# PALMER DISTRICT COURTHOUSE
# HVAC SYSTEM EVALUATION SUMMARY

Visited August 10, 2020. Inspected the rooftop air handling unit and toured the Lower and First level to determine if the spaces generally matched usage noted on the architectural plans. The Palmer District Courthouse, a two-story building, was constructed in 1991 and is approximately 21,000 square feet in size. The HVAC system includes one Carrier rooftop air handling unit (RTU-1), which contains a heating hot water coil, a chilled water cooling coil, a supply fan, and a return fan. This unit was designed to provide 17,500 CFM of supply air to the space, of which 3,000 CFM is outdoor air (OA). The remaining 14,500 CFM is return air (RA), which is returned via a return air plenum above the ceiling and is recirculated back into the building.

## 1.0 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)* |
| Courtroom 1 | 18 | 2,000 | 111 | 343 | 19 |
| Courtroom 2 | 13 | 1,000 | 77 | 171 | 13 |

## 2.0 Recommendations

| Section | Recommendation/Finding | Action |
|---|---|---|
| 2.1 | **Filtration Efficiency** | |
| RF-1 | RF-1: Replace filters with MERV-13 | Complete |
| RF-3 | Install a differential pressure sensor across the filter bank | In-progress |
| RF-3b | Pressure sensor shall have a display and be connected to the BMS system and/or local alarm | In-progress |
| 2.2 | **Testing and Balancing** | |
| RTB-1 | Test and rebalance air handling unit minimum outside air flow rate | Complete |
| RTB-2 | Rebalance system return and exhaust air flow rate | Complete |
| RTB-3 | Increase outside air flow rate beyond minimum under non-peak conditions | In-progress |
| RTB-4 | Test and balance VAV box flow rates | In-progress |
| RTB-5 | Test and balance all air inlets and outlets | In-progress |
| 2.3 | **Equipment Maintenance and Upgrades** | |
| RE-1 | Test existing air handling system dampers and actuators for proper operation | Complete |
| RE-2 | Clean air handler coils and drain pans | In-progress |
| RE-4 | Inspect VAV boxes and controllers to ensure they are in good working condition | Complete |
| RE-5 & 5b | Install freeze stat on the hot water coil and provide an alarm tied into the BMS | In-progress |

| | | |
|---|---|---|
| RE-7 | Test the existing control valves and actuators for proper operation. | Complete |
| | | |
| 2.4 | Control System | |
| RC-1 | Implement a pre and post-occupancy flush sequence | Complete |
| RC-2 | Install controls to introduce outside air beyond the minimum requirements | In-progress |
| RC-4 | Confirm the economizer control sequence is operational | Complete |
| | | |
| 2.5 | Additional Filtration and Air Cleaning | |
| RFC-1 | Install portable HEPA filters in high traffic areas – *if courthouse is to operate at a high occupancy (i.e. 50-75% or greater), install portable HEPA filters in high traffic areas.* | In-progress |
| | | |
| 2.6 | Humidity Control | |
| | Installing portable humidifiers and dehumidifiers is not recommended unless high-risk employees are present | No actionable Item |
| | | |
| 2.7 | Other Recommendations | |
| 2.7.1 | Install condensate trap on the cooling coil drip pan | Complete |
| 2.7.2 | Replacement of RTU1 in the next 1-3 years | Deferred – included in 5-year Capital Plan |
| 2.7.3 | Install fan powered VAV boxes | Deferred – included in 5-year Capital Plan |

**Palmer District Courthouse**
**Palmer, MA**

# HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

January 25, 2021

Tighe&Bond

100% Recyclable

# Section 1
# Existing Conditions & Site Observations

Tighe & Bond visited the Palmer District Courthouse on August 10, 2020. While on site, we inspected the rooftop air handling unit and toured the Lower and First level to determine if the spaces generally matched usage noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management*:
  - Darryl MacDonald, Manager of Court Facilities – Region 1
  - Kevin Byrne, Facilities
- *Tighe & Bond:*
  - Jason Urso, PE, Senior Mechanical Engineer
  - Sean Pringle, PE, Project Mechanical Engineer

## 1.1 Existing Ventilation System Description

The Palmer District Courthouse, a two-story building, was constructed in 1991 and is approximately 21,000 square feet in size. The HVAC system includes one Carrier rooftop air handling unit (RTU-1), which contains a heating hot water coil, a chilled water cooling coil, a supply fan, and a return fan. This unit was designed to provide 17,500 CFM of supply air to the space, of which 3,000 CFM is outdoor air (OA). The remaining 14,500 CFM is return air (RA), which is returned via a return air plenum above the ceiling and is recirculated back into the building.

