



Bringing Efficiency to LightSM

Final: SSL V4.4 DC/PoE, Field-Adjustable Light Output

Draft 2: Field-Adjustable Light Distribution

October 4, 2018

Webinar Logistics

- Slides and recorded webinar will be posted to www.designlights.org after presentation
- All attendees on mute; Please use GoToWebinar Interface (Question pane) to submit questions
- Questions will be answered via follow-up email to webinar attendees
- If you experience any technical issues, use Chat feature to let us know

Agenda

- Important Dates
- Final Policy Release
 - DC/PoE Lighting – Yao Jung Wen
 - Field Adjustable Light Output (revised) – Axel Pearson
- Draft 2 Policy Release
 - Field Adjustable Distribution – Gabe Arnold
- Next Steps

Important Dates

SSL V4.4 – DC / PoE, FA Light Output, and Horticultural Lighting

4/13/18
Draft 1

5/30/18
Comments
due

7/25/18
Draft 2

8/15/18
Comments
Due

10/1/18
Final
Release

10/18/18
Begin
Qualifying

SSL V4.4 – Field Adjustable Light Distribution

7/25/18
Draft 1

8/15/18
Comments
due

10/1/18
Draft 2

10/22/18
Comments
Due

12/5/18
Final
Release

12/5/18
Begin
Qualifying

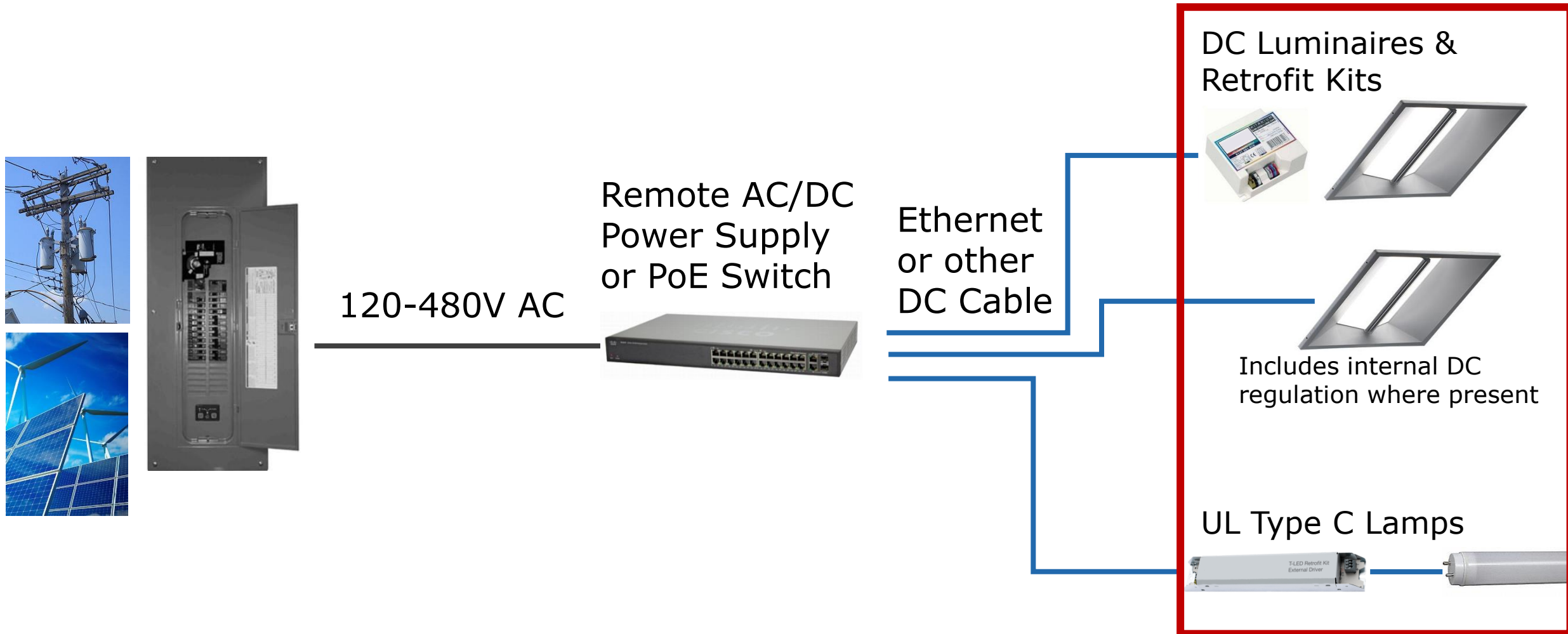
DC and PoE Lighting

Motivation and Background

- DC and PoE-based lighting systems have potential for significant energy savings and value from integration with networked controls and DC microgrids with generation.
- DC and PoE lamps, retrofit kits & luminaire are currently ineligible for listing on the DLC QPL.

