and outlets serving those spaces to the designed values. Prior to rebalancing the building, we recommend verifying the boiler are maintaining the correct supply water temperature. Incorrect supply water temperature may be contributing to the temperature control complaints instead of a lack of airflow.

RTB-6: *Test and balance all air handler DX coils.*

Due to the age of the coils, the coils may not perform as required to properly temper the supply air. Confirm that the air handler's refrigerant system is operating correctly to ensure the DX coil is receiving full refrigerant flow.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

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

Replace dampers and actuators that are not functioning properly.

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

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

2.4 Control System Recommendations

We recommend the following for the control system:

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

RC-2: *Install controls required to introduce outdoor air beyond the minimum requirements.*

The existing control system does not appear to be sophisticated enough to implement this type of sequence. Additional controls and sensors will be required.

Prior to implementing this control strategy, the TAB Contractor should verify the quantity of outdoor air the outdoor air louvers can accommodate without exceeding an intake air velocity of 450 feet/minute (FPM). Exceeding this air velocity through an intake air louver may result in rain or snow entering the louver.

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

2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

RFC-1: *Install portable HEPA filters.*

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

noise levels will vary depending on the manufacturer. Refer to the "Overview of Recommendations" document for further guidance on installing portable HEPA filters.

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

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 Mechanical Ventilation Feasibility Study

Most of the Courthouse is not mechanically ventilated. Operable windows do exist, and natural ventilation may be acceptable per code, however in reality windows are typically not opened during cold or hot outdoor air temperatures. We recommend a study of the Courthouse to determine how feasible it is to install mechanical ventilation in all occupied spaces.

2.7.2 Replace Air Handling Units & Return Fans

Rooftop air handling units have a life expectancy of 25 years, and ASHRAE states that the median life for these units is 15 years. The air handlers are approximately 25 years old and are in poor condition. Consider replacing these units in the next 5 years. We recommend replacing these with units that are capable of providing heating and cooling to allow for year-round ventilation. This recommendation is an energy saving and operations and maintenance measure and does not directly improve the indoor air quality of the building. It should be noted that replacing the existing RTUs will not have an impact on air quality or safety from COVID-19. It is expected that the quantity of ventilation air being brought into the building would be unaffected by replacement-in-kind of the existing RTUs.

2.7.3 Replace Unit Ventilators

As noted above, the unit ventilators in the building are very old and may be original to the building. We recommend replacing all unit ventilators and restoring the outside air openings to allow the units to provide ventilation to the space. The existing unit ventilators are heating only, we recommend replacing them with units that are capable of heating and cooling to allow for year-round ventilation.

2.7.4 Install a Building Management System

Along with the replacement of the existing RTUs, we recommend the installation of a Building Management System to control and monitor the new HVAC equipment. Installing a modern BMS to operate and monitor the mechanical systems in the building can save energy and lower maintenance and operating costs. This recommendation is an energy saving and maintenance measure and does not affect the indoor air quality of the building.

2.7.5 Replace damper actuator for AHU-1

As noted above, the outside air damper actuator for AHU-1 is not working. We recommend investigating the issue and repairing / replacing the damper actuator as necessary.

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 Waltham District Courthouse on November 4th, 2021 to test the airflow rates of the air handling units and the exhaust fans. A summary of the tested airflow rates versus the design airflow rates are shown below in Tables 5 and 7.

Wings Returned a second time on December 4th and tested the airflow rates to each zone served by each of the Air Handling units. A summary of these airflow is shown in Table 6 below. The full testing and balancing report is attached.

TABLE 5
Air Handler Airflow Testing & Balancing Results From 11/4/22

	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	Unknown	1,100	Unknown	5,100	0	5,100
RTU-2	Unknown	820	Unknown	1,759	780	979
RTU-3	Unknown	450	Unknown	1,904	394	1,510
AHU-1	Unknown	475	Unknown	1,803	1,803	NA

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

TABLE 6
Air Handler Airflow Testing & Balancing Results From 12/4/22

	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	Unknown	1,100	Unknown	3,353	Unknown	3,262
RTU-2	Unknown	820	Unknown	2,762	Unknown	1,731
RTU-3	Unknown	450	Unknown	1,603	Unknown	1,264
AHU-1	Unknown	475	Unknown	1,796	1,796	NA

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

TABLE 7
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Return/Exhaust Airflow (CFM)	Actual Return/Exhaust Airflow (CFM)	Comments
EF-1	Lock up	Unknown	995	Tested 11/4/22
EF-1	Lock up	Unknown	1,291	Tested 12/4/22
EF-2	Restrooms	Unknown	273	
EF-3	Restrooms	Unknown	428	
EF-4	Restrooms	Unknown	796	

