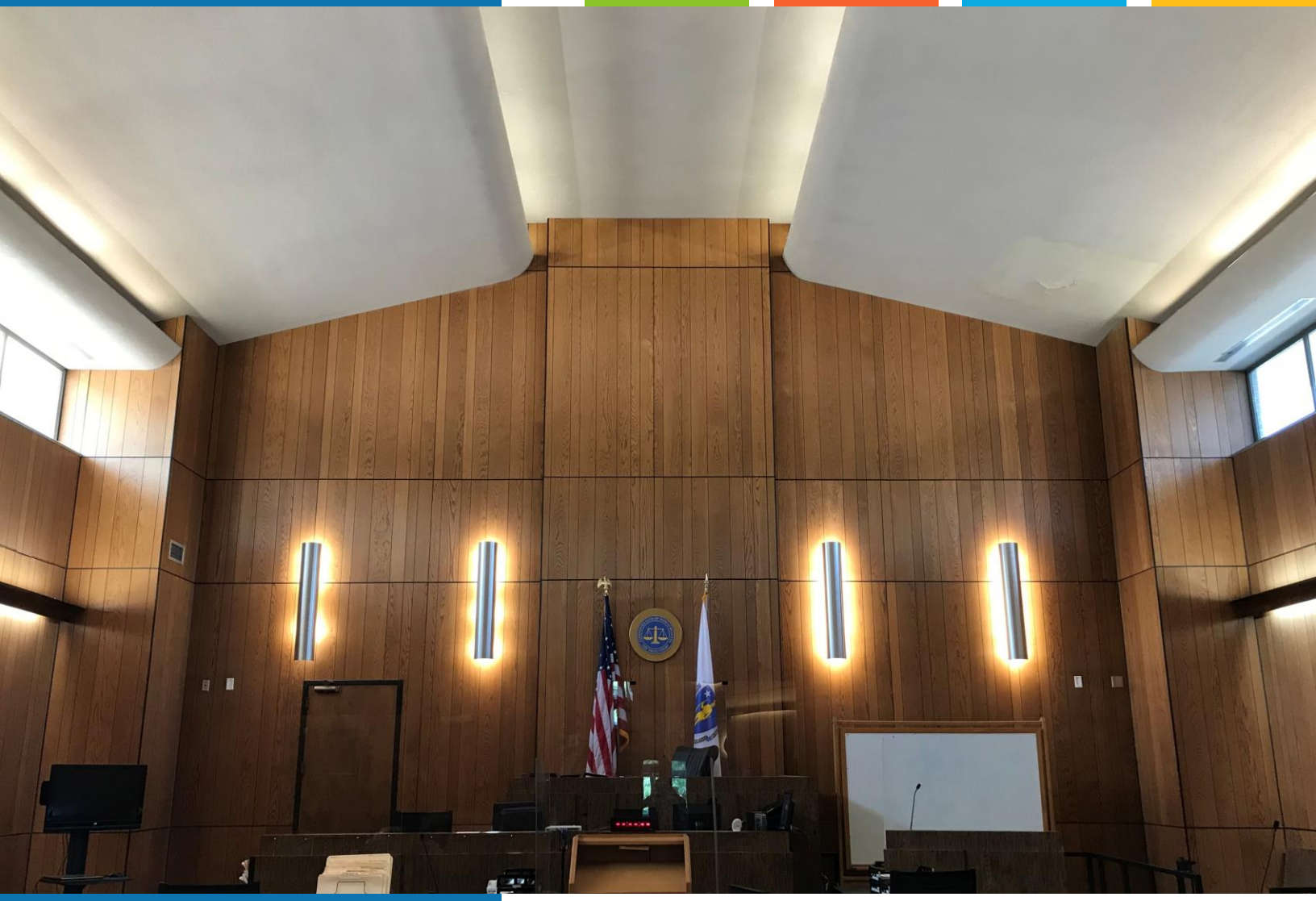

Westborough District Court
Westborough, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

March 15, 2022

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions and Site Observations

Tighe & Bond visited the Westborough District Courthouse located in Westborough, MA on June 2, 2021. While on site, we inspected the air handling units and toured the occupied portions of the building to determine if the spaces generally matched usage noted on the architectural plans.

Site Visit Attendees:

- Office of Court Management:
  - Raymond Nardone
- Tighe & Bond:
  - Todd Holland, PE, Senior Mechanical Engineer
  - Matt Mancini, Staff Engineer

1.1 Existing Ventilation System Description

The Westborough District Courthouse is a two-story building, built in 1971, with a floor area of approximately 17,000 square feet. Ventilation is provided by three constant-volume air handling units (AHUs), and unit ventilators in perimeter zones.

AHU-1 serves the lobby area on the upper floor and is located above the ceiling in the public men's room. This unit has a 1" thick MERV-13 inlet filter, direct expansion (DX) cooling coil, and a supply air fan. Two electric resistance heating coils, with 13-kW and 10-kW capacity, are located in the supply ductwork. AHU-1 is paired with a 4-ton outdoor air-cooled condensing unit (CU-1), mounted on the low roof. Both AHU-1 and CU-1 are original to the building and are in poor condition. Facility personnel indicated that this unit is scheduled for replacement in the near future.

