Dorchester District Court
Dorchester, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

December 26, 2021

Tighe&Bond

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Section 1
Existing Conditions and Site Observations

Tighe & Bond visited the Dorchester District Courthouse on September 10, 2020. While on site, we inspected the basement and penthouse 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:
    - Jeff Daru, Facilities Management and Capital Planning
    - Tyrone Whitley, Courthouse Facilities Staff

- Tighe & Bond:
    - Sean Pringle, PE, Project Mechanical Engineer
    - Timothy Bill, Staff Engineer

1.1 Existing Ventilation System

The Dorchester District Courthouse is a three-story building (including the basement), constructed in 1925 with a major renovation in 1994, with a floor area of approximately 77,000 Gross Square feet. The HVAC system includes eight air handling units (AHU), with AHU's 1 through 3 located in the basement mechanical room, and AHU's 4-8 located in mechanical penthouses.

All AHU's have a heating hot water coil, a chilled water coil, and supply air fan. All AHU's except for AHU-1 also have a return air fan and return, outside, and exhaust air dampers, with economizer capability. AHU-1 is a 100% outdoor air, constant volume unit that serves the lockup area and provides ventilation air to conference rooms throughout the building. This unit has a face and bypass damper arrangement for the hot water coil.

The air handling units are generally in fair condition. They appear to have been installed as part of the 1994 renovation. Motors, actuators, bearings, and other wear items appear to have been replaced as they failed. Most outdoor air dampers are in poor condition and are rusty but appear to be operational. Also, several filters were poorly fitted, and coils had dirty areas around the edges indicating possible bypass air around the filters.

Most AHU's are missing a trap on the cooling coil condensate drain piping. Only AHU-1 has a trap condensate drainage piping. All other AHU's have condensate drain piping without a trap. Without a trap, the negative pressure in the AHU causes the drain pan beneath the cooling coil to pool up with water, and in some cases has caused it to overflow and flood the downstream motor section. This excess water corrodes the equipment and can result in mold growth within the AHU, affecting indoor air quality. In AHU's 4 and 6, the blower sections were flooded at the time of the visit. In AHU-4, the cooling coil drain pan may have failed, as there was very little water in the condensate tray even though the blower section was flooded.

Condensate drains are piped from the hot water coils on all AHU's to nearby floor drains. These do not need to be piped, as the hot water coils do not produce condensate. This is an unnecessary opening that allows unfiltered mechanical room air to be drawn into the system.

The three basement AHU's draw outside air from, and exhaust air to, a confined mechanical pit. This causes some cross-contamination of exhausted air into the fresh air. Similarly, the penthouse AHU's draw outside air from, and exhaust air to, a combined exhaust/intake louver. The exhaust and intake openings are side by side. While partitions exist up to the louver face, this arrangement also can cause cross-contamination of exhausted air into the fresh air.

AHU-7 was missing a latch on the cooling coil access section, which appeared to be causing an air leak, allowing unfiltered air to be drawn into the system.

At the time of the visit, exhaust fans EF-9 and EF-10 were not operating. The drawings indicate that these fans serve toilet exhausts in the areas directly below these fans. All other roof exhaust fans were operating at the time of the visit.

Chilled water is provided by a pair of 130-Ton Daikin Air-cooled chillers located outside on grade. Hot Water is provided from a pair of 2.35 MMBH Smith cast iron boilers. Staff noted that the chillers shut off frequently because of alarms related to inadequate water flow, especially on moderate days. This happened several times while we were onsite. This may cause performance issues during the next cooling season.

All areas except the courtroom and the lockup area are served by the AHU-3 variable air volume (VAV) system. Supply air is regulated to each zone by VAV boxes. The VAV units do not have reheat. We assume the VAV boxes are original and have not been replaced. VAV boxes typically operate between a maximum and minimum position. The minimum position prevents the VAV box damper from fully closing, which allows constant airflow to the space when occupied, which is a code requirement for ventilation purposes. The 1994 design drawings do not list a minimum supply airflow for each VAV, so it is unknown if supply air is always being provided or if the minimum positions provide adequate ventilation air. The working condition of these boxes is also unknown.

For high density spaces such as conference rooms, constant 100% OA ventilation air is provided via separate diffusers from AHU-1 in addition to, and independently of, the air from the VAV system.

The lockup areas are provided with 100% outside air supply from AHU-1, supplied into the corridors and the cells. Air is exhausted from the cells through the toilet exhaust risers.

Each of the six courtrooms are served by a dedicated AHU. These AHU's (AHU-2 and AHU's 4-8) are constant airflow systems, with demand-controlled ventilation (DCV) This allows the outside air to be modulated based on CO2 concentrations within the space.

Around the perimeter, fan coil units provide heating and cooling for additional control. These units are in fair to poor condition and have 1" MERV 8 filters. Staff indicated that all hot water coils have been cleaned within the last three years.

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

TABLE 1
Existing Air Handlers

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Filters	Condition
AHU-1	5,100	5,100	2" MERV 8	Fair
AHU-2	4,300	1,375	2" MERV 8	Fair
AHU-3	32,500	6,600	2" MERV 8	Good
AHU-4	2,930	760	2" MERV 8	Fair
AHU-5	2,600	570	2" MERV 8	Fair
AHU-6	2,600	570	2" MERV 8	Fair
AHU-7	2,930	760	2" MERV 8	Fair
AHU-8	4,500	1,000	2" MERV 8	Fair

Photo 1 – Representative Air Handler

1.2 Existing Control System

The Courthouse has an Automated Logic building management control system (BMS). It monitors and controls the existing boiler, chiller, AHU's, VAV's, fan coils, and exhaust fans. The BMS and AHU control devices appear to have been upgraded more recently than the 1994 renovation and were likely upgraded within the last 10 years. While onsite, Tighe & Bond was able to observe various control system screens and setpoints and discussed the operation with staff. In addition to typical controls, we understand that the system provides the following key features for the AHU's:

1. All units:
    a. Economizer mode – 100% outdoor air.
    b. Safeties and alarms, including freeze stats.
2. Courtroom units (AHU's 2 & 4-8):
    a. Demand Controlled Ventilation (DCV) – varies the outside air percentage from a minimum to a maximum limit in response to CO2 concentration in the return air.
3. 100% outside air unit (AHU-1):
    a. Face and bypass damper control for hot water coil (note the hot water coil does not have a hot water control valve).

Section 2
Recommendations

Below is a list of recommendations that we propose for the Dorchester 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 a MERV 13 filter.*

TAB Contractor and Engineer shall verify that the existing air handlers can accommodate MERV-13 filters. Replace filters in AHU's and fan coils with 1" or 2" filters as applicable.

RF-3: *Install a differential pressure sensor (switch) across the filter banks.*

We recommend this measure for the air handers, but not the fan coil units. The existing automated logic controllers associated with the AHU's appeared to have spare binary inputs to accommodate the addition of a differential pressure switch.

RF-3b: *Pressure sensor (switch) shall have a display and be connected to the BMS system.*

2.2 Testing & Balancing Recommendations

The air handlers are approximately 27 years old and it is unknown to Tighe & Bond when the last time this units were tested and balanced to the proper airflow. Also, the code required outside air flow rates that were used to design the system in 1994 are different than the 2015 IMC and ASHRAE Standard 62.1 requirements.

We recommend the following measures:

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

We recommend rebalancing the air handlers to the recommended minimum O.A. values shown in Table 2. After rebalancing, the spaces should be monitored during peak heating and cooling conditions to confirm space temperature can be maintained.

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	5,100	5,100	5,100	5,100
AHU-2	4,300	1,375	1,160	1375
AHU-3	32,500	6,600	6,200	6,600
AHU-4	2,930	760	670	760
AHU-5	2,600	570	530	570
AHU-6	2,600	570	530	570
AHU-7	2,930	760	670	760
AHU-8	4,500	1,000	830	1,000

Based on this comparison, it appears that the original design outdoor airflows are adequate. Where the outside airflows calculated by Tighe & Bond are less than the original design values, we recommend using the original designed values, as these exceed the calculated code minimums and will likely result in improved indoor air quality (IAQ).

The airflow rate per person is shown below in Table 3. These values are based on the recommended outdoor airflow and the original design supply airflow rates shown in Table 2 above. The airflow rate per person also 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)	756	422	334
Total Supply Air (CFM/Person)	75	47	118
Outdoor Air (CFM/Person)	22	12	35

The airflow rate per person for each Courtroom is shown below in Table 4. These values are based on full occupancy without taking diversity into account, the original 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. At times when the supply airflow is reduced due to the space temperature being satisfied, the airflow rate per person will also be reduced.

