



Investigative Energy Audit For

Tanana Physician's Assistant Housing



Prepared For
Tanana Tribal Council

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PREFACE

The purpose of this report is to provide guidance in reducing facility operating costs and enhance the sustainability of this community. The report assess the current energy usage of the facility, provide options for reducing the amount of energy used, and evaluate the cost vs. benefit of each option.

Discussions of site specific concerns, financing options, general facility information, and an Energy Efficiency Action Plan are also included in this report.

ACKNOWLEDGMENTS

The Energy Projects Group gratefully acknowledges the assistance of the Tanana Tribal Council’s Maintenance Supervisor, Cliff Wiehl, and Executive Director, Shannon Erhart.

OVERVIEW

This report was prepared for the Tanana Tribal Council. The scope of the audit focused on the Physician’s Assistant Housing and includes an analysis of building occupancy schedules, building shell, heating systems, heating and ventilations systems, domestic hot water, lighting, and other electrical loads. The Housing is approximately 3,936 square feet, and has been renovated numerous times since its original construction. The building was originally constructed as a housing facility to support the local hospital, and continues to be used as housing for the local clinic. Data was based on a site survey and interviews with the building occupants and maintenance staff.

ENERGY BASELINE

Based on unsubsidized electricity and fuel oil prices in effect at the time of the audit, the total predicted energy costs are \$19,240 per year. This includes \$7,673 for electricity and \$11,568 for #1 fuel oil.

Annual Energy Costs By Fuel

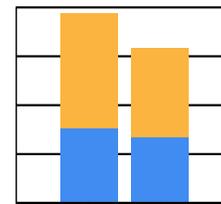


Table 1 lists the predicted annual energy usage before and after the proposed retrofits.

Table 1: Predicted Annual Energy Use

Predicted Annual Energy Use				
Fuel Use	Existing Building	With Proposed Retrofits	Total Energy Savings	Total Cost Savings
Electricity	11,592 kWh	10,176 kWh	1416 kWh	\$937
#1 Oil	2,722 gallons	2,158 gallons	564 gallons	\$2,397

PROPOSED ENERGY EFFICIENCY MEASURES (EEM)

Table 2 below summarizes the energy efficiency measures analyzed for the Building. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

Table 2: Priority List – Energy Efficiency Measures

Priority	Feature	Improvement Description	Cost Estimate Basis	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²
1	Install Programmable Thermostats	Automatically adjust indoor temperatures to 60.0 deg F when building is unoccupied	\$150 Materials 5hrs/thermostat @\$50/hr 4 thermostats	\$634	\$2,000	4.22	3.2
2	Air Tightening	Install weather stripping around all exterior doors and attic access hatch	\$100 materials /door 4 hrs/door @ \$50/hr 2 doors	\$183	\$600	2.80	3.3
3	Retrofit LED T8 Light Bulbs	Replace existing fluorescent lights with new LED bulbs and bypass existing ballasts	Materials: \$12/bulb Labor: \$50/hr @ 2hr/fixture Contingency: 20% 20 fixtures	\$518	\$3,000	1.06	5.8
4	Retro LED Standard Light Bulbs	Replace existing light bulbs with LED bulbs	Materials: \$10/bulb Labor: \$50/hr @ 15min/bulb 10 bulbs	\$34	\$230	0.91	6.7
5	Ventilation	Install Heat Recovery Ventilator (HRV) in coat closet on each side of duplex to distribute fresh air to entire building. Duct air to each room.	\$2,000 HRV \$5,000 Duct and Miscellaneous Materials 2 people, 8hrs/day, 10 days @ \$50/hr = \$8,000 20% overhead, logistics, and management 20% contingency	\$958	\$21,000	0.62	21.9
6	Above-Grade Wall: House	Install R-30 rigid foam board to exterior and cover with Vinyl siding or equivalent	\$5,000 Vinyl Siding \$5,000 Trim and Misc Materials \$6,000 Foam \$50/hr, 2 people, 8hrs/day, 5 days/week, 4 weeks = \$16,000 labor 50% logistics, coordination, transportation 50% contingency Total: \$64,000	\$1,005	\$64,000	0.36	63.6
TOTAL				\$3,356	\$91,530	0.55	27.1

Highly Recommended
Recommended
Not Recommended (Based on Estimated Cost)

Note 1: The boiler currently has no source of makeup air for the boiler and is at risk for pulling carbon monoxide into the occupied space if the exhaust fans were to be turned on. In order to protect the building occupants from carbon monoxide poisoning, a source of makeup air should be provided for the boiler before using the exhaust fans.