AHU-2 is located in the basement mechanical equipment room and serves the main courtroom on the upper floor. This unit has 2" thick MERV-13 inlet filters, a direct expansion (DX) cooling coil, and a supply air fan. AHU-2 is original to the building and is in fair condition. This air handler is paired with a 7.5-ton outdoor air-cooled condensing unit (CU-2) pad-mounted on grade. CU-2 appears to have been replaced recently, and the original unit is abandoned in place on the roof.

A 36-kW electric resistance heating coil is located in the supply ductwork just after of the unit. AHU-2 shares its outdoor air intake with AHU-3. A motorized damper is controlled by two thermostats, which appear to open the damper fully when outdoor air temperature is between the two setpoint temperatures. A rooftop exhaust fan, rated for 1,000 cfm, draws air from a low-mounted grille in the back of the courtroom.

AHU-3 is a heating-only 100% outdoor air makeup unit located in the basement mechanical equipment room and serves the holding cells in the lockup area. This unit has 2" thick MERV-13 inlet filters and a supply air fan. AHU-3 is original to the building and is in fair condition. The unit is sandwiched by a 17-kW electric resistance preheat coil and a 2-kW reheat coil. An inline exhaust fan, rated for 600 cfm, draws air from high-mounted sidewall grilles in each of the holding cells. These units were not operating at the time of our visit.

Photo 1 – Typical Air Handler

There are 18 heating-only unit ventilators serving areas around the building perimeter. These units each have a 36-kW electric resistance heating coil, a two-speed supply air fan, OA intake louver and control damper. The filters are washable expanded metal type, and do not have a MERV rating. We were unable to verify operation of the outdoor air dampers, and none of the intake louvers were observed to have any airflow. The condition of these units varies, as some are original to the building, and some are recent replacements.

Photo 2 – Original Unit Ventilator

Three intake louvers around the raised portion of the upper floor provide outdoor air to AHU-1 and makeup air to what used to be the incinerator room in the basement.

Several mini-split systems have been installed over the years to cool office areas. The indoor units do not provide ventilation air. The guard office in the lockup area has a window air conditioner.

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 Handlers

Unit #	*Design Airflow (CFM)*	*Design Min OA (CFM)*	*Filters*	*Condition*
AHU-1	1,400	210	1" MERV-13	Poor
AHU-2	2,000	1,000	2" MERV-13	Fair to Poor
AHU-3	600	600	2" MERV-13	Fair to Poor
Unit Ventilators	460/340*	Unknown	Expanded Metal	Varies

* Units have multi-speed fans

1.2 Existing Control System

The courthouse HVAC equipment is controlled by a mix of the original manual controls, timeclocks, programmable thermostats, and a programmable controller.

AHU-1 serves the lobby area on the upper floor and has the original controls.

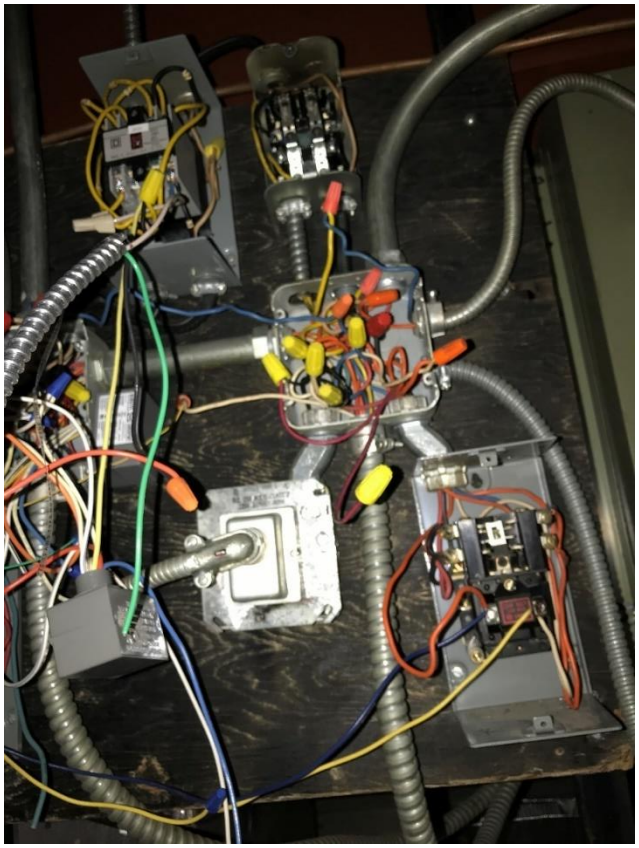

Photo 3 – Original Controls for AHU-1

AHU-2 serves the main courtroom and has a programmable controller for scheduling and temperature control. Some system components still the original controls, such as the outdoor air damper that appears to be using thermostats for upper and lower temperature limits.

It should also be noted that the programmable controller does not run the supply fan continuously during occupied hours and does not seem to control EF-1. The original design had AHU-1 and EF-1 under timeclock control. Facilities personnel indicated that EF-1 has been serviced to verify that it is operational, but they do not know how it is controlled.

Photos 4 and 5 – Programmable Controller and Outdoor Air Damper Controls for AHU-2

AHU-3 and EF-12, the makeup air unit and exhaust fan that serve the holding cells, also appear to have the original, temperature-based controls. The electric reheat coil is modulated to maintain temperature as sensed in the exhaust airstream. These fans were not running at the time of our visit, and do not appear to be controlled by a timeclock.

