

RETROFIT/UPGRADE QUARTERLY – SEPTEMBER 2003

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CHANGES IN THE FALL WIND

I do not know if I should call myself primarily a retrofitter anymore. When I look at most office spaces that have direct troffers, my first thought is replacing them with suspended indirects. Retrofitting takes second place. Usually suspended indirects consume less wattage and provides better lighting quality.

In the past I worked for companies that paid me straight salary and straight commission. In my new role as an independent consultant, it is billable hours. This experience has helped me understand more of the challenges that various people in the lighting industry have.

This issue includes some of the new products seen at Lightfair last May. In a quarterly column, it can take this long for events during the spring winds to be published.

RETURN OF THE DUST BOWL

One good thing about direct luminaires, like parabolic 2x4 troffers, was that although cleaning is highly recommended, that they do provide sufficient light without being cleaned for over a decade. This is not the case for suspended indirects, especially the ones with 100% upright. Since dust falls in the reflector cavities, these luminaires should be cleaned every year, worst case every two years. I have been finding that very few suspended indirects are cleaned very often. Recently I audited a high tech firm in Silicon Valley that the dust was so thick, I could not even see the reflector. The suspended indirects were installed in the early 90s and it did not look like they were ever cleaned. So more lamps were on than necessary, consuming unnecessary electricity. As suspended indirects are becoming the luminaire of choice for much new construction and relighting projects, this issue should be addressed. If suspended indirects will not be cleaned enough, then maybe suspended luminaires with bottom louvers, which allow the dust to fall through, should be considered.

BALLAST TEMPERATURE CONCERNS

As stated in last June's column, I am very concerned about exceeding the ballast case temperature rating in fluorescent hibays in hot facilities. I was amazed at Lightfair that so many of the T5HO and T8 hibays were made of steel instead of aluminum, which is a better heat sink, and that they had no venting. On my projects, I have started to require that hibay manufacturers thermal test their hibays with the stipulation that at 125° F (52° C), which is not an uncommon ambient temperature in unconditioned warehouses during summer afternoons in many areas, that the ballast case temperature will not exceed 70° C, the typical max rating. Although there are some 90° C case temperature rated ballasts, it is my understanding that all of the warranties are only three year if the case temperature is between 70° and 90° C.

Over the last year, I have usually found a 400 - 450W PS MH, electronic ballast and a high performance dome is often more cost effective than a T8 or T5HO hibay to replace 1000W HPS or probe start MH spun aluminum hibay. I also usually preferred replacing a 400W HPS or probe start MH low performance hibay with a T8 or T5HO hibay compared to PS MH high performance hibay with magnetic or electronic ballast.

When considering a T8 or T5HO hibay, I have been leaning toward T8 when there are no occupancy sensors and when the height is below 40 feet. For these applications 3100+ photopic lumen and extended life T8s usually have these advantages: less wattage, longer lamp life, less expensive lamp costs and can save more wattage, provide longer lamp life, help minimize lamp types. When occupancy sensors frequently turn lamps on and off, T5HOs with the industry standard program ballasts have an advantage over T8s with 1.14+ BF electronic ballasts, because up to now, the only 1.14+ BF electronic ballasts have been instant start, which can dramatically shorten lamp life with short cycles. But program start 1.14+ BF electronic ballasts for T8s are becoming available, so these T8s should have a longer lamp life than T5HOs even with short cycles. The downside with the program start ballasts for T8s will be that system wattage will be about the same as for T5HO hibays.

I have not recommended CFL hibays because of short lamp life, low lumens/watt, low luminaire efficiency, and high cost of typically eight lamps per fixture. One lamp manufacturer has eased some of these problems with a family of 18,000 hour rated (based on industry standard 3 hour cycles) with up to 120W and 9000 photopic lumen lamps. But, just like other CFLs, the efficacy is not nearly as good as high performance linear fluorescent.

The new 5000K T8, T5HO and induction lamps should work out great when doing scotopically enhanced lighting projects. The new 6500K, 80+ CRI, PS MH lamps could also be useful.

