Energy Audit



St. Andrews Episcopal Church 354 Main Street Hopkinton, NH

April 13, 2021





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Introduction

The purpose of an energy audit is to identify energy saving measures (ESM) in a building. Computer simulated energy models are developed to estimate energy consumption based on the local climate conditions, physical dimensions and characteristics of a building, mechanical systems, presumed lighting, equipment, and occupancy patterns, in addition to a number of other variables.

With the building modeled in existing conditions, energy savings can be estimated for improvements to the thermal envelope and/or more efficient mechanical systems. The cost of those measures can then be analyzed in terms of predicted energy saved and savings potential from converting to different sources of energy. The primary objective is to evaluate the level of investment warranted by energy and dollars saved from those specific measures.

In this case, the audit has been partially paid for by a grant from the Episcopal Diocese of New Hampshire. In keeping with the intent of the diocese, a reduction of raw energy consumption and carbon emissions has also been analyzed to address the pursuit ecological sustainability and addressing the climate crisis.

This audit has been prepared with the best of intentions to assist the Building & Grounds Ministry and other parishioners make informed decisions regarding energy saving improvements in keeping with their long term goals for the Church property. We do not make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed.

Executive Summary

The primary focus of this study has been to explore opportunities to upgrade the thermal envelope—that is the barrier between inside conditioned space and the climate outside. In most buildings in cold climates, the more effective the envelope, the less energy needed to achieve comfort inside. Effective thermal envelopes are tight (limiting air leakage), with effective levels of insulation installed in contact with an air barrier on all sides. Critical to managing heat transfer or flow, is effectively managing moisture. Buildings don't need to breathe, but material assemblies do need to be able to dry out if they get wet!

From a thermodynamic and construction perspective, St. Andrews Church can be thought of as four distinct buildings, served by seven distinct heating systems. All areas can be significantly improved by upgrading insulation levels in the ceiling or the walls, but in this case, instead of addressing each envelope component type as distinct, the building areas have been analyzed as somewhat separate sections.

A financial summary of the recommended ESM is on the next page with a summary of energy savings on page five. The ESM are described as four 'packages', each package addressing a distinct building section or area. It may be more cost effective for an insulation contractor to complete all ESM as one project, but each package has been developed to be able to do phase the improvements over time if necessary. Prioritizing which comes first can be based on predicted savings, available resources, or logistical parameters around occupied spaces or other work in progress. In this case, both the overall impact on savings and the ongoing work on the Sanctuary ceiling makes the Sanctuary the best place to start!

The propane fired furnaces are relatively new and efficient, so replacement options have not been explored, other than referencing the advantage of converting to electric heat pumps at some time in the future. Reducing heating loads through improvements to the envelope benefits both short and long term goals.



Summary of Recommended Energy Saving Measures

The ESM below are presented as packages per area to optimize energy and dollar savings for both heating. Savings for cooling has not been included due to not knowing which windows the units are installed. The ESM are described in greater detail within each "Areas" section of this report.

In short, investing a total of an estimated \$44,390, would result in an estimated annual dollar savings of \$5,061 at the \$1.95 per gallon price for propane. This also translates to a simple payback of 8.8 years. Since envelope measures typically have a service life of (at least) 25 years, the investment gain over that time period would be \$82,135 at current energy prices, and yield a 4.3% annual return on investment (RO1).

If the improvements were phased over time, it is recommended to complete the ESM for a building area, instead of, for example, improving all ceilings throughout the complex. That is why line item savings are not included: they are proposed as individual packages.

	Sq Ft SA or	Estimated	Estimated Annual	Simple Payback	Invest -	DOI	Annual
Area or Zone	Description	ESM Cost	Savings	Years	ment Gain	ROI	ROI
Great Hall	2 double doors and						
Air Sealing	2 double doors and spot sealing	\$425					
Foundation	300	\$2,950					
Ceiling Slopes	492	\$3,198					
0 1		\$6,573	\$699	7.3	\$10,902	165.9%	4.0%
2002 Upper Floor							
Ceiling	1982	\$9,117					
Thermodome	Purchased or constructed 10 windows	\$350					
Weather stripping	and one door	\$400					
		\$9,8 67	\$549	18.0	\$3,858	39.1%	1.3%
1990 Connector							
Ceiling	1305	\$5,155					
Weather-Strip	2 doors	\$125					
		\$5,2 80	\$372	14.2	\$35,220	667.1%	8.5%
Sanctuary							
Ceiling	2508	\$6,643					
Crawl Space Floor	2000	\$3,500					
Foundation Walls	328	\$1,312					
Walls	3298	\$11,215					
		\$22,67 0	\$3,441	6.6	\$63,355	279.5%	5.5%
All Four Areas	Totals	\$44,390	\$5,061	8.8	\$82,135	185%	4.3%



#	Sanctuary Envelope ESM	Cost of Measure	Dollars Saved	Simple Payback Years	Life of Measure	Invest ment Gain	ROI	Annual
1	Ceiling	\$6,643	\$95	69.9	25	-\$4,268	-64.3%	-4.0%
2	Basement	\$4,812	\$328	14.7	25	\$3,388	70.4%	2.2%
3	Walls	\$11,215	\$2,141	5.2	25	\$42,310	377.3%	6.5%
1-3	All three	\$22,670	\$3,441	6.6	25	\$64,067	291.8%	5.6%

The Sanctuary Package

Estimated savings from each measure is offered for the Sanctuary, in part because it has its own propane tank, and therefore there is greater confidence from comparing actual to modeled savings. But as with the other 'packages' the whole is indeed greater than the sum of its parts. In other words, the more comprehensive the improvements to the thermal envelope, the better the results so it is recommended to complete all three measures in order to yield the optimal benefits.

Energy Savings

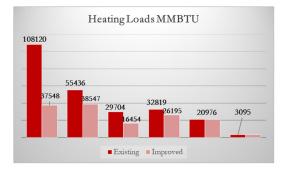
The chart below reflects the estimated reductions in energy and greenhouse gas emissions (CO2 only) from each completed ESM package.

Area	Annual Reduction LP Gallons	Site Energy Saved	Source Energy Saved	GHG Reduction Tons
Great Hall	358	32.7	36.0	2.4
2002 Wing Upper Floor	282	25.7	28.3	1.9
1990 Connector	191	17.4	19.2	1.3
Sanctuary	1765	161.1	177.2	12.0
	2595	237.0	260.7	17.6

Heating Load Reductions

The other consequence of improving the thermal envelope is the overall reduction in 'peak heating load'. In this case, because of the frequency of unoccupied hours, the peak heating load reflects the BTUS needed to maintain 55 degrees indoors when the outdoor temperature is -2 degrees. In other words a delta T of 57 degrees which is lower than what should be used for any calculation for sizing new equipment. The relative reductions would be similar with a 67 degree delta T. Load calculation software reports are included at the end of this document.

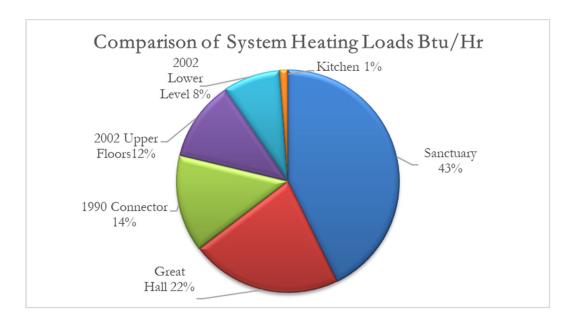
Area	Existing	Improved
Sanctuary	108,120	37,548
Great Hall	55,436	38,547
2002 Upper Floor	29,704	16,454
1990 Connector	32,819	26,195
2002 Lower Floor	20,976	20,976
Kitchen	3,095	3,095
Total Building	250,150	142,815

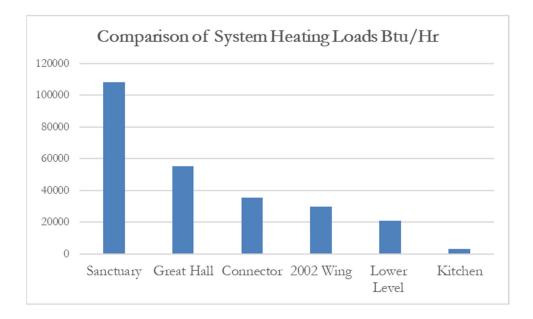




More Load Charts and Graphs

The information below is offered as a visual way to think about prioritizing improvement packages.







Historic Energy Use Analysis

The energy analysis below is based on the fuel data for 2019, at an average price of \$1.97 per gallon and three year average electric data, 2018-2020.

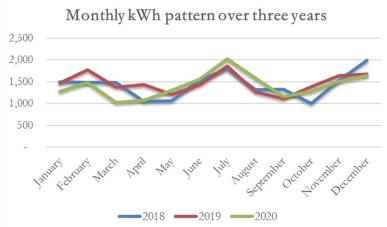
Energy	Units	Site Btus	Source Btus	\$Cost	Tons CO2
Electric kWh	17,259	58,887,708	196,079,499	\$3,405	24.3
Church Propane	2,862	261,300,600	287,430,660	\$5,686	17.7
Parish Propane	3,125	285,312,500	313,843,750	\$6,107	19.4
Totals		605,500,808	797,353,909	\$15,198	21.2
EUI KBtu/FT2	13257	45.7	60.1	\$1.15	82.6

The Energy Utilization Index (EUI) offers a simple snapshot analysis of a building's energy use by looking at total amount of energy input (converted to Btu's) divided by the floor area of conditioned space. "Site Energy" refers to units of energy delivered to a site. Source energy includes electric transmission losses and some allowance for off site generation and other considerations. Since the per unit cost for energy varies greatly over time, converting all forms of energy to Btus can be a more accurate way of looking at a building's energy demands and potential reductions from energy saving measures.

Based on the information provided, the Site EUI for the entire facility is 45.7 thousand Btus per square foot (KBtu/Ft2) and Source EUI is 60.1 KBtu/Ft2. Based on current prices, the cost per square foot is \$1.15. Greenhouse Gas emissions (CO2 only) for Source energy input is 82.6 tons per year.

	Floor Area	Site KBtu/FT2	Source KBtu/Ft2
Sanctuary Heating	2508	104.2	114.6

The EUI for the whole facility—estimated at 13,257 Ft2—is not excessively high when compared to other NH buildings of these construction eras. Heating alone for the Sanctuary is 104.2 KBtu, which is considerably higher.



The monthly electric usage shows a remarkably similar pattern over three years, including 2020 when the buildings were mostly unoccupied. The winter peaks could be due to air handlers while the summer peaks are likely due to air conditioning and dehumidification.



Building Electric Loads

A variety of electric devices serve important building functions: exhaust the kitchen hood, dehumidify the basement, heat water for handwashing, and pump

water from the sump. Window air conditioning units for space cooling range in efficiency but all found to be less than EER 9.5. Summer peak loads are estimated to cost about \$600 (including demand charges). Before replacing older window units, exploring installing ductless air source heat pumps to provide more efficient summer cooling and supplemental winter heating is advised following envelope improvements. An additional analysis can be provided at that time, and when occupancy patterns return to 'normal.'







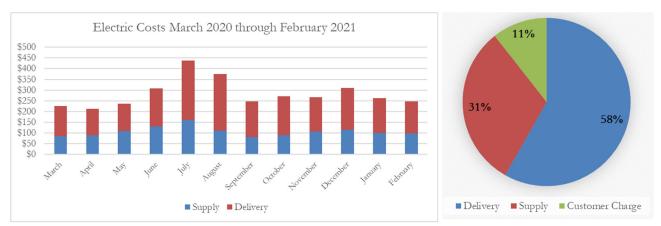
MFGD. FOR S	SEARS, ROEBUCK & COMPANY
3333 BEVERLY	Y RD. HOFFMAN ESTATES, IL 60179
MODEL 2537810	06890 SERIAL JK80734363
COOLING BTU/HR 100 COOLING AMPS 10.5 COOLING WATTS 111 COOLING EER DOE 9	10 c(VL)
DESIGN PRESSURE PSI	VALUES DETERMINED AT (AHAM RAC-1) CONDITIONS ULISTED
400 HIGH 150 LOW	MOTOR-COMPRESSOR THERMALLY PROTECTED 217G





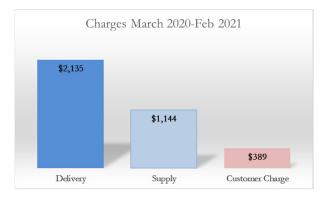
AC units range in age from 6 to 14 years.



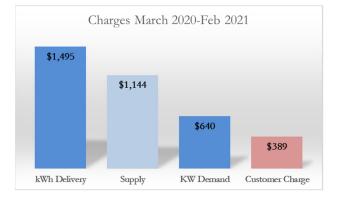


Electric Costs

Electric bills can be very confusing to decipher. As we move towards renewable energy and a greater reliance on the electric grid for more of our energy needs, it can be helpful to think in terms of separating the cost to generate electric energy and the costs to deliver it to our buildings. This is especially relevant if the Church considers installing a PV Solar Array for on site electric generation. For example, even if the Church were able to generate 75% of its annual electric usage, the dollar value would be equal to the cost of supply (about 7.5 cents per kWh) and a portion of the delivery cost, because you'd still be relying on administration, transmission lines and all the associated costs.



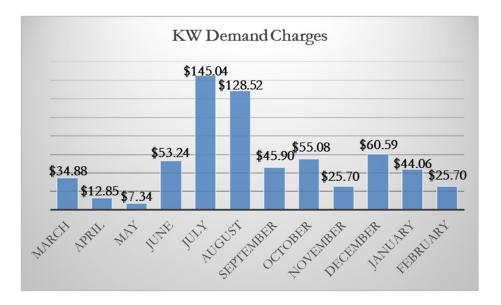
Breaking down delivery charges one more step, KW Demand has less to do with the kWh used and more about the time they were used: ie to compensate for the times when the grid has the highest demand for power; and to encourage customers to manage their demand reward strategies for demand side management.





Demand Charges

Energy efficiency measures can reduce the amount of electricity consumed, but may or may not impact the peak demand in any given month. That is, the hours each month which reflects the peak consumption. Since the electric grid must be able to provide enough supply to satisfy total demand at any given time (in order to prevent brown outs), non residential consumers are charged for their KW Peak Demand for each month.



From March 2020 through February 2021, the total charge for KW Demand was \$640; \$274 (43%) of which occurred in July and August. If understood correctly, the building was largely unoccupied in July and August 2020, so the spike in both kWh consumption and KW demand - which has happened for at least three years—is as likely due to window air conditioning units and / or dehumidification.

Installing a VB on the crawl space floor under the Great Hall may reduce humidity levels enough to put the dehumidifiers on a timer so they operate at low demand times, such as early morning or at night.



Heating Energy Cost Comparisons per million BTU (MMBTU)

The chart below was pasted from an on-line interactive calculator, where fuel prices and system efficiencies are inputs to determine the 1) Fuel (or energy) Price per millions Btus and the 2) Fuel (or energy) Cost per million Btus based on the system efficiency of the system used.

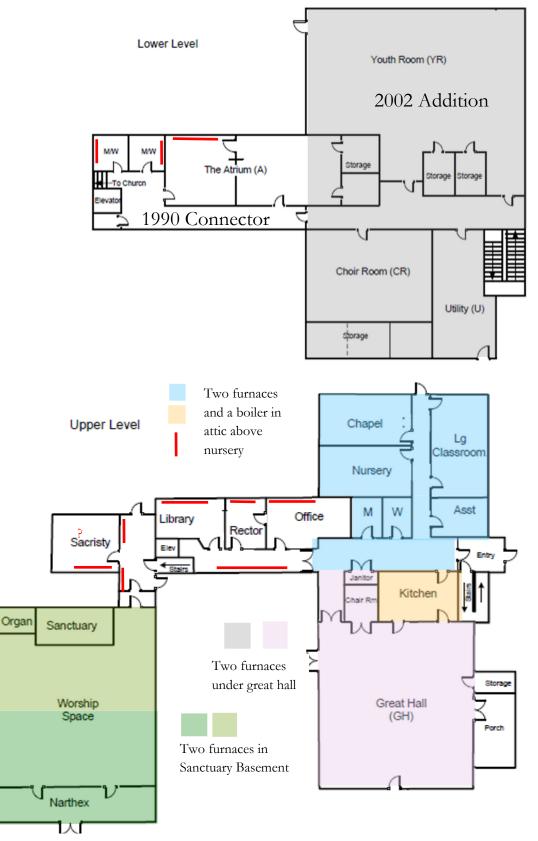
At current prices, note that the cost of heating with propane, via a high efficiency condensing unit, is \$22.48 per MMBTU and competitive with electric air source heat pumps (ASHP), though higher than heating with ground source heat pumps (AKA GSHP or Geothermal).

If the price of propane rises to \$2.95 per gallon, the cost per MMBTU would then be \$34.01. At that time, converting to ASHP would be a cost effective options. The other reason to convert to the highly efficient cold climate heat pumps is to transition off fossil fuels and offset electric usage with on site PV generation. Understanding, of course, that heating is needed mostly from November through April, where as solar PV in this region generates most of the electricity from April through October.

Space heating is currently requiring 546.6 MMBTU. Following all recommended measures, the heating load would be reduced an estimated 237 MMBTU to 310 MMTBU. Reducing demand or load is always a first step before replacing supply equipment.

Fuel Type	Fuel Unit	Fuel Price Per Unit (dollars)	Fuel Heat Content Per Unit (Btu)	Fuel Price Per Million Btu (dollars)	Heating Appliance Type	Type of Effi- ciency Rating	Approx. Efficiency (%)	Fuel Cost Per Million Btu (dollars)
Propane	gallons	\$1.95	91,300	\$21.36	HE Condensing Boiler	AFUE	95%	\$22.48
Pellets	Ton	\$255	16,500,000	\$15.45	Space Heater	EPA	78%	\$19.81
								-
Electricity	kWh	0.185	3,412	\$54.22	Space Heater	COP 1	99.9%	\$54.27
				domestic Hot water	Electric Resistance Water Heater	Energy Factor (EF)	0.90	\$60.24
				domestic Hot water	Hot Water Heat Pump - in uncondi- tioned space	EF (varies)	2.30	\$23.57
				domestic Hot water	Hot Water Heat Pump - in conditioned space	EF (up to)	3.70	\$14.65
				Space heating	VRF ASHP	COP 2.3	230%	\$23.57
				Space	GSHP (aka geothermal)	COP 3.8	400%	\$13.56



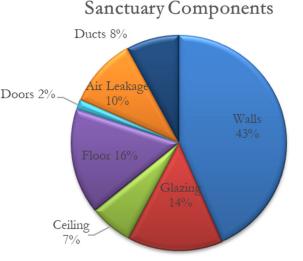




The Sanctuary

The thermal envelope of a building can be described in terms of the materials in each component: ie, foundation (or floor), walls, ceilings, windows, doors, and air leakage through all the cracks and gaps in the Doors 2% transitions between materials and components.

