

*3125 Bloomington Ave S  
HVAC Load Calculations*

for

Bobby Arndt



**RHVAC** RESIDENTIAL  
HVAC LOADS

Prepared By:

Kelly Ehret  
Air-It Indoor Comfort, LLC

Thursday, March 7, 2019



## Project Report

### General Project Information

Project Title: 3125 Bloomington Ave S  
 Project Date: Wednesday, February 13, 2019  
 Client Name: Bobby Arndt  
 Company Name: Air-It Indoor Comfort, LLC  
 Company Representative: Kelly Ehret

### Design Data

Reference City: Minneapolis/St. Paul AP, Minnesota  
 Building Orientation: Front door faces West  
 Daily Temperature Range: Medium  
 Latitude: 44 Degrees  
 Elevation: 834 ft.  
 Altitude Factor: 0.970

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-16	-11.42	n/a	n/a	72	n/a
Summer:	93	71	34%	50%	70	26

### Check Figures

Total Building Supply CFM:	694	CFM Per Square ft.:	0.233
Square ft. of Room Area:	2,982	Square ft. Per Ton:	1,920
Volume (ft³):	19,638		

### Building Loads

Total Heating Required Including Ventilation Air:	50,493 Btuh	50.493 MBH
Total Sensible Gain:	16,474 Btuh	88 %
Total Latent Gain:	2,163 Btuh	12 %
Total Cooling Required Including Ventilation Air:	18,637 Btuh	1.55 Tons (Based On Sensible + Latent)

### Notes

Rhvac is an ACCA approved Manual J and Manual D computer program.  
 Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.  
 All computed results are estimates as building use and weather may vary.  
 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 House Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-16	-11.42	100%	n/a	72	n/a
Summer:	93	71	34%	50%	70	25.92

### Duct Sizing Inputs

	Main Trunk	Runouts
Calculate:	Yes	Yes
Use Schedule:	Yes	Yes
Roughness Factor:	0.00300	0.01000
Pressure Drop:	0.1000 in.wg./100 ft.	0.1000 in.wg./100 ft.
Minimum Velocity:	650 ft./min	450 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:	0.220 AC/hr 72 CFM	0.110 AC/hr 36 CFM
Infiltration Actual:	0.072 AC/hr	0.000 AC/hr
Above Grade Volume:	X 19,638 Cu.ft. 1,421 Cu.ft./hr X 0.0167	X 19,638 Cu.ft. 0 Cu.ft./hr X 0.0167
Total Building Infiltration:	24 CFM	0 CFM
Total Building Ventilation:	68 CFM	68 CFM

---System 1---

Infiltration & Ventilation Sensible Gain Multiplier: 24.55 = (1.10 X 0.970 X 23.00 Summer Temp. Difference)  
 Infiltration & Ventilation Latent Gain Multiplier: 17.10 = (0.68 X 0.970 X 25.92 Grains Difference)  
 Infiltration & Ventilation Sensible Loss Multiplier: 93.92 = (1.10 X 0.970 X 88.00 Winter Temp. Difference)  
 Winter Infiltration Specified: 0.220 AC/hr (72 CFM), Construction: Semi-Tight  
 Summer Infiltration Specified: 0.110 AC/hr (36 CFM), Construction: Semi-Tight



## Load Preview Report

Scope	Net Ton	ft. <sup>2</sup> /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	1.55	1,920	2,982	16,474	2,163	18,637	50,493	590	694	694	
System 1	1.55	1,920	2,982	16,474	2,163	18,637	50,493	590	694	694	10x14
Ventilation				1,669	1,163	2,832	6,386				
Zone 1			2,982	14,805	1,000	15,805	44,107	590	694	694	10x14
1-Basement			994	936	400	1,336	5,692	76	44	44	1--4
2-Main Level			994	7,472	0	7,472	27,872	373	350	350	4--5
3-Upper Level			994	6,396	600	6,996	10,543	141	300	300	3--6