Note 2: There is no ventilation in the lower floor of the housing unit. The only source of air appears to be from the boiler pulling air from inside the building. Although this is a carbon monoxide poisoning hazard, it is likely what is preventing the lower floor of the housing from accumulating moisture and developing mildew. Some form of ventilation should be provided for the lower floor to prevent it from mildewing once the boiler is provided with proper outdoor combustion air. A basic exhaust fan would serve the purpose, although an HRV would be much more energy efficient and provide more comfortable ventilation.

Note 3: It is recommended that the hot water and heating piping in the boiler room be insulated. This would save a significant amount of energy.

¹ Savings to Investment Ratio (SIR) is a life-cycle cost measure calculated by dividing the total savings over the life of a project (expressed in today's dollars) by its investment costs. The SIR is an indication of the profitability of a measure; the higher the SIR, the more profitable the project. An SIR greater than 1.0 indicates a cost-effective project (i.e. more savings than cost). Remember that this profitability is based on the position of that Energy Efficiency Measure (EEM) in the overall list and assumes that the measures above it are implemented first.

² Simple Payback (SP) is a measure of the length of time required for the savings from an EEM to payback the investment cost, not counting interest on the investment and any future changes in energy prices. It is calculated by dividing the investment cost by the expected first-year savings of the EEM.

FACILITY DESCRIPTION

Building Occupancy Schedules

The building occupancy varies depending on the staff working at the clinic. At times the housing was filled to capacity on the floor, while at other times the entire building was occupied by a single resident. If the resident medical provider has family present, the facility is occupied frequently throughout the day. If the provider does not have family present, the building is only occupied when the nearby clinic is closed. The lower floor of the housing is primarily used for storage as the space has no natural sunlight and the interior finishes are noticeably damaged.

Building Shell

The exterior walls are 2x4 wood-framed construction with fiberglass batt insulation.

The roof of the building is a structural truss with a cold attic space. Cellulose Insulation was recently added to the attic space to improve the energy efficiency.

The lower floor of the building is a concrete basement with a floor level approximately 6 feet below grade.

All windows were recently replaced with triple pane windows. There are now approximately 262 square feet of triple pane window surface area.

There are 2 entrances into the building. The energy efficiency of the building could be improved by performing better sealing around the doors.

Heating Systems

The heating systems used in the building are:

Boiler 1

Fuel Type:	#1 Oil
Input Rating:	121,000 BTU/hr
Steady State Efficiency:	85 %
Estimated Idle Loss:	1.5 %
Heat Distribution Type:	Water
Boiler Operation:	12 Months/Year

Toyotomi Heater 1

Fuel Type:	#1 Oil
Input Rating:	26,900 BTU/hr
Steady State Efficiency:	87 %
Estimated Idle Loss:	0 %
Heat Distribution Type:	Air
Boiler Operation:	12 Months/Year

Toyotomi Heater 2

Fuel Type:	#1 Oil
Input Rating:	26,900 BTU/hr
Steady State Efficiency:	87 %
Estimated Idle Loss:	0 %
Heat Distribution Type:	Air
Boiler Operation:	12 Months/Year

Space Heating Distribution Systems

The building is heated by a baseboard heating system that circulates hot water around the building. The main living area on each side of the housing unit has supplementary heat provided by the Toyotomi Monitor Heaters.

Building Ventilation Systems

The building relies on operable windows and exhaust fans for ventilation.

Domestic Hot Water System

Domestic hot water for the building is provided by a hot water heater with an approximate capacity of 40 gallons. The heater is indirectly heated by the boiler.

Lighting

The interior space is lit with a combination of T8 and standard screw-in lighting element fixtures. The lights use an estimated 4,300 kWh annually.