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

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

1. The TAB contractor returned to the site for a second visit to test the airflow at each supply diffuser for RTU-1,2, 3, AHU-1, and at each exhaust register for EF-1. The sum of all the airflows for each unit are shown in Table 6 for the RTUs and AHU and Table 7 for EF-1. For the three RTUs and EF-1, there are large discrepancies in the tested airflows for both supply and return air between the two site visits. As a result, we are still not able to determine whether these units are providing the proper amount of ventilation air. We recommend that the TAB contractor return to the site and retest the airflow for each unit both at the unit itself and at the diffusers, on the same day, to determine exactly how much ventilation air each unit is providing to each space it serves. If the work to install access panels has been completed, it may be possible to access the supply and return main for each unit so they can be traversed which would provide a more accurate reading.

2. After the first site visit, the balancing contractor noted that the outside air damper actuator does not open properly for RTU-1 and AHU-1 and that there was no outside airflow to these units at the time of testing. The court has confirmed that RTU-1 outside actuator has been repaired but we have not heard whether AHU-1 is in good working order. We recommend confirming that the OA actuator for AHU-1 is in good working order.

3. RTU-3 has an outside airflow rate that is outside of the typical 10% tolerance of our recommendation. We recommend rebalancing this airflow rate to the recommended outside airflow rate in table 5.

4. The design airflow rates for the exhaust fan is unknown to Tighe & Bond, therefore we are unable to verify if the measured exhaust rates are within 10% of the design airflow rates.

WING'S TESTING & BALANCING CO., INC.

Waltham
District Court
HVAC Ventilation Survey
New Readings

* * * *

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

December 4th, 2021

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WING'S TESTING & BALANCING CO., INC.

December 4th, 2021

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

Re: Waltham District Court HVAC Ventilation Survey New Readings

UPDATED 12/04/21
Dear Jason,

Wing's has completed the extra readings for the above referenced location. During our return visit to Waltham District Court, we acquired all the space readings for the highlighted areas on the print. These spaces include readings for RTU-1 to RTU-3 and AHU-1, as well as EF-1 serving lock-up.

New device readings are attached at the end of the data sheets from our previous testing. **If you have any questions, or if we can be of further service, please do not hesitate to call.**

11/04/21
Dear Jason,

Wing's has completed the HVAC Survey for the above referenced location. Upon arriving onsite, it was noted that all units have MERV-13 filters. Also, the RTUs are cooling-only units and are often turned off in winter due to over-cooling. The results of our testing are as follows:

- The outside air controller for RTU-1 does not respond to a minimum OA setting.
- There were no designs or prints with mechanical schedules found on site.
- This building was built in 1940 and therefore adheres to 1940 compliance.

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
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SUPPLY FAN REPORT

PROJECT:	Waltham District Court	**DATE:**	11/1/2021
AREA SERVED:	RTUs	**TECH:**	BS

FAN DATA

FAN NUMBER	RTU-1		RTU-2		RTU-3	
LOCATION	Roof		Roof		Roof	
AREA SERVED	Court #1 + Library		2nd Session Court		3rd Session + Judge Lob.	
MANUFACTURER	Carrier		Carrier		Carrier	
MODEL OR SIZE	50HJ-017-500		50HJ-012-521		50HJ-007-521	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	ND	5100	ND	1759	ND	1904
RETURN AIR	ND	5100 (1)	ND	979	ND	1510
OUTSIDE AIR	1025	0 (1)	820	780	390	394
DISCH. STATIC	---	+0.69"	---	+1.31"	---	+0.70"
SUCTION STATIC	---	-1.11"	---	-1.16"	---	-1.47"
TOTAL STATIC	---	1.80"	---	2.47"	---	2.17"
FAN RPM	---	1073	---	1087	---	1406
PULLEY O.D.	8.0" X 1 3/8		8.0" x 1		4.0" x 3/4	
ESP	1.47		2.12		1.74	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	(1)		15%		10%	

MOTOR DATA

MANUFACTURER	Magnetek		GE		GE	
MODEL OR FR.	S184T		56H2		56Y	
HORSEPOWER	5	5	NA	NA	NA	NA
MOTOR RPM	1750	1750	1725	1725	1725	1725
VOLTAGE / PH.	208/3	208/3	206/3	206/3	208/3	208/3
AMPS LEG 1	15.0	10.4	10.6	7.6	5.8	5.4
AMPS LEG 2	---	10.9	---	7.6	---	5.5
AMPS LEG 3	---	11.2	---	7.8	---	5.5
SHEAVE O.D.	6.0" x 1 1/8		5.25" x 7/8		375" x 5/8	
BELTS - QUANTITY / SIZE	1/B49		1/AP52		1/AP3X	
SHEAVE POSITION	1/2 Open		Fully Closed		3/4 Closed	
C to C	15.0		15.5		14.5	

