Energy Code Ace™

HELPING YOU PLAY YOUR CARDS RIGHT

2016 Title 24, Part 6

Reference Joint Appendices JA8 & JA10

Residential Lighting — Test, Certify, & Comply

California's High Efficacy Lighting Requirements for Residential Applications

Kelly Cunningham

Pacific Gas & Electric Company

Host

Mike McGaraghan

Energy Solutions

Peter Strait

California Energy Commission

Guests

SDGE A Sempra Energy utility®

SoCalGas A Sempra Energy utility®

Southern California Edison® An Edison International® Company

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This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission.

Today's Speakers

Kelly Cunningham, Host

Codes & Standards, Pacific Gas and Electric Company

Kelly Cunningham, our host for this session, is currently a senior program manager on Pacific Gas & Electric's Codes and Standards team. Her role includes leading outreach and education efforts to increase compliance with California's Building Energy Efficiency and Appliance standards as part of Energy Code Ace, a statewide Investor Owned Utility project. Kelly has over seven years of experience presenting on lighting-related topics, with a special emphasis on Title 24, Part 6.

Mike McGaraghan, Guest

Energy Solutions

Mike McGaraghan is a Senior Project Manager at Energy Solutions where he leads the lighting-related appliance standards and building codes development team. He has been a lead technical subject matter expert on several lighting specification development projects, including the Voluntary California Quality LED Specification, and the 2016 Title 24 Residential Lighting standards update (including development of the Title 24 Joint Appendices 8 and 10). Mike has over 10 years of experience in the energy efficiency industry.

Peter Strait, Guest

California Energy Commission

Peter Strait is the supervisor of the Standards Development Unit within the Energy Commission's Building Standards Office. His role includes directing the team responsible for the triennial updates to California's Building Energy Efficiency Standards (Title 24, Part 6), ensuring transparency and openness in the rulemaking process, and facilitating public participation in the development of new and updated requirements. Peter has worked within the Efficiency Division of the California Energy Commission for nine years.

Agenda

Segment	Topic
Introduction	✦ Overview of Energy Code Ace
	✦ Overview of California's New Lighting Requirements
JA8 & JA10 Requirements	✦ Overview of 2016 Title 24, Part 6 - Reference Joint Appendix JA8 Check Your Understanding
	✦ Overview of 2016 Title 24, Part 6 - Reference Joint Appendix JA10 for Flicker Testing Check Your Understanding
Compliance	✦ How to Comply with 2016 Title 24, Part 6 - JA8 Check Your Understanding
Wrap Up	✦ Summary and Wrap Up

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2016 ENERGY CODE

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Residential

High Efficacy Lighting for Manufacturers

New Testing and Certification Requirements

On January 1, 2017, new lighting requirements in California's Building Energy Efficiency Standards (Title 24, Part 6 or Energy Standards) for new construction will be in effect. The Energy Standards require high efficacy lighting throughout newly constructed homes, and the definition of "high efficacy" luminaire has been expanded to include luminaires containing light sources that meet the new performance requirements outlined in Title 24 Reference Joint Appendix 8 (JA8), Qualification Requirements for High Efficacy Light Sources. In addition to more quality and efficacy requirements, JA8 now also references Joint Appendix 10 (JA10), Test Method for Measuring Flicker of Lighting Systems and Reporting Requirements, for additional flicker testing and data reporting requirements for JA8 light sources.

To qualify as a JA8 light source for compliance with Section 150.0(k) of the 2016 Energy Standards, the light source must be certified to the California Energy Commission in accordance with JA8 and JA10. This fact sheet is designed to help manufacturers understand how to certify their lighting equipment.

Why?

These residential lighting requirements are designed to significantly reduce energy use in new homes. The California Energy Commission estimates 110,000 single-family homes and 30,000 multifamily dwelling units will be built in California in 2017. The new requirements are projected to reduce lighting energy use in those homes by roughly 50%. Projected energy savings for the first year of implementation (2017) equal the amount of electricity consumed annually by 13,000 typical California homes (85 GWh).

Relevant Code Sections

2016 California Building Energy Efficiency Standards, Title 24, Part 6:

- Section 100.1 – Definitions and Rules of Construction
- Sections 110.9(a)(6)(F) – Mandatory Requirements for Lighting Control Devices and Systems, Ballasts, and Luminaires
- Section 130.0(b) – Lighting Systems and Equipment and Electrical Power Distribution Systems
- Section 150.0(k) – Mandatory Features and Devices
- Joint Appendix 1 (JA1) – Glossary
- Joint Appendix 8 (JA8) – Qualification Requirements for High Efficacy Light Sources
- Joint Appendix 10 (JA10) – Test Method for Measuring Flicker of Lighting Systems and Reporting Requirements

EnergyCodeAce

Page 1 of 4

- Energy Code Ace Fact Sheet "High Efficacy Lighting for Manufacturers"
- Energy Code Ace Reference Ace (JA8 & JA10)
- Energy Code Ace JA10 Flicker Test Best Practices
- Energy Code Ace Training On-Demand Videos

California Market for High Efficacy Lighting

- The current standards (2013 Title 24) still allow a significant portion of low efficacy lighting in new homes:

Type of Space	**Current Practice in New Homes:** Percent of Sockets/ Luminaires with High Efficacy Light Sources
Kitchen	81%
Bathrooms	34%
Bedroom	10%
Hallway/Stair	15%
Living Room	5%
Dining Room	2%
Whole Home	**30%**

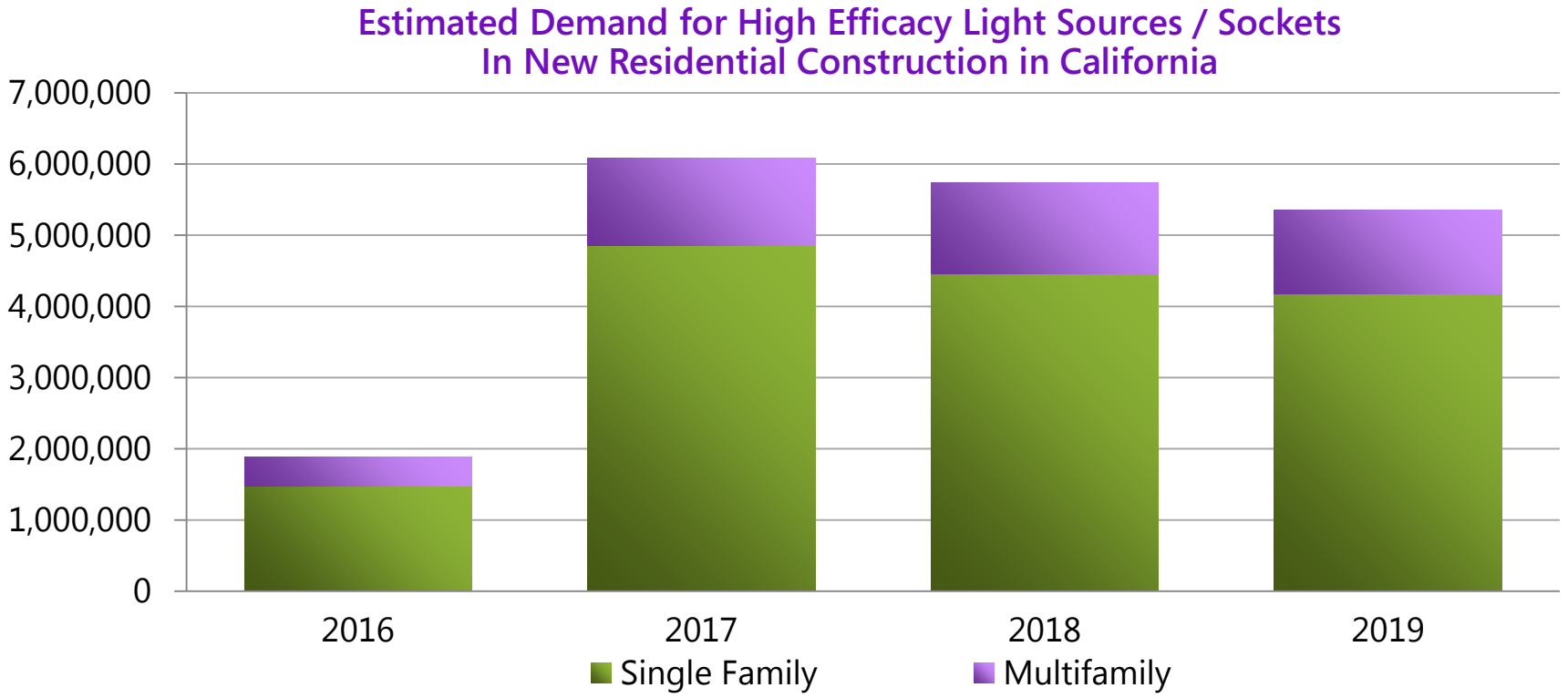
Source: Residential Lighting CASE Report, October, 2014. Statewide Utility C&S Team

- The 2016 standards will require **100%** high efficacy lighting in residential applications and nonresidential dwelling units

Opportunities Abound!

