

LED Application Series:

Portable Desk/Task Lighting

Portable desk and task lighting is a promising general illumination application for white LEDs. The small size and directionality of LEDs make a variety of innovative task light designs possible. This fact sheet describes the desk/task lighting application and compares the energy performance of some available LED desk/task luminaires to fixtures using traditional light sources.

Desk/task lighting is needed for home offices as well as commercial office spaces. The purpose of this type of lighting is typically to supplement ambient room lighting (from overhead fixtures, torchieres, or daylight) by providing a higher level of illuminance in a relatively small task area. The desktop active workspace is typically about 14 inches wide by 12 inches, enough to accommodate common paper sizes.

Key performance attributes desirable for portable desk/task lighting include even, shadow-free light distribution over the full task area, adjustability of the fixture to direct light to the desired location, and appropriate fixture design to eliminate glare for the user. Good color rendering is important and may be critical for tasks involving color matching or evaluation.

Portable desk/task luminaires are typically lamped with standard or halogen incandescent, or compact fluorescent lamps (CFLs). Luminaires are usually designed to direct light in a 0-60 degree cone; some are designed for an asymmetrical distribution, to illuminate the task instead of the fixture base, and to avoid reflected glare from the light source. With incandescent or halogen lamping, infrared radiation (heat) from the light source can be noticeable because of the proximity of the lamp to the task and the user.

A number of LED-based portable desk/task luminaires are on the market now. How do they compare to similar fixtures using traditional light sources? US DOE tests commercially-available fixtures to verify their wattage, total luminous flux, CCT and CRI. The table below summarizes the results compared to halogen and CFL-based portable desk/task fixtures. The three LED luminaires cited below measured more efficacious than halogen, but not as efficacious as an ENERGY STAR CFL task lamp tested for benchmarking purposes. LED technology continues to change quickly and new products appear frequently. The test results show performance varies widely and cannot be generalized. Products must be evaluated on an individual basis to check color quality, light output, and energy-efficiency.



Photo credit:
Office Details, Inc.

Comparison of Portable Desk/Task Lamps

	Halogen*	Non-ES CFL*	ES-CFL*	LED 1*	LED 2*	LED 3*
CCT	2856K	3432K	2891K	4390K	6255K	3631K
CRI	100	79	81	88	74	71
Luminaire Lumens	351	236	700	148	301	430
Luminaire Watts	38	10	16	10	11	10
Luminaire Efficacy (lm/W)	9	24	43	16	27	42

ES - ENERGY STAR qualified

* Based on photometric testing of halogen, CFL and LED portable desk/task luminaires Jun 2007 through Feb 2008.



Photo credit: Finelite, Inc.

Terms

Luminaire – a complete lighting unit consisting of a lamp or lamps and ballast(s) or driver(s) (when applicable) together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

Portable desk/task luminaire – Self-contained luminaire designed to direct light primarily downward onto a task surface; include a plug and outlet connection to electric power and usually contain integral switching and/or dimming. In this context, the term “portable” does not refer to handheld or battery-operated lighting devices.

Luminaire efficacy – total lumens emitted by the luminaire divided by total wattage of the fixture. Includes energy used by the light source and all electronics, controls, power supplies, and drivers included in the luminaire.

CCT – Correlated color temperature indicates the relative color appearance of a white light source, from yellowish-white or “warm” (2700-3000 K) to bluish-white or “cool” (5000 K).

CRI – Color rendering index is a measure of the ability of a light source to render colors, compared to a reference source (incandescent or daylight), on a scale of 0 to 100, with 100 being identical to the reference source.

Evaluating Currently Available LED Portable Desk/Task Luminaires

The quality of currently available LED desk/task luminaires varies. At this early stage of LED product development, it is worth evaluating products carefully before purchasing, to avoid some common problems. Design features to look for include the following:

- The luminaire should be designed to move heat away from the backs of the LEDs. How can you tell? Some things to look for: luminaire housing comprised of metal (thermally-conductive) material; metal “fins” to increase the surface area for dissipating heat; evidence that heat is moving from the LEDs to adjacent areas of the luminaire (i.e., these areas feel warm). If possible, turn on the luminaire, allow it to warm up for several minutes, and observe whether there is any change in light output or color.
- The color appearance of the light should be uniform, without color variations across the beam pattern. Some LED products exhibit noticeable color differences at the center and/or outside edges of the beam.
- The light distribution should adequately cover the full task surface. Some LED fixtures on the market provide only a small pool or narrow band of light, making them unsuitable for reading.
- The luminaire should provide appropriate shielding to avoid glare for the user when the lamp is positioned for reading or handiwork.
- The luminaire should take advantage of the directional nature of LEDs to efficiently light the intended surface without wasting light inside the fixture.
- The LEDs should be arranged to minimize shadowing of objects between the light source and illuminated surface. Check for shadows, especially on monochromatic matte finish surfaces.
- The luminaire should be designed to avoid off-state power consumption by placing the switch “upstream” of the power supply (see below).

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Off-State Power: a Drain on Resources

Most portable desk/task lighting fixtures have a problem that is not immediately obvious: they continue drawing power even when turned off. This is possible for all fixtures that use a power supply and also have an on-off and/or dimming switch located “downstream” of the power supply, such as a switch on the base of the fixture. LED fixtures tested by US DOE to date have measured off-state power use of 0.5 watt to 2.5 watts. What is the impact on the energy efficiency of the fixture? As an example, consider an LED fixture with luminaire efficacy of 18 lm/W and measured off-state power of 2 W. The “effective” efficacy of the fixture, assuming 3 hours per day average use drops to 9 lm/W. Designing the fixture so that the switch is between the plug and the power supply will ensure that when the fixture is turned off, it’s really off.

