Energy Audit

Funded by

EVERSOURCE ENERGY

Town Hall

18 Depot

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BUILDING STRATEGIES FOR AN AFFORDABLE FUTURE

S.E.E.D.S.

SUSTAINABLE ENERGY EDUCATION DEMONSTRATION SERVICES

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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 and equipment upgrades.

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.

This audit has been prepared with the best of intentions to assist the Town of Henniker make informed decisions regarding energy saving improvements in keeping with long term goals for the 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, apparatus, product or process disclosed.

Executive Summary

Henniker's Town Offices are located in the fist floor of the Henniker Meeting House. Constructed in 1787 as a wood framed structure on a granite and rubble stone foundation. Though now on the National Register of Historic Places, all but three of the original wood windows on the first floor had been replaced with double pane glass and vinyl or aluminum frames. The second floor meeting hall remains original, unconditioned and used for storage. At some point it was heated via two propane fired Modine units. They remain attached to the ceiling but not used and no known propane tank exists anymore.

The first floor is heated primarily by a cast iron oil fired boiler and hydronic baseboard, with one main circulator pump and three zone valves. In the Fall of 2022, four outdoor heat pump condensers were installed serving both non-ducted wall units and ducted ceiling units. The primary objective was to provide cooling with only supplemental heating. Based on the assessed values of the envelope and rated capacities of the installed heat pump, this study suggests that the heat pumps could serve as primary heating more efficiently and cost effectively than the oil fired hydronic system. Testing this theory will take some experimenting, but changes to the thermostatic controls is discussed on pages seven and eight, as is the potential for using the heat pumps for primary heating.

This would be especially possible after implanting the seven recommended envelope ESM, described briefly on the next page with estimated energy and dollar savings.

Summary of Energy Saving Envelope Measures

The recommended ESM are described in more detail later in this report.

The chart below summarizes the estimated cost of each ESM. Estimating contractor costs has become more challenging in this era of supply chain shortages and hard-to-find labor. Contacting a reliable insulation and air sealing contractor is recommended for a cost proposal for the recommended measures.

ESM #	Envelope Condition / ESM	Estimated Cost of Measure
1	Double Wood Doors	$325
2	Weather-Stripping	$450
3	Cellular Shades	$1,260
4	Insulate Entry Walls	$1,675
5	Limited Ceiling Insulation	$1,768
6	Insulate FND and Door	$2,325
7	Dense Pack Walls	$10,517
	Total Estimated Cost	$18,320

An investment of an estimated $18,320 is predicted to save at least $1,437 in energy (oil) costs at the two year average cost of $3.17 per gallon, and $0.13 per kWh. This would result in a simple payback within 12.7 years. Since ESM continue to save energy for the life of each measure, this also results in a minimum annual return on investment (ROI) of 2.7% over each of the next 25 years. Again, the savings are based on recent average energy prices. If (when) prices increase, so too will the ROI.

The ESM are presented as a whole package, because savings if completed as a package will be greater than the sum of implementing individual in a piece meal fashion.

Annual $ Savings	$1,437	
Simple Payback	12.7	Years
Life of Measure	25	Years
Investment Gain	$17,605	
ROI	96.1%	At end of 25 years
Annualized ROI	2.7%	For each of 25 years
Annual Oil Savings	540	Gallons
Annual Electric Savings	1094	kWh
Site Energy Saved	78.6	Million Btu
Source Energy Saved	98.5	Million Btu
CO_2 Emissions Reduction	6.79	Tons, Annually
CO_2 Emissions Reduction	169.8	Tons, 25 Years

Potential Eversource incentives are based on energy saved for the cost of the measures. Contact your Eversource representative, Jack Paloulek, to determine if the project is eligible for incentives. jack.paloucek@eversource.com

Assessed Values for Town Offices and Other Model Inputs

The thermal envelope is the assembly of materials which form the barrier between inside conditioned space and outdoor weather and climate. Its ability to conserve heat and manage moisture determines, primarily, the heating load or demand of a building. Continuity and thickness of insulation, in direct contact with air barrier, is key to an effective thermal barrier.

Square Feet Area (whole)	2802	
Volume (ft3) (whole)	29,910	
Design Temps	Outdoor Dry	Indoor Dry
Winter	-2	70
Summer	87	75
Reference City	Concord NH	

Summary reports for load calculations of the existing and retrofitted condition has been included at the end of this study. Below is a summary of values for existing and improved envelope components.

Envelope Component	Surface Area FT2	Assessed Effective R-Value	U-Factor	Improved U-factor	Improvement	ESM #
Single Pane Windows	28	1.27	0.79			
Double Pane Windows SHGC 0.49	326	2.6	0.38		Weather-Strip as needed	2
Glass Entry Doors	57	1.15	0.87		Weather-Strip as needed	2
Double Wood Doors 2nd floor	39	1.15	0.87	0.09	Foam board & seal	1
Lounge Entry Door	16	1.8	0.56		Weather-Strip as needed	2
Historic Frame Walls	2090	8.5	0.12		Blow in Cellulose	7
Uninsulated Walls - Entrance	200	3	0.33	0.071	Blow in cellulose	4
Slopes over Entrance	280	10	0.10	0.060	Blow in cellulose	5
FG Batts on Suspended Tiles	2110	15.5	0.06		(TBD if possible)	
Voids over Sheetrock Ceilings	272	5	0.20	0.038	Blow in cellulose	5
Floor over Crawlspace Walls SPF	2328	3	0.333			
Floor over Uninsulated Basement	474	2.0	0.50	0.083	Insulate Walls and Door	6
Air Leakage - Winter		Exist		Improved		
Volume	29910	295		195		

Other formulas used in this analysis:

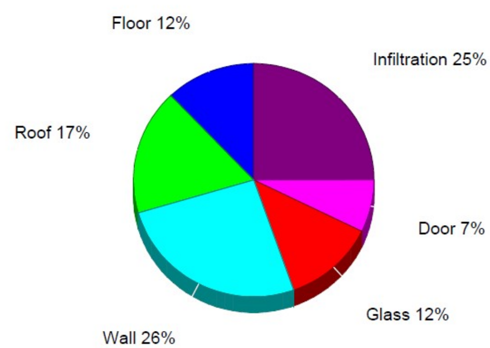
Oil: 138,500 Btu per gallon for site energy
Source energy: 159,275 Btu per gallon (1.15xSite)

Electric: 3412 Btu per kWh site energy.
Source energy: 11,361 Btu per kWh

CO_2 Emissions:

Oil: 23.25 lbs per gallon

Electric: CO_2 lbs = kWh X .89



Heat loss by the thermal envelope component

Heating and Cooling Loads for Existing & Improved Conditions

	Existing Heating	Btu/hr Cooling	ESM 1-7 Heating	Btu/hr Cooling
Main Entrance	36381		23869	
Lobby	5210	2346	4893	2241
Town Clerk / Tax Collector	6043	4482	5567	4325
Assessing Office	4817	2818	4409	2683
Finance	7803	4150	5765	3682
Small RR	1499	1170	1088	1084
Large RR	3497	1955	1742	1287
Staff Lounge & Kitchen	8378	4837	7663	4599
Town Administrator	3338	2079	3065	1989
Conference Room	9150	8769	8537	8566
Planning & Selectmen	4453	2901	4090	2779
	90569	35507	70688	33235

Descriptions of ESM

ESM 1: Seal and insulate this double door. Adhere 2", min R10 rigid foam board to this side of the door in such a way that it can be removed without (much) damage and add thick weatherstripping. The result should be a tight and insulated but fully functional doorway. See Page 12.

ESM 2: Add weather-stripping to all (other) exterior doors. See page 14.

ESM 3: Replace existing blinds on south facing windows with tracked cellular shades to 1) eliminate drafts, 2) reduce heat loss, and 3) reduce summer heating and glare. See page 16.

ESM 4: Blow in cellulose or mineral wool to wall cavities in the entrance. Refer to photos on pages 16 & 17.

ESM 5: Blow cellulose into floor over lounge area. Ask contractor to explore the viability of drilling holes into floor to dense pack walls from above (ESM 7) as well as rest of floor, with fee proposal for both options. See Page 18.

ESM 6: Insulate foundation walls in the basement with two inch, foil faced, polyisocyanurate. Spray closed cell foam from foam board to under floor decking for a continuous air, vapor, and thermal barrier. Attach same foam board to access door and weather-strip. If at all possible, drill holes through concrete blocks on the south wall and inject foam to air seal the original sill/granite connection. (Office above can use the floor to keep lunch cold). Other option would be to remove the cementitious ceiling and all fiberglass—spray foam rim joists, then add mineral wool (roxul rock wool) to ceiling cavity bays and replace fire-proof barrier.

ESM 7: If impossible from floor above, remove exterior clapboard at top of 1st floor wall, drill two inch holes, and dense pack cellulose (or mineral wool) into wall cavities. SEAL holes and replace clapboards.

Cost estimates are based on other projects but need a contractor's fee proposal to verify potential incentives.

Heating Cost From Oil VS Installed Air Source Heat Pumps

A gallon of oil contains (approximate average) 138,500 Btu. Based on that average, it takes about 7.25 gallons of oil to equal one million Btu of heat. At $2.49 a gallon and 100% efficiency, it would cost just over $18.00 to deliver one million Btu for space heating. When factoring in the efficiency of the existing boiler, the cost to deliver one million btu about $21.15. At $3.17 per gallon, the cost goes up to $26.31 per MMBTU.

Cost of Oil in existing Boiler	
Cost per MMBtu @ $2.49/gal	$21.15
Cost per MMBtu @ $3.17/gal	$26.31

We can use similar calculations to compare the cost to deliver heat from other energy sources. It's a little more complicated with electric heat pumps because the efficiency varies based on outdoor temperature and the specific heat pump equipment. The chart below offers a summary snap shot of the cost to heat with the installed heat pumps (based on published capacity and COP ratings) at three outdoor temperatures (OAT). Note that at $0.13 per kWh, heating with ASHP is less expensive per million Btu down to 5°OAT, compared to heating with oil at $2.49 per gallon.

Estimated Zone Loads	11716	11253	13603	24620	Average $
Heat per kWh @ 47° OAT	13409	12420	13614	11089	
Cost per MMBtu @ $0.13/kWh	$9.69	$10.47	$9.55	$11.72	$10.36
Heat per kWh @ 17° OAT	8871	8018	7813	7506	
Cost per MMBtu @ $0.13/kWh	$14.65	$16.21	$16.64	$17.32	$16.21
Heat per kWh @ 5° OAT	6926	6415	8257	7404	
Cost per MMBtu @ $0.13/kWh	$18.77	$20.27	$15.74	$17.56	$18.08

However, to rely on ASHP for heating a space, it is also important to note whether the heat capacity at low temperatures is adequate to maintain indoor comfort. With one exception, the estimated heating loads per zone (above) exceed the heating capacity of the installed equipment (matching color below) at 5°OAT.

	MXZ-2C20NA3 Wall Unit	MXZ-2C20NA3	MXZ-3C24NA3	MXZ-4C36NA3	Totals
Cooling Btu/hr	20000	20000	22000	36400	98400
SEER / SEER2	20/18	16/20	16/20	17.6/16	
Heating at 47°F Btu/hr	25500	25500	30600	43000	99100
Heating at 17°F Btu/hr	15000	14500	19600	26600	61200
Heating at 5°F Btu/hr	11000	10900	18200	24000	53200
COP at 47°F	3.93	3.64	3.99	3.25	3.72
COP at 17°F	2.60	2.35	2.29	2.20	2.36
COP at 5°F	2.03	1.88	2.42	2.17	2.21
Energy Star	Yes	No	No	No	
Compressor Type	DC Inverter	DC Inverter	DC Inverter	DC Inverter	
Heating Air Intake Max	5°	5°	5°	5°	
Heating Thermal Lock	-1.4	-1.4	-1.4	-1.4	
Re-start Temp	5°	5°	5°	5°	

Load Reductions Following Implementing ESM 1-7

Room Areas	Existing Heating	Btu/hr Cooling	ESM 1-7 Heating	Btu/hr Cooling
Main Entrance	36381		23869	
Lobby	5210	2346	4893	2241
Town Clerk / Tax Collector	6043	4482	5567	4325
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Totals	90569	35507	70688	33235

Keep doors open to main entrance and restrooms (when not in use).

Completing all seven recommended ESM is predicted to reduce the whole building's heating load by an estimated 20,000 Btu/hr and each zone's load enough that the published heating capacity at 5ºOAT may be adequate to maintain indoor comfort. The hydronic baseboard would still be available as back as needed, but potentially only when the OAT drops below 5ºOAT. The premise is that in addition to saving energy, the ESM would result in being able to use the lower cost heating source.

Estimated Reduced Zone Loads	10728	10460	12627	22174	Average $
Heat per kWh @ 47º OAT	13409	12420	13614	11089	
Cost per MMBtu @ $0.13/kWh	$9.69	$10.47	$9.55	$11.72	$10.36
Heat per kWh @ 17º OAT	8871	8018	7813	7506	
Cost per MMBtu @ $0.13/kWh	$14.65	$16.21	$16.64	$17.32	$16.21
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	MXZ-2C20NA3 Wall Unit	MXZ-2C20NA3	MXZ-3C24NA3	MXZ-4C36NA3	Totals
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COP at 17ºF	2.60	2.35	2.29	2.20	2.36
COP at 5ºF	2.03	1.88	2.42	2.17	2.21
Energy Star	Yes	No	No	No	
Compressor Type	DC Inverter	DC Inverter	DC Inverter	DC Inverter	

Historic Energy Use Analysis

The energy analysis below is based on the energy data provided for 2022.

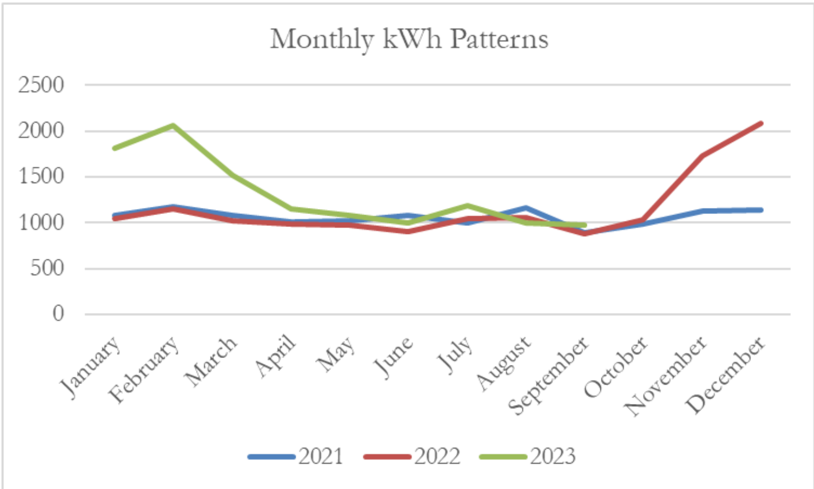
Energy	Units	Site Btus	Source Btus	$Cost
Electric - kWh	13914	47,474,568	158,076,954	$2,017
Oil - Gallons	1864	258,164,000	296,888,600	$5,916
Totals		305,638,568	454,965,554	$7,933
EUI KBtu/FT2	2802	109.1	162.4	$2.83

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 some allowance for off site generation and other considerations.

Based on the information provided the Site EUI for 2022 was 109.1 KBtu/ft2 for the whole building. Source EUI was 162.4 KBtu/ft2, with a cost per square foot of $2.83 per ft2 based on current energy prices. Since the per unit cost for energy can vary greatly over time, converting all forms of energy to Btus is a more useful way of looking at a building's energy demands and potential reductions from energy saving measures.

Monthly patterns of electric consumption can sometimes tell a useful story, though assumptions are never as useful as hard facts. Still, it is likely that the peak consumption pattern in the winter is due to the use of electric heating, especially in the basement where electric resistance (ER) baseboards are used to supplement the one indoor heat pump unit.

Another financial advantage of converting to heat pumps is that it offers the option for an annual offset with on-site generation of clean, renewable, and "free" solar energy.



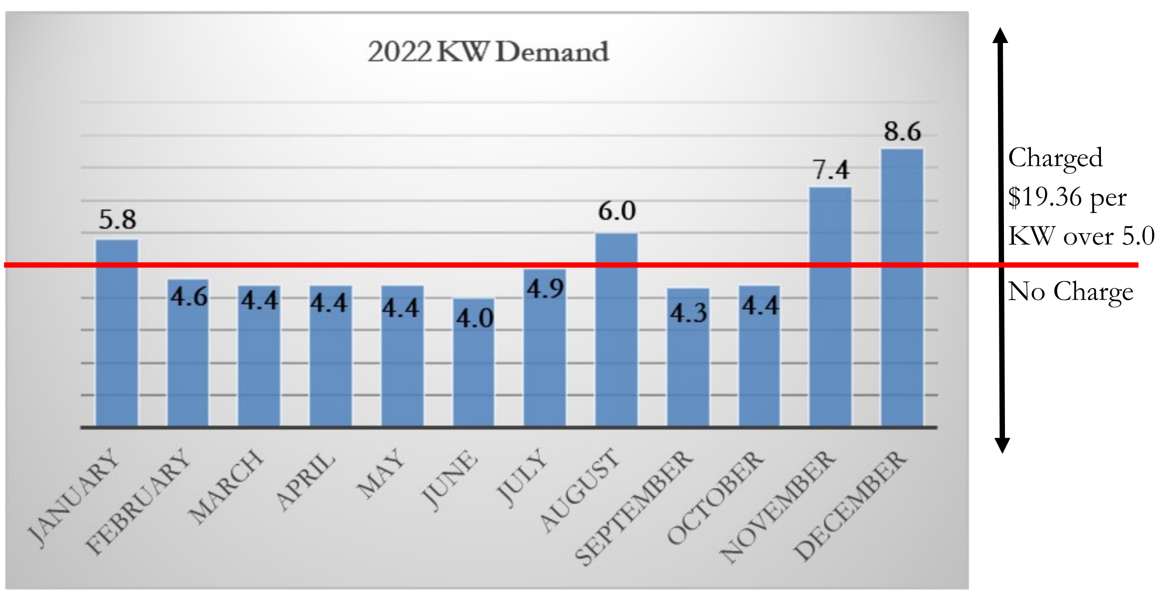
KW Demand and the Cost of Supply

The KW Demand is determined each month by the peak call for power during any 30 minute window within a billing cycle. The total charges for KW Demand in 2022 was $159, or just under 8% of the total cost for electricity in 2022.

