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**Report: UCM Skyhaven (Warrensburg, MO)  
Function: Test, Adjust, & Balance  
Date: 04/18/2023**

**PROJECT  
UCM Skyhaven (Warrensburg, MO)**

NW 251 Road

Warrensburg, MO 64019

**Client**

Metro Air Conditioning  
8151 McCoy  
Shawnee, KS 66227

# National TAB

Project: UCM Skyhaven (Warrensburg, MO)

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# CERTIFICATION



**PROJECT:** UCM Skyhaven (Warrensburg, MO)

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 NEBB Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems. The measurements shown, and the information given, in this report are certified to be accurate and complete, at the time and date information was gathered. Any variances from design quantities, which exceed NEBB tolerances, are noted in the TAB report project summary.

**NEBB TAB FIRM:** National TAB - Kansas City

**REGISTRATION NO:** 3768

**CERTIFIED BY:** Will Turnbough

**DATE:** 4/18/2023

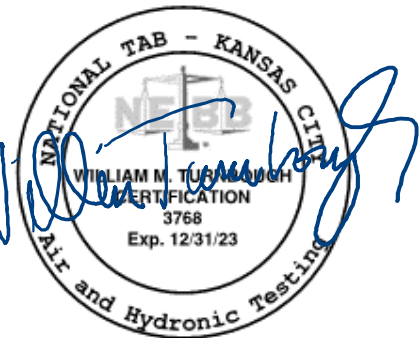
## Submitted and Certified by:

**NEBB TAB FIRM:** National TAB - Kansas City

**TAB PROFESSIONAL:** Will Turnbough

**REGISTRATION NO:** CP-24289

**CERTIFICATION EXP:** 12/31/2023





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## Testing, Adjusting, and Balancing Equipment



| Function    |                                   | Range                     | Minimum Accuracy            | Instrument Information                                         | Calibration Date | Date Due  |
|-------------|-----------------------------------|---------------------------|-----------------------------|----------------------------------------------------------------|------------------|-----------|
| AIR         | AIR PRESSURE                      | 0 in wg to 10 in wg       | 2% +/- 0.001 in wg          | TSI EBT731<br>EBT732117009                                     | 8/12/2022        | 8/12/2023 |
|             | AIR VELOCITY INSTRUMENT           | 50 fpm to 3900 fpm        | +/- 5 %<br>+/- 7 fpm        | Evergreen Telemetry CH-15D<br>1600185                          | 5/20/2022        | 5/20/2023 |
|             | DIRECT HOOD READING               | 100 cfm to 2000 cfm       | +/- 5 %<br>+/- 7 cfm        | Evergreen Telemetry CH-15D<br>1600185                          | 5/20/2022        | 5/20/2023 |
| TEMPERATURE | AIR METER                         | -20 F to 240 F            | +/- .5 %<br>2 F             | Cooper SRH77A S/N 100516003                                    | 8/12/2022        | 8/12/2023 |
|             | AIR PROBE                         | -20 F to 240 F            | +/- .5 %<br>2 F             | Cooper SRH77A S/N 100516003                                    | 8/12/2022        | 8/12/2023 |
|             | IMMERSION METER                   | -20 F to 240 F            | +/- .5 %<br>2 F             | Cooper SRH77A S/N 100516003                                    | 8/12/2022        | 8/12/2023 |
|             | IMMERSION PROBE                   | -20 F to 240 F            | +/- .5 %<br>2 F             | Cooper SRH77A S/N 100516003                                    | 8/12/2022        | 8/12/2023 |
|             | CONTACT METER                     | -20 F to 240 F            | +/- .5 %<br>2 F             | Cooper SRH77A S/N 100516003                                    | 8/12/2022        | 8/12/2023 |
|             | CONTACT PROBE                     | -20 F to 240 F            | +/- .5 %<br>2 F             | Cooper SRH77A S/N 100516003                                    | 8/12/2022        | 8/12/2023 |
| HUMIDITY    | HUMIDITY PROBE                    | 10 % RH to 90 % RH        | 3% of reading               | Cooper SRH77A S/N 100516003                                    | 8/12/2022        | 8/12/2023 |
| ELECTRICAL  | VOLTAGE MEASUREMENT               | 0 VAC to 600 VAC          | 2 % reading<br>+/- 5 digits | Fluke 323<br>S/N 35491023WS                                    | 8/11/2022        | 8/11/2023 |
|             | AMPERAGE MEASUREMENT              | 0 Amperers to 100 Amperes | 2 % reading +/-<br>5 digits | Fluke 323<br>S/N 35491023WS                                    | 8/11/2022        | 8/11/2023 |
| ROTATION    | ROTATION MEASUREMENT              | 60 rpm to 5000 rpm        | 2 % reading<br>2 rpm        | Shimpo DT 207Lp<br>S/N D1690029R                               | 8/11/2022        | 8/11/2023 |
| HYDRONIC    | PRESSURE MEASUREMENT              | -30 in Hg to 200 psi      | ±2% of reading<br>+/- 1 psi | Hydronic Manometer - Dwyer 490W-6-HKIT<br>S/N: 359515093207912 | 8/12/2022        | 8/12/2023 |
|             | DIFFERENTIAL PRESSURE MEASUREMENT | 0 psi - 80 psi            | ±2% of reading<br>+/- 1 psi | Hydronic Manometer - Dwyer 490W-6-HKIT<br>S/N: 359515093207912 | 8/12/2022        | 8/12/2023 |

