Steiner Residence, Steamboat Springs
HVAC Load Calculations

for

Kevin - G2 Consulting Engineers
5000 Goodman St., Unit 100
Timnath, CO 80547

Elite Software

RHVAC Residential HVAC Loads

Prepared By:

Beth Allan

Monday, June 6, 2022

Rhvac is an ACCA approved Manual J, D and S computer program.
Calculations are performed per ACCA Manual J 8th Edition, Version 2.50, and ACCA Manual D.

Project Report

General Project Information

Project Title:	Steiner Residence, Steamboat Springs
Designed By:	Beth Allan
Project Date:	June 6, 2022
Client Name:	Kevin - G2 Consulting Engineers
Client Address:	5000 Goodman St., Unit 100
Client City:	Timnath, CO 80547
Client Phone:	970-460-7400 x 205
Client E-Mail Address:	kdriscoll@g2ce.com
Company Representative:	Beth Allan
Company E-Mail Address:	dennybeth@hotmail.com
Company Comment:	

Design Data

Reference City:		Steamboat Springs, Colorado
Building Orientation:		Front door faces North
Daily Temperature Range:		High
Latitude:	40	Degrees
Elevation:	6732	ft.
Altitude Factor:	0.780	

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-15	-15.38	n/a	n/a	72	n/a
Summer:	85	56	17%	50%	75	-44

Check Figures

Total Building Supply CFM:	4,870	CFM Per Square ft.:	0.612
Square ft. of Room Area:	7,955	Square ft. Per Ton:	1,221
Volume (ft³):	90,126		

Building Loads

Total Heating Required Including Ventilation Air:	127,803	Btuh	127.803	MBH
Total Sensible Gain:	77,852	Btuh	100	%
Total Latent Gain:	336	Btuh	0	%
Total Cooling Required Including Ventilation Air:	78,188	Btuh	6.52	Tons (Based On Sensible + Latent)

Notes

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Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

Miscellaneous Report

System 1 Main Floor Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-15	-15.38	81%	n/a	72	n/a
Summer:	85	56	17%	50%	75	-43.58

Duct Sizing Inputs

	Main Trunk		Runouts	
Calculate:	Yes		Yes	
Use Schedule:	No		No	
Roughness Factor:	0.00300		0.01000	
Pressure Drop:	0.1000	in.wg./100 ft.	0.1000	in.wg./100 ft.
Minimum Velocity:	0	ft./min	0	ft./min
Maximum Velocity:	900	ft./min	750	ft./min
Minimum Height:	0	in.	0	in.
Maximum Height:	0	in.	0	in.

Outside Air Data

	Winter		Summer	
Infiltration Specified:	0.115	AC/hr	0.050	AC/hr
	173	CFM	75	CFM
Infiltration Actual:	0.115	AC/hr	0.050	AC/hr
Above Grade Volume:	X 90,126	Cu.ft.	X 90,126	Cu.ft.
	10,393	Cu.ft./hr	4,506	Cu.ft./hr
	X 0.0167		X 0.0167	
Total Building Infiltration:	173	CFM	75	CFM
Total Building Ventilation:	0	CFM	0	CFM

---System 1---

Infiltration & Ventilation Sensible Gain Multiplier: 8.57 = (1.10 X 0.780 X 10.00 Summer Temp. Difference)
Infiltration & Ventilation Latent Gain Multiplier: -23.10 = (0.68 X 0.780 X -43.58 Grains Difference)
Infiltration & Ventilation Sensible Loss Multiplier: 74.60 = (1.10 X 0.780 X 87.00 Winter Temp. Difference)
Winter Infiltration Specified: 0.100 AC/hr (150 CFM), Construction: Tight, Fireplaces: 3, 23 CFM, Semi-Tight
Summer Infiltration Specified: 0.050 AC/hr (75 CFM), Construction: Tight

