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SHOULD PS BALLASTS BE REQUIRED FOR T8 LAMPS WITH OCCUPANCY SENSORS?

Yes, instant start (IS) ballasts can reduce lamp life in short cycle applications. But there is more to consider. In many typical office applications, if the occupancy sensors are set at 15 minute delay, which is often recommended by sensor manufacturers, the average cycle can typically be 1.5 to 3 hours. Plus the long occupancy sensor delay setting helps prevent annoying false offs. There are several F32T8 models that are rated for 24,000 hours with IS ballasts at the industry standard 3 hour cycles. At 1.5 to 2 hour cycles these F32T8s may last almost as much as basic grade 20,000 hour rated F32T8s with rapid start (RS) or program start (PS) ballasts at 3 hour cycles. IS ballasts are usually more efficacious than similar grade RS or PS ballasts. It is important to be aware that some lamp manufacturers may not warranty their T8s driven by IS ballasts and controlled by occupancy sensors. At least one lamp manufacturer provides a warranty if the delay setting is at least 20 minutes. Even if lamp life is decreased with occupancy sensors, the calendar time to replace lamps can often increase. The two reasons that RS and PS ballasts tend to consume more wattage than equivalent IS ballasts, is because of the extra circuitry for starting and that some maintain voltage heating to the lamp cathodes. PS technology is replacing RS technology. A good way to look at ballast efficacy is ballast efficacy factor (BEF). BEF = (ballast factor x 100) / system wattage. BEFs should always be compared with similar number and type of lamp. The BEF table provides some good IS and PS comparisons.

With a higher BEF, less wattage is required for the same amount of light. The extra electrical savings with IS ballasts can often more than compensate for the parts and labor costs to replace lamps more often.

BALLAST EFFICACY FACTOR TABLE - 2F32T8

general type	*further description*	*ballast factor*	*system watts*	*BEF*
IS	extra efficient	0.87	53	1.64
	basic grade	0.87	58	1.50
	extra efficient	0.77	48	1.60
	basic grade	0.77	51	1.51
	extra efficient	1.15	72	1.60
	basic grade	1.15	77	1.49
PS	extra efficient	0.88	55	1.60
	basic grade	0.88	62	1.42
	extra efficient	0.71	46	1.54
RS/PS dimming	continuous 0-10V	0.88	64	1.38
		0.05	14	0.36
	continuous powerline	1.00	68	1.47
		0.05	15	0.33
	continous DALI	1.00	70	1.43
		0.54	45	1.20
		0.05	17	0.29
	three stages	0.88	62	1.42
		0.58	45	1.29
		0.27	28	0.96
notes: Wattages based on 277V.				
Values will vary among specific ballasts.				

There are other downsides of PS ballasts. They cost significantly more than IS ballasts. Since most are series wired, it takes more time to wire than parallel wired IS ballasts, and when one lamp burns out the remaining lamps can go out or get very dim. IS ballasts are parallel wired, so when one lamp burns out the remaining lamps keep operating normally, so maintenance is usually not as urgent. PS ballasts have about a ¾ of a second delay from when they are turned on to when they come on, which can be annoying.

PS ballasts can be the best solution for very short cycles. The prisons, that I have been working on, may be the prototype application. The inmates flick the lights on and off incessantly in their cells to get attention from the guards. With instant start ballasts the basic grade F32T8s typically last less than 6 months. PS ballasts have two significant advantages. One is much longer lamp life. Second is that with the ¾ of a second delay between turning the light switch on and the lamps turning on, the inmates are less prone to flick the switches as much.

Note: All the major ballast manufacturers make extra efficient IS ballasts. They include Advance Optanium, GE Ultramax. Howard Hex, Sylvania QHE and Universal ULTim8.

DO DIMMING BALLASTS REALLY SAVE THAT MUCH ENERGY?

