HOW TO RETROFIT PARABOLIC TROFFERS

By Stan Walerczyk, CLEP, LC

INTRODUCTION

This white paper discusses problems of parabolic troffers, various retrofit options, their financial returns, recommended lamps & ballasts, disadvantages of 25W and 28W F32T8s, benefits of spectrally or scotopically enhanced lighting, etc.

WHY PARABOLICS ARE SO BAD

There are millions of parabolic louvered troffers in North America. The 2x4 18-cell, with either 3 T12s or T8s, is the most common. Parabolics were very popular in the late ‘80s through the mid- ‘90s, because they reduced glare on the curved glass Video Display Terminals (VDTs) of that period.

Now the vast majority of computer screens are flat LCD or LED constructed with an anti-reflective coating. The image clarity of the modern flat screen is many times better than its older counterpart and the emission area very uniformly illuminated. With the glass VDT now a thing of the past, the disadvantages of parabolics in lighting the modern office space have become more obvious.

Most good lighting professionals have eliminated parabolic troffers from their design palette based upon the following attributes:

Only about 70% fixture efficiency
- 30% of the light from the lamps is wasted because it never gets out of the troffer, so extra wattage is required for sufficient light.

Overhead glare
- With no lens or anything else below the lamps, people who are directly underneath these troffers can get excessive direct light in their eyes, even when looking straight ahead. This causes eye strain and headaches.

Insufficient vertical footcandles
- It can be difficult to read and perceive details on vertical surfaces.

Excessive contrast ratios

Most of the light is directed straight down, which can be quite bright. Ceilings, walls, and sometimes even horizontal spaces between fixtures can be underlit. The result is very poor uniformity. As the eyes shift looking from computer monitors to brighter and darker areas, the eye muscles have to keep adjusting, which can cause eyestrain and headaches.

Dreaded ‘cave effect’
- Dark ceilings and upper walls can make the room feel shorter than it really is, and also appear gloomy.

Here are three examples of office workers struggling with parabolic fixtures. The first one shows pillowcases attached to the ceiling directly under parabolic troffers.

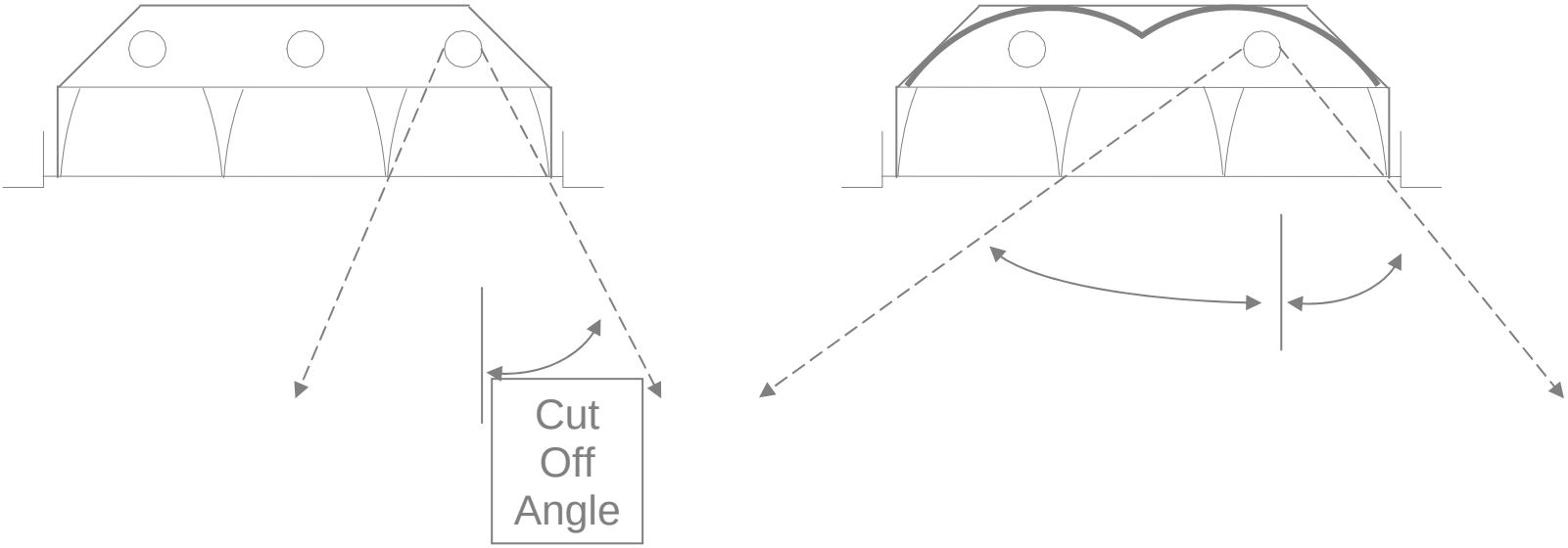
For some office workers in this building, that was not enough, so they also draped cloth over their office module walls.