Load Preview Report

Scope	Has AED	Net Ton	ft²/Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Min Htg CFM	Min Clg CFM	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building		6.52	1,221	7,955	77,852	336	78,188	127,803	2,129	4,540	4,870	4,870	4,870	
System 1 Main Floor	No	6.52	1,221	7,955	77,852	336	78,188	127,803	2,129	4,540	4,870	4,870	4,870	24x33
Zone 1 - Clg.: 70%, Htg.: 54%				3,818	83,515	-534	83,515	69,199	1,153	4,870	2,637	4,870	4,870	24x33
1-Entry				160	5,403	-90	5,403	7,410	123	315	282	315	315	3--6
2-Library				480	2,043	-82	2,043	3,342	56	119	127	119	119	2--5
3-Master Bath				540	10,469	-180	10,469	8,726	145	610	333	610	610	6--6
4-Master Bedroom				304	12,444	370	12,814	7,811	130	726	298	726	726	7--6
5-Hall				70	1,851	-19	1,851	1,216	20	108	46	108	108	1--6
6-Great Room				825	18,411	-156	18,411	17,399	290	1,074	663	1,074	1,074	10--6
7-Dining/Kitchen/Stair 2				1,075	27,585	-238	27,585	16,206	270	1,608	618	1,608	1,608	15--6
8-Booth				45	2,516	-52	2,516	3,263	54	147	124	147	147	2--6
9-Mud Room				319	2,793	-87	2,793	3,826	64	163	146	163	163	2--6
Zone 2 - Clg.: 4%, Htg.: 6%				500	4,797	-162	4,797	7,628	127	280	291	280	280	7x9
10-Gym				500	4,797	-162	4,797	7,628	127	280	291	280	280	3--6
Zone 3 - Clg.: 26%, Htg.: 40%				3,637	30,456	1,032	31,488	50,976	849	1,776	1,942	1,776	1,776	14x21
11-Guest Suite 3/Foyer 3				255	4,137	392	4,529	6,333	106	241	241	241	241	3--6
12-Bath/Closet/Whiskey Rm/Stair				345	41	-53	41	2,597	43	2	99	2	2	1--2
13-Vault/Storage/Mechanical				360	49	-61	49	3,892	65	3	148	3	3	1--2
14-Mud/Pwr/Hall				64	958	-15	958	1,473	25	56	56	56	56	1--5
15-Bar/Pool Table Area				360	2,801	-53	2,801	5,222	87	163	199	163	163	2--6
16-Rec Room				680	7,475	-96	7,475	11,176	186	436	426	436	436	4--7
17-Bunk Room				144	839	213	1,052	1,522	25	49	58	49	49	1--5
18-Guest Suite 1/Bath				493	5,602	344	5,946	9,158	153	327	349	327	327	3--7
19-Guest Suite 2/Bathrooms/Hall/Laundry				936	8,552	361	8,913	9,603	160	499	366	499	499	5--6

Sum of room airflows may be greater than system airflow because
system has multiple zones.

Duct Size Preview

Room or Duct Name	Source	Minimum Velocity	Maximum Velocity	Rough. Factor	Design L/100	SP Loss	Duct Velocity	Duct Length	Htg Flow	Clg Flow	Act. Flow	Duct Size	Reg Size
System 1													
Supply Runouts													
Zone 1													
1-Entry	Built-In	0	750	0.01	0.1		534.8		282	315	315	3--6	
2-Library	Built-In	0	750	0.01	0.1		436.9		127	119	119	2--5	
3-Master Bath	Built-In	0	750	0.01	0.1		518.2		333	610	610	6--6	
4-Master Bedroom	Built-In	0	750	0.01	0.1		527.9		298	726	726	7--6	
5-Hall	Built-In	0	750	0.01	0.1		549.6		46	108	108	1--6	
6-Great Room	Built-In	0	750	0.01	0.1		546.8		663	1,074	1,074	10--6	
7-Dining/Kitchen/Stair 2	Built-In	0	750	0.01	0.1		546.1		618	1,608	1,608	15--6	
8-Booth	Built-In	0	750	0.01	0.1		373.6		124	147	147	2--6	
9-Mud Room	Built-In	0	750	0.01	0.1		414.7		146	163	163	2--6	
Zone 2													
10-Gym	Built-In	0	750	0.01	0.1		474.9		291	280	280	3--6	
Zone 3													
11-Guest Suite 3/Foyer 3	Built-In	0	750	0.01	0.1		409.5		241	241	241	3--6	
12-Bath/Closet/Whiskey Rm/Stair	Built-In	0	750	0.01	0.1		110.5		99	2	2	1--2	
13-Vault/Storage/Mechani	Built-In	0	750	0.01	0.1		130.6		148	3	3	1--2	
14-Mud/Pwr/Hall	Built-In	0	750	0.01	0.1		409.9		56	56	56	1--5	
15-Bar/Pool Table Area	Built-In	0	750	0.01	0.1		416		199	163	163	2--6	
16-Rec Room	Built-In	0	750	0.01	0.1		407.7		426	436	436	4--7	
17-Bunk Room	Built-In	0	750	0.01	0.1		359		58	49	49	1--5	
18-Guest Suite 1/Bath	Built-In	0	750	0.01	0.1		407.4		349	327	327	3--7	
19-Guest Suite 2/Bathrooms/Hall/Laundry	Built-In	0	750	0.01	0.1		508		366	499	499	5--6	
Other Ducts in System 1													
Supply Main Trunk	Built-In	0	900	0.003	0.1		885.5		4,870	4,870	4,870	24x33	

