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TEST & BALANCE REPORT

THE CLIFF HOUSE
BALANCE OF REPLACEMENT
HEAT PUMPS
1090 POINT LOBOS
SAN FRANCISCO, CALIFORNIA
FINAL BALANCE

CLIENT: **WSP USA**

PROJECT NUMBER: 24702-F

DATE: 09/18/2020

TECHNICIAN: BRIAN CHUNG

TBE: MICHAEL T. RENOVICH

THIS IS TO CERTIFY THAT RSANALYSIS, INC. HAS BALANCED THE SYSTEM DESCRIBED HEREIN TO THEIR OPTIMUM PERFORMANCE CAPABILITIES, UNLESS OTHERWISE NOTED IN THE PROJECT SUMMARY. THE TESTING AND BALANCING HAS BEEN PERFORMED IN ACCORDANCE WITH THE STANDARD REQUIREMENTS AND PROCEDURES OF THE ASSOCIATED AIR BALANCE COUNCIL AND THE RESULTS OF THESE TESTS ARE HEREIN RECORDED.

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AABC National Performance Guaranty

Pursuant to the agreement between

RSANALYSIS, INC.

AABC Certified Testing & Balancing Agency

and WSP USA

Client

All systems shall be tested and balanced in accordance with the project plans and specifications and to the optimum performance capabilities of the equipment. Testing and balancing shall be done in accordance with the standards published by the Associated Air Balance Council.

If the Agency listed above fails to comply with the specifications for any reason other than termination of business by the AABC agency or equipment malfunction or inadequacy which prevents proper balancing of the systems, AABC will investigate and, if warranted, will provide supervisory personnel to assist the member Agency to perform work in accordance with AABC Standards. This supervision will be provided at no additional cost to the building owner.

This Guaranty is valid for one year from the date of submission of a test and balance report, provided the Agency is a current member of AABC, and may only be invoked in writing by the building owner, architect, or engineer of record. The Guaranty is limited to the terms and conditions as stated herein.

Project Name THE CLIFF HOUSE - BALANCE OF REPLACEMENT HEAT PUMPS

Address 1090 POINT LOBOS

SAN FRANCISCO, CALIFORNIA

Name of Engineer N/A

Engineering Firm N/A

Email Address N/A

Address N/A

Date 09/18/2020

TBE # 93-01-32

By

AABC Certified TBE

AABC

Associated Air Balance Council

1518 K Street, N.W.
Washington, D.C. 20005
202-737-0202 • Fax 202-638-4833
info@aabc.com • www.aabc.com

AABC

Associated Air Balance Council

Annual Certificate

Awarded to

Michael Renovich

RSAnalysis, Inc.

In recognition of his qualifications as a

Certified Test and Balance Engineer

under the rules, regulations, and requirements of the Associated Air Balance Council. The above named is fully authorized to perform total system balance in accordance with the standards as established by the AABC and as a member of the Associated Air Balance Council for the year

2020

This registration number **93-01-32** *is fully recognized by the bylaws and charter of this professional association. Certification is renewable on an annual basis after examination of the agency's record for the preceding year. This certificate expires December 31, 2020.*

ASSOCIATED AIR BALANCE COUNCIL AABC 2020

Benjiman J. Link, *President*

Raymond R. Bert, *Executive Director*

AABC

Associated Air Balance Council

hereby certifies that

Brian Chung

has met all requirements and passed the necessary examination to perform testing and balancing as an AABC

Certified Test & Balance Technician

under the supervision of a certified test and balance engineer for

RSAnalysis, Inc.

This registration number 74-01-01 *is only recognized under the auspices of the above named AABC member agency. This certificate expires December 31, 2020 and is renewable on an annual basis.*

Benjiman J. Link, *President*

Raymond R. Bert, *Executive Director*

GENERAL NOTES

Date	18-Sep-20	RSA Job #	24702

1	Correction for temperature and altitude have been made on all test results shown in this report.
2	Ceiling diffusers were measured with a direct CFM read-out meter (see calibration sheet).
3	Outlets for the fans were numbered with closest to the fan as #1.
4	All corrections for instruments used for testing and balancing are traceable back to the national bureau of standards and are tested in our own labs.

SYMBOL SHEET

A

AHU - Air Handling Unit
AC or ACU - Air Conditioning Unit
ACCU - Air Cooled Condensing Unit
ADJ P.D. - Adjusted Pitch Diameter
AMP - Amperage
AVG. - Average

B

B.H.P - Brake Horsepower

C

C.D. - Ceiling Diffuser
CFM - Cubic Feet Per Minute
C.E. - Ceiling Exhaust
CEF - Ceiling Exhaust Fan
CH - Chiller
CHWR - Chilled Water Return
CHW or CHWS - Chilled Water Supply
C.R. - Ceiling Return
CT - Cooling Tower
CWR - Condenser Water Return
CW or CWS - Condenser Water Supply

D

DB - Dry Bulb
D.D. - Direct Drive
D.P. - Difference, Net Increase or Decrease
DIA - Diameter
D.N.A. - Data Not Available
D.N.L. - Data Not Listed

E

EAT - Entering Air Temperature
EDC - Electric Duct Coil
EDH - Eclectic Duct Heater
EF - Exhaust Fan
EMCS - Energy Management Control System (s)
EWT - Entering Water Temperature

F

FCU - Fan Coil Unit
F.D. - Floor Diffuser
FH - Fume Hood
FG - Floor Grille
F.E. - Floor Exhaust or Return
F.L.A. - Full Load Amperage
FPB - Fan Powered Box
FPM - Feet Per Minute
F.S. - Floor Supply
F.S.R. - Floor Supply Register
FT. HD. - Feet of Head
FTU - Fan Terminal Unit

G

GPM - Gallons Per Minute
GFH - Gas Fired Heater
GFHC - Gas Fired Heating Coil

H

HC - Heating Coil
Heater O.L. - Thermal Overload Protection For Motors
HEPA - High Efficiency Particulate Arrestance
H.F. - Hepa Filter
HOA - Hand/Off/Auto Switch
H.P. - Horsepower
HPS - High Pressure Steam
HRC - Heat Recovery Coil or Heat Reclaim Coil
HVAC - Heating, Ventilation & Air Conditioning
HWR - Hot Water Return or Heating Water Return
HWS - Hot Water Supply or Heating Water Supply
HX - Heat Exchanger

I

I.D. - Inside Diameter

L

LAT - Leaving Air Temperature
L.D. - Linear Supply Diffuser
LPS - Low Pressure Steam
L.R.D. - Linear Return Diffuser
L.T. - Light Troffer
LWG - Low Wall Griller
LWR - Low Wall Return
LWT - Leaving Water Temperature

M

MAU/MUA - Make Up Air Unit
MBH - 1000 Btu's Per Hour

N

N.A. - Not Accessible
N.I. - Not Installed
N.T. - Not Taken
N.V.L - No Valid Location
N.Z. - Nozzle

