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**NATIONAL**

**TAB**

Comfort. Under control.

**Report: TAB Report  
Function: Test, Adjust, & Balance  
Date: 12/19/2022**

# **PROJECT**

## **CMS E.E. Waddell High Reno (Charlotte, NC)**

730 Nations Ford Rd

Charlotte, NC 28217

### **Client**

Action Mechanical Inc.

PO Box 7325

CHARLOTTE, NC 28241

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

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# CERTIFICATION

**PROJECT:** CMS E.E. Waddell High Reno (Charlotte, NC)

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 Standards for Testing, Adjusting, and Balancing of Environmental Systems*. Any variances from design quantities, which exceed NEBB tolerances, are noted in the Test-Adjust-Balance Report Project Summary.

The air distribution system has been tested and balanced and final adjustments have been made in accordance with NEBB standards and the project specifications.

**NEBB TAB FIRM:** National TAB-Southeast

**REGISTRATION NO:** 3755

**CERTIFIED BY:** J. Scott Springer 23312

**DATE:** 1/6/2023

The hydronic distribution system has been tested and balanced and final adjustments have been made in accordance with NEBB standards and the project specifications.

**NEBB TAB FIRM:** National TAB-Southeast

**REGISTRATION NO:** 3086

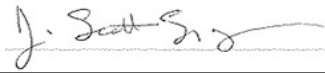
**CERTIFIED BY:** J. Scott Springer 23312

**DATE:** \_\_\_\_\_

## Submitted and Certified by:

**NEBB TAB FIRM:** National TAB-Southeast

**TAB PROFESSIONAL:** J. Scott Springer

**SIGNATURE:** 

**REGISTRATION NO:** 3755 (NTAB) / 23312

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





# National TAB

## 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	Shortridge ADM 880C - S/N M05066	9/28/2022	9/28/2023
	AIR VELOCITY INSTRUMENT	50 fpm to 3900 fpm	+/- 5 % +/- 7 fpm	Shortridge ADM 880C - S/N M05066	9/28/2022	9/28/2023
	DIRECT HOOD READING	100 cfm to 2000 cfm	+/- 3 % +/- 7 cfm	Shortridge ADM 880C - S/N M05066	9/28/2022	9/28/2023
TEMPERATURE	AIR METER	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - SRH77A S/N 081820093	10/12/2022	10/12/2023
	AIR PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - PD1388 7-6 S/N 5028	10/12/2022	10/12/2023
	IMMERSION METER	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - SRH77A S/N 081820093	10/12/2022	10/12/2023
	IMMERSION PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - PD1388 7-6 S/N 1075	10/12/2022	10/12/2023
	CONTACT METER	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - SRH77A S/N 081820093	10/12/2022	10/12/2023
	CONTACT PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - PD1388 7-6 S/N 4011	10/12/2022	10/12/2023
HUMIDITY	HUMIDITY PROBE	10 % RH to 90 % RH	3% of reading	Cooper ATKINS - SRH77A S/N 090315046	10/12/2022	10/12/2023
ELECTRICAL	VOLTAGE MEASUREMENT	0 VAC to 600 VAC	2 % reading +/- 5 digits	Dwyer CM-1 - S/N 190800099	10/12/2022	10/12/2023
	AMPERAGE MEASUREMENT	0 Amperes to 100 Amperes	2 % reading +/- 5 digits	Dwyer CM-1 - S/N 190800099	10/12/2022	10/12/2023
ROTATION	ROTATION MEASUREMENT	60 rpm to 5000 rpm	2 % reading 2 rpm	Dwyer TAC-L - S/N S1100123	10/12/2022	10/12/2023
HYDRONIC	PRESSURE MEASUREMENT	-30 in Hg to 200 psi	±2% of reading +/- 1 psi	Dwyer 490W-6 - S/N 01L6NK	6/29/2022	6/29/2023
	DIFFERENTIAL PRESSURE MEASUREMENT	0 psi - 80 psi	±2% of reading +/- 1 psi	Dwyer 490W-6 - S/N 01L6NK	6/29/2022	6/29/2023