California Market for High Efficacy Lighting Is Growing

- Projected New Residential Construction in 2017 is over 140,000 new dwelling units: Over 6 million light sources will need to be high efficacy

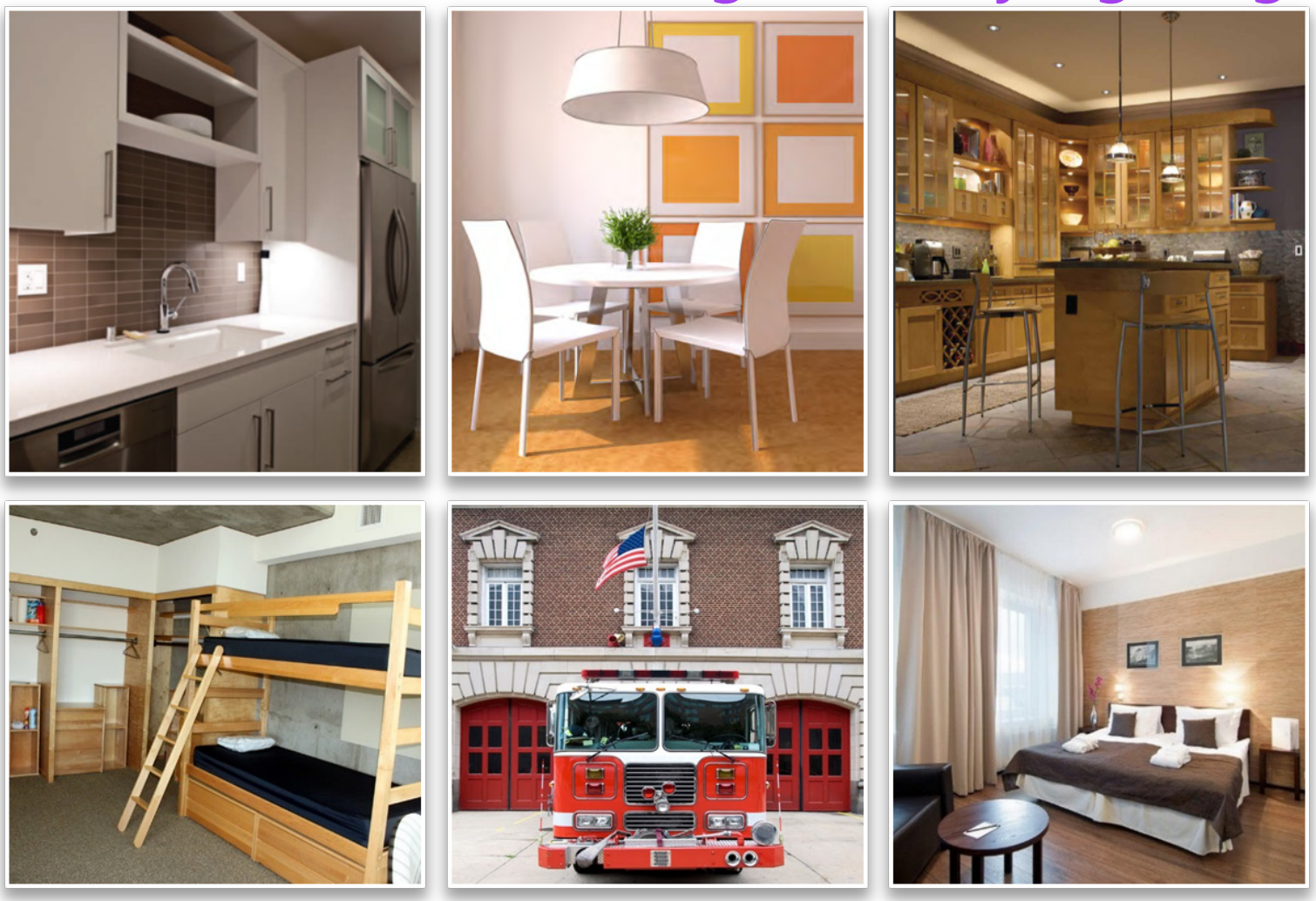


Source: Derived from the Residential Lighting CASE Report, October, 2014. Statewide Utility C&S Team and California Energy Commission's Demand Analysis Office Construction Forecasts

- In addition, market expansion for new construction in nonresidential dwelling units, including over 5 million square feet of new hotel/motel construction

Opportunities Abound!

California Market for High Efficacy Lighting



Overview of California's New and Upcoming Lighting Requirements

Buildings

Title 24

- Mandatory high efficacy lighting requirements for lamps and luminaires installed in new residential buildings
- New requirements go into effect on January 1, 2017

Products

Title 20

- Mandatory requirements for various lighting technologies, including replacement lamps
- New requirements for LEDs go into effect in 2018 and 2019

Rebates

Voluntary Specification

- Used for establishing eligible products for utility rebate programs
- **Coming soon:** updated specification based on forthcoming Title 20 requirements

Overview of California's Lighting Standards

Products designed to meet all specifications may reach a broader market

2016 Title 24, Part 6 Reference Joint Appendix JA8

- Focuses on performance and lighting quality to increase consumer retention of high efficacy lighting
- Technology-neutral specification

Title 20 Appliance Efficiency Regulations for LEDs

- Does not cover as many quality metrics as JA8, and some quality requirements are not as stringent as JA8

Voluntary California Quality LED Lamp Specification

- Used for CA IOU rebate eligibility
- Applies to smaller set of product types than JA8, but requirements are similar

High Efficacy Lighting Requirements

Title 24, Part 6 Residential Lighting

What's New for High Efficacy Lighting Requirements in 2017

- Starting January 1, 2017 California will require all high efficacy lighting in residential new construction and in dwelling units of nonresidential buildings
- Definition of "high efficacy" has been expanded to allow:
  - Luminaires with screw base sockets when a certified high efficacy lamp is installed
  - Sockets designed for incandescent or halogen base types (as long as a JA8 light source is installed at time of inspection)
  - Luminaires with screw base sockets may not be installed in recessed downlights
- No requirement for JA8 light source to be shipped with fixture

Mandatory Luminaire Requirements
Effective January 1, 2017

2016 Title 24, Part 6, Section 150.0(k) – Residential Lighting

Table 150.0-A: Classification of High Efficacy Light Sources

High Efficacy Light Sources

Luminaires installed with only the lighting technologies in this table shall be classified as high efficacy

Light sources in this column other than those installed in ceiling recessed downlight luminaires are classified as high efficacy and are **not** required to comply with Reference Joint Appendix JA8	Light sources in this column shall be certified to the Commission as High Efficacy Light Sources in accordance with Reference Joint Appendix JA8 and be marked as meeting JA8.
1. Pin-based linear or compact fluorescent light sources using electronic ballasts.	8. All light sources in ceiling recessed downlight luminaires. Note that ceiling recessed downlight luminaires shall not have screw bases regardless of lamp type as described in Section 150.0(k)1C.
2. Pulse-start metal halide.	9. GU-24 sockets containing LED light sources.
3. High pressure sodium.	10. Any light source not otherwise listed in this table and certified to the Commission as complying with Joint Appendix 8.
4. GU-24 sockets containing light sources other than LEDs. [a,b]	
5. Luminaires with hardwired high frequency generator and induction lamp.	
6. Inseparable SSL luminaires that are installed outdoors.	
7. Inseparable SSL luminaires containing colored light sources that are installed to provide decorative lighting.	