Corresponding with the highest usage of kWh, demand for power was highest in the coldest and hottest months of the year, most likely due to space conditioning. As noted elsewhere, heat pumps operate most efficiently when left at a stable thermostat setting. In other words: don't use setbacks for the heat pumps. (And do use deeper set backs at night and weekends when running the boiler).

Reducing electric usage saves energy and monthly costs in both the supply side (actual electricity used) and the delivery side (the very real transmission costs of delivering kWh to the meter, maintaining lines, etc).

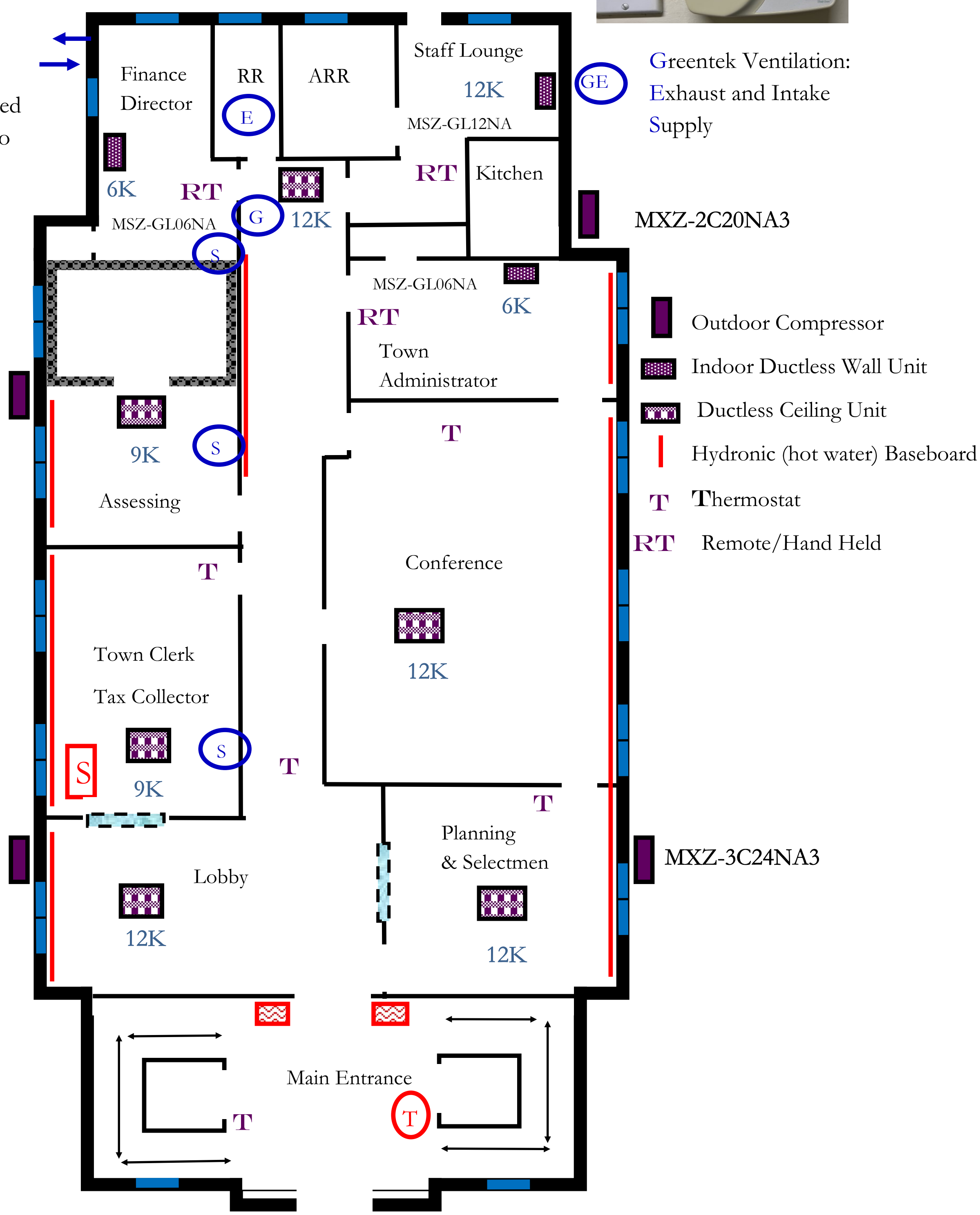
Lowering peak demand on the regional grid plays a critical part in reducing the need to build more generation plants. It may be impacted by a reduction in kWh consumption, but is mostly determined by time and the appliance used. Customers are allowed a peak use of 5.0KW each month before incurring charges.



Floorplan Graphic

Hornet nest removed but all ducts need to be cleaned

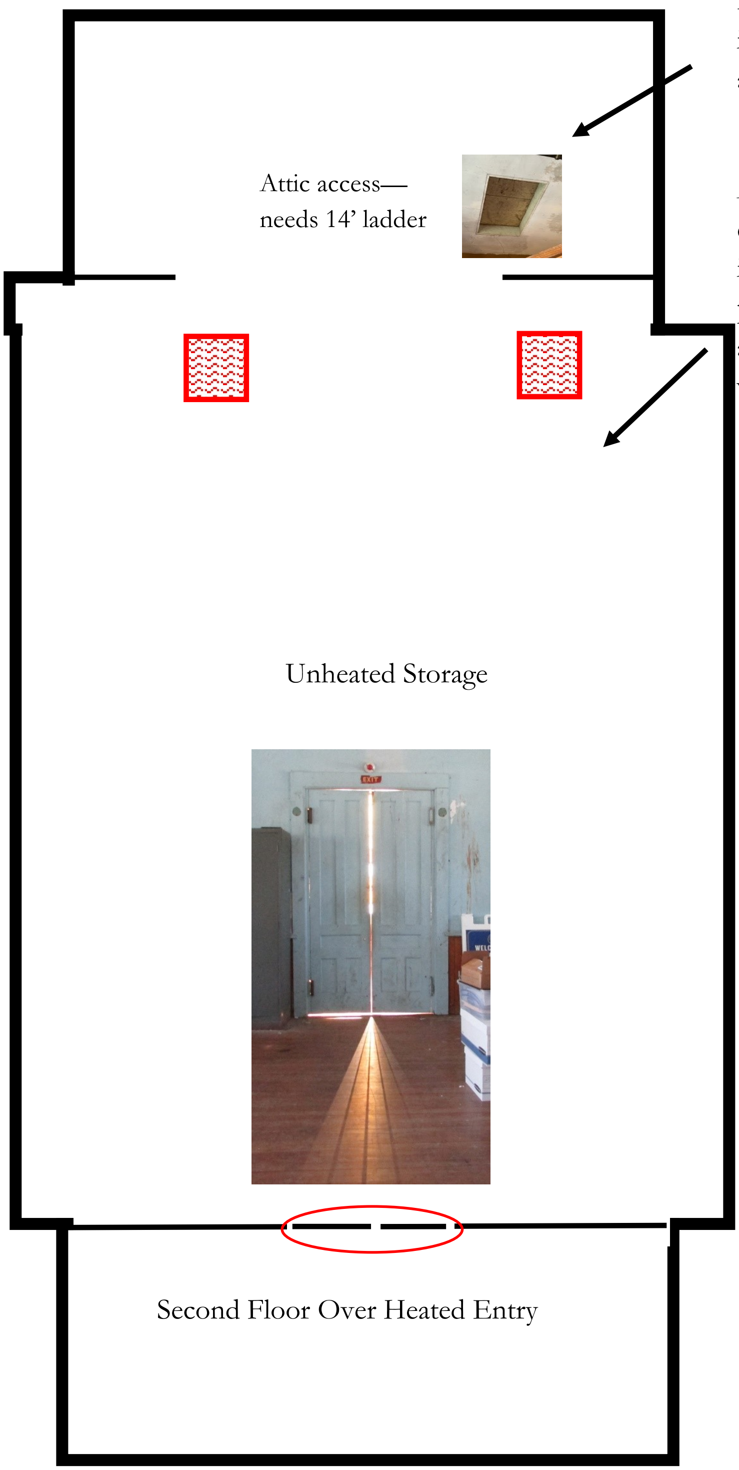
Greentek Ventilation: Exhaust and Intake Supply



ESM 5: Blow cellulose into floor over lounge area

AND

Ask contractor to explore drilling holes into floor to dense pack walls from above as well as rest of floor, with fee proposal for



ESM 1:

Seal and insulate this double door. Adhere 2", min R10 rigid foam board to this side of the door in such a way that it can be removed without (much) damage and add thick weatherstripping. The result should be a tight and insulated but fully functional doorway.

Thermostat Set Backs

There is a bit of controversy around whether setting a thermostat to a lower temperature saves energy or not. Two common myths:

1. "Thermostat setbacks during the winter won't save you money. Any energy you saved when the thermostat was turned down will be lost because of the amount of fuel the furnace needed to get you back to a comfortable level."

2. "Setting your thermostat back will save energy, but no more than four degrees." (or 6 or some set number)

The reality is that lowering the indoor air temperature through thermostat setbacks for fuel burning equipment almost always saves heating energy because one of the factors of heat transfer is the temperature difference between inside and outside (aka delta T or ΔT): the lower the ΔT, the slower the rate of heat transfer, therefore heat loss is reduced. While its true that a furnace or boiler will run longer to bring the temperature back up to comfort levels, fossil fuel (and biomass) equipment operates more efficiently when it keeps running as opposed to turning on and off multiple times. For those two reasons, the energy saved from lower setbacks will *almost* always be more than the energy used to bring it back up to temperature. NOTE: This does NOT apply to variable speed heat pumps which operate most efficiently when left at one temperature.

But it is especially true for single stage oil fired equipment which is 'oversized'. That is when its hourly BTU output capacity far exceeds the hourly heat loss. Ideally, peak capacity will equal peak heat lost—ie the BTU/hr heat loss during the coldest hour of the location's winter, occurring 99% of the time on average. But non-modulating furnaces and boilers are frequently oversized—but as much as 50-150% . So when it comes on to satisfy the thermostat setting, it puts out a lot of heat, likely turns off fairly quickly, then on again minutes later. This on and off again is referred to as 'short cycling' and it results in low seasonal efficiency. (There are other maintenance reasons for short cycling, including a damaged flame sensor and dirty or misaligned air filters, so regular maintenance and inspections and can keep a furnace performing as efficiently as possible.)

But when a building is unoccupied overnight or for days at a time, keeping the thermostat set back means that the boiler will be off for many if not most of the winter hours, then run at its highest efficiency to recover.

All that said, there are other considerations with thermostat set backs, especially in a building with minimal insulation levels. As surfaces cool, there is a risk of condensation forming if surface temperatures drop below the dew point, though with low interior humidity, this should be a very low risk. The other common consideration is preventing the risk of freezing pipes on exterior walls, though again, this should not be an issue in the Community Center as long as the baseboard in the meeting room restroom is left on to 45 degrees.

There is likely an 'optimal' set back temperature for the propane and oil systems in these buildings. But it is unique to each building based on the thermal performance of the envelope and which will vary for each hour as the delta T varies. I've asked contractors who recommend specific set back temperatures, why they pick 4º or 6º or whatever and the response has usually been something on the order of "because its complicated and customers won't understand. They just want simple instructions."

The mission of S.E.E.D.S. is based on the principle that to transition to a low energy, carbon neutral economy, people, as consumers, deserve to at least be offered the opportunity to understand the complexities of physics as they relate to our energy usage. For more information, check out the links below.

https://cbe.berkeley.edu/research/setpoint-energy-savings-calculator/

https://www.energyvanguard.com/blog/if-you-think-thermostat-setbacks-don-t-save-energy-you-re-wrong/

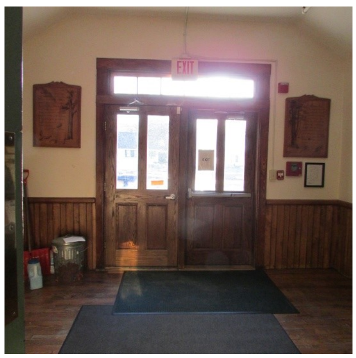
https://www.thisoldhouse.com/heating-cooling/21016013/how-thermostat-setbacks-save-money

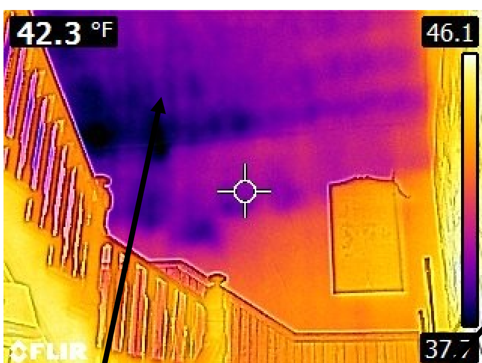
ESM: Main Entrance

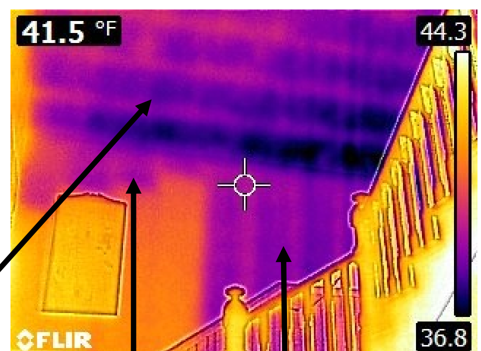
Thermographic (aka Infra Red or IR) images depict differences in surface temperatures. Darker colors indicate cooler surfaces than brighter colors. Dark "blobs" or streaks can indicate cold air leaking into the building on a cold day, or washing through low density insulation such as fiberglass. Though in this case, the voids or uninsulated and narrow wall cavities reflect the highly conductive cold brick of the exterior walls.

Air leakage around the three exterior doors offer a cost effective opportunity to reduce air filtration though installing professional quality weather stripping.

ESM 2: Add weather-stripping around exterior doors





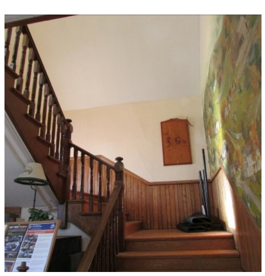


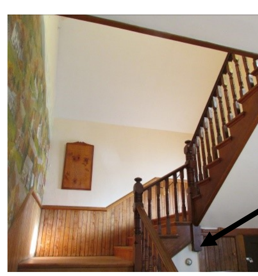
ESM 5: Blow in insulation above entrance ceiling (Access not known, possibly from ceiling hatch on northwest corner.

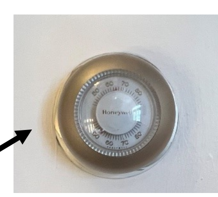
ESM 4: Blow in insulation into entrance's exterior wall cavities

Improving the thermal envelope* in the entrance and stairwell will save energy & dollars, but by reducing heat loss, it makes it possible to open doors to the office areas during the day and rely on heat pumps for heating.

* ESM 1, 4, 2, and 5



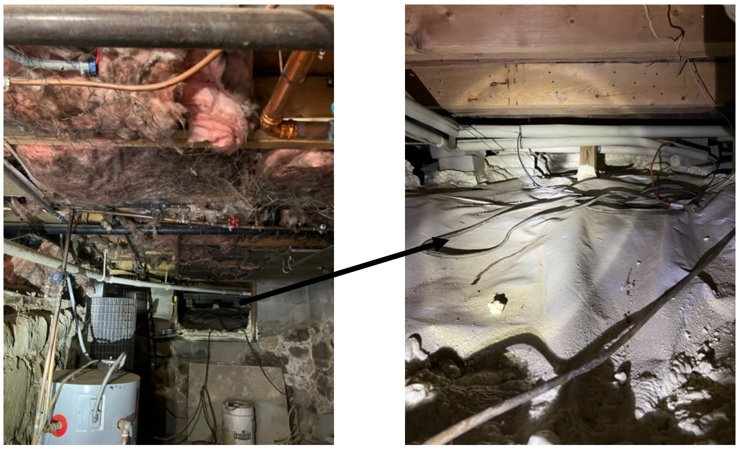




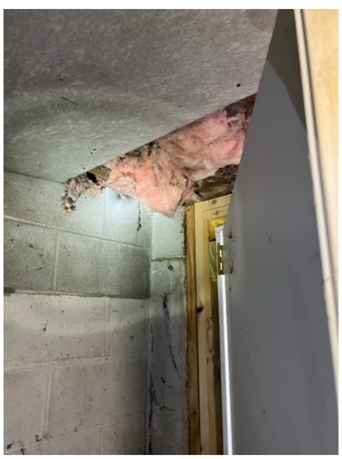
The thermostat is set to 64.

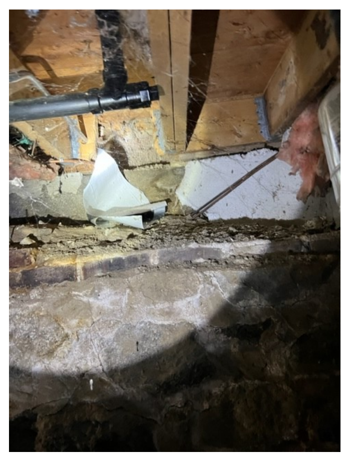
ESM #6: Insulate the Remaining Foundation Walls

The small basement, where the boiler and hot water tank are located, has an opening to a crawl space which presumably extends under the rest of the building. It has had spray foam applied to the foundation and which also seals a vapor barrier membrane over the floor. All this would have been recommended had it not already been accomplished!




However, there have been issues with freezing pipes which is being addressed through 'expensive to run' electric resistance heat tapes. And the office and bathrooms over the basement have very cold floors. The fiberglass in the ceiling shows the effect of air filtration, which means its barely serving as any insulation at all. So the recommendation is continue insulating the foundation walls and add R12 Thermax board to the door and air seal.





It appears that a block wall has been added to the interior of the original granite and stone foundation, and a cementitious ceiling board added above the boiler to serve as a fire barrier. The exterior granite and sill may be able to be accessed—and foam sealed—but cutting into or removing the fire board and then replacing. If so, it is worth doing if mostly for the benefit of comfort to the finance office above. (Though it will also save energy)

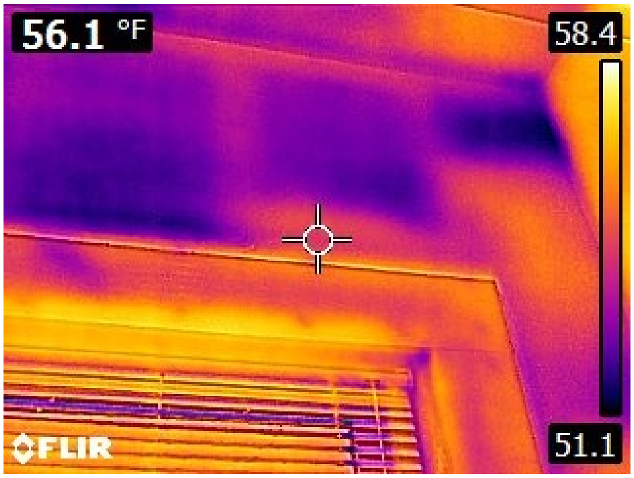
ESM #7 and #3

Wall cavities appear to have insulation material but it has settled in some cavities and appears 'performance-compromised' in others.