O

O.D. - Outside Diameter
OPEN - No Terminal Device Installed
OSA Min. - Outside Air Minimum
OAT - Outside Air Temperature

P

PF - Power Factor
PHC - Preheat Coil
PH - Phase (s)
PMP - Circulating Pump
P.P. - Perforated Plate
PSI - Pounds Per Square Inch
P.T. - Pitot Traverse

R

RA - Return Air
RF - Return Air Fan
R.G. - Return Grille
RHC - Reheat Coil
RPM - Revolutions Per Minute

S

SA - Supply Air
SAT - Supply Air Temperature
S.D. - Supply Diffuser
SEF - Smoke Exhaust Fan
SF (Air) - Supply Fan
S.F. (Electric) - Service Factor
SHC - Steam Heating Coil
SP "WC" - Static Pressure, Measured in Inches of Water Column
S.W.E - Sidewall Exhaust
S.W.R. - Sidewall Return
S.W.S. Sidewall Supply

T

TAB - Test, Adjust, & Balance
TSP - Total Static Pressure

U

UH - Unit Heater

V

V - Volts
VAV - Variable Air Volume
VD - Volume Damper
VFD - Variable Frequency Drive
VP - Velocity Pressure

W

W - Watts
WB - Wet Bulb
W.G. - Water Gauge

Misc.

ΔP - Differential (Delta) Pressure
ΔT - Differential (Delta) Temperature

TEST & BALANCE INSTRUMENTATION

Date	18-Sep-20	RSA Job #	24702	Technician	Brian Chung

THE FOLLOWING INSTRUMENTS WERE USED TO RECORD AND SET EACH DEVICE ON THIS PROJECT.

INSTRUMENT	MANUFACTURER	MODEL	SERIAL NO.	CALIBRATION DUE DATE
Flow Hood	Evergreen	CH15	1600186	3/9/2021
AMP Probe	Fluke	902	95360284	3/9/2021
Tachometer	Jaquet	252	73598	3/9/2021
Pressure/Velocity Module	Evergreen	S-PVF-1	1600252/1600253	3/9/2021
Temperature Sensor	Evergreen	S-T-1	N/L	3/9/2021

Project Summary

Date:	9/18/2020
Project:	24702-The Cliff House SF-Balance of Replacement Heat Pumps
Job Number:	24702
Technician:	Brian Chung

Scope of Work

Final Balance HP-1 thru HP-6 and MAU-1

Observations & Outcomes

- HP-2, 3, 4 & 5: JCI had OSA and return air dampers programmed as one-point operation. Return air dampers are reprogrammed to stay 100% open to relieve suction pressure at fans.

- HP-1:
  - Air distribution is proportioned at 70% of design with direct drive motor operating at high speed. There is no valid location to perform a pitot traverse for fan total.
  - OSA is at 75% of design with manual volume damper open 100%.

- HP-2: Fan and air distribution are operating within design criteria.

- HP-3:
  - Fan is operating at 90% of design. Air distribution total is at 86% of design. There is room left on the motor to increase airflow to design with a sheave change.
  - Outlet #4 has a kinked flex, operating at 77% of design airflow.
  - Outlets #7 & #8 are operating below design because of an undersized duct. Remote dampers are 100% opened.

- HP-4: Fan is operating at design airflow. Linear diffuser's total is at 83% of fan's total.

- HP-5:
  - Fan is operating at 78% of design. Motor is almost at full load amp. Air distribution's total is 67% of design.
  - Linear diffuser serving 102A does not have manual volume dampers installed.
  - FSD located on 2nd floor closet 201B is not functional. Thermal mechanical temporary locked FSD damper open so RSA can continue air balance.

- HP-6: Air distribution does not match print. Fan is set for total airflow.

- MAU-1: Fan is tested in Hand Mode at 60 Hertz. Not all hoods are operating at time of testing. Fan is tested with the restaurant front door open to relieve the positive air pressure.

In our efforts to constantly improve in all aspects of our performance, we would appreciate any feedback, positive or negative, regarding your experience with the RSA team.
Please click the link below to be directed to our Quality Assurance Survey. Thank you!
RSA Quality Assurance

AIR MOVING EQUIPMENT DATA

Date	3-Aug-20	Area Served	Kitchen	Unit	HP-1

Unit Information

Fan Identification	HP-1	Equipment MFG	Guardian
Equipment Location	Mechanical Room	Model Number	ME20DN21
Type/Size	-	Serial Number	W1H9224289

Fan Data

Measurement	Method	Specified	Actual	Fan	
Total Fan CFM	*NVL*	2,000	NVL	Fan Sheave	DD
Total S/A CFM	*Outlets*	2,230	1,700 (2)	Fan Shaft	DD
Total R/A CFM	*Inlets*	2,030	1,550	Shaft C/C	DD
O/A CFM		200	150 (1)	Belt Size/Number	DD
Fan RPM		DNL	DD	**Motor**	
TSP ☐ ESP ☑		1.2"	0.17"	Motor Sheave	DD
Inlet SP		Open		Motor Shaft	DD
Discharge SP		+0.17"		Sheave Adj.	DD
Pre / Final Filter ΔP		P 0.36"	F -	Fixed Sheave	☐
Control Set Point		-			

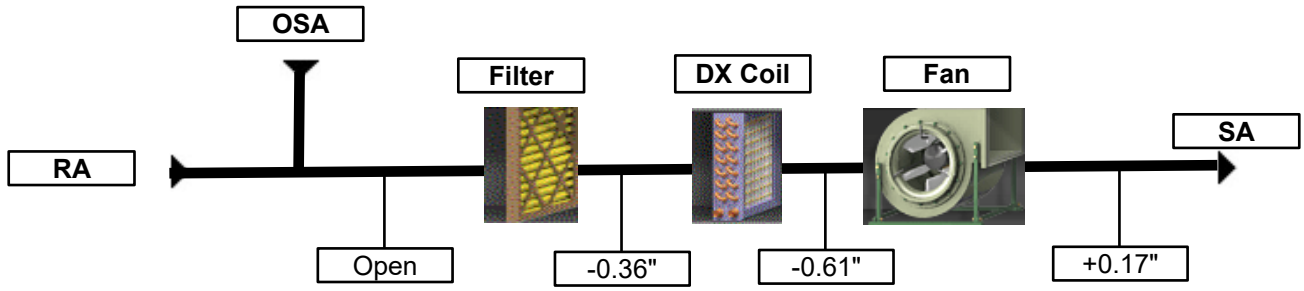
Motor Data

			Specified	Actual		
Motor MFG.	Zhongshan Broad-Ocean					
Motor HP	3/4	Voltage	230	-	230	-
Service Factor	-	Amperage	5.4	-	4.0	-
Phase/Hz	1/60	Motor BHP	DNL	0.56		
Heater Size/Rating	Thermally Protected	Motor RPM	1400	DD		
Motor Frame#	-	Speed (VFD)	Multiple	High Speed		

Temperature Data

Clg E.A.T.	73°	Clg L.A.T.	54°	Htg E.A.T.	74°	Htg L.A.T.	110°

Fan Static Profile



Remarks
(1) OSA: 8" rnd = 0.35 sq. ft.
0.35 X 430 FPM = 150 CFM
(2) See project summary.