WHAT MORE CAN BE LEARNED FROM RETROFITTERS

A previous column mentioned that retrofitters are aware of several low cost, but good value, kit and fixture manufacturers. Following is one more expertise that retrofitters can share. Although many retrofitters could learn a lot from the design community about lighting quality factors, there are many lighting designers, engineering firms and architects that could learn from retrofitters about the advantages of high performance (3100+ lumen and extended life) 32W F32T8s and new generation of instant and program start electronic ballasts. There are numerous lighting designers that specify high performance T8s and high performance electronic ballasts, but there are still way too many brand new buildings and gut rehabs that have basic grade 700 series T8s and generic standard BF electronic ballasts. Part of the problem is the spec build projects, that as long as energy codes are met, lowest initial cost is the rule. Another part of the problem is most of the luminaire manufacturers use cheap ballasts and want a big adder for high performance ballasts, even though the high performance instant start ballasts are the same price and others only cost about two dollars more. Many of the smaller luminaire manufacturers charge less for the high performance ballasts and the lead time is reasonable. Lead time can be critical. Often there are delays in awarding the contract, so the contractor has to get locally stocked luminaires, that usually have generic ballasts.

Upcoming stricter codes, like the 2005 version of California's Title 24, will help reduce reliance on basic grade 700 series T8s and generic electronic ballasts.

I won't get into that almost half of the new linear fluorescent luminaires sold across the country are still T12 with magnetic ballasts.

WHY ALL THE FUSS ABOUT 28 – 30 WATT F32T8s?

Although the 28 – 30W energy saving F32T8s may be good for some spot and group relamping projects, I do not understand why so many people think that they are so great. Considering lumens/watt, rated life, cost, minimal temperature rating, and ballasts that they can be used with, the 3100+ photopic lumen, 24,000 hour rated (based on 3 hour starts with instant start ballasts) 32W F32T8s are usually a superior solution. Usually fewer fixtures, fewer lamps or lower BF can be used with the high lumen extended life 32W F32T8s. This advantage will become more comprehensive after fixed output .50 - .60 BF program start electronic ballasts are introduced. (Instant start electronic ballasts, because they do not have constant filament heating, will not work with this low of a BF) For example, a fixture with two 28W F32T8s and extra efficient .77 BF instant start electronic ballast consumes about 43W. That same fixture with two high lumen 32W F32T8s and .55 BF program start electronic ballast consumes about 36W which is a 16% reduction. Based on the typical advantage of program start ballasts, lamp life can often be improved by 50% using these 32W F32T8s compared to 28-30W F32T8s with instant start ballasts.

MODESTO IRRIGATION DISTRICT CASE STUDY

MID is a municipal owned electric utility in the middle of California's Central Valley. Last year I audited and specified the lighting retrofits for them. Now the retrofit is complete and MID is very satisfied. The 30 year old Woodland Service Center is the most interesting.

The main fixture type in the office areas was a 2x4 lensed troffer with four F34T12s and two magnetic ballasts, consuming an average of 148 watts. Most lenses and reflective surfaces were very dirty, but cleanable. Since dual level switching was not an issue, each troffer was retrofitted with two 3100-lumen extended-life 32W F32T8 841s in the outboard lamp positions and an extra-efficient low-BF electronic ballast, consuming 48 watts, which is 67% reduction. As long as the reflective surfaces and lenses are cleaned every few years, the light levels are more than adequate for the typical offices tasks, which is mainly computer work. The substantial energy savings dwarfs the cost of cleaning. Limited funds precluding replacing these troffers with suspended indirects. If I did the project now, I would push more for replacing the existing troffers with suspended indirects and positive cash flow financing.

In the warehouse 400W merc vap low bays were replaced with 8' hooded industrials that have four 3100-lumen extended-life 32W F32T8 841s, high BF electronic ballasts and long cords so each new fixture could be mounted over the center of rack aisles. Even though numerous additional fixtures were installed, the wattage was still reduced by over 50%.

In the vehicle repair shop 400W merc vap high bays were replaced one for one with 4' high bays that have three F54T5HO 841s, reducing wattage from about 460 to about 178. Although T8s would have provided slightly better lamp life and wattage savings and would have minimized lamp types, MID and I agreed that T5HOs here and T8s in the warehouse would be good to show options to MID customers that are interested in replacing merc vap, MH and HPS.

Not all electricity in California is expensive. MID and some other municipal owned utilities provide electricity between \$0.05 and \$0.07 per KWH to commercial customers. Even at this low rate with relatively low hours of operation, these types of retrofits are very cost effective.

DOWN (BUT NOT OUT) ON DALI

After being involved with some DALI projects, I am very concerned about burdening end customers with this system. Yes, DALI, has a lot to offer, especially on reduced initial wiring costs. But, even if everything goes well with the controls, there are two significant maintenance issues. One big issue, with at least one ballast manufacturer, is that the ballasts can permanently fail if lamps are replaced when power is on and at least one pin is still in a socket and another socket touches the metal fixture housing. This problem can be taken care of in the future with a ballast redesign. Second is regular ballast replacement. Most maintenance crews are not sophisticated enough to address a new DALI ballast with the same electronic address that the failed DALI ballast had. These facilities may have to pay for a maintenance contract with a service company that has DALI expertise. As DALI evolves, I hope that easier ways to cost effectively address replacement ballasts are developed. Plus who is qualified and is willing to maintain the software control system? Will the I.T. department allow it to go on the corporation's system? Is DALI really better suited for conference rooms than large office spaces?