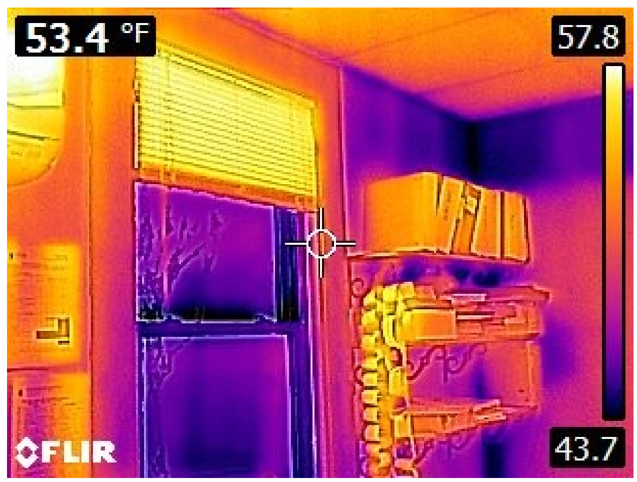
The objective of ESM 7 is to dense pack cellulose into each cavity—filling voids and compressing what already exists.

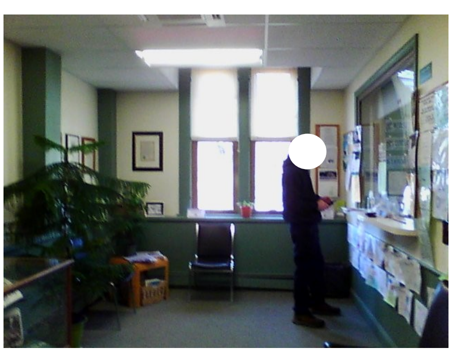
ESM #3 is intending to reduce drafts but also add "R-value" to the existing windows and frames by replacing the light filtering shades with insulated and tracked cellular shades.

There are many different styles and colors to choose from and only some on tracks to reduce air leakage. The most important criteria is to select a shade with two layers of material creating a 'honeycomb' pocket of air.



ESM #7 and #3





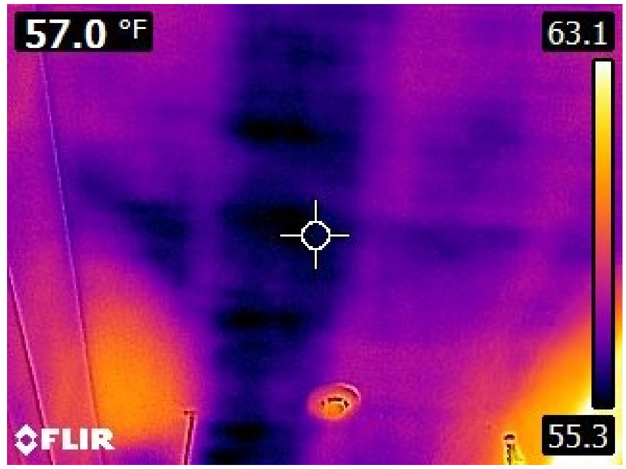
ESM #5

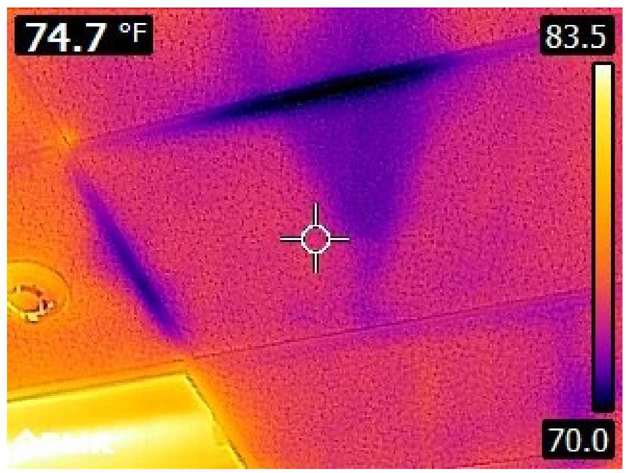
ESM #5 is intended to address the ceiling plane, where it also may provide access to top of walls.

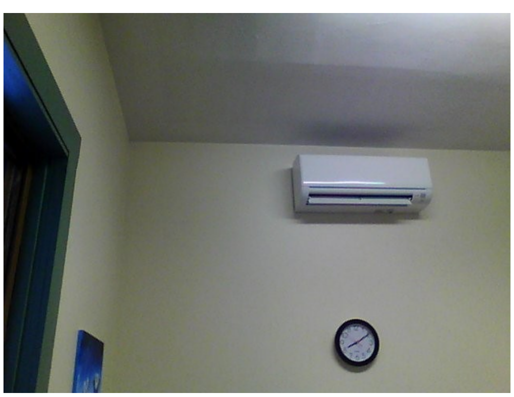
There are fiberglass batts above the suspending ceiling (where it exists) which does offer some level of thermal barrier.

But air can easily migrate through fiberglass and there also appears to be voids above the plaster ceiling of the lounge area.

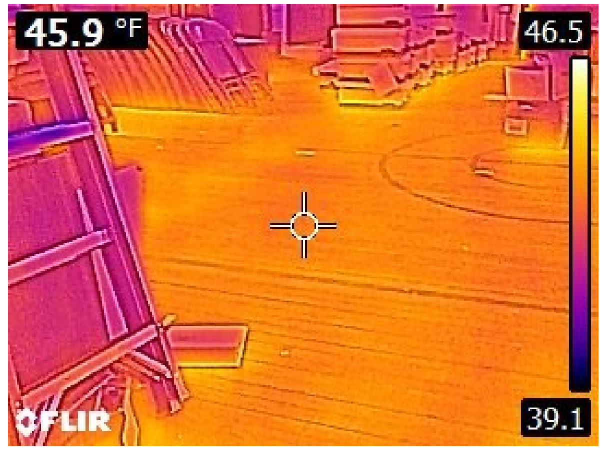
Ideally, the floor of the second floor would be dense packed with cellulose, but access and practicality of that measure needs to be explored by a contractor who would do the work.

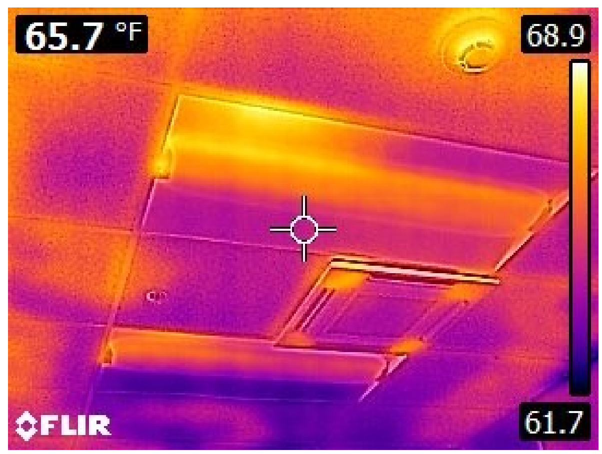




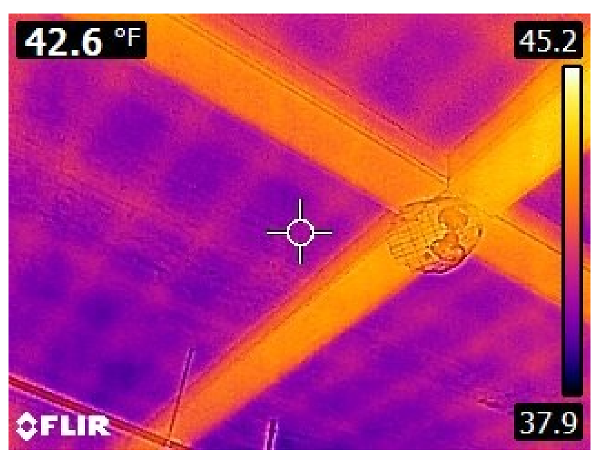


ESM #5

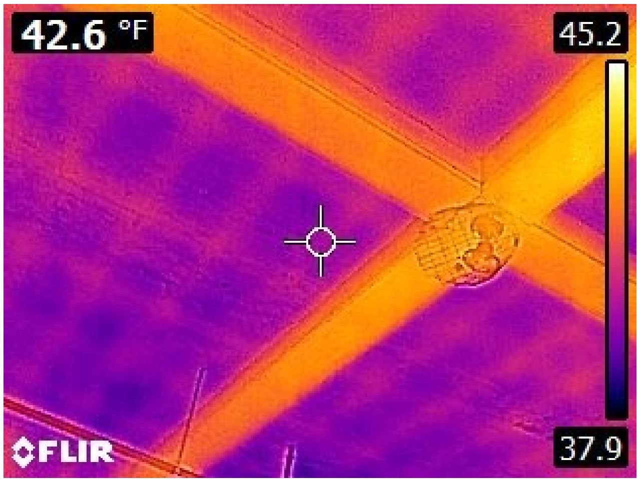


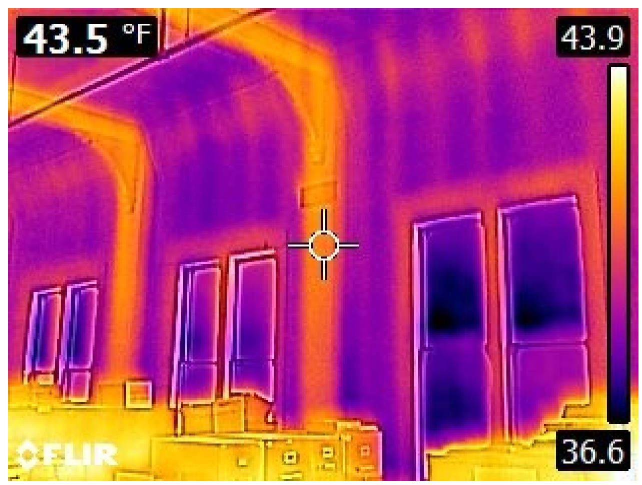


There does not appear to be insulation in the walls or above the ceiling of the second floor. As long is it remains un-heated, it is proposed to focus on improving the thermal barrier at the floor and stairwell wall boundary.



Unconditioned Second Floor Storage



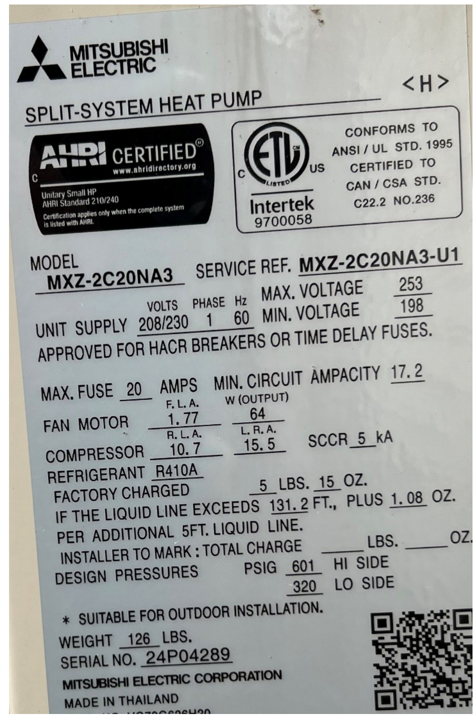


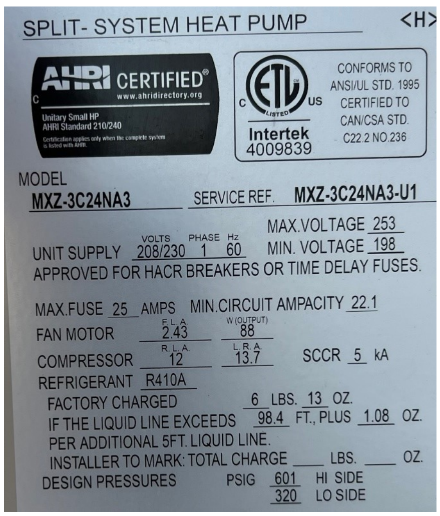
Heating and Cooling Equipment

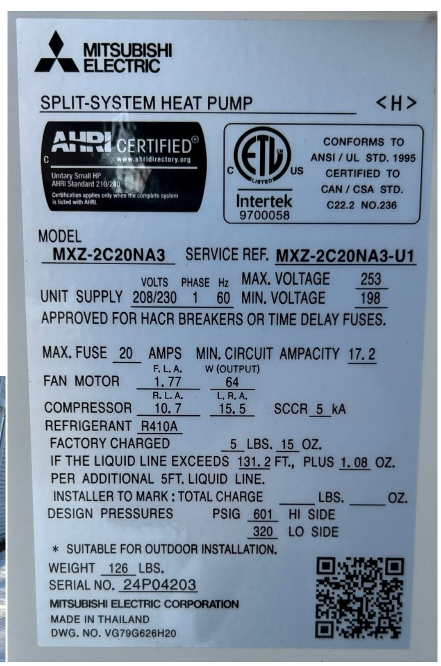
Weil-McLain
Model # WGO-5 or 5R
Output 152 or 128MBH

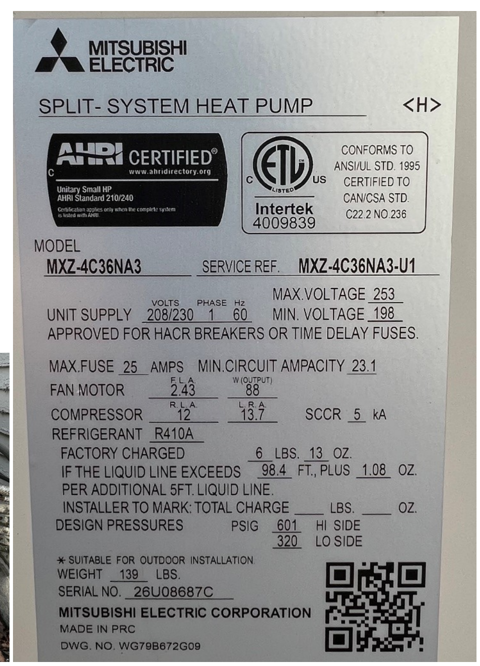
AFUE 85%

State Industries Elec
Water Heater
(2) 1650watt elements









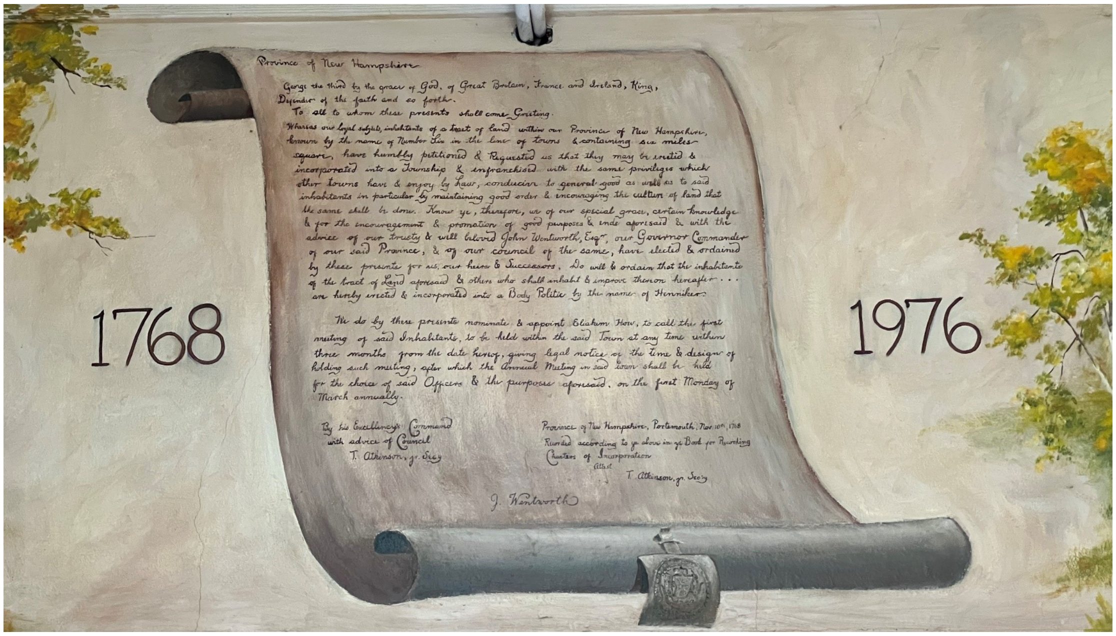
East Facing

North Facing

South Facing

West Facing

Just Because Its Such A Great Entrance



The Basics of Heat Transfer in a Building

Heat moves in three basic ways in a building: Conduction, convection, and radiation.

Heat **conducts** to coolth or cold in any direction and through physical contact of materials. Insulation can slow the rate of heat loss to the outside. The rate at which it moves is determined by the type and thickness of material and the temperature difference between inside and outside. Compare holding a ceramic mug of hot water vs a glass of hot water, vs a glass of cold water. The skin of your hand will be heated—or cooled—based on the conductivity of the mug, glass, and the temperature difference of the water and your hand.

In a building in our climate, heat moves, or 'is lost' to the outside as it moves from inside heated space to the colder outside through an assembly of materials. For the walls, the assembly may consist of plaster or sheet-rock, brick, or wood framing with insulation in cavities (or not), exterior board sheathing, wood clapboards, or perhaps a thin layer of insulation and vinyl siding. The rate of heat loss varies with the difference between the inside temperature and outside temperature. That is why setting the thermostat back to 55 degrees when the building is unoccupied saves energy; because the rate of heat loss is slowed.

Heat can also be transferred through air or water by **convection.** While heat moves to cold via conduction, warmer air rises because it is lighter, or less dense, than cooler air. This means that insulation can only work well if it doesn't allow air to pass through it. The other way to say it is: Insulation needs to be in contact with an air barrier on all sides to perform as expected. Weatherstripping around doors and windows, for example, can stop cold air infiltration which, when warmed, rises to the ceiling and exfiltrates through any cracks or gaps in the ceiling material.

