

*True Life Church
HVAC Load Calculations*

for



RHVAC RESIDENTIAL
HVAC LOADS

Prepared By:

Wednesday, November 8, 2023



Project Report

General Project Information

Project Title: True Life Church
 Designed By: Richard Carter
 Project Date: Wednesday, November 8, 2023

Design Data

Reference City: Bogalusa, Louisiana
 Building Orientation: Front door faces East
 Daily Temperature Range: Medium
 Latitude: 30 Degrees
 Elevation: 119 ft.
 Altitude Factor: 0.996

	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:	102	77	33%	50%	75	35

Check Figures

Total Building Supply CFM:	6,176	CFM Per Square ft.:	0.710
Square ft. of Room Area:	8,700	Square ft. Per Ton:	271
Volume (ft ³):	145,800		

Building Loads

Total Heating Required Including Ventilation Air:	71,839 Btuh	71.839 MBH
Total Sensible Gain:	135,291 Btuh	58 %
Total Latent Gain:	96,211 Btuh	42 %
Total Cooling Required Including Ventilation Air:	231,502 Btuh	32.07 Tons (Based On 75% Sensible Capacity) (and Elev. Derating).

Notes

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.
 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 Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	28	26.14	80%	n/a	70	n/a
Summer:	102	77	33%	50%	75	35.31

System 2 Copy of system 1 Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	28	26.14	80%	n/a	70	n/a
Summer:	102	77	33%	50%	75	35.31

System 3 Copy of system 1 Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	28	26.14	80%	n/a	70	n/a
Summer:	102	77	33%	50%	75	35.31

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:	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:	0.280 AC/hr 680 CFM	0.150 AC/hr 365 CFM
Infiltration Actual:	0.280 AC/hr	0.150 AC/hr
Above Grade Volume:	X 145,800 Cu.ft. 40,824 Cu.ft./hr	X 145,800 Cu.ft. 21,870 Cu.ft./hr
	X 0.0167	X 0.0167
Total Building Infiltration:	680 CFM	365 CFM
Total Building Ventilation:	0 CFM	0 CFM

---System 1---

Infiltration & Ventilation Sensible Gain Multiplier:	29.57 = (1.10 X 0.996 X 27.00 Summer Temp. Difference)
Infiltration & Ventilation Latent Gain Multiplier:	23.91 = (0.68 X 0.996 X 35.31 Grains Difference)
Infiltration & Ventilation Sensible Loss Multiplier:	46.00 = (1.10 X 0.996 X 42.00 Winter Temp. Difference)
Winter Infiltration Specified:	0.280 AC/hr (197 CFM), Construction: Average
Summer Infiltration Specified:	0.150 AC/hr (105 CFM), Construction: Average

---System 2---

Infiltration & Ventilation Sensible Gain Multiplier:	29.57 = (1.10 X 0.996 X 27.00 Summer Temp. Difference)
Infiltration & Ventilation Latent Gain Multiplier:	23.91 = (0.68 X 0.996 X 35.31 Grains Difference)
Infiltration & Ventilation Sensible Loss Multiplier:	46.00 = (1.10 X 0.996 X 42.00 Winter Temp. Difference)
Winter Infiltration Specified:	0.280 AC/hr (433 CFM), Construction: Average
Summer Infiltration Specified:	0.150 AC/hr (232 CFM), Construction: Average

---System 3---

Infiltration & Ventilation Sensible Gain Multiplier:	29.57 = (1.10 X 0.996 X 27.00 Summer Temp. Difference)
Infiltration & Ventilation Latent Gain Multiplier:	23.91 = (0.68 X 0.996 X 35.31 Grains Difference)
Infiltration & Ventilation Sensible Loss Multiplier:	46.00 = (1.10 X 0.996 X 42.00 Winter Temp. Difference)
Winter Infiltration Specified:	0.280 AC/hr (50 CFM), Construction: Average
Summer Infiltration Specified:	0.150 AC/hr (27 CFM), Construction: Average

Duct Load Factor Scenarios for System 1



Miscellaneous Report (cont'd)

No.	Type	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD
1	Supply		Attic	16B	0.12	8	100	No

Duct Load Factor Scenarios for System 2

No.	Type	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD
1	Supply		Attic	16B	0.12	8	100	No