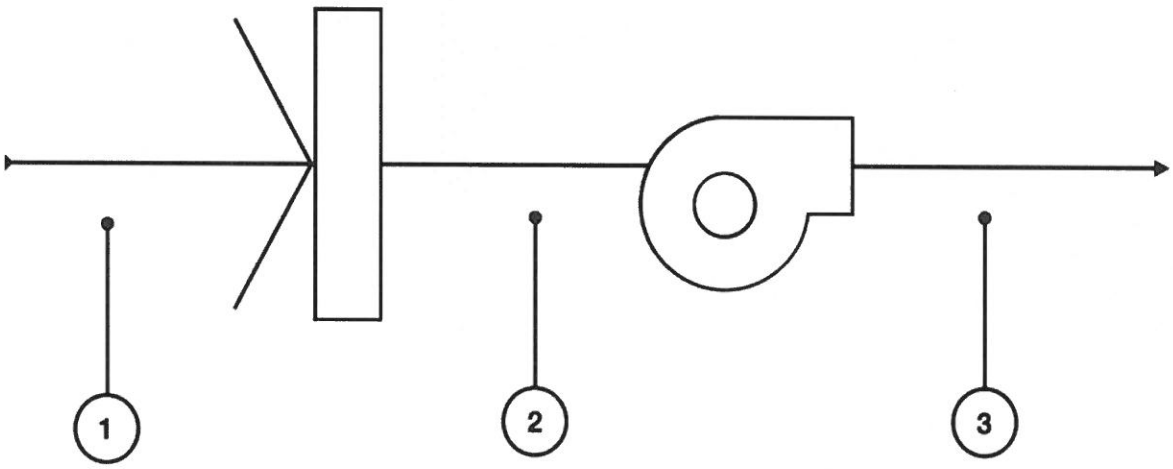
REMARKS

(1) Outside air activator does not open properly.

NA Not Available
ND No Design
DD Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Waltham District Court	**DATE:**	11/3/2021
SYSTEM/AREA:	RTUs	**TECH:**	BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	NOTES
RTU-1	-0.78"	-1.11"	+0.69"						
RTU-2	-0.81"	-1.16"	+1.31"						
RTU-3	-1.04"	-1.47"	+0.70"						

REMARKS

SUPPLY FAN REPORT

PROJECT:	Waltham District Court	**DATE:**	11/3/2021
AREA SERVED:	AHU-1	**TECH:**	BS

FAN DATA

FAN NUMBER	AHU-1					
LOCATION	Lock Up					
AREA SERVED	Lock up Area					
MANUFACTURER	Carrier					
MODEL OR SIZE	38NXH07/NVR					
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	NA	1803				
RETURN AIR	NA	0				
OUTSIDE AIR	NA	1803				
DISCH. STATIC	---	+0.44"	---		---	
SUCTION STATIC	---	-0.54"	---		---	
TOTAL STATIC	---	0.98"	---		---	
FAN RPM	---	788	---		---	
PULLEY O.D.	7.0" X 1 3/6					
ESP	0.72					
VFD SPEED	No VFD					
O.A.D.MIN POS	100%					

MOTOR DATA

MANUFACTURER	Magnetek					
MODEL OR FR.	M145T					
HORSEPOWER	1.5	1.5				
MOTOR RPM	1745	1745				
VOLTAGE / PH.	230/3	230/3				
AMPS LEG 1	5.2	3.6				
AMPS LEG 2	---	3.6	---		---	
AMPS LEG 3	---	3.9	---		---	
SHEAVE O.D.	3.5" x 7/8					
BELTS - QUANTITY / SIZE	1/4L320R					
SHEAVE POSITION	3/4 Closed					
C to C	7.5					