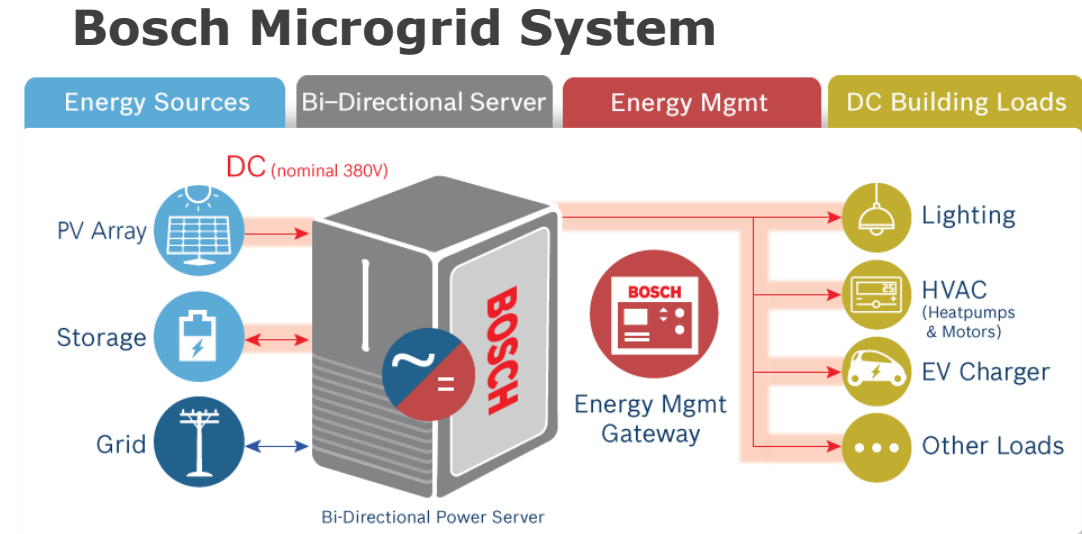


Example DC or PoE System Architecture



Definitions

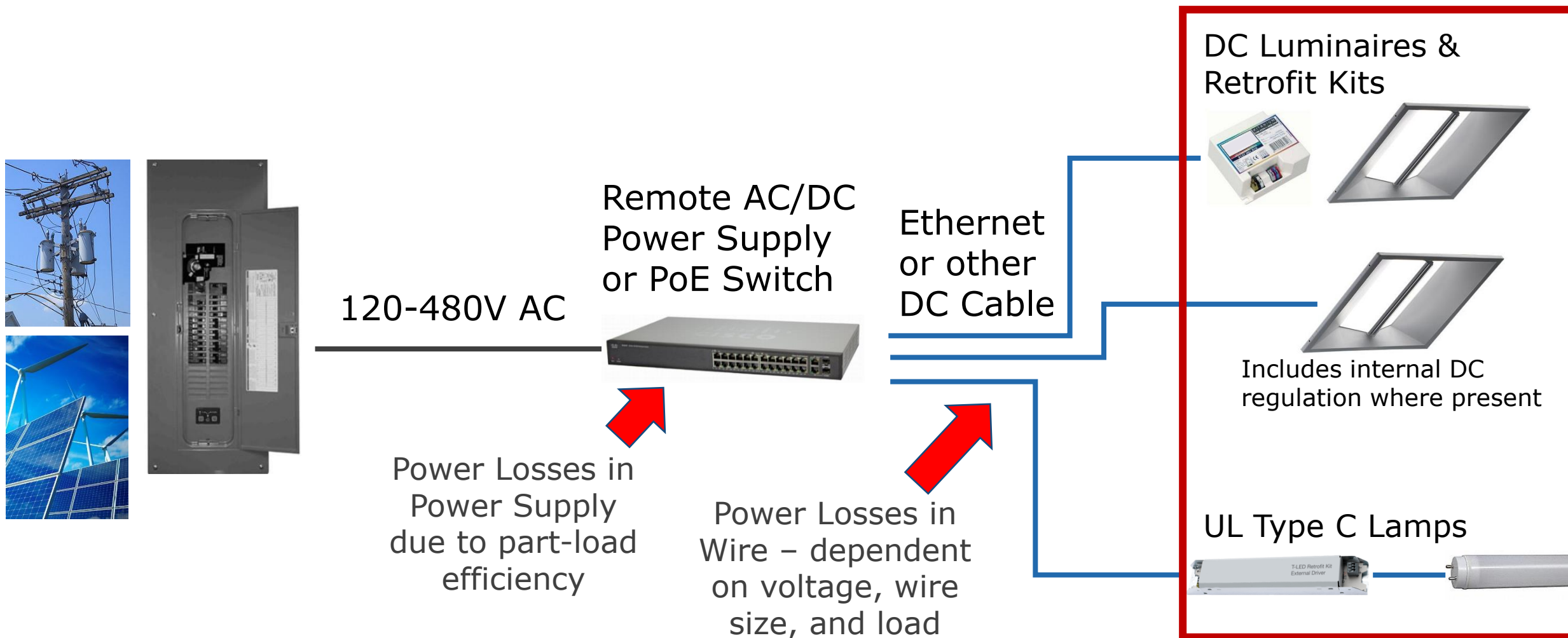
- **“DC Power Source”** is used to indicate the device(s) that connect AC mains to the lines directly providing DC input power to the DC/PoE product.
A DC Power Source may be known as any of the following:
 - **AC-to-DC Power Converter**
 - **Power-over-Ethernet Power Sourcing Equipment** (PoE PSE), also known as a PoE Switch
 - **AC/DC Multi-Directional Inverter**
- **“DC-to-DC Driver”** is an LED driver that converts the received DC voltage into the DC voltage required to operate the LEDs. Not all DC/PoE products require a DC-to-DC driver.



Philips Connected PoE Switch



Example DC or PoE System Architecture



DLC DC/PoE Policy Approach



120-480V AC

Remote AC/DC
Power Supply
or PoE Switch



Ethernet
or other
DC Cable

**Efficiency Program accounts
for other system losses
through custom calculations
– DLC provides basic
guidance for how to do it.**

LM-79 test

DC Luminaires &
Retrofit Kits



Includes internal DC
regulation where present

UL Type C Lamps





Scope and Definition

- DC/PoE products are defined as SSL lamps, luminaires, and retrofit kits that are powered by a DC voltage.
- If DC/PoE products are also capable of being powered by AC and the manufacturer desires to have them listed for both AC and DC, then the AC listing must have a distinct model number from the DC listed product and must be separately qualified.
- Though some DC products may be used entirely disconnected to the AC power grid, the primary focus of this policy is grid-connected SSL lighting.

Technical Requirements

- Must meet all DLC Technical Requirements with the exception of THD and Power Factor
 - If luminaire has a DC-to-DC driver, then an LED Driver ISTMT is required for DLC Premium