Insulation is usually described by its R-value, or resistance to allow heat transfer. But R-value doesn't tell the whole story because it only refers to conductive heat loss and doesn't consider convection. Manufactures of insulation test their products in a laboratory by placing it, fully lofted, in a perfectly sealed box, and measure the rate that heat moves from one side to the other to determine what "R-Value" to stamp on the product to be sold. If its not installed in exactly the same way, that R-value has very little meaning.

The third way heat moves is by **radiation**. This happens through space and from a warmer source to cooler surface in visual contact. Think of feeling the warmth of the sun and the immediate difference when a cloud blocks it. The sun still warms the earth surfaces and surrounding air, but direct radiation can be blocked—or shaded. Same thing with a wood stove. A hot stove warms air, but its greatest impact is by radiation which is only felt when one is in visible contact. And the further away, the less heat is felt. Its often tempting to replace windows because we feel so cold when next to them! That's because our body heat radiates to the cold surface. Insulated shades or quilts stops that radiative loss (but also eliminates view and daylight). Interior glazing panels can make a big difference for single pane windows because the air space raises the surface temperature of the inside glass.

In reality, all three mechanisms happen at the same time, though one usually dominates the others in terms of how much heat is moved.

The role of heating equipment is to replace the heat that is lost through the envelope. This is described or measured as replacing BTU per hour (BTU/hr). If the heating system (electric baseboard, oil or propane furnace or boiler, etc…) creates or moves more heat (BTU) in an hour than in lost to the outside, the system is considered "over-sized" which can waste energy unnecessarily. On the other hand, if the system cannot generate or move enough heat to replace what is lost in any given hour, the system is "undersized" and will not be able to maintain warm enough inside temperatures for human comfort. So correct sizing is important!

Henniker Town Hall EXISTING
HVAC Load Calculations

for

Town Of Henniker

Henniker NH 03242

Prepared By:

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

603-532-8979

Thursday, November 9, 2023

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:	Henniker Town Hall EXISTING
Project Date:	October 17, 2023 Town Of
Client Name:	Henniker
Client City:	Henniker NH 03242
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:	1,789	CFM Per Square ft.:	0.638
Square ft. of Room Area:	2,802	Square ft. Per Ton:	722
Volume (ft³):	29,910		

Building Loads

Total Heating Required Including Ventilation Air:	92,438	Btuh	92.438	MBH
Total Sensible Gain:	38,872	Btuh	83	%
Total Latent Gain:	7,696	Btuh	17	%
Total Cooling Required Including Ventilation Air:	46,568	Btuh	3.88	Tons (Based On Sensible + Latent)

Notes

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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 Oil Boiler. ASHP Supplement 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:	No		No	
Use Schedule:	No		Yes	
Roughness Factor:	0.00300		0.01000	
Pressure Drop:	0.1000	in.wg./100 ft.	0.1000	in.wg./100 ft.
Minimum Velocity:	0	ft./min	0	ft./min
Maximum Velocity:	900	ft./min	750	ft./min
Minimum Height:	0	in.	0	in.
Maximum Height:	0	in.	0	in.

Outside Air Data

	Winter		Summer	
Infiltration Specified:	0.592	AC/hr	0.592	AC/hr
	295	CFM	295	CFM
Infiltration Actual:	0.592	AC/hr	0.592	AC/hr
Above Grade Volume:	X 29,910	Cu.ft.	X 29,910	Cu.ft.
	17,700	Cu.ft./hr	17,700	Cu.ft./hr
	X 0.0167		X 0.0167	
Total Building Infiltration:	295	CFM	295	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: 0.592 AC/hr (295 CFM)
Summer Infiltration Specified: 0.592 AC/hr (295 CFM)

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	3.88	722	2,802	38,872	7,696	46,568	92,438	1,215	1,789	1,789	
System 1	3.88	722	2,802	38,872	7,696	46,568	92,438	1,215	1,789	1,789	0*
Zone 1			2,802	38,872	7,696	46,568	92,438	1,215	1,789	1,789	
1-Main Entrance			420	9,026	1,721	10,747	36,381	478	415	415	4--0*
2-Lobby			420	2,195	150	2,345	5,210	69	101	101	1--0*
3-Town Clerk.Tax Collector			294	3,856	625	4,481	6,043	79	177	177	2--0*
4-Assessing Office			252	2,425	393	2,818	4,817	63	112	112	2--0*
5-Finance			162	3,399	750	4,149	7,803	103	156	156	2--0*
6-Sm RR			40	1,127	43	1,170	1,499	20	52	52	1--0*
7-Lg RR			80	1,868	86	1,954	3,497	46	86	86	1--0*
8-Staff Lounge And Kitchen			192	4,419	738	5,157	10,247	135	203	203	2--0*
9-Town Administrator			162	1,749	329	2,078	3,338	44	81	81	1--0*
10-Meeting Room			540	6,479	2,289	8,768	9,150	120	298	298	3--0*
11-Planning & Selectmen			240	2,328	572	2,900	4,453	59	107	107	1--0*

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
1A-cm-o: Glazing-Single pane, operable window, clear, metal frame no break, U-value 1.27, SHGC 0.75	27.7	2,534	0	1,346	1,346
Replacement: Glazing-DP Pane with Low E, high SHGC, U-value 0.38, SHGC 0.49	326.2	8,920	0	8,290	8,290
Door: Door-Glass Entry Door, U-value 0.87	57.1	3,579	0	894	894
11D: Door-Wood - Solid Core, U-value 0.87	39.4	2,471	0	618	618
11L: Door-Metal - Paper Honeycomb Core, U-value 0.56	16.2	655	0	164	164
Historic Frame: Wall-Frame, Custom, Town Hall partially insulated frame walls, U-value 0.125	2089.8	18,809	0	2,454	2,454
12A-0bw: Wall-Frame, no insulation in stud cavity, no board insulation, brick finish, wood studs, U-value 0.353	200.6	5,097	0	665	665
Slopes.Poor: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Slopes Fiberglass, U-value 0.1	280	2,016	0	1,736	1,736
FG Batts-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, FG batts over suspended ceiling, light metal, U-value 0.067	2110	10,178	0	5,938	5,938
voids-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, minimal material over old plaster ceiling, light metal, U-value 0.2	272	3,917	0	2,285	2,285
19B-0sp: Floor-Over enclosed crawl space, R-4 insulation on exposed walls, sealed crawl space, passive, no floor insulation, carpet or hardwood, U-value 0.368	2328	5,461	0	910	910
Poor fg: Floor-Over enclosed crawl space, Custom, 19A fiberglass in poor condition, U-value 0.5	474	5,725	0	955	955
Subtotals for structure:		69,362	0	26,255	26,255
People:	20		4,000	4,600	8,600
Equipment:			0	1,250	1,250
Lighting:	545			1,858	1,858
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 295, Summer CFM: 295		23,076	3,696	3,846	7,542
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
AED Excursion:		0	0	1,062	1,062
Total Building Load Totals:		92,438	7,696	38,872	46,568

Check Figures

Total Building Supply CFM:	1,789	CFM Per Square ft.:	0.638
Square ft. of Room Area:	2,802	Square ft. Per Ton:	722
Volume (ft³):	29,910		

Building Loads

Total Heating Required Including Ventilation Air:	92,438	Btuh	92.438	MBH
Total Sensible Gain:	38,872	Btuh	83	%
Total Latent Gain:	7,696	Btuh	17	%
Total Cooling Required Including Ventilation Air:	46,568	Btuh	3.88	Tons (Based On Sensible + Latent)

Notes

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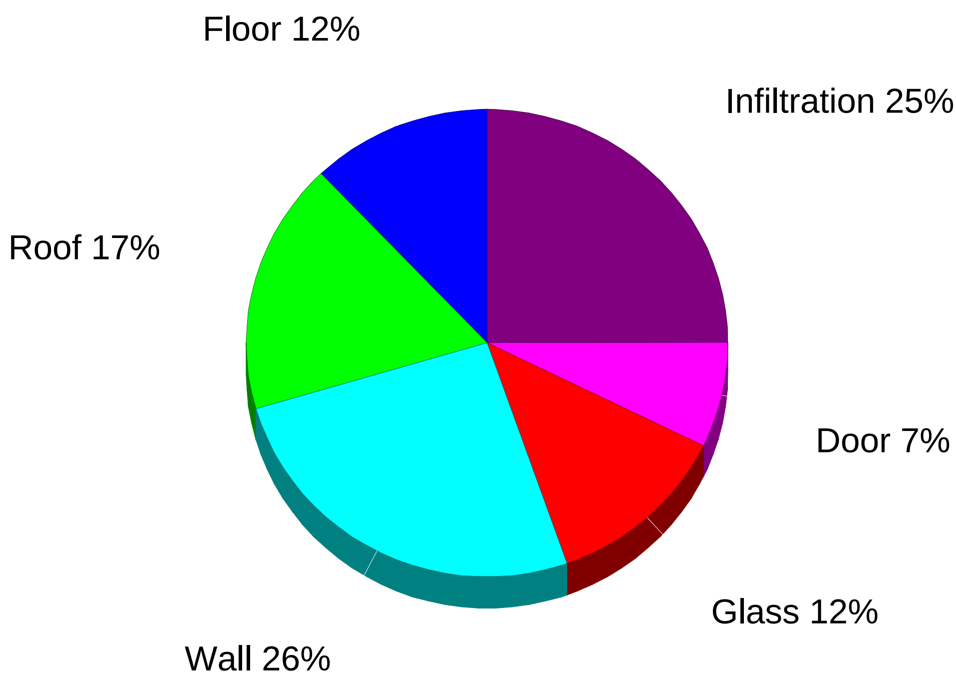
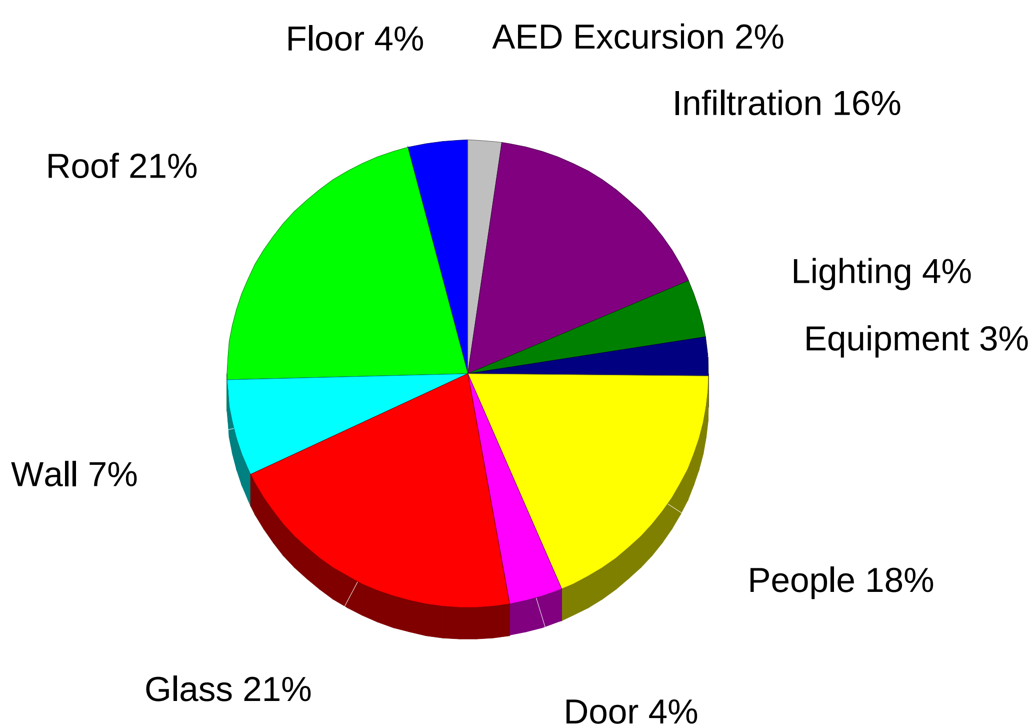
All computed results are estimates as building use and weather may vary.
Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

Building Pie Chart





Henniker Town Hall IMPROVED With DP Walls
HVAC Load Calculations

for

Town Of Henniker

Henniker NH 03242

Elite Software

RHVAC Residential HVAC Loads

Prepared By:

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

603-532-8979
Thursday, November 9, 2023

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

Project Report

General Project Information

Project Title:	Henniker Town Hall IMPROVED With DP Walls
Project Date:	Tuesday, October 17, 2023
Client Name:	Town Of Henniker
Client City:	Henniker NH 03242
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:	1,507	CFM Per Square ft.:	0.538
Square ft. of Room Area:	2,802	Square ft. Per Ton:	873
Volume (ft³):	29,910		

Building Loads

Total Heating Required Including Ventilation Air:	60,063	Btuh	60.063	MBH
Total Sensible Gain:	32,756	Btuh	85	%
Total Latent Gain:	5,753	Btuh	15	%
Total Cooling Required Including Ventilation Air:	38,509	Btuh	3.21	Tons (Based On Sensible + Latent)

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.

Miscellaneous Report

System 1 Oil Boiler. ASHP Supplement 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:	No		No	
Use Schedule:	No		Yes	
Roughness Factor:	0.00300		0.01000	
Pressure Drop:	0.1000	in.wg./100 ft.	0.1000	in.wg./100 ft.
Minimum Velocity:	0	ft./min	0	ft./min
Maximum Velocity:	900	ft./min	750	ft./min
Minimum Height:	0	in.	0	in.
Maximum Height:	0	in.	0	in.

Outside Air Data

	Winter		Summer	
Infiltration Specified:	0.281	AC/hr	0.281	AC/hr
	140	CFM	140	CFM
Infiltration Actual:	0.281	AC/hr	0.281	AC/hr
Above Grade Volume:	X 29,910	Cu.ft.	X 29,910	Cu.ft.
	8,400	Cu.ft./hr	8,400	Cu.ft./hr
	X 0.0167		X 0.0167	
Total Building Infiltration:	140	CFM	140	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: 0.281 AC/hr (140 CFM)
Summer Infiltration Specified: 0.281 AC/hr (140 CFM)

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	3.21	873	2,802	32,756	5,753	38,509	60,063	790	1,507	1,507	
System 1	3.21	873	2,802	32,756	5,753	38,509	60,063	790	1,507	1,507	0*
Zone 1			2,802	32,756	5,753	38,509	60,063	790	1,507	1,507	
1-Main Entrance			420	5,450	817	6,267	19,017	250	251	251	3--0*
2-Lobby			420	2,092	71	2,163	4,421	58	96	96	1--0*
3-Town Clerk.Tax Collector			294	3,709	507	4,216	4,964	65	171	171	2--0*
4-Assessing Office			252	2,292	292	2,584	3,832	50	105	105	1--0*
5-Finance			162	2,933	566	3,499	4,657	61	135	135	2--0*
6-Sm RR			40	1,045	20	1,065	985	13	48	48	1--0*
7-Lg RR			80	1,203	41	1,244	1,492	20	55	55	1--0*
8-Staff Lounge And Kitchen			192	3,863	560	4,423	6,603	87	178	178	2--0*
9-Town Administrator			162	1,664	261	1,925	2,708	36	77	77	1--0*
10-Meeting Room			540	6,294	2,137	8,431	7,798	103	290	290	3--0*
11-Planning & Selectmen			240	2,212	481	2,693	3,586	47	102	102	1--0*

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
SP with Int: Glazing-Historic single pane with interior panels, U-value 0.38, SHGC 0.6	27.7	758	0	866	866
Replacement: Glazing-DP Pane with Low E, high SHGC, U-value 0.38, SHGC 0.49	326.2	8,920	0	8,290	8,290
Door: Door-Glass Entry Door, U-value 0.87	57.1	3,579	0	894	894
Wood with Foam: Door-Foam insert over double wood doors, U-value 0.09	39.4	256	0	64	64
11L: Door-Metal - Paper Honeycomb Core, U-value 0.56	16.2	655	0	164	164
DP cellulose 4": Wall-Frame, Custom, Dense Pack Cellulose, U-value 0.083	2089.8	12,488	0	1,995	1,995
12D-0bw: Wall-Frame, R-15 insulation in 2 x 4 stud cavity, no board insulation, brick finish, wood studs, U-value 0.071	200.6	1,025	0	57	57
12D-0bw: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), , Slopes Fiberglass, U-value 0.06	280	1,210	0	1,042	1,042
FG Batts-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, FG batts over suspended ceiling, light metal, U-value 0.067	2110	10,178	0	5,938	5,938
Blow in Cellulose: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, Blow in 10" Cellulose over questionable fiberglass batts, U-value 0.038	80	219	0	188	188
voids-ml: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Custom, minimal material over old plaster ceiling, light metal, U-value 0.2	192	2,765	0	1,613	1,613
19B-0sp: Floor-Over enclosed crawl space, R-4 insulation on exposed walls, sealed crawl space, passive, no floor insulation, carpet or hardwood, U-value 0.368	2520	5,911	0	985	985
Thermax on Walls: Floor-Over enclosed crawl space, Custom, R12 Thermax on walls.SPF perimeter, U-value 0.083	282	1,149	0	191	191
Subtotals for structure:		49,113	0	22,287	22,287
People:	20		4,000	4,600	8,600
Equipment:			0	1,250	1,250
Lighting:	545			1,858	1,858
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 140, Summer CFM: 140		10,950	1,753	1,825	3,578
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
AED Excursion:		0	0	936	936
Total Building Load Totals:		60,063	5,753	32,756	38,509

Check Figures

Total Building Supply CFM:	1,507	CFM Per Square ft.:	0.538
Square ft. of Room Area:	2,802	Square ft. Per Ton:	873
Volume (ft³):	29,910		

Building Loads

Total Heating Required Including Ventilation Air:	60,063	Btuh	60.063	MBH
Total Sensible Gain:	32,756	Btuh	85	%
Total Latent Gain:	5,753	Btuh	15	%
Total Cooling Required Including Ventilation Air:	38,509	Btuh	3.21	Tons (Based On Sensible + Latent)

Notes

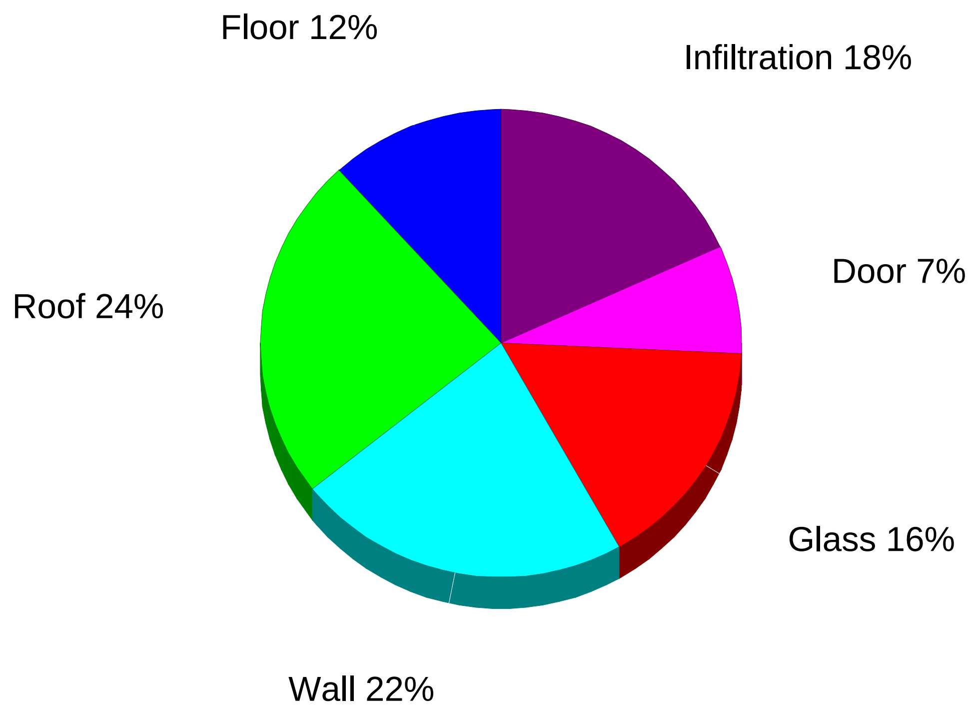
Rhvac is an ACCA approved Manual J, D and S computer program.