Notes:

a. GU-24 sockets containing light sources such as compact fluorescent lamps and induction lamps.

b. California Title 20 Section 1605(k)3 does not allow incandescent sources to have a GU-24 base.

Mandatory Luminaire Requirements
Effective January 1, 2017

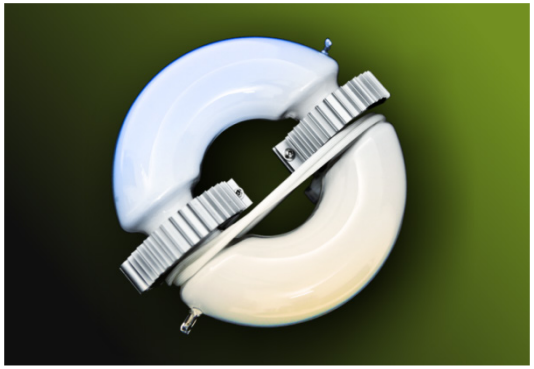
2016 Title, 24 Part 6, Section 150.0(k) – Residential Lighting

- Five "legacy" product categories are still considered "high efficacy" by definition
- They do NOT need to be certified to the Energy Commission

Pin-based linear or compact fluorescent lamps with electronic ballasts

Non-LED and non-incandescent lamps with Gu24 base

Pulse-start metal halide lamps

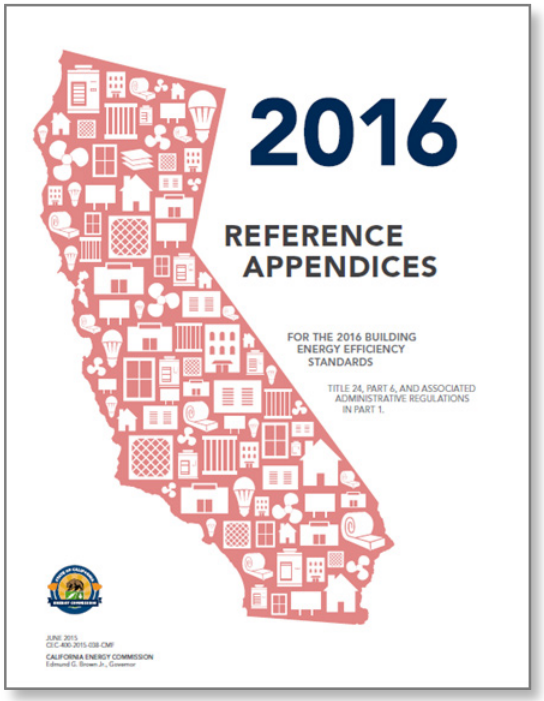


Induction lamps

High-pressure sodium lamps

Image source: California Lighting Technology Center (CLTC)

Scope



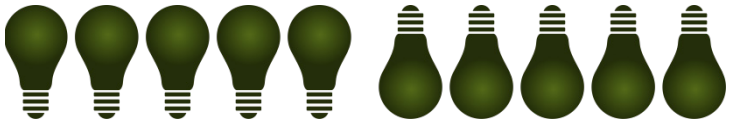
2016 Title 24, Part 6 – Joint Appendix JA8 (JA8.1)

High efficacy light sources include ballasts or drivers if needed for operation of the light source:

- All qualifying light sources shall be certified to Energy Commission in accordance with JA8
- Light sources shall be certified together with a driver or ballast
- If light source is inseparable from luminaire, the entire luminaire shall meet the requirements of JA8

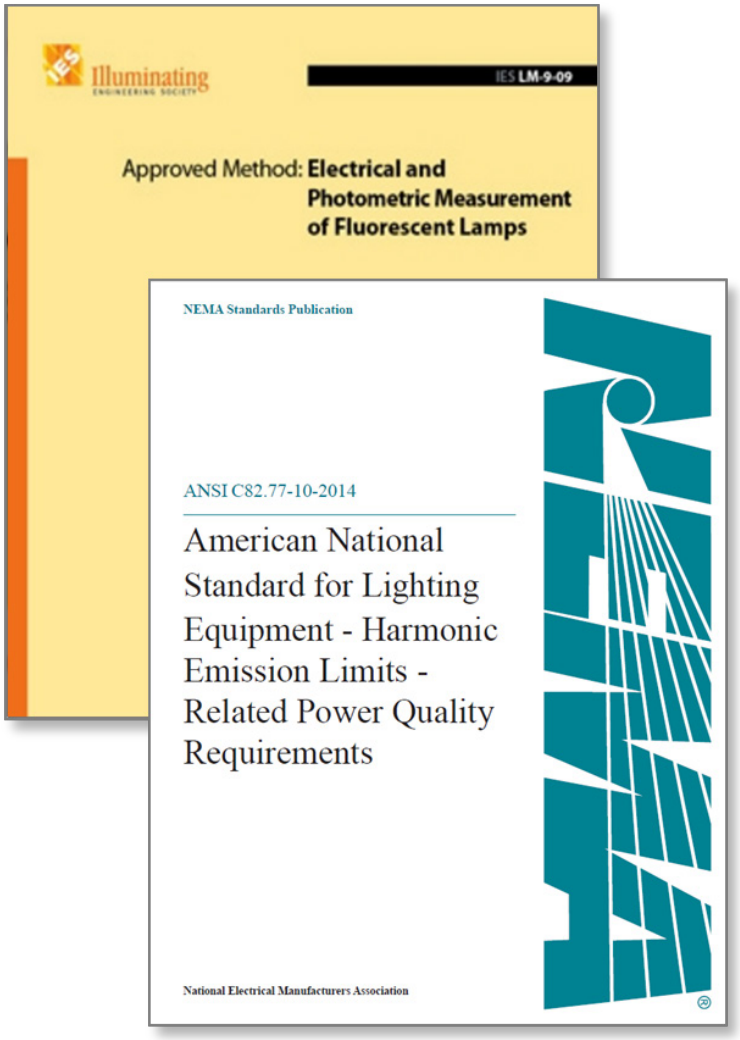
Testing Requirements

Image source: http://www.iqsindia.net/iso-iec-17025-2005.htm



- Test labs must be accredited to ISO/IEC 17025 (JA8.2)
  - Do not need to be pre-approved by the Energy Commission
- Sample Size:
  - 10 units for ANSI bases (5 up / 5 down)
  - 3 units for all other products, oriented towards manufacturer's instructions

Testing Requirements



2016 Title 24, Part 6 – Joint Appendix JA8 (JA8.3)

- In accordance with various industry standard test methods:
  - IES-LM9
  - IES-LM66
  - IES_LM-79
  - IES-LM-46
  - 10 CFR 430.23(q)
- Modifications for:
  - Ambient Temperature Life Test
  - Elevated Temperature Life Test
  - Tests for Minimum Dimming Level and Flicker (Joint Appendix JA10)

High Efficacy Qualification Requirements

2016 Title 24, Part 6 – Joint Appendix JA8 (JA8.4)

- Qualification requirements for high efficacy light sources installed to comply with Section 150.0(k) of Title 24, Part 6
- To be certified to JA8, products must meet qualification requirements for:
  - Luminous Efficacy
  - Power Factor
  - Start Time
  - Color Characteristics
  - Lumen Maintenance, Rated Life & Survival Rate
  - Dimming, Reduced Flicker Operation & Audible Noise (Joint Appendix JA10)