- DC/PoE products may also have Color-Tunable or Field-Adjustable product features, in which case they are also subject to the relevant DLC requirements

#	Category	General Application	Requirements							Primary Use***	Distribution
			Minimum Light Output (lm)	DLC Standard			DLC Premium**				
				Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L70	Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L90 / L70		
1	Outdoor	Outdoor – Low Output	250-5,000	90	5	≤5700 / ≥65 / ≥50,000	110	5	≤5700 / ≥65 / >36,000 / ≥50,000	<ul style="list-style-type: none"> • 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: _____ 	See Primary Use Zonal Lumen Density Requirements in Table 4, below
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	Indoor	Interior Directional	250-4,500	65	5	≤5000 / ≥80 / ≥50,000	90	5	≤5000 / ≥80 / >36,000 / ≥50,000	<ul style="list-style-type: none"> • Wall Wash Luminaires • Track or Mono-Point Luminaires • Specialty: _____ • Display Case Luminaires • Horizontal Refrigerated Case Luminaires • Vertical Refrigerated Case Luminaires • Specialty: _____ • 2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces • 1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces • 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces • Specialty: _____ • Direct Linear Ambient Luminaires • Linear Ambient Luminaires w/ Indirect component • Specialty: _____ • High Bay Luminaires for Commercial and Industrial Buildings • Low Bay Luminaires for Commercial and Industrial Buildings • High Bay Aisle Luminaires • Specialty: _____ 	See Primary Use Zonal Lumen Density Requirements in Table 4, below
6		Case Lighting	≥50 lm/ft	80			125				
7		Troffer	≥1,500	100			125				
8		Linear Ambient	≥375 lm/ft	105			130				
9		High Bay	≥5,000	105			≤5700 / ≥70 / ≥50,000				

