Municipal Energy Audit

December 15 2018

Plaistow Historical Society

127 Main Street

Plaistow, NH

Audit Prepared by

BUILDING STRATEGIES FOR AN AFFORDABLE FUTURE

S.E.E.D.S.

SUSTAINABLE ENERGY EDUCATION DEMONSTRATION SERVICES

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Introduction

This Energy Audit may be eligible for technical assistance funds from Unitil. Funding may also be available to help reduce energy usage through weatherization efforts.

The purpose of an energy audit is to identify Energy Saving Measures (ESM) in a building. A computer simulated model was developed for this project as well as heating and cooling load locations through Elites RHVAC software program. The model estimates 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 as well as equipment efficiencies. 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.

This audit has been prepared with the best of intentions to assist the Town to make informed decisions regarding improvements and/or equipment upgrades. 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 two story historic portion of the building is heated by a gas fired, forced hot air furnace. The one story office addition is heated via a wall hung gas fired Reznor Modine. Envelope improvements to reduce heating loads or 'demand' are often recommended prior to equipment replacement. The more effective the thermal envelope is in conserving heat, the less of an impact the efficiency of the heat supply. Since air sealing and insulation have a longer service life, improve comfort for occupants, and reduce risk of freezing pipes during power outages, it is often considered the wiser first step. However, in this case, the furnace is estimated to be 40 years old and failing. Therefore, the furnace needs to be replaced as soon as possible.

Prior to the site visit for this Audit had been scheduled, Reid Mechanical provided a proposal to replace the FHA furnace with a single stage, 80% AFUE. The first ESM recommends installing a more efficient, condensing furnace with two stages for a degree of modulation in response to milder outdoor temperatures. By applying for a Unitil rebate of $450, the upcharge for this measure is $1,550 and will pay for itself in less than four years.

In addition to the furnace upgrade, seven other ESM have been identified and broken down into two tiers. Tier One measures are recommended for the immediate future and Tier Two, with lower returns at current gas prices, are recommended when the price of gas, or carbon emissions rises. All seven ESM's may be eligible for financial incentives from Unitil, in which case the return on investment from the Town will be improved.

Converting to LED lighting is also recommended, and may also be eligible for a rebate. However, due to the infrequent use of the building, it is suggested to convert over time, as existing fluorescents need to be replaced.

Summary of Recommended Energy Saving Measures (ESM)

#	Recommended ESMs	Cost	$ Savings	Energy Savings MMBtu	Simple Payback Yrs	Life of Measure Yrs	Invest-ment Gain	ROI	Annual-ized ROI
	Furnace Replacement								
1	Upgrade to HE, Condensing, Two Stage Furnace	$1,550	$445	42.8	3.5	18	$6,460	416.7%	9.6%
2	Move Piano away from Return	N/A	N/A						
	Envelope Improvements Tier One								
3	Weather-strip all exterior doors, attic hatch and single pane windows	$450	$56	5.40	8.04				
4	Dense Pack Dormer Slopes	$521	$74	7.10	7.04				
5	Air Seal Ceiling Plane	$1,217	$93	8.90	13.09				
	Total Tier One Package	$2,188	$223	21.40	9.81	25	$3,387	154.8%	3.8%
	Envelope Improvements Tier Two								
6	Re-insulate 2nd floor closet slopes with SPF	$1,680	$115	11.10	14.61				
7	Insulate slopes behind knee wall (allowance)	$2,679	$121	13.60	22.14				
8	Add cellulose above ceiling planes to R40	$2,700	$95	9.10	28.42				
	Total Tier Two Package	$7,059	$331	33.80	21.33	25	$1,216	17.2%	64.0%
9	Replace lamps with LED as needed	N/A	N/A	N/A					

Notes:

1. The cost benefit analysis behind this recommendation is on the next page. The cost for this measure is based on the upcharge from the original proposal for a furnace replacement, less a $450 incentive rebate from Unitil—available to the Town through an application. Condensing equipment not only offers higher efficiencies, but with lower flue gasses, PVC pipes can be used to vent and bring in outside combustion air thereby allowing for sealed combustion. Removing atmospheric combustion allows for tightening the building further and safer indoor air quality.

2. It appears that the Return register is partially blocked by the piano, (photos on page 5) thereby limiting air flow back to the furnace. It also appears that the size of the return duct is considerably smaller than the sum total of supply ducts. This also reduces the efficacy of distributing heat and—in addition to outside air infiltration—results in the upstairs being much warmer than downstairs.

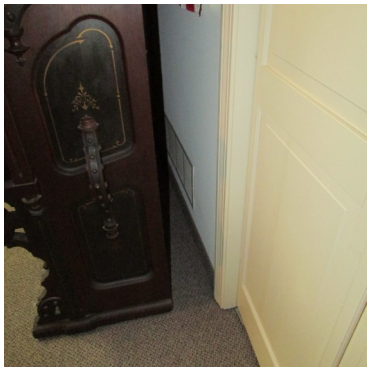
3-5. Tier One is suggested to be implemented as a relatively low cost package of three air sealing and insulation measures. Thermographic images and notes in this report depict areas to be addressed. Rich Burns of Shakes to Shingles has been asked to provide a detailed estimate for the scope of work, all of which will likely be eligible for financial incentives from Unitil.

6-8. The Tier Two envelope improvement package is strongly recommended to improve conservation, distribution of heating and cooling, and further reduce risk of icicles or ice dams. However, due to the low cost of natural gas at this time, and the improved efficiency of the recommended furnace, the return on investment is far less than other measures. Rich Burns can also offer detailed cost estimates to pursue funding incentives if deemed eligible.

Manual J approved heating and cooling loads have been calculated for the building in its existing condition and are included at the end of this report. They also include an analysis of the envelope components in terms of relative responsibility for heat loss to the outside.

