**Concord District Court**
**Concord, MA**

# HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

September 18, 2024

Tighe&Bond

# Section 1
# Existing Conditions and Site Observations

Tighe & Bond visited the Concord District Courthouse located in Concord, MA on October 20, 2020. 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:
  - Michael Norman
  - Raymond Nardone
- Tighe & Bond:
  - Todd Holland, PE, Senior Mechanical Engineer

## 1.1 Existing Ventilation System Description

The Concord District Courthouse is a single-story building, built in 1972, with a floor area of approximately 27,800 gross square feet. Ventilation is provided by two constant-volume air handling units (AHUs), located in a penthouse mechanical room, two rooftop units (RTUs), and unit ventilators in perimeter zones.

**TABLE 1**
Existing Air Handlers

| *Unit #* | *Design Airflow (CFM)* | *Design Min OA (CFM)* | *Filters* | *Condition* |
|---|---|---|---|---|
| AH-1 ("H") | 6,000 | Unknown | 2" MERV-8 | Fair to Poor |
| AH-3 ("J") | 6,000 | Unknown | 2" MERV-8 | Fair to Poor |
| RTU-2 | 2,000 | 0 | 2" MERV-8 | Poor |
| RTU-4 | 5,000 | 500 | 2" MERV-8 | Poor |
| Unit "G" | 3,000 | Unknown | N/A | Missing |

The air handlers AHU-1 and AHU-3 are called units "H" and "J" respectively on the original drawings. These units each have a direct expansion (DX) cooling coil with dual refrigerant circuits, electric resistance heating coils, a supply air fan, filter section, and mixing box with return air (RA) and outdoor air (OA) dampers. The filter section has 2" MERV-8 pleated filters. Each AHU is paired with an outdoor air-cooled condensing unit (ACU), mounted on the roof. These units serve the Criminal Courtroom and Civil Courtroom, respectively.

Each of the AHUs has two cold water centrifugal atomizing type humidifiers, one in the supply duct and one in the return duct. These units use a high-speed rotating wheel to sling water against copper comb to make droplets. They are mechanically simple units, but do not appear to have been used in decades.

During the site visit we noticed a third OA intake in the penthouse, disconnected from the duct drop which was capped at the floor. Copies of the original design drawings show an

air handling unit "G" serving the main lobby and corridors. We were able to verify that this unit and its accompanying ACU are no longer in place, and that there was no air movement at any of the supply diffusers or return grilles in the lobby and corridor.

Photo 1 – Typical Air Handler

The rooftop units, RTU-2 and RTU-4, each have a direct expansion (DX) cooling coil, natural gas-fired furnace, a supply air fan, and filter section with 2" pleated filters. It should be noted that neither of these units has an OA intake, and are configured to recirculate 100% of their airflow. RTU-2 serves the small center courtroom, and RTU-4 serves the probation department and lockup area.

There are 24 packaged terminal air conditioner (PTAC) unit ventilators serving office areas around the building perimeter. These units each have a direct expansion (DX) cooling coil, electric resistance heating coils, a supply air fan, OA intake louver and control damper. The filters are 1" thick "throwaway" type, rated MERV-5.

The AHUs are original to the building and in fair to poor condition, and the electric resistance heating coils were being replaced at the time of the visit. ACU-1 is in poor condition, replaced in 1993, and ACU-3 is newer but appears to be at least 10 years old. The RTUs are in poor condition, they are likely the second replacement since 1972, the first replacement happening in 1993. The existing RTUs are inexpensive, light commercial grade.

Photo 2 – Typical Rooftop Unit

Supply air is distributed from the AHUs in a multizone configuration, where each zone has a pneumatic control damper and an electric reheat coil. There are electric reheat coils in the supply air distribution for the RTUs.

The lockup area is served by RTU-4, which provides zero OA ventilation. Each of the holding cells is served by exhaust grilles over the combination toilet/lavatory fixture. This exhaust system was operational at the time of the visit.

## 1.2 Existing Control System

The courthouse HVAC equipment is controlled by the original Johnson Controls pneumatic control system. It is an old, obsolete system, and appears to be original although in fair condition with no major leaks noted, and a reasonably new compressor and air dryer.

There are control panels in each of the four front conference rooms with a changeover switch for winter and summer operation. Facilities staff did not know what these did.

We did not see any evidence or components of a Building Management System (BMS) during our site visit. We are not aware of any demand control ventilation sequences in use at this courthouse.


Photo 3 – Summer/Winter Changeover Switch

# Section 2
# Recommendations

Below is a list of recommendations that we propose for the Concord 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 the existing air handling units:

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

The TAB Contractor and/or Engineer shall verify that the air handlers can accommodate a MERV-13 filter.

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

## 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 air flow 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) |
|---|---|---|---|---|
| AH-1 ("H") | 6,000 | unknown | 1,200 | 1,200 |
| AH-3 ("J") | 6,000 | unknown | 1,200 | 1,200 |
| RTU-2 | 2,000 | unknown | 500 | 500 |
| RTU-4 | 5,000 | 500 | 500 | 1,000 |
| Unit "G" | 3,000 | unknown | 350 | 600 |

Note: Unit "G" is currently non-operational.

The airflow rates per person are shown below in Tables 3 and 4. These values are based on the original design supply and outdoor airflow rates shown in Table 2 above.