Other Electrical Loads

The coffee pots, oven/range, refrigerators, chest freezer, and other residential appliances contribute to the electrical load as well.

Major Equipment

Table 3: Major Electrical Equipment

Equipment	Rating (Watts)	Approx. Annual Usage (kWh)
TV	~100	~300
Microwave	~1000	~160
Coffee Maker	~1,000	~730
Oven / Cooking Range	~1000 per burner	~730
Clothes Dryer	~3400	~1000
Washing Machine	~425	~130

PROJECT FINANCING

The total estimated cost of the recommended EEM's \$5,830. The payback for the implemented EEM's is approximately 4.2 years. ANTHC is willing to assist the community with acquiring funds to complete the scope of work recommended in this energy audit.

There are several options for financing energy efficiency projects within the State of Alaska. These include the use of grants, loans, and other funding opportunities. Below is some information on potential funding opportunities.

Energy Efficiency Revolving Loan Program – This is a loan administered by the Alaska Housing Finance Corporation (AHFC) for use by any applicant who is also the owner of the building where the work will take place. It provides a loan for permanent energy-efficiency projects with a completion window of one year.

Sustainable Energy Transmission and Supply Program – This is a loan administered by the Alaska Energy Authority (AEA) for a government, business, or other organized body of people. It provides a loan for energy-efficiency or power transmission or distribution projects.

USDA-RD Communities Facilities Direct Loan & Grant Program - This is a loan or grant provided by the US Department of Agriculture – Rural Development (USDA-RD) for any essential community facility in a rural area. It provides a loan or grant to develop essential community facilities with upgrades or equipment for improvement.

MEASUREMENT AND VERIFICATION

The results of these recommended measures can be measured through the collection of energy use data through the monthly bills provided by the local electric utility and the local fuel oil supplier. Collecting data and performing a historical comparison is the simplest method of validating the energy and cost savings seen by the measures. Additionally, active remote monitoring systems are available that can collect and store data regarding energy and fuel usage. These systems allow the user to track the usage in real time and can be shared more easily with partners across the state.

APPENDICES

Appendix A – Scanned Energy Billing Data

Appendix B – Energy Audit Report – Project Summary

ENERGY AUDIT REPORT – PROJECT SUMMARY	
General Project Information	
PROJECT INFORMATION	AUDITOR INFORMATION
Building: PA Housing	Auditor Company: ANTHC
Address: Front Street	Auditor Name: Curtis Boudreau
City: Tanana	Auditor Address: Auditor Address
Client Name: Shannon Erhart	
Client Address:	Auditor Phone: (907) 729-3528
	Auditor FAX:
Client Phone: (907) 366-7160	Auditor Comment:
Client FAX:	
Design Data	
Building Area: 3,936 square feet	Design Space Heating Load: Design Loss at Space: 56,641 Btu/hour with Distribution Losses: 56,641 Btu/hour Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 86,343 Btu/hour Note: Additional Capacity should be added for DHW and other plant loads, if served.
Typical Occupancy: 2 people	Design Indoor Temperature: 70 deg F (building average)
Actual City: Tanana	Design Outdoor Temperature: -41.9 deg F
Weather/Fuel City: Tanana	Heating Degree Days: 14,590 deg F-days
Utility Information	
Electric Utility: Tanana Power Company, Inc - Commercial - Sm	Natural Gas Provider: None
Average Annual Cost/kWh: \$0.662/kWh	Average Annual Cost/ccf: \$0.000/ccf

