Date: May 11, 2017
To: Sargon Ishaya, HVAC Project Manager
From: Team SS, team of mechanical engineering students
Subject: Mechanical HVAC Plan

Memorandum

Please see the enclosed documents outlining our progress on HVAC Design Project 1. Attached are the zoning plan, basis of design, floor plan scaling, airflow quantities, and system checksums report. If any design changes are necessary, please let us know by 5/11/17.

M E C H A N I C A L H V A C
B A S I S O F D E S I G N

PROJECT: Mechanical Design of Office Floor

PREPARED BY: **Team SS**
Thien Hua
Matthew Stewart
Steven Saelee

Date: May 11, 2017

REV	DESCRIPTION	DATE
0	Added Space and Load Criteria, Zoning Plan	3/14/17
1	Added Ventilation Criteria	3/16/17
2	Added Appendix A	3/20/17
3	Changed ASHRAE outdoor criteria, included modified zoning plan	5/8/17

MECHANICAL / HVAC

1.0 Design Criteria

1.1 Outdoor Design Criteria

Season	Criteria	Basis
Summer	85.2°F dry bulb 65.2°F coincident wet bulb	2009 ASHRAE, 0.4% Criteria San Jose, CA
Winter	35.7°F db	2009 ASHRAE, 99.6% Criteria San Jose, CA

1.2 Space Criteria

The following areas will be conditioned as follows. Cubicles will be combined according to the zoning plan. Noise control based on Price Corporation 24” x 24” square plaque diffusers.

Setpoint Temperature	Cooling Dry Bulb	Heating Dry Bulb	Noise
72F	70F	72F	NC < 30

Offices	Floor Area (ft²)
Offices 2017,18,21,22	518
Offices 2025,26,29,30	509
Offices 2033,34,37,38	483
Offices 2019,20,23,24	516
Offices 2027,28,31,32	507
Offices 2035,36,39,40	482
Offices 2009,10,11,12,13,14,15,16,H2009A	1,067
Offices 2005,6,7,8,H2005A	781
Open Office 2041	1,275
Offices 2042,43,44	255
Office 2046	84
Office 2047	84
Office 2048	84
Office 2004	182
Office 2002	114
Office 2003	114
Office 2085	188
Offices 2088 - 2089	173
Offices 2058,59,60,61,H2057A,H2060A	569
Office 2065	129

Offices	Floor Area (ft^2)
Offices 2062 - 2063	189
Office 2064	123
Offices 2093,94,95,96	398
Offices 2067 - 2076	1,455
Offices 2119 - 2125	540
Offices 2111 - 2118	722
Offices 2103 - 2110	722
Office 2084	185
Office 2082	116
Office 2083	127
Office 2080	116
Office 2081	134
Office 2079	285
Break 2055/Open Office 2090	3,326
Hong Kong Pit Open Office 2077	962

Conference Rooms	
Conference 2001	242
Conference 2086	228
Conference 2056	228
Conference 2102	279

Labs	
Protoman Lab 2097	422
Fandango Lab 2098	817
Lab Network 2099	161
Shunra Lab 2100	228
Chotchckies Lab 2057	599

Miscellaneous	
Lobby 2000	481
Janitor 2000B	1,047
Copy/Mail 2050	224
MOTHER RM 2051	69
STOR 2052	77
Lounge/Game 2053	262
Coffee 2054	249
STOR 2049	108
STOR 2087	162
STOR 2101	189
Hallway 2065A	211
Print 2066	421
TELE IDF	97
Print 2078	825

1.3 Load Criteria

	People	Lights	Equipment
Office	150 sq. ft/person	1.2 W/sq. ft	0.5 W/sq. ft
Conference	# of chairs in room	1.2 W/sq. ft	0.5 W/sq. ft
Lab	# of stations	1.2 W/sq. ft	0.5 W/sq. ft
Misc	150 sq. ft/person	1.2 W/sq. ft	0.5 W/sq. ft

1.4 Minimum Ventilation Criteria

The ventilation of each area shall be per Title-24 meaning the greater of:

a. 0.15 cfm per square foot
b. 50 cfm per person

1.5 Envelope Assumptions

Component	U-value	SC	Basis	Height
Wall	0.091	-	R-11 insulation	15-feet floor to roof
Roof	-	-	Ignore Roof	-
Windows	0.95	0.7	Single Clear ¼”	72” tall, width per architectural
Skylights	n/a	n/a	No skylights in scope	n/a

Notes: (n/a= not applicable, n/c = no control)

1.6 Zoning Criteria

Please see the zoning plan attached to this document. Cubicles have been grouped into zones under 3000 ft^2.

Appendix A: Airflow Calculations

Airflow is calculated from the following formula:

$$cfm = \frac{Q_{sens}}{1.1 * \Delta T}$$

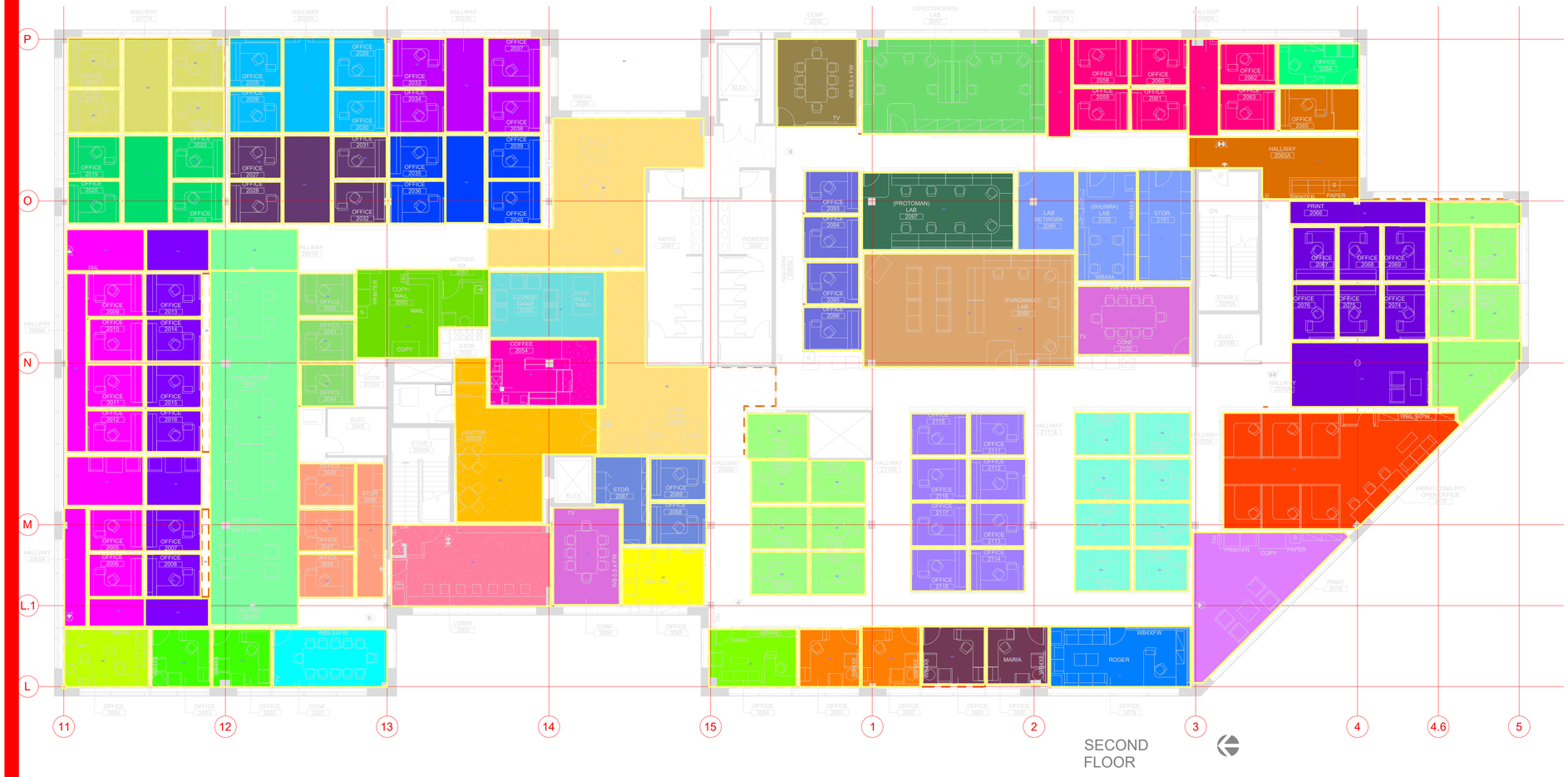
where Q_{sens} is the sensible cooling load of the area and ΔT is the difference between supply and set point temperature (72F set point, 55F supply).

Offices	Airflow (cfm)
Offices 2017,18,21,22	1445
Offices 2025,26,29,30	992
Offices 2033,34,37,38	1250
Offices 2019,20,23,24	549
Offices 2027,28,31,32	192
Offices 2035,36,39,40	182
Offices 2009,10,11,12,13,14,15,16,H2009A	1543
Offices 2005,6,7,8,H2005A	1129
Open Office 2041	483
Offices 2042,43,44	96
Office 2046	31
Office 2047	31
Office 2048	31
Office 2004	693
Office 2002	224
Office 2003	315
Office 2085	464
Offices 2088 - 2089	65
Offices 2058,59,60,61,H2057A,H2060A	1070
Office 2065	277
Offices 2062 - 2063	356
Office 2064	512
Offices 2093,94,95,96	150
Offices 2067 - 2076	1420
Offices 2119 - 2125	204
Offices 2111 - 2118	273
Offices 2103 - 2110	273
Office 2084	584
Office 2082	196
Office 2083	351
Office 2080	196
Office 2081	365
Office 2079	746
Break 2055/Open Office 2090	1260
Hong Kong Pit Open Office 2077	926

Conference Rooms	Airflow (cfm)
Conference 2001	1017
Conference 2086	506
Conference 2056	557
Conference 2102	281

Labs	Airflow (cfm)
Protoman Lab 2097	256
Fandango Lab 2098	437
Lab Network 2099	60
Shunra Lab 2100	173
Chotchckies Lab 2057	1204

Miscellaneous	Airflow (cfm)
Lobby 2000	947
Janitor 2000B	396
Copy/Mail 2050	85
MOTHER RM 2051	26
STOR 2052	29
Lounge/Game 2053	99
Coffee 2054	94
STOR 2049	41
STOR 2087	61
STOR 2101	71
Hallway 2065A	305
Print 2066	957
TELE IDF	36
Print 2078	802



THE SS COMPANY

LEGENDS

*NOTE: COLOR SCHEME BY ZONES

DATE	No.	REVISION
02/22/17	1	ZONING PLAN
03/14/17	2	PROGRESS MEETING 1
03/17/17	3	DESIGN REGISTER REVISION 1
04/20/17	4	DESIGN REGISTER REVISION 2
04/25/17	5	PROGRESS MEETING 2
05/11/17	6	AS BUILT

