Technical Requirements: Version 4.2
T5/T5HO Linear Replacement Lamps
Hazardous Location Lighting Allowances

May 3, 2017
Notes

• Slides will be posted on www.designlights.org after presentation

• Please use GoToWebinar Interface (Question pane) to submit questions during today’s webinar

• Repeat of this webinar will be held 5/3 at 2PM ET

• Webinar is being recorded

• Send any additional questions or comments to info@designlights.org
Agenda

• Specification Development Overview
  – Prioritization and Stakeholder Input Process

• Final V4.2 Technical Requirements
  – T5/T5HO Replacement Lamps
  – Hazardous Location Lighting
  – CRI and CCT Allowances

• Multiple LED Policy Correction

• Additional Efforts Under Development
Specification
Development Overview
General DLC Development Process

**DLC Aggregates Requests/Suggestions for Development**
- Maintain "wish lists"
- Spec Development (new primary uses)
- Spec Revision (new performance thresholds)
- Policy Development
- Policy Revision

**Prioritize Wish Lists Periodically**
- Active review with DLC Technical Committee
- Surveys of entire DLC Membership

**Prioritized Tasks Undertaken for Development**
- Any new spec development or program change goes through Stakeholder Input Process
General DLC Development Process

1. Prioritized Category evaluated, researched.
2. Draft requirements presented to Technical Committee; adjustments made based on feedback.
4. Commenters call held to discuss feedback received.
5. Stakeholder input summarized and discussed with TC.
6. Revisions made based on Stakeholder and TC input.
7. New Policy Released!

Iterative as needed
Linear Replacement Lamps
New TLED Replacements Background

• Existing TLED General Applications were developed with T8 fluorescent replacements in mind
  – No explicit rules regarding form-factor of TLEDs seeking qualification
  – Implicit restrictions: testing requirements are T8 specific (reference troffer, reference ballast for UL Type A)

• Discovery of “loopholes” to qualify TLED T5 and T5HOs
  – T5 versions of reference troffers
  – Claims of UL Type A T5 replacements being tested on Instant-Start ballasts

• Technical requirements and incentive measure confusion
  – T5HOs necessitate different technical requirements than T8s
  – Utility incentive offerings are different for T8s, T5, and T5HOs
New TLED Replacements Summary

• In addition to T8, covers both T5 and T5HO, addressing each distinctly

• Generally, have taken two potential approaches to lamps:
  – Similar to T8, CFLEDs: General Approach, limited testing
  – Similar to Mogul-Base lamps: Specific approach, test in each appropriate category distinctly

• New Requirements for T5s:
  – Similar baseline to T8s, similar approach to T8s (i.e., test in troffers)

• New Requirements for T5HOs:
  – Similar approach to T8s (i.e., test in high bays), distinct baseline
Eligibility, Marketing, and Testing

**T8**
- G13 Base
  - Nominal 48” length
- Replacement lamps for G13 Base, 48” fluorescent lamps, excluding UL Type A T12
- Testing in reference troffer
  - 0.88 BF Instant-Start ballast

**T5**
- G5 Base
  - Nominal 46” length
- Replacement lamps for T5 fluorescent lamps
- Testing in reference troffer
  - Normal (1.0) BF Programmed-Start Ballast