Summary

System 1

Heating Flow:	4870
Cooling Flow:	4870

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
4A-1v-o: Glazing-Double pane low-e (e = 0.20 or less), operable window, e=0.20 on surface 2, vinyl frame, U-value 0.3, SHGC 0.3	2656.1	69,321	0	40,960	40,960
R-27: Wall-Frame, Custom, R-27 2x6 Stud Cavity, U-value 0.037	3626.6	11,674	0	1,891	1,891
15B15-0w-2: Wall-Basement, , framing with R-15 sill to floor in 2 x 4 cavity, core, no board insulation, plus interior finish, wood studs, 2' floor depth, U-value 0.065, above grade U-value 0.088	2599.1	18,639	0	103	103
R-49: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R-49 Insulation, U-value 0.02	4318	7,514	0	5,182	5,182
21A-20: Floor-Basement, Concrete slab, any thickness, 2 or more feet below grade, no insulation below floor, any floor cover, shortest side of floor slab is 20' wide, U-value 0.027	3292	7,733	0	0	0
Subtotals for structure:		114,881	0	48,136	48,136
People:	9		2,070	2,700	4,770
Equipment:			0	2,400	2,400
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 173, Summer CFM: 75		12,922	-1,734	642	-1,092
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
AED Excursion:		0	0	23,974	23,974
Total Building Load Totals:		127,803	336	77,852	78,188

Check Figures

Total Building Supply CFM:	4,870	CFM Per Square ft.:	0.612
Square ft. of Room Area:	7,955	Square ft. Per Ton:	1,221
Volume (ft³):	90,126		

Building Loads

Total Heating Required Including Ventilation Air:	127,803	Btuh	127.803	MBH
Total Sensible Gain:	77,852	Btuh	100	%
Total Latent Gain:	336	Btuh	0	%
Total Cooling Required Including Ventilation Air:	78,188	Btuh	6.52	Tons (Based On Sensible + Latent)