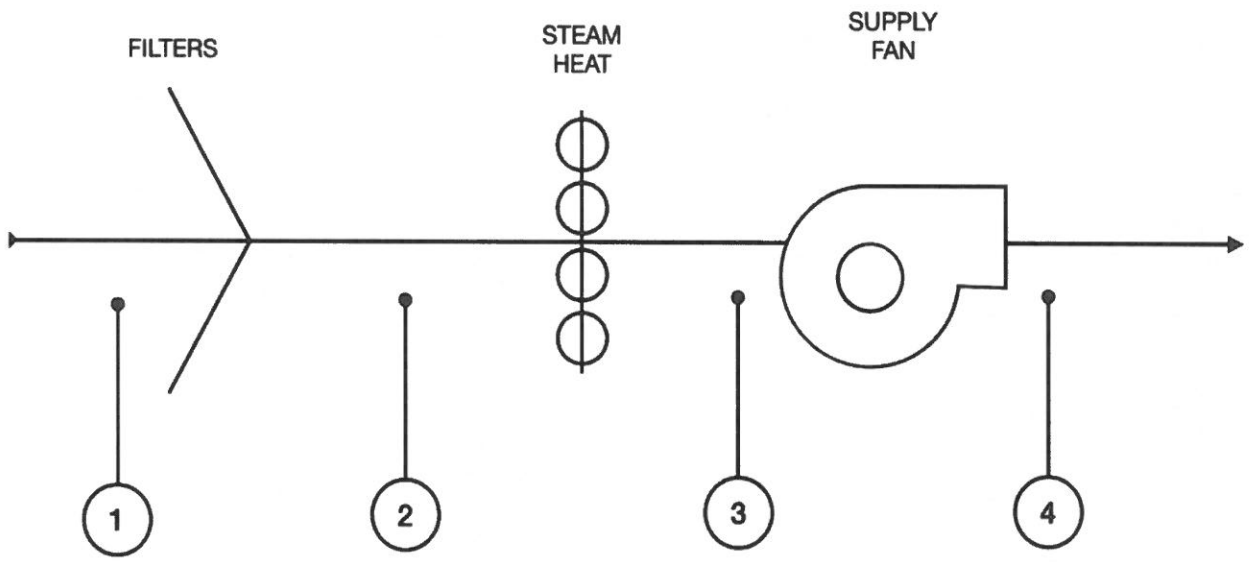
REMARKS

(1) Outside air activator does not open properly.

NA Not Available
ND No Design
DD Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Waltham District Court	**DATE:**	11/3/2021
SYSTEM/AREA:	AHU-1	**TECH:**	BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	NOTES
AHU-1	-0.28"	-0.36"	-0.54"	+0.44"					

REMARKS

VELOCITY PRESSURE READINGS

PROJECT:	Waltham District Court					**DATE:**	11/3/2021	
AREA SERVED:	AHUs and RTUs					**TECH:**	BS	
TRAVERSE LOCATIONS	**DUCT SIZE "**	**AREA SQ.FT.**	**DESIGN**		**CENT. STAT. PRESS."**	**TEST**		**NOTES**
			FPM	**CFM**		**FPM**	**CFM**	
AHU-1 Total	20" x 12"	1.66		ND	+0.44"	1086	1803	
RTU-1 Total	72" x 17"	8.5		ND	Velgrid	600	5100	
RTU-1 OA	72" x 17"	8.5		1025	Velgrid			(1)
RTU-1 Return				ND	Calculated		5100	
RTU-2 Total	33.5" x 22.5"	5.23		ND	Velgrid	336	1759	
RTU-2 OA	33.5" x 22.5"	5.23		820	Velgrid	149	780	
RTU-2 Return				ND	Calculated		979	
RTU-3 Total	26.5" x 23"	4.23		ND	Velgrid	450	1904	
RTU-3 OA	26.5" x 23"	4.23		390	Velgrid	93	394	
RTU-3 Return				ND	Calculated		1510	

REMARKS

(1) The outside air controller does not operate in the min position set mode. It is scheduled to be rewired.

EXHAUST FAN REPORT

PROJECT:	Waltham District Court	**DATE:**	11/4/2021
AREA SERVED:	EFs	**TECH:**	BS

FAN DATA

FAN NUMBER		EF-1	EF-2	EF-3	EF-4	
LOCATION		Lock Up	Roof	Roof	Roof	
AREA SERVED		Lock Up	Restrooms	Restrooms	Restrooms	
MANUFACTURER		Greenhack	Greenhack	Greenhack	Greenhack	
MODEL OR SIZE		BSQ-160-5	6KWK6	4YC66B	4YC66B	
TOTAL CFM	**DESIGN**	NA	NA	NA	NA	
	ACTUAL	995	273	428	796	
FAN RPM	**DESIGN**	NA	DD	DD	DD	
	ACTUAL	979	DD	DD	DD	
PULLEY	**O.D.**	4.5" x 1	DD	DD	DD	
SERVICE		1.25	NA	NA	NA	