**T5HO**
- G5 Base
  - Nominal 46” length
- Replacement lamps for T5HO fluorescent lamps
- Testing in reference high bay
  - Normal (1.0) BF Programmed-Start Ballast
<table>
<thead>
<tr>
<th>#</th>
<th>Category</th>
<th>General Application</th>
<th>Minimum Light Output (lm)</th>
<th>DLC Standard</th>
<th>Requirements</th>
<th>Primary Use</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>TB Four-Foot Linear Replacement Lamps</td>
<td>In luminaire: 2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000 Bare lamp: 1,600</td>
<td>In luminaire: 100 Bare lamp: 110</td>
<td>5</td>
<td>≤500 / ≥89 / ≥50,000</td>
<td>Replacement Lamps (&quot;Plug and Play&quot;) (UL Type A) Internal Driver/Line Voltage Lamp-Style Retrofit Kits (UL Type B) 2-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 3-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 4-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) Dual Mode Internal Driver (UL Type A or B)</td>
<td>See Primary Use Zonal Lumen Density Requirements in Table 4, below</td>
</tr>
<tr>
<td>18</td>
<td>T5 Four-Foot Linear Replacement Lamps</td>
<td>In luminaire: 2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000 Bare lamp: 1,600</td>
<td>In luminaire: 100 Bare lamp: 110</td>
<td>5</td>
<td>≤500 / ≥89 / ≥50,000</td>
<td>Replacement Lamps (&quot;Plug and Play&quot;) (UL Type A) Internal Driver/Line Voltage Lamp-Style Retrofit Kits (UL Type B) 2-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 3-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 4-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) Dual Mode Internal Driver (UL Type A or B)</td>
<td>See Primary Use Zonal Lumen Density Requirements in Table 4, below</td>
</tr>
<tr>
<td>19</td>
<td>Linear Replacement Lamp</td>
<td>In luminaire: 3 lamps: 7,500 4 lamps: 10,000 6 lamps: 15,000 Bare lamp: 3,000</td>
<td>In luminaire: 105 Bare lamp: 110</td>
<td>5</td>
<td>≤500 / ≥89 / ≥50,000</td>
<td>Replacement Lamps (&quot;Plug and Play&quot;) (UL Type A) Internal Driver/Line Voltage Lamp-Style Retrofit Kits (UL Type B) 3-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 4-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 6-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) Dual Mode Internal Driver (UL Type A or B)</td>
<td>See Primary Use Zonal Lumen Density Requirements in Table 4, below</td>
</tr>
<tr>
<td>20</td>
<td>TB Two-Foot Linear Replacement Lamps</td>
<td>In luminaire: 2 lamps: 1,350 3 lamps: 2,000 4 lamps: 2,700 Bare lamp: 800</td>
<td>In luminaire: 100 Bare lamp: 110</td>
<td>5</td>
<td>≤500 / ≥89 / ≥50,000</td>
<td>Replacement Lamps (&quot;Plug and Play&quot;) (UL Type A) Internal Driver/Line Voltage Lamp-Style Retrofit Kits (UL Type B) 2-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 3-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) 4-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) Dual Mode Internal Driver (UL Type A or B)</td>
<td>See Primary Use Zonal Lumen Density Requirements in Table 4, below</td>
</tr>
</tbody>
</table>
# Lamp-Level Criteria: T5/T5HO

<table>
<thead>
<tr>
<th>Individual Lamp Criteria</th>
<th>Four-Foot Lamps, T8 replacements</th>
<th>Two-Foot Lamps, T8 replacements</th>
<th>U-bend Lamps, T8 replacements</th>
<th>Four-Foot Lamps, T5 replacements</th>
<th>Four-Foot Lamps, T5HO replacements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Efficacy</strong></td>
<td>≥ 110 lm/W</td>
<td>≥ 110 lm/W</td>
<td>≥ 110 lm/W</td>
<td>≥ 110 lm/W</td>
<td>≥ 110 lm/W</td>
</tr>
<tr>
<td><strong>Initial Light Output</strong></td>
<td>≥ 1,600 lm</td>
<td>≥ 800 lm</td>
<td>≥ 1,400 lm</td>
<td>≥ 1,600 lm</td>
<td>≥ 3,200 lm</td>
</tr>
<tr>
<td><strong>Correlated Color Temp. (CCT)</strong></td>
<td>≤ 5000K</td>
<td>≤ 5000K</td>
<td>≤ 5000K</td>
<td>≤ 5000K</td>
<td>≤ 5000K</td>
</tr>
<tr>
<td><strong>Color Rendering Index (CRI)</strong></td>
<td>≥ 80</td>
<td>≥ 80</td>
<td>≥ 80</td>
<td>≥ 80</td>
<td>≥ 80</td>
</tr>
<tr>
<td><strong>Power Factor</strong></td>
<td>≥ 0.90</td>
<td>≥ 0.90</td>
<td>≥ 0.90</td>
<td>≥ 0.90</td>
<td>≥ 0.90</td>
</tr>
<tr>
<td><strong>Total Harmonic Distortion</strong></td>
<td>≤ 20%</td>
<td>≤ 20%</td>
<td>≤ 20%</td>
<td>≤ 20%</td>
<td>≤ 20%</td>
</tr>
<tr>
<td><strong>Warranty</strong></td>
<td>≥ 5 Years</td>
<td>≥ 5 Years</td>
<td>≥ 5 Years</td>
<td>≥ 5 Years</td>
<td>≥ 5 Years</td>
</tr>
</tbody>
</table>
## In-Situ Criteria: T5/T5HO

