Report By:

National TAB Intelligence - Kansas City
1126 Swift St
North Kansas City, MO, 64116

Report: TAB Report
Function: Test, Adjust, & Balance
Date: 06/22/2023

PROJECT

TUKHS HM Retail Space (Overland Park, KS)

6301-6621 W 119th St

Overland Park, KS

Client

Temp-Con, Inc.
15670 S Keller St

Olathe, KS 66062

TUKHS HM Retail Space (Overland Park, KS)

PROJECT TEAM MEMBERS

Owner/Client:	University of Kansas Health System 4000 Cambridge St Kansas City, KS, 66160
Architect/Engineer/Consultant:	Pulse Design Group 4622 Pennsylvania Ave Suite 1050 Kansas City, MO, 64112
Architect/Engineer/Consultant:	5BY5 Engineers 1100 Main Street 4th Floor Kansas City, MO, 64105
Mechanical Contractor:	Temp-Con, Inc. 15670 S Keller St Olathe, KS, 66062
Test, Adjust, & Balance:	National TAB Intelligence - Kansas City 1126 Swift St North Kansas City, MO, 64116

Project Summary

The summary below provides a quick understanding of our scope of work and general testing procedures. Enclosed in the report is further detail about your building performance including recommendations, asset data, and pictures. Our focus is to work with the trades to remedy any issues or deficiencies during the actual field balancing and not after the balancing has occurred to achieve a positive environment and outcome. The level of success is determined by the availability of the trades, possible parts needed, or time constraints.

RTU's (Roof Top Units) w/ Diffusers

Each of the RTU's were measured at their terminal devices or via traverse to establish a total flow for that unit. Each RTU was adjusted to within tolerance of the engineer's design flow. Each outlet was then adjusted to within tolerance of the design flow. Outside air was measured by reading the intake air opening with a velocity grid and multiplying by the free area. The outside air damper was adjusted until the airflow was within the design requirements. Any equipment that fell outside of that tolerance is noted throughout the report.

General Exhaust Fans w/ Grilles

The general exhaust fans were measured by reading each air device with a flow hood. The total airflow for each fan is equivalent to the sum of these readings. Fan speed was then adjusted so that the airflow was within tolerance of design. Each terminal device was balanced to within tolerance of the design volume using the installed volume dampers. Any equipment that fell outside of this tolerance is noted throughout the report.

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Project: TUKHS HM Retail Space (Overland Park, KS)

System/Unit: AHU/RTU

Comfort. Under control.

Asset: RTU1 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	CARRIER
Serial Num	-	3608G50364
Model Num	NA	48TFE007---511--
Configuration	VERTICAL	VERTICAL
Num OA Filters 1	-	1
OA Filter Size 1	-	8.5X7
Num PreFilter 1	-	2
PreFilter Size 1	-	16X25X2

Motor Data		
	Design	**Actual**
Motor MFG	-	GE COMMERICAL MOTORS
Frame	-	56Y
Horsepower	2.0	NA
Motor Rpm	-	1725
Phase	-	3
Rated Voltage	-	208-230V
Rated Amperage	-	5.2A
Service Factor	-	1.15

Test Data		
	Design	**Actual**
SF CFM	2100	2384
RA CFM	1800	2175
OA CFM	300	209
RL Voltage	-	211.9V
RL Amperage	-	3.7A
OA Damper Position	-	MAX SETPOINT

Performance Data		
	Design	**Actual**
MA Plenum SP	-	-0.15"
Fan Suction SP	-	-0.68"
Fan Discharge SP	-	0.50"
Total ESP	0.75	0.65"
Fan Total SP	1.10	1.18"

Completed By: Sergio Del Toro on 06/26/2023

Notes:
Motor sheave rusted and cannot be slowed down. Total flow is slightly above design. Operating at 397 CFM/ton which is a standard airflow for this type of unit, so it may not be an issue.

Written By: Will Turnbough on 06/26/2023

Diffuser Supply (GRD)

RTU1/

Asset							
Asset Name	**Location**	**Type**	**Size**	**DESIGN CFM**	**CFM(1)**	**FINAL CFM**	**% to design**
RTU1-SGRD1	LEFT-FRONT	S2	12X8	350	371	379	108.3
RTU1-SGRD2	LEFT-BACK	S2	12X8	350	391	381	108.9
RTU1-SGRD3	MIDDLE-FRONT	S2	10X8	300	337	328	109.3
RTU1-SGRD4	MIDDLE-BACK	S2	12X8	350	369	393	112.3
RTU1-SGRD5	RIGHT-FRONT	S2	10X8	300	325	337	112.3
RTU1-SGRD6	RIGHT-BACK	S2	12X8	350	424	383	109.4
RTU1-SGRD7	OFFICE	S1	8	100	167	167	167.0
Total				2100	2384	2368	112.76%

Asset	Notes	Date	Written By
RTU1-SGRD7	Damper is not installed.	06/26/2023	Will Turnbough

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Project: TUKHS HM Retail Space (Overland Park, KS)

System/Unit: AHU/RTU

Comfort. Under control.