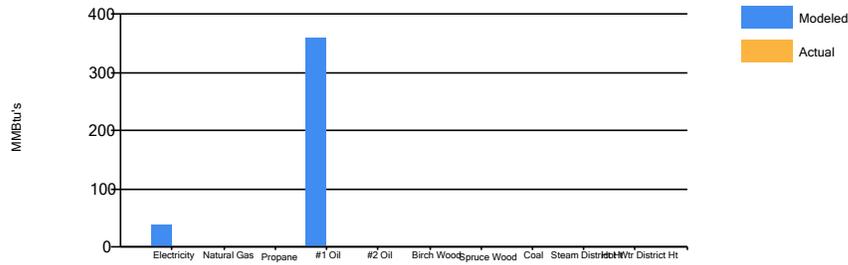
Annual Energy Cost Estimate									
Description	Space Heating	Space Cooling	Water Heating	Ventilation Fans	Lighting	Refrigeration	Other Electrical	Service Fees	Total Cost
Existing Building	\$6,677	\$0	\$6,681	\$243	\$2,829	\$753	\$2,058	\$0	\$19,240
With Proposed Retrofits	\$3,826	\$0	\$6,734	\$364	\$2,172	\$753	\$2,058	\$0	\$15,907
Savings	\$2,851	\$0	-\$53	-\$121	\$658	\$0	\$0	\$0	\$3,333

Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
Existing Building	101.3	6.95	\$4.89
With Proposed Retrofits	81.2	5.57	\$4.04
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: Energy Use Intensity per Heating Degree Day. ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.			

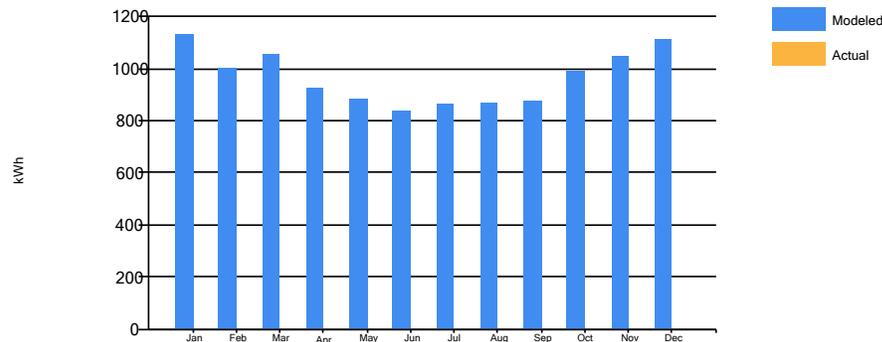
Appendix C – Actual Fuel Use versus Modeled Fuel Use

The graphs below show the modeled energy usage results of the energy audit process compared to the actual energy usage report data. The model was completed using AkWarm modeling software. The orange bars show actual fuel use, and the blue bars are AkWarm’s prediction of fuel use.

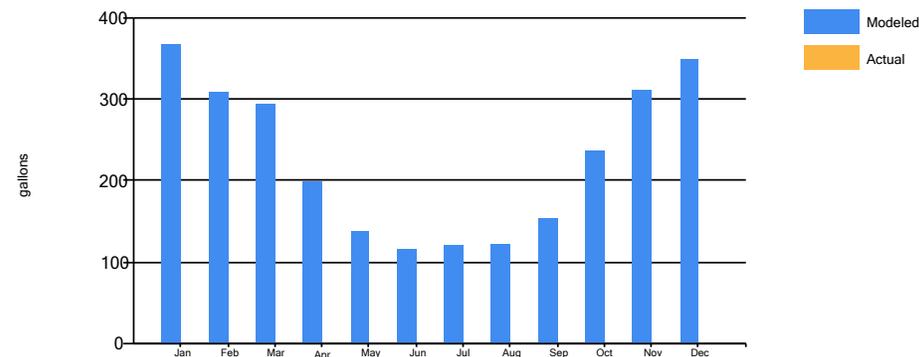
Annual Energy Use



Electricity Use



#1 Fuel Oil Use



Appendix D - EUI Calculation Details

The Tanana Power Company provides electricity to the residents of Tanana as well as to all commercial and public facilities.

The average cost for each type of fuel used in this building is shown below in Table 4. This figure includes all surcharges, subsidies, and utility customer charges:

Table 4: Energy Cost Rates for each Fuel Type.

Average Energy Cost	
Description	Average Energy Cost
Electricity	\$ 0.6619/kWh
#1 Oil	\$ 4.25/gallons

Table 5 shows the calculated results for the building Energy Use Index (EUI), which determines the total energy usage for a type of building for comparison with other buildings of the same type. This allows the user to determine the relative energy use of a building in relation to others of the same type or use.

