

## BBA High-Efficiency Troffer Lighting Specification

The U.S. Department of Energy's (DOE) Better Buildings Alliance (BBA) 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.

DOE's BBA Project Teams are focusing on reducing commercial building energy costs and consumption by working with a host of industry suppliers, including appliance, heating, cooling, and lighting manufacturers, to meet members' energy-efficiency needs. One area in particular that offers immediate returns is lighting. To date, the BBA Lighting Project Team has developed specifications for light-emitting diode (LED) site (i.e., parking lot) lighting, high-efficiency parking structure lighting, and LED refrigerated case display lighting, high-efficiency troffer lighting (see [https://www1.eere.energy.gov/buildings/commercial/bba\\_lighting\\_team.html](https://www1.eere.energy.gov/buildings/commercial/bba_lighting_team.html)).

In 2011, a BBA Project Team working to support the market introduction of high-efficiency troffers developed a specification that allowed for high-efficiency LED and fluorescent technologies, and addressed the 2'x2' category of troffer products. On February 15, 2012, Version 3.0 of the specification was released, expanding the specification to address 1'x4' and 2'x4' product configurations, which are also prominent applications in commercial buildings. In fact, 50% of all commercial fluorescent lighting fixtures are recessed troffers in 1'x4', 2'x2' and 2'x4' configurations and in operation more than 10 hours a day on average and collectively consuming more than 87 terawatt-hours of electricity annually. Potential savings from applying the specification range from 15–45% on a one-for-one basis and up to 75% with the use of controls. If all commercial troffers were upgraded today according to the specification, we could save 26 TWh of electricity annually.

### DOE Support

DOE provides technical assistance in support of this specification project, including:

- Product performance testing
- Product demonstration technical support
- Analysis of energy cost savings



Lithonia Lighting T Series fixture is a high-quality, general-purpose 2'x2' troffer luminaire.

- Analysis/quantification of maintenance cost savings
- Investigations into life measurements and other performance indicators
- Development and maintenance of the BBA product performance specification
- Technology specification technical assistance

The specification can be found at [https://www1.eere.energy.gov/buildings/commercial/bba\\_troffer\\_spec.html](https://www1.eere.energy.gov/buildings/commercial/bba_troffer_spec.html).

### BBA Member Opportunities and Benefits

There are several ways BBA members can get involved in this effort: identifying candidate products, reviewing product laboratory testing, conducting field demonstrations, evaluating candidate products, and installing these products in their facilities. Interested BBA members benefit from their participation in a variety of ways, including being better informed of the potential of high-efficiency troffers (from DOE research and reports from other members), and being among the first to hear about new and promising technologies, to participating in demonstration projects and purchasing products that meet the specification requirements.

## Project Next Steps

- Completing field assessments hosted by BBA members
- Sharing field performance experiences among BBA members and the larger commercial buildings community
- Purchasing and installing troffer lighting products that meet the specification requirements

## Energy Savings

If designed and installed properly, high-efficiency troffers that meet the specification can derive energy savings of 15–45% on a one-for-one basis compared to traditional fluorescent

troffers, and up to 75% if integrated with dimming, occupant, or daylight controls. In addition to the direct energy cost savings, maintenance costs are reduced because of the need for fewer and less frequent lamp replacements. For the benefits of high-efficiency troffers, see Table 1.

## Technical Specification

BBA Troffer Lighting Team members have developed a specification for 1'x4', 2'x2' and 2'x4' troffers. Key performance parameters of the specification can be found in Table 2. See [https://www1.eere.energy.gov/buildings/commercial/bba\\_troffer\\_spec.html](https://www1.eere.energy.gov/buildings/commercial/bba_troffer_spec.html) for the specification.