Required Metrics

Metric	Performance Requirements
Efficacy	≥45 lpw (when tested at full light output)
Power Factor	≥0.9 (when tested at full light output)
Start Time	≤ 0.5 seconds
CCT	Dedicated LED luminaires, LED light engines, and GU24 LEDs must be capable of providing a CCT ≤4000K
	All other sources (e.g. lamps with base types commonly used by incandescent products) must be capable of providing a CCT ≤3000K
CRI	≥90 (Note: for color changing products, this measurement must be taken when operating at a compliant CCT value.)
Duv	Within 0.0033 of the black body locus (this is approximately 4 MacAdam steps) (Note: for color changing products, this measurement must be taken when operating at a compliant CCT value)
R9	≥50 (Note: for color changing products, this measurement must be taken when operating at a compliant CCT value)
Lumen Maintenance	Corresponds to an L70 of 15,000 (≥86.7% maintenance at 6,000 hours)
Rated Life	≥15,000 hours
Early Failure	≥90% of units operational after 6,000 hour test
Dimmability	Must be dimmable down to 10% of full light output. Forward phase cut LEDs must meet NEMA SSL7A.
Flicker	<30%, at frequencies <200 Hz, at 100% and 20% light output; tested according to the requirements in Joint Appendix JA10
Audible Noise	≤24 dBA at 1 meter, tested at 100% and 20% light output

Marking Requirements

Image source: Soraa

2016 Title 24, Part 6 – Joint Appendix JA8 (JA8.5)

Compliant light sources must be permanently marked with:

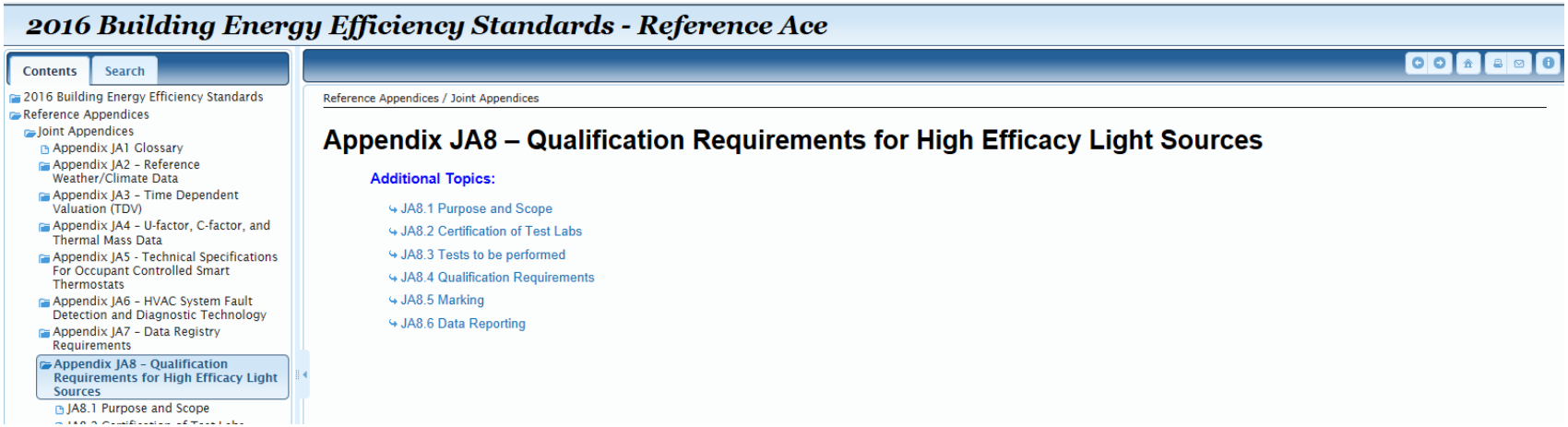
- "JA8-2016"

OR

- "JA8-2016-E"
  - For light sources that have passed the Elevated Temperature Life Test for enclosed or recessed fixtures
  - "E" marking lets installer and inspector know that the lamp is safe for recessed/enclosed fixture

Where to Find 2016 JA8 Online

Reference Ace 2016 Title 24, Part 6 – Joint Appendix JA8



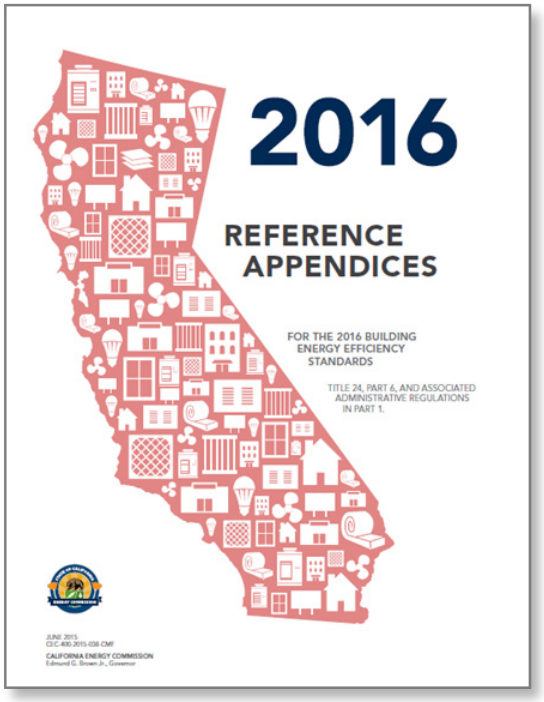
Energy Code Ace Reference Ace Tool:
http://energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/appendixja8qualificationrequirementsforhighefficacylightsources.htm

2016 Title 24, Part 6 Reference Joint Appendix JA8:
http://www.energy.ca.gov/2015publications/CEC-400-2015-038/CEC-400-2015-038-CMF.pdf

Check Your Understanding

Flicker Testing and Reporting

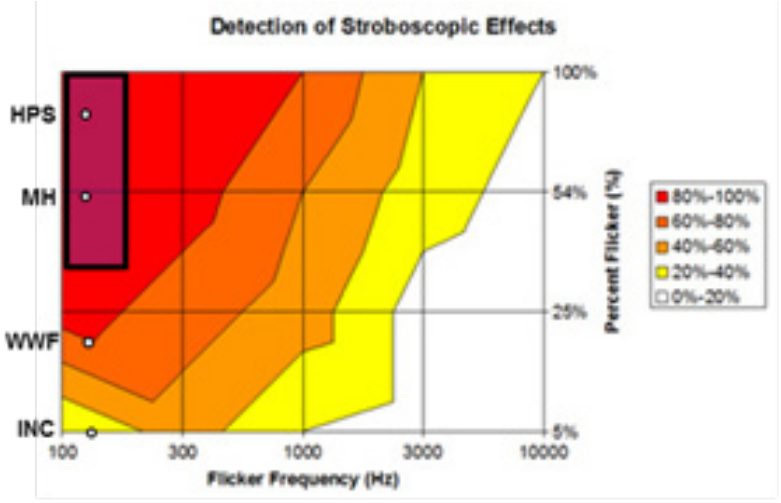
JA10 Testing Requirements

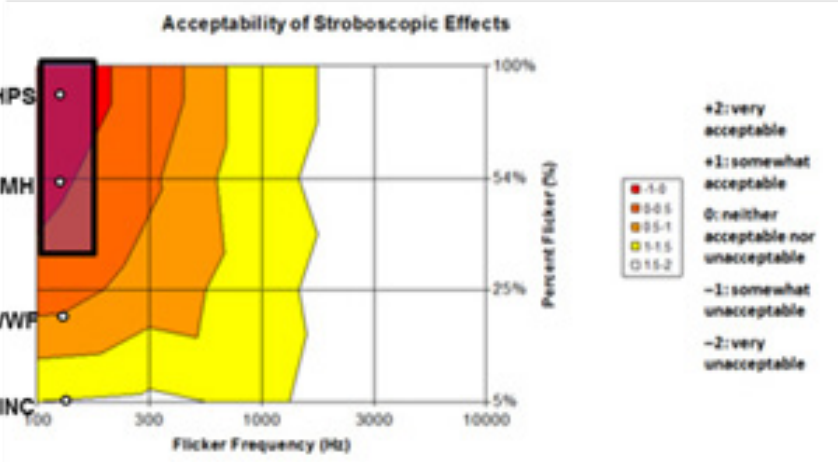


- JA10.2 Equipment Combinations
- JA10.3 Test Equipment Requirements
- JA10.4 Flicker Test Conditions
- JA10.5 Test Procedure
- JA10.6 Calculations
- JA10.7 Test Report and Data Format