Based on this study, the conductive and convective heat loss through each envelope component is presented in the pie chart in terms of 'relative responsibility'. In the case of the Sanctuary, the uninsulated walls are believed to account for 43% of the building's heat loss or load. This analysis helps inform and priorize the four recommended energy saving measures.



There has already been discussion around replacing (and adding) the insulation above the ceiling as part of the plaster repairs. The relatively low percentage of heat loss through the ceiling is due to the uninsulated foundation and large surface area of uninsulated stone walls. The recommendation is to improve all three components, which will also result in reducing air leakage and distribution losses from ducts. The exterior storm windows offer some improved thermal performance while also protecting the lovely stained glass, so no additional measures are recommended.

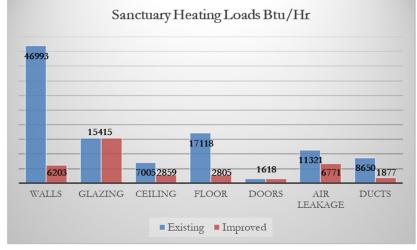
The advantage of spraying a one inch skim coat of closed cell foam over the attic floor is to provide a vapor retarder as well as some structure support for the weight of 18" cellulose or15" blown in mineral wool. The reason to consider mineral wool is that it would be an appropriate insulation to blow into the walls and curved ceiling from the attic above. Install netting over the arched structure at the top of the stairs and fill the cavity with insulation. Lastly, install a constructed or purchased thermodome over the top of the stairs and seal perimeter with weatherstripping.

Photos and a description of insulating the foundation walls are included on pages 19 and 20.

The chart to the right presents the resulting reductions in peak hourly heat loss following the recommended ESM. The totals for each condition:

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Existing conditions: 108,120 Btu/Hr
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Improved: 37,548 The 66% load reduction is largely due to insulating the walls.

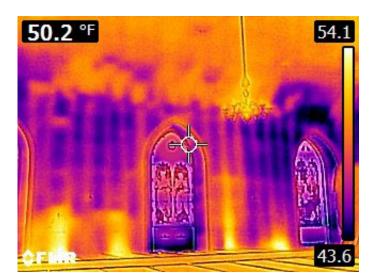




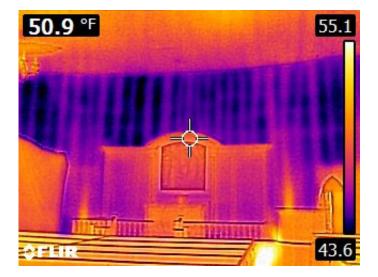
The Sanctuary

Thermographic (aka Infra Red or IR) images depict differences in surface temperatures. The darker the color, the cooler the surface temperature. So dark colors on inside surfaces, when taken on a cold day, usually indicates more rapid heat loss through the materials which make up that part of the building's shell or envelope. There are caveats: the emissivity of a reflective material, for example, such as glass or metal, may not show accurately.





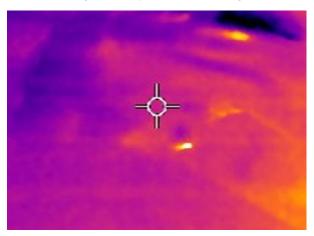






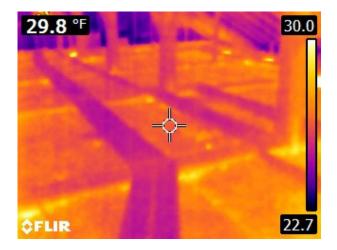
The Sanctuary—Ceiling

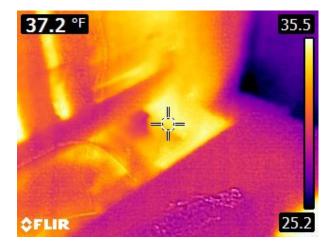
Standing in the attic looking at the floor, these bright colors indicate comparatively warmer surface temperatures as heat from below moves more rapidly along framing or penetrations or uninsulated cavities such as where the framing curves down to the wall. Attic was too dark for digital images, but its still fairly clear what we're looking at just by virtue of heat signatures. Clarke's photos are included on the next page, with gratitude.

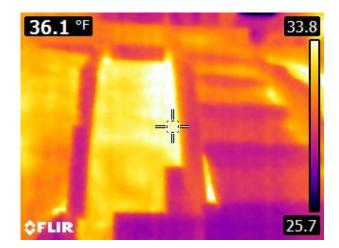
















Photos courtesy of Clarke



Upgrading the Sanctuary Ceiling Insulation-from an email prior to the site visit

Option A: From an energy cost/savings analysis, the energy savings from

simply blowing in more cellulose on top of what is there - possibly down the curved slopes as well - would be more easily justified from a dollar savings alone.

In other words, there should be energy savings but only enough for a 'reasonable payback' based on the relatively low cost of just blowing in more on top.

How much weight can be supported for additional cellulose is an unknown.

People often use much lighter blown in fiberglass (we in the building science community call it "white fluffy stuff" -

its lighter, so less risk, but its less dense, so poorer performance as it allows air movement. I have yet to ever recommend it

Option B: From a best practices perspective, my suggestion would have been / will be to:

1. remove / vaccum all the existing material (cellulose, foil faced paper and whatever other stuff is lying around)

2. Remove all knob and tube wiring - assuring there are no 'phantom loads' from the old wiring (which can still work, but is only safe when surrounded by air

3. Inspect all framing, wiring, etc - because you can!

4. Spray a 1-1.5" skim coat of closed cell foam onto the back of the lathe

5. Blow in 15" cellulose in an even layer - ideally, you would be covering all framing, though maintaining at least some sort of 'cat walk' is a good idea

6. You could also be sure that the cellulose would only have borates in it for fire/rodent retarding properties - not aluminum sulfates which was/ is cheaper and yet can cause corrosion of wiring. used less widely now, but still worth checking

The cost of that approach would likely not be justifiable from - energy savings alone. It is considered best practices - for the long term - because

a) you have removed all contaminated material, especially from rodents/bats etc

b) starting with a clean and know to be safe substrate - including wiring

c) the closed cell foam establishes an effective air barrier and class 1 vapor retarder, and additional R6 thermal barrier, while also providing some structural strength to support the weight of the cellulose

Option C: A third option would be to use blown in rock or mineral wool instead of cellulose - Rock wool has slightly higher Rvalue but more importantly, better fire retarding properties and is less inviting to rodents. It is also slightly heavier though 'should' still be okay over the foam substrate. Perhaps the plasterer will - at that time - be able to offer an opinion of the strength/condition of the lathe and new plaster layer.

Considerations

1. The energy saving impact from going from R20to R50 is relatively small. An effective R50 with no thermal bridging is minimum for a 21st century ceiling plane - but there is a law of diminishing returns from a dollar cost perspective

2. Closed cell foam has a relatively high GWP (global warming potential) and embodied energy; a two part chemical which off gasses (quickly) toxic materials, and is flammable. Its use is only suggested when its the 'best' product for the situation and in as limited a quantity as possible. Ie - its a very effective option for this type of ceiling skim coat and for below grade rock wall foundations.

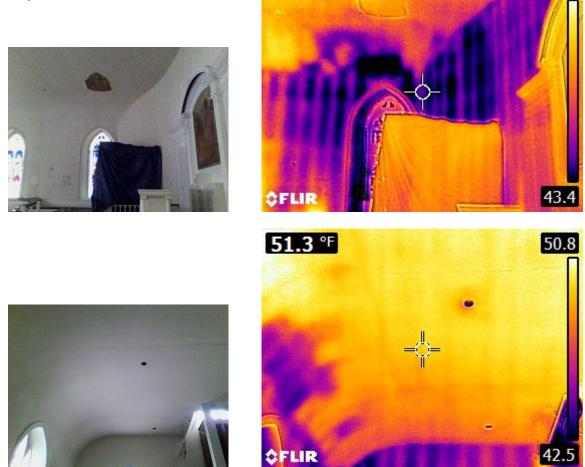
In sum, if you can accept the considerations, Option B or C remains 'best practices' but will be more expensive and beyond an impressive financial return on investment.

46.9 °F



52.4

The Sanctuary—Walls



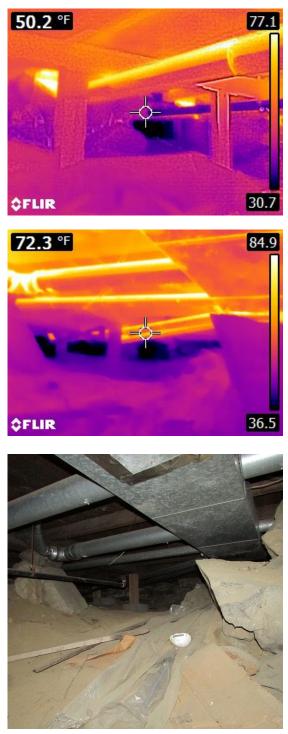
With all the discussion about improving the insulation above the ceiling—which is recommended as part of the plaster refurbishment—the uninsulated walls are a source of significant losses! People tend to say "heat rises", but in fact, warm air rises due to it being less dense or lighter than cold air and the process of convection. But heat moves to cold, via conduction, in any direction. In other words, an effective air and insulation barrier at the ceiling is important to slow heat loss by both conduction and convection, but insulating the walls effectively can be equally important.

Mineral—or rock—wool is recommended for the walls because it is resistant to moisture which may form as condensation on the cold stone. Like cellulose, the insulation is vapor open which means it would allow drying to the interior through the plaster walls.



The Sanctuary-Floor / Basement





Most of the Sanctuary is over narrow crawlspace and dirt floor. Served by two high efficiency condensing furnaces, the duct work is neither air sealed nor insulated. This is actually somewhat helpful in that the have helped keep the basement warm and dry. But note that the warmer floor above is also heating the crawlspace and basement.



The Sanctuary-Floor / Basement





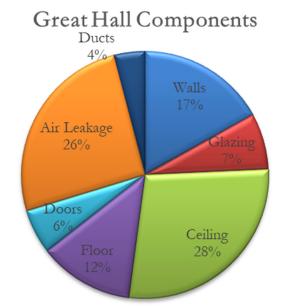
The recommendation is to lay (admittedly with some difficulty) a 10 ml vapor barrier (commercial grade Stego Wrap or similar) over the entire dirt floor, tape sealing it to piers, other penetrations, and exterior foundations walls. Then spraying 2" inches closed cell foam on the foundation walls up to the sills. The purpose of this is to effect both an air and vapor barrier at the floor and walls to prevent migration of moisture and other soil gasses. Mastic sealing all rigid duct work is also advised, though insulation is less necessary within what would then be the thermal envelope.



The Great Hall

As noted earlier, the type and thickness of the roof or ceiling insulation is not known. But based on my estimates, the total ceiling represents the most significant source of heat loss from the Hall, followed by air leakage, walls, and floor. As is often the case, selecting ESM is a balancing act between energy saving potential and the installed cost of the measure.

In this case, air sealing and re-insulating the slopes of the adjoining attic, insulating the crawlspace below, and targeted air sealing are predicted to be cost effective with annual savings of just under \$700 and a 4% yearly return for 25 years at today's energy prices.



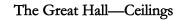
- 1. Air Sealing: Install commercial grade weatherstripping to the two double doors and original wood door.
- 2. Foundation: Lay a minimum thickness of 10ml Vapor Barrier on the floor of the crawl space, extending 6-10" up the foundation wall, then spray 3" closed cell foam from the rim joists/beam down over the liner, or to 1' above the floor in the basement area. This combination results in a continuous vapor (including soil gasses), air, and thermal barrier, thereby bringing the basement and crawlspace into the thermal envelope (Photos not available).
- 3. The slopes on the north end of the Hall are believed to be accessible by the 2009 attic, though not by me. If this presumption is correct, the IR images on the next page suggest that any insulation on the ceiling slope is performing very poorly. Air sealing all framing seams and insulating the rafter bays with a minimum effective R30 is what was modeled for this ESM. Spray foam is an option, but so would be installing netting and dense packing cellulose or mineral wool.

The existing heating load is calculated at 55,436 Btu/Hr. Following recommended improvements, the resulting load would be calculated at 38,547 Btu/Hr.

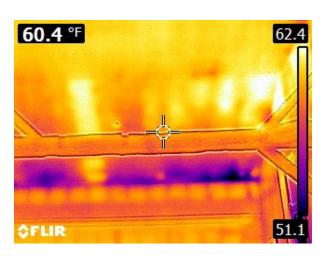
If the Church decided to convert to electric heat pumps at some point in the future, the existing conditions would likely require a 5-ton condensing unit while a 3-ton unit would likely suffice for the improved conditions.

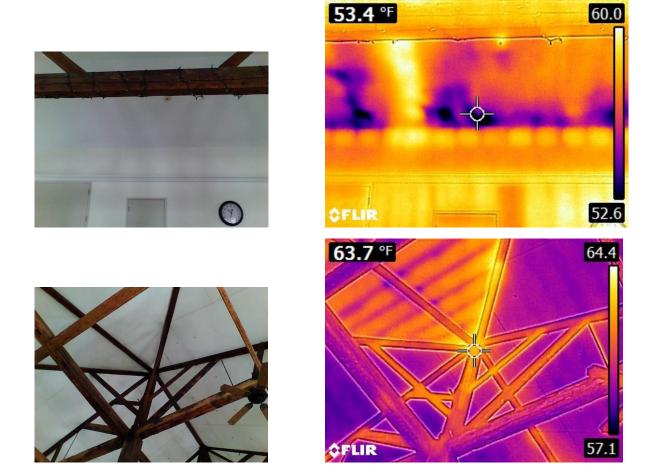








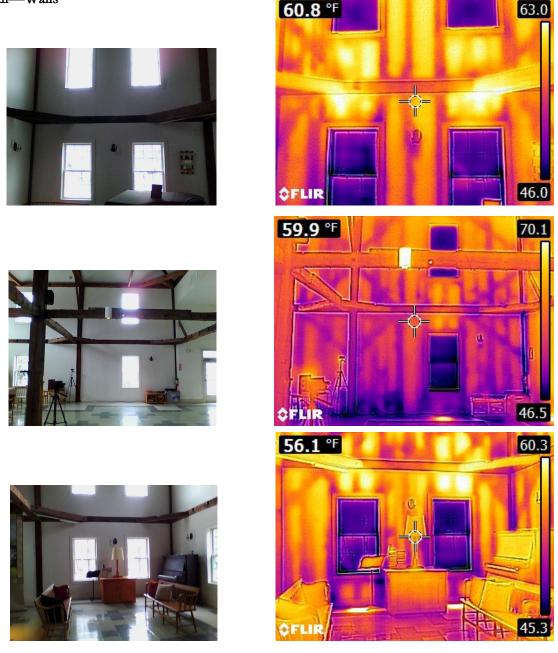




Its difficult to interpret the ceiling (s) of the Great Hall from the IR image above, but it appears that there are rigid foam panels above most of the framing. The slopes adjoining the attic of above the kitchen appear to have fiberglass batt insulation but without effective air sealing. I was not able to access this area in the attic but presume it is accessible (with difficulty) and that removing batts to air seal then replace batts with an air barrier membrane will effect a considerable improvement.



The Great Hall—Walls



The walls of the Great Hall have insulation in the cavity bays—which is a good thing! But note the impact of framing on what's called "thermal bridging". Wood framing accounts for 18-20% of the wall surface area—so what might be optimistically thought of as an "R19" wall, has an effective performance of R12. Improving wall performance by removing siding and wrapping the exterior with rigid insulation is part of what is considered a "Deep Energy Retrofit". In this case, the predicted savings would be less than \$400 per year at today's propane prices; very hard to justify the \$45-65K cost on dollar savings alone. Other benefits include reducing the total load if converting to heat pumps; replacing siding allows for improving window flashing and adding a drainage plane and back venting for greater durability, and reducing another ton of green house gas emissions.



The Great Hall—Walls

Framing Member Depth (inches)	5.5	
Framing Member Thermal Resistance (R/inch)	1.10	
Framing Member % of assembly surface area	20%	
Cavity Insulation Depth (inches)	5.5	
Cavity Insulation Thermal Resistance (R/inch)	2.25 🗲	Based on voids and
Continuous Insulation Thickness (inches)	0.00	air leakage sites
Continuous Thermal Resistance (R/inch)	0.00	
Drywall, sheathing and air films	2.00	
Nominal R Value, framing + insulation	12.4	
System R Value, framing + insulation	10.2	
Overall R value	12.2	

Framing Member Depth (inches)	5.5
Framing Member Thermal Resistance (R/inch)	1.10
Framing Member % of assembly surface area	20%
Cavity Insulation Depth (inches)	5.5
Cavity Insulation Thermal Resistance (R/inch)	2.75
Continuous Insulation Thickness (inches)	3.00
Continuous Thermal Resistance (R/inch)	4.00
Drywall, sheathing and air films	2.00
Nominal R Value, framing + insulation	27.1
System R Value, framing + insulation	24.6
Overall R value	26.6

Based on voids but air leakage sites sealed on the exterior

Adding three inches of vapor open Roxul Comfortboard on the exterior (R4 per inch) more than doubles the thermal performance of the walls. It also allows for improved window flashing, a continuous air barrier, and installing a drainage plane and vented siding to prolonged paint life and overall durability. It usually makes sense to also upgrade windows at the same time. It is not a cost effective energy saving measure at this time, but included here as it would be a 'next step' toward achieving a net zero building.

ROCKWOOL COMFORTBOARD[™] 110 is a rigid, high density, non-combustible, stone wool insulation board designed for use as an exterior continuous insulation in commercial applications. This thermally efficient, moisture resistant, vapor permeable board is effective against fire, moisture, thermal bridging and allows for superior drying potential.