DIFFUSER & GRILLE TEST SHEET (SUPPLY)

Date	3-Aug-20	Unit	HP-1	Flow Spec	-%	10%	+%	10%

Unit	Room	Outlet No.	Code	Size	Effective Area	Design FPM	Design CFM	Initial CFM	Final FPM	Final CFM	%
Supply	Kitchen	1	CD	24X24	-	-	100	100	-	75	75.0%
Supply	Kitchen	2	CD	`12X12	-	-	150	45	-	120 (1)	80.0%
Supply	Kitchen	3	CD	24X24	-	-	250	70	-	200	80.0%
Supply	Kitchen	4	CD	24X24	-	-	100	165	-	75	75.0%
Supply	Kitchen	5	CD	24X24	-	-	100	60	-	75	75.0%
Supply	Kitchen	6	CD	24X24	-	-	100	65	-	75	75.0%
Supply	Kitchen	7	CD	24X24	-	-	200	320	-	155	77.5%
Supply	Kitchen	8	SWS	6X6	0.15	1,333	200	145	967	145	72.5%
Supply	Kitchen	9	CD	24X24	-	-	100	75	-	70	70.0%
Supply	Kitchen	10	CD	24X24	-	-	300	225	-	220	73.3%
Supply	Kitchen	11	CD	24X24	-	-	280	270	-	210	75.0%
Supply	Kitchen	12	CD	24X24	-	-	350	155	-	280	80.0%
				Total	**Supply**		**2,230**	**1,695**		**1,700 (2)**	

Remarks

(1) MVD 100% open.

(2) See project summary.

AIR MOVING EQUIPMENT DATA

Date	8-Sep-20	Area Served	112	Unit	HP-2

Unit Information

Fan Identification	HP-2	Equipment MFG	Guardian
Equipment Location	Mechanical Room	Model Number	J15NCC00E6AAA2
Type/Size	-	Serial Number	N1H9184819

Fan Data

Measurement	Method	Specified	Actual	Fan	
Total Fan CFM	*Traverse*	4,800	4,913	Fan Sheave	2B5V94
Total S/A CFM	*Outlets*	4,500	4,555	Fan Shaft	1"
Total R/A CFM	*Traverse*	1,800	1,968	Shaft C/C	15"
O/A CFM		2,700	2,945 (1)	Belt Size/Number	B50 / 2
Fan RPM		767	890	**Motor**	
TSP ☐ ESP ☑		1.2"	1.88"	Motor Sheave	2VP50
Inlet SP		-0.87"		Motor Shaft	1-1/8"
Discharge SP		+1.01"		Sheave Adj.	Max
Pre / Final Filter ΔP		P 0.06"	F -	Fixed Sheave	☐
Control Set Point		-			

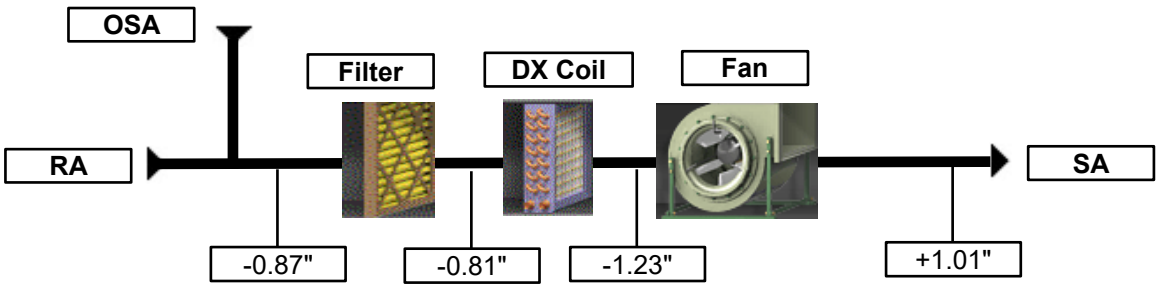
Motor Data

			Specified	Actual		
Motor MFG.	Baldor					
Motor HP	5.0	Voltage	208	208	208	208
Service Factor	1.15	Amperage	14	10	9.6	10.5
Phase/Hz	8.5	Motor BHP	2.28	3.58		
Heater Size/Rating	Thermally Protected	Motor RPM	1750	1750		
Motor Frame#	184T	Speed (VFD)	-	Single Speed		

Temperature Data

Clg E.A.T.	71°	Clg L.A.T.	53.1	Htg E.A.T.	68°	Htg L.A.T.	102°

Fan Static Profile



Remarks

(1) OSA: 36X36=4 sq. ft X 736 FPM = 2945 CFM. (OSA damper set-point is 60%)

RECTANGULAR TRAVERSE SHEET (SUPPLY)

Date	8-Sep-20	Unit	HP-2	Traverse No.	Main	Traverse Location	Mechanical Room

Point No.	1	2	3	4	5	6	7	8	9	10	11	12
A	1,134	1,363	1,421	1,320	1,084							
B	1,164	1,426	1,354	1,348	1,138							
C	1,340	1,347	1,368	1,314	1,213							
D	1,463	1,325	1,430	1,431	1,211							
E												
F												
G												
H												
I												
J												
K												
L												
M												
N												
Sub Total	5,101	5,461	5,573	5,413	4,646							

Total FPM	÷	No. of Readings	=	Avg. FPM	X	Area	=	Total CFM
26,194		20		1,310		3.750		4,913

Design Data			
Duct Size I.D.	30	X	18
Area Sq. Ft.	3.750		
FPM	1,200		
CFM	4,500		

Test Data			
Duct Size O.D.	33	X	21
Duct Size I.D.	30	X	18
Area Sq. Ft.	3.750		
Centerline S.P. In. W.C.	0.76"		

Remarks	

DIFFUSER & GRILLE TEST SHEET (SUPPLY)

Date	8-Sep-20	Unit	HP-2	Flow Spec	-%	10%	+%	10%

Unit	Room	Outlet No.	Code	Size	Effective Area	Design		Initial	Final		%
						FPM	CFM	CFM	FPM	CFM	
Supply	112	1	SWS	24X12	-	-	900	440	-	915	101.7%
Supply	112	2	SWS	24X12	-	-	900	590	-	955	106.1%
Supply	112	3	SWS	24X12	-	-	900	665	-	840	93.3%
Supply	112	4	SWS	24X12	-	-	900	710	-	930	103.3%
Supply	112	5	SWS	24X12	-	-	900	640	-	915	101.7%
				Total	Supply		4,500	3,045		4,555	