Testing

- **All DC/PoE products must be submitted as a Family Group**
- **Testing shall be in accordance with LM-79 for DC devices with the following additional DLC clarifications:**
 - Measurement of the luminaire efficacy shall be made under DC power without inclusion of DC Power Source losses or line losses.
 - Many DC/PoE products utilize cables with multiple pairs of conductors. LM-79 Test Reports shall reflect and document the number and combined power analysis of all conductors.
 - Accessories (e.g. sensors) not required to achieve full light output shall be removed or disabled/powered down during LM-79 testing.

Testing

- **Voltage and current measurements shall be made at the point of entry to the products.**
 - Luminaires and retrofit kits
 - Measurements shall include any DC-to-DC driver circuitry that is included and shipped under the same model number as the luminaire or retrofit kit
 - Exclude drivers that need to be ordered separately under a different model number
 - UL Type C replacement lamps
 - Measurements shall include the remote DC-to-DC driver circuitry.

LM-79 test

DC Luminaires & Retrofit Kits



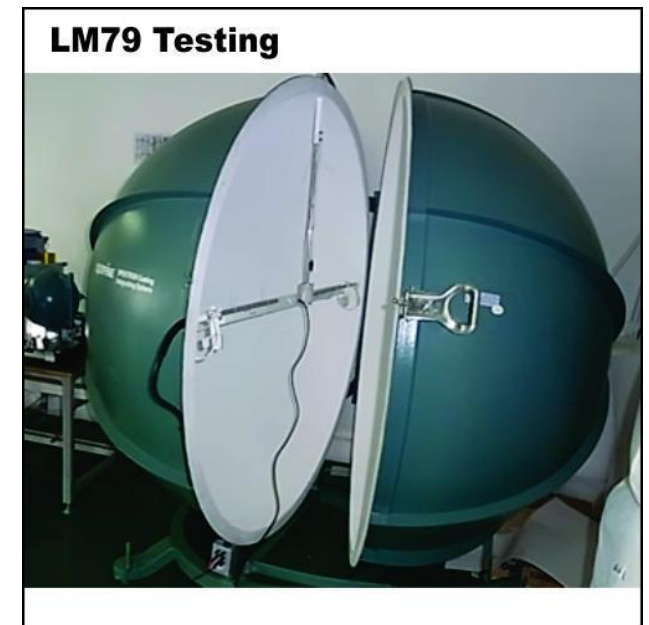
Includes internal DC regulation where present

UL Type C Lamps



Testing

- **Products must be LM-79 tested at 2 voltages:**
 1. DC input voltage that results in worst-case efficacy
 2. Nominal DC input voltage designated by the manufactures, different from the worst-case voltage
- **Manufacturers must provide clear instructions to the testing lab for how to achieve the full light output state mandated by the DLC for LM-79 testing.**
- **Lumen Maintenance: ISTMT must be conducted the same as with AC luminaires in worst-case condition**



Listing on the QPL

- DC/PoE product performance will be listed according to their lowest efficacy from the worst-case voltage LM-79 test(s)
- The nominal tested wattage will also be displayed as additional fields

Model# [REDACTED]

Manufacturer: [REDACTED]

Brand: [REDACTED]

