DESIGNLIGHTS CONSORTIUM®

Bringing Efficiency to Light.

November V4.1 Specifications

Four Pin-Base LED Replacements for CFLs

U-Bend Replacement Lamps

Very High Output Outdoor Lighting

Refrigerator Case Definitions

Other Efforts

November 9, 2016

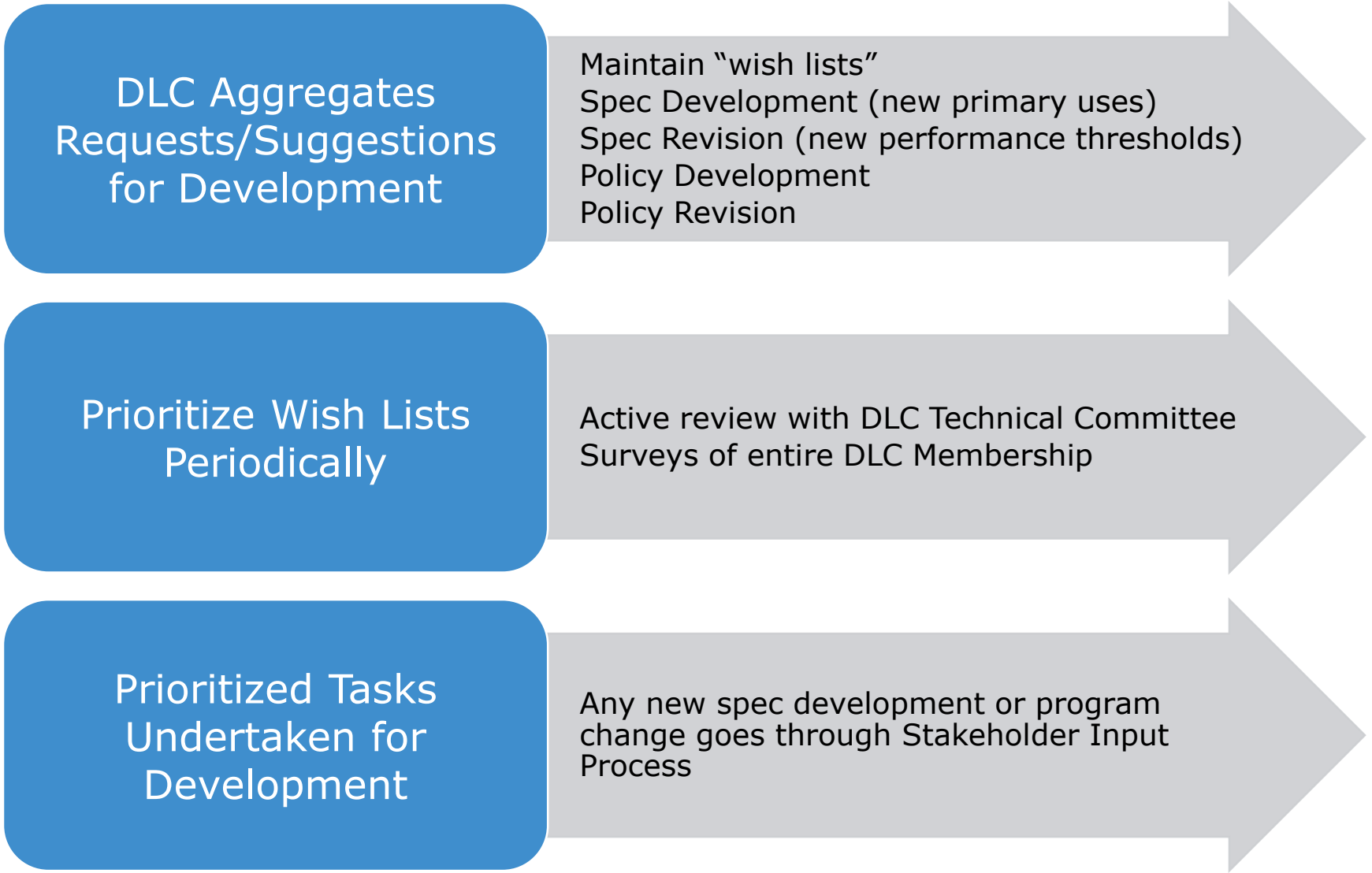
Misc. Notes

- 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 expected to be active for new categories

