

*410 Rhett Butler  
HVAC Load Calculations*

for

Pendum Group LLC



**RHVAC** RESIDENTIAL  
HVAC LOADS

Prepared By:

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Palmetto Home Energy Audit Inc  
4759 Franchise Street  
North Charleston, SC 29418  
843-607-4442  
Thursday, October 10, 2019

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Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.



## Project Report

### General Project Information

Project Title: 410 Rhett Butler  
 Project Date: Thursday, October 10, 2019  
 Client Name: Pendium Group LLC  
 Company Name: Palmetto Home Energy Audit Inc  
 Company Representative: Cody Whittemore  
 Company Address: 4759 Franchise Street  
 Company City: North Charleston, SC 29418  
 Company Phone: 843-607-4442

### Design Data

Reference City: Charleston CO, South Carolina  
 Building Orientation: Front door faces North  
 Daily Temperature Range: Low  
 Latitude: 32 Degrees  
 Elevation: 3 ft.  
 Altitude Factor: 1.000

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	28	26.14	n/a	n/a	70	n/a
Summer:	92	78	54%	50%	75	58

### Check Figures

Total Building Supply CFM: 931      CFM Per Square ft.: 0.351  
 Square ft. of Room Area: 2,654      Square ft. Per Ton: 1,061  
 Volume (ft³): 23,890

### Building Loads

Total Heating Required Including Ventilation Air: 45,694 Btuh      45.694 MBH  
 Total Sensible Gain: 22,509 Btuh      80 %  
 Total Latent Gain: 5,631 Btuh      20 %  
 Total Cooling Required Including Ventilation Air: 28,140 Btuh      2.34 Tons (Based On Sensible + Latent)  
    2.50 Tons (Based On 75% Sensible Capacity)

### Notes

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 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.



## Load Preview Report

Scope	Net Ton	Rec 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	2.34	2.50	1,061	2,654	22,509	5,631	28,140	45,694	578	931	931	
System 1	2.34	2.50	1,061	2,654	22,509	5,631	28,140	45,694	578	931	931	14
Supply Duct Latent						1,043	1,043					
Return Duct					2,040	817	2,857	1,204				
Zone 1 - Clq.: 69%, Htg.: 77%				1,969	16,558	2,327	18,885	34,286	445	753	753	14
1-Entry				108	747	91	838	1,803	23	34	34	1--4
2-Stairs				102	229	0	229	243	3	10	10	0--0*
3-Office				135	1,075	159	1,234	2,891	38	49	49	1--4
4-Bathroom				85	155	64	219	885	12	7	7	1--4
5-Garage Entry				55	176	41	217	405	5	8	8	1--4
6-Laundry				80	798	183	981	2,396	31	36	36	1--4
7-Pantry				43	110	46	156	683	9	5	5	1--4
8-Kitchen & Dining				387	4,530	404	4,934	7,665	100	206	206	2--6
9-Family Room				367	2,191	218	2,409	4,202	55	100	100	1--6
10-Master Bedroom				304	4,243	755	4,998	6,695	87	193	193	2--6
11-Master Bathroom				122	1,180	229	1,409	3,829	50	54	54	1--4
12-Master Water Closet				46	187	35	222	540	7	9	9	1--4
13-Master WIC				135	936	102	1,038	2,050	27	43	43	1--4
Zone 2 - Clq.: 31%, Htg.: 23%				685	7,602	1,444	9,046	10,203	133	346	346	10
14-Loft				248	1,984	401	2,385	3,528	46	90	90	1--6
15-Bathroom				77	319	61	380	562	7	14	14	2--4
16-Bedroom 1				162	2,536	460	2,996	2,807	36	115	115	2--4
17-Closet				18	105	27	132	223	3	5	5	1--4
18-Bedroom 2				151	2,488	451	2,939	2,722	35	113	113	2--4
19-Closet				29	171	44	215	362	5	8	8	1--4
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
System 1												
<b>Supply Runouts</b>												
Zone 1												
1-Entry	Built-In	450	750	0.01	0.1		389.1		23	34	34	1--4
2-Stairs	Built-In	450	750	0.01	0.1		0		3	10	10	0--0
3-Office	Built-In	450	750	0.01	0.1		560.3		38	49	49	1--4
4-Bathroom	Built-In	450	750	0.01	0.1		80.7		12	7	7	1--4
5-Garage Entry	Built-In	450	750	0.01	0.1		91.7		5	8	8	1--4
6-Laundry	Built-In	450	750	0.01	0.1		415.8		31	36	36	1--4
7-Pantry	Built-In	450	750	0.01	0.1		57.3		9	5	5	1--4
8-Kitchen & Dining	Built-In	450	750	0.01	0.1		524.5		100	206	206	2--6
9-Family Room	Built-In	450	750	0.01	0.1		507.3		55	100	100	1--6
10-Master Bedroom	Built-In	450	750	0.01	0.1		491.2		87	193	193	2--6
11-Master Bathroom	Built-In	450	750	0.01	0.1		614.9		50	54	54	1--4
12-Master Water Closet	Built-In	450	750	0.01	0.1		97.6		7	9	9	1--4
13-Master WIC	Built-In	450	750	0.01	0.1		487.4		27	43	43	1--4
Zone 2												
14-Loft	Built-In	450	750	0.01	0.1		459.3		46	90	90	1--6
15-Bathroom	Built-In	450	750	0.01	0.1		83		7	14	14	2--4
16-Bedroom 1	Built-In	450	750	0.01	0.1		660.5		36	115	115	2--4
17-Closet	Built-In	450	750	0.01	0.1		54.7		3	5	5	1--4
18-Bedroom 2	Built-In	450	750	0.01	0.1		648.1		35	113	113	2--4
19-Closet	Built-In	450	750	0.01	0.1		89.1		5	8	8	1--4
<b>Other Ducts in System 1</b>												
Supply Main Trunk	Built-In	650	900	0.003	0.1		870.5		578	931	931	14

