STERLING ENGINEERING
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May 4, 2010

Mr. Dean Charter
Town of Acton
472 Main Street
Acton, MA 01720

Re: Acton Memorial Library Energy Reduction Study

Dear Mr. Charter:

Based on our analysis of the energy used and our consideration of several energy reduction concepts, it is feasible to reduce the electrical energy use at the library by 13.7% and simultaneously reduce the natural gas consumption by approximately 24%. Refer to appendix 1, table 1 for a monthly estimate of the electrical energy currently used and appendix 1, graph 1 for a pie chart of the existing annual electrical use by category. Refer to appendix 1, table 2 for the predicted electrical energy use if all proposed energy reduction options outlined in this report are implemented.

FINDINGS AND RECOMMENDATIONS

PRIMARY INDOOR LIGHTING

The primary indoor lighting (excluding miscellaneous lighting off sub-panels) accounts for 18.4% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Re-lamp all 4 foot, 2 lamp 32 watt T8 fixtures with 25 watt T8 lamps for a 22% reduction in energy with a 14% reduction in light output. (Potential rebate available)
2. Provide occupancy sensors for lighting in bathrooms and other enclosed rooms that have intermittent use.
3. Provide daylight sensing controls in the children's section of the library next to the windows (expect to override lighting approximately 490 hours per year).
4. Retrofit the metal halide fixtures with 150 watt pulse start lamps and electronic ballasts

This work will reduce electrical consumption by more than 16,400 kW-hrs annually ($3200 minimum annual savings). The rough order of magnitude cost is $24,000 with a simple payback of 7.5 years.

OUTDOOR LIGHTING

The outdoor lighting accounts for 3.2% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Install a new timeclock control in series with the existing photocell control or alternatively retrofit the appropriate controller into the existing Douglas lighting control panel to shut down 3 of the 4 major parking lot lighting circuits from 12:00 AM – 4:00 AM. Leave one circuit on for security purposes.

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This work will reduce electrical consumption by more than 4,500 kW-hrs annually ($880 minimum annual savings). The rough order of magnitude cost is $2200 with a simple payback of 2.5 years.

BOILER

The boiler accounts for 0.8% of the annual electrical energy use. We have no recommendation to reduce electrical energy use associated with the boiler.

HEATING PUMPS

The heating pumps (5 hp motor B&G 1510 model 2.5BB, redundant) have considerable hydraulic power for a building the size of the library. The pumps account for 3.6% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Provide a new dual pump variable frequency drive with bypass controlled to maintain differential pump pressure. All two-way control valves should be in working order and any differential bypass valves should be eliminated or isolated.

This work will reduce electrical consumption by more than 3,800 kW-hrs annually ($740 minimum annual savings). The rough order of magnitude cost is $3600 with a simple payback of 4.9 years. The ROM cost does not include any work necessary to correct deficiencies with the existing two-way control valves in the building.

MISCELLANEOUS ELECTRIC HEATING

Several electric space heaters were identified during our survey. The heaters increase electric use in a building primarily heated through a gas fired boiler, but the heaters are currently necessary because there is insufficient heat in some spaces. The space heaters also increase risk of fire, and we suspect that they may be serving as primary heating in some spaces. The heaters account for 2.1% (estimate, may be higher) of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Supplement all under-heated spaces with hot water baseboard including new thermostats and a dedicated control valve for each space.

This work will reduce electrical consumption by more than 9,300 kW-hrs annually, but will increase natural gas usage by 320 therms ($1300 minimum annual savings including penalty for additional fuel). The rough order of magnitude cost is $12,000 with a simple payback of 9.2 years.

SUPPLY FANS

There are four primary supply fans associated with the four rooftop packaged air handling units. The packaged air handling units serve a distribution system with variable air volume (VAV) boxes and currently utilize either inlet vanes or bypass control dampers to modulate flow to the distribution system. The packaged air handling equipment includes Dx cooling – minimum flow must be maintained during cooling operations to prevent freeze-up of the cooling coil. The fans account for 14% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Provide four (4) new variable frequency drives (VFDs) with bypass - three (3) 7.5 hp and one (1) 5 hp drives controlled from supply air duct static pressure with an optional discharge coil minimum temperature sensor

override. All inlet vanes should be removed and all bypass ducts must be cut and capped or otherwise disabled.

This work will reduce electrical consumption by more than 15,200 kW-hrs annually ($2950 minimum annual savings). The rough order of magnitude cost is $15,600 with a simple payback of 5.3 years.

EXHAUST FANS

There are three primary exhaust fans that serve bathroom and utility spaces. The exhaust runs continuously during occupied times and all the air that is exhausted is offset by air either entering through the air handling equipment, doors, windows, or cracks in the envelope of the structure (make-up air). The heating and cooling associated with the make-up air is substantial. Energy recovery equipment recommended below will actually increase the electrical energy compared to the existing exhaust fans, but that energy will be offset by reduced compressor energy (air conditioning) and reduced fuel use. The fans account for 0.9% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Replace the existing three (3) exhaust fans with a single 1675 CFM energy recovery system (static core or similar technology) and connect the pre-conditioned make-up air to the return duct of each of the four air handling units. Set the minimum outdoor air damper position to closed and modulate only during economizer functions (minimum code required ventilation for 84 pp – 110 pp will be provided by the energy recovery unit). During economizer function, the energy recovery ventilator could be controlled as exhaust only mode (for optimal energy reduction). Refer to appendix 2 for an example of the proposed energy recovery system.

This work will increase electrical consumption by 2469 kW-hrs annually including the benefit of reduced compressor use, but it will also reduce natural gas usage by more than 1750 therms annually ($2200 minimum annual savings). The rough order of magnitude cost is $17,000 with a simple payback of 7.7 years.

AC COMPRESSORS

The four (4) rooftop unit's AC compressors account for 7% of the annual electrical energy use. We have no recommendation to reduce electrical energy use associated with the compressors except for the installation of the energy recovery equipment identified in the exhaust fan section above (energy reduction is accounted for under the exhaust fan section).

LIBRARY PC'S

There are 47 personal computers (PCs) that were found during our survey, of which 43 were either being used or were idling at reduced power consumption. The PC's account for 6.4% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Replace older CRT-type screens with low power consumption flat screens with automatic power save features. Adjust the power settings on all computers to enter power save mode after 15 minutes and to shut down after 1 hour of no use.

This work will reduce electrical consumption by more than 8600 kW-hrs annually ($1650 minimum annual savings). The rough order of magnitude cost is $3,000 (assumed $300 per CRT for 10 CRTs) with a simple payback of 1.8 years.

DATA CENTER

The data center equipment accounts for 18.8% of the annual electrical energy use. **If you consider the required cooling and air handling associated with the data center, the total data center with associated HVAC equipment accounts for 25.7% of the annual electrical energy use**. **If you further consider the PC electrical load as well, the total computer and data equipment accounts for 32.1% of the annual electrical energy use**. We have no recommendation to reduce electrical energy use associated with the data center except for free cooling and seasonal re-use of data center heat as described below.

DATA CENTER AC COMPRESSOR

The data center AC compressor (air cooled condensing unit) use can be reduced with a fan transfer system to remove heat generated from the data center and use it when appropriate for space heating. The data center compressors account for 4.7% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Add a 4000 CFM transfer fan to exhaust heat from the data center into the library (ideally into the return air duct) and a second 4000 CFM transfer fan to supply air from adjacent areas on the floor above when the outdoor air temperature is less than 55 degrees F. Always keep the data center air handling unit and air cooled condensing unit enabled as a secondary method of cooling. This concept will require setting the first stage cooling (transfer fans) to start at a space temperature of 68 degrees F and the second stage (AHU/ACCU) to start at a space temperature of 78 degrees F on the cold side of the equipment. The higher space setpoint should be verified with your IT department.

This work will reduce electrical consumption by more than 12,200 kW-hrs annually (including the AHU supply fan cycling off) and will reduce fuel consumption by not less than 1900 therms ($5300 minimum annual savings). The rough order of magnitude cost is $12,500 with a simple payback of 2.4 years.

DATA CENTER AHU

The data center AHU accounts for 2.2% of the annual electrical energy use. We have no recommendation to reduce electrical energy use associated with the air handling unit except for the transfer fan system described above.

DOMESTIC HOT WATER HEATER

The domestic hot water heater accounts for 1% of the annual electrical energy use. We recommend implementing the following energy reduction work:

1. Install a multi-channel digital electronic timeclock for the domestic water heater and associated hot water recirculating pump. Disable the water heater during unoccupied times and restart 20 minutes before occupancy. Cycle the pump during occupied times only to run for 5 minutes and stop for 10 minutes. Refer to appendix 2 for an example of the proposed timeclock.

This work will reduce electrical consumption by more than 4,100 kW-hrs annually including recirculation pump energy reduction ($800 minimum annual savings). The rough order of magnitude cost is $700 with a simple payback of 0.9 years.

DOMESTIC HOT WATER RECIRCULATION PUMP

The domestic hot water recirculation pump accounts for 1.4% of the annual electrical energy use. We have no recommendation to reduce electrical energy use associated with the air handling unit except for the digital electronic timeclock described above.