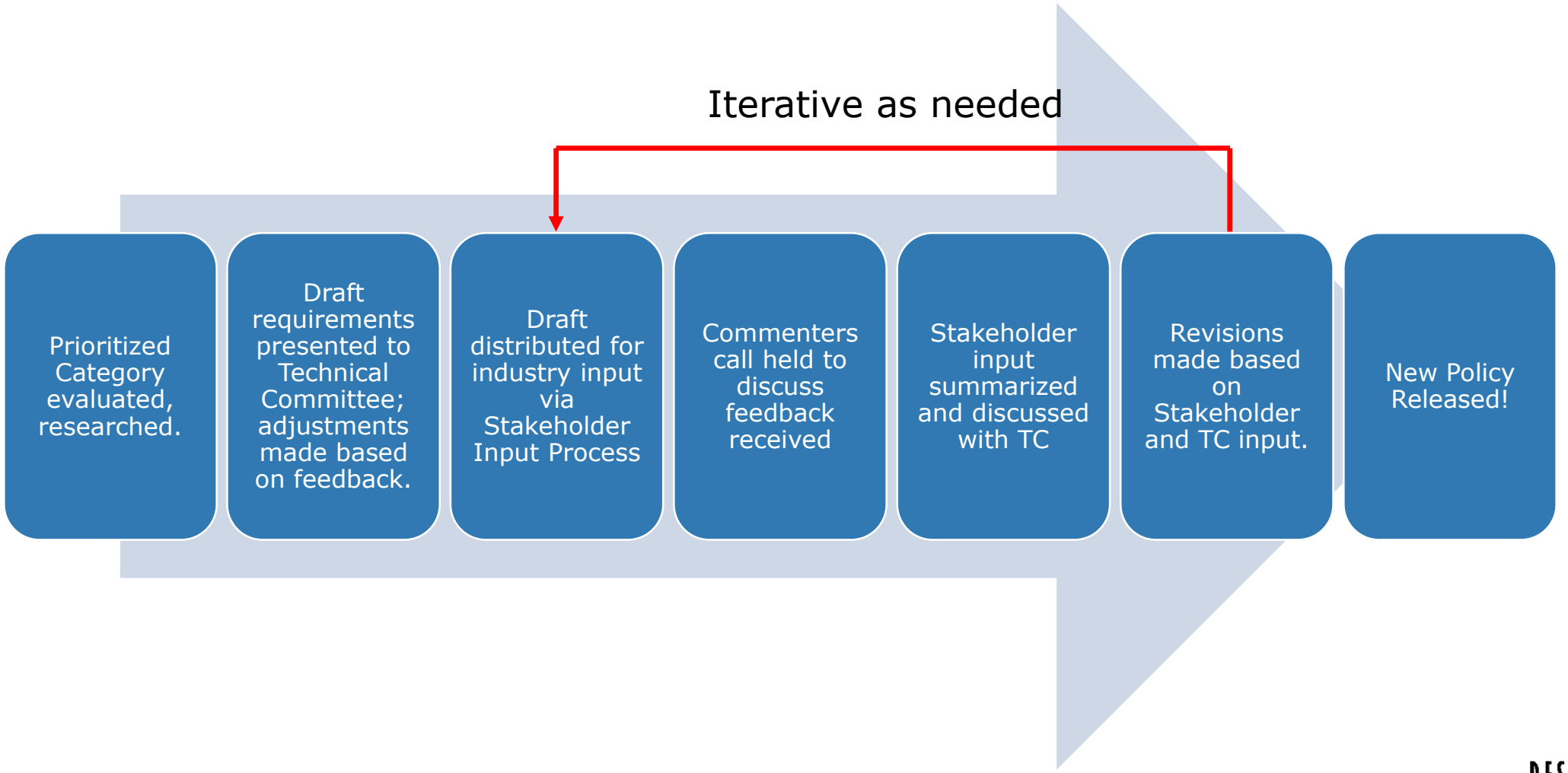
Agenda

- Specification Development Overview
  - Prioritization and process
- Final V4.1 Technical Requirements
  - Four Pin-Base Replacements for CFLs (CFLEDs)
  - U-Bend Replacement Lamps
  - Very High Output Outdoor Lighting
  - Refrigerated Case Lighting (Definitions)
- Additional Development Efforts
  - Hazardous Location lighting
  - T5 Replacement Lamps
  - Horticultural Lighting
  - Allowances Development