### Summary

System 1

Heating Flow: 578

Cooling Flow: 931



### System 1 Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
Pendium Group: Glazing-Pendium Group, u-value 0.5, SHGC 0.3	304.4	6,392	0	5,671	5,671
11D: Door-Wood - Solid Core	21	344	0	262	262
11P: Door-Metal - Polyurethane Core	21	0	0	104	104
12C-0bw: Wall-Frame, R-13 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs	2181.1	8,339	0	3,572	3,572
12C-0bw: Part-Frame, R-13 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs	104.2	0	0	113	113
16B-30: 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-30 insulation	2004.3	2,692	0	3,593	3,593
22A-ph: Floor-Slab on grade, No edge insulation, no insulation below floor, any floor cover, passive, heavy moist soil	192	10,950	0	0	0
Subtotals for structure:		28,717	0	13,315	13,315
People:	4		800	920	1,720
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		10,171	1,860	6,752	8,612
Infiltration: Winter CFM: 147, Summer CFM: 76		6,806	2,971	1,416	4,387
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
AED Excursion:		0	0	106	106
System 1 Load Totals:		45,694	5,631	22,509	28,140

#### Check Figures

Supply CFM:	931	CFM Per Square ft.:	0.351
Square ft. of Room Area:	2,654	Square ft. Per Ton:	1,061
Volume (ft³):	23,890		

#### System Loads

Total Heating Required Including Ventilation Air:	45,694 Btuh	45.694 MBH
Total Sensible Gain:	22,509 Btuh	80 %
Total Latent Gain:	5,631 Btuh	20 %
Total Cooling Required Including Ventilation Air:	28,140 Btuh	2.34 Tons (Based On Sensible + Latent)
		2.50 Tons (Based On 75% Sensible Capacity)

#### Notes

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

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
Pendium Group: Glazing-Pendium Group, u-value 0.5, SHGC 0.3	228.7	4,802	0	6,851	6,851
11D: Door-Wood - Solid Core	21	344	0	262	262
11P: Door-Metal - Polyurethane Core	21	0	0	104	104
12C-0bw: Wall-Frame, R-13 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs	1332.1	5,093	0	2,182	2,182
12C-0bw: Part-Frame, R-13 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs	104.2	0	0	113	113
16B-30: 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-30 insulation	1319.1	1,772	0	2,365	2,365
22A-ph: Floor-Slab on grade, No edge insulation, no insulation below floor, any floor cover, passive, heavy moist soil	192	10,950	0	0	0
Subtotals for structure:		22,961	0	11,877	11,877
People:	2		400	460	860
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		6,910	0	3,229	3,229
Infiltration: Winter CFM: 96, Summer CFM: 49		4,415	1,927	919	2,846
System 1, Zone 1 Load Totals:		34,286	2,327	16,558	18,885