## Abbreviation List

|                                              |                                             |
|----------------------------------------------|---------------------------------------------|
| A = Area (ft <sup>2</sup> )                  | S.F. = Service Factor                       |
| AHU = Air Handling Unit                      | SF = Supply Fan                             |
| A <sub>k</sub> = Effective Area              | SP = Static Pressure                        |
| BHP = Brake Horsepower (IP) HP               | SR = Supply Register                        |
| Btu = British Thermal Unit                   | T = Temperature                             |
| Btu/h = Btuh = BTUH = BTU/Hour               | T <sub>ma</sub> = Mixed Air Temperature     |
| CL = Center Distance (used in belt formula)  | T <sub>oa</sub> = Outside Air Temperature   |
| CD = Ceiling Diffuser                        | T <sub>ra</sub> = Return Air Temperature    |
| CF = Correction Factor                       | H = Head (in wc, ft wc, psi)                |
| CFM = Volumetric Flow: Cubic Feet Per Minute | h = Enthalpy                                |
| CO <sub>2</sub> = Carbon Dioxide             | HP = Horsepower                             |
| CO = Carbon Monoxide                         | hr = Hour                                   |
| C <sub>v</sub> = Flow Constant               | K <sub>v</sub> = Flow constant (SI)         |
| d = Diameter (in.) IP                        | kW = Kilowatt = 1000 Watts                  |
| Δ = Difference or Change (Final - Initial)   | LAT = Leaving Air Temperature               |
| DB = Dry Bulb                                | lb = Pounds                                 |
| EA = Exhaust Air                             | LWT = Leaving Water Temperature             |
| EAT = Entering Air Temperature               | ma = Mixed Air                              |
| EF = Exhaust Fan                             | MIN = Minimum                               |
| Eff = Efficiency                             | MAX = Maximum                               |
| EG = Exhaust Grille                          | N/A = Not Applicable                        |
| ESP = External Static Pressure               | NA = No Access                              |
| EWT = Entering Water Temperature             | NL = Not Listed                             |
| °F = Degrees Fahrenheit, °F                  | NPSHA = Net Positive Suction Head Available |
| FPB = Fan Powered Box                        | NS = Not Specified                          |
| FLA = Full Load Amps                         | OA = Outside Air                            |
| fpm = Feet per Minute (fpm)                  | OAT = Outside Air Temperature               |
| ft = Foot                                    | PD = Sheave Pitch Diameter                  |
| gal = Gallons                                | P.D. = Pressure Drop                        |
| GPM = Gallons Per Minute (GPM)               | PF = Power Factor                           |
| h = Enthalpy (BTU/lb dry air)                | SG = Supply Grille                          |
| P = Pressure                                 | SR = Supply Register                        |
| ppm = parts per million                      | TP = Total Pressure                         |
| psi = Pounds Per Square Inch                 | T <sub>ra</sub> = Return Air Temperature    |
| psid = PSI Differential                      | TS = Tip Speed (fpm) IP, (m/s) SI           |
| r = Radius (in)                              | TSP = Total Static Pressure                 |
| % <sub>ra</sub> = % of Return Air            | V = Velocity                                |
| RA = Return Air                              | VAV = Variable Air Volume                   |
| RAT = Return Air Temperature                 | VD = Volume Damper                          |
| RF = Return Fan                              | VFD = Variable Frequency Drive              |
| RG = Return Grille                           | W = Watt                                    |
| RH = Relative Humidity                       | WB = Wet Bulb                               |
| RPM = Revolutions Per Minute                 | wg = wc = water gauge = water column        |
| RTU = Roof Top Unit                          | WHP = Water Horsepower (IP)                 |
| SA = Supply Air                              | ω = Humidity Ratio                          |



