



Bringing Efficiency to Light.

V4.2 Specification Development

Allowances

T5 Replacement Lamps

Hazardous Location Lighting

December 12, 2016

Misc. Notes

- Slides will be posted on www.designlights.org after presentation
- Please use GoToWebinar Interface (Question pane) to submit questions during today's webinar
- Send any additional questions or comments to info@designlights.org
- Development of [FAQ](#) as questions received

Agenda

- Allowances
 - History, proposals
- T5/T5HOs
 - Existing Category Adjustments
 - New Category Proposals
- Hazardous Location Lighting
 - Adding specificity
 - Soliciting feedback re: potential allowances

Allowances

Allowances: Recap/Motivation

- Effort grew out of conversations and concerns in setting V4.0 requirements
- Desired goal: Standard Levels resulting in ~50% attrition
- Desired goal: Premium Levels targeted at top ~5% of products
- Stakeholder Feedback included:
 - 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)

Efficacy: Dealing with Special Cases

- Approach: DLC to consider “Allowances”
- How it was envisioned?
 - Finalized general requirements based on impacts on all products across a category (done!)
 - Continue discussions about particular product types/features that would need accommodation
 - Request submission of specific proposals, discuss at Stakeholders Meeting
 - **If** performance/feature can be objectively defined, include it in an “allowance table”, which would function similarly to tolerances
 - Note: Allowance applied to *requirement*, then tolerance applied to *testing*
 - *But* functionally: lower efficacy requirement

Allowances: Example (for illustration only)

- Relatively simple examples:

Feature	Allowance
CRI \geq 90	5 lm/W
CCT = 2700	5 lm/W

- Might be limited to indoor or outdoor products as needed

- More challenging requests:

Product Type	Allowance
"Non-planar" Troffers	5 lm/W
"Decorative Historical" Outdoor	10 lm/W
"Architectural" Linear Ambient	15 lm/W

- Challenge is in objectively defining these product types

Allowances: Request to Industry

- Stakeholders requested submit proposals for specific allowances by **July 18, 2016**.
 - Proposals must include a way to rigorously, objectively define products with need for specific allowances
 - Definitions: what does it mean to be “architectural”?
 - Performance Features: Metrics, Methods of Measurement
 - Reference test procedure(s) (standard(s)) and applicable accreditations are best
 - Proposals to be reviewed by DLC and TC, published for Stakeholder Review/Comment
 - Discussed at 2016 Stakeholders Meeting, and in follow-up conference call(s)
 - Discussions will include interested Stakeholders, Members
- Goal has been to finalize initial allowances to be implemented on same timeframe as V4.0 Transition (April 2017)

Allowances: Proposal Summary

- 42 Requests received from 12(+) organizations
 - Some organizations/commenters represented multiple stakeholders
- Detailed review, consideration of proposals
- Discussions at the DLC SHM
- Discussions/review with the DLC Technical Committee
 - Tiering interest in proposals received
 - Actionable/Potential Actionable
 - Need more definition
 - Outside of current interest/scope (Added to “Allowances Wish list”)

Allowances: Assessment

- For each allowance proposal/request received, considering:
 1. Is the request **implementable**?
 - Is the performance characteristic and/or physical feature rigorously and objectively defined?
 - Would identification of the eligible products be deemed as subjective?
 - Would it introduce new loopholes or gaming scenarios?
 2. Is the allowance **needed**?
 - Is there evidence that the performance/design feature results in necessarily lower efficacy?
 - **Also**: consider the goals of the DLC and needs of DLC Member programs?
 - Is there evidence that the request performance/design feature would result increased energy savings?
 - Increased market adoption? Increased persistence and customer satisfaction?
 - How compelling is the evidence?

