Subject:  
The Impact of Occupancy Sensors on Fluorescent Lamp Performance

The use of occupancy sensors with fluorescent lamps continue to grow and are a good opportunity for the end user to save energy in areas of a facility that has limited traffic. With this being said, there are certain operating parameters that should be considered when using these devices to insure that rated lamp performance and life requirements are met.

Fluorescent lamp life is dependent on the lamp electrode emitter loss rate. Emitter loss occurs during each start and during steady state operation. The effect of starting on lamp life is the main impact of concern when using occupancy sensors. With respect to starting, there are two main concerns, how the lamp is started, i.e. what type of ballast – instant start, rapid start, programmed rapid start and programmed start, and the cycle or time setting that is used in switching the lamps on and off.

Although ballast design and starting scenario will have a major impact on performance with occupancy sensors, the item that has the biggest impact on performance that can be controlled by the end user is the amount of on-time provided after the occupancy sensor has been activated. Although the greatest energy can be saved by setting the on time to the minimum levels available on the occupancy sensor, this energy savings can be quickly offset by the expense associated with the need to replace lamps that have failed prematurely due to this short setting.

Because of the physics of the lamps and the characteristics of the lamp electrode system, fluorescent lamps perform best when switching is kept to a minimum. The longer the lamps are allowed to operate, the better the life will be. This can be seen in many of the new fluorescent lamp ratings that indicate that lamp life can be increased as much as 25% by operating the lamps for a minimum of 12 hours and 50% when the lamps are operated continuously, as compared to the standard 3 hour cycle used for identifying median lamp life. The opposite occurs when going to more rapid switching cycles and the negative results are even more exaggerated as the switching cycle is reduced.

As previously mentioned, fluorescent lamp emitter is depleted to some degree every time the lamp is ignited. This degradation is far less with programmed start ballasts than with instant start or rapid start systems because the coils are always hot and on emission prior to starting. Due to this “soft start”, switching cycles in equal to and even in excess of 50k are common with programmed start ballasts. Instant start and rapid start ballasts offer far less starts and typically provide for only 10K and 15K switches, respectively. All ballast manufacturers should have information on the number of switching cycles available with their ballast design. Based on the number of switches expected and the switching cycle set with the occupancy sensor a simple calculation can be made to predict the expected lamp life when used on the different systems available. Based on this calculation, the following curve has been identified to show the impact on lamp life based on the expected switching cycles available from the ballast. This curve is based solely on indicated switching cycles provided by the ballast.

There may be other extenuating circumstances that impact lamp performance and life in occupancy sensor applications, but these must be addressed on a case by case basis.
Balancing Energy Efficiency and Longer Lamp Life

Most standard occupancy sensors a 30 second to 20 minute delay timer that engages when occupancy is no longer detected. Faster shutdown means greater energy savings but also increases fixture cycling, which ultimately shortens lamp life and increases maintenance costs. The lamp/maintenance cost for T5HO lamps is even greater, and that does not take into account other factors such as: lost production, diminished conditions and maintenance scheduling.

Impact on Lamp Life vs. Switching Cycles - Operating on Various Ballasts

Note: Switching cycle values per various ballast type is based on engineering data

Based on the curves provided, it is clear that instant start operation will always result in shortened lamp life when reduced on-time switching cycles are used. This is why PLC does not recommend the use of occupancy sensors in combination instant start systems.

The provided curves hold true for the whole of T8 rapid start family of lamps included the F17T8 (2’), F25T8 (3’), F32T8, and the 4’ F32T8 Energy Saver lamps. Based on the curve, standard lamp warranties should only be offered on lamps that are operated with occupancy sensors that allow the lamps to operate for at least 1 hour prior to shutting off on HF Programmed Rapid Start and HF Programmed Start ballasts. Based on the impact of starting with HF/IS ballasts, these systems will most likely never achieve rated life if occupancy sensors are used that operate the lamps much less than the 3 hours on / 20 minutes off cycles used in the normal life ratings. It should be stated for reference that the number of switches cycles experienced with the standard cycle median life requirement is 6006 cycles for a 20kHr rated life lamp and 7207 cycles for a 24kHr rated life lamp.

NOTE:
PIONEER LIGHTING USES ONLY PROGRAMMED START BALLASTS IN ALL T5HO HIBAYS.