Duct Load Factor Scenarios for System 3

No.	Type	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD
1	Supply		Attic	16B	0.12	8	100	No



Load Preview Report

Scope	Rec Ton	ft. ² /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM
Building	32.07	271	8,700	135,291	96,211	231,502	71,839	937	6,176	6,176
System 1	4.75	492	2,340	28,520	14,261	42,781	25,017	326	1,302	1,302
Supply Duct Latent					144	144				
Zone 1 - Clg.: 93%, Htg.: 100%			1,500	26,616	12,517	39,133	25,017	326	1,215	1,215
1-Entry			1,500	26,616	12,517	39,133	25,017	326	1,215	1,215
Zone 2 - Clg.: 7%, Htg.: 0%			840	1,904	1,600	3,504	0	0	87	87
2-BathRooms			840	1,904	1,600	3,504	0	0	87	87
System 2 Copy of system 1	26.05	198	5,160	96,357	78,153	174,509	34,536	450	4,399	4,399
Supply Duct Latent					202	202				
Zone 1			5,160	96,357	77,951	174,308	34,536	450	4,399	4,399
3-Auditorium			3,960	86,689	74,260	160,949	23,467	306	3,957	3,957
4-Stage			1,200	9,667	3,691	13,358	11,069	144	441	441
System 3 Copy of system 1	1.27	948	1,200	10,414	3,797	14,211	12,286	160	475	475
Supply Duct Latent					152	152				
Zone 1			1,200	10,414	3,645	14,059	12,286	160	475	475
5-BehindStage			1,200	10,414	3,645	14,059	12,286	160	475	475
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-Entrv	Built-In	0	750	0.01	0.1		378.9		326	1,215	1,215	12--7	
Zone 2													
2-BathRooms	Built-In	0	750	0.01	0.1		442.6		0	87	87	1--6	
Other Ducts in System 1													
Supply Main Trunk	Built-In	0	900	0.003	0.1		868		326	1,302	1,302	12x18	
System 2													
Supply Runouts													
Zone 1													
3-Auditorium	Built-In	0	750	0.01	0.1		411.3		306	3,957	3,957	36--7	
4-Stage	Built-In	0	750	0.01	0.1		449.5		144	441	441	5--6	
Other Ducts in System 2													
Supply Main Trunk	Built-In	0	900	0.003	0.1		807.9		450	4,399	4,399	28x28	
System 3													
Supply Runouts													
Zone 1													
5-BehindStage	Built-In	0	750	0.01	0.1		484.3		160	475	475	5--6	
Other Ducts in System 3													
Supply Main Trunk	Built-In	0	900	0.003	0.1		691.5		160	475	475	9x11	

Summary

System 1	
Heating Flow:	326
Cooling Flow:	1302
System 2	
Heating Flow:	450
Cooling Flow:	4399
System 3	
Heating Flow:	160
Cooling Flow:	475



Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
11D: Door-Wood - Solid Core, U-value 0.39	80	1,310	0	1,186	1,186
12C-0sw: Wall-Frame, R-13 insulation in 2 x 4 stud cavity, no board insulation, siding finish, wood studs, U-value 0.091	1120	4,281	0	3,414	3,414
16B-13: 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-13 insulation, U-value 0.07	3900	11,466	0	16,926	16,926
22A-ph: Floor-Slab on grade, No edge insulation, no insulation below floor, any floor cover, passive, heavy moist soil, U-value 1.358	320	18,251	0	0	0
Subtotals for structure:		35,308	0	21,526	21,526
People:	435		87,000	100,050	187,050
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		5,232	498	2,936	3,434
Infiltration: Winter CFM: 680, Summer CFM: 365		31,299	8,713	10,779	19,492
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		71,839	96,211	135,291	231,502

Check Figures

Total Building Supply CFM:	6,176	CFM Per Square ft.:	0.710
Square ft. of Room Area:	8,700	Square ft. Per Ton:	271
Volume (ft ³):	145,800		