Allowances: Proposals Received

Overview

- Limited detail and justification
- Mostly requests, without reasoning or implementation rationale
- Challenges or considerations of DLC or members not addressed
 - Implementation details
 - Justification as it relates to energy savings
- Affect on planned next steps:
 - Webinar where commenters and invited and details provided on what is needed to make an allowance proposal useful/actionable
 - Longer timeline for development of actionable allowances

Allowances: Proposals Received

- Actionable: CCT, CRI
 - Implementable, understandable
- Potentially Actionable: “Architectural” Linear Ambient
 - Aperture, Distribution; presence or properties of lensing?

Proposals needing more specifics (how to define/evaluate?):

- “Decorative/Historical Post-Top”
 - *Marketing-claim-based requirements are problematic; rigorous bright-line definitions are needed*
- Glare mitigation (Generally)
 - (Proposed as stand-alone and in context of several specific requests for broader allowances)
 - *How would this be identified/defined/evaluated? Testing?*
- Wall-wash
 - *Marketing-claim-based requirements are problematic; rigorous bright-line definitions are needed*

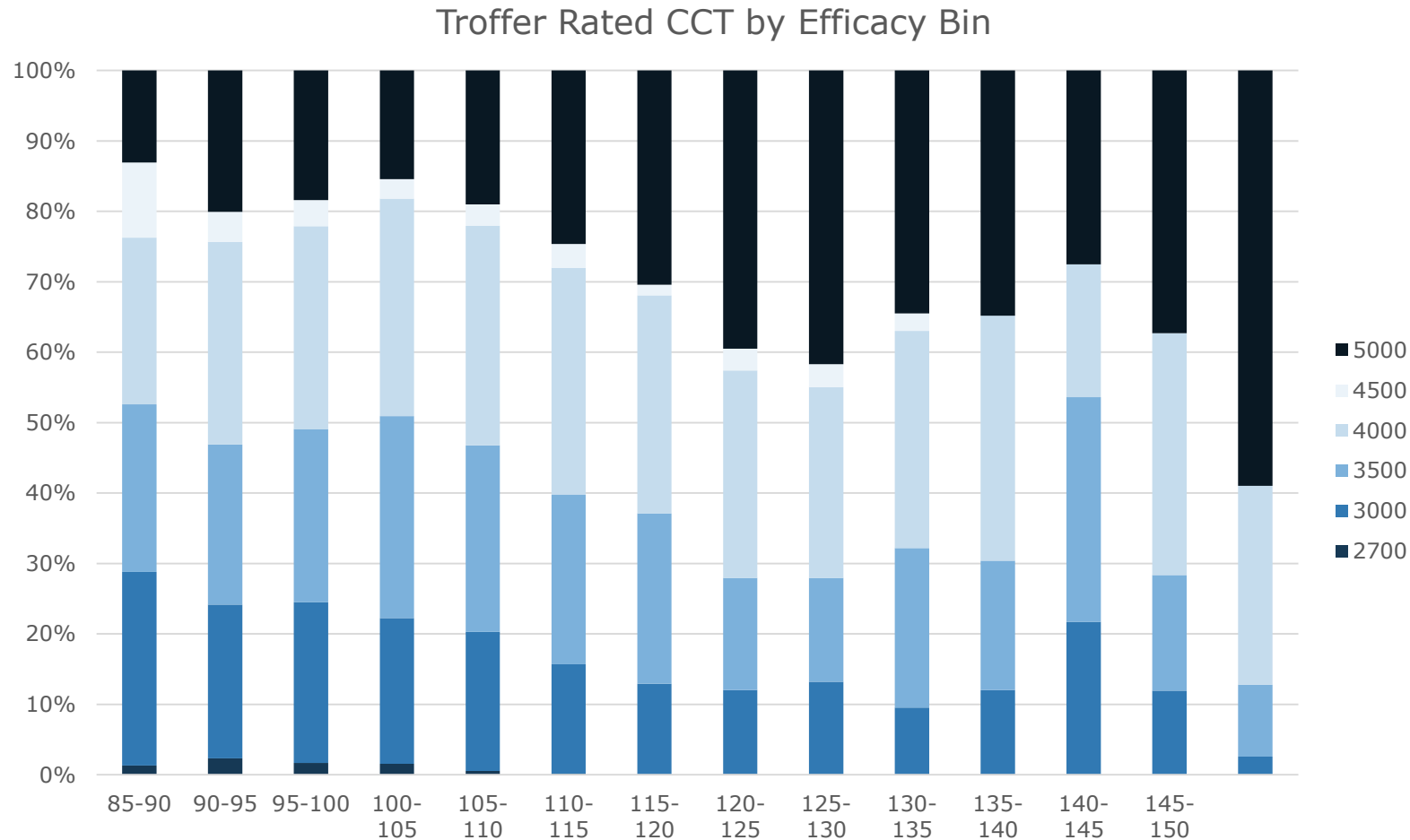
Allowances: CCT Proposals Received

- 9 Requests Received for providing CCT Allowance
 - Allowances only <2700K (20-30 lm/W, depending on 2200, 2500)
 - 5% Allowance on 2700K
 - 10% on $\leq 2700\text{K}$
 - 5-7% on $\leq 3000\text{K}$
 - 4% on 3500K, 9% on 3000K, 13% on 2700K
 - 3% on 4000K, 7% on 3000K, 18% on 2700K
 - 15% on 4000K, 25% on 3000K, 30% on $\leq 3000\text{K}$
 - Sliding scale: 0.3 lm/W allowance for every 100K below 5000K
 - (Not really an allowance request, but suggestion to require 3-step consistency)