Distribution Issues

Air flow is inhibited by piano and quite possibly to inadequate return ducts.



Heating Equipment

Plates were too worm or not found on eithr heating devices so heating capacities (Btus per hour) are unknown.

Heating loads have been calculated for both the original building and office and are presented below in Btus per hour:

	Heating	Cooling
Collections	59,171	26,332
Office	24,190	9,065
Totals	83,361	35,397

The above heating load on the building is why it is recommended to accept the proposal for a two stage furnace; ie a furnace with a high and low capacity, since the proposed unit's 'low' setting will be adequate for heating even at the lowest temperatures. The one stage 80% furnace would be oversized over 200% for most of the heating season.

Summary of Cost / Savings Analysis

Replacing old and failing heating equipment is a capital expense which often, as in this case, cannot be avoided. But unlike—for example—replacing failing roof shingles, replacing energy using equipment or devices with more efficient models actually offers annual dollar savings from reduced energy usage. Further, savings (ie lower annual costs) often continue long after the initial investment has been "paid back".

The chart below examines three case comparisons for the annual cost of heating the PHS based on the energy model developed for this Audit., the costs for improvement measures, and the current cost for natural gas.

Case #1 compares the existing annual heating cost and predicted savings (as shown in the model), of the existing equipment vs the two replacement options as proposed by Reid Mechanical. The originally proposed replacement furnace would result in an estimated average annual savings of $403 in the cost of heating fuel. Investing in the more efficient, condensing, two stage furnace—at an incremental end cost of $1,550—would result in estimated annual savings averaging $848 per year. In this case—looking at the whole capital investment, the more efficient furnace is predicted to show and annualized Return on Investment (ROI) of 1.3%.

Case #2 shows a 9.6% ROI when considering only the incremental cost increase for the more efficient furnace; since replacing the furnace is necessary anyway.

Case #3 again compares the two equipment proposals—but in the context of an improved thermal envelope. In other words, the cost of the measures includes $6,547 for recommended air sealing and insultation upgrades described in the Energy Audit Report, in addition to the incremental cost for the more efficient equipment. The other result of the envelope improvements would be to reduce the total heating load for the building from 83,036 to 70,500 Btus per hour. This can often reduce up front costs for equipment. For example, if the Town were planning to install air source heat pumps, this load reduction would translate to one ton less heating capacity! But in this case, reducing the heating load through envelope improvements has far less of an impact than improving the efficiency of the equipment.

In all three scenarios, investing in the more efficient, two stage condensing furnace, will yield a higher investment return. (Cost of furnace includes Unitil rebate, but possible rebates for Case 3 are not included)

Case	Comparisons	Annual Heating Cost	Cost of Measure	Annual Savings	Simple Payback Yrs	Life of Measure Yrs	Return	Investment Gain	ROI	Annualized ROI
1	Existing Conditions	$2,246								
	One Stage 80% Furnace	$1,843	$10,500	$403	26.1	18	$7,254	-$3,246	-30.9%	-2.0%
	HE Condensing Two Stage	$1,398	$12,050	$848	14.2	18	$15,264	$3,214	26.7%	1.3%
2	Upgrade to HE Two Stage									
	One Stage 80% Furnace	$1,843								
	HE Condensing Two Stage	$1,398	$1,550	$445	3.5	18	$8,010	$6,460	416.7%	9.6%
3	Improved Envelope*									
	One Stage 80% Furnace	$1,563	$9,247	$554	23.4	22	$13,850	$4,603	49.8	1.63%
	HE Condensing Two Stage	$1,364	$9,247	$384	16.9	22	$9,600	$353	3.8%	.15%

Overview

The Plaistow Historical Society (PHS) leases this former Fire Station from the Town for One Dollar a year to house its collections.

The PHS is opened to the public on Thursdays from 9am to 3PM and for Old Home Day in June—for a total of approximately 275 hours a year. In the winter, the thermostats are maintained at 60° F and turned up to 68° for the estimated 130 heating season hours.

The building is a slab just above grade with water on two sides (see right). It has a septic tank, and does not have its own water supply. The structure is a mixture of concrete block and 2x4 framing with minimal insulation. The gas fired forced hot air furnace is on its last legs and scheduled to be replaced this month. Despite these deficiencies, the community has a fondness for the structure and its historical past and it seems a fitting building for the Town's Historical collections.

Collections are on the first floor, with storage on the 2nd floor. Both floors heated by ducted hot air furnace with one zone. A one story addition to the east is used for an office and heated via a Reznor wall unit.

West facing

East facing

South facing

North facing

Historic Energy Use Analysis

The energy analysis below is based on average annual energy data provided for oil and electricity for the Library.

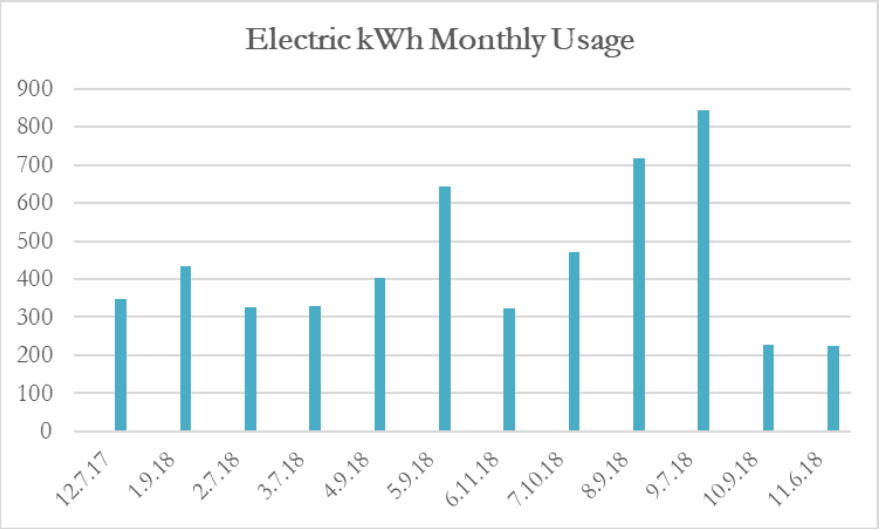
	Units	Site Btus	Source Btus	Dollar Cost
Nat Gas- Therms	2481	248,100,000	285,315,000	$2,522
Elec kWh	5295	18,066,540	60,156,495	$1,389
Totals		266,166,540	345,471,495	$3,911
EUI kBtu/FT2	3258	81.7	106.0	1.20

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 (See page 9).