The air handling unit is in very poor condition and is original from the 1991 installation. Courthouse staff noted that many repairs were made to help prevent water from leaking into the unit. The cooling coil drain pan was flooded with water and was not draining out of the drain. We suspect this is due to the lack of a condensate piping trap. Outside air was observed being drawn into the drain outlet. The suction pressure created by the supply fan is preventing the cooling coil condensate from draining out of the pan. The outside and return air dampers appear to be in good condition. The electric actuators appear to be in fair condition.

The rooftop air handler contains two sets of filters. There are prefilters within the outdoor air intake hood that filter the incoming outside air only. The MERV rating of these filters is unknown but the rating is assumed to be below MERV 7. There is another set of 2", MERV 10 filters inside the unit that filters both the outside air and return air. The upstream face of the adjacent heating coil appears to be dirty.

The chilled and hot water control valves and actuators serving RTU-1 were not visible during our site visit. It was reported from facility staff that the chilled water system contains glycol, an anti-freezing agent. It is unclear if the heating hot water system contains glycol.

Supply air is regulated to each zone by fan powered variable air volume (VAV) boxes. Some boxes have hot water reheat coils for heating the supply air during the winter, while others do not. 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 airflow to be supplied the space when occupied, which is a code requirement for ventilation purposes. The 1989 design drawings do not list a minimum supply airflow, so it is unknown if supply air is always being provided. The working condition of these boxes is also unknown.

It is not clear from the design drawings what type of fan powered VAV boxes are installed in the Courthouse, series or parallel fan powered. When the fan is activated inside these boxes, the integral fan has the ability to draw air from the plenum, mixes with primary air from the rooftop unit, and is supplied to the space.

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

**TABLE 1**
Existing Air Handling Unit

| Unit | Original Design Airflow (CFM) | Original Design Min. O.A. (CFM) | Filters | Condition |
|---|---|---|---|---|
| RT-1 | 17,500 | 3,000 | 2" MERV 10 | Poor |

Photo 1 – RTU-1

## 1.2 Existing Control System

The Courthouse has a Schneider Electric Building Management control system that was installed in 2013. It is tied to the existing boiler, chiller, rooftop air handling unit and provides basic controls. Tighe & Bond has spoken to a representative from Schneider Electric regarding the existing controls at the Courthouse. This representative provided as-built control system information from the 2013 project. We understand that the system provides the following controls for the rooftop air handler:

1. Start/stop based on an occupancy schedule.
2. Economizer mode – 100% outdoor air.
3. Modulation of fan speed via a VFD and duct static pressure sensor.
4. Supply air temperature control and supply temperature reset.
5. Other: Safeties and alarms.

It is our understanding that the existing fan powered VAV boxes and space thermostats are not connected to the control system. We assume the boxes operate independently and respond to space temperature requirements.

# Section 2
# Recommendations

Below is a list of recommendations that we propose for the Palmer 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 rooftop air handling unit, RTU-1, at the Palmer Courthouse:

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

Due to the age and condition of RTU-1, it is critical a Testing and Balancing (TAB) Contractor perform the system pressure drop check outlined in recommendation RF-1. This unit may not be able to accommodate a MERV 13 filter and should be verified based on the TAB results.

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

**RF-3b:** *Pressure sensor shall have a display and be connected to the BMS system and/or a local alarm.*

Since this unit is located on the roof, we recommend a differential pressure sensor be installed across the filter bank and be tied to the existing BMS to allow facility personal to check the status of the filter condition without having to travel up to the roof.

## 2.2 Testing & Balancing Recommendations

RTU-1 is approaching 30 years old and it is unknown to Tighe & Bond when the last time this unit was tested and balanced to the proper airflow. Also, the code requirements to determine the outside air flow rates that were used to design the original system may be different than the 2015 International Mechanical Code (IMC) and current ASHRAE Standard 62.1 requirements.

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

We recommend testing and balancing the outdoor air flow rates for all air handling units to the recommended minimum O.A. rates listed in Table 2.