## 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
System 1												
<b>Supply Runouts</b>												
Zone 1												
1-Basement	Built-In	450	750	0.01	0.1		502.7		76	44	44	1--4
2-Main Level	Built-In	450	750	0.01	0.1		641.8		373	350	350	4--5
3-Upper Level	Built-In	450	750	0.01	0.1		508.7		141	300	300	3--6
<b>Other Ducts in System 1</b>												
Supply Main Trunk	Built-In	650	900	0.003	0.1		713.4		590	694	694	10x14

### Summary

System 1  
 Heating Flow: 590  
 Cooling Flow: 694



### Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
Integrity: Glazing-Integrity, u-value 0.3, SHGC 0.27	256	6,757	0	5,422	5,422
11D: Door-Wood - Solid Core	42	554	0	214	214
15D22-8: Wall-Basement, , foam-concrete matrix ASTM certified R-21 to R-23, no framing, no blanket or board insulation, 8' floor depth	1232	3,218	0	128	128
12F-0bw: Wall-Frame, R-21 insulation in 2 x 6 stud cavity, no board insulation, brick finish, wood studs	0	0	0	0	0
12F-2sw: Wall-Frame, R-21 insulation in 2 x 6 stud cavity, R-2 board insulation, siding finish, wood studs	5243	27,682	0	6,700	6,700
16B-50: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Vented Attic, No Radiant Barrier, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane, R-50 insulation	994	1,749	0	1,153	1,153
21A-28: 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 28' wide	994	1,924	0	0	0
Subtotals for structure:		41,884	0	13,617	13,617
People:	5		1,000	1,150	2,150
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 24, Summer CFM: 0		2,223	0	0	0
Ventilation: Winter CFM: 68, Summer CFM: 68		6,386	1,163	1,669	2,832
AED Excursion:		0	0	38	38
<b>Total Building Load Totals:</b>		<b>50,493</b>	<b>2,163</b>	<b>16,474</b>	<b>18,637</b>

### Check Figures

Total Building Supply CFM:	694	CFM Per Square ft.:	0.233
Square ft. of Room Area:	2,982	Square ft. Per Ton:	1,920
Volume (ft <sup>3</sup> ):	19,638		