Technical Requirements Version: 4.3

Date Qualified: 04/18/2018

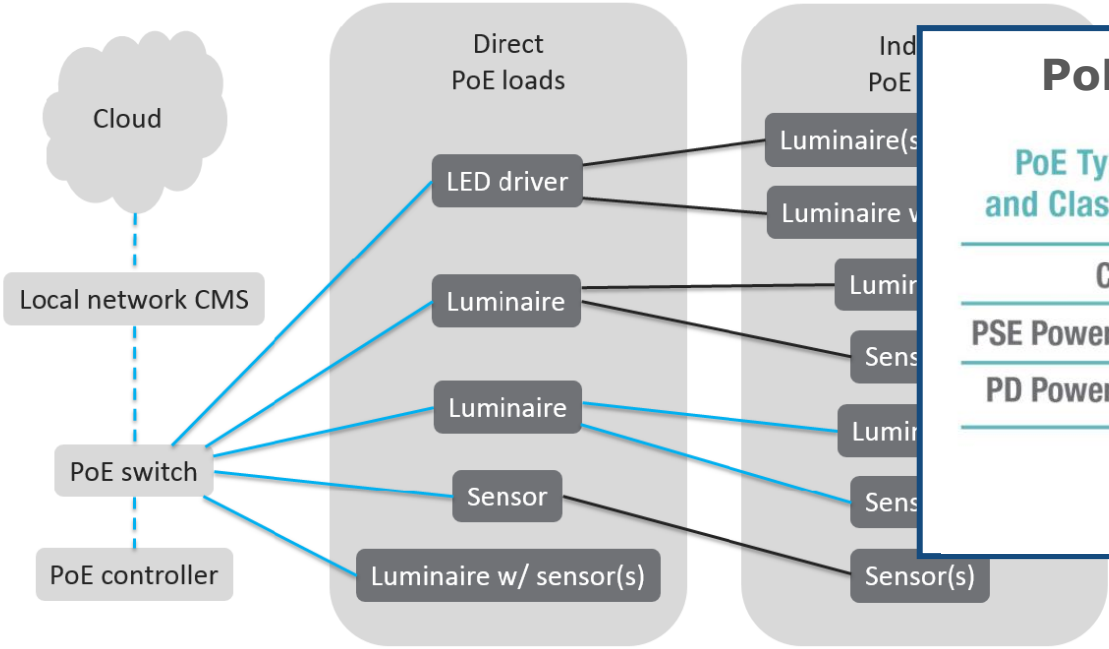
Product ID: [REDACTED]

Category

New fields added:

- System Type (AC, DC, PoE)
- Test Voltage (24 Volts, 300 Volts, etc.)
- Voltage Range (120-277VAC, 44-57VDC)
- Efficacy (DC)
- PoE Type/Class
- PoE Connection (direct or indirect PoE)

Indirect connection to the PoE network in some manufacturers' system architecture



PoE Types and Device Classes defined in IEEE 802.3

PoE Types and Classes	2-Pair PoE+ – Type 2					4-Pair PoE in Standardization			
	2-Pair PoE – Type 1				4	5	6	7	8
Class	0	1	2	3					
PSE Power (W)	15.4	4	7	15.4	30	45	60	75	90
PD Power (W)	13	3.84	6.49	13	25.5	40	51	62	71.3

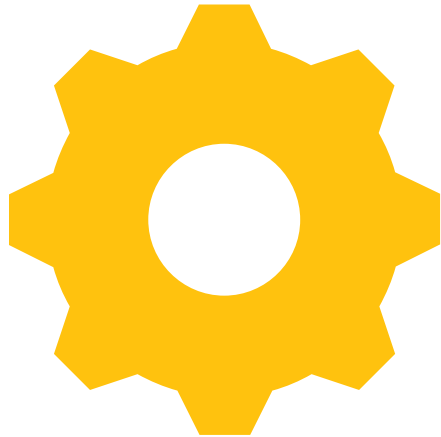
4-Pair PoE – Type 3

4-Pair PoE Type 4



Field Adjustable Light Output

Field Adjustable Light Output: Motivation and Background



- Field adjustable products are a growing industry trend
- This policy would enable high quality, energy efficient products with field-adjustable light output to be qualified and listed on the DLC SSL Qualified Products List (QPL)
- Benefits include economies of scale for manufacturers, streamlined stocking for distributors, and greater flexibility and value for customers

Definitions

- Dimmable products, including Field Adjustable Light Output products, are capable of being **adjusted to increase and/or decrease** lumen output and wattage from the default setting.

Default setting: *The setting at which the product emerges from production and is shipped with no adjustments to lumen output*



Technical Requirements

Dimmable products, including those with Field Adjustable Light Output, must meet all DLC Technical Requirements at the maximum light output setting.

Field Adjustable Output will be a manufacturer self-reported feature, similar to the current self-reporting of whether a product dims continuous or stepped.