TABLE 4
Airflow Rate per Person - (Full Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outside Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Jury Pool Room	38	480	13	150	4
Arraignment Courtroom	159	4,300	27	1,375	9
Medium Courtroom C204	92	2,930	32	760	8
Medium Courtroom C225	92	2,930	32	760	8
Small Courtroom C207	73	2,600	36	570	8
Small Courtroom C221	73	2,600	36	570	8
Large Courtroom 216	114	4,500	39	1,000	9

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. At times when the supply airflow is reduced due to the space temperature being satisfied, the airflow rate per person will also be reduced.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outside Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Jury Pool Room	15	480	32	150	10
Arraignment Courtroom	19	4,300	226	1,375	72
Medium Courtroom C204	17	2,930	172	760	45
Medium Courtroom C225	19	2,930	154	760	40
Small Courtroom C207	15	2,600	173	570	38
Small Courtroom C221	14	2,600	186	570	41
Large Courtroom 216	18	4,500	250	1000	56

RTB-3: *Increase outside air flow rate beyond minimum under non-peak conditions*.

We recommend increasing the outdoor air flow rate beyond the recommended outdoor air flow rates under non-peak conditions. We do not believe this would cause a threat of a potential coil to freeze based on the total percentage of outside air vs. the total amount of outside air, however cold spots on the coil may develop due to poor mixing.

Refer to the Control System upgrades section for the required controls to implement this strategy.

RTB-5: *Consider rebalancing all air inlets and outlets.*

Lockup Spaces
The lockup ventilation strategy is based on maintaining a slight negative airflow pattern in the cells relative to the corridors in the lockup area. If any exhaust grilles have been accidently closed or if the supply air flow is too high in these areas, the likelihood of cross contamination from one cell to another increases.

Whole building or spaces with airflow/temperature issues
If the Courthouse experiences regular cooling and heating comfort complaints, we recommend exploring rebalancing all air inlets and outlets throughout the building. Prior to rebalancing the building, we recommend verifying the chiller and boiler plants are maintaining the correct supply water temperatures.

RTB-6: *Test and balance all air handler chilled and hot water coils.*

Testing and balancing the air handler hot and chilled water coils will help ensure the coils are receiving the proper water flow rates. We understand that the chilled water coils were rebalanced as part of the recent chilled water replacement. Based on the test and balance report we were provided, the chilled water coils on AHU's 2-8 do not need to be rebalanced.

The chilled water flow rate for AHU-1 was reported at 55 GPM on the balance report and left unchanged. However, the original scheduled flow rate from the 1994 drawings is 38 GPM. This may have been left at a higher flowrate to improve the dehumidification capacity of this 100% OA unit. The justification for this flowrate should be determined prior to revising the flowrate of this AHU.

2.3 Equipment Maintenance & Upgrades

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

Replace dampers and actuators that are not functioning.

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

While most air handler coils were in good condition, several showed some signs of corrosion or buildup. These should be cleaned to ensure the airflow and heating/cooling capacity can be maintained. In addition, several drain pans were in poor condition due to the lack of condensate traps. These should be cleaned or replaced if damaged.

RE-4: *Inspect VAV Boxes and controllers.*

VAV boxes regulate the supply air delivered to each space. At a minimum, we recommend cycling the damper positions and testing the airflow to verify the maximum and minimum airflow rates are being delivered as designed. Consider cleaning airflow stations and reheat coils. Any boxes not delivering the expected airflow rates should be rebalanced.

2.4 Control System

We recommend the following control system strategies be implemented into the existing control system:

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

RC-3: *Install controls required to introduce outside air beyond the minimum requirement in a stepped approach.*

RC-5: *Disable Demand-Controlled Ventilation Sequences*

This measure applies to AHU's that serve individual courtrooms (AHU's 2, 4-8).

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.

The lockup area and other areas that receive a large amount of supply air from AHU-1 may benefit from local humidification. AHU-1 is a 100% outside air system. This lockup area has a relatively high ventilation rate and will tend to have a lower humidity than other areas. Studies indicate that as relative humidity is reduced below 40%, susceptibility to viruses such as COVID-19 progressively increases.

2.7 Other Recommendations

2.7.1 Replace Toilet Exhaust Fans and Controls

We recommend replacing the failed toilet exhaust fans. At the time of the visit, EF-9 and EF-10 were not functioning. After replacement, rebalance the toilet exhaust fans to the airflows shown on the drawings.

2.7.2 Add Condensate Traps to AHU Condensate Piping

The addition of condensate traps will prevent stagnant water from accumulating in the cooling coil tray due to negative internal AHU pressure inhibiting drainage, and also reduces unfiltered air leakage into the supply air stream. Also consider installing a removable cap on this piping during the winter when the chillers are shut down to reduce air leakage when the trap dries out.

Consider removing the condensate drain piping from the hot water coil. This piping is unnecessary and creates an air leakage path that is a source of unfiltered air in the supply air stream. Alternately, consider adding a valve or a removable cap to the end of the drain to allow the piping to be used during cleaning while preventing air leakage.

2.7.3 Increase the filter replacement frequency for AHU-1

Because this unit is 100% outside air, the filters will load 3-4 times faster than other units. The use of a filter differential pressure switch will help to inform the best frequency. Staff indicated that the current frequency is roughly monthly, compared to every 3 months for the other units.

2.7.4 Make AHU Adjustments to Reduce Air Leakage

In several units it was noted that the there was a small gap in the filter tray around the filters. Also, AHU-7 had missing door hardware that prevented the door from closing fully. These fitment issues cause unfiltered outside air to be drawn into the AHU supply air system and will clog and damage coils over time.

2.7.5 Improve the Control Sequence of the Chillers and Bypass Valve

The chilled water coils are all controlled by two-way valves, and a pair of 3-inch bypass valves are used to maintain minimum flow through the chillers. Staff stated that when the chillers are enabled, the operating unit often requires a minimum flow higher than what the building requires. This causes the bypass valve to start to open to maintain this flow. However, by the time the bypass valve has opened enough to generate the correct flow through the chiller, the chiller has generated an alarm and shut down. This issue should be reviewed in greater detail, and modifications made quickly. Proper operation of the

chillers is imperative to avoid excessive wear and tear on the equipment, and adverse effects on the building occupants and materials due to unstable temperature and humidity conditions.

2.7.6 Relocate AHU Exhaust Discharge

To comply with current code requirements, we recommend the location of the AHU exhaust air discharge be relocated a minimum of ten feet away from the air handling unit outside air intake louvers. The current locations present a risk of recirculating building air back into the intake air louvers. If this is occurring, the air handlers are bringing in less outside air and recirculating more.

Section 3
Testing & Balancing Results

Wings Testing & Balancing Co., INC. visited the Dorchester District Courthouse on March 26, 2021 to test the airflow rates of the air handling units and the exhaust fans.

On May 26, 2021, Wings returned to the Courthouse to test the airflow rate of exhaust fans EF-9 and EF-10, which were inoperable during the visit in March. They also measured the hot and chilled water flow rates through the air handlers. On June 25, 2021, Wings tested the airflow rates of additional fans.

On August 18, 2021 Wings changed and adjusted the sheave on AHU-2 to improve airflow and tested EF-8, which was inoperable previously.

A summary of the tested airflow rates versus the design airflow rates are shown below in Tables 5, 6, and 7. The full testing and balancing report is attached.

TABLE 5
Air Handler Testing & Balancing Results

	Design			Actual		
Unit	**Total Supply Fan Airflow (CFM)**	**Recommended Outdoor Airflow (CFM)**	**Return Airflow (CFM)**	**Supply Fan Airflow (CFM)**	**Outdoor Airflow (CFM)**	**Return Airflow (CFM)**
AHU-1	5,100	5,100	0	4,991	4,991	0
AHU-2	4,300	1,375	2,925	4,255	2,946	1,308
AHU-3	32,500	6,600	25,900	29,316	6,568	22,748
AHU-4	2,930	760	2,170	2,854	691	2,163
AHU-5	2,600	570	2,030	2,489	553	1,936
AHU-6	2,600	570	2,030	2,519	544	1,975
AHU-7	2,930	760	2,170	3,195	809	2,386
AHU-8	4,500	1,000	3,500	4,582	973	3,609

TABLE 6
Air Handler Waterflow Testing & Balancing Results

	Design		Actual	
Unit	Chilled Water Flow Rate (GPM)	Hot Water Flow Rate (GPM)	Chilled Water Flow Rate (GPM)	Hot Water Flow Rate (GPM)
AHU-1	38	44	38	45
AHU-2	33	19	13	20
AHU-3	225	107	210	105
AHU-4	21	10	22	10
AHU-5	17	9	18	10
AHU-6	17	9	18	10
AHU-7	21	10	22	11
AHU-8	33	14	14	13

TABLE 7
Exhaust Fan Testing & Balancing Results

Unit	Serving	Design Exhaust Airflow (CFM)	Actual Exhaust Airflow (CFM)
EF-2	Toilets	1,830	1,673
EF-4	Jury Pool	270	177
EF-5	Lockup	2,475	1,885
EF-6	Toilets	900	916
EF-7	Toilets	675	642
EF-8	Toilets	1,050	1,000
EF-9	Toilets	1,620	1385
EF-17	Conference Room	270	289

Typical balancing tolerances for air systems is ±10% of the design airflow.

