Energy Audit

Funded by

EVERSOURCE ENERGY

November 16, 2021

Deerfield Town Hall
Church Street

Audit Prepared by

BUILDING STRATEGIES FOR AN AFFORDABLE FUTURE
S.E.E.D.S.
SUSTAINABLE ENERGY EDUCATION DEMONSTRATION SERVICES
Margaret Dillon—603-532-8979—MDILLON@myfairpoint.net

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Table of Contents

Introduction

This Energy Audit has been funded by Eversource. Funds may, or may not, also be available to help reduce cost for eligible Energy Saving Measures (ESM) including weatherization efforts, lighting and equipment upgrades.

The purpose of an energy audit is to identify ESM in a building. Computer simulated and other energy models were developed for this project using multiple strategies and software. The models estimate predicted future 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. The cost of those measures can then be analyzed in terms of predicted energy saved. The primary objective is to evaluate the level of investment warranted by energy and dollars saved from those specific measures. In many cases, as in this one, improving the thermal envelope is expected to yield 'non energy saving' benefits, such as improving occupant comfort, building durability, and reducing the size of any future HVAC equipment.

This audit has been prepared with the best of intentions to assist the Town of Deerfield make informed decisions regarding energy improvements while also helping Eversource determine if the ESM warrant financial incentives. 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, apparatus, product or process disclosed.

Executive Summary

The Deerfield Town Hall was constructed in 1856 and noted as one of New Hampshire's best public examples of Greek Revival Architecture. It is a two story post and beam structure with a granite crawlspace foundation with dirt floor. Each floor is heated by its own oil fired forced hot air furnace.

The first floor is used infrequently for town meetings. The second floor has a large room and stage for community events and two smaller rooms which house articles belonging to the historical society. The building has had little to no use over the past 12 years, though has been heated up until this year.

The Town is seeking to restore the building and bring it up to meet codes in order to bring it back into full use.

This study offers five ESM which will result in significant reductions in energy consumption while also improving comfort and contributing to the overall durability and well being of the building.

A summary of energy and dollar savings can be found on the next page with more details described in pages 10-12.

The chart below summarizes four ESM in terms of estimated installed costs and predicted energy savings in gallons of oil and MMBTU, as well as the annual reduction of CO2 emissions from completing those measures. The lower chart summarizes the savings in terms of dollars for supply and delivery, based on the current price of $3.25 per gallon. The ESM are briefly described in the notes below with more details in following pages.

ESM #	Envelope Condition / ESM	Cost of Measure	Oil Gallons Saved	Site Energy Reduction MMBTU	Source Energy Reduction	Tons CO2 Reductions Annually
1	AS & Attic	$7,360	170	23.6	26.0	1.9
2	Foundation	$7,800	257	35.5	39.1	2.9
3	Window Ret	$15,000	329	45.6	50.1	3.7
4	Interior Panels	$5,214	1022	141.6	155.7	11.4
	ESM 1-4	$35,374	1778	246.3	270.9	19.9
5	Walls	$24,700	381	52.8	58.1	4.3
ESM 1-5	TOTALS	$60,074	2159	299.1	329.0	24.1

ESM #	Envelope Condition / ESM	Cost of Measure	Annual Savings	Simple Payback Years	Life of Measure	Investment Gain	ROI	Annual ROI
1	AS & Attic	$7,360	$554	13.3	25	$6,490	88.2%	2.6%
2	Foundation	$7,800	$834	9.4	25	$13,050	167.3%	4.0%
3	Window Ret	$15,000	$1,069	14.0	25	$11,725	78.2%	2.3%
4	Interior Panels	$5,214	$3,322	1.6	25	$77,836	1492.8%	11.7%
	ESM 1-4	$35,374	$5,779	6.1	25	$109,101	308.4%	5.8%
5	Walls	$24,700	$1,239	19.9	25	$6,275	25.4%	91.0%
ESM 1-5	TOTALS	$60,074	$7,018	8.6	25	$115,376	192.1%	4.4%

Investing $60,074 into the thermal envelope or shell of the Town Hall is estimated to save $7,018 a year heating costs based on 2019 occupancy patterns and the current price of $3.25 per gallon of oil. At that price, a simple payback would be less than nine years and a 4.4% annual return on investment for each of the 25 years life of measure. Peak heating load reductions following the measures is described on the next page

Brief ESM Notes. Refer to images and details for each later in this report:

1. Add weatherstripping to all exterior doors and air seal penetrations in the floor of the attic before blowing in additional cellulose to achieve a level 18". Seal the attic hatch and rig with a pulley so that it can be easily closed.
2. Lay a commercial grade (>10ml) vapor barrier on the floor of the crawlspace and seal to the walls by spraying three inches closed cell foam against the foundation walls to the floor decking.
3. This measure is based on a proposal the Town has received to repair and restore the historic wood windows.
4. Restoring the windows (#3) will reduce air leakage and improve operability. Adding air tight interior glazing panels (from Innerglass.com for one example) yields additional air sealing as well as improving glazing performance.
5. Separated due to the relative long 'payback' by itself, insulating the exterior walls by dense packing cellulose into all cavity bays will complete an 'energy upgrade' package and improve comfort substantially.

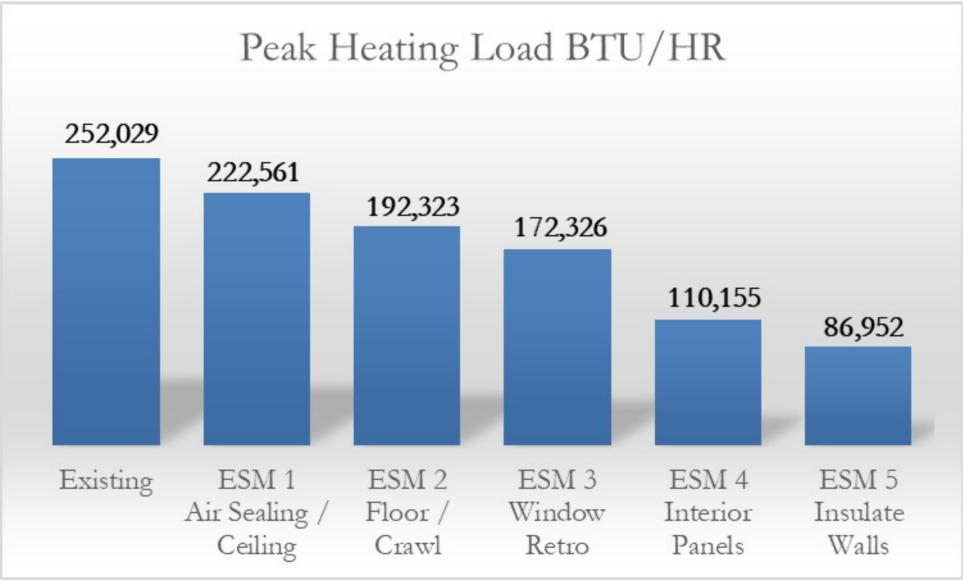
Assumptions and Inputs

Energy savings from envelope improvements have been calculated in the energy model based on the following thermal performance values.