As the saying goes, “A picture is worth a thousand words.”

DELAMPING, WHILE KEEPING PARABOLICS, MAKES IT WORSE

Delamping, while keeping parabolic louvers can actually make parabolic lighting worse in office applications. Typically this is done with a reflector and repositioned lamp holders. This alters the proper cut-off angles and tends to increase glare. I have had to re-retrofit several buildings originally converted this way because office workers complained so much about glare, even though light levels were fine. This delamping strategy may work out in non-office applications, for example, high ceiling retail and even some hallways.

The diagram on the left shows the end view of a 2x4 (3) lamp parabolic with proper cut-off angles. Cut-off angle is measured from directly below the lamp to the highest angle that the bare lamp can be seen. In parabolics, smaller cut-off angles are better. The diagram on the right shows that the cut-off angles have more than doubled.



A less common way to delamp these fixtures, while still keeping parabolic louvers, is removing the middle lamp and keeping the original positions for outboard lamps. This does save significant wattage and proper cut-off angles are maintained. Unfortunately, this creates an entirely dark center row, which can be aesthetically unacceptable and tends to make contrast ratios even worse.

Many ESCOs, lighting retrofitters and end users have, and continue to, retrofit these fixtures lamp-for-lamp with 32W F32T8s and low BF premium ballasts or reduced wattage F32T8s and standard or low BF extra efficient ballasts (also called premium or high performance). This general strategy saves considerable wattage, but keeps all of the disadvantages of fully lamped parabolics. An energy saving retrofit that does not improve lighting quality is a wasted opportunity.

ELIMINATE PARABOLIC LOUVERS

To eliminate the downsides of parabolics, improve lighting quality and save the most energy, I hope you join me in getting rid of parabolic louvers, and their smaller cell cousins – paracubes and eggcrates.

For several years, I specified the A.L.P. RDIAC 'HT' kit with (2) 3100 initial photopic or catalog lumen 80+ CRI 32W F32T8s, typically 5000K, and .71 - .77 BF extra efficient program- or instant-start parallel wired ballast. This combination only consumes 47 – 48 watts, compared to about 108 – 115 with (3) F34T12s and energy saving magnetic ballasts or about 89W with (3) 32W F32T8s and .88 BF generic electronic ballast (GEB) base cases. Normally during or after a retrofit, no news is good news, but after these kits are installed, it is not uncommon to get very positive feedback about the new lighting environment from individuals working in the upgraded spaces.

Now A.L.P. has the new improved 'RHT' kit, which is designed mainly for (1) F32T8 and which has become my primary recommendation for parabolic troffers. In all cases, these new projects achieve greater energy savings. Depending upon the amount of existing illumination and what the new target light levels are, the wattage and BF can range from a low of 28 – 30 watts with .87 - .89 BF to a high of 38 – 39 watts with 1.15 BF. This is based on high lumen 4100, 5000, 6500 or 8000K 32W F32T8s and extra efficient ballast.