Dimmable products with field adjustable output will be tested and listed at maximum output as with all other dimmable products

Manufacturers will self-report default wattage and light output if different from maximum

Example

- Manufacturer has a dimmable product with continuous dimming and field adjustable light output
- During application process, they will be asked to report:
 - Is product dimmable?
 - If yes, which type(s)?
 - ✓ Continuous
 - Down to 10%
 - ✓ Below 10%
 - Stepped
 - ✓ Field Adjustable Light Output
- Next slide shows how this will be displayed

Continuous and Stepped Type Definitions

- Adjusted post-installation, dynamically, or on a scheduled basis
- By occupant or control system signal
- In response to end-user preferences and/or energy saving measures

Field Adjustable Output Type Definitions

- Set before or during installation
- By manufacturer, distributor, installer, or commissioning agent
- To reduce product SKUs; sometimes for energy savings

Model# [AT30-VVV]-35W32LED3K-G2-LE3F-UNV-XX-[YYY-YYY]-ZZ



Manufacturer: [REDACTED]

Brand: [REDACTED]

Technical Requirements Version: 4.3

Date Qualified: 05/14/2018

Product ID: [REDACTED]

Categorization

Main: Outdoor Luminaires

General Application: Low Output

Primary Use: Outdoor Pole/Arm-Mounted Decorative Luminaires

Classification: standard

Is Parent Product: No

DLC Family Code: KKKZXT

Listing Status: Listed

[View Notes](#)

Reported Data

Zonal Lumens

Spacing Criteria

Product Features

Version History

Family Data

Dimming Status: Continuous Below 10 ←

Integral Controls: Has Integral Controls

Field-Adjustable: Light Output ←

Field Adjustable Light Distribution – Comments to Draft 1 and Proposed Changes in Draft 2

Field Adjustable Optics / Distribution

- New policy to allow products with field-adjustable optics or distribution
- Beneficial new product feature
 - Economies of scale for supply chain
 - More flexibility for customers and installers
- Seeing a lot more products with this feature





ILE-3-18



QD QUADCAST

Solid State LED

PARKING GARAGE/
CANOPY LUMINAIRE



field rotatable lens

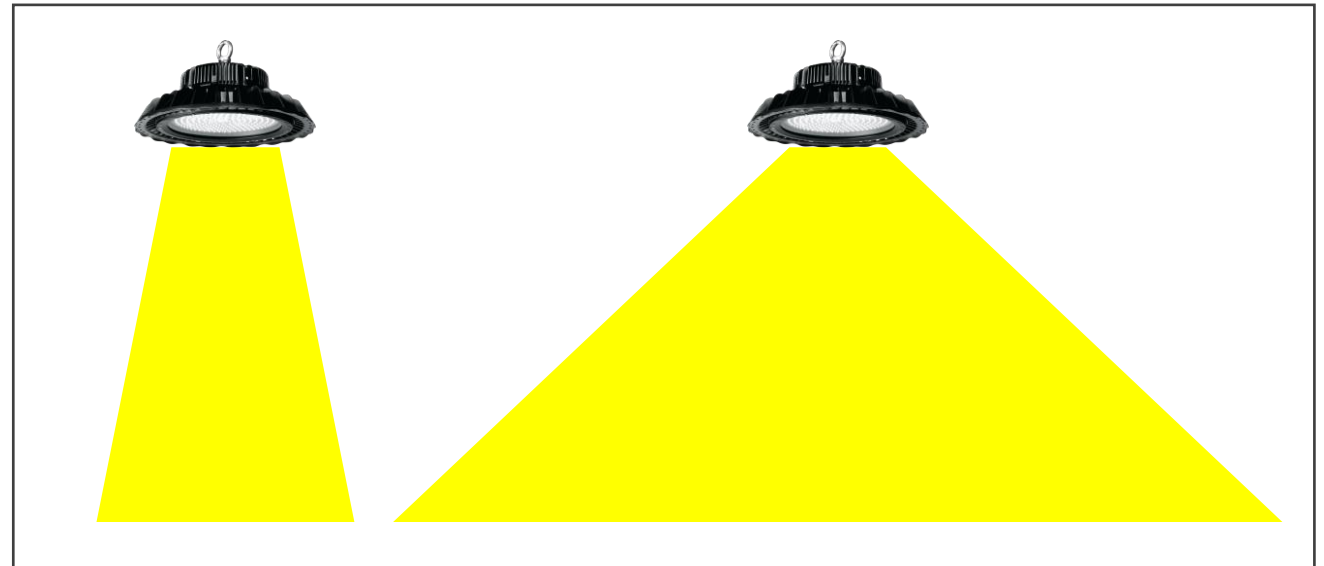


Qualification Considerations

- Adjustable Distribution enables products to be used in a variety of applications or DLC Categories/PUDs
- Requiring a product with adjustable distributions to meet DLC requirements for a category/PUD at all adjustment positions would defeat the purpose and benefits of adjustable distribution products