OTHER SYSTEMS

Other systems accounts for 15.5% of the annual electrical energy use. We recommend implementing the following energy reduction work (not included in the overall energy reduction numbers as work includes replacement upon failure, or repair or maintenance of existing systems):

1. Replace the filters in the air handling units with not less than ASHRAE 30% DSE filters and clean the cooling coils in the four rooftop air handling units. This may reduce coil pressure drop by up to 0.1" w.g. and could save an additional $600 annually.
2. Re-wire existing economizer controls as originally intended, add a return air enthalpy sensor to the existing controllers and re-initialize the economizer sequence. This may reduce compressor work and could save an additional $750 annually.
3. Upon failure of any motor, replace with premium efficiency motors. The savings associated with the largest motors (7.5 Hp) is less than $150 annually and probably doesn't justify proactive replacement.

Note: We recommend that all ROM costs be replaced with actual construction estimates prior to assigning a contract to perform the actual work. All energy reduction estimates are calculated based on measured data and available information that was reviewed – the actual reduction in energy following implementation of recommendations may vary. It is the intent of this report to provide conservative estimates of energy savings, and we expect that generally the savings will be not less than that identified in this report.

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Appendix 1

Electrical Usage/Reduction Tables

Electrical Usage Graph

Acton Memorial Library Table 1: Existing Electrical Energy Use

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
E1	**Primary Indoor Lighting (kW-hrs)**	**8240**	**8308**	**8240**	**8240**	**8514**	**8240**	**8514**	**8514**	**8240**	**8514**	**8240**	**8514**	**100319**
	Avg lighting power (kW)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	
	Avg hours of operation (hrs/day)	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	
	Percentage of total use	18.9%	16.5%	19.0%	19.0%	19.0%	18.1%	17.9%	17.6%	17.4%	19.0%	19.2%	19.3%	18.4%
E2	**Primary Outdoor Lighting (kW-hrs)**	**1784**	**1674**	**1476**	**1292**	**1144**	**1046**	**1144**	**1271**	**1415**	**1652**	**1722**	**1907**	**17525**
	Avg lighting power (kW)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
	Avg hours of operation (hrs/day)	14.5	13.5	12	10.5	9	8.5	9	10	11.5	13	14	15	
	Percentage of total use	4.1%	3.3%	3.4%	3.0%	2.6%	2.3%	2.4%	2.6%	3.0%	3.7%	4.0%	4.3%	3.2%
E3	**Boiler Blower (kW-hrs)**	**579**	**584**	**579**	**515**	**264**	**0**	**0**	**0**	**79**	**354**	**579**	**599**	**4133**
	HDD65	1097	923	825	513	254	57	6	8	79	341	599	919	
	Avg blower power (kW)	1.4	1.4	1.4	1.4	1.4	0.0	0.0	0.0	1.4	1.4	1.4	1.4	
	Avg hours of operation (hrs/day)	14.0	14.0	14.0	12.5	6.2	1.4	0.1	0.2	1.9	8.3	14.0	14.0	
	Percentage of total use	1.3%	1.2%	1.3%	1.2%	0.6%	0.0%	0.0%	0.0%	0.2%	0.8%	1.4%	1.4%	0.8%
E4	**Hot Water Pumps (kW-hrs)**	**2736**	**2759**	**2736**	**2437**	**1247**	**0**	**0**	**0**	**375**	**1674**	**2736**	**2827**	**19526**
	HDD65	1097	923	825	513	254	57	6	8	79	341	599	919	
	Avg pump power (kW)	3.8	3.8	3.8	3.8	3.8	0.0	0.0	0.0	3.8	3.8	3.8	3.8	
	Avg hours of operation (hrs/day)	24.0	24.0	24.0	21.4	10.6	2.4	0.3	0.3	3.3	14.2	24.0	24.0	
	Percentage of total use	6.3%	5.5%	6.3%	5.6%	2.8%	0.0%	0.0%	0.0%	0.8%	3.7%	6.4%	6.4%	3.6%
E5	**Miscellaneous heating (kW-hrs)**	**1585**	**1598**	**1585**	**1411**	**722**	**157**	**17**	**23**	**217**	**969**	**1585**	**1638**	**11506**
	HDD65	1097	923	825	513	254	57	6	8	79	341	599	919	
	Avg power (kW)	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	
	Avg hours of operation (hrs/day)	9.57	9.57	9.57	8.52	4.22	0.95	0.10	0.13	1.31	5.66	9.57	9.57	
	Percentage of total use	3.6%	3.2%	3.7%	3.3%	1.6%	0.3%	0.0%	0.0%	0.5%	2.2%	3.7%	3.7%	2.1%
E6	**Supply Air Fans (kW-hrs)**	**6271**	**6323**	**6271**	**6271**	**6480**	**6271**	**6480**	**6480**	**6271**	**6480**	**6271**	**6480**	**76343**
	Avg fan power (kW)	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	
	Avg hours of operation (hrs/day)	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	
	Percentage of total use	14.4%	12.6%	14.5%	14.4%	14.5%	13.8%	13.7%	13.4%	13.2%	14.5%	14.6%	14.7%	14.0%
E7	**Exhaust Fans (kW-hrs)**	**422**	**426**	**422**	**422**	**436**	**422**	**436**	**436**	**422**	**436**	**422**	**436**	**5140**
	Avg exhaust power (kW)	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	
	Avg hours of operation (hrs/day)	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	
	Percentage of total use	1.0%	0.8%	1.0%	1.0%	1.0%	0.9%	0.9%	0.9%	0.9%	1.0%	1.0%	1.0%	0.9%
E8	**AC Compressors (kW-hrs)**	**0**	**0**	**48**	**342**	**1635**	**7430**	**14669**	**10995**	**2949**	**294**	**14**	**0**	**38377**
	CDH74	0	0	7	50	239	1086	2144	1607	431	43	2	0	
	Load per CDH (ton-hrs)	0	0	47	338	1618	7351	14513	10878	2918	291	14	0	
	Percentage of total use	0.0%	0.0%	0.1%	0.8%	3.6%	16.3%	30.9%	22.7%	6.2%	0.7%	0.0%	0.0%	7.0%
E9	**Library Computers (kW-hrs)**	**2863**	**2887**	**2863**	**2863**	**2959**	**2863**	**2959**	**2959**	**2863**	**2959**	**2863**	**2959**	**34862**
	Avg power (kW)	9.03	9.03	9.03	9.03	9.03	9.03	9.03	9.03	9.03	9.03	9.03	9.03	
	Avg hours of operation (hrs/day)	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	
	Percentage of total use	6.6%	5.8%	6.6%	6.6%	6.6%	6.3%	6.2%	6.1%	6.0%	6.6%	6.7%	6.7%	6.4%
E10	**Data Center (kW-hrs)**	**8424**	**8494**	**8424**	**8424**	**8705**	**8424**	**8705**	**8705**	**8424**	**8705**	**8424**	**8705**	**102562**
	Avg UPS power (kW)	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	
	Avg hours of operation (hrs/day)	24	24	24	24	24	24	24	24	24	24	24	24	
	Percentage of total use	19.4%	16.9%	19.5%	19.4%	19.4%	18.5%	18.3%	17.9%	17.8%	19.4%	19.7%	19.7%	18.8%
E11	**Data Center ACCU (kW-hrs)**	**2121**	**2138**	**2121**	**2121**	**2191**	**2121**	**2191**	**2191**	**2121**	**2191**	**2121**	**2191**	**25817**
	Avg ACCU power (kW)	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	
	Avg hours of operation (hrs/day)	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	
	Percentage of total use	4.9%	4.3%	4.9%	4.9%	4.9%	4.7%	4.6%	4.5%	4.5%	4.9%	5.0%	5.0%	4.7%
E12	**Data Center AHU (kW-hrs)**	**995**	**1003**	**995**	**995**	**1028**	**995**	**1028**	**1028**	**995**	**1028**	**995**	**1028**	**12113**
	Avg AHU power (kW)	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	

Acton Memorial Library Table 1: Existing Electrical Energy Use

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Avg hours of operation (hrs/day)	24	24	24	24	24	24	24	24	24	24	24	24	
	Percentage of total use	2.3%	2.0%	2.3%	2.3%	2.3%	2.2%	2.2%	2.1%	2.1%	2.3%	2.3%	2.3%	2.2%
E13	**Hot Water Heater (kW-hrs)**	**459**	**463**	**459**	**459**	**474**	**459**	**474**	**474**	**459**	**474**	**459**	**474**	**5588**
	Avg power (kW)	0.6375	0.6375	0.6375	0.6375	0.6375	0.6375	0.6375	0.6375	0.6375	0.6375	0.6375	0.6375	
	Avg hours of operation (hrs/day)	24	24	24	24	24	24	24	24	24	24	24	24	
	Percentage of total use	1.1%	0.9%	1.1%	1.1%	1.1%	1.0%	1.0%	1.0%	1.0%	1.1%	1.1%	1.1%	1.0%
E14	**Hot Water Recirc Pump (kW-hrs)**	**612**	**617**	**612**	**612**	**632**	**612**	**632**	**632**	**612**	**632**	**612**	**632**	**7451**
	Avg power (kW)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	
	Avg hours of operation (hrs/day)	12	12	12	12	12	12	12	12	12	12	12	12	
	Percentage of total use	1.4%	1.2%	1.4%	1.4%	1.4%	1.3%	1.3%	1.3%	1.3%	1.4%	1.4%	1.4%	1.4%
E15	**Other (kW-hrs)**	**6406**	**12933**	**6458**	**7001**	**8401**	**6417**	**198**	**4787**	**12006**	**8453**	**5782**	**5690**	**84532**
	Percentage of total use	14.7%	25.8%	14.9%	16.1%	18.7%	14.1%	0.4%	9.9%	25.3%	18.9%	13.5%	12.9%	15.5%
	Total (kW-hrs)	**43496**	**50208**	**43288**	**43404**	**44832**	**45456**	**47448**	**48496**	**47448**	**44816**	**42824**	**44080**	**545796**

