

Project name

General Services Building

By

XYZ Inc.

License #

C-00017-01-08

Report #1. SPACE INPUTS

ID	Name	Floor area, ft ²	Wall area, ft ²	Window area, ft ²	People	Equipment sensible heat, Btu/h	Equipment latent heat, Btu/h	Lighting, kW	Zone #	System #
101	Assembling room	1,580	1,325	210	10	4,000	0	1.7	Z-4	1
102	Wash-down room	140	148	30	1	0	0	0.2	Z-5	1
103	Dark room	210	0	0	2	1,000	0	0.2	Z-5	1
104	Screen room	670	352	90	4	427	0	0.7	Z-5	1
105	Office	90	0	0	1	427	0	0.1	Z-5	1
106	Vestibule	1,580	870	120	16	0	0	1.7	Z-6	1
107	Archives	1,030	247	30	6	427	0	1.1	Z-7	1
108	Purchasing	370	253	30	2	853	0	0.4	Z-7	1
109	Storage	200	253	30	0	0	0	0.1	Z-7	1
110	Control centre	2,120	1,234	180	11	8,530	0	2.3	Z-9	1
111	Storage	60	226	0	0	0	0	0.0	Z-9	1
112	Electrical room	270	538	0	0	8,530	0	0.1	Z-10	2
113	Corridor	2,580	301	0	0	0	0	1.3	Z-8	1
114	Lettering room	1,290	1,206	180	7	2,730	0	1.4	Z-3	1
115	Sign shop	140	193	30	1	427	0	0.2	Z-3	1
116	Photocopy room	130	0	0	1	1,365	0	0.1	Z-3	1
117	Washroom	190	144	30	1	0	0	0.2	Z-10	2
118	Washroom	150	111	30	1	0	0	0.2	Z-10	2
119	Lunch room	1,400	978	120	30	3,950	3,960	1.8	Z-2	1
120	Decorating	1,280	263	60	7	6,000	0	1.4	Z-1	1
121	Mechanical room	1,700	1,320	0	9	0	0	1.9	Z-10	2
122	Boiler room	440	642	0	3	0	0	0.5	Z-10	2

Report #2. ENVELOPE INPUTS**WALLS**Uninterrupted U-value, Btu/h ft² °F

0.067

Design U-value, Btu/h ft² °F

0.067

Absorptance

0.700

ROOFUninterrupted U-value, Btu/h ft² °F

0.057

Design U-value, Btu/h ft² °F

0.057

Absorptance

0.800

WINDOWSDesign U-value, Btu/h ft² °F

0.650

Interior solar attenuation coefficient

1.000

Direct solar irradiance SHGC at 0° incidence angle

0.700

Diffusive solar irradiance SHGC

0.600

DOORSDesign U-value, Btu/h ft² °F

0.460

SLAB ON GRADE

Heat Loss Rate per Linear Foot, Btu/h ft °F

0.490

WALLS BELOW GRADER-value, h ft² °F/Btu

1.470

AIR INFILTRATIONSummer rate, ft³/min/ft²

0.016

Winter rate, ft³/min/ft³

0.032

Report #3. DESIGN OUTDOOR CONDITIONS

City	Toronto	
Standard time	Eastern	
Latitude	43.7	degree
Longitude	79.6	degree
Winter temperature	-2.9	°F
Summer temperature	87.0	°F
Coincident wet-bulb temperature	71.4	°F
Sky clearness	1.00	
Ground reflectivity	0.20	

SOLAR IRRADIANCE, Btu/h ft²

*LST	Roof	West	East	North	South
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	36	11	131	53	11
7	98	22	232	59	24
8	158	31	261	34	36
9	211	37	250	39	83
10	254	42	210	42	125
11	284	46	151	46	155
12	298	50	82	47	170
13	297	94	49	47	168
14	279	163	45	45	150
15	247	219	42	42	118
16	203	254	36	38	75
17	148	260	30	38	32
18	87	220	21	61	21
19	25	102	8	44	8
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0