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Project: UCM Skyhaven (Warrensburg, MO)  
System/Unit: AHU/RTU



Asset: RTU-1

AREA:105

| Unit Data        |        |                            |
|------------------|--------|----------------------------|
|                  | Design | Actual                     |
| MFG              | NA     | TRANE                      |
| Serial Num       | -      | C22E04153                  |
| Model Num        | NA     | TEH330BEA11B2DC400C0E00HHB |
| Configuration    | -      | HORIZONTAL                 |
| Num OA Filters 2 | -      | 3 METAL MESH               |
| OA Filter Size 2 | -      | 22.5X36.5                  |
| Num PreFilter 1  | -      | 16                         |
| PreFilter Size 1 | -      | 16X20X2                    |

| Motor Data     |        |                 |
|----------------|--------|-----------------|
|                | Design | Actual          |
| Motor MFG      | -      | BALDOR ELECTRIC |
| Frame          | -      | 215T            |
| Horsepower     | -      | 10.0            |
| Motor Rpm      | -      | 1770            |
| Phase          | -      | 3               |
| Rated Voltage  | -      | 230/460         |
| Rated Amperage | -      | 25/12.5         |
| Service Factor | -      | 1.15            |

| Drive Data         |        |         |
|--------------------|--------|---------|
|                    | Design | Actual  |
| Motor Sheave Size  | -      | BK67H   |
| Motor Bore Size    | -      | 1-3/8"  |
| Motor Sheave SetPt | -      | VFD     |
| Fan Sheave Size    | -      | BK140   |
| Fan Sheave Bore    | -      | 1-7/16" |
| Belt CL Distance   | -      | 35.5"   |
| Num of Belts       | -      | 1       |
| Belt Size          | -      | BX103   |

| Test Data              |        |             |
|------------------------|--------|-------------|
|                        | Design | Actual      |
| SF CFM                 | 10000  | 10280       |
| SF RPM                 | 677    | 709         |
| RA CFM                 | 9000   | 9268        |
| OA CFM                 | 1000   | 1012        |
| RL Voltage             | 460    | 211/213/214 |
| RL Amperage            | 12.60  | 18.2        |
| SF Motor Freq(HZ)      | 60     | 59.1        |
| SF System SetPt        | -      | 1.20" SP    |
| Min OA Damper Position | -      | 5%          |
| Brake Horse Power      | 6.64   |             |

| Performance Data  |        |        |
|-------------------|--------|--------|
|                   | Design | Actual |
| MA Plenum SP      | -      | -0.15" |
| Fan Suction SP    | -      | -0.46" |
| Fan Discharge SP  | -      | 1.44"  |
| Total ESP         | 1.500  | 1.59"  |
| Fan Total SP      | 2.050  | 1.90"  |
| Pre-Filter P.D.   | -      | 0.31"  |
| Cooling Coil P.D. | -      | 0.31"  |

Completed By: Michael Gabbert

Notes:



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Project:UCM Skyhaven (Warrensburg, MO)

Comfort. Under control.