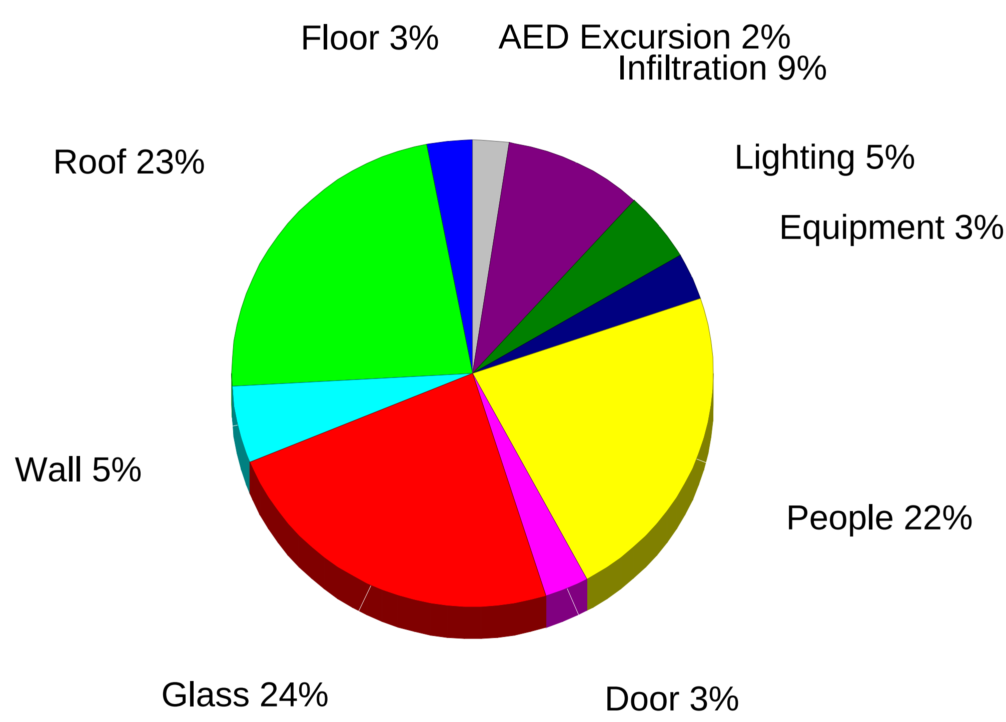
Total Building Summary Loads (cont'd)

Notes

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.

Building Pie Chart





Henniker Town Hall Oil as Primary Energy Cost Analysis

for

Town Of Henniker

Henniker NH 03242

Elite Software

ENERGY AUDIT

Residential and Light Commercial Energy Analysis

Prepared By:

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

603-532-8979
Wednesday, November 15, 2023

Project Information

Project Title:	Henniker Town Hall Oil as Primary	Company Name:	S.E.E.D.S.
Designed By:		Company Rep.:	Margaret Dillon
Project Date:	Thursday, November 2, 2023	Company Address:	
Project Comment:		Company City:	
Client Name:	Town Of Henniker	Company Phone:	603-532-8979
Client Address:		Company Fax:	
Client City:	Henniker NH 03242	Company Comment:	
Client Phone:			
Client Fax:			
Client Comment:			

Cooling Equipment — System 1

Model Type:	Standard Air Conditioner
Model Number:	
Capacity:	60,000 Btuh
Efficiency:	10 SEER

Heating Equipment — System 1

Model Type:	Fuel Oil Boiler
Model Number:	
Capacity:	154,000 Btuh
Efficiency:	85 AFUE
System Description:	Existing Oil As Primary

Cooling Equipment — System 2

Model Type:	Standard Air Conditioner
Model Number:	
Capacity:	60,000 Btuh
Efficiency:	10 SEER

Heating Equipment — System 2

Model Type:	Fuel Oil Boiler
Model Number:	
Capacity:	154,000 Btuh
Efficiency:	85 AFUE
System Description:	Existing Oil As Primary

Cooling Equipment — System 3

Model Type:	Standard Air Conditioner
Model Number:	
Capacity:	60,000 Btuh
Efficiency:	10 SEER

Heating Equipment — System 3

Model Type:	Fuel Oil Boiler
Model Number:	
Capacity:	154,000 Btuh
Efficiency:	85 AFUE
System Description:	Existing Oil As Primary

Project Summary

General Project Information

Project Title:	Henniker Town Hall Oil as Primary	Company Name:	S.E.E.D.S.
Project Date:	Thursday, November 2, 2023	Company Rep:	Margaret Dillon
Client Name:	Town Of Henniker	Company Phone:	603-532-8979
Client City:	Henniker NH 03242	Company E-Mail Address:	mdillon@myfairpoint.net

Design Data

Building Area:	2,802 sq.ft.	Cooling Load:	54,095 Btuh
People:	20	Heating Load:	95,428 Btuh
Occupancy:	8	Loads Adj. Factor:	0.71
		AC On Temp.:	75 °F
Actual City:	Concord AP, New Hampshire		
Weather Ref. City:	Concord, New Hampshire		
Summer Outdoor:	87 °F	Winter Outdoor:	-3 °F
Summer Indoor:	75 °F	Winter Indoor:	70 °F
Cooling Hours:	775	Degree Days:	7,471

Annual Operating Cost Estimate

System Description	Fuel Rates Set	Total Heating Cost	Total Cooling Cost	Annual Service Charges	Total Oper. Cost	Average Monthly Cost
Existing Oil As Primary	1	$6,517	$434	$0	$6,951	$579
Existing Oil As Primary	1	$5,808	$434	$0	$6,243	$520
Existing Oil As Primary	1	$5,080	$434	$0	$5,515	$460

Monthly Costs - System 1 - Existing Oil As Primary

Monthly System Cost

	Cooling		Heating		Total
Month	Cost	%	Cost	%	Cost
January	$0.00	0.0%	$1,059.05	100.0%	$1,059.05
February	$0.00	0.0%	$897.66	100.0%	$897.66
March	$0.00	0.0%	$835.12	100.0%	$835.12
April	$3.79	0.7%	$540.84	99.3%	$544.63
May	$40.31	11.0%	$325.49	89.0%	$365.80
June	$97.73	37.4%	$163.54	62.6%	$261.27
July	$142.42	62.6%	$85.20	37.4%	$227.62
August	$108.45	41.9%	$150.48	58.1%	$258.93
September	$35.47	11.1%	$283.63	88.9%	$319.10
October	$6.21	1.3%	$483.04	98.7%	$489.25
November	$0.00	0.0%	$679.19	100.0%	$679.19
December	$0.00	0.0%	$1,013.28	100.0%	$1,013.28
Total	$434.39	6.2%	$6,516.51	93.8%	$6,950.90

Monthly Fuel Usage and Cost

	Electricity		Natural Gas		Propane		Fuel Oil	
Month	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	Gallons
January	$0.00	0.0	$0.00	0.0	$0.00	0.0	$1,059.05	334.1
February	$0.00	0.0	$0.00	0.0	$0.00	0.0	$897.66	283.2
March	$0.00	0.0	$0.00	0.0	$0.00	0.0	$835.12	263.4
April	$3.79	29.2	$0.00	0.0	$0.00	0.0	$540.84	170.6
May	$40.31	310.1	$0.00	0.0	$0.00	0.0	$325.49	102.7
June	$97.73	751.8	$0.00	0.0	$0.00	0.0	$163.54	51.6
July	$142.42	1,095.5	$0.00	0.0	$0.00	0.0	$85.20	26.9
August	$108.45	834.2	$0.00	0.0	$0.00	0.0	$150.48	47.5
September	$35.47	272.9	$0.00	0.0	$0.00	0.0	$283.63	89.5
October	$6.21	47.8	$0.00	0.0	$0.00	0.0	$483.04	152.4
November	$0.00	0.0	$0.00	0.0	$0.00	0.0	$679.19	214.3
December	$0.00	0.0	$0.00	0.0	$0.00	0.0	$1,013.28	319.6
Total	$434.39	3,341.5	$0.00	0.0	$0.00	0.0	$6,516.51	2,055.7

Average Electric Cost Per kWh:	$0.130/kWh
Average Fuel Oil Cost Per Gallon:	$3.170/Gallon
Total annual cooling load energy:	27,517,924 BTU
Total annual heating load energy:	268,461,408 BTU

Monthly Costs - System 2 - Existing Oil As Primary

Monthly System Cost

	Cooling		Heating		Total
Month	Cost	%	Cost	%	Cost
January	$0.00	0.0%	$922.42	100.0%	$922.42
February	$0.00	0.0%	$784.23	100.0%	$784.23
March	$0.00	0.0%	$734.23	100.0%	$734.23
April	$3.79	0.8%	$487.88	99.2%	$491.68
May	$40.31	11.8%	$301.93	88.2%	$342.24
June	$97.73	38.6%	$155.62	61.4%	$253.35
July	$142.42	63.3%	$82.74	36.7%	$225.16
August	$108.45	43.0%	$143.70	57.0%	$252.15
September	$35.47	11.7%	$266.70	88.3%	$302.17
October	$6.21	1.4%	$440.63	98.6%	$446.84
November	$0.00	0.0%	$603.92	100.0%	$603.92
December	$0.00	0.0%	$884.33	100.0%	$884.33
Total	$434.39	7.0%	$5,808.31	93.0%	$6,242.71

Monthly Fuel Usage and Cost

	Electricity		Natural Gas		Propane		Fuel Oil	
Month	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	Gallons
January	$0.00	0.0	$0.00	0.0	$0.00	0.0	$922.42	291.0
February	$0.00	0.0	$0.00	0.0	$0.00	0.0	$784.23	247.4
March	$0.00	0.0	$0.00	0.0	$0.00	0.0	$734.23	231.6
April	$3.79	29.2	$0.00	0.0	$0.00	0.0	$487.88	153.9
May	$40.31	310.1	$0.00	0.0	$0.00	0.0	$301.93	95.2
June	$97.73	751.8	$0.00	0.0	$0.00	0.0	$155.62	49.1
July	$142.42	1,095.5	$0.00	0.0	$0.00	0.0	$82.74	26.1
August	$108.45	834.2	$0.00	0.0	$0.00	0.0	$143.69	45.3
September	$35.47	272.9	$0.00	0.0	$0.00	0.0	$266.70	84.1
October	$6.21	47.8	$0.00	0.0	$0.00	0.0	$440.63	139.0
November	$0.00	0.0	$0.00	0.0	$0.00	0.0	$603.92	190.5
December	$0.00	0.0	$0.00	0.0	$0.00	0.0	$884.33	279.0
Total	$434.39	3,341.5	$0.00	0.0	$0.00	0.0	$5,808.31	1,832.3

Average Electric Cost Per kWh:	$0.130/kWh
Average Fuel Oil Cost Per Gallon:	$3.170/Gallon
Total annual cooling load energy:	27,517,924 BTU
Total annual heating load energy:	209,530,864 BTU

Monthly Costs - System 3 - Existing Oil As Primary

Monthly System Cost

	Cooling		Heating		Total
Month	Cost	%	Cost	%	Cost
January	$0.00	0.0%	$791.43	100.0%	$791.43
February	$0.00	0.0%	$674.71	100.0%	$674.71
March	$0.00	0.0%	$635.73	100.0%	$635.73
April	$3.79	0.9%	$431.29	99.1%	$435.08
May	$40.31	12.9%	$272.25	87.1%	$312.56
June	$97.73	40.6%	$142.71	59.4%	$240.44
July	$142.42	65.0%	$76.84	35.0%	$219.26
August	$108.45	45.1%	$132.05	54.9%	$240.50
September	$35.47	12.8%	$242.64	87.2%	$278.11
October	$6.21	1.6%	$392.55	98.4%	$398.76
November	$0.00	0.0%	$527.87	100.0%	$527.87
December	$0.00	0.0%	$760.13	100.0%	$760.13
Total	$434.39	7.9%	$5,080.19	92.1%	$5,514.58

Monthly Fuel Usage and Cost

	Electricity		Natural Gas		Propane		Fuel Oil	
Month	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	Gallons
January	$0.00	0.0	$0.00	0.0	$0.00	0.0	$791.43	249.7
February	$0.00	0.0	$0.00	0.0	$0.00	0.0	$674.71	212.8
March	$0.00	0.0	$0.00	0.0	$0.00	0.0	$635.73	200.5
April	$3.79	29.2	$0.00	0.0	$0.00	0.0	$431.29	136.1
May	$40.31	310.1	$0.00	0.0	$0.00	0.0	$272.25	85.9
June	$97.73	751.8	$0.00	0.0	$0.00	0.0	$142.71	45.0
July	$142.42	1,095.5	$0.00	0.0	$0.00	0.0	$76.84	24.2
August	$108.45	834.2	$0.00	0.0	$0.00	0.0	$132.05	41.7
September	$35.47	272.9	$0.00	0.0	$0.00	0.0	$242.64	76.5
October	$6.21	47.8	$0.00	0.0	$0.00	0.0	$392.55	123.8
November	$0.00	0.0	$0.00	0.0	$0.00	0.0	$527.87	166.5
December	$0.00	0.0	$0.00	0.0	$0.00	0.0	$760.13	239.8
Total	$434.39	3,341.5	$0.00	0.0	$0.00	0.0	$5,080.19	1,602.6

Average Electric Cost Per kWh:	$0.130/kWh
Average Fuel Oil Cost Per Gallon:	$3.170/Gallon
Total annual cooling load energy:	27,517,924 BTU
Total annual heating load energy:	178,036,576 BTU

Henniker Town Hall ASHP AS PRIMARY
Energy Cost Analysis

for

Town Of Henniker

Henniker NH 03242

Residential and Light Commercial
Energy Analysis

Prepared By:

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

603-532-8979

Wednesday, November 15, 2023

Project Information

Project Title:	Henniker Town Hall ASHP AS PRIMARY	Company Name:	S.E.E.D.S.
Designed By:		Company Rep.:	Margaret Dillon
Project Date:	Thursday, November 2, 2023	Company Address:	
Project Comment:		Company City:	
Client Name:	Town Of Henniker	Company Phone:	603-532-8979
Client Address:		Company Fax:	
Client City:	Henniker NH 03242	Company Comment:	
Client Phone:			
Client Fax:			
Client Comment:			

Cooling Equipment — System 1

Model Type:	Air Source Heat Pump
Model Number:	
Capacity:	60,000 Btuh
Efficiency:	18 SEER

Heating Equipment — System 1

Model Type:	Air Source Heat Pump
Model Number:	
Capacity:	98,400 Btuh
Efficiency:	11 HSPF
System Description:	Existing ASHP Primary

Cooling Equipment — System 2

Model Type:	Air Source Heat Pump
Model Number:	
Capacity:	60,000 Btuh
Efficiency:	18 SEER

Heating Equipment — System 2

Model Type:	Air Source Heat Pump
Model Number:	
Capacity:	98,400 Btuh
Efficiency:	11 HSPF
System Description:	ESM 1-6 ASHP Primary

Cooling Equipment — System 3

Model Type:	Air Source Heat Pump
Model Number:	
Capacity:	60,000 Btuh
Efficiency:	18 SEER

Heating Equipment — System 3

Model Type:	Air Source Heat Pump
Model Number:	
Capacity:	98,400 Btuh
Efficiency:	11 HSPF
System Description:	ESM 1-7 ASHP Primary

Project Summary

General Project Information

Project Title:	Henniker Town Hall ASHP AS PRIMARY	Company Name:	S.E.E.D.S.
		Company Rep:	Margaret Dillon
Project Date:	Thursday, November 2, 2023	Company Phone:	603-532-8979
Client Name:	Town Of Henniker	Company E-Mail Address:	mdillon@myfairpoint.net
Client City:	Henniker NH 03242		

Design Data

Building Area:	2,802 sq.ft.	Cooling Load:	54,095 Btuh
People:	20	Heating Load:	95,428 Btuh
Occupancy:	8	Loads Adj. Factor:	0.98
		AC On Temp.:	75 °F
Actual City:	Concord AP, New Hampshire		
Weather Ref. City:	Concord, New Hampshire		
Summer Outdoor:	87 °F	Winter Outdoor:	-3 °F
Summer Indoor:	75 °F	Winter Indoor:	70 °F
Cooling Hours:	775	Degree Days:	7,471

Annual Operating Cost Estimate

System Description	Fuel Rates Set	Total Heating Cost	Total Cooling Cost	Annual Service Charges	Total Oper. Cost	Average Monthly Cost
Existing ASHP Primary	1	$3,782	$186	$0	$3,968	$331
ESM 1-6 ASHP Primary	1	$2,874	$186	$0	$3,060	$255
ESM 1-7 ASHP Primary	1	$2,420	$186	$0	$2,606	$217