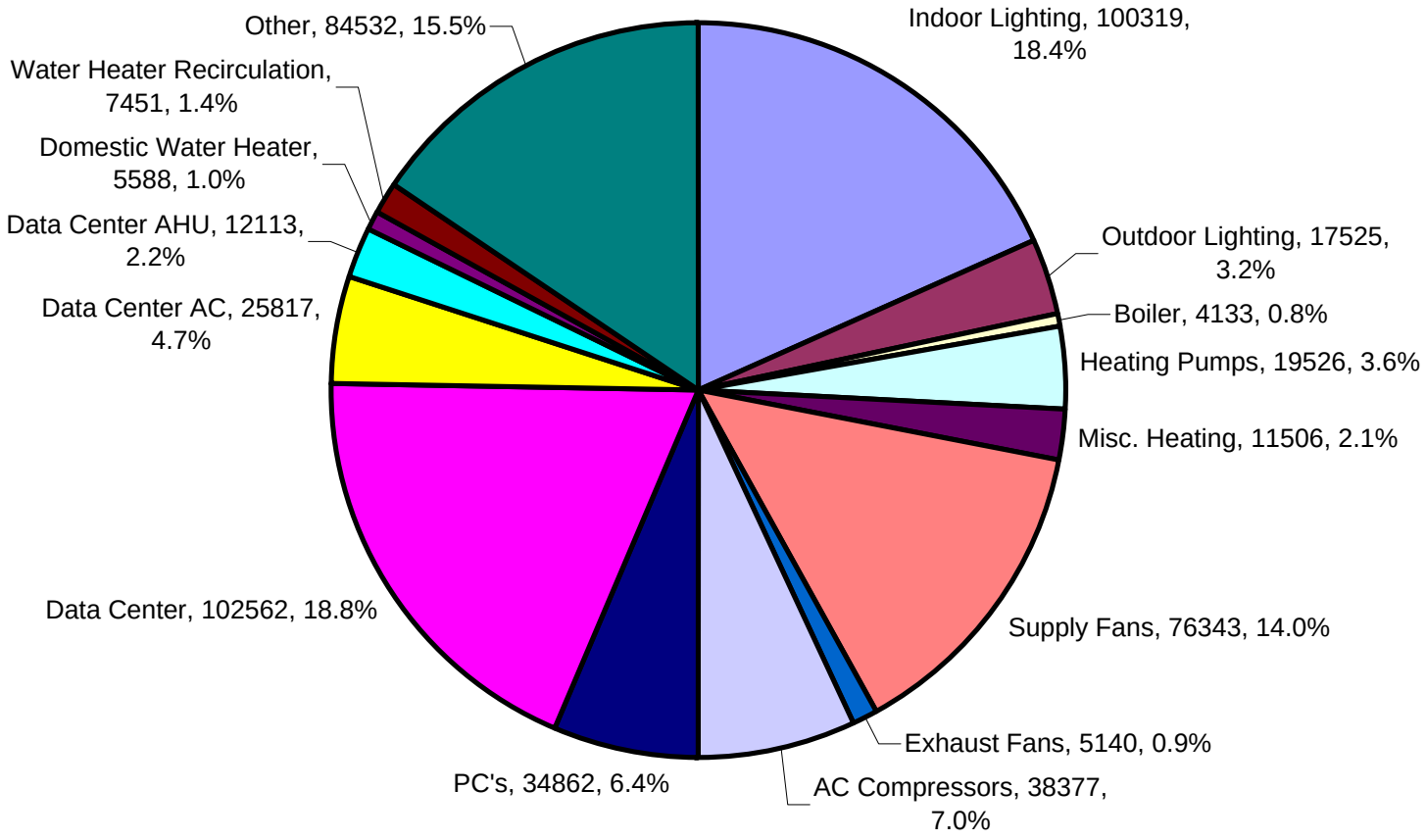
Acton Memorial Library Table 2: Proposed Electrical Energy Reduction

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
R1	**Primary Indoor Lighting (kW-hrs)**	**1349**	**1361**	**1349**	**1349**	**1394**	**1349**	**1394**	**1394**	**1349**	**1394**	**1349**	**1394**	**16429**
	Avg lighting reduction (kW)	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	
	Avg hours of operation (hrs/day)	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	
	Percentage of total use	3.1%	2.7%	3.1%	3.1%	3.1%	3.0%	2.9%	2.9%	2.8%	3.1%	3.2%	3.2%	3.0%
R2	**Primary Outdoor Lighting (kW-hrs)**	**372**	**375**	**372**	**372**	**384**	**372**	**384**	**384**	**372**	**384**	**372**	**384**	**4529**
	Avg lighting power (kW)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	
	Avg hours reduction (hrs/day)	4	4	4	4	4	4	4	4	4	4	4	4	
	Percentage of total use	0.9%	0.7%	0.9%	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%	0.9%	0.9%	0.9%	0.8%
R3	**Boiler Blower (kW-hrs)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	HDD65	1097	923	825	513	254	57	6	8	79	341	599	919	
	Avg power reduction (kW)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Avg hours of operation (hrs/day)	14.0	14.0	14.0	12.5	6.2	1.4	0.1	0.2	1.9	8.3	14.0	14.0	
	Percentage of total use	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
R4	**Hot Water Pumps (kW-hrs)**	**540**	**545**	**540**	**481**	**246**	**0**	**0**	**0**	**74**	**330**	**540**	**558**	**3854**
	HDD65	1097	923	825	513	254	57	6	8	79	341	599	919	
	Avg power reduction (kW)	0.75	0.75	0.75	0.75	0.75	0.0	0.0	0.0	0.75	0.75	0.75	0.75	
	Avg hours of operation (hrs/day)	24.0	24.0	24.0	21.4	10.6	2.4	0.3	0.3	3.3	14.2	24.0	24.0	
	Percentage of total use	1.2%	1.1%	1.2%	1.1%	0.5%	0.0%	0.0%	0.0%	0.2%	0.7%	1.3%	1.3%	0.7%
R5	**Miscellaneous heating (kW-hrs)**	**1292**	**1303**	**1292**	**1150**	**589**	**128**	**14**	**19**	**177**	**790**	**1292**	**1335**	**9380**
	HDD65	1097	923	825	513	254	57	6	8	79	341	599	919	
	Avg power (kW)	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	
	Avg hours of operation (hrs/day)	9.57	9.57	9.57	8.52	4.22	0.95	0.10	0.13	1.31	5.66	9.57	9.57	
	Percentage of total use	3.0%	2.6%	3.0%	2.7%	1.3%	0.3%	0.0%	0.0%	0.4%	1.8%	3.0%	3.0%	1.7%
R6	**Supply Air Fans (kW-hrs)**	**1256**	**1266**	**1256**	**1256**	**1298**	**1256**	**1298**	**1298**	**1256**	**1298**	**1256**	**1298**	**15289**
	Avg fan power (kW)	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	
	Avg hours of operation (hrs/day)	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	
	Percentage of total use	2.9%	2.5%	2.9%	2.9%	2.9%	2.8%	2.7%	2.7%	2.6%	2.9%	2.9%	2.9%	2.8%
R7	**Exhaust Fans (kW-hrs)**	**-568**	**-573**	**-568**	**-568**	**-587**	**-568**	**-587**	**-587**	**-568**	**-587**	**-568**	**-587**	**-6921**
	Avg exhaust power (kW)	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	
	Avg hours of operation (hrs/day)	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	
	Percentage of total use	-1.3%	-1.1%	-1.3%	-1.3%	-1.3%	-1.3%	-1.2%	-1.2%	-1.2%	-1.3%	-1.3%	-1.3%	-1.3%
R8	**AC Compressors (kW-hrs)**	**0**	**0**	**0**	**0**	**30**	**718**	**1584**	**1528**	**592**	**0**	**0**	**0**	**4452**
	CDH74	0	0	7	50	239	1086	2144	1607	431	43	2	0	
	Load reduction (ton-hrs)	0	0	0	0	30	710	1567	1512	586	0	0	0	
	Percentage of total use	0.0%	0.0%	0.0%	0.0%	0.1%	1.6%	3.3%	3.2%	1.2%	0.0%	0.0%	0.0%	0.8%
R9	**Library Computers (kW-hrs)**	**713**	**719**	**713**	**713**	**737**	**713**	**737**	**737**	**713**	**737**	**713**	**737**	**8687**
	Avg power reduction (kW)	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	
	Avg hours of operation (hrs/day)	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	10.57	
	Percentage of total use	1.6%	1.4%	1.6%	1.6%	1.6%	1.6%	1.6%	1.5%	1.5%	1.6%	1.7%	1.7%	1.6%
R10	**Data Center (kW-hrs)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Avg power reduction (kW)	0	0	0	0	0	0	0	0	0	0	0	0	
	Avg hours of operation (hrs/day)	24	24	24	24	24	24	24	24	24	24	24	24	
	Percentage of total use	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
R11	**Data Center ACCU (kW-hrs)**	**974**	**982**	**974**	**859**	**462**	**0**	**0**	**0**	**0**	**544**	**974**	**1006**	**6773**
	Avg ACCU power reduction (kW)	3.05	3.05	3.05	2.69	1.40	0.00	0.00	0.00	0.00	1.65	3.05	3.05	
	Avg hours of operation (hrs/day)	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	
	Percentage of total use	2.2%	2.0%	2.2%	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	1.2%	2.3%	2.3%	1.2%
R12	**Data Center AHU (kW-hrs)**	**792**	**799**	**792**	**698**	**379**	**0**	**0**	**0**	**0**	**439**	**792**	**818**	**5510**
	Avg AHU power reduction (kW)	1.10	1.10	1.10	0.97	0.51	0.00	0.00	0.00	0.00	0.59	1.10	1.10	