General DLC Development Process



Category Development Overview



DESIGNLIGHTS CONSORTIUM

Four Pin-Base Replacement Lamps for CFLs (CFLEDs)

DLC Spec Precedent: Lamps

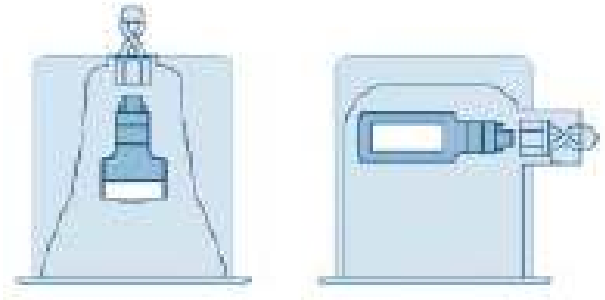
- Several Existing Lamp Categories
  - Two- and Four-Foot Linear Replacement Lamps
    - Type A, B, C
    - Testing in reference troffer, general qualification
  - Mogul Screw-Base Replacements for HID Lamps
    - Type B, C only
    - Testing in reference fixture, only qualified in that specific end-use application
- In-fixture performance requirements aligned with luminaire category
- Specific equivalency claims not policed (no requirements)

Four Pin-Base Lamps ("CFLEDs") Scope

- Scope: LED replacements for CFLs
  - Operate off existing CFL ballast ("Type A")
  - 4-pin-base (G24q/GX24q)

CFLEDs: Approach

- General Approach
  - General qualification, based upon assumed end-use in downlights (similar to linear fluorescent replacements)
  - Recognized that some end-use in decorative wall or ceiling mounted fixtures
    - Assessed that this is small enough portion of overall market that additional testing requirements were not valuable.
- Distinct identification/testing for
  - Horizontal Products
  - Vertical Products



CFLEDs Second Draft ***Proposal***: Performance Requirements

- Lamp-level testing
  - Clear desire from members to identify lamp-level performance
  - Adjustments made to luminaire-level requirements to ease testing burden

Individual Lamp Criteria (Bare Lamps)	
System Efficacy	≥ 80 lm/W
Initial Light Output	≥ 725 lm
Correlated Color Temperature (CCT)	≤ 5000K
Color Rendering Index (CRI)	≥ 80
Power Factor	≥ 0.90
Total Harmonic Distortion	≤ 20%
Warranty	≥ 5 Years

In-situ Lamp Criteria for 4-Pin-Base LED Replacement Lamps	
Luminaire Efficacy	≥ 65 lm/W
Minimum Initial Luminaire Light Output	Vertically-Mounted products: ≥ 575 lumens Horizontally-Mounted products: ≥ 800 lumens
Light Distribution	**Zonal Lumen Distribution:** 0-60°: ≥ 75%
Lumen Maintenance L_{70}	50,000 hours

CFLEDs ***Proposal***: Performance Testing

- Type A: test on reference ballast
  - Designed for/compatible with specific CFL ballasts
    - Primary descriptor in spec sheets: wattage (13W, 18W, 26W, 32W, 42W)
    - Limit product offering; typically products will serve multiple "replacement" levels
  - Test on reference 18W or 26W ballast
    - Common ballasts attempted to be chosen
    - Pre-approved equivalent possible
      - Intend to consider BF, efficiency, power quality for pre-approved equivalent requests
- End-use reference luminaire
  - 6" Downlight Reference
    - 8" more common, but 6" also common and worst-case
    - Approved list, with ability for pre-approved equivalent
    - Feedback on appropriate housings welcome
  - Vertical or Horizontal Mount, as appropriate
    - Horizontal-Mount: Double lamp
    - Vertical-Mount: Single lamp

