



# Investigative Energy Audit For

## Koliganek Village Council Main Office Building



Prepared For  
**Koliganek Village Council**

Prepared By  
**Curtis Boudreau, PE, CEM**

**February 22, 2017**

**ANTHC-DEHE  
4500 Diplomacy Dr.  
Anchorage, AK 99508**

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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 Rural Energy Initiative gratefully acknowledges the assistance of Water Treatment Plant Lead Operator Alexie Ishnook, Backup Operator Jack McCarr, Tribal Administrator Robert Larsen, and Tribal Transportation Director Frances Nelson.

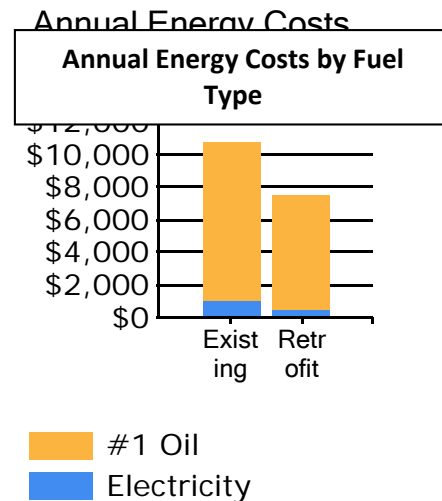
## OVERVIEW

This report was prepared for the Koliganek Village Council. The scope of the audit focused on the Main Office Building and includes an analysis of building occupancy schedules, building shell, heating systems, heating and ventilations systems, lighting, and other electrical loads. The building houses office space for administrative staff, a post office, and large meeting space. Data was based on a site survey and interviews with the building occupants.

## ENERGY BASELINE

Based on unsubsidized electricity and fuel oil prices in effect at the time of the audit, the total predicted energy costs are \$10,797 per year. This includes \$1,107 for electricity and \$9,690 for #1 fuel oil.

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	2,171 kWh	1,166 kWh	1,005 kWh	\$513
#1 Oil	1,938 gallons	1,380 gallons	558 gallons	\$2,790

# 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	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR <sup>1</sup>	Simple Payback (Years) <sup>2</sup>
1	Programmable Thermostats	Replace the existing mechanical thermostats with programmable thermostats to turn the inside temperature down to 60 degrees after-hours	\$150 materials each 3 hours labor @ \$50/hr each 2 thermostats	\$2,181	\$600	49.24	0.3
2	Air Tightening	Install weather-stripping and seal gaps around exterior doors	\$50 materials per door 2 hrs labor @ \$50/hr each 3 doors each	\$565	\$450	11.66	0.8
3	LED Lighting Retrofit (60W)	Replace standard 60 Watt light bulbs with LED	\$10 per bulb 1 bulb per fixture 30min/fixture @ \$50/hr 4 fixtures	\$66	\$140	2.84	2.1
4	LED Lighting Retrofit (40W)	Replace standard 40 Watt light bulbs with LED	\$10 per bulb 1 bulb per fixture 30min/fixture @ \$50/hr 4 fixtures	\$41	\$140	1.76	3.4
5	Replace windows on south wall	Replace broken windows with new vinyl triple pane windows	Materials: \$1,500 per window (3 windows) Total Shipment: \$1,000 Total Installation: \$2,000 Contingency: 9% Total: \$8,000	\$207	\$8,250	0.44	39.4
6	LED Lighting Retrofit (T8)	Retrofit T8 fluorescent light bulbs with LED	\$20/bulb 2 bulbs per fixture 1.5 hrs @ \$50/hr per fixture 12 fixtures	\$85	\$1,380	0.37	16.3
7	Replace broken skylight window	Replace broken window with new vinyl triple pane window	\$800 materials (single window) \$200 shipping \$500 installation \$1,500 total	\$15	\$1,500	0.18	94.8
			<b>TOTAL</b>	<b>\$3,161</b>	<b>\$12,460</b>	<b>3.23</b>	<b>3.9</b>

Highly Recommended
Recommended
Not Recommended (Based on Estimated Cost)

*Note 1: In reviewing the utility bills, there was a large amount of electricity being used by the facility that wasn't accounted for in the building loads identified during the survey. It is recommended that the staff look for the source of this extra electrical use and turn it off if possible. Possible sources of unnecessary electrical use are heat trace lines, electric heaters, or coffee pot warmers left running non-stop.*

*Note 2: A large amount of energy could also be saved by adjusting the settings on the Toyo stove in the main lobby to turn the temperature down when the building is unoccupied.*

*Note 3: The woodstove has a catalytic converter inside of it to help burn more efficiently and reduce the amount of smoke coming out of the chimney. In order to work properly, it requires periodic cleaning and replacement. It is recommended that it be cleaned and/or replaced as needed.*

<sup>1</sup> 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.

<sup>2</sup> 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 is occupied year-round from 8:00am-5:00pm every day by approximately 2 office staff. The building is frequently accessed throughout the day as it contains post-office boxes and the city main administrative staff. There is also a conference room that is used on an intermittent basis.

### **Building Shell**

The exterior walls are 2x6 wood-framed construction.

The roof of the building consists of rafters, assumed to be made of 12" deep wood I-beams insulated with 6" of blue-board foam.

The building is constructed on a concrete stem-wall foundation with a crawlspace.

There are approximately 17 total windows in the building, of widely varying sizes. The windows are double-pane glass, but 4 of the windows have cracked panes.

There are 2 entrances into the building. The front entrance doors did not fit well inside of the frames. It appeared that there had been a second set of arctic entry doors installed in the main entry at one time that are now removed.

### **Heating Systems**

The heating systems used in the building are:

#### **Toyo Stove**

Fuel Type:	#1 Oil
Input Rating:	40,000 BTU/hr
Steady State Efficiency:	85 %
Idle Loss:	0 %
Heat Distribution Type:	Air
Stove Operation:	9 Months/Year

#### **Wood Stove**

Fuel Type:	Wood
Stove Operation:	Intermittent

#### **Boiler 1**

Fuel Type:	#1 Oil
Input Rating:	148,000 BTU/hr
Steady State Efficiency:	85 %
Idle Loss:	1.0 %
Heat Distribution Type:	Water
Boiler Operation:	9 Months/Year

### **Space Heating Distribution Systems**

The central area of the building is heated by the Toyo Stove and Wood Stove. The rest of the building is heated by hydronic baseboards supplied by the Toyo water heater. The water heater is controlled by 2 heating zones that are controlled by individual thermostats.

### **Building Ventilation Systems**

The building relies on operable windows for ventilation.

### **Domestic Hot Water System**

The building is not provided with domestic hot water.

### **Lighting**

The interior space is lit with T8 fluorescent trougher fixtures and incandescent light bulbs. The lights use an estimated 1,105 kWh annually.

### **Other Electrical Loads**

The building is supplied with a drip style coffee machine and computers for the staff.

## **Major Equipment**

**Table 3: Major Electrical Equipment**

<b>Equipment</b>	<b>Rating (Watts)</b>	<b>Approx. Annual Usage (kWh)</b>
Coffee Pot	~1000	500
Desktop Computers	~80	300

## **PROJECT FINANCING**

The total estimated cost of the recommended EEM's is \$1,330. The payback for the implemented EEM's is approximately 0.5 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

### 1. Electricity Billing Data

Electric ▾	ID:	Notes:										Rate Schedule Type:		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
Qty	780	709	425	354	284	284	284	354	425	425	461	532	5,317	kWh
kW Demand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cost	398	362	216	180	144	144	144	180	216	216	234	271	2,705	
Year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016		