**TABLE 2**
Recommended Air Handler O.A. Flow Rates

| Unit | Original Supply Airflow (CFM) | Original Design Min. O.A. (CFM) | Current Code Min. O.A. Requirements (CFM) | Recommended Minimum O.A. (CFM) |
|---|---|---|---|---|
| RTU-1 | 17,500 | 3,000 | 6,500 | **3,000** |

Note: Although the ASHRAE Position Document on Infectious Aerosols recommends using the latest published standards and codes as a baseline for minimum ventilation, the mechanical code in effect at the time the HVAC systems were designed and constructed is what governs the required outdoor air flowrate for the HVAC equipment, if there have been no additions, renovations, alterations or changes in occupancy to the building. The 2015 International Mechanical Code does not prevent the continued use of existing systems.

In reviewing the originally designed entering air temperatures for the cooling and heating coils, it appears the air handler coils cannot accommodate the 2015 code required ventilation air under peak outdoor air conditions.

The average airflow rate per person is shown below in Table 3. These values are based on the original full design supply airflow rate and the recommended outdoor airflow rates shown in Table 2. The airflow rate per person assumes a diversity factor of 70%, meaning the maximum number of occupants assumed to be in all zones at all times equates to 70% of the code required occupancy.

**TABLE 3**
Average Airflow Rate per Person

| | ***All spaces*** | ***Courtrooms*** | ***Non-Courtroom Spaces*** |
|---|---|---|---|
| Total Occupancy (People) | 218 | 123 | 96 |
| Total Supply Air (CFM/Person) | 80 | 24 | 151 |
| Outdoor Air (CFM/Person) | 14 | 4 | 26 |

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 full design supply airflow rate, and the recommended outdoor airflow rate. The airflow rate per person assumes the full supply airflow is being delivered to the room. 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)*** |
| Courtroom 1 | 98 | 2,000 | 20 | 343 | 3.5 |
| Courtroom 2 | 77 | 1,000 | 13 | 171 | 2.2 |

The airflow rate per person for each Courtroom, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 4a. The airflow rate per person assumes the full supply airflow is being delivered to the room. 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)*** |
| Courtroom 1 | 18 | 2,000 | 111 | 343 | 19 |
| Courtroom 2 | 13 | 1,000 | 77 | 171 | 13 |

**RTB-2**: *Rebalance system return and exhaust air flow rate.*

The originally designed flow rate for the return fan in RTU-1 was 15,200 CFM. To accommodate the added 800 CFM of outside air, we recommend rebalancing the return fan to a reduced flowrate of 13,700 CFM. If this cannot be accomplished, we recommend balancing the exhaust air damper in RTU-1 to exhaust 800 CFM to alleviate additional return air.

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

Due to the age of the unit, the ability for the coils to maintain the supply air temperature with increased outdoor air flow rates is uncertain. We recommend increasing the outdoor air flow rate by only 10% beyond the new outdoor air flow rate of 3,800 CFM. This equates to a total outdoor air flow rate of 4,150 CFM, still below the current code minimum requirements. 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. This may cause nuisance freeze stat trips via the existing freeze stat.

**RTB-4**: *Test and balance VAV box flow rates.*

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

If the Courthouse experiences regular cooling and heating comfort complaints, we recommend 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. Incorrect supply water temperatures may be contributing to the temperature control complaints instead of a lack of airflow.

## 2.3 Equipment Maintenance & Upgrades

We recommend the following maintenance and upgrades to RTU-1:

**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.*

**RE-4:** *Inspect VAV boxes and controllers* to ensure they are in good working condition.

It is our understanding that the fan powered VAV boxes are original and have not been replaced. These units have passed their typical life expectancy and may not be operating correctly.

**RE-5 & 5b:** *Install freeze stat on the hot water coil and provide an alarm tied into the BMS.*

*Since we recommend increasing the outside air flow rate, as an extra precaution we recommend installing a freeze stat to help prevent the hot water coil from freezing.*

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

We were not able to inspect the control valves during out site visit, but we suspect they may be original and need replacement. The new valves should be tested and balanced to the original flow rates.