**TABLE 3**
Airflow Rate per Person

| | *Average for all spaces (CFM/Person)* | *Courtrooms (CFM/Person)* | *Non-Courtroom Spaces (CFM/Person)* |
|---|---|---|---|
| Total Supply Air | 49 | 32 | 94 |
| Outdoor Air (design) | unknown | unknown | unknown |
| Outdoor Air (code) | 8 | 6 | 11 |

**TABLE 4**
Airflow Rate per Person - Courtrooms

| | | *Total Air* | | *Outdoor Air* | |
|---|---|---|---|---|---|
| *Courtroom* | *Total People* | *Supply Airflow (CFM)* | *Airflow Rate (CFM/Person)* | *Outside Airflow (CFM)* | *Airflow Rate (CFM/Person)* |
| Jury Pool Room | 30 | 700 | 23 | 77 | 3 |
| Criminal Courtroom | 147 | 3,500 | 24 | 503 | 3 |
| Small Center Court | 58 | 1,800 | 31 | 261 | 4 |
| Civil Courtroom | 147 | 3,500 | 24 | 503 | 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 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 | 700 | 47 | 77 | 5 |
| Criminal Courtroom | 24 | 3,500 | 146 | 503 | 21 |
| Small Center Court | 16 | 1,800 | 113 | 261 | 16 |
| Civil Courtroom | 30 | 3,500 | 117 | 503 | 17 |

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

We recommend testing and balancing the OA flow rate for AHU-1 and AHU-3 to the recommended minimum OA rates listed in Table 2. If RTU-2 and RTU-4 are not replaced, we recommend modifying the units with OA intakes and rebalancing the OA flow rates to the recommended minimum OA 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*.

Some dampers and actuators were operational, while others were not. The OA damper for AHU-3 was scheduled for repair. We recommend testing the dampers and actuators to ensure they are functioning properly, including the OA dampers for all unit ventilators, and repairing or replacing dampers as required.

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

Cooling coils and drain pans for the AHUs were noted to be clean, but we were unable to inspect the coils in the RTUs and unit ventilators, so we recommend inspecting these and cleaning them as necessary.

## 2.4 Control System

The Concord District Courthouse has a pneumatic 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.*

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

## 2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

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

These are recommended for office and library areas served by unit ventilators, which cannot have their filters upgraded to MERV-13. 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

The original atomizing humidifiers have not been used in years and their condition is unknown. The design is unusual in that the humidifiers are located in the supply and return air streams, possibly because of the relatively long distance required for absorption

of the cold atomized water. Tighe & Bond does not recommend recommissioning these; they should be removed.

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of adding active humidification is determined by the building envelope. Buildings that were not designed to operate with active humidification can potentially be damaged due to a lack of a vapor barrier, adequate insulation, and air tightness.

Duct mounted humidifiers must be engineered, integrated into the building control system, tested, and commissioned. They are available in many configurations but require substantial maintenance and additional controls. They also run the risk of adversely affecting IAQ from growing microorganisms, or leaking water through poorly sealed ductwork damaging insulation and ceilings. Portable humidifiers are easier to install and require less maintenance, but still have the potential to damage the building envelope.

While active humidification is not recommended as a whole building solution due to high installation costs, operational costs, potential to damage the building envelope and adversely affect poor IAQ, it may be warranted as a temporary solution in some areas.

## 2.7 Other Recommendations

### 2.7.1 Replace/Reinstall Missing Air Handling Unit "G"

We strongly recommend immediately reinstalling air handling unit "G" to serve the main lobby and corridors. There is no mechanical ventilation for these areas presently, and heating and cooling is provided by units that serve the surrounding areas. The original design documents show this as a 7.5-ton split system, and the replacement should be a heat pump to minimize the use of electric resistance heat for energy and cost savings.

### 2.7.2 Replace Rooftop Units

We strongly recommend replacing RTU-2 and RTU-4 immediately. The primary problem is that they provide no ventilation air to the spaces they serve. The secondary problem is age and reliability. Outdoor air handling units have a life expectancy of 15 years for commercial grade equipment. These units are not commercial grade. The nameplates on the units are no longer readable but they appear to be 12-15 years old.

### 2.7.3 Replace Air Handling Units and Air-Cooled Condensing Units

Replacing AHU-1 and AHU-3 should be considered within the next 3-5 years. Indoor air handling units have a life expectancy of 35-40 years. The units in the Concord District Court are approximately 48 years old and are in fair to poor condition. The air-cooled condensing units ACU-1 and ACU-2 should be replaced along with the AHUs. These are beyond their expected service lives of 15 years, and they use 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.

### 2.7.4 Install a Building Management System

When the air handling units are replaced, we recommend replacing the Johnson Controls pneumatic control system with a BMS to control and monitor equipment. Pneumatic air systems are antiquated and do not offer the same benefits as a BMS.

### 2.7.5 Replace Unit Ventilators

We recommend replacing the PTAC unit ventilators. The average life of a unit ventilator is approximately 35 years. The fan coil units appear to be original and are approximately 48 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 electric resistance heating load.

### 2.7.6 Label Summer/Winter Changeover Switches

Each of the front conference rooms contains a control panels with a changeover switch for winter and summer operation. Facilities staff does not know how they work. We recommend determining how they function and labeling them as such. If they are not functional, we recommend removing them.

# Section 3
# Testing & Balancing Results

Milharmer Associates, Inc. visited the Concord District Courthouse on January 20, 2021 to test the airflow rates of the air handling units and the exhaust fans. A summary of the tested airflow rates versus the design airflow rates are shown below in Table 5. 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 Fan Airflow (CFM) | Supply Fan Airflow (CFM) | Outdoor Airflow (CFM) | Return Fan Airflow (CFM) |
| AHU-H | 6,000 | 1,200 | 4,800 | 4,199 | 1,232 | 2,967 |
| AHU-J | 6,000 | 1,200 | 4,800 | 4,259 | 1,109 | 3,150 |
| RTU-2 | 2,000 | 500 | 1,500 | 1,253 | - | 1,253 |
| RTU-4 | 5,000 | 1,000 | 4,000 | 1,076 | - | 1,076 |

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-H and AHU-J are performing below the acceptable airflow range, about 30% less than design. New fan sheaves would be required to substantially increase the airflow of both units.
    a. The measured motor currents were approximately 80% of full load amps (FLA), and increasing airflow to design levels may be beyond the motors' capacities. Airflow should be adjusted to the maximum capacity of the fan motors but not beyond.
    b. Since the outdoor airflows for these units are within the acceptable range, increasing the total airflow would not improve ventilation but may improve temperature control.
2. RTU-2 is performing below the acceptable airflow range, almost 40% below the nominal 400 cfm per ton used for many rooftop units. A new fan sheave would be required to increase the airflow to design.
3. RTU-4 is performing well below the acceptable airflow range, almost 80% less than 400 cfm per ton. At this low flow rate, it is unlikely that the refrigeration circuit or gas furnace is operating properly. An investigation by a mechanical contractor is required to troubleshoot the low airflow.