Remarks

AIR MOVING EQUIPMENT DATA

Date	8-Sep-20	Area Served	2nd Floor Bistro	Unit	HP-3

Unit Information

Fan Identification	HP-3	Equipment MFG	Guardian
Equipment Location	Ground Floor Mechanical Rm	Model Number	J15NCC00E6AAA2
Type/Size	-	Serial Number	N1H9184820

Fan Data

Measurement	Method	Specified	Actual	Fan	
Total Fan CFM	*Traverse*	4,800	4,343	Fan Sheave	2B5V94
Total S/A CFM	*Outlets*	4,800	4,115	Fan Shaft	1"
Total R/A CFM	*Traverse*	2,500	2,268	Shaft C/C	15"
O/A CFM		2,300	2,075 (1)	Belt Size/Number	B50 / 2
Fan RPM		767	887	**Motor**	
TSP ☐ ESP ☑		1.2"	1.90"	Motor Sheave	2VP50
Inlet SP		-0.84"		Motor Shaft	1-1/8"
Discharge SP		+1.06"		Sheave Adj.	Max
Pre / Final Filter ΔP		P 0.06"	F -	Fixed Sheave	☐
Control Set Point		-			

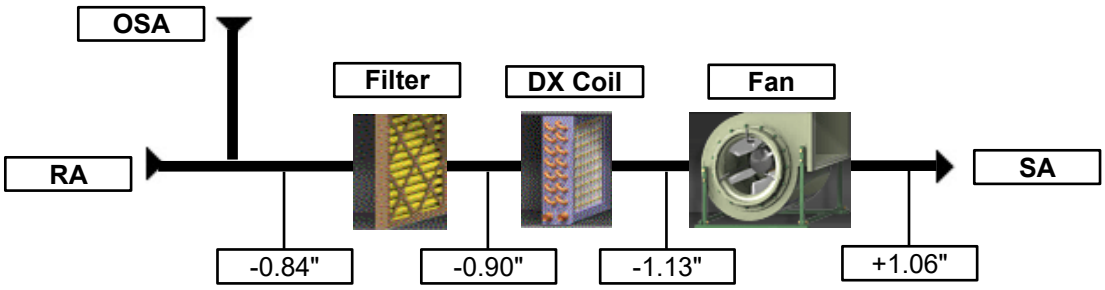
Motor Data

			Specified	Actual		
Motor MFG.	Baldor					
Motor HP	5.0	Voltage	208	208	208	208
Service Factor	1.15	Amperage	14	9.3	8.8	9.6
Phase/Hz	3 / 60	Motor BHP	2.28	3.30		
Heater Size/Rating	Thermally Protected	Motor RPM	1750	1750		
Motor Frame#	184T	Speed (VFD)	-	Single Speed		

Temperature Data

Clg E.A.T.	67.5°	Clg L.A.T.	52.7°	Htg E.A.T.	73°	Htg L.A.T.	106°

Fan Static Profile



Remarks

(1) OSA: 36X16 = 4 sq. ft. X FPM = 2075 CFM (OSA damper set-point is 40%).

RECTANGULAR TRAVERSE SHEET (SUPPLY)

Date	8-Sep-20	Unit	HP-3	Traverse No.	-	Traverse Location	Mechanical Room

Point No.	1	2	3	4	5	6	7	8	9	10	11	12
A	1,460	1,233	1,090	948	841							
B	1,474	1,317	1,152	1,078	892							
C	1,328	1,240	1,170	1,136	959							
D	1,320	1,237	1,213	1,146	908							
E												
F												
G												
H												
I												
J												
K												
L												
M												
N												
Sub Total	5,582	5,027	4,625	4,308	3,600							

Total FPM	÷	No. of Readings	=	Avg. FPM	X	Area	=	Total CFM
23,142		20		1,158		3.750		4,343

Design Data			
Duct Size I.D.	30	X	18
Area Sq. Ft.	3.750		
FPM	1,280		
CFM	4,800		

Test Data			
Duct Size O.D.	33	X	21
Duct Size I.D.	30	X	18
Area Sq. Ft.	3.750		
Centerline S.P. In. W.C.	1.04"		

Remarks
50% OSA : 4360 CFM
30% OSA: 3830 CFM 80%

DIFFUSER & GRILLE TEST SHEET (SUPPLY)

Date	8-Sep-20	Unit	HP-3	Flow Spec	-%	10%	+%	10%

Unit	Room	Outlet No.	Code	Size	Effective Area	Design FPM	Design CFM	Initial CFM	Final FPM	Final CFM	%
Supply	206B	1	SWS	16X12	-	-	650	680	-	680	104.6%
Supply	206B	2	SWS	16X12	-	-	650	655	-	655	100.8%
Supply	206A	3	CD	24X24	-	-	325	375	-	305	93.8%
Supply	206B	4	CD	24X24	-	-	325	225	-	250 (1)	76.9%
Supply	206B	5	SWS	16X12	-	-	650	650	-	650	100.0%
Supply	206B	6	SWS	16X12	-	-	650	590	-	590	90.8%
Supply	206B	7	CD	24X24	-	-	650	400	-	400 (2)	61.5%
Supply	206C	8	CD	24X24	-	-	650	355	-	355 (2)	54.6%
Supply	211	9	CD	24X24	-	-	250	230	-	230	92.0%
				Total	Supply		4,800	4,160		4,115	

Remarks

(1) Remote damper is 100% open. Existing flex is deteriorated and kinked.

(2) Duct work is undersized.

AIR MOVING EQUIPMENT DATA

Date	8-Sep-20	Area Served	Lobby 101	Unit	HP-4

Unit Information

Fan Identification	HP-4	Equipment MFG	Guardian
Equipment Location	Ground Floor Mechanical	Model Number	ME20DN21
Type/Size	-	Serial Number	W1H9224295

Fan Data

Measurement	Method	Specified	Actual	Fan	
Total Fan CFM	*Traverse*	1,400	1,344	Fan Sheave	DD
Total S/A CFM	*Outlets*	1,400	1,160	Fan Shaft	DD
Total R/A CFM	*Traverse*	1,175	1,124	Shaft C/C	DD
O/A CFM		225	220 (1)	Belt Size/Number	DD
Fan RPM		DNL	DD	**Motor**	
TSP ☐ ESP ☑		0.47"	1.26"	Motor Sheave	DD
Inlet SP		-0.61"		Motor Shaft	DD
Discharge SP		+0.65"		Sheave Adj.	DD
Pre / Final Filter ΔP		P 0.09"	F -	Fixed Sheave	☐
Control Set Point		-			