Report #4. INDOOR DESIGN CONDITIONS

	Winter	Summer
Air temperature, °F	70	75
Humidity ratio, gr/lb	32	64

Report #5. SPACE VENTILATION AND SUPPLY AIR REQUIREMENTS

Space ID	Space name	Outdoor air rate per person, ft ³ /min	Outdoor air rate per area, ft ³ /min/ft ²	Total outdoor airflow rate, ft ³ /hmin	Exhaust airflow rate, ft ³ /min	Supply airflow rate, ft ³ /min	Outdoor-to-supply air ratio
101	Assembling room	10.0	0.06	195	0	1,426	14%
102	Wash-down room	5.0	0.06	13	140	249	5%
103	Dark room	5.0	0.06	23	210	210	11%
104	Screen room	5.0	0.06	60	0	818	7%
105	Office	5.0	0.06	10	0	48	22%
106	Vestibule	5.0	0.06	175	0	1,037	17%
107	Archives	5.0	0.06	92	0	490	19%
108	Purchasing	5.0	0.06	32	0	347	9%
109	Storage	0.0	0.12	24	0	236	10%
110	Control centre	5.0	0.06	182	0	2,205	8%
111	Storage	0.0	0.12	7	0	21	35%
112	Electrical room	0.0	0.12	32	208	516	6%
113	Corridor	0.0	0.06	155	0	392	40%
114	Lettering room	5.0	0.06	112	0	1,472	8%
115	Sign shop	5.0	0.06	13	0	235	6%
116	Photocopy room	5.0	0.06	13	0	99	13%
117	Washroom	5.0	0.06	16	140	246	7%
118	Washroom	5.0	0.06	14	70	241	6%
119	Lunch room	7.5	0.18	477	420	1,413	34%
120	Decorating	5.0	0.06	112	0	858	13%
121	Mechanical room	5.0	0.06	147	850	850	17%
122	Boiler room	5.0	0.06	41	0	173	24%

Report #6. SPACE HEAT LOSSES, Btu/h

Space ID	Space name	Walls	Windows	Roof	Floor	Doors	Basement walls	Infiltration	Other	Total heat loss
101	Assembling room	5,448	9,951	7,386	2,639	0	0	3,338	7,190	35,952
102	Wash-down room	577	1,422	654	295	0	0	373	830	4,152
103	Dark room	0	0	982	0	0	0	0	245	1,227
104	Screen room	1,281	4,265	3,132	702	0	0	887	2,567	12,834
105	Office	0	0	421	0	0	0	0	105	526
106	Vestibule	3,313	5,686	7,386	1,733	2,414	0	10,153	7,672	38,358
107	Archives	1,062	1,422	4,751	493	0	0	623	2,087	10,437
108	Purchasing	1,090	1,422	1,707	504	0	0	638	1,340	6,700
109	Storage	1,090	1,422	922	504	0	0	638	1,144	5,720
110	Control centre	5,150	8,529	9,778	2,458	0	0	3,109	7,256	36,280
111	Storage	1,105	0	277	451	0	0	570	601	3,004
112	Electrical room	2,627	0	1,245	1,071	0	0	1,355	1,574	7,872
113	Corridor	767	0	11,900	599	4,829	0	20,306	9,600	48,002
114	Lettering room	5,013	8,529	5,950	2,402	0	0	3,038	6,233	31,166
115	Sign shop	794	1,422	646	383	0	0	485	932	4,661
116	Photocopy room	0	0	600	0	0	0	0	150	750
117	Washroom	554	1,422	876	286	0	0	361	875	4,374
118	Washroom	395	1,422	692	221	0	0	279	752	3,760
119	Lunch room	4,189	5,686	6,457	1,947	0	0	2,462	5,186	25,928
120	Decorating	989	2,843	5,904	523	0	0	661	2,730	13,650
121	Mechanical room	6,093	0	7,841	2,628	2,414	0	3,323	5,575	27,875
122	Boiler room	3,134	0	2,029	1,278	0	0	1,616	2,014	10,072