AS-BUILT
DATE 5/11/2017

MECHANICAL SECOND FLOOR ZONE PLAN

NORTH DIRECTION

BUILDING FLOOR 2

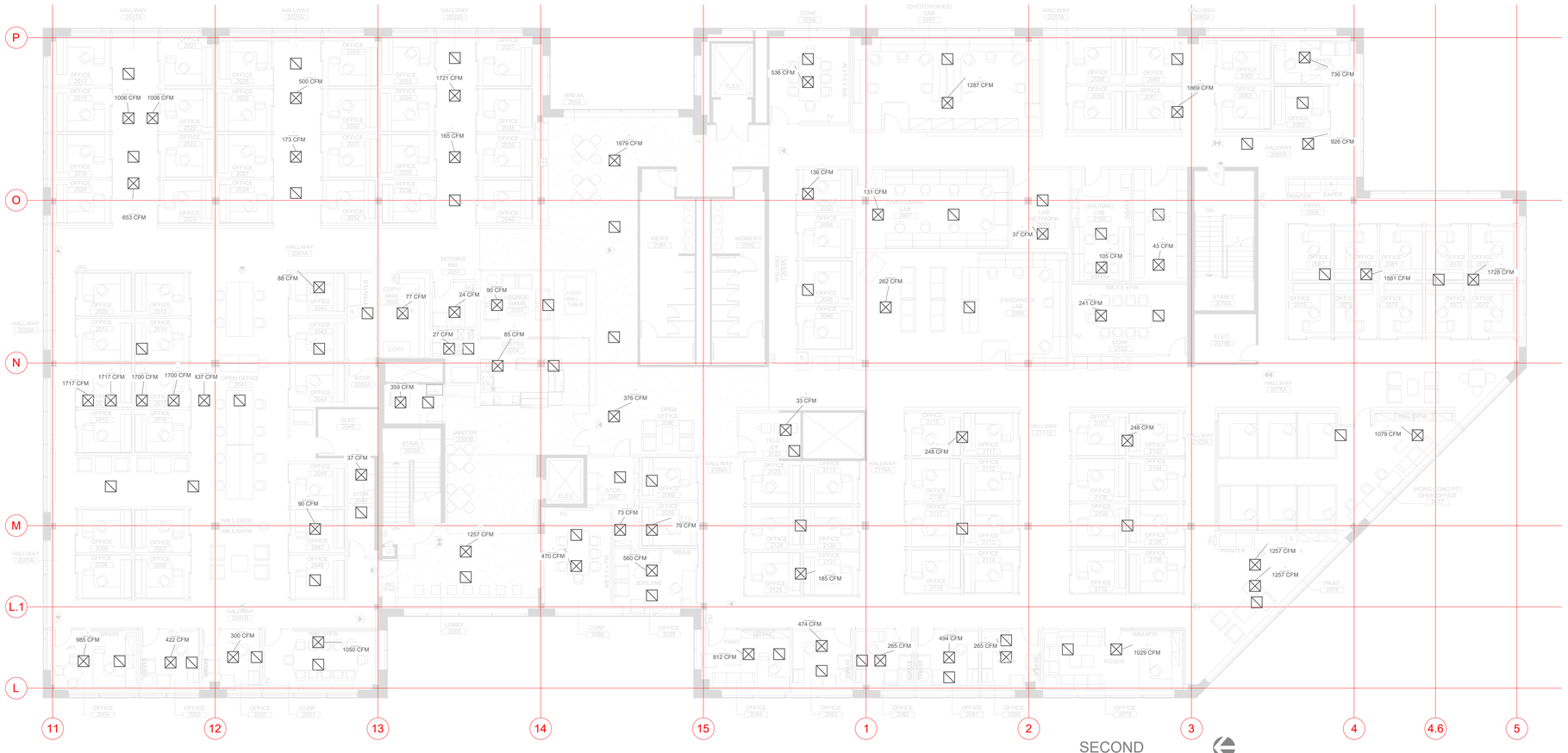
DRAWING NO. 1

PROJECT 1. DWG

SCALE 1/8"=1'-0"
DATE 5/11/17
ACT. NO. 1
FLOOR 2

Keep Noise Criteria (NC) less than 30. 24x24 registers. Price Square Plaque Diffusers									
Room	**Floor Area (ft^2)**	**Sensible Load (Btu/h)**	**Space Latent Load (Btu/h)**	**Airfow (cfm)**	**Throw 50**	**L greater than (ft)**	**L less than (ft)**	**Listed Size (see catalogue)**	**Number of Supply Registers**
Offices 2017,18,21,22	518	27008	863	2012	16	6	11	12	2
Offices 2025,26,29,30	509	18536	848	1312	18	7	13	15	1
Offices 2033,34,37,38	483	23362	806	1722	22	8	16	15	1
Offices 2019,20,23,24	516	10255	860	654	13	5	9	12	1
Offices 2027,28,31,32	507	3569	845	174	6	2	4	8	1
Offices 2035,36,39,40	482	3389	803	165	6	2	4	8	1
Office 2005, 6, 9, 10, 11, 12, H2009A	1118	47455	1864	3435	22	8	16	15	2
Offices 2007, 8, 13, 14, 15, 16	790	45192	1317	3401	22	8	16	15	2
Open Office 2041	1275	8970	2125	437	11	4	8	8	1
Offices 2042,43,44	255	1798	426	88	4	1	3	6	1
Office 2046	84	591	140	29	4	1	3	6	1
Office 2047	84	591	140	29	4	1	3	6	1
Office 2048	84	591	140	29	4	1	3	6	1
STOR 2049	108	762	180	37	4	1	3	6	1
Office 2004	182	12958	303	985	16	6	11	14	1
Office 2002	114	4200	190	301	9	3	6	8	1
Office 2003	114	5891	190	422	10	4	7	2	1
Conference 2001	242	19026	3750	1050	17	6	12	14	1
Lobby 2000	481	17698	801	1257	19	7	14	14	1
Janitor 2000B	1047	7365	1744	359	10	4	7	10	1
Copy/Mail 2050	224	1579	374	77	4	1	3	6	1
MOTHER RM 2051	69	485	115	24	4	1	3	6	1
STOR 2052	77	544	129	27	4	1	3	6	1
Lounge/Game 2053	262	1845	437	90	4	1	3	6	1
Coffee 2054	247	1737	411	85	4	1	3	6	1
Break 2055/Open Office 2090	1096	7712	1827	376	10	4	7	8	1
Conference 2086	228	9470	2500	470	11	4	8	12	1
Office 2085	188	8687	313	560	12	4	9	12	1
Offices 2088 - 2089	173	1219	289	79	4	1	3	6	1