4. No toilet exhaust fans were included in the testing and balancing report.
5. None of the unit ventilators were included in the testing and balancing report.

## Disclaimer

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

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Tighe&Bond

# Milharmer Associates, Inc. TAB Report

## January 20, 2021

**MILHARMER ASSOCIATES, INC.**
*534 New State Highway, Route 44, Suite 3*
*Raynham, MA 02767*
*Tel.: 508-823-8500; Facsimile: 508-823-8600*

# TEST AND BALANCE REPORT

**Project:** **Concord District Court**
**Concord, MA**

**Project No.:** **21-017** **Project Date:** **1/20/2021**

**MECHANICAL CONTRACTOR**
*Tighe & Bond*

3384

*A N.E.B.B. Certified Company*

| | | | |
|---|---|---|---|
| **Project:** | Concord District Court | | |
| **Address:** | Concord, MA | | |
| **Date:** | 1/20/2021 | **Project No.** | 21-017 |

## CERTIFICATION

*Submitted & Certified by:*

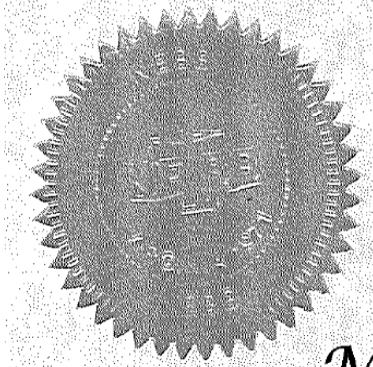
**Milharmer Associates, Inc.**

*Certification No.:* ***3384*** Certification Expiration Date: **3-31-21**

The data presented in this Report is a record of system measurements and final adjustments that have been obtained in accordance with the current edition of the ***N.E.B.B. Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.*** Any variances from design quantities which exceed N.E.B.B. tolerances, are noted in the Test-Adjust-Balance Report Project Summary.

N.E.B.B. Qualified TAB Supervisor Name: **Scott F. Miller**

N.E.B.B. Qualified TAB Supervisor Signature:_____



# Certification

**THIS IS TO CERTIFY THAT**

*Milharmer Associates, Inc.*

**HAS MET ALL REQUIREMENTS FOR NEBB CERTIFICATION IN THE FOLLOWING DISCIPLINE**

*Testing, Adjusting and Balancing of Environmental Systems*

**FOR THE NEBB BOARD OF DIRECTORS**

*March 31, 2021*

**Expiration Date**

**NEBB President**

*3384*

**NEBB Certification Number**

**NEBB President-Elect**

# NEBB Certification Board

## NEBB Certified Professional

*Scott F. Miller*

**HAS MET ALL THE NEBB REQUIREMENTS FOR NEBB CERTIFIED PROFESSIONAL STATUS IN**

*Testing, Adjusting and Balancing of Environmental Systems*

**This Certificate, as well as individual affiliation with a NEBB Certified Firm and associated NEBB Certification Stamp are REQUIRED to provide a NEBB Certified Report. Participation in the NEBB Quality Assurance Program requires the Certificant be affiliated with a NEBB Certified Firm.**

*March 31, 2021*

**Expiration Date**

*23541*

**NEBB Certificant Number**

Richard Farrell

**NEBB Certification Board Chairman**

Cynthia Heath

**NEBB Certification Director**

**The NEBB Certification Board retains sole ownership of all certificates. The NEBB Certification Board Policy Manual governs use of this certificate.**

| | | | |
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# INSTRUMENT SHEET

The following is a list of Instruments owned and operated by Milharmer Associates, Inc. and used on this project.

| Instrument ID Number | Instrument | Calibration Date | Calibration Due Date |
|---|---|---|---|
| 1 | ADM-870 Digital Multimeter | 8-20-20 | 8-20-21 |
| 2 | Shortridge Flow Hood | 8-20-20 | 8-20-21 |
| 3 | Ampmeter | 8-20-20 | 8-20-21 |
| 4 | Tachometer | 8-20-20 | 8-20-21 |
| 5 | Airflow Anemometer | 8-20-20 | 8-20-21 |
| 6 | Digital Thermometers | 8-20-20 | 8-20-21 |
| | | | |
| 7 | Shortridge Water Meter | 8-20-20 | 8-20-21 |
| | | | |
| 8 | Sound Meter | 8-20-20 | 8-20-21 |
| | | | |
| 9 | Vibration Meter | 8-20-20 | 8-20-21 |

Please Note: Instruments are tested annually at the M.A.I. Lab. and sent back to the factory if deviation exceeds manufacturing tolerance.

Technician:

## SYMBOL SHEET

| | | | |
|---|---|---|---|
| AHU | Air Handling Unit | HEATER O.L. | Thermal Overload Protection For Motors Located at Starter Motor |
| AC or ACU | Air Conditioner Unit | | |
| ACCU | Air Cooled Condensing Unit | | |
| ADJ P.D. | Adjusted Pitch Diameter | | |
| AMP | Amperage | HEPA | High Efficiency Particulate Arrestance |
| AVG | Average | | |
| A.D. | Air Density | HOA | Hand/Off/Auto Switch |
| | | H.P. | Horsepower |
| B.H.P. | Brake Horsepower | HPS | High Pressure Steam |
| | | HRC | Heat (Recovery or Recliam) Coil |
| CFM | Cubic Feet Per Minute | HVAC | Heating, Ventilation and Air Conditioning |
| CH | Chiller | | |
| CHWR | Chilled Water Return | HWR | Hot Water Return or Heating Water Return |
| CHW or CHWS | Chilled Water Supply | | |
| CT | Cooling Tower | HWS | Hot Water Supply or Heating Water Supply |
| CWR | Condenser Water Return | | |
| CW or CWS | Condenser Water Supply | HX | Heat Exchanger |
| DB | Dry Bulb | I.D. | Inside Diameter |
| D.D. | Direct Drive | | |
| DIA | Diameter | LAT | Leaving Air Temperature |
| | | L.D. | Linear Supply Diffuser |
| EAT | Entering Air Temperature | LPS | Low Pressure Steam |
| EDC | Electric Duct Coil | L.T. | Light Troffer |
| EDH | Electric Duct Heater | LWT | Leaving Water Temperature |
| EF | Exhaust Fan | | |
| EMS | Energy Mgt System | MAU/MUA | Make Up Air Unit |
| EWT | Entering Water Temperature | MBH | 1,000 BTU's per Hour |
| FCU | Fan Coil Unit | N.A. | Not Accessible |
| FH | Fume Hood | N/A | Not Applicable |
| F.L.A. | Full Load Amperage | N.I. | Not Installed |
| FPB | Fan Powered Box | N.L. | Not Listed |
| FPM | Feet Per Minute | | |
| FT. HD. | Feet of Head | | |
| GPM | Gallons Per Minute | | |

## SYMBOL SHEET CONTINUED

| | | | |
|---|---|---|---|
| O.D. | Outside Diameter | TAB | Testing, Adjusting, and Balancing |
| OA Min | Outside Air Minimum | TSP | Total Static Pressure |
| OAT | Outside Air Total | TP | Thermally Protected |
| PF | Power Factor | UH | Unit Heater |
| PHC | Preheat Coil | | |
| PH | Phase(s) | V | Volts |
| PSI | Pounds Per Square Inch | VAV | Variable Air Volume |
| P.T. | Pitot Traverse | VD | Volume Damper |
| | | VFD | Variable Frequency Drive |
| RA | Return Air | VP | Velocity Pressure |
| RF | Return Air Fan | | |
| R.G. | Return Grille | W | Watts |
| RHC | Reheat Coil | WB | Wet Bulb |
| RPM | Revolutions per Minute | W.D. | Water Density |
| | | W.G. | Water Guage |
| SA | Supply Air | | |
| SAT | Supply Air Temperature | F | Degrees Fahrenheit |
| S.D. | Supply Diffuser | | |
| SEF | Smoke Exhaust Fan | ΔP | Differential (Delta) Pressure or Pressure Drop |
| SF (AIR) | Supply Fan | | |
| S.F.(Elect) | Service Factors | | |
| SHC | Steam Heating Coil | ΔT | Differential (Delta) Temperature, Net Temperature Decrease or Increase |
| S.P. "W.C." | Static Pressure Measured in Inches of Water Column | # | PSI or Pounds Per Square Inch Decrease or Increase |

| | | | |
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## REPORT SUMMARY

The following is the report for the Concord District Court. A survey was performed on AHU-H, AHU-J, RTU-2 & RTU-4 with the following comments:

1. AHU-H was tested at 4,199 CFM and is designed for 6,000 CFM. A fan sheave change would be required in order to increase the airflow to design. The new fan sheave would need to be a BK110 x 1 1/4" with an A62 Belt.

2. AHU-J was tested at 4,259 CFM and is designed for 6,000 CFM. A fan sheave change would be required in order to increase the airflow to design. The new fan sheave would need to be a BK110 x 1 1/4" with an A62 Belt.

3. RTU-2 was tested at 1,253 CFM and is designed for 2,000 CFM. A motor sheave change would be required in order to increase the airflow to design. The new motor sheave would need to be a 1VP56 x 7/8" with an AX54 Belt.

3. RTU-4 was tested at 1,076 CFM and is designed for 5,000 CFM. This unit requires additional troubleshooting by a mechanical contractor due to the very low airflow.

| | | | |
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# REPORT SUMMARY

**AIR HANDLING UNITS**

| UNIT | SUPPLY | RETURN | OUTSIDE AIR |
|---|---|---|---|
| AHU-H | 4,199 CFM | 2,967 CFM | 1,232 CFM |
| AHU-J | 4,259 CFM | 3,150 CFM | 1,109 CFM |
| RTU-2 | 1,253 CFM | 1,253 CFM | NA |
| RTU-4 | 1.076 CFM | 1,076 CFM | NA |

**Project:** Concord District Court
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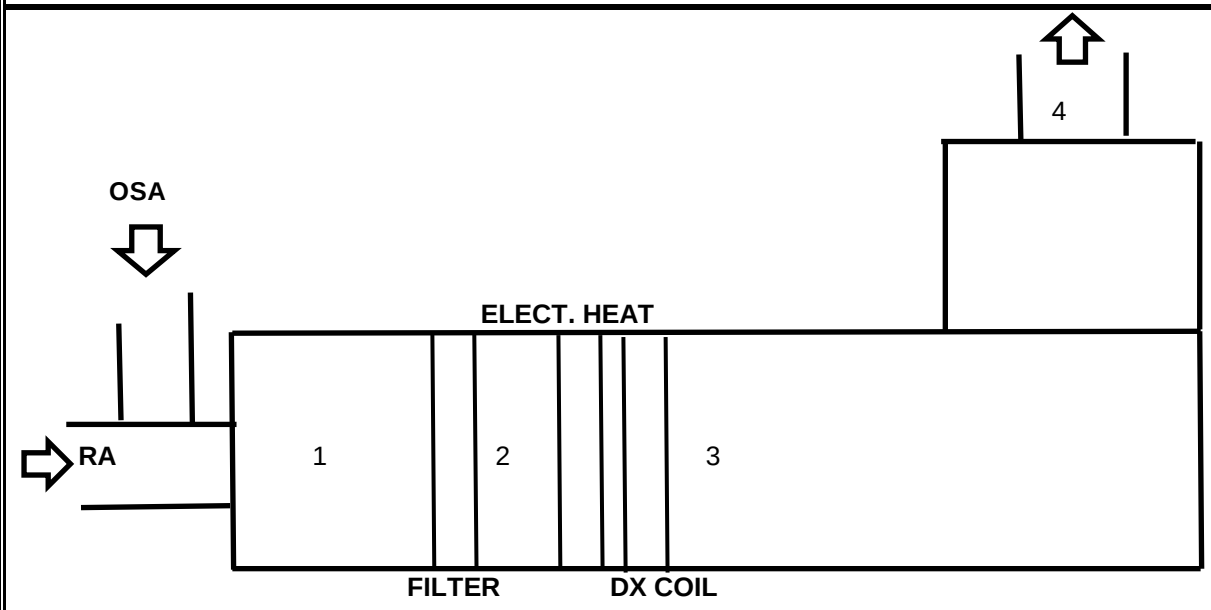
## FAN DATA SHEET