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

1. AHU-1, 3, 4, 5, 6, 7, and 8 are performing within the acceptable airflow range, with MERV 13 filters installed.
2. After adjusting the sheaves, AHU-2 now is performing within the acceptable airflow range.
3. The cooling coils in AHU's 2 and 8 are operating at 50% of design flow.
    a. For AHU-2, we recommend rebalancing the coil once the chillers are restarted in the spring, to achieve the design flowrate. In conversations with Wings, it was discovered that this unit was balanced in error to 13 GPM instead of 33 GPM.
    b. For AHU-8, the balancing valve is 100% open. We recommend checking control valve operation, and cleaning the strainer and coil, to ensure there are no flow restrictions. Once this cleaning is completed, the water flow should be rebalanced.
4. Lockup exhaust fan EF-5 is operating approximately 20% below design capacity, with the existing 1/2 horsepower motor operating slightly above nameplate capacity. We recommend investigating the cause of the low airflow. If no obvious obstructions or balancing issues are found, larger capacity fan should be selected by an engineer. As a larger horsepower motor will likely be necessary, an electrical engineer will need to determine if the existing circuit and controls can support the increased load.
5. EF-4 is operating at 66% of design capacity. A sheave change would improve the airflow but would not bring the airflow within acceptable tolerances. We recommend investigating the cause of the low airflow. If no obvious obstructions or balancing issues are found, larger capacity fan should be selected by an engineer. As a larger horsepower motor will likely be necessary, an electrical engineer will need to determine if the existing circuit and controls can support the increased load.
6. All other exhaust fans are performing within the acceptable airflow range.

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.

WING'S TESTING & BALANCING CO., INC.

Dorcester BMC
HVAC/Ventilation Survey
REVISED

* * * *

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

August 18, 2021

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WING'S TESTING & BALANCING CO., INC.

August 20, 2021

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

Re: Dorcester BMC/HVAC Ventilation Survey- **REVISED August 18, 2021**

Dear Jason,

We have recently revisited this site to complete the of EF-8 and AHU-2, we found the following:

- The sheave was changed on AHU-2 and is now at 99% of design
- EF-8 is running now and was re-tested at 95% of design.

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
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WING'S TESTING & BALANCING CO., INC.

June 25, 2021

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

Re: Dorcester BMC/HVAC Ventilation Survey- **REVISED June 25, 2021**

Dear Jason,

We have recently revisited this site to complete the Exhaust Fan testing, during our visit we found the following:

- The remainder of the exhaust fans which serve occupied areas were tested.
- EF-8 has no power at the fan.
  - The braker panel labeled EF-8 is on and the BMS is sending a command for this fan to run.
  - The motor and sheaves on this fan are brand new.
  - An electrician is required to investigate this further.
- EF-4 is below design and would require a sheave change to meet design CFM.

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.

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WING'S TESTING & BALANCING CO., INC.

March 26, 2021

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

Re: Dorcester BMC/HVAC Ventilation Survey- REVISED

Dear Jason,

REVISED 5/26/21: Since our last visit to this courthouse all the issues with EF-9 and EF-10 have been fixed and were retested. We also took both hot water and chilled water readings for all AHU's. They have been added to this report. Although we were not able to test with all AHU coils open at once, we did test with the 'biggest hitters' open and noted that we were controlling and making different pressure setpoint for the water loops.

We have completed our HVAC/Fresh-Air survey for the above-mentioned project. Through our testing we found:

- EF-9 is over-amping and shutting down on thermal over-load. This will need to be investigated.
- EF-10 has a very loose belt, and the motor sheave is seized. This fan needs a smaller belt installed.
- RF-8 has no access to the ductwork to take an accurate traverse total.

This report includes Brake Horsepower (BHP) calculations. When a motor has a VFD, we take the amperage measurements from there. When we calculate from volts and amps, it means there has to be a nameplate on the motor. Many times, these are missing or illegible. If BHP is not listed for an individual motor, this is because we do not have enough information to calculate it. It should be noted that that the older a motor is, the less likely it is to follow the affinity laws for BHP- since the efficiency degrades over time. We have used accepted constants for efficiency and the power factor, which should result in fairly close calculations, but are not as accurate for older motors.

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Dorcester BMC
March 26, 2021

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SUPPLY FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 3/26 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER	AHU-1		AHU-2		AHU-3	
LOCATION	Basement		Basement		Basement	
AREA SERVED	Lock Up		Court Room #1		All Areas	
MANUFACTURER	Trane		Trane		Trane	
MODEL OR SIZE	MCCA010GAL		MCCA010GAL		MCCA060GAM	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	5100	4991	4300	4255	32,500	29,316
RETURN AIR	---	---	2925	2946	25,900	22,748
OUTSIDE AIR	5100	4991	1375	1308	6600	6568
DISCH. STATIC	---	+0.50"	---	+.40"	---	+1.38"
SUCTION STATIC	---	-1.90"	---	-1.36"	---	-1.43"
TOTAL STATIC	---	2.40	---	1.76	---	2.81
FAN RPM	---	1207	---	797	---	2242
PULLEY O.D.	7 1/2" x 1 3/16"		8 1/2" x 1 3/16"		24 1/2" x 2 7/16"	
ESP	0.87		0.72		1.97	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D. MIN POS	100%		35%		30%	
MOTOR DATA						
MANUFACTURER	AO Smith		AO Smith		Baldor	
MODEL OR FR.	S 184T		S 184T		324T	
HORSEPOWER	5	5	5	5	40	40
MOTOR RPM	1745	1745	1745	1745	1775	1775
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	6.4	5.1	6.4	6.8	48	43.5
AMPS LEG 2	---	5.3	---	6.8	---	43.1
AMPS LEG 3	---	5.3	---	6.8	---	43.0
SHEAVE O.D.	7" x 7/8"		7.5" x 1 1/8"		10" x 2 1/8"	
BELTS - QTY / SIZE	1/Ax38		1/BX42		2/CX112	
SHEAVE POSITION	75% Open		Fixed		100% Open	
BHP	4.0		4.9		35.8	

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 3/26/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER	AHU-4		AHU-5		AHU-6	
LOCATION	Roof		Roof		Roof	
AREA SERVED	NA		NA		NA	
MANUFACTURER	Trane		Trane		Trane	
MODEL OR SIZE	MCCA006GAL		MCCA006GAL		MCCA006GAL	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2930	2854	2600	2489	2600	2519
RETURN AIR	2170	2163	2030	1936	2030	1975
OUTSIDE AIR	760	691	570	553	570	544
DISCH. STATIC	---	+0.84"	---	+0.66"	---	+0.88"
SUCTION STATIC	---	-1.82"	---	-1.37"	---	-1.92"
TOTAL STATIC	NA	2.66	NA	2.03	NA	2.80
FAN RPM	NA	1622	NA	1446	NA	1680
PULLEY O.D.	5" x 1"		5" x 1"		5" x 1"	
ESP	1.38		1.06		1.53	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D. MIN POS	30%		30%		35%	
MOTOR DATA						
MANUFACTURER	Baldor		Magnetek		Lincoln	
MODEL OR FR.	182 T		S 182T		182 T	
HORSEPOWER	3	3	3	3	3	3
MOTOR RPM	1765	1765	1745	1745	1760	1760
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	4.2	3.9	3.9	3.9	3.9	4.1
AMPS LEG 2	---	4.1	---	3.8	---	4.3
AMPS LEG 3	---	4.1	---	3.9	---	4.1
SHEAVE O.D.	5 1/2" x 1 1/8"		5 1/4" x 1 1/8"		5 1/4" x 1 1/8"	
BELTS - QTY / SIZE	1/A47		1/A45		1/A46	
SHEAVE POSITION	50% Open		100% Open		50% Open	
BHP	2.9		3.0		3.0	

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC	**DATE:** 3/26/21
AREA SERVED: Various	**TECH:** BS NC