STOR 2087	162	1138	270	73	4	1	3	6	1
Conference 2056	228	10422	2500	536	12	4	9	12	1
Chotchckies Lab 2057	599	22503	3750	1287	18	7	13	15	1
Offices2058, 59,60,61,62,63,H2057A, H2060A	750	26510	1250	1869	23	9	16	15	1
Office 2065, Hallway 2065A, Print 2066	524	13770	873	926	16	6	11	14	1
Office 2064	123	9577	205	736	14	5	10	14	1
Offices 2093,94,95,96	398	2797	663	136	6	2	4	6	1
Protoman Lab 2097	422	4765	2500	131	6	2	4	6	1
Fandango Lab 2098	817	8137	3750	262	9	3	6	8	1
Lab Network 2099	161	1130	268	37	4	1	3	6	1
Shunra Lab 2100	228	3226	2000	105	4	1	3	6	1
STOR 2101	189	1330	315	43	4	1	3	6	1
Conference 2102	290	4557	3000	241	8	3	6	6	1
Offices 2067,68,69,74,75,76	1087	23979	1812	1561	20	7	14	14	1
Offices 2119 - 2125	540	3797	899	185	6	2	4	10	1
TELE IDF	97	683	162	33	4	1	3	6	1
Offices 2111 - 2118	722	5083	1204	248	8	3	6	6	1
Offices 2103 - 2110	722	5083	1204	248	8	3	6	6	1
Hong Kong Pit Open Office 2077	962	17294	1604	1079	8	3	6	14	1
Print 2078	825	34763	1376	2514	23	9	16	15	2
Office 2084	185	10921	309	812	15	6	11	12	1
Office 2082	116	3663	193	265	9	3	6	8	1
Office 2083	127	6558	212	474	12	4	9	8	1
Office 2080	116	3668	193	265	12	4	9	8	1
Office 2081	134	6833	223	494	12	4	9	8	1
Office 2079	285	13942	475	1029	17	6	12	12	1
Break 2055	1512	26955	2521	1679	22	8	16	15	1
Office 2070,71,72,73	679	24457	1132	1728	22	8	16	15	1



THE SS COMPANY

LEGENDS

SUPPLY DIFFUSER

RETURN DIFFUSER

DATE	No.	REVISION
03/1/17	1	RETURN REGISTER PLAN
03/14/17	2	PROGRESS MEETING 1
03/17/17	3	DESIGN REGISTER REVISION 1
04/20/17	4	DESIGN REGISTER REVISION 2
04/25/17	5	PROGRESS MEETING 2
05/11/17	6	AS BUILT

AS-BUILT

DATE 5/11/2017

MECHANICAL SECOND FLOOR
SUPPLY/RETURN REGISTER PLAN

NORTH DIRECTION

BUILDING FLOOR 2

DRAWING NO. 1

PROJECT 1. DWG

SCALE 1/8"=1'-0"

DATE 5/11/17

ACT. NO. 1

FLOOR 2

System Checksums

By Therma

System - 001 **Single Zone**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 80 / 68 / 83

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	14,365	14,365	2
Glass Solar	317,419	0	317,419	37
Glass Cond	80,732	0	80,732	9
Wall Cond	92	3,455	3,547	0
Partition	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	398,243	17,820	416,063	48
Internal Loads				
Lights	80,462	20,116	100,578	12
People	119,182	0	119,182	14
Misc	41,907	0	41,907	5
Sub Total ==>	241,551	20,116	261,667	30
Ceiling Load	5,797	-5,797	0	0
Ventilation Load	0	0	94,367	11
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		-3,053	-3,053	0
Sup. Fan Heat			91,679	11
Ret. Fan Heat		2	2	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	645,592	29,087	860,725	100.00

CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	314,220	53
Glass Cond	86,143	15
Wall Cond	102	0
Partition	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	400,465	68
Internal Loads		
Lights	80,462	14
People	59,591	10
Misc	41,907	7
Sub Total ==>	181,960	31
Ceiling Load	7,599	1
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	0	0
Grand Total ==>	590,024	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 36

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-40,434	7.58
Glass Solar	0	0	0.00
Glass Cond	-356,018	-356,018	66.74
Wall Cond	-189	-7,199	1.35
Partition	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	0	0	0.00
Sub Total ==>	-356,207	-403,651	75.67
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-7,266	0	0.00
Ventilation Load	0	-131,132	24.58
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-2,453	-2,453	0.46
Exhaust Heat		3,827	-0.72
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-365,926	-533,410	100.00

TEMPERATURES

	Cooling	Heating
SADB	58.3	76.5
Ra Plenum	72.8	67.1
Return	72.8	67.1
Ret/OA	73.5	64.1
Fn MtrTD	0.2	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	38,676	38,676
Terminal	38,676	38,676
Main Fan	38,676	38,676
Sec Fan	0	0
Nom Vent	3,684	3,684
AHU Vent	3,684	3,684
Infil	0	0
MinStop/Rh	0	0
Return	38,676	38,676
Exhaust	3,684	3,684
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	9.5	9.5
cfm/ft²	1.57	1.57
cfm/ton	539.21	
ft²/ton	342.37	
Btu/hr·ft²	35.05	-21.72
No. People	238	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	71.7	860.7	741.3	38,676	73.5	61.1	60.9	56.2	53.4	56.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	71.7	860.7								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	24,557		
Part	0		
ExFlr	0		
Roof	24,557	0	0
Wall	14,670	12,126	83