| | FAN NO. | AHU-H (1) | FAN NO. | |
|---|---|---|---|---|
| Serves / Location: | Courtroom 1 | Penthouse | | |
| Manufacturer: | TRANE | | | |
| Model Number: | L-10 | | | |
| Size: | NL | | | |
| Serial Number: | K1H204763 | | | |
| **MOTOR** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Manufacturer: | NL | DAYTON | | |
| Frame Number: | NL | 145T | | |
| Horsepower: | NL | 2 | | |
| Brake Horsepower: | NL | NA | | |
| Safety Factor: | NL | 1.15 | | |
| Volts/Phase: | 460/3 | 460 | | |
| Motor Amperage: | 3.1 | 2.6/3.0/2.7 | | |
| Motor RPM: | 1740 | 1740 | | |
| Speeds: | 1 | 1 | | |
| Heater Size: | NL | CB | | |
| Heater Amps.: | NL | CB | | |
| **FAN** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Supply Air CFM: | 6000 | 4199 | | |
| Return Air CFM: | NL | 2967 | | |
| Exhaust Air CFM: | | | | |
| Outside Air CFM: | 1200 | 1232 | | |
| Suction Pressure: | NL | 0.85 | | |
| Discharge Pressure: | NL | 0.22 | | |
| Fan Static Pressure: | NL | 1.1 | | |
| External Pressure: | NL | NA | | |
| **RPM** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Fan RPM: | NL | 869 | | |
| Motor Drive: | NL | 1VP62 | | |
| Motor Size/Bore: | NL | 7/8" | | |
| Fan Drive: | NL | 12" OD | | |
| Fan Size/Bore: | NL | 1 1/4" | | |
| Belt Size / Number: | NL | A64/1 | | |
| Shafts C-C: | NL | 19" | | |
| Turns Open: | NL | 2.5 | | |

Comments:

| | | | |
|---|---|---|---|
| **Project:** | Concord District Court | | |
| **Address:** | Concord, MA | | |
| **Date:** | 1/20/2021 | **Project No.** | 21-017 |

## AHU-H(1) STATIC PROFILE




| LOCATION | STATIC |
|---|---|
| 1 | -0.41" |
| 2 | -.67" |
| 3 | -.85" |
| 4 | +.22" |
| | |
| | |
| | |
| | |
| | |
| | |

** Pressures measured wiith VAV Boxes at full cooling position.

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T1
Supply Zone 1 TRAVERSE LOCATION: Penthouse

| | | | | | | |
|---|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 56 | " WIDTH x | 16 | " DEPTH | Sq Ft = | 6.22 |

AIR DENSITY DATA

| | | | | | |
|---|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.29 | InWg. | DESIGN CFM = | | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | | 3624 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | | **3629** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 494 | 584 | 452 | 456 | 463 | 628 | 695 |
| B | 766 | 672 | 490 | 424 | 462 | 606 | 662 |
| C | 828 | 746 | 560 | 476 | 414 | 458 | 606 |
| D | 764 | 666 | 538 | 502 | 384 | 414 | 538 |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 36 AVERAGE FPM = 582

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | 690 | 606 | | | | | |
| K | 637 | 664 | | | | | |
| L | 649 | 683 | | | | | |
| M | 677 | 614 | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T2
Supply Zone 2 TRAVERSE LOCATION: Penthouse

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 10 | " WIDTH x | 6 | " DEPTH Sq Ft = | 0.42 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.17 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 313 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **314** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 760 | 685 | | | | | |
| B | 744 | 769 | | | | | |
| C | 774 | 782 | | | | | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 6 AVERAGE FPM = 752

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T3
Supply Zone 3 TRAVERSE LOCATION: Penthouse

| | | | | | | |
|---|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 10 | " WIDTH x | 6 | " DEPTH | Sq Ft = | 0.42 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.16 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 262 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **262** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 512 | 690 | | | | | |
| B | 682 | 670 | | | | | |
| C | 723 | 490 | | | | | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 6 AVERAGE FPM = 628

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T1
Return TRAVERSE LOCATION: Penthouse

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 24 | " WIDTH x | 20 " DEPTH | Sq Ft = | 3.33 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.15 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 2647 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **2649** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 805 | 808 | 812 | | | | |
| B | 843 | 810 | 854 | | | | |
| C | 824 | 855 | 838 | | | | |
| D | 642 | 659 | 886 | | | | |
| E | 798 | 715 | 846 | | | | |
| F | 640 | 808 | 850 | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 18 AVERAGE FPM = 794

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-H TRAVERSE NUMBER : T2
Return TRAVERSE LOCATION: Penthouse

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 10 | " WIDTH x | 6 | " DEPTH Sq Ft = | 0.42 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.17 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 320 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **320** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 574 | 861 | | | | | |
| B | 716 | 826 | | | | | |
| C | 818 | 814 | | | | | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 6 AVERAGE FPM = 768