MOTOR DATA

MANUFACTURER		Marathon	Dayton	Dayton	Dayton	
MODEL NUMBER		482	48Y	NA	NA	
MOTOR HP	**DESIGN**	1/2	1/4	1/8	1/8	
	ACTUAL	1/2	1/4	1/8	1/8	
MOTOR RPM		1725	1725	1550	1550	
VOLTAGE/PHASE		115/1	115/1	115/1	115/1	
MOTOR AMPS	**DESIGN**	7.2	3.1	2.6	2.6	
	ACT. LEG 1					
	ACT. LEG 2	5.7	3.3	2.0	2.6	
	ACT. LEG 3					
SHEAVE		3.0" x 1/2	DD	DD	DD	
BELTS - QUANTITY/SIZE		1/AX50	DD	DD	DD	
SHEAVE POSITION		1/2 Closed	DD	DD	DD	
C to C		20.0				

REMARKS

NA Not Available
ND No Design
DD Direct Drive

AIR DEVICE REPORT

PROJECT:	Waltham District Court	**DATE:**	11/1/21
SYSTEM / AREA:	EFs	**TECH:**	BS

LOCATION	NO.	SIZE	A K	DESIGN		TEST		FINAL		NOTES
				FPM	CFM	FPM	CFM	FPM	CFM	
EF-2										
229	1	8" x 8"	0.32		ND	383	123			
Men's Room	2	10" x 10"	0.50		ND	140	70			
036	3	10" x 10"	0.50		ND	160	80			
							273			
EF-3										
112	1	8" x 8"	FH		ND	---	56			
112	2	8" x 8"	FH		ND	---	54			
137	3	8" x 8"	0.32		ND	258	83			
235C	4	8" x 8"	0.32		ND	333	113			
235C	5	8" x 8"	0.32		ND	381	122			
							428			
EF-4										
215	1	8" x 8"	0.32		ND	545	174			
224	2	8" x 8"	0.32		ND	483	155			
209	3	8" x 8"	0.32		ND	320	102			
128	4	8" x 8"	0.32		ND	535	171			
126	5	8" x 8"	0.32		ND	287	92			
010	6	8" x 8"	0.32		ND	169	54			
009	7	8" x 8"	0.32		ND	150	48			
							796			

REMARKS

AIR DEVICE REPORT

PROJECT:	Waltham District Court	**DATE:**	12/4/21
SYSTEM / AREA:	RTU-1	**TECH:**	BS

LOCATION	NO.	SIZE	A K	DESIGN		TEST		FINAL		NOTES
				FPM	CFM	FPM	CFM	FPM	CFM	
RTU-1 Supply										
1st Session	1	20"x20"	FH	---	ND	---	319			
1st Session	2	20"x20"	FH	---	ND	---	302			
1st Session	3	20"x20"	FH	---	ND	---	265			
1st Session	4	20"x20"	FH	---	ND	---	297			
1st Session	5	20"x20"	FH	---	ND	---	285			
1st Session	6	20"x20"	FH	---	ND	---	223			
1st Session	7	20"x20"	FH	---	ND	---	231			
1st Session	8	20"x20"	FH	---	ND	---	307			
Judge's Chamber	9	12"x8"	0.48	---	ND	391	188			
Judge's Admin	10	12"x6"	0.36	---	ND	259	93			
Judge's Lobby	11	12"x6"	0.36	---	ND	297	107			
Library	12	12"x8"	0.48	---	ND	322	155			
2nd floor Judge	13	22"x22"	FH	---	ND	---	359			
2nd Floor Conf,	14	22"x22"	FH	---	ND	---	217			
							3353			
RTU-1 Return										
1st Session S	1	36"x22"	5.5	---	ND	194	1067			
1st Session S	2	36"x22"	5.5	---	ND	0	0			
1st Session N	3	36"x22"	5.5	---	ND	295	1623			
1st Session N	4	36"x22"	5.5	---	ND	29	160			
Judge's Chamber	5	12"x8"	0.48	---	ND	214	103			
Judge's Admin	6	12"x6"	0.36	---	ND	324	117			
Judge's Lobby	7	12"x6"	0.36	---	ND	249	90			
Library	8	12"x8"	0.48	---	ND	212	102			
							3262			

REMARKS

AIR DEVICE REPORT

PROJECT:	Waltham District Court	**DATE:**	12/4/21
SYSTEM / AREA:	RTU-2 and RTU-3	**TECH:**	BS

				DESIGN		TEST		FINAL		
LOCATION	**NO.**	**SIZE**	**A K**	**FPM**	**CFM**	**FPM**	**CFM**	**FPM**	**CFM**	**NOTES**
RTU-2 Supply										
Session 2	1	26"x12"	2.17	---	ND	481	1044			
Session 2	2	26"x12"	2.17	---	ND	254	551			
Session 2	3	26"x12"	2.17	---	ND	407	883			
Judge's Chamber	4	10"x10"	FH	---	ND	---	284			
							2762			
RTU-2 Return										
Session 2	1	30"x20"	4.17	---	ND	327	1364			
Session 3	2	30"x20"	4.17	---	ND	39	163			
Session 4	3	30"x20"	4.17	---	ND	26	104			
Session 5	4	30"x20"	4.17	---	ND	23	96			
							1731			
RTU-3 Supply										
3rd Session	1	30"x10"	2.08	---	ND	324	677			
3rd Session	2	30"x10"	2.08	---	ND	321	668			
Judge's Lobby	3	12"x8"	0.48	---	ND	538	258			
							1603			
RTU-3 Return										
3rd Session	1	30"x18"	3.75	---	ND	337	1264			