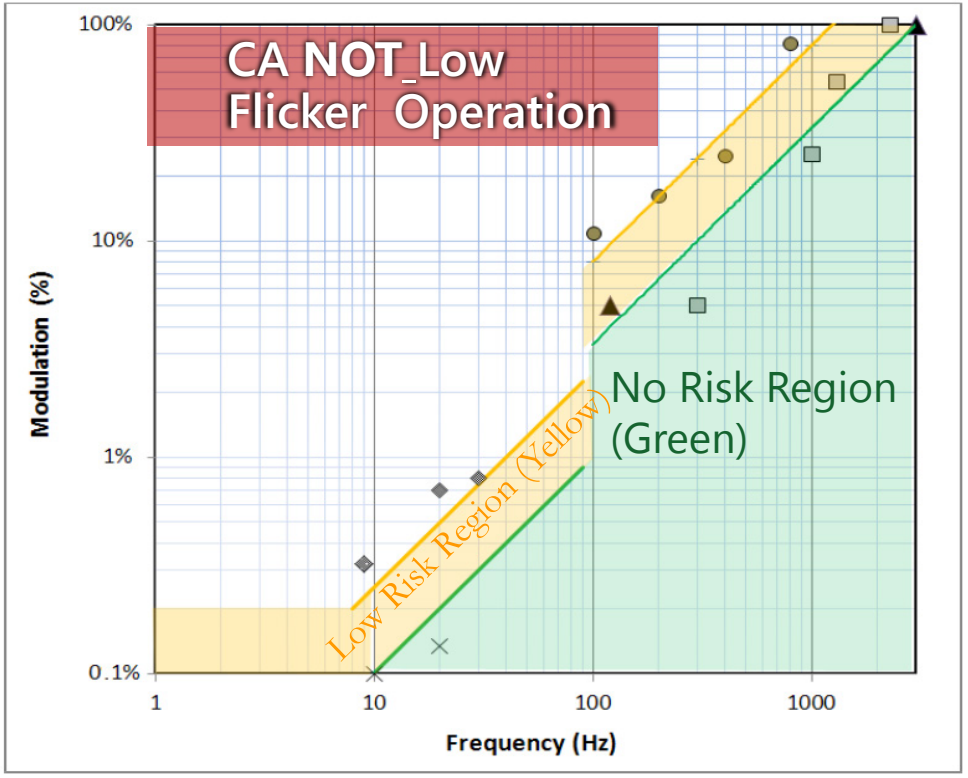
Flicker Test Method Overview

2016 Title 24, Part 6 Joint Appendix JA10 (JA10.1)





Source: LRC 2012



Lehman et al 2014

Flicker Test Equipment Combinations

2016 Title 24, Part 6 Joint Appendix JA10 (JA10.2)

Measurements specific to each combination of:

- Light source and a representative dimmer; or
- Low voltage lamp together with a representative transformer and a representative dimmer (if applicable); or
- Light source together with a representative driver, and a representative dimming control (if applicable); or
- Light source together with a representative ballast, and a representative dimming control (if applicable)

Flicker Test Equipment Requirements

2016 Title 24, Part 6 Joint Appendix JA10 (JA10.3)

Test enclosure

- Does not admit stray light
- Maintain constant temperature of 25°C ±5°C

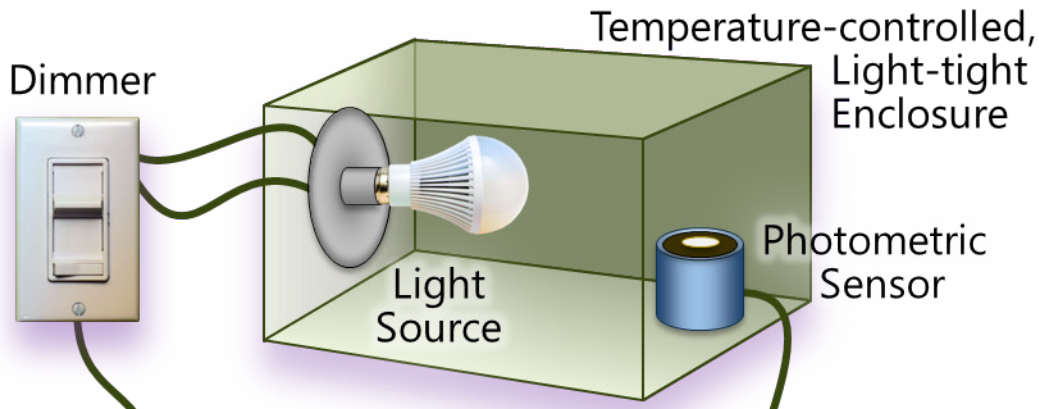
Device for data collection

- Photodetector, with rise time of ≤10 microseconds, a transimpedance amplifier, and oscilloscope
- Alternate device with same accuracy and function may be used

Temporal response, amplification, & filtering characteristics

- Capture photometric data at intervals of 50 microseconds or less,
- Corresponding to data recording rate of no less than 20 kHz, and
- Capable of capturing at least 1 second of data

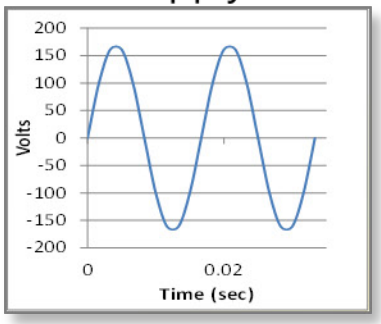
Flicker Test Set Up



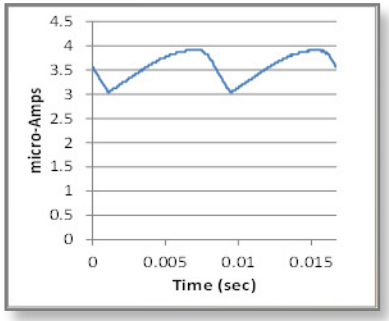
Transimpedance Amplifier

Digital Oscilloscope

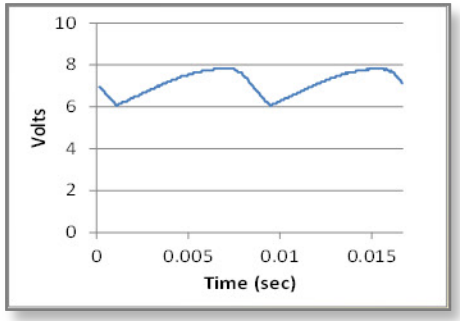
Regulated Power Supply



Sensor Output



Amplified Sensor Output



Digital Time Series Data

Time (sec)	Volts
0	7.125
1E-04	7.037
0.00015	6.949
0.0002	6.949
0.00025	6.861
0.0003	6.861
0.00035	6.773
0.0004	6.773
0.00045	6.686
0.0005	6.598

Flicker Test Procedure

2016 Title 24, Part 6 Joint Appendix JA10 (JA10.5)

Lamp stabilization

- In accordance with IES-LM9, IES-LM66, IES_LM-79, IES-LM-46, and 10 CFR 430.23(q)

Lamp light output

- Should be stabilized before taking measurements at each dimming level
- Stabilized = consecutive measurements taken at one minute intervals that deviate by no more than 0.5%

