

# RETROFIT/UPGRADE QUARTERLY – JUNE 2003

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This is the summer solstice edition and hope you find the topics hot.

## **SMOKE AND MIRRORS – LITERALLY & FIGURATIVELY**

Sad, but true, many retrofitters and others still think that reflectors are usually necessary for delamping and that specular reflectors are recommended so people would still think that the fixtures have the original number of lamps.

For anybody that is considering installing reflectors and delamping in troffers or wrap arounds, please do the following type of test. Although it can be done with various numbers of lamps, this example is based on four lamp fixtures.

Experiment with a 2x4 troffer, 2x4 surface mount or 4' wrap with 4 F34T12 CW lamps and magnetic ballasts in a typical 8 or 9 foot ceiling.

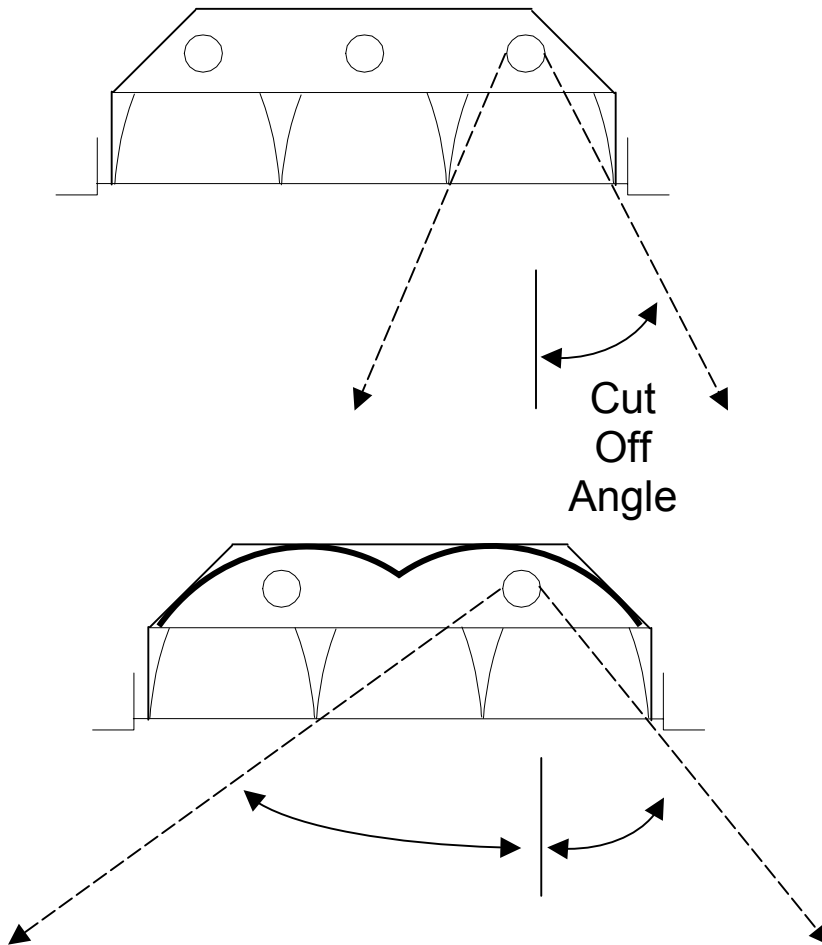
1. Measure light levels directly below and 4' around fixture at 30" above floor.
2. Clean the housing and lens and install four new F34T12 CW lamps.
3. Measure light levels exactly as before, which should often increase 20 to 50%, depending how dirty the fixture was and how depreciated the lamps were.
4. Install two 2800 – 2950 lumen F32T8 lamps and standard BF electronic ballast. The lamps can often go in the outboard position. If the inboard and outboard positions are too far away from center, which is unusual, the lamps should be centered.
5. Measure light levels, which is usually like original with old T12s and dirty housing & lens.
6. Install a white or specular reflector.
7. Measure light levels. How do you think it compares to #5?

Based on doing this many times with various fixtures, following are my findings. If the fixture has angled or sloped interior sides and cleanable good white paint with about 85% reflectivity, a reflector usually provides negligible benefit, in the 5 to 15% average increased light range. Average is a key term, because specular reflectors tend to direct the light straight down, so although there may be more light directly underneath the fixture, there is often less light between fixtures. I have seen a confidential independent research report that shows no significant light level difference in new troffers with or without reflectors. I have found in older fixtures, that if the fixture housing is white powder coat, which has up to 94% reflectivity, there can be a slight decrease of light with some reflectors. At least two major manufacturers use white powder coating in their interior

fixtures. In these types of fixtures the benefits are more from delamping than from the reflectors. Delamping increases luminaire efficiency, because there is less light bouncing into adjacent lamps and with fewer lamps the lamp bulb wall temperature is often closer to optimal, which results in more light coming out the lamp. Willard Warren told me that it is his understanding that T12 and T8 lamp output decreases 1% for every degree F that the lamp exceeds 100 degrees. He has measured over 115° in troffers with four F40T12s. A way to confirm how luminaire efficiency goes up as the number of lamps is reduced from 4 to 3 to 2, either all T12s or all T8s, in a typical type of 2x4, is to check it out in major fixture catalogs or websites.