Asset: RTU2 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	CARRIER
Serial Num	-	4011G50528
Model Num	NA	48TCED09A2A5A0A0A0
Configuration	VERTICAL	VERTICAL
Num OA Filters 1	-	NA
OA Filter Size 1	-	NA
Num PreFilter 1	-	4
PreFilter Size 1	-	20X20X2

Motor Data		
	Design	**Actual**
Motor MFG	-	MARATHON
Frame	-	56Y
Horsepower	2.0	NA
Motor Rpm	-	1725
Phase	-	3
Rated Voltage	-	208-230V
Rated Amperage	-	5.2A
Service Factor	-	1.15

Test Data		
	Design	**Actual**
SF CFM	2900	3184
RA CFM	2500	3184
OA CFM	400	0
RL Voltage	-	208.1/208.4/208.8
RL Amperage	-	3.7/3.5/3.6
OA Damper Position	-	NA

Performance Data		
	Design	**Actual**
MA Plenum SP	-	-0.24"
Fan Suction SP	-	-0.52"
Fan Discharge SP	-	0.57"
Total ESP	0.75	0.81"
Fan Total SP	1.20	1.09"

Completed By: Sergio Del Toro on 06/26/2023

Notes:
Outside air intake is not installed.

Written By: Will Turnbough on 06/26/2023

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Project:TUKHS HM Retail Space (Overland Park, KS)

AHU/RTU

Comfort. Under control.

Diffuser Supply (GRD)

RTU2/

Asset							
Asset Name	**Location**	**Type**	**Size**	**DESIGN CFM**	**CFM(1)**	**FINAL CFM**	**% to design**
RTU2-SGRD1	ROOM 103	S1	8	125	177	138	110.4
RTU2-SGRD2	ROOM 102	S1	8	175	170	189	108.0
RTU2-SGRD3	OPEN AREA	S1	12	400	421	384	96.0
RTU2-SGRD4	OPEN AREA	S1	12	400	476	366	91.5
RTU2-SGRD5	NEAR FRONT DOOR	S2	12X6	250	202	217	86.8
RTU2-SGRD6	NEAR FRONT DOOR	S2	12X6	250	198	264	105.6
RTU2-SGRD7	OPEN AREA	S1	12	400	461	386	96.5
RTU2-SGRD8	OPEN AREA	S1	12	400	509	419	104.8
RTU2-SGRD9	NEAR SIDE DOOR	S2	12X6	250	267	307	122.8
RTU2-SGRD10	NEAR SIDE DOOR	S2	12X6	250	303	376	150.4
Total				2900	3184	3046	105.03%

Asset	Notes	Date	Written By
RTU2-SGRD5	Decorative ceiling is blocking access to dampers for diffusers 5, 9 or 10. Serves open space and not anticipated to be an issue.	06/26/2023	Will Turnbough

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Project: TUKHS HM Retail Space (Overland Park, KS)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF1 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	ECON-AIR
Model Num	NA	EABDU18
Serial Num	-	2845862
Type	CRE	CRE

Test Data		
	Design	**Actual**
CFM	350	1429
RL Voltage	-	NA
RL Amperage	-	NA
Total ESP	0.50	0.86"

Motor Data		
	Design	**Actual**
Motor MFG	-	WEG
Frame	-	56
Horsepower	0.10	1.00
Motor Rpm	-	1750
Phase	1	1
Voltage (rated)	120	115/208-230V
Amperage (rated)	-	9.0/4.98-4.50A
Service Factor	-	1.15

Completed By: Sergio Del Toro on 06/26/2023

Notes:
Speed controller is not installed. Unable to reduce airflow.