Table 5: EUI Calculations

Energy Type	Building Fuel Use per Year	Site Energy Use per Year, kBTU	Source/Site Ratio	Source Energy Use per Year, kBTU
Electricity	11,592 kWh	39,564	3.340	132,145
#1 Oil	2,722 gallons	359,281	1.010	362,873
Total		398,845		495,018
BUILDING AREA		3,936	Square Feet	
BUILDING SITE EUI		101	kBTU/Ft ² /Yr	
BUILDING SOURCE EUI		126	kBTU/Ft²/Yr	
* Site – Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued March 2011.				

Table 6 shows information on common energy use benchmarks used to characterize the efficiency of a building.

Table 6: Energy Efficiency Benchmarks for Building

Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
Existing Building	101.3	6.95	\$4.89
With Proposed Retrofits	81.2	5.57	\$4.04
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: Energy Use Intensity per Heating Degree Day. ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.			

Appendix F – Materials Specifications

Man-Door Bottom Sweep

Pemko 18062_NB Brush Seal/180 Degree Aluminum Retainer

- This brush gasketing is supplied with a Nylon Brush ("NB") insert - item number P38062 (available in gray or black).
- Painted white insert is item number P516062W.

Ratings

BHMA BHMA Certified
CERTIFIED



Smoke Tested - UL1784



Fire Rated - UL10C - Positive Pressure



Underwriters Laboratory 4L10



GREENGUARD Gold Certified

Finishes



18062CNB: C - Clear Anodized Aluminum with Gray Nylon Brush insert



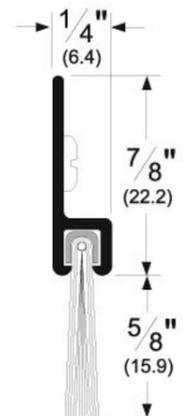
18062DNB: D - Dark Bronze Anodized Aluminum with Black Nylon Brush insert



18062GNB: G - Gold Anodized Aluminum with Black Nylon Brush insert



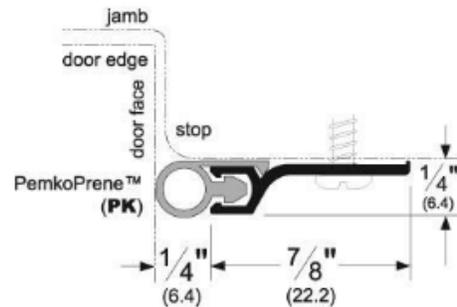
18062PWNB: PW - Painted White Aluminum with White Nylon Brush insert



Man-Door Gasket for Top Sill and Side Jambs

Pemko 303_PK (PG) Standard Perimeter Gasketing

- Category J gaskets for use with listed steel frames and/or classified steel covered composite, hollow metal doors rated up to and including 3 hours; wood and plastic covered composite doors rated up to and including 1-1/2 hours; and wood core doors rated for 20 minutes.
- Rigid jamb weatherstrip is shown mounted on openings with 1/16" gaps; however, each weatherstrip can seal gaps up to the depth of its seal.
- Seal depth is provided on each illustration.
- Stainless Steel fasteners are standard.
- Other fasteners are available.
- Model 303_ is available with self-adhesive, two-sided tape (TST) and tek screws (3 slotted holes per part) for easy installation.
- To obtain this option, add "TST" to the end of the part number when ordering (i.e. 303APK36TST).
- This perimeter gasketing is supplied with a PemkoPrene® ("PK") insert - item number PK47 (available in gray or black).



Ratings



Air Infiltration Tested



BHMA Certified



Smoke Tested - UL1784



Fire Rated - UL10C - Positive Pressure



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Environmental Product Declaration



