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ENERGY SAVINGS ON ESCALATORS ATTRACTS UTILITY-SPONSORED REBATES

by Kevin Gigler

Objective of Testing

Performance Control suggested to the Honolulu International Airport management that the Performance Controller be used on their 80-plus escalators. Believing the Performance Controller might reduce energy consumption as well as provide soft starting, airport management agreed to install two controllers on a randomly selected pair of escalators (one up and one down) for testing and evaluation.

The objective of the test was to measure the kWh consumption of the escalators over a two-week period and establish the difference in power consumption between the motor run off of a standard AC motor starter (controller in bypass) and when controlled by the Performance Controller. The escalators chosen were equipped with 15-horsepower, three-phase AC induction motors with approximately a thirty foot rise/descent. The escalators chosen were subject to various loading conditions based upon the number of passengers traveling at a given time.

The test was originally performed by Performance Control staff, and findings were submitted to the Department of Transportation and Hawaiian Electric Co. (the local utility) for evaluation. Later testing by Hawaiian Electric (HEI) verified the claims; data provided below are test results obtained by HEI. The testing on the down escalator was conducted January 28-February 11, 1999, and the up tests were performed April 20-May 4, 1999, with HEI and Performance Control service engineers present during the installation and data-collection processes.

Operation of Controller

An AC induction motor converts electrical energy to mechanical energy. The design of an AC Induction motor performs this "conversion" at its most efficient point when the motor is approximately 80% loaded. At any other point, the motor efficiency falls.

Until now, this rapid drop in motor efficiency has been the cause of waste in the form of kilowatts, heat and early motor failure. The Performance Controller is the only solid-state motor controller that has bridged the gap.

The controller senses this drop in mechanical loading (efficiency) and adjusts the energy to an AC Induction motor to the precise level required to perform the mechanical work. In doing so, high amounts of wasted energy that was dissipated in the form of motor losses are eliminated.

This study was performed to examine the effects and energy savings obtained with a Performance Controller installed on a 15-horsepower AC Induction motor operating a single-width, single-level escalator. Escalators represent ideal candidates for the Performance Controller technology, due to their motors being sized to handle the maximum number of passengers yet most frequently operate in an underloaded or unloaded condition.

Escalator motors must be designed to drive the full load of the escalator regardless of the actual amount of load (people and materials). This design requirement causes the AC motor to fall from its most efficient operating load point to an under-loaded condition, which results in motor losses.

Motor Survey Information

A survey of both the up and down escalators' motors determined:

1. The escalators were rarely loaded to their designed capacity.
2. The load on the motors was variable.
3. The motors were started across the line.
4. Both escalators ran 24 hours per day, seven days per week, 52 weeks per year for a total of 8,760 hours per year.

The controllers were installed and ran for six days (140 hours) being controlled and six days in bypass. The results were collected in 15-minute intervals by the local utility with an electric power analyzer.

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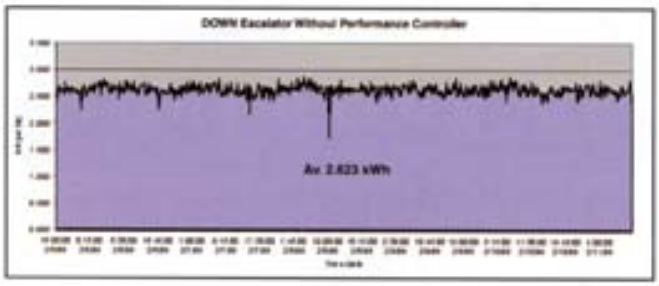
Honolulu International Airport main tower

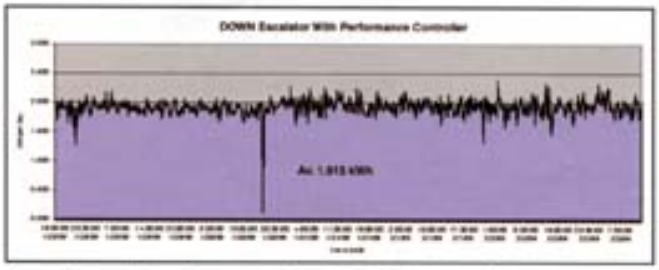
Installation of controller in pit

Performance Controller installed atop existing escalator controls within pit

DOWN ESCALATOR TEST RESULTS



	Average kWh Consumption	Electric Rate per kWh	Runtime Hours	Annual Operating Cost
Without Performance Controller	2.623 kWh	x $.08	x 8,760	= $1,838.29
With Performance Controller	1.915 kWh	x $.08	x 8,760	= $1,342.35
Annual kWh Savings				$495.94
Utility Rebate				$398.00
Total Annual Savings				$893.94



Results of Testing on the DOWN Escalator

The testing provided several interesting results, as indicated by the data. A translation of that data follows:

1. The claim of power savings was evident. The Performance Controller lowered average daily kWh consumption by 27% – from 2.623 kWh per day without the controller to 1.915 kWh per day with the controller.
2. Power provided was via Hawaiian Electric. The actual power being supplied to the escalator was delivered through the Performance Controller equipment at 460 volts.
3. The motor, under soft-start control, caused less "jarring" of the escalator into motion than under standard starter systems. This could provide considerable changes in equipment and repair life.
4. The recovery capability of the motor (ability to respond to sharp increases in load) was not noticeably reduced by the Performance Controller.