Reflectors are often marketed in apples and oranges tests. Dirty fixtures with depreciated T12s are compared to clean lenses, new reflectors and new T8 lamps. The initial result looks great: 60% wattage savings with about same amount of light. But many end users that approved delamping with reflectors years ago now have too little light, because the reflectors and lenses got dirty and the T8 lamps depreciated. Using high lumen F32T8s and higher BF ballasts with or without reflectors can usually solve this problem. On the other hand often less light is an improvement. An example is an office building built before 1985 when paper tasks were the main task and 50 to 75 fc were recommended. Now with computer tasks being predominant, 30 fc is often more appropriate. This can be achieved with delamping and/or lower BF ballasts with or without reflectors.

Additionally, if the retrofitting industry wants any respect from the general lighting community, then the practice of retrofitting 18 cell 3F34T12 2x4s with two repositioned T8s and a reflector should be eliminated, because it destroys proper cut-off angles, which can produce a glare bomb. The worst is with specular reflectors, which with the parabolic louvers, make the fixture look like a house of mirrors.



In addition to the above problems, this type of retrofit can also reduce switching flexibility and can provide 'ghost savings'. There are probably millions of 18 cell 3 lamp 2x4s in individual offices with inboard/outboard switching in North America. Often all three lamps are on for paper tasks, two lamps on for combination paper and computer tasks and one lamp on for computer tasks. Retrofitting this type of fixture with two F32T8s and one two-lamp ballast reduces switching flexibility to either both lamps on or off. Since computer only work is so prevalent, many office workers just have one lamp on in each troffer. The 'ghost savings' from the retrofit result, because one F34T12 driven by an energy saving magnetic ballast consumes less wattage than two F32T8s driven by an electronic ballast. I have been notified of many retrofit projects, that the actual savings were much less than the projected savings.

There are some fixtures that reflectors are very beneficial. They include fixtures with vertical interior sides & bad paint condition and strip fixtures that uplight is not important. Vertical interior sides allow too much light to bounce back and forth horizontally, preventing it to get out of the fixture. Bad paint condition is often the result of cigarette smoke. Being in California for so long, I forgot about this issue until I recently audited a facility in Western Illinois, my home state. As Willard Warren states "You'll scrape the paint off before you remove the products of combustion from cigarette smoke". Willard and I also agree that in areas that smoking is prevalent, an old 2x4 4F34T12 lensed troffer can have an 'effective' luminaire efficiency half of that as a new 2x4 2F32T8 lensed troffer, before it gets an extended bombardment of smoke. Another good reason to prohibit smoking is that energy could be saved because better maintained luminaire efficiency.

Check if the cost to buy and install reflectors is really worth it for specific applications, where fixtures could be delamped without reflectors.

However reflectors can provide two other useful functions. One is centering lamps. Although it is usually okay just to use the inboard or outboard lamp holder position when delamping a four lamp 2x4 to two lamps, there are some fixtures that centering the two remaining lamps is important for appearance and performance. A reflector is often an easier solution than custom lamp holder brackets or using a Whitney punch to modify existing lamp holder brackets. The second is providing a repositioned ballast compartment and lamp socket assembly. An example is retrofitting 9 cell 2x2 troffer that has two FB34T12 U-bend lamps with three F17T8s. The ballast which was in the middle of the fixture has to be moved because one of the F17T8s will go in the middle and wires and lamp holders have to be on both ends of the troffers with the straight lamps. Another example is retrofitting an 8' hooded industrial that has two F96T12 CW 60W lamps with two high lumen F32T8 lamps and 1.15 BF ballast. Although a new hooded industrial reflector kit usually does not provide that much more luminaire efficiency, it is a low parts and labor method to be able to use the 4' lamps.

At least on the West Coast, white is much more popular than specular for reflectors mounted below 14'. White is a diffuse reflector and can provide better uniformity and comfort. At these lower mounting heights, specular reflectors can have a bad appearance. Every bend in a specular reflector can often be seen on the lens. As long as the light quantity and quality is okay, there is no need to make the fixture look like it was not delamped, so specular reflectors are not required. The two major types of white reflectors are white powder coat and 91% reflective white paint. White powder coat is recommended, because it is more reflective, reflectivity can actually increase over time if kept clean, and the process is more environmentally friendly, because there are no paint solvents. There is a new white paint with up to 97% reflectivity, which could change the balance.

For higher mounting, specular is usually better, because it is easier to direct the light where useful. Let's not even discuss the basic grade aluminum reflectors with reflectivity of 88% or less. The recommended specular product is enhanced aluminum with 95% reflectivity. Although silver film has slightly better reflectivity at 96%, it can be scratched easily.