Building Loads

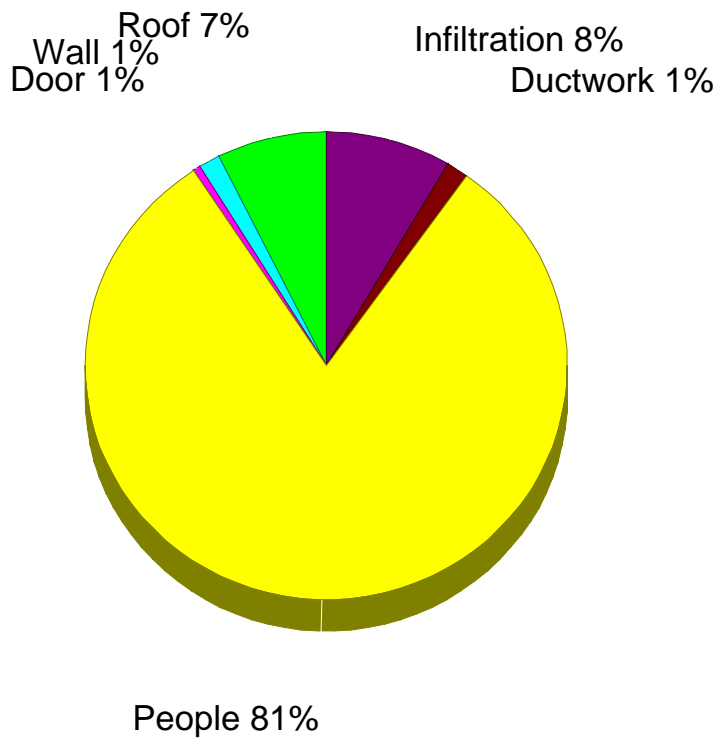
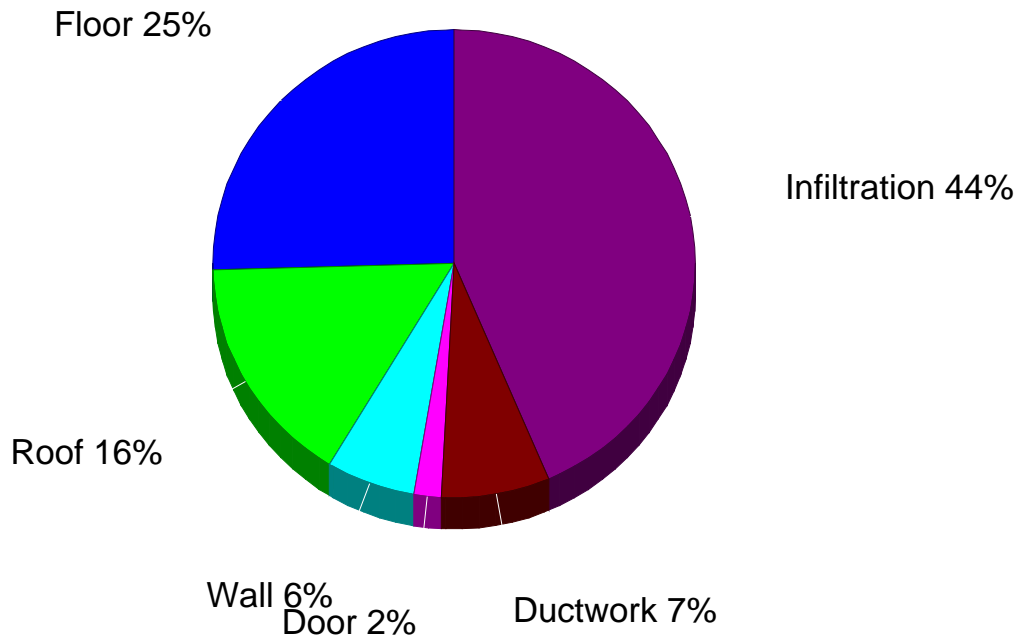
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Total Cooling Required Including Ventilation Air:	231,502 Btuh	32.07 Tons (Based On 75% Sensible Capacity) (and Elev. Derating).