<table>
<thead>
<tr>
<th>In-situ Lamp Criteria</th>
<th>Four-Foot Linear T8 and T5 Replacement Lamps</th>
<th>Four-Foot Linear T5HO Replacement Lamps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Luminaire Efficacy</strong></td>
<td>≥ 100 lm/W</td>
<td>≥ 105 lm/W</td>
</tr>
</tbody>
</table>
| **Minimum Initial Luminaire Light Output** | 2 lamps installed = 3,000 lm  
3 lamps installed = 4,500 lm  
4 lamps installed = 6,000 lm | 3 lamps installed = 7,500 lm  
4 lamps installed = 10,000 lm  
6 lamps installed = 15,000 lm |
| **Spacing Criteria** | **Spacing Criteria:**  
0-180° = 1.0 - 2.0  
90-270° = 1.0 - 2.0  
Zonal Lumen Distribution:  
0-60°: ≥ 75% | **Zonal Lumen Distribution:**  
20-50°: ≥ 30% |
| **Lumen Maintenance L_{70}** | 50,000 hours | 50,000 hours |
Spec Sheet and Marketing Claim Requirements

• Marketing material shall indicate the **lamp type** (i.e., T8, T5, T5HO, or other) and **length** (i.e., 46” or 48”) the product is intended to replace
  – For example: “This product is intended to replace T5 fluorescent lamps with a nominal length of 46 inches.”

• **Not eligible:**
  – Products of different lengths and bases
  – Products intended to replace **UL Type A T12** fluorescent lamps
  – Products that can operate off magnetic ballasts

• Manufacturers of products that were previously qualified in the “four-foot” General Application that do not meet these new requirements will need to submit update applications to maintain their listings
How to update products

1. Download from the QPL the list of products you’d like to update
2. Create a new application under the apps.designlights.org application portal
3. Identify the application being submitted as an “Update” application in the application type and the description sections
4. Upload the additional application documents, including application form as described in the application page as appropriate for the type of group you are seeking to update
5. Upload to the application the downloaded list of products you are seeking to update
6. Hit submit
Hazardous Location Lighting
Hazardous Location Lighting Background

• With development of “Specialty” Primary Use Designation, DLC seeing increased requests for “Hazardous” descriptors
  – Appears to be driven by product marketing, rather than performance

• Challenge:
  – Previously, no specific policies governing the qualification of “Hazardous” location products
  – If DLC used as marketing tool, concern about expectation that DLC is verifying that products are appropriate for hazardous location use

• DLC sought initial comment and proposals under V4.1 comment period

• Consensus around requiring UL 844 testing and certification
  – UL 844: Standard for Luminaires for Use in Hazardous (Classified) Locations
Hazardous Location Lighting Policy
Summary

• Products submitted under the Specialty Use Designation with the descriptor “Hazardous” must provide documentation to demonstrate the appropriateness of the product for Hazardous Locations.

• Products seeking qualification must provide the Certification of Compliance, Notice of Authorization to Mark, or lab-specific directory listing from an applicable safety organization, explicitly stating that the model numbers in question are certified to the UL844 standard and including the Class and Division to which the products are certified.
How to update products

1. Download from the QPL the list of products you’d like to update
2. Create a new application under the apps.designlights.org application portal
3. Identify the application being submitted as an “Update” application in the application type and the description sections
4. Upload the safety certification documentation as specified in the policy, as well as the downloaded list of products you are seeking to update
5. Hit submit
Timeline
V4.2 Transition Timeline

• Manufacturers may submit under the V4.2 requirements immediately

• Two grace periods available for manufacturers to submit and update their listings
  – **Submission Grace Period**: Manufacturers can submit under V4.1 requirements until **May 19, 2017**
  – **Update Grace Period**: Products that do not meet V4.2 requirements must be updated by **July 28, 2017** to remain listed

• All products not meeting V4.2 requirements on **July 28, 2017** will be delisted

• DLC will conduct two rounds of individual communication to affected manufacturers, in mid-May and mid-June
V4.2 Implementation Timeline