REMARKS

AIR DEVICE REPORT

PROJECT:	Waltham District Court	**DATE:**	12/4/21
SYSTEM / AREA:	AHU-1 and EF-1	**TECH:**	BS

LOCATION	NO.	SIZE	A K	DESIGN		TEST		FINAL		NOTES
				FPM	CFM	FPM	CFM	FPM	CFM	
AHU-1 Supply										
Lock-Up	1	16"x16"	FH	---	ND	---	474			
Lock-Up	2	16"x16"	FH	---	ND	---	360			
Lock-Up	3	16"x16"	FH	---	ND	---	103			
Lock-Up	4	16"x16"	FH	---	ND	---	465			
New Conference Rm	5	14"x14"	FH	---	ND	---	255			
New Conference TLT	6	10"x10"	FH	---	ND	---	139			
							1796			
EF-1										
New Conference Rm	1	8"x8"	FH	---	ND	---	69			
Cell 2	2	8"x8"	FH	---	ND	---	220			
Cell 1	3	24"x12"	FH	---	ND	---	430			
Cell 1	4	24"x12"	FH	---	ND	---	274			
Cell 1	5	8"x8"	FH	---	ND	---	21			
Cell 3	6	8"x8"	FH	---	ND	---	66			
Cell 4	7	8"x8"	FH	---	ND	---	53			
Restroom	8	8"x8"	FH	---	ND	---	47			
Men's Room	9	12"x12"	0.72	---	ND	154	111			
							1291			