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-533.4	38,676	64.1	76.5
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-533.4			

Project Name:
Dataset Name: C:\USERS\STEVEN\DOCUMENTS\ME 183\ME 183_PROJECT 1_REV.2.TRC

System Checksums

By Therma

System - 001 **Single Zone**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 80 / 68 / 83

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	14,366	14,366	2
Glass Solar	317,419	0	317,419	38
Glass Cond	80,732	0	80,732	10
Wall Cond	92	3,455	3,547	0
Partition	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	398,243	17,821	416,064	49
Internal Loads				
Lights	80,462	20,116	100,578	12
People	100,682	0	100,682	12
Misc	41,907	0	41,907	5
Sub Total ==>	223,051	20,116	243,167	29
Ceiling Load	5,791	-5,791	0	0
Ventilation Load	0	0	94,811	11
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		-3,050	-3,050	0
Sup. Fan Heat			91,801	11
Ret. Fan Heat		2	2	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	627,085	29,098	842,795	100.00

CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	314,220	54
Glass Cond	86,143	15
Wall Cond	102	0
Partition	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	400,465	69
Internal Loads		
Lights	80,462	14
People	50,341	9
Misc	41,907	7
Sub Total ==>	172,710	30
Ceiling Load	7,590	1
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	0	0
Grand Total ==>	580,766	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 36

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-40,435	7.58
Glass Solar	0	0	0.00
Glass Cond	-356,018	-356,018	66.74
Wall Cond	-189	-7,200	1.35
Partition	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	0	0	0.00
Sub Total ==>	-356,207	-403,653	75.67
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-7,258	0	0.00
Ventilation Load	0	-131,132	24.58
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-2,453	-2,453	0.46
Exhaust Heat		3,822	-0.72
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-365,918	-533,416	100.00

TEMPERATURES

	Cooling	Heating
SADB	58.5	76.5
Ra Plenum	72.7	67.1
Return	72.8	67.1
Ret/OA	73.5	64.1
Fn MtrTD	0.2	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	38,728	38,728
Terminal	38,728	38,728
Main Fan	38,728	38,728
Sec Fan	0	0
Nom Vent	3,684	3,684
AHU Vent	3,684	3,684
Infil	0	0
MinStop/Rh	0	0
Return	38,728	38,728
Exhaust	3,684	3,684
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	9.5	9.5
cfm/ft²	1.58	1.58
cfm/ton	551.42	
ft²/ton	349.66	
Btu/hr·ft²	34.32	-21.72
No. People	201	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	70.2	842.8	732.2	38,728	73.5	61.1	60.8	56.4	53.6	56.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	70.2	842.8								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	24,557		
Part	0		
ExFlr	0		
Roof	24,557	0	0
Wall	14,670	12,126	83

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-533.4	38,728	64.1	76.5
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-533.4			

Date: May 11, 2017
To: Sargon Ishaya, HVAC Project Manager
From: Team SS, team of mechanical engineering students
Subject: A note on equipment selection and HVAC system design

This HVAC system has been designed to minimize cost and wasted energy. We have selected a packaged AC unit and duct furnace rather than a custom solution as modern packaged units are efficient and save on design and manufacturing costs. Heating and cooling supply air is delivered to each zone via Variable Air Volume (VAV) boxes. Compared to Constant Air Volume (CAV) systems, VAV systems offer many advantages.The VAV terminals are coupled to the AC unit so that both and compressor and fan speeds can be varied based on need. To save costs, zones that do not require heating have been outfitted with cooling-only VAV boxes.

VAV Box Schedule

Note: "A,B" correspond to zones that have been split

Zone	Metal Aire Model	Maxiumum Cooling Airflow (cfm)	Cooling Inlet Size (Inches)	Maxiumum Heating Airflow (cfm)	Heating Inlet Size (Inches)	Minimum Ventilation (cfm)
1	DD-500	2012	12	2,012	12	80
2	DD-500	1312	10	1,312	10	75
3	DD-500	1722	12	1,722	12	75
4	DD-500	654	8	654	8	75
5	TH-500	174	6	174	-	75
6	TH-500	165	6	165	-	70
7	DD-500	3435	-	3,435	-	-
7A	DD-500	1717	12	1,718	12	85
7B	DD-500	1717	12	1,718	12	85
8	DD-500	3401	-	3,401	-	-
8A	DD-500	1701	12	1,701	12	60
8B	DD-500	1701	12	1,701	12	60
9	TH-500	437	6	437	-	190
10	TH-500	88	4	88	-	40
11	TH-500	29	4	29	-	15
12	TH-500	29	4	29	-	15
13	TH-500	29	4	29	-	15
14	TH-500	37	4	37	-	15
15	DD-500	985	8	985	8	25
16	DD-500	301	6	301	6	15
17	DD-500	422	6	422	6	15
18	DD-500	1050	10	1,050	10	35
19	DD-500	1257	10	1,257	10	70
20	TH-500	359	6	359	-	155
21	TH-500	77	4	77	-	35
22	TH-500	24	4	24	-	10
23	TH-500	27	4	27	-	10
24	TH-500	90	4	90	-	40
25	TH-500	85	4	85	-	35
26	TH-500	376	6	376	-	165
27	DD-500	470	8	470	8	35