Acton Memorial Library Table 2: Proposed Electrical Energy Reduction

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Avg hours of operation (hrs/day)	24	24	24	24	24	24	24	24	24	24	24	24	
	Percentage of total use	1.8%	1.6%	1.8%	1.6%	0.8%	0.0%	0.0%	0.0%	0.0%	1.0%	1.8%	1.9%	1.0%
R13	**Hot Water Heater (kW-hrs)**	**135**	**136**	**135**	**135**	**140**	**135**	**140**	**140**	**135**	**140**	**135**	**140**	**1644**
	Avg power reduction (kW)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
	Avg hours of operation (hrs/day)	15	15	15	15	15	15	15	15	15	15	15	15	
	Percentage of total use	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
R14	**Hot Water Recirc Pump (kW-hrs)**	**205**	**207**	**205**	**205**	**212**	**205**	**212**	**212**	**205**	**212**	**205**	**212**	**2498**
	Avg power reduction (kW)	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	
	Avg hours of operation (hrs/day)	12	12	12	12	12	12	12	12	12	12	12	12	
	Percentage of total use	0.5%	0.4%	0.5%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%	0.5%
													Total Annual Reduction (kw-hrs):	**72124**
	Percentage Reduction (%)	16.2%	14.2%	16.3%	15.3%	11.8%	9.5%	10.9%	10.6%	9.1%	12.7%	16.5%	16.5%	**13.2%**

Graph 1: Acton Town Library Electricity Usage (kW-hrs, % of total)



STERLING ENGINEERING
COMPANY • INCORPORATED

Appendix 2

Timeclock Selection

RenewAire ERV Selection

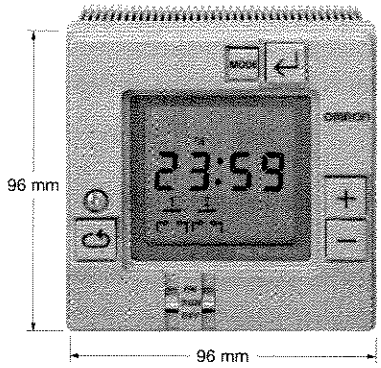
Daily Time Switch
H5L

CSM_H5L_DS_E_2_1

Weekly Control with a Large Time Display

Easy Programming with Large Display and Interactive Functions.

- Easy operation with five keys.
- Up to 24 steps of ON/OFF operations can be set.
- Power supply freely selectable from 100 to 240 VAC.
- Memory protection during power failure for up to 10 years.
- Certified for UL and CSA safety standards.
- The same setting can be used for multiple-day operation and timer operation.



⚠ Refer to *Safety Precautions for All Timers.*
Refer to *Safety Precautions* on page 12

Ordering Information

Wiring	Backup power supply function for memory protection	No. of program steps	Model
Screw terminals	Provided (approx. 10 years at 25°C)	24 (Each ON or OFF is considered to be one step.)	H5L-A

Specifications

■ Time Ranges

Rated time	Time setting range	Time division
24 hrs x 7 days	00:00 to 23:59	1 min

■ Ratings

Rated supply voltage	100 to 240 VAC (50/60 Hz)
Operating voltage range	85% to 110% of rated supply voltage
Power consumption	Approx. 4 VA at 240 VAC
Control outputs	15 A at 250 VAC, resistive load at 50°C 12 A at 250 VAC, resistive load at 55°C Minimum applied load: 100 mA at 5 VDC (failure level: P, reference value)

■ Characteristics

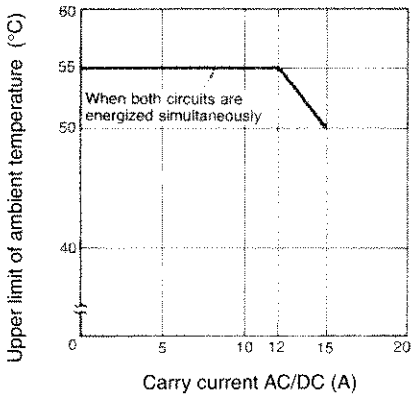
Accuracy of operating time	±0.01% ±0.05 s max. (see note 1)
Setting error	
Influence of voltage	
Influence of temperature	
Time accuracy	±15 s per month (at 25°C)
Insulation resistance	100 MΩ min.
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min (between current-carrying terminals and exposed non-current-carrying metal parts and between control power supply circuit and contact control output circuits) 1,000 VAC, 50/60 Hz for 1 min (between non-continuous contacts)
Vibration resistance	Destruction: 10 to 55 Hz with 0.75-mm double amplitude Malfunction: 10 to 55 Hz with 0.5-mm double amplitude
Shock resistance	Destruction: 300 m/s^2 (approx. 30G) Malfunction: 100 m/s^2 (approx. 10G)
Ambient temperature	Operating: −10°C to 55°C
Ambient humidity	Operating: 35% to 85%
Life expectancy	100,000 operations min. (15 A at 250 VAC, resistive load)
Approved standards	UL (File No. E52800), CSA (File No. LR22310)
Weight	Approx. 350 g

Note: The overall error, which includes repeat accuracy, setting error, and variations due to changes in voltage and temperature, is ±0.01% or ±0.05 s max. The accuracy of ±0.01% also indicates the error in the time interval of the set time.

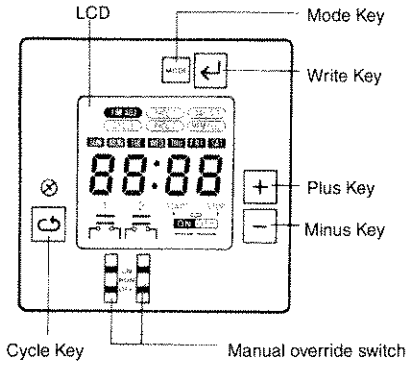
Engineering Data

Ambient Operating Temperature and Carry Current

Note that the upper limit of the ambient operating temperature lowers when a large carry current is being applies as shown below.



Nomenclature



Note: This figure shows the LCD section with all display items being displayed on the screen.

Key Operation

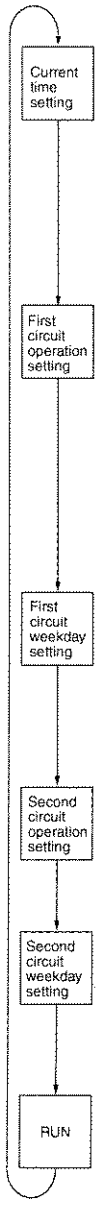
Key	Name	Function
MODE	Mode Key	Changes program mode RUN mode → Current time setting mode → First circuit operation setting mode → First weekday setting mode → Second circuit operation setting mode → Second circuit weekday setting mode → RUN mode
↵	Write Key	To write the set data using the Plus and/or Minus Key. Reads out the set program.
+	Plus Key	Changes "day of week" while setting day of week. Changes "hours" or "minutes" while setting current time. When the Plus Key is held down, the displayed digit increments continuously; when the Minus Key is held down, it decrements continuously. When specifying output. The Plus Key specifies output ON while the Minus Key specifies output OFF. Note that if the same key is pressed twice, the output specification becomes invalid; neither ON nor OFF is set.
−	Minus Key	
↻	Cycle Key	Specifies the cycle program. Pressing this key twice causes the set cycle program to be cleared.
ON RUN OFF	Manual override switch	ON: Turns ON output regardless of program RUN: Executes program OFF: Turns OFF output regardless of program First and second circuit can be operated independently.

Operation

■ Programming

The H5L Weekly Timer has the following six program modes. Use the Mode Key to change the modes. Use the Write Key, Plus Key, Minus Key, and Cycle Key for programming in each mode.

Mode Change Sequence **Programming Details**



Current time setting

To set the current time in the order of "day of week", "hour" and "minute".

1. Press the Mode Key for longer than 1 s to put the H5L in "TIM ADJ" mode.
2. Set "DAY OF WEEK" using the Plus and/or Minus Keys. Then press the Write Key to write the set weekday.
3. Set "hour" using the Plus and/or Minus Keys. Then press the Write Key to write the set hour.
4. Set "minute" using Plus and/or Minus Keys. Then press the Write Key to write the set minute.

First circuit operation setting

To specify first circuit operation in the order of "hour", "minute", and "output ON or OFF"

1. Press the Mode Key to put the H5L in "PROG 1" mode.
2. Set "hour" using the Plus and/or Minus Keys. Then press the Write Key to write the set hour.Set minute" using the Plus and/or Minus Keys. Then press the Write Key to write the set minute.
3. Specify "ON" or "OFF" of output using the Plus or Minus Key and press the Write Key to write the set output specification.

In this manner, set ON time and OFF time as many times as necessary.

First circuit weekday setting

To set for each weekday whether the program for the first circuit set in the previous step is to be executed or not.