Health Product Declaration

Declare. Declare



GREENGUARD Gold Certified

Finishes



303APK: A - Mill Finish Aluminum Aluminum with Gray PemkoPrene insert



303BDGPK: BDG - Bright Dip Gold Anodized Aluminum with Black PemkoPrene insert



303CPK: C - Clear Anodized Aluminum with Gray PemkoPrene insert



303DPK: D - Dark Bronze Anodized Aluminum with Black PemkoPrene insert



303GPK: G - Gold Anodized Aluminum with Black PemkoPrene insert



303PWPk: PW - Painted White Aluminum with Black PemkoPrene insert



303SNPK: SN - Satin Nickel Anodized Aluminum with Black PemkoPrene insert

Attic Access Hatch Weather-Stripping

PRODUCT	SKU	UPC	SPECS	COLOR
D-Section 1/4" Thick - Fits Medium Gaps	V25GA	077578012551	5/16" W, 1/4" T, 17 ft L, D-Section	Grey
	V25BA	077578011776	5/16" W, 1/4" T, 17 ft L, D-Section	Brown
	V25WA	077578011783	5/16" W, 1/4" T, 17 ft L, D-Section	White
	V25BK	077578059228	5/16" W, 1/4" T, 17 ft L, D-Section	Black



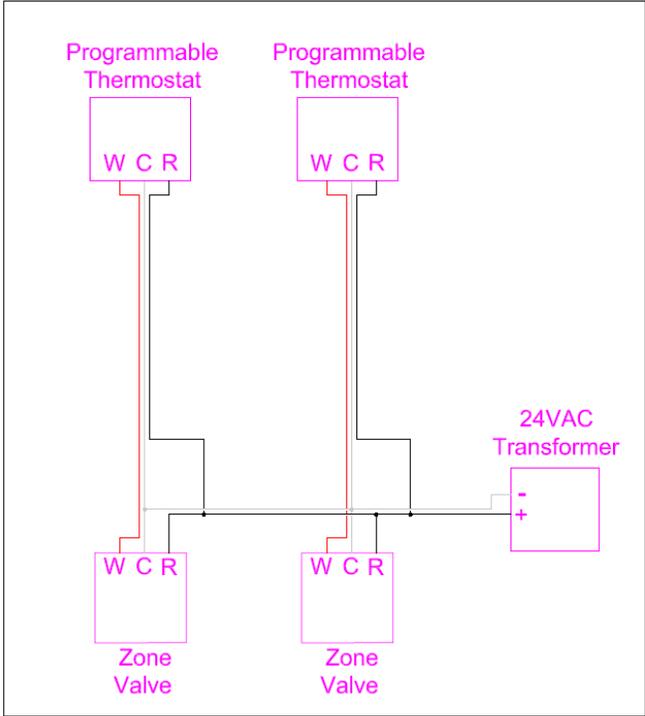
Programmable Thermostat

Robertshaw 9701i2

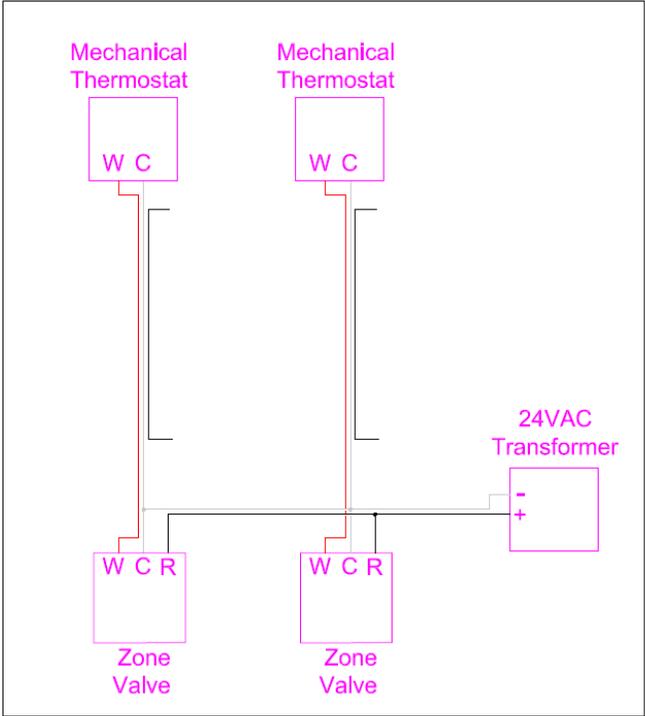


Menu Driven Display
7 Day Programmable with 2, 4 or 6 Events Per Day
9701i2 - 1 Heat / 1 Cool

Worry-Free Memory Storage
 Even during power outages, the thermostat maintains set point and programmed parameters.