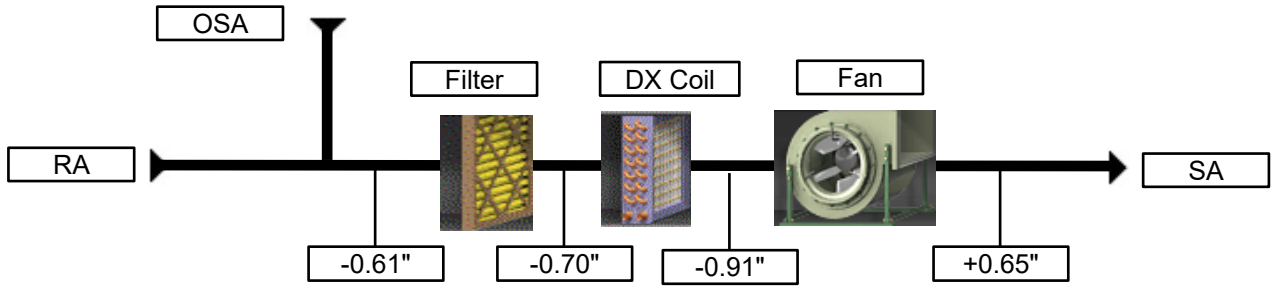
Motor Data

			Specified	Actual		
Motor MFG.	Zhongshan Broad-Ocean					
Motor HP	3/4	Voltage	230	-	230	-
Service Factor	-	Amperage	5.4	-	5.4	-
Phase/Hz	1/60	Motor BHP	DNL	0.75		
Heater Size/Rating	Thermally Protected	Motor RPM	1400	DD		
Motor Frame#	-	Speed (VFD)	Multi Spd	Hi Speed		

Temperature Data

Clg E.A.T.	72.5°	Clg L.A.T.	46.8°	Htg E.A.T.	73°	Htg L.A.T.	121°

Fan Static Profile



Remarks

(1) OSA = 23x11.5 = 1.84 sq. ft. X120 FPM = 220 CFM

(OSA damper set-point is 20%)

RECTANGULAR TRAVERSE SHEET (SUPPLY)

Date	8-Sep-20	Unit	HP-4	Traverse No.	Main	Traverse Location	1st Fl. Ceiling

Point No.	1	2	3	4	5	6	7	8	9	10	11	12
A	855	872	899	900	841							
B	714	1,017	854	838	848							
C												
D												
E												
F												
G												
H												
I												
J												
K												
L												
M												
N												
Sub Total	1,569	1,889	1,753	1,738	1,689							

Total FPM	÷	No. of Readings	=	Avg. FPM	X	Area	=	Total CFM
8,638		10		864		1.556		1,344

Design Data			
Duct Size I.D.	28	X	8
Area Sq. Ft.	1.556		
FPM	900		
CFM	1,400		

Test Data			
Duct Size O.D.	28	X	8
Duct Size I.D.	28	X	8
Area Sq. Ft.	1.556		
Centerline S.P. In. W.C.	+0.48"		

Remarks	

DIFFUSER & GRILLE TEST SHEET (SUPPLY)

Date	8-Sep-20	Unit	HP-4	Flow Spec	-%	10%	+%	10%

Unit	Room	Outlet No.	Code	Size	Effective Area	Design FPM	Design CFM	Initial CFM	Final FPM	Final CFM	%
Supply	101	1	LD	25'	-	-	1,400	680	-	1,160 (1)	82.9%
				Total	Supply		1,400	680		1,160	

Remarks
(1) See project summary.

AIR MOVING EQUIPMENT DATA

Date	17-Sep-20	Area Served	102A,B&C & 201A	Unit	HP-5

Unit Information

Fan Identification	HP-5	Equipment MFG	Guardian
Equipment Location	Mechanical Room	Model Number	J20NMC00F2BAA2
Type/Size	-	Serial Number	N1H9153486

Fan Data

Measurement	Method	Specified	Actual	Fan	
Total Fan CFM	*Traverse*	8,050	6,276	Fan Sheave	2B5V94
Total S/A CFM	*Outlets*	8,050	5,365	Fan Shaft	1-3/16"
Total R/A CFM	*Traverse*	5,770	4,442	Shaft C/C	12.5
O/A CFM		2,280	1,834 (1)	Belt Size/Number	B50 / 2
Fan RPM		1,005	1,163	**Motor**	
TSP ☐ ESP ☑		1.2"	1.90"	Motor Sheave	2VP66
Inlet SP		-1.07"		Motor Shaft	1-3/8"
Discharge SP		+0.83"		Sheave Adj.	Max
Pre / Final Filter ΔP		P 0.21"	F -	Fixed Sheave	☐
Control Set Point		-			

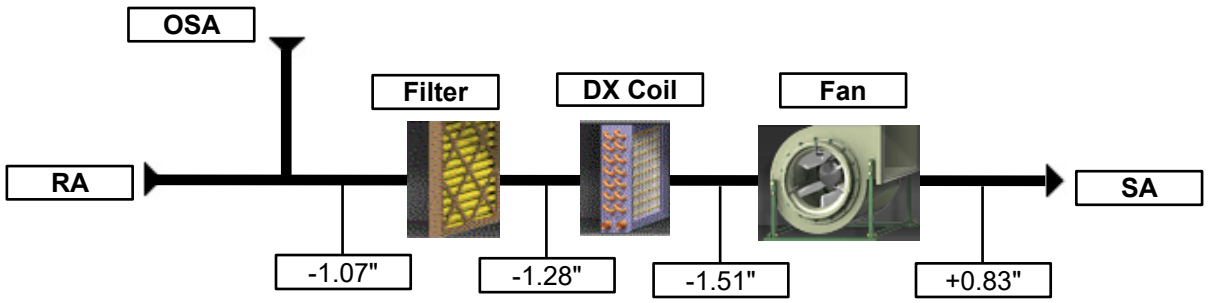
Motor Data

			Specified	Actual		
Motor MFG.	Baldor					
Motor HP	7.5	Voltage	230	-	230	-
Service Factor	1.15	Amperage	19.4	-	18.2	-
Phase/Hz	3 / 60	Motor BHP	5.46	7.03		
Heater Size/Rating	VFD Protected	Motor RPM	1770	1770		
Motor Frame#	213T	Speed (VFD)	VFD	60 Hertz		

Temperature Data

Clg E.A.T.	68.4°	Clg L.A.T.	53.8°	Htg E.A.T.	72°	Htg L.A.T.	120°

Fan Static Profile



Remarks

(1) OSA Plenum: 32x22=4.89 sq. ft X 375 FPM = 1834 CFM

(OSA damper set-point is 35%)

DIFFUSER & GRILLE TEST SHEET (SUPPLY)

Date	17-Sep-20	Unit	HP-5			Flow Spec		-%	10%	+%	10%
Unit	Room	Outlet No.	Code	Size	Effective Area	Design		Initial	Final		%
						FPM	CFM	CFM	FPM	CFM	
Supply	102B	1	Duct	14" rnd	1.07	533	570	675	360	385	67.5%
Supply	102B	2	Duct	14" rnd	1.07	533	570	375	364	390	68.4%
Supply	102B	3	Duct	14" rnd	1.07	533	570	440	350	375	65.8%
Supply	102B	4	Duct	14" rnd	1.07	533	570	525	355	380	66.7%
Supply	102C	5	LD	40'	-	-	2,080	1,790	-	1,345	64.7%
Supply	201A	6	LD	28'	-	-	1,850	850	-	1,050	56.8%
Supply	201A	7	SWS	12" Rnd	-	-	700	330	-	430	61.4%
Supply	102A	8	LD	10'	-	-	1,140	850	-	1,010(1)	88.6%
				Total	Supply		8,050	5,835		5,365(2)	

Remarks

(1) No MVD installed. Recommend to installed branch damper in the ground floor mechanical room.