This issue came up in a recent consulting project. Most fluorescent dimming ballasts are PS with some of the older models being RS. With the additional dimming circuitry, the BEF at full output is typically lower than fixed output PS and RS ballasts. As the BEF table also shows, the full output BEF is lower for dimming ballasts, and the BEF decreases with dimming due to consistent ballast losses factored with lower BF and increased cathode heating voltage.

Let's examine an example:

Assumptions

- 100 12' x 12' offices
- Each office has 1 8' fixture with 6 F32T8 lamps
- 6 AM to 12 midnight, 5 days per week, operation (4680 annual hours)
- Windows provide significant daylight
- Approximate amount of electric light required
  - 100% for 6 hours per day
  - 67% for 4 hours per day
  - 33% for 8 hours per day
- $.10 KWH rate (no demand charges)

DIMMING BALLASTS vs. STAGED FIXED BF EXTRA EFFICIENT IS BALLASTS TABLE

ballast type	*number of 2F32T8 ballasts per fixture*	*BF*	*number of F32T8s on per fixture*	*wattage per fixture*	*annual hours*	*KWH rate*	*itemized annual KWH*	*total annual electrical cost per fixture*	*total annual electrical cost per 100 fixtures*	*advantage with fixed BF EE IS ballasts*
dimming	**3**	**0.88**	**6**	**189**	**1560**	**$0.10**	**$29.48**	**$62.56**	**$6,255.60**	**24%**
	3	**0.59**	**6**	**138**	**1040**	**$0.10**	**$14.35**			
	3	**0.29**	**6**	**90**	**2080**	**$0.10**	**$18.72**			
fixed BF EE IS	**3**	**0.88**	**6**	**162**	**1560**	**$0.10**	**$25.27**	**$47.74**	**$4,773.60**	
	3	**0.88**	**4**	**108**	**1040**	**$0.10**	**$11.23**			
	3	**0.88**	**2**	**54**	**2080**	**$0.10**	**$11.23**			

notes:

Dimming ballasts can either be continous or stage dimming.

Both systems are automatically controlled.

Fixed BF EE IS is fixed ballast factor extra efficient instant start.

Each fixture could also have 3 2-lamp dimming ballasts or 1 4-lamp ballast and 1 2-lamp EE IS ballast.

Plus extra efficient IS ballasts cost ¼ - ⅓ of dimming ballasts. Also wiring usually costs much less with extra efficient IS ballasts.

Having lamps automatically switch between full on to off in a down light fixture, like a troffer, can be disconcerting to people in the space. This potential problem can be reduced with suspended indirects where the light distribution does not change that much when one or more lamps are turned off. This is quite common in several fixtures that have three lamps in a cross section with inboard/outboard switching. There is at least one two-lamp cross section fixture that the lamp on the right or left side can be turned off and the uniformity appears intact.

Let's add another option to this example, no automatic controls with fixed BF extra efficient IS ballasts. Having all six lamps on for all 4680 hours would consume $75.81 per year, which is $7581.00 for 100 fixtures. That is 21% higher electrical cost than with the dimming ballasts. But because the installed cost would be a fraction of buying and installing dimming ballasts, control wiring and controls and doing the commissioning and re-commissioning, it may be more cost effective to use extra efficient IS ballasts and keep all lamps on for the hours of operation. Even with peak load demand charges, it could take five to ten years to recoup the extra costs of dimming ballasts and system based on reasonable interest or opportunity rates. Hopefully education and reinforcement could motivate workers to manually turn off lamps driven by extra efficient IS ballasts, when there is sufficient daylight. This could bring KWH below automatically controlled dimming ballasts.

A potential big time concern with a dimming system is the facility staff having to maintain it and being able to get suitable replacement components. For example, many people think that all 0-10V dimming ballasts are basically the same and can use the same controllers, which is a big mistake. I have seen too many buildings that the companies that made the original ballasts and controllers when out of business.

Don't get me wrong; there are some very good applications for dimming ballasts, especially continuous dimming ones, including a full range of light levels, gradual changes, very low light levels, and dimming a lamp when it has to remain on.