Monthly Costs - System 1 - Existing ASHP Primary

Monthly System Cost

	Cooling		Heating		Total
Month	Cost	%	Cost	%	Cost
January	$0.00	0.0%	$782.10	100.0%	$782.10
February	$0.00	0.0%	$646.02	100.0%	$646.02
March	$0.00	0.0%	$475.20	100.0%	$475.20
April	$1.62	0.7%	$241.25	99.3%	$242.87
May	$17.26	12.2%	$124.41	87.8%	$141.67
June	$41.85	43.5%	$54.39	56.5%	$96.24
July	$60.99	70.7%	$25.27	29.3%	$86.26
August	$46.44	48.5%	$49.31	51.5%	$95.76
September	$15.19	13.0%	$101.83	87.0%	$117.02
October	$2.66	1.3%	$205.11	98.7%	$207.77
November	$0.00	0.0%	$341.25	100.0%	$341.25
December	$0.00	0.0%	$735.42	100.0%	$735.42
Total	$186.02	4.7%	$3,781.56	95.3%	$3,967.58

Monthly Fuel Usage and Cost

	Electricity		Natural Gas		Propane		Fuel Oil	
Month	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	Gallons
January	$528.64	4,066.5	$0.00	0.0	$0.00	0.0	$253.46	80.0
February	$408.61	3,143.2	$0.00	0.0	$0.00	0.0	$237.41	74.9
March	$453.80	3,490.8	$0.00	0.0	$0.00	0.0	$21.40	6.8
April	$242.87	1,868.3	$0.00	0.0	$0.00	0.0	$0.00	0.0
May	$141.67	1,089.8	$0.00	0.0	$0.00	0.0	$0.00	0.0
June	$96.24	740.3	$0.00	0.0	$0.00	0.0	$0.00	0.0
July	$86.26	663.5	$0.00	0.0	$0.00	0.0	$0.00	0.0
August	$95.76	736.6	$0.00	0.0	$0.00	0.0	$0.00	0.0
September	$117.02	900.2	$0.00	0.0	$0.00	0.0	$0.00	0.0
October	$207.77	1,598.2	$0.00	0.0	$0.00	0.0	$0.00	0.0
November	$337.12	2,593.2	$0.00	0.0	$0.00	0.0	$4.13	1.3
December	$472.00	3,630.8	$0.00	0.0	$0.00	0.0	$263.42	83.1
Total	$3,187.77	24,521.3	$0.00	0.0	$0.00	0.0	$779.81	246.0

Average Electric Cost Per kWh:	$0.130/kWh
Average Fuel Oil Cost Per Gallon:	$3.170/Gallon
Total annual cooling load energy:	25,757,124 BTU
Total annual heating load energy:	268,461,408 BTU

Monthly Costs - System 2 - ESM 1-6 ASHP Primary

Monthly System Cost

	Cooling		Heating		Total
Month	Cost	%	Cost	%	Cost
January	$0.00	0.0%	$581.56	100.0%	$581.56
February	$0.00	0.0%	$487.83	100.0%	$487.83
March	$0.00	0.0%	$359.95	100.0%	$359.95
April	$1.62	0.9%	$188.29	99.1%	$189.92
May	$17.26	15.1%	$97.10	84.9%	$114.36
June	$41.85	49.6%	$42.45	50.4%	$84.30
July	$60.99	75.6%	$19.72	24.4%	$80.71
August	$46.44	54.7%	$38.49	45.3%	$84.93
September	$15.19	16.0%	$79.48	84.0%	$94.67
October	$2.66	1.6%	$160.08	98.4%	$162.75
November	$0.00	0.0%	$263.99	100.0%	$263.99
December	$0.00	0.0%	$555.26	100.0%	$555.26
Total	$186.02	6.1%	$2,874.20	93.9%	$3,060.23

Monthly Fuel Usage and Cost

	Electricity		Natural Gas		Propane		Fuel Oil	
Month	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	Gallons
January	$444.80	3,421.5	$0.00	0.0	$0.00	0.0	$136.77	43.1
February	$337.23	2,594.0	$0.00	0.0	$0.00	0.0	$150.60	47.5
March	$359.68	2,766.7	$0.00	0.0	$0.00	0.0	$0.28	0.1
April	$189.92	1,460.9	$0.00	0.0	$0.00	0.0	$0.00	0.0
May	$114.36	879.7	$0.00	0.0	$0.00	0.0	$0.00	0.0
June	$84.30	648.5	$0.00	0.0	$0.00	0.0	$0.00	0.0
July	$80.71	620.9	$0.00	0.0	$0.00	0.0	$0.00	0.0
August	$84.93	653.3	$0.00	0.0	$0.00	0.0	$0.00	0.0
September	$94.67	728.2	$0.00	0.0	$0.00	0.0	$0.00	0.0
October	$162.75	1,251.9	$0.00	0.0	$0.00	0.0	$0.00	0.0
November	$263.99	2,030.7	$0.00	0.0	$0.00	0.0	$0.00	0.0
December	$388.79	2,990.7	$0.00	0.0	$0.00	0.0	$166.46	52.5
Total	$2,606.12	20,047.1	$0.00	0.0	$0.00	0.0	$454.11	143.3

Average Electric Cost Per kWh:	$0.130/kWh
Average Fuel Oil Cost Per Gallon:	$3.170/Gallon
Total annual cooling load energy:	25,757,124 BTU
Total annual heating load energy:	209,530,864 BTU

Monthly Costs - System 3 - ESM 1-7 ASHP Primary

Monthly System Cost

	Cooling		Heating		Total
Month	Cost	%	Cost	%	Cost
January	$0.00	0.0%	$484.37	100.0%	$484.37
February	$0.00	0.0%	$408.46	100.0%	$408.46
March	$0.00	0.0%	$305.70	100.0%	$305.70
April	$1.62	1.0%	$159.99	99.0%	$161.62
May	$17.26	17.3%	$82.50	82.7%	$99.77
June	$41.85	53.7%	$36.07	46.3%	$77.92
July	$60.99	78.4%	$16.76	21.6%	$77.75
August	$46.44	58.7%	$32.70	41.3%	$79.15
September	$15.19	18.4%	$67.53	81.6%	$82.72
October	$2.66	1.9%	$136.02	98.1%	$138.68
November	$0.00	0.0%	$224.31	100.0%	$224.31
December	$0.00	0.0%	$465.62	100.0%	$465.62
Total	$186.02	7.1%	$2,420.04	92.9%	$2,606.07

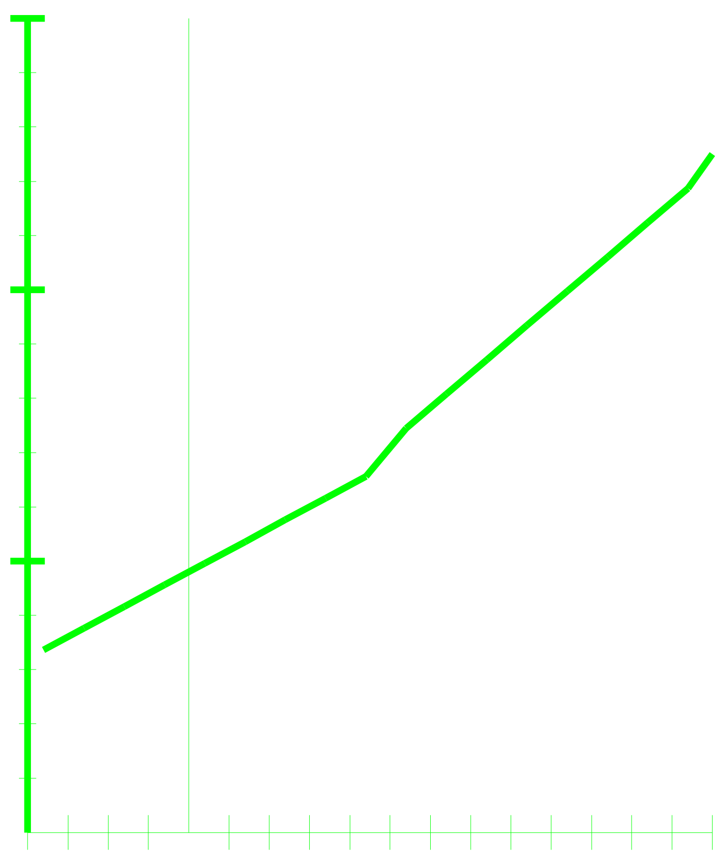
Monthly Fuel Usage and Cost

	Electricity		Natural Gas		Propane		Fuel Oil	
Month	Cost	kWh	Cost	Therm	Cost	Gallons	Cost	Gallons
January	$384.08	2,954.4	$0.00	0.0	$0.00	0.0	$100.29	31.6
February	$290.33	2,233.3	$0.00	0.0	$0.00	0.0	$118.14	37.3
March	$305.70	2,351.6	$0.00	0.0	$0.00	0.0	$0.00	0.0
April	$161.62	1,243.2	$0.00	0.0	$0.00	0.0	$0.00	0.0
May	$99.77	767.4	$0.00	0.0	$0.00	0.0	$0.00	0.0
June	$77.92	599.4	$0.00	0.0	$0.00	0.0	$0.00	0.0
July	$77.75	598.1	$0.00	0.0	$0.00	0.0	$0.00	0.0
August	$79.15	608.8	$0.00	0.0	$0.00	0.0	$0.00	0.0
September	$82.72	636.3	$0.00	0.0	$0.00	0.0	$0.00	0.0
October	$138.68	1,066.8	$0.00	0.0	$0.00	0.0	$0.00	0.0
November	$224.31	1,725.4	$0.00	0.0	$0.00	0.0	$0.00	0.0
December	$334.24	2,571.0	$0.00	0.0	$0.00	0.0	$131.39	41.4
Total	$2,256.26	17,355.8	$0.00	0.0	$0.00	0.0	$349.81	110.3

Average Electric Cost Per kWh:	$0.130/kWh
Average Fuel Oil Cost Per Gallon:	$3.170/Gallon
Total annual cooling load energy:	25,757,124 BTU
Total annual heating load energy:	178,036,576 BTU

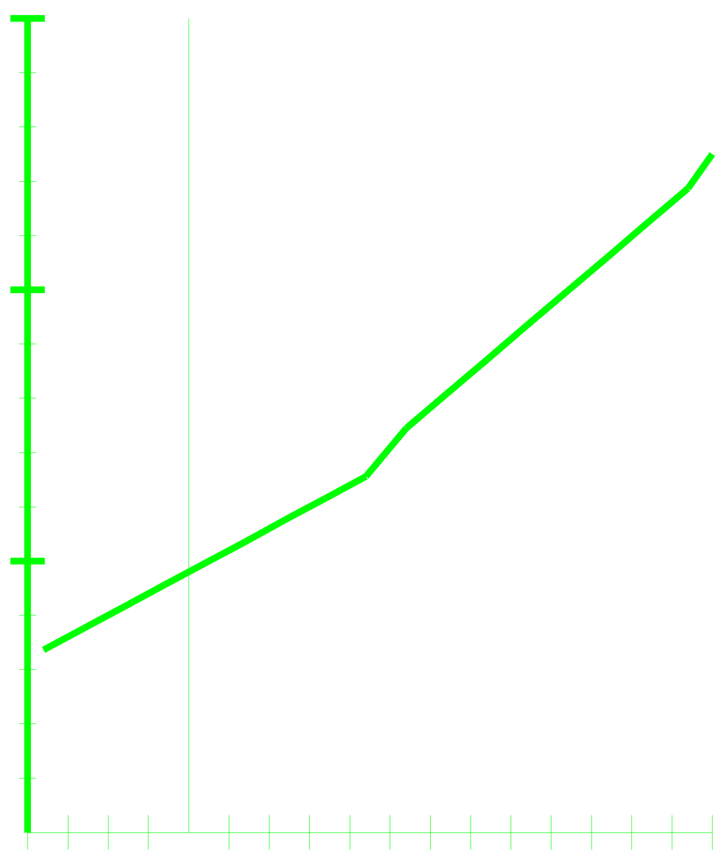
Bin Analysis Report - System 1 - Existing ASHP Primary

Bin Temp Ranges Degree F	Hours Per Bin	Heating Load Btuh	Adjusted Load (x 0.98)	Heat Pump Output Btuh	H. Pump Run Time Fraction	Backup Output Btuh	H.Pump Heating Cost	Backup Heating Cost	Total Heating Cost
-20 to -15	1	109,179	106,996	0	0.000	106,996	0.00	2.88	2.88
-15 to -10	18	102,976	100,916	0	0.000	100,916	0.00	48.91	48.91
-10 to -5	19	96,772	94,837	0	0.000	94,837	0.00	48.52	48.52
-5 to 0	52	90,569	88,758	0	0.000	88,758	0.00	124.28	124.28
0 to 5	136	84,366	82,678	0	0.000	82,678	0.00	302.78	302.78
5 to 10	154	78,162	76,599	54,000	1.000	22,999	142.36	97.01	239.37
10 to 15	209	71,959	70,520	58,000	1.000	12,920	200.75	83.24	283.99
15 to 20	312	65,756	64,440	62,000	1.000	2,840	310.23	67.01	377.24
20 to 25	385	59,552	58,361	58,361	0.878	0	344.84	0.00	344.84
25 to 30	666	53,349	52,282	52,282	0.696	0	463.95	0.00	463.95
30 to 35	878	47,146	46,203	46,203	0.568	0	500.80	0.00	500.80
35 to 40	650	40,942	40,123	40,123	0.457	0	299.93	0.00	299.93
40 to 45	658	34,739	34,044	34,044	0.362	0	241.12	0.00	241.12
45 to 50	679	28,535	27,965	27,965	0.279	0	192.08	0.00	192.08
50 to 55	619	22,332	21,885	21,885	0.205	0	129.26	0.00	129.26
55 to 60	717	16,129	15,806	15,806	0.140	0	102.32	0.00	102.32
60 to 65	685	9,925	9,727	9,727	0.082	0	57.09	0.00	57.09
Totals:	6,838						$3,001.75	$779.81	$3,781.56



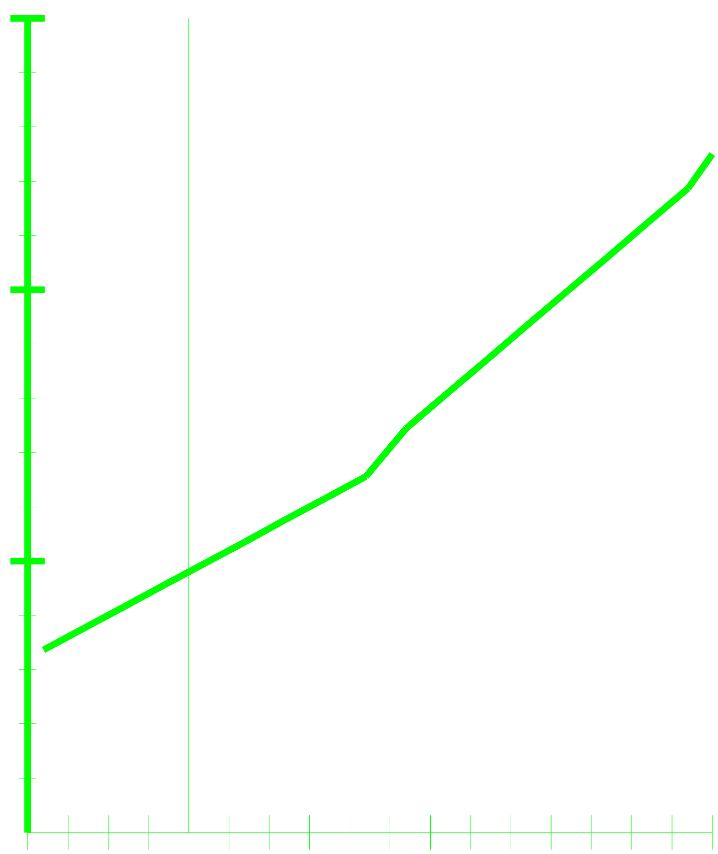
Bin Analysis Report - System 2 - ESM 1-6 ASHP Primary

Bin Temp Ranges Degree F	Hours Per Bin	Heating Load Btuh	Adjusted Load (x 0.98)	Heat Pump Output Btuh	H. Pump Run Time Fraction	Backup Output Btuh	H.Pump Heating Cost	Backup Heating Cost	Total Heating Cost
-20 to -15	1	85,213	83,509	0	0.000	83,509	0.00	2.25	2.25
-15 to -10	18	80,371	78,764	0	0.000	78,764	0.00	38.18	38.18
-10 to -5	19	75,530	74,019	0	0.000	74,019	0.00	37.87	37.87
-5 to 0	52	70,688	69,274	0	0.000	69,274	0.00	97.00	97.00
0 to 5	136	65,846	64,529	0	0.000	64,529	0.00	236.33	236.33
5 to 10	154	61,005	59,785	54,000	1.000	6,185	142.36	41.41	183.77
10 to 15	209	56,163	55,040	55,040	0.949	0	190.50	0.00	190.50
15 to 20	312	51,321	50,295	50,295	0.811	0	251.67	0.00	251.67
20 to 25	385	46,480	45,550	45,550	0.685	0	269.14	0.00	269.14
25 to 30	666	41,638	40,805	40,805	0.543	0	362.11	0.00	362.11
30 to 35	878	36,797	36,061	36,061	0.443	0	390.87	0.00	390.87
35 to 40	650	31,955	31,316	31,316	0.357	0	234.10	0.00	234.10
40 to 45	658	27,113	26,571	26,571	0.283	0	188.19	0.00	188.19
45 to 50	679	22,272	21,826	21,826	0.217	0	149.92	0.00	149.92
50 to 55	619	17,430	17,081	17,081	0.160	0	100.89	0.00	100.89
55 to 60	717	12,588	12,337	12,337	0.109	0	79.86	0.00	79.86
60 to 65	685	7,747	7,592	7,592	0.064	0	44.56	0.00	44.56
Totals:	6,838						$2,420.10	$454.11	$2,874.20