(2) See project summary.

RECTANGULAR TRAVERSE SHEET (RETURN)

Date	17-Sep-20	Unit	HP-5	Traverse No.	-	Traverse Location	Return Main

Point No.	1	2	3	4	5	6	7	8	9	10	11	12
A	1,325	1,454	1,364	1,457	1,452	1,364	1,457					
B	1,326	1,587	1,425	1,472	1,456	1,419	1,459					
C	1,457	1,697	1,645	1,580	1,643	1,674	1,578					
D												
E												
F												
G												
H												
I												
J												
K												
L												
M												
N												
Sub Total	4,108	4,738	4,434	4,509	4,551	4,457	4,494					

Total FPM	÷	No. of Readings	=	Avg. FPM	X	Area	=	Total CFM
31,291		21		1,491		2.979		4,442

Design Data			
Duct Size I.D.	42	X	14
Area Sq. Ft.	4.083		
FPM	1,413		
CFM	5,770		

Test Data			
Duct Size O.D.	42	X	14
Duct Size I.D.	39	X	11
Area Sq. Ft.	2.979		
Centerline S.P. In. W.C.	-0.88"		

Remarks	

AIR MOVING EQUIPMENT DATA

Date	18-Sep-20	Area Served	Gift Shop	Unit	HP-6

Unit Information

Fan Identification	HP-6	Equipment MFG	Guardian
Equipment Location	Ceiling	Model Number	ME16CN21
Type/Size	-	Serial Number	W1H9190353

Fan Data

Measurement	Method	Specified	Actual	Fan	
Total Fan CFM	*NVL*	1,200	NVL	Fan Sheave	DD
Total S/A CFM	*DNL/Outlets*	DNL	1,305	Fan Shaft	DD
Total R/A CFM	*Traverse*	900	1,184	Shaft C/C	DD
O/A CFM		300	121 (1)	Belt Size/Number	DD
Fan RPM		DD	DD	**Motor**	
TSP ☐ ESP ☑		0.4"	0.57"	Motor Sheave	DD
Inlet SP		Open		Motor Shaft	DD
Discharge SP		+0.57"		Sheave Adj.	DD
Pre / Final Filter ΔP		P 0.34"	F -	Fixed Sheave	☐
Control Set Point		-			

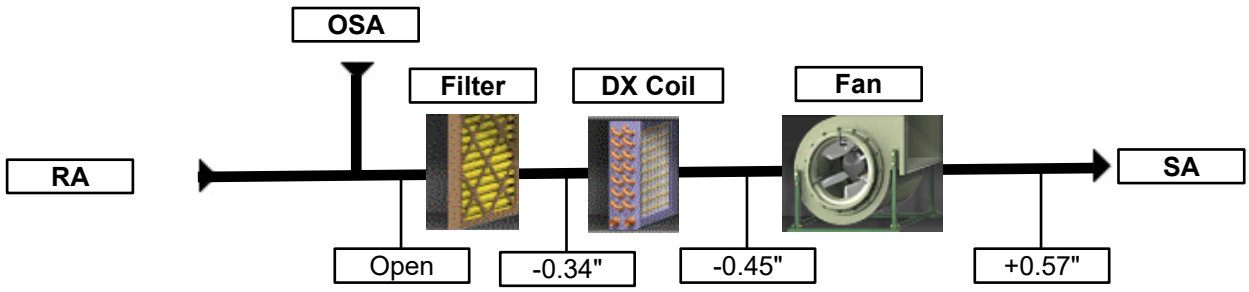
Motor Data

			Specified	Actual		
Motor MFG.	Zhongshan Broad-Ocean					
Motor HP	3/4	Voltage	208	-	208	-
Service Factor	-	Amperage	5.4	-	3.1	-
Phase/Hz	1/60	Motor BHP	DNL	0.43		
Heater Size/Rating	Thermally Protected	Motor RPM	1400	DD		
Motor Frame#	-	Speed (VFD)	Multiple	High Speed		

Temperature Data

Clg E.A.T.	59.5°	Clg L.A.T.	43°	Htg E.A.T.	71°	Htg L.A.T.	98°

Fan Static Profile



Remarks

(1) OSA: 10" rnd = 0.55 sq. ft

0.55 X 220 FPM = 121 CFM

DIFFUSER & GRILLE TEST SHEET (SUPPLY)

Date	18-Sep-20	Unit	HP-6	Flow Spec	-%	10%	+%	10%

Unit	Room	Outlet No.	Code	Size	Effective Area	Design FPM	Design CFM	Initial CFM	Final FPM	Final CFM	%
Supply	Gift Shop	1	CD	12X12	-	-	DNL	320	-	310	
Supply	Gift Shop	2	CD	12X12	-	-	DNL	295	-	270	
Supply	Gift Shop	3	CD	12X12	-	-	DNL	80	-	330	
Supply	Gift Shop	4	CD	12X12	-	-	DNL	475	-	395 (1)	
				Total	Supply		DNL	1,170		1,305	

Remarks

(1) No manual volume damper installed.

AIR MOVING EQUIPMENT DATA

Date	18-Sep-20	Area Served	Make-Up Air	Unit	MAU-1

Unit Information

Fan Identification	2nd Floor	Equipment MFG	DNL
Equipment Location	DNL	Model Number	DNL
Type/Size	DNL	Serial Number	DNL

Fan Data

Measurement	Method	Specified	Actual	Fan	
Total Fan CFM	*Traverse*	21,000	21,313	Fan Sheave	2PD5V136
Total S/A CFM	*DNL/DNT*	DNL	DNT	Fan Shaft	B-1-7/16"
Total R/A CFM	*100% OSA*	-	-	Shaft C/C	14.75"
O/A CFM		-	-	Belt Size/Number	5VX630 / 2
Fan RPM		1,725	833	**Motor**	
TSP ☐ ESP ☑		1.5"	0.89"	Motor Sheave	2PD5V64
Inlet SP		-0.29"		Motor Shaft	B-1-5/8"
Discharge SP		+0.60"		Sheave Adj.	-
Pre / Final Filter ΔP		P 0.21"	F -	Fixed Sheave	☑
Control Set Point		-			