Notes

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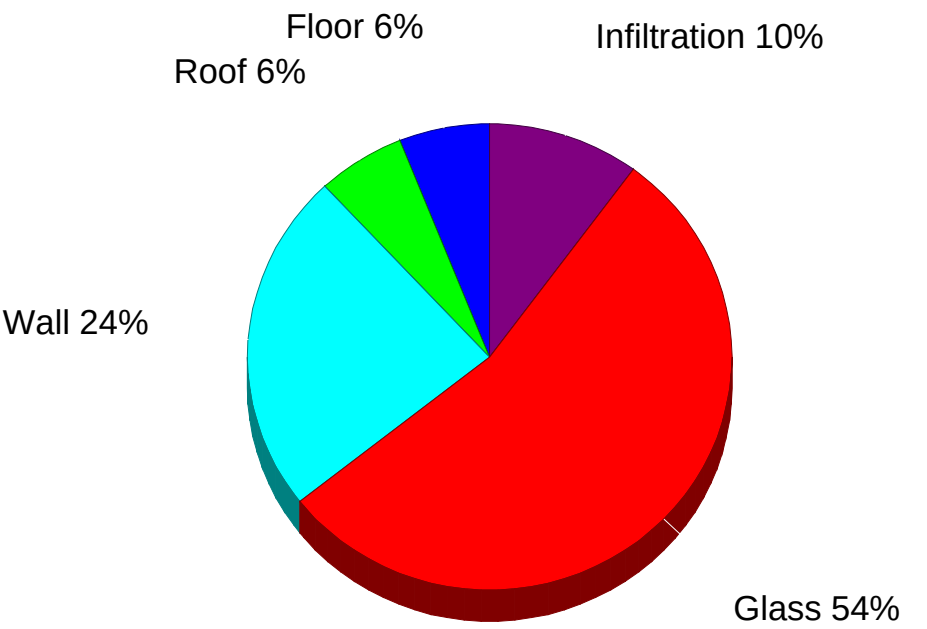
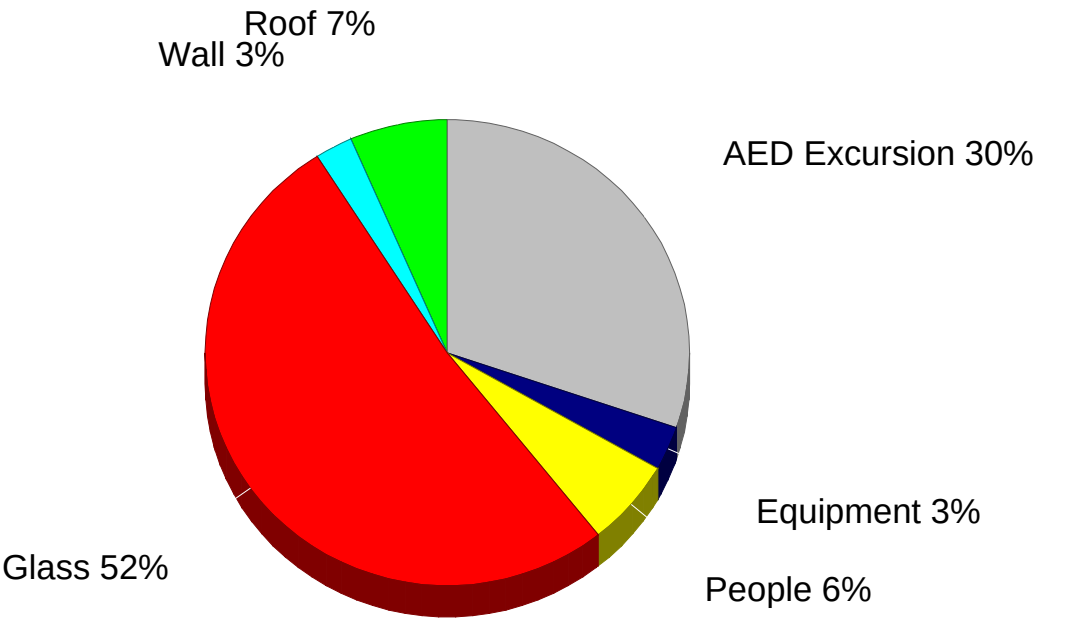
Building Pie Chart





System 1 Main Floor Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
4A-1v-o: Glazing-Double pane low-e (e = 0.20 or less), operable window, e=0.20 on surface 2, vinyl frame, U-value 0.3, SHGC 0.3	2656.1	69,321	0	40,960	40,960
R-27: Wall-Frame, Custom, R-27 2x6 Stud Cavity, U-value 0.037	3626.6	11,674	0	1,891	1,891
15B15-0w-2: Wall-Basement, , framing with R-15 sill to floor in 2 x 4 cavity, core, no board insulation, plus interior finish, wood studs, 2' floor depth, U-value 0.065, above grade U-value 0.088	2599.1	18,639	0	103	103
R-49: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R-49 Insulation, U-value 0.02	4318	7,514	0	5,182	5,182
21A-20: Floor-Basement, Concrete slab, any thickness, 2 or more feet below grade, no insulation below floor, any floor cover, shortest side of floor slab is 20' wide, U-value 0.027	3292	7,733	0	0	0
Subtotals for structure:		114,881	0	48,136	48,136
People:	9		2,070	2,700	4,770
Equipment:			0	2,400	2,400
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 173, Summer CFM: 75		12,922	-1,734	642	-1,092
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
AED Excursion:		0	0	23,974	23,974
System 1 Main Floor Load Totals:		127,803	336	77,852	78,188