Example: Adjustable High-Bay Fixture Narrow Aisle to Wide Distribution

DLC Zonal Lumen Density Requirements	20-50° Zone	0-20° Zone
High Bay Luminaire	≥30%	N/A
High Bay Aisle Luminaire	≥50%	≥30%



- At wide distribution setting, product may not comply with DLC High-Bay Aisle ZLD Requirements
- Therefore product could not be qualified for High-Bay Aisle even though with adjustment it can meet DLC High-Bay Aisle Requirements

Proposed Qualification Approach

Ensure that the listed model number meets **or can at any time be adjusted to meet** the DLC requirements for the Category and Primary Use Designation it is listed under.

Field Adjustable Light Distribution Definition

Draft 1 Definition:

Lamps, luminaires, or retrofit kits whose light distribution can be altered from the default factory as-shipped configuration, either at the time of installation or subsequently.

Draft 1 Comment Received:

Adjusting distributions should be allowed at distributors before shipping to customers.

Draft 2 Proposed New Definition:

Lamps, luminaires, or retrofit kits whose light distribution can be altered from the default factory as-shipped configuration.

- **Draft 1 Proposal:**

- Only products where distribution can be altered without the addition, removal, or replacement of any parts or accessories are eligible

- **Draft 1 Comments Received:**

- Optional parts that are added or removed to alter the distribution should be eligible.
- We believe mechanical changes SHOULD be included if electronic changes are allowed.

- **DLC proposal in Draft 2:**

Field-Adjustable Light Distribution (FALD) products may fall into one of three categories

- **Integral FALD Products** – Light distribution can be altered by electrical or mechanical means without the addition, removal or replacement of any parts or accessories.
- **Standard Accessory FALD Products** – Light distribution is altered by adding or removing parts or components that are shipped as standard components with the product under a single model number.
- **Optional Accessory FALD Products** – Light distribution is altered by adding or removing optional parts or components that are ordered separately or as an option.



* A product may simultaneously fall under more than one of the three categories.

Principle: Ensure that the listed model number meets or can at any time be adjusted to meet the DLC requirements for the PUD(s) it is listed under.

**Integral
FALD Products**

Must meet all DLC Technical Requirements for the category and PUD at **one** of the product's light distribution settings

**Standard
Accessory
FALD Products**

Must meet all DLC Technical Requirements for the category and PUD at **every** combination of the included distribution altering parts

**Optional
Accessory
FALD Products**

Must be submitted with separate model numbers and treated as non-FALD products. **Not governed by this policy.**

Principle: Ensure that the listed model number meets or can at any time be adjusted to meet the DLC requirements for the PUD(s) it is listed under.

With **each Standard Accessory installed**, the product must meet all DLC Technical Requirements for the category and PUD at **one** light distribution setting adjusted using the integral means.

**Integral
FALD Products**

Must meet all DLC Technical Requirements for the category and PUD at **one** of the product's light distribution settings

**Standard
Accessory
FALD Products**

Must meet all DLC Technical Requirements for the category and PUD at **every** combination of the included distribution altering parts

**Optional
Accessory
FALD Products**

Must be submitted with separate model numbers and treated as non-FALD products. **Not governed by this policy.**

Principle: Ensure that the listed model number meets or can at any time be adjusted to meet the DLC requirements for the PUD(s) it is listed under.

**Integral
FALD Products**

Must meet all DLC Technical Requirements for the category and PUD at **one** of the product's light distribution settings

The product, paired with each Optional Accessory, must be submitted with a separate model number, each of which is treated as a **Standard Accessory FALD Product** for the purpose of this policy.