### Building Loads

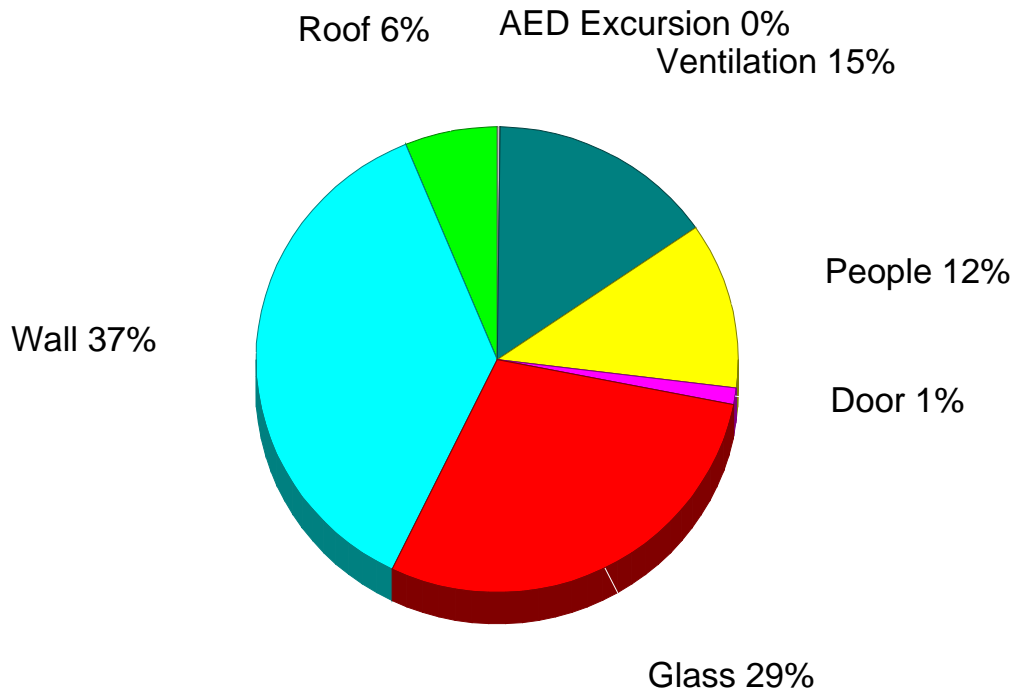
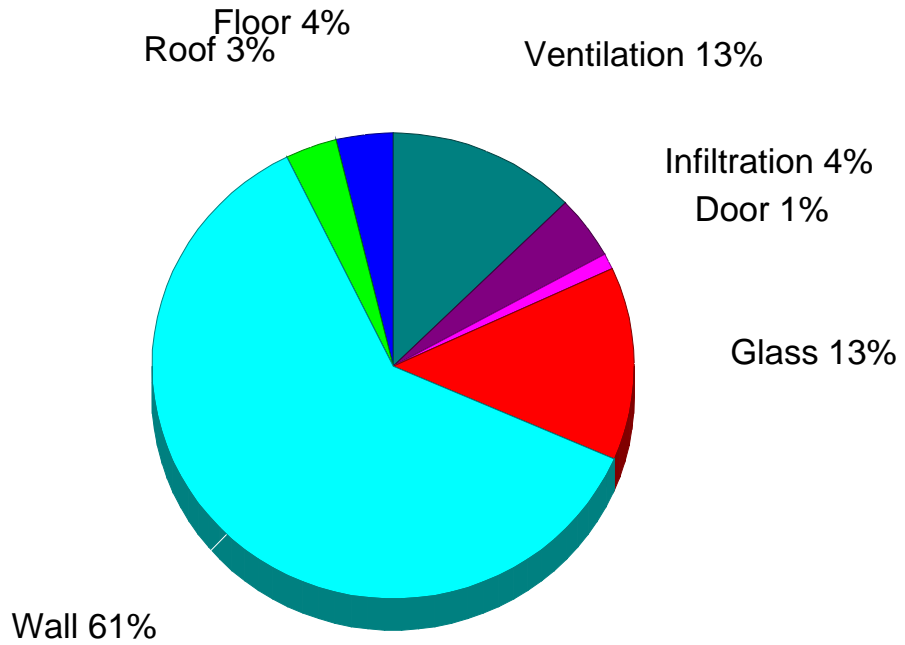
Total Heating Required Including Ventilation Air:	50,493 Btuh	50.493 MBH
Total Sensible Gain:	16,474 Btuh	88 %
Total Latent Gain:	2,163 Btuh	12 %
Total Cooling Required Including Ventilation Air:	18,637 Btuh	1.55 Tons (Based On Sensible + Latent)

### Notes

Rhvac is an ACCA approved Manual J and Manual D computer program. Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. All computed results are estimates as building use and weather may vary. Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.