# NEBB Fundamental Formulas

NEBB ABBREVIATIONS	
A = Area (ft <sup>2</sup> ) IP, (m <sup>2</sup> ) SI	M = Mass (lb) IP, (kg) SI
ACH = Air Changes per Hour	ma = Mixed Air
A <sub>k</sub> = Effective Area	m = meter (metre)
AV = Average	m <sup>3</sup> /s = Volumetric Flow: Cubic Meters Per Second
BHP = Brake Horsepower (IP) HP	NLA = No Load Amperage
BP = Brake Power (SI) kW	NPSHA = Net Positive Suction Head Available
Btu = British Thermal Unit	oa = Outside Air
Btu/h = Btuh = BTUH = BTU/Hour	% <sub>oa</sub> = % of Outside Air
ϕ = Center Distance (used in belt formula)	Ω = Ohm
°C = Degrees Celsius, °C	P = Pressure
C = Friction Loss Coefficient (For Duct Fittings)	P <sub>a</sub> = Atmospheric Pressure
CCF = 100 Cubic Feet	P <sub>ab</sub> = Absolute Pressure (Atmospheric Pressure + Gauge Pressure)
CFM = Volumetric Flow: Cubic Feet Per Minute	Pa = Pascals, Pressure SI
C <sub>p</sub> = Specific Heat	π = 3.14
C <sub>v</sub> = Flow Constant (IP)	PD = Sheave Pitch Diameter
ρ = Density (lb/ft <sup>3</sup> ) IP, (kg/m <sup>3</sup> ) SI	P <sub>ϕ</sub> = Pressure at Pump Centerline
d = Diameter (in.) IP, (mm) SI	ppm = parts per million
Δ = Difference or Change (Final - Initial)	psi = Pounds Per Square Inch
d <sub>imp</sub> = Impeller Diameter	psia = Pounds Per Square Inch Absolute
E = Volts	psig = Pounds Per Square Inch Gauge
Eff = Efficiency	P <sub>vp</sub> = Absolute Vapor Pressure
EP = Pump Efficiency	Q (flow) = Volumetric Fluid Flow Rate: (i.e. CFM, GPM, m <sup>3</sup> /s, l/s, etc.)
°F = Degrees Fahrenheit, °F	Q (heat) = Heat Flow Rate (BTU/Hour) IP, (W or kW) SI
f = Friction Factor	°R = °Rankin = Degrees Rankin, °R
FLA = Full Load Amps	r = Radius (in) IP, (mm) SI
fpm = Feet per Minute (fpm)	% <sub>ra</sub> = % of Return Air
ft = Foot	R = Resistance
g = Acceleration of Gravity	ra = Return Air
gal = Gallons	rad = Radians
GPM = Gallons Per Minute (GPM)	RH = Relative Humidity
h = Enthalpy (BTU/lb dry air) IP, (kJ/kg dry air) SI	RPM = Revolutions Per Minute
H = Head (in wc, ft wc, psi) IP, (Pa, kPa) SI	R <sub>value</sub> = Thermal Resistance
Hg = Mercury	s = second
h <sub>ma</sub> = Mixed Air Enthalpy	SHR = Sensible Heat Ratio
h <sub>oa</sub> = Outside Air Enthalpy	SME = Sash Movement Effect Performance Rating (SME-XX yyy)
HP = Horsepower	SP = Static Pressure
hr = Hour	Sp Gr = Specific Gravity (for water use 1.00)
h <sub>ra</sub> = Return Air Enthalpy	T = Temperature
HT = Height (in) IP, (mm) SI	T <sub>a</sub> = Absolute Temperature (460° + T) or °R
I = Amps	T <sub>ma</sub> = Mixed Air Temperature
J = Joules	T <sub>oa</sub> = Outside Air Temperature
K = Kelvin, K	TP = Total Pressure
K <sub>v</sub> = Flow constant (SI)	T <sub>ra</sub> = Return Air Temperature
kg = Kilogram	TS = Tip Speed (fpm) IP, (m/s) SI
kJ = Kilojoule	U = Heat Transfer Coefficient
kPa = Kilopascal	μ = viscosity, dynamic
kW = Kilowatt = 1000 Watts	V = Velocity
l = Liter (Litre)	VP = Velocity Pressure
l/s = Volumetric Flow: Liters Per Second	W = Watt
lb = Pounds	WD = Width (in) IP, (mm) SI
lm = Lumens	wg = wc = water gauge = water column
ln = natural log	WHP = Water Horsepower (IP)
LG = Length (in) IP, (mm) SI	WP = Water Power (SI)
lx = Lux	ω = Humidity Ratio (lb or grains of water/lb of dry air) (g H <sub>2</sub> O/kg dry air)

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Project: CMS E.E. Waddell High Reno (Charlotte, NC)



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## VAV - Single Duct

### VAV/

Asset								
Asset Name	Type	Inlet Size	Design Max CFM	Max CFM	Design Min CFM	Min CFM	Design Heat CFM	Heat CFM
VAV-1	VAV	10"	1250	674	320	322	630	674

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)



Comfort. Under control.