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

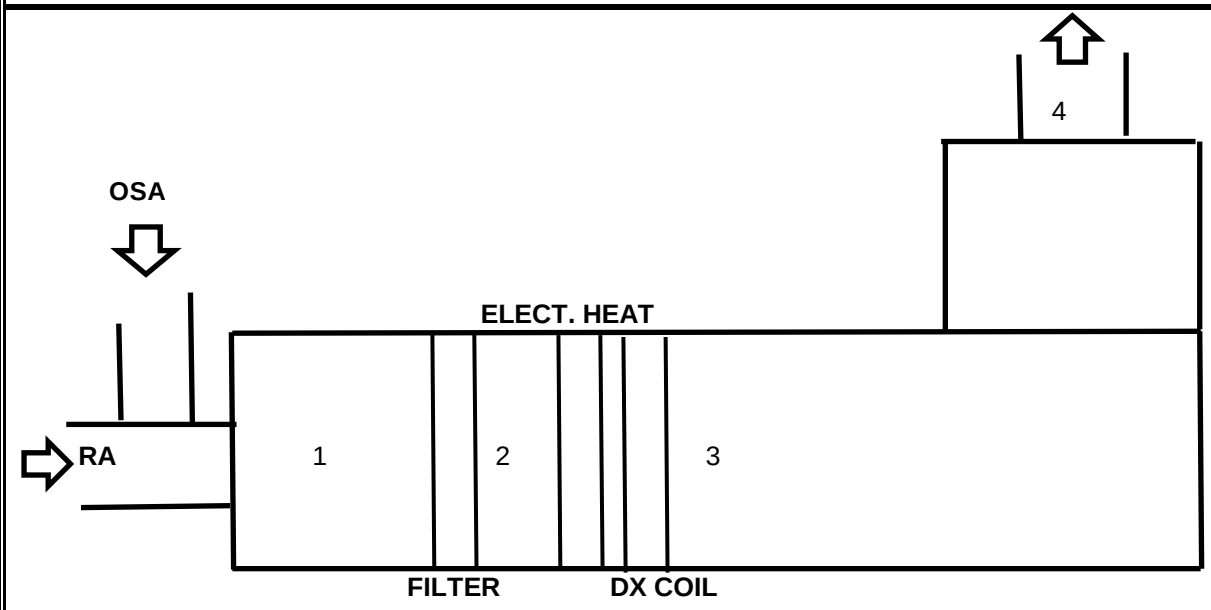
## FAN DATA SHEET

| | FAN NO. | AHU-J (3) | FAN NO. | |
|---|---|---|---|---|
| Serves / Location: | Courtroom 3 | Penthouse | | |
| Manufacturer: | TRANE | | | |
| Model Number: | L-10 | | | |
| Size: | NL | | | |
| Serial Number: | K1H204764 | | | |
| **MOTOR** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Manufacturer: | NL | DAYTON | | |
| Frame Number: | NL | 145T | | |
| Horsepower: | NL | 2 | | |
| Brake Horsepower: | NL | 1.7 | | |
| Safety Factor: | NL | 1.15 | | |
| Volts/Phase: | 460/3 | 460 | | |
| Motor Amperage: | 2.7 | 2.1/2.2/2.2 | | |
| Motor RPM: | 1735 | 1735 | | |
| Speeds: | 1 | 1 | | |
| Heater Size: | NL | CB | | |
| Heater Amps.: | NL | CB | | |
| **FAN** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Supply Air CFM: | 6000 | 4259 | | |
| Return Air CFM: | NL | 3150 | | |
| Exhaust Air CFM: | | | | |
| Outside Air CFM: | 1200 | 1109 | | |
| Suction Pressure: | NL | 0.86 | | |
| Discharge Pressure: | NL | 0.18 | | |
| Fan Static Pressure: | NL | 1.04 | | |
| External Pressure: | NL | NA | | |
| **RPM** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Fan RPM: | NL | 859 | | |
| Motor Drive: | NL | 1VP62 | | |
| Motor Size/Bore: | NL | 7/8" | | |
| Fan Drive: | NL | 12" OD | | |
| Fan Size/Bore: | NL | 1 1/4" | | |
| Belt Size / Number: | NL | A64/1 | | |
| Shafts C-C: | NL | 19" | | |
| Turns Open: | NL | 2.5 | | |

Comments:

| | | | |
|---|---|---|---|
| **Project:** | Concord District Court | | |
| **Address:** | Concord, MA | | |
| **Date:** | 1/20/2021 | **Project No.** | 21-017 |

## AHU-J(3) STATIC PROFILE




| LOCATION | STATIC |
|---|---|
| 1 | -0.47" |
| 2 | -.69" |
| 3 | -.86" |
| 4 | +.18" |
| | |
| | |
| | |
| | |
| | |
| | |

** Pressures measured wiith VAV Boxes at full cooling position.

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-J TRAVERSE NUMBER : T1
Supply Zone 1 TRAVERSE LOCATION: Penthouse

| | | | | | | |
|---|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 56 | " WIDTH x | 16 | " DEPTH | Sq Ft = | 6.22 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.28 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 3777 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **3782** |

| | |
|---|---|
| AIR DENSITY RATIO CORRECTION = | 1.00 |
| SCFM CORRECTION FACTOR | 1.00 |
| ACTUAL DENSITY | 0.075 |

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 612 | 514 | 376 | 554 | 456 | 504 | 554 |
| B | 512 | 528 | 490 | 491 | 527 | 663 | 689 |
| C | 634 | 576 | 529 | 500 | 574 | 658 | 782 |
| D | 644 | 554 | 507 | 548 | 484 | 742 | 832 |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 36 AVERAGE FPM = 607

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | 613 | 846 | | | | | |
| K | 698 | 714 | | | | | |
| L | 784 | 704 | | | | | |
| M | 698 | 762 | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-J TRAVERSE NUMBER : T2
Supply Zone 2 TRAVERSE LOCATION: Penthouse

| | | | | | | |
|---|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 10 | " WIDTH x | 6 | " DEPTH | Sq Ft = | 0.42 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.15 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 241 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **241** |

| | |
|---|---|
| AIR DENSITY RATIO CORRECTION = | 1.00 |
| SCFM CORRECTION FACTOR | 1.00 |
| ACTUAL DENSITY | 0.075 |

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 534 | 576 | | | | | |
| B | 600 | 603 | | | | | |
| C | | | | | | | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 4 AVERAGE FPM = 578