Bin Analysis Report - System 3 - ESM 1-7 ASHP Primary

Bin Temp Ranges Degree F	Hours Per Bin	Heating Load Btuh	Adjusted Load (x 0.98)	Heat Pump Output Btuh	H. Pump Run Time Fraction	Backup Output Btuh	H.Pump Heating Cost	Backup Heating Cost	Total Heating Cost
-20 to -15	1	72,405	70,957	0	0.000	70,957	0.00	1.91	1.91
-15 to -10	18	68,291	66,925	0	0.000	66,925	0.00	32.44	32.44
-10 to -5	19	64,177	62,893	0	0.000	62,893	0.00	32.18	32.18
-5 to 0	52	60,063	58,862	0	0.000	58,862	0.00	82.43	82.43
0 to 5	136	55,949	54,830	0	0.000	54,830	0.00	200.85	200.85
5 to 10	154	51,835	50,798	50,798	0.941	0	133.92	0.00	133.92
10 to 15	209	47,721	46,767	46,767	0.806	0	161.87	0.00	161.87
15 to 20	312	43,607	42,735	42,735	0.689	0	213.84	0.00	213.84
20 to 25	385	39,493	38,704	38,704	0.582	0	228.69	0.00	228.69
25 to 30	666	35,380	34,672	34,672	0.462	0	307.68	0.00	307.68
30 to 35	878	31,266	30,640	30,640	0.376	0	332.12	0.00	332.12
35 to 40	650	27,152	26,609	26,609	0.303	0	198.91	0.00	198.91
40 to 45	658	23,038	22,577	22,577	0.240	0	159.90	0.00	159.90
45 to 50	679	18,924	18,545	18,545	0.185	0	127.38	0.00	127.38
50 to 55	619	14,810	14,514	14,514	0.136	0	85.72	0.00	85.72
55 to 60	717	10,696	10,482	10,482	0.093	0	67.86	0.00	67.86
60 to 65	685	6,582	6,451	6,451	0.054	0	37.86	0.00	37.86
Totals:	6,838						$2,070.24	$349.81	$2,420.04



SPECIFICATIONS: MXZ-4C36NA3

Cooling[1] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	36,400 // 36,400 // 36,400
	Rated Capacity	BTU/H	35,400 // 34,900 // 34,400
	Minimum Capacity	BTU/H	11,700 // 11,500 // 11,300
	Maximum Power Input	W	3,960 // 3,960 // 3,960
	Rated Power Input	W	3,760 // 3,850 // 3,940
	Power Factor (208V, 230V)	%	99.0, 99.0 // 99.0, 99.0 // 99.0, 99.0
Heating at 47°F[2] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	43,000 // 43,000 // 43,000
	Rated Capacity	BTU/H	36,000 // 35,200 // 34,400
	Minimum Capacity	BTU/H	18,300 // 18,800 // 19,300
	Maximum Power Input	W	4,020 // 4,020 // 4,020
	Rated Power Input	W	3,020 // 3,060 // 3,100
	Power Factor (208V, 230V)	%	98.7, 98.7 // 98.8, 98.8 // 98.8, 98.8
Heating at 17°F[3] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	26,600 // 26,600 // 26,600
	Rated Capacity	BTU/H	22,400 // 22,400 // 22,400
	Maximum Power Input	W	3,440 // 3,490 // 3,540
	Rated Power Input	W	2,300 // 2,470 // 2,640
Heating at 5°F[4] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	24,000 // 24,000 // 24,000
	Maximum Power Input	W	3,320 // 3,280 // 3,240
Efficiency (Non-Ducted // Mix // Ducted)	SEER | SEER2		19.2 // 17.6 // 16.0 | 19.20 // 17.60 // 16.00
	EER[1] | EER2[1]		9.41 // 9.07 // 8.73 | 9.40 // 9.05 // 8.70
	HSPF (IV) | HSPF2 (IV)		11.0 // 10.4 // 9.8 | 9.8 // 9.65 // 9.5
	COP at 47°F[2]		3.5 // 3.37 // 3.25
	COP at 17°F at Maximum Capacity[3]		2.27 // 2.24 // 2.2
	COP at 5°F at Maximum Capacity[4]		2.12 // 2.14 // 2.17
	ENERGY STAR® Certified		No // No // No
Electrical	Electrical Power Requirements	Voltage, Phase, Frequency	208/230, 1, 60
	Guaranteed Voltage Range	V AC	187-253
	Voltage: Indoor - Outdoor, S1-S2	V AC	208/230
	Voltage: Indoor - Outdoor, S2-S3	V DC	24
	Short-circuit Current Rating (SCCR)	kA	5
	Recommended Fuse/Breaker Size	A	25
	Recommended Wire Size	AWG	14
	Minimum Circuit Ampacity	A	23.1
	Maximum Overcurrent Protection	A	25
	Fan Motor Full Load Amperage	A	2.43
Outdoor unit	Airflow Rate (Cooling / Heating)	CFM	2,287 / 2,382
	Refrigerant Control		LEV
	Defrost Method		Reverse Cycle
	Heat Exchanger Type		Plate fin coil
	Sound Pressure Level, Cooling[1]	dB(A)	54
	Sound Pressure Level, Heating[2]	dB(A)	56
	Compressor Type		DC INVERTER-driven Twin Rotary
	Compressor Model		SNB220FQGMC
	Compressor Rated Load Amps	A	12
	Compressor Locked Rotor Amps	A	13.7
	Compressor Oil Type // Charge	oz.	FV50S // 23.7
	Base Pan Heater		Optional
	Unit Dimensions	W: In. [mm]	37-13/32 [950]
		D: In. [mm]	13 [330]
		H: In. [mm]	31-11/32 [796]
	Package Dimensions	W: In. [mm]	40-15/16 [1,040]
		D: In. [mm]	17-11/16 [450]
		H: In. [mm]	40-11/16 [1,033]
	Unit Weight	Lbs.[kg]	139 [63]
	Package Weight	Lbs.[kg]	159 [72]
Outdoor unit operating temperature range	Cooling Intake Air Temp (Maximum / Minimum[*A])	°FDB	115 / 14
	Cooling Thermal Lock-out / Re-start Temperatures	°FDB	10.4 / 14
	Heating Intake Air Temp (Maximum / Minimum)	°FWB	65 / 5
	Heating Thermal Lock-out / Re-start Temperatures	°FDB	1.4 / 5
Refrigerant	Charge	Lbs, oz	6.0, 13.0
	Chargeless Piping Length	Ft. [m]	98.0 [30.0]
	Additional Refrigerant Charge Per Additional Piping Length	oz./Ft. [g/m]	0.216 [20]

NOTES:

AHRI Rated Conditions (Rated data is determined at a fixed compressor speed)	[1]Cooling (Indoor // Outdoor)	°F	80 DB, 67 WB // 95 DB, 75 WB
	[2]Heating at 47°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 47 DB, 43 WB
	[3]Heating at 17°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 17 DB, 15 WB
Conditions	[4]Heating at 5°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 5 DB, 4 WB

[*]Applications should be restricted to comfort cooling only; equipment cooling applications are not recommended for low ambient temperature conditions.
[*A] 5°F DB - 115°F DB when optional wind baffles are installed

For actual capacity performance based on indoor unit type and number of indoor units connected, please refer to MXZ Operational Performance.
Although the maximum connectable capacity is 130%, the outdoor unit cannot provide more than 100% of the rated capacity. Please utilize this over capacity capability for load shedding or applications where it is known that all connected units will NOT be operating at the same time.

Specifications are subject to change without notice.

SPECIFICATIONS: MXZ-4C36NA3

Indoor unit connection	Maximum Number of Connected IDU		4
	Minimum Number of Connected IDU		2
	Minimum connected capacity	BTU/H	12,000
	Maximum connected capacity	BTU/H	42,000
Piping	Liquid Pipe Size O.D. (Flared)	In.[mm]	A,B,C,D: 1/4 [A,B,C,D: 6.35]
	Gas Pipe Size O.D. (Flared)	In.[mm]	A: 1/2; B,C,D: 3/8 [A: 12.72; B,C,D: 9.52]
	Total Piping Length	Ft. [m]	230 [70]
	Maximum Height Difference, ODU above IDU	Ft. [m]	49 [15]
	Maximum Height Difference, ODU below IDU	Ft. [m]	49 [15]
	Farthest Piping Length from ODU to IDU	Ft. [m]	82 [25]
	Maximum Number of Bends for IDU		70

NOTES:

AHRI Rated Conditions (Rated data is determined at a fixed compressor speed)	[1]Cooling (Indoor // Outdoor)	°F	80 DB, 67 WB // 95 DB, 75 WB
	[2]Heating at 47°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 47 DB, 43 WB
	[3]Heating at 17°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 17 DB, 15 WB
Conditions	[4]Heating at 5°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 5 DB, 4 WB

[*]Applications should be restricted to comfort cooling only; equipment cooling applications are not recommended for low ambient temperature conditions.
[*^] 5°F DB - 115°F DB when optional wind baffles are installed

For actual capacity performance based on indoor unit type and number of indoor units connected, please refer to MXZ Operational Performance.
Although the maximum connectable capacity is 130%, the outdoor unit cannot provide more than 100% of the rated capacity. Please utilize this over capacity capability for load shedding or applications where it is known that all connected units will NOT be operating at the same time.

A.9.1 SPECIFICATIONS

A.9.1.1 Inverter Heat Pump

Item			Outdoor model	MXZ-2C20NA2-U1	
			Indoor type	Non-Duct (09+09)	Duct (09+12)
Capacity	Cooling	*1	Btu/h	18,000	20,000
	Heating 47	*1	Btu/h	22,000	22,000
	Heating 17	*2	Btu/h	1,2500	13,500
Power consumption	Cooling	*1	W	1,417	2,000
	Heating 47	*1	W	1,641	1,771
	Heating 17	*2	W	1,300	1,350
EER	Cooling			12.7	10.0
SEER	Cooling			20.0	16.0
HSPF IV(V)	Heating			10.0	9.3
COP	Heating			3.93	3.64
External finish				Munsell 3.0Y 7.8/1.1	
Power supply			V, phase, Hz	208/230, 1, 60	
Max. fuse size (time delay)			A	20	
Min. circuit ampacity			A	17.2	
Fan motor			F.L.A	1.77	
Compressor	Model			SNB140FQUH2T	
	Winding resistance (at 68 ºF)		Ω	U-V1.99 V-W 1.99 W-U 1.99	
			R.L.A	10.7	
			L.R.A	15.5	
Refrigerant control				LEV	
Sound level			dB(A)	50/54	
Defrost method				Reverse cycle	
Dimensions	W		in.	33-1/16	
	D		in.	13	
	H		in.	27-15/16	
Weight			lb.	126	
Remote controller				Wireless type	
Control voltage (by built-in transformer)				12 - 24 VDC	
Refrigerant piping				Not supplied (optional parts)	
Valve size	Liquid		in.	1/4	
	Gas		in.	3/8	
Connection method	Indoor			Flared	
	Outdoor			Flared	
Refrigerant charge (R410A)			lb.	5 lb. 15 oz.	
Refrigeration oil (Model)			fl oz. (L)	20.3 (0.6) (NEO22)	

NOTE: Test conditions are based on ARI 210/240.

Unit: °F

Mode	Test	Indoor air condition		Outdoor air condition	
		Dry bulb	Wet bulb	Dry bulb	Wet bulb
Cooling	*1: "A" Cooling steady state at rated compressor speed	80	67	95	(75)
	"B-2" Cooling steady state at rated compressor speed	80	67	82	(65)
	"B-1" Cooling steady state at minimum compressor speed	80	67	82	(65)
	Low ambient cooling steady state at minimum compressor speed	80	67	67	(53.5)
	Intermediate cooling steady state at intermediate compressor speed	80	67	87	(69)
Heating	*1: Standard rating-heating at rated compressor speed	70	60	47	43
	*2: Low temperature heating at maximum compressor speed	70	60	17	15
	Maximum temperature heating at minimum compressor speed	70	60	62	56.5
	High temperature heating at minimum compressor speed	70	60	47	43
	Frost accumulation at rated compressor speed	70	60	35	33
	Frost accumulation at intermediate compressor speed	70	60	35	33

Item			Outdoor model	MXZ-3C24NA2-U1	
			Indoor type	Non-Duct (06+09+09)	Duct (09+09+09)
Capacity	Cooling	*1	Btu/h	22,000	23,600
	Heating 47	*1	Btu/h	25,000	24,600
	Heating 17	*2	Btu/h	19,600	19,600
Power consumption	Cooling	*1	W	1,620	2,100
	Heating 47	*1	W	1,750	1,900
	Heating 17	*2	W	2,580	2,440
EER	Cooling			13.6	11.2
SEER	Cooling			20.0	16.0
HSPF IV(V)	Heating			9.8 (7.6)	9.2 (7.6)
COP	Heating			4.20	3.80
External finish				Munsell 3.0Y 7.8/1.1	
Power supply			V, phase, Hz	208/230, 1, 60	
Max. fuse size (time delay)			A	25	
Min. circuit ampacity			A	22.1	
Fan motor			F.L.A	2.43	
Compressor	Model			SNB220FQGMC	
	Winding resistance (at 68 ºF)		Ω	U-V 0.95 V-W 0.95 W-U 0.95	
			R.L.A	12	
			L.R.A	13.7	
Refrigerant control				LEV	
Sound level			dB(A)	51/55	
Defrost method				Reverse cycle	
Dimensions	W		in.	37-13/32	
	D		in.	13	
	H		in.	31-11/32	
Weight			lb.	137	
Remote controller				Wireless type	
Control voltage (by built-in transformer)				12-24 VDC	
Refrigerant piping				Not supplied (optional parts)	
Valve size	Liquid		in.	1/4	
	Gas		in.	A:1/2 B,C:3/8	
Connection method	Indoor			Flared	
	Outdoor			Flared	
Refrigerant charge (R410A)			lb.	6lb. 13oz.	
Refrigeration oil (Model)			fl oz. (L)	23.7 (0.7) (FV50S)	

NOTE: Test conditions are based on ARI 210/240.

Unit: °F

Mode	Test	Indoor air condition		Outdoor air condition	
		Dry bulb	Wet bulb	Dry bulb	Wet bulb
Cooling	*1: "A" Cooling steady state at rated compressor speed	80	67	95	(75)
	"B-2" Cooling steady state at rated compressor speed	80	67	82	(65)
	"B-1" Cooling steady state at minimum compressor speed	80	67	82	(65)
	Low ambient cooling steady state at minimum compressor speed	80	67	67	(53.5)
	Intermediate cooling steady state at intermediate compressor speed	80	67	87	(69)
Heating	*1: Standard rating-heating at rated compressor speed	70	60	47	43
	*2: Low temperature heating at maximum compressor speed	70	60	17	15
	Maximum temperature heating at minimum compressor speed	70	60	62	56.5
	High temperature heating at minimum compressor speed	70	60	47	43
	Frost accumulation at rated compressor speed	70	60	35	33
	Frost accumulation at intermediate compressor speed	70	60	35	33

Item			Outdoor model	MXZ-4C36NA2-U1	
			Indoor type	Non-Duct (09+09+09+09)	Duct (09+09+09+09)
Capacity	Cooling	*1	Btu/h	35,400	34,400
	Heating 47	*1	Btu/h	36,000	34,400
	Heating 17	*2	Btu/h	26,600	26,600
Power consumption	Cooling	*1	W	3,760	3,940
	Heating 47	*1	W	3,020	3,100
	Heating 17	*2	W	3,440	3,540
EER	Cooling			9.4	8.7
SEER	Cooling			19.2	16.0
HSPF IV(V)	Heating			11.0 (8.4)	9.8 (8.4)
COP	Heating			3.50	3.25
External finish				Munsell 3.0Y 7.8/1.1	
Power supply			V, phase, Hz	208/230, 1, 60	
Max. fuse size (time delay)			A	25	
Min. circuit ampacity			A	22.1	
Fan motor			F.L.A	2.43	
Compressor	Model			SNB220FQGMC	
	Winding resistance (at 68 ºF)		Ω	U-V 0.95 V-W 0.95 W-U 0.95	
			R.L.A	12	
			L.R.A	13.7	
Refrigerant control				LEV	
Sound level			dB(A)	54/56	
Defrost method				Reverse cycle	
Dimensions	W		in.	37-13/32	
	D		in.	13	
	H		in.	31-11/32	
Weight			lb.	139	
Remote controller				Wireless type	
Control voltage (by built-in transformer)				12-24 VDC	
Refrigerant piping				Not supplied (optional parts)	
Valve size	Liquid		in.	1/4	
	Gas		in.	A:1/2 B,C,D:3/8	
Connection method	Indoor			Flared	
	Outdoor			Flared	
Refrigerant charge (R410A)			lb.	6lb. 13oz.	
Refrigeration oil (Model)			fl oz. (L)	23.7 (0.7) (FV50S)	

NOTE: Test conditions are based on ARI 210/240.

