

Hadco's Quick-Change LED Post Top Upgrade Hits the Streets with Future Lighting Solutions

With Hadco's refractive post top fixtures installed throughout North America, switching from HID to LED illumination must be done on-site without rewiring



Quick-swap LumiLock LED retrofit module for Hadco's post top fixtures



Hadco's original HID LumiLock module

LED retrofits are always an engineering challenge, but Hadco Lighting faced unusual complexities in developing an LED upgrade for its widely deployed family of HID post top fixtures. With tens of thousands of Hadco's refractive globes installed on roadways and walkways through North America, the company needed an LED light engine that could not only direct light properly through the globes' distinctive prisms but also be quickly swapped on-site with the original HID assembly. Hadco engaged Future Lighting Solutions engineers to help build a replacement module using LUXEON® Rebel LEDs from Philips Lumileds. Today, Hadco's LumiLock™ LED retrofit fills the optical bill while also enabling road crews to convert HID post tops to LEDs in a matter of minutes.

UPGRADE WITH A TWIST

The goal of the project was to provide an easy transition from traditional HID sources to 'greener' LED technology for municipalities, utilities and commercial developers using Hadco's Fentress Refractive Series of post top fixtures. The switch would reduce power consumption by 55 to 60%, while also providing a typical 14-year lamp life that would eliminate the costs associated with replacing HID bulbs every 48 months.

To accommodate the vastly different LED shape and technical requirements of solid-state lighting, Hadco designed a replacement for the integrated ballast and socket module at the heart of the fixture. The new LumiLock LED module



“Future’s technical assistance simplified the selection and analysis of the entire LED system, from the LEDs themselves to optical, thermal and driver solutions. They helped us get to market faster as well as optimize the performance of our LED retrofit.”

Michael Riebling, Manager, Solid-State Lighting R&D, Hadco



Hadco’s refractive prisms create a distinct light distribution pattern that had to be considered in developing the LED retrofit

replaced the original HID lamp with four rectangular ‘light bars’ housing one or two 10-LED boards each, but retained Hadco’s patented ‘twist-lock’ mechanism for tool-less disconnect and reconnect of the wiring system. That mechanism - previously developed for easy relamping of the HID post tops - would now permit easy installation of the LED upgrade.

With no LED board designers on staff, Hadco sought outside help to develop the solid-state lighting assembly itself. “We were facing complex decisions on everything from LED selection and board configuration to optics, thermal management and even selection of the board manufacturer,” said Michael Riebling, Hadco Solid-State Lighting R&D Manager. “It was a project that had to be handled with a team that specializes in LED application development.”

REFRACTION ACTION

Hadco turned to Future Lighting Solutions for the firm’s extensive LED application development tools and in-house engineering expertise, as well as its ability to supply the necessary LEDs, components and manufacturing referrals. Future’s first step was to analyze Hadco’s system requirements to recommend the best power LED for the job.

The team quickly zeroed in on the cool white LUXEON Rebel product for several reasons. The Rebel’s ultra-compact footprint would allow tight clustering on each 10-LED board for optimal positioning on the LumiLock module. It also had the ability to withstand higher drive currents and elevated junction temperatures without sacrificing lifetime or reliability, and it offered a minimum 100-lumen part that would deliver needed light output with the fewest emitters to minimize costs and board real estate.

Next, Future’s optics experts performed a series of optical simulations to determine how best to replicate the light distribution of the original HID lamp. The refractive prisms on all of Hadco’s globe shapes are cut for a 360-degree



Converting the module from asymmetric to symmetric light distribution for different environments is as simple as 1-2-3



1 - Remove screws from two light bars



2 - Move bars to the spaces provided



3 - Light now shines around entire perimeter

metal halide light source, bending the light horizontally for maximum coverage, minimum light trespass, and glare control as well as shadow reduction. Future's challenge was to develop a board design that filled the globe with light to provide similar refraction capabilities with the directional LED beam.

"It was a question of doing optical modeling to determine where the LED arrays needed to be positioned on the LumiLock module and on the boards themselves to deliver HID-equivalent optical performance," said Michael Quijano, Optical Design Engineer for Future Lighting Solutions. "We knew we needed to cluster the LEDs toward the center of each light bar so that the light would be coming from roughly the same location as the HID bulb, but even moving the array 1 or 2 mm up or down altered the effect."

HEAT, LIGHT & LIFETIME

With the optical simulations completed and several scenarios provided for Hadco to choose from, the work torch passed to Future's thermal and electrical engineers.

Using proprietary Future Lighting Solutions software, the team turned its attention to determining the most appropriate drive current to ensure optimum light output and life span. Exclusive Future tools were also used to calculate the expected luminous flux of various combinations of drive current, ambient temperature and heatsink thermal resistance levels, as well as to provide thermal guidelines to aid Hadco in developing its custom heatsink. This made it possible to evaluate alternative designs with accurate LED modeling – requiring no prototyping that would slow down the design process - and thereby optimize the performance of the final light engine.

In addition, Future engineers utilized Future-developed tools to calculate the expected lifetime of the LED system based on the LED model, drive current and junction temperature specified in the proposed design. Future's analysis predicted that Hadco's design would provide a minimum 50,000-hour working life at 70% lumen maintenance – precisely the goal outlined in Hadco's design criteria.

MISSION ACCOMPLISHED

The final design turned out to be more versatile and flexible than even Hadco had imagined. The same four-light-bar LumiLock LED module, for example, is able to provide an LED retrofit for both Hadco's 100W and 175W metal halide post tops simply by utilizing one or two 10-LED boards per light bar,





Use of 10- or 20-LED boards enables the same LumiLock LED module to replace 100W or 175W HID post tops (Hadco is a Philips group brand)

respectively. The same basic module also fits narrow and wide globes with only minor manufacturing changes. This in turn simplifies production and inventory management. “Our distributors have to stock only four LumiLock LED SKUs to cover all of our non-glass refractive post tops – one- and two-board versions for narrow and wide globes,” Riebling noted.

In addition, a patent-pending bracket system developed by Hadco permits rapid conversion from symmetric to asymmetric light distribution or vice versa simply by unscrewing and reorienting two of the module’s four light bars. This eliminates the need to change globes or use a house-side shield for different illumination patterns.

With that initial project completed, Riebling’s team of designers began the process of building LUXEON-based LED retrofits for the rest of Hadco’s post top line. Eventually, the company expects to offer LED replacements for virtually every post top fixture in its catalog, ideally using the same basic module design for every globe offering in the entire line to help fixture owners reduce energy costs, prolong lamp life, and lower the total cost of ownership.

Stay tuned: LUXEON-driven Hadco post tops will soon shine everywhere from streets to shopping districts, industrial parks, parking lots and college campuses – with Future Lighting Solutions helping to light the way.

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