The Great Hall—Floor (Basement)





The Great Hall—Floor (Basement)



Unfortunately, photos of the basement were not saved. However these exterior IR images suggest the significance of uninsulated foundation walls and the relative heat loss—heat which is lost from the floor, down into the crawlspace and basement, then out the foundation walls. Insulating the walls—and not the floor—is strongly recommended in order to prevent an even colder—and damper - crawlspace.

While not a perfect analogy, one can think of a warm and dry basement the same way one might think of warm and dry feet. A good pair of socks can make the difference for one's comfort and health: so it is with a warm and dry basement's impact on the durability and comfort of a building.



Heating Systems—Great Hall Basement



Great Hall

It appears that a dehumidifier may be set up to drain into a humidifier in the furnace air handler. Current thinking in building science is to resist adding moisture to ducted air systems. Dry air is a condition of outside air leakage so air sealing can raise indoor humidity enough to improve comfort, without blowing or 'forcing' moisture into the envelope layers.



2002 Downstairs





There are more modern programmable thermostats, but it appears that the dial type thermostats set up for 'occupied' and 'unoccupied' may be working adequately. One advantage to installing 7-day digital programmable would be the 'auto reset' function. If someone overrides the program, it will automatically revert to the pre-set temperature in 2 hours.



2002 Addition

In this part of the building, the ceiling and air leakage account for over 62% of heat loss. Window glass accounts for 17% of conductive losses, but both windows and doors are partly responsible for the air leakage—which is not included in the 4% and 17% which is only about conductive heat transfer.

These percentages are not at all uncommon for buildings constructed in NH from the 1980's to 2010 or even more recently. The reliance on fiberglass batts for ceiling insulation, without being in contact with a continuous air barrier on all six sides, allows for outside air to bypass the insulation and cool the outer surface of the ceiling, especially around the framing. (See photos on next two pages).

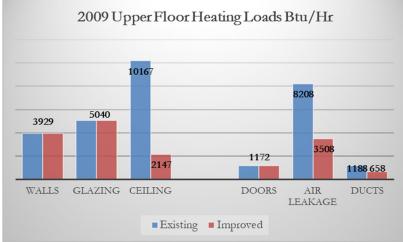


Adding weather-stripping to the exterior doors and around the windows is recommended. However, the most effective way to reduce uncontrolled air leakage is to effect a continuous air barrier at the ceiling plane.

A good place to start is to construct or purchase a thermodome for above the drop down ladder. It should be weighted or heavy enough to form a good seal against weatherstripping when in place. Air sealing all ceiling penetrations, the perimeter of the attic, and all interior wall top plates—with silicone sealant or a two part foam—will require moving the existing fiberglass aside. In this case, it is suggested to move the insulation aside on half the attic, air seal, then blow in 6 inches of cellulose on top of the existing vapor retarder, before spreading the batts back on top of the cellulose—perpendicular to the joists—followed by an other 8" layer of cellulose—making sure to keep the fiberglass at least two feet from the perimeter of the attic and completely incased in cellulose. Mound insulation over the ducts at least one foot thick.

While not an ideal strategy, it is less expensive than removing all the insulation entirely and puts to the best use possible of all that fiberglass. The goal is to limit its exposure to air to prevent wind washing and thermal bypass areas.

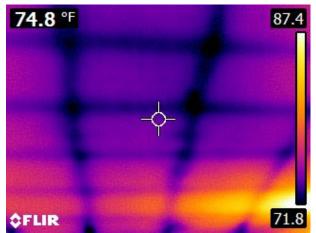
These measures are predicted to result in a 45% reduction in heat loss through envelope components and duct work.





2009 Addition—Ceiling

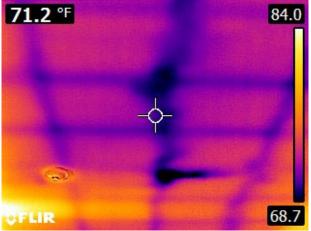










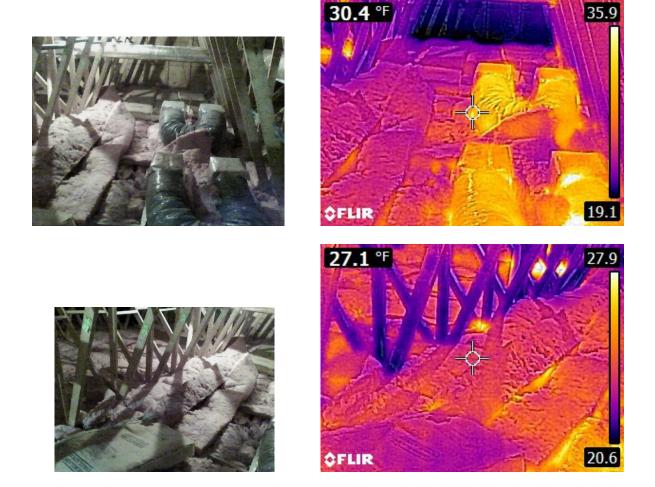




2002 Addition—Ceiling







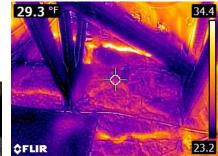
Brighter colors indicate warmer surfaces—and in this case, when standing in a cold attic, heat loss from conditioned space below.



2002 Addition—Ceiling

There is a lot of fiberglass material on the floor of this attic, but it is installed in such a way which still allows considerable heat loss through thermal bridging and thermal 'bypass'; that is, wherever fiberglass isn't in contact with an air barrier on the ceiling side, cold air can move into contact with the ceiling, thereby bypassing the insulation.







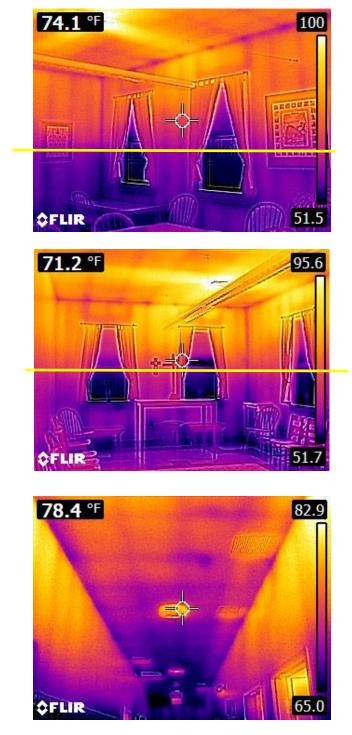


2002 Addition—Pressure Plane









Warm air rises because its lighter—and less dense—than colder air. When heating ducts are in the ceiling, warm air can tend to stay closer to the ceiling, also in part due to a 'pressure plane' - that is a line of pressure caused by cold air filtration coming from lower in the building then rising as it is heated. This can cause a stratification of temperature layers such as in the photos above. The top of the exterior walls are over 20 degrees warmer than the floor. As the ceiling plane gets 'tighter' and air infiltration from the floor and windows is reduced, the temperature difference between the floor and the ceiling is reduced.





Weil McLean oil boiler converted to propane. Input 105,000 Btu/hr

D.O.E. Output Capacity 92MBH and Net IBR 80MBH

Reznor serves kitchen heating and range hood air handling







1990 Connector Addition

The Connector Addition is defined, for this study, as the two story structure and Sacristy, all heated by the propane boiler in the 2002 attic and hydronic (hot water) baseboard.

The pie char shows a fairly equal distribution of 'heat loss responsibility'. In this case, the ESM are based on what's more easily accessible: weather-stripping exterior doors and air sealing and adding insulation above the ceiling.

The 'floor's losses include the crawl space under the Sacristy, but no access was located. The rim and band joists of the ceiling, and walls, of the Youth Room all show signs of air leakage, but the cost to remove and replace drywall makes the cost to high for the potential savings and CO2 reductions. These areas are mentioned here in the event that renovations or other changes are planned.

Connector Components

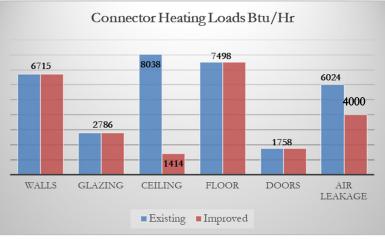


Generally speaking, whenever finished surfaces are removed, it is always worth diligently air sealing and exploring opportunities to improve the insulation layer. That can often mean replacing fiberglass with dense pack cellulose, or other high density strategy.

The recommended ESM in this study are:

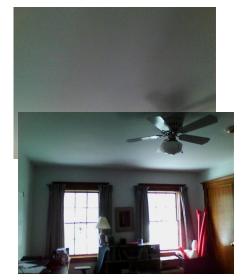
- 1. Install commercial grade weatherstripping to the two exterior doors in the hall between the Sacristy and the Sanctuary.
- 2. There appears to be an access to the space above the ceiling in the Office of the upper level. This was not accessed during the site visit but the IR images as shown on the next page clearly indicate severe deficiencies in the insulation. Access above the Sacristy was not located. The estimated cost is based on 1305 ft2 of ceiling at \$3.95 per ft2. This should allow for any necessary air sealing and blowing in an additional 16-18" cellulose. If the existing material has gotten wet, or is contaminated by rodents, it should be removed which may increase the cost.

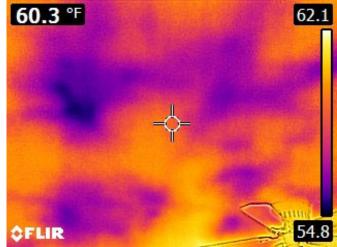
The two measures are predicted to result in a load reduction of 28% - from 29,704Btu/Hr (2.5 tons of heat pump) to 16,454 (1.5 tons of heat pump) is substantial.





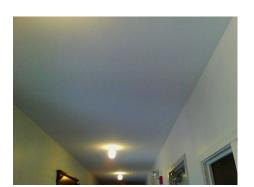
2002 Addition Ceiling











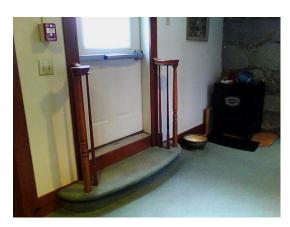


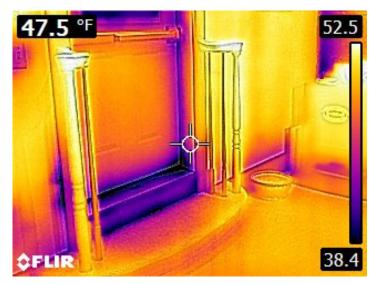


Sacristy and Hall















1990 Addition; Lower Floor

There are deficiencies in the thermal envelope of the lower levels of both the 1990 and 2002 additions, however the costs would involve removing and replacing finished surface, which would substantially outweigh the potential energy savings.

Air sealing the gaps and cracks between wood framing members and transitions from one structural element to another is the most glaring issue as seen below: where foundation wall meets stick framing and the rim/band joists between floors.

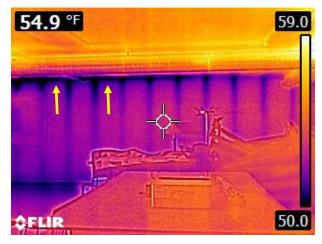












St. Andrews EXISTING CONDITIONS HVAC Load Calculations

for

St Andrews Episcopal Church Main Street Hopkinton, NH





Prepared By:

Margaret Dillon S.E.E.D.S.

603-532-8979 Tuesday, April 13, 2021

Rhvac is an ACCA approved Manual J, D and S computer program. Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.

Elite Software Development, Inc. St. Andrews EXISTING CONDITIONS Page 2

Project Report

Project Report						
General Project Informat	tion					
Project Title:	St. Andrews EX		DITIONS			
Project Date:	Saturday, April					
Client Name:	St Andrews Ep	iscopal Church	ו			
Client Address:	Main Street					
Client City:	Hopkinton, NH					
Company Name:	S.E.E.D.S.					
Company Representativ		1				
Company Phone:	603-532-8979					
Company E-Mail Addres	s: mdillon@myfai	rpoint.net				
Design Data						
Reference City:		Concore	d AP, New Ha	mpshire		
Building Orientation:		Front do	oor faces East			
Daily Temperature Rang	e:	High				
Latitude:		43 Degree	S			
Elevation:		510 ft.				
Altitude Factor:	().982				
	Outdoor Outdoor	Outdoor	Indoor	Indoor	Grains	
	Dry Bulb Wet Bulb		Rel.Hum	Dry Bulb	Difference	
Winter:	-2 -2.6		n/a	<u>55</u>	n/a	
Summer:	87 70		50%	75	19	
Check Figures		4.000	0514.0	0 "		0 173
Total Building Supply CF		1,862		er Square ft.	:	0.175
Square ft. of Room Area		10,779	Square	ft. Per Ton:		0
Volume (ft ³):		7,912*** alad (which ave		tom) rothor	than antira flaar a	
 * Based on area of room ** Based on area of room 		oled (whicheve	er governs sys	stem) rather	than entire noor a	area.
***Indicated volume is ba		na volume				
Building Loads						
Total Heating Required I	ncluding Ventilation A	vir: 142	030 Btuh	142.030	MBH	
Total Fleating Required I		1+2,	000 Dian	142.000		
Notes						
Rhvac is an ACCA appro	oved Manual J. D and	S computer p	rogram			
Calculations are perform				d ACCA Mar	nual D.	
All computed results are						
Be sure to select a unit t					ufacturer's perfo	rmance data at
your design conditions.				•		



Miscellaneous Report

Miscellaneous Rep							
System 1 Great Hall	Outdoo			ıtdoor	Indoor	Indoor	Grains
Input Data	Dry Bult				Rel.Hum	Dry Bulb	Difference
Winter:	-2		.6	80%	n/a	55	n/a
Summer:	87		70	43%	50%	75	18.94
System 2 Choir And Youth F Input Data	Room	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:		-2	-2.6	80%	n/a	55	n/a
Summer:		87	70	43%	50%	75	18.94
System 3 Kitchen	Outdoor	Outdoor	· Out	door	Indoor	Indoor	Grains
Input Data	Dry Bulb	Wet Bulb			el.Hum	Dry Bulb	Difference
Winter:	-2	-2.6		80%	n/a	55	n/a
Summer:	87	70		43%	50%	75	18.94
System 4 Classroom Wing 8	Hall	Outdoor	Outdoor	Outdoor	Indoor	Indoor	Grains
Input Data		Dry Bulb	Wet Bulb	Rel.Hum	Rel.Hum	Dry Bulb	Difference
Winter:		-2	-2.6	80%	n/a	55	n/a
Summer:		87	70	43%	50%	75	18.94
System 5 Boiler.Connector			utdoor	Outdoor	Indoor Bol Hum	Indoor Dry Bulb	Grains
Input Data Winter:	Dr	<u>y Bulb We</u> -2	et Bulb -2.6	Rel.Hum 80%	Rel.Hum n/a	Dry Bulb 55	Difference n/a
Summer:		-2 87	-2.6 70	80% 43%	50%	55 75	18.94
		07	10	-570	50 /0	75	10.34
Duct Sizing Inputs	ain Trunk		Puncuto				
Calculate:	Yes		<u>Runouts</u> Yes				
Use Schedule:	Yes		Yes				
Roughness Factor:	0.00300		0.01000				
Pressure Drop:	0.1000 in.wg./10)O ft		in.wg./100 ft			
Minimum Velocity:	0 ft./min	ю н.		ft./min	•		
Maximum Velocity:	900 ft./min			ft./min			
Minimum Height:	0 in.		0	in.			
Maximum Height:	0 in.		0	in.			
Outside Air Data							
Outside Air Data	Winter		Sur	nmer			
Infiltration Specified:		AC/hr		0.142 AC/hr			
		CFM	· · · ·	280 CFM			
Infiltration Actual:		AC/hr	C).142 AC/hr			
Building Volume:	0.267 <u>X 117,912*</u>			<u>.912*</u> Cu.ft.			
Balang Volume.		Cu.ft./hr		6,776 Cu.ft./	hr		
	<u>X 0.0167</u>	J G G G G G G G G G G		0167	••		
Total Building Infiltration:		CFM	<u>~_</u> 0.	280 CFM			
Total Building Ventilation:		CFM		0 CFM			
*Indicated volume is based of							
		-					
System 1							
Infiltration & Ventilation Sens	sible Gain Multiplier	: 12.96	= (1.10 X	0.982 X 12.0	00 Summer T	emp. Differen	ce)
Infiltration & Ventilation Late	nt Gain Multiplier:	12.64			94 Grains Diff		
Infiltration & Ventilation Sens						np. Difference	e)
Winter Infiltration Specified:	0.280 AC/hr (2	231 CFM), Cor	nstruction: A	verage			
Summer Infiltration Specified	l: 0.150 AC/hr (1	24 CFM), Cor	nstruction: A	verage			
System 2			· · · - · ·	0.000.11.1-	-		`
Infiltration & Ventilation Sens						emp. Differen	ce)
Infiltration & Ventilation Late					94 Grains Diff		
Infiltration & Ventilation Sens					o winter ler	np. Difference	<i>;)</i>
Winter Infiltration Specified:							
Summer Infiltration Specified	a. 0.050 AC/Nr (2	$C C \Gamma WI$, CONS	Suucuon: H	gnt			
System 3							