EF-2 serves the public toilet rooms and janitor closets on both floors and is controlled by a manual switch.

There are five small ceiling exhaust fans that serve private toilet rooms, and these are interlocked to the light switches.

Three inline exhaust fans serve the storage, mechanical, and electrical rooms in the basement. These are under manual switch or local thermostat control.

Three conference rooms on the upper floor are served by EF-11, which is controlled by a manual switch.

Section 2
Recommendations

Below is a list of recommendations that we propose for the Westborough 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 that serve occupied areas:

RF-1: *Replace filters.*

We recommend the continued use of MERV-13 filters which meet the ASHRAE recommendation. Existing filters should be checked periodically to ensure they are within their service lives and installed properly. The filter racks should be inspected to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass.

RF-3: *Install differential pressure sensors across the filter banks.*

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

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

2.2 Testing & Balancing Recommendations

The AHUs are almost 50 years old, and it is unknown to Tighe & Bond when the last time the units were tested and balanced. Also, the code required outside airflow rates that were used to design the system in 1972 are different than the 2015 International Mechanical Code (IMC) and ASHRAE Standard 62.1.

TABLE 2
Recommended Air Handler O.A. Flow Rates

Unit	Original Supply Airflow (CFM)	Original Design Min. O.A. (CFM)	Current Code Min. O.A. Requirements (CFM)	Recommended Minimum O.A. (CFM)
AHU-1	1,400	210	117	**210**
AHU-2	2,000	1,000	732	**1,000**
AHU-3	600	600	105	**600**
Unit Ventilators	460/340*	Unknown	107	**110**

* Units have multi-speed fans

The airflow rates per person are shown below in Tables 3. These values are based on the original design supply and outdoor airflow rates shown in Table 2 above.

TABLE 3
Airflow Rate per Person – Spaces Served by Air Handlers

	All Spaces	***Courtrooms***	***Non-Courtroom Spaces***
Total Occupancy (People)	197	105	92
Total Supply Air (CFM/Person)	60	28	96
Outdoor Air (CFM/Person)	16	12	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 rates per person assumes the full supply and code minimum outdoor airflows are being delivered to the room.

TABLE 4
Airflow Rate per Person - Courtrooms

		Total Air		***Outdoor Air***	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Courtroom C-116	100	2,000	20	1,000	10
Courtroom 114	97	920	9	330	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 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 rates per person assumes the full supply and minimum outdoor airflows are 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)***
Courtroom C-116	21	2,000	95	1,000	48
Courtroom 114	14	920	66	330	24

RTB-1: *Test and rebalance air handling unit supply air and minimum outside 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.

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

We recommend rebalancing all air inlets and outlets throughout the building, including the unit ventilators. This will ensure that proper ventilation is provided to each individual space.

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*.

We recommend testing the dampers and actuators in air handlers to ensure they are functioning properly, as well as the OA dampers for all unit ventilators, and repairing or replacing dampers and actuators as required.

RE-2: *Clean air handler cooling coils.*

We recommend inspecting the DX coils in AHU-1 and AHU-2 and continuing to clean them on a regular basis, at least once a year.

2.4 Control System

The Westborough District Courthouse has a control system with limited functionality. We recommend the following short-term control system strategies be implemented into the existing control system.

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

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

2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

RFC-1: *Install portable HEPA filters.*

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

Due to the lack of ventilation in the areas below, we recommend the use of portable HEPA filters or similar air purification 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.

- Court Officers G-2
- Juvenile Hearing G-9
- Library 101
- Staff Lounge 105
- Clerk's Office 111
- Conference C-112
- Police Rm. G-4
- Chief Juv. P.O. G-10
- P.O. Office 109
- Lobby 113
- Conference C-113
- Juvenile Waiting G-8
- Conference Rm. G-11
- Clerk's Office 110
- Courtroom 114
- Conference 116

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

2.1.1 Run Supply Fans Continuously During Occupied Hours

Air handlers and unit ventilators were either not running or set to run the fan in "auto" mode, which runs the supply fan only when units are actively heating or cooling. This should be changed on each of the systems to run the supply fans continuously in occupied mode, to supply ventilation air to the spaces. Note that this may cause comfort issues because supply air temperature can fluctuate as the heating and cooling is staged on and off, and the systems may not have been designed to operate like this originally.

2.1.2 Repair or Replace Controls for Exhaust Fans

We recommend repairing or replacing the controls for exhaust fans that were not working at the time of our visit. Exhaust fans can be interlocked the air handlers that serve the same space or get their own timeclock controls. Small toilet rooms with individual fans can continue using controls interlocked to the lights, but we recommend using a time

delay relay that runs the fans for a period after the lights are switched off, such as the Panasonic SmartExhaust AirCycler combination fan/light timer control.

2.7.3 Replace Air Handling Units and Air-Cooled Condensing Units

We strongly recommend replacing AHU-1 immediately, and the other units in 3-5 years. Small indoor air handling units have a life expectancy of 25-30 years. The units in the Westborough District Court are approximately 50 years old and are in fair to poor condition. The air-cooled condensing units should be replaced along with the AHUs. CU-1 is well beyond its expected service lives of 15 years, and it uses R-22 refrigerant which is no longer manufactured. This will limit repair options and increase costs should a failure occur. The replacement systems should use heat pump technology, which will generate energy and operational savings by minimizing the use of electric resistance heat. This will also provide AHU-3 and the holding cells with air conditioning and dehumidification in summer.