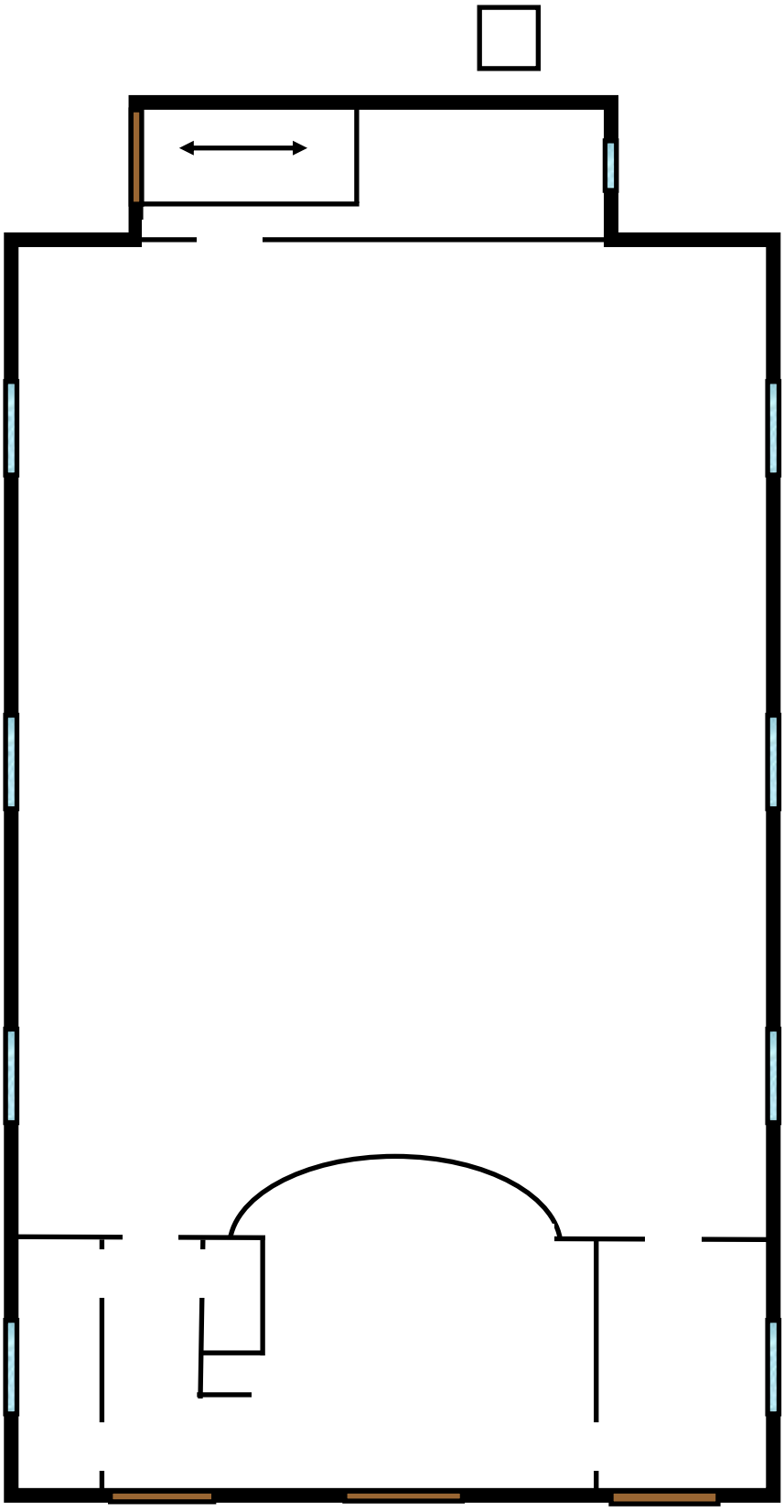
Envelope Component	Surface Area FT2	Existing u-Value	ESM 1 - Air Seal & Ins Attic	ESM 2 - Crawlspace/ Floor	ESM 3- Window Retrofit	ESM 4 Interior Panels	ESM 5 Insulate Walls
Walls-Frame	4940	0.19	no change	no change	no change	no change	0.048
Door	87.3	0.5	no change	no change	no change	no change	no change
Door	28.1	0.39	no change	no change	no change	no change	no change
Windows	659	0.99	no change	no change	no change	0.39	no change
Ceiling	3452	0.063	0.02	no change	no change	no change	no change
Floor over Crawl	3452	0.368	no change	0.072	no change	no change	no change
	Volume	CFM	CFM	CFM	CFM	CFM	CFM
Winter infiltration	91478	660	420	410	270	245	210
Duct Losses		36507	36507	24076	24041	23265	22585
Heating Load BTU/HR		252029	222561	192323	172326	110155	86952

In addition to saving energy and dollars annually from improving the envelope, each subsequent measure will also reduce the peak heating load. That is the amount of heat (in Btus per hour) which is lost to the outside during the near coldest hour in Deerfield, on average over the past 30 years. Also referred to as the Design Load, this informs the size of any new heating equipment installed. The capacities of the existing furnaces are not known but they likely exceed the existing peak load and will greatly exceed what is needed after implementing the ESM. However, completing all five ESM would make converting to electric heat pumps a reasonable option in the future.