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-J TRAVERSE NUMBER : T3
Supply Zone 3 TRAVERSE LOCATION: Penthouse

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 10 | " WIDTH x | 6 | " DEPTH Sq Ft = | 0.42 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.13 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 241 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **241** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 514 | 556 | | | | | |
| B | 620 | 623 | | | | | |
| C | | | | | | | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 4 AVERAGE FPM = 578

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-J TRAVERSE NUMBER : T1
Return TRAVERSE LOCATION: Penthouse

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 24 | " WIDTH x | 20 " DEPTH | Sq Ft = | 3.33 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.32 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 2881 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **2884** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 1024 | 997 | 882 | | | | |
| B | 957 | 898 | 707 | | | | |
| C | 1105 | 801 | 718 | | | | |
| D | 1033 | 895 | 491 | | | | |
| E | 971 | 884 | 672 | | | | |
| F | 1046 | 784 | 690 | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 18 AVERAGE FPM = 864

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: AHU-J TRAVERSE NUMBER : T2
Return TRAVERSE LOCATION: Penthouse

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 10 | " WIDTH x | 6 | " DEPTH Sq Ft = | 0.42 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.31 | InWg. | DESIGN CFM = | NL |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 269 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **269** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 662 | 680 | | | | | |
| B | 605 | 633 | | | | | |
| C | | | | | | | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 4 AVERAGE FPM = 645

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

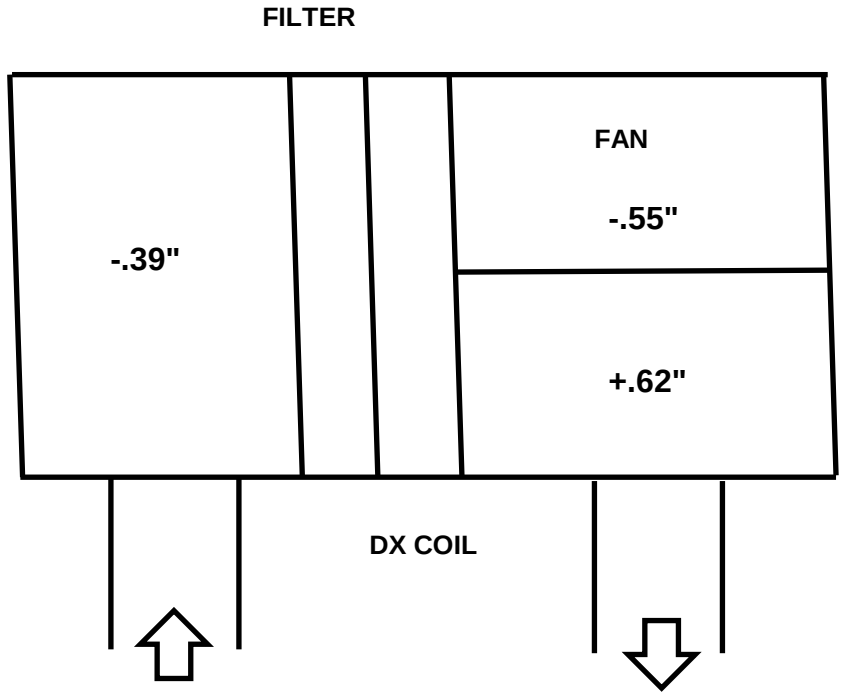
## FAN DATA SHEET

| | FAN NO. | RTU-2 | FAN NO. | |
|---|---|---|---|---|
| Serves / Location: | Center Courtroom | Roof | | |
| Manufacturer: | GOODMAN | | | |
| Model Number: | CPM060XX4BXXX83A | | | |
| Size: | NL | | | |
| Serial Number: | 10042054 | | | |
| **MOTOR** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Manufacturer: | NL | CENTURY | | |
| Frame Number: | NL | 56H | | |
| Horsepower: | NL | 1 | | |
| Brake Horsepower: | NL | 0.67 | | |
| Safety Factor: | NL | 1.15 | | |
| Volts/Phase: | 460/3 | 460 | | |
| Motor Amperage: | 1.5 | 1 | | |
| Motor RPM: | 1725 | 1725 | | |
| Speeds: | 1 | 1 | | |
| Heater Size: | NL | CB | | |
| Heater Amps.: | NL | CB | | |
| **FAN** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Supply Air CFM: | 2000 | 1253 | | |
| Return Air CFM: | | 100% Recirc | | |
| Exhaust Air CFM: | | | | |
| Outside Air CFM: | | | | |
| Suction Pressure: | NL | 0.55 | | |
| Discharge Pressure: | NL | 0.62 | | |
| Fan Static Pressure: | NL | 1.17 | | |
| External Pressure: | NL | NA | | |
| **RPM** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Fan RPM: | NL | 1252 | | |
| Motor Drive: | NL | 1VL44 | | |
| Motor Size/Bore: | NL | 5/8" | | |
| Fan Drive: | NL | AK61 | | |
| Fan Size/Bore: | NL | 1" | | |
| Belt Size / Number: | NL | AX53/1 | | |
| Shafts C-C: | NL | 20" | | |
| Turns Open: | NL | 2.5 | | |

Comments:

| | | | |
|---|---|---|---|
| **Project:** | Concord District Court | | |
| **Address:** | Concord, MA | | |
| **Date:** | 1/20/2021 | **Project No.** | 21-017 |

## STATIC PRESSURE PROFILE
## RTU-2



**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: RTU-2 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: Room 119

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 22 | " WIDTH x | 12 " DEPTH | Sq Ft = | 1.83 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.54 | InWg. | DESIGN CFM = | 2000 |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 1253 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **1255** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 635 | 710 | 684 | 652 | 657 | 627 | |
| B | 669 | 612 | 600 | 635 | 676 | 600 | |
| C | 726 | 810 | 817 | 837 | 872 | 484 | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 18 AVERAGE FPM = 684