2.7.4 Install a Building Management System

When the air handling units are replaced, we recommend adding a BMS to control and monitor equipment. The existing controls are antiquated and do not offer the same benefits as a BMS.

2.7.5 Replace Unit Ventilators

We recommend replacing the unit ventilators. The average life of a unit ventilator is approximately 35 years. The units that appear to be original are approximately 50 years old, exceeding their expected useful life. The replacement units should be specified with MERV-13 filters, code-compliant OA volumes, and packaged terminal heat pump (PTHP) technology to minimize the electric resistance heating load. This will also provide these areas with air conditioning and dehumidification in summer. Units can be selected with less fan noise for sensitive areas.

2.7.6 Install Occupancy or CO_2 Controls for Exhaust Fan

The conference rooms are served by EF-11, which is controlled by a manual switch. Facility personnel indicated that this fan is not run in warm or cold weather, because it sucks conditioned air from the surrounding space. We recommend installing automatic controls to run this fan when one or more of the rooms are occupied.

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.

Section 3
Testing & Balancing Results

Wing's Testing and Balancing Co. visited the Westborough District Courthouse on January 28 through February 2, 2022 to test the airflow rates of the air handling units, unit ventilators, and exhaust fans. Summaries of the tested airflow rates versus the design values are shown below in Tables 5 and 6. A copy of the full testing and balancing report is attached.

TABLE 5
Air Handler Airflow Testing & Balancing Results

	Design			Actual		
Unit	**Total Supply Fan Airflow (CFM)**	**Recommended Outdoor Airflow (CFM)**	**Return Airflow (CFM)**	**Supply Fan Airflow (CFM)**	**Outdoor Airflow (CFM)**	**Return Airflow (CFM)**
AHU-1	1,400	210	1,190	1,017	0[1]	1,017
AHU-2	2,000	1,000	1,000	1,822	928	894
AHU-3	600	600	0	1,423	1,423	0
CUH-10	460[2]	110	350	287	0[3]	287
CUH-11	460[2]	110	350	291	0[3]	291
CUH-20	460[2]	110	350	381	0[3]	381
CUH-22	460[2]	110	350	316	0[3]	316
CUH-26	460[2]	110	350	378	0[3]	378
CUH-31	460[2]	110	350	367	0[3]	367

1. Balancing contractor noted that AHU-1 does not have an outdoor air intake.
2. Unit has a multi-speed fan. The airflow shown is at high speed.
3. Balancing contractor noted that none of the unit ventilators (CUHs) have operational outdoor air intakes.

TABLE 6
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Exhaust Airflow (CFM)	Actual Exhaust Airflow (CFM)
EF-1[1]	Lobby	1,000	unknown
EF-2[1]	Restrooms	560	352
EF-3	Restroom	80	35
EF-4	Restroom	80	52
EF-4A	Restroom	80	32
EF-5	Restroom	80	45
EF-6	Restroom	80	61
EF-7	Restroom	80	71
EF-9	Mechanical Room	435	401
EF-10	Electrical Room	125	252
EF-11[1]	Conference Rooms	440	969
EF-12	Lock Up	600	390

1. Exhaust fans located on the roof could not be tested due to excessive snow on the day of testing. In some cases, the exhaust grilles connected to the fans could be tested in order to get an actual airflow.

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. AHU-1 does not have an outdoor air intake, according to the balancing contractor. The existing HVAC drawings indicate that there should be a 10”x10” duct running from the unit to a 10”x24” outdoor air louver. We recommend investigating whether that intake is still operational and design improvements if required.
2. The balancing contractor noted that all unit ventilators have been replaced and no longer have an outdoor air intake. We recommend investigating whether the original outdoor air intake louvers are operational, if they can be connected to the new unit ventilators, and if the new units can have dampers and/or controls installed.
3. The balancing contractor could not gain roof access during the days of testing due to excessive snow, and therefore could not test EF-1, EF-2, or EF-11. The exhaust air grilles were tested for EF-2 and EF-11 were tested in order to obtain an estimate of total exhaust airflow. However, the fans themselves should be tested in order to get the most accurate reading, and we recommend that the balancing contractor return to test these exhaust fans.

4. According to the balancing contractor, EF-1 does not have power. This exhaust fan serves the main courtroom and lobby, and these areas may become over-pressurized and spill supply air into adjacent spaces if EF-1 is not operational. The ventilation system for these spaces will not be operating as designed without this exhaust fan, we recommend re-powering the fan and scheduling it to run in concert with AHU-2.

5. The ceiling exhaust fans for individual restrooms were noted to be clogged by excessive amounts of dust and debris. These fans, EF-3 through EF-7, are not operating within the recommended tolerance of design airflows. We recommend clearing the blockages in these fans and rebalancing them to their design airflow rates.

6. EF-10 is exhausting more than double its design airflow rate. This not only wastes energy, it can also result in a negative pressurization of the room it is serving, which would then pull supply air from adjacent spaces and increase infiltration. We recommend rebalancing this fan closer to its design airflow rate.