**Building Pie Chart**





**Detailed Room Loads - Room 1 - Basement (Average Load Procedure)**

**General**

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	35.5 ft.	System Number:	1
Room Width:	28.0 ft.	Zone Number:	1
Area:	994.0 sq.ft.	Supply Air:	44 CFM
Ceiling Height:	9.3 ft.	Supply Air Changes:	0.3 AC/hr
Volume:	9,277 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	1	Actual Winter Vent.:	9 CFM
Runout Air:	44 CFM	Percent of Supply.:	20 %
Runout Duct Size:	4 in.	Actual Summer Vent.:	4 CFM
Runout Air Velocity:	503 ft./min.	Percent of Supply:	10 %
Runout Air Velocity:	503 ft./min.	Actual Winter Infil.:	1 CFM
Actual Loss:	0.280 in.wg./100 ft.	Actual Summer Infil.:	0 CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
W -Wall-15D22-8 28 X 9.3	261.3	0.028	2.6	683	0.1	0	27
N -Wall-15D22-8 38 X 9.3	354.7	0.028	2.6	926	0.1	0	37
E -Wall-15D22-8 28 X 9.3	261.3	0.028	2.6	683	0.1	0	27
S -Wall-15D22-8 38 X 9.3	354.7	0.028	2.6	926	0.1	0	37
S -Wall-12F-0bw 3 X 3	0	0.065	5.7	0	1.2	0	0
S -Wall-12F-0bw 3 X 3	0	0.065	5.7	0	1.2	0	0
S -Gls-Integrity shgc-0.27 0%S	9	0.300	26.4	238	19.2	0	173
S -Gls-Integrity shgc-0.27 0%S	9	0.300	26.4	238	19.2	0	173
Floor-21A-28 28 X 35.5	994	0.022	1.9	1,924	0.0	0	0
Subtotals for Structure:				5,618		0	474
Infil.: Win.: 0.8, Sum.: 0.0	190		0.389	74	0.000	0	0
Ductwork:				0			0
AED Excursion:							2
People: 200 lat/per, 230 sen/per:	2					400	460
Room Totals:				5,692		400	936





**Detailed Room Loads - Room 2 - Main Level (Average Load Procedure)**

**General**

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	35.5 ft.	System Number:	1
Room Width:	28.0 ft.	Zone Number:	1
Area:	994.0 sq.ft.	Supply Air:	350 CFM
Ceiling Height:	10.3 ft.	Supply Air Changes:	2.1 AC/hr
Volume:	10,189 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	4	Actual Winter Vent.:	43 CFM
Runout Air:	88 CFM	Percent of Supply.:	12 %
Runout Duct Size:	5 in.	Actual Summer Vent.:	34 CFM
Runout Air Velocity:	642 ft./min.	Percent of Supply:	10 %
Runout Air Velocity:	642 ft./min.	Actual Winter Infil.:	18 CFM
Actual Loss:	0.332 in.wg./100 ft.	Actual Summer Infil.:	0 CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
W -Wall-12F-2sw 28 X 28	711.2	0.060	5.3	3,755	1.3	0	909
N -Wall-12F-2sw 38 X 38	1419.2	0.060	5.3	7,494	1.3	0	1,814
E -Wall-12F-2sw 28 X 28	748	0.060	5.3	3,949	1.3	0	956
S -Wall-12F-2sw 38 X 38	1427.5	0.060	5.3	7,537	1.3	0	1,824
W -Door-11D 3 X 7	21	0.150	13.2	277	5.1	0	107
E -Door-11D 3 X 7	21	0.150	13.2	277	5.1	0	107
W -Gls-Integrity shgc-0.27 98%S (3)	40.5	0.300	26.4	1,068	12.4	0	501
W -Gls-Integrity shgc-0.27 98%S	11.2	0.300	26.4	297	12.4	0	139
N -Gls-Integrity shgc-0.27 100%S	13.5	0.300	26.4	356	12.0	0	162
N -Gls-Integrity shgc-0.27 100%S	11.2	0.300	26.4	297	12.0	0	135
E -Gls-Integrity shgc-0.27 0%S	15	0.300	26.4	396	32.1	0	482
S -Gls-Integrity shgc-0.27 0%S	10.5	0.300	26.4	277	19.1	0	201
S -Gls-Integrity shgc-0.27 0%S (2)	6	0.300	26.4	158	19.3	0	116
Subtotals for Structure:				26,138		0	7,453
Infil.: Win.: 18.5, Sum.: 0.0	4,456		0.389	1,734	0.000	0	0
Ductwork:				0			0
AED Excursion:							19
Room Totals:				27,872		0	7,472