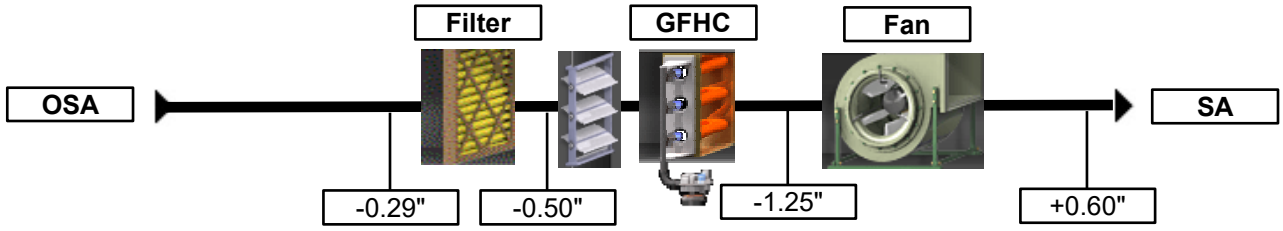
Motor Data

			Specified	Actual		
Motor MFG.	Baldor					
Motor HP	20	Voltage	208	-	208	-
Service Factor	1.15	Amperage	48	-	39	-
Phase/Hz	3/60	Motor BHP	18.73	16.25		
Heater Size/Rating	VFD Protected	Motor RPM	1770	1757		
Motor Frame#	256T	Speed (VFD)	VFD	60 Hertz		

Temperature Data

Clg E.A.T.	-	Clg L.A.T.	-	Htg E.A.T.	-	Htg L.A.T.	-

Fan Static Profile



Remarks	

RECTANGULAR TRAVERSE SHEET (SUPPLY)

Date	18-Sep-20	Unit	MAU-1	Traverse No.	Main	Traverse Location	-

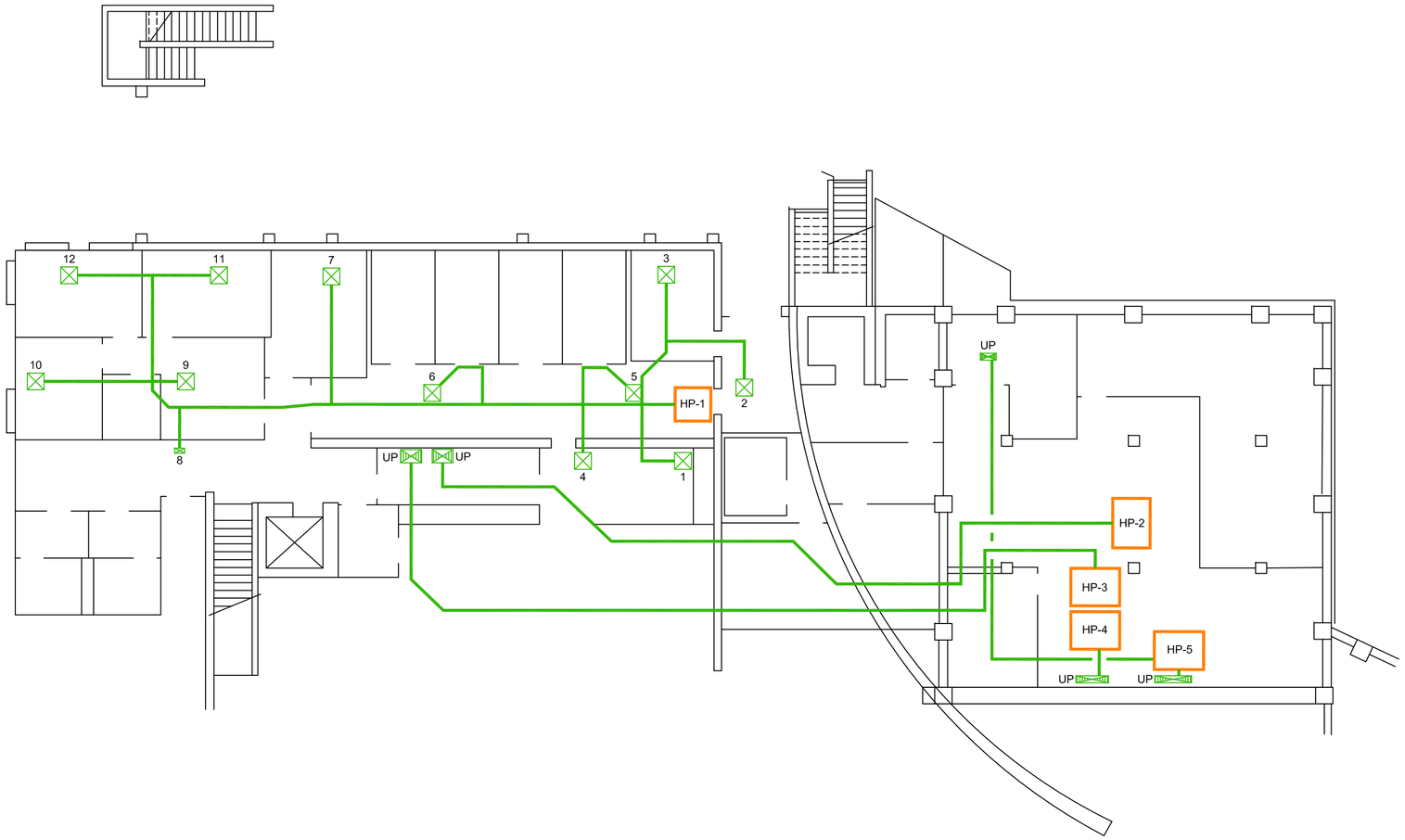
Point No.	1	2	3	4	5	6	7	8	9	10	11	12
A	715	928	1,171	1,112								
B	537	1,093	1,085	1,085								
C	1,007	1,406	1,128	1,016								
D	1,668	1,241	606	885								
E	1,840	1,883	1,493	822								
F	2,209	2,036	1,563	1,374								
G	2,139	2,356	2,248	1,955								
H	2,042	2,451	2,708	2,467								
I	1,902	2,589	2,734	2,569								
J	1,716	2,693	3,033	2,686								
K												
L												
M												
N												
Sub Total	15,775	18,676	17,769	15,971								

Total FPM	÷	No. of Readings	=	Avg. FPM	X	Area	=	Total CFM
68,191		40		1,705		12.500		21,313

Design Data			
Duct Size I.D.	60	X	30
Area Sq. Ft.	12.500		
FPM	1,680		
CFM	21,000		

Test Data			
Duct Size O.D.	60	X	30
Duct Size I.D.	60	X	30
Area Sq. Ft.	12.500		
Centerline S.P. In. W.C.	+0.60		