7. EF-12 serving the lock-up area is exhausting significantly less air than it was designed for. This could mean that it is not exhausting the code-required airflow from the holding cells, which could also result in the buildup of odors or other airborne contaminants in the space. We recommend rebalancing this exhaust fan to its design airflow rate.

8. The supply fan for AHU-3 is providing more than double the design airflow rate for this unit. While this unit does have adequate heating and cooling capacities to handle the additional outdoor air, it would be significantly over-pressurizing the lockup area causing air to leak into the adjacent spaces. We recommend rebalancing AHU-3 to provide balanced ventilation with EF-12 (the exhaust fan serving this area) in order to maintain neutral pressurization in the lockup area.

9. EF-8 from the original design has been eliminated and no longer exists.

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WING'S TESTING & BALANCING CO., INC.

Westborough District Court
HVAC Survey

* * * *

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

February 2nd, 2022

94 North Branford Road • Suite One • Branford, CT 06405
(203) 481-4988 • Fax (203) 488-5634 • wings@wingstesting.com
SM-1 License #6803
www.wingstesting.com

WING'S TESTING & BALANCING CO., INC.

February 2nd, 2022

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

Re: Westborough District 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:

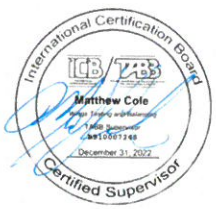
- There was no water to test, the heating is electric heaters, and the cooling is DX.
- EFs 1, 2 and 4 couldn't be tested at the fan.
- There was no access to the roof due to excessive snow.
- To access the roof, technician would also be required to put an extension ladder up from the lower roof into the higher one.

Testing observations:

- AHU-3 would need a sheave change to slow it down to meet design.
- AHU-1 does not have outside air ducted to it.
- All CUHs insides have been replaced and no longer have outside air to them.
- EF-8 has been eliminated and no longer exists.

The following pages are your record of the tested conditions. If you have any questions or if we can be of further assistance, please do not hesitate to call.

Very truly yours,
Wing's Testing & Balancing Co., Inc.
ICB Certified Contractor for:
TABB—Commissioning—Fire/Life Safety L1&L2—Sound & Vibration



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

SUPPLY FAN REPORT

PROJECT:	Westborough District Court	**DATE:**	1/31/22
AREA SERVED:	AHU-1, AHU-2, AHU-3	**TECH:**	BS

FAN DATA

FAN NUMBER	AHU-1		AHU-2		AHU-3	
LOCATION	Men's Room Ceiling		Basement		Basement	
AREA SERVED	Lobby		Main Courtroom		Lock-Up	
MANUFACTURER	NA		Daikin			
MODEL OR SIZE	NA		DAR0904AB		HF-103H	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
TOTAL CFM	1400	1017	2000	1822	600	1423
RETURN AIR	1190	1017	1000		0	0
OUTSIDE AIR	210	0	1000	928	600	1423
DISCH. STATIC	---	-0.38"	---	+0.26"	---	+0.54"
SUCTION STATIC	---	+0.30"	---	-0.41"	---	-0.26"
TOTAL STATIC	---	0.68"	NA	0.67"	NA	0.80"
FAN RPM	---	750	NA	1068	NA	956
PULLEY O.D.	12.0 x 1		6.0 x 7/8		5.0 x 7/8	
ESP	0.44		0.44		0.56	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	No O.A.		25%		100%	

MOTOR DATA

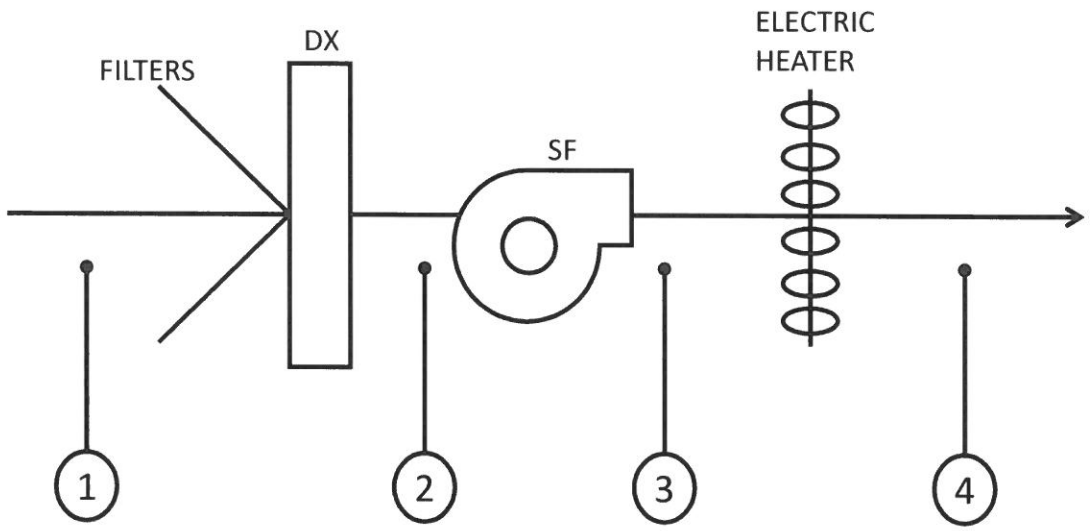
MANUFACTURER	Marathon		WS Motors		Magnetech	
MODEL OR FR.	48		NA		Y48	
HORSEPOWER	1/2	1/2	1/2	1/2	1/2	1/2
MOTOR RPM	3450	3450	1725	1725	1725	1725
VOLTAGE / PH.	208/1	208/1	208/3	208/3	115/1	115/1
AMPS LEG 1	2.2		5.2	2.6	7.1	
AMPS LEG 2	---	2.1	---	2.6	---	6.6
AMPS LEG 3	---		---	2.6	---	
SHEAVE O.D.	3.0" x 1/2		3.0" x 5/8		3.0 x 1/2	
BELTS - QUANTITY / SIZE	4L530		4L410 (1)		4L410 (1)	
SHEAVE POSITION	Closed		1/2 Open		3/4 Closed	
C to C	14.0		13.0		14.0	