## Diffuser Supply (GRD)

### RTU-3 DIFFUSER/

Asset								
Asset Name	Location	Type	Size	DESIGN CFM	AK	CFM(1)	FINAL CFM	% to design
3-1	301	A	12	460		239	239	52.0

Asset	Notes
3-1	AHU 3 at full speed

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)



Comfort. Under control.

## Diffuser Supply (GRD)

### VAV-1/301A

Asset								
Asset Name	Location	Type	Size	DESIGN CFM	AK	CFM(1)	FINAL CFM	% to design
3.1-1	301A	A	12"12"	400		257	257	64.3
3.1-2	301A	A	12"12"	400		166	166	41.5
3.1-3	301A	A	12"12"	400		251	251	62.8

Asset	Notes
3-1	AHU 3 at full speed

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF1

AREA:

Unit Data		
	Design	Actual
<b>MFG</b>	GREENHECK	GREENHECK
<b>Model Num</b>	USF-12	USF-12
<b>Serial Num</b>	-	20512849
<b>Type</b>	-	UTILITY SET

Motor Data		
	Design	Actual
<b>Motor MFG</b>	-	WEG
<b>Frame</b>	-	56
<b>Horsepower</b>	-	0.25
<b>Motor Rpm</b>	-	1740
<b>Phase</b>	-	1
<b>Voltage (rated)</b>	-	115
<b>Amperage (rated)</b>	-	2.9
<b>Service Factor</b>	-	1.35

Drive Data		
	Design	Actual
<b>Motor Sheave Size</b>	-	VL34
<b>Motor Bore Size</b>	-	0.625
<b>Fan Sheave Size</b>	-	AK58
<b>Fan Sheave Bore</b>	-	1.0
<b>Belt CL Distance</b>	-	7.75
<b>Num of Belts</b>	-	1
<b>Belt Size</b>	-	3L280

Test Data		
	Design	Actual
<b>CFM</b>	870	456
<b>Fan RPM</b>	1187	1070
<b>RL Voltage</b>	-	118
<b>RL Amperage</b>	-	2.8
<b>Suction ESP</b>	-	0.39
<b>Discharge ESP</b>	-	0.21
<b>Total ESP</b>	0.50	0.60
<b>Brake Horse Power</b>	-	0.24

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Notes: NO HORSEPOWER REMAINING TO INCREASE FAN SPEED/CFM

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF2

AREA:

Unit Data		
	Design	Actual
MFG	GREENHECK	GREENHECK
Model Num	USF-12	USF-12
Serial Num	-	20512850
Type	-	UTILITY SET

Motor Data		
	Design	Actual
Motor MFG	-	WEG
Frame	-	56
Horsepower	-	0.25
Motor Rpm	-	1740
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	2.9
Service Factor	-	1.35

Drive Data		
	Design	Actual
Motor Sheave Size	-	VL34
Motor Bore Size	-	0.625
Fan Sheave Size	-	AK58
Fan Sheave Bore	-	1.0
Belt CL Distance	-	7.75
Num of Belts	-	1
Belt Size	-	3L280

Test Data		
	Design	Actual
CFM	870	507
Fan RPM	1187	1061
RL Voltage	-	118
RL Amperage	-	2.8
Suction ESP	-	0.38
Discharge ESP	-	0.22
Total ESP	0.50	0.60
Brake Horse Power	-	.24

Completed By: Scott Springer

Notes: NO HORSEPOWER REMAINING TO INCREASE FAN SPEED/CFM

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF3

AREA:

Unit Data		
	Design	Actual
MFG	GREENHECK	GREENHECK
Model Num	USF-12	USF-12
Serial Num	-	20512851
Type	-	UTILITY SET

