AEDG Implementation Recommendations: Interior Lighting Good Design Practice

The Advanced Energy Design Guide (AEDG) seeks to achieve 30 percent savings over Standard 90.1-1999. This guide focuses on improvements to small office buildings, less than 20,000 square feet. The recommendations below are adapted from the implementation section of the guide, and should be used in cooperation with the whole document.* The full design guide is available from the ASHRAE website, Advanced Energy Design Guide for Small Office Buildings .

Lighting Walls and Ceilings

Better eye adaptation and luminous comfort are achieved when light is distributed to the walls and ceilings. Totally direct solutions should be avoided, since they create harsh shadows and dim rooms. To light walls, use wall wash luminaries or locate fixtures closer to walls. In open plan offices, lower furniture partitions and translucent partitions are more energy efficient than higher partitions, for both daylighting and electric lighting.

Task Lighting

Consider hardwiring the lower output level of a two-stepped T8 electronic ballast (Ballast Factor 0.40 to 0.50) for under cabinet lighting, since full output is too bright and wastes energy. Use "articulated" task lights (i.e. adjustable in three planes by the worker) with compact fluorescent sources for desktops. Provide local switches on task lighting, or connect them to specialized plugstrips controlled by local occupancy sensors.

Reflectances

A 90% ceiling reflectance is preferred for indirect luminaires and daylighting. Reflectance values are available from paint and fabric manufacturers. Reflectances should be verified by the quality assurance provider. Avoid shiny surfaces (mirrors, polished metals, or stone) in work areas.

Lamps and Ballasts

To achieve the maximum 0.9 W/ft2 connected load recommended in chapter 3, "high performance" T8 lamps and instant start ballasts were assumed. High-performance T8 lamps are defined, for the purpose of this document, as having a lamp/ballast efficacy of 92 lumens per watt, based on "mean lumens" (published in the lamp catalogs as the degraded lumen output occurring at 40% of the lamp"s rated life) and the input watts of a very efficient two-lamp parallel Instant Start electronic ballast.

High performance T8 lamps (initial lumens 3100, CRI 85, lumen maintenance 92%, extended rated life 24,000 hours) and program start two-lamp ballasts (ballast factor 0.88, input watts 62) were assumed, to achieve the 0.9 w/sf recommendation. High performance T8 lamps are brighter than standard T8"s so a ballast with a BF of .77 may be used to provide a more comfortable lamp brightness above workers without sacrificing efficiency. Program Start ballasts are recommended on frequently switched lamps like those controlled by occupancy sensors because they greatly extend lamp life over Instant Start Ballasts. Instant Start T8 ballasts typically provide greater energy savings and are the least costly option, but will reduce lamp life when controlled by occupancy sensors. If Instant Start (IS) ballasts are used, use "efficient IS" ballasts with a maximum of 55 watts at a Ballast Factor of at least 0.87 (on a two-lamp ballast). This can provide up to a 7.5% additional savings in the connected load for lighting. T5 ballasts should always be Program Start.

Occupancy Sensors

The greatest energy savings are achieved with manual on, automatic off occupancy sensors in daylit spaces. In open plan offices, ceiling mounted ultrasonic sensors connected to an automatic or momentary contact switch, so that the operation always reverts to manual on, after either manual or automatic turn-off. Automatic time scheduling is an alternate to occupancy sensors in open plan offices. In private offices, infra-red wall box sensors should be pre-set for manual-on automatic off operation. In non-daylit areas, ceiling mounted occupancy sensors are preferred. The occupant should not be able to override the settings. Unless otherwise recommended, factory-set occupancy sensors for medium to high sensitivity, and a 15 minute time delay. Work with the manufacturer for proper placement, especially when partial-height partitions are present.

Multi-Level Switching

Consider going beyond the minimum control requirements of local codes or Standard 90.1, by providing more discrete levels of switching controls. Label all switches. Specify luminaries with multiple lamps to be factory wired for inboard-outboard switching or inline switching. The objective is to have each level of light uniformly distributed. Avoid checkerboard patterns. Avoid non-uniform switching patterns, unless different areas of a large space are used at different times.

Electric Lighting and Daylight Controls

Factory-setting of calibrations should be specified when feasible to avoid field labor. Lighting calibration and commissioning should be performed after furniture installation but prior to occupancy to ensure user acceptance.

Exit Signs

Use LED exit signs or other sources that consume no more than 5 watts per face. The selected exit sign and source should provide the proper luminance to meet all building and fire code requirements.

Fluorescent T5 Sources

T5HO and T5 may be part of a solution. They have initial lumens per watt which compare favorable to the "high performance" T8. However, when evaluating the lamp and ballast at the mean lumens of the lamps, T5HO performs much more poorly. On instant start ballasts, high performance T8 is significantly more efficient than T5"s. In addition, since T5"s have higher surface brightness and should not be used in open-bottom fixtures, it may be difficult to achieve the 30% savings and maintain the desired light levels using current T5 technology as the primary light source.

Light Fixture Distribution

Recessed direct fixtures may meet the watts per square foot allowance and the illuminance recommendations for offices, but they do not provide the same quality of light as pendant direct-indirect lighting fixtures. Extensive use of totally indirect luminaires or recessed direct-indirect (coffer-type) fixtures may not achieve the desired light levels while meeting the 0.9 W/ft2 goal.