1. Press the Mode Key to put the H5L in "PROG 1" "DAY SET" mode.
2. Press the Plus Key to run the first circuit and press the Minus Key for it not to run.
3. Press the Write Key to change day of week.

Repeat steps 2 and 3 for Sunday to Saturday.

Second circuit operation setting

To specify second circuit operation in the order of "hour", "minute", and "output ON or OFF"

1. Press the Mode Key to put the H5L in "PROG 2" mode.
2. Proceed with the settings in the same manner as in the first circuit operation setting above.

Second circuit weekday setting

To set for each weekday whether the program for the second circuit set in the previous steps is to be executed or not.

1. Press the Mode Key to put the H5L in "PROG 2" "DAY SET" mode.
2. Proceed with the settings in the same manner as in the first circuit operation setting above.

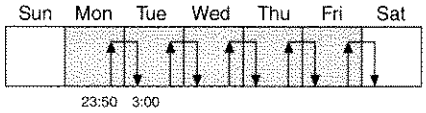
RUN

Run the H5L using the set program. In RUN mode, the current time and output status are displayed but the operation mode is not displayed. After starting the H5L, the colon between the "hour" and "minute" blinks to indicate that time count is in execution.

Note: The H5L operates in accordance with the program already set even while another program is being set. The output status display (⌐¬, ¬⌐ etc.) during programming displays the setting being programmed. Therefore, note that the output status displayed on the LCD may not agree with the actual output status.

Setting Multiple-day Operation

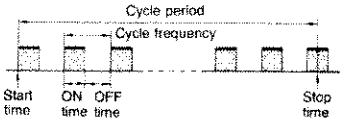
Example for Turning ON Circuit 1 Every Day from Monday to Friday at 11:50 pm and Turning Circuit 1 OFF at 3:00 am the Next Morning



1. Use the procedure *First circuit operation setting* given at the left to set the ON time to 23:50 and the OFF time to 3:00.
2. Use the procedure *First circuit weekday setting* given at the left to set Monday, Tuesday, Wednesday, Thursday, and Friday.

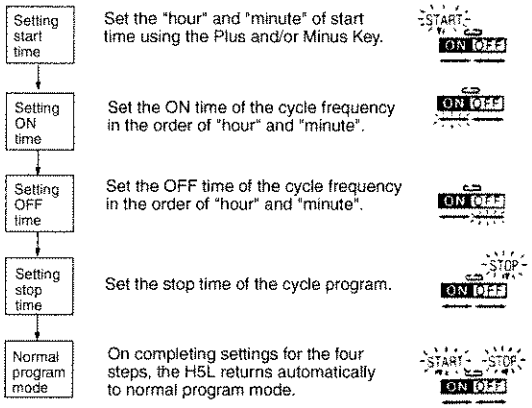
Cycle Program

In the H5L, the cycle program can be used to repeat ON and OFF of output for a certain period in a predetermined cycle. A cycle program consists of the following four steps:
Start time, ON time, OFF time, Stop time



Setting A Cycle Program

Set the four steps of the cycle program in the following procedure.

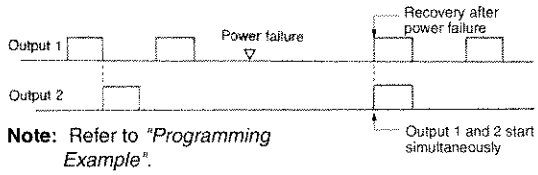


Cautions on Using Cycle Programs

1. When the current time is included within the set cycle period, the cycle operation starts (output turns ON) on completing the cycle program setting (when stop time is written).
2. When any of the following occurs during a cycle period, the cycle operation restarts from output ON.

   Recovery after power failure
   Current time adjustment

   Change of start or stop time of the cycle program during operation. For this reason, if the cycle programs for the first and second circuits are set in such a manner that outputs 1 and 2 have a phase difference, note that the phase difference is changed when any of the conditions above occur as shown in the example below. (Therefore, it is recommended that cycle programs are used sequentially.)



Note: Refer to *"Programming Example"*.

3. The cycle period (from start time to stop time) does not need to be a multiple of the cycle frequency (ON time plus OFF time). The cycle period can be set within a range of 1 min to 24 hrs.
4. ON time as well as OFF time can be set within a range of 1 min to 23 hrs 59 min.

Deleting Programming

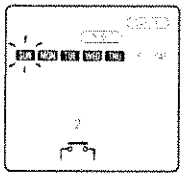
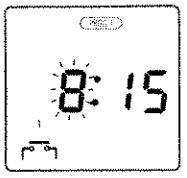
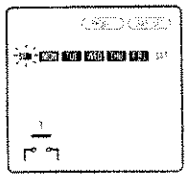
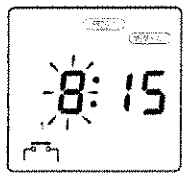
1. **Deleting from Normal Operation Programs (ON Time/OFF Time)**
   Call up the output display for the program to be deleted by pressing the Write Key. The minus sign (–) for the output point will flash.
   Next, change the display to disable the output using the Plus and Minus Keys. For NC contacts, press the Plus Key and for NO contacts, press the Minus Key. The connecting bar above the contacts will disappear and the display will flash to indicate that the output has been displayed. If the Write Key is pressed at this time, the step will be deleted.

2. **Deleting from Cyclic Programs**
   Four steps will be simultaneously deleted from the cyclic program if the program is called up and then the Cycle and Write Keys are pressed in order. The start time display will remain, but the program will be deleted.

■ LCD Display

LCD Display (Display Example in Each Mode)

Since the H5L employs interactive programming, the program mode and setting data are displayed on the LCD.

Display	Mode	Display data	Display	Mode	Display data
	RUN	Current day of week: Monday Current time:10:11 First circuit: OFF Second circuit: ON		Second operation time setting	The second circuit turns ON Sunday to Thursday (operation by the set program is executed). It turns OFF on Friday and Saturday (operation by the set program stops).
	Current time setting	Current day of week: Tuesday Current time: 9:31		Second Weekday setting	The second circuit turns ON Sunday to Thursday (operation by the set program is executed). It turns OFF on Friday and Saturday (operation by the set program stops).
	First operation time setting	The first circuit turns on at 8:15		Cycle Program setting	The first circuit starts cycle operation at 1:10 (for details, refer to Cycle Program).
	First weekday setting	The first circuit turns OFF on Sunday and Saturday (operation by the set program stops). It turns ON Monday to Friday (operation by the set program is executed).		Memory over	Indicates that all 24 program steps have been written (on writing the 24th step, the data set for the first step is displayed on the LCD).

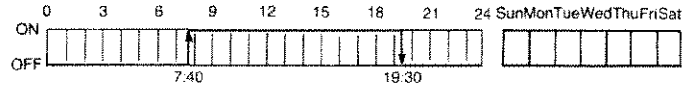
Note: Meaning of output status indications
:Output ON, ⌐¬ ; Output OFF, ⌐ ¬ : Invalid (if an invalid instruction is written to a step, that step will be cleared.)

■ Programming Example

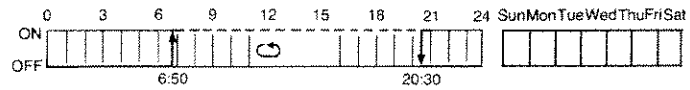
Be sure to create a timing chart before programming.

Operating Timing Chart

First Circuit



Second Circuit



Example

ON and OFF Programs
Cyclic Programs

In this example, the first circuit is programmed to turn ON at 7:40 and OFF at 19:30. This circuit is operated from Monday through Friday and stopped on Saturday and Sunday.
The second circuit is cyclically operated with each parameter set as follows:
Start time: 6:50
ON time: 5 min
OFF time: 20 min
Stop time: 20:30
The second circuit is stopped from operating on Sunday and operated from Monday through Saturday. The current time is assumed to be 11:15 a.m. on Tuesday.

Writing Program

Even while being programmed, the timer generates output according to the previous program. If you don't want an unexpected operation of output relay, turn on (or off) the manual switch.
In the figure, the indicators and digits shown in are blinking.

1. Setting Current Time

To set the current time, "day of the week", "hour", and "minute" must be specified.
First, turn on the power to the H5L.
The contents of the memory are cleared on power-up and the TIM ADJ indicator is displayed as shown on the left.As an example, set the time to 11:15 on Tuesday.

Start by setting the day of the week. The blinking indicator indicates the parameter that can be set. Set the current day of the week to Tuesday by pressing the Plus or Minus Key.

When "TUE" is displayed, press the Write Key to store the current day of the week in memory. The "hour" indicator will begin to flash and the day of the week" indicator will stop flashing.

Set the current hour to 11 by pressing the Plus or Minus Key, followed by the Write Key.

At this time, the "minute" indicator will blink. Set the current minute to 15 by pressing the Plus or Minus Key, followed by the Write Key.

This completes the current time setting.

2. First Circuit Operation Setting

To program the operation of the first circuit, "hour", "minute", and "output" must be specified.
Press the Mode Key to place the H5L into PROG 1 mode. The display will be as shown on the left.

Since the first circuit is to be turned ON at 7:40, set the "hour" to 7 by pressing the Plus or Minus Key and then store it in memory by using the Write Key.

The "minute" will start blinking. Set it to 40 by using the Plus or Minus Key and store it in memory by pressing the Write Key.

Now, the output status indicator will blink. Set the output to the ON state with the Plus Key followed by the Write Key.
(If the Plus Key is pressed twice at this time, the display will give an invalid indication, and if the Write Key is pressed, this program will be deleted.)