## 2.4 Control System

The Palmer District Courthouse has a BMS. 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-2:** *Install controls required to introduce outside air beyond the minimum requirements.*

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

## 2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

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

If the Palmer Courthouse is to operate at a high capacity (i.e. 50%-75% 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 space mounted humidifiers are not recommended unless there are high risk employees who are required to be in the Courthouse who cannot work remotely.

## 2.7 Other Recommendations

### 2.7.1 Install Condensate Trap on RTU-1

We recommend installing a condensate trap on the cooling coil drip pan so the condensate can discharge out of the unit appropriately. Condensate trap size depends on the static pressure of the air handler.

### 2.7.2 Replacement of RTU-1

We recommend replacing RTU-1. A rooftop air handling unit has a life expectancy of 15-25 years. This unit is approximately 30 years old and is in very poor condition and is susceptible to an imminent failure.

### 2.7.3 Replace VAV Boxes

We also recommend the replacement of the fan powered VAV boxes as part of a capital improvement plan. Assuming the existing VAV boxes are original, they are 29 years old and are past their normal life expectancy of 20-25 years. We recommend evaluating the replacement of these fan powered boxes with non-fan powered, single duct VAV boxes. Fan powered VAV boxes use more energy and require more maintenance than single duct boxes. If the fan powered boxes are to be replaced by non-fan powered single duct boxes, the VAV box replacement should occur at the same time as the air handler replacement so the air handler can be properly sized.

# Section 3
# Testing & Balance Results

Wings Testing and Balancing visited the Palmer District Courthouse on October 5, 2020 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) |
| RTU-1 | 17,500 | 3,000 | 14,500 | 10,656 | 2,623 | |

Typical balancing tolerances for air systems is ±10% of the design airflow. In reviewing the airflow report data, the following should be noted:

1. RTU-1 supply fan is significantly underperforming. It is only supplying approximately 10,600 CFM of the designed airflow rate of 17,500 CFM.
2. Some of the air handler dampers are not functional.
3. The exhaust fans were not operating at the time of testing. We recommend repairing or replacing the exhaust fans and balancing them to the correct airflows.

## Disclaimer

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

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WING'S TESTING & BALANCING CO., INC.

# Palmer Courthouse
# HVAC Survey
# Palmer, MA

* * * *

Tighe & Bond Engineering
Attn: Jason R. Urso
53 South Hampton Road
Westfield, MA 01085

October 12, 2020

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.

October 12, 2020

Tighe & Bond Engineering
Attn: Jason R. Urso
53 South Hampton Road
Westfield, MA 01085

Re: Palmer Courthouse

Dear Jason,

Our HVAC Survey of the Roof Top Units, Return Fans, Outside Air and Exhaust Air has been completed. Our findings are as follows:

- The total supply flow is only 60% of design.
  - The fan is operating at full speed.
  - The mixed air and spill dampers are not modulating.
  - Fresh air was at 87% of design.
    - If the supply fan was sped up, OA would be well *over* design.
- None of the roof mounted exhaust fans are operational.
  - In-house tech told us they haven't operated in years.
  - We recommend replacing the exhaust fans.
- There is no location or circuit setter to measure water flows at the unit.

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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# SUPPLY FAN REPORT

| | |
|---|---|
| **PROJECT:** Palmer Courthouse | **DATE:** 10/5/20 |
| **AREA SERVED:** Courthouse | **TECH:** BS |

| FAN DATA | | | | | | |
|---|---|---|---|---|---|---|
| FAN NUMBER | RTU-1 | | | | | |
| LOCATION | Roof | | | | | |
| AREA SERVED | Courthouse | | | | | |
| MANUFACTURER | Carrier | | | | | |
| MODEL OR SIZE | NA | | | | | |
| | **DESIGN** | **ACTUAL** | **DESIGN** | **ACTUAL** | **DESIGN** | **ACTUAL** |
| TOTAL CFM | 17,500 | 10,656 | | | | |
| RETURN AIR | 14,500 | 8033 | | | | |
| OUTSIDE AIR | 3000 | 2623 | | | | |
| DISCH. STATIC | --- | --- | --- | | --- | |
| SUCTION STATIC | --- | --- | --- | | --- | |
| TOTAL STATIC | --- | --- | | | | |
| FAN RPM | --- | 1202 | | | | |
| PULLEY O.D. | 9.5" | | | | | |
| ESP | --- | | | | | |
| VFD SPEED | 60 Hz | | | | | |
| O.A.D.MIN POS | (1) | | | | | |
| **MOTOR DATA** | | | | | | |
| MANUFACTURER | Century | | | | | |
| MODEL OR FR. | S 254T | | | | | |
| HORSEPOWER | 20 | 20 | | | | |
| MOTOR RPM | 1750 | 175 | | | | |
| VOLTAGE / PH. | 208/3 | 208/3 | | | | |
| AMPS LEG 1 | --- | 36.9 | | | | |
| AMPS LEG 2 | --- | 37.5 | --- | | --- | |
| AMPS LEG 3 | --- | 38.1 | --- | | --- | |
| SHEAVE O.D. | 10.5" | | | | | |
| BELTS - QTY / SIZE | 2/5WX600 | | | | | |
| SHEAVE POSITION | Fully Open | | | | | |
| Filters/QTY/Size | 16/25" x 25" x 2" | | | | | |
| | 4/25" x 12" x 2" | | | | | |