More than one manufacturer is working on improved dimming T8 ballasts for daylight harvesting and peak load shedding applications. The various strategies are quite interesting. Reducing cost is common goal.

T5HO BALLASTS

There are some instant start ballasts for T5HOs, that although use less wattage and cost less than program start ballasts, may not be the best solution.

Program start ballasts are the norm for T5HOs for good reason; rated lamp life can go down to 16,000 hours without them, and even less in some occupancy sensor applications. It is also my understanding that the major lamp companies will only warranty their T5HOs with program start ballasts.

So when you buy T5HO suspended indirects, hibays or other fixtures, it may be wise to specify program start ballasts. The same applies for replacement ballasts.

HIBAYS

After seeing so much marketing hype from both HID and fluorescent hibay manufacturers, I decided to write my fifth hibay article, 'Hibays – It's All About The Details'. It is downloadable at the DOE website, www.rebuild.org. Or if you prefer, I can email it.

This article includes showing how ceramic MH with electronic ballast and high performance dome in certain applications can outperform the best T8 or T5HO hibays. In other applications fluorescents can be best. So if any company tries to convince you that HID, T8, T5HO, CFL or induction is the best single general solution, find another company. Recently a fluorescent hibay manufacturer sent me a catalog, which included a fluorescent and MH comparison. This comparison used the worst for the MH side, such as only 70% luminaire efficiency, to try to show how much better T8s and T5HOs are. When this company made their follow up call, I told them that I would not consider specifying their products unless they would make their comparison more fair. On the other side of the fence, I have seen one manufacturer state that you need an unrealistic number of T5HOs to be the equivalent of PS MH.

It often boils down to 'follow the money'. Is a manufacturer trying to sell what they have or what is best for the customer? I think that it is good that numerous hibay manufacturers are expanding their lines. Some traditional HID only companies have started to include T8 and T5HO fixtures. Some fluorescent companies are considering high performance HID. Several T5HO companies have seen the advantages of T8s for some applications, so are now offering them as well. Be very cautious of a one trick pony.

Before I finished this article, I sent it numerous parties for comment. It is interesting to note that a hibay manufacturer, that only offers T5HOs and T5s, provided no feedback after two requests.

Like many people, I used to think that T5HOs were better than T8s at high heights. Now I am not so sure about that, especially being informed about T8 hibays working quite well at 85'.

I invite you to my hibay seminar at the IESNA Annual Conference in July in Tampa, Florida. It is 'MH vs. FLUORESCENT - 10 Rounds in the Hibay Arena'. The main contestants will be electronically ballasted ceramic MH and T8. The 10 rounds will probably be lamp temperature and light output, ballast temperature, system efficacy, CRI and Kelvin, system performance, aesthetics, control flexibility, initial parts and labor costs, lamp life and maintenance, and mercury and lead content. Attendees will score the fight. Now that there are some low priced electronic ballasts for MH, fluorescent hibays are not that much less expensive.

CONTROVERSIAL TOPICS

I write about some controversial subjects to get a discussion going. Often the discussion starts during the research phase, getting input from manufacturers and impartial experts. For this column it was interesting getting feedback from a die hard dimming ballast proponent who started off with, 'I had to read the draft three times before my hackles went down'. He ended with 'I really cannot disagree the advantages of extra efficient IS ballasts'. After many of my articles I have received numerous emails, which have lead to very informative dialogs on both sides. If somebody explains a flaw in my data, logic or conclusion, I am very willing to make the correction. I encourage you to email me with agreements or disagreements.

ABOUT THE AUTHOR

Stan Walerczyk, LC, is principal of Lighting Wizards, whose main consulting clients include Sun Energy Solutions. He is also a partner in R.A.D. Lighting, a newly formed lighting collaborative for research, applications, design and product procurement services. 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.sunenergysolutionsllc.com. For questions, comments and ideas for future topics please email lightingwizard@sbcglobal.net.