Based on the information provided, the PHS Site EUI is 82 kBtu per square foot of floor area and the Source EUI is 106 KBtu/ft2.Source Energy EUI is 100.2 KBtu/FT2 and energy costs are $1.11 per sq ft in 2017 energy prices. Source Energy factors transmission losses and attempts to account for off site energy requirements.

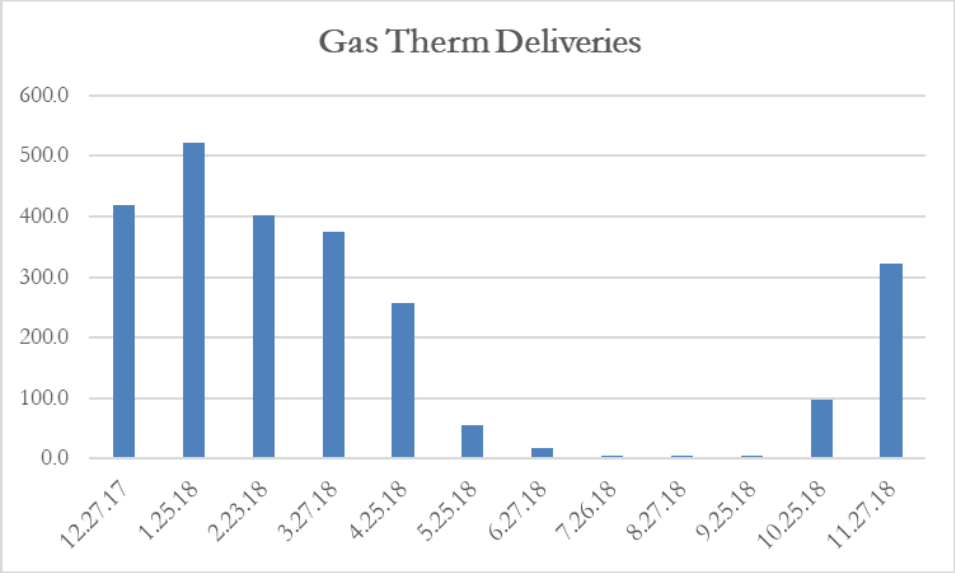
Electric Usage and Charge

Note: Monthly Demand was not made available except for the November 6th bill, so italicized charges are estimates only.



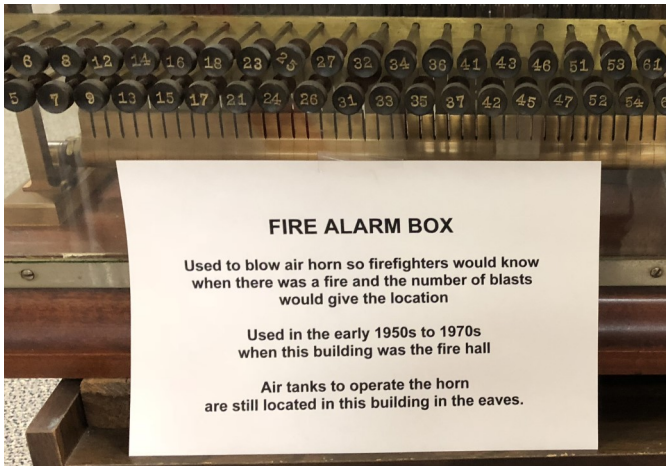
Read Date Rates	Usage kWh	Supply $0.0849	Delivery $0.02522	Demand Charge $10.24	Other $0.0053	Service Charge $29.02	Totals
12.7.17	348	$29.56	$8.78	*$35.84*	$1.85	$29.02	$105.06
1.9.18	434	$36.85	$10.95	*$35.84*	$2.31	$29.02	$114.96
2.7.18	327	$27.75	$8.24	*$35.84*	$1.74	$29.02	$102.59
3.7.18	330	$28.01	$8.32	*$35.84*	$1.76	$29.02	$102.94
4.9.18	405	$34.34	$10.20	*$35.84*	$2.15	$29.02	$111.56
5.9.18	642	$54.55	$16.20	*$35.84*	$3.42	$29.02	$139.03
6.11.18	324	$27.53	$8.18	*$35.84*	$1.72	$29.02	$102.29
7.10.18	471	$40.02	$11.89	*$35.84*	$2.51	$29.02	$119.27
8.9.18	718	$60.98	$18.12	*$35.84*	$3.82	$29.02	$147.78
9.7.18	845	$71.70	$21.30	*$35.84*	$4.49	$29.02	$162.36
10.9.18	227	$19.30	$5.73	*$35.84*	$1.21	$29.02	$91.10
11.6.18	224	$18.68	$5.55	$35.84	$1.13	$29.02	$90.22
Totals	**5,295**	**$449.26**	**$133.46**	**$430.08**	**$28.11**	**$348.24**	**$6,684**