FAN DATA						
FAN NUMBER	AHU-7		AHU-8			
LOCATION	Roof		Roof			
AREA SERVED	NA		NA			
MANUFACTURER	Trane		Trane			
MODEL OR SIZE	MCCA006GAL		MCCA010GAL			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2930	3195	4500	4582		
RETURN AIR	2170	2386	3500	3609		
OUTSIDE AIR	760	809	1000	973		
DISCH. STATIC	---	+0.88"	---	+0.46"	---	
SUCTION STATIC	---	-2.01"	---	-1.14"	---	
TOTAL STATIC	NA	---	NA	---		
FAN RPM	NA	1724	NA	1149		
PULLEY O.D.	5" x 1"		8" x 1 3/16"			
ESP	1.53		0.95			
VFD SPEED	No VFD		No VFD			
O.A.D. MIN POS	30%		30%			
MOTOR DATA						
MANUFACTURER	AO Smith		Magnetek			
MODEL OR FR.	S 182 T		A 184 T			
HORSEPOWER	3	3	5	5		
MOTOR RPM	1725	1725	1745	1745		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	3.9	4.0	6.2	3.5		
AMPS LEG 2	---	4.0	---	3.7	---	
AMPS LEG 3	---	4.2	---	3.5	---	
SHEAVE O.D.	5 1/4" x 1 1/8"		7" x 1 1/8"			
BELTS - QTY / SIZE	1/A47		1/A38			
SHEAVE POSITION	50% Open		75% Open			
BHP	3.0		2.9			

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC				**DATE:** 3/26/21		
AREA SERVED: Various				**TECH:** BS NC		
FAN DATA						
FAN NUMBER	RF-2		RF-3			
LOCATION	Basement		Basement			
AREA SERVED	NA		NA			
MANUFACTURER	Centri Master		Acme			
MODEL OR SIZE	XB 200L		8154 A/3 CL/1			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	---	---	---	---		
RETURN AIR	---	3280	---	19,580		
OUTSIDE AIR	---	---	---	---		
DISCH. STATIC	---	---	---	---	---	
SUCTION STATIC	---	---	---	---	---	
TOTAL STATIC	---	---	---	---		
FAN RPM	---	---	---	---		
PULLEY O.D.	Inline - NA		NA			
ESP	---		---			
VFD SPEED	---		57.3 Hz			
O.A.D. MIN POS	---		---			
MOTOR DATA						
MANUFACTURER	Magnetek		Magnetek			
MODEL OR FR.	N 145 T		S 254 T			
HORSEPOWER	ND	---	ND	15		
MOTOR RPM	1745	1745	1750	1697		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	3.2	3.0	19.0	10.7 (1)		
AMPS LEG 2	3.2	3.1	19.0	10.7 (1)	---	
AMPS LEG 3	3.2	3.0	19.0	10.7 (1)	---	
SHEAVE O.D.	3 1/8" x 7/8"		NA			
BELTS - QTY / SIZE	1/A55		NA			
SHEAVE POSITION	100% Open		NA			
BHP			8.4			

REMARKS

(1) From VFD

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC	**DATE:** 3/26/21
AREA SERVED: Various	**TECH:** BS NC

FAN DATA

	RF-4		RF-5		RF-6	
FAN NUMBER						
LOCATION	---		---		---	
AREA SERVED	---		---		---	
MANUFACTURER	Centri Master		Centri Master		Centri Master	
MODEL OR SIZE	---		---		SB 161 H	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	---	---	---	---	---	---
RETURN AIR	---	---	---	---	2030	---
OUTSIDE AIR	---	---	---	---	---	---
DISCH. STATIC	---	---	---	---	---	---
SUCTION STATIC	---	---	---	---	---	---
TOTAL STATIC	---	---	---	---	---	---
FAN RPM	---	---	---	---	---	---
PULLEY O.D.	Inline - NA		Inline - NA		Inline - NA	
ESP	---		---		---	
VFD SPEED	---		---		---	
O.A.D. MIN POS	---		---		---	

MOTOR DATA

MANUFACTURER	Magnetek		Lesson		Magnetek	
MODEL OR FR.	JA 56		RS 56		HA 56	
HORSEPOWER	1.0	1.0	3/4	3/4	ND	3/4
MOTOR RPM	1725	1725	1725	1725	1750	1750
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	1.7	1.6	2.8	2.5	1.3	1.3
AMPS LEG 2	---	1.6	---	2.5	1.3	1.3
AMPS LEG 3	---	1.6	---	2.5	1.3	1.3
SHEAVE O.D.	3 3/4" x 5/8"		3 3/4" x 5/8"		3 1/4" x 5/8"	
BELTS - QTY / SIZE	1/A46		1/A46		1/A46	
SHEAVE POSITION	50% Open		50% Open		75% Closed	
BHP	0.9		0.7		0.8	

REMARKS

(1) From VFD

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC	**DATE:** 3/26/21
AREA SERVED: Various	**TECH:** BS NC

FAN DATA						
FAN NUMBER	RF-7		RF-8			
LOCATION	---		---			
AREA SERVED	---		---			
MANUFACTURER	Centri Master		Centri Master			
MODEL OR SIZE	XB 161J		XB 200L			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	---	---	---	---		
RETURN AIR	2170	2881	3500	---		
OUTSIDE AIR	---	---	---	---		
DISCH. STATIC	---	---	---	---	---	
SUCTION STATIC	---	---	---	---	---	
TOTAL STATIC	ND	---	ND	---		
FAN RPM	ND	---	ND	---		
PULLEY O.D.	Inline - NA		Inline - NA			
ESP	---		---			
VFD SPEED	---		---			
O.A.D. MIN POS	---		---			

MOTOR DATA						
MANUFACTURER	Magnetek		Lincoln			
MODEL OR FR.	JA56					
HORSEPOWER	ND	1.0	ND	2		
MOTOR RPM	1725	1725	1750	1750		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	1.7	1.6	3.3	2.7		
AMPS LEG 2	1.7	1.7	3.3	2.6	---	
AMPS LEG 3	1.7	1.6	3.3	2.6	---	
SHEAVE O.D.	2 3/4" x 5/8"		3 3/4" x 7/8"			
BELTS - QTY / SIZE	1/A48		1/A58			
SHEAVE POSITION	50%		100% Open			
BHP	1.0		1.6			

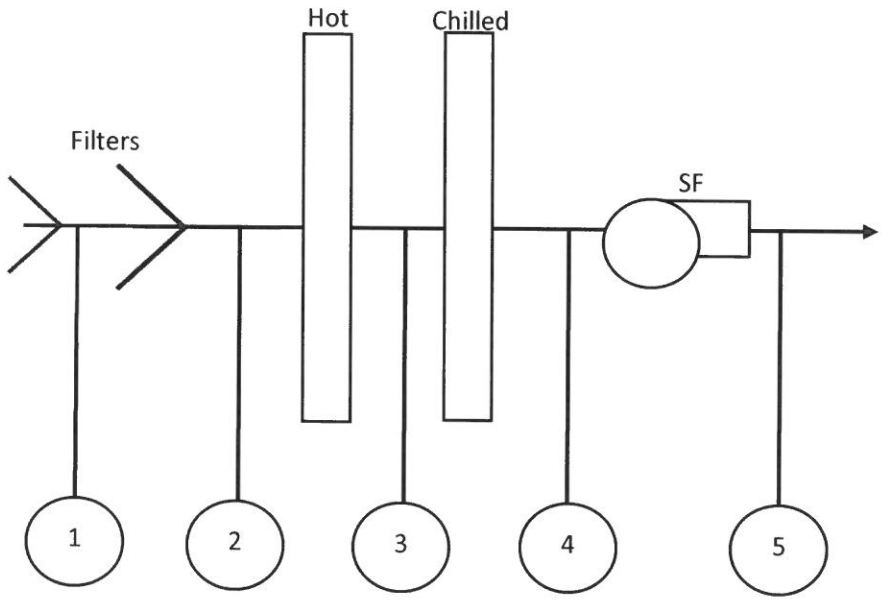
REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Dorcester BMC | **DATE:** 3/26/21

SYSTEM/AREA SERV: AHU's | **TECH:** BS NC



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	NOTES
AHU-1	-0.37"	-0.54"	-1.75"	-1.90"	+0.50"			
AHU-2	-0.21"	-0.33"	-0.55"	-0.90"	+0.28"			
AHU-3	-0.52"	-0.61"	-0.86"	-1.43"	+1.38"			
AHU-4	-0.54"	-0.88"	-1.36"	-1.82"	+0.84"			
AHU-5	-0.40"	-0.60"	-1.06"	-1.37"	+0.66"			
AHU-6	-0.65"	-0.87"	-1.50"	-1.92"	+0.88"			
AHU-7	-0.65"	-0.96"	-1.48"	-2.01"	+0.88"			
AHU-8	-0.49"	-0.65"	-0.82"	-1.14"	+0.42"			