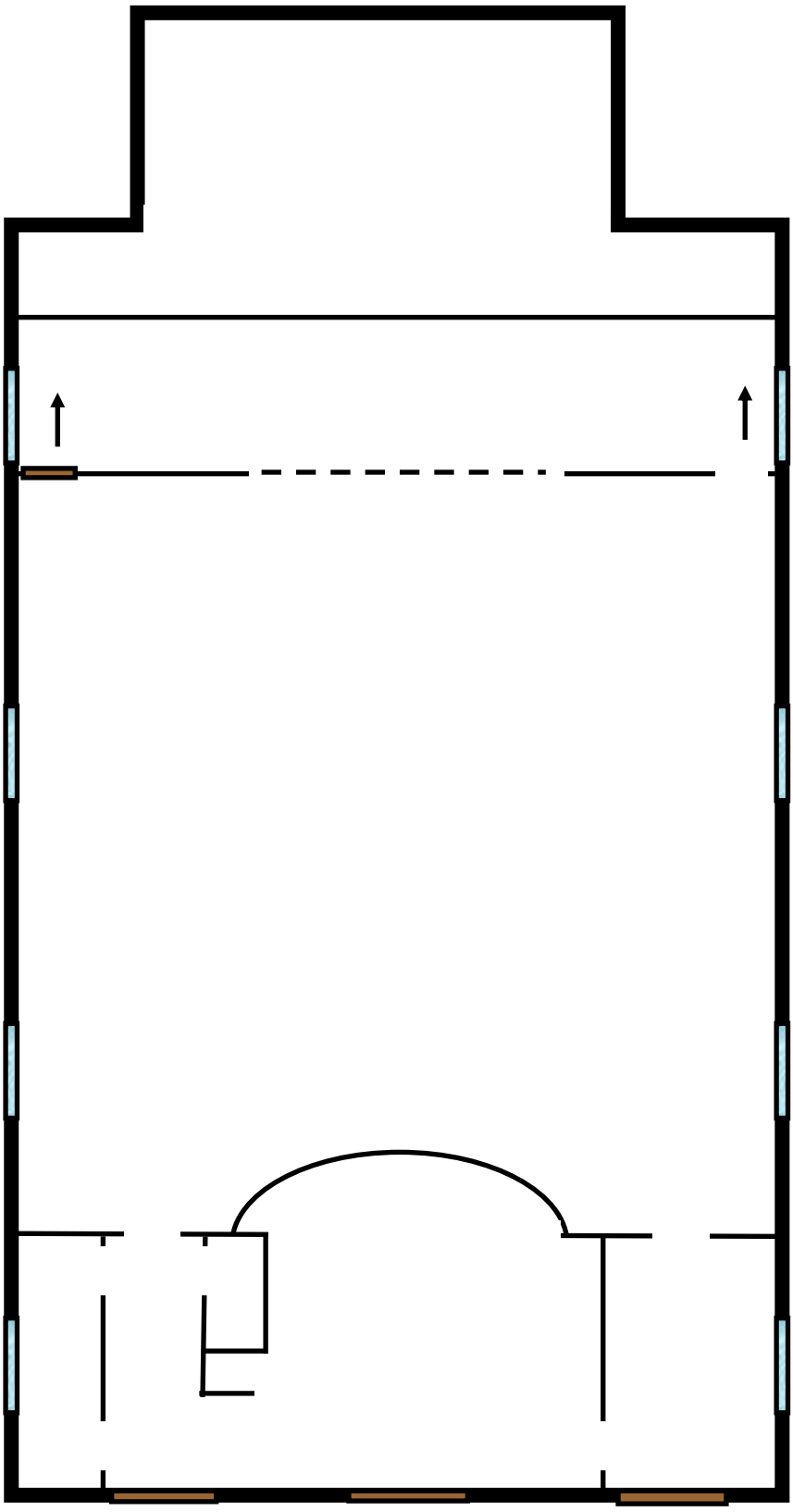
Load calculation report summaries have been included at the back of this report.



Conceptual Floor Plan Graphic: First Floor



Conceptual Floor Plan Graphic: Second Floor



Historic Energy Usage

The energy analysis below is based on oil and electric consumption in 2019.

Energy	Units	Site Btus	Source Btus	$Cost
Town Hall Electric kWh	11,573	39,487,076	131,480,853	$3,061
Pump House Electric kWh	13,341	45,519,492	151,567,101	$2,563
Oil - gallons	3,578	326,671,400	375,672,110	$11,629
Totals		411,677,968	658,720,064	$17,253
EUI KBtu/FT2	6904	59.6	95.4	$2.50

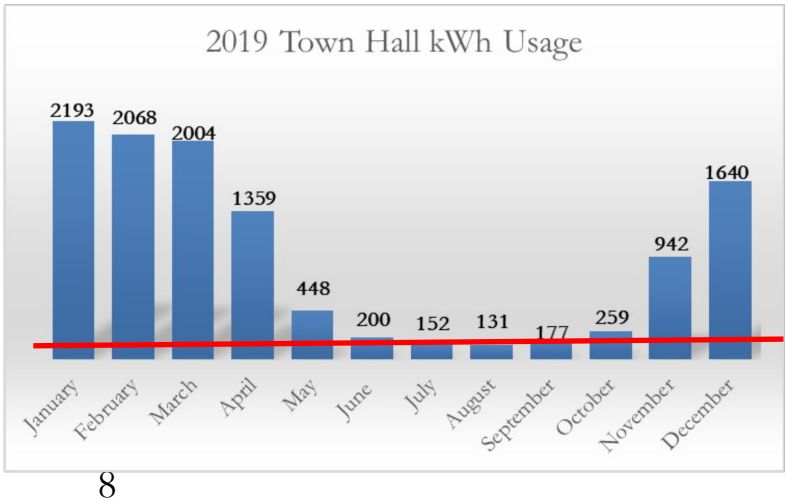
The Energy Utilization Index (EUI) offers a simple snapshot analysis of a building's energy use by looking at total amount of energy input (converted to Btu's) divided by the floor area of conditioned space. "Site Energy" refers to units of energy delivered to a site. Source energy includes transmission and total raw energy the building requires .

Based on the information provided, the Town Hall's EUI is 59.6 KBtu/ft2; Source Energy EUI is 95.4 KBtu/FT2 with energy costs at $5.22 per sq ft in 2021 energy rates.