**Check Figures**

Supply CFM:	753	CFM Per Square ft.:	0.382
Square ft. of Room Area:	1,969	Square ft. Per Ton:	1,172
Volume (ft³):	17,723		

**Zone Loads**

Total Heating Required:	34,286 Btuh	34.286 MBH
Total Sensible Gain:	16,558 Btuh	88 %
Total Latent Gain:	2,327 Btuh	12 %
Total Cooling Required:	18,885 Btuh	1.57 Tons (Based On Sensible + Latent)
		1.68 Tons (Based On 75% Sensible Capacity)

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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
Pendium Group: Glazing-Pendium Group, u-value 0.5, SHGC 0.3	75.7	1,590	0	2,511	2,511
12C-0bw: Wall-Frame, R-13 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs	849	3,246	0	1,390	1,390
16B-30: 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-30 insulation	685.2	920	0	1,228	1,228
Subtotals for structure:		5,756	0	5,129	5,129
People:	2		400	460	860
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		2,056	0	1,483	1,483
Infiltration: Winter CFM: 52, Summer CFM: 27		2,391	1,044	497	1,541
System 1, Zone 2 Load Totals:		10,203	1,444	7,602	9,046

**Check Figures**

Supply CFM:	346	CFM Per Square ft.:	0.504
Square ft. of Room Area:	685	Square ft. Per Ton:	835
Volume (ft³):	6,167		

**Zone Loads**

Total Heating Required:	10,203 Btuh	10.203 MBH
Total Sensible Gain:	7,602 Btuh	84 %
Total Latent Gain:	1,444 Btuh	16 %
Total Cooling Required:	9,046 Btuh	0.75 Tons (Based On Sensible + Latent)
		0.82 Tons (Based On 75% Sensible Capacity)

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### 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	Entry	108	1,803	23	1-4	389	747	91	34	34
2	Stairs	102	243	3	0-0	0	229	0	10	10
3	Office	135	2,891	38	1-4	560	1,075	159	49	49
4	Bathroom	85	885	12	1-4	81	155	64	7	7
5	Garage Entry	55	405	5	1-4	92	176	41	8	8
6	Laundry	80	2,396	31	1-4	416	798	183	36	36
7	Pantry	43	683	9	1-4	57	110	46	5	5
8	Kitchen & Dining	387	7,665	100	2-6	524	4,530	404	206	206
9	Family Room	367	4,202	55	1-6	507	2,191	218	100	100
10	Master Bedroom	304	6,695	87	2-6	491	4,243	755	193	193
11	Master Bathroom	122	3,829	50	1-4	615	1,180	229	54	54
12	Master Water Closet	46	540	7	1-4	98	187	35	9	9
13	Master WIC	135	2,050	27	1-4	487	936	102	43	43
Zone 1 subtotal		1,969	34,286	445			16,558	2,327	753	753
---Zone 2---										
14	Loft	248	3,528	46	1-6	459	1,984	401	90	90
15	Bathroom	77	562	7	2-4	83	319	61	14	14
16	Bedroom 1	162	2,807	36	2-4	660	2,536	460	115	115
17	Closet	18	223	3	1-4	55	105	27	5	5
18	Bedroom 2	151	2,722	35	2-4	648	2,488	451	113	113
19	Closet	29	362	5	1-4	89	171	44	8	8
Zone 2 subtotal		685	10,203	133			7,602	1,444	346	346
Duct Latent Return Duct			1,204				2,040	1,043 817		
System 1 total		2,654	45,694	578			22,509	5,631	931	931

System 1 Main Trunk Size: 14 in.  
Velocity: 870 ft./min  
Loss per 100 ft.: 0.110 in.wg

Note: Since the system is multizone, the Peak Fenestration Gain Procedure was used to determine glass sensible gains at the room and zone levels, so the sums of the zone sensible gains and airflows for cooling shown above are not intended to equal the totals at the system level. Room and zone sensible gains and cooling CFM values are for the hour in which the glass sensible gain for the zone is at its peak. Sensible gains at the system level are based on the "Average Load Procedure + Excursion" method.

#### Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	2.34	80% / 20%	22,509	5,631	28,140
Recommended:	2.50	75% / 25%	22,509	7,503	30,012

#### 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