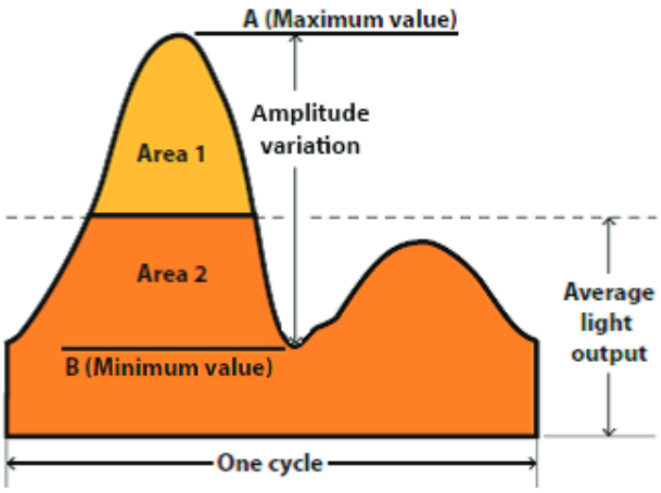
Recording Interval

- Record to 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 20kHz, and capture at least 1 second of data

Readings

- For each dimming level, after lamps have stabilized, record lighting measurements (in footcandles or volts) from test equipment

Flicker Test Calculations



$$\text{Percent Flicker} = 100\% \times \frac{A - B}{A + B} \qquad \text{Flicker Index} = \frac{\text{Area 1}}{\text{Area 1} + \text{Area 2}}$$

Source: DOE Flicker Fact Sheet Modified from IES Handbook

2016 Title 24, Part 6, Joint Appendix JA10 (JA10.6)

- For each dimming level (100%, 20% & manufacturer's minimum dimming level)
- Calculate percent flicker of unfiltered data for each dimming level using equation:

$$\text{Percent Amplitude Modulation} = \frac{(\text{Max} - \text{Min})}{(\text{Max} + \text{Min})} \times 100$$

Flicker Raw Data Filtering

2016 Title 24, Part 6 Joint Appendix JA10 (JA10.6 cont.)

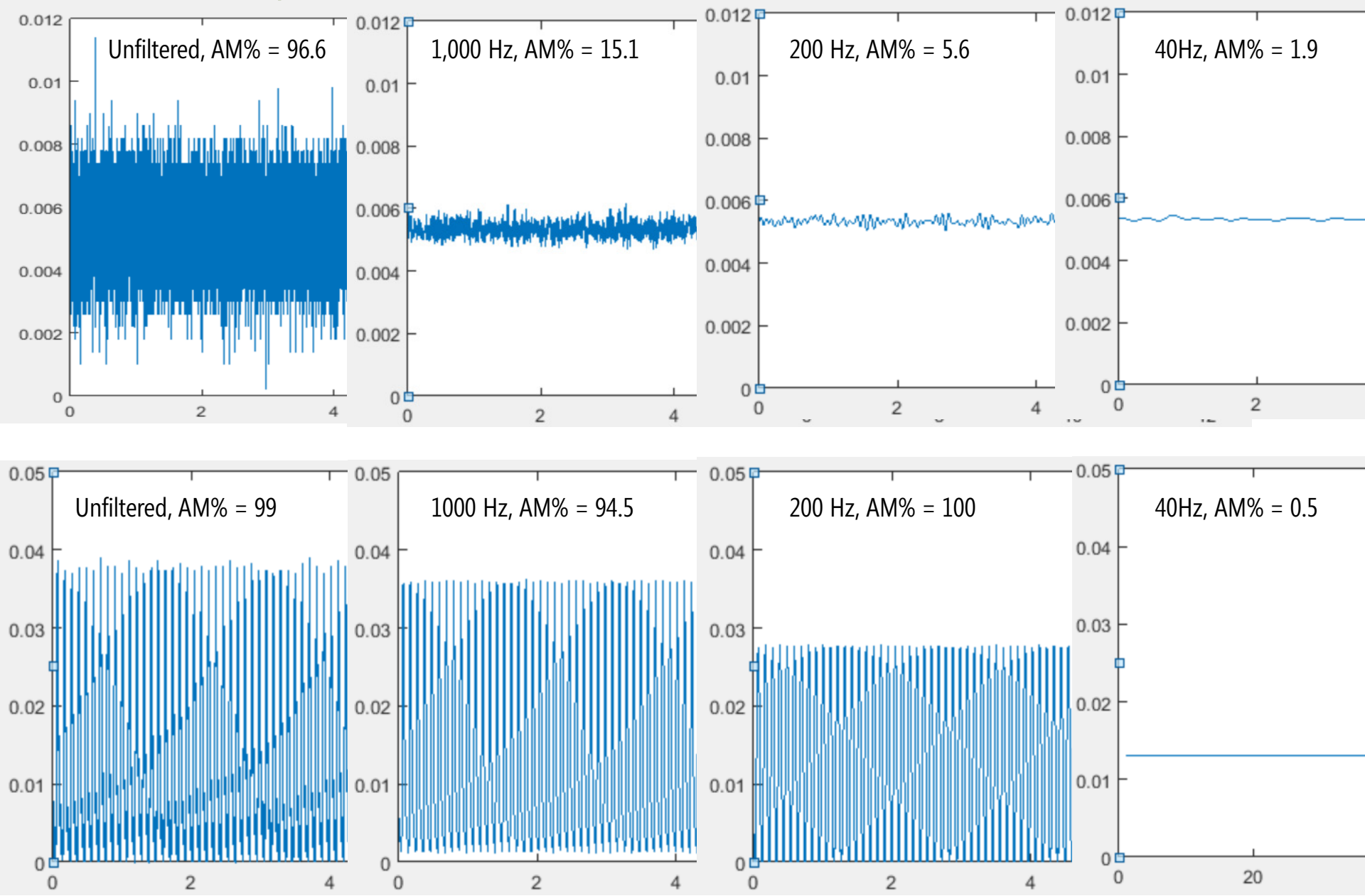
Filtering Raw Data

- Method to isolate percent flicker that occurs at frequencies below 200Hz
- Also requires data to be filtered below several other cut-off frequencies (40 Hz, 90 Hz, 400 Hz and 1,000 Hz) for reporting purposes only