April 28
- V4.2 Released
- Submissions under V4.2 accepted
- Submissions under V4.1 accepted

May 19
- Submission Grace Period Ends
- All new submissions MUST meet V4.2

July 28
- Update Grace Period Ends
- All listed products MUST meet V4.2
Allowances
Allowances: Background and Motivation

• Effort grew out of conversations and following V4.0 steep efficacy increase

• Efficacy levels set at General Application, mismatched effects on Primary Uses due to unique considerations
  - e.g., optical/distribution needs

• Technical Challenges in meeting proposed levels for specific types of products
  - “Architectural” Indoor products,
  - “Historical/Decorative” Outdoor Products,
  - High CRI/Low CCT products
  - Products with particular Optical Qualities
Efficacy: Special Cases

• Sensitive to feedback about impact on specific product types
  – No desire to exclude high-quality products from QPL
  – Don’t want to drive poor optics, high CCTs, or other effects

• Challenge: difficult to define “quality” parameters

• Challenge: lowering requirements for a whole category to accommodate specific product types allows more products to qualify that don’t have the features we are trying to accommodate
  – How do we isolate just those products we need to accommodate?

• Challenge: creating additional categories is administratively burdensome
  – Any approach requires rigor to isolate specific products/features (as above)
# Adopted Allowances

<table>
<thead>
<tr>
<th>Feature or Performance Metric</th>
<th>Allowance to Efficacy Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCT: ≤3000K, &gt;2700K</td>
<td>-3%</td>
</tr>
<tr>
<td>CCT: ≤2700K</td>
<td>-5%</td>
</tr>
<tr>
<td>CRI*: ( R_a \geq 90 )</td>
<td>-5%</td>
</tr>
<tr>
<td>(*must also conduct TM-30 testing and report results per the TM-30 policies)</td>
<td></td>
</tr>
</tbody>
</table>

- Allowances are **not cumulative**. Products may not take multiple allowances, even if they meet more than one of these features:
  - A product that has CCT of 2700K and has 90 CRI will only receive one 5% allowance
  - However, a product may take advantage of an efficacy allowance **in conjunction** with the luminaire efficacy tolerance
- Please note: Allowances will be **retroactively applied** to all products on the QPL prior to 4/1/2017 (prior to the V4.0 de-listing)
Allowance Example

• A linear ambient luminaire has the following characteristics:
  – 98 LPW
  – 92 CRI
  – 3500 Kelvin

• To calculate if the product meets the efficacy requirement, the allowance is applied first:
  – 105 LPW base requirement – 5% allowance for a CRI ≥ 90 = \(99.75\) LPW

• Then apply the 3% tolerance
  – 99.75 LPW allowed requirement – 3% tolerance = \(96.75\) LPW

• This product meets the DLC Standard Requirement for minimum efficacy
Model # CL120-3-AA

Manufacturer: LED Industries, Inc.
Brand: LED Lights
Technical Requirements Version: 4.2
Date Qualified: 11/18/2019
Product ID: P9HU1Z2D

CCT 3% Allowance: True
Multiple LED Policy Correction
Multiple LED Policy Update

• The DLC Multiple LEDs policy has been updated, removing the reference to white-light LEDs:

Prior to V4.2:

“Products employing multiple types of white-light LEDs are eligible under the following conditions: 1) the types and quantities of the LED packages/modules/arrays are known, and 2) the LEDs are not dynamically controlled, other than for dimming purposes.”

V4.2:

“Products employing multiple types of LEDs are eligible under the following conditions: 1) the types and quantities of the LED packages/modules/arrays are known, and 2) the LEDs are not dynamically controlled, other than for dimming purposes.”
Additional Efforts Under Development
Additional Efforts Under Development

• Color Tunable Products
• DC/PoE Luminaires
• Flicker
• Replacement Lamps (various)
• Field Adjustable Performance
• Additional Allowances
2017 Stakeholder Meeting
Learn about current lighting industry topics

Network with over 250 attendees in a professional setting

Engage in discussion about DLC developments

Learn about products during networking receptions

View the Agenda and Register Online
www.designlights.org/DLCmeeting17
You’re Invited!

Stakeholder MEETING 2017
July 10 - 12 • Portland, OR
Thank You!

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For questions regarding new requirements, please email: applications@designlights.org