The display returns to the initial state as shown on the left and waits for the next program command to be input.

Since the first circuit should be turned OFF at 19:30, set the hour to 19 and the minute to 30 by using the Plus or Minus Key and then the Write Key.

The output status indicator starts blinking. Set the output to the OFF state using the Minus Key and store it in memory by pressing the Write Key.

The display returns to the initial state and waits for the next program command to be input. Now let us turn to the setting of the "day of the week".

3. Fist Circuit Day-of-the-week Setting

By pressing the Mode Key, place the H5L into DAY SET mode.
The display will be as shown on the left.
Press the Plus Key to operate the first circuit on a particular day of the week and press the Minus Key to stop it. The reverse video (i.e., white characters on a black background) of the day-of-the-week indicators means that the first circuit is operated on that day. The day on which circuit operation is stopped is indicated by bold indicators. Initially, the circuit is set to operates on all the days of the week and the SUN indicator blinks.

In this example, since circuit operation is to be stopped on Sunday, select SUN and press the Minus Key, then store the setting in memory by pressing the Write Key.

The MON indicator will start blinking. Press the Write Key, until the SAT indicator blinks.

Since the first circuit is not to be operated on Saturday, press the Minus Key followed by the Write Key.

The SUN indicator will start blinking again. This completes the setting of all the days of the week for the first circuit.

4. Second Circuit Operation Setting

Press the Mode Key to place the H5L into PROG 2 mode. The display appears as shown on the left.

In this example, as the second circuit is to be cyclically operated, specify the cycle program by pressing the Cycle Key.

Select the start time by setting the hour to 6 and the minute to 50 using pressing the Plus or Minus Key. Write each set value by pressing the Write Key.

The timer will now wait for you to set the ON time (5 min in this example).

Press the Write Key to select 0 hrs, then use the Plus or Minus Keys followed by the Write Key to select 5 min.

The timer will now wait for the OFF time to be set (20 min in this example).

Press the Write Key to select 0 hrs, then use the Plus or Minus Keys followed by the Write Key to select 20 min.

The timer will now wait for the cyclic circuit operation stop time to be set (20:30 in this example).

Set the hour to 20 using the Plus or Minus Keys, then press the Write Key. Set the minutes to 30 and press the Write Key again.

The programming of the cyclic operation is now complete. The timer will wait for input of a new program as shown. We will now have to set the day of the week for the second circuit.

5. Second Circuit Day-of-the Week Setting

Press the Mode Key to place the H5L into PROG 2, DAY WET mode. Initially, all days of the week are selected (shown by reverse video) and the SUN indicator will be flashing.

In our example, the second circuit is to be operated on all days except Sunday. To inhibit Sunday operation, press the Minus Key while the SUN indicator is flashing. The circuit will now be operated only from Monday to Saturday.

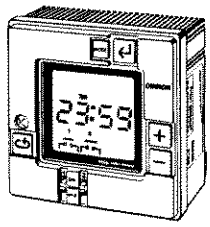
All of the parameters have now been programmed for this example. Press the Mode Key to place the timer into RUN mode. The display will be as shown (assuming five minutes have elapsed while programming). The output status indicators indicate the status of each of the circuit.

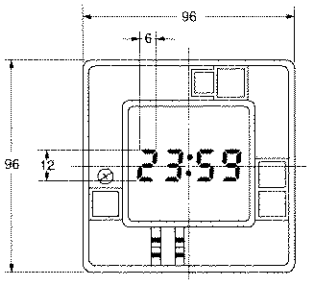
Note: Set manual override switches 1 and 2 to RUN.

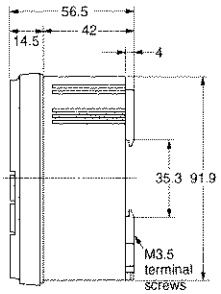
Dimensions

Note: All units are in millimeters unless otherwise indicated.

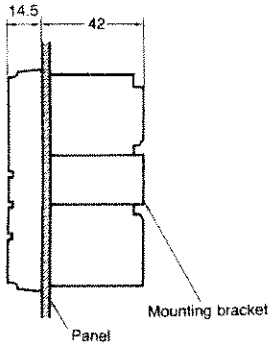
H5L-A



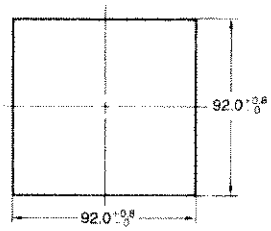




Dimensions

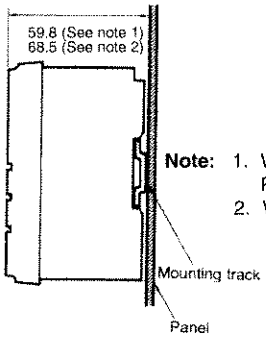


Panel Cutout



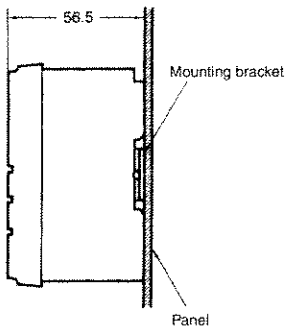
Mounting Bracket (Included)

Dimensions

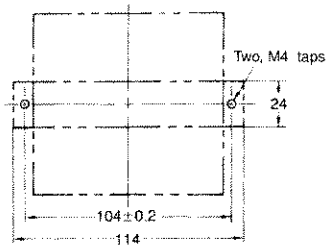


Note: 1. When using mounting track PFP-100N or PFP-50N.
2. When using mounting track PFP-100N2.

Dimensions



Panel Cutout

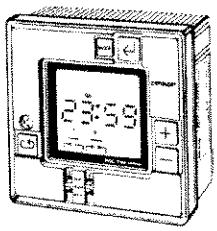


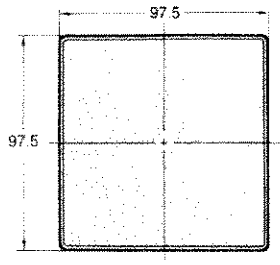
Mounting Bracket (Included)

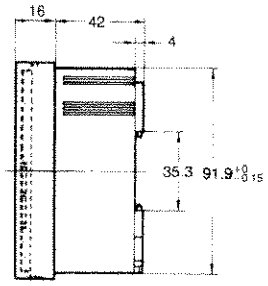
■ Accessories (Order Separately)

Front Cover

Y92A-96A

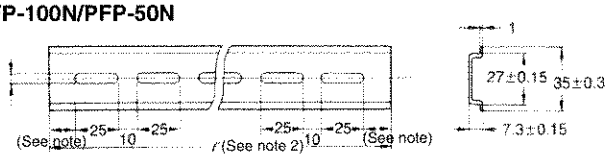




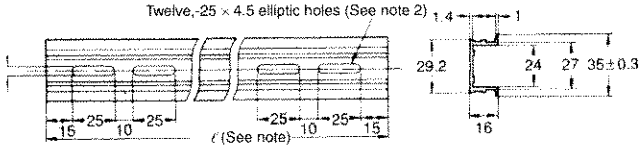


Mounting Track (Meets DIN EN 50022)

PFP-100N/PFP-50N



PFP-100N2



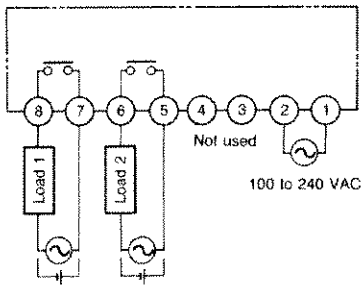
Note:
1. This dimension is 15 mm on both ends in the case of the PFP-100N but on one end in the case of the PFP-50N.
2. The length l of each mounting track is shown in this table.
3. A total of twelve 25 × 4.5 elliptic holes are provided, with six holes cut from each end of the track at a pitch of 10 mm between holes.

PFP-100N	1 m
PFP-50N	50 cm
PFP-100N2	1 m

Installation

■ Connections

Connect the power supply between terminals ① and ②, the load for the first circuit between terminals ⑦ and ⑧, and the load for the second circuit between terminals ⑤ and ⑥. Terminals ③ and ④ are no connects.



Note: To each load, connect the power supply for load.

Safety Precautions

Refer to *Safety Precautions for All Timers.*

⚠ CAUTION

Tighten terminal screws to the specified torque of approx. 0.8 N·m (maximum torque: 0.98 N·m). Loose screws may occasionally cause fires or malfunction.

The Time Switch contains a lithium battery (explosion-proof). Do not disassemble the Time Switch, deform the Time Switch under pressure, heat the Time Switch to above 100°C, or incinerate the Time Switch. Doing any of these may result in fire or battery rupture.

■ Precautions for Safe Use

Observe all of the following precautions to maintain safety.

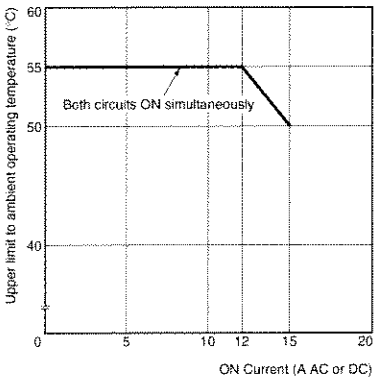
1. The Time Switch is not waterproof or oil resistant. Do not use it in locations subject to water or oil.
2. Use the following wire to wire the Time Switch: 600-V vinyl-insulated wire (solid wire or twisted wire, copper), 14 to 24 AWG
3. Do not connect more than two crimp terminals to each Time Switch terminal.
4. None of the Time Switch components are user-replaceable, including the battery.