All of these single lamp combinations consume less wattage than any equivalent (2) or (3) lamp 25W or 28W F32T8 retrofit, while still providing good lighting. Although many people think that 25W or 28W F32T8s are the most efficacious T8s, high lumen 32W F32T8s provide the most lumens per watt, when ballasting is included, and ballasts should be included, because fluorescents provide no light without ballasts. Plus, with only (1) high lumen 32W F32T8 per fixture, the customer will save more money down the road from having fewer lamps to buy, stock, install and recycle.

A.L.P.'s RDIAC RHT – WHY IT WORKS

I will try not to come over too much like a salesman for a company in this section.

Fixture efficiency is very good and honest at very close to 85% (84.4%). A.L.P. continues to work on improving this with new materials and shapes.

The center curved optical element (shown below left) utilizes newly developed DuriFlex HT™. This is a 100% clear material with a precise micro-optic built into the surface. This allows the material to transmit 93% of the light while producing an 89% haze factor. Traditional lighting plastic uses white pigment to create this diffusing or haze effect, often with a transmission below 60%. www.alplighting.com/pdf/uardiac%20rht.pdf

This kit provides high angle brightness, not glare. Given the focal point of the DuriFlex HT™ optic and the lamp position, the kit produces a smooth spherical distribution with a 90° spacing criteria of 1.31. Most importantly, over 77% of distributed light is in the 0-60 degree zone. This provides for brighter vertical surfaces (shown below right) and lower contrast ratios, without uncomfortable glare in the field of view.

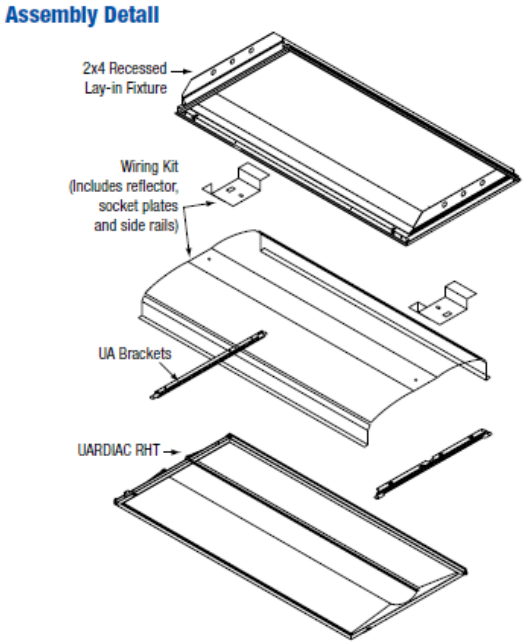
The IES (www.IESNA.org) is on a similar track. The IES revamped RP1 (Recommended Practice for Office Lighting -- RP-1-04) in 2004 to provide designers and users with significant tools and information to accommodate the new requirements of the modern office space. Among the key modifications was a significant reduction in recommended footcandle levels (Section 9.2) and an emphasis on balancing brightness with visual comfort and occupant wellbeing. This revised guide goes on to separate simple "full distribution" fixtures that can produce significant glare, from those with the appropriate balance of control and brightness.

A.L.P.'s RDIAC RHT conversion kit follows the IES' recommended max candela curve angle by angle.

A.L.P.'s RDIAC RHT – GETTING THEM INSTALLED

What many people do not realize is that most aluminum parabolic louvers have a built-in hinge and latch system and do not have a door frame. Unlike flat lensed troffers where you can disassemble a door frame and slide a new lens or optic into the rails, manufacturers of deep cell parabolic fixtures use the structure of the louver itself to eliminate the door. Eliminating the louver created a challenge.

So A.L.P. created the patent pending Universal Adapter (UA) system which, as the name implies, is a universal hinge and latch system. This allows the new optic to be installed in a large variety of fixtures without door frames. With over 100,000 kits installed by end of 2009 into dozens of different parabolic fixture types, only two recessed parabolic fixture types so far have required additional hardware to convert.



There are typically two part numbered kits required to convert a single fixture, the reflector/wiring kit (RDIARK…) and the optic (RDIAC…). The reflector/wiring kit installs in a similar fashion to most in the industry and the lower optic can be positioned and secured easily.