Report #7. SPACE PEAK SENSIBLE COOLING LOADS, Btu/h

Space ID	Space name	Walls	Windows	Roof	People	Lighting	Equipment	Infiltration	Other	Total
101	Assembling room	936	15,875	1,862	2,606	3,931	3,892	231	1,467	30,800
102	Wash-down room	116	4,228	165	237	348	0	26	256	5,376
103	Dark room	0	0	269	471	519	970	0	111	2,340
104	Screen room	257	12,685	790	948	1,667	415	61	841	17,664
105	Office	0	0	115	236	223	414	0	49	1,036
106	Vestibule	713	10,331	1,862	3,791	3,931	0	703	1,067	22,397
107	Archives	213	4,228	1,198	1,422	2,562	415	43	504	10,585
108	Purchasing	219	4,228	430	474	920	830	44	357	7,503
109	Storage	219	4,228	233	0	136	0	44	243	5,102
110	Control centre	1,112	25,369	2,465	2,606	5,274	8,300	215	2,267	47,609
111	Storage	315	0	46	0	41	0	22	21	445
112	Electrical room	684	0	268	0	0	8,530	74	478	10,034
113	Corridor	193	0	3,307	0	2,885	0	1,671	403	8,459
114	Lettering room	191	23,436	256	1,415	2,507	2,459	0	1,513	31,779
115	Sign shop	45	3,906	28	202	272	384	0	242	5,079
116	Photocopy room	0	0	164	236	322	1,324	0	102	2,147
117	Washroom	31	3,906	38	202	369	0	0	227	4,774
118	Washroom	22	3,906	30	202	292	0	0	223	4,674
119	Lunch room	478	14,209	618	6,456	3,608	3,666	22	1,453	30,509
120	Decorating	113	7,104	565	1,506	2,791	5,568	6	883	18,537
121	Mechanical room	1,197	0	2,145	2,120	4,205	0	260	496	10,424
122	Boiler room	718	0	555	707	1,088	0	127	160	3,355

Report #8. ZONE DESIGN LOAD SUMMARY

Zone ID	Peak of coincident space sensible loads, Btu/h	Peak hour	Design airflow rate, ft ³ /min	Supply airflow calculation method
Z-1	18,537	10	858	CAV
Z-2	30,509	10	1,413	CAV
Z-3	38,654	9	1,806	CAV
Z-4	30,800	17	1,426	CAV
Z-5	26,398	17	1,325	CAV
Z-6	22,397	17	1,037	CAV
Z-7	23,191	17	1,074	CAV
Z-8	8,459	15	392	CAV
Z-9	48,027	17	2,225	CAV

Report #9. SYSTEM DESIGN LOAD SUMMARY

System name	Space peak coincident sensible loads, Btu/h	Peak hour	Space latent load, Btu/h	Plenum load, Btu/h	Supply airflow rate, ft ³ /min	Outdoor airflow rate, ft ³ /min	Outdoor to supply air ratio	Floor area, ft ²	Airflow to area ratio, ft ³ /min per ft ²	Supply airflow calculation method
S-1	217,910	17	25,736	44,240	11,557	2,423	21%	14,870	0.78	CAV
S-2	0	0	0	0	0	0	0%	0	0.00	CAV
S-3	0	0	0	0	0	0	0%	0	0.00	CAV

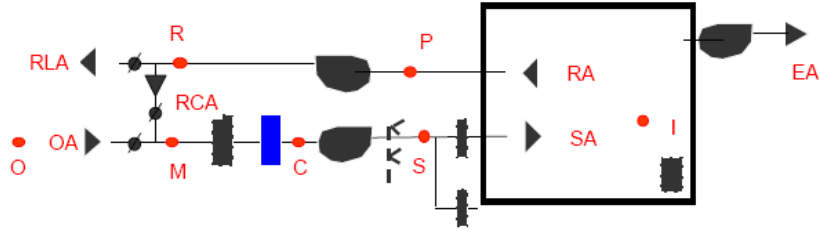
Report #10. SIZING OF SUPPLY FAN

System name	S-1	S-2	S-3
Airflow rate, ft ³ /min	11,557	0	0
Static pressure, in. w.c.	4.3	0.0	0.0
Temperature rise, °F	3.1	0.0	0.0