**REMARKS**

(1) Mixed air and dump dampers not modulating, making it impossible to set O.A.
(2) Hot water coil is 102" x 45"
(3) Chilled water coil is 112" x 45"
NA-Not Available
ND-No Design DD-Direct Drive

# EXHAUST FAN REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| **PROJECT:** Palmer Courthouse | | | | | **DATE:** 10/5/20 | |
| **AREA SERVED:** Courthouse | | | | | **TECH:** BS | |
| **FAN DATA** | | | | | | |
| FAN NUMBER | | RF-1 | | | | |
| LOCATION | | RTU-1 | | | | |
| AREA SERVED | | Courthouse | | | | |
| MANUFACTURER | | Carrier | | | | |
| MODEL OR SIZE | | NA | | | | |
| TOTAL CFM | DESIGN | 15,200 | | | | |
| | ACTUAL | 8033 | | | | |
| FAN RPM | DESIGN | NA | | | | |
| | ACTUAL | 997 | | | | |
| PULLEY | O.D. | 9.0 | | | | |
| SERVICE | | 1.15 | | | | |
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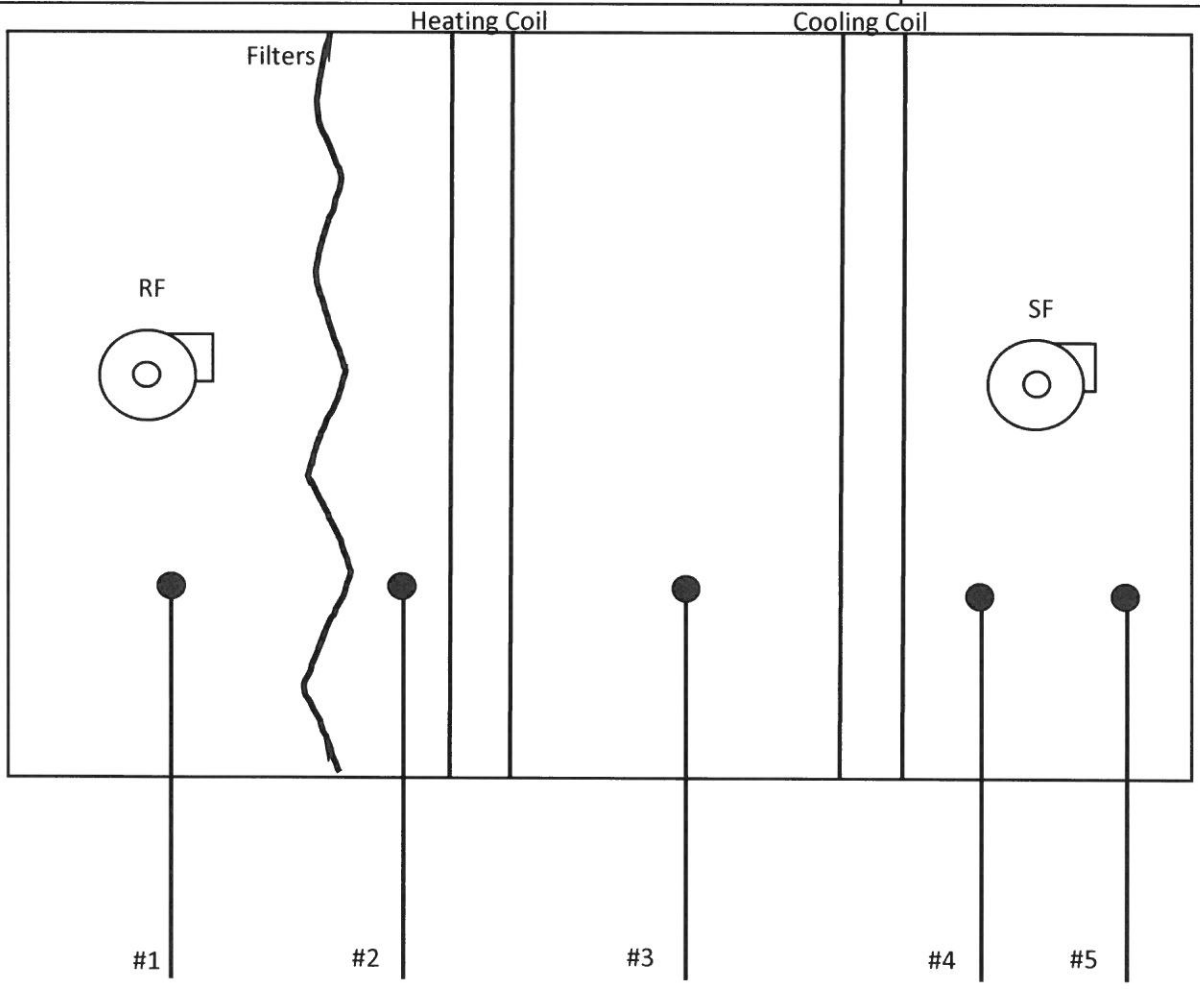
| **MOTOR DATA** | | | | | | |
| MANUFACTURER | | Century | | | | |
| MODEL NUMBER | | S 215T | | | | |
| MOTOR HP | DESIGN | 10 | | | | |
| | ACTUAL | 10 | | | | |
| MOTOR RPM | | 1750 | | | | |
| VOLTAGE/PHASE | | 208/3 | | | | |
| MOTOR AMPS | DESIGN | 30.0 | | | | |
| | ACT. LEG 1 | 19.9 | | | | |
| | ACT. LEG 2 | 20.7 | | | | |
| | ACT. LEG 3 | 20.5 | | | | |
| SHEAVE | | 6.5 | | | | |
| BELTS-QTY/SIZE | | 2/A58 | | | | |
| SHEAVE POSITION | | Fully Open | | | | |
| **REMARKS** | | | | | | |
| | | | | | | |