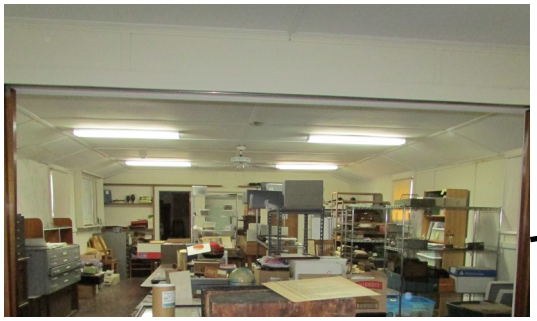
Natural Gas Deliveries and Charges



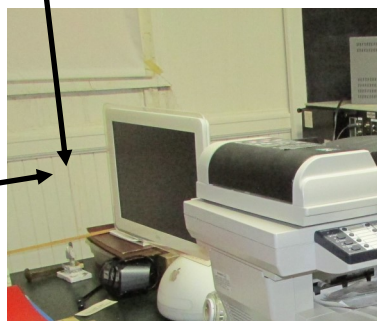
Read Dates	Therms	Supply	Distribution	Delivery	Total
Charges per therm		0.801	0.1795	0.038	Costs
12.27.17	418.8	$335.47	$75.18	$15.91	$426.56
1.25.18	522.1	$418.16	$93.71	$19.84	$531.71
2.23.18	401.2	$321.36	$72.02	$15.25	$408.62
3.27.18	374.0	$299.58	$67.13	$14.21	$380.93
4.25.18	256.3	$205.29	$46.00	$9.74	$261.03
5.25.18	55.5	$44.49	$9.97	$2.11	$56.57
6.27.18	17.5	$14.01	$3.14	$0.66	$17.81
7.26.18	4.1	$3.30	$0.74	$0.16	$4.20
8.27.18	4.1	$3.29	$0.74	$0.16	$4.19
9.25.18	4.3	$3.40	$0.76	$0.16	$4.33
10.25.18	96.5	$77.31	$17.33	$3.67	$98.31
11.27.18	321.7	$257.68	$57.75	$12.22	$327.65
Totals	**2476**	**$1,983**	**$444**	**$94**	**$2,522**

Insulation is only visible in the three small closets on the southeast, southwest, and northwest corners of the building. There is an access panel to behind the north kneewall (under the dormer) but it was blocked by a desk. A small hole in the wainscoting gave a limited view of an old air tank—referred to in one of the displays on the first floor as part of the alarm system used from the 1950's to 1970's. Removing all fiberglass and spraying 3-4" closed cell foam in cavities, followed by 15 minute flame barrier paint is recommended.





Large air tank can be seen through a crack in this wall. It appears to be an access hatch, but blocked and needed leverage to open.



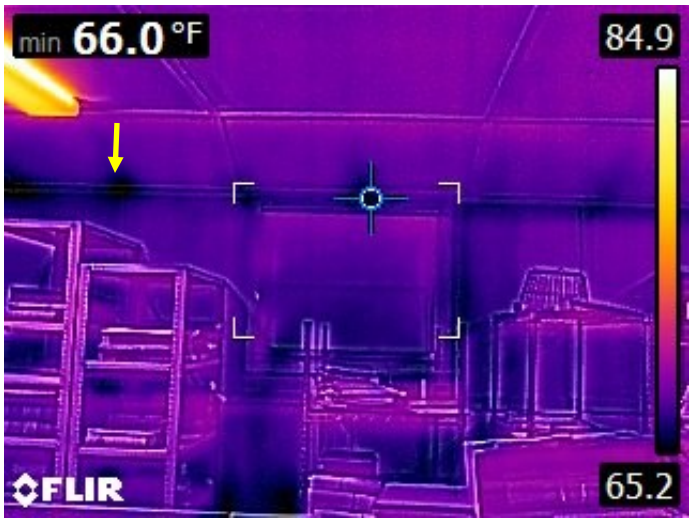
Pocket doors on 2nd floor allow

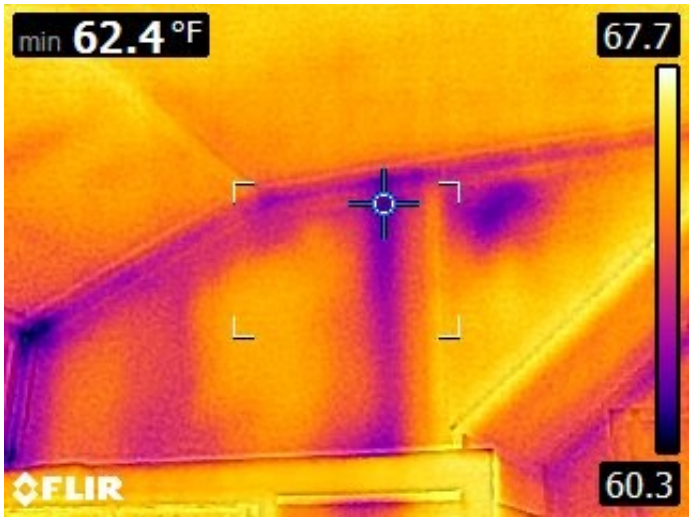
Staining—especially along wood strips covering fiber board seams—indicating air leakage sites and likely condensation.

Tier One air sealing package addresses air sealing these seams from the attic with a skim coat of foam.

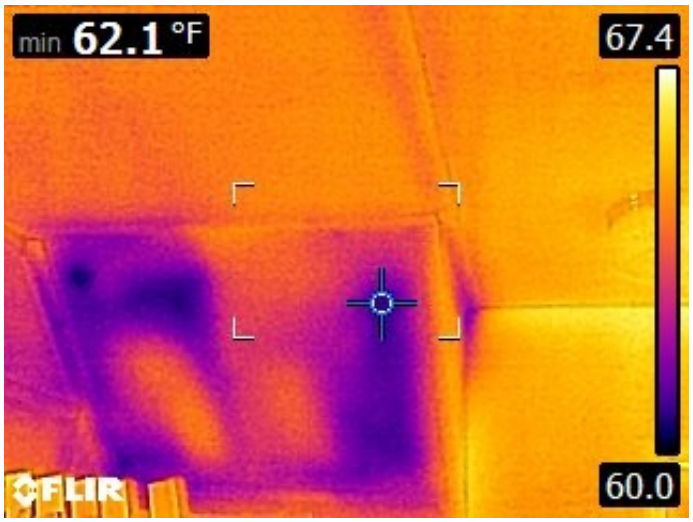
Small access for above ceiling over steep stairs. Challenging access - Consider creating a new one over floor area with insulation and weather-stripping and permanently sealing this

Thermographic, or infra red, images depict differences in surface temperatures. Black or darker colors indicate cooler surfaces. Note the coolth at where each rafter meets the top of the wall.