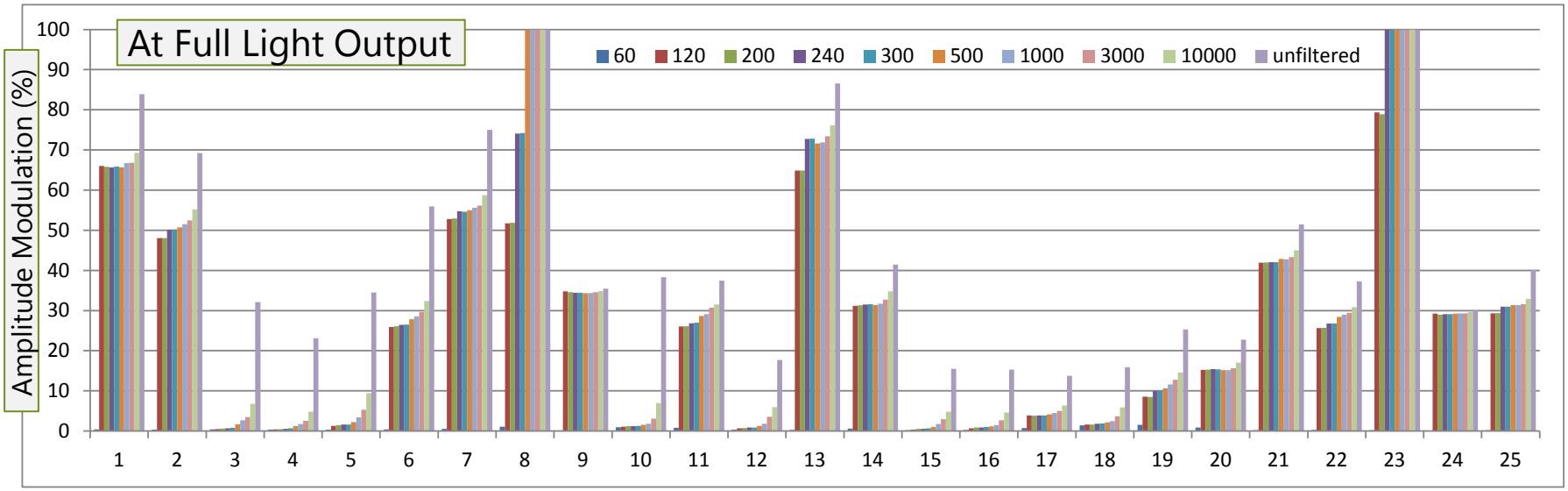
Fourier Analysis

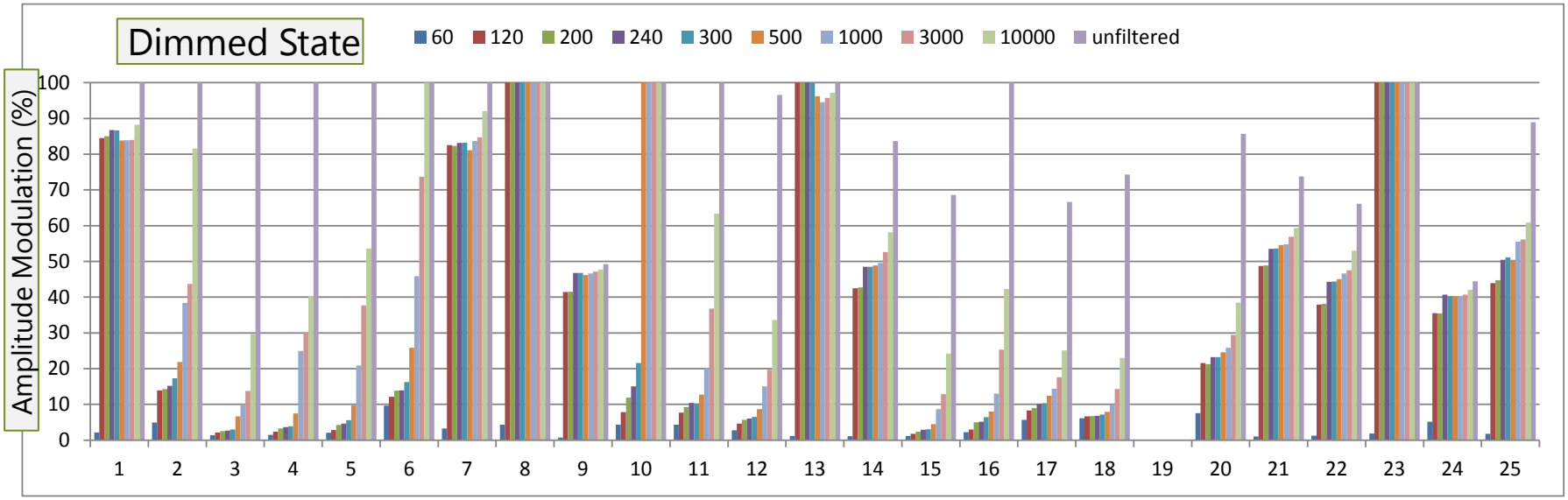
- Data must be filtered using a Fourier transform to get raw data into specified format
- Can use or develop own software
- Can refer to Energy Code Ace "Best Practices" document for MatLab command language

Example of Filtered Waveform



A Lamp Test Results – 25 lamps





JA10 Reporting Requirements

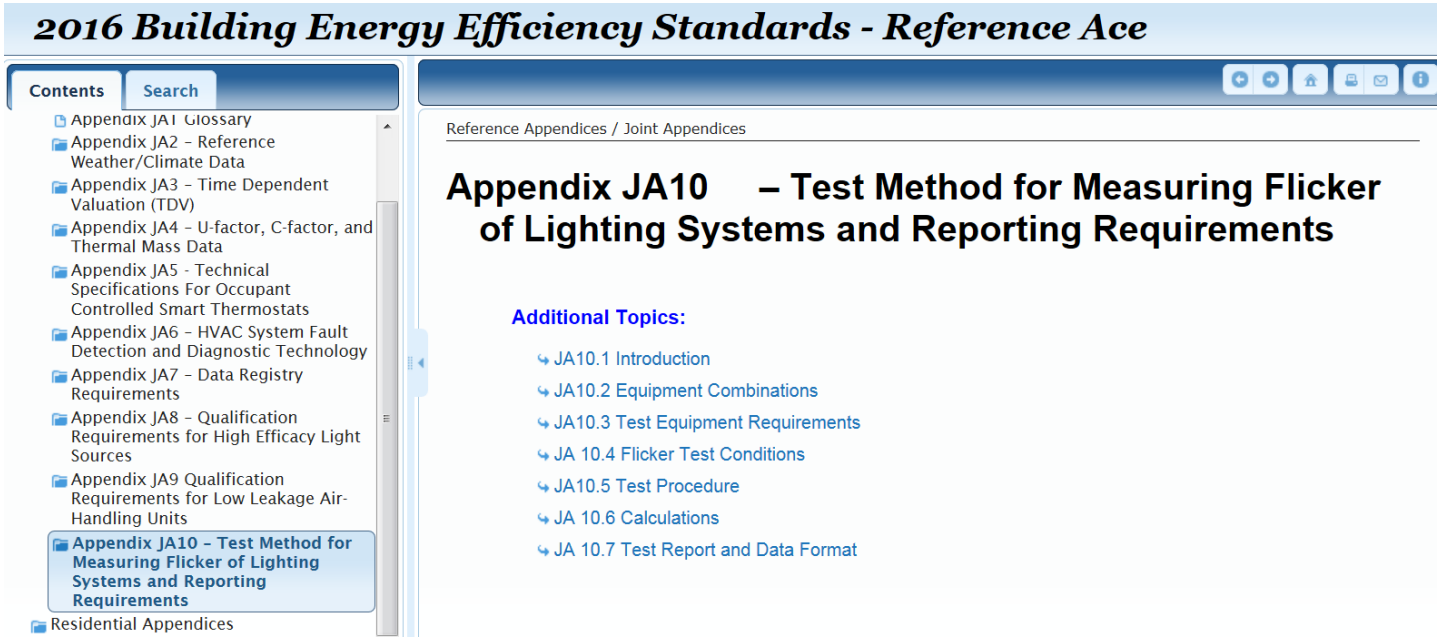
2016 Title 24, Part 6 Joint Appendix 10 (JA10.7)

TABLE JA-10-1 lists required submissions as well as data to keep on file for two years

Data	Units/Format
Test Date	
Test Operator	Company Name, Contact Name, Address, Phone Number, e-mail address
Entity submitting results	Company Name, Contact Name, Address, Phone Number, e-mail address
	Manufacturer or Brand
Tested lighting system component: Dimmer	**Dimmer type**, Manufacturer or Brand, model number
Tested lighting system component: light source (lamp or light engine)	**Light source type (lamp, light engine, etc.), Manufacturer, Brand, model number**
Tested lighting system component: Ballast or Driver	Ballast or Driver, Manufacturer or Brand, model number
Recording interval	seconds (no greater than 0.00005 seconds)
Equipment Measurement Period	seconds (no less than 1 second)
Fraction of rated light output integrated over measurement period at 100%, 20% and minimum fraction of light output.	Fraction of rated light output integrated over measurement period at 100%, 20% and minimum fraction of light output.
Amplitude modulation unfiltered	**calculated percent amplitude modulation unfiltered for each dimming level (100%, 20% and minimum fraction of light output)**
Percent amplitude modulation with 1,000 Hz cut-off	**calculated percent amplitude modulation, data filtered with a 1,000 Hz cut-off frequency for each dimming level: (100%, 20%, and minimum fraction of light output)**
Percent amplitude modulation with 400 Hz cut-off	**calculated percent amplitude modulation, data filtered with a 400 Hz cut-off frequency for each dimming level: (100%, 20%, and minimum fraction of light output)**
Percent amplitude modulation with 200 Hz cut-off	**calculated percent amplitude modulation, data filtered with a 200 Hz cut-off frequency for each dimming level: (100%, 20% and minimum fraction of light output)**
Percent amplitude modulation with 90 Hz cut-off	**calculated percent amplitude modulation, data filtered with a 90 Hz cut-off frequency for each dimming level: (100%, 20% and minimum fraction of light output)**
Percent amplitude modulation with 40 Hz cut-off	**calculated percent amplitude modulation, data filtered with a 40 Hz cut-off frequency for each dimming level: (100%, 20% and minimum fraction of light output)**