REMARKS

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

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Westborough District Court	**DATE:**	2/2/22
SYSTEM/AREA:	AHU-1 and AHU-2	**TECH:**	BS



STATIC PRESSURE READINGS "wc

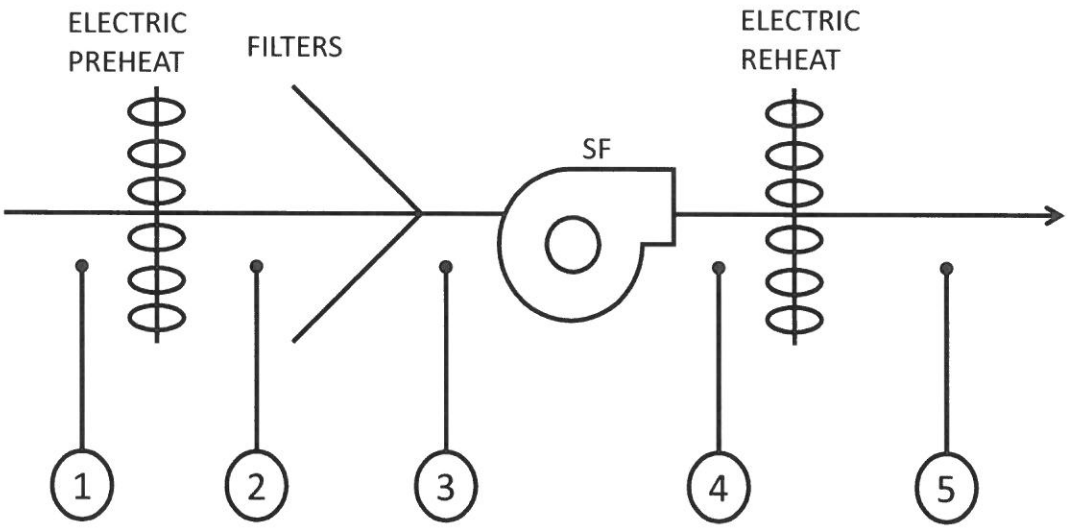
POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	NOTES
AHU-1	-0.16"	-0.38"	+0.30"	+0.28"					
AHU-2	-0.20"	-0.41"	+0.26"	+0.24"					

REMARKS

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

SYSTEM STATIC PRESSURE PROFILE

PROJECT:	Westborough District Court	**DATE:**	2/2/22
SYSTEM/AREA:	AHU-3	**TECH:**	BS



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	8	NOTES
AHU-3	-0.04"	-0.05"	-0.26"	+0.54"	+0.52"				

REMARKS

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

VELOCITY PRESSURE READINGS

PROJECT:	Westborough District Court					**DATE:**	1/28/22	
AREA SERVED:	AHU-1, AHU-2, AHU-3					**TECH:**	BS	
TRAVERSE LOCATIONS	**DUCT SIZE "**	**AREA SQ.FT.**	**DESIGN**		**CENT. STAT. PRESS."**	**TEST**		**NOTES**
			FPM	**CFM**		**FPM**	**CFM**	
AHU-1	30"x16"	3.33	---	1400	w/ Velgrid	305	1017	
AHU-2 Total	32"x14"	3.11	---	2000	+0.26"	586	1822	
AHU-2 O.A.	58"x16"	6.44	---	1000	w/ Velgrid	144	928	
AHU-2 Return					Calculated		894	
AHU-3	12"x10"	0.83	---	600	+0.54"	1715	1423	

REMARKS

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

SUPPLY FAN REPORT

PROJECT:	Westborough District Court	**DATE:**	2/1/22
AREA SERVED:	CUH-20, CUH-22 and CUH-26	**TECH:**	BS

FAN DATA

	CUH-20		CUH-22		CUH-26	
FAN NUMBER						
LOCATION	Clerks		Magistrate		Judge's Lobby	
AREA SERVED	Clerks		Magistrate		Judge's Lobby	
MANUFACTURER	CNI		CNI		CNI	
MODEL OR SIZE	CRKOC154		CRKOC154		CRKOC154	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	460	381	460	316	460	378
RETURN AIR	350	381	350	316	350	378
OUTSIDE AIR	110	0	110	0	110	0
DISCH. STATIC	---	-0.04"	---	-0.04"	---	-0.03"
SUCTION STATIC	---	+0.05"	---	+0.04"	---	+0.05"
TOTAL STATIC	---	---	NA	---	NA	---
FAN RPM	NA	NA	NA	NA	NA	NA
PULLEY O.D.	DD		DD		DD	
ESP	---		---		---	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	No O.A.		No O.A.		No O.A.	