Motor Data		
	Design	Actual
Motor MFG	-	WEG
Frame	-	CRE
Horsepower	-	0.25
Motor Rpm	-	1740
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	2.9
Service Factor	-	1.35

Drive Data		
	Design	Actual
Motor Sheave Size	-	VL34
Motor Bore Size	-	0.625
Fan Sheave Size	-	AK58
Fan Sheave Bore	-	1.0
Belt CL Distance	-	7.75
Num of Belts	-	1
Belt Size	-	3L280

Test Data		
	Design	Actual
CFM	870	482
Fan RPM	1187	1098
RL Voltage	-	118
RL Amperage	-	2.8
Suction ESP	-	0.39
Discharge ESP	-	0.20
Total ESP	0.50	0.59
Brake Horse Power	-	0.24

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Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-4

AREA:GENERAL EXHAUST

Unit Data		
	Design	Actual
MFG	NA	GREENHECK
Model Num	NA	G-140-VG
Serial Num	-	20518303
Type	-	CRE

Test Data		
	Design	Actual
CFM	1300	1348
RL Voltage	-	284
RL Amperage	-	2.0
Total ESP	0.50	0.42

Motor Data		
	Design	Actual
Motor MFG	-	VARIGREEN
Horsepower	-	0.50
Motor Rpm	-	300-1750
Phase	-	1
Voltage (rated)	-	277
Amperage (rated)	-	3.2

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Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-5

AREA:

Unit Data		
	Design	Actual
MFG	NA	GREENHECK
Model Num	NA	SP-A510

Test Data		
	Design	Actual
CFM	350	400

Motor Data		
	Design	Actual
Horsepower	-	224 W
Motor Rpm	-	1015
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	3.3

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Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-6

AREA:

Unit Data		
	Design	Actual
<b>MFG</b>	NA	GREENHECK
<b>Model Num</b>	NA	SP-A390-VG

Test Data		
	Design	Actual
<b>CFM</b>	175	340

Motor Data		
	Design	Actual
<b>Horsepower</b>	-	26 W
<b>Motor Rpm</b>	1099	1099
<b>Phase</b>	1	1
<b>Voltage (rated)</b>	115	115
<b>Amperage (rated)</b>	-	1.5

Completed By: Scott Springer

Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-7

AREA:

Unit Data		
	Design	Actual
MFG	NA	GREENHECK
Model Num	NA	SP-A390-VG

Test Data		
	Design	Actual
CFM	175	330

Motor Data		
	Design	Actual
Horsepower	-	26 W
Motor Rpm	1099	1099
Phase	1	1
Voltage (rated)	115	115
Amperage (rated)	-	1.5

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Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-8

AREA:

Unit Data		
	Design	Actual
MFG	NA	GREENHECK
Model Num	NA	SP-A90-130-VG

Test Data		
	Design	Actual
CFM	129	131

Motor Data		
	Design	Actual
Motor MFG	-	Baldor
Horsepower	-	12 W
Motor Rpm	-	1041
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	0.29

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Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-9

AREA:

Unit Data		
	Design	Actual
MFG	NA	GREENHECK
Model Num	NA	SP-A90-130-VG

Test Data		
	Design	Actual
CFM	129	132

Motor Data		
	Design	Actual
Horsepower	-	12 W
Motor Rpm	-	1041
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	0.29

Completed By: Scott Springer

Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-10

AREA:

Unit Data		
	Design	Actual
MFG	NA	GREENHECK
Model Num	NA	SP-A90-130-VG

Test Data		
	Design	Actual
CFM	129	115

Motor Data		
	Design	Actual
Horsepower	-	12 W
Motor Rpm	-	1041
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	0.29

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Notes:

# National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

## System/Unit: FAN - Exhaust



Comfort. Under control.

Asset: EF-11

AREA:

Unit Data		
	Design	Actual
<b>MFG</b>	NA	GREENHECK
<b>Model Num</b>	NA	SP-A90-130-VG

Test Data		
	Design	Actual
<b>CFM</b>	129	122

Motor Data		
	Design	Actual
<b>Horsepower</b>	-	12 W
<b>Motor Rpm</b>	1041	1041
<b>Phase</b>	1	1
<b>Voltage (rated)</b>	115	115
<b>Amperage (rated)</b>	-	0.29

Completed By: Scott Springer

Notes: