ANALYSIS OF THE SAVINGS IN HYDRO COMSUMPTION WITH THE ADDITION OF THERMOSTATS TO GAUGEHOUSES IN SOUTHERN ONTARIO

(Summary Report)

WATER RESOURCES BRANCH
ONTARIO REGION
INLAND WATERS DIRECTORATE

ENVIRONMENT CANADA

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INTRODUCTION

The Water Resources Branch, Ontario Region, operates and maintains about 365 hydrometric gauging stations. One part of the operating and maintenance budget is that of Hydro power used in the gaugehouses. It amounts to approximately 1/7th of the total O&M budget (salaries are not included). This is not a negligible expense and it represents quite a significant amount of electric energy being used every year.

Basically, most of the electric energy is used when heating cables, baseboard heaters and/or heating lamps are in operation. There are also other electrical appliances in the gaugehouses whose energy consumption is not substantial , such as light bulbs, electric clocks, and battery chargers. Up to 1978 heating cables and heat lamps were usually left in operation throughout the "cold" season without interruption or any requlation. The time of switching on and off (or rather plugging in and out) of the cables and lamps was determined by field staff according to the weather conditions at the beginning and at the end of the winter season.

To keep the overall operation and maintenance budget to a minimum and also to conserve energy, it makes good sense to try to reduce hydro comsuption to a minimum at each station. This can be achieved with the aid of thermostats.

The purpose of this short study was to analyse how the energy consumption changed after the introduction of thermostats at some 25 gauging stations in Southern Ontario. It must be stressed that this report is of a rather preliminary nature, since data on yearly energy comsumption with thermostats is limited. Results will be updated as more data and experience is obtained.

ENERGY CONSUMPTION AT STATIONS WITHOUT THERMOSTAT CONTROL:

The main reason for a heating cable and/or heating lamp installation in the stilling well of a gauge is to prevent intake pipes and/or in some cases the well itself from freezing up during winter.

The standard heating cable, code-named "EASY", has been used routinely in most installations in Ontario. This is a regular 120V/750 Watt, 95 feet long, pipe heating cable (see Appendix 1).

The following are examples of yearly hydro consumptions in some gauging stations in Southern Ontario, before installation of thermostats:

SCHNEIDER CREEK at KITCHENER

Period	Consumption (kWh)
June '73 - June '74	- 1570
" '74 - " '75	- 1910
" '75 - " '76	- 1290
" '76 - " '77	- 1000
" '77 - " '78	- 1450

BEAVERTON RIVER near BEAVERTON

Period	Consumption (kWh)
June '73 - June '74	- 3130
" '74 - " '75	- 4920
" '75 - " '76	- 2890
" '76 - " '77	- 2430
" '77 - " '78	- 3290
" '78 - " '79	- 3060

EAST CANAGAGIGUE CREEK near FLORADALE

Period	Consumption (kWh)
June '73 - June '74	- 1880
" '74 - " '75	- 2440
" '75 - " '76	- 2100
" '76 - " '77	- 1110
" '77 - " '78	- 1520
" '78 - " '79	- 2200

The approximate averages of yearly hydro comsumption from a sample of about 25 hydrometric stations in Southern Ontario ranged from 1,500 to 4,500 kilowatt hours for the years 1973 to 1977.

Since 1978 thermostats have been systematically installed in the majority of the stations with heating cables. Sixteen stations were equipped with thermostats in 1978, an additional 51 in 1979 and 7 in 1980. Now all newly built shelters have thermostats installed during construction.

The typical cost involved in the installation of a Type 4688 thermostat (see Appendix 1) is around $100.00. This consists of about $50.00 for materials and travel and another $50.00 for salaries.

SAVINGS IN HYDRO CONSUMPTION WITH ADDITION OF THERMOSTATS TO GAUGEHOUSES IN SOUTHERN ONTARIO

Analysis was completed on the savings in hydro consumption that resulted from the installation of thermostats in gaugehouses in the Ontario Region. A total of 25 gauging stations were included in the analysis sample from which 5 stations had thermostats installed for the past three years and 20 stations had thermostats for two years (see Appendix 2).

In summary, the analysis has shown that:

1. In 21 cases there have been substantial savings in hydro consumption ranging from 50% to 85%.
2. In 2 cases the savings were close to 50%.
3. In two other cases the savings in hydro consumption after thermostat installation were 17% only.

The following are some examples of electric power savings:

1. Patterson Creek near Simcoe (Account #1966006)

Period	Consumption (kWh)
July '73 - July '74	- 4980
" '74 - " '75	- 3610
" '75 - " '76	- 2710
" '76 - " '77	- 3080
" '77 - " '78	- 2560
" '78 - " '79	- 3660
" '79 - " '80	- 320
" '80 - " '81	- 730

Thermostat installed July 13, 1979.

2. Lynn River at Simcoe (Account #20-0089)

Period	Consumption (kWh)
July '74 - July '75	- 3840
" '75 - " '76	- 2800
" '76 - " '77	- 2570
" '77 - " '78	- 2960
" '78 - " '79	- 3440
" '79 - " '80	- 330
" '80 - " '81	- 1440

Thermostat installed July 12, 1979.

3. Schneider Creek at Kitchener (Account #1106-0192-09)

Period	Consumption (kWh)
June '73 - June '74	- 1570
" '74 - " '75	- 1910
" '75 - " '76	- 1290
" '76 - " '77	- 1000
" '77 - " '78	- 1450
" '78 - " '79	- 330
" '79 - " '80	- 180
" '80 - " '81	- 300

Thermostat installed May 9, 1978.

The foregoing illustrates that thermostats, IF PROPERLY SET, are very good energy and money savers. But again it must be stressed that proper setting of thermostats on $\neq 3^{o}C$ and higher only if the site conditions necessitate, is the key condition to maximizing the savings. The thermostat settings and also connections to heating cables should be checked annually before the winter season's arrival.

CONCLUSIONS:

The analysis of hydro usage at hydrometric stations has shown that after introduction of thermostats to control the heating devices, hydro consumption has dropped in average by 64% for the 25 stations selected.

The initial moderate expense for the installation of thermostats (approximately $100.00 each) is in most cases quickly recouped, usually during the first season of winter operation.

RECOMMENDATIONS:

It is recommended that thermostats be set on $\neq 3^{o}C$ and that connections of all heating devices be inspected before winter season's arrival.

It is recommended that heating elements in ALL Water Resources Branch field installations be controlled by thermostats.

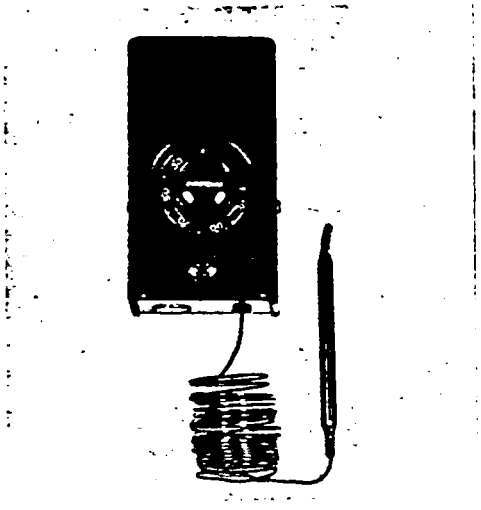
It is recommended that hydro consumption recording procedure be reviewed and improved.

Finally it is recommended to update the hydro consumption analysis as shown in Appendix 2, annually and also to perform similar analysis on all the rest of Ontario Region hydrometric stations, where applicable.

APPENDICES

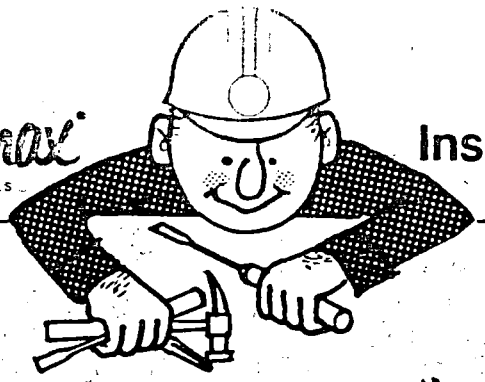
TABLE II — STANDARD HEATING CABLE UNITS

			120 VOLTS		208 VOLTS		240 VOLTS	
Code Name	Design	Length in ft.	Watts	Unit Recommended for*	Watts	Unit Recommended for*	Watts	Unit Recommended for*
FOX	A	108	200	P	650	F,P,E	900	P,E
BAKER	A	72	300	F,P	1000	P,E	1300	
TEAR	A	177	400	P	1200	P,E	1600	P,E
GOLF	A	54	450	F,P,E	1300		1700	
HOTEL	A	68	500	P,E	1500		2000	
UNCLE	A	264	550	F,P	1650	F,P,E	2100	P,E
INDIA	A	40	550	P,E	1650		Not Recommended	
EASY	A	95	750	F,P,E	2300		3000	
VICE	A	177	800	P,E	2400	P	3200	E
MOM	A	132	1100	P,E	3300		4300	
NAN	A	264	1100	F,P	3300	P,E	4300	P,E



Type 4688 Thermostat:
Used to control pipe and tank temperatures up to 120°F, and slab temperatures such as floor warming and animal pens.
Remote bulb type with temperature range 30-120°F. Temperature differential 3¾%°F, ambient compensated. Electrical rating 30 amps on 115 or 230 V.A.C. 10 foot copper capillary, moisture and dust-resistant enclosure. S.P.S.T. contacts open on temperature rise. Also available as 4688-P with nylon coated capillary.

Pyrotenax
TYPE MI CABLES



Installation Recommendation No. 535

March, 1980

Installation of 4688P, 4688WP and 4395W Thermostats

Specification Reference 4688P Series Thermostats

Type: Remote bulb;
Temperature Set Range: 0°C to 50°C
Maximum Permissible
Temperature at Bulb: 68°C
Rating: 30 amps on 125 or 250 VAC
Description: 10 ft. copper capillary with HDPE jacket; contacts open on temperature rise, SPST, ambient compensated. Sensing bulb is 3/8" diameter X 5-3/4" long.
ALSO AVAILABLE AS 4688WP.

Specification Reference 4395W Thermostat

Type: Remote bulb; weathertight case
Temperature Set Range: 0°C to 120° C
Maximum Permissible
Temperature at Bulb: 176°C
Rating: 30 amps on 125 or 250 volts
Description: 10 ft. copper capillary: contacts open on temperature rise, SPST, ambient compensated. Sensing bulb is 1/4" diameter x 5-1/2" long.

Case

(REFERENCE 4688P)

Case is moisture and dust resistant with external temperature adjustment knob and red indicating lamp; 6-9/16" x 4" x 2-5/8" deep. Two 1/2" knockouts.

(REFERENCE 4688WP & 4395W)

Case is cast aluminum weathertight box, suitable for direct exposure to weather but NOT FOR UNDERGROUND BURIAL; 6" x 5-3/4" x 3-1/2" deep.
Two 1/2" NPT ENTRIES.

Installation

After a suitable location has been chosen, surface-mount the box in a vertical position with the capillary tube emerging from the bottom.

The switch mechanism of remote bulb types may be mounted at any convenient point away from the controlled area within the length of the capillary. The bulb should be located against the heated medium with the least amount of capillary in the controlled area. Excessive capillary should be coiled and secured in some convenient location close to the switch mechanism.

CAUTION: PROTECT THE CAPILLARY FROM KINKS, SHARP BENDS (OF LESS THAN 1/2 INCH IN RADIUS) AND UNNECESSARY HANDLING.

Install wiring as per approved method (Refer to wiring diagram).

Testing

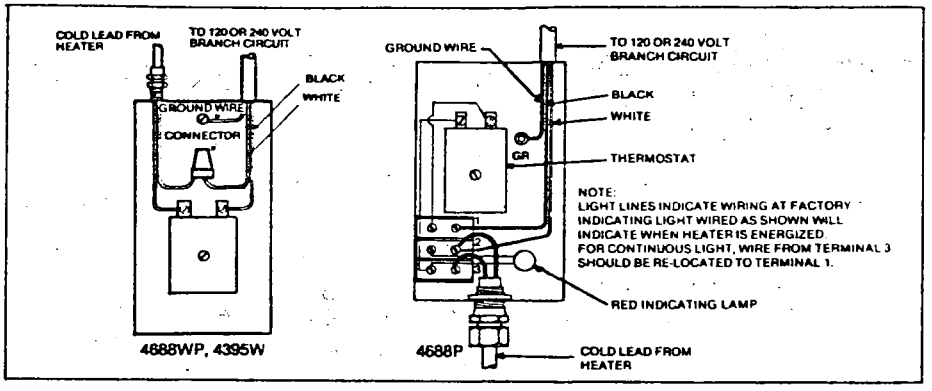
The bulb may be inserted in a liquid, heated to the temperature to be maintained. Turn the shaft until a 'CLICK' is heard. This indicates that the contacts are making and breaking and will ensure that the setting corresponds to the guide scale.

Wiring

All wiring should be in accordance with the local and national codes.

Note: The connection diagrams below refer to installations where the supply voltage is 250 volts or less. For higher voltages a contactor must be used with a separate supply for the contactor coil-thermostat circuit of 250 volts or less.

Connection Diagrams



Pyrotenax of Canada Limited, Trenton, Ontario

ANALYSIS OF HYDRO CONSUMTION AT SOME ONTARIO HYDROMETRIC STATIONS (IN KWH)

HYDROMETRIC STATION	HYDRO USAGE DURING YEAR -										THERMOSTAT INSTALLED	AVERAGE W/O THERMOSTAT	AVERAGE WITH THERMOSTAT	[%] REDUCTION
	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83				
Schomberg R. nr. Schomberg	4800	?	4220	4580	?	1170	740	1200			Apr. 78	4530	1040	77
Schneider Crk. at Kitchiner	1570	1910	1290	1000	1450	330	180	300			May 78	1446	270	81
Lutteral Crk. nr. Dustic	3310	5200	4970	3890	2980	1390	1560	1660			Apr. 78	4070	1540	62
Twenty Mi. Crk at Ball's Falls	1632	2388	1680	1610	1472	270	170	730			Oct, 78	1760	390	78
Alder Crk. nr. New Dundee	3120	2110	1760	1250	1470	770	660	680			Mar. 78	1940	670	65
Collins Crk nr. Kingston	3450	?	–	–	2700	3130	820	640			Aug. 79	3090	730	76
S/Maitland at Summer Hill	3070	3130	3390	3710	3010	1390	1530	1380			Oct. 79	2950	1455	51
Beaverton R. nr. Beaverton	3130	4920	2890	2430	3290	3060	730	860			Aug. 79	3290	795	76
Sydenham R. nr. Owen Sound	2080	3005	?	1951	2076	2230	322	1040			Oct. 79	2270	680	70
N/Saugeen R. nr. Paisley	2680	3729	3418	4799	4695	2713	3030	1200			Oct. 79	3850	2115	45
Maitland R. bel. Wingham	2859	3700	3641	3164	?	?	1320	888			Oct. 79	3340	1105	67
Sauble R. at Sauble Falls	3270	3502	4203	3370	3584	?	914	600			Oct. 79	3585	760	79
Castor Cr. at Russell	2910	1080	1810	3280	4180	5030	1250	1420			May 79	3050	1335	56
E/Canagagigue Crk. nr. Flor.	1880	2440	2100	1110	1520	2200	410	490			May 79	1875	450	76
Bronte Crk. nr. Zimmerm.	3090	2680	4080	2380	2969	?	630	720			May 79	2450	675	72
Gamaraska R. nr. Osaca	3453	4300	3415	2242	?	4850	730	1350			May 79	2960	1040	65
Patterson Crk. nr. Simcoe	4980	3610	2710	3080	2560	3660	320	730			Jul. 79	3430	525	85
Lynn R. at Simcoe	?	3840	2800	2570	2960	3440	330	1440			Jul. 79	3120	885	72
Nanticoke Crk. at Nantic.	5350	4000	4100	2360	?	3640	1600	2230			Jul. 79	3890	1915	51
L/Otter Crk. nr. Straffordv.	2390	?	1370	1490	1110	1580	610	1020			Jul. 79	1590	1325	17
S/Parkhill Crk. nr. Parkh.	?	2873	2910	3314	2500	3343	1534	?			Jul. 79	2990	1530	49
Trent R. at Heeley Falls	?	2070	2500	5580	?	1850[3]	810	1420			Aug. 79	3000	1115	63
Cold Crk. nr. Bolton	2827	5663	4016	6377	3483	5383	1400[2]	?			Oct. 79	4620	1400	70
Fish Crk. nr. Prosp. Hill	1760	2738	3042	1193	2394	3660	530	?			May 79	2465	530	78
Shelter Valley Brk. nr. Grafton	1770	1720	1600	2240	1390	1450	1200	1700			Apr. 78	1745	1450	17

APPENDIX 2.