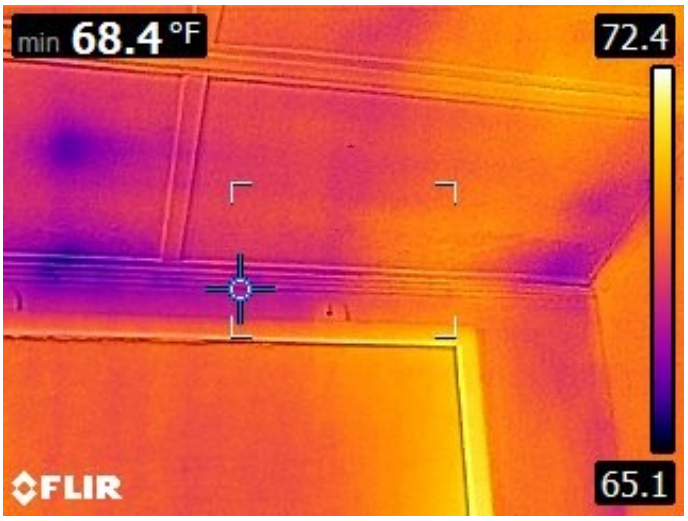


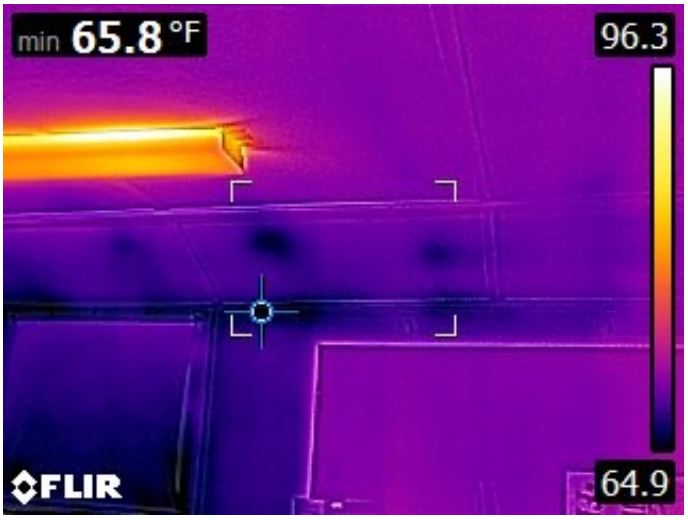


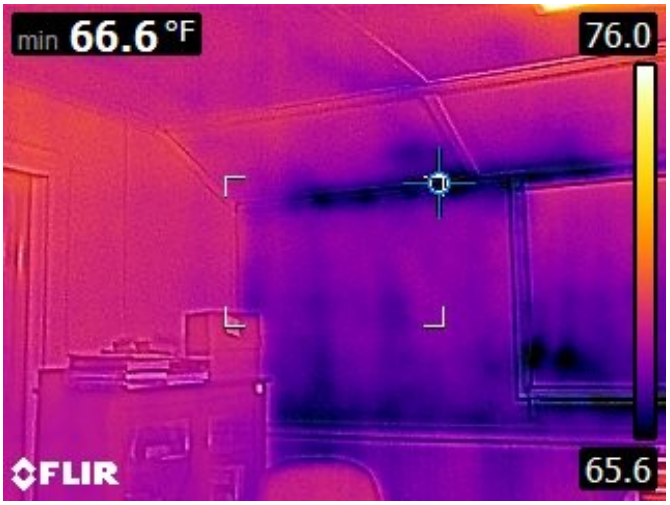
Thermal bypasses occur as cold air is allowed to move through low density insulation, such as fiberglass.