Written By: Will Turnbough on 06/26/2023

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Project:TUKHS HM Retail Space (Overland Park, KS)

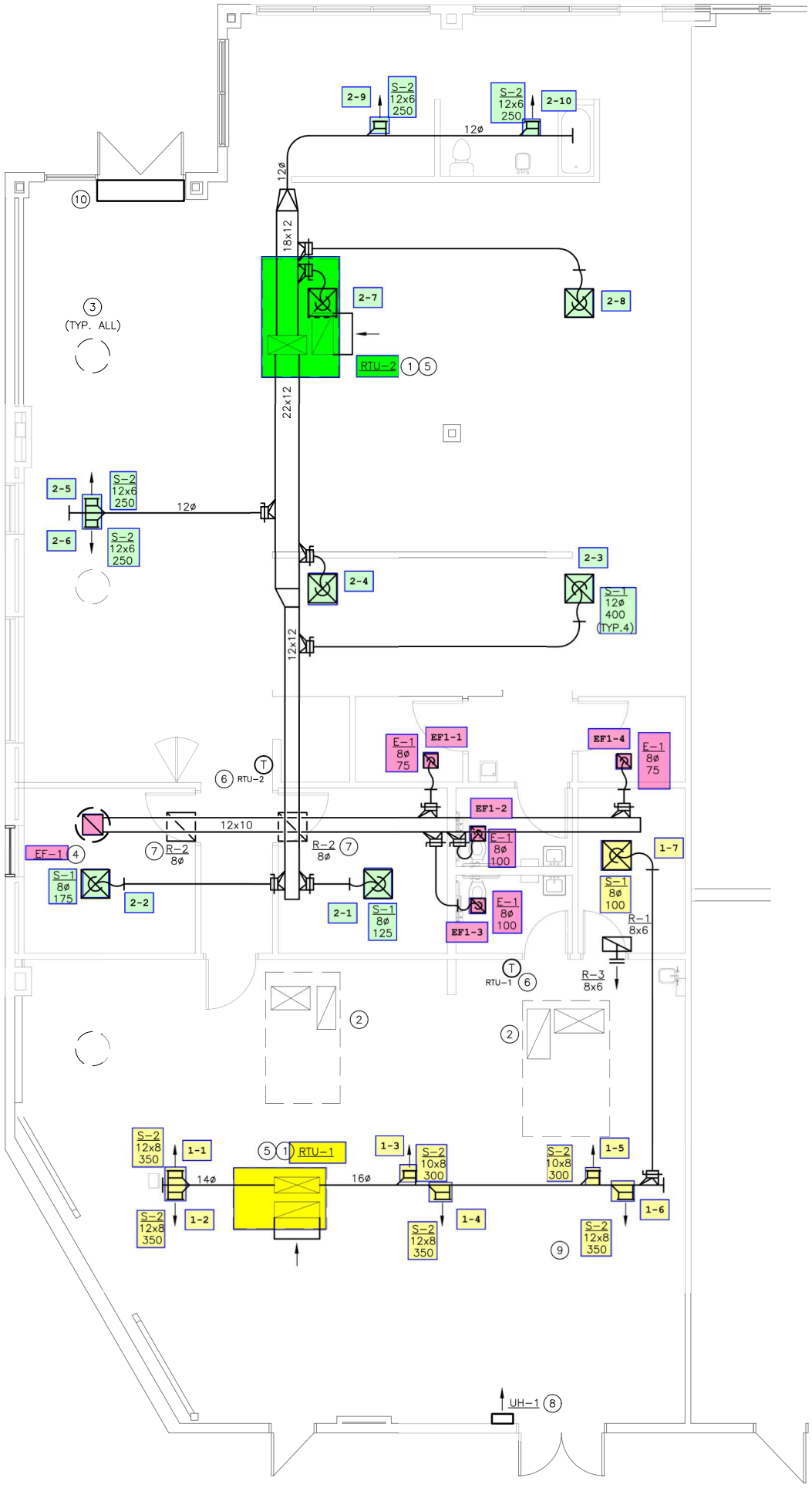
FAN - Exhaust

Comfort. Under control.