Unit: °F

Mode	Test	Indoor air condition		Outdoor air condition	
		Dry bulb	Wet bulb	Dry bulb	Wet bulb
Cooling	*1: "A" Cooling steady state at rated compressor speed	80	67	95	(75)
	"B-2" Cooling steady state at rated compressor speed	80	67	82	(65)
	"B-1" Cooling steady state at minimum compressor speed	80	67	82	(65)
	Low ambient cooling steady state at minimum compressor speed	80	67	67	(53.5)
	Intermediate cooling steady state at intermediate compressor speed	80	67	87	(69)
Heating	*1: Standard rating-heating at rated compressor speed	70	60	47	43
	*2: Low temperature heating at maximum compressor speed	70	60	17	15
	Maximum temperature heating at minimum compressor speed	70	60	62	56.5
	High temperature heating at minimum compressor speed	70	60	47	43
	Frost accumulation at rated compressor speed	70	60	35	33
	Frost accumulation at intermediate compressor speed	70	60	35	33

MLZ-KP12NA2
12,000 BTU/H EZ FIT CEILING CASSETTE

MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

Job Name:
System Reference: Date:

GENERAL FEATURES

- Fits between 16” joists spacing
- Stylish, square design panel
- Built-in condensate lift mechanism (19.6”)
- Serviceable from the bottom (electrical and flare connections)
- Adjustable fan speeds and vane directions
- Washable antibacterial and deodorizing filter
- Multiple control options available:
  - Hand-held Remote Controller (provided with unit)
  - kumo cloud® smart device app for remote access
  - Third-party interface options
  - Wired or wireless controllers
- Pocket inside the access panel for kumo cloud® Wireless Interface

Specifications			System
Unit Type			MLZ-KP12NA2
Cooling Capacity[1, 3]		BTU/H	12,000
Heating Capacity[2, 3]		BTU/H	15,400
Electrical	Voltage, Phase, Frequency		208/230, 1, 60
	Guaranteed Voltage Range	V AC	187- 253V
	Voltage: Indoor - Outdoor, S1-S2	V AC	208/230
	Voltage: Indoor - Outdoor, S2-S3	V DC	24
	Short-circuit Current Rating [SCCR]	kA	5
Indoor Unit	MCA	A	1.0
	Fan Motor Full Load Amperage	A	0.68
	Airflow Rate at Cooling, Dry	CFM	212–272–297–332
	Airflow Rate at Cooling, Wet	CFM	180–219–252–282
	Airflow Rate at Heating, Dry	CFM	212–272–311–350
	Sound Pressure Level [Cooling]	dB[A]	27–32–36–40
	Sound Pressure Level [Heating]	dB[A]	26–32–36–40
	Drain Pipe Size	In. [mm]	1-1/4 [32]
	Condensate Lift Mechanism, Maximum Distance	In. [mm]	19-11/16 [500]
	Coating on Heat Exchanger		—
	External Finish Color		Munsell 4.0GY 9.1/0.2
	Unit Dimensions	W x D x H: In. [mm]	43-3/8 x 14-3/16 x 7-5/16 [1,102 x 360 x 185]
	Package Dimensions	W x D x H: In. [mm]	46-5/16 x 15-3/4 x 11-1/8 [1,177 x 400 x 284]
	Unit Weight	Lbs. [kg]	34 [15.5]
	Package Weight	Lbs. [kg]	41 [19.0]
Refrigerant	Type		R410A
Piping	Gas Pipe Size O.D. [Flared]	In.[mm]	3/8 [9.52]
	Liquid Pipe Size O.D. [Flared]	In.[mm]	1/4 [6.35]

NOTES:

Conditions			
	[1]Cooling (Indoor // Outdoor)	°F	80 DB, 67 WB // 95 DB, 75 WB
	[2]Heating at 47°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 47 DB, 43 WB

[3]Capacity varies based on the number of indoor units operating and the model of the Multi-zone Outdoor Unit. For reference to connected capacity charts, please refer Multi-zone Outdoor Unit Operational Performance.:

SPECIFICATIONS: MSZ-GL06NA

Cooling Capacity[1, 3]		BTU/H	6,000
Heating Capacity[2, 3]		BTU/H	7,200
Electrical	Voltage, Phase, Frequency		208/230V, 1 phase, 60Hz
	Guaranteed Voltage Range	V AC	187 - 253
	Voltage: Indoor - Outdoor, S1-S2	V AC	208 / 230
	Voltage: Indoor - Outdoor, S2-S3	V DC	24
	Short-circuit Current Rating (SCCR)		Wireless Type
MCA		A	1
Blower Motor Full Load Amperage		A	0.76
Blower Motor Output		W	30
Airflow Rate at Cooling, Dry		CFM	145-170-237-321-399
Airflow Rate at Cooling, Wet		CFM	109-134-201-286-364
Airflow Rate at Heating, Dry		CFM	145-170-237-321-406
Sound Pressure Level (Cooling)		dB(A)	19-22-30-37-43
Sound Pressure Level (Heating)		dB(A)	19-22-30-37-43
Drain Pipe Size		In. (mm)	5/8 (15.88)
Heat Exchanger Type			Plate fin coil
External Finish Color			Munsell 1.0Y 9.2/0.2
Unit Dimensions		W: In. (mm)	31-7/16 (798)
		D: In. (mm)	9-1/8 (232)
		H: In. (mm)	11-5/8 (295)
Package Dimensions		W: In. (mm)	33-1/2 (850)
		D: In. (mm)	12 (300)
		H: In. (mm)	14 (350)
Unit Weight		Lbs. (kg)	22 (10)
Package Weight		Lbs. (kg)	26 (11.5)
Refrigerant	Type		R410A
Piping	Gas Pipe Size O.D. (Flared)	In. (mm)	3/8 (9.52)
	Liquid Pipe Size O.D. (Flared)	In. (mm)	1/4 (6.35)

Notes:

Nominal Conditions	[1]Cooling (Indoor // Outdoor)	°F	80 DB, 67 WB // 95 DB, 75 WB
	[2]Heating at 47°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 47 DB, 43 WB

[3]Capacity varies based on the number of indoor units operating and the model of the Multi-zone Outdoor Unit. For reference to connected capacity charts, please refer Multi-zone Outdoor Unit Operational Performance.

SPECIFICATIONS: MSZ-GL12NA

Cooling Capacity[1, 3]		BTU/H	12,000
Heating Capacity[2, 3]		BTU/H	14,400
Electrical	Voltage, Phase, Frequency		208/230V, 1 phase, 60Hz
	Guaranteed Voltage Range	V AC	187 - 253
	Voltage: Indoor - Outdoor, S1-S2	V AC	208 / 230
	Voltage: Indoor - Outdoor, S2-S3	V DC	24
	Short-circuit Current Rating (SCCR)		5
MCA		A	1
Blower Motor Full Load Amperage		A	0.76
Blower Motor Output		W	30
Airflow Rate at Cooling, Dry		CFM	399-321-237-170-145
Airflow Rate at Cooling, Wet		CFM	364-286-201-134-109
Airflow Rate at Heating, Dry		CFM	406-321-237-170-145
Sound Pressure Level (Cooling)		dB(A)	45-37-30-22-19
Sound Pressure Level (Heating)		dB(A)	43-37-30-22-19
Drain Pipe Size		In. (mm)	5/8 (15.88)
Heat Exchanger Type			Plate fin coil
External Finish Color			Munsell 1.0Y 9.2/0.2
Unit Dimensions		W: In. (mm)	31-7/16 (798)
		D: In. (mm)	9-1/8 (232)
		H: In. (mm)	11-5/8 (295)
Package Dimensions		W: In. (mm)	33-1/2 (850)
		D: In. (mm)	12 (300)
		H: In. (mm)	14 (350)
Unit Weight		Lbs. (kg)	22 (10)
Package Weight		Lbs. (kg)	26 (11.5)
Refrigerant	Type		R410A
Piping	Gas Pipe Size O.D. (Flared)	In. (mm)	3/8 (9.52)
	Liquid Pipe Size O.D. (Flared)	In. (mm)	1/4 (6.35)

Notes:

Nominal Conditions	[1]Cooling (Indoor // Outdoor)	°F	80 DB, 67 WB // 95 DB, 75 WB
	[2]Heating at 47°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 47 DB, 43 WB

[3]Capacity varies based on the number of indoor units operating and the model of the Multi-zone Outdoor Unit. For reference to connected capacity charts, please refer Multi-zone Outdoor Unit Operational Performance.

SLZ-KF12NA
12,000 BTU/H 2' X 2' 4-WAY CEILING CASSETTE

MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

Job Name:

System Reference: Date:

GENERAL FEATURES

- Ceiling-recessed cassette (24"x24") ductless heat pump
- Install Konnect Series in a drywalled ceiling (with an access panel for servicing) or in a 2'x2' drop ceiling
- Wide airflow pattern for excellent air distribution
- Optional 3D i-see Sensor®
- Fresh air intake provided in the main body
- Built-in drain condensate lift mechanism (lifts to 33")
- Multiple control options available:
    - kumo cloud® smart device app for remote access
    - Third-party interface options
    - Wired or wireless controllers
- Long-life air filter included
- Individual vane control

Specifications			System
Unit Type			SLZ-KF12NA
Cooling Capacity[1, 3]		BTU/H	12,000
Heating Capacity[2, 3]		BTU/H	13,000
Electrical	Voltage, Phase, Frequency		208/230, 1, 60
	Guaranteed Voltage Range	V AC	187- 253V
	Voltage: Indoor - Outdoor, S1-S2	V AC	208/230
	Voltage: Indoor - Outdoor, S2-S3	V DC	24
	Short-circuit Current Rating [SCCR]	kA	5
Indoor Unit	MCA	A	0.3
	Fan Motor Full Load Amperage	A	0.24
	Airflow Rate at Cooling, Dry	CFM	230–265–335
	Airflow Rate at Cooling, Wet	CFM	207–252–302
	Airflow Rate at Heating, Dry	CFM	230–265–335
	Sound Pressure Level [Cooling]	dB[A]	25–30–34
	Sound Pressure Level [Heating]	dB[A]	25–30–34
	Drain Pipe Size	In. [mm]	1-1/4 [32]
	Condensate Lift Mechanism, Maximum Distance	In. [mm]	33 [850]
	Coating on Heat Exchanger		—
	External Finish Color		Munsell 1.0Y 9.2/0.0
	Unit Dimensions	W x D x H: In. [mm]	22-7/16 x 22-7/16 x 9-21/32 [570 x 570 x 245]
	Package Dimensions	W x D x H: In. [mm]	24-13/32 x 27-15/16 x 9-7/16 [620 x 710 x 240]
	Unit Weight	Lbs. [kg]	31 [13.9]
	Package Weight	Lbs. [kg]	37 [17]
Refrigerant	Type		R410A
Piping	Gas Pipe Size O.D. [Flared]	In.[mm]	3/8 [9.52]
	Liquid Pipe Size O.D. [Flared]	In.[mm]	1/4 [6.35]

NOTES:

Conditions			
	[1]Cooling (Indoor // Outdoor)	°F	80 DB, 67 WB // 95 DB, 75 WB
	[2]Heating at 47°F (Indoor // Outdoor)	°F	70 DB, 60 WB // 47 DB, 43 WB

[3]Capacity varies based on the number of indoor units operating and the model of the Multi-zone Outdoor Unit. For reference to connected capacity charts, please refer Multi-zone Outdoor Unit Operational Performance.

Specifications are subject to change without notice.

M-Series Efficiencies

Outdoor Unit Model	Indoor Unit Model	Configuration	Rated Capacity (Cooling)	Rated Capacity (Heating)	SEER	EER	HSPF	COP @ 47° F	COP @ 17° F
WALL-MOUNTED COOLING ONLY									
MUY-GL09NA-U1	MSY-GL09NA-U1	Mini-Splits	9,000	-	24.60	15.40	-	-	-
MUY-GL12NA-U1	MSY-GL12NA-U1	Mini-Splits	12,000	-	23.10	13.00	-	-	-
MUY-GL15NA-U1	MSY-GL15NA-U1	Mini-Splits	14,000	-	21.60	13.00	-	-	-
MUY-GL18NA-U1	MSY-GL18NA-U1	Mini-Splits	18,000	-	20.50	13.40	-	-	-
MUY-GL24NA-U1	MSY-GL24NA-U1	Mini-Splits	22,500	-	20.50	12.50	-	-	-
MUY-GE09NA	MSY-GE09NA-8	Mini-Splits	9,000	-	21.0	13.6	-	-	-
MUY-GE12NA	MSY-GE12NA-8	Mini-Splits	12,000	-	20.5	12.5	-	-	-
MUY-GE15NA-1	MSY-GE15NA-8	Mini-Splits	14,000	-	21.0	13.0	-	-	-
MUY-GE18NA-1	MSY-GE18NA-8	Mini-Splits	17,200	-	19.2	10.5	-	-	-
MUY-GE24NA	MSY-GE24NA	Mini-Splits	22,400	-	19.0	12.5	-	-	-
MUY-GE09NA2	MSY-GE09NA-9	Mini-Splits	9,000	-	23.2	13.6	-	-	-
MUY-GE12NA2	MSY-GE12NA-9	Mini-Splits	12,000	-	22.7	12.5	-	-	-
MUY-GE15NA2	MSY-GE15NA-9	Mini-Splits	14,000	-	21.6	13.0	-	-	-
MUY-D30NA	MSY-D30NA	Mini-Splits	30,600	-	16.0	9.1	-	-	-
MUY-D36NA	MSY-D36NA	Mini-Splits	34,600	-	15.1	8.2	-	-	-
WALL-MOUNTED HEAT PUMP									
MUZ-FE09NA	MSZ-FE09NA	Mini-Splits	9,000	10,900	15.5	26.0	10.0	4.50	3.02
MUZ-FE12NA1	MSZ-FE12NA	Mini-Splits	12,000	13,600	12.9	23.0	10.5	4.20	3.01
MUZ-FE18NA	MSZ-FE18NA	Mini-Splits	18,000	21,600	14.2	20.2	10.3	4.11	2.77
MUZ-FH06NA	MSZ-FH06NA	Mini-Splits	6,000	8,700	33.1	19.0	13.5	4.68	3.46
MUZ-FH09NA	MSZ-FH09NA	Mini-Splits	9,000	10,900	30.5	16.1	13.5	4.50	3.33
MUZ-FH09NA	MSZ-FH09NA-1	Mini-Splits	9,000	10,900	30.5	16.1	13.5	4.50	3.33
MUZ-FH12NA	MSZ-FH12NA	Mini-Splits	12,000	13,600	26.1	13.8	12.5	4.20	3.34
MUZ-FH12NA	MSZ-FH12NA-1	Mini-Splits	12,000	13,600	26.1	13.8	12.5	4.20	3.34
MUZ-FH15NA	MSZ-FH15NA	Mini-Splits	15,000	18,000	22.0	12.5	12.0	4.06	3.19
MUZ-FH18NA	MSZ-FH18NA	Mini-Splits	17,200	20,300	21.0	12.0	12.0	3.46	3.04
MUZ-FH18NA2	MSZ-FH18NA2	Mini-Splits	17,200	20,300	21.0	12.5	12.0	3.46	3.04
MSZ-GL09NA-U1	MUZ-GL09NA-U8	Mini-Splits	9,000	10,900	24.6	15.4	12.8	4.44	3.3
MUZ-GL12NA-U1	MSZ-GL12NA-U1	Mini-Splits	12,000	14,400	23.10	13.0	12.50	3.84	3.13
MUZ-GL15NA-U1	MSZ-GL15NA-U1	Mini-Splits	14,000	18,000	21.60	13.0	11.70	3.30	3.00
MUZ-GL18NA-U1	MSZ-GL18NA-U1	Mini-Splits	18,000	21,600	20.50	13.4	11.20	3.77	2.73
MUZ-GL24NA-U1	MSZ-GL24NA-U1	Mini-Splits	22,400	27,600	20.50	12.5	10.00	3.46	2.65
MUZ-GE09NA	MSZ-GE09NA-8	Mini-Splits	9,000	10,900	21.0	13.6	10.0	4.20	2.76
MUZ-GE12NA	MSZ-GE12NA-8	Mini-Splits	12,000	14,400	20.5	12.5	10.0	3.61	2.87
MUZ-GE15NA-1	MSZ-GE15NA-8	Mini-Splits	14,000	18,000	21.0	13.0	10.0	3.30	2.88
MUZ-GE18NA-1	MSZ-GE18NA-8	Mini-Splits	17,200	21,600	19.2	10.5	10.0	3.33	2.71
MUZ-GE24NA	MSZ-GE24NA	Mini-Splits	22,500	27,600	19.0	12.5	10.0	3.46	2.64
MUZ-GE09NA-2	MSZ-GE09NA-8	Mini-Splits	9,000	10,900	23.2	13.6	11.0	4.20	2.76
MUZ-GE12NA-2	MSZ-GE12NA-8	Mini-Splits	12,000	14,400	22.7	12.5	11.4	3.61	2.87
MUZ-GE15NA-2	MSZ-GE15NA-8	Mini-Splits	14,000	18,000	21.6	13.0	11.2	3.30	2.88
MUZ-HM09NA2***	MSZ-HM09NA***	Mini-Splits	9,000	10,900	18.00	12.0	8.50	3.55	2.80
MUZ-HM12NA2***	MSZ-HM12NA***	Mini-Splits	12,000	12,200	18.00	9.9	8.50	3.61	2.78
MUZ-HM15NA2***	MSZ-HM15NA***	Mini-Splits	14,000	18,000	18.00	12.0	8.50	3.30	2.55
MUZ-HM18NA2***	MSZ-HM18NA***	Mini-Splits	17,200	18,000	18.00	10.5	8.50	3.32	2.59
MUZ-HM24NA2***	MSZ-HM24NA***	Mini-Splits	22,400	26,000	18.00	8.6	8.50	3.05	2.36
MUZ-HE09NA	MSZ-HE09NA	Mini-Splits	9,000	10,900	18.0	12.0	8.5	3.55	2.76
MUZ-HE12NA	MSZ-HE12NA	Mini-Splits	12,000	12,200	18.0	9.9	8.5	3.61	2.87
MUZ-HE15NA	MSZ-HE15NA	Mini-Splits	14,000	18,000	18.0	12.0	8.5	3.30	2.81
MUZ-HE18NA	MSZ-HE18NA	Mini-Splits	17,200	18,000	18.0	10.5	8.5	3.32	2.71
MUZ-HE24NA	MSZ-HE24NA	Mini-Splits	22,500	26,600	18.0	8.6	8.5	3.45	2.64
MUZ-D30NA-1	MSZ-D30NA-8	Mini-Splits	30,600	32,600	14.5	8.0	8.2	2.84	2.33
MUZ-D36NA-1	MSZ-D36NA-8	Mini-Splits	33,200	35,200	14.5	7.6	8.2	2.69	2.23
FLOOR-MOUNTED HEAT PUMP									
MUFZ-KJ09NAHZ	MFZ-KJ09NA	Mini-Splits	9,000	11,000	28.20	15.80	13.00	4.30	2.71
MUFZ-KJ12NAHZ	MFZ-KJ12NA	Mini-Splits	12,000	13,000	25.50	13.60	12.00	4.20	2.77
MUFZ-KJ15NAHZ	MFZ-KJ15NA	Mini-Splits	15,000	18,000	21.80	13.50	11.60	3.70	2.71
MUFZ-KJ18NAHZ	MFZ-KJ18NA	Mini-Splits	17,000	21,000	21.00	12.60	11.30	3.50	2.62

SEZ HORIZONTAL-DUCTED HEAT PUMP SYSTEMS									
SUZ-KA09NA	SEZ-KD09NA4	Ducted	8,100	10,900	15.0	12.0	10.0	3.13	2.14
SUZ-KA12NA	SEZ-KD12NA4	Ducted	11,500	13,600	16.0	12.5	10.0	3.50	2.43
SUZ-KA15NA	SEZ-KD15NA4	Ducted	14,100	18,000	15.5	12.0	10.0	3.52	2.43
SUZ-KA18NA	SEZ-KD18NA4	Ducted	17,200	21,600	17.5	12.5	10.0	3.72	2.40
SLZ CEILING-RECESSED HEAT PUMP SYSTEMS									
SUZ-KA09NA	SLZ-KA09NA	Mini-Splits	8,400	10,900	15.0	12.0	9.6	3.44	2.46
SUZ-KA12NA	SLZ-KA12NA	Mini-Splits	11,100	13,600	15.4	12.0	9.6	3.38	2.62
SUZ-KA15NA	SLZ-KA15NA	Mini-Splits	15,000	18,000	16.0	10.2	9.6	2.70	2.38

FORM# MXZ Multi-Zone Efficiencies - 201602Ver2

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