## Appendix B – Energy Audit Report – Project Summary

ENERGY AUDIT REPORT – PROJECT SUMMARY – Created 9/26/2017 11:33 AM	
General Project Information	
<b>PROJECT INFORMATION</b>	<b>AUDITOR INFORMATION</b>
<b>Building:</b> Koliganek Village Council	<b>Auditor Company:</b> ANTHC
<b>Address:</b> Koliganek	<b>Auditor Name:</b> Curtis Boudreau, Kevin Ulrich, Cody Uhlig
<b>City:</b> Koliganek	<b>Auditor Address:</b>
<b>Client Name:</b> Herman Nelson	
<b>Client Address:</b> P.O. Box 5057 Koliganek, AK 99576	<b>Auditor Phone:</b> (907) 729-3528
<b>Client Phone:</b> (907) 596-3434	<b>Auditor FAX:</b>
<b>Client FAX:</b>	<b>Auditor Comment:</b>
Design Data	
<b>Building Area:</b> 1,512 square feet	<b>Design Space Heating Load:</b> Design Loss at Space: 71,734 Btu/hour with Distribution Losses: 71,734 Btu/hour Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 109,351 Btu/hour Note: Additional Capacity should be added for DHW and other plant loads, if served.
<b>Typical Occupancy:</b> 2 people	<b>Design Indoor Temperature:</b> 70 deg F (building average)
<b>Actual City:</b> Koliganek	<b>Design Outdoor Temperature:</b> -21.9 deg F
<b>Weather/Fuel City:</b> Koliganek	<b>Heating Degree Days:</b> 11,175 deg F-days
Utility Information	
<b>Electric Utility:</b> Koliganek Village Council - Commercial - Lg	<b>Fuel Oil Provider:</b> Koliganek Village Council
<b>Average Annual Cost/kWh:</b> \$0.510/kWh	<b>Average Annual Cost/Gal:</b> \$5.00/gal

Annual Energy Cost Estimate					
Description	Space Heating	Ventilation Fans	Lighting	Other Electrical	Total Cost
<b>Existing Building</b>	\$9,816	\$8	\$563	\$410	<b>\$10,797</b>
<b>With Proposed Retrofits</b>	\$6,927	\$8	\$292	\$410	<b>\$7,636</b>
<b>Savings</b>	\$2,889	\$0	\$272	\$0	<b>\$3,161</b>

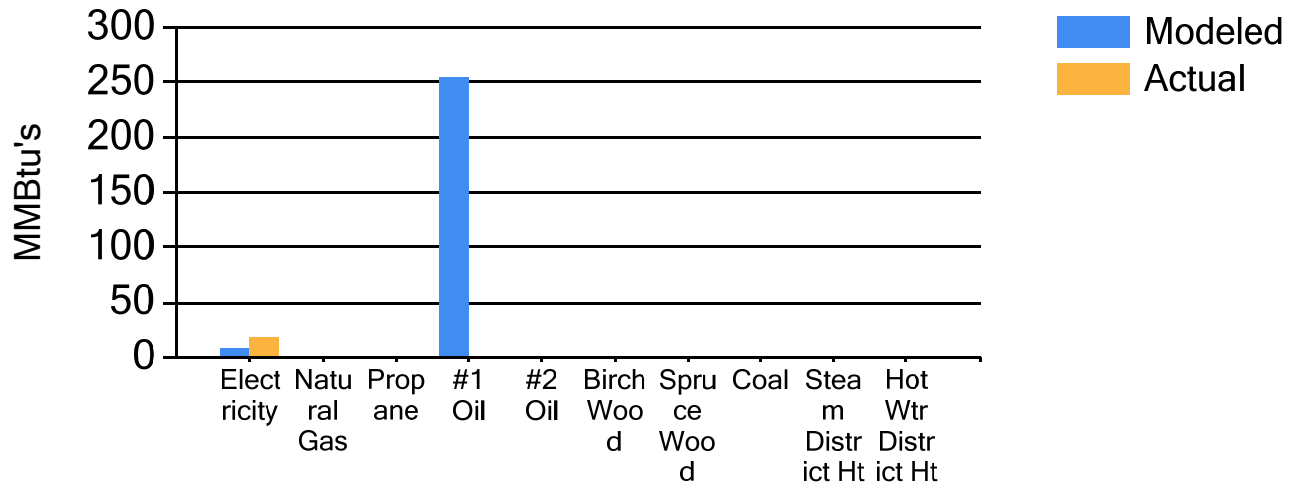
Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
<b>Existing Building</b>	174.1	15.58	\$7.14
<b>With Proposed Retrofits</b>	122.9	11.00	\$5.05

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.