REMARKS

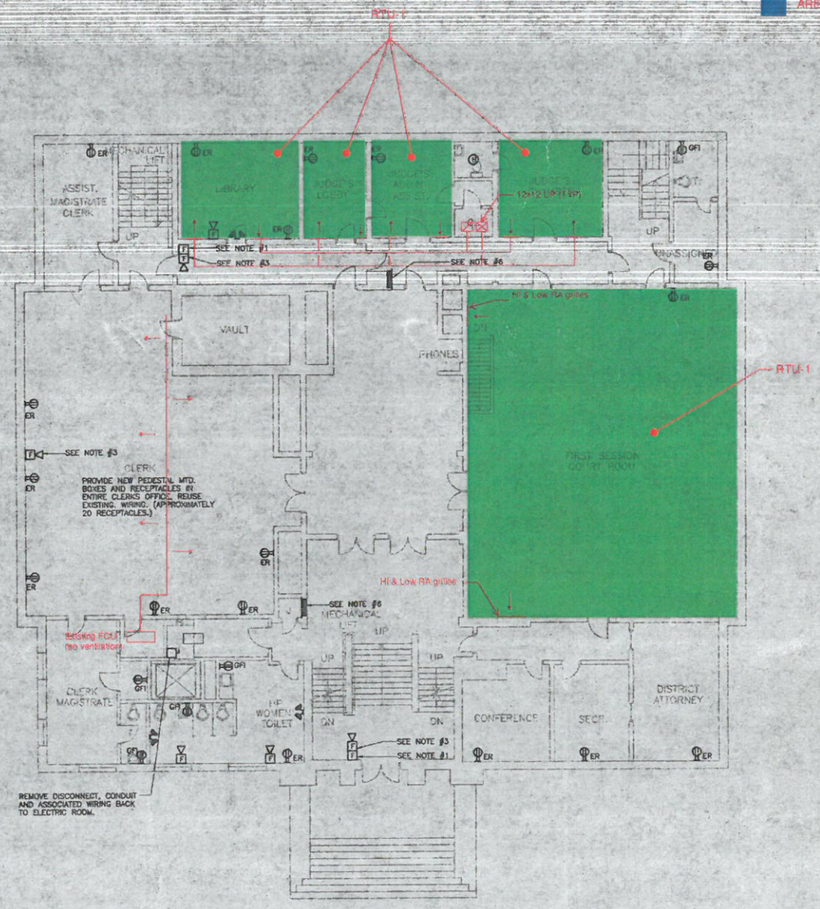
AREA SERVED BY RTU-1

AREA SERVED BY AHU-1

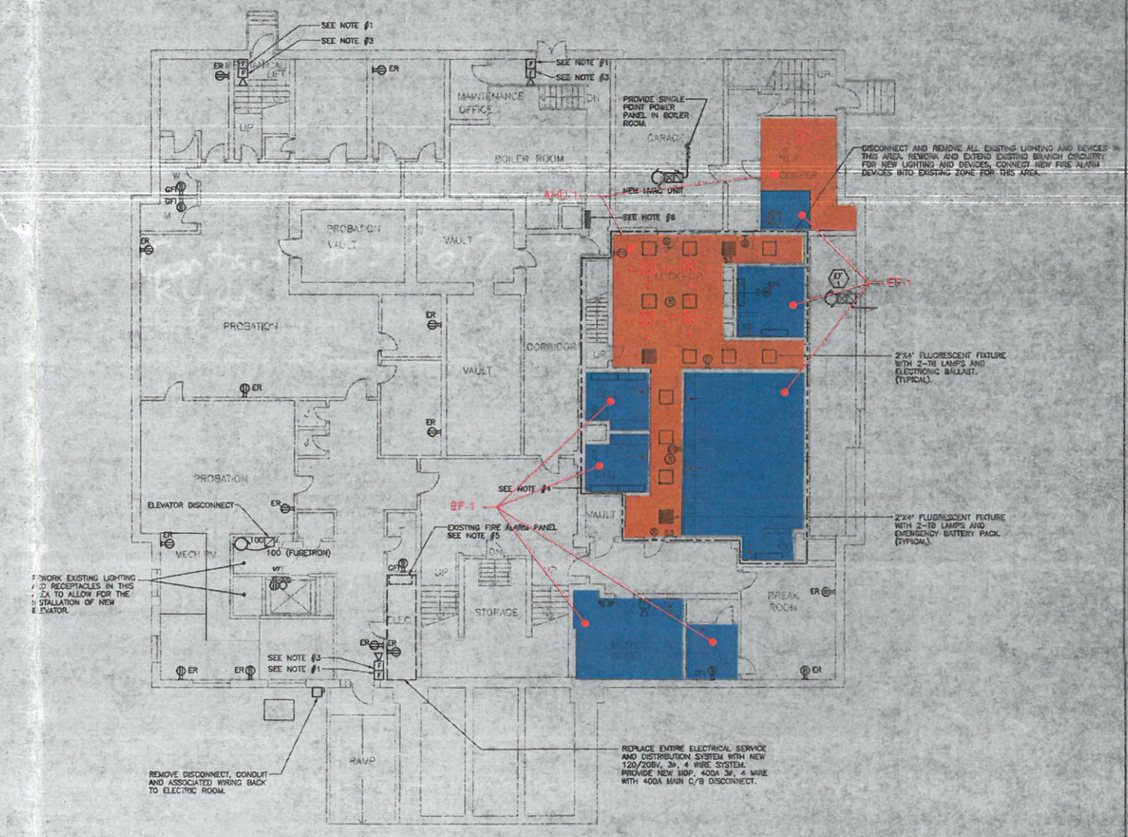
AREA SERVED BY EF-1

NOTES:

1. MANUAL PULL STATIONS SHALL BE LOWERED AND MOUNTED AT 48" A.F.F.
2. ALL EQUIPMENT SHOWN OUT OF FUNCTION ARE EXISTING TO REMAIN. ALL NEW EQUIPMENT ARE SHOWN IN FUNCTION.
3. ALL AUDIO/VISUAL DEVICES SHALL BE DISCONNECTED, REMOVED AND REPLACED WITH NEW DEVICES TO MEET ADA REQUIREMENTS.
4. PROVIDE MAXIMUM SECURITY FIXTURES WITHIN CELLS (TYPICAL).
5. PROVIDE ADDITIONAL STANDBY BATTERY CAPACITY IN THE EXISTING FIRE ALARM PANEL FOR EXISTING DEVICES ADDED.
6. REPLACE EXISTING PANELBOARD WITH A NEW 120/208V 3Φ 4 WIRE PANELBOARD. FEED FROM ELECTRICAL ROOM TO EACH PANELBOARD.
7. REMOVE ALL EXISTING WIRING FROM RACEWAYS FEEDING RECEPTACLES THAT ARE TO BE REPLACED AND PROVIDE ALL NEW WIRING.