28	DD-500	560	8	560	8	30			
29	TH-500	79	4	79	-	25			
30	TH-500	73	4	73	-	25			
31	DD-500	536	8	536	8	35			
32	DD-500	1287	10	1,287	10	90			
33	DD-500	1869	12	1,869	12	110			
34	DD-500	926	8	926	8	80			
35	DD-500	736	8	736	8	20			
36	TH-500	136	6	136	-	60			
37	TH-500	131	6	131	-	65			
38	TH-500	262	6	262	-	125			
39	TH-500	37	4	37	-	25			
40	TH-500	105	6	105	-	35			
41	TH-500	43	4	43	-	30			
42	TH-500	241	6	241	-	45			
43	DD-500	1561	12	1,561	12	165			
44	TH-500	185	6	185	-	80			
45	TH-500	33	4	33	-	15			
46	TH-500	248	6	248	-	110			
47	TH-500	248	6	248	-	110			
48	DD-500	1079	10	1,079	10	145			
49	DD-500	2514	14	2,514	14	125			
50	DD-500	812	8	812	8	30			
51	DD-500	265	6	265	6	15			
52	DD-500	474	8	474	8	20			
53	DD-500	265	6	265	6	15			
54	DD-500	494	8	494	8	20			
55	DD-500	1029	10	1,029	10	45			
56	DD-500	1679	12	1,679	12	225			
57	DD-500	1728	12	1,728	12	100			

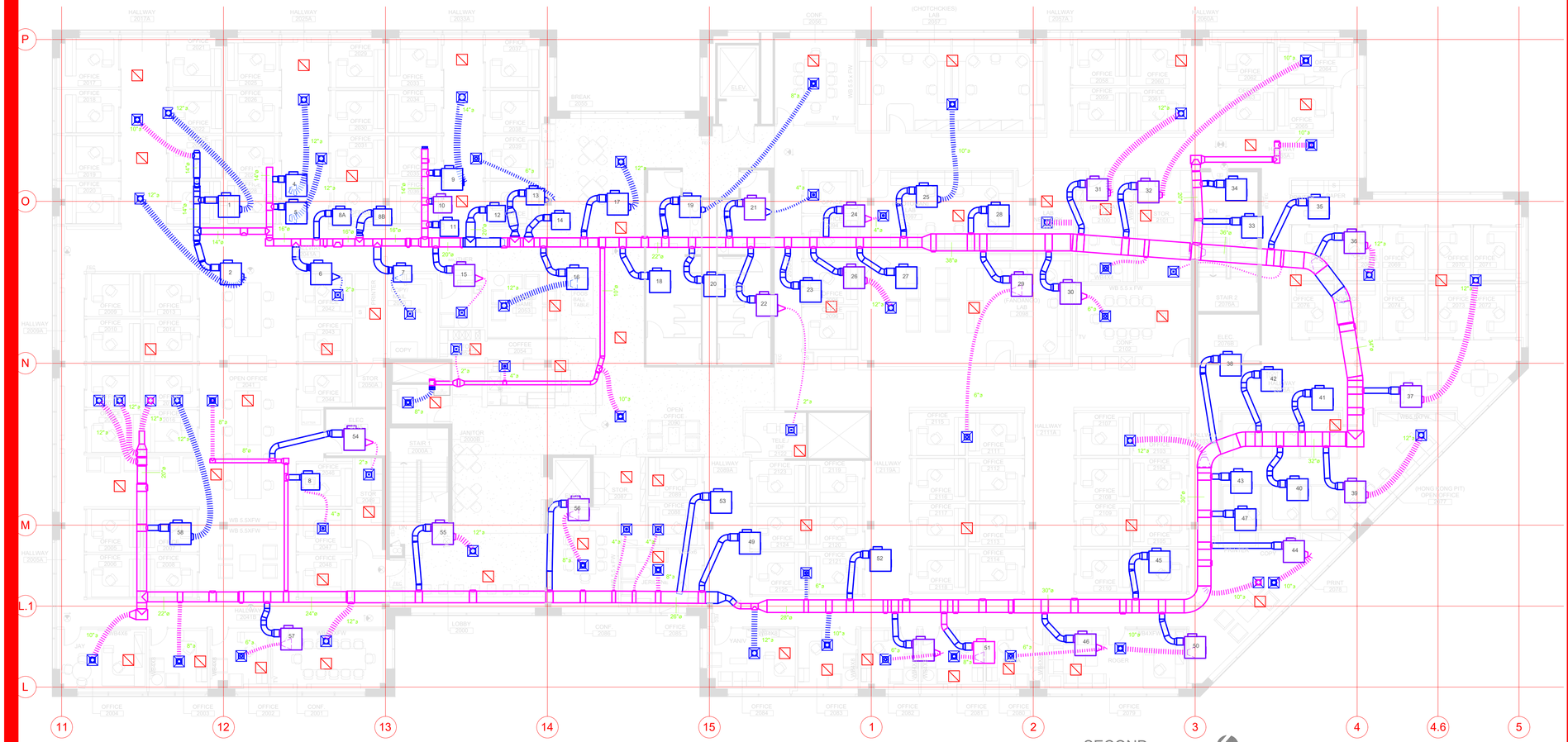
Double Duct	Max CFM	250	450	1000	1400	2200	3000	3600
(DD-500)	Inlet Size	4	6	8	10	12	14	16

Cooling Only	Max CFM	500	500	1000	1600	2000	3300	3600	
(TH-500)	Inlet Size	4	6	8	10	12	14	16	

Assumptions								
a)	55	F is the supply air temperature of the room						
b)	72	F is the room setpoint temperature						
c)	0.15	cfm per square foot is the outside air ventilation load						
d)	0.65	is the fan efficiency at design airflow						
e)	15	cfm per person						
f)	2	is the external static pressure required at the unit						
g)	80	F dry bulb outdoor temperature during system block load						
h)	68	F wet bulb outdoor temperature during system block load						
i)	61	F is the room and return wet bulb temperature						
Calculations for AC Package Unit					**Duct Furnance**			
a)	3695	cfm is the unit outdoor airflow			a)	-343432	Btu/h Total Sensible Heat Load (SI	
b)	32516	Btu/hr is the outside airload			b)	1.3	Safety Factor	
c)	31552	cfm is the unit airflow			c)	-446461	Duct Furnance Load	
d)	15	is the fan brake horsepower			d)	6000	cfm Unit	
e)	38971	Btu/hr is the fan heat			e)	129	F Supply Air Temperature	
f)	72	F is the entering dry bulb temperature			f)	500	SIZE	
g)	64	F is the entering wet bulb temperature						
h)	661510	Btu/hr is the required sensible heat capacity						
i)	75	ton air-cooled-standard capacity						
	Supply Air Temp.	34	F					
Required Airflow	**CFM**	22000	CFM					
	CAP	823	CFM					