Comments Received – Lamp Testing

- Few comments
- Generally supportive
- Adjustments to Efficacy levels proposed
  - Differences in assumed fixture efficiency (from limited benchmarking)
  - Proposal: 80 lm/W (lamp), 65 lm/W (luminaire) proposed
  - Suggestion 1: 75 lm/W (lamp)
  - Suggestion 2: 70 lm/W (luminaire) (strong sentiment against on call)
- Requests for clarification on testing protocol for multi-lamp ballasts
  - Luminaire configuration; lamp configuration
  - Similar to TLED provisions

Comments Received – Light Output

- Little commentary
- Request to clarify that 800 lumens is 2-lamp horizontal, 575 1-lamp vertical
- Comment that 575/800 too little light, suggest 800/1200 lumen
  - Benchmark to reference CFL, assumed fixture efficiency; consistency with ENERGY STAR
  - One 18W CFL (vert); two 13W CFLs (horizontal); ~50% fixture efficiency
  - Concern that this is too little light; suggest benchmark of one 26W CFL (vert), two 18W CFL (horizontal)
- Final: as lower wattage CFLs are common, do not increase light output requirement

CFLEDs *Final*: Performance Testing

- Type A: test on reference ballast
  - Pre-approved equivalent possible
    - Intend to consider BF, efficiency, power quality for pre-approved equivalent requests
- End-use reference luminaire
  - Any reflector kit acceptable
  - Pre-approved equivalent possible
    - Size, shape, construction materials

- Philips ICF-2S18-HI-LD
- Philips ICF-2S26-HI-LD
- OSRAM/Sylvania QTP1/2x18CF/UNV
- OSRAM/Sylvania QTP2x26CF/UNV
- Triad C218UNVBE
- Triad C2642UNVBE
- GE GEC218-MVPS-3W
- GE GEC226-MVPS-3W
- Keystone KTEB-226-UV-PS-DW
- Or Pre-approved Equivalent

Horizontally-mounted Lamp Reference Downlights:

- Lithonia 6HF 2/18DTT MVOLT
- Lithonia 6HF 2/26DTT MVOLT
- Prescolite LF6CFH 218 EB LCFH WT
- Prescolite LF6CFH 226 EB LCFH WT
- Or Pre-approved Equivalent

Vertically-mounted Lamp Reference Downlights:

- Lithonia 6VF 18DTT/TRT MVOLT
- Lithonia 6VF 26-42TRT MVOLT
- Prescolite LF6CFV 32 EB LCFHV WT
- Or Pre-approved Equivalent

CFLEDs *Final*: Performance Requirements

In-situ Lamp Criteria for 4-Pin-Base LED Replacement Lamps	
Luminaire Efficacy	≥ 65 lm/W
Minimum Initial Luminaire Light Output	Vertically-Mounted products: ≥ 575 lumens Horizontally-Mounted products: ≥ 800 lumens
Light Distribution	**Zonal Lumen Distribution:** 0-60°: ≥ 75%
Lumen Maintenance L_{70}	50,000 hours

Individual Lamp Criteria (Bare Lamps)	
System Efficacy	≥ 75 lm/W
Initial Light Output	≥ 675 lm
Correlated Color Temperature (CCT)	≤ 5000K
Color Rendering Index (CRI)	≥ 80
Power Factor	≥ 0.90
Total Harmonic Distortion	≤ 20%
Warranty	≥ 5 Years

DESIGNLIGHTS CONSORTIUM

Second Draft Proposal- ISTMT

- Thermal testing clarification
  - ISTMT to be conducted in most-restrictive UL/CSA (1993) Environment
  - Dependent on product ratings (closed vs. open), etc.