The Performance Controller lowered average daily kWh consumption by 27%.

Summary of Testing on the DOWN Escalator

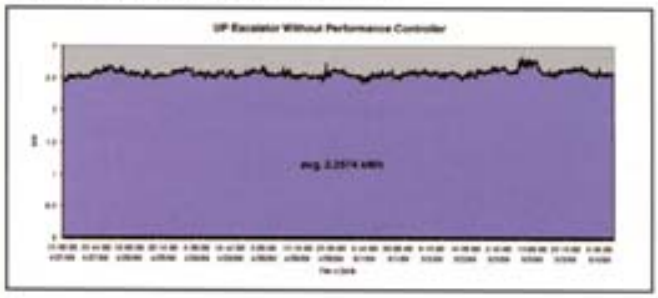
Without the Performance Controller in operation, it is estimated that the escalator would cost approximately US $1,838.29 to operate annually (at US $0.08 per kWh). With the controller in operation, the escalator would cost approximately US $1,342.35 to operate annually – roughly US $495.94 in annual savings.

In addition to the Performance Controller's direct savings, the local utility offered a US $398 rebate for this particular application. Consumers considering the installation of the Performance Controller are advised to contact their local utility for rebate opportunities within their region.

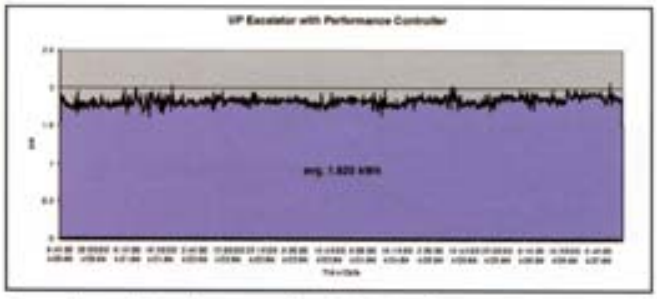
Based upon the estimated annual savings from energy conservation alone, this application would have a short payback period. Additional savings, aside from those generated as a result of energy conservation and utility-sponsored rebates, include:

1. Extended motor life and reduced service and maintenance costs – attributable to the soft start feature reducing mechanical and electrical stress upon driven components.
2. Extended motor life due to a reduction in generated heat from wasted energy. Surface temperature reductions range from 10°F to 40° F.

UP ESCALATOR TEST RESULTS



	Average kWh Consumption	Electric Rate per kWh	Runtime Hours	Annual Operating Cost
Without Performance Controller	2.574 kWh	x $.08	x 8,760	= $1,803.86
With Performance Controller	1.825 kWh	x $.08	x 8,760	= $1,278.96
Annual kWh Savings				$524.90
Utility Rebate				$424.00
Total Annual Savings				$948.90



Results of Testing on the UP Escalator

The testing provided several interesting results, as indicated by the data. A translation of that data follows:

1. The claim of power savings was evident. The Performance Controller lowered average daily kWh consump-

tion by 29% – from 2.574 kWh per day without the controller to 1.825 kWh per day with the controller.

2. Power provided was via Hawaiian Electric. The actual power being supplied to the escalator was delivered through the Performance Controller equipment at 460 volts.

3. The motor, under soft-start control, caused less "jarring" of the escalator into motion than under standard starter systems. This could provide considerable changes in equipment and repair life.

4. The recovery capability of the motor (ability to respond to sharp increases in load) was not noticeably reduced by the Performance Controller.

The Performance Controller lowered average daily kWh consumption by 29%.

Summary of Testing on the UP Escalator

Without the controller in operation, the escalator would cost approximately US $1,803.86 to operate annually at US $0.08 per kWh. With the controller in operation, it is estimated that the escalator would cost approximately US $1,278.96 to operate annually – roughly US $524.90 in annual savings.

In addition to the Performance Controller's direct savings, the local utility offered a US $424 rebate for this particular application. Consumers considering the installation of the Performance Controller are advised to contact their local utility for rebate opportunities within their region.

Based upon the estimated annual savings from energy conservation alone, this application would have a short payback period. Additional savings, aside from those generated as a result of energy conservation and utility-sponsored rebates, include:

1. Extended motor life and reduced service and maintenance costs – attributable to the soft start feature by reducing mechanical and electrical stress upon driven components.

2. Extended motor life due to a reduction in generated heat from wasted energy. Surface temperature reductions range from 10° to 40° F.

Escalator from bottom

Most Recent Information:

The Honolulu International Airport issued a purchase order in the first part of July, and subsequently, 81 controllers have been shipped to Honolulu for installation upon the airport's escalators and power walks.

The Performance Controller is compatible with the latest microprocessor type escalators in addition to existing relay logic control systems already in use. Installations have been successfully performed upon escalators manufactured by KONE, Otis, Westinghouse, Haughton, and Schindler.