IMPORTANT NOTES

Most contractors report that each experienced retrofitter can totally retrofit a fixture in 20 minutes, which equates to 24 in an 8-hour shift or 30 in a 10-hour shift. That is about the same as, or just slightly more than, installing a typical reflector kit.

Don't forget to recycle the aluminum louvers. These weigh between 3 and 7 pounds. Not only will most commercial recyclers offer to pick the louvers up, they'll pay real money to do so.

Ballasts and lamps are not included in the A.L.P. kits. These must be ordered separately.

The RDIAC family includes 2x2 and 2x4 troffer assemblies. Custom kits may be available for large quantities of specific 1x4 troffers.

Please be aware that surface mount fixtures do not work with UA kits.

It is recommended to check the interior length of 2x2 U-Lamp fixtures to confirm that they can accommodate 2' T8 lamps. A couple of models on the market have an interior length of less than 23 3/4". In this case, new troffers or T5 lamps can be options. Also note that the Columbia 2x2 housing with the ballast mounted in the end panel above the large lampholder plate can be converted to the UA system, but this requires a special kit.

The UA system provides adequate circulation path for typical air return fixtures. If large air volume capacity is required, consult A.L.P. for options.

IN MOST CASES, A SIMPLE DIGITAL PHOTOGRAPH OF THE EXISTING FIXTURE WITH THE LOUVER OPEN CAN HELP A PROJECT STEER CLEAR OF FIT ISSUES.

COST EFFECTIVENESS

While the installed cost and payback for the new A.L.P. RHT kit is generally higher than lamp for lamp conversions or a de-lamping while keeping the existing parabolic louvers, the net benefit long term from the additional savings can make this more expensive solution a much better investment. It is important to note that 'payback' may not always be the best analytical financial tool, depending upon your objectives.

From chapter 25, pages 2 - 3 of 9th edition of IES Handbook:

> Those who like the simple payback method argue that it is easy to use and a simple way to determine the profitability of a proposed action. In fact, however, it is actually a risk assessment tool posing as a profitability metric. This is seen by examining the question the method answers. It does not answer the question, is a certain investment profitable? Rather, it responds to the concerns of the person who is unsure about the future and hopes to recoup the investment as soon as possible. **If getting money back is the primary concern, then there is no reason to make the investment at all. If no investment is made, then that money is available immediately, and the payback is zero years, the ideal result of a simple payback calculation.**
>
> Another problem with this method is that it fails to consider what happens after the investment is paid back...
>
> As with all first-level methods, simple payback does not consider the time value of money...

The following example demonstrates how a three-year payback can be a much better investment than a project with a two-year payback.

Option A

Costs $100,000 after rebate and saves $50,000 per year

- 2 year payback
- $ 650,000 benefit over typical 15 year ballast life

Option B

Costs $300,000 after rebate and saves $100,000 per year

- 3 year payback
- $1,200,000 benefit over typical 15 year ballast life

Even though option B costs three times more initially, the end customer would have an extra $550,000 after 15 years, which is 85% more than option A.

This very simple long term benefit = (annual savings x number of years) – initial investment. Annual KWH rate increases can be thought of to offset the time value of money.

Fifteen years could be reduced, if the end customer plans to move out the building in, for example, 10 years.

More complex long-term financial tools, such as life cycle costing and cost of ownership equations, are available on the web and other places.

Payback should only be used in short-term applications. For instance, if the end-customer's lease is only three years, the payback needs to be shorter than that.

COST EFFECTIVENESS—COMPARING SOLUTIONS

Let's look at how cost effective the A.L.P. RHT kit with (1) lamp compares to other options over 15 years. The two base cases, F32T8 735s and F34T12CWs, provide about the same spectrally or scotopically enhanced light at 40% of lamp life, so options are the same for both. The far right column is the most important. Often worker productivity benefits can dwarf electrical savings. For example, just a 0.5% worker productivity improvement for somebody making $50,000 per year is $250 benefit per office worker per year, year after year.