Read Date	Town Hall	Pump House	Total kWh	Town Hall Cost	Pump House Cost
1.16.19	2193	1659	3852	$456.17	$291.68
2.14.19	2068	2309	4377	$446.10	$374.74
3.15.19	2004	2184	4188	$404.01	$359.68
4.16.19	1359	1632	2991	$342.68	$267.33
5.16.19	448	565	1013	$161.02	$271.51
6.17.19	200	270	470	$112.03	$79.46
7.17.19	152	154	306	$96.08	$58.12
8.16.19	131	167	298	$96.71	$62.82
9.17.19	177	229	406	$128.81	$76.90
10.16.19	259	577	836	$157.96	$148.99
11.14.19	942	1485	2427	$252.18	$251.88
12.16.19	1640	2110	3750	$407.13	$319.68
	11573	13341	24914	$3,061	$2,563

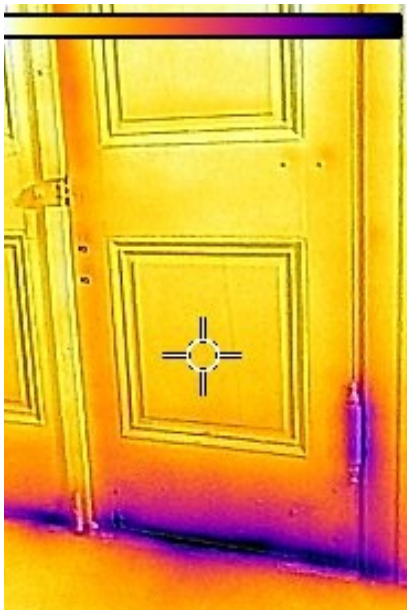
Electric usage is lowest in the summer months and highest in the coldest months, likely due to furnace blowers and what appears to be electric resistance heating in the bathroom. Based on a base load of 200 kWh per month, heating loads potentially consume 9300 kWh. Envelope improvements will also yield electric savings, but have not been estimated for this study.

As a non-residential customer, there is also a monthly charge for KW demand, which also varies each month and may yield reductions.



ESM 1

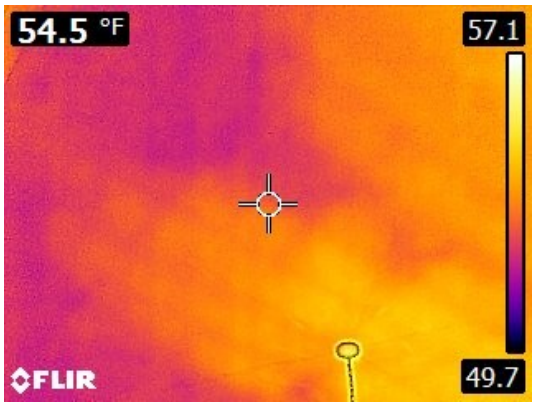
Thermographic (aka Infra red or IR) images depict differences in surface temperatures. Darker colors indicate cooler surfaces, so in the winter usually mean heat loss to the outside. Streaking or 'large dark blobs' often indicate cold air infiltration, such as through the doors below. Carefully installed commercial grade weatherstripping will greatly reduce this air leakage.

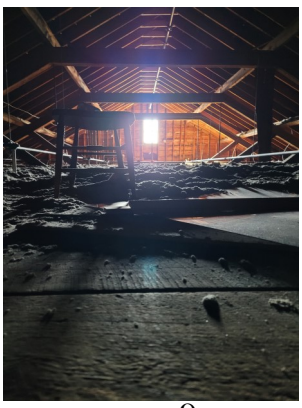


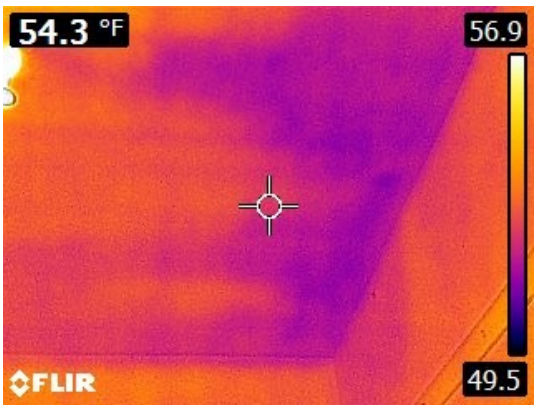
At the same time, establishing a continuous air barrier at the top ceiling plane can also help reduce air leakage below by reducing the 'stack' or chimney effect as warm air rises, pulling colder outside air in at lower levels.

This first ESM is designed to reduce air infiltration and exfiltration while also improving the insulation layer above the ceiling. After air sealing targeted areas in the attic floor and insulating and weather-stripping the attic hatch, dense pack cellulose into each floor bay, then blow in additional 12" for even and level coverage.

Note: Replace lighting fixtures to Rated LED units prior to insulation. Also, rig a pulley and rope on the hatch so it will close tightly.





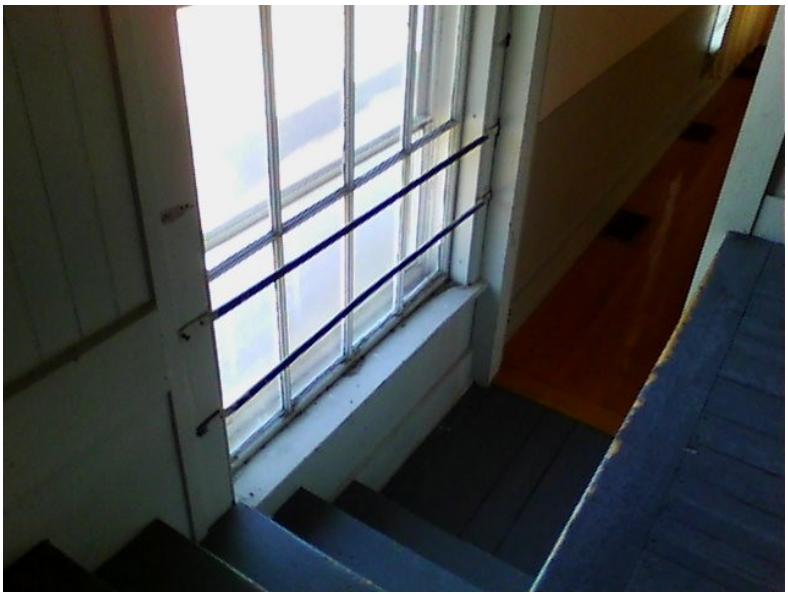


ESM 2

Installing a vapor barrier on the dirt floor and air sealing and insulating the foundation walls with closed cell foam, effectively separates soil gasses and moisture from the entire building, while reducing heat loss to the outside. It also brings the uninsulated ducts into the thermal envelope, further reducing losses.