REMARKS

EXHAUST FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 3/26 & 5/26/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER		EF-5	EF-9	EF-17		
LOCATION		Rooftop	Rooftop	Roof		
AREA SERVED		Lock Up	Toilets	Toilets		
MANUFACTURER		Centri Master	Centri Master	Greenheck		
MODEL OR SIZE		PNN200G	PNN163B	GB-80-4		
TOTAL CFM	DESIGN	2475	1520	270		
	ACTUAL	1885	1385	289		
FAN RPM	DESIGN	809	1106	---		
	ACTUAL	1007	1056	1069		
PULLEY	O.D.	6 1/4" x 1"	4 1/4" x 5/8"	4 1/4" x 5/8"		
SERVICE		1.35	1.35	1.35		
MOTOR DATA						
MANUFACTURER		Century	Dayton	AO Smith		
MODEL NUMBER		Y56	48	48 Y		
MOTOR HP	DESIGN	ND	ND	1/4		
	ACTUAL	1/2	1/3	1/4		
MOTOR RPM		1725	1725	1725		
VOLTAGE/PHASE		460/3	115/1	115/1		
MOTOR AMPS	DESIGN	1.0	5.8	4.2		
	ACT. LEG 1	1.1	5.4	---		
	ACT. LEG 2	1.1	---	3.8		
	ACT. LEG 3	1.1	---	---		
SHEAVE		3 3/4" x 5/8"	3" x 5/8"	2 3/4" x 1/2"		
BELTS-QTY/SIZE		1/A30	1/3L240R	1/3L220		
SHEAVE POSITION		80% Closed	50%	50% Open		

REMARKS

EXHAUST FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 6/23 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER		EF-2	EF-4	EF-6	EF-7	EF08
LOCATION		Roof	Roof	Roof	Roof	Roof
AREA SERVED		Toilets	Jury Pool	Toilets	Toilets	Toilets
MANUFACTURER		Greenheck	Greenheck	Greenheck	Greenheck	Greenheck
MODEL OR SIZE		GB-160-3	GB-80-4	GB-100-4	GB-90-4	GB-120-4
TOTAL CFM	DESIGN	1830	270	900	675	1050
	ACTUAL	1673	177	916	642	1000
FAN RPM	DESIGN	---	---	---	---	---
	ACTUAL	1239	1031	1458	1330	1711
PULLEY	O.D.	4" x 5/8"	4 1/4" x 5/8"	4 1/2" x 5/8"	4 3/4" x 5/8"	3 1/2" x 3/4"
SERVICE		1.35	1.35	1.35	1.35	1.35
MOTOR DATA						
MANUFACTURER		AO Smith	AO Smith	Dayton	Dayton	Dayton
MODEL NUMBER		48	48	48 YZ	48 Y	48 YZ
MOTOR HP	DESIGN	1/3	1/4	1/4	1/4	1/4
	ACTUAL	1/2	1/4	1/3	1/3	1/3
MOTOR RPM		1725	1725	1725	1725	1725
VOLTAGE/PHASE		115/1	115/1	115/1	115/1	115/1
MOTOR AMPS	DESIGN	5.5	4.2	6.6	6.6	6.6
	ACT. LEG 1	---	---	---	---	---
	ACT. LEG 2	5.1	3.0	6.4	5.9	6.5
	ACT. LEG 3	---	---	---	---	---
SHEAVE		3" x 1/2"	2 3/4" x 1/2"	3 1/2" x 1/2"	3 1/4" x 1/2"	3 1/4" x 1/2"
BELTS-QTY/SIZE		1/AX24	1/3L220	1/3L240	1/3L240	1/3L240
SHEAVE POSITION		100% Closed	50% Open	50% Open	50% Open	100% Closed
BHP		0.5	0.2	0.3	0.3	

REMARKS

VELOCITY PRESSURE READINGS

PROJECT: Dorcester BMC | **DATE:** 3/26 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
RF-2 Total	20" x 20"	2.78	---	ND	-0.50"	1180	3280	
RF-3 Total	84" x 28"	16.33	---	ND	-0.90"	1199	19,580	
RF-4 Total	24" x 16"	2.67	---	ND	-0.35"	1120	2991	
RF-5 Total	20" x 14"	1.94	---	ND	-0.10"	825	1601	
RF-6 Total	22" x 16"	2.44	---	ND	-0.13"	740	1806	
RF-7 Total	24" x 16"	2.67	---	ND	-0.31"	1079	2881	
RF-8 Total	---	---	---	ND	---	---	---	(1)
EF-5 Total	30" x 16"	3.33	---	2475	-0.09"	566	1885	
EF-2 Total	16" x 16"	1.78	---	1830	-0.59"	940	1673	
EF-4 Total	8" x 8"	0.44	---	270	-0.26"	398	177	
EF-6 Total	14" x 10"	0.97	---	900	-0.42"	941	916	
EF-7 Total	10" x 10"	0.67	---	675	-0.59"	1070	642	
EF-8 Total	14" x 14"	1.36	---	1050	-0.44"	735	1000	
EF-9 Total	16" x 16"	1.78	---	1520	-0.32"	778	1385	
EF-14 Total	13" x 13"	1.17	---	270	-0.26"	246	289	

REMARKS

(1) There is no place to access the ductwork to take a traverse reading.

HYDRONIC FLOW ELEMENTS

PROJECT: Dorcester BMC | **DATE:** 5/26/21

AREA SERVED: Various | **TECH:** BS

LOCATION	NO.	ELEMENT	MFG.	SIZE	DESIGN GPM	TEST I			FINAL			NOTES
						POS.	PR.DIF	GPM	POS.	PR.DIF	GPM	
Hot Water		**DP=28**										**(2)**
AHU-1	1	ultrasound	---	2.5	44	100	---	55	80	---	45	
AHU-2	2	ultrasound	---	1.5	19	100	---	24	90	---	20	
AHU-3	3	ultrasound	---	3.5	107	100	---	119	80	---	105	
AHU-4	4	ultrasound	---	1.25	10	100	---	12	90	---	10	
AHU-5	5	ultrasound	---	1.25	9	100	---	14	80	---	10	
AHU-6	6	ultrasound	---	1.5	9	100	---	11	90	---	10	
AHU-7	7	ultrasound	---	1.25	10	100	---	11	100	---	11	
AHU-8	8	ultrasound	---	1.5	14	100	---	13	100	---	13	
Chilled Water												**(1)**
AHU-1	1	CS	Nexus	4A	38	100	212	45	90	163	38	
AHU-2	2	CS	Nexus	4A	13	100	5.5	1.0	50	18.7	13	
AHU-3	3	ultrasound	---	---	225	open	---	196	open	---	210	
AHU-4	4	CS	Nexus	6B	21	50	7.2	14	50	9.2	22	
AHU-5	5	CS	Nexus	5A	17	50	8.8	18	50	8.8	18	
AHU-6	6	CS	Nexus	5A	17	50	8.6	18	50	8.6	18	
AHU-7	7	CS	Nexus	5A	21	50	9.6	22	50	9.6	22	
AHU-8	8	CS	Nexus	5A	13	100	6.2	14	100	6.4	14	

REMARKS

(1) Pumps were at 52 Hz wth a DP of 12 psi

(2) Pumps were at 44 Hz with a DP of 28 psi

VELOCITY PRESSURE READINGS

PROJECT: Dorcester BMC | **DATE:** 3/26 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
AHU-1 Total	30" x 18"	3.75	1360	5100	+0.47"	1331	4991	
AHU-2 Total	24" x 20"	3.33	1291	4300	+0.33"	1278	4255	
AHU-2 OA	20" x 12"	1.67	823	1375	-0.087"	783	1308	
AHU-2 Return				2925	Calc		2946	
AHU-3 Total	72" x 28"	14.0	2321	32,500	+1.38"	2094	29,316	
AHU-3 Return	84" x 28"	16.33	1586	25,900	-0.50"	1393	22,748	
AHU-3 OA				6600	Calc		6568	
AHU-4 Total	22" x 13"	1.99	1472	2930	+0.84"	1437	2854	
AHU-4 Return	29" x 12"	2.42	897	2170	-0.25"	894	2163	
AHU-4 OA				780	Calc		691	
AHU-5 Total	22" x 13"	1.99	1307	2600	+0.64"	1251	2489	
AHU-5 Return	29" x 12"	2.42	839	2030	-0.18"	800	1936	
AHU-5 OA				570	Calc		553	
AHU-6 Total	26" x 13"	2.35	1106	2600	+0.70"	1073	2519	
AHU-6 Return	29" x 12"	2.42	839	2030	-0.18"	816	1975	
AHU-6 OA				570	Calc		544	
AHU-7 Total	28" x 13"	2.53	1158	2930	+0.86"	1263	3195	
AHU-7 OA	30" x 14"	2.91	261	760	-0.17"	278	809	
AHU-7 Return				2170	Calc		2386	
AHU-8 Total	17" x 17"	2.01	2239	4500	+1.16"	2283	4582	
AHU-8 OA	54" x 20"	7.0	143	1000	-0.03"	139	973	
AHU-8 Return				3500	Calc		3609	

REMARKS

WING'S TESTING & BALANCING CO., INC.