Notes

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Building Pie Chart





Detailed Room Loads - Room 1 - Entry (Peak Fenestration Gain Procedure)

General

Room is in zone 1, which peaks at 7 pm

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	60.0 ft.	System Number:	1
Room Width:	25.0 ft.	Zone Number:	1
Area:	1,500.0 sq.ft.	Supply Air:	1,215 CFM
Ceiling Height:	18.0 ft.	Supply Air Changes:	2.7 AC/hr
Volume:	27,000 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	12	Actual Winter Vent.:	0 CFM
Runout Air:	101 CFM	Percent of Supply.:	0 %
Runout Duct Size:	7 in.	Actual Summer Vent.:	0 CFM
Runout Air Velocity:	379 ft./min.	Percent of Supply:	0 %
Runout Air Velocity:	379 ft./min.	Actual Winter Infil.:	197 CFM
Actual Loss:	0.075 in.wg./100 ft.	Actual Summer Infil.:	105 CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
E -Wall-12C-0sw 60 X 20	1120	0.091	3.8	4,281	3.0	0	3,414
E -Door-11D 8 X 10	80	0.390	16.4	1,310	14.8	0	1,186
UP-Ceil-16B-13 60 X 25	1500	0.070	2.9	4,410	4.3	0	6,510
Floor-22A-ph 75 ft..Per.	75	1.358	57.0	4,278	0.0	0	0
Subtotals for Structure:				14,279		0	11,110
Infil.: Win.: 196.6, Sum.: 105.3	1,200		7.535	9,042	2.595	2,517	3,114
Ductwork:				1,696			892
People: 200 lat/per, 230 sen/per:	50					10,000	11,500
Room Totals:				25,017		12,517	26,616



Detailed Room Loads - Room 2 - BathRooms (Peak Fenestration Gain Procedure)

General

Room is in zone 2, which peaks at 7 pm

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	60.0 ft.	System Number:	1
Room Width:	14.0 ft.	Zone Number:	2
Area:	840.0 sq.ft.	Supply Air:	87 CFM
Ceiling Height:	18.0 ft.	Supply Air Changes:	0.3 AC/hr
Volume:	15,120 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	1	Actual Winter Vent.:	0 CFM
Runout Air:	87 CFM	Percent of Supply.:	0 %
Runout Duct Size:	6 in.	Actual Summer Vent.:	0 CFM
Runout Air Velocity:	443 ft./min.	Percent of Supply:	0 %
Runout Air Velocity:	443 ft./min.	Actual Winter Infil.:	0 CFM
Actual Loss:	0.126 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
Subtotals for Structure:				0		0	0
Infil.: Win.: 0.0, Sum.: 0.0	0		0	0	0	0	0
Ductwork:				0			64
People: 200 lat/per, 230 sen/per:	8					1,600	1,840
Room Totals:				0		1,600	1,904



Detailed Room Loads - Room 3 - Auditorium (Average Load Procedure)

General

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	60.0 ft.	System Number:	2
Room Width:	66.0 ft.	Zone Number:	1
Area:	3,960.0 sq.ft.	Supply Air:	3,957 CFM
Ceiling Height:	18.0 ft.	Supply Air Changes:	3.3 AC/hr
Volume:	71,280 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	36	Actual Winter Vent.:	0 CFM
Runout Air:	110 CFM	Percent of Supply.:	0 %
Runout Duct Size:	7 in.	Actual Summer Vent.:	0 CFM
Runout Air Velocity:	411 ft./min.	Percent of Supply:	0 %
Runout Air Velocity:	411 ft./min.	Actual Winter Infil.:	333 CFM
Actual Loss:	0.088 in.wg./100 ft.	Actual Summer Infil.:	178 CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
Floor-22A-ph 120 ft..Per.	120	1.358	57.0	6,844	0.0	0	0
Subtotals for Structure:				6,844		0	0
Infil.: Win.: 332.6, Sum.: 178.2	0		0	15,302	0	4,260	5,270
Ductwork:				1,321			919
People: 200 lat/per, 230 sen/per:	350					70,000	80,500
Room Totals:				23,467		74,260	86,689



Detailed Room Loads - Room 4 - Stage (Average Load Procedure)

