HEATING FUEL OIL

PRACTICAL PAYBACK METHODS

TO SAVING ON HEATING FUEL OIL FOR COMMERCIAL & RESIDENTIAL BUILDINGS

A GUIDE FOR RURAL ALASKANS IN BECOMING MORE SELF-SUFFICIENT IN ENERGY MANAGEMENT

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energy
Money Isn't All You're Saving

IAPMO MEMBER

NOVEMBER FY 2006
REVISION MAY 2008

HEATING FUEL OIL - MAKING THE DOLLAR WORK FOR YOU

PREFACE

The hefty price of Heating Fuel Oil ranging in cost from $4.00 to over $6.00 a gallon is a commodity in rural Alaska that is creating devastation to building owner's budgets. This article illustrates how to make existing oil prices work for owners and pay substantially less for heating fuel oil.

When old inefficient boilers still have many years of service left, and the building owner does not want to or cannot invest in a complete replacement. ***Than improving, the performance of an existing building's boiler system is one of the most effective ways of reducing heating fuel oil, electrical, maintenance and operating costs*** plus making the system more efficient and reliable. While retrofit projects that focus on replacement of boilers and components can achieve the same — and often even greater — benefits, their high implementation costs, long term payback and corresponding high level of disruption often makes it unsuitable for many commercial and residential buildings.

This documentation demonstrates to owners their best options is simply make certain that the boilers already installed operate properly at peak efficiency which also would definitely help ***reduce the greenhouse gases***, which is becoming a worldwide issue and concern.

INTRODUCTION and CONTENTS

BOILERS WITH CAST IRON SECTIONS, *Page 2-3 and Appendix "A", Page 12* - Studies have shown that ½" of ***soot/slag*** deposits results in an increase in fuel oil consumption of approximately 42%. ***Scale*** in boiler waterways have a heat loss of 8% and increased fuel oil consumption of 2% from only 1/32" of scale in the boiler waterway sections. ***Cleaning soot, slag, and scale in boilers reduces service costs and saves on oil consumption*.**

PIPE INSULATION, *Page 4* - Bare heating piping mains covered with fiberglass pipe insulation SAVES on heating fuel oil consumption.

PREHEAT OIL DAY TANK, Page 5 - The installation of an inside preheat oil day would have significant value in reducing fuel oil costs.

OIL BURNERS, Page 5-6-7 - Replacing an old antiquated burner with a new flame retention burner can save up to 15% on oil consumption and the electric cost of running the burner.

AUTOMATIC OUTDOOR RESET CONTROLS, *Page 8 and Appendix "B", Page 13-14* – Automatic outdoor reset controls are at affordable prices to building owners. A typical payback can be under one year. Documented savings have been recorded in FY 1990 for Chevak School 12%($10,000), FY 2001, Bethel Church 21% ($3,000), and FY 1991, King Salmon Airline Terminal 40% ($7,500) for one year usage.

GLYCOL HEAT LOOPS, *Page 9* - Outside air temperature controllers are low cost resulting in instant oil or electrical savings for heat loops.

ENERGY SAVING PROGRAMMABLE AND LIGHT SENSING THERMOSTATS, *Page 9* - Automatic Night Setback of 72F to 62F from 10pm to 6am equates to 20% savings in heating costs

PREVENTATIVE MAINTENANCE and CONCLUSION, *Page 10* – Taking all above together a facility owner can realize huge savings of their heating fuel oil and electrical costs. If the facility is in very poor condition (e.g. Boilers have not been cleaned in years) an owner could conceivably recover 100% of their fuel costs (e.g. When newly installed, the boilers were using as an example 5000 gallons a year, 15 years later the boilers are now burning 10,000 gallons a years because of no maintenance or upgrades.

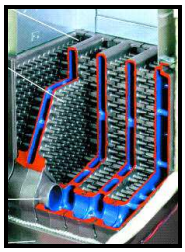
ABOUT THE AUTHOR, *Page 11*– Jerry Nicholson has lived in rural Alaska for over 40 years and has acquired expertise in the design, installation and maintenance of oil fired boiler systems, which includes energy management. He also is highly knowledgeable in the needs of rural Alaskans and shares their concerns and frustrations in rising fuel oil heating costs***. This article is his contribution to owners who are in need of technical knowledge and who want to save money.***

BOILERS WITH CAST IRON SECTIONS

For demonstration a Weil McLain & Burnham are shown at left

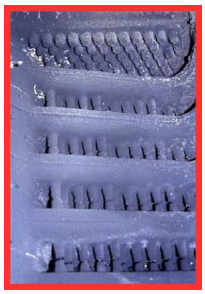
"Cleaning boilers reduces service costs and saves oil"

NEW CAST IRON BOILER W/O JACKET



CUT AWAY FLUE

FLUE GAS FLOW



FLUE SOOT BUILDUP

AFTER CLEANING

2003 COMMERCIAL BUILDING BETHEL, AK

BOILER SOOT & HARD SLAG DEPOSITS

PILOT STATION, ALASKA 2003

EFFICIENCY OPERATIONS AND MAINTENANCE PRACTICES

Proper yearly mandatory maintenance procedures for any standard cast iron oil fired boilers extends the life expectancy to 30 to 50 years. The boilers (Example at left) also retain most of its AFUE efficiency rating of approximately 85% if these fundamentals are followed exactly.

AFUE is "*Annual Fuel Utilization Efficiency". Indicated as a percentage, the Boiler AFUE tells how much energy is being converted to heat. For example, an AFUE of 85 means that 85% of the fuel oil is being used to warm the facility, while the other 15% escapes as exhaust with the combustion gases*

SOOT and SCALE DEPOSITS

In an AFUE 85% cast iron boiler, water surrounds the flues and hot fuel oil gases rise from the combustion area and travel through the flues between each boiler section. This results in soot and hard slag deposits accumulating within the flue. No matter what fuel is used (gas, oil, coal or wood) the flues need to be cleaned. If the flues are not cleaned regularly, boiler efficiency is sacrificed and heating fuel oil consumption increases.

Because soot and hard slag deposits have five times the insulating capacity of asbestos, the heat transfer loss in a sooty boiler rises dramatically as the layer of soot builds up. ***For example, government studies have shown that 1/2 inch of soot and hard slag deposits results in an increase in heating fuel oil consumption of approximately 42%*** and reduces substantially the AFUE and BTU rating of the boiler, which is why an old sooty boiler wants to run 24/7 during cold weather. For a cast iron boiler that had an AFUE rating of 85%, that is a good argument for ***mandatory boiler cleaning.***

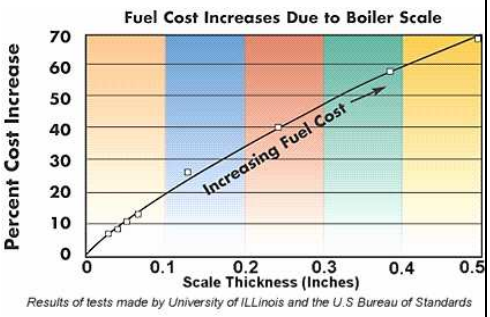
FACILTY ANNUAL SAVINGS DEMONSTRATION (Appendix A)

See Appendix "A": Modeling the above scenario a 35% factor was used to demonstrate as an approximation sample of fuel oil consumption when boilers have a little less than ½" of soot and scale.

MINERIAL (SCALE) DEPOSITS IN THE WATERWAYS

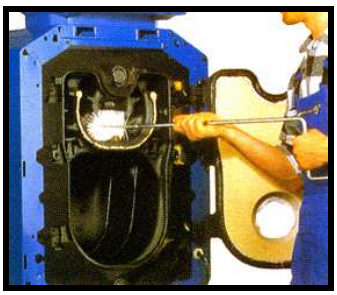
Mineral (Lime) and sludge in the waterways of cast iron sections can cause loss of efficiency and premature boiler failure such as a cracked section. As lime deposits or sludge accumulates in the bottom of sections, it will insulate the water from the cast iron, causing "hot" spots. Expanding and contracting from overheating and cooling eventually will weaken the cast iron, causing it to crack. Early symptoms are percolating sounds or a knock or ping when the boiler reaches its set point temperature.

Scale build-up up on the casting over a long period reduces heat transfer to the facility. BTU heat loss of 8% and increased fuel oil consumption of 2% will result from only 1/32" of scale in the boiler waterway sections.

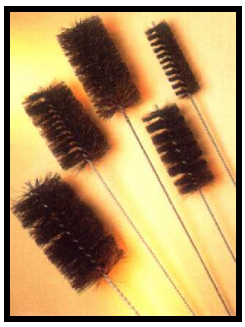


SCALE INEFFICIENCY'S

DAMAGED BOILER SECTION FROM SCALE



EXAMPLE CLEANING METHOD



FLUE CLEANING WIRE BRUSHES

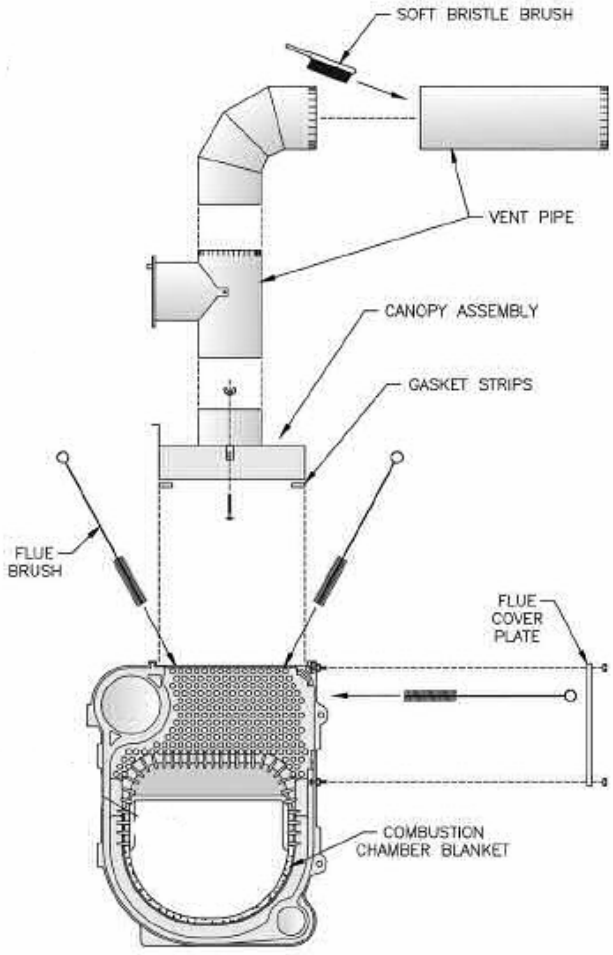
Boilers that exhibit symptoms of scale need replacement or an inhibited muriatic acid pumped through the boiler to remove the scale. Extreme caution should be taken muriatic acid is a highly toxic chemical, and qualified personnel experienced in chemical handling should perform this endeavor. Sometimes this procedure does not remove all of the scale from the boiler.

As an example, this procedure was used for the Chevak School District (Kashunamuit) in 1991. The boilers were two 1 million BTU Weil Mclain boilers (Pictured above and in burner section) and one boiler was knocking consistently when it reached its high setpoint temperature. Muriatic Acid was pumped through the boiler for three days. After completion, the boiler still had a noticeable ping or knock during its temperature-cycling period.

Common causes for scale build-up are:

1. Weeping relief valve (undersized expansion tank or water logged expansion tank will cause the pressure to rise and lift the relief valve.)
2. Leaking system piping mains, branches and fittings
3. Air vents that fail to close
4. Piping in utilidors or soffit space with hard to detect leaks

PROPER PROCEDURES FOR CLEANING A BOILER TO REMOVE SOOT



COURTESTY OF BURNHAM CORPORATION

COMMERCIAL BUILDING. BETHEL, AK 2002

PIPE INSULATION

"Bare heating piping mains covered with fiberglass pipe insulation SAVES on heating fuel oil consumption"

FIBER GLASS PIPE INSULATION

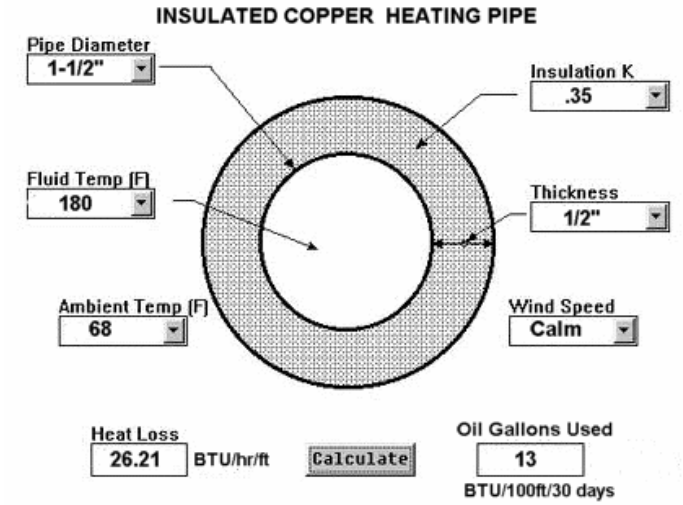


FIGURE 1. 100 FT OF 1-1/2" INSULATED PIPE 30 DAYS OIL USAGE

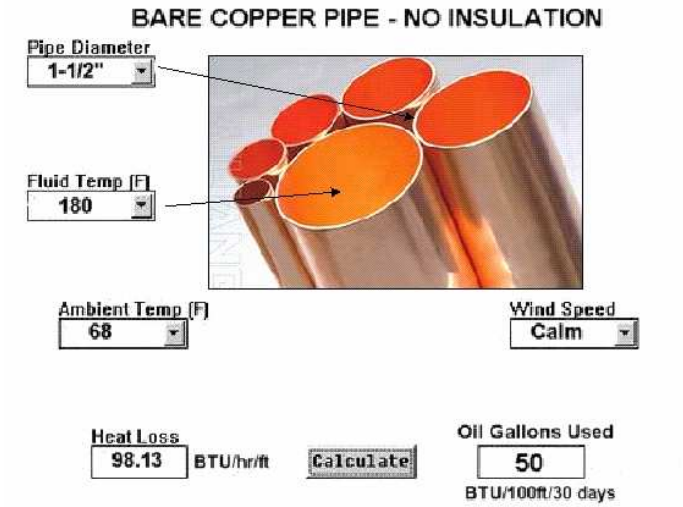


FIGURE 2. 100 FT OF 1-1/2" BARE PIPE 30 DAYS OIL USAGE

BTU is *"A British thermal unit (Btu) is a standard unit of energy that is used in the United States. The Btu is used as a quantitative specification for the energy-producing or energy-transferring capability of heating equipment"*

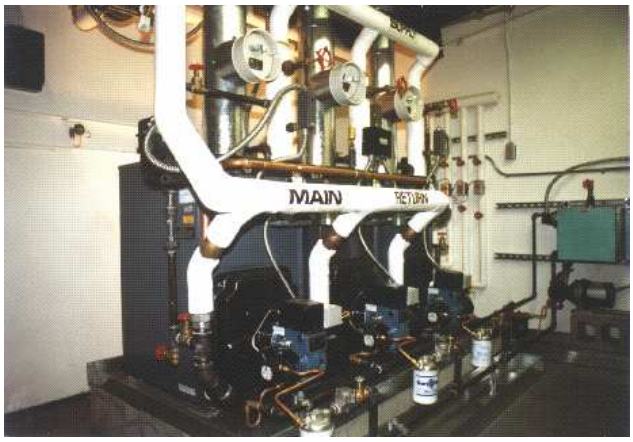
BOILER HEADERS & HEATING MAINS

Excess heat in boiler rooms and overheating in commercial buildings (Office's, Schools, Apartments, etc.) are also significant factors in increase heating fuel oil consumption.

A thermostat in a room turned all the way down to 68F and its still 85F degrees in the room hours later is usually an indication that copper pipe heating mains in the crawl or ceiling space are not insulated and are radiant heating the floor space into the room.

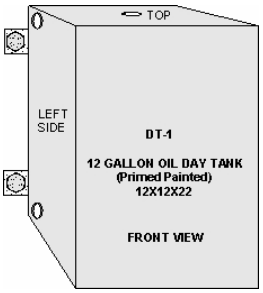
Figure one ***(13 gallons used)*** and figure two ***(50 gallons used)*** models 100 feet of heating mains piping in a building that are insulated and not insulated. The BTU losses for each were converted into fuel oil gallons used (140,000 BTU =1 gallon of heating fuel oil).

Using the same calculation for 20 feet total of non-insulated 3" Copper boiler headers (Supply & Return) would result in ***18 gallons*** of heating fuel used in a 30 day period versus if the headers were insulated with a heating fuel consumption of only ***4 gallons*** in the same 30 day period.



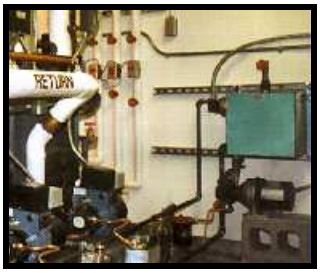
COMMERICIAL BUILDING – FAIRBANKS, ALASKA 1994

Notes: All boiler and pump photographs viewed in this article are projects completed by Nushagak Consultants. View more at www.nakco.com



PREHEAT OIL DAY TANK

"The installation of a preheat oil day (illustration left) would have significant value in reducing fuel oil costs"

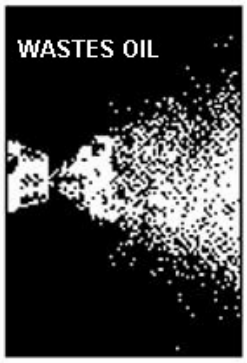


DAY TANK
FAIRBANKS, ALASKA 1994

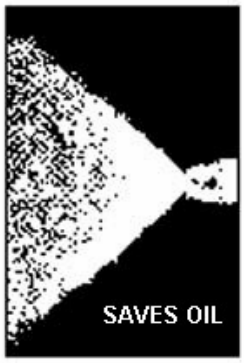
Outdoor fuel oil storage tanks that are exposed to temperatures lower than 32F degrees certain problems can occur. For example, outdoor tanks can easily become quite cold so that the oil in it thickens enough to change the atomizing pattern of the oil burner nozzle located on the boiler.

A change such as this (oil thickens), will result partly in oil droplets becoming bigger thus making the oil burner flame longer and more "sluggish" in burning. It also increases nozzle output resulting in smokier burner operation, the result of which is soot caked in the combustion chamber and flue and more heating fuel oil is consumed.

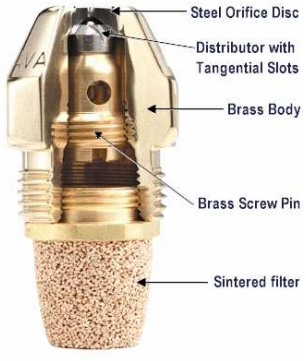
DAY TANK (RED)
1991 KING SALMON, AK



COLD OIL NOZZLE SPRAY



WARM OIL SPRAY

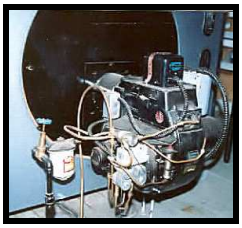


BURNER NOZZLE

Above photographs courtesy of Delavan Spray Technologies (A BF GoodRich Company): A Total Look at Oil Burner Nozzles a Reference Guide for Burner Service Technicians **"Effects of Viscosity On Nozzle Performance"**

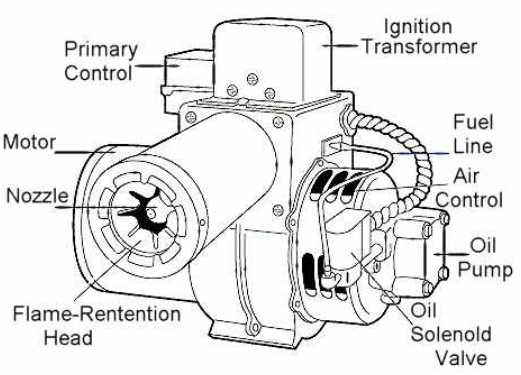
OIL BURNERS

For demonstration a Beckett & Gordon Piatt are shown at left



GORDON PIATT BURNER REPLACEMENT , CHEVAK AK 1992
BEFORE & AFTER BY NUSHAGAK CONSULTANTS

"Replacing an old antiquated burner with a new flame retention burner can save up to 15 percent on oil consumption and the electric cost of running the burner".



1980'S – 1990'S VINTAGE OIL BURNER

DEMONSTRATION: BECKETT'S NEW HIGH-TECH OIL BURNER

PILOT STATION NATIVE STORE - 1992

Since the turn of the century, technology continues to advance making life much easier and less costly. Computers and cell phones have had major breakthroughs moving from efficient to high-tech.

Oil burners have moved in the same direction offering customers the latest and the best in high-tech efficiency versus burners that were born in the 80's and 90's. Static pressure has been getting higher and higher. The electronic controls are getting smarter and more reliable. Burner manufactures are going back to interrupted ignition and using igniters instead of ignition transformers. The pumps feature more positive cut-off. They have switched from sleeved bearing motors to ball-bearing PSC motors. The new nozzles are better in many little ways. The new smart controls feature pre- and post-purge for cleaner startup and shutdown. These burners can run so clean that there is almost no soot and scale build-up over the heating season. This means that the efficiency does not go down through the season as it does with older burners. Properly adjusted new burners do not need to be tuned up every year.

The result is that while the new burners look pretty much the same as the old burners, they are far superior. They are more efficient, more reliable, safer and even quieter than the 1980's and 1990's flame-retention burners. They use a *great deal less electricity* than the older models.

In October 2006, Nushagak Consultants replaced the early 1990's vintage oil burners and installed Beckett's new high-tech oil burners on the boilers for the Pilot Station Native Store, Pilot Station Alaska; a 7,000 sq ft building heating system that Nushagak originally designed and installed in 1992.

On startup it was absolutely astounding the performance of the new burners. Instantly the new burners went from old burner hard to adjust erratic flame to a smooth flame stability caused by the higher static pressure of the new improved burners. The burners ran clean with the air intakes set open not nearly as far as the old burner settings, which shall definitely reduce off-cycle airflow through the boilers reducing heat loss in the building during cold weather.

THE NEW ADVANCED TECHNOLOGY

Residential and Light Commercial Applications

BECKETT ELECTRONIC OIL IGNITION

- Higher constant output voltage
- More reliable ignition, especially with cold oil
- Long life electrodes require less adjustment
- Smaller lighter and more compact than ever

BECKETT CLEANCUT PUMP

- Smoother, cleaner shutdown and light-off
- Less moving parts compared to conventional pumps
- Reduced load on motor
- Higher capacity – up to 4 gph @ 100 psi
- Build-in Solenoid valve cuts oil flow instantly

BECKETT PSC MOTOR

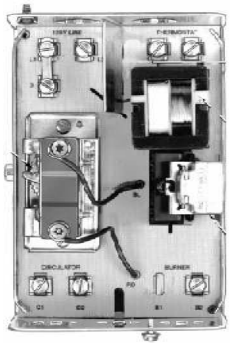
- Lower amp draw
- Cooler operation
- Fewer Failures
- Delivers more power
- Ball Bearings for longer life

BECKETT R7184 SERIES CONTROLS

- Interrupted-Duty Ignition--**extends the life of the ignition system** (igniter/transformer and electrodes) and **reduces** component **noise**.
- Limited Recycle/Limited Reset--**minimizes** the number (2) of times the **operator** can hit the **reset** button.
- Communications Port--enables the control to communicate with service instruments, security systems or data acquisition equipment.
- **Diagnostic LED**--a service tool that indicates cad cell resistance and operational status (lockout, recycle, etc.).
- Ambient Range from **-40 to +150 F**
- 15 second **pre-purge**, selectable **post-purge** and **alarm contacts**.

AUTOMATIC OUTDOOR RESET CONTROLS

"By adding Automated Outdoor Reset Control that works alongside the Boiler manual controls, fuel oil savings Of up to 30% or more may be seen"



MANUAL CONTROLLER

OLD MARKAIR – BETHEL, ALASKA 2001

MORAVIAN CHURCH – BETHEL, AK 2001

MARKAIR – KING SALMON 1991

CHEVAK SCHOOL DISTRICT - 1992

Note: Good practice is to install Outdoor Reset Controls only on boilers that first follow mandatory maintenance procedures.

Standard conventional manual temperature controls supplied with boilers are just "MANUAL CONTROLLERS". When you manually set the control to shut the boiler off at 180F degrees it stays that way 24/7 365 days of the year unless the operator manually decides to turn it down. This consumes a tremendous amount of fuel oil and in some cases 40% excessively too much fuel oil!

Adding automatic outdoor reset controls to recover that lost fuel oil is not a new concept. Throughout the United States, Europe and Alaska, automatic controls are installed in commercial applications such as office buildings, apartment buildings, hospitals, and churches by major HVAC Corporations such as Landis Gyr, Siemens, Honeywell, and Johnson Controls.

Automatic temperature outdoor reset controls are at affordable prices to commercial and residential building owners, a typical payback can be less than a year on capital investment to an owner due to high cost of oil.

As delineated throughout this documentation percentage of fuel oil payback savings varies based on many factors, e.g. building type, etc. Since 1990, Nushagak Consultants has been installing automatic outdoor reset controls and has documented some installations showing the variations in savings:

1990 - Chevak School District- $10,000. saved annually; 12% in Heating Fuel Oil Savings

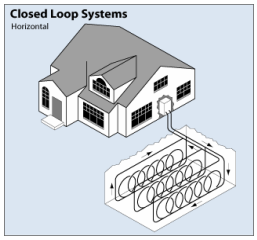
2001 - Bethel Moravian Church: $3,000 saved annually- 21% in Heating Oil Savings

1991 – Markair Terminal King Salmon – 15,000 gallons past year usage – 9000 gallons used 1992 – 40% savings in Heating fuel oil costs

In 1993 based on the substantial savings in King Salmon Markair elected to install automatic outdoor reset controls in their facilities locations at Deadhorse, Barrow, Fairbanks and Kodiak.

Other installations of Automatic Outdoor Reset Controls installed by Nushagak Consultants are located in the Pilot Station Native Store (2004) and Old Markair Terminal Bethel (2001). No historical data is available for these current installations.

Visit Appendix "B" Pages 13 & 14 for more information on Outdoor reset controls.



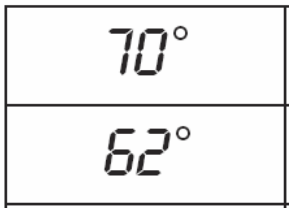
WATER AND SEWER GLYCOL HEAT LOOPS

"Outside air temperature controllers are low cost resulting in instant oil or electrical savings"

OUTSIDE AIR TEMPERATURE CONTROLLER

Facilities with glycol heat loops that provide protection for outside water and sewer lines and tanks are sometimes piped directly into the boiler supply and return headers with a circulator attached that usually runs 24/7 365 days a year. Unless turned off by an operator it continues to consume oil even when the heat loop serves no purpose (Temperatures above freezing).

The installation of an outside air temperature controller would have significant effect in reducing oil consumption for heat loops. The controller could also be used to save on electricity costs when electrical heat tapes are used to protect water and sewer lines and tanks. Outside air temperature controllers are low cost resulting in instant oil or electrical savings.



DAY

NIGHT SETBACK

PROGRAMMABLE AND LIGHT SENSING THERMOSTATS

"Automatic Night Setback of 72F to 62F from 10pm to 6am equates to 20% savings in heating costs"

24V PROGRAMMABLE

LIGHT SENSING

It is a common misconception that setting back thermostats uses more energy than if set at 72F degrees 24/7. In fact, setback thermostats when used properly *will* save on heating fuel oil costs.

Savings occur by lowering the temperature settings in the winter when the building is unoccupied. The savings happen because there is no excess waste of heating oil when nobody is there. Thermostats can be set to warm the space prior to people arriving.

Programming the thermostat will reduce heating costs by two percent for every one degree of setback in an 8-hour period; e.g., Automatic Night Setback of 72F to 62F from 10pm to 6am equates to 20% savings in heating costs.

One particularly interesting model uses a photosensor (light sensing) to adjust the temperatures up and down according to whether or not lights are on or off in the area being controlled. This is an ideal thermostat for oversized baseboard in a room and for hot air furnaces. Sunlight does not affect this thermostat.

PREVENTATIVE MAINTENANCE

Is Annual Preventive Maintenance of A Heating System Really Necessary?

It is safe to say that most heating systems are not operating at peak efficiency. That is not too surprising when you realize that in rural Alaska, a heating system runs about 1850 hours per year.

To put this "run time' in perspective, a snow machine or 4 wheeler driven for 1850 hours at 55 miles per hour would travel over 101,750 miles. Not many snow machines or 4 wheelers put 101,750 miles on the odometer in a single year.

Even so, no one would consider such a journey without arranging for oil changes, lubrication, and routine maintenance to assure the efficiency, safety, and reliability of the vehicles.

LOGO BY: MOE WASSILIE

Simply put, a heating system serves many more hours each year than a vehicle and like any vehicle needs routine maintenance to operate efficiently, safely, and reliably throughout its design life.

Long before a heating system breaks down, it silently and unavoidably loses efficiency requiring more energy and more money to keep occupants comfortable.

Some of the possible reasons contributing to inefficiency are:

- Soot, Slag and Scale
- Improper burner adjustment.
- Old, inefficient equipment.
- Improperly sized equipment.
- Improper combustion air
- The list goes on and on.

OIL BURNER COMBUSTION TEST KIT

The Best way to keep heating equipment operating at peak efficiency is with a regular program of expert cleaning, serving and burner tune-up. This must be done at least once a year, preferably well before the heating season arrives, and it must be done properly. It is not a half hour job. Boiler manufactures, instructors who train service persons, and this author agree that a proper cleaning and tune-up cannot be done in less than two hours, but often, it takes longer. A boiler depending on size may take as long as a full day.

About the Author

Visit www.nakco.com for a pictorial resume of author's projects

Jerry Nicholson, M.A. owner of Nushagak Consultants and an Alaska Native (Aleut) born (1944) and raised in the commercial fishing capital of the world Bristol Bay, started his career as a heating technician in the late 1950's working on his mother's antiquated oil pot burner stove which was used for cooking and heating in a 1930's vintage log home. In the Bristol Bay Region he became an expert in oil fired burners and primary controls. During this period, a master instructed him in the design and installation of oil fired hydronic boilers and warm air furnaces.

MR. NICHOLSON'S CREDENTIALS

CERTIFIED BY THE STATE OF ALASKA AS A COMMERCIAL MECHANICAL ADMINISTRATOR

PROFICIENCIES:

BUILDING HEAT LOSS TO CALCULATE HEATING LOAD REQUIREMENTS FOR HYDRONIC BOILERS AND HEAT EMISSION UNITS;

OIL FIRED BURNERS AND OIL PUMPS; DESIGN SINGLE AND TWO PIPE OIL SYSTEMS;

DESIGN MONOFLOW, DIRECT RETURN, REVERSE RETURN, AND LOOP HYDRONIC CIRCUITS;

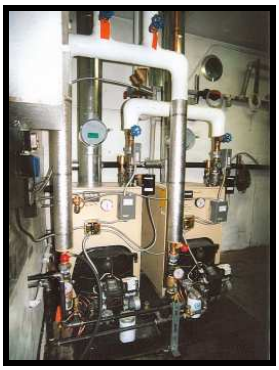
BOILER PRIMARY AND SECONDARY CONTROLS;

DESIGN HEATING CIRCULATOR PUMP GPM FLOW REQUIREMENTS;

DESIGN HEATING PIPE SIZING AND PRESSURE DROPS, RELATIVE WATER VELOCITIES, PUMPING HEADS AND STATIC PRESSURE, HEATING SYSTEM CURVES, AND CONTROL VALVE CV RATINGS;

COMPUTERIZED DRAWINGS; AUTOCAD MECHANICAL DRAFTING AND LAYOUT; (SEE ON CD OR WEBSITE)

DESIGN AUTOMATIC TEMPERATURE CONTROLS AND ELECTRICAL WIRING FOR BOILERS



EXAMPLE PROJECT
BETHEL, ALASKA 2005

Moving to the Yukon/Kuskokwin region in the 1970's Mr. Nicholson perfected his heating career by home correspondence and became Bethel, Alaska's Head Honcho oil fired burner expert. In addition, he designed and installed numerous residential and commercial hydronic heating systems that still exist in excellent working condition in Bethel today.

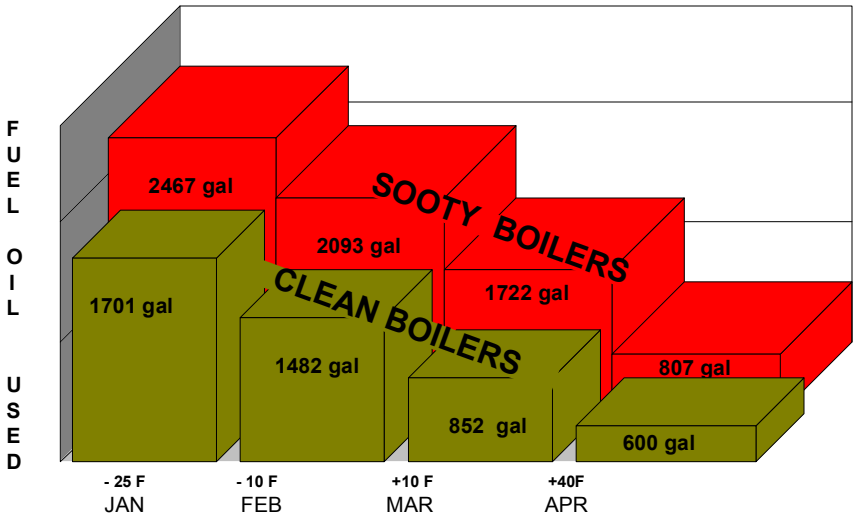
Moving to Anchorage in the early 1980's to centralize his business Mr. Nicholson continued his heating education by attending Anchorage Community College (made Dean's List) and partnering with major HVAC corporations (Johnson Controls and Control Systems International) in the design and installation of heating computerized Direct Digital Controls (DDC). He is also very appreciative to many colleagues (Alaska Mechanical Engineers and Master Heating Mechanics) who have contributed to his professionalism in the heating industry.

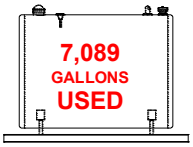
Mr. Nicholson's major accomplishments in the heating contracting industry have been in both the private and government sector. Highlights of his commercial achievements has been a 1.5 million dollar project in Juneau, Alaska; a $800,000 project renovating airline terminals throughout Alaska, and 1.3 million dollars worth of projects renovating Alaska Native service hospitals in rural Alaska and Anchorage. In the residential market, Mr. Nicholson has performed hundreds of thousands of dollars worth of heating work for Alaska Indian Housing Authorities.

Mr. Nicholson also has unique abilities in damage control in assessment of heating systems and has saved client's money and made innumerable people happy. Comments by individuals: 1993, Neil Bergt, owner Markair Inc, *"I want to shake your hand Jerry for making my employee's warm in Prudhoe Bay"*. — 2005, Joel Bowles manager in Bethel, Alaska for the Pacifica Guest House, *"For six years we have been freezing in this hotel, and spent thousands trying to correct the problem and nobody could fix it until you came along, Thank you"*. — 1990, Wayne Hill store owner, Chevak, Alaska, *"The Kashunamuit School District suffered until you came along"*; — 2006, Peter Giannini, Chief Operating Officer, Tatitlek Corporation, Anchorage, *"You never cease to amaze me in your capacities and abilities"*.

Any questions or need technical assistance feel free to e-mail Jerry at Nushagak Consultants: jerrynicholson@alaska.net

APPENDIX "A" - DEMONSTRATION ONLY

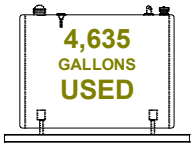




BETHEL, ALASKA
CURRENT BULK PRICE
PER GALLON 2006

X$4.19 = $29,703.00

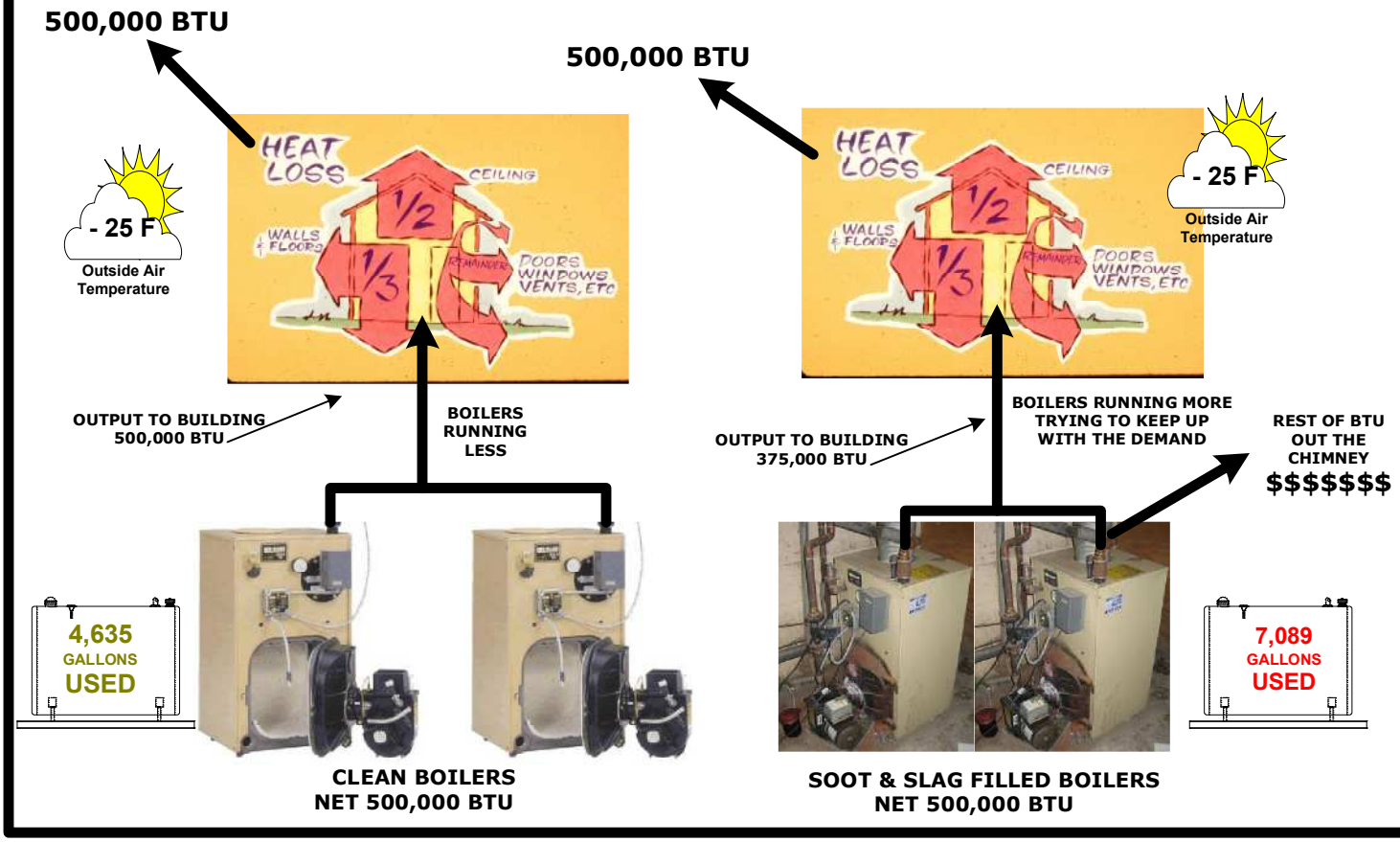
HEATING OIL TANKS

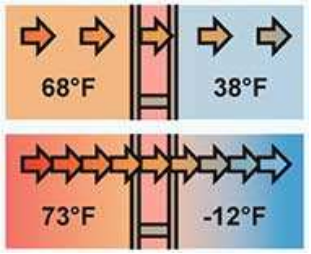


X$4.19 = $19,421.00

$10,396.00 (35%) SAVINGS OF FUEL OIL JUST FOR MANDATORY CLEANING OF BOILERS

HEAT LOSS (Measured in BTU) is the rate at which the building is losing heat to the outside environment, and it varies based on outside air temperature and wind conditions. Boilers are sized for the coldest outside day temperature and must replenish this heat at the same rate at which the building's heat is being lost to maintain the building's heat demand.





As the disparity between indoor & outdoor temperature increases, so does the rate of heat transfer fromhot areas to cold.

Energy Saving Features

Outdoor Reset:

A building's heat loss or gain depends considerably on two things:

1. Outdoor air temperature
   (as temperature difference between the exterior and interior increases, so does the rate of heat transfer)

2. The building envelope's resistance to heat transfer
   (a higher R value in building materials will impede the transfer of heat)

While a control will not impact the R-Value of building materials, it can ensure that the system does not waste heat by exceeding current requirements. Providing only the required amount of heat reduces fuel consumption, creating less pollution while saving you money.

How an Average Heating System Works...

When the interior air temperature drops below the thermostat setting, a signal is sent to the boiler to turn on. Unfortunately, the thermostat only tells the boiler to turn on when the house is too cold or turn off when the house is too warm. There is no in-between.

How many miles per gallon would your car get if the only method of controlling your speed was to accelerate until you're going too fast, and then apply the brakes?

How Your Heating System Should Work...

You adjust your car's gas pedal to maintain a comfortable driving speed and good fuel economy. Why not the same with your heating system? By adding a tekmar Outdoor Reset Control, heating system water temperatures are adjusted to maintain comfort and improve system efficiency.

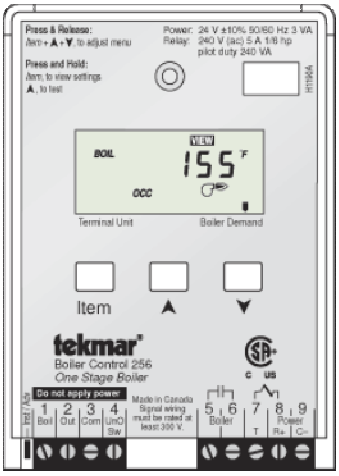
It's Not Your Heating System's Fault!

If a heating system does not know if it is a cool autumn night or the coldest winter day, it works as if it's always the coldest day of the year and heats the water to a maximum temperature. Having this hot water in the distribution piping when it's not needed results in stand-by heat loss. By adding a tekmar Outdoor Reset Control that works alongside of your boiler and thermostat, you may see energy savings of up to 30%.

Tekmar Single and Two Stage Boiler Controllers

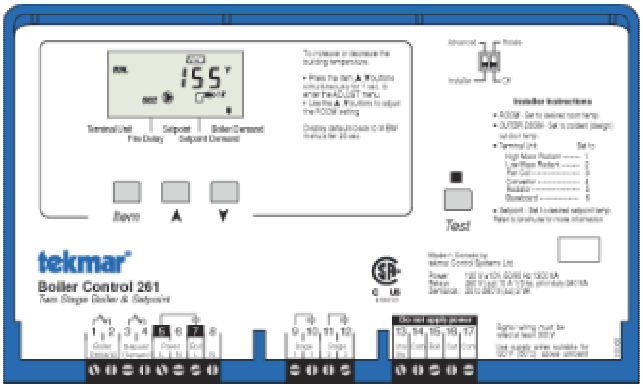
Note: These are not safety (limited) Controllers

Boiler Control 256 - One Stage Boiler



Control Description The Boiler Control 256 is a microprocessor-based control designed to regulate the supply water temperature from a single boiler based on the outdoor temperature. To avoid boiler short cycling and large temperature swings, the 256 is able to continuously adjust the boiler differential. The 256 includes control functions such as Warm Weather Shut Down (WWSD) and Minimum Boiler setting. The control has a liquid crystal display (LCD) that normally displays the Boiler Supply temperature, but can display other temperatures and settings.

Boiler Control 261 - Two Stage Boiler



Control Description The Boiler Control 261 is a microprocessor-based two stage boiler control designed to regulate the supply water temperature from a single two stage boiler or two single stage boilers based on either outdoor air temperature or a setpoint demand. The 261 can stage and rotate two single fire boilers or it can stage a single Lo/Hi fire boiler. The 261 also operates the system pump.