**Table 1. Benefits of High-Efficiency Troffers, as Defined in the BBA Specification**

| Product Feature               | LED   | Fluorescent  |
|-------------------------------|---|--|
| Efficacy                      | Less wattage is required to produce equivalent light levels.  |  |
| Controls                      | Inherently dimmable but compatibility should be verified prior to commitment.                         | Dimmable when mated with a dimming ballast and associated controls.                                      |
| Environmental Impact          | Contains no mercury.  | Contains a very limited amount of mercury (less than the amount allowed in fish). Some lead in glass.    |
| Longer Life/Lumen Maintenance | Expected long life of 50,000+ hours, but actual end-of-life performance is not completely understood. | Expected life of 24,000 to 52,000 hours. Actual value depends on ballast plus lamp pairing and controls. |

**Table 2. Performance Parameters of the BBA High-Efficiency Troffer Specification**

| Performance Attribute   | Specification  | Notes  |                |             |     |   |      |     |      |      |     |      |      |  |
|---|--|--|----------------|-------------|-----|---|------|-----|------|------|-----|------|------|--|
| Minimum Initial Luminaire Light Output (lumens)   | <table border="1"> <thead> <tr> <th></th> <th>LED</th> <th>Fluorescent</th> </tr> </thead> <tbody> <tr> <td>1x4</td> <td>1500</td> <td>1300</td> </tr> <tr> <td>2x2</td> <td>2000</td> <td>1800</td> </tr> <tr> <td>2x4</td> <td>3000</td> <td>2800</td> </tr> </tbody> </table> |  | LED            | Fluorescent | 1x4 | 1500  | 1300 | 2x2 | 2000 | 1800 | 2x4 | 3000 | 2800 | Differing initial values are due to the high lumen maintenance of fluorescent lamps. |
|   |  | LED  | Fluorescent    |             |     |   |      |     |      |      |     |      |      |  |
|   | 1x4  | 1500   | 1300           |             |     |   |      |     |      |      |     |      |      |  |
|   | 2x2  | 2000   | 1800           |             |     |   |      |     |      |      |     |      |      |  |
| 2x4   | 3000   | 2800   |                |             |     |   |      |     |      |      |     |      |      |  |
| Minimum Luminaire Efficacy (LE) (for LED) or Luminaire Efficacy Rating (LER) (for Fluorescent) (lm/W) | 85 lm/W  | Measured according to IESNA LM-79-2008 (LED) or LM-41-1998 (Fluorescent).  |                |             |     |   |      |     |      |      |     |      |      |  |
| Minimum Lumen Maintenance/ Rated Lamp Life  | For LED-based luminaires— $L_{70} \geq 50,000$ hours<br>For Fluorescent-based luminaires—Rated lamp life $\geq 30,000$ hours   | For LED-based luminaires—Based upon $L_{70}$ based upon IESNA LM-80, In-situ Temperature Measurement Test (ISTMT) and IESNA TM-21.<br>For Fluorescent-based luminaires—Rated lamp life based upon rapid-start ballasts with 12-hour operating cycles.  |                |             |     |   |      |     |      |      |     |      |      |  |
| Spacing Criteria (SC)   | <table border="1"> <thead> <tr> <th>0°–180° Plane</th> <th>90°–270° Plane</th> </tr> </thead> <tbody> <tr> <td colspan="2">1.0–2.0</td> </tr> </tbody> </table>  | 0°–180° Plane  | 90°–270° Plane | 1.0–2.0     |     | 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. |      |     |      |      |     |      |      |  |
| 0°–180° Plane   | 90°–270° Plane   |  |                |             |     |   |      |     |      |      |     |      |      |  |
| 1.0–2.0   |  |  |                |             |     |   |      |     |      |      |     |      |      |  |
| Correlated Color Temperature (CCT)  | 2700K<br>3000K<br>3500K<br>4000/4100K<br>4500K (LED only)<br>5000K   | <u>Nominal CCTs and tolerances as defined by:</u><br>For LED-based luminaires—ANSI/NEMA/ANSI C78.377-2008 “Specifications for the Chromaticity of Solid State Lighting Products.”<br>For Fluorescent-based luminaires—ANSI/NEMA/ANSI C78.376-2001 “Specifications for the Chromaticity of Fluorescent Lamps.”<br>Chromaticity tolerances defined by ANSI C78.376 correspond to a 4-step MacAdam ellipse and ANSI C78.377 corresponds to a 7-step MacAdam ellipse (approximated in the case of C78.377). In addition to the nominal CCTs defined for fluorescent sources, SSL products add a 4500K nominal CCT. |                |             |     |   |      |     |      |      |     |      |      |  |
| Minimum Color Rendering Index (CRI)   | $R_a \geq 80$ and $R_g > 0$  | Equivalent to “800” series fluorescent lamps.  |                |             |     |   |      |     |      |      |     |      |      |  |
| Minimum Warranty  | 3 years  |  |                |             |     |   |      |     |      |      |     |      |      |  |