Miscellaneous Report (cont'd)

ation & V	entilation Sensible						e)			
ation & V er Infiltrat	entilation Sensible	e Loss Multiplier: 0.280 AC/hr (22 CFN	61.55 = 1), Constru	= (1.10 X 0.982 X 57 uction: Average						
		e Gain Multiplier:	12.96 =	= (1.10 X 0.982 X 12	2.00 Summer T	emp. Differenc	e)			
Infiltration & Ventilation Latent Gain Multiplier:12.64= (0.68 X 0.982 X 18.94 Grains Difference)Infiltration & Ventilation Sensible Loss Multiplier:61.55= (1.10 X 0.982 X 57.00 Winter Temp. Difference)Winter Infiltration Specified:0.430 AC/hr (133 CFM), Construction: Semi-LooseSummer Infiltration Specified:0.230 AC/hr (71 CFM), Construction: Semi-Loose										
ration & V ration & V ration & V er Infiltrat mer Infiltr	entilation Sensible entilation Latent G entilation Sensible ion Specified: ration Specified:	Gain Multiplier: E Loss Multiplier: 0.280 AC/hr (98 CFN 0.150 AC/hr (52 CFN	12.64 = 61.55 = 1), Constru	= (0.68 X 0.982 X 18 = (1.10 X 0.982 X 57 uction: Average	3.94 Grains Diff	ference)	,			
Load Fa	ctor Scenarios for	System 1								
Туре	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD			
Supply Return			-	0.12 0.12	6 6	677 251	No No			
Load Fa	ctor Scenarios for	System 2								
Type	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD			
Supply	2 000p.io	Closed Crawl B	-	0.12	6	677	No No			
			-	0.12	0	201				
Load Fa	ctor Scenarios for	System 3	A. (.)							
Type	Description	Location					From [T]MDD			
Supply	Decemption	Closed Crawl B	-	0.12	6	677	No			
Return		Closed Crawl A	-	0.12	6	251	No			
Load Fa	ctor Scenarios for	System 4								
Type	Description	Location					From [T]MDD			
	Description	Closed Crawl B	-	0.12		677	No			
Return		Closed Crawl A	-	0.12	6	251	No			
	ide Air Da ration & V ration & V ration & V er Infiltrat mer Infiltr System 4 ration & V ration & V	ide Air Data ration & Ventilation Sensible ration & Ventilation Sensible ration & Ventilation Sensible er Infiltration Specified: mer Infiltration Specified: System 4 ration & Ventilation Sensible ration & Ventilation Sensible ration & Ventilation Sensible ration & Ventilation Specified: mer Infiltration Specified: System 5 ration & Ventilation Sensible ration & Ventilation Sens	ide Air Data ration & Ventilation Sensible Gain Multiplier: ration & Ventilation Sensible Loss Multiplier: ration & Ventilation Sensible Loss Multiplier: ration & Ventilation Specified: 0.280 AC/hr (22 CFW mer Infiltration Specified: 0.150 AC/hr (12 CFW System 4 ration & Ventilation Sensible Gain Multiplier: ration & Ventilation Sensible Gain Multiplier: ration & Ventilation Sensible Loss Multiplier: ration & Ventilation Sensible Gain Multiplier: ration & Ventilation Sensible Coss Multiplier: ration & Ventilation Sensible Coss Multiplier: ration & Ventilation Sensible Coss Multiplier: ration & Ventilation Sensible Loss Multiplier: ration & Ventilation Sensible Coss Multiplier: ration & Ventilatio	ration & Ventilation Sensible Gain Multiplier: 12.96 = ration & Ventilation Latent Gain Multiplier: 61.55 = ration & Ventilation Sensible Loss Multiplier: 61.55 = re Infiltration Specified: 0.280 AC/hr (22 CFM), Construmer Infiltration Specified: 0.150 AC/hr (12 CFM), Construction & Ventilation Latent Gain Multiplier: 12.96 = ration & Ventilation Latent Gain Multiplier: 12.96 = ration & Ventilation Sensible Loss Multiplier: 61.55 = ration & Ventilation Sensible Loss Multiplier: 61.55 = ration & Ventilation Sensible Gain Multiplier: 61.55 = ration & Ventilation Sensible Loss Multiplier: 61.55 = ration & Ventilation Sensible Loss Multiplier: 61.55 = ration & Ventilation Sensible Loss Multiplier: 61.55 = ration & Ventilation Sensible Gain Multiplier: 12.96 = ration & Ventilation Sensible Gain Multiplier: 12.96 = ration & Ventilation Sensible Gain Multiplier: 12.96 = ration & Ventilation Sensible Loss Multiplier: 12.96 = ration & Ventil	ide Air Data ration & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 × 0.982 × 12 ration & Ventilation Latent Gain Multiplier: 12.64 = (0.68 × 0.982 × 12 ration & Ventilation Specified: 0.280 AC/hr (22 CFM), Construction: Average mer Infiltration Specified: 0.150 AC/hr (12 CFM), Construction: Average System 4 ration & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 × 0.982 × 12 ration & Ventilation Specified: 0.150 AC/hr (12 CFM), Construction: Average System 4 ration & Ventilation Latent Gain Multiplier: 12.96 = (1.10 × 0.982 × 12 ration & Ventilation Specified: 0.430 AC/hr (133 CFM), Construction: Semi-Loose mer Infiltration Specified: 0.230 AC/hr (71 CFM), Construction: Semi-Loose System 5 ration & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 × 0.982 × 12 ration & Ventilation Specified: 0.230 AC/hr (71 CFM), Construction: Semi-Loose System 5 ration & Ventilation Specified: 0.280 AC/hr (98 CFM), Construction: Average ration & Ventilation Specified: 0.150 AC/hr (98 CFM), Construction: Average ration & Ventilation Specified: 0.150 AC/hr (98 CFM), Construction: Average run Infiltration Specified: 0.160 AC/hr (52 CFM), Construction: Average S	ide Air Data ide Air Data ration & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 × 0.982 × 18.94 Grains Dif ration & Ventilation Sensible Loss Multiplier: 12.64 = (0.68 × 0.982 × 18.94 Grains Dif ration & Ventilation Specified: 0.280 AC/hr (22 CFM), Construction: Average System 4 ration & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 × 0.982 × 12.00 Summer T ration & Ventilation Specified: 0.150 AC/hr (12 CFM), Construction: Average System 4 ration & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 × 0.982 × 12.00 Summer T ration & Ventilation Sensible Loss Multiplier: 12.64 = (0.68 × 0.982 × 18.94 Grains Dif ration & Ventilation Sensible Loss Multiplier: 12.64 = (0.68 × 0.982 × 12.00 Summer T ration & Ventilation Sensible Gain Multiplier: 12.64 = (0.68 × 0.982 × 12.00 Summer T ration & Ventilation Sensible Gain Multiplier: 12.64 = (0.68 × 0.982 × 12.00 Summer T ration & Ventilation Latent Gain Multiplier: 12.64 = (0.68 × 0.982 × 12.00 Summer T ration & Ventilation Sensible Loss Multiplier: 12.64 = (0.68 × 0.982 × 12.00 Summer T ration & Ventilation Latent Gain Multiplier: 12.64 = (0.68 × 0.982 × 12.00 Summer T	ide Air Data ation & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 X 0.982 X 12.00 Summer Temp. Difference) ation & Ventilation Latent Gain Multiplier: 61.55 = (1.10 X 0.982 X 18.94 Grains Difference) ation & Ventilation Specified: 0.280 AC/hr (12 CFM), Construction: Average ation & Ventilation Specified: 0.150 AC/hr (12 CFM), Construction: Average System 4 ation & Ventilation Specified: 0.430 AC/hr (133 CFM), Construction: Semi-Loose ation & Ventilation Specified: 0.230 AC/hr (133 CFM), Construction: Semi-Loose ation & Ventilation Specified: 0.230 AC/hr (133 CFM), Construction: Semi-Loose System 5 ation & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 X 0.982 X 12.00 Summer Temp. Difference) ation & Ventilation Specified: 0.230 AC/hr (133 CFM), Construction: Semi-Loose System 5 ation & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 X 0.982 X 12.00 Summer Temp. Difference) ation & Ventilation Specified: 0.230 AC/hr (133 CFM), Construction: Semi-Loose System 5 ation & Ventilation Sensible Gain Multiplier: 12.96 = (1.10 X 0.982 X 12.00 Summer Temp. 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Load Preview Report

Scope	Net Ton	ft.² /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	0.00	0	10,779	0	0	0	142,030	1,862	0	1,862	
System 1	0.00	0	2,173	0	0	0	55,436	725	0	725	10x14
Return Duct				0	0	0	600				
Zone 1			2,173	0	0	0	54,837	725	0	725	10x14
1-Great Hall			2,173	0	0	0	54,837	725	0	725	77
System 2	0.00	0	3,285	0	0	0	20,976	273	0	273	7x9
Return Duct				0	0	0	340				
Zone 1			3,285	0	0	0	20,635	273	0	273	7x9
2-Utility Room			644	0	0	0	488	6	0	6	14
3-Choir Room			504	0	0	0	1,815	24	0	24	14
4-Hall			343	0	0	0	428	6	0	6	14
5-Youth Room			1,794	0	0	0	17,905	237	0	237	36
Svstem 3	0.00	0	371	0	0	0	3,095	40	0	40	4x4
Return Duct				0	0	0	33				
Zone 1			371	0	0	0	3,061	40	0	40	4x4
15-Kitchen			371	0	0	0	3,061	40	0	40	15
System 4	0.00	0	2,110	0	0	0	29,704	389	0	389	8x11
Return Duct				0	0	0	321				
Zone 1			2,110	0	0	0	29,383 <mark>-</mark>	389	0	389	8x11
16-Entry & Hall			660	0	0	0	7,056	93	0	93	16
17-Assistant			192	0	0	0	2,495 <mark>-</mark>	33	0	33	14
18-Lg Classroom			442	0	0	0	8,668 <mark></mark>	115	0	115	25
19-Chapel			344	0	0	0	7,254	96	0	96	16
20-Nursery			344	0	0	0	3,910	52	0	52	15
21-2009 Restrooms			128	0	0	0	0	0	0	0	00
System 5	0.00	0	2,840	0	0	0	32,819	434	0	434	8x12
Zone 1			2,840	0	0	0	32,819	434	0	434	8x12
6-Atrium			1,260	0	0	0	8,846	117	0	117	25
7-Restroom			104	0	0	0	1,041	14	0	14	14
8-Hall			170	0	0	0	2,095	28	0	28	14
9-2nd Floor Connector Hall			154	0	0	0	3,428 <mark>-</mark>	45	0	45	15
10-Office			288	0	0	0	3,025	40	0	40	15
11-Rector			144	0	0	0	1,905 <mark>-</mark>	25	0	25	14
12-Library			240	0	0	0	2,729	36	0	36	14
13-Hall Landing			216	0	0	0	3,853 <mark>-</mark>	51	0	51	15
14-Sacristy			264	0	0	0	5,897	78	0	78	16



Total Building Summary Loads

Component	Area	Sen	Lat	Sen	Tota
Description eplacement: Glazing-Wood double hung, DP, clear, U-	Quan 192.2	<u>Loss</u> 3,939	Gain 0	<u> </u>	Gai
value 0.36, SHGC 0.57	192.2	5,555	0	0	
E-cm: Glazing-Double pane window, fixed sash, clear,	6.2	244	0	0	
metal frame no break, U-value 0.69, SHGC 0.69					
puble pane: Glazing-wood thermal pane window 90s, U-	253.4	6,788	0	0	
value 0.47, SHGC 0.56					
puble pane: Glazing-wood thermal pane window 90s, U-	120.5	2,542	0	0	
value 0.37, SHGC 0.56					
1G: Door-Wood - Panel, U-value 0.54	175.4	5,400	0	0	
1J: Door-Metal - Fiberglass Core, U-value 0.6 reat Hall Walls: Wall-Frame, Custom, Insulated 2x6	39.4 1964.9	1,349 8,961	0 0	0 0	
with 20% framing factor, U-value 0.08	1904.9	0,901	0	0	
2E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud	2952	11,444	0	0	
cavity, no board insulation, siding finish, wood studs,	2002	,	Ũ	Ũ	
U-value 0.068					
5A11-0ocw-2: Wall-Basement, , framing with R-11 sill to	1077	5,856	0	0	
floor in 2 x 4 cavity, open core, no board insulation,					
plus interior finish, wood studs, 2' floor depth, U-					
value 0.074					
3A-13: Roof/Ceiling-Roof Joists Between Roof Deck	2371.2	10,272	0	0	
and Ceiling or Foam Encapsulated Roof Joists, Dark					
or Bold-Color Asphalt Shingle, Dark Metal, Dark Membrane, Dark Tar and Gravel, R-13 blanket or					
loose fill, U-value 0.076					
lopes to Attic: Roof/Ceiling-Roof Joists Between Roof	492	6,759	0	0	
Deck and Ceiling or Foam Encapsulated Roof Joists,	102	0,700	Ũ	Ũ	
Custom, Slopes Enclosed by new attic, U-value 0.241					
berglass: Roof/Ceiling-Under Attic with Insulation on	851.5	4,368	0	0	
Attic Floor (also use for Knee Walls and Partition					
Ceilings), Custom, Batts on VB with penetrations, U-					
value 0.09					
berglass-ml: Roof/Ceiling-Under Attic with Insulation on	1130.5	5,799	0	0	
Attic Floor (also use for Knee Walls and Partition					
Ceilings), Custom, Batts on VB with penetrations,					
light metal, U-value 0.09 lown In: Roof/Ceiling-Under Attic with Insulation on Attic	1305.8	8,038	0	0	
Floor (also use for Knee Walls and Partition	1505.0	0,000	0	0	
Ceilings), Custom, R10 Estimated.Large Voids, U-					
value 0.108					
9A-0tp: Floor-Over enclosed crawl space, No insulation	4712.1	23,182	0	0	
on exposed walls, sealed or vented space, passive,					
no floor insulation, tile or vinyl, U-value 0.168					
Subtotals for structure:		104,941	0	0	
People:	20		0	0	
quipment:	_		0	0	
ighting:	0	4 700	2	0	
Ductwork:		4,788	0	0	
nfiltration: Winter CFM: 525, Summer CFM: 280 /entilation: Winter CFM: 0, Summer CFM: 0		32,301 0	0 0	0 0	
otal Building Load Totals:		142,030	0	0	
Check Figures					
Total Building Supply CFM:1,862		Per Square ft.:			0.173
Square ft. of Room Area: 10,779	Square	e ft. Per Ton:			0
olume (ft ³): 117,912***					

Total Building Summary Loads (cont'd)

Check Figures

** Based on area of rooms being cooled.

***Indicated volume is based on custom building volume.

Building Loads

Total Heating Required Including Ventilation Air:

142,030 Btuh 142.030 MBH

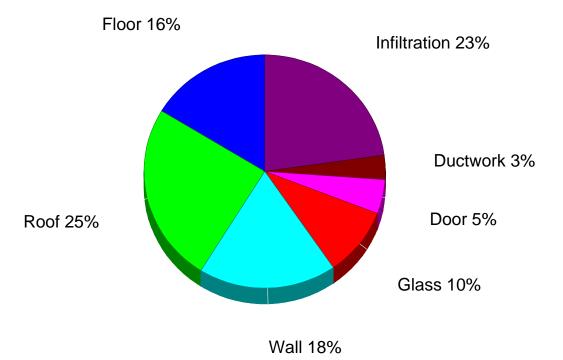
Notes

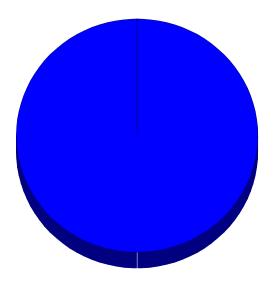
Rhvac is an ACCA approved Manual J, D and S computer program.

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.





100.0%



System 1 Great Hall Summary Loads

`omponent						
Component Description		Area Quan	Sen Loss	Lat Gain		Tot Ga
eplacement: Glazing-Wood double hung, value 0.36, SHGC 0.57	DP, clear, U-	192.2	3,939	0	0	0
E-cm: Glazing-Double pane window, fixed metal frame no break, U-value 0.69, S		3.2	126	0	0	
G: Door-Wood - Panel, U-value 0.54		61.2	1,884	0	0	
J: Door-Metal - Fiberglass Core, U-value	9.6	39.4	1,349	0	0	
reat Hall Walls: Wall-Frame, Custom, Ins with 20% framing factor, U-value 0.08		1964.9	8,961	0	0	
2E-0sw: Wall-Frame, R-19 insulation in 2 cavity, no board insulation, siding finisl U-value 0.068		112	434	0	0	
BA-13: Roof/Ceiling-Roof Joists Between and Ceiling or Foam Encapsulated Ro or Bold-Color Asphalt Shingle, Dark M Membrane, Dark Tar and Gravel, R-13 loose fill, U-value 0.076	of Joists, Dark etal, Dark	2000	8,664	0	0	
opes to Attic: Roof/Ceiling-Roof Joists Be Deck and Ceiling or Foam Encapsulate Custom, Slopes Enclosed by new attic	ed Roof Joists,	492	6,759	0	0	
A-0tp: Floor-Over enclosed crawl space on exposed walls, sealed or vented sp no floor insulation, tile or vinyl, U-value	No insulation ace, passive,	1394	6,858	0	0	
Subtotals for structure:			38,974	0	0	
People:		20	,	0	0	
quipment:		-		0	0	
ighting:		0			0	
Juctwork:			2,217	0	0	
nfiltration: Winter CFM: 231, Summer CF 'entilation: Winter CFM: 0, Summer CFM			14,245 0	0 0	0 0	
system 1 Great Hall Load Totals:			55,436	0	0	
Check Figures						
Supply CFM: Square ft. of Room Area: /olume (ft³):	725 2,173 49,592***		Per Square ft e ft. Per Ton:			0.334 0
Based on area of rooms being heated o * Based on area of rooms being cooled. **Indicated volume is based on custom b	r cooled (which		/stem) rather	than entire f	loor area.	
ystem Loads	on Air:	55.436 Btub	55 / 36	MBH		
		55,450 Diun	55.450			
System Loads Total Heating Required Including Ventilati Iotes	on Air:	55,436 Btuh	55.436	MBH		

Jaffrey, NH 03452					Page 1
System 2 Choir And Youth Room Sum	nmary Loads				
Component	Area	Sen	Lat	Sen	Tota
Description	Quan	Loss	Gain	Gain	Gai
E-cm: Glazing-Double pane window, fixed sash, clear, metal frame no break, U-value 0.69, SHGC 0.69	3	118	0	0	
louble pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56	- 56.2	1,504	0	0	
1G: Door-Wood - Panel, U-value 0.54	19	586	0	0	
5A11-0ocw-2: Wall-Basement, , framing with R-11 sill to floor in 2 x 4 cavity, open core, no board insulation, plus interior finish, wood studs, 2' floor depth, U-value 0.074		5,614	0	0	
2E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud cavity, no board insulation, siding finish, wood studs, U-value 0.068	156.8	608	0	0	
9A-0tp: Floor-Over enclosed crawl space, No insulation on exposed walls, sealed or vented space, passive, no floor insulation, tile or vinyl, U-value 0.168	1794	8,826	0	0	
Subtotals for structure:		17,256	0	0	
People:	0	,	0 0	0 0	
Equipment:	Ũ		0 0	0 0	
ighting:	0		C C	0	
Ductwork:	Ũ	1,259	0	0 0	
nfiltration: Winter CFM: 40, Summer CFM: 20		2,461	0	0	
/entilation: Winter CFM: 0, Summer CFM: 0		0	0	0	
system 2 Choir And Youth Room Load Totals:		20,976	0	0	
Check Figures		.			
Supply CFM: 273 Square ft. of Room Area: 3,285 /olume (ft ³): 23,991*** Based on area of rooms being heated or cooled (which	Square	er Square ft.: ft. Per Ton: tem) rather tha	an entire floor	area.	0.083 0
** Based on area of rooms being cooled. ***Indicated volume is based on custom building volume.		,			
System Loads					
	20,976 Btuh	20.976 M	BH		
Notes Rhvac is an ACCA approved Manual J, D and S compute Calculations are performed per ACCA Manual J 8th Editi All computed results are estimates as building use and w Be sure to select a unit that meets both sensible and late your design conditions.	ion, Version 2, and veather may vary.			ormance dat	a at