Dorcester BMC
HVAC/Ventilation Survey
REVISED

* * * *

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

August 18, 2021

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.

August 20, 2021

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

Re: Dorcester BMC/HVAC Ventilation Survey- **REVISED August 18, 2021**

Dear Jason,

We have recently revisited this site to complete the of EF-8 and AHU-2, we found the following:

- The sheave was changed on AHU-2 and is now at 99% of design
- EF-8 is running now and was re-tested at 95% of design.

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 BB996928T

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WING'S TESTING & BALANCING CO., INC.

June 25, 2021

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

Re: Dorcester BMC/HVAC Ventilation Survey- **REVISED June 25, 2021**

Dear Jason,

We have recently revisited this site to complete the Exhaust Fan testing, during our visit we found the following:

- The remainder of the exhaust fans which serve occupied areas were tested.
- EF-8 has no power at the fan.
  - The braker panel labeled EF-8 is on and the BMS is sending a command for this fan to run.
  - The motor and sheaves on this fan are brand new.
  - An electrician is required to investigate this further.
- EF-4 is below design and would require a sheave change to meet design CFM.

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.

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WING'S TESTING & BALANCING CO., INC.

March 26, 2021

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

Re: Dorcester BMC/HVAC Ventilation Survey- REVISED

Dear Jason,

REVISED 5/26/21: Since our last visit to this courthouse all the issues with EF-9 and EF-10 have been fixed and were retested. We also took both hot water and chilled water readings for all AHU's. They have been added to this report. Although we were not able to test with all AHU coils open at once, we did test with the 'biggest hitters' open and noted that we were controlling and making different pressure setpoint for the water loops.

We have completed our HVAC/Fresh-Air survey for the above-mentioned project. Through our testing we found:

- EF-9 is over-amping and shutting down on thermal over-load. This will need to be investigated.
- EF-10 has a very loose belt, and the motor sheave is seized. This fan needs a smaller belt installed.
- RF-8 has no access to the ductwork to take an accurate traverse total.

This report includes Brake Horsepower (BHP) calculations. When a motor has a VFD, we take the amperage measurements from there. When we calculate from volts and amps, it means there has to be a nameplate on the motor. Many times, these are missing or illegible. If BHP is not listed for an individual motor, this is because we do not have enough information to calculate it. It should be noted that that the older a motor is, the less likely it is to follow the affinity laws for BHP- since the efficiency degrades over time. We have used accepted constants for efficiency and the power factor, which should result in fairly close calculations, but are not as accurate for older motors.

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WING'S TESTING & BALANCING CO., INC.

Dorcester BMC
March 26, 2021

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,
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SUPPLY FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 3/26 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER	AHU-1		AHU-2		AHU-3	
LOCATION	Basement		Basement		Basement	
AREA SERVED	Lock Up		Court Room #1		All Areas	
MANUFACTURER	Trane		Trane		Trane	
MODEL OR SIZE	MCCA010GAL		MCCA010GAL		MCCA060GAM	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	5100	4991	4300	4255	32,500	29,316
RETURN AIR	---	---	2925	2946	25,900	22,748
OUTSIDE AIR	5100	4991	1375	1308	6600	6568
DISCH. STATIC	---	+0.50"	---	+.40"	---	+1.38"
SUCTION STATIC	---	-1.90"	---	-1.36"	---	-1.43"
TOTAL STATIC	---	2.40	---	1.76	---	2.81
FAN RPM	---	1207	---	797	---	2242
PULLEY O.D.	7 1/2" x 1 3/16"		8 1/2" x 1 3/16"		24 1/2" x 2 7/16"	
ESP	0.87		0.72		1.97	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D. MIN POS	100%		35%		30%	
MOTOR DATA						
MANUFACTURER	AO Smith		AO Smith		Baldor	
MODEL OR FR.	S 184T		S 184T		324T	
HORSEPOWER	5	5	5	5	40	40
MOTOR RPM	1745	1745	1745	1745	1775	1775
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	6.4	5.1	6.4	6.8	48	43.5
AMPS LEG 2	---	5.3	---	6.8	---	43.1
AMPS LEG 3	---	5.3	---	6.8	---	43.0
SHEAVE O.D.	7" x 7/8"		7.5" x 1 1/8"		10" x 2 1/8"	
BELTS - QTY / SIZE	1/Ax38		1/BX42		2/CX112	
SHEAVE POSITION	75% Open		Fixed		100% Open	
BHP	4.0		4.9		35.8	

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 3/26/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER	AHU-4		AHU-5		AHU-6	
LOCATION	Roof		Roof		Roof	
AREA SERVED	NA		NA		NA	
MANUFACTURER	Trane		Trane		Trane	
MODEL OR SIZE	MCCA006GAL		MCCA006GAL		MCCA006GAL	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2930	2854	2600	2489	2600	2519
RETURN AIR	2170	2163	2030	1936	2030	1975
OUTSIDE AIR	760	691	570	553	570	544
DISCH. STATIC	---	+0.84"	---	+0.66"	---	+0.88"
SUCTION STATIC	---	-1.82"	---	-1.37"	---	-1.92"
TOTAL STATIC	NA	2.66	NA	2.03	NA	2.80
FAN RPM	NA	1622	NA	1446	NA	1680
PULLEY O.D.	5" x 1"		5" x 1"		5" x 1"	
ESP	1.38		1.06		1.53	
VFD SPEED	No VFD		No VFD		No VFD	
O.A.D. MIN POS	30%		30%		35%	
MOTOR DATA						
MANUFACTURER	Baldor		Magnetek		Lincoln	
MODEL OR FR.	182 T		S 182T		182 T	
HORSEPOWER	3	3	3	3	3	3
MOTOR RPM	1765	1765	1745	1745	1760	1760
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	4.2	3.9	3.9	3.9	3.9	4.1
AMPS LEG 2	---	4.1	---	3.8	---	4.3
AMPS LEG 3	---	4.1	---	3.9	---	4.1
SHEAVE O.D.	5 1/2" x 1 1/8"		5 1/4" x 1 1/8"		5 1/4" x 1 1/8"	
BELTS - QTY / SIZE	1/A47		1/A45		1/A46	
SHEAVE POSITION	50% Open		100% Open		50% Open	
BHP	2.9		3.0		3.0	

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC	**DATE:** 3/26/21
AREA SERVED: Various	**TECH:** BS NC

FAN DATA						
FAN NUMBER	AHU-7		AHU-8			
LOCATION	Roof		Roof			
AREA SERVED	NA		NA			
MANUFACTURER	Trane		Trane			
MODEL OR SIZE	MCCA006GAL		MCCA010GAL			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	2930	3195	4500	4582		
RETURN AIR	2170	2386	3500	3609		
OUTSIDE AIR	760	809	1000	973		
DISCH. STATIC	---	+0.88"	---	+0.46"	---	
SUCTION STATIC	---	-2.01"	---	-1.14"	---	
TOTAL STATIC	NA	---	NA	---		
FAN RPM	NA	1724	NA	1149		
PULLEY O.D.	5" x 1"		8" x 1 3/16"			
ESP	1.53		0.95			
VFD SPEED	No VFD		No VFD			
O.A.D. MIN POS	30%		30%			
MOTOR DATA						
MANUFACTURER	AO Smith		Magnetek			
MODEL OR FR.	S 182 T		A 184 T			
HORSEPOWER	3	3	5	5		
MOTOR RPM	1725	1725	1745	1745		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	3.9	4.0	6.2	3.5		
AMPS LEG 2	---	4.0	---	3.7	---	
AMPS LEG 3	---	4.2	---	3.5	---	
SHEAVE O.D.	5 1/4" x 1 1/8"		7" x 1 1/8"			
BELTS - QTY / SIZE	1/A47		1/A38			
SHEAVE POSITION	50% Open		75% Open			
BHP	3.0		2.9			

REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC				**DATE:** 3/26/21		
AREA SERVED: Various				**TECH:** BS NC		
FAN DATA						
FAN NUMBER	RF-2		RF-3			
LOCATION	Basement		Basement			
AREA SERVED	NA		NA			
MANUFACTURER	Centri Master		Acme			
MODEL OR SIZE	XB 200L		8154 A/3 CL/1			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	---	---	---	---		
RETURN AIR	---	3280	---	19,580		
OUTSIDE AIR	---	---	---	---		
DISCH. STATIC	---	---	---	---	---	
SUCTION STATIC	---	---	---	---	---	
TOTAL STATIC	---	---	---	---		
FAN RPM	---	---	---	---		
PULLEY O.D.	Inline - NA		NA			
ESP	---		---			
VFD SPEED	---		57.3 Hz			
O.A.D. MIN POS	---		---			
MOTOR DATA						
MANUFACTURER	Magnetek		Magnetek			
MODEL OR FR.	N 145 T		S 254 T			
HORSEPOWER	ND	---	ND	15		
MOTOR RPM	1745	1745	1750	1697		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	3.2	3.0	19.0	10.7 (1)		
AMPS LEG 2	3.2	3.1	19.0	10.7 (1)	---	
AMPS LEG 3	3.2	3.0	19.0	10.7 (1)	---	
SHEAVE O.D.	3 1/8" x 7/8"		NA			
BELTS - QTY / SIZE	1/A55		NA			
SHEAVE POSITION	100% Open		NA			
BHP			8.4			

REMARKS

(1) From VFD

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC	**DATE:** 3/26/21
AREA SERVED: Various	**TECH:** BS NC

FAN DATA

	RF-4		RF-5		RF-6	
FAN NUMBER						
LOCATION	---		---		---	
AREA SERVED	---		---		---	
MANUFACTURER	Centri Master		Centri Master		Centri Master	
MODEL OR SIZE	---		---		SB 161 H	
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	---	---	---	---	---	---
RETURN AIR	---	---	---	---	2030	---
OUTSIDE AIR	---	---	---	---	---	---
DISCH. STATIC	---	---	---	---	---	---
SUCTION STATIC	---	---	---	---	---	---
TOTAL STATIC	---	---	---	---	---	---
FAN RPM	---	---	---	---	---	---
PULLEY O.D.	Inline - NA		Inline - NA		Inline - NA	
ESP	---		---		---	
VFD SPEED	---		---		---	
O.A.D. MIN POS	---		---		---	

MOTOR DATA

MANUFACTURER	Magnetek		Lesson		Magnetek	
MODEL OR FR.	JA 56		RS 56		HA 56	
HORSEPOWER	1.0	1.0	3/4	3/4	ND	3/4
MOTOR RPM	1725	1725	1725	1725	1750	1750
VOLTAGE / PH.	460/3	460/3	460/3	460/3	460/3	460/3
AMPS LEG 1	1.7	1.6	2.8	2.5	1.3	1.3
AMPS LEG 2	---	1.6	---	2.5	1.3	1.3
AMPS LEG 3	---	1.6	---	2.5	1.3	1.3
SHEAVE O.D.	3 3/4" x 5/8"		3 3/4" x 5/8"		3 1/4" x 5/8"	
BELTS - QTY / SIZE	1/A46		1/A46		1/A46	
SHEAVE POSITION	50% Open		50% Open		75% Closed	
BHP	0.9		0.7		0.8	

REMARKS

(1) From VFD

NA-Not Available
ND-No Design DD-Direct Drive

SUPPLY FAN REPORT

PROJECT: Dorcester BMC	**DATE:** 3/26/21
AREA SERVED: Various	**TECH:** BS NC

FAN DATA						
FAN NUMBER	RF-7		RF-8			
LOCATION	---		---			
AREA SERVED	---		---			
MANUFACTURER	Centri Master		Centri Master			
MODEL OR SIZE	XB 161J		XB 200L			
	DESIGN	**ACTUAL**	**DESIGN**	**ACTUAL**	**DESIGN**	**ACTUAL**
TOTAL CFM	---	---	---	---		
RETURN AIR	2170	2881	3500	---		
OUTSIDE AIR	---	---	---	---		
DISCH. STATIC	---	---	---	---	---	
SUCTION STATIC	---	---	---	---	---	
TOTAL STATIC	ND	---	ND	---		
FAN RPM	ND	---	ND	---		
PULLEY O.D.	Inline - NA		Inline - NA			
ESP	---		---			
VFD SPEED	---		---			
O.A.D. MIN POS	---		---			

MOTOR DATA						
MANUFACTURER	Magnetek		Lincoln			
MODEL OR FR.	JA56					
HORSEPOWER	ND	1.0	ND	2		
MOTOR RPM	1725	1725	1750	1750		
VOLTAGE / PH.	460/3	460/3	460/3	460/3		
AMPS LEG 1	1.7	1.6	3.3	2.7		
AMPS LEG 2	1.7	1.7	3.3	2.6	---	
AMPS LEG 3	1.7	1.6	3.3	2.6	---	
SHEAVE O.D.	2 3/4" x 5/8"		3 3/4" x 7/8"			
BELTS - QTY / SIZE	1/A48		1/A58			
SHEAVE POSITION	50%		100% Open			
BHP	1.0		1.6			

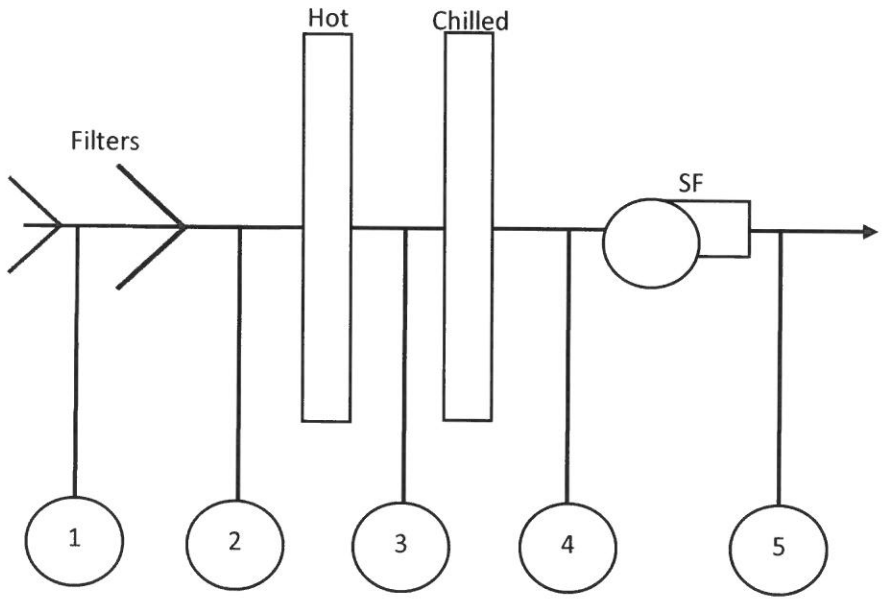
REMARKS

NA-Not Available
ND-No Design DD-Direct Drive

SYSTEM STATIC PRESSURE PROFILE

PROJECT: Dorcester BMC | **DATE:** 3/26/21

SYSTEM/AREA SERV: AHU's | **TECH:** BS NC



STATIC PRESSURE READINGS "wc

POS. (+) / NEG.(-)	1	2	3	4	5	6	7	NOTES
AHU-1	-0.37"	-0.54"	-1.75"	-1.90"	+0.50"			
AHU-2	-0.21"	-0.33"	-0.55"	-0.90"	+0.28"			
AHU-3	-0.52"	-0.61"	-0.86"	-1.43"	+1.38"			
AHU-4	-0.54"	-0.88"	-1.36"	-1.82"	+0.84"			
AHU-5	-0.40"	-0.60"	-1.06"	-1.37"	+0.66"			
AHU-6	-0.65"	-0.87"	-1.50"	-1.92"	+0.88"			
AHU-7	-0.65"	-0.96"	-1.48"	-2.01"	+0.88"			
AHU-8	-0.49"	-0.65"	-0.82"	-1.14"	+0.42"			

REMARKS

EXHAUST FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 3/26 & 5/26/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER		EF-5	EF-9	EF-17		
LOCATION		Rooftop	Rooftop	Roof		
AREA SERVED		Lock Up	Toilets	Toilets		
MANUFACTURER		Centri Master	Centri Master	Greenheck		
MODEL OR SIZE		PNN200G	PNN163B	GB-80-4		
TOTAL CFM	DESIGN	2475	1520	270		
	ACTUAL	1885	1385	289		
FAN RPM	DESIGN	809	1106	---		
	ACTUAL	1007	1056	1069		
PULLEY	O.D.	6 1/4" x 1"	4 1/4" x 5/8"	4 1/4" x 5/8"		
SERVICE		1.35	1.35	1.35		
MOTOR DATA						
MANUFACTURER		Century	Dayton	AO Smith		
MODEL NUMBER		Y56	48	48 Y		
MOTOR HP	DESIGN	ND	ND	1/4		
	ACTUAL	1/2	1/3	1/4		
MOTOR RPM		1725	1725	1725		
VOLTAGE/PHASE		460/3	115/1	115/1		
MOTOR AMPS	DESIGN	1.0	5.8	4.2		
	ACT. LEG 1	1.1	5.4	---		
	ACT. LEG 2	1.1	---	3.8		
	ACT. LEG 3	1.1	---	---		
SHEAVE		3 3/4" x 5/8"	3" x 5/8"	2 3/4" x 1/2"		
BELTS-QTY/SIZE		1/A30	1/3L240R	1/3L220		
SHEAVE POSITION		80% Closed	50%	50% Open		