## VAV - Single Duct

### RTU-1/105

| Asset      |               |            |                |         |                |         |                 |          |                         |
|------------|---------------|------------|----------------|---------|----------------|---------|-----------------|----------|-------------------------|
| Asset Name | Type          | Inlet Size | Design Max CFM | Max CFM | Design Min CFM | Min CFM | Design Heat CFM | Heat CFM | Ak (max)                |
| VAV-1      | ELECTRIC HEAT | 10"        | 1000           | 982     | 200            | 182     | 500             | 517      | 1.11 GAIN -1.36% OFFSET |
| VAV-2      | ELECTRIC HEAT | 8"         | 700            | 716     | 140            | 134     | 350             | 351      | 1.01 GAIN 0% OFFSET     |
| VAV-3      | ELECTRIC HEAT | 6"         | 550            | 504     | 80             | 78      | 190             | 195      | 0.88 GAIN 0.08% OFFSET  |
| VAV-4      | ELECTRIC HEAT | 10"        | 1030           | 1040    | 210            | 193     | 520             | 516      | 1.01 GAIN 0% OFFSET     |
| VAV-5      | ELECTRIC HEAT | 14"        | 1860           | 1797    | 380            | 386     | 930             | 954      | 1.1 GAIN -1.75% OFFSET  |
| VAV-6      | ELECTRIC HEAT | 6"         | 300            | 306     | 60             | 59      | 150             | 156      | 0.89 GAIN 1.82% OFFSET  |
| VAV-7      | ELECTRIC HEAT | 12"        | 1700           | 1646    | 330            | 327     | 830             | 835      | 0.91 GAIN 0% OFFSET     |
| VAV-8      | ELECTRIC HEAT | 12"        | 1260           | 1237    | 260            | 246     | 630             | 638      | 0.97 GAIN 0% OFFSET     |
| VAV-9      | ELECTRIC HEAT | 14"        | 2100           | 2088    | 420            | 427     | 1050            | 1077     | 1.18 GAIN 0% OFFSET     |
| VAV-10     | ELECTRIC HEAT | 12"        | 1310           | 1264    | 270            | 261     | 660             | 670      | 1.18 GAIN 0% OFFSET     |
| VAV-11     | ELECTRIC HEAT | 8"         | 800            | 774     | 140            | 153     | 340             | 348      | 1.06 GAIN -0.82% OFFSET |

| Asset | Notes          |
|-------|----------------|
| VAV-1 | S/N: R22K06501 |
| VAV-2 | S/N: R22K06504 |

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Project: UCM Skyhaven (Warrensburg, MO)  
**System/Unit: FAN - Exhaust**



Asset: EF-1

AREA:117

| Unit Data  |        |                   |
|------------|--------|-------------------|
|            | Design | Actual            |
| MFG        | NA     | GREENHECK         |
| Model Num  | NA     | G-100-4-VG-1-19-Z |
| Serial Num | -      | 21253792          |
| Type       | -      | DOWNBLAST         |

| Test Data   |        |        |
|-------------|--------|--------|
|             | Design | Actual |
| CFM         | 700    | 721    |
| RL Voltage  | -      | 122V   |
| RL Amperage | -      | 0.7A   |
| Total ESP   | 0.5    | 0.17"  |

| Motor Data       |        |             |
|------------------|--------|-------------|
|                  | Design | Actual      |
| Motor MFG        | -      | BROAD OCEAN |
| Frame            | -      | NL          |
| Horsepower       | -      | 1/4         |
| Motor Rpm        | -      | 300-1725    |
| Phase            | -      | 1           |
| Voltage (rated)  | -      | 115/208-230 |
| Amperage (rated) | -      | 2.85/1.7    |
| Service Factor   | -      | 1.25        |

Completed By: Jacob Davidson

Notes:

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Project:UCM Skyhaven (Warrensburg, MO)  
**FAN - Exhaust**



**Diffuser Ret/Exh (GRD)**

**EF-1/117**

| <b>Asset</b>      |             |             |                   |                               |               |               |                  |                    |
|-------------------|-------------|-------------|-------------------|-------------------------------|---------------|---------------|------------------|--------------------|
| <b>Asset Name</b> | <b>Type</b> | <b>Size</b> | <b>DESIGN CFM</b> | <b>AK</b>                     | <b>CFM(1)</b> | <b>CFM(2)</b> | <b>FINAL CFM</b> | <b>% to design</b> |
| E1-1              | EG-1        | 8           | 100               | 1                             | 315           | 198           | 102              | 102.0              |
| E1-2              | EG-1        | 8           | 100               | 1                             | 245           | 181           | 109              | 109.0              |
| E1-3              | EG-1        | 8           | 200               | 261.5CFM/<br>572FPM=0.<br>457 | 239           | 335           | 209              | 104.5              |
| E1-4              | EG-1        | 8           | 100               | 1                             | 234           | 175           | 105              | 105.0              |
| E1-5              | EG-1        | 8           | 200               | 1                             | 265           | 378           | 196              | 98.0               |

Completed By: Jacob Davidson on