■ Precautions for Correct Use

Be sure that the capacity of the power supply is large enough, otherwise the Time Switch may not start due to the inrush current (approx. 3 A) that flows for an instant when the power to the Time Switch is turned ON.

ON Current and Ambient Temperature (Reference Values)

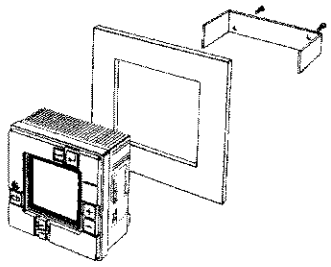
If the ON current is too large, the upper limit to the ambient operating temperature must be reduced as shown in the following diagram.



Mounting Dimensions

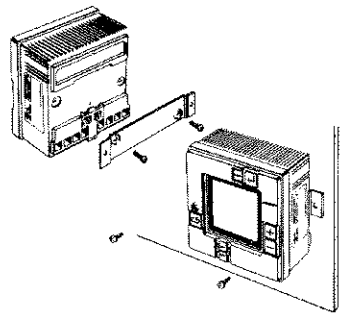
Flush Mounting

• Use a U-shaped mounting bracket to flush mount the unit.



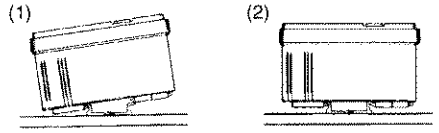
Surface Mounting

• Use a straight mounting bracket to surface mount the unit.

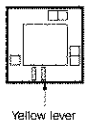


Track Mounting

• Hook the upper part on the rear surface to the upper edge of the mounting track and press the unit down.



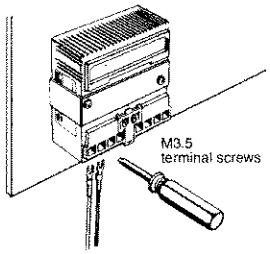
• To remove the Timer Switch from the DIN Track, pull down on the yellow lever at the back of the Timer Switch.



Wiring

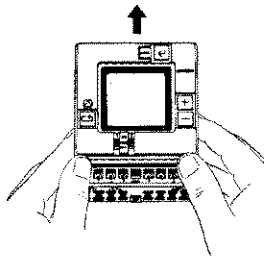
Wiring From the Rear

• Perform wiring from the rear of the unit when the unit is flush mounted.



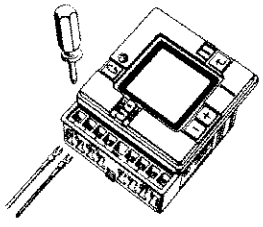
Wiring From the Front

• Perform wiring from the front of the unit when the unit is track or surface mounted.



Wiring Procedure

1. Loosen the screw on the left side of the front.
2. Slide the upper part of the unit approx. 15 mm upward.
3. After the terminals appear, perform wiring.
4. Return the upper part of the unit to the original position and tighten the screw.



Note: Screw tightening torque: 0.98 N·m max.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

Read and Understand This Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

2008.11

In the interest of product improvement, specifications are subject to change without notice.

OMRON Corporation
Industrial Automation Company

http://www.ia.omron.com/

5/4/2010

RenewAire
Energy Recovery Ventilators
4510 Helgesen Dr, Madison, WI 53718
800.627.4499 Fax: 608.221.2824
support@renewaire.com

Engineer	
Phone/Fax:	
CC:	
Phone/Fax:	
Date:	
Project Name:	
Prepared By:	

General Description:

Design Conditions:

Room Air	Winter	Summer		Outside Air	Winter	Summer
Exhaust Rate (RA)	1,675		(CFM)	Supply Rate (FA)	1,675	
External Static Pressure	*0.50*		*("H_2O)*	External Static Pressure	*0.50*	
Dry Bulb Temp	68	74	(°F)	Dry Bulb Temp	5	91

Enter either Wet Bulb or Relative Humidity: (Hint!! Delete contents of other cell first).

Wet Bulb Temp.	48.8	61.8	(°F)	Wet Bulb Temp.	0	73
Relative Humidity				Relative Humidity		
Absolute Humidity	*0.0028*	*0.0090*	(lbH20/lbdryair)	*Absolute Humidity*	*0.0000*	*0.0136*
Enthalpy	*19.7*	*27.8*	*(BTU/lb.)*	*Enthalpy*	*0.0*	*36.8*

Select Units:

Quantity *1* *MODEL* RenewAire HE2X 500-2000 cfm

G4 Core

Air flow varies based on unit configuration and External Static Pressure. Consult catalog for Airflow Data.

Effectiveness:

		Winter	Summer
Sensible Effectiveness:	*69%*	*Total (Enthalpy) Effectiveness*	*75%*	*39%*

Total enthalpy will vary as design conditons deviate from ARI 1060 test conditions.

Air into Room and Loads are based on ARI 1060 Certified sensible and latent performance.

Air into Room:

	Winter	Summer	
Dry Bulb Temp.	48.6	79.3	(°F)
Wet Bulb Temp.	39.2	69.2	(°F)
Absolute Humidity	0.0029	0.0129	(lbH20/lbdryair)
Enthalpy	14.8	33.3	(BTU/lb)

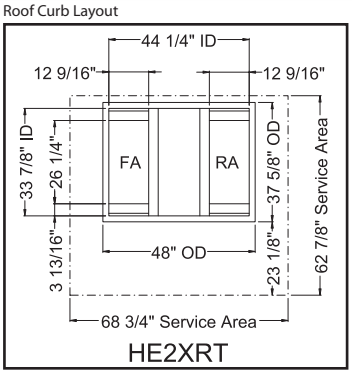
LOADS	SENSIBLE		LATENT		TOTAL		
	Winter	Summer	Winter	Summer	Winter	Summer	
Heating or cooling load of Ventilation at Design Conditions **without** RenewAire:	113,967	30,753	22,700	37,290	136,667	68,043	(BTU/h)
		2.6		3.1		5.7	(Tons)
Heating or cooling load of Ventilation at Design Conditions **with** RenewAire:	35,095	9,588	-810	31,620	34,285	41,208	(BTU/h)
		0.8		2.6		3.4	(Tons)
Total Energy Savings at Design Conditions with RenewAire:	78,872	21,165	23,510	5,670	102,382	26,835	(BTU/h)
		1.8		0.5		2.2	(Tons)

HE2XRT *Outdoor Unit*

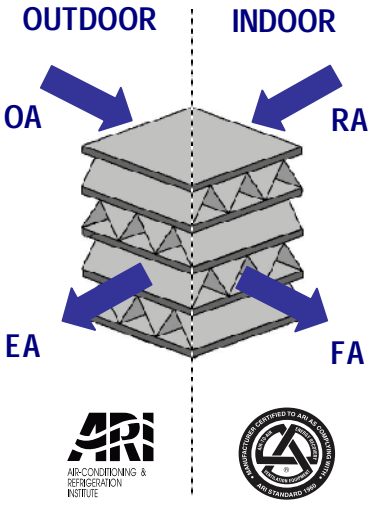
Submittal Data

Job Name:			
Job Location:			
Job Reference Number:			
Unit Reference Number:			
Engineer:			
Distributor:			
Contractor:			
For Reference: ✓	For Approval: ✓	For Construction: ✓	
Requested Delivery Date:			
Submitted by:		Date:	
Address:			
Tel:	Fax:		

Roof Curb Layout



Winter	Summer	Units
		DB °F
		WB °F
		RH %
		Enthalpy BTU/Lb



Winter	Summer	Units
		Airflow CFM
		DB °F
		WB °F
		RH %
		Enthalpy BTU/Lb

Design Ventilation Load		
Winter	Summer	BTU/Hr
	Tons	Without RenewAire
	Tons	With RenewAire
		RenewAire Savings

Winter	Summer	Units
		Airflow CFM
		DB °F
		WB °F
		RH %
		Enthalpy BTU/Lb

ARI-1060 Certified Performance - Model Number L125-00			
Type	Tilt Angle	Nominal Airflow	Pressure Drop
Plate	N/A	100% - 750 SCFM 75% - 563 SCFM	0.7 in. H_2O 0.5 in. H_2O

Leakage Ratings					Thermal Effectiveness Ratings at 0" Pressure Differential							
	Pressure Differential	EATR	OACF	Purge Angle or Setting	Nominal Airflow		Sensible	Latent	Total	Net Airflow	Net Sensible	Net Latent	Net Total
Test 1	-1 in. H_2O	1.5%	1.0	N/A	750 CFM	Heating	70%	45%	62%	750 CFM	70%	45%	62%
Test 2	0 in. H_2O	0.0%	1.02	N/A		Cooling	69%	25%	42%		69%	25%	42%
Test 3	1 in. H_2O	0.0%	1.05	N/A	563 CFM	Heating	74%	50%	66%	563 CFM	74%	50%	66%
						Cooling	73%	31%	47%		73%	31%	47%

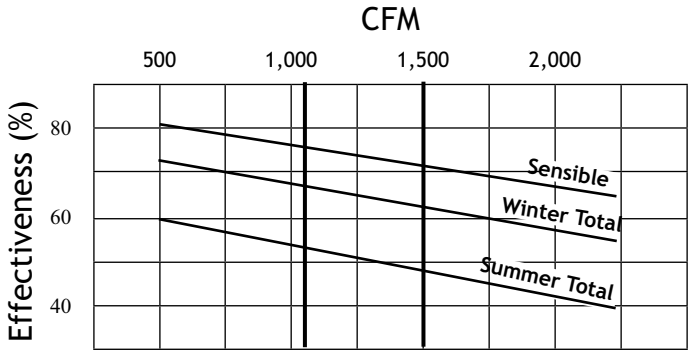
NOTE: SCFM = Standard Cubic Feet per Mnute OACF = Outdoor Air Correction Factor EATR = Exhaust Air Transfer Ratio N/A = Not Applicable

Energy recovery component certified in accordance with ARI standard 1060-2000. Actual performance in packaged equipment may vary.