FEASIBILITY TABLE

$0.125	KWH rate		$0.05	/KWH 1st year saved rebate	15	years of long term benefit								
existing			proposed											
fixture type	total watts	annual hours	annual electrical cost	option letter	retrofit description (just instant start ballasts are listed, but program start ballasts could be used)	total watts	watts redux	annual electrical savings	appr. incentive	appr. installed cost	rated lamp life @ 3 hour cycles	pay-back just electricity	payback including maintenance savings & worker productivity benefits	long term benefit just electricity	**long term benefit including maintenance savings & worker productivity benefits**
2x4 18 cell parabolic troffer with 3 32W 735 series 15,000 - 24,000 hour rated F32T8s and generic .88 BF ballasting	89	3000	$33	A	ALP 1-lamp kit, 1 high lumen F32T8 850 lamp & extra efficient .87 BF instant start ballast	28	61	$23	$9	$110	24,000 - 30,000	4.4	2.2	$242	**$585**
				B	ALP 1-lamp kit, 1 high lumen F32T8 850 or 841 lamp & extra efficient 1.00 BF instant start ballast	35	54	$20	$8	$110	24,000 - 30,000	5.0	2.5	$202	**$506**
				C	3 28W F32T8 850 or 841 lamps & extra efficient .77 BF instant start ballast	64	25	$9	$4	$50	24,000 - 30,000	4.9	4.1	$94	**$123**
				D	3 25W F32T8 850 lamps & extra efficient .77 BF instant start ballast	57	32	$12	$5	$51	24,000 - 30,000	3.9	3.2	$134	**$170**
				E	3 25W F32T8 850 or 841 lamps & extra efficient .87 BF instant start ballast	64	25	$9	$4	$51	24,000 - 30,000	5.0	4.2	$93	**$122**
				F	2-cove white reflector, 2 high lumen F32T8 850 lamps & extra efficient .77 BF instant start ballast	48	41	$15	$6	$62	24,000 - 30,000	3.6	4.5	$175	**$129**
				G	2-cove white reflector, 2 high lumen F32T8 850 or 841 lamps & extra efficient .87 BF instant start ballast	54	35	$13	$5	$62	24,000 - 30,000	4.3	5.4	$140	**$101**
2x4 18 cell parabolic troffer with 3 20,000 hour rate F34T12CW and 1.5 energy saving magnetic ballasts	108	3000	$41	A	ALP 1-lamp kit, 1 high lumen F32T8 850 lamp & extra efficient .87 BF instant start ballast	28	80	$30	$12	$110	24,000 - 30,000	3.3	1.6	$352	**$847**
				B	ALP 1-lamp kit, 1 high lumen F32T8 850 or 841 lamp & extra efficient 1.00 BF instant start ballast	35	73	$27	$11	$110	24,000 - 30,000	3.6	1.7	$312	**$763**
				C	3 28W F32T8 850 or 841 lamps & extra efficient .77 BF instant start ballast	64	44	$17	$7	$50	24,000 - 30,000	2.6	2.0	$204	**$278**
				D	3 25W F32T8 850 lamps & extra efficient .77 BF instant start ballast	57	51	$19	$8	$51	24,000 - 30,000	2.3	1.7	$244	**$330**
				E	3 25W F32T8 850 or 841 lamps & extra efficient .87 BF instant start ballast	64	44	$17	$7	$51	24,000 - 30,000	2.7	2.2	$203	**$253**
				F	2-cove white reflector, 2 high lumen F32T8 850 lamps & extra efficient .77 BF instant start ballast	48	60	$23	$9	$62	24,000 - 30,000	2.4	2.9	$285	**$217**
				G	2-cove white reflector, 2 high lumen F32T8 850 or 841 lamps & extra efficient .87 BF instant start ballast	54	54	$20	$8	$62	24,000 - 30,000	2.7	3.3	$250	**$189**

Note: A.L.P. or Lighting Wizards can provide an Excel version of this table and a similar one with extra efficient program start ballasts, so customers can change numbers in colored cells, which will automatically modify associated cells and also change installed costs, etc. In Word format, double clicking this table turns it into an excel file.