Report #11. SIZING OF RETURN FAN

System name	S-1	S-2	S-3
Airflow rate, ft ³ /min	10,369	-850	0
Static pressure, in. w.c.	1.1	0.0	0.0
Temperature rise, °F	0.7	0.0	0.0

Report #12. SIZING OF COOLING COIL



SYSTEM AIR BALANCE, ft³/min

System name	S-1	S-2	S-3
Supply air (SA)	11,557	0	0
Outdoor air (OA)	2,423	0	0
Exhaust air (EA)	1,188	850	0
Return air RA	10,369	-850	0
Recirculating air RCA	9,135	0	0
Relief air RLA	1,235	-850	0

PSYCHROMETRICS

Temperature - °F, humidity ratio - gr/lb

T _O	87.0	87.0	87.0
HR _O	93.0	93.0	93.0
T _I	75.0	75.0	75.0
HR _I	64.0	64.0	64.0
T _P	79.0	75.0	75.0
HR _P	64.0	64.0	64.0
T _R	79.6	75.0	75.0
HR _R	64.0	64.0	64.0
T _M	81.2	75.0	75.0
HR _M	70.0	64.0	64.0
T _S	55.0	57.0	57.0
HR _S	60.8	64.0	64.0
T _C	51.9	57.0	57.0
HR _C	60.8	64.0	64.0
T _{ADP}	50.0	51.5	45.0
HR _{ADP}	50.0	49.0	49.0
BF	0.062	0.235	0.400

COOLING COIL LOAD, Btu/h

Sensible cooling load	364,541	0	0
Latent cooling load	74,135	0	0
Total cooling load	438,676	0	0

COOLING REQUIREMENTS BREAKDOWN, Btu/h

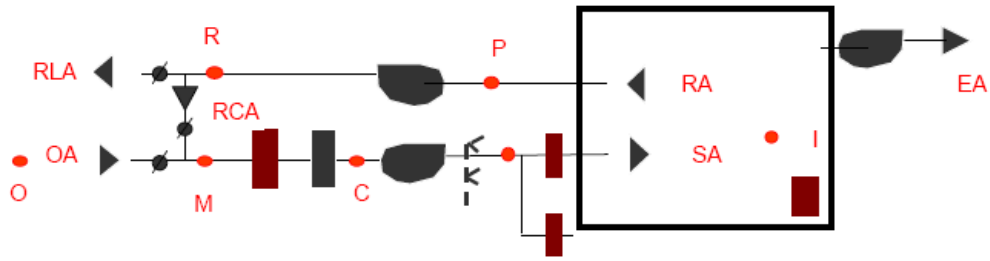
Space sensible cooling load	217,910	0	0
Space latent cooling load	25,736	0	0
Ventilation sensible load	25,211	0	0
Ventilation latent load	49,088	0	0
Heat gain from plenum	44,240	0	0
Supply fan heat gain	38,165	0	0
Return fan heat gain	7,633	0	0
Total cooling load	407,983	0	0

FRACTIONAL COOLING REQUIREMENTS

Space sensible load	53%	0%	0%
Space latent load	6%	0%	0%
Ventilation sensible load	6%	0%	0%
Ventilation latent load	12%	0%	0%
Plenum cooling load	11%	0%	0%
Heat gain from supply fan	9%	0%	0%
Heat gain from return fan	2%	0%	0%
Total	100%	0%	0%

Floor area ft ² per ton of cooling	437	0	0
Airflow rate ft ³ /min per ton of cooling	340	0	0