MOTOR DATA

MANUFACTURER	NA		NA		NA	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	1/4	1/4	1/4	1/4	1/4	1/4
MOTOR RPM						
VOLTAGE / PH.	230/1	230/1	230/1	230/1	230/1	230/1
AMPS LEG 1						
AMPS LEG 2	---	1.3	---	1.2	---	1.3
AMPS LEG 3	---		---		---	
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	
C to C	---		---		---	

REMARKS

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

SUPPLY FAN REPORT

PROJECT:	Westborough District Court	**DATE:**	2/1/22
AREA SERVED:	CUH-10, CUH-11, CUH-31	**TECH:**	BS

FAN DATA						
FAN NUMBER	CUH-10		CUH-11		CUH-31	
LOCATION	Probation		G10		Lounge 105	
AREA SERVED	Probation		G10		Lounge 105	
MANUFACTURER	CNI		CNI		CNI	
MODEL OR SIZE	CRKOC154		CRITOC154		CRKOC154	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	460	287	460	291	460	367
RETURN AIR	350	287	350	291	350	367
OUTSIDE AIR	110	0 (1)	110	0 (1)	110	0 (1)
DISCH. STATIC	---	-0.03"	---	-0.02"	---	-0.04"
SUCTION STATIC	---	+0.03"	---	+0.03"	---	+0.05"
TOTAL STATIC	---	---	---	---	---	---
FAN RPM	NA	NA	NA	NA	NA	NA
PULLEY O.D.	DD		DD		DD	
ESP	---		---		---	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D.MIN POS	No O.A.		No O.A.		No O.A.	

MOTOR DATA						
MANUFACTURER	NA		NA		NA	
MODEL OR FR.	NA		NA		NA	
HORSEPOWER	1/4	1/4	1/4	1/4	1/4	1/4
MOTOR RPM	NA	NA	NA	NA	NA	NA
VOLTAGE / PH.	230/1	230/1	230/1	230/1	230/1	230/1
AMPS LEG 1	1.5		1.5		1.5	
AMPS LEG 2	---	1.3	---	1.2	---	1.3
AMPS LEG 3	---		---		---	
SHEAVE O.D.	DD		DD		DD	
BELTS - QUANTITY / SIZE	DD		DD		DD	
SHEAVE POSITION	DD		DD		DD	
C to C	---		---		---	

REMARKS

(1) CUHs have no O.A.

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

EXHAUST FAN REPORT

PROJECT:	Westborough District Court			**DATE:** 2/2/22
AREA SERVED:	EF-1 to EF-3			**TECH:** BS
FAN DATA				
FAN NUMBER		EF-1 (2) (3)	EF-2 (2)	EF-3
LOCATION		Roof	Roof	Lock-Up
AREA SERVED		Lobby	Restrooms	Toilet
MANUFACTURER		PENN	PENN	Nutone
MODEL OR SIZE		---	---	8810
TOTAL CFM	**DESIGN**	1000	560	80
	ACTUAL	---	352	35 (1)
FAN RPM	**DESIGN**	735	552	NA
	ACTUAL	---	---	2800
PULLEY	**O.D.**	---	---	DD
SERVICE		---	---	DD
MOTOR DATA				
MANUFACTURER		NA	NA	Nutone
MODEL NUMBER		NA	NA	NA
MOTOR HP	**DESIGN**	1/6	1/6	NA
	ACTUAL	NA	NA	NA
MOTOR RPM		NA	NA	2800
VOLTAGE/PHASE		NA	NA	115/1
MOTOR AMPS	**DESIGN**	NA	NA	0.9
	ACT. LEG 1	NA	NA	
	ACT. LEG 2	NA	NA	0.6
	ACT. LEG 3	NA	NA	
SHEAVE		NA	NA	DD
BELTS - QUANTITY/SIZE		NA	NA	DD
SHEAVE POSITION		NA	NA	DD

REMARKS

(1) Fan and duct clogged with dust.

(2) There was no access to the EFs located on the roof due to excessive snow. The only way to access these fans is to put an extension ladder up to the lower roof and then drag the ladder up onto the lower roof to extend to the higher roof.

(3) This fan does not operate and it does not have power to it.

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

EXHAUST FAN REPORT

PROJECT:	Westborough District Court			**DATE:** 2/2/22
AREA SERVED:	EF-4 to EF-5			**TECH:** BS
FAN DATA				
FAN NUMBER		EF-4	EF-5	EF-6
LOCATION		Judge	Assistant Clerk	Judge's Chamber
AREA SERVED		Judge's Toilet	Assistant Clerk Toilet	Judge's Toilet
MANUFACTURER		Nutone	Nutone	Nutone
MODEL OR SIZE		8810	8810	8810
TOTAL CFM	**DESIGN**	80	80	80
	ACTUAL	52	45 (1)	61
FAN RPM	**DESIGN**	NA	NA	2800
	ACTUAL	2800	2800	DD
PULLEY	**O.D.**	DD	DD	DD
SERVICE		DD	DD	
MOTOR DATA				
MANUFACTURER		Nutone	Nutone	Nutone
MODEL NUMBER		NA	NA	NA
MOTOR HP	**DESIGN**	NA	NA	NA
	ACTUAL	NA	NA	NA
MOTOR RPM		2800	2800	2800
VOLTAGE/PHASE		115/1	115/1	115/1
MOTOR AMPS	**DESIGN**	0.9	0.9	0.9
	ACT. LEG 1	---	---	---
	ACT. LEG 2	0.7	0.7	0.8
	ACT. LEG 3	---	---	---
SHEAVE		DD	DD	DD
BELTS - QUANTITY/SIZE		DD	DD	DD
SHEAVE POSITION		DD	DD	DD
REMARKS				