Þ



System 2 Kitchen Summary Loads

A-13: Roof/Ceiling-Roof Joists Between Roof Deck 371.2 1,608 0 0 and Ceiling or Foam Encapsulated Roof Joists, Dark or Bold-Color Asphalt Shingle, Dark Metal, Dark Membrane, Dark Tar and Gravel, R-13 blanket or loose fill, U-value 0.076 ubtotals for structure: 1,608 0 0 eople: 0 0 0 0 ghting: 0 0 0 ghting: 0 0 0 ghting: 0 0 0 itlitration: Winter CFM: 22, Summer CFM: 12 1,363 0 0 entilation: Winter CFM: 0, Summer CFM: 12 1,363 0 0 entilation: Winter CFM: 0, Summer CFM: 12 3,095 0 0 entilation: Winter CFM: 0, Summer CFM: 12 0,0000000000000000000000000000000000	omponent	Area	Sen	Lat	Sen	Tota
loose fill, U-value 0.076 ubtotals for structure: 1,608 0 0 eople: 0 0 0 quipment: 0 0 0 ghing: 0 124 0 0 uctwork: 124 0 0 0 filtration: Winter CFM: 22, Summer CFM: 12 1,363 0 0 0 uctwork: 3,095 0 0 0 0 stitchen Load Totals: 3,095 0 0 0 0 wystem 3 Kitchen Load Totals: 3,095 0 <td>or Bold-Color Asphalt Shingle, Dark Metal, Dark</td> <td>Quan 371.2</td> <td><u>Loss</u> 1,608</td> <td>Gain 0</td> <td><u>Gain</u> 0</td> <td>Gai</td>	or Bold-Color Asphalt Shingle, Dark Metal, Dark	Quan 371.2	<u>Loss</u> 1,608	Gain 0	<u>Gain</u> 0	Gai
eople:000quipment:00ghting:00uctwork:1240filtration: Winter CFM: 22, Summer CFM: 121,3630entilation: Winter CFM: 0, Summer CFM: 0000ystem 3 Kitchen Load Totals:3,09500heck Figures3,09500upply CFM:40CFM Per Square ft.:0.109quare ft. of Room Area:371Square ft. Per Ton:0olume (ft ³):4,745***00Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.0Based on area of rooms being cooled.*0*Indicated volume is based on custom building volume.3095MBHotal555theating Required Including Ventilation Air:3,095Btuh3.095total Heating Required Including Ventilation Air:3,095Btuh3.095total113,095Btuh1.095total113,095MBH5otal113,095Manual J.1.005total1133.095MBHotas113.095Manual J.1.005totas are performed per ACCA Manual J. 8th Edition, Version 2, and ACCA Manual D.1.000000000000000000000000000000000000						
quipment: 0 0 ghting: 0 0 uctwork: 124 0 0 filtration: Winter CFM: 22, Summer CFM: 12 1,363 0 0 entilation: Winter CFM: 0, Summer CFM: 0 0 0 0 system 3 Kitchen Load Totals: 3,095 0 0 heck Figures 3,095 0 0 upply CFM: 40 CFM Per Square ft.: 0.109 quare ft. of Room Area: 371 Square ft. Per Ton: 0 olume (ff³): 4,745*** 0 0 0 Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. Based on area of rooms being cooled. * *Indicated volume is based on custom building volume. ystem Loads ystem Loads	ubtotals for structure:	0	1,608			
optiming: 0 0 uctwork: 124 0 0 filtration: Winter CFM: 22, Summer CFM: 12 1,363 0 0 entilation: Winter CFM: 0, Summer CFM: 0 0 0 0 settination: Winter CFM: 0, Summer CFM: 0 0 0 0 ystem 3 Kitchen Load Totals: 3,095 0 0 heck Figures 3,095 0 0 upply CFM: 40 CFM Per Square ft.: 0.109 quare ft. of Room Area: 371 Square ft. Per Ton: 0 olume (ft³): 4,745*** 0 0 a Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. Based on area of rooms being cooled. * *Indicated volume is based on custom building volume. ystem Loads ystem Loads ystem Loads otal Heating Required Including Ventilation Air: 3,095 Bth 3.095 MBH otes		0		-		
uctwork: 124 0 0 filtration: Winter CFM: 22, Summer CFM: 12 1,363 0 0 entilation: Winter CFM: 0, Summer CFM: 0 0 0 0 ystem 3 Kitchen Load Totals: 3,095 0 0 heck Figures 3,095 0 0 upply CFM: 40 CFM Per Square ft.: 0.109 quare ft. of Room Area: 371 Square ft. Per Ton: 0 olume (ft ³): 4,745*** 8ased on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads ystem Loads ystem Loads ottal Heating Required Including Ventilation Air: 3,095 Btuh 3.095 MBH otes hvac is an ACCA approved Manual J, D and S computer program. alculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. I I I computed results are estimates as building use and weather may vary. e sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at		0		Ũ		
entilation: Winter CFM: 0, Summer CFM: 0 ystem 3 Kitchen Load Totals: a,095 0 0 0 0 0 0 0 0 0 0 0 0 0	uctwork:		124	0	0	
ystem 3 Kitchen Load Totals: 3,095 0 0 heck Figures upply CFM: 40 CFM Per Square ft.: 0.109 quare ft. of Room Area: 371 Square ft. Per Ton: 0 olume (ft ³): 4,745*** Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads total Heating Required Including Ventilation Air: 3,095 Btuh 3.095 MBH otes hvac is an ACCA approved Manual J, D and S computer program. alculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. I computed results are estimates as building use and weather may vary. e sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at	filtration: Winter CFM: 22, Summer CFM: 12					
heck Figures upply CFM: 40 CFM Per Square ft.: 0.109 quare ft. of Room Area: 371 Square ft. Per Ton: 0 olume (ft³): 4,745*** 0 0 Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. 0 Based on area of rooms being cooled. * * *Indicated volume is based on custom building volume. * ystem Loads * otal Heating Required Including Ventilation Air: 3,095 Btuh otes * hvac is an ACCA approved Manual J, D and S computer program. alculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. I I computed results are estimates as building use and weather may vary. e sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at	entilation: Winter CFM: 0, Summer CFM: 0		0	0	0	
upply CFM: 40 CFM Per Square ft.: 0.109 quare ft. of Room Area: 371 Square ft. Per Ton: 0 olume (ft ³): 4,745*** 0 0 Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. 0 Based on area of rooms being cooled. * * *Indicated volume is based on custom building volume. * * ystem Loads * 3,095 Btuh 3.095 MBH otes * * 10	ystem 3 Kitchen Load Totals:		3,095	0	0	
quare ft. of Room Area: 371 Square ft. Per Ton: 0 olume (ft ³): 4,745*** 0 Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. 0 Based on area of rooms being cooled. * * *Indicated volume is based on custom building volume. * * ystem Loads * 0 total Heating Required Including Ventilation Air: 3,095 Btuh 3.095 MBH otes * 0	heck Figures					
blume (ft ³): 4,745*** Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads Detal Heating Required Including Ventilation Air: 3,095 Btuh 3.095 MBH otes hvac is an ACCA approved Manual J, D and S computer program. alculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. Il computed results are estimates as building use and weather may vary. e sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at						
Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area. Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads Datal Heating Required Including Ventilation Air: 3,095 Btuh 3.095 MBH otes hvac is an ACCA approved Manual J, D and S computer program. alculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. Il computed results are estimates as building use and weather may vary. e sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at		Square	ft. Per Ton:			0 ^
otes hvac is an ACCA approved Manual J, D and S computer program. alculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. Il computed results are estimates as building use and weather may vary. e sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled.	r governs syst	em) rather tha	n entire floor	area.	
hvac is an ACCA approved Manual J, D and S computer program. alculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D. Il computed results are estimates as building use and weather may vary. e sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads				area.	
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads otal Heating Required Including Ventilation Air: 3,0 otes	095 Btuh			area.	
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. Indicated volume is based on custom building volume. <u>Astem Loads</u> total Heating Required Including Ventilation Air: 3,0 <u>betes</u> hvac is an ACCA approved Manual J, D and S computer pr alculations are performed per ACCA Manual J 8th Edition, V I computed results are estimates as building use and weath a sure to select a unit that meets both sensible and latent lo	095 Btuh ogram. Version 2, and her may vary.	3.095 ME	3H I D.		ta at
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. Indicated volume is based on custom building volume. Indicated volume is based on custom building v	095 Btuh ogram. Version 2, and her may vary.	3.095 ME	3H I D.		ta at
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. *Indicated volume is based on custom building volume. /stem Loads otal Heating Required Including Ventilation Air: 3,0 otes hvac is an ACCA approved Manual J, D and S computer pr alculations are performed per ACCA Manual J 8th Edition, V I computed results are estimates as building use and weath e sure to select a unit that meets both sensible and latent lo	095 Btuh ogram. Version 2, and her may vary.	3.095 ME	3H I D.		ta at
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads otal Heating Required Including Ventilation Air: 3,0 otes hvac is an ACCA approved Manual J, D and S computer pr alculations are performed per ACCA Manual J 8th Edition, V Il computed results are estimates as building use and weath e sure to select a unit that meets both sensible and latent lo	095 Btuh ogram. Version 2, and her may vary.	3.095 ME	3H I D.		ta at
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads otal Heating Required Including Ventilation Air: 3,0 otes hvac is an ACCA approved Manual J, D and S computer pr alculations are performed per ACCA Manual J 8th Edition, V Il computed results are estimates as building use and weath	095 Btuh ogram. Version 2, and her may vary.	3.095 ME	3H I D.		ta at
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads otal Heating Required Including Ventilation Air: 3,0 otes hvac is an ACCA approved Manual J, D and S computer pr alculations are performed per ACCA Manual J 8th Edition, V Il computed results are estimates as building use and weath e sure to select a unit that meets both sensible and latent lo	095 Btuh ogram. Version 2, and her may vary.	3.095 ME	3H I D.		ta at
	Based on area of rooms being heated or cooled (whicheve Based on area of rooms being cooled. *Indicated volume is based on custom building volume. ystem Loads btal Heating Required Including Ventilation Air: 3,0 otes hvac is an ACCA approved Manual J, D and S computer pr alculations are performed per ACCA Manual J 8th Edition, V I computed results are estimates as building use and weath e sure to select a unit that meets both sensible and latent lo	095 Btuh ogram. Version 2, and her may vary.	3.095 ME	3H I D.		ta at

System 4 Classroom Wing & Hall Summary Loads Component Area Description Quan puble pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56 188.2 G: Door-Wood - Panel, U-value 0.54 38.1 2E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud 1013.3 cavity, no board insulation, siding finish, wood studs, U-value 0.068 1013.3 berglass: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.09 1130.5 berglass-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.09 1130.5 buttotals for structure: People: 0 cavity metal, U-value 0.09 0	S Sen Loss 5,040 1,172 3,929 4,368 5,799	Lat Gain 0 0 0 0	Sen Gain 0 0 0	Tota Gaii
DescriptionQuanpuble pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56188.2G: Door-Wood - Panel, U-value 0.5438.12E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud1013.3cavity, no board insulation, siding finish, wood studs, U-value 0.0681013.3berglass: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.091130.5berglass-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.091130.5berglass-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, light metal, U-value 0.091130.5buttotals for structure: 'eople:0	Loss 5,040 1,172 3,929 4,368	<u>Gain</u> 0 0 0	Gain 0 0 0	<u>Gai</u> i
buble pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56188.2G: Door-Wood - Panel, U-value 0.5438.12E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud cavity, no board insulation, siding finish, wood studs, U-value 0.0681013.3berglass: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.09851.5berglass-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.091130.5berglass-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, light metal, U-value 0.091130.5bubtotals for structure: eople:0	5,040 1,172 3,929 4,368	0 0 0	0 0 0	
value 0.47, SHGC 0.5638.1G: Door-Wood - Panel, U-value 0.5438.12E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud1013.3cavity, no board insulation, siding finish, wood studs, U-value 0.0681013.3berglass: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.091130.5berglass-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, Light metal, U-value 0.091130.5butotals for structure: Yeople:0	1,172 3,929 4,368	0 0	0 0	
2E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud 1013.3 cavity, no board insulation, siding finish, wood studs, 1013.3 U-value 0.068 851.5 berglass: Roof/Ceiling-Under Attic with Insulation on 851.5 Attic Floor (also use for Knee Walls and Partition 1130.5 Ceilings), Custom, Batts on VB with penetrations, U-value 0.09 1130.5 berglass-ml: Roof/Ceiling-Under Attic with Insulation on 1130.5 Attic Floor (also use for Knee Walls and Partition 1130.5 Ceilings), Custom, Batts on VB with penetrations, 1130.5 Uight metal, U-value 0.09 0 Subtotals for structure: 0	3,929 4,368	0	0	
cavity, no board insulation, siding finish, wood studs, U-value 0.068 berglass: Roof/Ceiling-Under Attic with Insulation on 851.5 Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.09 berglass-ml: Roof/Ceiling-Under Attic with Insulation on 1130.5 Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, light metal, U-value 0.09 subtotals for structure: 'eople: 0	4,368	0	-	
berglass: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, U- value 0.09 851.5 berglass-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, light metal, U-value 0.09 1130.5 Subtotals for structure: 'eople: 0			0	
Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Batts on VB with penetrations, light metal, U-value 0.09 Subtotals for structure: Yeople: 0	5,799	0		
eople: 0			0	
eople: 0	20,308	0	0	
•	20,000	0	0	
		0		
		U	0	
ighting: 0	1 400	0	0	
Ouctwork:	1,188	0	0	
nfiltration: Winter CFM: 133, Summer CFM: 71	8,208	0	0	
entilation: Winter CFM: 0, Summer CFM: 0	0	0	0	
system 4 Classroom Wing & Hall Load Totals:	29,704	0	0	
heck Figures				
	Per Square ft.:			0.184 *
'olume (ft ³): 18,606***	e ft. Per Ton:			0 *
Based on area of rooms being heated or cooled (whichever governs system) Based on area of rooms being cooled. Indicated volume is based on custom building volume.	stem) rather tha	n entire floor a	area.	
system Loads				
otal Heating Required Including Ventilation Air: 29,704 Btuh	29.704 ME	BH		
Intes Shvac is an ACCA approved Manual J, D and S computer program. Calculations are performed per ACCA Manual J 8th Edition, Version 2, an all computed results are estimates as building use and weather may vary. The sure to select a unit that meets both sensible and latent loads accordin our design conditions.	' .		rmance data	at

System 5 Boiler.Connector Summary Loads

Component	Area	Sen	Lat	Sen	Tota
Description	Quan	Loss	Gain	Gain	Gai
ouble pane: Glazing-wood thermal pane window 90s, U- value 0.37, SHGC 0.56	120.5	2,542	0	0	(
ouble pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56	9.1	244	0	0	(
1G: Door-Wood - Panel, U-value 0.54	57.1	1,758	0	0	(
5A11-0ocw-2: Wall-Basement, , framing with R-11 sill to floor in 2 x 4 cavity, open core, no board insulation, plus interior finish, wood studs, 2' floor depth, U-value 0.074	48	242	0	0	
2E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud cavity, no board insulation, siding finish, wood studs, U-value 0.068	1669.9	6,473	0	0	(
Blown In: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R10 Estimated.Large Voids, U- value 0.108	1305.8	8,038	0	0	(
9A-0tp: Floor-Over enclosed crawl space, No insulation on exposed walls, sealed or vented space, passive, no floor insulation, tile or vinyl, U-value 0.168	1524.1	7,498	0	0	
Subtotals for structure:		26,795	0	0	(
People:	0	-,	0	0	
Equipment:			0	0	
Lighting:	0			0	
Ductwork:		0	0	0	
Infiltration: Winter CFM: 98, Summer CFM: 52		6,024	0	0	
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	
System 5 Boiler.Connector Load Totals:		32,819	0	0	
Check Figures					
Supply CFM: 434 Square ft. of Room Area: 2,840 Volume (ft ³): 20,978***		er Square ft.: ft. Per Ton:			0.153 * 0 *
 * Based on area of rooms being heated or cooled (whicheve ** Based on area of rooms being cooled. ***Indicated volume is based on custom building volume. 	er governs sys	tem) rather tha	in entire floor	area.	
System Loads					
Total Heating Required Including Ventilation Air: 32,	819 Btuh	32.819 ME	3H		

Rhvac is an ACCA approved Manual J, D and S 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.

St. Andrews IMPROVED HVAC Load Calculations

for

St Andrews Episcopal Church Main Street Hopkinton, NH





Prepared By:

Margaret Dillon S.E.E.D.S.

603-532-8979 Tuesday, April 13, 2021

Rhvac is an ACCA approved Manual J, D and S computer program. Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.