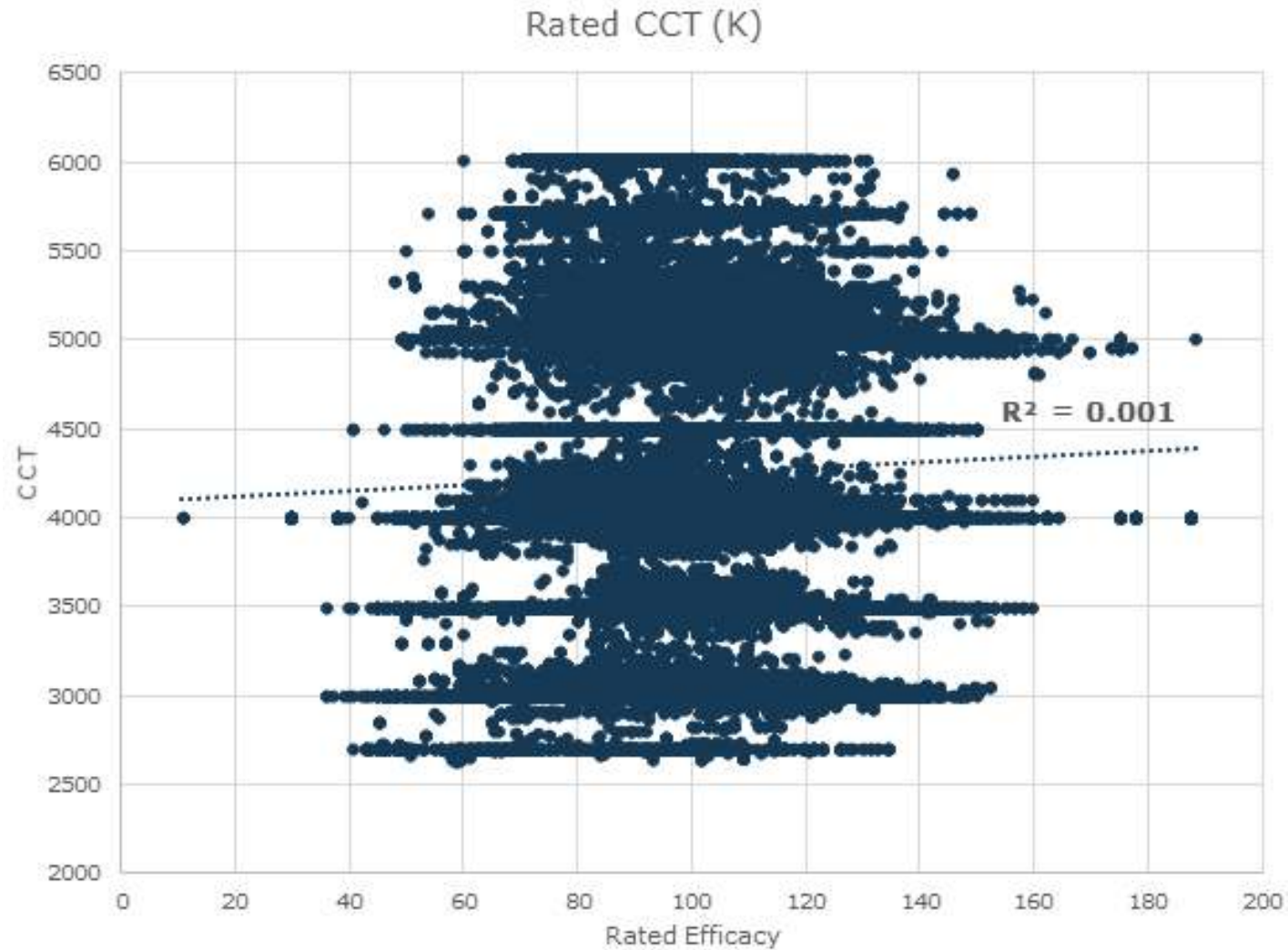
Actionable: CCT

- Clear? Implementable?
 - Not directly addressed in comments, but
 - Rigorous definitions and test procedures exist
 - ANSI C78.377
 - LM-79 Test Procedures
- Needed?
 - Evidence that product performance impacted? Some.
 - Augmented with DLC internal analysis (next slides)
 - Evidence that advances goals...? Much more anecdotal.
 - Possible Consensus?

First look: Color Availability Impacts CCT (Example)



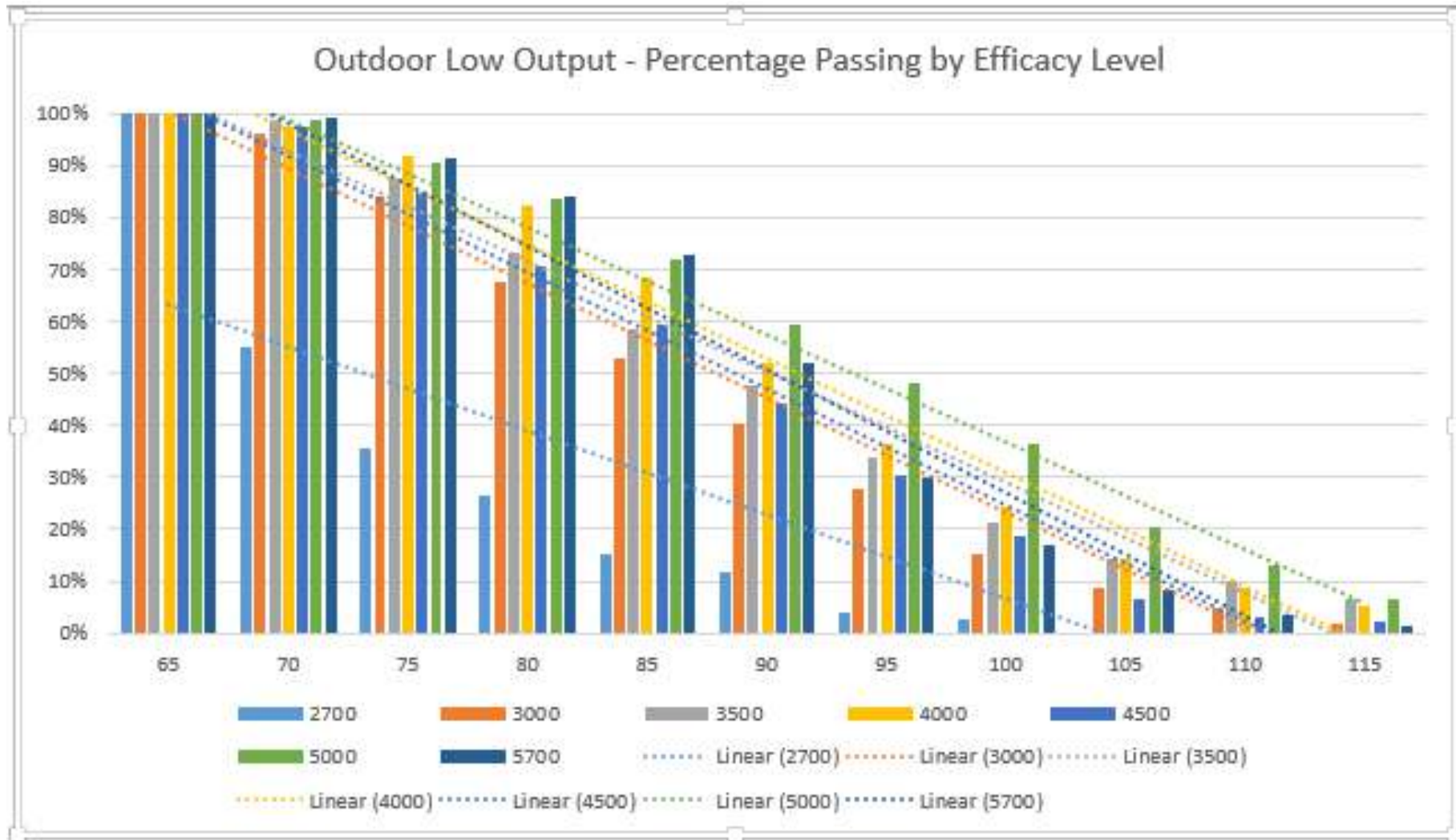
Generally: Efficacy vs. CCT



Deeper Look: CCT (Example)

Outdoor Low Output			
Nominal CCT	20 th Percentile	50 th Percentile	80 th Percentile
2700	65.8	70.0	80.0
3000	75.0	85.0	97.8
3500	77.0	88.0	100.0
4000	80.0	90.0	101.3
4500	71.8	86.0	98.6
5000	80.0	93.4	104.8
5700	80.4	90.0	98.1

Deeper Look: CCT (Example)



CCT: Proposed Approach

- Don't want to influence/bias market towards higher CCT
- Don't want to give "too much" allowance for lower CCT
 - Not directly tied to energy savings; customer choice/market adoption/NEBs
 - Default towards too little than too much
- CCT differences should be equivalent in various applications
 - Same physical mechanism
- 2700K – allowance probably justified
- 3000K – allowance possibly justified
- **Proposal for CCT: (start small)**
 - **Propose: 3% for 3000K, 5% for $\leq 2700K$**

Allowances: CRI Proposals Received

- 4 Requests Received for providing CCT Allowance
 - 5% for CRI above 90
 - 10 lm/w for CRI above 90
 - 15% for CRI ≥ 90 @ CCT $\leq 3500\text{K}$; 20% for CRI ≥ 90 @ CCT $\geq 4000\text{K}$
 - Indoor 17% for CRI ≥ 90 ; Outdoor 8% for CRI ≥ 80 , 14% for CRI ≥ 90

Actionable: CRI

- Clear? Implementable?
 - Not directly addressed in comments, but
 - Rigorous definitions and test procedures exist
 - CIE 13.3-1995
 - LM-79 Test Procedures
- Needed?
 - Evidence that product performance impacted? Some.
 - Few products on QPL at 90 CRI; difficult to analyze due to few numbers of products
 - Strong consensus from certain parts of industry; others concerned about IP and proprietary approaches that give some manufacturers a competitive advantage
 - Evidence that advances goals...? Much more anecdotal.
 - Discussion/thoughts? Worth promoting?