REMARKS

EXHAUST FAN REPORT

PROJECT: Dorcester BMC | **DATE:** 6/23 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

FAN DATA						
FAN NUMBER		EF-2	EF-4	EF-6	EF-7	EF08
LOCATION		Roof	Roof	Roof	Roof	Roof
AREA SERVED		Toilets	Jury Pool	Toilets	Toilets	Toilets
MANUFACTURER		Greenheck	Greenheck	Greenheck	Greenheck	Greenheck
MODEL OR SIZE		GB-160-3	GB-80-4	GB-100-4	GB-90-4	GB-120-4
TOTAL CFM	DESIGN	1830	270	900	675	1050
	ACTUAL	1673	177	916	642	1000
FAN RPM	DESIGN	---	---	---	---	---
	ACTUAL	1239	1031	1458	1330	1711
PULLEY	O.D.	4" x 5/8"	4 1/4" x 5/8"	4 1/2" x 5/8"	4 3/4" x 5/8"	3 1/2" x 3/4"
SERVICE		1.35	1.35	1.35	1.35	1.35
MOTOR DATA						
MANUFACTURER		AO Smith	AO Smith	Dayton	Dayton	Dayton
MODEL NUMBER		48	48	48 YZ	48 Y	48 YZ
MOTOR HP	DESIGN	1/3	1/4	1/4	1/4	1/4
	ACTUAL	1/2	1/4	1/3	1/3	1/3
MOTOR RPM		1725	1725	1725	1725	1725
VOLTAGE/PHASE		115/1	115/1	115/1	115/1	115/1
MOTOR AMPS	DESIGN	5.5	4.2	6.6	6.6	6.6
	ACT. LEG 1	---	---	---	---	---
	ACT. LEG 2	5.1	3.0	6.4	5.9	6.5
	ACT. LEG 3	---	---	---	---	---
SHEAVE		3" x 1/2"	2 3/4" x 1/2"	3 1/2" x 1/2"	3 1/4" x 1/2"	3 1/4" x 1/2"
BELTS-QTY/SIZE		1/AX24	1/3L220	1/3L240	1/3L240	1/3L240
SHEAVE POSITION		100% Closed	50% Open	50% Open	50% Open	100% Closed
BHP		0.5	0.2	0.3	0.3	

REMARKS

VELOCITY PRESSURE READINGS

PROJECT: Dorcester BMC | **DATE:** 3/26 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
RF-2 Total	20" x 20"	2.78	---	ND	-0.50"	1180	3280	
RF-3 Total	84" x 28"	16.33	---	ND	-0.90"	1199	19,580	
RF-4 Total	24" x 16"	2.67	---	ND	-0.35"	1120	2991	
RF-5 Total	20" x 14"	1.94	---	ND	-0.10"	825	1601	
RF-6 Total	22" x 16"	2.44	---	ND	-0.13"	740	1806	
RF-7 Total	24" x 16"	2.67	---	ND	-0.31"	1079	2881	
RF-8 Total	---	---	---	ND	---	---	---	(1)
EF-5 Total	30" x 16"	3.33	---	2475	-0.09"	566	1885	
EF-2 Total	16" x 16"	1.78	---	1830	-0.59"	940	1673	
EF-4 Total	8" x 8"	0.44	---	270	-0.26"	398	177	
EF-6 Total	14" x 10"	0.97	---	900	-0.42"	941	916	
EF-7 Total	10" x 10"	0.67	---	675	-0.59"	1070	642	
EF-8 Total	14" x 14"	1.36	---	1050	-0.44"	735	1000	
EF-9 Total	16" x 16"	1.78	---	1520	-0.32"	778	1385	
EF-14 Total	13" x 13"	1.17	---	270	-0.26"	246	289	

REMARKS

(1) There is no place to access the ductwork to take a traverse reading.

HYDRONIC FLOW ELEMENTS

PROJECT: Dorcester BMC | **DATE:** 5/26/21

AREA SERVED: Various | **TECH:** BS

LOCATION	NO.	ELEMENT	MFG.	SIZE	DESIGN GPM	TEST I			FINAL			NOTES
						POS.	PR.DIF	GPM	POS.	PR.DIF	GPM	
Hot Water		**DP=28**										**(2)**
AHU-1	1	ultrasound	---	2.5	44	100	---	55	80	---	45	
AHU-2	2	ultrasound	---	1.5	19	100	---	24	90	---	20	
AHU-3	3	ultrasound	---	3.5	107	100	---	119	80	---	105	
AHU-4	4	ultrasound	---	1.25	10	100	---	12	90	---	10	
AHU-5	5	ultrasound	---	1.25	9	100	---	14	80	---	10	
AHU-6	6	ultrasound	---	1.5	9	100	---	11	90	---	10	
AHU-7	7	ultrasound	---	1.25	10	100	---	11	100	---	11	
AHU-8	8	ultrasound	---	1.5	14	100	---	13	100	---	13	
Chilled Water												**(1)**
AHU-1	1	CS	Nexus	4A	38	100	212	45	90	163	38	
AHU-2	2	CS	Nexus	4A	13	100	5.5	1.0	50	18.7	13	
AHU-3	3	ultrasound	---	---	225	open	---	196	open	---	210	
AHU-4	4	CS	Nexus	6B	21	50	7.2	14	50	9.2	22	
AHU-5	5	CS	Nexus	5A	17	50	8.8	18	50	8.8	18	
AHU-6	6	CS	Nexus	5A	17	50	8.6	18	50	8.6	18	
AHU-7	7	CS	Nexus	5A	21	50	9.6	22	50	9.6	22	
AHU-8	8	CS	Nexus	5A	13	100	6.2	14	100	6.4	14	

REMARKS

(1) Pumps were at 52 Hz wth a DP of 12 psi

(2) Pumps were at 44 Hz with a DP of 28 psi

VELOCITY PRESSURE READINGS

PROJECT: Dorcester BMC | **DATE:** 3/26 & 8/18/21

AREA SERVED: Various | **TECH:** BS NC

TRAVERSE LOCATIONS	DUCT SIZE "	AREA SQ.FT.	DESIGN		CENTERLINE STATIC PRES."	TEST		NOTES
			FPM	CFM		FPM	CFM	
AHU-1 Total	30" x 18"	3.75	1360	5100	+0.47"	1331	4991	
AHU-2 Total	24" x 20"	3.33	1291	4300	+0.33"	1278	4255	
AHU-2 OA	20" x 12"	1.67	823	1375	-0.087"	783	1308	
AHU-2 Return				2925	Calc		2946	
AHU-3 Total	72" x 28"	14.0	2321	32,500	+1.38"	2094	29,316	
AHU-3 Return	84" x 28"	16.33	1586	25,900	-0.50"	1393	22,748	
AHU-3 OA				6600	Calc		6568	
AHU-4 Total	22" x 13"	1.99	1472	2930	+0.84"	1437	2854	
AHU-4 Return	29" x 12"	2.42	897	2170	-0.25"	894	2163	
AHU-4 OA				780	Calc		691	
AHU-5 Total	22" x 13"	1.99	1307	2600	+0.64"	1251	2489	
AHU-5 Return	29" x 12"	2.42	839	2030	-0.18"	800	1936	
AHU-5 OA				570	Calc		553	
AHU-6 Total	26" x 13"	2.35	1106	2600	+0.70"	1073	2519	
AHU-6 Return	29" x 12"	2.42	839	2030	-0.18"	816	1975	
AHU-6 OA				570	Calc		544	
AHU-7 Total	28" x 13"	2.53	1158	2930	+0.86"	1263	3195	
AHU-7 OA	30" x 14"	2.91	261	760	-0.17"	278	809	
AHU-7 Return				2170	Calc		2386	
AHU-8 Total	17" x 17"	2.01	2239	4500	+1.16"	2283	4582	
AHU-8 OA	54" x 20"	7.0	143	1000	-0.03"	139	973	
AHU-8 Return				3500	Calc		3609	

REMARKS