I understand the resistance to using spray foam on historic elements, but in the case of a crawl space, there is no real or effective substitute for closed cell foam. It can adhere to uneven surfaces and does not deteriorate like fiberglass; nor house rodents, nor allow for mold growth.

ESM 3



The historic windows of the Town Hall, including the muntins, glazing and some sashes, are in disrepair. Restoring them is a matter of safety and preservation more than energy savings, though a proper restoration should help reduce air leakage. Ideally, rope and pulleys are replaced with quality metal tape mechanisms and the weights removed and chases filled with cellulose.

ESM 4

Installing interior, tightly sealed, but removable glazing panels is an excellent way to improve the energy performance of historic single pane windows. Many companies offer products that can be ordered on line. Custom wood units can also be made, though at a far higher cost.

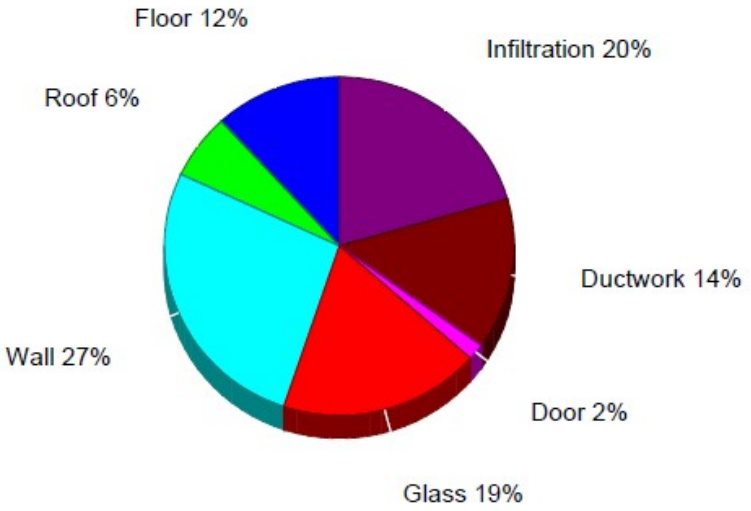
The option presented here is a single, compression fitting unit from Storm Windows: Commercial & Residential Interior Storm Window Solutions - Custom Interior Storm Windows by Innerglass, Affordable Windows, Energy Saving Windows

Technically not storm windows because they are on the inside, they can—and should—be air tight to prevent air borne vapor to migrate to the now colder wood sashes where condensation will form. Exterior storms protect the window from weather and offer some reduction in heat loss but should have weep holes maintained to prevent trapping moisture inside.

Image from Innerglass website

ESM 5

Sources of heat loss



Based on the assessment of existing conditions, the uninsulated walls of the Town Hall account for 27% of the building's heat loss. After completing ESM 4, walls would account for 32% of the building's heat loss and the next focus for improvement. The IR image below, taken from the outside when the outdoor air temperature was 30 degrees, the surface of the wall—at framing—was 47.7 degrees, and the wall cavities approximately 52 degrees. Note you can see the post and beam framing, showing as cooler since the solid wood slows the rate of heat loss more than the the rest of the assembly. The inside images also show the variations of conductive losses through the walls.

This measure calls for removing at least two clapboards (top of each floor) and drilling a two inch hole in the sheathing, then running a hose into the wall to blow in, and densely pack as much as possible without damaging the plaster, cellulose insulation. This is recommended only after completing ESM 2 which will reduce moisture loads from the basement. Humidity levels should be kept at 40% or below to eliminate the risk of excessive vapor migration into the walls. Cellulose can hold vapor without issues, then dry either to the inside or outside. With no penetrations in the wall, where air can move vapor outward in the winter, there is minimal risk of condensation on the inside of the exterior sheathing.

Deerfield Town Hall EXISTING
HVAC Load Calculations

for

Town Of Deerfield
8 Raymond Road
Deerfield, NH 03037

Elite Software

RHVAC Residential HVAC Loads

Prepared By:

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

(603) 532-8979
Thursday, December 2, 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 Information

Project Title:	Deerfield Town Hall EXISTING
Project Date:	Wednesday, November 17, 2021
Client Name:	Town Of Deerfield
Client Address:	8 Raymond Road
Client City:	Deerfield, NH 03037
Company Name:	S.E.E.D.S.
Company Representative:	Margaret Dillon
Company Phone:	(603) 532-8979
Company E-Mail Address:	mdillon@myfairpoint.net

Design Data

Reference City:		Concord AP, New Hampshire
Building Orientation:		Front door faces North
Daily Temperature Range:		High
Latitude:	43	Degrees
Elevation:	342	ft.
Altitude Factor:	0.988	

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-2	-2.6	n/a	n/a	70	n/a
Summer:	87	70	43%	50%	75	19

Check Figures

Total Building Supply CFM:	3,192	CFM Per Square ft.:	0.462	*
Square ft. of Room Area:	6,904	Square ft. Per Ton:	0	**
Volume (ft³):	91,478			

* Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.
** Based on area of rooms being cooled.

Building Loads

Total Heating Required Including Ventilation Air:	252,029	Btuh	252.029	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.

Miscellaneous Report

System 1 Newer Furnace.Main Floor Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-2	-2.6	80%	n/a	70	n/a
Summer:	87	70	43%	50%	75	18.65

System 2 Older Furnace 2nd Floor Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-2	-2.6	80%	n/a	70	n/a
Summer:	87	70	43%	50%	75	18.65

Duct Sizing Inputs

	Main Trunk		Runouts	
Calculate:	Yes		Yes	
Use Schedule:	Yes		Yes	
Roughness Factor:	0.00300		0.01000	
Pressure Drop:	0.1000	in.wg./100 ft.	0.1000	in.wg./100 ft.
Minimum Velocity:	0	ft./min	0	ft./min
Maximum Velocity:	900	ft./min	750	ft./min
Minimum Height:	6	in.	6	in.
Maximum Height:	12	in.	10	in.