- No comments received

Figure 9.1
Small temperature test box
(See Clauses 8.5.3, 8.5.6, and 9.5.1.1)

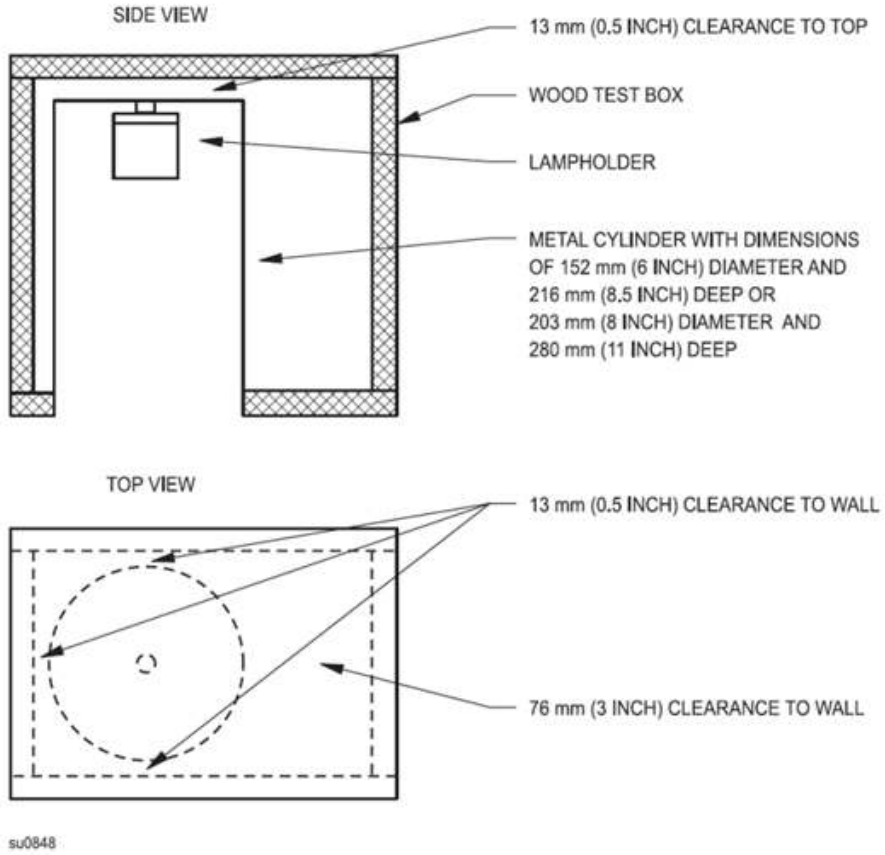


Illustration should not be taken as definitive. Please refer to Standard.

Second Draft ***Proposal***: Compatibility

- Compatible ballast information must be included in marketing and installation literature (spec sheet, product guides, etc.)
- Based on industry feedback; testing *designed to ensure* broad compatibility
- Must conduct ENERGY STAR Operating Frequency Testing on 9 reference ballasts
  - 6 ballasts specified as acceptable for LM-79 testing
  - 3 additional ballasts (specified)
- No pre-approved equivalents
- Must be conducted at a Laboratory on ENERGY STAR recognized laboratory list
  - (Labs on the Lighting list; scope includes LED lamps)
- Comments sought on sufficiency and burden or proposed compatibility testing

Second Draft *Proposal*: Compatibility

Requirement	Methods of Measurement and/or Reference Document	Testing Guidance
Lamp light output shall have a frequency of ≥120 Hz	Method of Measurement: None Reference Document: IEEE Std 1789™ - 2015	Sample Size: One unit per model Light output waveform shall be measured with a photodetector with a rise time of 10 microseconds or less, transimpedance amplifier and oscilloscope. Employed equipment models and method of measurement shall be documented. Temporal response, amplification and filtering characteristics of the system shall be suitably designed to capture the photometric waveform. Digitized photometric waveform data and an image of the relative photometric amplitude waveform shall be recorded. Measured data shall be recorded to a digital file with an interval between each measurement no greater than 0.00005 sec (50 microseconds) corresponding to an equipment measurement rate of no less than 20 kHz, and capture at least 1 second of data.

Comments – Compatibility

- Clarification of intent
  - Must be compatible with all ballasts; no failures allowed
- Concern regarding burden
  - Acknowledged to be many tests; alternate suggestions welcome
  - Testing proposal developed at suggestion of industry commenters
- Concern regarding the ballasts specified
  - Model number confusion: clarification need;
  - Some concerns about availability of AC electronics ballast

Comments – Compatibility

- Requests for adding additional ballasts
  - Concern on burden, open comment
  - Comments on how to evaluate inclusion requests welcome (these and future)
- Requests for additional clarification on input voltage during testing
  - Suggest to specifically call out testing must be done at both 120 and 277
- Comments stating that DLC should not dictate manufacturer compatibility claims
  - Balanced against: need for ensuring some minimum level of compatibility
- Comments stating that DLC should not require on-going updates
  - What are concerns regarding updating of compatibility information?