Project Report

General Project Inform Project Title:								
	mation							
		Andrews IMP	ROVED					
Project Date:	Sat	urday, April 3,	2021					
Client Name:		Andrews Episo						
Client Address:		n Street						
Client City:		kinton, NH						
Company Name:		.E.D.S.						
Company Representa		rgaret Dillon						
Company Phone:	60.9	-532-8979						
Company E-Mail Add		llon@myfairp	oint net					
	1000. 110	lonemylanp	Sintenot					
Design Data								
Reference City:				I AP, New Ha				
Building Orientation:			Front do	or faces East				
Daily Temperature Ra	ange:		High					
Latitude:			43 Degrees	;				
Elevation:		5	10 ft.					
Altitude Factor:		0.9	82					
						o :		
	Outdoor	Outdoor	Outdoor	Indoor	Indoor	Grains		
	<u>Dry Bulb</u>	Wet Bulb	<u>Rel.Hum</u>	<u>Rel.Hum</u>	<u>Dry Bulb</u>	<u>Difference</u>		
Winter:	-2	-2.6	n/a	n/a	55	n/a		
Summer:	87	70	43%	50%	75	19		
Check Figures								
Total Building Supply	CFM:		1,353	CFM P	er Square ft.	:		0.126 *
Square ft. of Room Ar			0,779		ft. Per Ton:			0 *
Volume (ft ³):			912***	- 1				-
* Based on area of ro	ooms beina h			r aoverns svs	tem) rather	than entire floor	area.	
** Based on area of ro				gereine eye				
***Indicated volume is			volume.					
Building Loads								
		/ontilation Air	103,2	242 Btuh	103.242	MBH		
	ed Including \							
	ed Including \							
Total Heating Require	ed Including \							
Total Heating Require	-		computer pr	ogram.				
Total Heating Require	oproved Man	ual J, D and S			d ACCA Mar	nual D.		
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo	oproved Manu ormed per AC	ual J, D and S CCA Manual J	8th Edition, Y	Version 2, and	d ACCA Mar	nual D.		
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a	oproved Manu ormed per AC are estimates	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at
Total Heating Require Notes Rhvac is an ACCA ap Calculations are perfo All computed results a Be sure to select a un	oproved Manu ormed per AC are estimates nit that meets	ual J, D and S CA Manual J as building u	8th Edition, V se and weath	Version 2, and her may vary.			ormance da	a at



Miscellaneous Report

INISCEIIAITEOUS REP							
System 1 Great Hall	Outdoor			utdoor	Indoor	Indoor	Grains
Input Data	Dry Bulb				Rel.Hum	Dry Bulb	Difference
Winter:	-2		2.6	80%	n/a	55	n/a
Summer:	87		70	43%	50%	75	18.94
System 2 Choir And Youth Input Data	Room	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:		-2	-2.6	80%	n/a	55	n/a
Summer:		87	70	43%	50%	75	18.94
System 3 Kitchen	Outdoor	Outdoo	r Out	door	Indoor	Indoor	Grains
Input Data	Dry Bulb	Wet Bulk			el.Hum	Dry Bulb	Difference
Winter:	-2	-2.6		80%	n/a	55	n/a
Summer:	87	70		43%	50%	75	18.94
System 4 Classroom Wing		Outdoor	Outdoor	Outdoor	Indoor	Indoor	Grains
Input Data		Dry Bulb	Wet Bulb	Rel.Hum	Rel.Hum	Dry Bulb	Difference
Winter:		<u>-2</u>	-2.6	80%	n/a	55	n/a
Summer:		-2 87	-2.0	43%	50%	75	18.94
System 5 Boiler.Connector Input Data			Outdoor et Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:		-2	-2.6	80%	n/a	55	n/a
Summer:		87	70	43%	50%	75	18.94
Duct Sizing Inputs							
	lain Trunk		Runouts				
Calculate:	Yes		Yes				
Use Schedule:	Yes		Yes				
Roughness Factor:	0.00300		0.01000				
Pressure Drop:	0.1000 in.wg./10	0 ft		in.wg./100 ft			
Minimum Velocity:	0 ft./min	010.		ft./min	•		
Maximum Velocity:	900 ft./min			ft./min			
Minimum Height:	0 in.		0	in.			
Maximum Height:	0 in.		0				
Outside Air Data							
	Winter		Su	mmer			
Infiltration Specified:	0.170	AC/hr CFM		0.155 AC/hr 304 CFM			
Infiltration Actual:	0.170			0.155 AC/hr			
Building Volume:	<u>X 117,912*</u>			<u>.912*</u> Cu.ft.			
		Cu.ft./hr		. <u>912</u> Cu.ft./ 8,231 Cu.ft./	hr		
	<u>X 0.0167</u>	C G.10,111		.0167			
Total Building Infiltration:		CFM	<u>~_</u> 0.	304 CFM			
Total Building Ventilation:		CFM		0 CFM			
*Indicated volume is based				5 51 10			
	stream sunding						
System 1							
Infiltration & Ventilation Ser	sible Gain Multiplier	12.96	= (1.10)	(0.982 X 12.0	00 Summer T	emp. Differen	ce)
Infiltration & Ventilation Late				(0.982 X 18.9			/
Infiltration & Ventilation Ser						np. Difference	e)
Winter Infiltration Specified:			(110)				'
Summer Infiltration Specifie							
		/					
System 2							
Infiltration & Ventilation Ser	nsible Gain Multiplier	: 12.96	= (1.10 ×	(0.982 X 12.0	00 Summer T	emp. Differen	ce)
Infiltration & Ventilation Late				(0.982 X 18.9			,
Infiltration & Ventilation Ser						np. Difference	e)
Winter Infiltration Specified:							
Summer Infiltration Specifie							
System 3	, , , , , , , , , , , , , , , , , , ,	, -		-			



Miscellaneous Report (cont'd)

		eous Repor						
	side Air Da		- Osia Maltinlian	40.00		0.00.0	D:#***	-)
Infilt Infilt Wint	ration & V ration & V ter Infiltrat	entilation Latent	e Gain Multiplier: Gain Multiplier: e Loss Multiplier: 0.280 AC/hr (22 CFN 0.150 AC/hr (12 CFN	12.64 61.55 I), Constr		8.94 Grains Dif	fference)	
 Infilt Infilt	System 4 ration & V ration & V			12.64	= (1.10 X 0.982 X 1 = (0.68 X 0.982 X 1 = (1.10 X 0.982 X 5	8.94 Grains Dif	fference)	,
		ion Specified: ration Specified:	0.184 AC/hr (57 CFN 0.184 AC/hr (57 CFN					
Infilt Infilt Infilt Wint	ration & V ration & V ter Infiltrat			12.64 61.55 1)	= (1.10 X 0.982 X 1 = (0.68 X 0.982 X 1 = (1.10 X 0.982 X 5	8.94 Grains Dif	fference)	
Duc	t Load Fa	ctor Scenarios for	System 1					
				Attic	Duct	Duct	Surface	From
	Туре	Description	Location	Ceiling	Leakage	Insulation	Area	T]MDE
1 1	Supply Return		Closed Crawl B Closed Crawl A	-	0.12 0.12	6 6	677 251	Ni Ni
Duc	t Load Fa	ctor Scenarios for	System 2					
No	Туре	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	Fron [T]MD[
1 1	Supply Return	Decomption	Closed Crawl B Closed Crawl A	-	0.12 0.12	6 6	677 251	No No
Duc	t Load Fa	ctor Scenarios for	System 3					
000				Attic	Duct	Duct	Surface	Fron
No.	Туре	Description	Location	Ceiling	Leakage	Insulation	Area	
1 1	Supply Return	•	Closed Crawl B Closed Crawl A	-	0.12 0.12	6 6	677 251	No No
Duc	t Load Fa	ctor Scenarios for	· System 4					
				Attic	Duct	Duct	Surface	Fron
No.	Туре	Description	Location	Ceiling	Leakage	Insulation	Area	[T]MDI
1	Supply		Closed Crawl B	-	0.12	6	677	N
1	Return		Closed Crawl A	-	0.12	6	251	No



Load Preview Report

Scope	Net Ton	ft.² /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	0.00	0	10,779	0	0	0	103,242	1,353	0	1,353	
System 1	0.00	0	2,173	0	0	0	38,547 <mark>-</mark>	504	0	504	9x11
Return Duct				0	0	0	417				
Zone 1			2,173	0	0	0	38,130	504	0	504	9x11
1-Great Hall			2,173	0	0	0	38,130 <mark></mark>	504	0	504	56
System 2	0.00	0	3,285	0	0	0	20,976	273	0	273	7x9
Return Duct				0	0	0	340				
Zone 1			3,285	0	0	0	20,635 <mark>-</mark>	273	0	273	7x9
2-Utility Room			644	0	0	0	488	6	0	6	14
3-Choir Room			504	0	0	0	1,815 <mark>-</mark>	24	0	24	14
4-Hall			343	0	0	0	428	6	0	6	14
5-Youth Room			1,794	0	0	0	17,905 <mark>-</mark>	237	0	237	36
System 3	0.00	0	371	0	0	0	3,095	40	0	40	4x4
Return Duct				0	0	0	33				
Zone 1			371	0	0	0	3,061	40	0	40	4x4
15-Kitchen			371	0	0	0	3,061	40	0	40	15
System 4	0.00	0	2,110	0	0	0	16,454	215	0	215	6x9
Return Duct				0	0	0	178				
Zone 1			2,110	0	0	0	16,276	215	0	215	6x9
16-Entry & Hall			660	0	0	0	3,512 <mark>-</mark>	46	0	46	15
17-Assistant			192	0	0	0	1,390 <mark>_</mark>	18	0	18	14
18-Lg Classroom			442	0	0	0	5,110	68	0	68	16
19-Chapel			344	0	0	0	4,315	57	0	57	15
20-Nursery			344	0	0	0	1,950 <mark>-</mark>	26	0	26	14
21-2009 Restrooms			128	0	0	0	0	0	0	0	00
System 5	0.00	0	2,840	0	0	0	24,171	320	0	320	7x10
Zone 1			2,840	0	0	0	24,171	320	0	320	7x10
6-Atrium			1,260	0	0	0	8,579	113	0	113	25
7-Restroom			104	0	0	0	883	12	0	12	14
8-Hall			170	0	0	0	1,824	24	0	24	14
9-2nd Floor Connector Hall			154	0	0	0	2,377	31	0	31	14
10-Office			288	0	0	0	1,409	19	0	19	14
11-Rector			144	0	0	0	1,020	13	0	13	14
12-Library			240	0	0	0	1,357	18	0	18	14
13-Hall Landing			216	0	0	0	2,584	34	0	34	14
14-Sacristy			264	0	0	0	4,138	55	0	55	15

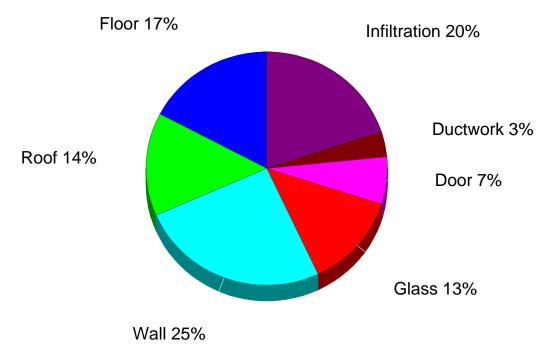


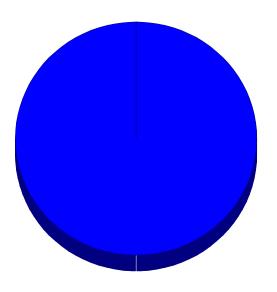
Total Building Summary Loads

Component Description Replacement: Glazing-Wood double hung, DP, clear, U- value 0.36, SHGC 0.57 1E-cm: Glazing-Double pane window, fixed sash, clear, metal frame no break, U-value 0.69, SHGC 0.69 double pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56 double pane: Glazing-wood thermal pane window 90s, U- value 0.37, SHGC 0.56 11G: Door-Wood - Panel, U-value 0.54 11J: Door-Metal - Fiberglass Core, U-value 0.6	Area Quan 192.2 6.2 253.4 120.5 175.4	Sen Loss 3,939 244 6,788	Lat Gain 0 0 0	Sen Gain 0 0	Total Gain 0
 Replacement: Glazing-Wood double hung, DP, clear, U-value 0.36, SHGC 0.57 1E-cm: Glazing-Double pane window, fixed sash, clear, metal frame no break, U-value 0.69, SHGC 0.69 double pane: Glazing-wood thermal pane window 90s, U-value 0.47, SHGC 0.56 double pane: Glazing-wood thermal pane window 90s, U-value 0.37, SHGC 0.56 11G: Door-Wood - Panel, U-value 0.54 	192.2 6.2 253.4 120.5	3,939 244 6,788	0 0	0 0	0
value 0.36, SHGC 0.57 1E-cm: Glazing-Double pane window, fixed sash, clear, metal frame no break, U-value 0.69, SHGC 0.69 double pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56 double pane: Glazing-wood thermal pane window 90s, U- value 0.37, SHGC 0.56 11G: Door-Wood - Panel, U-value 0.54	6.2 253.4 120.5	244 6,788	0	0	-
 1E-cm: Glazing-Double pane window, fixed sash, clear, metal frame no break, U-value 0.69, SHGC 0.69 double pane: Glazing-wood thermal pane window 90s, U-value 0.47, SHGC 0.56 double pane: Glazing-wood thermal pane window 90s, U-value 0.37, SHGC 0.56 11G: Door-Wood - Panel, U-value 0.54 	253.4 120.5	6,788			0
 double pane: Glazing-wood thermal pane window 90s, U-value 0.47, SHGC 0.56 double pane: Glazing-wood thermal pane window 90s, U-value 0.37, SHGC 0.56 11G: Door-Wood - Panel, U-value 0.54 	120.5		0	-	
double pane: Glazing-wood thermal pane window 90s, U- value 0.37, SHGC 0.56 11G: Door-Wood - Panel, U-value 0.54		0 5 40		0	0
11G: Door-Wood - Panel, U-value 0.54	175 /	2,542	0	0	0
		5,400	0	0	0
113. D001-101etat - 1 10etglass 001e, 0-value 0.0	39.4	1,349	0	0	0
Great Hall Walls: Wall-Frame, Custom, Insulated 2x6	1964.9	8,961	0	0	0
with 20% framing factor, U-value 0.08	2052	11 111	0	0	0
12E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud cavity, no board insulation, siding finish, wood studs, U-value 0.068	2952	11,444	0	0	0
15A11-0ocw-2: Wall-Basement, , framing with R-11 sill to	1077	5,856	0	0	0
floor in 2 x 4 cavity, open core, no board insulation, plus interior finish, wood studs, 2' floor depth, U- value 0.074					
18A-13: Roof/Ceiling-Roof Joists Between Roof Deck	2371.2	10,272	0	0	0
and Ceiling or Foam Encapsulated Roof Joists, Dark or Bold-Color Asphalt Shingle, Dark Metal, Dark Membrane, Dark Tar and Gravel, R-13 blanket or					
loose fill, U-value 0.076 16B-30: Roof/Ceiling-Under Attic with Insulation on Attic	492	897	0	0	0
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, U-value 0.032 N16A-50: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition	2157.3	2,336	0	0	0
Ceilings), Custom, Open Blow 18" Cellulose, U-value 0.019	1120 5	4 005	0	0	0
N16A-50-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Open Blow 18" Cellulose, light	1130.5	1,225	0	0	0
metal, U-value 0.019 19C1-11osp: Floor-Over enclosed crawl space, R-11 insulation on exposed walls, spray foam insulation,	1394	1,518	0	0	0
sealed crawl space, passive, R-11 open cell 1/2 lb. spray foam, 3 inches in 2 x 10 joist cavity, U-value 0.072					
19A-0tp: Floor-Over enclosed crawl space, No insulation on exposed walls, sealed or vented space, passive,	3318.1	16,324	0	0	0
no floor insulation, tile or vinyl, U-value 0.168 Subtotals for structure:		79,095	0	0	0
People:	20	13,035	0	0	0
Equipment:	20		0	0	0
Lighting:	0		U	0	0
Ductwork:	U	3,582	0	0	0
Infiltration: Winter CFM: 334, Summer CFM: 304		20,565	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		20,565	0	0	0
Total Building Load Totals:		103,242	0	0	0
Check Figures					
Total Building Supply CFM: 1,353	CFM P	er Square ft.:		(.126 *

C:\ ...\Parish Improved.rh9

Rhvac - Residential & Light Commerci S.E.E.D.S.	al HVAC Loads	Elite Software Development, Inc. St. Andrews IMPROVED
Jaffrey, NH 03452	•	Page 7
Total Building Summary	/ Loads (cont'd)	
Check Figures		
Square ft. of Room Area: Volume (ft³):	10,779 So 117,912***	quare ft. Per Ton: 0 **
* Based on area of rooms being he	eated or cooled (whichever goverr	ns system) rather than entire floor area.
** Based on area of rooms being c ***Indicated volume is based on cu		
Building Loads		
Total Heating Required Including V	/entilation Air: 103,242 Btu	uh 103.242 MBH
Notes		
Rhvac is an ACCA approved Manu Calculations are performed per AC		2 and ACCA Manual D
All computed results are estimates		
Be sure to select a unit that meets your design conditions.	both sensible and latent loads acc	cording to the manufacturer's performance data at
your design conditions.		