Outside Air Data

	Winter		Summer	
Infiltration Specified:	0.433	AC/hr	0.433	AC/hr
	660	CFM	660	CFM
Infiltration Actual:	0.433	AC/hr	0.433	AC/hr
Above Grade Volume:	X 91,478	Cu.ft.	X 91,478	Cu.ft.
	39,600	Cu.ft./hr	39,600	Cu.ft./hr
	X 0.0167		X 0.0167	
Total Building Infiltration:	660	CFM	660	CFM
Total Building Ventilation:	0	CFM	0	CFM

---System 1---
Infiltration & Ventilation Sensible Gain Multiplier: 13.04 = (1.10 X 0.988 X 12.00 Summer Temp. Difference)
Infiltration & Ventilation Latent Gain Multiplier: 12.52 = (0.68 X 0.988 X 18.65 Grains Difference)
Infiltration & Ventilation Sensible Loss Multiplier: 78.23 = (1.10 X 0.988 X 72.00 Winter Temp. Difference)
Winter Infiltration Specified: 0.459 AC/hr (330 CFM)
Summer Infiltration Specified: 0.459 AC/hr (330 CFM)

---System 2---
Infiltration & Ventilation Sensible Gain Multiplier: 13.04 = (1.10 X 0.988 X 12.00 Summer Temp. Difference)
Infiltration & Ventilation Latent Gain Multiplier: 12.52 = (0.68 X 0.988 X 18.65 Grains Difference)
Infiltration & Ventilation Sensible Loss Multiplier: 78.23 = (1.10 X 0.988 X 72.00 Winter Temp. Difference)
Winter Infiltration Specified: 0.410 AC/hr (330 CFM)
Summer Infiltration Specified: 0.410 AC/hr (330 CFM)

Duct Load Factor Scenarios for System 1

No.	Type	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD
1	Supply		Closed Crawl B	-	0.12	6	932	No
1	Return		Closed Crawl B	-	0.12	0	345	No

Duct Load Factor Scenarios for System 2

No.	Type	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD
1	Supply		Closed Crawl B	-	0.12	6	1864	No
1	Return		Closed Crawl B	-	0.12	0	690	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	6,904	0	0	0	252,029	3,192	0	3,192	
System 1	0.00	0	3,452	0	0	0	127,354	1,631	0	1,631	28x12
Return Duct				0	0	0	3,296				
Zone 1			3,452	0	0	0	124,058	1,631	0	1,631	28x12
1-Main Floor			3,452	0	0	0	124,058	1,631	0	1,631	15--7
System 2	0.00	0	3,452	0	0	0	124,675	1,561	0	1,561	22x12
Return Duct				0	0	0	5,979				
Zone 1			3,452	0	0	0	118,696	1,561	0	1,561	22x12
2-Second Floor			3,452	0	0	0	118,696	1,561	0	1,561	15--7

Duct Size Preview

Room or Duct Name	Source	Minimum Velocity	Maximum Velocity	Rough. Factor	Design L/100	SP Loss	Duct Velocity	Duct Length	Htg Flow	Clg Flow	Act. Flow	Duct Size
System 1												
Supply Runouts												
Zone 1												
1-Main Floor	Built-In	0	750	0.01	0.1		406.9		1,631	0	1,631	15--7
Other Ducts in System 1												
Supply Main Trunk	Built-In	0	900	0.003	0.1		699.1		1,631	0	1,631	28x12
System 2												
Supply Runouts												
Zone 1												
2-Second Floor	Built-In	0	750	0.01	0.1		389.3		1,561	0	1,561	15--7
Other Ducts in System 2												
Supply Main Trunk	Built-In	0	900	0.003	0.1		851.3		1,561	0	1,561	22x12

Summary

System 1
Heating Flow: 1631
Cooling Flow: 0
System 2
Heating Flow: 1561
Cooling Flow: 0

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
SPwithStorm: Glazing-Wood frame with single pane and alumin storm, U-value 0.99, SHGC 0.64	658.7	46,947	0	0	0
11D: Door-Wood - Solid Core, U-value 0.5	87.3	3,143	0	0	0
11D: Door-Wood - Solid Core, U-value 0.39	28.1	790	0	0	0
Historic 2x4: Wall-Frame, Custom, Historic, U-value 0.19	4940.9	67,593	0	0	0
Blown in Cellulose: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Blown in Cellulose with voids and varying depths, U-value 0.063	3452	15,658	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 0.368	3452	29,761	0	0	0
Subtotals for structure:		163,892	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		36,507	0	0	0
Infiltration: Winter CFM: 660, Summer CFM: 660		51,630	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		252,029	0	0	0

Check Figures

Total Building Supply CFM:	3,192	CFM Per Square ft.:	0.462	*
Square ft. of Room Area:	6,904	Square ft. Per Ton:	0	**
Volume (ft^3):	91,478			

* Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.
** Based on area of rooms being cooled.

Building Loads

Total Heating Required Including Ventilation Air: 252,029 Btuh 252.029 MBH

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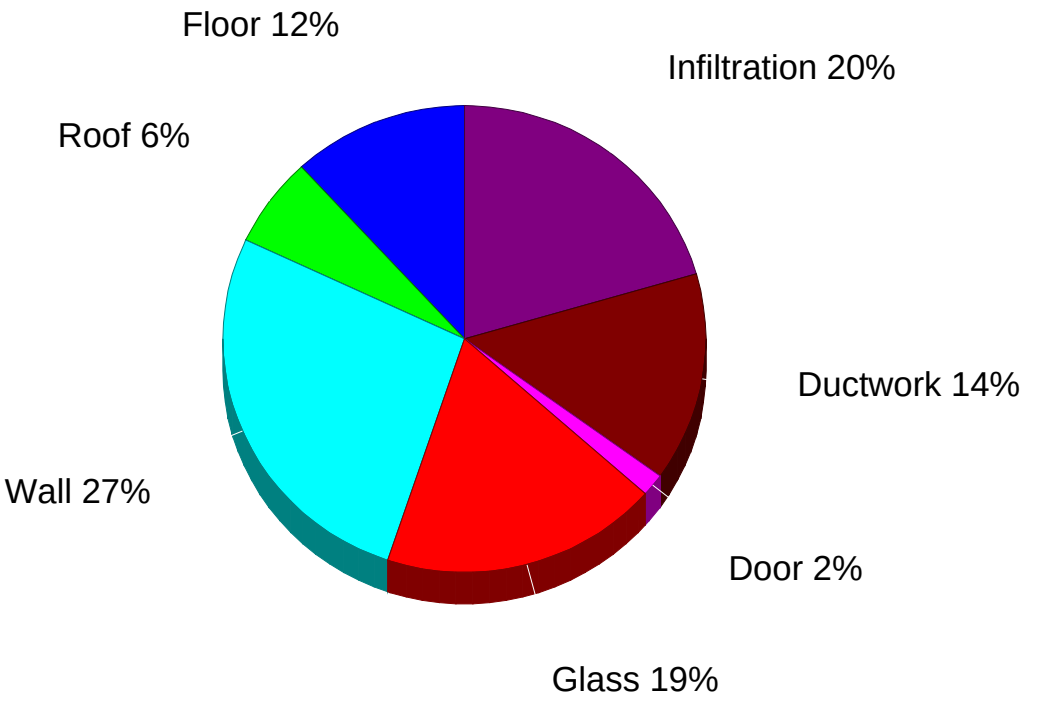
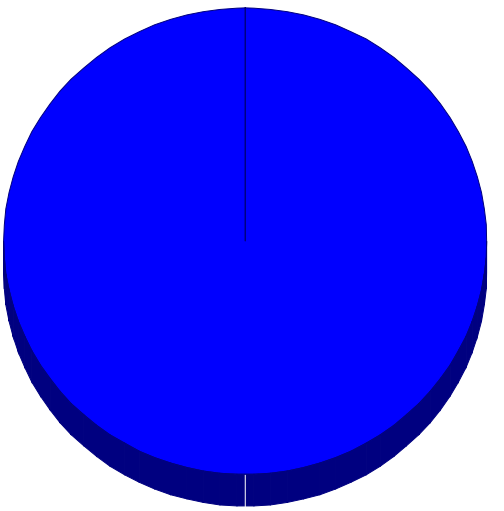
Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