FIRST FLOOR PLAN
SCALE: 1/8"=1'-0"



BASEMENT PLAN
SCALE: 1/8"=1'-0"

DESIGN DEVELOPMENT 7/30/93

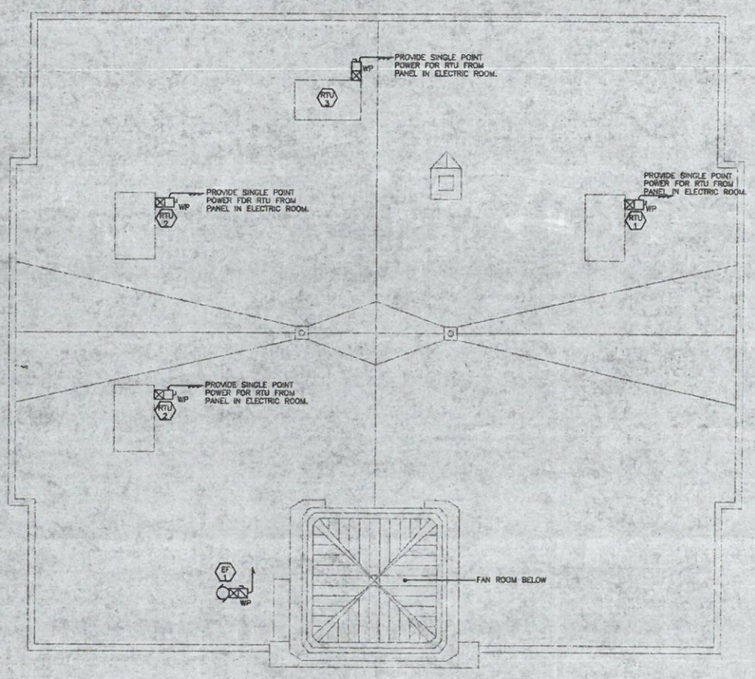
PROJECT J98-24 (2)
REPAIR AND RENOVATION OF WALTHAM DISTRICT COURTHOUSE
THE COMMONWEALTH OF MASSACHUSETTS
DIVISION OF CAPITAL PLANNING AND OPERATIONS
OFFICE OF TRIAL COURTS

GROUND & FIRST FLOOR ELECTRICAL PLANS

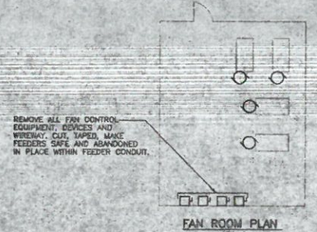
TAMS Consultants, Inc.
ARCHITECTS
ENGINEERS, AND ELECTRICAL ENGINEERS
SAR ENGINEERING, INC.
MECHANICAL AND ELECTRICAL ENGINEERS
QUINCY, MA.

SCALE: 1/8" = 1'-0"
DATE:

DRAWING NO.
E-2



ROOF PLAN
SCALE: 1/8"=1'-0"



FAN ROOM PLAN
1/8"=1'-0"

NOTES:
1. MANUAL PULL STATIONS SHALL BE LOWERED AND MOUNTED AT 48" A.F.F.
2. ALL EQUIPMENT SHOWN OUT OF FUNCTION ARE EXISTING TO REMAIN. ALL NEW EQUIPMENT ARE SHOWN IN FUNCTION.
3. ALL AUDIO/VISUAL DEVICES SHALL BE DISCONNECTED, REMOVED AND REPLACED WITH NEW DEVICES TO MEET ADA REQUIREMENTS.
4. REMOVE EXISTING AUDIO/VISUAL DEVICE.
5. REPLACE ALL TYPE NM CABLE WITHIN ATTIC SPACE AND TO ALL DEVICES WITHIN WALLS OF CONFERENCE AND JUDGE'S LOBBY WITH TYPE MC CABLE (APPROXIMATE 12 ASSEMBLIES). EXISTING TYPE NM RUNS FROM RECEPTACLES TO JUNCTION BOXES ABOVE THE CEILING.

AREA SERVED BY RTU-1
AREA SERVED BY RTU-2
AREA SERVED BY RTU-3

SECOND FLOOR PLAN
SCALE: 1/8"=1'-0"

DESIGN DEVELOPMENT 7/30/93

PROJECT J80-24 501
REPAIR AND RENOVATION OF WALTHAM DISTRICT COURTHOUSE
THE COMMONWEALTH OF MASSACHUSETTS
DIVISION OF CAPITAL PLANNING AND OPERATIONS
OFFICE OF TRIAL COURTS

SECOND FLOOR & ROOF ELECTRICAL PLAN

TAMS Consultants, Inc.
ARCHITECTS 100 SUMMER STREET, BOSTON MA. 02110
SAR ENGINEERING, INC.
MECHANICAL AND ELECTRICAL ENGINEERS BRAINTREE, MA.

DRAWING NO. E-3

SCALE: 1/8" = 1'-0"
DATE:

SAR FILE NAME: E2DRAW