Diffuser Ret/Exh (GRD)

EF1/

Asset								
Asset Name	**Type**	**Size**	**DESIGN CFM**	**AK**	**CFM(1)**	**CFM(2)**	**FINAL CFM**	**% to design**
EF1-EGRD1	E1	8	75	1	365	365	365	486.7
EF1-EGRD2	E1	8	100	1	336	336	336	336.0
EF1-EGRD3	E1	8	100	1	373	373	373	373.0
EF1-EGRD4	E1	8	75	1	355	355	355	473.3
Total			350		1429	1429	1429	408.29%



1. EXISTING ROOFTOP UNIT CONTRACTOR TO VERIFY ANY DEFICIENCIES TO OW ROOFTOP UNIT SCHEDULE REQUIREMENTS. REMOVE BACK TO DUCT RISER AN
2. ABANDON EXISTING ROOF OTHER TRADES TO DISCC REMOVE ALL ASSOCIATED 6" BELOW ROOF PENETR INSULATION.
3. DEMO ALL UNUSED HVAC CAP.
4. NEW EXHAUST FAN TO B SHOWN. REUSE EXISTING ADAPTER. BALANCE FAN
5. PROVIDE RETURN AIR DU ELBOW DUCT FOR SOUNI RTU OPENING.
6. RELOCATE EXISTING THER ON PLAN. PROVIDE NEW TO ACCOMMODATE NEW I CONTROLLER PER MANUF
7. PROVIDE RETURN AIR GR INSULATED BOOT FOR SC MINIMUM SIZE OF BOOT
8. LOCATE UNIT HEATER ON PER MANUFACTURER'S RI
9. LOCATE SUPPLY GRILLE TOWARD IT EQUIPMENT L
10. LOCATE AIR CURTAIN WHI ARCHITECT FOR MOUNTIN ACCORDING TO MANUFAC INSTRUCTIONS.

1 MECHANICAL PLAN
SCALE: 3/16" = 1'-0"

Abbreviation List

A = Area (ft^2)	S.F. = Service Factor
AHU = Air Handling Unit	SF = Supply Fan
A_k = 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_{ma} = Mixed Air Temperature
CL = Center Distance (used in belt formula)	T_{oa} = Outside Air Temperature
CD = Ceiling Diffuser	T_{ra} = Return Air Temperature
CF = Correction Factor	H = Head (in wc, ft wc, psi)
CFM = Volumetric Flow: Cubic Feet Per Minute	h = Enthalpy
CO2 = Carbon Dioxide	HP = Horsepower
CO = Carbon Monoxide	hr = Hour
C_v = Flow Constant	K_v = 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_{ra} = Return Air Temperature
psid = PSI Differential	TS = Tip Speed (fpm) IP, (m/s) SI
r = Radius (in)	TSP = Total Static Pressure
$\%_{ra}$ = % 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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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	Evergreen Telemetry S-PVF-1 2300177A	2/23/2023	2/23/2024
	AIR VELOCITY INSTRUMENT	50 fpm to 3900 fpm	+/- 5 % +/- 7 fpm	Evergreen Telemetry S-PVF-1 2300177A	2/23/2023	2/23/2024
	DIRECT HOOD READING	100 cfm to 2000 cfm	+/- 5 % +/- 7 cfm	Evergreen Telemetry CH-15D 2300114	2/20/2023	2/23/2024
TEMPERATURE	AIR METER	-20 F to 240 F	+/- .5 % 2 F	Cooper SRH77A S/N 100516003	8/12/2022	8/12/2023
	AIR PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper SRH77A S/N 100516003	8/12/2022	8/12/2023
	IMMERSION METER	-20 F to 240 F	+/- .5 % 2 F	Cooper SRH77A S/N 100516003	8/12/2022	8/12/2023
	IMMERSION PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper SRH77A S/N 100516003	8/12/2022	8/12/2023
	CONTACT METER	-20 F to 240 F	+/- .5 % 2 F	Cooper SRH77A S/N 100516003	8/12/2022	8/12/2023
	CONTACT PROBE	-20 F to 240 F	+/- .5 % 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 +/- 5 digits	Fluke 323 S/N 35491023WS	8/11/2022	8/11/2023
	AMPERAGE MEASUREMENT	0 Amperers to 100 Amperes	2 % reading +/- 5 digits	Fluke 323 S/N 35491023WS	8/11/2022	8/11/2023
ROTATION	ROTATION MEASUREMENT	60 rpm to 5000 rpm	2 % reading 2 rpm	Shimpo DT 207Lp S/N D1690029R	8/11/2022	8/11/2023
HYDRONIC	PRESSURE MEASUREMENT	-30 in Hg to 200 psi	±2% of reading +/- 1 psi	Hydronic Manometer - Dwyer 490W-6-HKIT S/N: 359515093207912	8/12/2022	8/12/2023
	DIFFERENTIAL PRESSURE MEASUREMENT	0 psi - 80 psi	±2% of reading +/- 1 psi	Hydronic Manometer - Dwyer 490W-6-HKIT S/N: 359515093207912	8/12/2022	8/12/2023