CRI: Proposed Approach

- Generally: don't want to give "too much" allowance
 - Not directly tied to energy savings; customer choice/market adoption/NEBs
- CRI differences should be equivalent in various applications
 - Same physical causes
- Limited existing QPL data
- Some IP/competitive concerns
- **Proposal CRI: start small**
 - **Propose: 5% for CRI ≥ 90**
- **Proposal: No combining allowance**
 - **I.e.: Max allowance of 5% for CCT of 2700K, CRI of 90**

Allowances: Linear Ambient

- “Architectural” Linear Ambient Products: Common themes
 - Aperture, Distribution, Glare Mitigation
- Needed?
 - Anecdotal arguments that desirable for certain customers
 - Consensus?
- Implementable?
 - Some elements (aperture) implementable
 - Others need additional specificity (distribution) or creative approach (glare)

T5 Replacement Lamps

TLED Replacements

- Summary:
 - Existing (2- and 4-foot) TLED categories developed with T8 fluorescent replacements in mind
 - No explicit rules regarding form-factor of TLEDs seeking qualification
 - Implicit restrictions: testing requirements (reference troffer, reference ballast for Type A)
 - Discovery of “loopholes” being used by industry to qualify TLED T5s
 - T5 versions of troffers
 - Claims of Type A T5 replacements being tested on Instant-start ballast
- Initial comments sought during V4.1 comment period

Previous T5 Discussion

- Consensus from all stakeholders to separate T5s, T8s
 - T5 and especially T5HOs have different incumbent references, need to be addressed separately from T8s
- Strong support from industry for creating T5 categories in parallel
- Technical Committee direction:
 - Isolate existing categories for T8 replacements only
 - Restrict existing T8 category to G13 base, 48" length
 - Align with V4.0 – move/delist outstanding products on 4/1/17
 - Develop new T5 categories
 - T5 and T5HO
 - All UL Types (A, B, C, Dual Mode)
 - Four-foot only

T5 Draft Proposal

- Cover both T5 and T5HO
- Address each distinctly
- Generally, have taken two potential approaches to lamps:
 - Similar to T8: General Approach, limited testing
 - Similar to Mogul-Base lamps: Specific approach, test in each appropriate category distinctly
- Initial Proposal: T5s similar baseline to T8s, approach similarly to T8s (i.e. test in troffers)
- Initial Proposal: T5HO's distinct baseline, used commonly in high-bay

T5

- G5 Base, ~46" length
- Type A, B, C, Dual Mode
- Appropriate reference housings
 - (T5 versions of existing troffer housings)
- Normal (1.0) BF, programmed start ballast for Type A

T5

Individual Lamp Criteria, T8 and T5* Replacements			
	Four-Foot T8, T5 Lamps	Two-Foot Lamps	U-bend Lamps
System Efficacy	≥ 110 lm/W	≥ 110 lm/W	≥ 110 lm/W
Initial Light Output	≥ 1,600 lm	≥ 800 lm	≥ 1,400 lm
Correlated Color Temperature (CCT)	≤ 5000K	≤ 5000K	≤ 5000K
Color Rendering Index (CRI)	≥ 80	≥ 80	≥ 80
Power Factor	≥ 0.90	≥ 0.90	≥ 0.90
Total Harmonic Distortion	≤ 20%	≤ 20%	≤ 20%
Warranty	≥ 5 Years	≥ 5 Years	≥ 5 Years

In-situ Lamp Criteria for Four-Foot Linear Replacement Lamps	
Luminaire Efficacy	≥ 100 lm/W
Minimum Initial Luminaire Light Output	2 lamps installed = 3,000 lm 3 lamps installed = 4,500 lm 4 lamps installed = 6,000 lm
Spacing Criteria	<u>Spacing Criteria:</u> 0-180° = 1.0 - 2.0 90-270° = 1.0 - 2.0 <u>Zonal Lumen Distribution:</u> 0-60°: ≥ 75%
Lumen Maintenance L ₇₀	50,000 hours

*T5 four-foot only (?)