# SYSTEM STATIC PRESSURE PROFILE

**PROJECT:** Palmer Courthouse | **DATE:** 10/5/20

**SYSTEM/AREA SERV:** Courthouse | **TECH:** BS




**STATIC PRESSURE READINGS "wc**

| POS. (+ ) / NEG.(-) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | -0.54" | -0.57" | -0.66" | 1.21" | +1.43" | | | |
| | | | | | | | | |
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**REMARKS**

# VELOCITY PRESSURE READINGS

**PROJECT:** Palmer Courthouse | **DATE:** 10/5/20

**AREA SERVED:** Courthouse | **TECH:** BS

| TRAVERSE LOCATIONS | DUCT SIZE " | AREA SQ.FT. | DESIGN | | CENTERLINE STATIC PRES." | TEST | | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | | FPM | CFM | | FPM | CFM | |
| | | | | | | | | |
| **RTU-1** | | | | | | | | |
| Partial Total | 48" x 36" | 12.0 | --- | 8750 | w/velgrid | 407 | 4884 | |
| Partial Total | 48" x 36" | 12.0 | --- | 8750 | w/velgrid | 481 | 5772 | |
| | | | | | | | 10,656 | |
| | | | | | | | | |
| RF-1 | 34 1/2" x 17 1/2" | 4.19 | --- | 15,200 | w/velgrid | 11,916 | 8033 | |
| | | | | | | | | |
| | | | | | | | | |
| **OA** | | | | | | | | |
| Partial Total | 48" x 36" | 12.0 | --- | 1500 | --- | --- | --- | (1) |
| Partial Total | 48" x 36" | 12.0 | --- | 1500 | --- | --- | --- | (1) |
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**REMARKS**

(1) Mixed air and dump dampers do not modulate making it impossible to set OA