Check Figures

Supply CFM:	4,870	CFM Per Square ft.:	0.612
Square ft. of Room Area:	7,955	Square ft. Per Ton:	1,221
Volume (ft³):	90,126		

System Loads

Total Heating Required Including Ventilation Air:	127,803	Btuh	127.803	MBH
Total Sensible Gain:	77,852	Btuh	100	%
Total Latent Gain:	336	Btuh	0	%
Total Cooling Required Including Ventilation Air:	78,188	Btuh	6.52	Tons (Based On Sensible + Latent)

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Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

System 1, Zone 1 Summary Loads (Peak Load Procedure for Rooms)

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
4A-1v-o: Glazing-Double pane low-e (e = 0.20 or less), operable window, e=0.20 on surface 2, vinyl frame, U-value 0.3, SHGC 0.3	1744.4	45,527	0	57,150	57,150
R-27: Wall-Frame, Custom, R-27 2x6 Stud Cavity, U-value 0.037	2987.6	9,618	0	1,558	1,558
R-49: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R-49 Insulation, U-value 0.02	3818	6,644	0	4,582	4,582
Subtotals for structure:		61,789	0	63,290	63,290
People:	2		460	600	1,060
Equipment:			0	2,400	2,400
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 99, Summer CFM: 43		7,410	-994	367	-627
System 1, Zone 1 Load Totals:		69,199	-534	83,515	82,981

Check Figures

Supply CFM:	4,870	CFM Per Square ft.:	1.275
Square ft. of Room Area:	3,818	Square ft. Per Ton:	552
Volume (ft³):	53,082		

Zone Loads

Total Heating Required:	69,199	Btuh	69.199	MBH
Total Sensible Gain:	83,515	Btuh	100	%
Total Latent Gain:	-534	Btuh	0	%
Total Cooling Required:	83,515	Btuh	6.96	Tons (Based On Sensible + Latent)

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System 1, Zone 2 Summary Loads (Peak Load Procedure for Rooms)

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
4A-1v-o: Glazing-Double pane low-e (e = 0.20 or less), operable window, e=0.20 on surface 2, vinyl frame, U-value 0.3, SHGC 0.3	133.8	3,492	0	2,836	2,836
R-27: Wall-Frame, Custom, R-27 2x6 Stud Cavity, U-value 0.037	639	2,056	0	333	333
R-49: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R-49 Insulation, U-value 0.02	500	870	0	600	600
Subtotals for structure:		6,418	0	3,769	3,769
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 16, Summer CFM: 7		1,210	-162	60	-102
System 1, Zone 2 Load Totals:		7,628	-162	4,797	4,635

Check Figures

Supply CFM:	280	CFM Per Square ft.:	0.559
Square ft. of Room Area:	500	Square ft. Per Ton:	1,294
Volume (ft³):	4,200		

Zone Loads

Total Heating Required:	7,628	Btuh	7.628	MBH
Total Sensible Gain:	4,797	Btuh	100	%
Total Latent Gain:	-162	Btuh	0	%
Total Cooling Required:	4,797	Btuh	0.40	Tons (Based On Sensible + Latent)

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System 1, Zone 3 Summary Loads (Peak Load Procedure for Rooms)

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
4A-1v-o: Glazing-Double pane low-e (e = 0.20 or less), operable window, e=0.20 on surface 2, vinyl frame, U-value 0.3, SHGC 0.3	777.9	20,302	0	21,890	21,890
15B15-0w-2: Wall-Basement, , framing with R-15 sill to floor in 2 x 4 cavity, core, no board insulation, plus interior finish, wood studs, 2' floor depth, U-value 0.065, above grade U-value 0.088	2599.1	18,639	0	103	103
21A-20: Floor-Basement, Concrete slab, any thickness, 2 or more feet below grade, no insulation below floor, any floor cover, shortest side of floor slab is 20' wide, U-value 0.027	3292	7,733	0	0	0
Subtotals for structure:		46,674	0	21,993	21,993
People:	7		1,610	2,100	3,710
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 58, Summer CFM: 25		4,302	-578	215	-363
System 1, Zone 3 Load Totals:		50,976	1,032	30,456	31,488