**Detailed Room Loads - Room 3 - Upper Level (Average Load Procedure)**

**General**

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	35.5 ft.	System Number:	1
Room Width:	28.0 ft.	Zone Number:	1
Area:	994.0 sq.ft.	Supply Air:	300 CFM
Ceiling Height:	8.1 ft.	Supply Air Changes:	2.2 AC/hr
Volume:	8,035 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	3	Actual Winter Vent.:	16 CFM
Runout Air:	100 CFM	Percent of Supply.:	5 %
Runout Duct Size:	6 in.	Actual Summer Vent.:	29 CFM
Runout Air Velocity:	509 ft./min.	Percent of Supply:	10 %
Runout Air Velocity:	509 ft./min.	Actual Winter Infil.:	4 CFM
Actual Loss:	0.163 in.wg./100 ft.	Actual Summer Infil.:	0 CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
W -Wall-12F-2sw 28 X 8.1	188.8	0.060	5.3	997	1.3	0	241
N -Wall-12F-2sw 38 X 8.1	289.7	0.060	5.3	1,529	1.3	0	370
E -Wall-12F-2sw 28 X 8.1	188.8	0.060	5.3	997	1.3	0	241
S -Wall-12F-2sw 38 X 8.1	269.7	0.060	5.3	1,424	1.3	0	345
W -Gls-Integrity shgc-0.27 0%S (2)	30	0.300	26.4	792	32.1	0	964
W -Gls-Integrity shgc-0.27 0%S	7.5	0.300	26.4	198	32.1	0	241
N -Gls-Integrity shgc-0.27 100%S (2)	17.5	0.300	26.4	462	12.0	0	210
E -Gls-Integrity shgc-0.27 0%S	7.5	0.300	26.4	198	32.1	0	241
E -Gls-Integrity shgc-0.27 0%S (2)	30	0.300	26.4	792	32.1	0	964
S -Gls-Integrity shgc-0.27 0%S (2)	30	0.300	26.4	792	19.2	0	576
S -Gls-Integrity shgc-0.27 0%S	7.5	0.300	26.4	198	19.2	0	144
UP-Ceil-16B-50 35.5 X 28	994	0.020	1.8	1,749	1.2	0	1,153
Subtotals for Structure:				10,128		0	5,690
Infil.: Win.: 4.4, Sum.: 0.0	1,067		0.389	415	0.000	0	0
Ductwork:				0			0
AED Excursion:							16
People: 200 lat/per, 230 sen/per:	3					600	690
Room Totals:				10,543		600	6,396



### System 1 Room Load Summary

No	Room Name	Area SF	Htg Sens Btuh	Min Htg CFM	Run Duct Size	Run Duct Vel	Clg Sens Btuh	Clg Lat Btuh	Min Clg CFM	Act Sys CFM
---Zone 1---										
1	Basement	994	5,692	76	1-4	503	936	400	44	44
2	Main Level	994	27,872	373	4-5	642	7,472	0	350	350
3	Upper Level	994	10,543	141	3-6	509	6,396	600	300	300
Ventilation			6,386				1,669	1,163		
System 1 total		2,982	50,493	590			16,474	2,163	694	694

System 1 Main Trunk Size: 10x14 in.  
 Velocity: 713 ft./min  
 Loss per 100 ft.: 0.092 in.wg

### Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	1.55	88% / 12%	16,474	2,163	18,637

### Equipment Data

	Heating System	Cooling System
Type:	Natural Gas Furnace	Standard Air Conditioner
Model:		
Indoor Model:		
Brand:		
Efficiency:	0 AFUE	0 SEER
Sound:	0	0
Capacity:	0 Btuh	0 Btuh
Sensible Capacity:	n/a	0 Btuh
Latent Capacity:	n/a	0 Btuh