Energy Evaluation
Of The
Westmark Hotel
In
Whitehorse, Yukon

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ENERGY EVALUATION OF THE WESTMARK HOTEL IN WHITEHORSE, YUKON

Energy assessment of a 188 room hotel included an examination of all interior spaces and mechanical systems and infrared survey of a sampling of building envelope interior surfaces. Investigation of energy use related to the building shell, heating, domestic hot water use, lighting and ventilation was performed. This report covers all aspects of energy use and improvement options for the owner's consideration in reducing overall hotel operating costs. The options considered within this report represent a preliminary analysis of the total potential for energy savings. More specific investigation may be necessary and should be undertaken prior to application of efficiency measures to validate their full potential.

The building is was built over a number of years beginning in the early to mid- 1970s and consists of modular units stacked one upon another to result in three, three story wings of rooms, lobby, restaurant, kitchen, conference rooms and public areas. The building structure is suitable for long term use and I estimate the future life of the building to be at least thirty years if modified as outlined and maintained appropriately. Numerous renovations have been recently undertaken and additions constructed to improve the dining, lobby and reception areas. Even though these modifications were recently applied the hotel has suffered several expensive maintenance failures in the past year resulting in an expense of approximately forty thousand dollars. No business can afford to experience such frequent and costly occurrences in addition to elevated energy and resource use.

Damage associated with broken pipes and subsequent flooding would not have occurred had the following building envelope and mechanical system retrofit options been in place. Such offsetting repair costs and the ability to avoid similar future occurrences present additional incentive for their implementation beyond simple justification through life-cycle costing and common return on investment accounting practices.

This report is not intended to be the final word on application of energy options to the Westmark hotel structure but serves as a guide to selection of a responsible project that includes treating the 'building as a system'. This is to say that changing one system at one end of the building affects areas at the opposite end. Example: by adding insulation and tightening the envelope we reduce heat loss but cause the heating systems to become greatly oversized. Oversized boilers have short burner run time cycles and are inefficient. To change one part of the building system means that we need to modify the other.

Envelope Observations

ENVELOPE OBSERVATIONS:

Problems attributed to the building envelope were identified through interviews with maintenance personnel, the building engineer and through use of infrared imaging and depressurization equipment. Of significant note was the discovery of air leakage corridors between each of the building modules. It is common to provide such a 'shim space' in construction of modular buildings. This space provides room for proper alignment of modules so as to create a straight and true building. Individual shim spaces vary in size due to differences in module to module dimensions and placement but they occur throughout the structure, under, between and over each separate module except for the upper most floors. These shim spaces create a perfect conveyance or plenum for air to move around, through and between modules from any pressure driven flow. The majority of the structure consists of three floors and we suspect the stack effect during a winter heating season is sufficient to move great volumes of air through the building to the outside.

Using a blower door to depressurize the interiors of a sampling of rooms allowed visualization of air leakage entry areas and insulation effectiveness with a FLIR DS digital infrared scanning camera. Our sampling was large enough to validate that similar construction practices were utilized in manufacturing modules for all three wings. The infrared images are included with this report and serve to illustrate the need for retrofit application of thermal and air tightness improvements. Efficiency options listed herein will assist to minimize maintenance costs, greatly reduce space and water heating expense, lengthen the useful life of the building and improve and extend the profit picture for the owners. While some of these energy efficient options are expensive most are of a low cost to implement and will greatly improve hotel maintenance staff's operational effectiveness.

FOUNDATION:

Three types of foundations are used in the hotel. These are basement, slab on grade and crawspace foundations. Two wings, the Travel and Office wings, are fully supported over a crawlspace in addition to the entry, and restaurant dining and lounge areas. The Travel wing also has a portion of slab on grade equal to approximately eight rooms in size and the kitchen is also on a concrete slab. The only part of the hotel where a basement is present is the space below the large ballroom. Boiler room one, laundry, maintenance workshop and storage is located in the basement area along with the elevator room and other smaller offices. The third wing, referred to here as the Ballroom Wing, consists of two floors above the ballroom containing thirty-four rooms.

Crawlspace walls are insulated with one and one-half inch thick expanded polystyrene insulation providing an R-7.5. However, many of the sheets of insulation were missing or had fallen off onto the floor (gravel with no vapor barrier). This creates a situation where the computer model is actually predicting a lower efficiency gain than the 'real life' instance would. Savings and increased protection to mechanical systems by adding insulation to the crawlspace are enough to warrant implementation. I simulated this enhancement by installing an additional R-10 to the walls and perimeter of the foundation on top of the soil resulting in a solid R-17 wall and R-10 perimeter. The effect of the HOT2000 crawlspace enhancement is combined with additional wall insulation and the associated air tightness improvement coming from a properly installed exterior wall retrofit. Breaking out crawlspace energy efficiency advantage is possible but unnecessary since to leave the building as it exists makes no sense at all for threat of more broken pipes, freeze-ups etc., therefore, the additional insulation is assumed to be installed.

In modeling energy use using the HOT2000 computer program I configured the total floor areas of the Office and Travel wings as having a crawlspace with the Ballroom wing being slab on grade. While this is not fully accurate, the representative savings in wall energy use are and the foundation model supports relative efficiency gains from addressing crawlspace improvements. Slab foundations are difficult to enhance thermally as only perimeter insulation can be installed once the slab is in place.

WALLS:
We located numerous anomalies throughout the building on interior imbedded walls where outside air was found to be entering into the building. Some locations were measured to be as much as twenty feet away from exterior walls. In fact, so frequent are these leakage areas that any attempt to seal them individually, one-by-one, was rapidly discarded due to reasons of inaccessibility. It is my opinion that only by application of a continuous exterior located continuous air barrier could one expect appropriate results in leakage area reduction. Should an exterior retrofit be undertaken the minimum R-value attached to the exterior is required to be either impermeable to water vapor transmission, or twice the R-value of the insulated portion on the warm side of the new air vapor barrier. Since we found between R-0 to R-7.5 installed in existing 2x4 walls an exterior retrofit of R-15 would meet this requirement. Because R-21 high density fiberglass batts are readily available for six inch framing I configured the Hot2000 retrofit model to provide R-28.5 composite wall insulation. (see Hot2000 for more detail)

During evaluation of a portion of the hotel undergoing renovations I observed numerous thermal deficiencies. Within the exterior wall construction in rooms 366 and 288, I noted good structural integrity but insufficient thermal quality, especially in consideration of the Whitehorse climate location. Exterior walls of this wing contain only three inches of poorly installed fiberglass bat insulation (estimate R-7.5) except where modules meet. In these joint locations I found one and one-half inches of fiberglass, sometimes, and nothing in other areas. I was unable to find any consistent application of exterior wall thermal insulation in the wing where renovation was being performed indicating a wonderful opportunity for energy savings.

Numerous thermograms were taken of the hotel walls and some of ceilings. These are included in the section titled **Thermograms** at the back of this report. Additional thermograms including control images are on file with Arctic Technical Services.

Hot2000 version 6.02 was used to provide a good understanding of potential wall retrofit savings. Since Hot2000 has area size input limitations I had to derive a method of modeling the structures and then multiplying portions of the results in order to create an acceptably accurate model for the three story wings. In so doing I used only the three wings containing hotel rooms in my analysis. The Office Wing was modeled with a crawlspace foundation and one floor, as was the Travel Wing. The Ballroom Wing was modeled as being one floor slab on grade. There are two each Hot2000 runs for each wing with a spread sheet analysis of the results. I assumed an R-30 for the roof as that would be a minimum acceptable level for a commercial building in Whitehorse. Further investigation to determine the composition of the existing roofs would be nice, and it would provide for more complete economic modeling.

NOTE:
Factors used in multiplying these single floor models to bring them up to three story models were taken from the respective Hot2000 printouts. I used the percentage of heat loss values for walls to create the additional two stories. Simply by taking this percentage times two (to represent two additional floors) I was able to closely model the buildings as if they contained three floors instead of one. Additional windows in these two floors were not considered as we only wished to view potential effects of modifying the 'net' wall area. Using the percentage heat loss instead of area calculations as a multiplier accomplished this quite satisfactorily.

In addition to output tables being affected by wall inputs, crawlspace wall, perimeter floor insulation and air tightness values were also changed to reflect the following criteria: Crawlspace inputs were described in the Foundation section. Air tightness was modeled to realistically portray the advantage provided by applying a continuous exterior air barrier. Therefore, the *retrofit* model building tightness was input as being 'Energy tight' instead of 'Average' as was input into the *existing* model. This is easily doable with such large rectangular structures, especially when working from the outside.

Program manipulation is a small 'broad brush' that was necessary in order to use a sophisticated program that has area input restrictions to large buildings. The size of the hotel is such that minor errors in calculating heat loss are of little consequence to the overall energy picture. Roof and foundation heat loss inputs were unchanged making it unnecessary to perform further program manipulation. (see the Excel spreadsheet titled Building Wall and Crawlspace Analysis for more information)

WINDOWS:
Most hotel windows had been replaced in recent years with pvc framed double pane units. While improving performance over the original windows these units do not reflect the optimum in energy retention. In addition, all new windows observed during my evaluation were found to be missing insulation between the window frame and rough opening. This lack of insulation was unacceptable to the hotel manager and the window manufacturer resulting in all installations in the latest wing to be retrofitted by the installing contractor. I recommend doing the same with all windows in the building, whether recent additions or old, as this feature is very necessary in order to provide for a well insulated installation.

NOTE:
In review of the expense incurred with replacing windows it is advisable to always pay the extra cost for enhanced glazing such as low emissivity coatings and gas filling. The increased incremental cost for the enhanced glazing is such a small percentage of the total cost that the improved resistance to heat loss is rapidly amortized. In addition to providing a higher insulating quality with high performance products it is recommended that glazing which blocks a majority of solar transmission be used on South and West facing walls to minimize the occurrence of overheating.

ROOFS:
Time did not allow for a thorough evaluation of all building roof areas, however, areas observed did not include insulation R-value sufficient for the climate area. I modeled all Wing examples at R-30 to keep a constant value that would not affect the wall retrofit calculation. The state of Alaska requires a minimum thermal value of R-38 for roofs throughout the state. In addition, R-50 to R-60 are fairly common. Unfortunately, I am unfamiliar with Canadian minimums or local Whitehorse common practice.

All roofs of the hotel appear to be of the 'hot' variety. This term is used to describe any roof insulated in such a fashion as to allow the insulation material to contact the underside of the exterior surface without any ventilated air space between. Such a roof typically consists of rigid foam insulation directly above the roof exterior surface and covered by a durable weather barrier. This weather barrier, as in the case of the Hotel, might consist of a layering of asphalt impregnated 'tar' paper of various weights having a top surface of graveled tar, 'hot-mopped' over the felt to provide weather tight protection for the insulating materials.

Flat roofs in arctic climates where there is an annual accumulation of snow are prone to leaking, creating a need for periodic reconditioning or rebuilding of the exterior surface. Installation of additional insulation should be considered when the roofs are in need of reconditioning next.

Lighting
And
Electrical

LIGHTING AND ELECTRICAL:

On January 7, 2000, a detailed lighting audit was performed by Stan Wieczorek of MACK Electrical Sales in Sherwood Park Alberta. The audit Project Summary calculates that with a total cost of $24,755 in bulbs that the simple payback would be 6.6 months **providing a first year savings of $20,043**. This provides **a return on investment of 51.8%** in the first year and subsequent **annual savings estimated at $44,798**. Some of these savings are from a reduction in cooling load during hot Whitehorse summers. This reduction is cooling is possible as the retrofit lamps operate at significantly lower temperatures.

Additionally, there are significant labor savings resulting from installation of compact fluorescent lamps since they typically outlast common incandescent bulbs ten-to-one. The maintenance labor savings estimate was calculated in the MACK analysis to be at 572 hour each year. Labor savings from not having to replace an estimated 1670 lamps several times each year must be considered attractive to any building owner plus the increased safety margins for guests and maintenance personnel. This effectively frees up one maintenance position for three and one half months!

Simple analysis of exit signs being modified from an *existing* 30 watts down to a *retrofit of* 1.5 watts is also economically favorable. Savings from re-lamping thirty exit signs will provide calculated annual savings of $1,258. I did notice where one or two of the exit signs had received such lamp upgrades however, it was apparent that due to a lack of maintenance follow through the majority of signs were yet to be modified. **SAVE up to $1,258 annually.**

Conference room lighting was not evaluated due to time constraints. However, all florescent fixtures should be retrofitted with the newer T-8 bulbs and the ballasts changed to electronic models. A typical cost / savings analysis is included in this report.

Kitchen lighting was also not evaluated because of time constraints, however, significant savings should also be possible here due to the long operating hours of the area.

Exterior lighting was also not considered in this evaluation but it is believed that further scrutiny will provide a financially beneficial return to the owners, whether from installation of controls or re-lamping.

Lighting Options

Examples

Panasonic
Lutron
Ener Tech
Exit Sign LED

PANASONIC LIGHTING AUDIT

PREPARED FOR

WESTMARK HOTEL

WHITEHORSE, YUKON

MACK
ELECTRICAL SALES

349 Wyecliff, 22560 Wye Road
Sherwood Park, AB
Canada T8A 4T6

Stan Wieczorek
Phone (780) 464-0420
Fax (780) 464-7735

Panasonic® Lighting

LIGHTING AUDIT
AND
LIFE CYCLE COST ANALYSIS

ELECTRICAL UTILITY RATES

ENERGY CHARGE - $0.168/kwh.
DEMAND CHARGE - $5.50/kw.

ANALYSIS OF ZONES

GUESTROOMS

The Guestrooms included in this audit were from Wings, 201, 301,232,259,332,359, Atlas and Office. Contained in each room were 100 watt. Tri-lites and G25 40watt bulbs., quantity of which varies per room. Mean average of life 1000 hrs Per light bulb. Usage 6 hrs. per day.

We propose the use of EFS15E27 Quad-Tubes for the Tri-lites and EFG10E28 light capsules to replace the G25 bulbs.

Cost of Panasonic Quad-Tubes and Light Capsules ----------------------$23,637.00
Annual cost Savings ---$40,603.00
Payback ---7.0 mons.
R.O.I.--50.0% per annum.
Annual labor savings on lamp replacement.--------------------------------572hrs.

RESTAURANT

The restaurant utilizes 30 - A19 100 watt. 20 - A19 60 watt. and 20 - R30 65 watt. Incandescent bulbs.

Changes proposed replace the A19 bulbs with EFT15E28 and the R30s with EFG15E28 Light Capsules.

Cost of Panasonic Light Capsules ---$1,118.00
Annual Cost Savings---$4,195.00

Payback--3.2 mons.
R.O.I.--77.8%
Annual labor savings on lamp replacement.-------------------------------72 hrs.

SUMMARY OF REPORT

TOTAL COST OF PANASONIC LAMPS --------------------- $24,755.00
TOTAL ANNUAL COST SAVINGS ----------------------------$44,798.00
PAYBACK ---6.6 mons.
R.O.I. ---$51.8%
ANNUAL LABOR SAVINGS --------------------------------------644 hrs.

NB: No amount of savings on labor has been carried in this audit. This amount if required can be calculated by multiplying the hours saved by the local labor rate per hr.

The staff of the Westmark Hotel, Whitehorse, provided all the information for this audit.

1018.
Bob Fick

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: WING 201 / 301 RMS.
LIGHTING: EFS15E27 VERSUS100 WATT TRI-LITE
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
Cost/Kwh: $0.168
Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%
ANNUAL LIGHTING USAGE: 1,534 Hours
Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
SENSIBLE RATIO: 70%

EXISTING LAMP: 95 X 100 Watt Bulbs
ANNUAL USAGE: 14,574 Kwh
LAMP COST: $1.50
TOTAL ELECTRICAL DEMAND: 9.5 Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
ANNUAL SENSIBLE LOAD: 16,517 MBTU
TOTAL ANNUAL COOLING LOAD: 23,596 MBTU
ESTIMATED LAMP LIFE: 7.8 Months
ANN COOLING Kwh: 2,360

PANASONIC LAMP: 95 X 15 Watt Lamps
ANNUAL USAGE: 2,186 Kwh
LAMP COST: $13.06
TOTAL ELECTRICAL DEMAND: 1.4 Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
ANNUAL SENSIBLE LOAD: 2,478 MBTU.
POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 3,539 MBTU
ESTIMATED LAMP LIFE: 87.2 Months
ANN COOLING Kwh: 354

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$1,241	$0	$0	$1,241	($1,241)
1	$219	$0	$3,075	$396	$3,690	$0	$461	$59	$1,761	$1,929
2	$219	$0	$3,075	$396	$7,381	$0	$461	$59	$2,282	$5,099
3	$219	$0	$3,075	$396	$11,071	$0	$461	$59	$2,803	$8,388
4	$219	$0	$3,075	$396	$14,762	$0	$461	$59	$3,324	$11,438
5	$219	$0	$3,075	$396	$18,452	$0	$461	$59	$3,845	$14,608

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: 0 Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: 0 Hours
TOTAL ELECTRICAL LOAD REDUCTION: 8.1 Kilowatts
TOTAL COOLING LOAD REDUCTION: 39 MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: 4.7 Months
HOURLY LABOUR RATE: $0.00
ANNUAL COST SAVINGS: $3,170
DISCOUNTED CASH RATE OF RETURN: 48.4% Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: WING 232 RMS.
LIGHTING: EFS15E27 VERSUS 100 WATT TRI-LITE
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
Cost/Kwh: $0.168
Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%
ANNUAL LIGHTING USAGE: 1,534 Hours
Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
SENSIBLE RATIO: 70%

EXISTING LAMP: 81 X 100 Watt Bulbs
ANNUAL USAGE: 12,426 Kwh
LAMP COST: $1.50
TOTAL ELECTRICAL DEMAND: 8.1 Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
ANNUAL SENSIBLE LOAD: 14,083 MBTU
TOTAL ANNUAL COOLING LOAD: 20,119 MBTU
ESTIMATED LAMP LIFE: 7.8 Months
ANN COOLING Kwh: 2,012

PANASONIC LAMP: 81 X 15 Watt Lamps
ANNUAL USAGE: 1,864 Kwh
LAMP COST: $13.06
TOTAL ELECTRICAL DEMAND: 1.2 Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
ANNUAL SENSIBLE LOAD: 2,112 MBTU
POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 3,018 MBTU
ESTIMATED LAMP LIFE: 87.2 Months
ANN COOLING Kwh: 302

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$1,058	$0	$0	$1,058	($1,058)
1	$186	$0	$2,622	$338	$3,147	$0	$393	$51	$1,502	$1,645
2	$186	$0	$2,622	$338	$6,293	$0	$393	$51	$1,948	$4,347
3	$186	$0	$2,622	$338	$9,440	$0	$393	$51	$2,390	$7,170
4	$186	$0	$2,622	$338	$12,586	$0	$393	$51	$2,834	$9,752
5	$186	$0	$2,622	$338	$15,733	$0	$393	$51	$3,278	$12,455

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: 0 Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: 0 Hours
TOTAL ELECTRICAL LOAD REDUCTION: 6.9 Kilowatts
TOTAL COOLING LOAD REDUCTION: 34 MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: 4.7 Months
HOURLY LABOUR RATE: $0.00
ANNUAL COST SAVINGS: $2,703
DISCOUNTED CASH RATE OF RETURN: 48.4% Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: WING 232 RMS.
LIGHTING: EFG10E28 VERSUS 40 WATT, G25 BULBS
PREPARED BY: BRENT GLASER
COMPANY: WESTBURNE - G.P.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
ROOM OCCUPANCY RATE: 70%
ANNUAL COOLING USAGE: 4 Months
Cost/Kwh: $0.168
ANNUAL LIGHTING USAGE: 1,534 Hours
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
Demand Charge: $5.50
Inflation: 0.0%
SENSIBLE RATIO: 70%

EXISTING LAMP: 216 X 40 Watt Bulbs
TOTAL ELECTRICAL DEMAND: 8.6 Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
TOTAL ANNUAL COOLING LOAD: 21,460 MBTU
ANNUAL USAGE: 13,255 Kwh
ANNUAL SENSIBLE LOAD: 15,022 MBTU
ESTIMATED LAMP LIFE: 7.8 Months
LAMP COST: $3.00
ANN COOLING Kwh: 2,146

PANASONIC LAMP: 216 X 15 Watt Lamps
TOTAL ELECTRICAL DEMAND: 3.2 Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
TOTAL ANNUAL COOLING LOAD: 8,047 MBTU
ANNUAL USAGE: 4,970 Kwh
ANNUAL SENSIBLE LOAD: 5,633 MBTU.
ESTIMATED LAMP LIFE: 87.2 Months
LAMP COST: $16.06
POWER FACTOR: 1.0
ANN COOLING Kwh: 805

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$3,469	$0	$0	$3,469	($3,469)
1	$994	$0	$2,797	$361	$4,152	$0	$1,049	$135	$4,653	($501)
2	$994	$0	$2,797	$361	$8,303	$0	$1,049	$135	$5,837	$2,466
3	$994	$0	$2,797	$361	$12,455	$0	$1,049	$135	$7,021	$5,554
4	$994	$0	$2,797	$361	$16,606	$0	$1,049	$135	$8,205	$8,401
5	$994	$0	$2,797	$361	$20,758	$0	$1,049	$135	$9,389	$11,369

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: 10 Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [illegible] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [illegible] Kilowatts
TOTAL COOLING LOAD REDUCTION: [illegible] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [illegible] Months
HOURLY LABOUR RATE: [illegible]
ANNUAL COST SAVINGS: [illegible]
DISCOUNTED CASH RATE OF RETURN: [illegible] Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: WING 259 RMS.
LIGHTING: EFS15E27 VERSUS 100 WATT TRI-LITE
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
Cost/Kwh: $0.168
Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%
ANNUAL LIGHTING USAGE: 1,534 Hours
Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
SENSIBLE RATIO: 70%

EXISTING LAMP: 104 X 100 Watt Bulbs
ANNUAL USAGE: 15,955 Kwh
LAMP COST: $1.50
TOTAL ELECTRICAL DEMAND: 10.4 Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
ANNUAL SENSIBLE LOAD: 18,082 MBTU
TOTAL ANNUAL COOLING LOAD: 25,831 MBTU
ESTIMATED LAMP LIFE: [illegible] Months
ANN COOLING Kwh: 2,583

PANASONIC LAMP: 104 X 15 Watt Lamps
ANNUAL USAGE: 2,393 Kwh
LAMP COST: $13.06
TOTAL ELECTRICAL DEMAND: 1.6 Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
ANNUAL SENSIBLE LOAD: 2,712 MBTU.
POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 3,875 MBTU
ESTIMATED LAMP LIFE: [illegible] Months
ANN COOLING Kwh: 387

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$1,358	$0	$0	$1,358	($1,358)
1	$239	$0	$3,367	$434	$4,040	$0	$505	$65	$1,928	$2,112
2	$239	$0	$3,367	$434	$8,080	$0	$505	$65	$2,498	$5,582
3	$239	$0	$3,367	$434	$12,120	$0	$505	$65	$3,069	$9,172
4	$239	$0	$3,367	$434	$16,160	$0	$505	$65	$3,639	$12,522
5	$239	$0	$3,367	$434	$20,200	$0	$505	$65	$4,209	$15,991

<u>POTENTIAL AREAS OF OPERATING COST REDUCTION</u>

ESTIMATED REPLACEMENT TIME: [illegible] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [illegible] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [illegible] Kilowatts
TOTAL COOLING LOAD REDUCTION: [illegible] MBTU/H

<u>IMPORTANT FINANCIAL CRITERIA:</u>

SIMPLE PAYBACK: [illegible] Months
HOURLY LABOUR RATE: [illegible]
ANNUAL COST SAVINGS: [illegible]
DISCOUNTED CASH RATE OF RETURN: [illegible] Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE — ZONE: WING 259 RMS.
LIGHTING: EFG10E28 VERSUS 40 WATT, G25 BULBS
PREPARED BY: KEVIN KANE — COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week — Cost/Kwh: $0.168 — Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70% — ANNUAL LIGHTING USAGE: [redacted] Hours — Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months — SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt — SENSIBLE RATIO: 70%

EXISTING LAMP: 224 X 100 Watt Bulbs — ANNUAL USAGE: 34,364 Kwh — LAMP COST: $1.50
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 1,000 Hours — ANNUAL SENSIBLE LOAD: 38,945 MBTU
TOTAL ANNUAL COOLING LOAD: 55,636 MBTU — ESTIMATED LAMP LIFE: [redacted] Months — ANN COOLING Kwh: 5,564

PANASONIC LAMP: 224 X 15 Watt Lamps — ANNUAL USAGE: 5,155 Kwh — LAMP COST: $16.06
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 10,000 Hours — ANNUAL SENSIBLE LOAD: 5,842 MBTU. — POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 8,345 MBTU — ESTIMATED LAMP LIFE: [redacted] Months — ANN COOLING Kwh: 835

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$3,597	$0	$0	$3,597	($3,597)
1	$515	$0	$7,251	$935	$8,702	$0	$1,088	$140	$4,825	$3,876
2	$515	$0	$7,251	$935	$17,403	$0	$1,088	$140	$6,053	$11,350
3	$515	$0	$7,251	$935	$26,105	$0	$1,088	$140	$7,281	$18,944
4	$515	$0	$7,251	$935	$34,807	$0	$1,088	$140	$8,509	$26,297
5	$515	$0	$7,251	$935	$43,508	$0	$1,088	$140	$9,737	$33,771

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [redacted] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [redacted] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [redacted] Kilowatts
TOTAL COOLING LOAD REDUCTION: [redacted] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [redacted] Months
HOURLY LABOUR RATE: [redacted]
ANNUAL COST SAVINGS: [redacted]
DISCOUNTED CASH RATE OF RETURN: [redacted] Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE | ZONE: WING 332 RMS.

LIGHTING: EFS15E27 VERSUS 100 WATT TRI-LITE

PREPARED BY: KEVIN KANE | COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week | Cost/Kwh: $0.168 | Demand Charge: $5.50

ROOM OCCUPANCY RATE: 70% | ANNUAL LIGHTING USAGE: [redacted] Hours | Inflation: 0.0%

ANNUAL COOLING USAGE: 4 Months | SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt | SENSIBLE RATIO: 70%

EXISTING LAMP: 81 X 100 Watt Bulbs | ANNUAL USAGE: 12,426 Kwh | LAMP COST: $1.50

TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts

RATED AVERAGE LIFE: 1,000 Hours | ANNUAL SENSIBLE LOAD: 14,083 MBTU

TOTAL ANNUAL COOLING LOAD: 20,119 MBTU | ESTIMATED LAMP LIFE: [redacted] Months | ANN COOLING Kwh: 2,012

PANASONIC LAMP: 81 X 15 Watt Lamps | ANNUAL USAGE: 1,864 Kwh | LAMP COST: $13.06

TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts

RATED AVERAGE LIFE: 10,000 Hours | ANNUAL SENSIBLE LOAD: 2,112 MBTU. | POWER FACTOR: 1.0

TOTAL ANNUAL COOLING LOAD: 3,018 MBTU | ESTIMATED LAMP LIFE: [redacted] Months | ANN COOLING Kwh: 302

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$1,058	$0	$0	$1,058	($1,058)
1	$186	$0	$2,622	$338	$3,147	$0	$393	$51	$1,502	$1,645
2	$186	$0	$2,622	$338	$6,293	$0	$393	$51	$1,946	$4,347
3	$186	$0	$2,622	$338	$9,440	$0	$393	$51	$2,390	$7,170
4	$186	$0	$2,622	$338	$12,586	$0	$393	$51	$2,834	$9,752
5	$186	$0	$2,622	$338	$15,733	$0	$393	$51	$3,278	$12,455

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [redacted] Minutes per Lamp

TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [redacted] Hours

TOTAL ELECTRICAL LOAD REDUCTION: [redacted] Kilowatts

TOTAL COOLING LOAD REDUCTION: [redacted] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [redacted] Months

HOURLY LABOUR RATE: [redacted]

ANNUAL COST SAVINGS: [redacted]

DISCOUNTED CASH RATE OF RETURN: [redacted] Per Annum After Taxes

(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: WING 332 RMS.
LIGHTING: EFG10E28 VERSUS 40 WATT, G25 BULBS
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE:	6 Hours/Day X 7 Days/Week	Cost/Kwh:	$0.168	Demand Charge:	$5.50
ROOM OCCUPANCY RATE:	70%	ANNUAL LIGHTING USAGE:	[illegible] Hours	Inflation:	0.0%
ANNUAL COOLING USAGE:	4 Months	SEASONAL ENERGY EFF. RATIO:	10.0 BTU/Watt	SENSIBLE RATIO:	70%

EXISTING LAMP:	216 X 40 Watt Bulbs	ANNUAL USAGE:	13,255 Kwh	LAMP COST:	$3.00
TOTAL ELECTRICAL DEMAND:	8.6 Kilowatts				
RATED AVERAGE LIFE:	1,000 Hours	ANNUAL SENSIBLE LOAD:	15,022 MBTU		
TOTAL ANNUAL COOLING LOAD:	21,460 MBTU	ESTIMATED LAMP LIFE:	7.8 Months	ANN COOLING Kwh:	2,146

PANASONIC LAMP:	216 X 10 Watt Lamps	ANNUAL USAGE:	3,314 Kwh	LAMP COST:	$16.06
TOTAL ELECTRICAL DEMAND:	2.2 Kilowatts				
RATED AVERAGE LIFE:	10,000 Hours	ANNUAL SENSIBLE LOAD:	3,755 MBTU.	POWER FACTOR:	1.0
TOTAL ANNUAL COOLING LOAD:	5,365 MBTU	ESTIMATED LAMP LIFE:	87.2 Months	ANN COOLING Kwh:	536

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$3,469	$0	$0	$3,469	($3,469)
1	$994	$0	$2,797	$361	$4,152	$0	$699	$90	$4,258	($107)
2	$994	$0	$2,797	$361	$8,303	$0	$699	$90	$5,048	$3,256
3	$994	$0	$2,797	$361	$12,455	$0	$699	$90	$5,837	$6,738
4	$994	$0	$2,797	$361	$16,606	$0	$699	$90	$6,626	$9,980
5	$994	$0	$2,797	$361	$20,758	$0	$699	$90	$7,416	$13,342

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [illegible] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [illegible] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [illegible] Kilowatts
TOTAL COOLING LOAD REDUCTION: [illegible] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [illegible] Months
HOURLY LABOUR RATE: [illegible]
ANNUAL COST SAVINGS: [illegible]
DISCOUNTED CASH RATE OF RETURN: [illegible] Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
LIGHTING: EFS15E27 VERSUS 100 WATT TRI-LITE
PREPARED BY: KEVIN KANE

ZONE: WING 359 RMS.
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
ROOM OCCUPANCY RATE: 70%
ANNUAL COOLING USAGE: 4 Months

Cost/Kwh: $0.168
ANNUAL LIGHTING USAGE: 1,534 Hours
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt

Demand Charge: $5.50
Inflation: 0.0%
SENSIBLE RATIO: 70%

EXISTING LAMP: 210 X 100 Watt Bulbs
TOTAL ELECTRICAL DEMAND: 21.0 Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
TOTAL ANNUAL COOLING LOAD: 52,159 MBTU

ANNUAL USAGE: 32,216 Kwh
ANNUAL SENSIBLE LOAD: 36,511 MBTU
ESTIMATED LAMP LIFE: 7.8 Months

LAMP COST: $1.50
ANN COOLING Kwh: 5,216

PANASONIC LAMP: 210 X 15 Watt Lamps
TOTAL ELECTRICAL DEMAND: 3.1 Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
TOTAL ANNUAL COOLING LOAD: 7,824 MBTU

ANNUAL USAGE: 4,832 Kwh
ANNUAL SENSIBLE LOAD: 5,477 MBTU.
ESTIMATED LAMP LIFE: 87.2 Months

LAMP COST: $13.06
POWER FACTOR: 1.0
ANN COOLING Kwh: 782

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$2,743	$0	$0	$2,743	($2,743)
1	$483	$0	$6,798	$876	$8,158	$0	$1,020	$131	$3,894	$4,264
2	$483	$0	$6,798	$876	$16,316	$0	$1,020	$131	$5,045	$11,271
3	$483	$0	$6,798	$876	$24,473	$0	$1,020	$131	$6,196	$18,397
4	$483	$0	$6,798	$876	$32,631	$0	$1,020	$131	$7,347	$25,284
5	$483	$0	$6,798	$876	$40,789	$0	$1,020	$131	$8,499	$32,290

<u>POTENTIAL AREAS OF OPERATING COST REDUCTION</u>

ESTIMATED REPLACEMENT TIME: [illegible] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [illegible] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [illegible] Kilowatts
TOTAL COOLING LOAD REDUCTION: [illegible] MBTU/H

<u>IMPORTANT FINANCIAL CRITERIA:</u>

SIMPLE PAYBACK: [illegible] Months
HOURLY LABOUR RATE: [illegible]
ANNUAL COST SAVINGS: [illegible]
DISCOUNTED CASH RATE OF RETURN: [illegible] Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: ATLAS WING
LIGHTING: EFS15E27 VERSUS 100 WATT TRI-LITE
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE:	6 Hours/Day X 7 Days/Week	Cost/Kwh:	$0.168	Demand Charge:	$5.50
ROOM OCCUPANCY RATE:	70%	ANNUAL LIGHTING USAGE:	[illegible] Hours	Inflation:	0.0%
ANNUAL COOLING USAGE:	4 Months	SEASONAL ENERGY EFF. RATIO:	10.0 BTU/Watt	SENSIBLE RATIO:	70%

EXISTING LAMP:	59 X 100 Watt Bulbs	ANNUAL USAGE:	9,051 Kwh	LAMP COST:	$1.50
TOTAL ELECTRICAL DEMAND:	5.9 Kilowatts				
RATED AVERAGE LIFE:	1,000 Hours	ANNUAL SENSIBLE LOAD:	10,258 MBTU		
TOTAL ANNUAL COOLING LOAD:	14,654 MBTU	ESTIMATED LAMP LIFE:	7.8 Months	ANN COOLING Kwh:	1,465

PANASONIC LAMP:	59 X 15 Watt Lamps	ANNUAL USAGE:	1,358 Kwh	LAMP COST:	$13.06
TOTAL ELECTRICAL DEMAND:	0.9 Kilowatts				
RATED AVERAGE LIFE:	10,000 Hours	ANNUAL SENSIBLE LOAD:	1,539 MBTU.	POWER FACTOR:	1.0
TOTAL ANNUAL COOLING LOAD:	2,198 MBTU	ESTIMATED LAMP LIFE:	87.2 Months	ANN COOLING Kwh:	220

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$771	$0	$0	$771	($771)
1	$136	$0	$1,910	$246	$2,292	$0	$286	$37	$1,094	$1,198
2	$136	$0	$1,910	$246	$4,584	$0	$286	$37	$1,417	$3,167
3	$136	$0	$1,910	$246	$6,876	$0	$286	$37	$1,741	$5,255
4	$136	$0	$1,910	$246	$9,168	$0	$286	$37	$2,064	$7,104
5	$136	$0	$1,910	$246	$11,460	$0	$286	$37	$2,388	$9,072

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [redacted] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [redacted] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [redacted] Kilowatts
TOTAL COOLING LOAD REDUCTION: [redacted] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [redacted] Months
HOURLY LABOUR RATE: [redacted]
ANNUAL COST SAVINGS: [redacted]
DISCOUNTED CASH RATE OF RETURN: [redacted] Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
LIGHTING: EFG10E28 VERSUS 40 WATT, G25 BULBS
PREPARED BY: KEVIN KANE

ZONE: ATLAS WING
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
ROOM OCCUPANCY RATE: 70%
ANNUAL COOLING USAGE: 4 Months
Cost/Kwh: $0.168
ANNUAL LIGHTING USAGE: [redacted] Hours
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
Demand Charge: $5.50
Inflation: 0.0%
SENSIBLE RATIO: 70%

EXISTING LAMP: 108 X 40 Watt Bulbs
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
TOTAL ANNUAL COOLING LOAD: 10,730 MBTU
ANNUAL USAGE: 6,627 Kwh
ANNUAL SENSIBLE LOAD: 7,511 MBTU
ESTIMATED LAMP LIFE: [redacted] Months
LAMP COST: $3.00
ANN COOLING Kwh: 1,073

PANASONIC LAMP: 108 X 10 Watt Lamps
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
TOTAL ANNUAL COOLING LOAD: 2,682 MBTU
ANNUAL USAGE: 1,657 Kwh
ANNUAL SENSIBLE LOAD: 1,878 MBTU.
ESTIMATED LAMP LIFE: [redacted] Months
LAMP COST: $16.06
POWER FACTOR: 1.0
ANN COOLING Kwh: 268

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$1,734	$0	$0	$1,734	($1,734)
1	$497	$0	$1,399	$180	$2,076	$0	$350	$45	$2,129	($53)
2	$497	$0	$1,399	$180	$4,152	$0	$350	$45	$2,524	$1,628
3	$497	$0	$1,399	$180	$6,227	$0	$350	$45	$2,919	$3,429
4	$497	$0	$1,399	$180	$8,303	$0	$350	$45	$3,313	$4,990
5	$497	$0	$1,399	$180	$10,379	$0	$350	$45	$3,708	$6,671

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [redacted] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [redacted] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [redacted] Kilowatts
TOTAL COOLING LOAD REDUCTION: [redacted] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [redacted] Months
HOURLY LABOUR RATE: [redacted]
ANNUAL COST SAVINGS: [redacted]
DISCOUNTED CASH RATE OF RETURN: [redacted] Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: OFFICE WING RMS.
LIGHTING: EFS15E27 VERSUS 100 WATT TRI-LITE
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
Cost/Kwh: $0.168
Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%
ANNUAL LIGHTING USAGE: 1,534 Hours
Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
SENSIBLE RATIO: 70%

EXISTING LAMP: 51 X 100 Watt Bulbs
ANNUAL USAGE: 7,824 Kwh
LAMP COST: $1.50
TOTAL ELECTRICAL DEMAND: 5.1 Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
ANNUAL SENSIBLE LOAD: 8,867 MBTU
TOTAL ANNUAL COOLING LOAD: 12,667 MBTU
ESTIMATED LAMP LIFE: 7.8 Months
ANN COOLING Kwh: 1,267

PANASONIC LAMP: 51 X 15 Watt Lamps
ANNUAL USAGE: 1,174 Kwh
LAMP COST: $13.06
TOTAL ELECTRICAL DEMAND: 0.8 Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
ANNUAL SENSIBLE LOAD: 1,330 MBTU.
POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 1,900 MBTU
ESTIMATED LAMP LIFE: 87.2 Months
ANN COOLING Kwh: 190

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$666	$0	$0	$666	($666)
1	$117	$0	$1,651	$213	$1,981	$0	$248	$32	$946	$1,036
2	$117	$0	$1,651	$213	$3,962	$0	$248	$32	$1,225	$2,737
3	$117	$0	$1,651	$213	$5,944	$0	$248	$32	$1,505	$4,559
4	$117	$0	$1,651	$213	$7,925	$0	$248	$32	$1,784	$6,140
5	$117	$0	$1,651	$213	$9,906	$0	$248	$32	$2,064	$7,842

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: 0 Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: 0 Hours
TOTAL ELECTRICAL LOAD REDUCTION: 4.3 Kilowatts
TOTAL COOLING LOAD REDUCTION: 21 MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: 4.7 Months
HOURLY LABOUR RATE: $0.00
ANNUAL COST SAVINGS: $1,702
DISCOUNTED CASH RATE OF RETURN: 48.4% Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

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PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: OFFICE WING RMS.
LIGHTING: EFG10E28 VERSUS 40 WATT, G25 BULBS
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANAOA INC.

ESTIMATED LIGHTING USAGE: 6 Hours/Day X 7 Days/Week
Cost/Kwh: $0.168
Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%
ANNUAL LIGHTING USAGE: 1,534 Hours
Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
SENSIBLE RATIO: 70%

EXISTING LAMP: 154 X 40 Watt Bulbs
ANNUAL USAGE: 9,450 Kwh
LAMP COST: $3.00
TOTAL ELECTRICAL DEMAND: 6.2 Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
ANNUAL SENSIBLE LOAD: 10,710 MBTU
TOTAL ANNUAL COOLING LOAD: 15,300 MBTU
ESTIMATED LAMP LIFE: 7.8 Months
ANN COOLING Kwh: 1,530

PANASONIC LAMP: 154 X 10 Watt Lamps
ANNUAL USAGE: 2,363 Kwh
LAMP COST: $16.06
TOTAL ELECTRICAL DEMAND: 1.5 Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
ANNUAL SENSIBLE LOAD: 2,678 MBTU.
POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 3,825 MBTU
ESTIMATED LAMP LIFE: 87.2 Months
ANN COOLING Kwh: 383

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$2,473	$0	$0	$2,473	($2,473)
1	$709	$0	$1,994	$257	$2,960	$0	$499	$64	$3,036	($76)
2	$709	$0	$1,994	$257	$5,920	$0	$499	$64	$3,599	$2,321
3	$709	$0	$1,994	$257	$8,880	$0	$499	$64	$4,162	$4,838
4	$709	$0	$1,994	$257	$11,840	$0	$499	$64	$4,724	$7,115
5	$709	$0	$1,994	$257	$14,800	$0	$499	$64	$5,287	$9,513

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: 0 Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: 0 Hours
TOTAL ELECTRICAL LOAD REDUCTION: 4.6 Kilowatts
TOTAL COOLING LOAD REDUCTION: 28 MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: 12.4 Months
HOURLY LABOUR RATE: $0.00
ANNUAL COST SAVINGS: $2,387
DISCOUNTED CASH RATE OF RETURN: 28.1% Per Annum After Taxes
(AFTER 87.2 MONTHS)

NOTE:

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PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: RESTAURANT / LOUNGE
LIGHTING: EFT15E28 VERSUS 100 WATT A19 BULBS
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 16 Hours/Day X 7 Days/Week
Cost/Kwh: $0.168
Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%
ANNUAL LIGHTING USAGE: [redacted] Hours
Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
SENSIBLE RATIO: 70%

EXISTING LAMP: 30 X 100 Watt Bulbs
ANNUAL USAGE: 12,273 Kwh
LAMP COST: $0.50
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
ANNUAL SENSIBLE LOAD: 13,909 MBTU
TOTAL ANNUAL COOLING LOAD: 19,870 MBTU
ESTIMATED LAMP LIFE: [redacted] Months
ANN COOLING Kwh: 1,987

PANASONIC LAMP: 30 X 15 Watt Lamps
ANNUAL USAGE: 1,841 Kwh
LAMP COST: $15.94
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
ANNUAL SENSIBLE LOAD: 2,086 MBTU.
POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 2,981 MBTU
ESTIMATED LAMP LIFE: [redacted] Months
ANN COOLING Kwh: 298

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$478	$0	$0	$478	($478)
1	$61	$0	$2,260	$334	$2,655	$0	$339	$50	$867	$1,788
2	$61	$0	$2,260	$334	$5,310	$0	$339	$50	$1,256	$4,054
3	$61	$0	$2,260	$334	$7,965	$0	$339	$50	$1,645	$6,440
4	$61	$0	$2,260	$334	$10,620	$0	$339	$50	$2,034	$8,586
5	$61	$0	$2,260	$334	$13,275	$0	$339	$50	$2,423	$10,852

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [redacted] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [redacted] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [redacted] Kilowatts
TOTAL COOLING LOAD REDUCTION: [redacted] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [redacted] Months
HOURLY LABOUR RATE: [redacted]
ANNUAL COST SAVINGS: [redacted]
DISCOUNTED CASH RATE OF RETURN: [redacted] Per Annum After Taxes
(AFTER 43.9 MONTHS)

NOTE:

Annual usage values and operating costs are estimates based on the information provided by the end user and/or the local utility. These estimates are intended to provide only a common basis for the comparison of the lighting sources in question. While care has been taken in the preparation of these estimates, no responsibility can be assumed for any miscalculation or other error, including any omission of data.

PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT:	WESTMARK HOTEL - WHITEHORSE	ZONE:	RESTAURANT / LOUNGE
LIGHTING:	EFG15E28 VERSUS 65 WATT R30 FLOOD		
PREPARED BY:	KEVIN KANE	COMPANY:	PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 16 Hours/Day X 7 Days/Week	Cost/Kwh: $0.168	Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%	ANNUAL LIGHTING USAGE: [illegible] Hours	Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months	SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt	SENSIBLE RATIO: 70%

EXISTING LAMP: 20 X 65 Watt Bulbs	ANNUAL USAGE: 5,318 Kwh	LAMP COST: $3.00
TOTAL ELECTRICAL DEMAND: [illegible] Kilowatts		
RATED AVERAGE LIFE: 1,000 Hours	ANNUAL SENSIBLE LOAD: 6,027 MBTU	
TOTAL ANNUAL COOLING LOAD: 8,610 MBTU	ESTIMATED LAMP LIFE: [illegible] Months	ANN COOLING Kwh: 861

PANASONIC LAMP: 20 X 15 Watt Lamps	ANNUAL USAGE: 1,227 Kwh	LAMP COST: $16.06
TOTAL ELECTRICAL DEMAND: [illegible] Kilowatts		
RATED AVERAGE LIFE: 10,000 Hours	ANNUAL SENSIBLE LOAD: 1,391 MBTU.	POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 1,987 MBTU	ESTIMATED LAMP LIFE: [illegible] Months	ANN COOLING Kwh: 199

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$321	$0	$0	$321	($321)
1	$245	$0	$979	$145	$1,369	$0	$226	$33	$581	$789
2	$245	$0	$979	$145	$2,739	$0	$226	$33	$840	$1,899
3	$245	$0	$979	$145	$4,108	$0	$226	$33	$1,099	$3,129
4	$245	$0	$979	$145	$5,477	$0	$226	$33	$1,359	$4,119
5	$245	$0	$979	$145	$6,847	$0	$226	$33	$1,618	$5,229

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [illegible] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [illegible] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [illegible] Kilowatts
TOTAL COOLING LOAD REDUCTION: [illegible] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [illegible] Months
HOURLY LABOUR RATE: [illegible]
ANNUAL COST SAVINGS: [illegible]
DISCOUNTED CASH RATE OF RETURN: [illegible] Per Annum After Taxes
(AFTER 43.9 MONTHS)

NOTE:

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PANASONIC LIGHTING
DISCOUNTED CASH RATE OF RETURN ANALYSIS

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
ZONE: RESTAURANT / LOUNGE
LIGHTING: EFG15E28 VERSUS 60 WATT A19 BULBS
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

ESTIMATED LIGHTING USAGE: 16 Hours/Day X 7 Days/Week
Cost/Kwh: $0.168
Demand Charge: $5.50
ROOM OCCUPANCY RATE: 70%
ANNUAL LIGHTING USAGE: [redacted] Hours
Inflation: 0.0%
ANNUAL COOLING USAGE: 4 Months
SEASONAL ENERGY EFF. RATIO: 10.0 BTU/Watt
SENSIBLE RATIO: 70%

EXISTING LAMP: 20 X 60 Watt Bulbs
ANNUAL USAGE: 4,909 Kwh
LAMP COST: $0.50
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 1,000 Hours
ANNUAL SENSIBLE LOAD: 5,564 MBTU
TOTAL ANNUAL COOLING LOAD: 7,948 MBTU
ESTIMATED LAMP LIFE: [redacted] Months
ANN COOLING Kwh: 795

PANASONIC LAMP: 20 X 15 Watt Lamps
ANNUAL USAGE: 1,227 Kwh
LAMP COST: $15.94
TOTAL ELECTRICAL DEMAND: [redacted] Kilowatts
RATED AVERAGE LIFE: 10,000 Hours
ANNUAL SENSIBLE LOAD: 1,391 MBTU.
POWER FACTOR: 1.0
TOTAL ANNUAL COOLING LOAD: 1,987 MBTU
ESTIMATED LAMP LIFE: [redacted] Months
ANN COOLING Kwh: 199

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$319	$0	$0	$319	($319)
1	$41	$0	$904	$134	$1,078	$0	$226	$33	$578	$500
2	$41	$0	$904	$134	$2,157	$0	$226	$33	$838	$1,319
3	$41	$0	$904	$134	$3,235	$0	$226	$33	$1,097	$2,258
4	$41	$0	$904	$134	$4,313	$0	$226	$33	$1,356	$2,957
5	$41	$0	$904	$134	$5,392	$0	$226	$33	$1,616	$3,776

POTENTIAL AREAS OF OPERATING COST REDUCTION

ESTIMATED REPLACEMENT TIME: [redacted] Minutes per Lamp
TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [redacted] Hours
TOTAL ELECTRICAL LOAD REDUCTION: [redacted] Kilowatts
TOTAL COOLING LOAD REDUCTION: [redacted] MBTU/H

IMPORTANT FINANCIAL CRITERIA:

SIMPLE PAYBACK: [redacted] Months
HOURLY LABOUR RATE: [redacted]
ANNUAL COST SAVINGS: [redacted]
DISCOUNTED CASH RATE OF RETURN: [redacted] Per Annum After Taxes
(AFTER 43.9 MONTHS)

NOTE:

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PROJECT SUMMARY

PANASONIC LIGHTING

SUMMARY OF DISCOUNTED CASH RATE OF RETURN ANALYSES

Print Date: 1/7/00

PROJECT: WESTMARK HOTEL - WHITEHORSE
PREPARED BY: KEVIN KANE
COMPANY: PANASONIC CANADA INC.

EXISTING LAMPS

TOTAL NUMBER OF LAMPS:	1,669	TOTAL LAMP KILOWATTS:	123.8	ANNUAL COOLING Kwh:	33,016
TOTAL ANNUAL LAMP Kwh:	203,922	ANNUAL LIGHTING ENERGY COST:	$42,427	ANNUAL COOLING ENERGY COST:	$5,547
ESTIMATED INFLATION RATE:	0.0%	ANN REPLACEMENT LAMP COST:	$5,624	TOTAL ANNUAL LIGHTING COST:	[redacted]

Panasonic LAMPS

TOTAL NUMBER OF LAMPS:	1,669	TOTAL LAMP KILOWATTS:	22.6	ANNUAL COOLING kwh:	6,059
TOTAL ANNUAL LAMP Kwh:	37,424	ANNUAL LIGHTING ENERGY COST:	$7,782	ANNUAL COOLING ENERGY COST:	$1,018
ESTIMATED INFLATION RATE:	0.0%	COST OF LIGHT CAPSULES:	$24,755	TOTAL ANNUAL LIGHTING COST:	[redacted]

YEAR	REPLACEMT LAMP COST	LABOUR COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	RETROFIT LAMP COST	Kwh & DEMAND	COOLING COST	CUMULATIVE COST	CUMULATIVE SAVINGS
0	$0	$0	$0	$0	$0	$24,755	$0	$0	$24,755	($24,755)
1	$5,624	$0	$42,427	$5,547	$53,598	$0	$7,782	$1,018	$33,555	$20,043
2	$5,624	$0	$42,427	$5,547	$107,196	$0	$7,782	$1,018	$42,355	$64,841
3	$5,624	$0	$42,427	$5,547	$160,794	$0	$7,782	$1,018	$51,154	$109,759
4	$5,624	$0	$42,427	$5,547	$214,392	$0	$7,782	$1,018	$59,954	$154,437
5	$5,624	$0	$42,427	$5,547	$267,990	$0	$7,782	$1,018	$68,754	$199,236

<u>SUMMARY OF AREAS OF POTENTIAL OPERATING COST REDUCTION:</u>

TOTAL ANNUAL REPLACEMENT LABOUR SAVING: [redacted] Hours

TOTAL ELECTRICAL LOAD REDUCTION: [redacted] Kilowatts

TOTAL COOLING LOAD REDUCTION: [redacted] MBTU/H

<u>SUMMARY OF IMPORTANT FINANCIAL CRITERIA:</u>

SIMPLE PAYBACK: [redacted] Months

ELECTRICAL COST SAVINGS: [redacted] Per Annum

DISCOUNTED CASH RATE OF RETURN: [redacted] Per Annum After Taxes.
(AFTER 5 YEARS)

NOTE:

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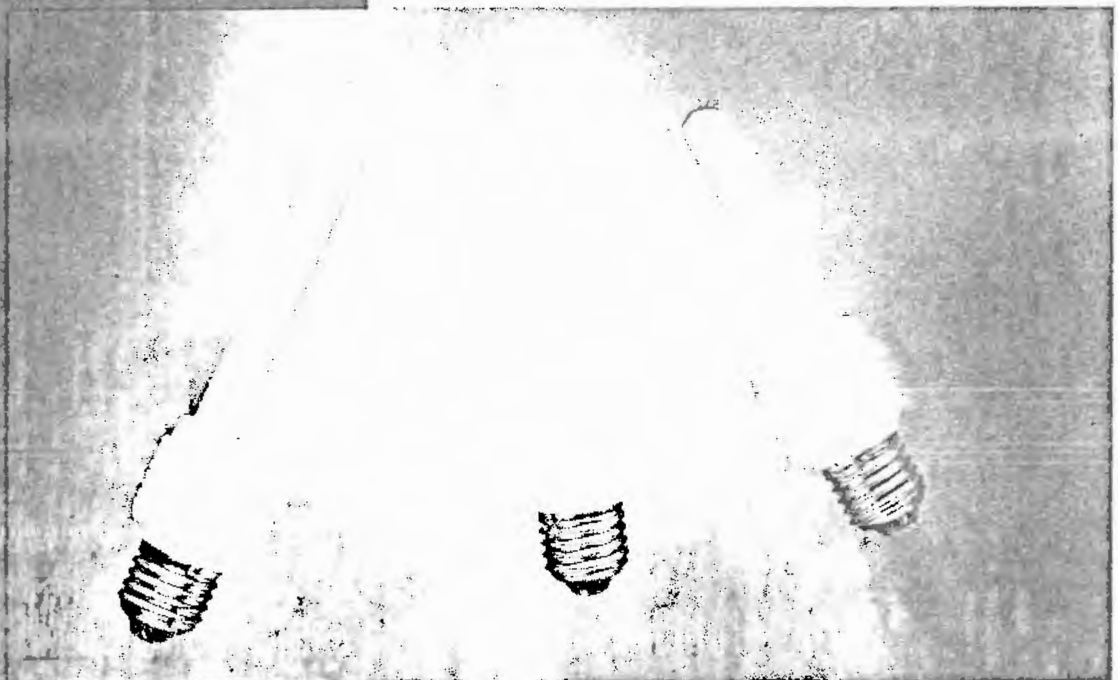
Panasonic

Economically Priced Compact Fluorescent Lamps. . .



. . . with no compromise in quality or performance.

Advanced Electronics
Superior Efficiency
Ultra Slim Design
Extra Long Life

Panasonic LIGHTING

5770 Ambler Drive, Mississauga, ON L4W 2T3
Tel.: (905) 238-2302 Fax: (905) 238-2414

New **Panasonic** ELECTRONIC QUAD-TUBES
Our most economically priced self-ballasted compact fluorescent lamps ever offer these advantages:

Designed to replace standard 40, 60 and 75 watt light bulbs **reducing electrical costs by over 70%.**

Long life, **up to 10 times longer** than ordinary incandescent light bulbs, **reduces replacement labour cost.**

New economical price makes them more cost effective than other screw-in compact fluorescent lamps.

Light immediately without annoying flicker, for safety and convenience.

Ultra-slim design allows ELECTRONIC QUAD-TUBES to be used in very low profile light fixtures.

High quality [illegible] will enhance [illegible]

Will start at [illegible]

Panasonic

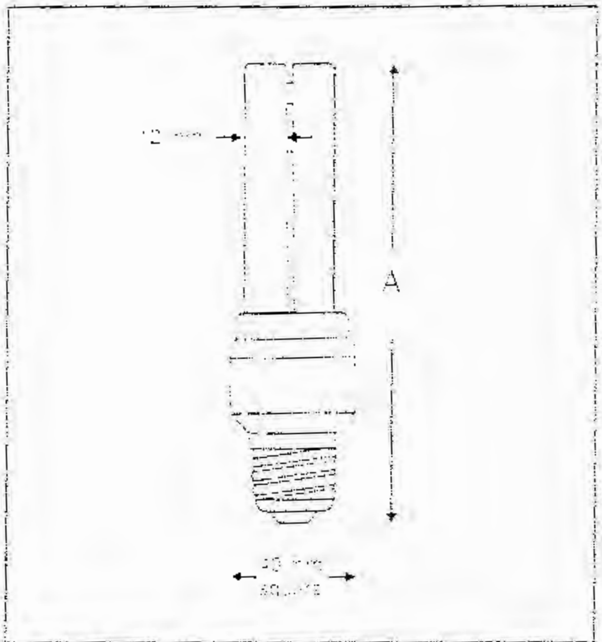
The high initial cost of compact fluorescent lamps has been one of the major obstacles to their wide spread use, especially in residential applications. Panasonic ELECTRONIC QUAD TUBES have overcome this cost barrier. Finally! High performance compact fluorescent lamps at an economical price.

Panasonic's ELECTRONIC QUAD TUBES lamps provide instant, maintenance free service, with a rated life expectancy of 10,000 hours. The high efficiency screw-in lamps will start at temperatures as low as minus 30 C.

Consuming 75% less energy, the Panasonic ELECTRONIC QUAD TUBES of 11, 15 and 20-watt models will fit into light sockets traditionally reserved for GLS bulbs.

Panasonic ELECTRONIC QUAD-TUBES are extremely lightweight and provide superior lumen output. The 11-watt model features output of 600 initial lumens, the 15-watt model features output of 900 initial lumens and the 20-watt model features output of 1200 initial lumens.

Panasonic ELECTRONIC QUAD-TUBES also feature excellent colour rendition of 84 CRI and a colour temperature of 2700K to provide a soft, warm glow comparable to incandescent light.



SUGGESTED INDOOR APPLICATIONS

Table lamps, wall sconces, recessed ceiling fixtures, ceiling fans, livestock barns - almost anywhere that incandescent lamps are used.

SUGGESTED OUTDOOR APPLICATIONS

Coach lamps, porch and patio lighting, garage lighting, garage door openers, recessed fixtures, agricultural or commercial yard lighting. Almost any application not directly exposed to the elements.

Specifications subject to change without notice

DIMENSIONS

Ordering Code	A (mm)
EFS11E27	136 mm
EFS15E27	151 mm
EFS20E27	172 mm

SPECIFICATIONS

Ordering Code	Shape	Rated Volts	Rated Watts	Equiv. Incan. Lamp (W)	Initial Lumens (lm)	Rated Life (h)	Base	Min. Start Temp.	Colour (K)	CRI	Weight (gm)	Case Qty.
EFS11E27	QUAD	120	11	50	600	10,000	MED	-30 C	2700	84	68	10
EFS15E27	QUAD	120	15	60	900	10,000	MED	-30 C	2700	84	82	10
EFS20E27	QUAD	120	20	75	1200	10,000	MED	-30 C	2700	84	100	10

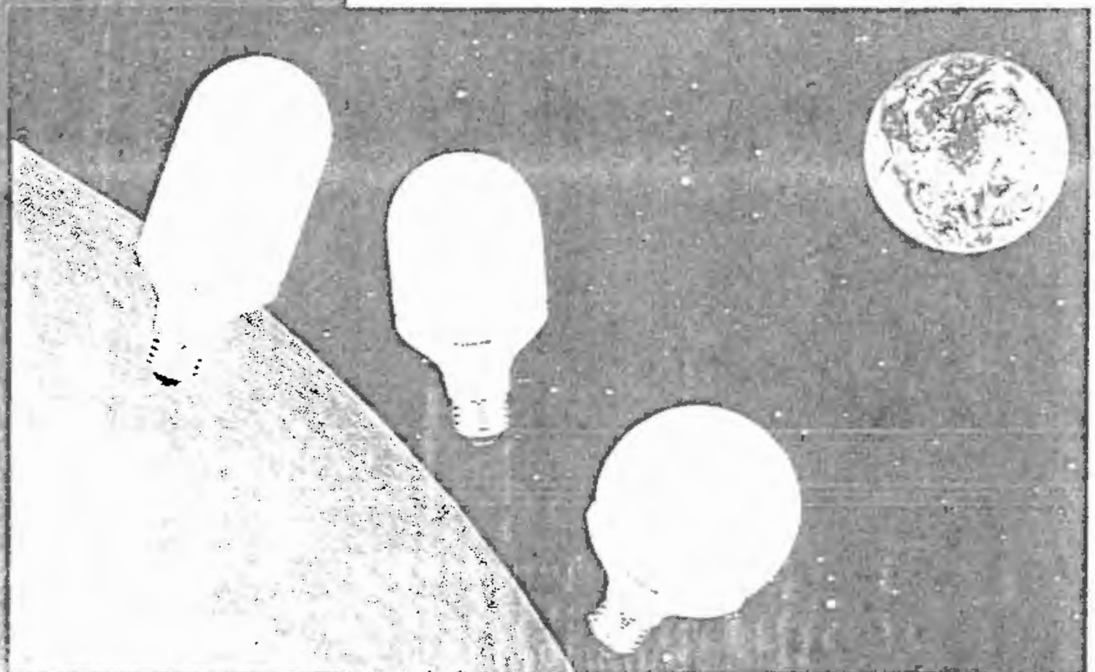
*MED [illegible] E26/24 [illegible] E26/24 based on IEC. Power Factor >60%, Total Harmonic Distortion [illegible]

Panasonic

Dealer Address:

Panasonic®

The shape of the future . . .



. . . highlighting the form in high performance.

Attractive Design
Super-Efficiency
Extra Long Life
Ultra-Compact

Panasonic LIGHTING
ISO 9002
[illegible] Drive, [illegible] ON [illegible]
Tel [illegible]

Attractive new **Panasonic** ELECTRONIC LIGHT CAPSULES are smaller, brighter and more efficient than any we have offered to date. Designed to last at least 10 times longer than ordinary incandescent light bulbs, and to reduce electrical costs by over 70%, **Panasonic** ELECTRONIC LIGHT CAPSULES offer these significant advantages:

1. Light immediately without annoying flicker, for both convenience and safety, at temperatures down to -30° C.
2. Double amalgam technology maintains rated light output at extremely low, as well as extremely high temperatures, indoors or out.
3. Ultra-compact size - both the EFT15 and EFT20 are the same diameter as a normal light bulb - and tastefully contoured base allow the replacement of any incandescent light bulb in almost any application.
4. Attractively styled glass diffuser complements the appearance of [illegible] the most elegant light fixtures.
5. Newly [illegible] phosphors give a natural [illegible]
6. [illegible] power [illegible]

Panasonic

EFG Globe-shaped Light Capsule

The early generations of compact fluorescent lamps were unable to displace the venerable, but energy hungry, incandescent light bulb. Educated consumers demand a smaller, light weight, attractive design that will provide immediate light, without flicker, indoors or out, summer or winter. In short, although they are environmentally responsible, most consumers are not prepared to compromise on performance, quality or appearance!

Our engineers, with over 15 years of experience in the development of screw-in compact fluorescent lamps, have responded with the introduction of the newest generation of **Panasonic** ELECTRONIC LIGHT CAPSULES. They are available in 2 attractive configurations, 5 wattage ratings and 2 colour temperatures. The EFG10E, EFG15E and EFG25E Globes are designed to replace "Fat Albert" type lamps in decorative applications. The ultra-compact EFT15E and EFT20E are shaped like futuristic "A" lamps and because they are the same diameter, can replace traditional 60 and 75 watt light bulbs in virtually any application. The slightly larger EFT28E will replace a 100 watt incandescent lamp. **Panasonic** Pana-FLECTORS are available for EFT models allowing them to replace most "R" and "PAR" type light bulbs in recessed fixtures and track lighting.

IMPORTANT DESIGN FEATURES

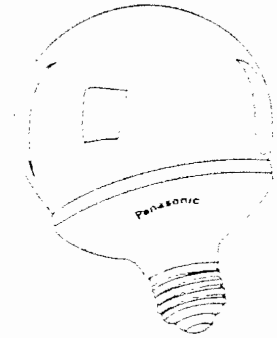
- state of the art rapid switching power transistors and extremely heat resistant electrolytic capacitors allow a small, lightweight rugged ballast that is virtually immune to voltage fluctuation or extremes of temperature.
- high quality triphosphors give a more natural coloured light with a colour rendering index (CRI) of up to 88.
- advanced electronic circuitry allows rapid, flicker free starts, even at frigid outdoor temperatures.
- double amalgam technology for rapid build up to, and uniform maintenance of, usable light output, over a broad ambient temperature range.
- a break resistant glass diffuser is bonded to a heat resistant Polybutylene telephthalate base and a corrosion resistant nickel plated screw cap to maximize cost savings by ensuring years of trouble free operation.

SUGGESTED INDOOR APPLICATIONS

Tiffany lamps, swag lamps, table lamps, vanity lighting, track lighting, recessed ceiling fixtures, ceiling fans, livestock barns - Almost anywhere that incandescent lamps are used.

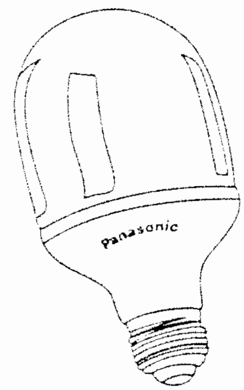
SUGGESTED OUTDOOR APPLICATIONS

Coach lamps, porch and patio lighting, garage lighting, garage door openers, recessed fixtures, [illegible] commercial yard lighting. Almost any application not directly exposed to the elements.



Model Number	Rated Watts	Initial Lumens	Height/ Diameter (mm)	Weight (grams)	Min Starting Temp.
EFG10E	10	500	130 / 95	160	-30°C
EFG15E	15	850	130 / 95	160	-30°C
EFG25E	25	1370	135 / 95	180	-30°C

EFT Tubular-shaped Light Capsule



Model Number	Rated Watts	Initial Lumens	Height/ Diameter (mm)	Weight (grams)	Min Starting Temp.
EFT15E	15	850	135 / 60	130	-30°C
EFT20E	20	1200	157 / 60	150	-30°C
EFT28E	28	1750	169 / 70	190	-30°C

TECHNICAL NOTES

Colour Temperatures - 2800K at 84 CRI, 5000K at 88 CRI

Rated Average Life - 10,000 Hours

Rated Voltage - 120 Volts, 60 Hertz

Medium Screw Base

Power Factor: <60%, Total Harmonic Distortion: [illegible]

Panasonic
Panasonic Canada Inc. 577[illegible] Amb[illegible] Drive, M[illegible]
[illegible] Fax: 905 [illegible]

LUTRON THE WORLD LEADER IN LIGHTING CONTROL SINCE 1961

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Decide if your application calls for architectural, high performance, or lighting management dimming.

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Fluorescent

1% Architectural Dimming

Hi-lume Electronic Fluorescent Dimming Ballasts deliver true architectural dimr performance from 100% to 1% measured light (10% perceived). They meet th applications, and are ideal for executive, computer intensive, and presentation

HI-LUME

- Dims T8 and T12 linear fluorescent lamps to 1%
- 3-wire line voltage control

HI-LUME

- Dims new T5 high output linea
- Slim profile design--just 1" higl
- 3-wire line voltage control

5% High Performance Dimming

Dimming Systems Technical Guide

Hi-Lume Ballast Information

Tu-Wire Ballast Information

Eco10 Ballast Information

Hi-lume and Eco-10 (ECO-series) Single Source Controls

Tu-Wire Single Source Controls

Eco-10 (TVE) Single Source Controls

Hi-Lume Compact and Tu-Wire Electronic Fluorescent Dimming Ballasts offer I perofrmance dimming --from 100% to 5% measured light (22% perceived). Th designed for demanding applications, including energy efficient compact and lii

HI-LUME COMPACT

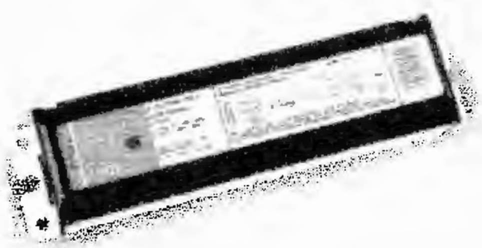
- Dims T4 and T5 twin tube compact fluorescent lamps to 5%
- 3-wire line voltage control

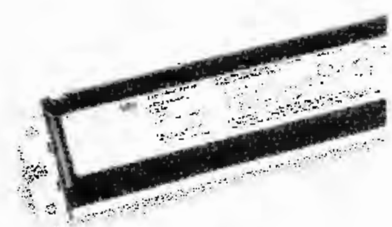
TU-WIRE

- Dims T8 linear and T4 compac lamps to 5%
- 2-wire line voltage power and
- Color-keyed push-in connectoı without leads)

10% Lighting Management Dimming

Eco-10 Electronic Fluorescent Dimming Ballasts provide lighting management applications. they dim from 100% to 10% measured light (32% perceived) and commercial and institutional applications, including daylight harvesting.





ECO-10 (ECO-SERIES)

- Dims T8 linear and T5 twin tube compact fluorescent lamps to 10%
- 3-wire line voltage control

ECO-10 (TVE-SERIES)

- Dims T8 linear, T4 compact ar fluorescent lamps to 10%
- 0 - 10 VDC control
- For retrofits or new constructic control and power wiring are tc

Lutron ballasts for T5, T8, and T12 lamps are available through distribution and for OEM fixture installation. Ballasts that dim T4 lamps are intended only for OEM fixture installation.

7200 Suter Rd.
Coopersburg, PA 18036 USA
Phone: 610-282-3800
Technical HOTLINE:
1-800-523-9466 / product@lutron.com
Questions or problems with this page:
webmaster@lutron.com

EnerTech Systems, Inc.

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Sample Cost Savings

Sample Cost Savings

Sample 2

Type of facility:	Manufacturing Facility
Fixture type:	1x8 two lamp strip fixture Two F96CW/SS/HO lamps & 1 standa ballast
Fixture consumption:	228 watts/hour
Fixture quantity:	500
Hours	M-F 17 hours/day S-S 5 hours/week
Electrical cost:	$0.10/KWH

SOLUTION

Install custom design optical reflector, electronic ballast and F32'

New fixture consumption:	110 watts
Power reduction:	118 watts (52%)

Additional benefits:	Improved lighting quality Reduced air conditioning require Reduced maintenance cost Longer lamp life (66% longer)
Annual KWH savings:	276,120 KWH
Annual Cost savings:	$27,612

Click on another sample to see some more examples of cost sav

Sample 1 Sample 3 Sample 4

EnerTech Systems, Inc.

Energy Efficient Lighting Technology

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Sample Cost Savings

Sample 3

Type of facility:

Fixture type:

Fixture quantity:

Fixture consumption: Warehouse

Hours 1,000 watt Mercury Vapor high bay

1,080 watts/hour

Electrical cost:

300

M-F 10 hours/day
S-S 5 hours/week

$0.10/KWH

SOLUTION

Retrofit existing fixture to 400 watt Metal Halide

New fixture consumption:	460 watts
Power reduction:	620 watts (57%)
Additional benefits:	Improved lighting quality Reduced air conditioning require
Annual KWH savings:	531,960 KWH
Annual Cost savings:	$53,196

Click on another sample to see some more examples of cost savi

Sample 1 Sample 2 Sample 4

ENERTECH Systems, Inc.

Energy Efficient Lighting Technology

Sample Cost Sheet

Sample 4

Type of facility:	Hotel/Retail
Fixture type:	Recessed downlight with 75 watt R40 I
Fixture consumption:	75 watts/hour
Fixture Quantity:	500
Hours:	M-F 18 hours/day S-S 18 hours/week
Electrical cost:	$0.10/KWH

SOLUTION

Replace with 13 watt compact fluorescent lamp

New fixture consumption:	15 watts
Power reduction:	60 watts (80%)
Additional benefits:	Reduced air conditioning require Reduced maintenance cost Longer lamp life (up to 13 times
Annual KWH savings:	196,560 KWH
Annual Cost savings:	$19,656

Click on another sample to see some more examples of cost sav

Sample 1 Sample 2 Sample 3

LED EXIT RETROFIT

XER-HW

- LED Hardwired kit for 120/277 volt
- Two LED Lamps, complete with mounting bracket and double faced tape.
- 2.8 input watts per kit
- Not for use with stepdown transformers.

XER-2S

- Two LED Retrofit Screw in lamps
- 2.8 input watts per kit
- Ships with socket adapters for signs with bayonet, intermediate or candelabra light bulb sockets.
- Not for use with stepdown transformers.

Domestic Hot Water

DOMESTIC HOT WATER MAKING:

Domestic hot water is made with large capacity shell and tube type heat exchangers. At least one of these units, located in Boiler Room Two, is uninsulated and a large reason why the room temperature was 105° F when we entered. Insulating these heat exchangers will reduce losses to the room and improve efficiency of the exchanger. Currently there are no controls other than simple circulator pumps operated by aquastats acting through relays to make enough hot water for the building.

Installing larger, heavily insulated storage tanks will result in longer operating cycles for the boiler but increase the time interval between cycles. The effect is to have the boilers off for longer periods but when they operate they operate for a lengthened run cycle. This saves energy and money because the unit has fewer 'ramps up", from off to steady state efficiency. Boilers are most efficient when they run all the time as this eliminates off cycle losses and inefficient start up portions of the burner duty cycle. Operating on an aquastat in a large volume tank allows large batches of hot water to be made eliminating the nuisance and energy wasteful 'short cycle'.

No savings estimate was calculated for this efficiency option due to limited use information available.

DOMESTIC WATER USE:

I received total water use records prior to formulating this report. In review of the past two years water bills I noticed that the cost for water has risen almost seven and one half percent over the period. It's well documented that low flow faucet aerators and showerheads produce a good return on investment as noted in the attached showerhead spreadsheet. **Payback is attractive at 65 days and continuing long term savings of over $75,000 in the first five years is nothing but outstanding**. None of this includes the cost savings from a forty seven percent reduction in shower water use. (see the Shower Energy Use Analysis spreadsheet)

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Tel (907)452-8368 Fax (907) 452-8007

Water Use Analysis

Analysis of:	Westmark Hotel	
Community:	Whitehorse, Yukon, Canada	
Telephone:	**Fax:**	
Period of Analysis :		**December-98 to December 00**
Number of Months in Analysis:		**24**

Date of Water Meter Reading	Water Use Quantity Imp. Gallons	Water Use Quantity US Gallons	Cost of Water In Canadian Dollars	Percentage Use for Time Period Considered	
Dec-98	Start				
Feb-99	24,000	28,808	2,505.15	4.2%	L
Apr-99	29,300	35,170	3,170.15	5.1%	
Jun-99	76,100	91,346	8,537.21	13.3%	
Aug-99	60,900	73,100	6,832.01	10.7%	
Oct-99	54,900	65,898	6,158.91	9.6%	
Dec-99	32,800	39,371	3,679.64	5.7%	
Feb-00	30,300	36,370	3,399.18	5.3%	
Apr-00	43,500	52,215	4,880.01	7.6%	
Jun-00	59,800	71,780	6,708.61	10.5%	
Aug-00	87,300	104,789	9,739.67	15.3%	H
Oct-00	37,100	44,532	4,162.03	6.5%	
Dec-00	35,000	42,012	3,926.45	6.1%	

2 Year Total Use	2 Year Total Use	2 Year Total Cost
571,000	**685,392**	**$63,699.02**

1999 Total Gal	2000 Total Gal	% Change
278,000	**293,000**	**Up 5.4%**

Water cost rose	**Up 7.4% in 2000**
Water use rose	**Up 5.4% in 2000**

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Shower Energy Use Analysis

Analysis of:	Westmark Hotel		
Community:	Whitehorse, Yukon, Canada		
Telephone:			
Type of Fuel	Oil	**Units**	Gallon
Cost per Unit	$2.40	**Btu / Unit**	135,000
Efficiency %	65.00%	(steady state efficiency less estimated heat exchange efficiency)	

Location	Existing GPM Use	Number of Showers	Minutes of Use	Delta T (Th-Tc)	Gallons of H2O Used	Btu/Total	$ / MBtu	% In Use	Daily Existing Shower Cost
Guestrooms	3.5	181	15	60	9,503	4,635,320	$0.027	0.7	**$88.74**

Location	Retrofit GPM Use	Number of Showers	Minutes of Use	Delta T (Th-Tc)	Gallons of H2O Used	Btu/Total	$ / MBtu	% In Use	Daily Retrofit Shower Cost
Guestrooms	1.8	181	15	60	4,887	2,383,879	$0.027	0.7	**$45.64**

Retrofit Cost Analysis

Cost of New Showerhead	$12.00
Cost of Installation Labor/Hr	$14.00
Time to Install Showerhead (Hrs)	0.25
Cost of One Shower Retrofit	**$15.50**
# of Showerheads	181
Total Cost of Retrofit	**$2,805.50**

Savings Analysis

Daily Savings =	$43.10
Annual Savings =	$15,733.15
First Year Savings =	$12,927.65
Simple Payback (Days) =	**65.1**
(Total Cost / Daily Savings)	

Cumulative Savings

2nd Yr	$28,660.79
3rd Yr	$44,393.94
4th Yr	$60,127.08
5th Yr	**$75,860.23**

Assumptions:	No fuel cost increases or inflation
	One person per room @ one shower per day
	70% annual average occupancy rate
	Cost values are in Canadian Dollars

Heating Systems

HEATING SYSTEMS:

Four water tube oil fired boilers, two each located within two boiler rooms are used to heat the building. Operating controls are standard, simple and good opportunities for savings are available. In each location the boilers are operated in a 'lead/lag' manner with instructions to maintenance personnel to alternate the lead boiler week by week. This is an archaic and unnecessary task to impose on busy maintenance personnel when numerous proven electronic controls are available.

While it was not the coldest weather I observed numerous short cycle times for the lead boilers. Abbreviated operation cycles are an indication of boiler system over-sizing. Short cycles are also wasteful and result in more wear and tear on equipment from voltage inrush from starting and stopping pumps and motors. A popular method used to lengthen cycle times is downsizing the burner nozzle. While this provides some measure of savings it's important to insure that the proper burner end cone or flame retention air delivery parts are installed and adjusted if reductions in nozzle size greater than ten percent are desired. (refer to the ABC Oil Burner Data Booklet, page 1) Maintenance personnel reported that these burners had been modified to operate at lower capacities but no record of this was provided to me. I clocked the fuel flow meter on several units and one in BR2 seemed lower but the others (in BR10) were recorded to be at maximum capacity.

If keeping the existing oversized boilers (which will be even more oversized as the heating load is reduced) installation of automatic boiler controls are a good option and can result in fuel savings approaching twenty percent, without human intervention. I've listed several options below.

Option One:

Install a common and inexpensive indoor / outdoor reset aquastat with exterior bulb sensor. This control will drift the water temperature in the heating circulation loop according to the outside temperature. The result of using this control is lower temperature water circulating in summer/spring/fall and higher temperatures during winter months. Savings are great for the low price of $250 to $450 CAN estimated installed cost. (See Aquatrol, Outdoor Temperature Compensator literature)

Option Two:

Installation of intelligent digital controls can result in even greater savings. Controls of this type will automatically alternate the lead/lag boiler sequencing and some will 'learn' the typical operating pattern and extend cycle times and maximize off cycles to provide maximum fuel efficiency. Expect seven to fifteen percent savings from installing these controls. (See Tekmar Control literature)

Option Three:

Replace existing oversized units with multiple small units controlled to stage fire as the demand increases. This retrofit strategy further lowers off season standby losses by shutting off boilers that are not needed while randomly alternating operation of 'primary' units between the available systems. Typical controls are placed on the return of the circulation loop to sense when the return water temperature needs to be raised for lowering outside temperatures. Unless there are current plans to replace the heating systems, economic justification must be calculated prior to implementation of this option. (Requires engineered boiler replacement with multiple small units)

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Heating Energy Analysis

Analysis of:	Westmark Hotel		
Community:	Whitehorse, Yukon, Canada		
Telephone:		Fax:	
Type of Fuel	Oil	Units	US Gallon/Liter
Cost per Unit	Last 2.4	Btu / Gallon	135,000
Efficiency %	80.00%	Btu / Liter	29,696
Exp Surface Area	106,535	HeatedFloor Area	95,653
Volume	904,274		
Date of Fuel Delivery	Fuel Delivery Liters	Fuel Delivery US Gallons	Cost of Fuel In Canadian Dollars/Gallon
03/2/2000	14,120	3,106	5,958.64
03/15/00	11,822	2,600	5,645.01
04/12/00	14,219	3,128	6,789.57
04/21/00	13,867	3,050	7,586.64
05/11/00	7,968	1,753	3,575.24 Lowest
06/09/00	10,856	2,388	4,871.09
07/12/00	16,504	3,630	7,454.86
08/18/00	11,431	2,514	5,150.81
09/11/00	15,220	3,348	7,273.64
10/02/00	16,918	3,721	8,467.46
10/13/00	7,090	1,560	3,705.94
11/07/00	15,000	3,300	7,840.50
11/27/00	14,391	3,166	7,873.32
12/08/00	7,316	1,609	4,002.58
12/20/00	15,729	3,460	8,605.34 Highest
01/03/01	13,608	2,993	7,444.94
01/17/01	12,153	2,673	6,405.85
01/30/01	12,958	2,850	6,830.16
02/13/01	15,595	3,430	8,220.12
Total Days	Total Liters	Total Gallons	Total Cost ($CAN)
348	246,765	54,281	$123,701.69

Average Cost per Liter	Average Cost per Gallon	Average Liters / Day	Average Gallons/Day
$0.5013	$2.28	709.09	156

Average Gallons/Month	Average Cost per Day	Average Cost per Month	Average Annual Cost per Room
4,523	$355.46	$10,308.47	$683.43

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Westmark, Whitehorse, Dimension Calc Sheet

	VOLUME Cubic Feet	FLOOR Square Feet	WALLS Square Feet	ROOF Square Feet
Crawlspace Totals	78,518	19,630	3,284	0
First Floor	446,748	37,229	14,880	9,979
Second Floor	189,504	27,658	15,792	0
Third Floor	189,504	27,250	15,720	27,250
TOTALS	**904,274**	**92,137**	**49,676**	**37,229**
		(heated floor area - no crawl)		

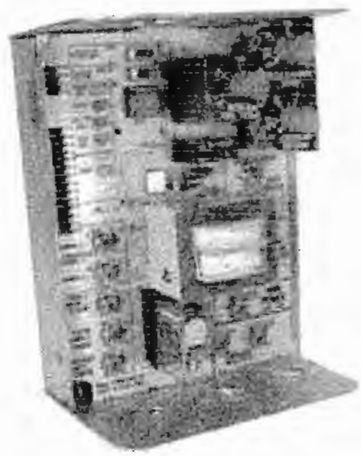
Exposed Surface Area	**106,535**

Envelope Surface / Volume Analysis

Btu/Square Foot of Exposed Surface Area	**68,784**
Btu/Square Foot of Heated Floor Area	**76,609**
Btu/Cubic Foot of Heated Volume	**8,104**

Boiler Controls

Aquatrol



Application

The AQ475A Aquatrol Outdoor Temperature Compensator automatically regulates boiler water temperature to provide outdoor reset. The DHW Priority option operates the boiler at the Boiler Maximum Temperature setting to heat domestic hot water and can operate or shut down the system circulator. The boiler High Limit safety function must still be provided by the boiler manufacturer's high limit.

Features

- Adjustable settings for boiler maximum temperature, boiler minimum temperature and outdoor low (design) temperature.
- Selectable Warm Weather Shut Down (WWSD) at 70°F (21°C) to prevent summer boiler operation.
- Domestic Hot Water (DHW) priority.
- Replaceable circulator relay common to other Honeywell replacement controls.
- Supply and outdoor sensors included.
- Automatic boiler operating differential.
- Automatic system circulator exercising.
- Long-life DC relay drive control technology.
- Troubleshooting LEDs.
- Push-to-test button.
- Full size screw terminals.
- Functional replacement for Honeywell T475A Outdoor Reset Controller and W964F Aquatrol (on-off mode).

Specifications

Important

The specifications given in this publication do not include normal manufacturing tolerances; therefore, an individual unit may not exactly match the listed specifications. Also, this product is tested and calibrated under closely controlled conditions and some minor differences in performance can be expected if those conditions are changed.

Model:

The AQ475A Aquatrol Outdoor Temperature Compensator automatically cycles the boiler to regulate heating supply water temperature using an outdoor reset curve. The AQ475A includes a supply and outdoor sensor, tie-clamp, mounting bracket and wire-nuts.

Electrical Ratings:
L1-L2 Power Supply: 120 Vac,60 Hz, 1200 VA.
C1-C2 Circulator Output: 120 Vac, 10 A; 1/3 hp (7.4 AFL, ` 44.4 ALR); 240 VA pilot duty powered contact.
T-T Boiler Output: 24 to 120 Vac, 3.7 AFL, 22.2 ALR maximum; 240 VA pilot duty, isolated (dry) contact.
DHW Demand input opto-isolated: 24 to 240 Vac.
R-W Thermostat input: Dry contacts from thermostat or end switches; 24 Vac, 0.10 A.

Temperature Control Ranges:
Boiler (Supply) Maximum: 120°F to 225°F (50°C to 107°C).
Outdoor Low (Design): –50°F to 30°F (–46°C to –1°C).
Boiler Minimum: OFF, 80°F to 180°F (OFF, 27°C to 82°C).

Temperature Ratings:
Control: 32°F to 122°F (0°C to 50°C).
Sensors: -50°F to 255°F (-45°C to 125°C).

Humidity Ratings:
Less than 90% RH, non-condensing.

Electrical Connections:
No. 6 wire clamp screw terminals.

Outdoor and Supply Sensors:
10 k□ @ 77°F (25°C), NTC ±1%, beta = 3950.
Lead Length: 42 in. (1067 mm).

Approvals:
Canadian Standards Association
C/US Certified, LR: 95329-1

Dimensions:
See Fig. 1.

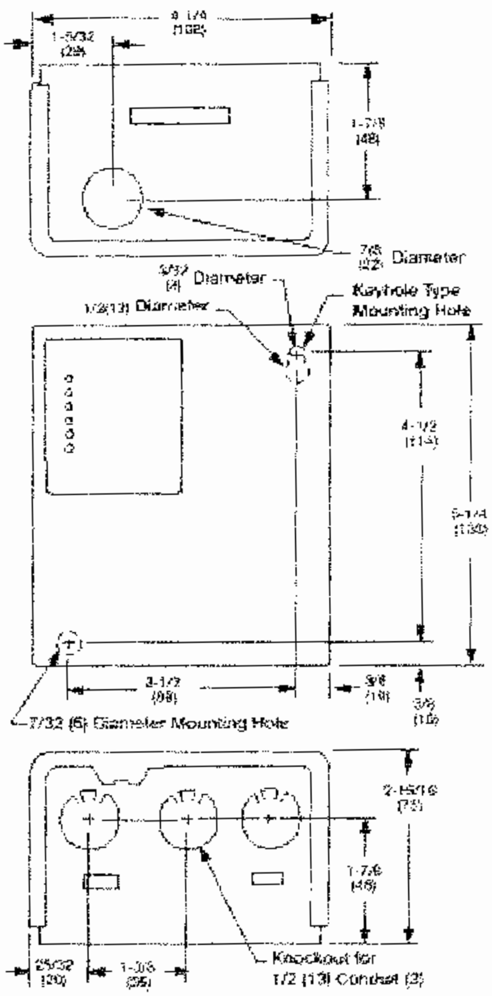
Cross Reference:
Functionally replaces Honeywell T475A Outdoor Reset Controller and W964F Aquatrol configured in on-off mode.

Thermostat Compatibility:
Contemporary Honeywell electromechanical and electronic 2-wire thermostats.

Replacement Parts:
32002190-001 Circulator Replacement Relay.
32002100-001 Outdoor or Supply Sensor.

Fig. 1 AQ475A Approx. mounting dimensions in inches (mm)

Fig. 1. Dimensions in inches (mm)



Get the PDF version: Includes application and wiring drawings

TOP

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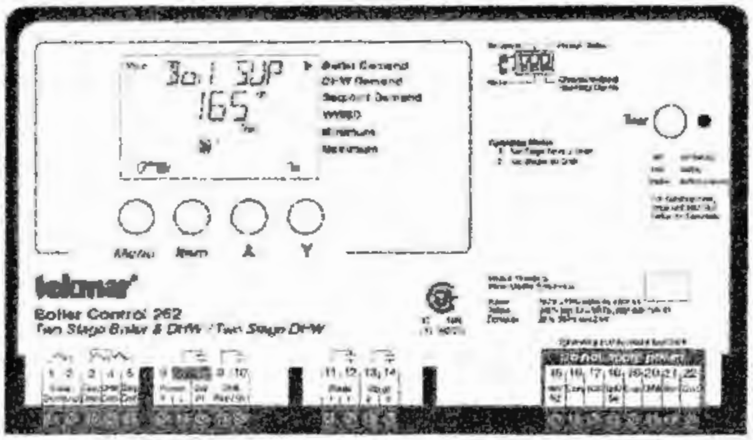
Please send comments to water-controls@honeywell.ca

Tekmar Controls

Boiler Control 262 *Two Stage Boiler & DHW / Two Stage DHW*



Control Description The Boiler Control 262 is a microprocessor-based boiler outdoor reset that has two modes of operation. Mode 1 operates as two stage boiler and DHW, and mode 2 operates two boilers or a Lo / Hi fire boiler for DHW applications. A tekmar Indoor Sensor, Digital RTU, or a Zone Control can be connected to provide indoor temperature feedback from single or multiple zones. An optional Remote Display Module 040 and DHW indirect sensor can also be added. For a list of boiler / DHW control functions, click here. For DHW only click here.

Applications (A's)

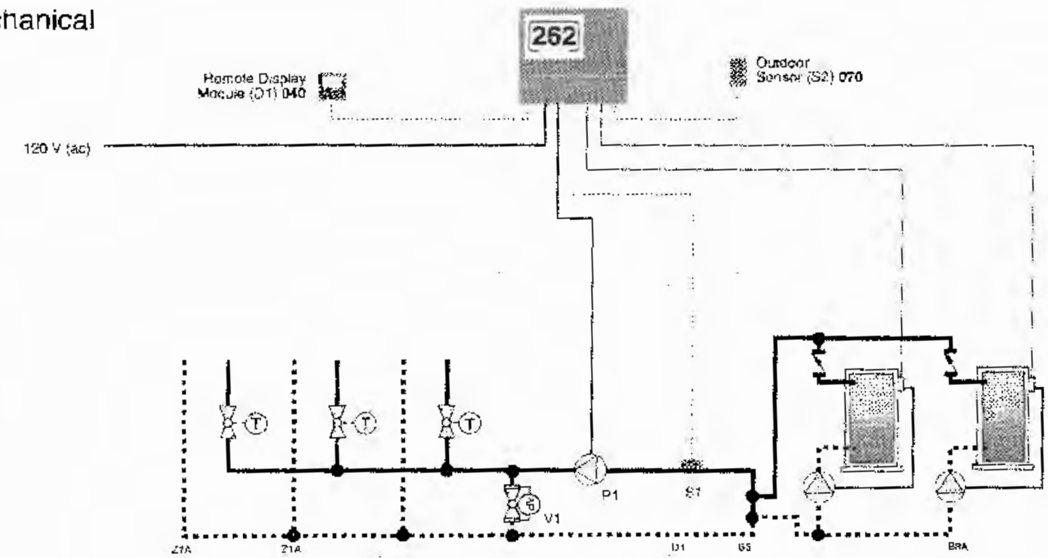
A 262-1	Thermostat controlled zone valves with pool or spa setpoint operation, DHW priority generation and boiler outdoor reset.
A 262-2	Zones controlled by thermostatic radiator valves (TRV) with boiler outdoor reset of two boilers.
A 262-3	Thermostat controlled zone pumps with DHW priority generation and boiler outdoor reset of two boilers.
A 262-4	DHW generation with two boilers.

Literature (Downloadable)	D 262, A 262's, D 001, D 070, E 003, U 262
Control	Microprocessor PID control; This is **not a safety (limit) control**
Packaged weight	4 lb. (1810 g), Enclosure A, blue PVC plastic
Dimensions	6-5/8" H x 7-9/16" W x 2 13/16" D (170 x 193 x 72mm)
Approvals	CSA C US, meets ICES & FCC regulations for EMI / RFI
Ambient conditions	Indoor use only, 32 to 122°F (0 to 50°C), <95% RH non-condensing
Power supply	120 V (ac) ±10% 50/60Hz 1300 VA
Relays	240 V (ac) 10 A 1/3 hp, pilot duty 240 VA
Demands	20 to 260 V (ac) 2 VA
Sensors included	NTC thermistor, 10kΩ @ 77°F (25°C ±0.2°C) ß=3892 Outdoor Sensor 070 and Universal Sensor 071
Optional Devices	tekmar type #: 031, 040, 062, 063, 071, 072, 073, 076, 077, 367, 368, 369

Home Search Request

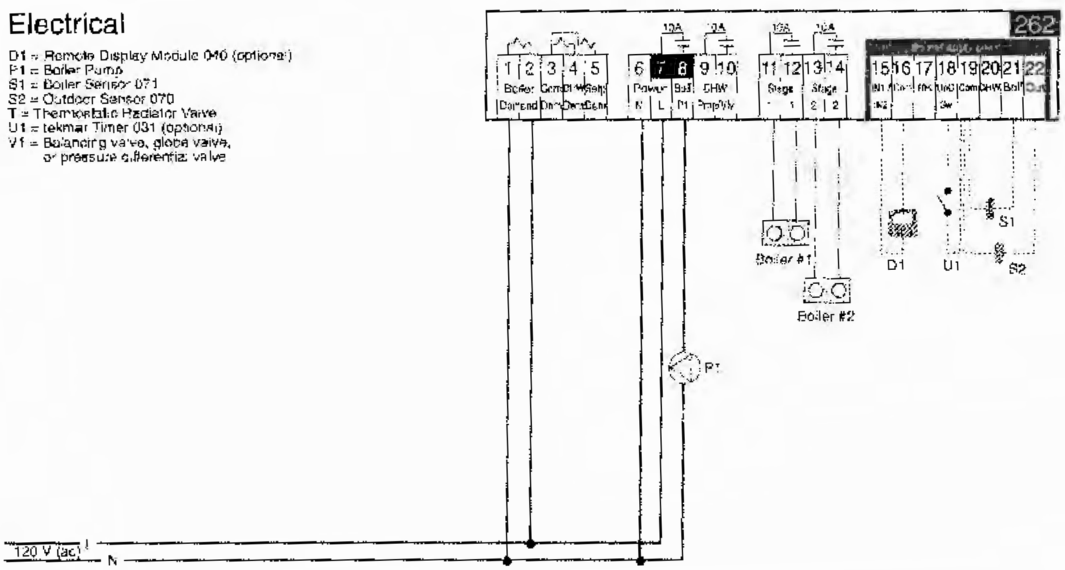
Mechanical

MODE -1-



Electrical

D1 = Remote Display Module 040 (optional)
P1 = Boiler Pump
S1 = Boiler Sensor 071
S2 = Outdoor Sensor 070
T = Thermostatic Radiator Valve
U1 = tekmar Timer 031 (optional)
V1 = Balancing valve, globe valve, or pressure differential valve



Note: This is only a concept drawing. The designer must determine whether this application will work in his system and must ensure compliance with code requirements. Necessary auxiliary equipment, isolation relays (for loads greater than the specified tekmar internal relay ratings), and other safety and limit devices must be added.

System Operation

The Boiler Control 262 provides partial or full outdoor reset to three (or more) thermostatic radiator valve zones. Constant circulation to the zones is provided by the boiler pump (P1). The boilers are staged as required to provide the supply water temperature that satisfies the loads. An optional Remote Display Module (RDM) provides remote adjustment and monitoring of the control.

Heat Source Details The heat source can be either high mass or low mass non-condensing or low temperature boilers.

Piping Details Thermostatic radiator valve (TRV) zones are piped into the boiler loop. A pressure differential valve (V1) provides a bypass for the boiler pump (P1) in the event that most of the TRV's are closed. The boilers are piped using parallel primary / secondary in order to provide equal and isolated flow through each boiler.

Boiler Demand When the outdoor air temperature is below the Warm Weather Shut Down (WWSD) setting, the 262 turns on the boiler pump (P1). The boiler supply water temperature is based on the *Reset Ratio* or *Characterized Heating Curve* settings. The boilers are staged to satisfy the required boiler supply water temperature. Whenever the boilers are fired, the 262 aims to increase the boiler supply water temperature to at least the Boil MIN setting.

All control functions and specifications are listed in the Product Catalog I 000 and the Data Brochure D 262.

Required Material and Essential Control Settings

Required tekmar Products

Boiler Control 262

Optional tekmar Products

Remote Display Module (RDM) 040

Timer 031

262 Essential Application Control Settings (Adjust Menu)

Item Field	Setting
MODE	--1--
STAGE 1	AUTO
STAGE 2	AUTO

Note For all other settings, refer to the Data Brochure D 262.

tekmar Control Systems

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tekmar Control Systems, Inc., U.S.A.
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Vernon, B.C. Canada V1T 4K7
Tel. (250) 545-7749 Fax. (250) 545-0650
Web Site: www.tekmarcontrols.com

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*ECONOMICAL AND COST EFFECTIVE

*OFTEN PAYS FOR ITSELF IN FIRST YEAR

*Does NOT have troublesome outdoor temperature sensors

*WORKS WITH EITHER GAS OR OIL FIRED BOILERS

*EXTENDS THE LIFE OF YOUR SYSTEM **by reducing the number of burner ignitions.**

* IMPROVES AIR QUALITY: **fewer burner ignitions produce less soot, pollutants and toxic materials, resulting in cleaner operation and a cleaner environment.**

*** Is a UL LISTED ENERGY MANAGEMENT DEVICE, and complies with the limits for a class A digital device (FCC rules part 15)**

*** Was developed in Sweden and is now manufactured in the United States in an ISO 9002 certified plant to the international standard for world class companies.**

*** IS VIRTUALLY MAINTENENCE-FREE and is designed for long life and productivity**

*** US GOVERNMENT SALES NUMBER (NSN) 4520-01-426-3292**

*** UL LISTED 9T59**

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MICROtherm Case Study

From *New York Real Estate Jornal*

MICROtherm Case Study

From New York Real Estate Jornal

The Glen Oaks Co-op is one of the largest Co-ops East of the Mississippi. It is comprised of 134 buildings, each two stories high, which contain a total of 2904 units. Situated on a 150-acre piece of property, the Co-op takes up the entire village of Glen Oaks plus parts of Bellrose In Queens. The buildings, built in 1947, are constructed of plaster with brick facades. To heat the entire Co-Op and maintain hot water in each unit, Glen Oaks management has 96 boilers serviced by 20 different gas lines.

In the Fall of 1996, Stuart Schwartz, contacted Glen Oaks management regarding a product - MICROTherm that SNS was representing. MiCROTherm is an energy savng device for commercial hot water heaters and boilers that guarantees lower fuel bills without lowering thermostsats. Actual installations have proven a 10-20% savings in fuel usage. As a corporation, we've been in the energy-savings business for more than 20 years and represent many sucsessful energy conservation products," said Schwartz. *We are amazed* by MICROTherm and what it delivers."

MICROTherm lowers fuelusage by extending the off-cycle and creating longer, more efficient, but less frequent on-cycles. The result of this patented process is a reduction in the number of ignitions and total operating time.

The device which is a microprocessor based computer, constantly monitors the demand on the boiler by assimilating all factors affecting a buildings heating requirements,

including occpancy, climate, wind chill, solar gain, type of building, and many others. Most other energy saving devices only consider outdoor temperature. With this information, MICROTherm then calculates the optimum time between off and on cycles and controls burner ignitions accordingly. unlike any other product, MICROTherm can, at any time, actually compute its economy in terms of percentage savings and reduced ignitions, displaying it on the LCD screen.

After a formal presentation and further discussions, Glen Oaks was interested enough in the product to conduct a demonstration. Randy Gunther, controller, Glen Oaks reviewed the twenty gas line accounts and found three that tracked almost identically in terms of thermal usage over the past four years. In late December, 1996, MICROTherms were installed on four boilers, all fed by the same gas line, and charted the results over five months. Gunther then compared the results to the two other similar gas lines, consisting of a total of eight boilers, that did not have MICROTherms. W'e have discovered a 2O+ percent savings in fuel usage," said Gunther. And not only did we save a substantial amount in fuel, but we did so without inconveniencing our tenants. No one noticed a difference."

"We know what MICROTherm can do for commercial hot water heaters and boilers," said Schwartz. Believe it or not, because the results can be so dramatic, it is sometimes difficult to convince building owners to give MICROTherm a try. In a situation like this, where you can actually make legitimate comparisons between boilers with MICROTherms and those without, it just doestn't make sense not to try it." MICROTherm works under the principle that all boilers are inherently oversized because boilers are built to accommodate the coldest days only 5% of the year. The other 95% of the year, In which the burner cycles on and off maintaining temperature In the boiler, is where MICROTherm saves energy.

Should the temperature of the water drop to a programmable low limit, perhaps due to a sudden increase in demand, the microprocessor immediately cancels any extended off-cycle; allowing the burner to ignite. MICROTherm also has a watchdog technology that immediately shuts itself down in the event of power interruption and will restart itself at its last programmed setting when power is restored. Other significant product advantages include virtually no maintenance, a payback period between three months to a year, and, with less burner ignitions, *a cleaner, healthier environment, and a boiler that has a longer life.*

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Arthur Dworin 1-800-706-5007
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Ventilation Systems

VENTILATION SYSTEMS:

Current building ventilation systems are problematic. There are five areas affecting ventilation of the Hotel: #1 Range hood exhaust; #2 Make up Air Handler above Pantry; AH1 in Boiler Room One; AH@ in the Office Wing; #5 Individual Room Bathroom Exhaust Fans. None of these areas operate automatically in conjunction with one another. I found negative pressures (-8 to –12 pascals) near the main entrance doors with lower pressures (-2 to –4) in guest rooms throughout the building during my observations. In only two rooms on the third floor did I find a positive pressure with reference to outdoors. According to the hotel maintenance personnel the building was unable to maintain a positive pressure and this was evident when passing through the main entrance with a large amount of air entering into the building whenever the doors were opened. All HVAC systems need to be balanced together.

RANGE HOOD EXHAUST AND MAKE-UP AIR:

Upon visiting the kitchen I noticed where all range hoods were operating without the roof mounted, propane fired make-up air unit operating. When asked, the chef reported he believed the unit was inoperable for the past month and that they had not initiated it's used for that reason. A hotel maintenance representative stated he believed the unit had been repaired and that it was operable but did not feel authorized to over-rule the chef and therefore left the unit off. Afterward, I was unable to find out whether or not the make-up air unit was functional and believe the source of negative pressure to be caused by operating the range exhaust hoods without sufficient make-up air. These are very large units and are equipped with powerful motors capable of moving several thousand cubic feet of air per minute.

It is likely that the negative pressure caused by these hoods is a major contributor to infiltration and freezing pipes, etc, as such cold air leaking in through random areas throughout the building envelope would be necessary to supply the high flows of the range exhaust hoods. Balancing kitchen area pressures to make them only very slightly negative with reference to the outside will be necessary to enable other air handling equipment to operate successfully, as designed.

In reviewing the fuel Btu content and costs for propane and oil I noticed an interesting anomaly. *While oil presently costs six percent more per liter than propane, one liter of oil contains approximately thirty-five percent more energy.* Seems unfortunate that a, bigger and better *propane fired*, roof top mounted make-up air handler is soon to be installed! Combustion efficiency differences can not make up this great of a difference in price per Btu. Oil seems to be the best buy for fuel in the Yukon. (fuel switching should be considered for this type of application)

There is a room adjacent to the bar and kitchen area named the 'valve room'. This room contains the heat distribution manifold for boiler room one and is very hot at ~100° F. An innovative approach to efficiency would be to consider using the excess/waste heat available in the valve room to temper make-up air for the kitchen exhaust range hoods. A mechanical engineer could likely make use of waste heat from this space.

AIR HANDLER 1

This unit is in need of a thorough going over, cleaning and posting of labels on all dampers, valves and actuators. I found the primary fan motor slipping the belt and only making a small percent of the unit's rated air flow. Filter trays are in need of gasketing and the controls were not clearly marked or intuitive. All of the units dampers were closed when I arrived and one set of controls were completely inoperable. A lack of maintenance interest or knowledge is evident and the only explanation for the poor condition of this unit. In not allowing any fresh air to enter the building via the closed damper position, the exhaust only situation was additive to the negative pressure supplied by the kitchen range hoods and no make-up air. This is not a healthy condition for the building's mechanical system to be in (frozen pipes?).

I recommend a thorough re-commissioning of this unit with associated labeling of all moving parts and a clearly written O#M manual. Such recommendation is valid for all mechanical systems in the building. This is a necessity for a building this size with the employee turn-over rate being what it has been. The common response to my questioning maintenance personnel was "Well, that's the way it's always been ever since I got here!" This is not an adequate excuse.

AIR HANDLER 2

AHU2 is situated in a small room accessible by a climbing a short ladder and squeezing through a 'cubby hole". While not the most comfortable entry I suppose it serves the purpose. Several things were curious about AHU2.

First, the outside filters had been removed along with gasketing designed to keep air passing through the filter and not around it. The filter trays had a considerable amount of snow accumulating in them which will eventually melt and leak through to the floor below.

Second, the door to the outside would not seal air tight and a high negative pressure was sucking in cold air cooling the room. Extreme cold temperatures could freeze water pipes in the area and create an embarrassing situation for persons in the room below when they thaw.

Third, nobody could sufficiently explain the recently installed digital control. If I can't determine what the thing does then who is going to repair, program or over-ride the unit when a failure occurs? Just one more example of the need to create a detailed O&M manual

Thermograms

Index

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2.) T.2 Room 228, Livingroom Wall Intersection with Bedroom Wall
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4.) T.4 Room 203, Wall Intersection In Bedroom
5.) T.5 Room 203, Wall Intersection In Bedroom With Hot Distribution Pipe In Wall Partition
6.) T.6 Room 301, Wall Intersection In Bedroom showing Cold Window Air Leakage
7.) T.7 Room 301, Window Installation Air Leakage
8.) T.8 Room 301, Electrical Outlet Air Leakage
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10.) T.10 Room 309, Temperature Variations Due To Misplaced Insulation
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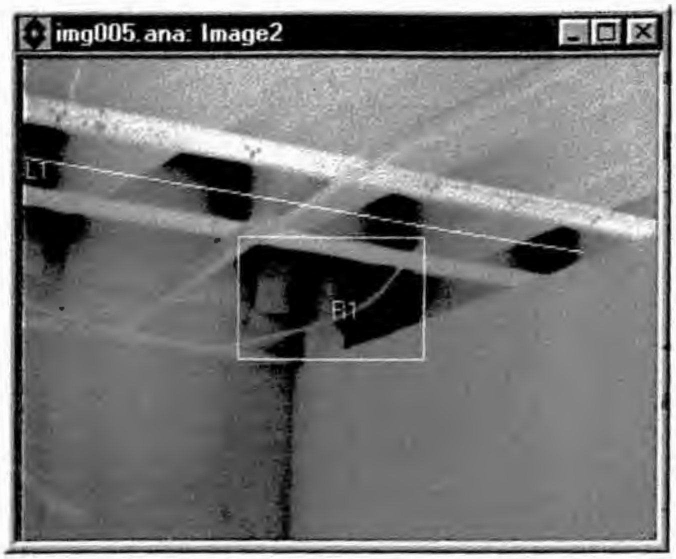
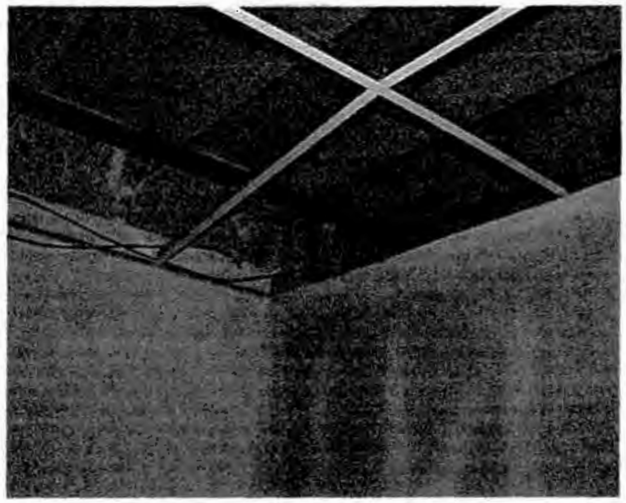
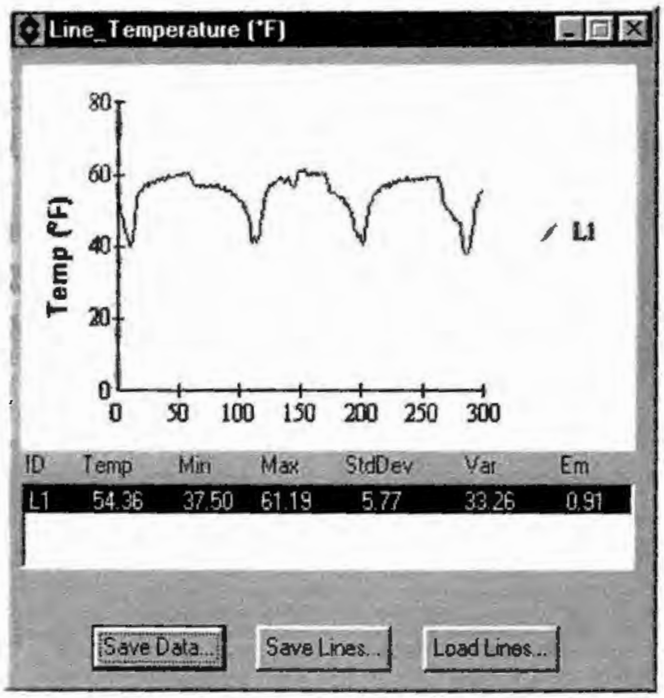
WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM ONE: Room 228, Living room wall and rim joist intersection with bathroom wall.

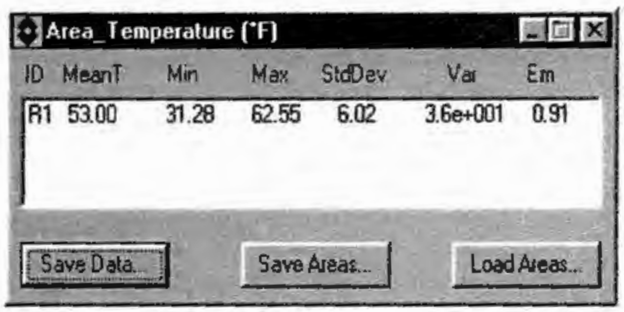




This image shows cold surfaces as the result of air leakage into the building due to a negative pressure being applied with a blower door. It is most interesting as the position of the image is located approximately twenty feet from any outside surface and should reflect normal interior temperatures. This indicates a need for air-sealing the exterior surfaces of the building.



ID	Temp	Min	Max	StdDev	Var	Em
L1	54.36	37.50	61.19	5.77	33.26	0.91

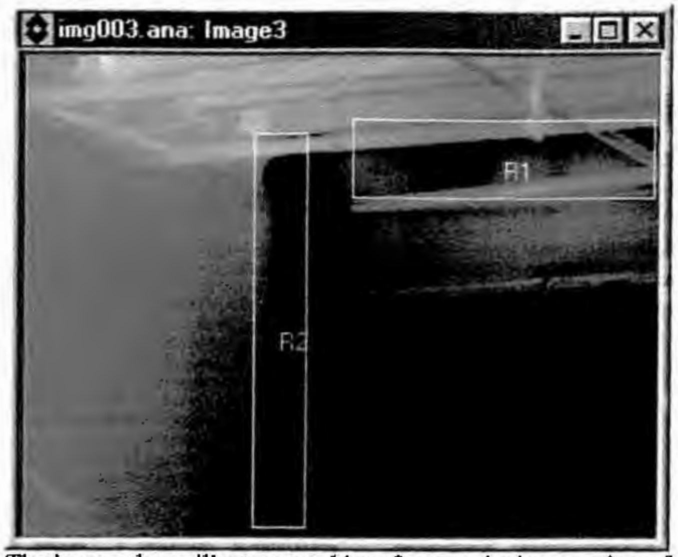


ID	MeanT	Min	Max	StdDev	Var	Em
R1	53.00	31.28	62.55	6.02	3.6e+001	0.91

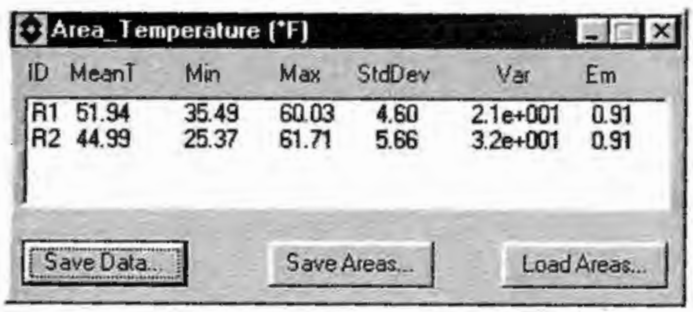
Line L1 is a histogram of surface temperatures occurring along the line. As previously noted, this location is twenty feet into the building and on an interior wall. The minimum temperature recorded is 37.5 F. In the right hand Area temperature are thermal qualities within the box designated R1 on the thermogram image. The coldest temperature recorded within R1 is 31.28F while the warmest surface is 62.55F. Operation of the building in a negative pressure mode will provide cold interior surfaces due to air leaking into the building via the 'shim spaces' between individual modules. Only by completely air sealing the exterior building fabric can these air leakage pathways be easily eliminated.

WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM TWO: Room 228, Living room wall intersection with bedroom wall.



The image above illustrates cold surfaces at the intersection of an interior wall with the exterior wall. Two rectangular boxes, R1 and R2 are drawn around the colder surfaces and the temperatures measured within are shown in the graphic below. It is obvious that energy lost through conduction and convection is occurring at a rapid rate, enough to result in a low temperature of 25F, well below freezing.



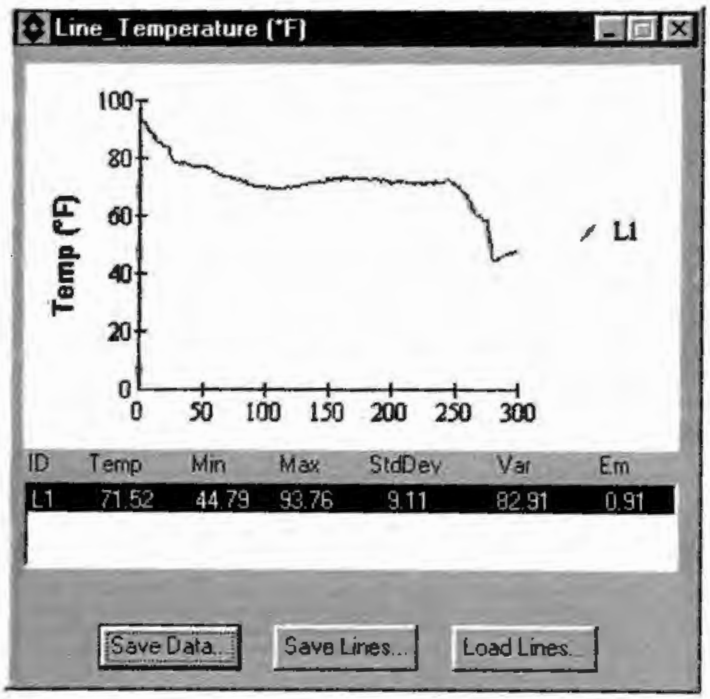
Area_Temperature (°F)

ID	MeanT	Min	Max	StdDev	Var	Em
R1	51.94	35.49	60.03	4.60	2.1e+001	0.91
R2	44.99	25.37	61.71	5.66	3.2e+001	0.91

Save Data... Save Areas... Load Areas...

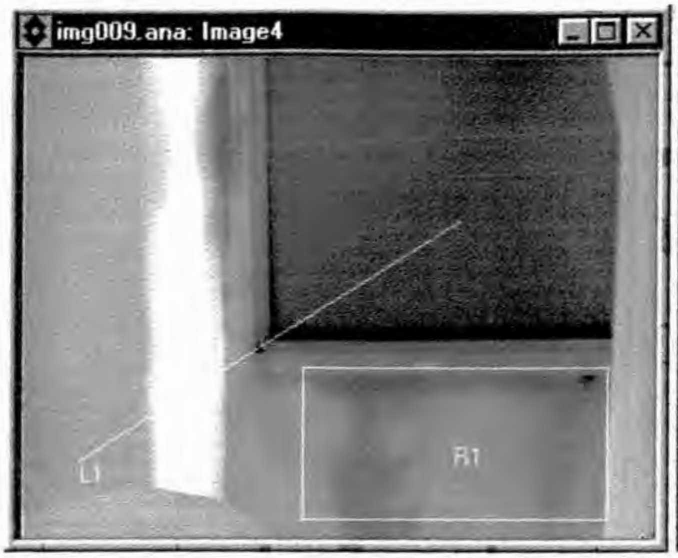
WESTMARK HOTEL, WHITEHORSE, YUKON
THERMOGRAM THREE: Room 203, Radiator below window.

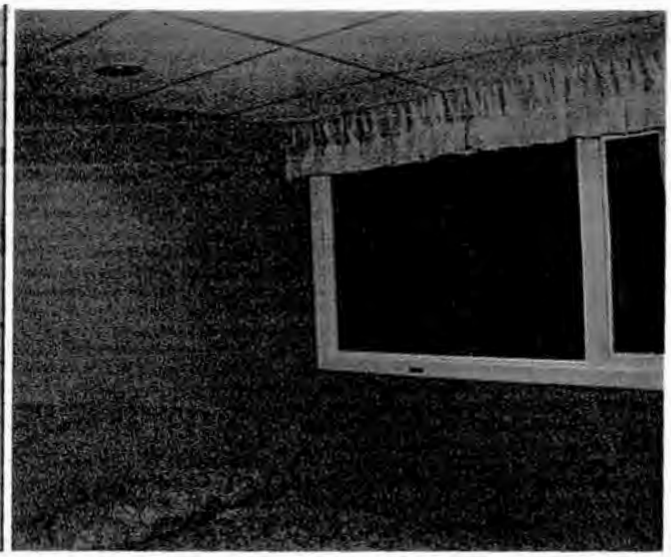
Thermogram Three illustrates the pattern of heating that we found to be common to all hotel room exterior walls. Cold window surfaces and hot baseboard surfaces are evident resulting in heat exiting the structure primarily through windows. Wall insulation is estimated to be at a low R-7.5 at most due to compression and voids found in rooms representative of module construction. Double pane glazing is typically rated as being R-1.8 at the center of glass, lower at the perimeter.



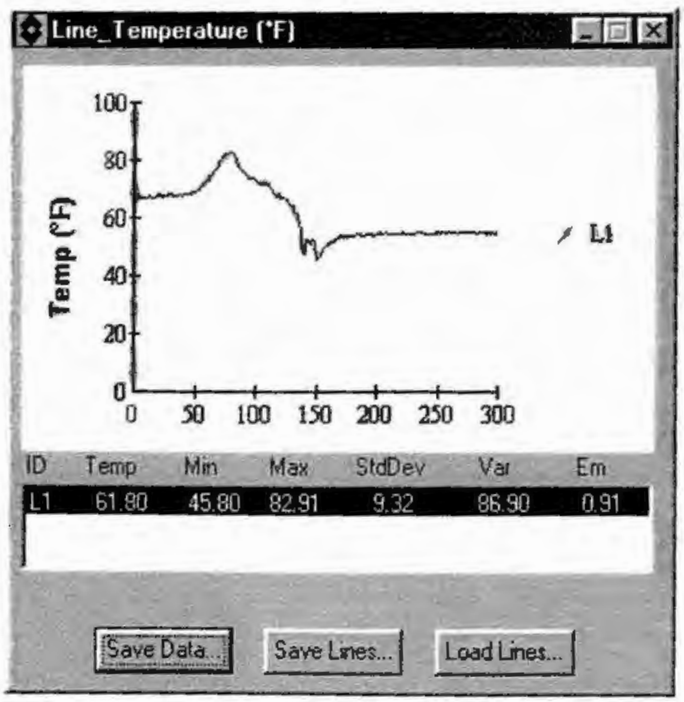
Installation of higher quality glazing would easily halve existing window heat loss and minimize condensation on window interior surfaces. Triple pane units with Low e coatings and argon gas filling can rate as high as R-4.5.

WESTMARK HOTEL, WHITEHORSE, YUKON
THERMOGRAM FOUR: Room 203, Wall intersection in bedroom.

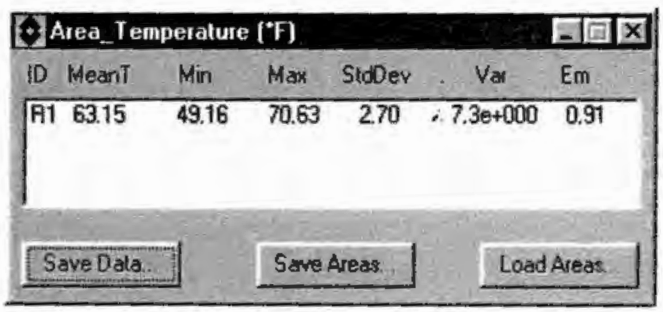




Thermogram Four reveals a heating pipe riser hidden within an interior partition wall between adjacent units. Distribution piping such as this is responsible for overheating in various units during summer months. When additional solar gain is present with warm outside temperatures, the constant circulation loop, still operating at 160 – 180 degrees F, causes elevated temperatures to occur within these rooms. Application of air-sealing and insulating the exterior envelope will allow the owner to drift the heating circulation loop water temperature lower using an inexpensive digital controller to minimize summer overheating. As it currently exists, the building is out of control.



ID	Temp	Min	Max	StdDev	Var	Em
L1	61.80	45.80	82.91	9.32	86.90	0.91

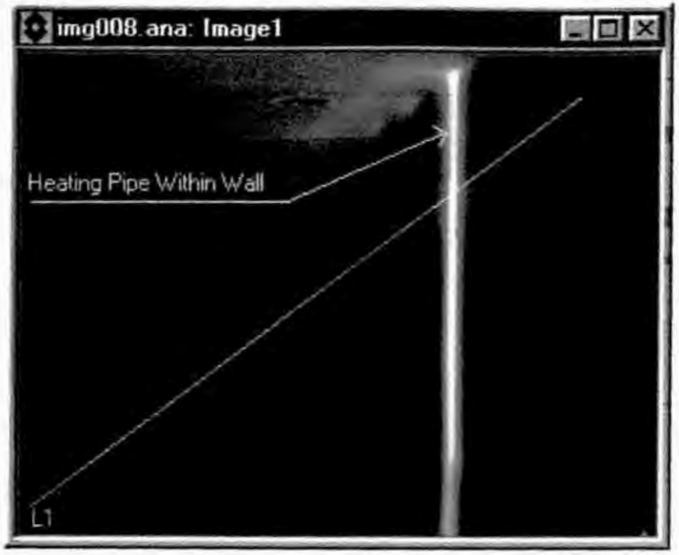


ID	MeanT	Min	Max	StdDev	Var	Em
R1	63.15	49.16	70.63	2.70	7.3e+000	0.91

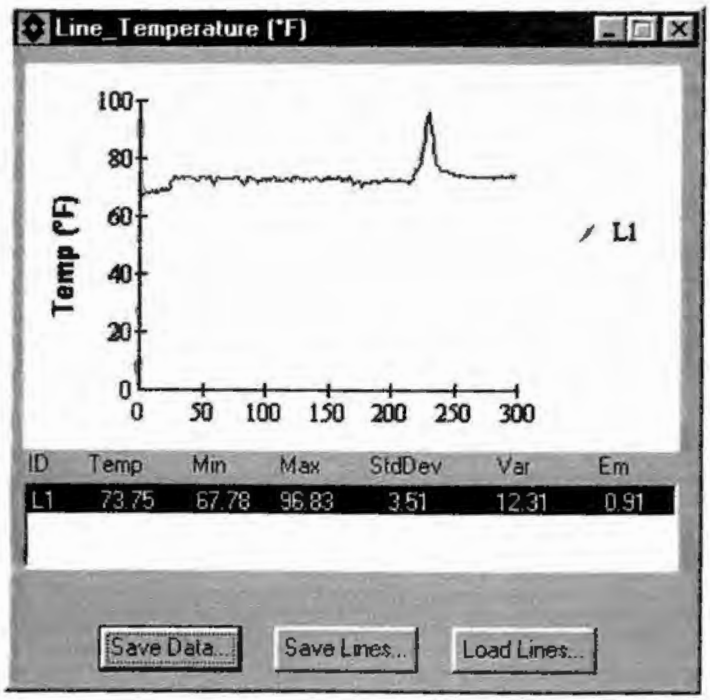
Adding pipe insulation to heating and domestic hot water piping will further lessen room overheating but at a cost for gaining access and refinishing affected wall areas. Drifting heating water temperatures is believed to be the best approach to gaining room temperature control and lowering energy use. If summer overheating continues after reductions in distribution water temperature have taken place, insulating piping within walls of a test portion of the building should be considered.

WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM FIVE: Room 203, Wall intersection in bedroom with hot distribution pipe in partition wall.

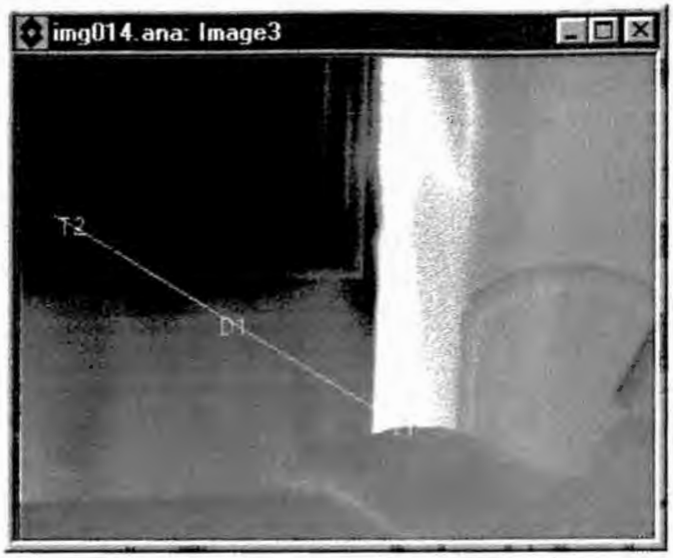


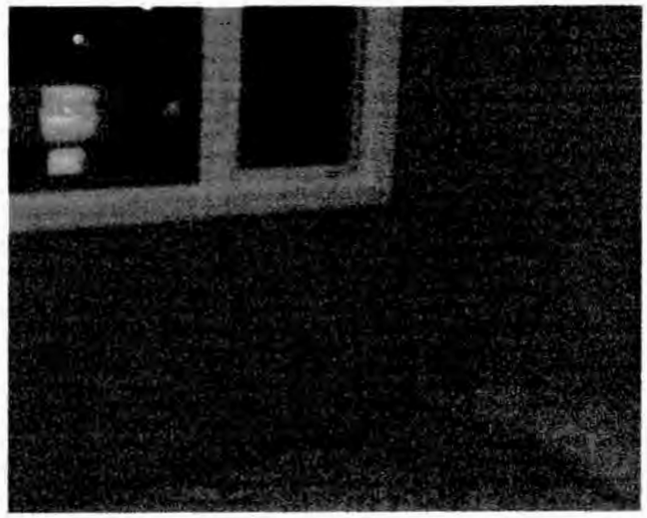
Another example of heat input from high temperature distribution piping imbedded within interior walls. The same process is occurring here as in the previous Thermogram Four. This is the same room and therefore the heat input is compounded by having a 'hot' wall on either side leaving little opportunity to control temperatures on a day to day basis.



WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM SIX: Room 301, Wall intersection in bedroom showing cold window air leakage.



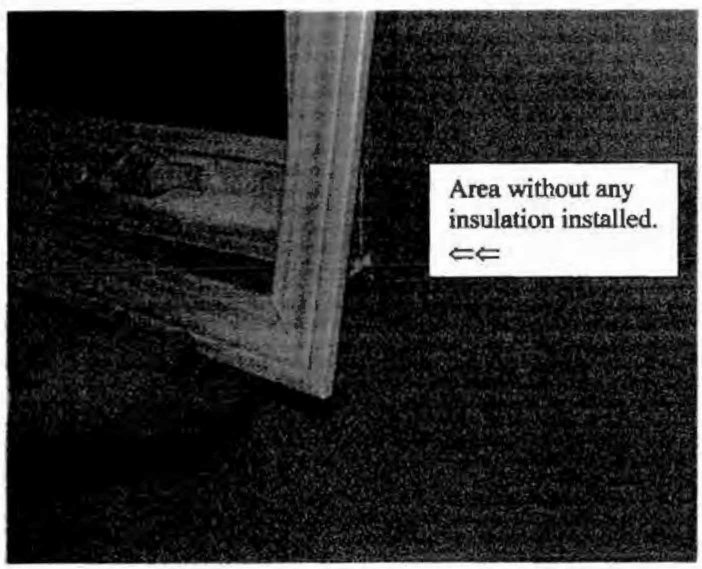


There are two points located within the above thermogram six. The temperature difference between the points is approximately 30 degrees F. This results in localized areas of discomfort for the resident and potential condensation damage from moisture forming on cold surfaces. Increased maintenance and occupant complaints are certain to follow. During our investigation as to why the 'new' window might be leaking so much we found that the units were installed without insulation being applied between the frame and rough opening. This facilitates increased air leakage and promotes rapid deterioration of the framing material. It is my recommendation that the installer be requested to correct the deficiency as soon as possible.

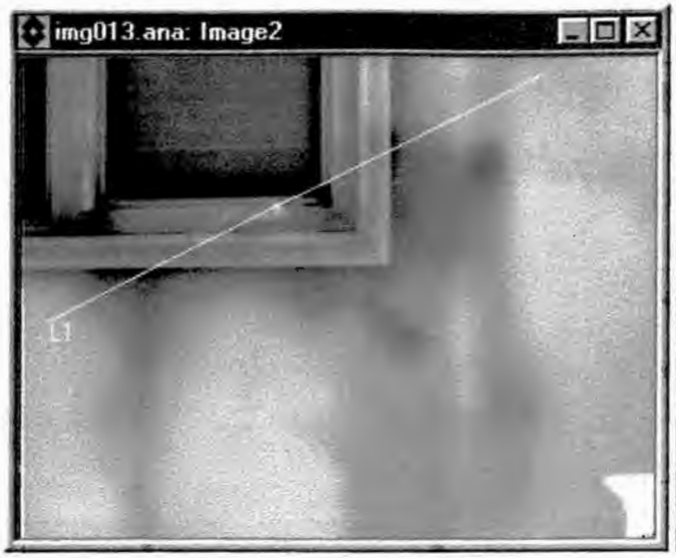
Delta-T (°F)

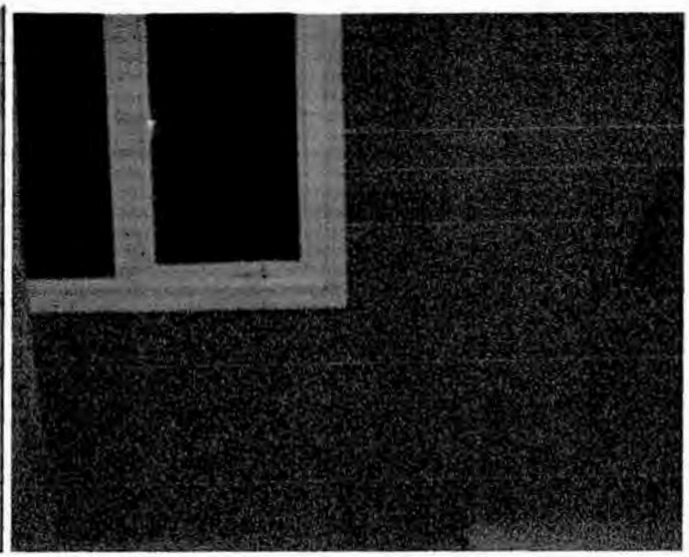
ID	Delta-T	Temp1	Temp2	Em1	Em2
D1	29.95	71.18	41.23	0.91	0.91

Save Data... Save Points... Load Points...

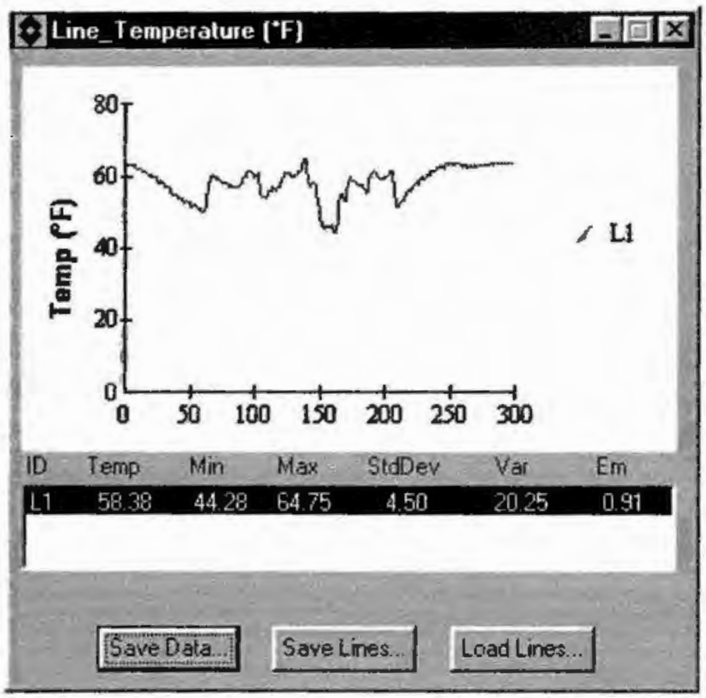


WESTMARK HOTEL, WHITEHORSE, YUKON
THERMOGRAM SEVEN: Room 301, Window installation air leakage.



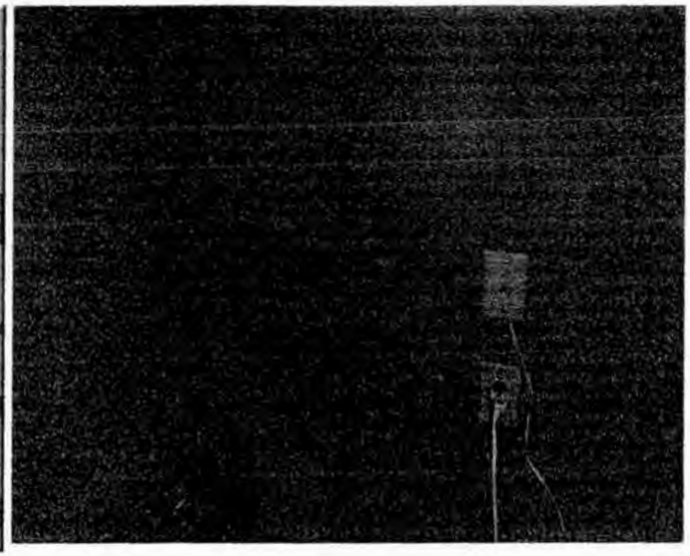


Another view of an uninsulated 'new' window installation. Application of foam insulation in the perimeter area of the window frame to the rough opening will minimize the possibility for cold air to leak between the room and outside.

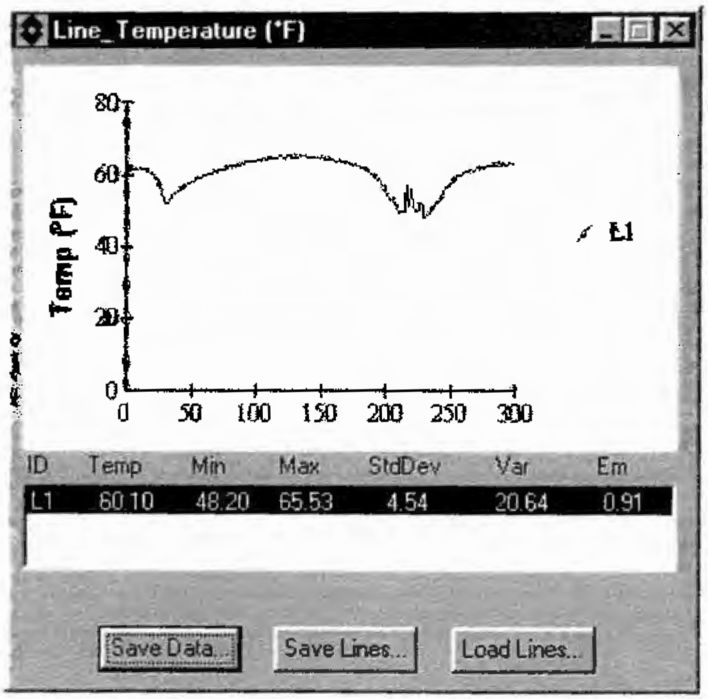


WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM EIGHT: Room 301, Electrical outlet air leakage.



Outside air entering through interior wall outlets is pervasive throughout the building due primarily to the modular construction style. Application of a continuous exterior air barrier and additional insulation on the outside will solve this problem, improve comfort and significantly reduce energy costs.



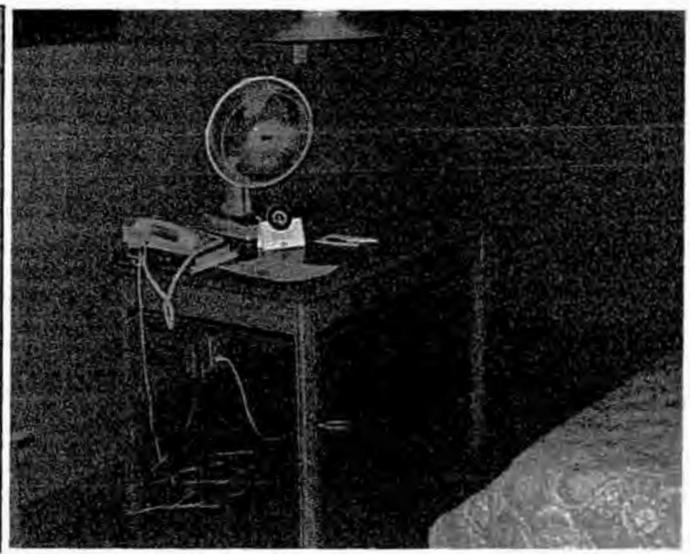
Area_Temperature (°F)

ID	MeanT	Min	Max	StdDev	Var	Em
R1	60.42	46.00	67.88	4.33	1.9e+001	0.91

Save Data... Save Areas... Load Areas...

WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM NINE: Room 309, Electrical outlet air leakage and cold outside corner



Thermal characteristics of the circled areas of interest are presented within the chart below. C1 illustrates cold air leaking into the room from outside while C2 and C3 represent cold surfaces from conductive loss through framing at an outside corner.

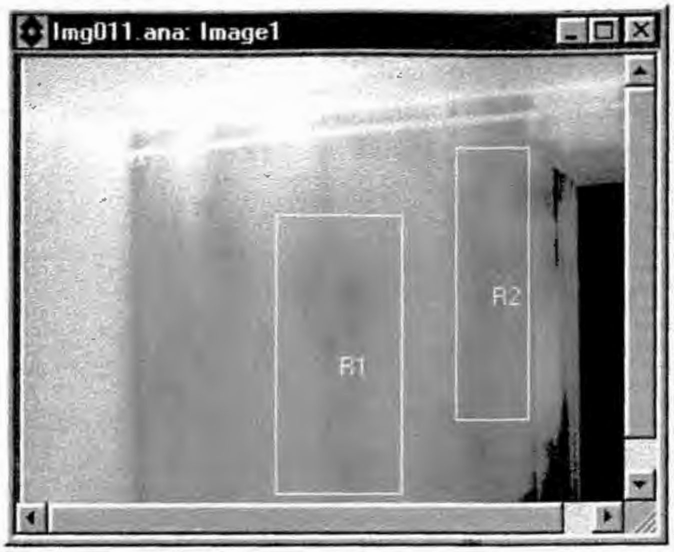
Area_Temperature (°F)

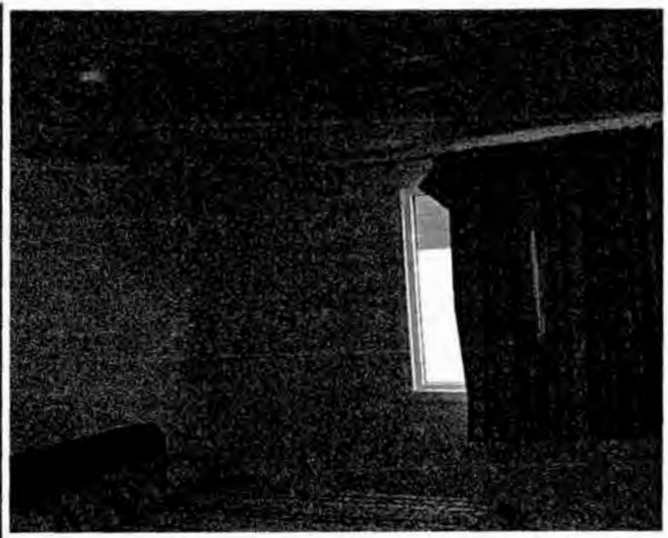
ID	MeanT	Min	Max	StdDev	Var	Em
C1	57.13	37.67	63.35	4.51	2.0e+001	0.91
C2	57.66	35.64	61.09	2.79	7.8e+000	0.91
C3	52.78	42.91	61.71	4.75	2.3e+001	0.91

Save Data... Save Areas... Load Areas...

WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM TEN: Room 309, Temperature variations due to misplaced insulation.





Above is a typical exterior wall panel. The modular style of construction lends itself to consistent quality of assembly so we believe the temperature profile of this outside wall section is likely to be common throughout the building. Some of what is seen in this view is the difference between insulated and frame portions of the wall. The mottled look comes from insulation that has been installed in a compressed manner resulting in wider temperature variations. R2 has a temperature difference of almost ten degrees F. Cold areas near the perimeter of the window frame are due to the space between frame and rough opening being left uninsulated.

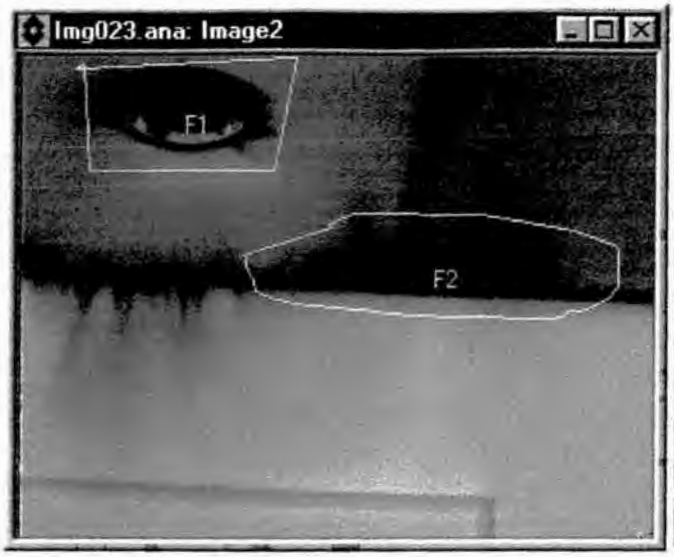
Area_Temperature (°F)

ID	MeanT	Min	Max	StdDev	Var	Em
R1	57.68	54.94	60.64	0.82	6.8e-001	0.91
R2	56.32	50.62	59.32	0.93	8.7e-001	0.91

Save Data... Save Areas... Load Areas...

WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM ELEVEN: Room 309, Temperature variations due to air leakage at interior surfaces.



A clear image showing the result of air leakage occurring at an interior wall and ceiling. Because the ceiling is dropped it allows free flow of air throughout the building. F2 indicates a twenty degree difference between the highest and lowest temperature while the ceiling light fixture indicates a twenty-four degree difference. This room was the first unit we measured with a positive pressure with reference to outdoors.

Area_Temperature (°F)

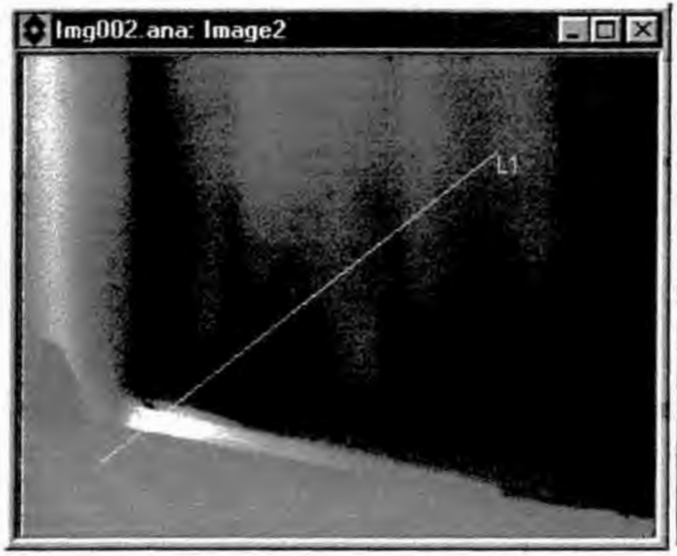
ID	MeanT	Min	Max	StdDev	Var	Em
F1	51.83	38.30	61.66	3.94	1.6e+001	0.91
F2	51.77	40.29	59.82	3.33	1.1e+001	0.91

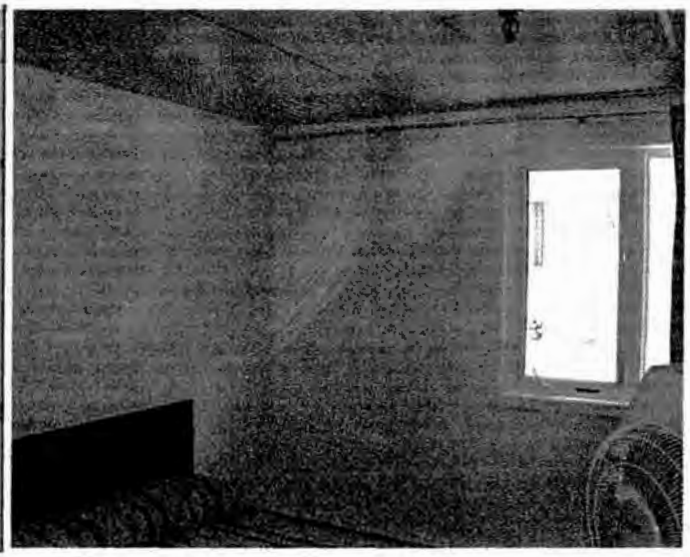
Save Data... Save Areas... Load Areas...

During my observations the majority of rooms were operating in a negative pressure regime with reference to outdoors. This is due to imbalances in the HVAC systems and the absence of make-up air being supplied for the range exhaust hoods located in the kitchen.

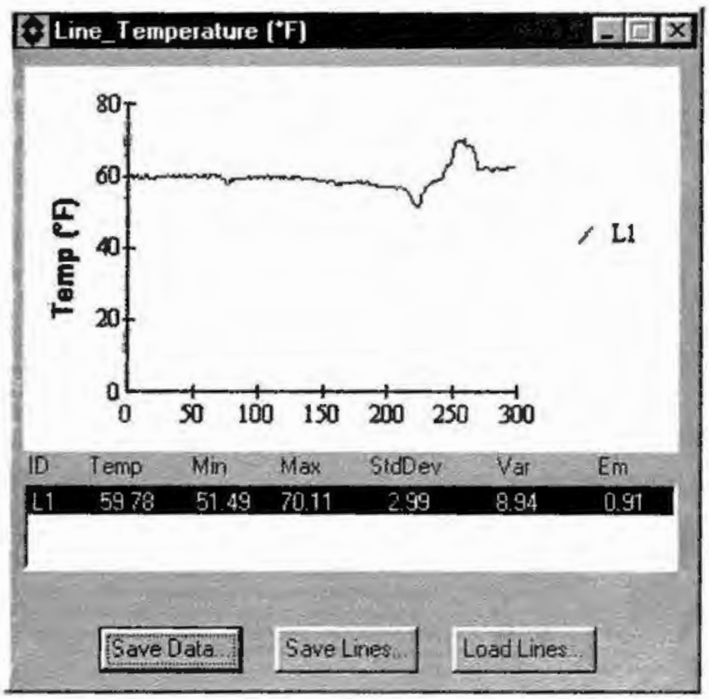
WESTMARK HOTEL, WHITEHORSE, YUKON

THERMOGRAM TWELVE: Room 257, Temperature variations due to framing at interior surfaces





Thermogram Twelve illustrates the effect of conduction losses through framing members. In this case the bottom plate and corner studs are moving heat to the outside rapidly enough to lower interior surface temperatures to below 52 F. Performing an exterior retrofit will minimize the effect.



Hot 2000

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*            Version 6.02              *
*               CANMET                 *
* Energy, Mines and Resources CANADA   *
*            July 1, 1991              *
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House Data Filename=C:\WINDOWS\DESKTOP\HOT2000\WSTOFICE.HDF

Weather Data is for WHITEHORSE, YUKON TERRITORY

Builder Code =RETROFIT Data Entry by:P. LOUDON

Client name:	WESTMARK, WHITEHORSE		
Street address:	OFFICE WING 1FLR W/CRWL		
City:	WHITEHORSE	Region:	YUKON TERRITORY
Postal code:		Telephone:	

*** GENERAL HOUSE CHARACTERISTICS ***

House type:	Triplex
Number of storeys:	Three storeys
Wall construction:	Single stud wall

SOIL TYPE: Normal Conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 0.5 in. gyproc walls and ceiling, wooden floor

Occupants : 10 Adults for 100.0 % of the time
10 Children for 100.0 % of the time

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 69.8 F
	Crawl Space	= 59.0 F
	Calculated Crawl Space	= 18.8 F
	TEMP. Swing from 69.8 F	= 6.3 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement
Closed Crawl Space	None	On Grade

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Location Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC
South	1	M1	9	200214	8.000	4.500	.000	.000	.6653
North	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	6	200214	8.000	4.500	.000	.000	.6653

*** WINDOW PARAMETER CODES SCHEDULE ***

Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1 200214	Double (DG), Clear, 13 mm Air, Insulating, Hinged, Vinyl

*** BUILDING PARAMETERS ***

Component		Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Above Grade Components						
Ceiling						
C1		9964.00	9964.00	30.00		
	TOTAL:	9964.00	9964.00	30.00	115.728	10.59
Main Walls						
M1		5556.00	4650.00	7.50		
	TOTAL:	5556.00	4650.00	7.50	206.404	18.88
Doors						
D1 Location: M1		42.00	42.00	3.00		
	TOTAL:	42.00	42.00	3.00	4.878	.45
Crawl Space Area						
Crawl space wall area		3284.00		7.00		
	TOTAL:	3284.00		7.00	157.994	14.45
Perimeter area (1 M or 3.3 Ft wide)		1449.00		1.14		
	TOTAL:	1449.00		.00	43.114	3.94
Centre area		8303.00		1.14		
	TOTAL:	8303.00		.00	93.724	8.57

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss
South							
W1	9	200214	324.00	2.12			
TOTAL:			324.00	2.12		53.254	4.87
North							
W1	9	200214	324.00	2.12			
W1	6	200214	216.00	2.12			
TOTAL:			540.00	2.12		88.756	8.12

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
117024.1 Ft3	.51 ACH	329.296	30.12

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area	= 28556.0 Ft2
Air Tightness Level is Average (4.55 ACH @50 Pa.)	
Building Envelope is NOT Sheltered from the Wind.	
Estimated Equivalent Leakage Area	= 708.7 in2
Normalized Leakage Area	= .0248 in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference	= 615 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference	= 966 cfm
Estimated Airflow to cause a 15 Pa Pressure Difference	= 1257 cfm
ELA used to calculate Estimated Airflows	= 283.5 in2

F-326 VENTILATION REQUIREMENTS:

Kitchen,living,dining:	10 rooms @ 10 cfm	=100 cfm
Utility rooms:	10 rooms @ 10 cfm	=100 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	5 rooms @ 10 cfm	= 50 cfm
Bathrooms:	10 rooms @ 10 cfm	=100 cfm
Other habitable rooms:	10 rooms @ 10 cfm	=100 cfm
Basement Rooms:		0 cfm

*** EXHAUST FLOW RATES (cfm) ***

	Continuous	Intermittent
Dryer		450.9
Kitchen	.0	.0
All Bathrooms	.0	75.0
All other exhaust devices	.0	.0
Vented central vac.		.0
Largest Intermittent exhaust (other than Dryer)		.0

Total continuous exhaust flow .0 cfm
Exhaust Fan Power .0 watts

F-326 Required continuous ventilation rate = 497.9 cfm (.31 ACH)
Average Ventilation Supply Rate (Balanced) = 500.0 cfm (.31 ACH)
Average Ventilation Exhaust Rate = 500.0 cfm (.31 ACH)

Ventilation System: Fans without Heat Recovery
Manufacturer: POWERFUL
Model Number: USE A LOT

Mechanical Ventilator Fan Power = 600. Watts

Gross Air Leakage and Ventilation Energy Load = 347.157 Mil.BTU
Seasonal Heat Recovery Ventilator Efficiency = .000 %
Estimated Ventilation Electrical Load: Heating Hours = 17.788 Mil.BTU
Estimated Ventilation Electrical Load: Non-Heating Hours = .146 Mil.BTU
Net Air Leakage and Ventilation Energy Load = 338.190 Mil.BTU

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flue vent damper
Manufacturer :
Model :
Output Capacity = 34120.0 BTU/hr (Insufficient capacity)

Steady State Efficiency = 82.0 %

Fan Mode : Auto Fan Power 1940. watts

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -41.8 F = 3.14 BTU/hr/Ft3	=367937. BTU/hr
Gross Space Heating Load	=******** Mil.BTU
Sensible Daily Heat Gain From Occupants	= 24.00 kWh/day
Usable Internal Gains	= 47.326 Mil.BTU
Usable Internal Gains Fraction	= 4.3 %
Usable Solar Gains	=106.580 Mil.BTU
Usable Solar Gains Fraction	= 9.7 %
Ventilation Equipment Electrical Contribution	= 8.894 Mil.BTU
Auxiliary Energy Required	=939.242 Mil.BTU
Space Heating System Load	=940.248 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 80.2 %
Furnace/Boiler Annual Energy Consumption	=******** Mil.BTU

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel :
Water Heating Equipment : No DHW system installed

*** LIGHTING AND APPLIANCES SUMMARY ***

Total Electrical Load	= 16.0 kWh/day
Average External Electrical Load	= .0 kWh/day
Total Annual Energy Consumption	= 5840. kWh

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	5213.1	4843.8	.0
Neither	42.9	.0	.0
Cooling	.0	.0	.0
Total	5256.0	4843.8	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	=1219743. MJ	=338817.4 kWh
Ventilator Electrical Consumption: Heating Hours	= 18767. MJ	= 5213.1 kWh
Estimated Annual DHW Heating Energy Consumption	= 0. MJ	= .0 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	=1238510. MJ	=344030.5 kWh
ANNUAL R-2000 SPACE + DHW ENERGY CONSUMPTION TARGET	= 405946. MJ	=112762.8 kWh
Estimated Annual Base Electrical Energy Consumption	= 21024. MJ	= 5840.0 kWh
Ventilator Electrical Consumption: Non Heating Hours	= 154. MJ	= 42.9 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel		Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil	(U.S. Gal)	8364.2	.0	.0	.0	8364.2
Electricity (kWh)		10056.9	.0	.0	5882.9	15939.8

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

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*                                      *
*               Hot2000                *
*             Version 6.02             *
*                CANMET                *
*  Energy, Mines and Resources CANADA  *
*             July 1, 1991             *
*                                      *
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House Data Filename=C:\WINDOWS\DESKTOP\HOT2000\WSTOFICR.HDF

Weather Data is for WHITEHORSE, YUKON TERRITORY

Builder Code =RETROFIT Data Entry by:P. LOUDON

Client name:	WESTMARK, WHITEHORSE		
Street address:	OFFICE WING 1FLR W/CRWL Retro		
City:	WHITEHORSE	Region:	YUKON TERRITORY
Postal code:		Telephone:	

*** GENERAL HOUSE CHARACTERISTICS ***

House type:	Triplex
Number of storeys:	Three storeys
Wall construction:	Single stud wall

SOIL TYPE: Normal Conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 0.5 in. gyproc walls and ceiling, wooden floor

Occupants : 10 Adults for 100.0 % of the time
10 Children for 100.0 % of the time

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 69.8 F
	Crawl Space	= 59.0 F
	Calculated Crawl Space	= 19.2 F
	TEMP. Swing from 69.8 F	= 6.3 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement
Closed Crawl Space	None	On Grade

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Location Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC
South	1	M1	9	200214	8.000	4.500	.000	.000	.6653
North	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	6	200214	8.000	4.500	.000	.000	.6653

*** WINDOW PARAMETER CODES SCHEDULE ***

Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1 200214	Double (DG), Clear, 13 mm Air, Insulating, Hinged, Vinyl

*** BUILDING PARAMETERS ***

Component		Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Above Grade Components						
Ceiling						
C1		9964.00	9964.00	30.00		
	TOTAL:	9964.00	9964.00	30.00	115.728	15.30
Main Walls						
M1		5556.00	4650.00	28.50		
	TOTAL:	5556.00	4650.00	28.50	54.317	7.18
Doors						
D1 Location: M1		42.00	42.00	3.00		
	TOTAL:	42.00	42.00	3.00	4.878	.64
Crawl Space Area						
Crawl space wall area						
		3284.00		17.00		
	TOTAL:	3284.00		17.00	72.680	9.61
Perimeter area (1 M or 3.3 Ft wide)						
		1449.00		10.00		
	TOTAL:	1449.00		10.00	18.009	2.38
Centre area						
		8303.00		1.14		
	TOTAL:	8303.00		.00	120.382	15.91

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss
South							
M1	9	200214	324.00	2.12			
TOTAL:			324.00	2.12		53.254	7.04
North							
M1	9	200214	324.00	2.12			
M1	6	200214	216.00	2.12			
TOTAL:			540.00	2.12		88.756	11.73

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
117024.1 Ft3	.37 ACH	228.528	30.21

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area	= 28556.0 Ft2
Air Tightness Level is Energy tight (1.5 ACH @50 Pa.)	
Building Envelope is NOT Sheltered from the Wind.	
Estimated Equivalent Leakage Area	= 231.8 in2
Normalized Leakage Area	= .0081 in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference	= 201 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference	= 316 cfm
Estimated Airflow to cause a 15 Pa Pressure Difference	= 411 cfm
ELA used to calculate Estimated Airflows	= 92.7 in2

F-326 VENTILATION REQUIREMENTS:

Kitchen,living,dining:	10 rooms @ 10 cfm	=100 cfm
Utility rooms:	10 rooms @ 10 cfm	=100 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	5 rooms @ 10 cfm	= 50 cfm
Bathrooms:	10 rooms @ 10 cfm	=100 cfm
Other habitable rooms:	10 rooms @ 10 cfm	=100 cfm
Basement Rooms:		0 cfm

*** EXHAUST FLOW RATES (cfm) ***

	Continuous	Intermittent
Dryer		450.9
Kitchen	.0	.0
All Bathrooms	.0	75.0
All other exhaust devices	.0	.0
Vented central vac.		.0
Largest Intermittent exhaust (other than Dryer)		.0

Total continuous exhaust flow .0 cfm
Exhaust Fan Power .0 watts

F-326 Required continuous ventilation rate = 497.9 cfm (.31 ACH)
Average Ventilation Supply Rate (Balanced) = 500.0 cfm (.31 ACH)
Average Ventilation Exhaust Rate = 500.0 cfm (.31 ACH)

Ventilation System: Fans without Heat Recovery
Manufacturer: POWERFUL
Model Number: USE A LOT

Mechanical Ventilator Fan Power = 600. Watts

Gross Air Leakage and Ventilation Energy Load = 246.359 Mil.BTU
Seasonal Heat Recovery Ventilator Efficiency = .000 %
Estimated Ventilation Electrical Load: Heating Hours = 17.788 Mil.BTU
Estimated Ventilation Electrical Load: Non-Heating Hours = .146 Mil.BTU
Net Air Leakage and Ventilation Energy Load = 237.422 Mil.BTU

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flue vent damper
Manufacturer :
Model :
Output Capacity = 34120.0 BTU/hr (Insufficient capacity)

Steady State Efficiency = 82.0 %

Fan Mode : Auto Fan Power 1940. watts

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -41.8 F = 2.02 BTU/hr/Ft3	=236239. BTU/hr
Gross Space Heating Load	=756.532 Mil.BTU
Sensible Daily Heat Gain From Occupants	= 24.00 kWh/day
Usable Internal Gains	= 47.326 Mil.BTU
Usable Internal Gains Fraction	= 6.3 %
Usable Solar Gains	=102.834 Mil.BTU
Usable Solar Gains Fraction	= 13.6 %
Ventilation Equipment Electrical Contribution	= 8.894 Mil.BTU
Auxiliary Energy Required	=606.372 Mil.BTU
Space Heating System Load	=607.100 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 80.3 %
Furnace/Boiler Annual Energy Consumption	=739.790 Mil.BTU

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel :
Water Heating Equipment : No DHW system installed

*** LIGHTING AND APPLIANCES SUMMARY ***

Total Electrical Load	= 16.0 kWh/day
Average External Electrical Load	= .0 kWh/day
Total Annual Energy Consumption	= 5840. kWh

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	5213.1	4814.0	.0
Neither	42.9	.0	.0
Cooling	.0	.0	.0
Total	5256.0	4814.0	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	= 780520. MJ	=216811.1 kWh
Ventilator Electrical Consumption: Heating Hours	= 18767. MJ	= 5213.1 kWh
Estimated Annual DHW Heating Energy Consumption	= 0. MJ	= .0 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	= 799287. MJ	=222024.2 kWh
ANNUAL R-2000 SPACE + DHW ENERGY CONSUMPTION TARGET	= 405946. MJ	=112762.9 kWh
Estimated Annual Base Electrical Energy Consumption	= 21024. MJ	= 5840.0 kWh
Ventilator Electrical Consumption: Non Heating Hours	= 154. MJ	= 42.9 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel		Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil	(U.S. Gal)	5352.3	.0	.0	.0	5352.3
Electricity	(kWh)	10027.1	.0	.0	5882.9	15910.0

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

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****************************************
*                                      *
*               Hot2000                *
*             Version 6.02             *
*               CANMET                 *
* Energy, Mines and Resources CANADA   *
*            July 1, 1991              *
*                                      *
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House Data Filename=C:\WINDOWS\DESKTOP\HOT2000\WSTBALRM.HDF

Weather Data is for WHITEHORSE, YUKON TERRITORY

Builder Code =RETROFIT Data Entry by:P. LOUDON

Client name: **WESTMARK, WHITEHORSE**
Street address: **BALLROOM WING 1FLR SLAB**
City: WHITEHORSE Region: YUKON TERRITORY
Postal code: Telephone:

*** GENERAL HOUSE CHARACTERISTICS ***

House type: Triplex
Number of storeys: Three storeys
Wall construction: Single stud wall

SOIL TYPE: Normal Conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 0.5 in. gyproc walls and ceiling, wooden floor

Occupants : 10 Adults for 100.0 % of the time
10 Children for 100.0 % of the time

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 69.8 F
	TEMP. Swing from 69.8 F	= 6.3 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement
Slab on Grade	1 Side	Not Edge Interior

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Location Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC
East	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	1	200214	8.000	4.500	.000	.000	.6653
North	1	M1	4	200214	8.000	4.500	.000	.000	.6653
West	1	M1	7	200214	8.000	4.500	.000	.000	.6653

*** WINDOW PARAMETER CODES SCHEDULE ***

Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1 200214	Double (DG), Clear, 13 mm Air, Insulating, Hinged, Vinyl

*** BUILDING PARAMETERS ***

Component		Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Above Grade Components						
Ceiling						
C1		6466.00	6466.00	30.00		
	TOTAL:	6466.00	6466.00	30.00	75.100	9.87
Main Walls						
M1		3732.00	2934.00	7.50		
	TOTAL:	3732.00	2934.00	7.50	130.235	17.12
Doors						
D1 Location: M1		42.00	42.00	3.00		
	TOTAL:	42.00	42.00	3.00	4.878	.64
Slab on Grade						
Perimeter area						
		960.00		1.14		
	TOTAL:	960.00		.00	56.863	7.47
Centre area						
		5506.00		1.14		
	TOTAL:	5506.00		.00	74.293	9.77

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss
East							
M1	9	200214	324.00	2.12			
M1	1	200214	36.00	2.12			
TOTAL:			360.00	2.12		59.171	7.78
North							
M1	4	200214	144.00	2.12			
TOTAL:			144.00	2.12		23.668	3.11
West							
M1	7	200214	252.00	2.12			
TOTAL:			252.00	2.12		41.420	5.44

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
77592.1 Ft3	.59 ACH	295.178	38.80

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area	= 16664.0 Ft2
Air Tightness Level is Average (4.55 ACH @50 Pa.)	
Building Envelope is NOT Sheltered from the Wind.	
Estimated Equivalent Leakage Area	= 562.1 in2
Normalized Leakage Area	= .0337 in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference	= 488 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference	= 766 cfm
Estimated Airflow to cause a 15 Pa Pressure Difference	= 997 cfm
ELA used to calculate Estimated Airflows	= 224.8 in2

F-326 VENTILATION REQUIREMENTS:

Kitchen,living,dining:	10 rooms @ 10 cfm	=100 cfm
Utility rooms:	10 rooms @ 10 cfm	=100 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	5 rooms @ 10 cfm	= 50 cfm
Bathrooms:	10 rooms @ 10 cfm	=100 cfm
Other habitable rooms:	10 rooms @ 10 cfm	=100 cfm
Basement Rooms:		0 cfm

*** EXHAUST FLOW RATES (cfm) ***

	Continuous	Intermittent
Dryer		450.9
Kitchen	.0	.0
All Bathrooms	.0	75.0
All other exhaust devices	.0	.0
Vented central vac.		.0
Largest Intermittent exhaust (other than Dryer)		.0

Total continuous exhaust flow .0 cfm
Exhaust Fan Power .0 watts

F-326 Required continuous ventilation rate = 497.9 cfm (.39 ACH)
Average Ventilation Supply Rate (Balanced) = 500.0 cfm (.39 ACH)
Average Ventilation Exhaust Rate = 500.0 cfm (.39 ACH)

Ventilation System: Fans without Heat Recovery
Manufacturer: POWERFUL
Model Number: USE A LOT

Mechanical Ventilator Fan Power = 600. Watts

Gross Air Leakage and Ventilation Energy Load = 313.039 Mil.BTU
Seasonal Heat Recovery Ventilator Efficiency = .000 %
Estimated Ventilation Electrical Load: Heating Hours = 17.788 Mil.BTU
Estimated Ventilation Electrical Load: Non-Heating Hours = .146 Mil.BTU
Net Air Leakage and Ventilation Energy Load = 304.072 Mil.BTU

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flue vent damper
Manufacturer :
Model :
Output Capacity = 34120.0 BTU/hr (Insufficient capacity)

Steady State Efficiency = 82.0 %

Fan Mode : Auto Fan Power 1940. watts

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -41.8 F = 3.24 BTU/hr/Ft3 =251515. BTU/hr

Gross Space Heating Load	=760.806 Mil.BTU
Sensible Daily Heat Gain From Occupants	= 24.60 kWh/day
Usable Internal Gains	= 47.326 Mil.BTU
Usable Internal Gains Fraction	= 6.2 %
Usable Solar Gains	= 84.445 Mil.BTU
Usable Solar Gains Fraction	= 11.1 %
Ventilation Equipment Electrical Contribution	= 8.894 Mil.BTU
Auxiliary Energy Required	=629.034 Mil.BTU
Space Heating System Load	=629.990 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 80.2 %
Furnace/Boiler Annual Energy Consumption	=769.202 Mil.BTU

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel :
Water Heating Equipment : No DHW system installed

*** LIGHTING AND APPLIANCES SUMMARY ***

Total Electrical Load	= 16.0 kWh/day
Average External Electrical Load	= .0 kWh/day
Total Annual Energy Consumption	= 5840. kWh

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	5213.1	4700.0	.0
Neither	42.9	.0	.0
Cooling	.0	.0	.0
Total	5256.0	4700.0	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	= 811551. MJ	=225431.0 kWh
Ventilator Electrical Consumption: Heating Hours	= 18767. MJ	= 5213.1 kWh
Estimated Annual DHW Heating Energy Consumption	= 0. MJ	= .0 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	= 830319. MJ	=230644.1 kWh
ANNUAL R-2000 SPACE - DHW ENERGY CONSUMPTION TARGET	= 269160. MJ	= 74766.7 kWh
Estimated Annual Base Electrical Energy Consumption	= 21024. MJ	= 5840.0 kWh
Ventilator Electrical Consumption: Non Heating Hours	= 154. MJ	= 42.9 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel		Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil	(U.S. Gal)	5565.1	.0	.0	.0	5565.1
Electricity	(kWh)	9913.1	.0	.0	5882.9	15796.0

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

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*                                      *
*               Hot2000                *
*             Version 6.02             *
*                CANMET                *
* Energy, Mines and Resources CANADA   *
*             July 1, 1991             *
*                                      *
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House Data Filename=C:\WINDOWS\DESKTOP\HOT2000\WSTBALRR.HDF

Weather Data is for WHITEHORSE, YUKON TERRITORY

Builder Code =RETROFIT Data Entry by:P. LOUDON

Client name: WESTMARK, WHITEHORSE
Street address: BALLROOM WING 1FLR-SLAB Retro
City: WHITEHORSE Region: YUKON TERRITORY
Postal code: Telephone:

*** GENERAL HOUSE CHARACTERISTICS ***

House type: Triplex
Number of storeys: Three storeys
Wall construction: Single stud wall

SOIL TYPE: Normal Conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 0.5 in. gyproc walls and ceiling, wooden floor

Occupants : 10 Adults for 100.0 % of the time
10 Children for 100.0 % of the time

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 69.8 F
	TEMP. Swing from 69.8 F	= 6.3 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement
Slab on Grade	1 Side	Not Edge Interior

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Location Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC
East	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	1	200214	8.000	4.500	.000	.000	.6653
North	1	M1	4	200214	8.000	4.500	.000	.000	.6653
West	1	M1	7	200214	8.000	4.500	.000	.000	.6653

*** WINDOW PARAMETER CODES SCHEDULE ***

	Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1	200214	Double (DG), Clear, 13 mm Air, Insulating, Hinged, Vinyl

*** BUILDING PARAMETERS ***

Component		Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Above Grade Components						
Ceiling						
C1		6466.00	6466.00	30.00		
	TOTAL:	6466.00	6466.00	30.00	75.100	12.73
Main Walls						
M1		3732.00	2934.00	28.50		
	TOTAL:	3732.00	2934.00	28.50	34.272	5.81
Doors						
D1 Location: M1		42.00	42.00	3.00		
	TOTAL:	42.00	42.00	3.00	4.878	.83
Slab on Grade						
Perimeter area						
		960.00		1.14		
	TOTAL:	960.00		.00	56.863	9.64
Centre area						
		5506.00		1.14		
	TOTAL:	5506.00		.00	74.293	12.59

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss
East							
M1	9	200214	324.00	2.12			
M1	1	200214	36.00	2.12			
TOTAL:			360.00	2.12		59.171	10.03
North							
M1	4	200214	144.00	2.12			
TOTAL:			144.00	2.12		23.668	4.01
West							
M1	7	200214	252.00	2.12			
TOTAL:			252.00	2.12		41.419	7.02

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
77592.0 Ft3	.46 ACH	220.305	37.34

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area = 16664.0 Ft2
Air Tightness Level is Energy tight (1.5 ACH @50 Pa.)
Building Envelope is NOT Sheltered from the Wind.
Estimated Equivalent Leakage Area = 183.9 in2
Normalized Leakage Area = .0110 in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference = 160 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference = 251 cfm
Estimated Airflow to cause a 15 Pa Pressure Difference = 326 cfm
ELA used to calculate Estimated Airflows = 73.5 in2

F-326 VENTILATION REQUIREMENTS:

Kitchen,living,dining:	10 rooms @ 10 cfm	=100 cfm
Utility rooms:	10 rooms @ 10 cfm	=100 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	5 rooms @ 10 cfm	= 50 cfm
Bathrooms:	10 rooms @ 10 cfm	=100 cfm
Other habitable rooms:	10 rooms @ 10 cfm	=100 cfm
Basement Rooms:		0 cfm

*** EXHAUST FLOW RATES (cfm) ***

	Continuous	Intermittent
Dryer		450.9
Kitchen	.0	.0
All Bathrooms	.0	75.0
All other exhaust devices	.0	.0
Vented central vac.		.0
Largest Intermittent exhaust (other than Dryer)		.0

Total continuous exhaust flow .0 cfm
Exhaust Fan Power .0 watts

F-326 Required continuous ventilation rate = 497.9 cfm (.39 ACH)
Average Ventilation Supply Rate (Balanced) = 500.0 cfm (.39 ACH)
Average Ventilation Exhaust Rate = 500.0 cfm (.39 ACH)

Ventilation System: Fans without Heat Recovery
Manufacturer: POWERFUL
Model Number: USE A LOT

Mechanical Ventilator Fan Power = 600. Watts

Gross Air Leakage and Ventilation Energy Load = 238.166 Mil.BTU
Seasonal Heat Recovery Ventilator Efficiency = .000 %
Estimated Ventilation Electrical Load: Heating Hours = 17.788 Mil.BTU
Estimated Ventilation Electrical Load: Non-Heating Hours = .146 Mil.BTU
Net Air Leakage and Ventilation Energy Load = 229.199 Mil.BTU

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flue vent damper
Manufacturer :
Model :
Output Capacity = 34120.0 BTU/hr (Insufficient capacity)

Steady State Efficiency = 82.0 %

Fan Mode : Auto Fan Power 1940. watts

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -41.8 F = 2.35 BTU/hr/Ft3	=151958. BTU/hr
Gross Space Heating Load	=589.969 Mil.BTU
Sensible Daily Heat Gain From Occupants	= 24.00 kWh/day
Usable Internal Gains	= 47.326 Mil.BTU
Usable Internal Gains Fraction	= 8.0 %
Usable Solar Gains	= 81.536 Mil.BTU
Usable Solar Gains Fraction	= 13.8 %
Ventilation Equipment Electrical Contribution	= 8.894 Mil.BTU
Auxiliary Energy Required	=461.107 Mil.BTU
Space Heating System Load	=461.783 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 80.3 %
Furnace/Boiler Annual Energy Consumption	=558.686 Mil.BTU

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel :
Water Heating Equipment : No DHW system installed

*** LIGHTING AND APPLIANCES SUMMARY ***

Total Electrical Load	= 16.0 kWh/day
Average External Electrical Load	= .0 kWh/day
Total Annual Energy Consumption	= 5840. kWh

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	5213.1	4705.8	.0
Neither	42.9	.0	.0
Cooling	.0	.0	.0
Total	5256.0	4705.8	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	= 589445. MJ	=163734.6 kWh
Ventilator Electrical Consumption: Heating Hours	= 18767. MJ	= 5213.1 kWh
Estimated Annual DHW Heating Energy Consumption	= 0. MJ	= .0 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	= 608212. MJ	=168947.8 kWh
ANNUAL R-2000 SPACE + DHW ENERGY CONSUMPTION TARGET	= 269160. MJ	= 74766.6 kWh
Estimated Annual Base Electrical Energy Consumption	= 21024. MJ	= 5840.0 kWh
Ventilator Electrical Consumption: Non Heating Hours	= 154. MJ	= 42.9 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel		Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil	(U.S. Gal)	4042.0	.0	.0	.0	4042.0
Electricity (kWh)		9918.9	.0	.0	5882.9	15801.8

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Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

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*                                      *
*              Hot2000                 *
*            Version 6.02              *
*               CANMET                 *
* Energy, Mines and Resources CANADA   *
*            July 1, 1991              *
*                                      *
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House Data Filename=C:\WINDOWS\DESKTOP\HOT2000\WSTTRAVL.HDF

Weather Data is for WHITEHORSE, YUKON TERRITORY

Builder Code =RETROFIT   Data Entry by:P. LOUDON

Client name:	WESTMARK, WHITEHORSE		
Street address:	TRAVEL-BARBER WING 1FLR W/CRWL		
City:	WHITEHORSE	Region:	YUKON TERRITORY
Postal code:		Telephone:	

*** GENERAL HOUSE CHARACTERISTICS ***

House type:	Triplex
Number of storeys:	Three storeys
Wall construction:	Single stud wall

SOIL TYPE: Normal Conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 0.5 in. gyproc walls and ceiling, wooden floor

Occupants : 10 Adults for 100.0 % of the time
10 Children for 100.0 % of the time

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 69.8 F
	Crawl Space	= 59.0 F
	Calculated Crawl Space	= 18.8 F
	TEMP. Swing from 69.8 F	= 6.3 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement
Closed Crawl Space	None	On Grade

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Location Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC
South	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	7	200214	8.000	4.500	.000	.000	.6653
North	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	6	200214	8.000	4.500	.000	.000	.6653

*** WINDOW PARAMETER CODES SCHEDULE ***

Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1 200214	Double (DG), Clear, 13 mm Air, Insulating, Hinged, Vinyl

*** BUILDING PARAMETERS ***

Component		Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Above Grade Components						
Ceiling						
C1		9752.00	9752.00	30.00		
	TOTAL:	9752.00	9752.00	30.00	113.265	10.19
Main Walls						
M1		5340.00	4182.00	7.50		
	TOTAL:	5340.00	4182.00	7.50	185.630	16.70
Doors						
D1 Location: M1		42.00	42.00	3.00		
	TOTAL:	42.00	42.00	3.00	4.878	.44
Crawl Space Area						
Crawl space wall area						
		3284.00		7.00		
	TOTAL:	3284.00		7.00	157.994	14.22
Perimeter area (1 M or 3.3 Ft wide)						
		1449.00		1.14		
	TOTAL:	1449.00		.00	43.114	3.88
Centre area						
		8303.00		1.14		
	TOTAL:	8303.00		.00	93.724	8.43

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss
South							
M1	9	200214	324.00	2.12			
M1	7	200214	252.00	2.12			
TOTAL:			576.00	2.12		94.673	8.52
North							
M1	9	200214	324.00	2.12			
M1	6	200214	216.00	2.12			
TOTAL:			540.00	2.12		88.756	7.99

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
117024.0 Ft3	.51 ACH	329.296	29.63

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area	= 28128.0 Ft2
Air Tightness Level is Average (4.55 ACH @50 Pa.)	
Building Envelope is NOT Sheltered from the Wind.	
Estimated Equivalent Leakage Area	= 708.7 in2
Normalized Leakage Area	= .0252 in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference	= 615 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference	= 966 cfm
Estimated Airflow to cause a 15 Pa Pressure Difference	= 1257 cfm
ELA used to calculate Estimated Airflows	= 283.5 in2

F-326 VENTILATION REQUIREMENTS:

Kitchen,living,dining:	10 rooms @ 10 cfm	=100 cfm
Utility rooms:	10 rooms @ 10 cfm	=100 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	5 rooms @ 10 cfm	= 50 cfm
Bathrooms:	10 rooms @ 10 cfm	=100 cfm
Other habitable rooms:	10 rooms @ 10 cfm	=100 cfm
Basement Rooms:		0 cfm

*** EXHAUST FLOW RATES (cfm) ***

	Continuous	Intermittent
Dryer		450.9
Kitchen	.0	.0
All Bathrooms	.0	75.0
All other exhaust devices	.0	.0
Vented central vac.		.0
Largest Intermittent exhaust (other than Dryer)		.0

Total continuous exhaust flow .0 cfm
Exhaust Fan Power .0 watts

F-326 Required continuous ventilation rate = 497.9 cfm (.31 ACH)
Average Ventilation Supply Rate (Balanced) = 500.0 cfm (.31 ACH)
Average Ventilation Exhaust Rate = 500.0 cfm (.31 ACH)

Ventilation System: Fans without Heat Recovery
Manufacturer: POWERFUL
Model Number: USE A LOT

Mechanical Ventilator Fan Power = 600. Watts

Gross Air Leakage and Ventilation Energy Load = 347.157 Mil.BTU
Seasonal Heat Recovery Ventilator Efficiency = .000 %
Estimated Ventilation Electrical Load: Heating Hours = 17.788 Mil.BTU
Estimated Ventilation Electrical Load: Non-Heating Hours = .146 Mil.BTU
Net Air Leakage and Ventilation Energy Load = 338.190 Mil.BTU

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flue vent damper
Manufacturer :
Model :
Output Capacity = 34120.0 BTU/hr (Insufficient capacity)

Steady State Efficiency = 82.0 %

Fan Mode : Auto Fan Power 1940. watts

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -41.8 F = 3.19 BTU/hr/Ft3 =373450. BTU/hr

Gross Space Heating Load	=******* Mil.BTU
Sensible Daily Heat Gain From Occupants	= 24.00 kWh/day
Usable Internal Gains	= 47.326 Mil.BTU
Usable Internal Gains Fraction	= 4.3 %
Usable Solar Gains	=154.657 Mil.BTU
Usable Solar Gains Fraction	= 13.9 %
Ventilation Equipment Electrical Contribution	= 8.894 Mil.BTU
Auxiliary Energy Required	=909.348 Mil.BTU
Space Heating System Load	=910.389 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 80.1 %
Furnace/Boiler Annual Energy Consumption	=******* Mil.BTU

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel :
Water Heating Equipment : No DHW system installed

*** LIGHTING AND APPLIANCES SUMMARY ***

Total Electrical Load	= 16.0 kWh/day
Average External Electrical Load	= .0 kWh/day
Total Annual Energy Consumption	= 5840. kWh

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	5213.1	4622.7	.0
Neither	42.9	.0	.0
Cooling	.0	.0	.0
Total	5256.0	4622.7	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	=1183211. MJ	=328669.6 kWh
Ventilator Electrical Consumption: Heating Hours	= 18767. MJ	= 5213.1 kWh
Estimated Annual DHW Heating Energy Consumption	= 0. MJ	= .0 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	=1201978. MJ	=333882.7 kWh
ANNUAL R-2000 SPACE + DHW ENERGY CONSUMPTION TARGET	= 405946. MJ	=112762.8 kWh
Estimated Annual Base Electrical Energy Consumption	= 21024. MJ	= 5840.0 kWh
Ventilator Electrical Consumption: Non Heating Hours	= 154. MJ	= 42.9 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel		Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil	(U.S. Gal)	8113.7	.0	.0	.0	8113.7
Electricity	(kWh)	9835.8	.0	.0	5882.9	15718.7

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

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*                                      *
*              Hot2000                 *
*            Version 6.02              *
*               CANMET                 *
*  Energy, Mines and Resources CANADA  *
*            July 1, 1991              *
*                                      *
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House Data Filename=C:\WINDOWS\DESKTOP\HOT2000\WSTTRVLR.HDF

Weather Data is for WHITEHORSE, YUKON TERRITORY

Builder Code =RETROFIT Data Entry by:P. LOUDON

Client name: WESTMARK, WHITEHORSE
Street address: TRAVEL WING 1FLR W/CRWL Retro
City: WHITEHORSE Region: YUKON TERRITORY
Postal code: Telephone:

*** GENERAL HOUSE CHARACTERISTICS ***

House type: Triplex
Number of storeys: Three storeys
Wall construction: Single stud wall

SOIL TYPE: Normal Conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 0.5 in. gyproc walls and ceiling, wooden floor

Occupants : 10 Adults for 100.0 % of the time
10 Children for 100.0 % of the time

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 69.8 F
	Crawl Space	= 59.0 F
	Calculated Crawl Space	= 19.2 F
	TEMP. Swing from 69.8 F	= 6.3 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement
Closed Crawl Space	None	On Grade

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Location Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC
South	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	7	200214	8.000	4.500	.000	.000	.6653
North	1	M1	9	200214	8.000	4.500	.000	.000	.6653
	2	M1	6	200214	8.000	4.500	.000	.000	.6653

*** WINDOW PARAMETER CODES SCHEDULE ***

Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1 200214	Double (DG), Clear, 13 mm Air, Insulating, Hinged, Vinyl

*** BUILDING PARAMETERS ***

Component		Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Above Grade Components						
Ceiling						
C1		9752.00	9752.00	30.00		
	TOTAL:	9752.00	9752.00	30.00	113.265	14.34
Main Walls						
M1		5340.00	4182.00	28.50		
	TOTAL:	5340.00	4182.00	28.50	48.850	6.18
Doors						
D1 Location: M1		42.00	42.00	3.00		
	TOTAL:	42.00	42.00	3.00	4.878	.62
Crawl Space Area						
Crawl space wall area						
		3284.00		17.00		
	TOTAL:	3284.00		17.00	72.680	9.20
Perimeter area (1 M or 3.3 Ft wide)						
		1449.00		10.00		
	TOTAL:	1449.00		10.00	18.009	2.28
Centre area						
		8303.00		1.14		
	TOTAL:	8303.00		.00	120.382	15.24

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss
South							
M1	9	200214	324.00	2.12			
M1	7	200214	252.00	2.12			
TOTAL:			576.00	2.12		94.673	11.98
North							
M1	9	200214	324.00	2.12			
M1	6	200214	216.00	2.12			
TOTAL:			540.00	2.12		88.756	11.23

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
117024.1 Ft3	.37 ACH	228.529	28.93

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area = 28128.0 Ft2
Air Tightness Level is Energy tight (1.5 ACH @50 Pa.)
Building Envelope is NOT Sheltered from the Wind.
Estimated Equivalent Leakage Area = 231.8 in2
Normalized Leakage Area = .0082 in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference = 201 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference = 316 cfm
Estimated Airflow to cause a 15 Pa Pressure Difference = 411 cfm
ELA used to calculate Estimated Airflows = 92.7 in2

F-326 VENTILATION REQUIREMENTS:

Kitchen,living,dining:	10 rooms @ 10 cfm	=100 cfm
Utility rooms:	10 rooms @ 10 cfm	=100 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	5 rooms @ 10 cfm	= 50 cfm
Bathrooms:	10 rooms @ 10 cfm	=100 cfm
Other habitable rooms:	10 rooms @ 10 cfm	=100 cfm
Basement Rooms:		0 cfm

*** EXHAUST FLOW RATES (cfm) ***

	Continuous	Intermittent
Dryer		450.9
Kitchen	.0	.0
All Bathrooms	.0	75.0
All other exhaust devices	.0	.0
Vented central vac.		.0
Largest Intermittent exhaust (other than Dryer)		.0

Total continuous exhaust flow .0 cfm
Exhaust Fan Power .0 watts

F-326 Required continuous ventilation rate = 497.9 cfm (.31 ACH)
Average Ventilation Supply Rate (Balanced) = 500.0 cfm (.31 ACH)
Average Ventilation Exhaust Rate = 500.0 cfm (.31 ACH)

Ventilation System: Fans without Heat Recovery
Manufacturer: POWERFUL
Model Number: USE A LOT

Mechanical Ventilator Fan Power = 600. Watts

Gross Air Leakage and Ventilation Energy Load = 246.390 Mil.BTU
Seasonal Heat Recovery Ventilator Efficiency = .000 %
Estimated Ventilation Electrical Load: Heating Hours = 17.788 Mil.BTU
Estimated Ventilation Electrical Load: Non-Heating Hours = .146 Mil.BTU
Net Air Leakage and Ventilation Energy Load = 237.423 Mil.BTU

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flue vent damper
Manufacturer :
Model :
Output Capacity = 34120.0 BTU/hr (Insufficient capacity)

Steady State Efficiency = 82.0 %

Fan Mode : Auto Fan Power 1940. watts

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -41.8 F = 2.11 BTU/hr/Ft3 =246884. BTU/hr

Gross Space Heating Load	=790.023 Mil.BTU
Sensible Daily Heat Gain From Occupants	= 24.00 kWh/day
Usable Internal Gains	= 47.326 Mil.BTU
Usable Internal Gains Fraction	= 6.0 %
Usable Solar Gains	=147.223 Mil.BTU
Usable Solar Gains Fraction	= 18.6 %
Ventilation Equipment Electrical Contribution	= 8.894 Mil.BTU
Auxiliary Energy Required	=595.473 Mil.BTU
Space Heating System Load	=596.200 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 80.1 %
Furnace/Boiler Annual Energy Consumption	=728.844 Mil.BTU

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel :
Water Heating Equipment : No DHW system installed

*** LIGHTING AND APPLIANCES SUMMARY ***

Total Electrical Load	= 16.0 kWh/day
Average External Electrical Load	= .0 kWh/day
Total Annual Energy Consumption	= 5840. kWh

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	5213.1	4530.8	.0
Neither	42.9	.0	.0
Cooling	.0	.0	.0
Total	5256.0	4530.8	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	= 768971. MJ	=213603.0 kWh
Ventilator Electrical Consumption: Heating Hours	= 18767. MJ	= 5213.1 kWh
Estimated Annual DHW Heating Energy Consumption	= 0. MJ	= .0 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	= 787738. MJ	=218816.1 kWh
ANNUAL R-2000 SPACE + DHW ENERGY CONSUMPTION TARGET	= 405946. MJ	=112762.8 kWh
Estimated Annual Base Electrical Energy Consumption	= 21024. MJ	= 5840.0 kWh
Ventilator Electrical Consumption: Non Heating Hours	= 154. MJ	= 42.9 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel	Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil (U.S. Gal)	5273.1	.0	.0	.0	5273.1
Electricity (kWh)	9743.9	.0	.0	5882.9	15626.8

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

Conclusions

CONCLUSIONS

The hotel is a wonderful example of what a comprehensive energy efficiency retrofit can do for an older building. Not only will owners experience a far lower overhead from reductions in energy use but the reduced operation and maintenance activity level will allow employees to concentrate on keeping the building interior more pleasant for guests. This is a great advantage compared to the present operation where weekly boiler control changes and light bulb replacements take them away from such activities. Not to mention the frequent need for inspections of out-of-the-way places to check for freezing pipes. Or, pulling ceiling panels aside so warm air is able to circulate with everyone working in fear of being blamed for the next frozen pipe and the emergency situation such an occurrence places on the entire staff… and guests.

How many floods from broken pipes blasting water into the dining room does it take to justify application of energy efficiency enhancements? Five? Maybe, but with two already in the recent past it won't take to many cold snaps for three more in the condition this building is in. A common sense approach to improving the tightness level of the exterior envelope is all that it takes to keep cold air from rushing in and freezing such areas. It's not free, but again, how cheap is flood damage and disruption to guests? Leaving the building the way it is will never show a payback, only a pay-out. Apply these retrofit items and the guests will marvel at the comfortable surroundings and patient staff.

It is my opinion after analysis of the building energy use and estimated retrofit savings that a potential savings of around $115,000 per year is likely from observing the existing condition. This is possible since nothing in my analysis considered savings from balancing and proving ventilation systems, fuel switching, improving domestic hot water production, reductions in water use, reductions in electricity from outside lights and tube florescent lights. Add to this installation of smart boiler controls, not operating 181 fans so often, savings in air-conditioning, adding roof insulation, etc.

Couple all of the incentives above with the December 7, 2000 Wall Street Journal article titled

"U.S. Warns of 50% Rise in Heating Costs"

As fuel resources become depleted and more demand is placed upon existing sources the costs for energy are sure to have a more negative impact upon energy inefficient buildings than on ones with low operating overhead. In addition, transportation costs rise and manufacturing cost rise and materials become elevated in cost. Adding insulation now, replacing boilers now, installing efficiency options now, will never become less expensive than today.

ARCTIC TECHNICAL SERVICES
1318 WELL STREET, FAIRBANKS, AK 99701
Tel (907)452-8368 Fax (907) 452-8007

Building Wall and Crawlspace - Retrofit Analysis

Analysis of:	Westmark Hotel
Community:	Whitehorse, Yukon, Canada
Telephone:	**Fax:**

HOT 2000 Model Identifier Location	Energy Use for Existing KwH	Energy Use for Retrofit KwH	ExistingHeating Fuel Oil Use US Gallons	Retrofit Heating Fuel Oil Use US Gallons	Percentage of Energy/Fuel Use Retrofit to Existing %	Total Annual Oil Saved US Gallons
Office Wing	338,817	216,811	8,364	5,352	64%	**3,012**
Three Storys	466,212	247,945	11,509	6,121	53%	5,388
Travel Wing	1,201,978	787,738	8,114	5,273	65%	**2,841**
Three Storys	1,603,439	885,102	10,824	5,925	55%	4,899
Ballroom Wing	225,431	169,445	5,565	4,042	73%	**1,523**
Three Storys	302,619	189,135	7,471	4,512	60%	2,959
TOTAL	ANNUAL GALLONS OF OIL SAVED AFTER RETROFIT				(hotel wings only)	13,246
TOTAL	ESTIMATED COST SAVINGS IN CANADIAN DOLLARS TODAY				(hotel wings only)	$31,740.67

Support Documents

Boiler Room #1

Pump #24	Main Booster
Pump #25	Main Backup Booster
Pump #26	Main Booster;Domestic Hot Water, Air Handling Unit, Heat Exchanger
Pump #27	Auxiliary Booster; Domestic Hot Water & Air Handling Unit
Pump #28	Domestic Hot Water Recirc 201 - 301 - Kitchen
Pump #29	Pre Heat For Air Handling Unit/Glycol
Pump #30	Hot Deck For Air Handling Unit/Glycol
Pump #31	Main Booster/Heating 201 - 301 Wing
Pump #32	Auxiliary Booster/Heating 201 - 301 Wing

Valve Room

Pump #13	Main Booster; Pre Heat Coil/Second Floor Air Unit/Glycol
Pump #14	Auxiliary Booster; Pre Heat/Second Floor Air Unit/Glycol
Pump #15	Auxiliary Booster; Hot Deck/Second Floor Air Unit& Heat Exchanger
Pump #16	Main Booster; Hot Deck/Second Floor Air Unit & Heat Exchanger
Pump #17	1st & 2nd Floor Heat/Southside Of 138 & 232 Wings
Pump #18	1 st & 2nd Floor Heat/Northside Of 138 & 232 Wings
Pump #19	Domestic Hot Water Heat Exchanger
Pump #20	3rd Floor Heat/North & South Of 332 Wing
Pump #21	Restaurant & Bar Heat
Pump #22	Domestic Hot Water Storage Tank Recirc
Pump #23	Domestic Hot Water Recirc/Entire North Wings 138, 232, 332, & Bar

Boiler Room # 2

Pump #1	2nd Floor Heat / 259 Wing North Side
Pump #2	2nd Floor Heat / 260 Wing South Side
Pump #3	1 st Floor / 165 Wing North Side
Pump #4	Heat Exchanger For Air Unit / 165, 259, 359 Wings
Pump #5	Out Of Service / Crawl Space Heater
Pump #6	Commerical Wing / 165 South Side, Gift Shop & Banquet Office
Pump #7	3rd Floor / North & South 359 Wing
Pump #8	Preheat/Air Handling Unit/Glycol/ Entir South Wings 165/259/359 Wings
Pump #9	Hot Deck/Air Handling Unit/Glycol/Entire South Wings 165/259/359 Wing
Pump #10	Domestic Hot Water Ricirc./Entire South Wings 165/259/359 Wings
Pump #11	Domestic Hot Water; Heat Exchange Boiler #2/Plus Storage Tank
Pump #12	Sprinkler Tree/City Recirc.

DATE	1	1	2	2	GLY	GLY	P	U	M	P	S	&	M	O	T	O	R	S
Boiler room #1	P	T	P	T	P	T	24	25	26	27	28	29	30	31	32			
Boiler room #1	P/1	T/1	P/2	T/2	Gly	Gly	24	25	26	27	28	29	30	31	32			

Boiler room #2	1	1	2	2	GLY	GLY	P	U	M	P	S	&	M	O	T	O	R	S
	P	T	P	T	P	T	1	2	3	4	5	6	7	8	9	10	11	12
Mon.																		
Tues.																		
Wed.																		
Thurs.																		
Fri.																		
Sat.																		
Sun.																		

Valve Room	BW	BW	GLY	GLY			P	U	M	P	S	&	M	O	T	O	R	S
	P	T	P	T	13	14	15	16	17	18	19	20	21	22	23			
Mon.																		
Tues.																		
Wed.																		
Thurs.																		
Fri.																		
Sat.																		
Sun.																		

OIL BURNER DATA BOOKLET

FOR

Single Stage Firing (on-off) Models

3450 R.P.M. Burners With Flame Retention

MODELS WITH FLAME RETENTION

Model 95A	3.00	-	7.00 G.P.H.
Model 95A300	3.00	-	7.00 G.P.H.
Model 96A-2	5.00	-	7.00 G.P.H.
Model 96A-1	7.00	-	12.00 G.P.H.
Model 96A-B	11.00	-	16.00 G.P.H.
Model 970	10.00	-	20.00 G.P.H.

ABC® OIL BURNERS

AUTOMATIC BURNER CORPORATION—1823 CARROLL AVE., CHICAGO, ILL., 60612

U-90 10/69

FOREWORD

FUEL OIL SPECIFICATIONS: The Underwriters' Laboratories, Inc., have listed these burners for use with #1 or #2 fuel oil, National Bureau of Standards, Commercial Standard No. "CS-12-48".

OPERATING INSTRUCTION CARD: Detailed instructions pertaining to the operation of the burner should be carefully explained to the owner by the installer at the time of installation. The instruction card should then be hung in a prominent place near the burner.

APPROVALS: These burners are listed by the Underwriters' Laboratories, Inc., the New York Board of Standards and Appeals, the State Fire Marshall of the Commonwealth of Massachusetts, the Department of State Police of Connecticut and others. Burners with a capacity of 7.00 G. P. H. and under are manufactured in accordance with the National Bureau of Standards, Commercial Standard No. CS-75-56.

OPERATING INSPECTION: Be sure to inspect the installation at least twice within two weeks after it has been placed in operation. Examine and clean, if necessary, the filter and the strainer in the fuel unit. Inspect all tubing and equipment for oil leaks. Check the oil pressure and flame adjustment. Also, start and stop the burner several times to see that it and the controls are functioning correctly. Check the setting of all controls.

SERVICE AND PARTS INFORMATION: Special pamphlets pertaining to service, the ordering of replacement parts and the return of parts for repairs can be furnished upon request.

GENERAL SPECIFICATIONS: Several ratings may be utilized to insure combustion efficiency over the entire capacity range of the burner (a rating is a combination of various air delivery parts and nozzles). It should be noted that there is no difference in the burners for the various ratings except as relates to the air delivery parts and nozzles. Since the rating is not indicated on the nameplate of the burner, the burner may be changed from one rating to another merely by changing certain parts as specified in the Burner Rating Table.

UNDERWRITERS' REQUIREMENTS: Oil burners, oil storage tanks, piping and electrical work must be installed strictly in accordance with the regulations of the National Board of Fire Underwriters and local ordinances.

UNPACKING BURNER AND CONTROLS: While unpacking burner, check for concealed damages, inspect air inlet assembly and housing for breakage or other damage. If controls are packed with burner, remove them from their cartons and inspect. If any damage is found, notify transportation company and supplier immediately.

Also included with your Oil Burner shipment is a copy of "90" Series Service Manual. This booklet provides helpful service hints and also contains information concerning fuel units.

SPECIAL NOTATION

THE INFORMATION SHOWN IN THIS BOOKLET IS INTENDED FOR GENERAL CONVERSION BURNER INSTALLATIONS. THE BURNER & DRAWER ASSEMBLY ADJUSTMENT SETTINGS WHICH ARE SHOWN IN THE DRAWINGS CONTAINED IN THIS MANUAL ARE BASED ON TEST FIRING IN CONVERSION UNITS. WHEN FIRING ORIGINAL EQUIPMENT UNITS ALWAYS REFER TO MANUFACTURER'S SPECIFIC DATA FOR ADJUSTMENT SETTINGS & SERVICE INFORMATION.

OIL TANKS AND PIPING:

a. Miscellaneous Information: Underwriters' Laboratories, requirements now in effect stipulate a bottom outlet on all 275 gallon tanks so that the tank can be drained. This is to prevent the accumulation of condensate which causes the tank to rust. A water trap can be installed at the tank outlet to prevent the condensate from entering the burner. There are a number of additives on the market that can be put in the tank with the fuel oil. These additives hold the water in suspension and allow it to pass into the burner. Consult a local fuel oil dealer for information concerning the use of these additives.

b. Two Line System: A two line (suction and return) installation must be made. On this type of installation, the by-pass plug has to be installed in the fuel unit.

c. Suction Line: It is recommended that 1/2" O.D. (or larger) copper tubing be used for this line. If standard wrought iron pipe is used, it should be scale-free and not smaller than 1/2". A complete loop of 1/2" copper tubing should be installed to connect the pipe to the fuel unit. Where tubing is used, one complete loop should be made in the tubing immediately below the fitting connecting it to the oil pump in order to reduce transmission of noise and to prevent strain on the burner. When the top of the tank is below the level of the fuel unit, high points or air pockets in the suction line must be avoided between the tank and the fuel unit, and a ball check valve should be installed in the basement to prevent the return of the oil to the tank during the off-cycle period of the burner. Do not run suction or return line overhead as this greatly increases the possibility of air traps, oil leaks, syphoning and transmission of noise. When the top of the tank is above the fuel unit, the suction line should be run to a point above the tank where an approved anti-syphon valve and a gate valve must be installed. These valves should be installed inside. No ball check valve is required, but a union should be installed between the gate valve and the strainer to facilitate the removal of the strainer for cleaning when necessary.

d. Return Line: The return line should be the same size as the suction line and run as directly as possible from the return opening in the fuel unit to the tank. It should extend into the tank to the same depth as the suction line. (See Illustration).

e. Pressure Test for Buried Oil Lines: It is important that buried oil line be thoroughly tested for leaks before being covered.

DRAFT REGULATORS: Use a draft regulator on all installations, unless otherwise specified by appliance refs, but never one smaller than the smoke pipe diameter. Install the draft regulator as close as possible to the chimney. If the smoke pipe is too short to make a satisfactory installation, the draft regulator may be installed in the chimney either above or below the smoke pipe entry into the chimney. There is a considerable difference of opinion as to whether or not the draft regulator should be installed in the chimney; however, many satisfactory installations have been made with the draft regulator installed in the chimney either above or below the smoke pipe.

FILTER: Install a good filter (sized for the 30 gallon capacity of the fuel unit) in the suction line in a location where it can be easily serviced. The filter cartridge should be replaced at least once a year. The filter body should be thoroughly cleaned before installing a new cartridge.

AIR FOR COMBUSTION: Do not install burners in rooms with insufficient air to support combustion. Occasionally, it is necessary to install windows or cut holes in a door to these rooms to obtain sufficient air. An opening at least twice the area of the smoke pipe is necessary. An exhaust fan operating in the building may cause a smoky or pulsating fire if the air intake in the heater room is too small. The air intake in this room should be of sufficient size so that there is no change in the draft reading in the stack when the burner is in operation and the exhaust fan is turned on or off.

COMBUSTION CHAMBERS: If the combustion chamber is not furnished with the heating unit, it should be constructed to the proper dimensions for heating load as shown in Nozzle and Combustion Chamber Data Chart. Slight variations can be made in the dimensions when required.

WIRING: All wiring must be done in accordance with the National Electric Code and/or in accordance with local ordinances. The controls and wiring furnished with the burner are tested at the factory. It is suggested that all wiring be run in rigid conduit, but a short length of flexible conduit used between the burner and the rigid conduit will facilitate removing the burner for inspection without disconnecting any wiring. See the wiring diagrams incorporated in this form and those furnished with the controls supplied with each burner.

BURNER INSTALLATION

a. Controls: Instructions for installing and wiring the controls will be found packed with the controls. The controls should be installed strictly in accordance with these instructions, and, in case the control should prove defective, it should be returned direct to the control manufacturer or one of his service stations for repair or replacement. See Page 18 for control suffixes and types available.

b. Setting the Burner: The center line of the burner air tube should coincide with the center line of the heating plant. The burner should level across the top of the motor and fuel unit. The air tube should slant slightly downward (2^{o} to 4^{o}) toward the combustion chamber. The end of the burner air tube should be recessed approximately 3/4" from the front wall of the combustion chamber. For distance of the air tube above the floor of the combustion chamber, refer to Nozzle and Combustion Chamber Data Chart. If combustion chamber is already installed in heater, use opening provided for burner tube. Space between burner tube and refractory should be sealed with asbestos or other insulating material. Where a pedestal mounted burner is used, make sure that the burner does not touch heating unit at any point.

c. Installing Nozzles: Make sure that the proper size nozzles for the installation have been selected. Disconnect oil line and ignition leads and remove drawer assembly. The drawer assembly should be removed from the burner for screwing the nozzles in place. Do not attempt to insert the nozzles through the front end of blower tube, as it is almost impossible to get a tight joint between the nozzles and the nozzle adaptor unless two wrenches are used. Although electrodes are adjusted at time of manufacture, they should be checked at time of installation to be sure that they are set in accordance with drawing in this manual.

d. Rotate Blower Wheel: The blower wheel should be rotated by hand to be sure that the motor and fuel unit turn freely.

e. Oil Motor: Pour one teaspoon of good motor oil in each cup on motor.

f. To Put Burner Under Fire: See that all controls are set in normal starting position. Install pressure gauge in fuel unit. With the heating plant door open and with the air inlet on burner about half open, close the main cutout switch. Do not stand in front of open door. The burner should start, ignite and burn. Then close the heating plant door. After you have obtained a flame, the oil pressure should be checked and adjusted (if necessary). The air inlet can then be adjusted so that the flame is a clean yellow with slightly smoky tips. It may be necessary to readjust the air inlet after the burner is running twenty minutes or more in order to obtain the proper fire with a hot heating plant. After final adjustment, tighten lock screws on air inlet, let unit cool and start burner once again in order to be sure burner operates properly on a cold start. Remove pressure gauge and install pipe plug.

g. Using Instruments to Set Fire: It is far better to use combustion test instruments when adjusting a flame. National Bureau of Standards Commercial Standard CS-75-56 (for burners with a 7.00 G.P.H. capacity or less) require a minimum of 8% CO_2 with a smoke reading no darker than No. 5 on the Bacharach scale; however, we recommend a smoke reading no darker than No. 1. When using instruments to obtain this, adjust air inlet on burner for minimum air for clean combustion while combustion chamber is hot. Adjust the draft regulator so that there is .02" draft over the fire. Seal all air leaks around combustion chamber, heater joints and stack. Take your readings and adjust air so that a minimum of 8% CO_2 is obtained with the least smoke possible. When using instruments in setting a fire, do not lean towards getting a greater percentage of CO_2 than a clean fire will give. It is more important to keep the inside of the heating plant clean than to obtain a higher CO_2.

h. Nozzle (oil input) Variations: Several nozzles of different manufacture, angles and types of spray should be carried by installer to determine the most suitable for the particular application. Fuel oils vary greatly. Because of this, nozzles will not always deliver the gallonage per hour or angle of spray that is stamped on them. In addition, it has been found that, in certain areas, due to local conditions, nozzles other than those furnished as original equipment give better performance due to the type of oil being delivered.

i. Draft: Check to be sure that there is sufficient draft for the proper burning of the oil. At least .02" of draft over the fire is necessary. The draft in the stack also should be checked to determine whether or not there is an abnormally high draft loss through the heating plant for this may cause back pressure (draft) resulting in oil fumes in the building and/or pulsation when the burner starts and stops. This may cause an excessive deposit of soot in the flues of the heating plant and in the smoke pipe. High draft loss may be caused by overfiring or too much excess air. If there is back draft or down draft, do not install the burner until this situation is corrected. Back pressure (back draft or down draft) may also be caused by the chimney being lower than surrounding objects, such as buildings, hills, trees, rooftops, etc. (This paragraph concerning draft applies to burners being fired with draft in the firebox. Disregard these instructions on installations where the burner is fired under pressure.)

j. Conversion Installations: Clean Heating unit thoroughly before starting burner installation and inspect for leaks and other defects.

k. Inspection: After installation of the burner, check to see if there are any loose parts on the burner, controls or on the heating unit which might cause vibration. Check the operation on all electrical controls and inspect the installation carefully for oil leaks and other defects.

MISCELLANEOUS REMINDERS:

a. Install all electrical work in strict accordance with local ordinances.
b. Solder all splices or use approved wire nuts.
c. Steam pressure controls must be protected by a "pig-tail" or patented trap.
d. All unions must be of the ground seat type. Gasket unions will not do.
e. A check valve must be installed in the suction line when the tank is below the burner to prevent the return of the oil to the tank when the fuel unit is not in operation.
f. Do not permit any part of the burner to come in metallic contact with any part of the heating plant.
g. Rotate burner blower wheel by hand to be sure pump and motor are free.
h. Lubricate oil burner motor.
i. See if the draft conditions are right. Air leaks may kill the draft. Test chimney, smoke pipe and heating unit for air leaks.
j. See that the smoke pipe enters into chimney far enough to be tight and yet not so far as to reduce flue area. Its end should be flush with the inside of the flue.
k. Be sure that there is at least .02" draft over the fire.
l. Be sure there is no down draft or back draft.
(Disregard Items "k" and "l" if burner is being fired under pressure in firebox)
m. Be sure that there is sufficient air in heater room for proper combustion at all times.
n. Explain the operation of the burner to the owner--show where to oil--how to operate controls and main cutout switch.
o. Hang Burner Operating Instructions in prominent place near installation.

NOZZLE AND COMBUSTION CHAMBER DATA

FOR CONVERSION BURNER INSTALLATIONS

Gallon per Hour Input	Combustion Chamber		Height of Air Tube*	B. T. U. per Hour		Net Standing Load Sq. Ft. Radiation		Percent Piping & Pick Up Allowance	Boiler Output Sq.Ft. E.D.R.		Boiler Output H. P.
	Width	Length		Heater Input	Output At 70% Eff.	Steam	Water		Steam	Water	
3.00	15"	18"	4.0"	420,000	299,000	810	1300	50.0	1210	1920	8.60
3.50	15"	20"	4.0"	490,000	343,000	950	1510	50.0	1410	2270	10.00
4.00	15"	20"	4.0"	560,000	392,000	1090	1720	50.0	1615	2620	11.70
4.50	16"	22"	5.0"	620,000	441,000	1220	1960	50.0	1830	2850	13.10
5.00	16"	22"	5.0"	700,000	490,000	1360	2170	50.0	2030	3250	14.60
5.50	18"	24"	5.5"	770,000	539,000	1490	2400	50.0	2240	3600	16.00
6.00	18"	24"	5.5"	840,000	588,000	1630	2600	50.0	2440	3900	17.50
6.50	19"	25"	5.5"	910,000	637,000	1767	2825	50.0	2648	4235	18.95
7.00	23"	30"	6.0"	980,000	686,000	1904	3049	50.0	2856	4570	20.40
8.00	24"	30"	6.5"	1120,000	784,000	2176	3485	50.0	3264	5222	23.40
9.00	26"	32"	6.5"	1260,000	882,000	2448	3921	50.0	3662	5814	26.20
10.00	26"	34"	7.0"	1400,000	980,000	2720	4357	50.0	4070	6526	29.10
11.00	27"	36"	7.0"	1540,000	1078,000	2992	4739	50.0	4478	7178	32.01
12.00	28"	37"	7.5"	1680,000	1176,000	3264	5229	50.0	4886	7830	34.92
13.00	28"	38"	7.5"	1820,000	1274,000	3536	5665	50.0	5296	8452	37.83
14.00	30"	39"	8.0"	1960,000	1372,000	3808	6101	50.0	5702	9104	40.74
15.00	30"	40"	8.0"	2100,000	1470,000	4080	6536	50.0	6110	9756	43.65
16.00	32"	41"	8.5"	2240,000	1568,000	4352	6912	50.0	6518	10408	46.57
17.00	32"	42"	8.5"	2380,000	1666,000	4624	7408	50.0	7020	11160	49.47
18.00	34"	44"	9.0"	2520,000	1764,000	4896	7844	50.0	7434	11812	52.38
19.00	36"	46"	9.0"	2660,000	1862,000	5196	8280	50.0	7848	12464	55.29
20.00	36"	46"	10.0"	2800,000	1960,000	5441	8716	50.0	8262	13118	59.20

* The height of the air tube shown above is the distance between the bottom of the air tube and the floor of the combustion chamber.

MODEL
95A
95A-300

MOTOR: 1/3 H.P., 115-230 volt/60 cycle single phase, 3450 R.P.M., continuous duty, flange mounted with built-in manual overload protector.

TRANSFORMER: 115 volt/60 cycle primary voltage with 10,000 volt secondary voltage, mid-point grounded. (Stud Mounted).

PUMP: Incorporated in a two-stage fuel unit. Operates at motor speed through flexible coupling connected to motor. (Single-stage fuel unit available.)

BLOWER HOUSING: Designed with a true scroll and accurately fabricated to insure proper alignment of motor and fuel unit.

BLOWER TUBE: 4-1/8" O.D. Standard usable and overall tube lengths are shown on dimensional drawings.

MOUNTINGS: Pedestal (adjustable from 8" to 11" from floor to center line of blower tube). Welded flange available at additional charge for all models.

FINISH: Baked Synthetic Enamel.

SHIPPING WEIGHT: Approx. 74 lbs. (Less Controls).

OIL VALVE: Installed in line between drawer assembly and fuel unit to improve starting and cut-off.

CONTROLS: Honeywell controls standard. Other controls available.

Listed by Underwriters' Laboratories, Inc., under Commercial Standard CS-75-56 for use with number 1 and 2 fuel oil, commercial grade CS12-48.

All specifications are subject to change without notice.

Capacity Ranges

(2.0 to 7.0 GPH - Model 95A
(2.0 to 7.0 GPH - Model 95A-300

MODEL 96A

MOTOR: 1/3 H.P., 115-230 volt/60 cycle, single phase, 3450 R.P.M. continuous duty, flange mounted, with built-in manual overload protector.

TRANSFORMER: 115 volt/60 cycle primary voltage with 10,000 volt secondary voltage, mid-point grounded. (Stud mounted)

PUMP: Incorporated in a two-stage fuel unit. Operates at motor speed through flexible coupling connected to motor.

BLOWER HOUSING: Designed with a true scroll and accurately fabricated to insure proper alignment of motor and fuel unit.

BLOWER TUBE: 6-1/8" O.D. Standard usable and overall tube lengths are shown on dimensional drawings

MOUNTINGS: Pedestal (adjustable from 8-5/16" to 11-5/16" from floor to center line of blower tube). Welded flange available at additional charge for either model.

FINISH: Baked Synthetic Enamel.

SHIPPING WEIGHT: Approximately 85 lbs. (With standard controls).

OIL VALVE: Installed in line between drawer assembly and fuel unit to improve starting and cut-off.

CONTROLS: Honeywell Controls standard. Other controls available.

Listed by Underwriters' Laboratories, Inc. for use with number 1 and 2 fuel oil, commercial grade CS12-48.

All specifications are subject to change without notice.

Capacity Ranges

(5.0 to 12.0 GPH - Model 96A

MODEL 96A-B

MOTOR: 1/2 H.P., 115-230 volt/60 cycle, single phase, 3450 R.P.M., continuous duty, flange mounted, with built-in manual overload protector.

TRANSFORMER: 115 volt/60 cycle primary voltage with 10,000 volt secondary voltage, mid-point grounded. (Stud mounted)

PUMP: Incorporated in a two-stage fuel unit. Operates at motor speed through flexible coupling connected to motor.

BLOWER HOUSING: Designed with a true scroll and accurately fabricated to insure proper alignment of motor and fuel unit.

BLOWER TUBE: 6-1/8" O.D. Standard usable and overall tube lengths are shown on dimensional drawings.

MOUNTINGS: Pedestal (adjustable from 8-5/16" to 11-5/16" from floor to center line of blower tube). Welded flange available at additional charge for either model.

FINISH: Baked Synthetic Enamel.

SHIPPING WEIGHT: Approximately 85 lbs. (With standard controls).

OIL VALVE: Installed in line between drawer assembly and fuel unit to improve starting and cut-off.

CONTROLS: Honeywell Controls standard. Other controls available.

Listed by Underwriters' Laboratories, Inc. for use with number 1 and 2 fuel oil, commercial grade CS12-48.

All specifications are subject to change without notice.

Capacity Range 11.0 to 16.0 GPH

MODEL 970

MOTOR: 1/2 H.P., 115-230 volt/60 cycle, single phase, 3450 R.P.M., continuous duty, flange mounted, capacitor type, with built-in manual overload protector.

TRANSFORMER: 115 volt/60 cycle primary voltage, with 10,000 volt secondary voltage, mid-point grounded. (Stud Mounted).

PUMP: Incorporated in a two stage fuel unit. Operates at motor speed through flexible coupling connected to motor.

BLOWER HOUSING: Designed with a true scroll and accurately fabricated to insure proper alignment of motor and fuel unit.

BLOWER TUBE: 7-1/8" O.D. Standard usable and overall tube lengths are shown on dimensional drawings

MOUNTINGS: Pedestal (adjustable from 13" to 16" from floor to centerline of blower tube). Welded flange available at additional charge.

OIL VALVE: Installed in line between drawer assembly and fuel unit to improve starting and cutoff.

CONTROLS: Minneapolis Honeywell Flame Safeguard Controls are standard. Other controls available.

FINISH: Black Baked Synthetic Enamel.

SHIPPING WEIGHT: Approximately 140 lbs.

Listed by Underwriters' Laboratories, Inc., for use with number 1 and 2 fuel oil, commercial grade CS12-48.

All specifications are subject to change without notice.

Capacity Range 10.0 to 20.0 GPH

The chart below shows the U/L approved maximum firing rates (gallons per hour) with all available air. When firing certain heating units where it is necessary to obtain as low as 9% to 10% CO_2, with all available air, the maximum firing rate may be reduced. In such cases, testing will be necessary to determine the maximum firing rate.

Burner Model	U/L Approved Max. Firing Rate (GPH)	Burner Model	U/L Approved Max. Firing Rate (GPH)
95	3.00 to 7.00	96A	5.00 to 12.00
95A	3.00 to 7.00	96A-B	11.00 to 16.00
95A-300	3.00 to 7.00	970	10.00 to 20.00
96	6.00 to 12.00		

All of the above capacities are based on operation at sea level with 115 volt/60 cycle current, catalytic oil and fuel unit pressure set at 100 p.s.i. When used with 25 or 50 cycle current, the capacity of the burner is reduced 20%. For each 1,000 feet of elevation over 1,000 feet above sea level, the capacity is reduced approximately 5%. All specifications are subject to change without notice.

MODEL 95A RATING CHART (WITH 6-5/16" DIA. X 3-1/4" WIDE BLOWER WHEEL).

					NOZZLE DATA		QUANTITY
RATING	CHOKE	SPINNER	BANDS	G.P.H.RANGE	ANGLE	TYPE	REQUIRED
#2	3-3/8"	3-1/2"	Std.	4.00 - 5.00	45-90 °	S	1
#3	None	3-1/2"	Std.	5.00 - 7.00	45-90 °	S	1
#4	*3-9/16"	3-1/2"	Std.	3.00 - 7.00	45-90 °	S	1
#5	*3-9/16"	3-1/2"	Std.	3.00 - 7.50	45-90 °	S	1
#8	*3-9/16"	3-1/2"	Std.	4.50 - 7.50	45-90 °	S	2
#9	*3-9/16"	3-1/2"	#1 Set.	2.50 - 5.50	45-90 °	S	2
#10	*3-9/16"	3-1/2"	Std.	4.00 - 5.50	45-90 °	S	2
#11	*3-9/16"	3-1/2"	Std	5.00 - 7.00	45-90 °	S	2

* 3-9/16" Choke is set 7/8" from end of Air Tube.

RATINGS 10 & 11 HAVE NOZZLE ADAPTOR MOUNTED IN VERTICAL POSITION. SEE ILLUSTRÀTION SHOWN IN DRAWER ASSEMBLY DRAWING.

MODEL 95A

SPECIAL BURNER RATING CHART

With 6-5/16" Diameter x 3-1/4" Wide Blower Wheel

				Capacity Range		
Rating	Choke	Spinner	Bands	Range	Spray Angle	Type
1	3-3/8"	3-1/2"	#1 Set	3.00-4.00	45-90	S
6	*3-9/16"	2-15/16"	#1 Set	2.00-4.00	45-90	S
7	**3-9/16"	3-1/2"	Std.	3.00-5.00	45-90	S

*3-9/16" choke has an attached ring with 3" diameter bore. Standard setting.
**3-9/16" choke standard setting
#1 Band set consists of a 5/8" plain band and two SA9608 bands.
Rating #7 has a triple adaptor and three nozzles.

MODEL 95A-300

With 6-5/16" x 3-1/4" Diameter Blower Wheel

Rating	Choke	Spinner	Bands	Range GPH***	Spray Angle	Type
2	3-3/8"	3-1/2"	Std.	4.00-5.00	45-90	S
3	None	3-1/2"	Std.	5.00-7.00	45-90	S
4	*3-9/16"	3-1/2"	Std.	3.00-7.00	45-90	S
5	*3-9/16"	3-1/2"	Std.	3.00-7.50	45-90	S

*3-9/16" Choke is set 7/8" from end of air tube.

All of the above capacities are based on operation at sea level with 115 volt/60 cycle current, catalytic oil and fuel unit pressure set at 200 p.s.i. When used with 25 or 50 cycle current, the capacity of the burner is reduced 20%. For each 1,000 feet over 1,000 feet above sea level, the capacity is reduced approximately 5%. All specifications are subject to change without notice.

APPROXIMATE NOZZLE DELIVERY RATES - G.P.H.

Fuel Pump Pressure PSI	TOP LINE IS NOMINAL NOZZLE SIZE										
100	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5
120	1.6	2.1	2.6	3.2	3.7	4.2	4.7	5.3	5.7	6.3	6.8
140	1.7	2.3	2.9	3.4	3.9	4.5	5.0	5.6	6.1	6.7	7.2
160	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.5	7.2	7.8
180	1.9	2.6	3.2	3.8	4.5	5.1	5.7	6.4	7.0	7.7	
200	2.0	2.7	3.4	4.0	4.7	5.4	6.1	6.8	7.3		
220	2.1	2.9	3.6	4.2	4.9	5.6	6.3	7.1	7.7		
240	2.2	3.0	3.7	4.4	5.2	5.9	6.6	7.3			
260	2.3	3.1	3.8	4.7	5.4	6.2	7.0	7.7			
280	2.4	3.2	4.0	4.8	5.6	6.4	7.2				
300	2.5	3.3	4.1	5.0	5.9	6.7	7.4				

Delivery rates are on basis of actual tests with pressure gauge inserted in pump gauge port.

NOTE: SEE NEXT PAGE FOR 95A-300 SPECIAL BURNER RATING CHART

SPECIAL BURNER RATING CHART

With 6-5/16" Diameter x 3-1/4" Wide Blower Wheel

				Capacity Range		
Rating	Choke	Spinner	Bands	Range	Spray Angle	Type
1	3-3/8"	3-1/2"	#1 Set	3.00-4.00	45-90	S
6	*3-9/16"	2-15/16"	#1 Set	2.00-4.00	45-90	S

*3-9/16" choke has an attached ring with 3" diameter bore. Standard setting.
#1 Band set consists of a 5/8" plain band and two SA9608 bands.

All of the above capacities are based on operation at sea level with 115 volt/60 cycle current, Catalytic oil and fuel unit pressure set at 100 P.S.I. When used with 25 or 50 cycle current, the capacity of the burner is reduced 20%. For each 1000 feet of elevation over 1000 feet above sea level, the capacity is reduced approximately 5%. All specifications are subject to change without notice.

MODEL 96

Rating Chart				
No.	Choke	Disc	Firing Rate	Required Controls
1	5" Dia.	3 11/16" Dia.	7.00 - 12.00	Group 7 & 8

MODEL 96A-B BURNER RATING CHART

Rating	No. 5	No. 6
Outer Air Tube Ring	None	#10829
Choke	#12412 - 5-1/4" (Recessed 1")	None
Disc	#12016 - 3" Solid	#12016 - 3" Solid
Spinner	#12416 - 3-1/2" O.D. x 1-13/16" I.D.	#12416 - 3-1/2" O.D. x 1-13/16" I.D.
Range - G.P.H.	11.00 to 15.00	13.00 to 16.00

RATING CHART FOR MODELS 96A-1 & 96A-2

Model 96A-2 : 5.00 to 7.00 G.P.H.
Model 96A-1 : 7.00 to 12.00 G.P.H.

BURNER RATING CHART

Rating Number	1	2	3	4	5	6
Choke - Part No. Diameter	9065 5"	11793 4" Straight	9065 5"	10447 4-1/2" Straight	10465 5" Straight	10471 5-1/4" Straight
Stabilizer Ring Part No.	None	None	None	10454 3-3/4" I.D. x 4-1/4" O.D.	10454 3-3/4" I.D. x 4-1/4" O.D.	10454 3-3/4" I.D. x 4-1/4" O.D.
Turbulator Part No.	9477	None	9477	None	None	None
Static Pressure Disc - Part No.	12016 3" Solid	12016 3" Solid	12016 3-11/16" Solid	12016 3" Solid	12016 3" Solid	12016 3" Solid
Range - G.P.H.	6.00-14.00	3.00-7.00	6.00-12.00	6.00-8.00	7.00-11.00	11.00-14.00
Nozzle Data Spray Angle Type	60° - 90° Solid	60° - 90° Solid	60° - 90° Solid	60° - 90° Solid	60° - 90° Solid	60° - 90° Solid

All of the above capacities are based on operation at sea level with 115 volt/60 cycle current, catalytic oil and fuel unit pressure set at 100 p.s.i. When used with 25 or 50 cycle current, the capacity of the burner is reduced 20%. For each 1,000 feet over 1,000 feet above sea level, the capacity is reduced approximately 5%. All specifications are subject to change without notice.

MODEL 970

BURNER RATING CHART

RATING	NO. 1	NO. 2
CHOKE	6-1/4" Diameter	6-1/2" Diameter
STABILIZER RING (BEHIND CHOKE)	5-1/4" O.D. x 4-5/8" I.D. w/Legs	5-1/4" O.D. x 4-5/8" I.D. w/Legs
TWELVE BLADE SPINNER TWO (2) REQUIRED	(1) 4-1/4" O.D. x 2-1/16" I.D. (1) 3-3/16" O.D. x 1-13/16" I.D.	(1) 4-1/4" O.D. x 2-1/16" I.D. (1) 3-3/16" O.D. x 1-13/16" I.D.
STATIC PRESSURE DISC	NONE	NONE
RANGE - GALLONS PER HOUR	10.00 to 15.00	15.00 to 20.00

NOZZLES: TWO 70° SPRAY ANGLE SOLID TYPE NOZZLES (RANGING FROM 5.00 TO 10.00 G.P.H.) ARE GENERALLY USED. MAKE OF NOZZLE, SPRAY ANGLE AND TYPE OF SPRAY FOR BEST RESULTS IN SPECIFIC UNITS CAN ONLY BE DETERMINED BY TESTS.

THE FIRING RATES SHOWN ON ALL OF THE PRECEDING RATING CHARTS ARE BASED ON THE USE OF 60 CYCLE CURRENT AT SEA LEVEL. I.B.R. FIRING RATES CAN BE ESTABLISHED ONLY BY LABORATORY TESTING. 25 AND 50 CYCLE CURRENT REDUCE MAXIMUM CAPACITY BY 20%. MAXIMUM CAPACITY IS REDUCED BY 5% FOR EACH 1000 FEET ELEVATION ABOVE SEA LEVEL. CATALYTIC FUEL OIL WAS USED IN TESTING BURNERS TO ESTABLISH FIRING RATES SHOWN. THESE FIRING RATES ARE FOR CONVERSION BURNERS.

SPECIAL NOTE: WITH THE EXCEPTION OF MODEL 95A-300 BURNER ALL FUEL UNITS ARE FACTORY SET AT 100 P.S.I.

SERVICE POINTERS ON FLAME RETENTION FIRING.

SEE ILLUSTRATIONS BELOW:

FIG. 1 — CORRECT RETENTION - FLAME SHOULD BURN OFF THE 12 BLADE SPINNER APPROXIMATELY 1/4" TO 1/2".

FIG. 2 — FLAME IMPINGEMENT - TO CORRECT THIS PULL THE DRAWER ASSEMBLY BACK.

FIG. 3 — POOR RETENTION (FLAME BLOWING OFF SPINNER) TO CORRECT THIS MOVE THE DRAWER ASSEMBLY FORWARD.

NOTE: THE CUT-AWAY VIEW OF THE DRAWER ASSEMBLY SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY.

CLEANING IMPROVES A HOT WATER HEATING SYSTEM

One important phase in completing Hot Water Heating installations is too often neglected in the specifications. No provision has been made for cleaning the system. It is sometimes drained for changes and adjustments but never actually cleaned. The architect, engineer, or contractor selects hot water heating for an office building, apartment or home. It represents the best system....but it will be better if it is a clean system.

HOW TO TELL IF A SYSTEM NEEDS CLEANING

There are definite indications of an unclean system. Here is a check list. If any of these test positive, the system needs cleaning.

1. Obviously discolored, musky, dirty water.
2. Vented gases at high points in the radiation that will ignite and burn with an almost invisible bluish flame.
3. A pH or alkalinity test that gives a pH test reading below 7. (Below 7 indicates the water in the system is acid.)

No matter how carefully a system is installed certain extraneous materials do find their way inadvertently into the system during construction. Pipe dope, thread cutting oils, soldering flux, rust preventatives or slushing compounds, core sand, welding slag, and dirt, sand, or clays from the job site are usually found. Fortunately the proportions of these are usually small and do not cause trouble. In some cases there are sufficient quantities to break down chemically during the operation of the system causing gas formation and acid system water.

Hot water systems, in most cases, naturally operate with a pH of 7 or better. The condition of the water can be quickly tested with Hydrion paper which is used in the same manner as Litmus paper except it gives specific readings. A color chart on the side of the small Hydrion despenser gives the readings in pH. Hydrion paper is inexpensive and obtainable from any chemical supply house or through your local druggist.

A system that tests acid (below 7 on the scale, sometimes as low as 4) will usually have the following symptoms:

1. Gas formation (air troubles).
2. Pump seal and gland problems.
3. Air vent sticking and leaking.
4. Frequent relief valve operating.
5. Piping leaks at joints.

Once in this condition the symptoms continue for years until corrected by cleaning. Many times, because of the gas formation, automatic air vents are added throughout the system to attempt a cure. The promiscuous use of automatic air vents can defeat the function of the Airtrol system because in a normal system the small quantities of air finding their way to the system and piping must be returned to the expansion tank to maintain the balance between the air cushion and the water volume.

If system deterioration is permitted and leaks develop and water losses increase, it is possible to cause serious damage to the boiler. Therefore, our main aim is to have a closed system that is clean, neutral, and water tight.

SNOW MELTING and RADIANT PANELS, because of the large quantities of pipe used, should be cleaned. CONVERTORS and systems using anti-freeze solutions must be cleaned. If not, the anti-freeze solutions bring back the debris from the piping and deposit it on the convertor tubes. This destroys heat transfer ability shortly after placed in operation, cutting its capacity as much as 50% in a few weeks time.

We propose that all hot water systems be cleaned on completion, making even the finest job better and helping to eliminate the few bothersome jobs that sometimes occur.

HOW TO CLEAN A HOT WATER HEATING SYSTEM

Cleaning a hot water system (either steel or copper piping) is neither difficult nor expensive. The materials for cleaning are readily available. Trisodium phosphate, sodium carbonate, and sodium hydroxide (lye) are the most common materials for cleaning. They are available at all paint and hardware stores. Their preference is in the order named and should be used in the following proportions, using a solution of only one type in the system: Trisodium phosphate, one pound for each fifty gallons in the system; Sodium carbonate, one pound for each thirty gallons in the system; Sodium hydroxide (lye), one pound for each fifty gallons in the system.

Fill, vent, and circulate the system with this solution, allowing it to reach design or operating temperatures if possible. After circulating a few hours, the system should be drained completely and refilled with fresh water. Usually enough of the cleaner will adhere to the piping to give an alkaline solution satisfactory for operation. A pH reading between 7 and 8 is preferred, and a small amount of cleaner can be added if necessary.

A clean, neutral hot water system should never be drained except for an emergency or necessary servicing of equipment which may be after years of operation. Anti-freeze solutions in systems should be tested from year to year as recommended by the manufacturers of the anti-freeze used. It is our contention that a clean system is a better system. Once cleaned, it will never need cleaning again.

SAFE SHUTDOWN CHECKS

LIMIT ACTION

With the burner operating, lower the high limit setting to simulate an overheated boiler or furnace. Normal shutdown should occur. Restore the normal limit setting, and the burner should restart.

The use of manual reset limits is desirable with the RA890F to prevent the system from cycling off the high limit and to insure that the condition which causes the limit action is detected as soon as possible.

FLAME FAILURE

With the burner operating, close the manual fuel valves to simulate a flame failure. System should lock out in safety switch timing (15 or 30 seconds). After the safety switch has cooled, open the manual valves and reset the safety switch, and the burner should restart.

POWER FAILURE

With the burner operating, open, and then immediately close, the line switch to simulate a power failure. Burner should shut down. After a short delay for component check, burner should restart and operate normally.

HOT REFRACTORY HOLD-IN

(PHOTOCELL OIL INSTALLATIONS ONLY)

If hot refractory holds in the flame relay at the end of the burner-on cycle, the system cannot restart until the relay drops out. Check for hot refractory hold-in by observing the flame relay for immediate dropout at the end of a long burner-on period. If the relay does not drop out, resight the photocell so it does not sight the refractory.

NOTE: At the completion of all CHECKOUT tests, make sure that the RA890 is not on safety lockout, that the pilot is turned up to its normal level, and that all limit settings are correct. Operate the system through one normal cycle before leaving the installation.

SERVICE AND TROUBLESHOOTING

GENERAL SERVICE

1. Only qualified personnel should attempt to service heating equipment or controls.

2. Do all checks required under the CHECKOUT section on page 5 when replacing the RA890, or when relighting or restoring power to the system after shutdown.

3. The captive mounting screws carry current; always disconnect power before loosening or tightening the mounting screws.

4. On each service call check the controller for approximately correct calibration and differential; ensure that it is mounted securely. (See controller instructions.)

5. Never use oil on any part of the RA890F.

6. When cleaning the burner, clean the flame detector.

7. DO NOT PUSH IN THE RA890 RELAYS MANUALLY. This may damage the relays and it is an unsafe practice in that it overrides the protective features of the relay. Clean relay contacts only as instructed below.

PERIODIC MAINTENANCE

The specific maintenance schedule set up will depend on a number of factors, including type of equipment being controlled, operating conditions (dirt and heat especially), the cost of a nuisance shutdown, etc. The following should be included in any program:

Replace the vacuum tubes in the C7012 Flame Detector (if used) annually.

Perform a flame failure check and pilot turndown test whenever the burner is serviced, and at least annually.

Inspect and clean the detector and any viewing windows as often as required by soot accumulation and heat conditions at the detector.

Do a flame current check at least monthly and more often where a shutdown may be costly.

Clean contacts only when required by failure to operate properly.

CONTACT CLEANING

The relay contacts on the RA890 should be cleaned only when required and then only with Honeywell contact cleaner, part number 132569. The contact cleaner comes in pressurized spray cans; directions for its use are printed on the can. Do not use other commercial contact cleaners. Most cleaners tested have been found to leave deposits on the contact surfaces or to attack RA890 chassis parts.

TROUBLE SHOOTING

If trouble occurs in the heating system and its cause is not immediately apparent, the serviceman can apply the following step-by-step checkout to locate the cause of most problems.

TEST STANDBY OPERATION

1. Set controller not to call for heat.

2. Reset the safety switch by pushing in and then releasing the green safety switch button.

3. Close the line switch.

4. Check for line voltage at terminals 2 and 6. (Voltage will be zero if a line voltage controller is used; check for line voltage when controller is set to call for heat.)
   a. Voltage must be within +10 to -15 percent of rated voltage.
   b. If voltage is zero (with low voltage controller) be sure limit switch contacts are closed and check power supply. Check for blown fuses, open circuit, or open disconnect switch.

5. Check position of flame relay (if a line voltage controller is used, observe the action of the flame relay on a call for heat).

   a. If the flame relay is out, proceed to step 6.
   b. If the flame relay is pulled in, check for a flame simulating condition.
      (1) Insert flame simulator plug or 117053 cable plug into the test jack; do not ground the other end.
      (2) If flame relay holds in replace the RA890.
      (3) If flame relay drops out, trouble is in the flame detector or external circuit. Check for light reaching photocell, hot refractory hold-in, or defective wiring.

TESTING STARTING OPERATION

6. Set controller to call for heat. (If control uses a line voltage controller, go back to steps 4 and 5.)

7. Observe load relay for pull-in.
   a. Load relay pulls in to light pilot and start burner — proceed to step 11.
   b. Load relay doesn't pull in—proceed to step 8.
   c. Load relay pulls in but pilot doesn't light or burner doesn't start—proceed to step 10.

8. Check line voltage controller, if used, and the limit; if the load relay doesn't pull in, check for power at terminal 6 again with the controller calling for heat. If there is power at terminal 6 and a line voltage controller is used, clean all relay contacts. Replace the RA890 if the relay still doesn't pull in. If a low voltage controller is used proceed to step 9.

9. Check the low voltage controller, if used, by jumpering T-T.
   a. Load relay pulls in with T-T jumpered; check controller and external circuit.
   b. Load relay doesn't pull in with T-T jumpered; clean all relay contacts. Replace the RA890 if the load relay still doesn't pull in.

10. If the load relay pulls in but the pilot won't light or the burner won't start, check voltage at terminals 3-2 or 4-2.
   a. If no voltage at terminals 3-2 or 4-2; clean relay contacts. Replace the RA890 if trouble cannot be corrected.
   b. If normal line voltage at terminals 3-2 and 4-2, check external burner, ignition, and valve circuits. Check wiring, burner adjustment, ignition system including electrode spacing and location, oil quality, character and efficiency of oil atomization, fuel supply pressure, flame pattern, flame character and quality, pilot location with respect to main burner, flame detector, or other conditions that may delay light-off.

TESTING FLAME DETECTING FUNCTION

11. Observe the flame relay (right hand relay) for pull-in when flame is established.
   a. Flame relay pulls in; proceed to step 13.
   b. Flame relay doesn't pull in; proceed to step 12.

12. Check the flame relay with a 121708 Flame Simulator, if available (follow the instructions with the simulator) or check the following:
   a. Perform a flame current check (refer to page 6.)
   b. If the current is satisfactory, replace the RA890.
   c. If the current is not satisfactory, check all items listed on page 6.

OBSERVE SEQUENCING OPERATION

13. Observe the second stage oil valve or main gas valve for opening when flame relay pulls in.
   a. If valve doesn't open, check for line voltage at terminals 2-5.
      (1) Normal voltage—check valve and valve circuit.
      (2) Zero voltage—clean relay contacts. Replace the RA890 if this does not correct problem.

14. Observe ignition for cutoff when flame relay pulls in if connected to terminal 4.
   a. If ignition stays on and wiring checks out, replace the RA890.

MISCELLANEOUS PROBLEMS

RELAY CHATTER

Load relay chatter may result from extreme low voltage (notify power company) or from a loose connection (tighten).

Flame relay chatter may result from improper combustion (adjust burner) or soot or carbon on flame detector (clean, and correct cause).

REPEATED LOCKOUTS OR CONTROL FAILURES

The most common causes of repeated failures of the control or flame detector, or repeated lockouts are:

a. High ambient temperatures—over 125 F. Subtract 10 degrees for alarm contacts and 10 degrees for 50 Hz operation.
b. Supply voltage variation greater than +10 to -15 percent.
c. Electrical overloading of the contacts.
d. Marginal microamp signal.
e. Frequent cycling with high ambient temperatures.

IGNITION INTERFERENCE
(FLAME ROD DETECTORS ONLY)

Ignition interference is a false signal from a spark ignition system superimposed on the flame signal. The interference may be additive or subtractive (increase or decrease the flame current), and in some instances may be sufficient to destroy the electronic network of the RA890E. The RA890F network is protected against interference by the arc gap shown in Fig. 8.

The arc gap conducts at high voltage levels. It also glows when it conducts, providing a visual indication that interference is occurring. This prevents the control from operating and causes a shutdown.

Ignition interference (below the arcing level) can be determined by measuring the flame current with ignition and pilot on, and then with pilot only. Any significant difference may indicate interference.

NOTE: When an RA890F is replacing an RA890E — There may be installations where ignition interference is not sufficient to destroy the RA890E, but is sufficient to prevent operation of the RA890F due to its arc gap protection. Be very suspicious of ignition interference on any installation where the RA890E operates and the RA890F does not.

HOW TO ELIMINATE INTERFERENCE
(TABULATED IN ORDER OF IMPORTANCE)

1. Provide adequate flame grounding area.

2. Be sure the ignition electrode and the flame rod are on opposite sides of the grounding area.

3. Check for correct spacings on the ignition electrode. Spacing should be 1/16 in. to 3/32 in. for 6,000 volt systems, 1/8 in. for 10,000 volt systems.

4. Eliminate any marginal spacings at other areas along the lead routes. Replace any deteriorated leads.

Operating Instructions

TO START BURNER

1. Do not start burner when combustion chamber is hot or when oil vapor is present in furnace.
2. See that all valves in the oil lines are open.
3. With main cutout switch in oil burner electrical circuit in "OFF" position set thermostat at a point above room temperature.
4. Set electric switch to "ON" position. If burner fails to start instantly set master switch to "OFF" position and call service man.
5. If burner starts to operate normally leave switch "ON" and RESET thermostat to temperature desired.

TO STOP BURNER

1. Set main cutout switch to "OFF" position.
2. Set thermostat pointer as far below room temperature as possible.

IF BURNER FAILS TO OPERATE

Call your installer or service man.
The trouble may be due to:

1. Blown fuses in electrical circuit.
2. Thermostat may be set below room temperature.
3. Combustion control may require "re-setting".
4. Oil valve may be closed.
5. Oil supply may be too low.

TO STOP BURNER FOR THE SUMMER

1. The main cutout switch should be set to "OFF" position.
2. All oil valves should be closed.
3. Burner should be covered to protect it from dust and dampness.

TO START BURNER IN THE FALL

1. The heating plant should be checked and cleaned if necessary.
2. The strainer in the pump should be cleaned, and if a filter is installed in the oil line, it should be cleaned and the filter cartridge replaced.
3. The fan and the blower housing should be cleaned of all accumulated dust and lint.
4. The ignition points should be checked and the nozzle cleaned and replaced.
5. Oil motor (see LUBRICATION).
6. Start burner by following instructions under paragraph, "TO START BURNER".
7. It is recommended that a competent service man be called to clean the unit and burner and make sure that the burner is operating properly. In an emergency set the master switch to "OFF" position and call your service man. The installer should identify the emergency shut off switch and valves.

CAUTION:
Never burn garbage or refuse in furnace.
Do not leave paper or rags around burner or furnace.
Do not change oil without having your burner re-adjusted.

WHEN BURNER IS IN OPERATION

1. Check flame periodically, if it becomes out of shape or smoky, call your service man.
2. When cleaning furnace room or utility room, always stop the burner to reduce the amount of dust and lint drawn into the burner.
3. Electric ignition system, and all controls should be checked periodically for reliability of operation and adjusted if necessary.

LUBRICATION

1. Only the motor requires lubrication.
2. Only a good grade of "medium" detergent-free automobile engine oil should be used.
3. Twice each year one teaspoon of oil should be poured slowly into the oil cup.

TO CLEAN STRAINER

1. Oil valves between the tank and burner should be shut.
2. Strainer cover should be removed.
3. Strainer baskets should be taken out and washed in kerosene.
4. Strainer baskets and covers should be reassembled with gaskets clean and in good condition.

The Combustion Control System is designed to insure safe operation of the oil burner.

TO RESET GROUP 1 AND 2 CONTROLS

It consists of an automatic electrical relay operating in conjunction with a thermostatic element responding to changes in temperature in the flues or smoke pipe of the heater. When for any reason the burner fails to ignite promptly the control will stop the burner. After being shut off in this manner the burner cannot again be started until the control is "Reset".
The Combustion Control is mounted on the smoke pipe of the heater, or in a position where the thermostatic element projects into one of the flue passages.
The "Reset" button projects through the cover of the control box and should be pushed in to "Reset".

TO RESET GROUP 7, 8 & 9 CONTROLS

It consists of an electrical relay operating in conjunction with a flame detector mounted on the oil pipe of the drawer assembly of the burner. When for any reason the burner fails to ignite promptly the control will stop the burner. After being shut off in this manner, the burner cannot again be started until the control is "Reset".
The burner mounted relay may be attached to the burner housing or incorporated in a panel and is reset by moving the "Reset" lever to the left and then releasing.

DO NOT EXPERIMENT WITH YOUR BURNER.

FUEL SPECIFICATIONS: THIS BURNER IS LISTED BY THE UNDERWRITERS' LABORATORIES, INC., FOR USE WITH #1 AND #2 FUEL OIL, NATIONAL BUREAU OF STANDARDS, COMMERCIAL STANDARD CS-12-48. DO NOT USE GASOLINE, CRANK-CASE OIL, OR ANY OIL CONTAINING GASOLINE.

WIRING: All wiring must be done in accordance with the National Electric Code and/or in accordance with local ordinances. The controls and wiring furnished with the burner are tested at the factory. It is suggested that all wiring be run in rigid conduit, but a short length of flexible conduit used between the burner and the rigid conduit will facilitate removing the burner for inspection without disconnecting any wiring. See the wiring diagrams incorporated in this form and those furnished with the controls supplied with each burner.

BURNER INSTALLATION

a. Controls: Instructions for installing and wiring the controls will be found packed with the controls. The controls should be installed strictly in accordance with these instructions, and, in case the control should prove defective, it should be returned direct to the control manufacturer or one of his service stations for repair or replacement. See Page 18 for control suffixes and types available.

b. Setting the Burner: The center line of the burner air tube should coincide with the center line of the heating plant. The burner should level across the top of the motor and fuel unit. The air tube should slant slightly downward (2^{o} to 4^{o}) toward the combustion chamber. The end of the burner air tube should be recessed approximately 3/4" from the front wall of the combustion chamber. For distance of the air tube above the floor of the combustion chamber, refer to Nozzle and Combustion Chamber Data Chart. If combustion chamber is already installed in heater, use opening provided for burner tube. Space between burner tube and refractory should be sealed with asbestos or other insulating material. Where a pedestal mounted burner is used, make sure that the burner does not touch heating unit at any point.

c. Installing Nozzles: Make sure that the proper size nozzles for the installation have been selected. Disconnect oil line and ignition leads and remove drawer assembly. The drawer assembly should be removed from the burner for screwing the nozzles in place. Do not attempt to insert the nozzles through the front end of blower tube, as it is almost impossible to get a tight joint between the nozzles and the nozzle adaptor unless two wrenches are used. Although electrodes are adjusted at time of manufacture, they should be checked at time of installation to be sure that they are set in accordance with drawing in this manual.

d. Rotate Blower Wheel: The blower wheel should be rotated by hand to be sure that the motor and fuel unit turn freely.

e. Oil Motor: Pour one teaspoon of good motor oil in each cup on motor.

f. To Put Burner Under Fire: See that all controls are set in normal starting position. Install pressure gauge in fuel unit. With the heating plant door open and with the air inlet on burner about half open, close the main cutout switch. Do not stand in front of open door. The burner should start, ignite and burn. Then close the heating plant door. After you have obtained a flame, the oil pressure should be checked and adjusted (if necessary). The air inlet can then be adjusted so that the flame is a clean yellow with slightly smoky tips. It may be necessary to readjust the air inlet after the burner is running twenty minutes or more in order to obtain the proper fire with a hot heating plant. After final adjustment, tighten lock screws on air inlet, let unit cool and start burner once again in order to be sure burner operates properly on a cold start. Remove pressure gauge and install pipe plug.

g. Using Instruments to Set Fire: It is far better to use combustion test instruments when adjusting a flame. National Bureau of Standards Commercial Standard CS-75-56 (for burners with a 7.00 G.P.H. capacity or less) require a minimum of 8% CO_2 with a smoke reading no darker than No. 5 on the Bacharach scale; however, we recommend a smoke reading no darker than No. 1. When using instruments to obtain this, adjust air inlet on burner for minimum air for clean combustion while combustion chamber is hot. Adjust the draft regulator so that there is .02" draft over the fire. Seal all air leaks around combustion chamber, heater joints and stack. Take your readings and adjust air so that a minimum of 8% CO_2 is obtained with the least smoke possible. When using instruments in setting a fire, do not lean towards getting a greater percentage of CO_2 than a clean fire will give. It is more important to keep the inside of the heating plant clean than to obtain a higher CO_2.

h. Nozzle (oil input) Variations: Several nozzles of different manufacture, angles and types of spray should be carried by installer to determine the most suitable for the particular application. Fuel oils vary greatly. Because of this, nozzles will not always deliver the gallonage per hour or angle of spray that is stamped on them. In addition, it has been found that, in certain areas, due to local conditions, nozzles other than those furnished as original equipment give better performance due to the type of oil being delivered.

i. Draft: Check to be sure that there is sufficient draft for the proper burning of the oil. At least .02" of draft over the fire is necessary. The draft in the stack also should be checked to determine whether or not there is an abnormally high draft loss through the heating plant for this may cause back pressure (draft) resulting in oil fumes in the building and/or pulsation when the burner starts and stops. This may cause an excessive deposit of soot in the flues of the heating plant and in the smoke pipe. High draft loss may be caused by overfiring or too much excess air. If there is back draft or down draft, do not install the burner until this situation is corrected. Back pressure (back draft or down draft) may also be caused by the chimney being lower than surrounding objects, such as buildings, hills, trees, rooftops, etc. (This paragraph concerning draft applies to burners being fired with draft in the firebox. Disregard these instructions on installations where the burner is fired under pressure.)

j. Conversion Installations: Clean Heating unit thoroughly before starting burner installation and inspect for leaks and other defects.

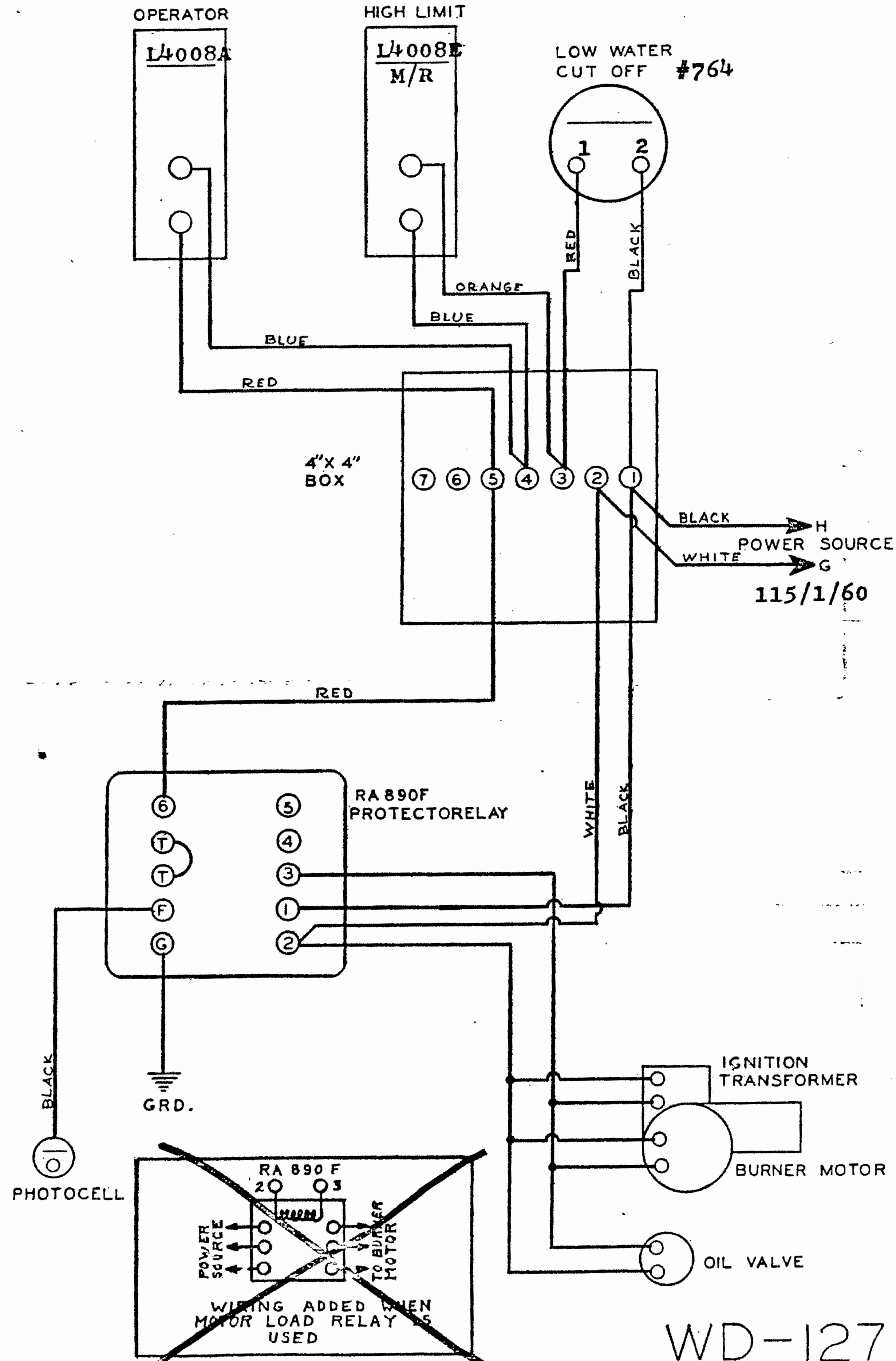
k. Inspection: After installation of the burner, check to see if there are any loose parts on the burner, controls or on the heating unit which might cause vibration. Check the operation on all electrical controls and inspect the installation carefully for oil leaks and other defects.

MISCELLANEOUS REMINDERS:

a. Install all electrical work in strict accordance with local ordinances.
b. Solder all splices or use approved wire nuts.
c. Steam pressure controls must be protected by a "pig-tail" or patented trap.
d. All unions must be of the ground seat type. Gasket unions will not do.
e. A check valve must be installed in the suction line when the tank is below the burner to prevent the return of the oil to the tank when the fuel unit is not in operation.
f. Do not permit any part of the burner to come in metallic contact with any part of the heating plant.
g. Rotate burner blower wheel by hand to be sure pump and motor are free.
h. Lubricate oil burner motor.
i. See if the draft conditions are right. Air leaks may kill the draft. Test chimney, smoke pipe and heating unit for air leaks.
j. See that the smoke pipe enters into chimney far enough to be tight and yet not so far as to reduce flue area. Its end should be flush with the inside of the flue.
k. Be sure that there is at least .02" draft over the fire.
l. Be sure there is no down draft or back draft.
   (Disregard Items "k" and "l" if burner is being fired under pressure in firebox)
m. Be sure that there is sufficient air in heater room for proper combustion at all times.
n. Explain the operation of the burner to the owner--show where to oil--how to operate controls and main cutout switch.
o. Hang Burner Operating Instructions in prominent place near installation.

BRYAN CONTROL CIRCUIT

OIL FIRED BOILERS–ELECTRONIC COMBUSTION SAFETY CONTROLS — RA890F



WD-127

energy solutions centre inc.
206 Lowe St., 1st Floor Whitehorse Yukon Y1A 1W6
Phone (867) 393-7062 Facsimile (867) 393-7061

Energy Technologies Inc

Att: Phil

Here's the stuff. I cann't seem to get away from the crowds these days. We are working with the Territorial Government on setting out a full program to do all their buildings as well as all the municipal buildings. We will have three full teams working out of here by next fall if it goes the way I want.

Don F.

8 pages attached

THE YUKON ELECTRICAL CO LTD

ACCOUNT HISTORY - AH UFLS PROD

05 0009784 1 01 5 STATUS 03 CYCLE 16 DOWNLD 1 RATE 2160 OL ACCT N
¢WESTMARK WHITEHORSE BUDGET N
AGENCY 571 COMM 0628 MR ID 11336 ROUTE 8706/5335
210 STEELE ST WHITEHORSE YT Y1A2C4 KEY 0 EST CD 1
MTR 11100700001618 IN/CH 00/09/12 #MTRS 1 LOC 1FMRM BILL 01/01/24
OCCUPIED 81/10/05 SPEC USE ANN CONS 1193670 DUE 01/02/14
REBILL POT PENALTY A/R 15389.07

TIME	READ	DAYS	READING	TYP	B CONST	CONSUMPTION	NET BILL
1252	010123	35	1968A	A	200	101000	15389.07
1606	001219	27	1463A	A	200	86600	13418.12
932	001122	30	1030A	A	300	83200	12378.09
1406	001023	32	614A	A	200	94600	13866.16
1510	000921	30	141A	A	200	99600	14566.17
1402	000822	32	5282A	A	200	130200	18830.58
1242	000721	30	4631A	A	200	125000	18181.79
1354	000621	29	4006A	A	200	113400	16607.65
1305	000523	34	3439A	A	200	107000	15682.30
1557	000419	29	2904A	A	200	84600	12578.49
942	000321	29	2481A	A	200	90200	13291.83
1343	000221	31	2030A	A	200	87800	12888.60
1206	000121	31	1591A	A	200	88200	12940.83

9784 1 01 METER

Post-it™ Fax Note 7671E	Date 01/02/16 # of pages ▸ 1
To Larry	From Cam
Co./Dept.	Co. YECL
Phone #	Phone # 633-7019
Fax # 668-2789	Fax #

Great Northern Oil
Consumption Analysis
By Ship To and Quantity Shipped

Ship To Number	Mailing Name	Address Line 1	Invoice Date	Prod Code	Quantity Shipped	Unit Price	Extended Price
38,691	Westmark-Whitehorse	Box 4250	03/02/00	F	14120	.4220	5,958.64
38,691	Westmark-Whitehorse	Box 4250	03/15/00	F	11822	.4775	5,645.01
38,691	Westmark-Whitehorse	Box 4250	04/12/00	F	14219	.4775	6,789.57
38,691	Westmark-Whitehorse	Box 4250	04/27/00	F	13867	.4487	6,222.12
38,691	Westmark-Whitehorse	Box 4250	05/11/00	F	7968	.4487	3,575.24
38,691	Westmark-Whitehorse	Box 4250	06/09/00	F	10856	.4487	4,871.09
38,691	Westmark-Whitehorse	Box 4250	07/12/00	F	16504	.4517	7,454.86
38,691	Westmark-Whitehorse	Box 4250	08/18/00	F	11431	.4506	5,150.81
38,691	Westmark-Whitehorse	Box 4250	09/11/00	F	15220	.4779	7,273.64
38,691	Westmark-Whitehorse	Box 4250	10/02/00	F	16918	.5005	8,467.46
38,691	Westmark-Whitehorse	Box 4250	10/13/00	F	7090	.5227	3,705.94
38,691	Westmark-Whitehorse	Box 4250	11/07/00	F	15000	.5227	7,840.50
38,691	Westmark-Whitehorse	Box 4250	11/27/00	F	14391	.5471	7,873.32
38,691	Westmark-Whitehorse	Box 4250	12/08/00	F	7316	.5471	4,002.58
38,691	Westmark-Whitehorse	Box 4250	12/20/00	F	15729	.5471	8,605.34
38,691	Westmark-Whitehorse	Box 4250	01/03/01	F	13608	.5471	7,444.94
38,691	Westmark-Whitehorse	Box 4250	01/17/01	F	12153	.5271	6,405.85
38,691	Westmark-Whitehorse	Box 4250	01/30/01	F	12958	.5271	6,830.16
38,691	Westmark-Whitehorse	Box 4250	02/13/01	F	15595	.5271	8,220.12
...d Item Number. . . . .tal					246765		127,337.19

LITERS X 4.5461 = GALLONS

54,280 GALLONS
$2.35 / GAL AVG CAN

ATTN: L. Watling

UP 24.9%

FROM: Tracy GNO.

H_2O

Westmark Whitehorse

Water Consumption
for
1999 2000

Billing Dates	Reading	Consumption	Billed Amount
Dec-98	6769		
Feb-99	7009	2400	2,505.15
Apr-99	7302	2930	3,170.88
Jun-99	8063	7610	8,537.21
Aug-99	8672	6090	6,832.01
Oct-99	9221	5490	6,158.91
Dec-99	9549	3280	3,679.64
		27800	30,883.80
Feb-00	9852	3030	3,399.18
Apr-00	287	4350	4,880.01
Jun-00	885	5980	6,708.61
Aug-00	1758	8730	9,793.67
Oct-00	2129	3710	4,162.03
Dec-99	2479	3500	3,926.45
		29300	32,869.95

Utility Rates
Jan 1 ,1999 to Mar 31,1999 - $4.75 per Thousand Imperial Gallons
Apr 1, 1999 to present - $5.10 per Thousand Imperial Gallons up 7.4%

Meter Code	5573895
Account	30101701.00 WESTMARK WHITEHORSE
Service Address	201 WOOD ST
Meter Status	A Active
Meter Group Code	W Water
Meter Type	M Metric
Number of dials	4
Multiplier	10
Install Date	06/08/96
Manufacturer Code	ECR ECR SENSUS METER
Location Code	01 DOWNTOWN
Size Code	4" 4" SENSUS ECR TURBO
Meter Class	
Serial #	1506106

Post-it™ brand fax transmittal memo 7671 | # of pages ▸

To Larry	From Rose
Co. Westmark	Co. City of Whitehorse
Dept.	Phone # 668 8607
Fax # 668 2789	Fax # 668 8398

Propane

2022

NAME: Westmark Whse TANK SIZE: 2000

ADDRESS: SERIAL #

DIRECTION

Sept .497 est

DATE	LITRES	INV#	%	DATE	LITRES	INV#	%	DATE	LITRES	INV#	%
Sept 14/00	3601	27013	82								
Sept 27/00	2400	27080	82								
Oct 11/00	3097	27292	85								
Oct 24/00	2200	27348	80								
Nov 8/00	2500	27586	80								
Nov 22/00	1855	27743	80								
Dec 5/00	4499	27997	80								
Dec 29/00	3050	28316	80								
Jan 11/01	2772	33307	82								
Jan 25/01	2600	28546	82								
Feb 13/01	3800	28814	82								

2022
14 L

NAME: Whse Westmark TANK SIZE: 2000

ADDRESS: Wood St & 2nd Ave. SERIAL # 29001 .417

DIRECTION

Pricing ~~.389~~ ~~.404~~ ~~.389~~ .414 Pricing .497

DATE	LITRES	INV#	%	DATE	LITRES	INV#	%	DATE	LITRES	INV#	%
May 14/99	2501 ~~2213~~	22113	70	Oct 28/99	2300	23417	82%	[illegible]	[illegible]	[illegible]	[illegible]
May 21/99	1999	22139	80	Nov 12/99	2500	23554	82%	Mar 2/00	3550	25693	82
June 2/99	3610	22287	80	Nov 24/99	at 60%			Apr 6/00	1699	25825	82%
June 11/99	2600	22316	80	Dec 1/99	3664	23896	80%	Apr 15/00	2501	25879	82
June 23/99	3000	22305	80	Dec 17/99	2875	24232	80%	May 3/00	2800	25918	82
July 12/99	3802	22418	80	Dec 30 at 65%				May 26/00	4071	26056	80
July 22/99	3301	22510	80	Jan 11/00	3600	24564	82%	June 8/00	3435	26283	80
Aug 5/99	3909	22604	"	Jan 19/00	3600	24782	82%	June 22/00	3332	26302	80
Aug 19/99	3111	22702	"	Jan 31/00	2224	24932	72%	July 7/00	3914	26395	80
Sept 10/99	5500	22943	"	Feb 14/00	5015	25232	78	July 21/00	3527	26452	"
Sept 27/99	3600	23104	"	Feb 28/00	4500	25452	82	Aug 4/00	3499	26582	"
Oct 12/99	2800	23277	"	Mar 9/00	3533	25509	80	[illegible]	[illegible]	[illegible]	[illegible]

DRAFT

MEMORANDUM OF UNDERSTANDING

YUKON TOURISM INDUSTRY ENERGY SOLUTIONS PARTNERSHIP

FOR THE HOTEL & HOSPITALITY SECTOR

BETWEEN

YUKON ZONE OF THE B.C. & YUKON HOTEL ASSOCIATION & OTHER PARTICIPATING HOTELIERS

AND,

YUKON TOURISM INDUSTRY PARTNERSHIP, REPRESENTED BY TOURISM INDUSTRY ASSOCIATION OF THE YUKON AND YUKON DEPARTMENT OF TOURISM

AND,

CANADIAN HOTEL ASSOCIATION

AND,

YUKON DEVELOPMENT CORPORATION AND ENERGY SOLUTIONS CENTRE INC.

AND,

NATURAL RESOURCES CANADA

OTHERWISE KNOWN AS THE PARTIES

WHEREAS,

The hotel sector is a vital component of the infrastructure for Yukon's growing tourism industry providing year-round employment and services in communities throughout the territory;

There are significant opportunities to produce substantial energy savings and reduce greenhouse gas emissions through integrated energy solutions for hotel facilities and operations;

The hotel sector has the opportunity to lead the implementation of sustainable energy and environmental practices, enhancing the Yukon's international image as a unique visitor destination;

DRAFT

The Canadian hotel industry, through its national association, has partnered with Natural Resources Canada to support energy innovations and environmental stewardship by its members associations;

Natural Resources Canada established the Energy Innovators Program to facilitate energy efficiency investments in the commercial and institutional sectors to lower costs and created the Renewable Energy Deployment Initiative to support the use of renewable and alternative energy systems in northern and remote areas and to reduce greenhouse gas emissions;

The Yukon government, through its Energy Efficiency Initiative, is committed to making energy efficiency a standard, ongoing practice in the territory and to fostering the production and sale of cost-competitive renewable energy through its Green Power Initiative to meet the needs of Yukon consumers, business and industry.

PURPOSE

The purpose of this Agreement is to establish an action-oriented partnership that will produce cost-effective, long-term, integrated and predominantly renewable energy solutions for the Yukon hotel and hospitality sector through a two-year initiative consistent with the principles of sustainable energy development.

HOTEL SECTOR UNDERTAKINGS

The Yukon Zone of the B.C. & Yukon Hotel Association and other participating hoteliers hereby agree,

- that any member of the Yukon Zone of the B.C. & Yukon Hotel Association is eligible to voluntarily participate as a charter member and any other hotel owner/operator in the Yukon may participate by signing the memorandum of agreement
- to facilitate cost-effective and comprehensive energy assessments of their facilities and operations
- to optimize renewable energy systems through an integrated energy management approach in the best interests of the hotel owner/operator, the tourism industry, the environment and economy
- to give every consideration to implementing recommended long-term total energy solutions
- to participate in a Yukon tourism and energy sponsored environmental 'green' certification program building on the Green Leaf Program of the Canadian Hotel Association
- to actively promote and communicate the partnership and the cost saving, energy efficiency programs and services of the Energy Solutions Centre Inc. to its members on an ongoing basis

DRAFT

ENERGY SOLUTIONS PARTNERSHIP UNDERTAKINGS

Yukon Development Corporation and Natural Resources Canada, the partners supporting Energy Solutions Centre Inc., hereby agree,

- to carry out comprehensive technical assessments of hotel facilities and operating systems to identify opportunities for energy savings for interested members of the Yukon Zone of the B.C. and Yukon Hotel Association and other hoteliers
- to prepare a recommended facility specific, energy action business plan that includes appropriate and cost-effective efficiency and renewable energy solutions
- to provide one-window access to available federal and territorial government energy efficiency, renewable energy, and other community energy management programs, services and related investments
- to recover costs for technical assessments and development of energy action business plans, not otherwise provided through programs from Natural Resources Canada or Yukon Development Corporation, as a fee for service financed by energy solution projects implemented by the participant
- to support adaptation of the Green Leaf Program or a similar market recognition process in cooperation with the Yukon Zone of the B.C. and Yukon Hotel Association and the Tourism Industry Partnership
- to compile an annual report for distribution to the partners detailing cost savings achieved by hotelier participants implementing recommended energy solutions

TOURISM INDUSTRY PARTNERSHIP UNDERTAKINGS

The Yukon Tourism Industry Partnership hereby agrees,

- to join with the Energy Solutions Centre Inc. in developing and implementing an environmental 'green' certification program building on the Green Leaf Program of the Canadian Hotel Association
- to recognize and promote the Yukon hotel sector for its participation in the energy and environmental partnership initiative
- to actively promote and communicate the partnership and the cost saving, energy efficiency programs and services from the Energy Solutions Centre Inc. to its members on an ongoing basis

TERM OF AGREEMENT

This agreement is for two years effective on the date of signing, and may be renewed or amended by the parties in writing.

DRAFT

SIGNATORIES,

____

MINISTER RESPONSIBLE OR PRESIDENT
YUKON DEVELOPMENT CORPORATION & ENERGY SOLUTIONS CENTRE INC.

____

PRESIDENT
YUKON ZONE OF THE B.C. & YUKON HOTEL ASSOCIATION & ON BEHALF OF OTHER PARTICIPATING HOTELIERS

____

PRESIDENT
TOURISM INDUSTRY ASSOCIATION OF YUKON

____

MINISTER
YUKON DEPARTMENT OF TOURISM

____

PRESIDENT
CANADIAN HOTEL ASSOCIATION

____

MINISTER
NATURAL RESOURCES CANADA

THURSDAY, DECEMBER 7, 2000

U.S. Warns Of 50% Rise In Heat Costs

Price of Natural Gas Quadruples Over Year

By NEELA BANERJEE

Just as winter tightens an icy grip on much of the United States, the federal government warned yesterday that consumers can expect to pay about 50 percent more than a year ago to heat their homes with natural gas.

In its latest short-term energy outlook, the Energy Information Administration estimated that consumers who rely on natural gas would spend an extra $300 on average than last winter. Slightly more than half of American homes are heated with gas, according to 1997 census figures.

But a quadrupling of the price of natural gas over the last year will spread its effects through the economy as a whole, as factories, electric utilities and retailers join suburbanites in the scramble to pay their mounting gas bills.

"This will be a hardship for many families," said Martin Cohen, executive director of the Citizens Utilities Board, a utility watchdog group in Illinois, where residential consumers are expected to spend $400 more this winter on natural gas. "That will be $400 less going into the economy, into food, clothing and entertainment."

With demand soaring in a hot economy and supplies tight, wholesale prices for natural gas had nearly doubled by early July to about $4.44 for a million British thermal units, compared with $2.39 one year earlier. At that time, experts predicted that prices would level off or decline, and that consumers might have to pay 25 percent to 30 percent more for heat this winter.

Instead, the supply-demand imbalance grew more severe, and the price of natural gas continued to climb. Prices jumped sharply in the last week, as a cold snap rippled through the Northeast, Midwest and South, raising both demand for gas and concern that wellheads could freeze, further curtailing supplies. The price of natural gas for January delivery was $8.49 per million B.T.U.'s at the close of trading on the New York Mercantile Exchange yesterday, an increase of $1.10, or 15 percent, from the day before.

Although Energy Information Administration analysts expect that prices will settle back from the spikes this week, they nonetheless decided to revise their earlier estimates about how much it would cost to heat with natural gas this winter. The new estimate projects that it will cost the average family about $834 to heat their home, compared with about $540 last year, said David Costello, an analyst with the agency, the statistical arm of the Energy Department.

"This assumes that spot market prices won't stay as high as they are," Mr. Costello said, "but it presumes that we have something like normal temperatures," rather than the mild winters of the last two years.

In some big urban areas that rely heav-

Continued on Page 15

THURSDAY, DECEMBER 7, 2000

U.S. Warns of 50% Rise in Heating Costs

Continued From First Business Page

ily on natural gas for heating, bills are poised to rise more steeply than the average.

In the Chicago area, where more than 90 percent of residents heat with gas, People's Gas, a unit of **People's Energy**, predicts that gas bills will rise 64 percent this winter. Mr. Cohen's estimate for Chicago residents was even higher: an 80 percent increase.

In San Diego, where summer electric bills doubled or more under a much-criticized deregulation program, December gas bills are expected to double to an average of $70, utility executives said; in the Los Angeles area, bills could rise to $80 from $50 last year.

"We have given a great deal of warning to people about the situation," said Steve Baum, chairman and chief executive of Sempra Energy, the parent company of San Diego Gas and Electric and Southern California Gas. "But people are just now seeing higher bills. I don't know if there will be the same revolt as we had on electricity prices. I think there will be outrage."

In New York City, **Keyspan** and **Consolidated Edison** expect to keep price rises within the 25 percent to 30 percent range predicted earlier in the year.

But the utilities may be hard pressed to meet that pledge if the winter — like fall — turns out to be colder than expected. In the 24 hours ending Wednesday morning, for instance, Keyspan customers used more than twice the amount of natural gas they had a year ago, because temperatures were so much lower.

The rise in natural gas prices began in late spring, and the fear now is that it will not abate soon. Because gas prices were low over the last two years, oil and gas companies lacked the capital to invest in new drilling, so supplies gradually fell.

At the same time, the economy — and hence demand — was growing briskly. Manufacturers that use natural gas for their industrial processes demanded more. Electric power plants that kept the economy running needed more natural gas, too; nearly all the latest plants use gas, which burns more cleanly than other fuels.

(Consumers who heat with electricity generated by gas-burning plants generally pay regulated rates, and so will not bear the brunt of rising gas prices.)

There is no shortage looming, but inventory has been slow to build at many factories and some utilities that rely on natural gas. Market nervousness about those lower storage rates has also fueled higher prices.

"A lot of people feel that if we have normal winter temperatures, we could move to record low levels of storage, and that could drive prices up," Mr. Costello said.

Many gas utilities appear to have hedged their costs by purchasing natural gas through long-term contracts. But long stretches of cold weather could send them to the spot market for additional supplies. And that would be costly. At the New York citygate — the pipeline's point of entry into the city — bids ranged from $15 to $30 per million B.T.U.'s yesterday.

The inexorable rise of natural gas prices has spurred significantly more drilling in the United States than last year, and that could lead to a decline in prices — but not for the another year or two.

"We will make a transition, hopefully, into a period of more supply," Mr. Costello said, "but that is not going to do much for us this winter."

COMMODITIES

Source: Bloomberg Financial Markets — The New York Times

52-WEEK HIGH	52-WEEK LOW	INDEX	YESTERDAY CLOSE	YESTERDAY CHANGE		YEAR TO DATE	52 WEEKS
262.66	186.23	Gldmn Schs Overall	253.48	+ 7.50	+ 3.06%	+30.30%	+30.23%
133.55	81.38	Energy	128.13	+ 5.28	+ 4.37	+46.14	+45.24
183.82	158.37	Agriculture	180.82	− 0.28	− 0.15	+11.04	+10.01
199.72	169.46	Livestock	193.96	+ 2.30	+ 1.20	+ 9.74	+ 8.69
427.54	367.81	Prec. Metal	383.49	+ 4.64	+ 1.22	− 1.36	+ 0.43
178.04	163.91	Indus. Metal	161.01	+ 0.60	+ 0.37	− 8.17	− 0.09
233.45	201.64	CmdtyRschBur/Bridge	232.05	+ 2.48	+ 1.06	+13.12	+13.38