CFLEDs *Final* Requirements: Compatibility

- Compatibility testing required
- Revise ballast list: removed AC ballast (no longer in production)
  - 8 ballasts now required
- Products must be compatible with all 8 specified ballasts to qualify
- Will consider revisions to ballast list in future revision rounds
  - Add requested ballasts to the pre-approved ballast list for LM-79 only
- Compatibility testing should be at both 120V and 277V
- No requirement for updating of marketing material
  - Planned policy development/revision efforts to address this next year

- Philips ICF-2S18-HI-LD
- Philips ICF-2S26-HI-LD
- OSRAM/Sylvania QTP1/2x18CF/UNV
- OSRAM/Sylvania QTP2x26CF/UNV
- Triad C218UNVBE
- Triad C2642UNVBE
- Fulham NPY-120-226-CFL
- Robertson RED1L10-120

CFLEDs: FAQ Development

- Anticipate active development of FAQs
- Post on DLC website: here
- Early clarifications
  - OSRAM/Sylvania reference ballast
  - Input voltage for compatibility testing
  - Applicability of family grouping for compatibility testing
    - Test any variation that would impact electrical compatibility
      - Test wattage and dimming variations
      - Not needed to test optical or color variations
- Currently under investigation
  - Accessibility of Robertson ballast
- Send questions or concerns to info@designlights.org!

DESIGNLIGHTS CONSORTIUM

Other Finalized Specs in V4.1

Final: U-Bend Replacement Lamps

- Parallels requirements in 2-foot and 4-foot replacement category
  - Testing approach, product types, performance requirements (benchmarking, adjustments)
- Clarification: both 6” and 1 5/8” geometries eligible
- Changes from original draft: add 3-lamp Type-C provisions
- Next steps on linear fluorescent replacements: distinct categories for T5 replacement lamps

Final: U-Bend Replacement Lamps

Individual Lamp Criteria	
System Efficacy	≥ 110 lm/W
Initial Light Output	≥ 1,400 lumens
Correlated Color Temperature (CCT)	≤ 5000K
Color Rendering Index (CRI)	≥ 80
Power Factor	≥ 0.90
Total Harmonic Distortion	≤ 20%
Warranty	≥ 5 years

Final: U-Bend Replacement Lamps

In-situ Lamp Criteria	
Luminaire Efficacy (2 lamps in a reference troffer)	≥ 100 lm/W
Minimum Initial Luminaire Light Output (2 lamps in a reference troffer) 3-lamp Type-C	***2,500 lumens*** ***3,750 lumens***
Distribution	**Spacing Criteria:** 0-180° = 1.0-2.0 90-270° = 1.0- 2.0 **Zonal Lumen Distribution:** 0-60°: ≥75%
Lumen Maintenance	50,000 hours

DESIGNLIGHTS CONSORTIUM

Very High Output Outdoor Lighting

- Challenge
  - Program savings determined both by performance of LED products AND by that of incumbent (baseline) products
  - As LED products produce more light, they are assumed to be replacing higher-wattage HID incumbents, which are more efficacious.
    - This results in a new baseline!

- HID Performance highly variable (data collected by PNNL)
  - Technology (HPS, MH, PMH)
  - Fixture efficiency (55-89%)
  - Wattages (35W – 1000^{+}W)
  - Low-end efficacies ~25 lm/W
  - High-end efficacies ~110^{+} lm/W

Very High Output: Need and approach

- Due to range of efficacy as incumbent products increase in power/light output, savings of LED relative to benchmark changes greatly.
- Splitting into subcategories may allow members to better determine savings.
- Approach: identify lumen “break points” that correspond with increasing incumbent technology power levels. Set higher efficacy requirements for higher-power equivalents.