WHAT ABOUT BI-LEVEL LIGHTING?

Many 3-lamp parabolic troffers are designed with inboard/outboard switching where the center lamp and outboard lamps can be operated independently. Converting to a single lamp and standard electronic ballast eliminates bi-level lighting in each fixture, but alternate fixtures can be controlled with alternate switches for an overall bi-level lighting strategy. This is commonly called ‘checker-boarding’. Another option is to install a bi-level ballast.

Regardless of the type of ambient lighting, providing office workers the ability to turn on/off and aim good task lighting is a very effective way to offer control and achieve energy savings. Please read ‘Task-Ambient’ section, near end of this document.

WHAT ABOUT REDUNDANCY?

Some end customers want more than one lamp in a fixture, so if one burns out, there is still some light from that fixture, and maintenance is not as urgent.

In the vast majority of applications, this has not been an issue. The high lumen T8s typically recommended with these projects possess longer lamp life than most existing lamps. Program start ballasts, especially in occupancy sensor applications, can substantially improve lamp life. Fixture efficiency is typically higher with a single lamp and the temperature in the lamp compartment is typically closer to optimal 77ºF with one lamp. Group relamping at 75 - 80% of rated lamp life, which usually saves money compared to spot replacements, would also greatly reduce this potential problem.

When redundancy is really necessary, two lamps could be used in A.L.P. kits.

ATTENTION RISK AVERSE ESCOs, RETROFIT CONTRACTORS & END CUSTOMERS

ESCOs, retrofit contractors and end customers seem to be getting polarized.

On one end are people and companies trying to save every watt, while providing sufficient light, improving lighting quality, reducing carbon footprint as much as possible and being sustainable in general.

On the other end of the spectrum are the ‘less adventurous.’ Their recommendations are typically conservative, including simple lamp-for-lamp replacements, keeping the same Kelvin and maintaining existing light levels, even if spaces are over-lit. Unfortunately, this rarely captures the full benefit of tuning light levels to meet modern demands and almost always leaves a lot of potential savings on the table.

The good news is that more and more savings maximizing projects are getting installed using solutions as outlined here. The updated IES RP1 document, new energy legislation, utility incentives and studies are all helping to break these old habits. The bad news, of course, is that old habits die hard. Then again, as consumers and influencers are becoming educated, they’re making decisions with their checkbooks, and the more thoughtful contractors and project developers are being rewarded.

ADDITIONAL REASONS WHY SOME ESCOs & RETROFIT CONTRACTORS LIKE LAMP FOR LAMP

Surveys and Designs Appear Much Simpler: Indeed, many highly customized projects require additional survey and design time, all in a climate of higher perceived risk. I have seen many failed projects attempted by contractors not equipped to collect or interpret the additional data required for an aggressive retrofit.

ANTIDOTE: The UA system is very universal, especially when called out for parabolic fixtures. In addition, the typical 'parabolic' space is fairly homogeneous and less likely to contain a lot of task variety. Therefore, measures containing the UA RDIAC family require little or any additional time to survey or design.

Shorter Payback/Lower Project Cost: It's typically easier to sell a short payback.

ANTIDOTE: Take a minute to learn about and present the long-term benefits of comparable measures. This sells itself, but only if it is presented.

OTHER GOOD KIT OPTIONS FROM OTHER MANUFACTURERS

Although it can be considered that A.L.P. has taken the lead on high performance kits, other manufacturers have developed some very good and not so good kits. I invite ESCOs, retrofit contractors and end customers to evaluate all of their options.

Often the best way to retrofit parabolics in retail applications is the Lithonia 2-lamp ES8 kit type. Some other manufacturers have similar versions. Lithonia also has the 2-lamp Relight RT8-R kit, which is similar to the RT8 new fixture. Amerillum, Energy Solutions International, Precision Fluorescent and others also have some upscale kits worth evaluating.

In general, 1-lamp kits are usually better than 2-lamp kits, however, a two lamp kit might be appropriate for a "two row" parabolic that was originally designed for (4) lamps (i.e. 12 cell 2x4 or 6 cell 2x2).