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy

**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

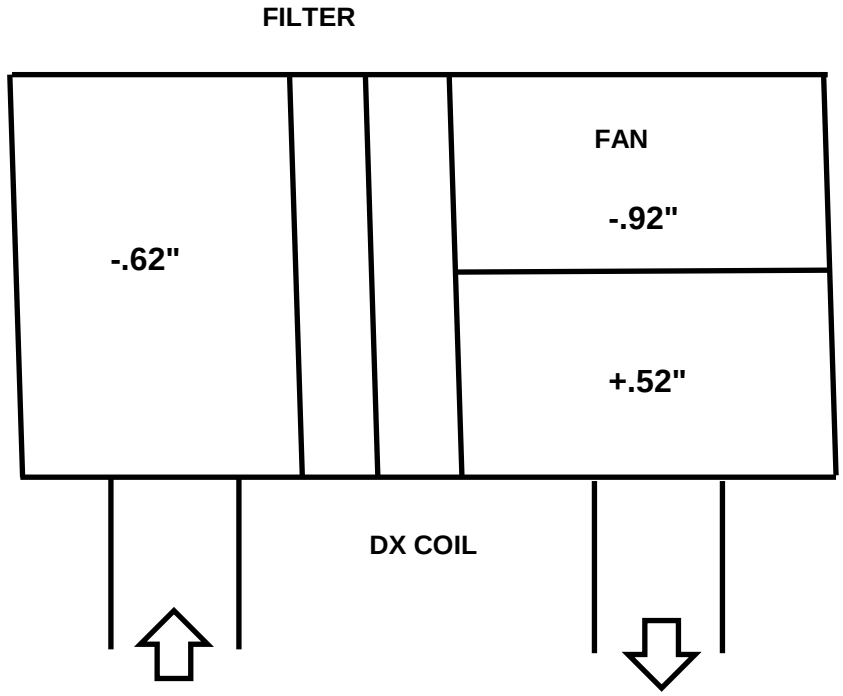
## FAN DATA SHEET

| | FAN NO. | RTU-4 | FAN NO. | |
|---|---|---|---|---|
| Serves / Location: | Lock Up Area | Roof | | |
| Manufacturer: | GOODMAN | | | |
| Model Number: | No Tag | | | |
| Size: | No Tag | | | |
| Serial Number: | No Tag | | | |
| **MOTOR** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Manufacturer: | NL | CENTURY | | |
| Frame Number: | NL | 56HZ | | |
| Horsepower: | NL | 3 | | |
| Brake Horsepower: | NL | 2.8 | | |
| Safety Factor: | NL | 1.15 | | |
| Volts/Phase: | 460/3 | 460 | | |
| Motor Amperage: | 4.5 | 4.3 | | |
| Motor RPM: | 1750 | 1750 | | |
| Speeds: | 1 | 1 | | |
| Heater Size: | NL | CB | | |
| Heater Amps.: | NL | CB | | |
| **FAN** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Supply Air CFM: | 5000 | 1076 | | |
| Return Air CFM: | | 100% Recirc | | |
| Exhaust Air CFM: | | | | |
| Outside Air CFM: | | | | |
| Suction Pressure: | NL | 0.92 | | |
| Discharge Pressure: | NL | 0.52 | | |
| Fan Static Pressure: | NL | 1.44 | | |
| External Pressure: | NL | NA | | |
| **RPM** | **DESIGN** | **TESTED** | **DESIGN** | **TESTED** |
| Fan RPM: | NL | 1008 | | |
| Motor Drive: | NL | 1VL40 | | |
| Motor Size/Bore: | NL | 7/8" | | |
| Fan Drive: | NL | AK66 | | |
| Fan Size/Bore: | NL | 1" | | |
| Belt Size / Number: | NL | AX49/1 | | |
| Shafts C-C: | NL | 18" | | |
| Turns Open: | NL | 2 | | |

Comments:

| | | | |
|---|---|---|---|
| **Project:** | Concord District Court | | |
| **Address:** | Concord, MA | | |
| **Date:** | 1/20/2021 | **Project No.** | 21-017 |

## STATIC PRESSURE PROFILE
## RTU-4



**Project:** Concord District Court
**Address:** Concord, MA
**Date:** 1/20/2021 **Project No.** 21-017

## TRAVERSE DATA

SYSTEM: RTU-4 TRAVERSE NUMBER : T1
TRAVERSE LOCATION: Room 127

| | | | | | |
|---|---|---|---|---|---|
| DUCT SIZE (ROUND) | | " DIAMETER | | Sq Ft = | 0.00 |
| DUCT SIZE (RECT.) | 26 | " WIDTH x | 18 " DEPTH | Sq Ft = | 3.25 |

AIR DENSITY DATA

| | | | | |
|---|---|---|---|---|
| STATIC PRESS @ CL: | 0.49 | InWg. | DESIGN CFM = | 5000 |
| DUCT AIR TEMP : | 70 | Deg F | ACTUAL CFM = | 1076 |
| BAROMETRIC PRESS : | 29.92 | In Hg. | SCFM= | **1078** |

AIR DENSITY RATIO CORRECTION = 1.00
SCFM CORRECTION FACTOR 1.00
ACTUAL DENSITY 0.075

| TEST HOLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| A | 335 | 283 | 365 | 404 | 323 | 348 | |
| B | 260 | 414 | 309 | 257 | 239 | 413 | |
| C | 372 | 273 | 406 | 399 | 374 | 333 | |
| D | 227 | 391 | 366 | 153 | 406 | 297 | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| I | | | | | | | |

NO. OF READINGS = 24 AVERAGE FPM = 331

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J | | | | | | | |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |
| N | | | | | | | |
| O | | | | | | | |
| P | | | | | | | |
| Q | | | | | | | |
| R | | | | | | | |

TECHNICIAN: Nick Cifelli / Brian Murphy