New Programmable Thermostat Wiring



Existing Mechanical Thermostat Wiring

- (Red) Thermostat Off/On Signal, typically red or white
- (Gray) -24VAC Common, typically white or blue
- (Black) +24VAC Power Supply, typically red, black, or orange

Heat Recovery Ventilator (HRV)

BROAN[®]

HRV160 ECM
Part no. HRV160TE



VB0239

LED T8 Light Bulb



4 FOOT
Fluorescent Replacement



DIRECT WIRE
Ballast Bypass

High Output



LED
T8 | T12

Performance Specifications

REPLACEMENT FOR:	T8 OR T12 4 FOOT FLUORESCENT TUBE
BRIGHTNESS (LUMENS):	2400
COLOR TEMPERATURE:	4000K 5000K
COLOR ACCURACY (CRI):	80
DIMENSIONS	1.02" X 47.2"
POWER CONSUMPTION:	18 WATTS
VOLTAGE:	120-277 VOLTS
DIMMABLE:	NO

Dimensions / Additional Data

CERTIFICATIONS:	UL, DESIGNLIGHTS (DLC)
PRODUCT/ORDER CODE:	4000K - 18WT8P-4F-40K-BYP 5000K - 18WT8P-4F-50K-BYP

Lifespan / Cost To Run

PROJECTED LIFE: @3 HRS/DAY	50,000 HRS
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YEARLY ENERGY COST: 3 HRS/DAY @ .11 KWH	\$2.17
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WARRANTY	5 YEAR THINKLUX LIGHTING LIMITED WARRANTY EARTHLED PRODUCT PROTECTION PLAN IS AVAIL
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LED Standard Light Bulb

ULTRA LED™ A-line Lamps

Omnidirectional



Rated up to 15,000 hours at 70% lumen maintenance, SYLVANIA ULTRA LED A-line omnidirectional lamps offer years of service and reduce energy and maintenance costs. SYLVANIA ULTRA LED lamps are environmentally preferred products. They are RoHS compliant and contain no mercury, lead or other hazardous materials. They emit no UV or IR radiation. A CRI of 80 ensures good color definition and 2700K, 3000K, 3500K and 5000K color temperatures, these lamps can be used in many applications in both homes and businesses.

Key Features & Benefits

- Dimmable down to 10%*
- Long life: up to 15,000 hours (L₇₀)
- UV and IR free
- Mercury and lead free
- RoHS compliant
- Available in 2700K, 3000K, 3500K and 5000K color temperatures
- Suitable for indoor/outdoor environments
- Reduces energy consumption up to 85%
- Last up to 20 times longer than incandescent lamps
- No warm-up time, instant-on with full light output and stable color

* Performance may vary depending on dimmer used in application. Please refer to Dimmer Compatibility List (RETRO-DIM) for a list of compatible dimmers or visit www.SYLVANIA.com/LED Retrofit



Product Offering

Ordering Abbreviation	Wattage	Color Temperature	Typical Lumens
LED5.5W A19	5.5	2700K, 3000K, 3500K & 5000K	450
LED9W A19	9	2700K, 3000K, 3500K & 5000K	800
LED12W A19	12	2700K, 3500K & 5000K	1100
LED16W A21	16	2700K, 3500K & 5000K	1600
LED25W A21	25	2700K	2550

Energy Savings

Basic Product Description	LED Life (hrs.)	LED Lumens	Similar Incandescent	Incandescent Life (hrs.)	Incandescent Lumens	Watts Saved	Energy Savings*	LED Life vs. Incandescent
LED5.5A19	15,000	450	40W A19	1500	465	34.5	\$56	10x
LED9A19	15,000	800	60W A19	1000	850	51	\$84	15x
LED12A19	15,000	1100	75W A19	750	1170	63	\$103	20x
LED16A21	15,000	1600	100W A19	750	1600	84	\$138	20x
LED25A21	15,000	2550	150W A21	750	2670	125	\$165	20x

*Energy savings over life of lamp calculated at \$0.11/kWh