General

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	60.0 ft.	System Number:	2
Room Width:	20.0 ft.	Zone Number:	1
Area:	1,200.0 sq.ft.	Supply Air:	441 CFM
Ceiling Height:	18.0 ft.	Supply Air Changes:	1.2 AC/hr
Volume:	21,600 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	5	Actual Winter Vent.:	0 CFM
Runout Air:	88 CFM	Percent of Supply.:	0 %
Runout Duct Size:	6 in.	Actual Summer Vent.:	0 CFM
Runout Air Velocity:	450 ft./min.	Percent of Supply:	0 %
Runout Air Velocity:	450 ft./min.	Actual Winter Infil.:	101 CFM
Actual Loss:	0.130 in.wg./100 ft.	Actual Summer Infil.:	54 CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
UP-Ceil-16B-13 60 X 20	1200	0.070	2.9	3,528	4.3	0	5,208
Floor-22A-ph 40 ft..Per.	40	1.358	57.0	2,281	0.0	0	0
Subtotals for Structure:				5,809		0	5,208
Infil.: Win.: 100.8, Sum.: 54.0	0		0	4,637	0	1,291	1,597
Ductwork:				623			102
People: 200 lat/per, 230 sen/per:	12					2,400	2,760
Room Totals:				11,069		3,691	9,667



Detailed Room Loads - Room 5 - BehindStage (Average Load Procedure)

General

Calculation Mode:	Htg. & clg.	Occurrences:	1
Room Length:	60.0 ft.	System Number:	3
Room Width:	20.0 ft.	Zone Number:	1
Area:	1,200.0 sq.ft.	Supply Air:	475 CFM
Ceiling Height:	9.0 ft.	Supply Air Changes:	2.6 AC/hr
Volume:	10,800 cu.ft.	Req. Vent. Clg:	0 CFM
Number of Registers:	5	Actual Winter Vent.:	0 CFM
Runout Air:	95 CFM	Percent of Supply.:	0 %
Runout Duct Size:	6 in.	Actual Summer Vent.:	0 CFM
Runout Air Velocity:	484 ft./min.	Percent of Supply:	0 %
Runout Air Velocity:	484 ft./min.	Actual Winter Infil.:	50 CFM
Actual Loss:	0.150 in.wg./100 ft.	Actual Summer Infil.:	27 CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
UP-Ceil-16B-13 60 X 20	1200	0.070	2.9	3,528	4.3	0	5,208
Floor-22A-ph 85 ft..Per.	85	1.358	57.0	4,848	0.0	0	0
Subtotals for Structure:				8,376		0	5,208
Infil.: Win.: 50.4, Sum.: 27.0	0		0	2,318	0	645	798
Ductwork:				1,592			958
People: 200 lat/per, 230 sen/per:	15					3,000	3,450
Room Totals:				12,286		3,645	10,414



System 1 Room Load Summary

Room 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	1,500	25,017	326	12-7	379	26,616	12,517	1,215	1,215
Zone 1 subtotal		1,500	25,017	326			26,616	12,517	1,215	1,215
---Zone 2---										
2	BathRooms	840	0	0	1-6	443	1,904	1,600	87	87
Zone 2 subtotal		840	0	0			1,904	1,600	87	87
Duct Latent								144		
System 1 total		2,340	25,017	326			28,520	14,261	1,302	1,302

System 1 Main Trunk Size: 12x18 in.
 Velocity: 868 ft./min
 Loss per 100 ft.: 0.105 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
Recommended:	4.75	75% / 25%	42,784	14,261	57,045

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



System 2 Room Load Summary

Room 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---										
3	Auditorium	3,960	23,467	306	36-7	411	86,689	74,260	3,957	3,957
4	Stage	1,200	11,069	144	5-6	450	9,667	3,691	441	441
Duct Latent								202		
System 2 total		5,160	34,536	450			96,357	78,153	4,399	4,399

System 2 Main Trunk Size: 28x28 in.
 Velocity: 808 ft./min
 Loss per 100 ft.: 0.039 in.wg

Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Recommended:	26.05	75% / 25%	234,458	78,153	312,611

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



System 3 Room Load Summary

Room 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---										
5	BehindStage	1,200	12,286	160	5-6	484	10,414	3,645	475	475
	Duct Latent							152		
	System 3 total	1,200	12,286	160			10,414	3,797	475	475

System 3 Main Trunk Size: 9x11 in.
 Velocity: 691 ft./min
 Loss per 100 ft.: 0.109 in.wg

Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Recommended:	1.27	75% / 25%	11,392	3,797	15,189

Equipment Data

	<u>Heating System</u>	<u>Cooling System</u>
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