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

EXHAUST FAN REPORT

PROJECT:	Westborough District Court			**DATE:** 2/2/22
AREA SERVED:	EF-4 to EF-5			**TECH:** BS
FAN DATA				
FAN NUMBER		EF-7	EF-9	EF-10
LOCATION		Clerk	Basement	Basement
AREA SERVED		Clerk's Toilet	Mechanic G18	Electric G17
MANUFACTURER		Nutone	Zephyr	Nutone
MODEL OR SIZE		8810	2100	NA
TOTAL CFM	**DESIGN**	80	435	125
	ACTUAL	71	401	252
FAN RPM	**DESIGN**	2800	DD	DD
	ACTUAL	DD	DD	DD
PULLEY	**O.D.**	DD	DD	DD
SERVICE		---	---	---
MOTOR DATA				
MANUFACTURER		Nutone	Fasco	Nutone
MODEL NUMBER		NA	NA	NA
MOTOR HP	**DESIGN**	NA	1/20	NA
	ACTUAL	NA	1/20	NA
MOTOR RPM		2800	1045	2800
VOLTAGE/PHASE		115/1	115/1	115/1
MOTOR AMPS	**DESIGN**	0.9	1.95	2.5
	ACT. LEG 1	---	---	---
	ACT. LEG 2	0.8	1.6	2.2
	ACT. LEG 3	---	---	---
SHEAVE		DD	DD	DD
BELTS - QUANTITY/SIZE		DD	DD	DD
SHEAVE POSITION		DD	DD	DD

REMARKS

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

EXHAUST FAN REPORT

PROJECT:	Westborough District Court		**DATE:** 2/2/22
AREA SERVED:	EF-11, EF-12, EF-4A		**TECH:** BS

FAN DATA				
FAN NUMBER		EF-11 (2)	EF-12	EF-4A
LOCATION		Roof	Basement	Women's 102
AREA SERVED		Conference Rooms	Lock-Up	Women's 102
MANUFACTURER		PENN	Barry Blanc	Nutone
MODEL OR SIZE		10FC10FR	BVF-105	8810
TOTAL CFM	**DESIGN**	440	600	80
	ACTUAL	969	390	32 (1)
FAN RPM	**DESIGN**	513	NA	NA
	ACTUAL	NA	638	2800
PULLEY	**O.D.**	NA	6.5 x 3/4	DD
SERVICE		NA	1.35	DD
C to C		---	7.5	---

MOTOR DATA				
MANUFACTURER		NA	Century	Nutone
MODEL NUMBER		NA	F48	NA
MOTOR HP	**DESIGN**	1/6	1/2	NA
	ACTUAL	NA	1/2	NA
MOTOR RPM		NA	1725	2800
VOLTAGE/PHASE		NA	115/1	115/1
MOTOR AMPS	**DESIGN**	NA	3.4	0.9
	ACT. LEG 1	NA	---	---
	ACT. LEG 2	NA	3.5	---
	ACT. LEG 3	NA	---	---
SHEAVE		NA	3.0 x 1/2	DD
BELTS - QUANTITY/SIZE		NA	---	DD
SHEAVE POSITION		NA	1/2 Closed	DD

REMARKS

(1) Fan and duct clogged with dust.

(2) No access to fan, roof covered in snow.

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

AIR DEVICE REPORT

PROJECT:	Westborough District Court	**DATE:**	1/28/22
SYSTEM / AREA:	AHU-3, EF-2 and EF-11	**TECH:**	BS

LOCATION	NO.	SIZE	A K	DESIGN		TEST		FINAL		NOTES
				FPM	CFM	FPM	CFM	FPM	CFM	
AHU-3										
Cell 1	1	8"x6"	0.33	---	ND	684	226			
Cell 2	2	8"x6"	0.33	---	ND	695	229			
Cell 3	3	8"x6"	0.33	---	ND	735	243			
Cell 4	4	12"x6"	0.50	---	ND	649	325			
Cell 5	5	12"x6"	0.50	---	ND	716	358			
							1381			
EF-2										
GC-9	1	8"x6"	0.24	---	ND	92	22			
GC-8	2	4"x4"	0.08	---	ND	157	13			
GC-7	3	8"x6"	0.24	---	ND	253	61			
C108	4	8"x6"	0.24	---	ND	649	156			
C108A	5	4"x4"	0.08	---	ND	57	5			
C110	6	8"x6"	0.24	---	ND	397	95			
							352			
EF-11										
C112	1	12"x6"	0.36	---	ND	1329	478			
C113	2	12"x6"	0.36	---	ND	1074	387			
C116	3	12"x6"	0.36	---	ND	289	104			
							969			

REMARKS

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