Report #13. SIZING OF PREHEAT COIL



System name	S-1	S-2	S-3
Airflow rate, ft ³ /min	11,557	0	0
T _O	-2.9	-2.9	-2.9
HR _O	3.3	3.3	3.3
T _I	70.0	70.0	70.0
HR _I	32.0	32.0	32.0
T _P	70.0	70.0	70.0
HR _P	32.0	32.0	32.0
T _R	70.7	70.0	70.0
HR _R	32.0	32.0	32.0
T _M	53.5	70.0	70.0
HR _M	25.3	32.0	32.0
T _S	68.2	0.0	0.0
HR _S	28.8	32.0	32.0
T _D	68.2	57.0	57.0
HR _D	28.8	32.0	32.0
T _C	65.1	0.0	0.0
HR _C	25.3	32.0	32.0
T _F	68.2	0.0	0.0
HR _F	25.3	32.0	32.0
Heating coil load, Btgu/h	145,760	0	0

Temperature - °F, humidity ratio - gr/lb

Report #14. SIZING OF HUMIDIFIER

Minimum humidifier load, lb/h	26	0	0
Maximum humidifier load, lb/h	45	0	0

Report #15. BUILDING HEATING REQUIREMENTS, Btu/h

Breakdown by loads:

System name	S-1	S-2	S-3
Ventilation load	191,582	0	0
Space heating load	279,346	53,954	0
Total	470,928	53,954	0

Breakdown by equipment:

Space heating units	279,346	53,954	0
Central heating coil	145,760	0	0
Supply fan heating	38,165	0	0
Return fan heating	7,633	0	0
*Imbalance or winter reheat coil load	24	0	0

Fractional breakdown:

Space heating units	59%	100%	0%
Central heating coil	31%	0%	0%
Supply fan heating	8%	0%	0%
Return fan heating	2%	0%	0%
*Imbalance or winter reheat coil load	0%	0%	0%
Total	100%	100%	0%

* An imbalance is caused by the assumption of constant air density at various elements of the air system

Heating load density, W/m² of floor area

Floor area, m ²	14,870	0	0
Ventilation load	13	0	0
Space heating load	19	0	0
Total	32	0	0

Report #16. BOILER PLANT HEATING OUTPUT, Btu/h

Capacity of space heating units	333,300
Winter duty of reheat coils	24
Central heating coils load	145,760
Other heating loads	0
Total load	479,084
Number of boilers	2
Redundancy	67%
One boiler output capacity	319,389

Report #17. REHEAT COIL SUMMARY

Zone ID	Zone airflow rate, ft ³ /min	Winter reheat load, Btu/h	Summer reheat load, Btu/h	Water flow rate, US gal/min
Z-1	858	2	18,537	1.9
Z-2	1,413	3	30,509	3.0
Z-3	1,806	4	38,654	3.9
Z-4	1,426	3	30,800	3.1
Z-5	1,325	3	26,398	2.6
Z-6	1,037	2	22,397	2.2
Z-7	1,074	2	23,191	2.3
Z-8	392	1	8,459	0.8
Z-9	2,225	5	48,027	4.8

Report #18. SPACE HEATING UNIT SUMMARY

Space	Supply airflow rate, ft ³ /min	Space heat losses, Btu/h	Reheat, Btu/h	Total unit heating load, Btu/h	Water flow rate, US gal/min
101	1,426	35,952	0	35,952	3.6
102	249	4,152	0	4,152	0.4
103	210	1,227	0	1,227	0.1
104	818	12,834	0	12,834	1.3
105	48	526	0	526	0.1
106	1,037	38,358	0	38,358	3.8
107	490	10,437	0	10,437	1.0
108	347	6,700	0	6,700	0.7
109	236	5,720	0	5,720	0.6
110	2,205	36,280	0	36,280	3.6
111	21	3,004	0	3,004	0.3
112	516	7,872	0	7,872	0.8
113	392	48,002	0	48,002	4.8
114	1,472	31,166	0	31,166	3.1
115	235	4,661	0	4,661	0.5
116	99	750	0	750	0.1
117	246	4,374	0	4,374	0.4
118	241	3,760	0	3,760	0.4
119	1,413	25,928	0	25,928	2.6
120	858	13,650	0	13,650	1.4
121	850	27,875	0	27,875	2.8
122	173	10,072	0	10,072	1.0