100.0%



System 1 Great Hall Summary Loads

	Area	Sen	Lat	Sen	Total
Description	Quan	Loss	Gain	Gain	Gair
eplacement: Glazing-Wood double hung, DP, clear, U- value 0.36, SHGC 0.57	192.2	3,939	0	0	C
E-cm: Glazing-Double pane window, fixed sash, clear, metal frame no break, U-value 0.69, SHGC 0.69	3.2	126	0	0	C
1G: Door-Wood - Panel, U-value 0.54	61.2	1,884	0	0	(
1J: Door-Metal - Fiberglass Core, U-value 0.6	39.4	1,349	0 0	0	(
Great Hall Walls: Wall-Frame, Custom, Insulated 2x6	1964.9	8,961	Ö	0	(
with 20% framing factor, U-value 0.08	1004.0	0,001	0	0	, c
2E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud	112	434	0	0	(
cavity, no board insulation, siding finish, wood studs, U-value 0.068	112	-0-	0	0	, c
8A-13: Roof/Ceiling-Roof Joists Between Roof Deck	2000	8,664	0	0	(
and Ceiling or Foam Encapsulated Roof Joists, Dark or Bold-Color Asphalt Shingle, Dark Metal, Dark Membrane, Dark Tar and Gravel, R-13 blanket or loose fill, U-value 0.076	2000	8,004	0	0	C
6B-30: Roof/Ceiling-Under Attic with Insulation on Attic	492	897	0	0	(
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, U-value 0.032	492	097	0	0	U
9C1-11osp: Floor-Over enclosed crawl space, R-11 insulation on exposed walls, spray foam insulation, sealed crawl space, passive, R-11 open cell 1/2 lb. spray foam, 3 inches in 2 x 10 joist cavity, U-value 0.072	1394	1,518	0	0	C
Subtotals for structure:		27,772	0	0	0
People:	20	,	0	0	C
Equipment:			0	0	C
_ighting:	0		-	0	C
Ductwork:	-	1,542	0	0	C
nfiltration: Winter CFM: 150, Summer CFM: 150		9,233	0	0	C
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	C
System 1 Great Hall Load Totals:		38,547	0	0	C
Check Figures					
Supply CFM: 504	CFM P	er Square ft.:			0.232 *
Square ft. of Room Area: 2,173 Volume (ft³): 49,592***		ft. Per Ton:			0 **
 * Based on area of rooms being heated or cooled (whicher ** Based on area of rooms being cooled. ***Indicated volume is based on custom building volume. System Loads 	ever governs sys	stem) rather tha	n entire floor a	area.	
	38,547 Btuh	38.547 ME	3H		
· · · · · · · · · · · · · · · · · · ·	21011				
Notes					

Jaffrey, NH 03452			Page 10		
System 2 Choir And Youth Room Summ	ary Loads				
Component	Area	Sen	Lat	Sen	Total
Description	Quan	Loss	Gain	Gain	Gain
1E-cm: Glazing-Double pane window, fixed sash, clear, metal frame no break, U-value 0.69, SHGC 0.69	3	118	0	0	0
double pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56	56.2	1,504	0	0	0
11G: Door-Wood - Panel, U-value 0.54	19	586	0	0	0
15A11-0ocw-2: Wall-Basement, , framing with R-11 sill to floor in 2 x 4 cavity, open core, no board insulation, plus interior finish, wood studs, 2' floor depth, U- value 0.074	1029	5,614	0	0	0
12E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud cavity, no board insulation, siding finish, wood studs, U-value 0.068	156.8	608	0	0	0
19A-0tp: Floor-Over enclosed crawl space, No insulation on exposed walls, sealed or vented space, passive, no floor insulation, tile or vinyl, U-value 0.168	1794	8,826	0	0	0
Subtotals for structure:		17,256	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		1,259	0	0	0
Infiltration: Winter CFM: 40, Summer CFM: 20		2,461	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
System 2 Choir And Youth Room Load Totals:		20,976	0	0	0
Check Figures					
Supply CFM:273Square ft. of Room Area:3,285		er Square ft.: ft. Per Ton:			0.083 * 0 **

Volume (ft³): 23,991*** * Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.

** Based on area of rooms being cooled.

***Indicated volume is based on custom building volume.

System Loads

Total Heating Required Including Ventilation Air:20,976Btuh20.976MBH

Notes

Rhvac is an ACCA approved Manual J, D and S 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.



System 3 Kitchen Summary Loads

Component	Area	Sen	Lat	Sen	Tota
Description	Quan	Loss	Gain	Gain	Gair
8A-13: Roof/Ceiling-Roof Joists Between Roof Deck and Ceiling or Foam Encapsulated Roof Joists, Dark or Bold-Color Asphalt Shingle, Dark Metal, Dark Membrane, Dark Tar and Gravel, R-13 blanket or loose fill, U-value 0.076	371.2	1,608	0	0	(
Subtotals for structure:		1,608	0	0	C
People:	0	,	0	0	(
Equipment:	-		0	0	(
Lighting:	0			0	(
Ductwork:		124	0	0	(
nfiltration: Winter CFM: 22, Summer CFM: 12		1,363	0	0	(
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	(
System 3 Kitchen Load Totals:		3,095	0	0	(
Check Figures					
Supply CFM: 40		er Square ft.:		(0.109 *
Square ft. of Room Area: 371 Volume (ft ³): 4,745***	Square	ft. Per Ton:			0 *
* Based on area of rooms being heated or cooled (whic ** Based on area of rooms being cooled.	liever gevenie eye				
***Indicated volume is based on custom building volume).				
***Indicated volume is based on custom building volume System Loads		2 005 M	оц		
***Indicated volume is based on custom building volume	3,095 Btuh	3.095 MI	ВН		

Component

Sen

Cair

Page 12

Total

Cair

System 4 Classroom Wing & Hall Summary Loads Area Sen Lat S - 1

Description	Quan	Loss	Gain	Gain	Gain
double pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56	188.2	5,040	0	0	0
11G: Door-Wood - Panel, U-value 0.54	38.1	1,172	0	0	0
12E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud cavity, no board insulation, siding finish, wood studs, U-value 0.068	1013.3	3,929	0	0	0
N16A-50: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Open Blow 18" Cellulose, U-value 0.019	851.5	922	0	0	0
N16A-50-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Open Blow 18" Cellulose, light metal, U-value 0.019	1130.5	1,225	0	0	0
Subtotals for structure:		12,288	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		658	0	0	0
Infiltration: Winter CFM: 57, Summer CFM: 57		3,508	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
System 4 Classroom Wing & Hall Load Totals:		16,454	0	0	0
Check Figures					
Supply CFM: 215	CFM P	er Square ft	.:		0.102 *
Square ft. of Room Area: 2,110 Volume (ft³): 18,606***	Square	ft. Per Ton:			0 **
 * Based on area of rooms being heated or cooled (whichev ** Based on area of rooms being cooled. ***Indicated volume is based on custom building volume. 	er governs sys	tem) rather	than entire flo	or area.	
System Loads					
	,454 Btuh	16.454	MBH		
Notes					
Rhvac is an ACCA approved Manual J, D and S computer p Calculations are performed per ACCA Manual J 8th Edition All computed results are estimates as building use and wea Be sure to select a unit that meets both sensible and latent your design conditions.	, Version 2, an ther may vary.			erformance da	ata at

System 5 Boiler.Connector Summary Loads

System 5 Doller. Connector Summary Loc	203				
Component	Area	Sen	Lat	Sen	Total
Description	Quan	Loss	Gain	Gain	Gain
double pane: Glazing-wood thermal pane window 90s, U- value 0.37, SHGC 0.56	120.5	2,542	0	0	0
double pane: Glazing-wood thermal pane window 90s, U- value 0.47, SHGC 0.56	9.1	244	0	0	0
11G: Door-Wood - Panel, U-value 0.54	57.1	1,758	0	0	0
15A11-0ocw-2: Wall-Basement, , framing with R-11 sill to floor in 2 x 4 cavity, open core, no board insulation, plus interior finish, wood studs, 2' floor depth, U-value 0.074	48	242	0	0	0
12E-0sw: Wall-Frame, R-19 insulation in 2 x 6 stud cavity, no board insulation, siding finish, wood studs, U-value 0.068	1669.9	6,473	0	0	0
N16A-50: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Open Blow 18" Cellulose, U-value 0.019	1305.8	1,414	0	0	0
19A-0tp: Floor-Over enclosed crawl space, No insulation on exposed walls, sealed or vented space, passive, no floor insulation, tile or vinyl, U-value 0.168	1524.1	7,498	0	0	0
Subtotals for structure:		20,171	0	0	0
People:	0	_0,	0	0 0	0 0
Equipment:	Ū.		0	0 0	0 0
Lighting:	0		Ũ	0 0	0
Ductwork:	Ũ	0	0	0 0	0
Infiltration: Winter CFM: 65, Summer CFM: 65		4,000	0 0	0 0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		4,000	Ő	0	0
System 5 Boiler.Connector Load Totals:		24,171	0	0	0
Check Figures					
Supply CFM:320Square ft. of Room Area:2,840		er Square ft.: ft. Per Ton:			0.113 * 0 **
Volume (ft ³): 20,978*** * Based on area of rooms being heated or cooled (whicheve ** Based on area of rooms being cooled. ***Indicated volume is based on custom building volume.	er governs sys	tem) rather tha	n entire floor	area.	
System Loads					
	171 Btuh	24.171 ME	SH		
Notes					

Rhvac is an ACCA approved Manual J, D and S 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.

Elite Software Development, Inc. St. Andrews IMPROVED

St. Andrews Sanctuary Existing HVAC Load Calculations

for

St Andrews Episcopal Church Main Street Hopkinton, NH





Prepared By:

Margaret Dillon S.E.E.D.S.

603-532-8979 Tuesday, April 13, 2021

Rhvac is an ACCA approved Manual J, D and S computer program. Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.

Rhvac - Residential & Light Commercial HVAC Loads S.E.E.D.S. Jaffrey, NH 03452		S.E.E.D.S. St. Andrews Sanctuary Existing									
Project Report											
General Project InformationProject Title:St. Andrews SandProject Date:Saturday, April 3,Client Name:St Andrews EpiscClient Address:Main StreetClient City:Hopkinton, NHCompany Name:S.E.E.D.S.Company Representative:Margaret DillonCompany E-Mail Address:mdillon@myfairpot	2021 opal Church										
	Concord AP, New Hampshire Front door faces South High 43 Degrees 10 ft. 32										
Outdoor Dry BulbOutdoor Wet BulbWinter:-2-2.6Summer:8770	OutdoorIndoorIndoorRel.HumRel.HumDry Bulbn/an/a5543%50%75	Grains <u>Difference</u> n/a 19									
Square ft. of Room Area:		0 **									
Building Loads											
Total Heating Required Including Ventilation Air:	108,120 Btuh 108.120	MBH									
Calculations are performed per ACCA Manual J All computed results are estimates as building us	Notes Rhvac is an ACCA approved Manual J, D and S 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										

Rhvac - Residential & Light Commercial HVAC Loads S.E.E.D.S. Jaffrey, NH 03452



Miscellaneous Report

Input Data Dry Bulb Wet Bulb Rel.Hum Rel.Hum Dry Bulb Differer Winter: -2 -2.6 80% n/a 55 n Summer: 87 70 43% 50% 75 18 Duct Sizing Inputs Main Trunk Runouts Calculate: Yes Yes Yes Calculate: Yes Yes Yes Yes Yes Yes Roughness Factor: 0.00300 0.01000 in.wg/100 ft. 0.1000 in.wg/100 ft. Main Trunk Main Trunk Runouts Maximum Velocity: 0 ft./min 0 ft./min Maximum Velocity: 00 in. 0		is Report							
Winter: -2 -2.6 80% n/a 55 n Summer: 87 70 43% 50% 75 18. Duct Sizing Inputs Main Trunk Runouts 50% 75 18. Duct Sizing Inputs Main Trunk Runouts 50% 75 18. Calculate: Yes Yes <t< td=""><td>System 1</td><td>Outdoo</td><td>or</td><td>Outdoor</td><td>Outdoor</td><td></td><td>Indoor</td><td>Indoor</td><td>Graii</td></t<>	System 1	Outdoo	or	Outdoor	Outdoor		Indoor	Indoor	Graii
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Main TrunkRunoutsCalculate:YesCalculate:YesSub Schedule:YesRoughness Factor:0.003000.0000in.wg/100 ft.Oressure Drop:0.1000 in.wg/100 ft.Uninum Velocity:900 ft./minO tf./min0 in.Maximum Velocity:900 ft./minAaximum Height:0 in.0 in.0 in.Aaximum Height:0 in.0 in.0 in.Outside Air DataMiltitration Specified:0.220 AC/hr0.110 Ac/hrBuilding Volume: $\chi_{.50,160^{\circ}}$ Cu.ft. <tr< td=""><td>Summer:</td><td>8</td><td>7</td><td>70</td><td>43%</td><td></td><td>50%</td><td>75</td><td>18.9</td></tr<>	Summer:	8	7	70	43%		50%	75	18.9
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No. TypeDescriptionLocationCeilingLeakageInsulationArea[T]MI1SupplyClosed Crawl B-0.120677				Δtti	<u>^</u>	Duc		ict Surfac	e Ero
1 Supply Closed Crawl B - 0.12 0 677	No Type Des	cription I	ocation						
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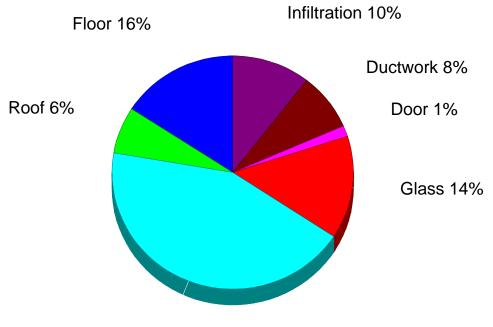
Load Preview Report

Scope	Net Ton	ft.² /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	0.00	0	2,508	0	0	0	108,120	1,399	0	1,399	
System 1	0.00	0	2,508	0	0	0	108,120	1,399	0	1,399	16x16
Return Duct				0	0	0	2,339				
Zone 1			2,508	0	0	0	105,780	1,399	0	1,399	16x16
1-Sanctuary			2,508	0	0	0	105,780	1,399	0	1,399	137

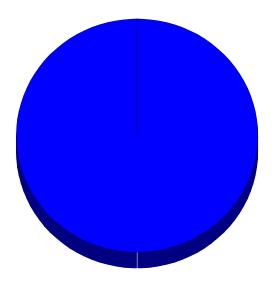


Total Building Summary Loads

	Area	Sen	Lat	Sen	Tot
Description	Quan	Loss	Gain	Gain	Ga
tained Glass: Glazing-Historic stained glass with	460	14,944	0	0	
exterior storms, U-value 0.57, SHGC 0.6 C-cm: Glazing-Single pane window with storm, clear,	9.5	471	0	0	
metal frame no break, U-value 0.87, SHGC 0.67	9.5	471	0	0	
ID: Door-Wood - Solid Core, U-value 0.39	72.8	1,618	0	0	
one Church: Wall-Block, Custom, 14 inch stone with	12.0	1,010	Ũ	Ũ	
interior framing					
laster finish, U-value 0.25	3297.7	46,993	0	0	
BR-19-ml: Roof/Ceiling-Under Attic with Insulation or		7,005	0	0	
Attic Floor (also use for Knee Walls and Partition					
Ceilings), unvented attic with radiant barrier, R-19					
insulation, light metal, U-value 0.049					
A-0tp: Floor-Over enclosed crawl space, No insulatio		17,118	0	0	
on exposed walls, sealed or vented space, passive	,				
no floor insulation, tile or vinyl, U-value 0.368					
ubtotals for structure:		88,149	0	0	
eople:	0		0	0	
quipment:			0	0	
ghting:	0	0.050	0	0	
uctwork:		8,650	0	0	
nfiltration: Winter CFM: 184, Summer CFM: 92 entilation: Winter CFM: 0, Summer CFM: 0		11,321 0	0 0	0 0	
otal Building Load Totals:		108,120	0	0	
heck Figures					
otal Building Supply CFM: 1,399		Per Square ft.:			0.558
Total Building Supply CFM:1,399Square ft. of Room Area:2,508		Per Square ft.: e ft. Per Ton:			0.558 0
Total Building Supply CFM: 1,399 Square ft. of Room Area: 2,508 'olume (ft ³): 50,160***	Square	e ft. Per Ton:		2762	
otal Building Supply CFM:1,399quare ft. of Room Area:2,508olume (ft³):50,160***Based on area of rooms being heated or cooled (white	Square	e ft. Per Ton:		area.	
otal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled.	Square ichever governs sy	e ft. Per Ton:		area.	
tal Building Supply CFM:1,399quare ft. of Room Area:2,508olume (ft³):50,160***Based on area of rooms being heated or cooled (whiBased on area of rooms being cooled.*Indicated volume is based on custom building volume	Square ichever governs sy	e ft. Per Ton:		area.	
balance 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads	Square ichever governs sy ne.	e ft. Per Ton: stem) rather t	han entire floor	area.	
based on area of rooms being heated or cooled (white Based on area of rooms being cooled. *Indicated volume is based on custom building volume uilding Loads botal Heating Required Including Ventilation Air:	Square ichever governs sy	e ft. Per Ton:	han entire floor	area.	
bital Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads bital Heating Required Including Ventilation Air: otes	Square ichever governs sy ne. 108,120 Btuh	e ft. Per Ton: stem) rather t	han entire floor	area.	
otal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads otal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compo	Square ichever governs sy ne. 108,120 Btuh uter program.	e ft. Per Ton: stem) rather t 108.120	han entire floor MBH	area.	
otal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads otal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compo alculations are performed per ACCA Manual J 8th Ec	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH	area.	
balance 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads btal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compralculations are performed per ACCA Manual J 8th Ecol Il computed results are estimates as building use and	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
balance 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads botal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S computed Icolutions are performed per ACCA Manual J 8th Ecolution Il computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
batal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 blume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads btal Heating Required Including Ventilation Air: btas bta	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
balance 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads botal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compound alculations are performed per ACCA Manual J 8th Ecol I computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
bala Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 blume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads btal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compo alculations are performed per ACCA Manual J 8th Ec I computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
batal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 blume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads btal Heating Required Including Ventilation Air: btas bta	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
bala Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 blume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads btal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compo alculations are performed per ACCA Manual J 8th Ec I computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
bala Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 blume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads btal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compo alculations are performed per ACCA Manual J 8th Ec I computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
balance 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads botal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compound alculations are performed per ACCA Manual J 8th Ecol I computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
bital Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads otal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compralculations are performed per ACCA Manual J 8th Ecol ll computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
balance 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads botal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S computed Icolutions are performed per ACCA Manual J 8th Ecolution Il computed results are estimates as building use and estimates both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
otal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads otal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S computed alculations are performed per ACCA Manual J 8th Ec II computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
otal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. **Indicated volume is based on custom building volum uilding Loads otal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S comp alculations are performed per ACCA Manual J 8th Ec Il computed results are estimates as building use and e sure to select a unit that meets both sensible and la	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
otal Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160***	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0
bital Building Supply CFM: 1,399 quare ft. of Room Area: 2,508 olume (ft ³): 50,160*** Based on area of rooms being heated or cooled (whi Based on area of rooms being cooled. *Indicated volume is based on custom building volum uilding Loads otal Heating Required Including Ventilation Air: otes hvac is an ACCA approved Manual J, D and S compralculations are performed per ACCA Manual J 8th Ecol ll computed results are estimates as building use and e sure to select a unit that meets both sensible and late	Square ichever governs sy ne. 108,120 Btuh uter program. dition, Version 2, ar	e ft. Per Ton: stem) rather t 108.120 I nd ACCA Man	han entire floor MBH wal D.		0



Wall 43%



100.0%



System 1 Summary Loads

System 1 Summary Loads					
Component	Area	Sen	Lat	Sen	Total
Description	Quan 460		Gain 0	Gain	Gain 0
Stained Glass: Glazing-Historic stained glass with exterior storms, U-value 0.57, SHGC 0.6	460	14,944	0	0	0
IC-cm: Glazing-Single pane window with storm, clear,	9.5	471	0	0	0
metal frame no break, U-value 0.87, SHGC 0.67	0.0		C C	C C	
1D: Door-Wood - Solid Core, U-value 0.39	72.8	1,618	0	0	0
Stone Church: Wall-Block, Custom, 14 inch stone with					
interior framing					
plaster finish, U-value 0.25	3297.7	46,993	0	0	C
I6BR-19-ml: Roof/Ceiling-Under Attic with Insulation on	2508	7,005	0	0	C
Attic Floor (also use for Knee Walls and Partition					
Ceilings), unvented attic with radiant barrier, R-19 insulation, light metal, U-value 0.049					
19A-0tp: Floor-Over enclosed crawl space, No insulation	า 2508	17,118	0	0	C
on exposed walls, sealed or vented space, passive,		17,110	Ũ	Ũ	
no floor insulation, tile or vinyl, U-value 0.368					
Subtotals for structure:		88,149	0	0	C
People:	0	00,110	0	0	C
Equipment:	-		0	0	C
Lighting:	0			0	C
Ductwork:		8,650	0	0	0
Infiltration: Winter CFM: 184, Summer CFM: 92		11,321	0	0	C
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	C
System 1 Load Totals:		108,120	0	0	C
Check Figures					
Supply CFM: 1,399		Per Square ft.:			0.558 *
Square ft. of Room Area: 2,508 Volume (ft ³): 50,160***	Squar	e ft. Per Ton:			0 **
Volume (ft ³): 50,160*** * Based on area of rooms being heated or cooled (white	chover governe ev	ctom) rathor th	on ontiro floor	2102	
** Based on area of rooms being cooled.	chever governs sy	stern) rather ti		alea.	
***Indicated volume is based on custom building volum	e.				
System Loads					
Total Heating Required Including Ventilation Air:	108,120 Btuh	108.120 N	ЛВН		
Notes	· .				
Rhvac is an ACCA approved Manual J, D and S compu	iter program.				
Calculations are performed per ACCA Manual J 8th Ed		nd ACCA Man	ual D.		
All computed results are estimates as building use and					
Be sure to select a unit that meets both sensible and la	tent loads accordi	ng to the manu	ufacturer's perfo	rmance dat	a at
your design conditions.		-			

St. Andrews ESM 1-3 HVAC Load Calculations

for

St Andrews Episcopal Church Main Street Hopkinton, NH





Prepared By:

Margaret Dillon S.E.E.D.S.