Now let's go back to the point that specular reflectors help make the delamped lensed fixture look like it still has the original number of lamps. Maybe that was important for some people in the 80s or early 90s, but hopefully that concern can evaporate like the concern regarding electronic ballast reliability in the early 90s. There is no valid reason why the fixture needs to look like the original number of lamps was maintained as long as the performance is there. End customers can be educated.

Regarding delamping with or without reflectors and other energy-efficient lighting measures, it is important for retrofitters and end customers to do what is best in the big picture, which is not always what gets the highest utility or other party incentive. Let's use California as an example. At least some of the utilities have offered prescriptive incentive 'rebate' programs since the 80s. Early on there were very high rebates for reflectors in conjunction with delamping. Later reflectors and kits were not required for delamping rebate and the dollar amount was reduced. Now the major investor owned utilities have a consistent prescriptive program called 'Express Efficiency' directed by the California Public Utility Commission. The rebate is much higher to retrofit a 4F34T12 fixture with four F32T8s and low BF ballast than with two F32T8s and higher BF ballast, even though the latter is often a much better solution, including saving significantly more wattage. I have been trying to get these utilities to offer equivalent rebates for each T8 lamp installed compared to for each similar length T12 lamp removed without a replacement. That way the program would not artificially sway retrofitters and end customers one way or another.

## **LAMP HOLDERS FOR T8s & T5HOs**

It has come to my attention that some of the lamp holders for T5HOs are not handling the heat well. Make sure that lamp holders using with T5HOs, especially in hibays, have an adequate temperature rating.

There is a different issue for T8/T12 lamp holders. Some retrofit and engineering firms recommend replacing all existing lamp holders with new ones when they replace T12s with T8s. Other firms only replace damaged lamp holders with the same type of retrofit. What I think works the best is to replace lamp holders that are damaged and ones that are blackened, which is a sign of not the best electrical contact. Also on projects that have a mix of T8s and T12s, it is helpful to have the dimpled sockets in the T8 fixtures, so T12 lamps cannot be accidentally installed in fixtures with T8 ballasts.

## **WHAT WAS EXPECTED IS STARTING TO HAPPEN**

When writing 'Essay By Invitation', which was published in LD+A in February of 2002, I was concerned that there would probably be a T5HO and ballast life problem due to excess heat in hibays. Recently I have become aware of several end-customers that do not want even to discuss getting any additional T5HO hibays.

Most of this problem can be eliminated not allowing ballast case temperature rating to be exceeded. One ballast rep told me that he has seen ballasts get so hot that they bowed and cracked. Glenn Gara of 1<sup>st</sup> Source Lighting is trying to get the major lamp and ballast companies to require fixture OEMs have thermal testing done before letting the fixture OEMs sell T5HO fixtures with their lamps and ballasts. Hopefully this testing would provide the maximum ambient temperature for specific T5HO hibays. The ambient temperature can get over 130<sup>0</sup> F during summer afternoons at 30+ feet where hibays are installed in many unconditioned warehouses and industrial facilities. Ballast case temperatures can usually be kept under the maximum rating with good design, including ballast placement, heat sinking and venting. Any old venting may not work. One hibay manufacturer told me that if vents are put in some places, the ballast case temperature can actually be higher compared to having no vents at all.

The new 90° C case temperature T5HO ballasts, which are designed for higher temperatures, should help. But some of the components in these ballasts only have a limited warranty. Most, if not all, of these ballasts have a five year warranty up to 70° C case temperature and only a three year warranty from 70-90° C case temperature.

I have been told that there are a lot more components and systems that can fail in T5HO than instant start T8 ballasts. But this same heat issue also applies to T8 hibays, especially as T8 hibays become more popular and as high BF program start T8 ballasts become available.

## **SCOPOTIA IN PHOTOPIA**

PG&E (Pacific Gas & Electric) is in the process of having their own facilities retrofitted or relighted with 5000K lamps. PG&E thought that the term ‘scotopically enhanced lighting’ was too long and too difficult, so on their own, they came up with the term ‘clear vision lighting’, because the PG&E staff that work under the new lighting can see more clearly. Earlier this year PG&E issued a press release on this topic.

## **GOOD GENERAL INFO**

Learning about energy efficient lighting does not need to be boring. Two examples are the ‘The Big Picture’ and ‘Power Check’ from Rebuild America, a division of the Department of Energy. These free CDs on energy efficiency are available by calling 800-503-0098 or emailing [rebuildorders@rebuild.org](mailto:rebuildorders@rebuild.org). Rebuild America is also presenting energy efficient seminars across the country.

If you are not aware, Bill Attardi offers a free periodic informative newsletter, called Energy Watch. It is available at [www.attardimarketing.com](http://www.attardimarketing.com) or by emailing him at [wattardi@attardimarketing.com](mailto:wattardi@attardimarketing.com).

Richard Miller may have his website on DALI up and running by the time that this is published. Check out [www.DALIbyDesign.us](http://www.DALIbyDesign.us).

## **ABOUT THE AUTHOR**

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