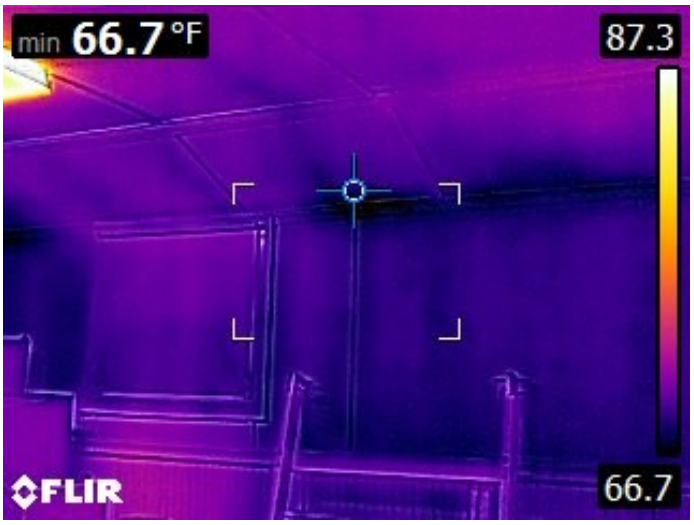


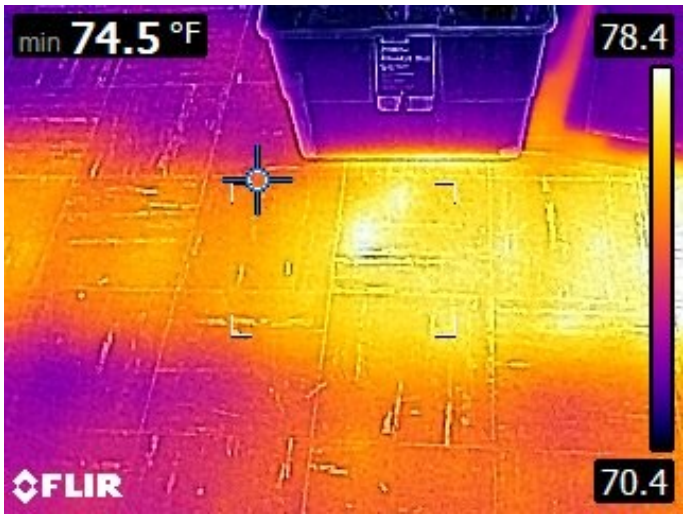
Envelope ESM's are designed to address these areas of coolth. Stains suggest water damage from backed up ice dams or where condensation formed.



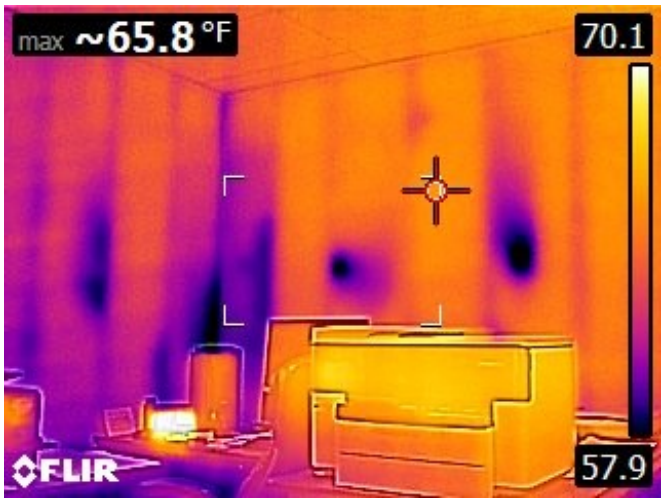






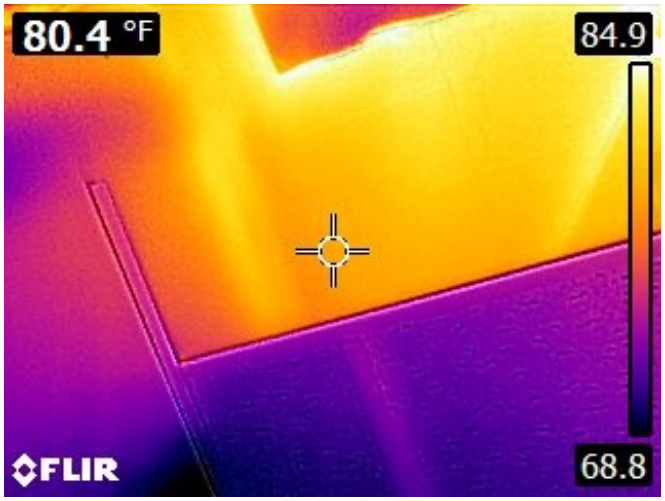


Furnace ducts run along under the floor of the 2nd floor with at least three supply registers and no return. Air was likely intended to return down the stairwell, though the door is now closed. Second floor is at least 10 degrees warmer than the first floor.



First floor office addition: appears to be 2x4 stick framed with fiberglass batts in the cavities. The southeast corner appears to have suffered water damage at some time.

Rubber roof replaced in 2012—no clue as to insulation if any was installed at that time.



Project Report

General Project Information

Project Title:	Plaistow Historical Society
Project Date:	Wednesday, December 12, 2018
Client Name:	Town Of Plaistow
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:	90	ft.
Altitude Factor:	0.997	

	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	18

Check Figures

Total Building Supply CFM:	1,489	CFM Per Square ft.:	0.476
Square ft. of Room Area:	3,128	Square ft. Per Ton:	1,060
Volume (ft³):	31,012***		

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

Building Loads

Total Heating Required Including Ventilation Air:	83,361	Btuh	83.361	MBH
Total Sensible Gain:	32,652	Btuh	92	%
Total Latent Gain:	2,745	Btuh	8	%
Total Cooling Required Including Ventilation Air:	35,397	Btuh	2.95	Tons (Based On Sensible + Latent)

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.

Load Preview Report

Scope	Net Ton	ft.³ /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	2.95	1,060	3,128	32,652	2,745	35,397	83,361	1,086	1,489	1,489	
System 1	2.19	1,153	2,530	24,203	2,129	26,332	59,171	771	1,104	1,104	12x16
Zone 1			2,530	24,203	2,129	26,332	59,171	771	1,104	1,104	12x16
1-Collections			1,430	9,167	1,210	10,377	35,371	461	418	418	4--7
2-2nd Floor Research			1,100	15,036	919	15,955	23,800	310	686	686	7--7
System 2	0.76	792	598	8,449	616	9,065	24,190	315	385	385	8x11
Zone 1			598	8,449	616	9,065	24,190	315	385	385	8x11
3-Office			598	8,449	616	9,065	24,190	315	385	385	4--7