				Cooling	Heating								
Room	**Room Area**	**Space Sensible Load**	**Space Sensible Heating**	**Space Air Flow**	**Space Air Flow**	**Space needs heating? (Yes=1)**	**Zone Number**	**People Quality**	**People Criteria**	**Area Criteria**	**Minimum Ventilation**	**Room Dry Bulb**	**Room Wet Bulb**
	ft²	**Cooling Btu/h**	**Btu/h**	**cfm**	**cfm**					**ft²**	**cfm**	**°F**	**°F**
Offices 2017,18,21,22	518	27008	-12001	1444		1	1	4	60	7764	80	72	67
Offices 2025,26,29,30	509	18536	-14	991	1312	1	2	4	60	7635	75	72	67
Offices 2033,34,37,38	483	23362	-17958	1249	1722	1	3	4	60	7250	75	72	67
Offices 2019,20,23,24	516	10255	-6110	548	654	1	4	4	60	7736	75	72	67
Offices 2027,28,31,32	507	3569	-150	191	174	0	5	4	60	7609	75	72	62
Offices 2035,36,39,40	482	3389	-143	181	165	0	6	4	60	7225	70	72	62
Office 2005, 6, 9, 10, 11, 12, H2009A	1118	47455	-35681	2538	3435	1	7	6	90	16774	170	72	67
Offices 2007, 8, 13, 14, 15, 16	790	45192	-35584	2417	3401	1	8	5	75	11853	120	72	67
Open Office 2041	1275	8970	-377	480	437	0	9	20	300	19122	190	72	62
Offices 2042,43,44	255	1798	-76	96	88	0	10	3	45	3832	40	72	62
Office 2046	84	591	-25	32	29	0	11	1	15	1260	15	72	62
Office 2047	84	591	-25	32	29	0	12	1	15	1260	15	72	62
Office 2048	84	591	-25	32	29	0	13	1	15	1260	15	72	62
STOR 2049	108	762	-32	41	37	0	14	2	30	1624	15	72	62
Office 2004	182	12958	-10431	693	985	1	15	4	60	2729	25	72	68
Office 2002	114	4200	-3260	225	301	1	16	2	30	1713	15	72	68
Office 2003	114	5891	-4573	315	422	1	17	2	30	1713	15	72	67
Conference 2001	242	19026	-12535	1017	1050	1	18	7	105	3627	35	72	67
Lobby 2000	481	17698	-12934	946	1257	1	19	8	120	7213	70	72	67
Janitor 2000B	1047	7365	-310	394	359	0	20	4	60	15700	155	72	62
Copy/Mail 2050	224	1579	-67	84	77	0	21	4	60	3365	35	72	62
MOTHER RM 2051	69	485	-20	26	24	0	22	4	60	1033	10	72	62
STOR 2052	77	544	-23	29	27	0	23	4	60	1160	10	72	62
Lounge/Game 2053	262	1845	-78	99	90	0	24	6	90	3932	40	72	62
Coffee 2054	247	1737	-73	93	85	0	25	6	90	3703	35	72	62
Break 2055/Open Office 2090	1096	7712	-324	412	376	0	26	10	150	16439	165	72	62
Conference 2086	228	9470	-5207	506	470	1	27	10	150	3416	35	72	67
Office 2085	188	8687	-6632	465	560	1	28	2	30	2813	30	72	67
Offices 2088 - 2089	173	1219	-931	65	79	0	29	2	30	2599	25	72	62
STOR 2087	162	1138	-869	61	73	0	30	3	45	2425	25	72	62
Conference 2056	228	10422	-6054	557	536	1	31	10	150	3418	35	72	67
Chotchckies Lab 2057	599	22503	-14073	1203	1287	1	32	10	150	8978	90	72	67
Offices2058,59,60,61,62,63,H2057A, H2060A	750	26510	-19202	1418	1869	1	33	8	120	11249	110	72	67
Office 2065, Hallway 2065A, Print 2066	524	13770	-9189	736	926	1	34	4	60	7858	80	72	67
Office 2064	123	9577	-7775	512	736	1	35	1	15	1848	20	72	68
Offices 2093,94,95,96	398	2797	-118	150	136	0	36	4	60	5963	60	72	62
Protoman Lab 2097	422	4765	-125	255	131	0	37	8	120	6327	65	72	62
Fandango Lab 2098	817	8137	-242	435	262	0	38	6	90	12254	125	72	62

Lab Network 2099	161	1130	-48	60	37	0	39	2	30	2409	25	72	62
Shunra Lab 2100	228	3226	-136	172	105	0	40	4	60	3424	35	72	62
STOR 2101	189	1330	-56	71	43	0	41	2	30	2835	30	72	62
Conference 2102	290	4557	-86	244	241	0	42	12	180	4350	45	72	62
Offices 2067,68,69,74,75,76	1087	23979	-14980	1282	1561	1	43	6	90	16307	165	72	67
Offices 2119 - 2125	540	3797	-160	203	185	0	44	7	105	8095	80	72	62
TELE IDF	97	683	-29	37	33	0	45	3	45	1456	15	72	62
Offices 2111 - 2118	722	5083	-214	272	248	0	46	8	120	10836	110	72	62
Offices 2103 - 2110	722	5083	-214	272	248	0	47	8	120	10836	110	72	62
Hong Kong Pit Open Office 2077	962	17294	-9763	925	1079	1	48	10	150	14432	145	72	67
Print 2078	825	34763	-26102	1859	2514	1	49	6	90	12382	125	72	67
Office 2084	185	10921	-8605	584	812	1	50	1	15	2780	30	72	68
Office 2082	116	3663	-2843	196	265	1	51	1	15	1735	15	72	68
Office 2083	127	6558	-5091	351	474	1	52	1	15	1907	20	72	67
Office 2080	116	3668	-2843	196	265	1	53	1	15	1737	15	72	68
Office 2081	134	6833	-5296	365	494	1	54	1	15	2009	20	72	67
Office 2079	285	13942	-10738	746	1029	1	55	1	15	4275	45	72	67
Break 2055	1512	26955	-15194	1441	1679	1	56	4	60	22687	225	72	67
Office 2070,71,72,73	679	24457	-17788	1308	1728	1	57	4	60	10189	100	72	67
Total: 57 zones		590024	-343432	31552							3695		