T5HO

- G5 Base, ~46" length
- Type A, B, C, Dual Mode
- Appropriate reference housings
 - 4-lamp High-Bay Fluorescents
- Normal (1.0) BF, programmed start ballast for Type A

T5HO

Individual Lamp Criteria, T5HO Replacements

Four-Foot Lamps

System Efficacy ≥ 110 lm/W

Initial Light Output $\geq 3,200$ lm

Correlated Color Temperature (CCT) ≤ 5000 K

Color Rendering Index (CRI) ≥ 80

Power Factor ≥ 0.90

Total Harmonic Distortion $\leq 20\%$

Warranty ≥ 5 Years

In-situ Lamp Criteria for Four-Foot T5HO Replacement Lamps

Luminaire Efficacy ≥ 105 lm/W

Minimum Initial Luminaire Light Output
4-lamp High-Bay
 $\geq 10,000$ lumens

Distribution Zonal Lumen Distribution:
20-50°: $\geq 30\%$

Lumen Maintenance L₇₀ $\geq 50,000$ hours

T5 Technical Requirements Table

Table 3: Technical Requirements: Lamps**, ***

#	Category	General Application	Minimum Light Output (lm)	DLC Standard			Requirements	Distribution
				Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L70		
17	Linear Replacement Lamp	Four-Foot Linear Replacement Lamps (T8 replacements)	In troffer: 2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000 Bare lamp: 1,600	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> Replacement Lamps ("Plug and Play") (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) 	See Primary Use Zonal Lumen Density Requirements in Table 4, below
18		Four-Foot Linear Replacement Lamps (T5 replacements)	In troffer: 2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000 Bare lamp: 1,600	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> Replacement Lamps ("Plug and Play") (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) 	
19		Four-Foot Linear Replacement Lamps (T5HO replacements)	In high-bay: 4 lamps: 10,000 Bare lamp: 3,200	In luminaire: 105 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> Replacement Lamps ("Plug and Play") (UL Type A) Internal Driver/Line Voltage Lamp-Style Retrofit Kits (UL Type B) External Driver Lamp-Style Retrofit Kits (UL Type C) Dual Mode Internal Driver (UL Type A or B) 	
20		Two-Foot Linear Replacement Lamps	In luminaire: 2 lamps: 1,350 3 lamps: 2,000 4 lamps: 2,700 Bare lamp: 800	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> Replacement Lamps ("Plug and Play") (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) 	
21		U-Bend Replacement Lamps	In luminaire: 2 lamps: 2,500 3 lamps: 3,750 Bare lamp: 1,400	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> Replacement Lamps ("Plug and Play") (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) Dual Mode Internal Driver (UL Type A or B) 	

Hazardous Location Lighting

Hazardous Location Lighting

- Hazardous location products not explicitly excluded from other categories, but existing requirements often commented on as inappropriately limiting
 - Efficacy, ZLD accommodations sought
- With development of “Specialty”, DLC seeing increased requests for “Hazardous” descriptors
 - Appears to be driven by product marketing, rather than performance
- Challenge:
 - Currently, no specific policies governing the qualification of “Hazardous” location products
 - If DLC used as marketing tool, concern about expectation of verification of appropriateness for hazardous location use
- DLC ought 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: Proposal

- Require testing and certification documentation to ANSI/UL 844
 - Documentation must clearly identify class and division ratings for product
 - Dovetails with broader safety questions and specificity in safety requirements for further consideration in 2017
- Proposal will be *definitional* proposal to identify products as “hazardous location” on DLC QPL
- Will maintain under specialty; not separate category(ies)
- Prompt will include request for information/justification for allowances
 - Mixed information from industry in previous comment period

Specification Development Timeline

Task	Tentative Timeline
Publish Draft V4.2 Proposals	Early December 2016
Stakeholder Comment Period	Through January 20, 2017
Review comments, hold commenters call	Late January
TC Review	February
Amend proposals/additional research (as necessary)	February-March
Finalize V4.2 (Allowances, T5s, Haz Loc)	March 2017
(Assumes no additional comment rounds needed)	

Thank You!

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