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
1C-cm: Glazing-Single pane window with storm, clear, metal frame no break, U-value 0.87, SHGC 0.67	176.9	11,080	0	6,710	6,710
3A-m-o: Glazing-Double pane low-e (e = 0.40), operable window, metal frame no break, U-value 0.32, SHGC 0.61	112.9	2,601	0	6,885	6,885
3A-m-o: Glazing-Double pane low-e (e = 0.40), operable window, metal frame no break, U-value 0.82, SHGC 0.61	158.4	9,351	0	4,493	4,493
11D: Door-Wood - Solid Core, U-value 0.39	36	1,009	0	253	253
11D: Door-Wood - Solid Core, U-value 0.5	18.6	670	0	167	167
13BB-0ocw: Wall-Block, framing with R-11 in 2 x 4 stud cavity, open core, wood studs, U-value 0.088	1022.5	6,478	0	422	422
12B-0bw: Wall-Frame, R-11 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs, U-value 0.097	1130.7	7,897	0	516	516
16A-7: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Unvented Attic, No Radiant Barrier, Any Roofing Material, Any Roof Color, R-7 insulation, U-value 0.112	440	3,548	0	3,055	3,055
16A-15: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Unvented Attic, No Radiant Barrier, Any Roofing Material, Any Roof Color, R-15 insulation, U-value 0.061	880	3,865	0	3,328	3,328
18A-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	598	3,272	0	1,454	1,454
22A-ph: Floor-Slab on grade, No edge insulation, no insulation below floor, any floor cover, passive, heavy moist soil, U-value 1	208	14,976	0	0	0
Subtotals for structure:		64,747	0	27,283	27,283
People:	6		1,200	1,380	2,580
Equipment:			0	384	384
Lighting:	320			1,091	1,091
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 236, Summer CFM: 125		18,614	1,545	1,646	3,191
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
AED Excursion:		0	0	868	868
Total Building Load Totals:		83,361	2,745	32,652	35,397

Check Figures

Total Building Supply CFM:	1,489	CFM Per Square ft.:	0.476
Square ft. of Room Area:	3,128	Square ft. Per Ton:	1,060
Volume (ft³):	31,012***		

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

Building Loads

Total Heating Required Including Ventilation Air:	83,361	Btuh	83.361	MBH
Total Sensible Gain:	32,652	Btuh	92	%
Total Latent Gain:	2,745	Btuh	8	%
Total Cooling Required Including Ventilation Air:	35,397	Btuh	2.95	Tons (Based On Sensible + Latent)

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.

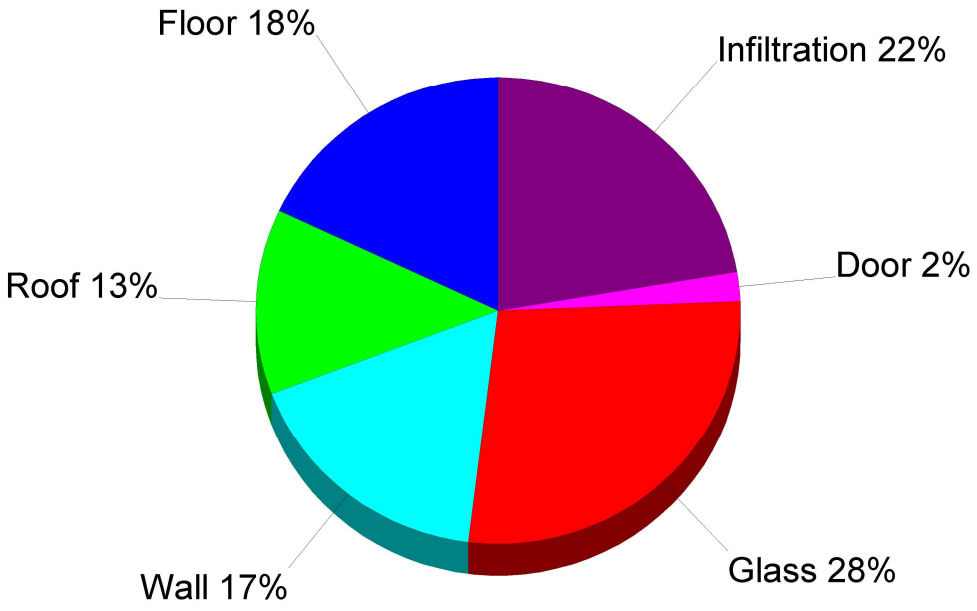
Total Building Summary Loads (cont'd)

Notes

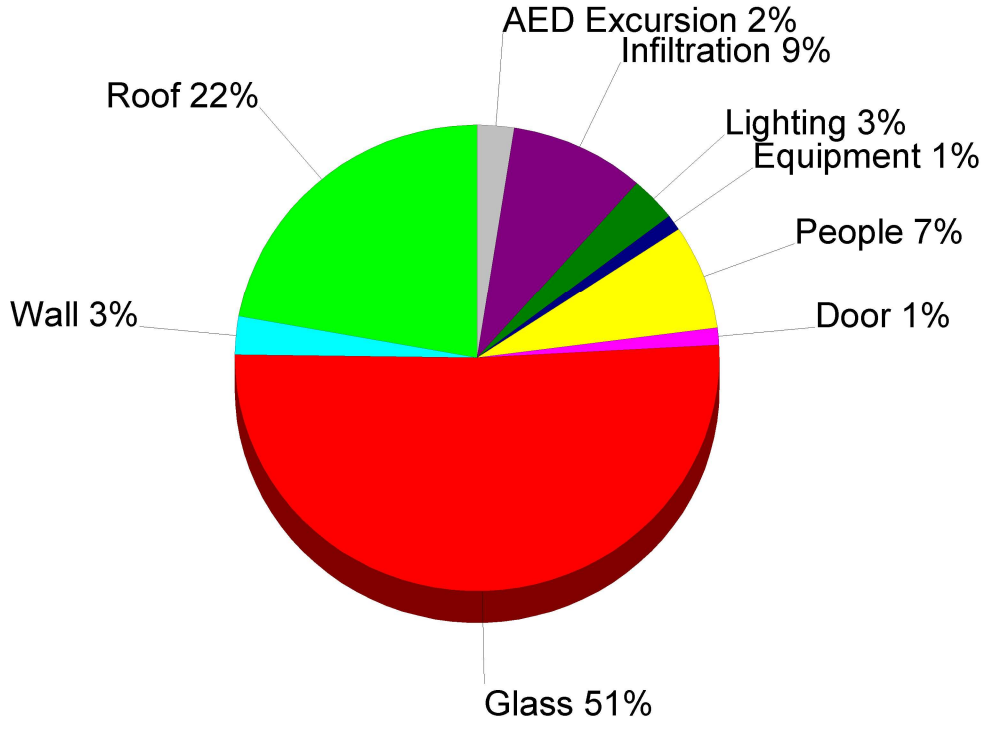
All computed results are estimates as building use and weather may vary.
Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