Remarks	



GROUND FLOOR

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FAX: 916-358-5673

ASSOCIATED AIR BALANCE COUNCIL

AABC

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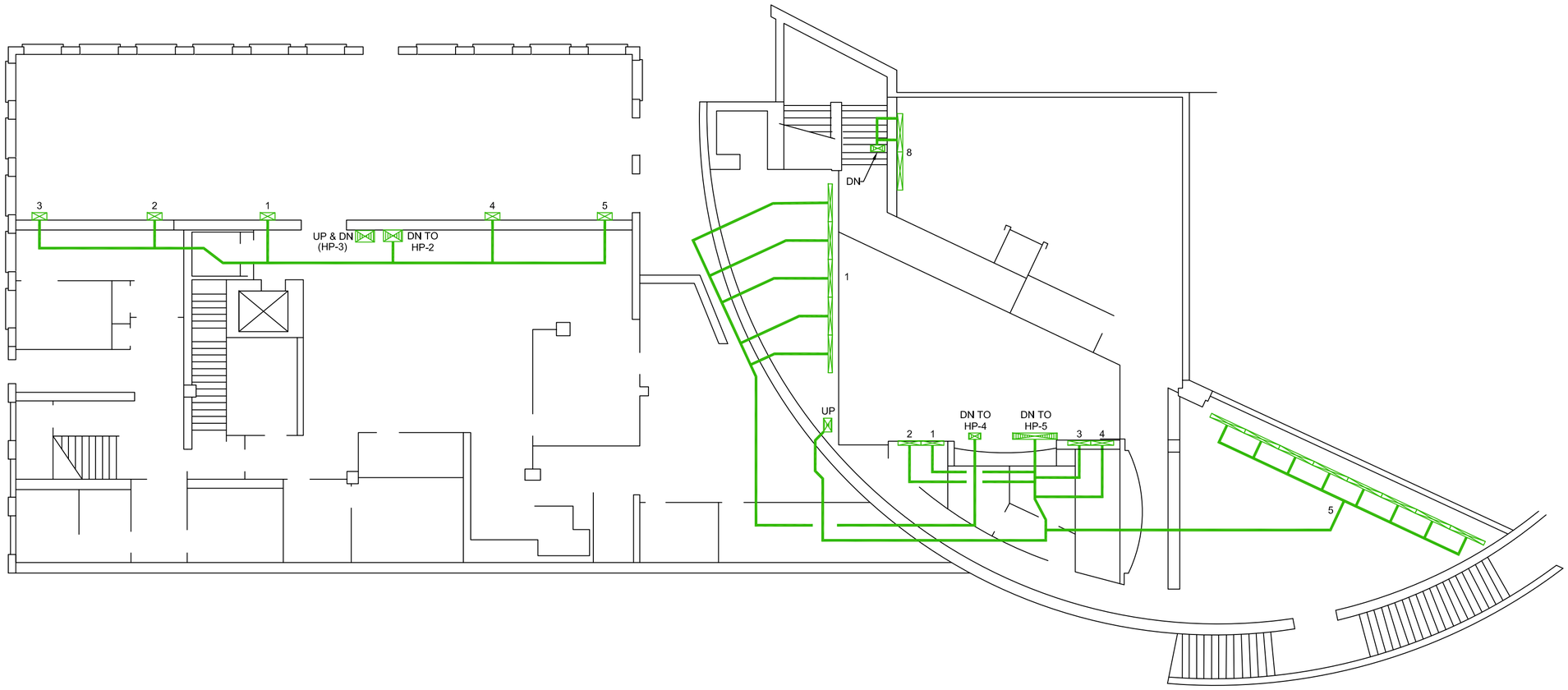

1ST FLOOR

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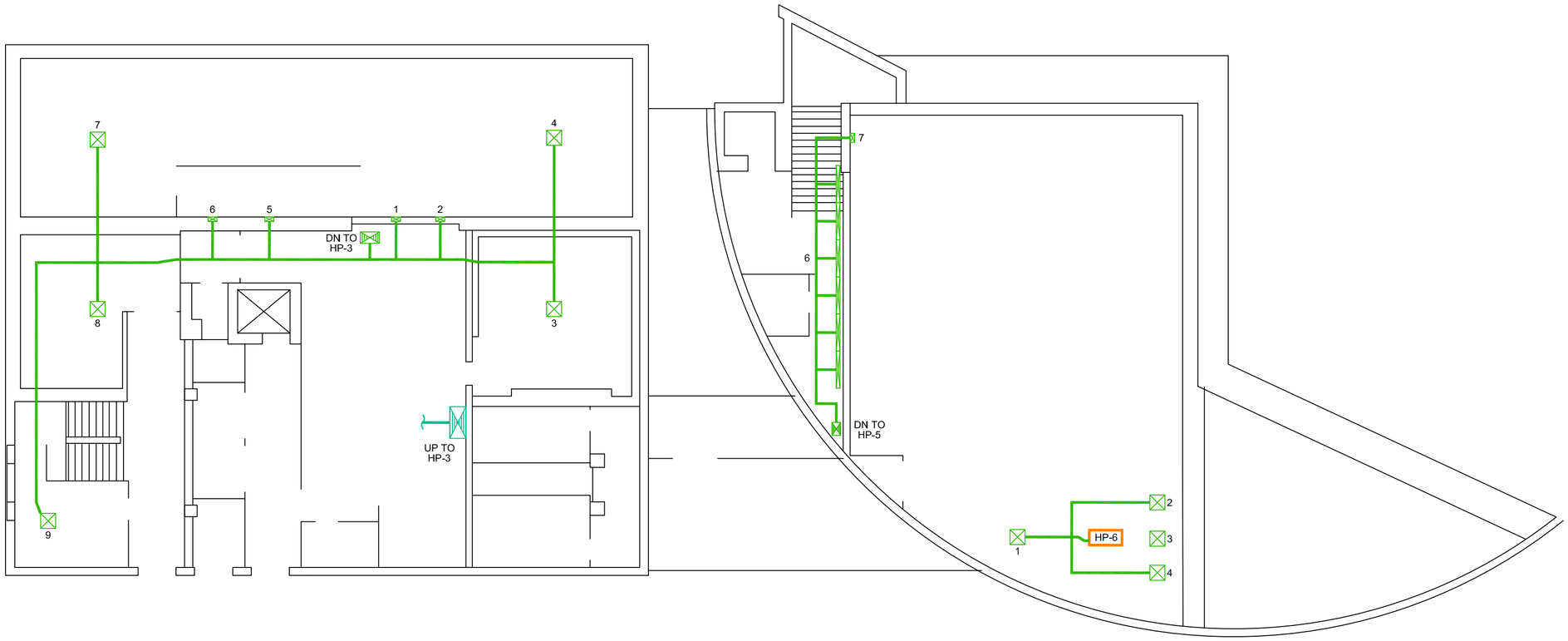

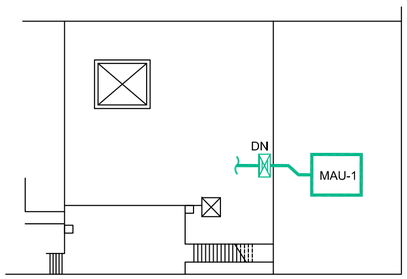

PARTIAL MECHANICAL MEZZANINE

2ND FLOOR

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M2.3
& M2.4