603-532-8979 Tuesday, April 13, 2021

Rhvac is an ACCA approved Manual J, D and S computer program. Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.



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Project Report	
General Project Information	
Project Date:Saturday, April 3, 2021Client Name:St Andrews Episcopal Church	
Client Address: Main Street Client City: Hopkinton, NH	
Company Name:S.E.E.D.S.Company Representative:Margaret Dillon	
Company Phone:603-532-8979Company E-Mail Address:mdillon@myfairpoint.net	
Design Data Reference City: Concord AP, Ne	ew Hampshire
Building Orientation:Front door facesDaily Temperature Range:HighLatitude:43Elevation:510	
Altitude Factor: 0.982	
<u>Dry Bulb Wet Bulb Rel.Hum Rel.H</u>	•
Winter: -2 -2.6 n/a Summer: 87 70 43% 5	n/a 55 n/a 0% 75 19
Check FiguresTotal Building Supply CFM:490C	FM Per Square ft.: 0.195 *
	quare ft. Per Ton: 0 **
Building Loads	
Total Heating Required Including Ventilation Air: 37,548 Btr	uh 37.548 MBH
Notes	
Rhvac is an ACCA approved Manual J, D and S computer program. Calculations are performed per ACCA Manual J 8th Edition, Version All computed results are estimates as building use and weather may Be sure to select a unit that meets both sensible and latent loads act your design conditions.	vary.

Rhvac - Residential & Light Commercial HVAC Loads S.E.E.D.S. Jaffrey, NH 03452



Miscellaneous Report

WISCEII dHE	ous Report							
System 1	Outo	door	Outdoor	Outdoor		Indoor	Indoor	Grains
Input Data	Dry I	Bulb	Wet Bulb	Rel.Hum	n R	el.Hum	Dry Bulb	Difference
Winter:		-2	-2.6	80%)	n/a	55	n/a
Summer:		87	70	43%)	50%	75	18.94
Duct Sizing Inp	uts							
. .	Main Tru	nk		<u>Runouts</u>				
Calculate:	Ye	es		Yes				
Use Schedule:	Ye	es		Yes				
Roughness Fac	ctor: 0.0030	00		0.01000				
Pressure Drop:	0.100	0 in.wg./1	00 ft.	0.1000	in.wg./100	D ft.		
Minimum Veloc		0 ft./min			ft./min			
Maximum Veloo	city: 90	00 ft./min		750	ft./min			
Minimum Heigh	nt:	0 in.		0	in.			
Maximum Heigl		0 in.		0	in.			
Outside Air Dat								
	<u> </u>	Winter		Sur	nmer			
Infiltration Spec	ified:	0.132	AC/hr	C).132 AC/	hr		
•			CFM		110 CFM			
Infiltration Actua	al·		AC/hr	ſ).132 AC/			
Building Volume		× 50.160*			<u>160*</u> Cu.t			
Dulialing Volum	.		Cu.ft./hr		600 Cu.			
		X 0.0167		X 0.		11./111		
Total Building In	ofiltration		CFM	Λ 0.	110 CFN	Л		
Total Building V			CFM		0 CFN			
	ne is based on cust				U CFI	VI		
muicaleu voiui		Jin building	volume.					
System 1	_							
	ntilation Sensible G	ain Multinlia	r: 12.	96 - (1 10 X	0 082 X 1	2 00 Summe	r Temp. Differei	nce)
	ntilation Latent Gair		1. 12. 12.			8.94 Grains [nce)
	ntilation Sensible Lo						Temp. Difference	(n)
Winter Infiltratic		132 AC/hr ($55 = (1.10 \times$	0.902 A 3		emp. Dinerenc	e)
Summer Infiltra		132 AC/11 (132 AC/hr (
	or Scenarios for Sys		۸		Durat	Dur (Occurring a	F
No. Type	Description	Location	Atti		Duct Leakage	Duct Insulation	Surface Area	From [T]MDE
1 Supply	Description	Closed C		iirig	0.12	0	677	<u>I JIVIDL</u> No
1 Return		Closed C			0.12	0	251	N
i Ketuin		Closed C			0.12	0	201	



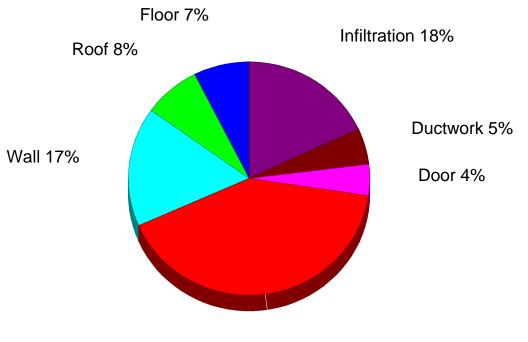
Load Preview Report

Scope	Net Ton	ft.² /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	0.00	0	2,508	0	0	0	37,548	490	0	490	
System 1	0.00	0	2,508	0	0	0	37,548	<mark>490</mark>	0	490	9x11
Return Duct				0	0	0	508				
Zone 1			2,508	0	0	0	37,041	<mark>490</mark>	0	490	9x11
1-Sanctuary			2,508	0	0	0	37,041	490	0	490	56

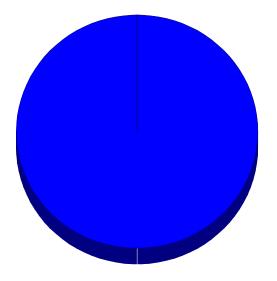


Total Building Summary Loads

Component Description Stained Glass: Glazing-Historic stained glass with exterior storms, U-value 0.57, SHGC 0.6 IC-cm: Glazing-Single pane window with storm, clear, metal frame no break, U-value 0.87, SHGC 0.67 I1D: Door-Wood - Solid Core, U-value 0.39 R30 Roxul: Wall-Block, Custom, R30 Blown in Roxul, U- value 0.033 R50 Roxul: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R50 Blown in Roxul (or cellulose), U-value 0.02 R12 Foundation: Floor-Over enclosed crawl space, Custom, two inches SPF on walls, U-value 0.08 Subtotals for structure: People: Equipment: Lighting: Ductwork: Infiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0 Total Building Load Totals:	Area Quan 460 9.5 72.8 3297.7 2508 2508 0 0	Sen Loss 14,944 471 1,618 6,203 2,859 2,805 28,900 1,877	Lat Gain 0 0 0 0 0 0 0 0 0	Sen Gain 0 0 0 0 0 0 0 0 0 0 0 0	Tota Gai
 Stained Glass: Glazing-Historic stained glass with exterior storms, U-value 0.57, SHGC 0.6 IC-cm: Glazing-Single pane window with storm, clear, metal frame no break, U-value 0.87, SHGC 0.67 I1D: Door-Wood - Solid Core, U-value 0.39 R30 Roxul: Wall-Block, Custom, R30 Blown in Roxul, U- value 0.033 R50 Roxul: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R50 Blown in Roxul (or cellulose), U-value 0.02 R12 Foundation: Floor-Over enclosed crawl space, Custom, two inches SPF on walls, U-value 0.08 Subtotals for structure: People: Equipment: Lighting: Ductwork: Infiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0 	460 9.5 72.8 3297.7 2508 2508	14,944 471 1,618 6,203 2,859 2,805 28,900	0 0 0 0 0 0	0 0 0 0 0 0	
 C-cm: Glazing-Single pane window with storm, clear, metal frame no break, U-value 0.87, SHGC 0.67 Door-Wood - Solid Core, U-value 0.39 R30 Roxul: Wall-Block, Custom, R30 Blown in Roxul, U-value 0.033 R50 Roxul: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R50 Blown in Roxul (or cellulose), U-value 0.02 R12 Foundation: Floor-Over enclosed crawl space, Custom, two inches SPF on walls, U-value 0.08 Subtotals for structure: People: Equipment: Lighting: Ductwork: Infiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0 	72.8 3297.7 2508 2508 0	1,618 6,203 2,859 2,805 28,900	0 0 0 0 0	0 0 0 0 0	
 1D: Door-Wood - Solid Core, U-value 0.39 R30 Roxul: Wall-Block, Custom, R30 Blown in Roxul, U-value 0.033 R50 Roxul: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R50 Blown in Roxul (or cellulose), U-value 0.02 R12 Foundation: Floor-Over enclosed crawl space, Custom, two inches SPF on walls, U-value 0.08 Subtotals for structure: People: Equipment: Lighting: Ductwork: Infiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0 	3297.7 2508 2508 0	6,203 2,859 2,805 28,900	0 0 0 0 0	0 0 0 0	
 R30 Roxul: Wall-Block, Custom, R30 Blown in Roxul, U-value 0.033 R50 Roxul: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R50 Blown in Roxul (or cellulose), U-value 0.02 R12 Foundation: Floor-Over enclosed crawl space, Custom, two inches SPF on walls, U-value 0.08 Subtotals for structure: People: Equipment: Lighting: Ductwork: Infiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0 	3297.7 2508 2508 0	6,203 2,859 2,805 28,900	0 0 0 0 0	0 0 0 0	
 850 Roxul: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, R50 Blown in Roxul (or cellulose), U-value 0.02 812 Foundation: Floor-Over enclosed crawl space, Custom, two inches SPF on walls, U-value 0.08 8 Subtotals for structure: People: Equipment: Lighting: Ductwork: nfiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0 	2508 0	2,805 28,900	0 0 0	0 0 0	
 End at the second structure in the second structure is the second str	0	28,900	0 0	0	
People: Equipment: Lighting: Ductwork: nfiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0			0	0	
People: Equipment: Lighting: Ductwork: nfiltration: Winter CFM: 110, Summer CFM: 110 Ventilation: Winter CFM: 0, Summer CFM: 0			0	0	
Equipment: Lighting: Ductwork: nfiltration: Winter CFM: 110, Summer CFM: 110 /entilation: Winter CFM: 0, Summer CFM: 0		1,877	-		
.ighting: Ductwork: nfiltration: Winter CFM: 110, Summer CFM: 110 /entilation: Winter CFM: 0, Summer CFM: 0	0	1,877	Ŭ		
ouctwork: nfiltration: Winter CFM: 110, Summer CFM: 110 /entilation: Winter CFM: 0, Summer CFM: 0	Ū	1,877		0 0	
nfiltration: Winter CFM: 110, Summer CFM: 110 /entilation: Winter CFM: 0, Summer CFM: 0		1,077	0	0 0	
entilation: Winter CFM: 0, Summer CFM: 0		6,771	Õ	0 0	
		0,771	Ő	0 0	
		37,548	0	0	
building Supply CFM: 490 quare ft. of Room Area: 2,508 olume (ft ³): 50,160***		er Square ft.: ft. Per Ton:		C	0.195 0
Based on area of rooms being heated or cooled (whichever ge * Based on area of rooms being cooled. **Indicated volume is based on custom building volume.	overns sys	tem) rather that	ו entire floor	area.	
Building Loads Total Heating Required Including Ventilation Air: 37,548	Btub	37.548 ME	2		
lotes	Diuli	37.340 IVIE			
Rhvac is an ACCA approved Manual J, D and S computer progression of the progression of the performed per ACCA Manual J 8th Edition, Ver All computed results are estimates as building use and weather be sure to select a unit that meets both sensible and latent load our design conditions.	sion 2, and may vary.			ormance data	at







100.0%



System 1 Summary Loads

System 1 Summary Loads					
Component	Are		Lat		Total Gain
Description Stained Glass: Glazing-Historic stained glass with	Qua 46		<u>Gain</u> 0	Gain 0	<u> </u>
exterior storms, U-value 0.57, SHGC 0.6	-10	14,044	0	0	
1C-cm: Glazing-Single pane window with storm, clear,	9	.5 471	0	0	C
metal frame no break, U-value 0.87, SHGC 0.67					
11D: Door-Wood - Solid Core, U-value 0.39	72	.8 1,618	0	0	C
R30 Roxul: Wall-Block, Custom, R30 Blown in Roxul, U-	3297	.7 6,203	0	0	C
value 0.033					
R50 Roxul: Roof/Ceiling-Under Attic with Insulation on	250	08 2,859	0	0	(
Attic Floor (also use for Knee Walls and Partition					
Ceilings), Custom, R50 Blown in Roxul (or cellulose),	,				
U-value 0.02	050	0 005	0	0	
R12 Foundation: Floor-Over enclosed crawl space, Custom, two inches SPF on walls, U-value 0.08	250	2,805	0	0	(
Subtotals for structure:		28,900	0	0	C
People:		0	0	0	C
Equipment:		0	0	0	(
Lighting: Ductwork:		0 1,877	0	0	C
Infiltration: Winter CFM: 110, Summer CFM: 110		6,771	0 0	0 0	C
Ventilation: Winter CFM: 0, Summer CFM: 0		0,771	0	0	C
System 1 Load Totals:			0		
System 1 Load Totals.		37,548	0	0	(
Check Figures					
Supply CFM: 490		M Per Square f			0.195 *
Square ft. of Room Area: 2,508	59	uare ft. Per Tor	1:		0 **
Volume (ft ³): 50,160***		a votam) ratha	r than antira fl		
* Based on area of rooms being heated or cooled (which ** Based on area of rooms being cooled.	never govern	s system) rame	i inan enure n	oor area.	
***Indicated volume is based on custom building volume					
System Loads	·•				
Total Heating Required Including Ventilation Air:	37,548 Btu	n 37.548	MBH		
Notes					
Rhvac is an ACCA approved Manual J, D and S comput	or program				
Calculations are performed per ACCA Manual J 8th Edit		and ACCA M			
All computed results are estimates as building use and v			anual D.		
Be sure to select a unit that meets both sensible and late			nufacturer's r	erformance o	lata at
your design conditions.	ent loads acc				
your design conditions.					

St Andrews Sanctuary Energy Cost Analysis

for

St Andrews Episcopal Church Main Street Hopkinton, NH



Prepared By:

Margaret Dillon S.E.E.D.S.

603-532-8979 Tuesday, April 13, 2021



Project Summary

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Gonora	Droject	Information

General Project Inform	nation		
Project Title: Project Date: Client Name: Client Address: Client City:	St Andrews Sanctuary Saturday, April 3, 2021 St Andrews Episcopal Church Main Street Hopkinton, NH	Company Name: Company Rep: Company Phone: Company E-Mail Address:	S.E.E.D.S. Margaret Dillon 603-532-8979 mdillon@myfairpoint.net
Design Data			
Building Area: People: Occupancy: Actual City: Weather Ref. City:	2,508 sq.ft. 0 0 Hopkinton, NH Concord AP, New Hampshire	Heating Load: Loads Adj. Factor: AC On Temp.:	99,470 Btuh 0.73 0 °F
Summer Outdoor: Summer Indoor: Cooling Hours:	87 °F 75 °F 0	Winter Outdoor: Winter Indoor: Degree Days:	-2 °F 55 °F 6,005

Annual Operating Cost Estimate

	Fuel	Total	Total	Annual	Total	Average
System	Rates	Heating	Cooling	Service	Oper.	Monthly
Description	Set	Cost	Cost	Charges	Cost	Cost
Great Hall Existing	1	\$2,295	\$0	\$0	\$2,295	\$191
Connector Existing	1	\$1,519	\$0	\$0	\$1,519	\$127
2009 Wing Existing	1	\$1,230	\$0	\$0	\$1,230	\$102
2009 Lower Level Existing	1	\$869	\$0	\$0	\$869	\$72
Kitchen Existing	1	\$173	\$0	\$0	\$173	\$14
Great Hall Improved	1	\$1,596	\$0	\$0	\$1,596	\$133
Connector Improved	1	\$1,090	\$0	\$0	\$1,090	\$91
2009 Wing Improved	1	\$681	\$0	\$0	\$681	\$57
Great Hall Improved Walls	1	\$1,247	\$0	\$0	\$1,247	\$104



Project Summary Bar Chart