SECOND FLOOR

LEGENDS

- RETURN DIFFUSER
- SUPPLY DIFFUSER
- VAV UNIT
- DIAMETER OF RETURN/SUPPLY AND VAV

THE SS COMPANY

DATE	No.	REVISION
02/22/17	1	ZONING PLAN
03/14/17	2	PROGRESS MEETING 1
03/17/17	3	DESIGN REGISTER REVISION 1
04/20/17	4	DESIGN REGISTER REVISION 2
04/25/17	5	PROGRESS MEETING 2
05/11/17	6	AS BUILT ROOF PLAN

AS-BUILT

DATE 5/11/2017

MECHANICAL SECOND FLOOR FLOOR PLAN

NORTH DIRECTION

BUILDING FLOOR 2

DRAWING NO. 1

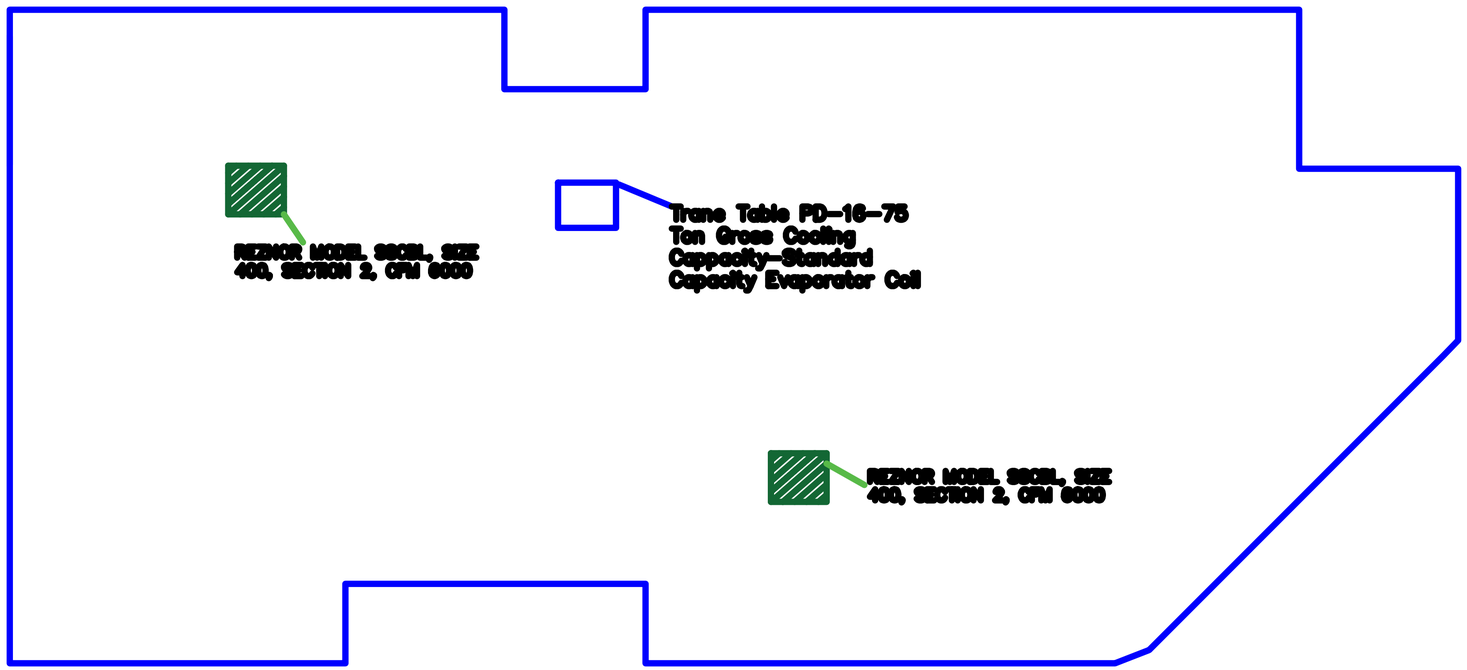
PROJECT 1. DWG

SCALE 1/8"=1'-0"

DATE 5/11/17

ACT. NO. 1

FLOOR 2



LEGENDS

- AC PACKAGE UNIT
- DUCT FURNACE

THE SS COMPANY

DATE	No.	REVISION
10/25/17	1	ISSUED PLANS
03/01/17	2	PERMITTED REVISED 1
04/25/17	3	REVISED REVISED REVISED 1
04/25/17	4	REVISED REVISED REVISED 2
04/25/17	5	PERMITTED REVISED 2
05/25/17	6	AS BUILT AS A PERMIT LAYOUT

AS-BUILT

MECHANICAL SECOND FLOOR
AC AND FURNACE LAYOUT

BUILDING FLOOR 2

REVISION No. 1

PROJECT 1. DWG

SCALE 1/8"=1'-0"
DATE 8/11/17
DRAWN No. 1
CHECK 2