

BETTER BUILDINGS HIGH EFFICIENCY TROFFER LIGHTING

**Better Buildings Alliance High Efficiency Troffer Lighting Specification**

The U.S. Department of Energy's (DOE) Better Building Alliance (BBA or the Alliance) is driven and managed by key industry partners whose goal is to transform the energy efficiency of commercial buildings. Members of the BBA troffer lighting team are working to support the increased use of high-efficiency lighting troffers that are reliable, energy efficient, and competitively priced. With half of all commercial fluorescent lighting fixtures comprised of recessed troffers, the BBA specification provides commercial building stakeholders guidance for taking advantage of opportunities to save energy and money by upgrading to high-efficiency fluorescent or LED technology.

On February 15, 2012, DOE released the BBA High-Efficiency Troffer Lighting Specification (version 3.0) which sets performance requirements for high-efficiency LED and fluorescent troffer products in the 1x4, 2X2, and 2X4 configurations. Lighting troffers are recessed ceiling fixtures that commonly use lower efficiency fluorescent technology. Their trough-like shape and downward-facing placement allow light to be distributed evenly and widely.

The BBA specifications can be found at [www1.eere.energy.gov/buildings/alliances/technologies.html](http://www1.eere.energy.gov/buildings/alliances/technologies.html)

**Energy Savings and Other Benefits**

High efficiency troffers that meet the specification are up to 45% more efficient on a one-for-one basis compared to traditional fluorescent troffers. Savings can reach 75% if integrated with dimming, occupant, or daylight controls (See Table 1).<sup>1</sup> For the average commercial building, these energy savings from high efficiency troffers can translate into utility bill savings of up to 12% without controls and up to 20% with controls.<sup>2</sup> Maintenance costs are reduced on top of energy bill savings because they need less frequent lamp replacements.

**Table 1. Average One-for-One Energy Savings by Troffer Configuration**

Configuration	Troffer Upgrade	With Controls (e.g. dimmers)
1X4	15-45%	Up to 75%
2X2	20-25%	Up to 55%
2X4	15-45%	Up to 75%

The high efficiency troffer specification is lighting technology neutral, and the right choice of technology is dependent on a number of different factors. LED technology is rapidly improving, but facility managers should consider both fluorescent and LED technologies noted in Table 2.

**Table 2. Features of Fluorescent and LED Technologies**

Feature	LED	Fluorescent
Light Output and Product Lifetime	Expected life of over 50,000 hours. Higher temperatures reduce product life and must be considered in system design and in maintenance of light levels over time.	Expected life of 24,000 to 52,000 hours. T5 bulbs have some temperature-related limitations that reduce product lifetime.
Costs	Higher initial cost, but lower energy and maintenance costs.	Currently lower initial cost (this may change in the future due to the rising costs of rare metals used to manufacture lamps).
Dimming and Occupancy Controls	Dimming ability is not automatic, thus driver and dimming electronics must be matched to allow for dimming.	Dimming requires specialized ballasts that use more energy at full power than a non-dimming ballast. Using occupancy-based controls with instant-start ballasts can reduce lamp life.
Design Flexibility	Low-profile design allows new building design to maximize floor space.	The lamp ballast system is more flexible and allows for more options in design.
Durability and Disposal	No mercury contained in the product. Less fragile and therefore less prone to breakage.	Small amount of mercury contained in each lamp.

<sup>1</sup> Savings based on the characteristics of troffers that are currently installed across the commercial building stock

<sup>2</sup> Average savings based on comparison to DOE Commercial Reference Buildings, Small Office ([http://en.openei.org/wiki/Commercial\\_Reference\\_Buildings](http://en.openei.org/wiki/Commercial_Reference_Buildings)). Actual savings will vary according to the percentage of energy used by lighting troffers in a specific building

## Troffer Specification Use

Whether constructing a new property, conducting a major retrofit, or simply replacing inefficient fixtures, you can maximize the efficiency of your indoor lighting by installing troffers that meet BBA specifications. You are encouraged to follow the steps below to identify troffers that comply with the specification.

**Step 1. Download the full BBA troffer specification at** <http://www1.eere.energy.gov/buildings/alliances/technologies.html>

### Step 2. Select LED or fluorescent lighting troffers

The specification provides criteria for both fluorescent and LED technologies. Some fluorescent and LED luminaires available on the market will meet the specifications, but the technologies have inherent traits that make one better-suited than the other depending on the application. Consider the features listed in the Table 2 when deciding between technologies.

### Step 3. Find products that meet the specification

To find high-efficiency LED and fluorescent products, refer to the following organizations for a list of qualifying products:

- ▶ **DesignLights Consortium** – Provides a qualified products list of high-efficiency LED lighting luminaires at [http://www.designlights.org/solidstate.about.QualifiedProductsList\\_Publicv2.php](http://www.designlights.org/solidstate.about.QualifiedProductsList_Publicv2.php)
- ▶ **Consortium for Energy Efficiency (CEE)** – Provides a database of high performance T8 fluorescent lamps and ballasts at <http://www.cee1.org/com/com-lt/com-lt-main.php3>
- ▶ **National Electrical Manufacturer’s Association (NEMA)** – Provides a list of premium ballasts to be used with T8 fluorescent bulbs at <http://www.nema.org/Products/Pages/NEMA-Premium-Lighting-Programs.aspx>



The BBA high efficiency troffer specification saves commercial buildings energy and money because it is up to 45% more efficient than traditional fluorescent models.

These lists are separate from the BBA specifications, but provide a starting point for identifying high-efficiency lighting products. Review these lists and search for products that meet the basic BBA specification requirements for light output, efficacy, and spacing criteria. There will be products on the lists that do not comply, so pay close attention to the BBA requirements.

**Step 4. Conduct analysis of energy savings using the Commercial Lighting Solutions Application at** <https://www.lightingsolutions.energy.gov/comlighting/login.htm>

The Commercial Lighting Solutions Application allows you to estimate the energy usage of the lighting in your existing building. Then compare this usage to the proposed installation with your new high-efficiency troffer and see the impact on your energy savings. The tool can also determine your eligibility in receiving the 179D Federal Energy Tax Deduction.

## Key Specification Requirements

When selecting a high-efficiency troffer, refer to the key specification performance requirements in Table 3.

**Table 3. Key BBA Lighting Troffer Specification Performance Requirements**

Configuration	Minimum Initial Luminaire Light Output (lumens)*		Minimum Luminaire Efficacy (lm/W)**	Spacing Criteria***	
	LED	Fluorescent		0 180 plane (along)	90° 270° plane (across)
1X4	2,000	1,800	74	1.05-1.40	1.15-1.80
2X2	3,000	2,700	69		1.10-1.70
2X4	4,000	3,600	74		1.15-1.80

\* Differing values are due to the greater ability of fluorescent lamps to maintain light output over time (high lumen maintenance)

\*\* Measured according to IESNA LM-79-2008 (LED) or LM-41-1998 (fluorescent)

\*\*\* Spacing criteria is the ratio of fixture spacing to mounting height and establishes the point at which uniform illumination occurs between fixtures at a given mounting height

For more information, contact Linda Sandahl, Pacific Northwest National Laboratory, at [linda.sandahl@pnnl.gov](mailto:linda.sandahl@pnnl.gov).