Check Figures

Supply CFM:	1,776	CFM Per Square ft.:	0.488
Square ft. of Room Area:	3,637	Square ft. Per Ton:	1,386
Volume (ft³):	32,844		

Zone Loads

Total Heating Required:	50,976	Btuh	50.976	MBH
Total Sensible Gain:	30,456	Btuh	97	%
Total Latent Gain:	1,032	Btuh	3	%
Total Cooling Required:	31,488	Btuh	2.62	Tons (Based On Sensible + Latent)

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Building Rotation Duct Sizes

Room or Duct Name	Direction Front door Faces																Max Duct Size
	N		NE		E		SE		S		SW		W		NW		
	Htg Flow	Clg Flow	Htg Flow	Clg Flow	Htg Flow	Clg Flow	Htg Flow	Clg Flow	Htg Flow	Clg Flow	Htg Flow	Clg Flow	Htg Flow	Clg Flow	Htg Flow	Clg Flow	
System 1																	
Supply Runouts																	
Zone 1																	
1-Entry	282	315	123	232	123	290	123	315	123	381	123	388	123	676	262	588	7--6
2-Library	127	119	56	83	56	83	56	85	56	97	56	67	56	127	118	151	2--6
3-Master Bath	333	610	145	593	145	371	145	200	145	252	145	303	145	305	309	409	6--6
4-Master Bedroom	298	726	130	790	130	659	130	427	130	275	130	360	130	324	276	425	8--6
5-Hall	46	108	20	117	20	70	20	29	20	36	20	52	20	44	43	56	2--5
6-Great Room	663	1,074	290	1,637	290	1,677	290	1,066	290	606	290	584	290	870	616	1,091	16--6
7-Dining/Kitchen/Stair 2	618	1,608	270	1,140	270	660	270	695	270	828	270	906	270	801	574	1,442	15--6
8-Booth	124	147	54	134	54	128	54	161	54	98	54	128	54	191	115	184	2--6
9-Mud Room	146	163	64	135	64	108	64	117	64	97	64	123	64	149	135	176	2--6
Zone 2																	
10-Gym	291	280	127	291	127	285	127	324	127	301	127	322	127	297	270	306	3--6
Zone 3																	
11-Guest Suite 3/Foyer 3	241	241	106	358	106	369	106	359	106	275	106	133	106	184	224	190	4--6
12-Bath/Closet/Whiskey Rm/Stair	99	2	43	2	43	2	43	2	43	2	43	2	43	2	92	2	1--2
13-Vault/Storage/Mechanical	148	3	65	3	65	3	65	3	65	2	65	2	65	2	138	3	1--2
14-Mud/Pwr/Hall	56	56	25	112	25	114	25	62	25	22	25	35	25	51	52	47	2--5
15-Bar/Pool Table Area	199	163	87	325	87	332	87	180	87	63	87	103	87	150	185	137	4--6
16-Rec Room	426	436	186	851	186	878	186	490	186	191	186	276	186	400	396	398	8--7
17-Bunk Room	58	49	25	54	25	52	25	78	25	74	25	27	25	33	54	39	1--6
18-Guest Suite 1/Bath	349	327	153	169	153	157	153	182	153	184	153	129	153	232	324	452	5--6
19-Guest Suite 2/Bathrooms/Hall/Lau	366	499	160	539	160	327	160	140	160	138	160	330	160	287	340	263	5--6
Other Ducts in System 1																	
Supply Main Trunk	4,870	4,870	2,129	5,154	2,129	4,868	2,129	4,130	2,129	3,229	2,129	3,616	2,129	3,647	4,523	4,523	25x33
Bldg. High Dir.: Northeast																	
Sensible Gain: 88,391																	
Latent Gain: 336																	

Summary

System 1

Heating Flow: 4870

Cooling Flow: 4870