Building Pie Chart

Building Loss 83,361 Btuh



Building Gain 35,397 Btuh



System 1 Existing Furnace Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
1C-cm: Glazing-Single pane window with storm, clear, metal frame no break, U-value 0.87, SHGC 0.67	176.9	11,080	0	6,710	6,710
3A-m-o: Glazing-Double pane low-e (e = 0.40), operable window, metal frame no break, U-value 0.32, SHGC 0.61	112.9	2,601	0	6,885	6,885
11D: Door-Wood - Solid Core, U-value 0.39	18.6	522	0	131	131
11D: Door-Wood - Solid Core, U-value 0.5	18.6	670	0	167	167
13BB-0ocw: Wall-Block, framing with R-11 in 2 x 4 stud cavity, open core, wood studs, U-value 0.088	1022.5	6,478	0	422	422
12B-0bw: Wall-Frame, R-11 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs, U-value 0.097	658.5	4,599	0	301	301
16A-7: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Unvented Attic, No Radiant Barrier, Any Roofing Material, Any Roof Color, R-7 insulation, U-value 0.112	440	3,548	0	3,055	3,055
16A-15: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Unvented Attic, No Radiant Barrier, Any Roofing Material, Any Roof Color, R-15 insulation, U-value 0.061	880	3,865	0	3,328	3,328
22A-ph: Floor-Slab on grade, No edge insulation, no insulation below floor, any floor cover, passive, heavy moist soil, U-value 1	136	9,792	0	0	0
Subtotals for structure:		43,155	0	20,999	20,999
People:	4		800	920	1,720
Equipment:			0	0	0
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 203, Summer CFM: 108		16,016	1,329	1,416	2,745
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
AED Excursion:		0	0	868	868
System 1 Existing Furnace Load Totals:		59,171	2,129	24,203	26,332

Check Figures

Supply CFM:	1,104	CFM Per Square ft.:	0.436
Square ft. of Room Area:	2,530	Square ft. Per Ton:	1,153
Volume (ft³):	24,842***		

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

System Loads

Total Heating Required Including Ventilation Air:	59,171	Btuh	59.171	MBH
Total Sensible Gain:	24,203	Btuh	92	%
Total Latent Gain:	2,129	Btuh	8	%
Total Cooling Required Including Ventilation Air:	26,332	Btuh	2.19	Tons (Based On Sensible + Latent)

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 2 Gas Fired Reznor Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
3A-m-o: Glazing-Double pane low-e (e = 0.40), operable window, metal frame no break, U-value 0.82, SHGC 0.61	158.4	9,351	0	4,493	4,493
11D: Door-Wood - Solid Core, U-value 0.39	17.4	487	0	122	122
12B-0bw: Wall-Frame, R-11 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs, U-value 0.097	472.2	3,298	0	215	215
18A-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	598	3,272	0	1,454	1,454
22A-ph: Floor-Slab on grade, No edge insulation, no insulation below floor, any floor cover, passive, heavy moist soil, U-value 1	72	5,184	0	0	0
Subtotals for structure:		21,592	0	6,284	6,284
People:	2		400	460	860
Equipment:			0	384	384
Lighting:	320			1,091	1,091
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 33, Summer CFM: 17		2,598	216	230	446
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
System 2 Gas Fired Reznor Load Totals:		24,190	616	8,449	9,065

Check Figures

Supply CFM:	385	CFM Per Square ft.:	0.644
Square ft. of Room Area:	598	Square ft. Per Ton:	792
Volume (ft³):	6,170***		

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

System Loads

Total Heating Required Including Ventilation Air:	24,190	Btuh	24.190	MBH
Total Sensible Gain:	8,449	Btuh	93	%
Total Latent Gain:	616	Btuh	7	%
Total Cooling Required Including Ventilation Air:	9,065	Btuh	0.76	Tons (Based On Sensible + Latent)

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.

Proposal

Reid Mechanical Corp.
27 Charles Street #3
North Andover, Ma 01845

Phone: 978-682-7604 Fax: 978-685-5210

October 4, 2018

To: Plaistow Historical Society
Plaistow NH.

Job: Replace existing gas furnace, coil and condensing unit and install new American standard/Trane 80% gas furnace with ECM motor, new 4 ton cased coil and 410-A condensing unit on roof. New flue pipe and refrigeration lines, new Humidifier and supply air register for office area.

Total Price Installed : $ 10500.00

Authorized by : John Reid

Acceptance by : _____

Proposal

Reid Mechanical Corp.
27 Charles Street #3
North Andover, Ma 01845

Phone: 978-682-7604 Fax: 978-685-5210

November 13, 2018

To: Plaistow Historical Society
Plaistow , NH.

Job: Replace existing 80% gas furnace, coil and condensing unit on roof and Install new American Standard / Trane S9V2D120U5 120000 btu. 97% 2 stage gas furnace with ecm motor new high efficiency cased 4 ton and 13 seer condensing unit, new PVC flue pipe, new refrigeration lines new humidifier, programmable thermostat, new supply duct work and register to office in back.

Total price for Above work: $ 12500.00

Add For upgrade to 16 Seer Condensing unit : $ 800.00

Authorized by : John C Reid

Acceptance by : _____

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