WHAT ABOUT NEW FIXTURES?

There is a good trend to 1-T8 high performance 2x2 and 2x4 troffers. One very good example is the 1-lamp version of the Finelite HPR.

If you are not already aware, A.L.P. is one of the largest OEM component suppliers in the world. The RDIAC RHT is already designed into some manufacturer's new product lines. For instance, Deco Lighting's DPL-C uses the A.L.P. RDIAC RHT 1-lamp design. This allows the same look and performance for new troffers and retrofits.

Even the best troffer isn't always the best solution. Often high performance suspended indirect/direct fixtures with 1-T8 per cross section can be the best choice for a space.

WHAT ABOUT TASK-AMBIENT LIGHTING?

Often the best way to get the best watts per square foot power densities is with an effective task-ambient lighting system. With them, good ambient ceiling fixtures provide relatively low illumination levels, sufficient for walking around and doing computer tasks, and quality task lighting provides additional light for paperwork and other tasks.

A word of caution… Many office modules already have under-cabinet fluorescent task lighting. Unfortunately, the 'classic' design often provides too much light for the modern electronic office and entirely too much glare. Those who are serious about maximizing energy performance and keeping their staff comfortable often include a task lighting upgrade in their project. Some of the most popular include the use of very effective LED array including controls. One of the better examples is the Finelite's PLS (Personal Lighting System).

T8 LAMPS

High lumen 32W F32T8s are often called 'high performance', 'super' or '3rd generation' and are approved by the Consortium for Energy Efficiency. Many utility rebates use this CEE approval in defining qualifying products. www.cee1.org.

Although the Consortium also approved many 25 and 28W F32T8s, it is important to be aware that when including the ballast, the high lumen 32W F32T8s have higher lumens per watt. These reduced wattage T8s have other disadvantages, including that they should not be used below 60 degrees F. Reduced wattage T8s may be very good for lamp manufacturers and distributors, because they are profitable and popular, which helps keep volume up, but they are often not the best solution for end customers. Best Practice Report, which is available through www.lightingwizards.com, details advantages of high lumen 32W F32T8s over reduced wattage F32T8s and all T5s and T5HOs.

T8 BALLASTS

Other names for extra efficient electronic ballasts are the CEE's 'high performance' and the National Electrical Manufacturer Association's 'premium', www.nema.org.

Since extra efficient ballasts typically cost less than a buck more than equivalent generic electronic ballasts, when purchased properly, and they save 3 – 6 watts with same BF, there is usually no reason to use generic electronic ballasts (GEBs).

Over the last two years, when I have gone over the pros and cons of instant and program start ballasts, about half of my clients have chosen program start. Often with program start ballasts, the extra lamp life, especially when controlled by occupancy sensors, outweighs the extra cost.

The A.L.P. kits can be ordered with non-shunted lamp holders, which can be used with program start ballasts.

SPECTRALLY OR SCOTOPICALLY ENHANCED LIGHTING

Although the benefits of high Kelvin lamps (i.e. 5000K) could be an entire separate white paper, this is a short description. Lamps with higher Kelvin have more blue content and are perceived brighter and with better visual acuity than similar lower Kelvin lamps. High Kelvin lamps are called spectrally or scotopically enhanced. The U.S. Department of Energy has already funded three phases on research on this, which I have been involved with, and the results have been positive. This table shows how more energy efficient 3rd generation 5000K 32W F32T8s are compared to other lamps.