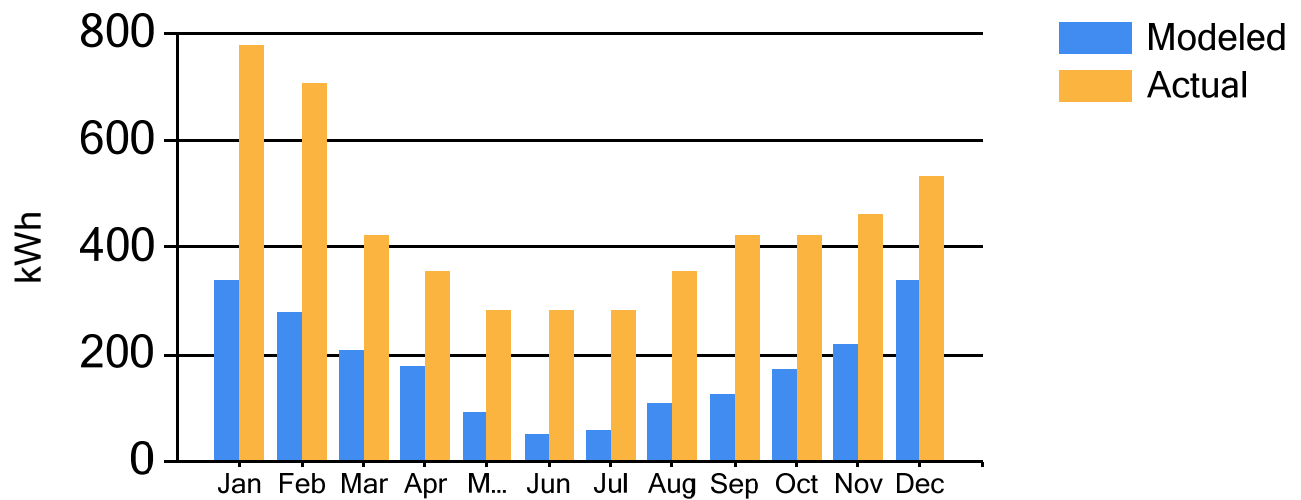
## Appendix C – Actual Fuel Use versus Modeled Fuel Use

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



## Appendix D - EUI Calculation Details

The Koliganek Village Council provides electricity and fuel to the residents of Koliganek 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	\$ 0.51/kWh
#1 Oil	\$ 5.00/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	2,171 kWh	7,408	3.340	24,744
#1 Oil	1,938 gallons	255,822	1.010	258,380
Total		263,230		283,124
BUILDING AREA		1,512	Square Feet	
BUILDING SITE EUI		174	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		187	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	174.1	15.58	\$7.14
With Proposed Retrofits	122.9	11.00	\$5.05
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 E – Materials Specifications



**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
YEARLY ENERGY COST: 3 HRS/DAY @ .11 KWH	\$2.17
WARRANTY	5 YEAR THINKLUX LIGHTING LIMITED WARRANTY EARTHLED PRODUCT PROTECTION PLAN IS AVAIL

# ULTRA LED™ A-line Lamps

Omnidirectional



## Key Features & Benefits

- Dimmable down to 10%\*
- Long life: up to 15,000 hours (L<sub>70</sub>)
- 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](http://www.SYLVANIA.com/LED Retrofit)



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.

## 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

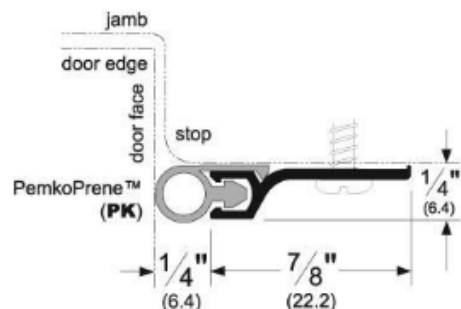
Basic Product Description	LED Life (hrs.)	LED Lumens	Similar Incandescent	Incandescent Life (hrs.)	Incandescent Lumens	Watts Saved	Energy Savings*	LED Life vs. Incandescent
LED5.5A19	15,000	450	40W A19	1500	465	34.5	\$56	10x
LED9A19	15,000	800	60W A19	1000	850	51	\$84	15x
LED12A19	15,000	1100	75W A19	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

## 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



Underwriters Laboratory 4L10



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

## 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



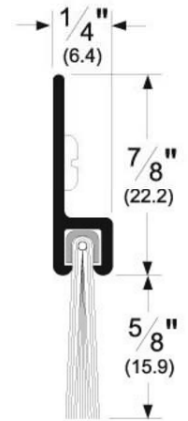
**18062DNB:** D - Dark Bronze Anodized Aluminum with Black Nylon Brush insert