Building Pie Chart





100.0%

Detailed Room Loads - Room 1 - Main Floor

General

Calculation Mode:	Htg. only		Occurrences:	1	
Room Length:	n/a		System Number:	1	
Room Width:	n/a		Zone Number:	1	
Area:	3,452.0	sq.ft.	Supply Air:	1,631	CFM
Ceiling Height:	12.5	ft.	Supply Air Changes:	2.3	AC/hr
Volume:	43,150	cu.ft.	Req. Vent. Clg:	0	CFM
Number of Registers:	15		Actual Winter Vent.:	0	CFM
Runout Air:	109	CFM	Percent of Supply.:	0	%
Runout Duct Size:	7	in.	Actual Summer Vent.:	0	CFM
Runout Air Velocity:	407	ft./min.	Percent of Supply:	0	%
Runout Air Velocity:	407	ft./min.	Actual Winter Infil.:	330	CFM
Actual Loss:	0.074	in.wg./100 ft.	Actual Summer Infil.:	0	CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
E -Wall-Historic 2x4 74 X 12.5	744.5	0.190	13.7	10,185	0.0	0	0
S -Wall-Historic 2x4 27 X 10	270	0.190	13.7	3,694	0.0	0	0
E -Wall-Historic 2x4 10 X 10	100	0.190	13.7	1,368	0.0	0	0
W -Wall-Historic 2x4 10 X 10	88	0.190	13.7	1,204	0.0	0	0
W -Wall-Historic 2x4 74 X 12.5	775.6	0.190	13.7	10,610	0.0	0	0
N -Wall-Historic 2x4 43 X 12.5	453.1	0.190	13.7	6,199	0.0	0	0
N -Door-11D 3.8 X 7.4	28.1	0.500	36.0	1,012	0.0	0	0
N -Door-11D 3.8 X 7.4	28.1	0.500	36.0	1,012	0.0	0	0
N -Door-11D 3.8 X 7.4	28.1	0.390	28.1	790	0.0	0	0
E -Door-11D 4.2 X 7.4	31.1	0.500	36.0	1,119	0.0	0	0
E -Gls-SPwithStorm shgc-0.64 0%S (4)	149.4	0.990	71.3	10,648	0.0	0	0
W -Gls-SPwithStorm shgc-0.64 0%S	12	0.990	71.3	855	0.0	0	0
W -Gls-SPwithStorm shgc-0.64 0%S (4)	149.4	0.990	71.3	10,648	0.0	0	0
Floor-19A-0tp 1 X 3452	3452	0.368	8.6	29,761	0.0	0	0
Subtotals for Structure:				89,105		0	0
Infil.: Win.: 330.0, Sum.: 0.0	2,858		9.034	25,815	0.000	0	0
Ductwork:				9,138			0
Room Totals:				124,058		0	0

Detailed Room Loads - Room 2 - Second Floor

General

Calculation Mode:	Htg. only		Occurrences:	1	
Room Length:	n/a		System Number:	2	
Room Width:	n/a		Zone Number:	1	
Area:	3,452.0	sq.ft.	Supply Air:	1,561	CFM
Ceiling Height:	14.0	ft.	Supply Air Changes:	1.9	AC/hr
Volume:	48,328	cu.ft.	Req. Vent. Clg:	0	CFM
Number of Registers:	15		Actual Winter Vent.:	0	CFM
Runout Air:	104	CFM	Percent of Supply.:	0	%
Runout Duct Size:	7	in.	Actual Summer Vent.:	0	CFM
Runout Air Velocity:	389	ft./min.	Percent of Supply:	0	%
Runout Air Velocity:	389	ft./min.	Actual Winter Infil.:	330	CFM
Actual Loss:	0.068	in.wg./100 ft.	Actual Summer Infil.:	0	CFM

Item Description	Area Quantity	-U- Value	Htg HTM	Sen Loss	Clg HTM	Lat Gain	Sen Gain
E -Wall-Historic 2x4 74 X 12.5	811.6	0.190	13.7	11,103	0.0	0	0
S -Wall-Historic 2x4 27 X 10	246	0.190	13.7	3,365	0.0	0	0
E -Wall-Historic 2x4 10 X 10	88	0.190	13.7	1,204	0.0	0	0
W -Wall-Historic 2x4 10 X 10	100	0.190	13.7	1,368	0.0	0	0
W -Wall-Historic 2x4 74 X 12.5	811.6	0.190	13.7	11,103	0.0	0	0
N -Wall-Historic 2x4 43 X 12.5	452.5	0.190	13.7	6,190	0.0	0	0
E -Gls-SPwithStorm shgc-0.64 0%S (4)	113.4	0.990	71.3	8,084	0.0	0	0
E -Gls-SPwithStorm shgc-0.64 0%S	12	0.990	71.3	855	0.0	0	0
S -Gls-SPwithStorm shgc-0.64 0%S (2)	24	0.990	71.3	1,710	0.0	0	0
W -Gls-SPwithStorm shgc-0.64 0%S (4)	113.4	0.990	71.3	8,084	0.0	0	0
N -Gls-SPwithStorm shgc-0.64 100%S (3)	85.1	0.990	71.3	6,063	0.0	0	0
UP-Ceil-Blown in Cellulose 3452 X 1	3452	0.063	4.5	15,658	0.0	0	0
Subtotals for Structure:				74,787		0	0
Infil.: Win.: 330.0, Sum.: 0.0	2,858		9.034	25,815	0.000	0	0
Ductwork:				18,094			0
Room Totals:				118,696		0	0