S/P Benefits of 5000K 3100 Lumen F32T8s

lamp	mean photopic (catalog) lumens	S/P ratio	brightness $P(S/P)^{.5}$	paper $P(S/P)^{.78}$	computer $P(S/P)^{1.0}$
F34T12 CW	2300	1.50	2817	3156	3450
F34T12 WW	2350	1.00	2350	2350	2350
F32T8 730	2650	1.19	2891	3035	3154
F32T8 735	2650	1.30	3021	3252	3445
F32T8 741	2650	1.56	3310	3749	4134
F32T8 830 2nd	2800	1.29	3180	3415	3612
F32T8 835 2nd	2800	1.41	3325	3661	3948
F32T8 841 2nd	2800	1.62	3564	4079	4536
F32T8 830 3rd	2950	1.29	3351	3598	3806
F32T8 835 3rd	2950	1.41	3503	3857	4160
F32T8 841 3rd	2950	1.62	3755	4298	4779
F32T8 850 3rd	2950	1.95	4119	4966	5753
Increase of energy efficiency of 3000+-initial-photopic-lumen 850 3rd generation F32T8s when considering full field of view compared to		**CW**	**46%**	**57%**	**67%**
		WW	**75%**	**111%**	**145%**
		730	**43%**	**64%**	**82%**
		735	**36%**	**53%**	**67%**
		741	**24%**	**32%**	**39%**
		830 2nd	**30%**	**45%**	**59%**
		835 2nd	**24%**	**36%**	**46%**
		841 2nd	**16%**	**22%**	**27%**
		830 3rd	**23%**	**38%**	**51%**
		835 3rd	**18%**	**29%**	**38%**
		841 3rd	**10%**	**16%**	**20%**

notes : Lumens and S/P ratios can vary among lamps and manufacturers.
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Since an F32T8 850 3rd generation lamp provides 16% – 111% more visually effective lumens for paper tasks than these other lamps, wattage can be saved by using lower ballast factor ballasts, delamping or installing a new fixture scheme.

If you think 5000K is “extreme,” consider the following. There are also 6500K and 8000K. 6500K may be the most common Kelvin lamp produced on the planet today because it is so popular in China, India, Japan, Australia, Sub-Africa, etc. I have developed a large number of projects utilizing 5000K lamps with very good customer satisfaction.

As this table shows, 5000K may be the best balance of photopic or catalog lumens, spectrally or scotopically enhanced lumens, availability and cost.

S/P Info for 32W F32T8s and 34W F34T12s

lamp	mean photopic (catalog) lumens	S/P ratio	brightness $P(S/P)^{.5}$	paper $P(S/P)^{.78}$	computer $P(S/P)^{1.0}$
F34T12 CW	2300	1.50	2817	3156	3450
F34T12 WW	2350	1.00	2350	2350	2350
F32T8 730	2650	1.19	2891	3035	3154
F32T8 735	2650	1.30	3021	3252	3445
F32T8 741	2650	1.56	3310	3749	4134
F32T8 830 2nd	2800	1.29	3180	3415	3612
F32T8 835 2nd	2800	1.41	3325	3661	3948
F32T8 841 2nd	2800	1.62	3564	4079	4536
F32T8 830 3rd	2950	1.29	3351	3598	3806
F32T8 835 3rd	2950	1.41	3503	3857	4160
F32T8 841 3rd	2950	1.62	3755	4298	4779
F32T8 850 3rd	2950	1.95	4119	4966	5753
F32T8 865	2750	2.20	4079	5087	6050
F32T8 880	2518	2.50	3981	5146	6295

notes : Lumens and S/P ratios can vary among lamps and manufacturers.
Listed F32T8 865 is Sylvania XPS. Listed F32T8 880 is Sylvania Skywhite XP.
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About the author

Stan Walerczyk is principal of Lighting Wizards and has 21 years of experience of working in the area of energy-efficient lighting and controls. He has published dozens of articles and has presented hundreds of seminars, both live and on the web. Known for maximizing savings and keeping the customer satisfied, Stan has developed hundreds of projects and remains one of the most sought after specifiers in the market today. Visit www.lightingwizards.com for complete bio, seminar schedule, testimonials, publications, etc.

Author’s Note: As an independent lighting consultant, I have written few white papers for manufacturers, but because of the large number of very successful projects that I have worked on utilizing the RDIAC family, manufactured by A.L.P., I agreed to write this one. While I was paid for my time to write this white paper, I do not get any commission, compensation or benefits for specifying A.L.P. products or on A.L.P. sales.

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