**Standard
Accessory
FALD Products**

Must meet all DLC Technical Requirements for the category and PUD at **every** combination of the included distribution altering parts

**Optional
Accessory
FALD Products**

Must be submitted with separate model numbers and treated as non-FALD products. **Not governed by this policy.**

Principle: Ensure that the listed model number meets or can at any time be adjusted to meet the DLC requirements for the PUD(s) it is listed under.

The product, paired with each Optional Accessory, must be submitted with a separate model number, each of which is treated as an **Integral FALD Product** for the purpose of this policy.

Integral FALD Products

Must meet all DLC Technical Requirements for the category and PUD at **one** of the product's light distribution settings

Must meet all DLC Technical Requirements for the category and PUD at **every** combination of the included distribution altering parts

Optional Accessory FALD Products

Must be submitted with separate model numbers and treated as non-FALD products. **Not governed by this policy.**

Listing on the QPL

- **Integral FALD** products will be listed on the QPL at the tested light distribution setting, with the product performance characteristics from that LM-79 testing at that setting: Light Output, Watts, Efficacy, THD, Power Factor, CRI, CCT, Zonal Lumens, and Spacing Criteria.
- **Standard Accessory FALD** products will be listed on the QPL at the tested light distribution configuration that produces the worst-case efficacy performance, with product performance characteristics from that test: Light Output, Watts, Efficacy, THD, Power Factor, CRI, CCT, Zonal Lumens, and Spacing Criteria.

Model#

Manufacturer:

Brand:

Technical Requirements Version: 4.3

Date Qualified: 05/14/2018

Product ID:

New fields added:

- Adjustable Distribution Setting – for Integral FALD products to document the light distribution setting at which the products are tested and reported.

Categorization

Main: Outdoor Luminaires

General Application: Low Output

Primary Use: Outdoor Pole/Arm-Mounted Decorative Luminaires

Classification: standard

Is Parent Product: No

DLC Family Code: KKKZXT

Listing Status: Listed

[View Notes](#)

Reported Data

Zonal Lumens

Spacing Criteria

Product Features

Version History

Family Data

Dimming Status: Continuous Below 10

Integral Controls: Has Integral Controls

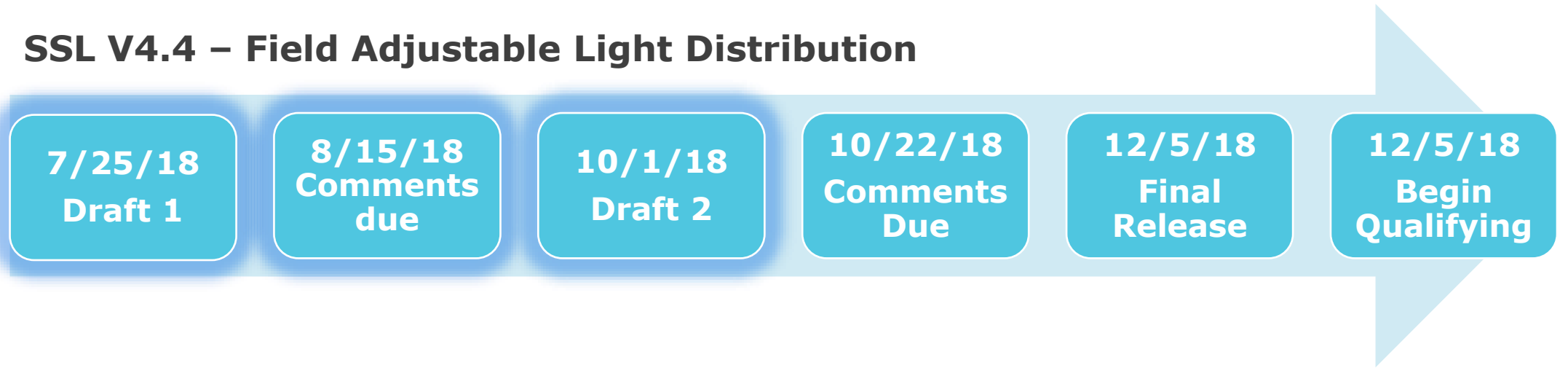
Field-Adjustable: Light Distribution

This “product feature” will be identified here for **Integral FALD** and **Standard Accessory FALD** products, but not **Optional Accessory FALD** products.

Next Steps

Next Steps

SSL V4.4 – Field Adjustable Light Distribution



Thank You!

Gabe Arnold

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