SHADOWS ON DAYLIGHT STUDIES

Although I am a big fan and proponent of daylighting with skylights, clearstories and windows, I am sick and tired of people stating that daylight improves student performance and increases retail sales. I may throw something at the next skylight sales person that refers to the existing studies like the best thing since sliced bread. It seems that these people have read or have heard about certain daylight studies and do not understand the limitations of those studies and that the researchers state that the benefits of daylighting are relational, not causal. I look forward to further and repeatable research on what daylight really provides. The past studies that I am aware of have more than one variable. For example, do sales increase because of daylight or because light levels from the daylight were substantially increased? If the answer is just the amount of light, it may be more cost effective to double horizontal and vertical light levels with high CRI and efficacious electric light systems in states that have very low electric rates than to install skylights. Another example is classrooms. How would student performance compare in a classroom that has suspended indirect luminaires, 85 CRI fluorescent lamps and small windows to a similar classroom that has identical light levels from a combination of significant daylighting and the same type of electric lighting system?

SCOPOTIA

I and other proponents of scotopically enhanced lighting, that I work with, are often accused of focusing too much on using high Kelvin lamps and focusing too little on other aspects of good lighting, including good ambience and low glare. That is not reality.

We understand that in relaxed atmospheres, like restaurants, scotopically enhanced lighting is usually not appropriate. In most work applications, practices such as using white paint with warm tones, can eliminate the 'stark sterile coldness' often related to high Kelvin lamps. A long time ago, I learned from Brian Liebel, that when possible, pick the lamp type first, and then select furnishing color and textures that go well with those lamps.

Brian Liebel has spearheaded testing the scotopic enhanced lighting method in office buildings with a multitude of real office workers. Several Northern California retrofit/redesign projects and preliminary results of the two United States Department of Energy research projects in the San Francisco Bay Area are giving a fairly good picture how much wattage can be saved with scotopically enhanced lighting and the user acceptance of 5000K lamps. Lighting professionals that still consider that rods are only active in dark conditions and that the photopic function for interior lighting applications should not be supplemented, will need a reality check.

On this point I would like to mention a study reported at this year's Lightfair and recently published in the British Lighting Journal, Lighting Research Technology. The study was led by Peter Boyce of Lighting Research Center and compared some effects of two different CCT (correlated color temperature) lamps on pupil size and visual performance. Their measurements of pupil size at the same photopic levels were in agreement with those previously published by Sam Berman and his group and support Berman's claim that pupil size control is predominantly scotopically driven. However, Boyce did not find any effect of CCT on visual performance. Berman claims in his discussion of Boyce's paper, that this is because Boyce only tested to a level of 20/30 vision and that you need to test for 20/20 vision to see the spectral effect. It is puzzling why Boyce did not test at the same condition for visual acuity, as is the usual for eye testing. Interested parties should read 'The impact of spectral power distribution on the performance of an achromatic visual task' and the discussions.

The improved acuity from scotopically enhanced lighting is relatively easy to experience. Many people, including myself, have been able to read at least one smaller line on a Snellen Eye Chart with the same photopic amount of light from 850s compared to 835s at the Pacific Energy Center.

On the meter front, hopefully a new light meter, capable of measuring scotopic illumination and also providing S/P ratio values should be available by the time this column is published.

Numerous retrofitters across North America have done many projects with 5000K lamps, resulting in additional energy savings and happy customers. I plan to include some of these case studies in future columns. If readers, that I do not know, have scotopically enhanced retrofit project case studies, please send them to me.

HUMOR

After one of my seminars one of the attendees asked how I learned so much about lighting. I could not resist mimicking the TV commercials and told him I spent the night at a Holiday Inn Express.

AFTERWORD

Repeated thanks to all of the people that helped me on this and other editions. Without their assistance, these quarterlies would not be nearly as good.

ABOUT THE AUTHOR

Stan Walerczyk, LC, is an independent lighting consultant, including working with Brian Liebel at AfterImage+Space and being Director of Lighting for Sun Energy Solutions. He is a member of IESNA's Energy Management Committee and Retrofit/Upgrade Subcommittee. Most of Stan's articles and links to other articles are available at www.sunindustriesinc.com. For questions, comments and ideas for future topics please email lightingwizard@sbcglobal.net.