HE2XRT

Outdoor Unit

G4 Performance

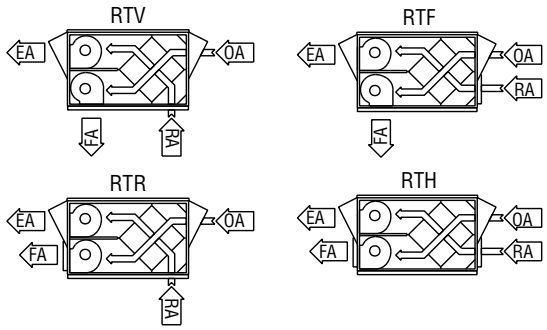


*At ARI 1060 standard conditions
(See certified data on page 66 for core components).

Specifications

Ventilation Type: Static Plate, Heat and Humidity Transfer						
Typical Airflow Range: 500-2,000 CFM						
ARI 1060 Certified Core: Two L125-00						
Airflow Rating Points (for ARI): 1,500 CFM and 1,120 CFM						
Number Motors: Direct Drive (DD) Four, Belt Drive (BD) Two						
Field Selectable Voltage (you must order phase)						
HP	Volts	HZ	Phase	FLA	Min. Cir. Amps	Max. Fuse Size
DD 0.75	115 208-230	60 60	1 1	8.6 4.3	36.6 18.3	45 20
BD 1.5	208-230 460	60 60	3 3	5.6-5.0 2.8	12.6 6.3	20 15
BD 2	208-230 460	60 60	3 3	7.0-6.6 3.5	15.8 7.9	20 15
Control Voltage: 24, 115, 230 Volt available						
Filters: Four total, MERV 8, 2” pleated, 20” x 20” nominal size						
Weight: 488 lbs (unit), 525 lbs (shipping weight)						
Shipping Dimensions: 51” W x 76” L x 45” H						

Base Type/Airflow Orientations



Airflow Performance

Motor HP	Blower RPM Nominal	Turns Open	External Static Pressure (Inches Water Column)													
			0.0		0.25		0.5		0.75		1.0		1.25		1.5	
			CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
0.75 (Four DD)	N/A N/A	N/A N/A	1,770 2,220	CFM Watts	1,680 2,145	CFM Watts	1,555 2,015	CFM Watts	1,375 1,825	CFM Watts	1,110 1,560	CFM Watts	760 1,195	CFM Watts	- -	- -
1.5 (Two BD)	1,000 1,230 1,420	4.5 2 0	1,378 1,694 1,956	0.5 0.9 1.4	1,175 1,550 1,850	0.5 0.9 1.4	900 1,335 1,680	0.4 0.8 1.2	635 1,125 1,475	0.4 0.7 1.2	- 1,000 1,300	- 0.7 1.1	- 500 1,200	- 0.6 1.1	- - 930	- - 0.9
2 (Two BD)	1,220 1,470 1,660	4.5 2 0	1,681 2,025 -	0.9 1.6 -	1,530 1,925 -	0.9 1.5 -	1,315 1,750 2,000	0.7 1.4 2.0	1,100 1,575 1,900	0.7 1.3 1.9	975 1,375 1,750	0.6 1.2 1.8	430 1,275 1,570	0.6 1.2 1.7	- 1,125 1,475	- 1.1 1.7

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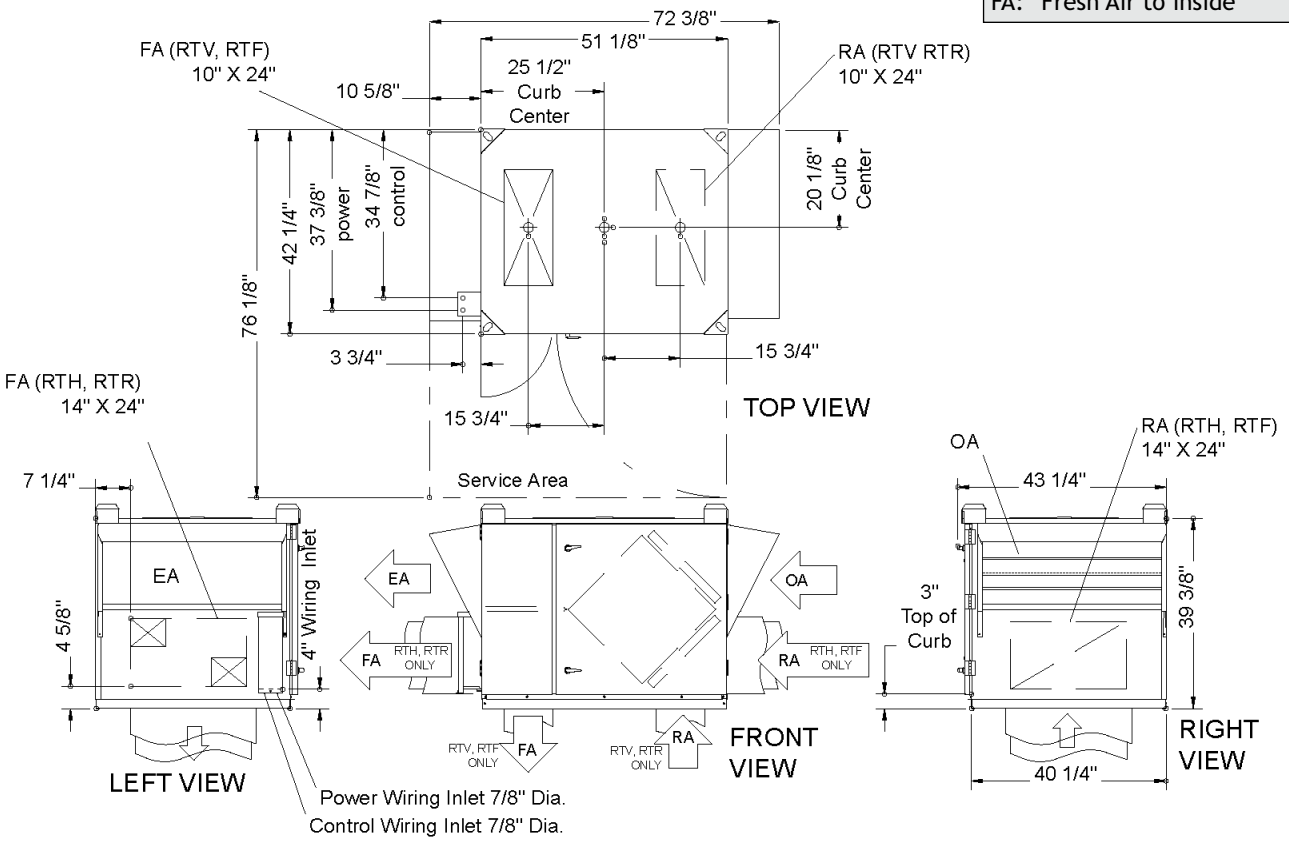
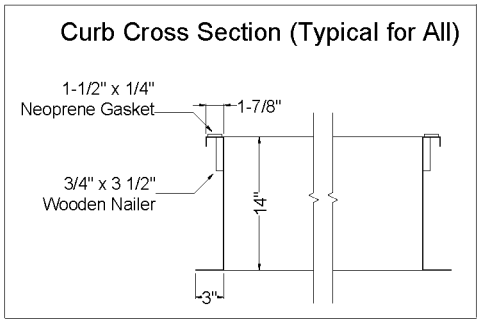
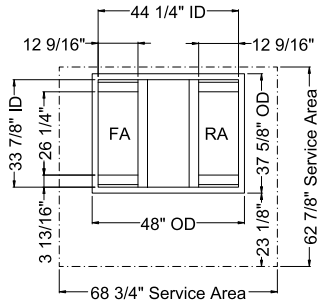
HE2XRT
UNIT DIMENSIONS

EA: Exhaust Air to outdoors
OA: Outdoor Air intake
RA: Room Air to be exhausted
FA: Fresh Air to inside





CURB2X



Model Configuration HE2XKRT...

Base Type	Wall	Phase	Voltage	FA Hp	EA Hp	Contactor	Disconnect	Transformer
V (vertical)	S (single)	1	4 (460)	J (1.5)	J (1.5)	A (24 VAC)	– (none)	– (none)
H (horizontal)	D (double)	3	5 (208-230)	K (2.0)	K (2.0)	D (two 24 VAC)	N (nonfused)	T (TR40)
R (RA vertical)			6 (115/208-230)	Q (two 0.75)	Q (two 0.75)	R (inverter ready)	F (fused)	
F (FA vertical)			7 (208-230/460)					
			8 (575)					
			9 (277)					

Filter Monitor	Other	UL
– (none)	– (none)	L (UL listed)
F (filter monitor)	W (white paint)	N (not UL listed)
	C (custom paint)	