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



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





# Programmable Thermostat



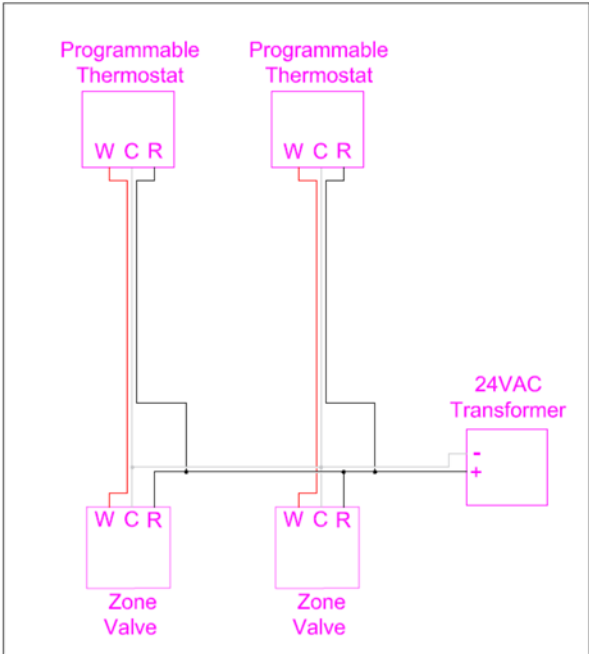
**Menu Driven Display**

**7 Day Programmable with 2, 4 or 6 Events Per Day**

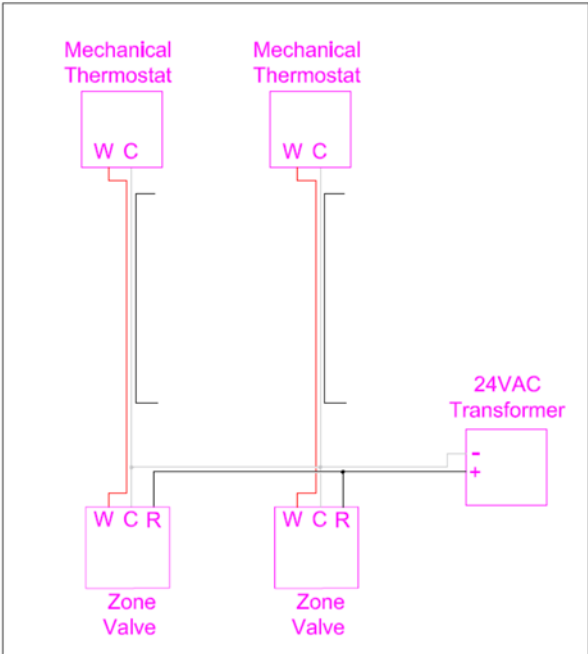
**9701i2 - 1 Heat / 1 Cool**

**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

## Triple-Pane Windows

### Capitol Glass Northerm Window Kodiak Series Both Casement and Fixed Pane (Picture) Types

 National Fenestration Rating Council® <b>CERTIFIED</b>	<b>Northerm Windows</b> <b>3800 SERIES VINYL</b>  Triple Glaze Argon Fill 2 coats Low E Product Type: Picture NRW-A-6-00020-00001
<b>ENERGY PERFORMANCE RATINGS</b>	
U-Factor (U.S./I-P) 0.16	Solar Heat Gain Coefficient 0.27
<b>ADDITIONAL PERFORMANCE RATINGS</b>	
Visible Transmittance 0.47	Air Leakage ( U.S./I-P ) < 0.3
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.</small> <a href="http://www.nfrc.org">www.nfrc.org</a>	

 National Fenestration Rating Council® <b>CERTIFIED</b>	<b>Northerm Windows</b> <b>3800 SERIES VINYL</b>  Triple Glaze Argon Fill 2 coats Low E Product Type: Casement NRW-A-7-00001-00001
<b>ENERGY PERFORMANCE RATINGS</b>	
U-Factor (U.S./I-P) 0.19	Solar Heat Gain Coefficient 0.20
<b>ADDITIONAL PERFORMANCE RATINGS</b>	
Visible Transmittance 0.35	Air Leakage ( U.S./I-P ) ≤ 0.3
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.</small> <a href="http://www.nfrc.org">www.nfrc.org</a>	