- Complication #1: Due to multiple variables (power, technology, luminaire efficiency), lumen “bins” overlap. Where to set breakpoints to achieve goals without hindering necessary flexibility?
- Complication #2: Assumption that LED can achieve necessary performance with fewer total lumens. How to adjust lumen breakpoints to account for this?

Very High Output: Signaling

Technical Requirements Table, V4.1

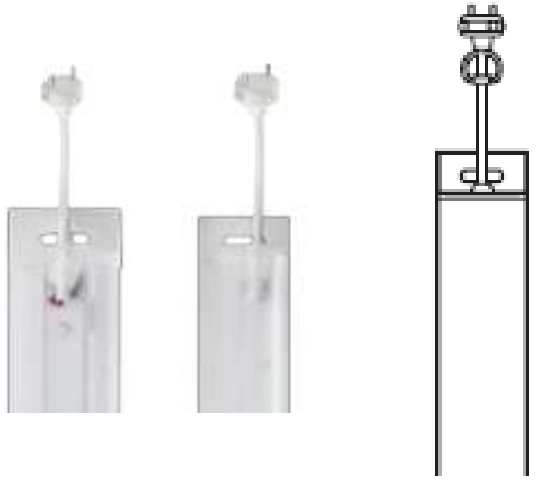
Technical Requirements: Luminaires

#	Category	General Application	Requirements								
			Minimum Light Output (lm)	DLC Standard			DLC Premium*			Primary Use**	Distribution
				Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L_{70}	Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L_{90} / L_{70}		
1	Outdoor	Outdoor – Low Output	250-5,000	90	5	≤5700 / ≥65 / ≥50,000	110	5	≤5700 / ≥65 / >36,000 / ≥50,000	• Outdoor Pole/Arm-mounted Area and Roadway Luminaires • Outdoor Pole/Arm-mounted Decorative Luminaires • Outdoor Full-Cutoff Wall-mounted Area Luminaires • Outdoor Non-Cutoff and Semi-Cutoff Wall-mounted Area Luminaires • Bollards • Parking Garage Luminaires • Fuel Pump Canopy Luminaires • Landscape/Accent Flood and Spot Luminaires • Architectural Flood and Spot Luminaires • Stairwell and Passageway Luminaires • Specialty:_____	
2		Outdoor – Mid Output	5,000-10,000	95			115				
3		Outdoor – High Output	10,000-30,000	100			120				
4		Outdoor – Very High Output*	≥30,000	100			120				
5		Interior Directional	250-4,500	65			90			• Wall-wash Luminaires • Track or Mono-point Luminaires	See Primary Use Zonal

* Under the next revision to the efficacy requirements (V5.0), DLC intends to split the "very high" outdoor lumen bin from the "high" lumen bin, and set unique efficacy requirements for each bin.

Refrigerator Case lighting: Definitions

- Proposed definition does not provide enough clarity to market; likely will add confusion and potential for future loopholes
- Define “dongle” connects as equivalent to pin-bases; therefore, these products not eligible unless evaluated as lamp
- Add explicit category for TLEDs/lamps intended for use in REF cases to wish list
  - 5-foot, 6-foot, etc.
  - Would include all ANSI-standard connections (“pin bases”), including dongle.
  - For consideration in future prioritization/development round



Next Steps: Specs Development

- Hazardous Location
  - Definition input solicited as part of V4.1 proposals
  - Next step: release full proposal for Stakeholder Input
- T5 Replacement Lamps
  - Will split out T5s from T8s
  - Will develop specific T5 categories
- Allowances
  - CCT, CRI under development
  - Glare, "Architectural Linear Ambient" under discussion
- Target Draft Proposals Released for Comment: late November
- Comment Period will run through mid January 2017
- Other Efforts:
  - Horticultural Lighting
  - Wish List (publicly available on the DLC website)

Thank You!

Irina Rasputnis	irasputnis@neep.org	781-860-9177 x133
Liesel Whitney-Schulte	lschulte@neep.org	781-860-9177 x162
Jenna Winer	jwiner@drintl.com	857-496-0007
Dave Ryan	dryan@drintl.com	301-588-9387 x1078

DESIGNLIGHTS CONSORTIUM