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
SPwithStorm: Glazing-Wood frame with single pane and alumin storm, U-value 0.99, SHGC 0.64	658.7	46,947	0	0	0
11D: Door-Wood - Solid Core, U-value 0.5	87.3	3,143	0	0	0
11D: Door-Wood - Solid Core, U-value 0.39	28.1	790	0	0	0
Historic 2x4: Wall-Frame, Custom, Historic, U-value 0.19	4940.9	67,593	0	0	0
Blown in Cellulose: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Blown in Cellulose with voids and varying depths, U-value 0.02	3452	4,971	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 0.368	3452	29,761	0	0	0
Subtotals for structure:		153,205	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		36,502	0	0	0
Infiltration: Winter CFM: 420, Summer CFM: 420		32,854	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		222,561	0	0	0

Check Figures

Total Building Supply CFM:	2,807	CFM Per Square ft.:	0.407	*
Square ft. of Room Area:	6,904	Square ft. Per Ton:	0	**
Volume (ft³):	91,478			

* Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.
** Based on area of rooms being cooled.

Building Loads

Total Heating Required Including Ventilation Air:	222,561	Btuh	222.561	MBH

Notes

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

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
SPwithStorm: Glazing-Wood frame with single pane and alumin storm, U-value 0.99, SHGC 0.64	658.7	46,947	0	0	0
11D: Door-Wood - Solid Core, U-value 0.5	87.3	3,143	0	0	0
11D: Door-Wood - Solid Core, U-value 0.39	28.1	790	0	0	0
Historic 2x4: Wall-Frame, Custom, Historic, U-value 0.19	4940.9	67,593	0	0	0
Blown in Cellulose: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Blown in Cellulose with voids and varying depths, U-value 0.02	3452	4,971	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 0.072	3452	12,731	0	0	0
Subtotals for structure:		136,175	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		24,076	0	0	0
Infiltration: Winter CFM: 410, Summer CFM: 410		32,072	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		192,323	0	0	0

Check Figures

Total Building Supply CFM:	2,453	CFM Per Square ft.:	0.355	*
Square ft. of Room Area:	6,904	Square ft. Per Ton:	0	**
Volume (ft³):	91,478			

* Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.
** Based on area of rooms being cooled.

Building Loads

Total Heating Required Including Ventilation Air:	192,323	Btuh	192.323	MBH

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Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
SPwithStorm: Glazing-Wood frame with single pane and alumin storm, U-value 0.8, SHGC 0.64	658.7	37,935	0	0	0
11D: Door-Wood - Solid Core, U-value 0.5	87.3	3,143	0	0	0
11D: Door-Wood - Solid Core, U-value 0.39	28.1	790	0	0	0
Historic 2x4: Wall-Frame, Custom, Historic, U-value 0.19	4940.9	67,593	0	0	0
Blown in Cellulose: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Blown in Cellulose with voids and varying depths, U-value 0.02	3452	4,971	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 0.072	3452	12,731	0	0	0
Subtotals for structure:		127,163	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		24,041	0	0	0
Infiltration: Winter CFM: 270, Summer CFM: 270		21,122	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		172,326	0	0	0

Check Figures

Total Building Supply CFM:	2,192	CFM Per Square ft.:	0.317	*
Square ft. of Room Area:	6,904	Square ft. Per Ton:	0	**
Volume (ft³):	91,478			

* Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.
** Based on area of rooms being cooled.

Building Loads

Total Heating Required Including Ventilation Air:	172,326	Btuh	172.326	MBH

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Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
SP with Int Panels: Glazing-Historic single pane with interior panels, U-value 0.39, SHGC 0.6	658.7	18,496	0	0	0
11D: Door-Wood - Solid Core, U-value 0.5	87.3	3,143	0	0	0
11D: Door-Wood - Solid Core, U-value 0.39	28.1	790	0	0	0
Historic 2x4: Wall-Frame, Custom, Historic, U-value 0.1	4940.9	35,577	0	0	0
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	3452	4,971	0	0	0
19C1-11osp: 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	3452	4,748	0	0	0
Subtotals for structure:		67,725	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		23,265	0	0	0
Infiltration: Winter CFM: 245, Summer CFM: 245		19,165	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		110,155	0	0	0

Check Figures

Total Building Supply CFM:	1,381	CFM Per Square ft.:	0.200	*
Square ft. of Room Area:	6,904	Square ft. Per Ton:	0	**
Volume (ft³):	91,478			

* Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.
** Based on area of rooms being cooled.

Building Loads

Total Heating Required Including Ventilation Air: 110,155 Btuh 110.155 MBH

Notes

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

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
SP with Int Panels: Glazing-Historic single pane with interior panels, U-value 0.39, SHGC 0.6	658.7	18,496	0	0	0
11D: Door-Wood - Solid Core, U-value 0.5	87.3	3,143	0	0	0
11D: Door-Wood - Solid Core, U-value 0.39	28.1	790	0	0	0
Rock Wool 4": Wall-Frame, Custom, Dense packed cavities with 4" Rock Wool, U-value 0.048	4048.9	13,993	0	0	0
Rock Wool 4": Wall-Frame, Custom, Dense packed cavities with 4" Rock Wool, U-value 0.028	892	1,798	0	0	0
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	3452	4,971	0	0	0
19C1-11osp: 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	3452	4,748	0	0	0
Subtotals for structure:		47,939	0	0	0
People:	0		0	0	0
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		22,585	0	0	0
Infiltration: Winter CFM: 210, Summer CFM: 210		16,428	0	0	0
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		86,952	0	0	0

Check Figures

Total Building Supply CFM:	1,081	CFM Per Square ft.:	0.157 *
Square ft. of Room Area:	6,904	Square ft. Per Ton:	0 **
Volume (ft³):	91,478		

* Based on area of rooms being heated or cooled (whichever governs system) rather than entire floor area.
** Based on area of rooms being cooled.

Building Loads

Total Heating Required Including Ventilation Air: 86,952 Btuh 86.952 MBH

Notes

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