



Photos: David Rodstein

The difference between day and night is virtually indistinguishable thanks to 4-ft by 4-ft custom daylighting units. On the left, natural sunlight only; on the right, the unit is on full-power electric light.

# DAYLIGHT AT NIGHT WORKERS' DELIGHT

BY REBECCA FALZANO

Inside the Firestone Distribution Center, a seamless blend of natural and electric light diminishes the difference between night and day

Warehouse facilities, by nature, typically aren't the most attractive of work environments. Luckily, for the employees at the Firestone Distribution Center in East Berlin, CT, daylighting has saved the day—literally—to help improve the aesthetics and make it a more inviting place to work.

Designers David Rodstein (Rodstein Design, Haverford, PA) and Brad Sagona (Hasco and Apollo Lighting, Mount Vernon, NY) designed the lighting retrofit of the 12,000-sq ft facility with two goals in mind: to save energy and to



improve the quality of light with a subtle combination of daylight and fluorescent light.

Prior to the relighting, interior light levels were so poor that visual tasks were hard to accomplish. The original outdated mercury vapor HID pendant fixtures, typical in facilities like this, created uneven pools of light—"50 footcandles here, 12 footcandles there and so on," says Sagona. Employees struggled to maneuver forklifts and read labels on inventory stored on shelves amid shadows and uneven illumination. "It was an inefficient facility with a bad lighting job. We wanted to brighten the place up to make it inviting to customers and employees," he adds.

By installing custom skylights that offer a hybrid of daylight and artificial light, the team was able to reduce energy and boost footcandles—not to mention morale. "Nothing is better than natural daylight in terms of CRI and visual acuity. The warehouse now changes hues as clouds and shadows pass, making it a much more dynamic, happier environment. People get a sense of what time of day it is now," explains Rodstein.

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#### HERE COMES THE SUN

A seamless transition from daylight to electric light was necessary to avoid disrupting the tasks of employees below. "What you don't want in a system like this with two different light sources is a flicker or color change. So if it's 3 p.m. in January and it's starting to get dark outside, the fluorescent lights come on and the daylight disappears, but the work environment stays the same," says Sagona.

Designers chose 4-ft by 4-ft custom daylighting units (SunPort 2 from SunPort Industries) with T5HO 54-W fluorescent lamps. The long fixture depth enables high cut-off, and diffracting lens material on both the top and bottom of the shaft reduces glare, heat and hot spots at peak solar exposure. The skylights' appearance at night is nearly identical to their appearance during the day thanks to the fluorescent tubes behind the bottom diffuser. Interior photosensors in multiple zones switch on the fluorescent when the footcandle levels fall below owner/tenant specifications. Designers calculated light levels at full darkness with electric light on and winter solstice and summer

noontime solar angle levels with electric light off. So while the lighting source will change throughout the day and with the seasons, the perception of the space will not.

Each of the 11 daylighting units also has a rooftop lens that blocks 97 percent of the UV rays that create heat to contribute virtually no heat to the interior space. The use of eight T5HO fluorescent lamps inside each unit maximizes the watts per sq ft in the space (0.46 watts per sq ft at full power).

#### TO THE ROOF

While comfort and aesthetics for the employees were a major consideration, so too was the physical structure of the space. The new daylighting system simplifies the ceiling plane, though this wasn't an easy task. The original skylight openings were not laid out symmetrically so designers had to be careful about the new unit placement in the roof to ensure even illumination. "We would have just laid them out 24 ft on center, but when one opening is 2 ft off center from the other one, we had to figure out how to balance the light," explains Rodstein. The fixture placement was influenced by the pho-

tometrics of the fixture and the electric light mode to provide even light throughout the space in between the shelves. The high installation cost of the daylighting units and roof structure interference required careful placement and minimum number of fixtures while meeting the design objectives and not pushing ahead the payback period.

In addition, a vertical member of the roof supports the daylighting system. Around each skylight is a perimeter curb with roofing material sealed around it. A plug-and-play wiring system allowed installation with a pre-wired harness that plugs into an electrical panel on the unit itself. Connecting one unit to another into a network is done easily with a minimum of time and no cutting and stripping of wires by the contractor. Faster installation brought down the cost of installation and will reduce the overall payback of the project.

#### MAINTENANCE & ENERGY SAVINGS

Energy savings over the previous system are more than 60 percent per year with a payback period of three years. "The majority of savings are the result of converting a dis-



## PROJECT



The skylights' appearance at night (right) is nearly identical to their appearance during the day (left) thanks to the fluorescent tubes behind the bottom diffuser.

tribution center using electrical power during the day to a facility that uses daylighting for 80 percent of its operating hours," says Sagona. As an example, the kilowatt usage during the months of May through September from the hours of 8 a.m. to 3 p.m. was reduced to zero. In comparison, the total kW usage before the installation was 5.3 kW during the same months. The building owners received a rebate from the local utility company after proving that the kW use could be offline during summer peak hours.

An added bonus is maintenance. The skylight units themselves require very little maintenance as the interior is sealed to protect the specular aluminum material of the system. The only real maintenance to speak of is that of the T5HO fluorescent lamps and conventional electronic ballasts inside the units. Even so, because the lights are only on for a few hours a day—as opposed to 10-12 hours like in an office building—the replacement cycle is longer. From a cost perspective, this is significant. Designers estimate that for every \$5 spent on ballast and lamp replacement for the original mercury vapor system, the new system will cost \$1 in maintenance over the useful life cycle of the system, about 20 years. Now that's a sunny outlook. ☀️



**About the Designers:** David Rodstein, LC, Member IES (1987), has a Bachelor of Industrial Design from Pratt Institute, a Graduate Certification in Management from the Wharton School - University of Pennsylvania and has studied design in Denmark and England. He has held full-time design positions with Lightolier, The Pace Collection and Simkar Lighting. Mr. Rodstein is the principal of Rodstein Design which concentrates on fixture design, lighting design and product strategy.



J. Brad Sagona, Member IES (1998), is the owner of two lighting companies, Hasco Lighting and Apollo Lighting, in Mount Vernon, NY. He began his lighting career in 1979 at Hasco Electric Corp. with a background in engineering and product design. Hasco and Apollo have won several design awards and hold a patent for the ParaCloud light fixture, awarded in 2001. Mr. Sagona's areas of expertise include architectural fluorescent lighting design and manufacturing and custom and special designs for the architectural community. Hasco has manufactured exclusive light fixtures for Dan Flavin and Dan Flavin Studio, as well as artwork by Robert Irwin.

### METRICS THAT MATTER

#### Firestone Distribution Center

Watts per sq ft: 0.46 when all fluorescent lamps are at full power (complies with ASHRAE/IESNA 90.1-2004)

Illuminance Levels: daylight hours=28 fc; full power electric lights=32 fc

Lamp Types: 1

Fixture Types: 1