Where to Find 2016 JA10 Online

Reference Ace 2016 Title 24, Part 6 Joint Appendix JA10



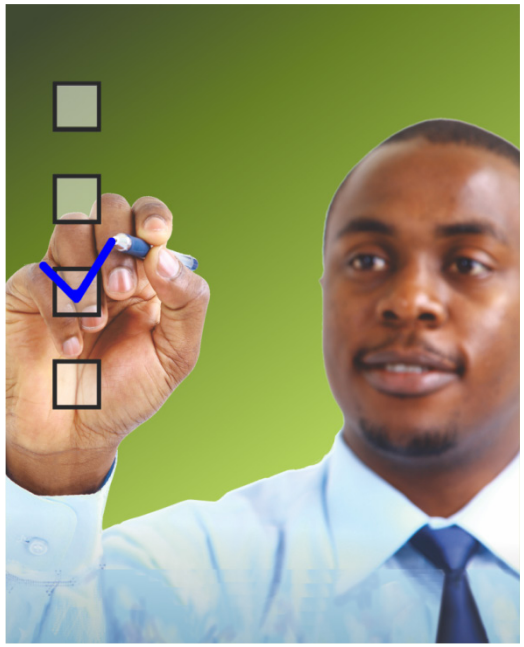
Energy Code Ace Reference Ace Tool:
http://energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/appendixja10testmethodformeasuringflickeroflightingsystemsandrep.htm

2016 Title 24, Part 6 Reference Joint Appendix JA10:
http://www.energy.ca.gov/2015publications/CEC-400-2015-038/CEC-400-2015-038-CMF.pdf

Check Your Understanding

Compliance

How to Comply

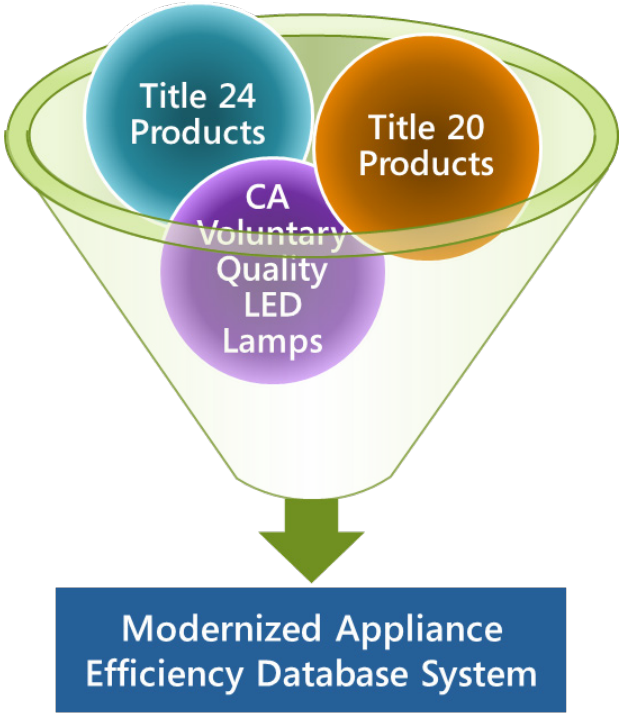


Manufacturers and test labs are responsible for compliance

1. Design products according to JA8 regulations
2. Test products according to JA8 and JA10 testing requirements
3. Certify products to the Energy Commission

   Compliant products can be certified before January 1, 2017 effective date
4. Permanently mark compliant products as “JA8-2016” or “JA8-2016-E”

Certification Under Title 24

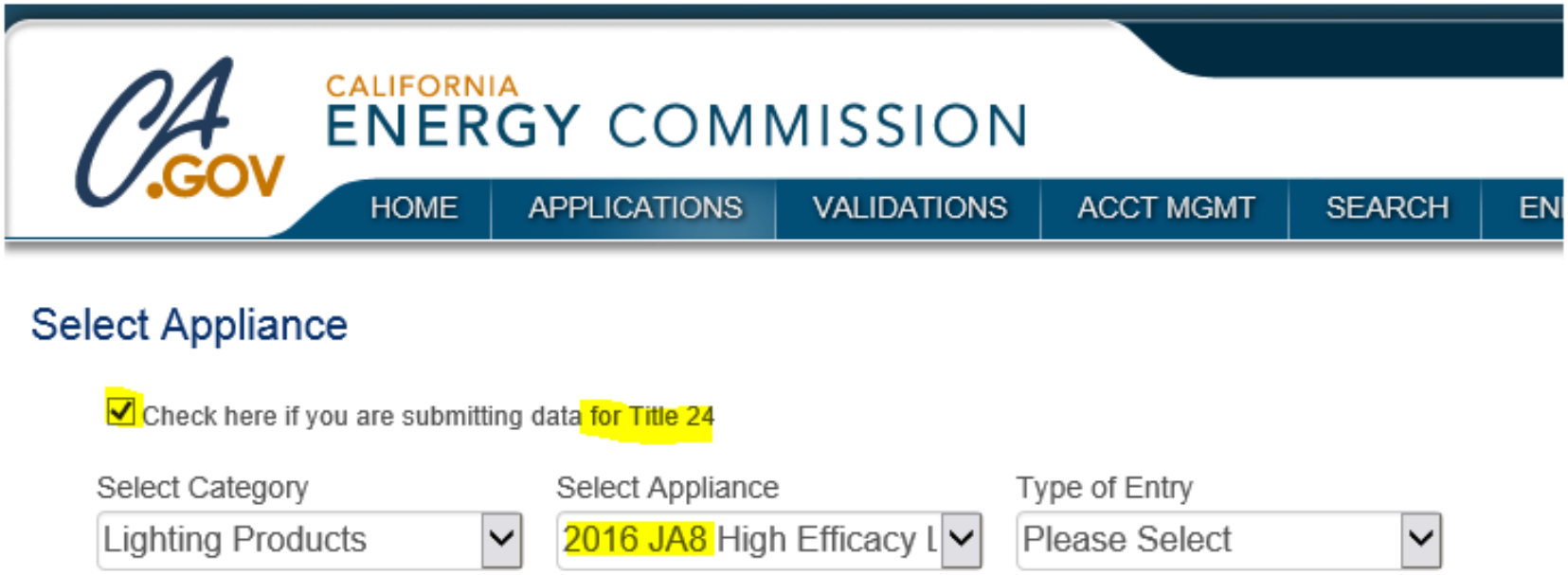


- Certification is in accordance with Title 24 requirements
  - Separate check box for Title 24 submittals
  - See 2016 JA8 certification instructions
  - All inquires directed to Title 24 Energy Standards Hotline
    - 1-800-772-3300
    - Title24@energy.ca.gov
- List of certified products can be found on the Modernized Appliance Efficiency Database System (MAEDBS)

Certification to California Energy Commission

Modernized Appliance Efficiency Database System

Certifiers may access the JA8 2016 submittal template only if they acknowledge that their certification is for Title 24 (and not Title 20)



Data Reporting Requirements

2016 Title 24, Part 6 – Joint Appendix JA8 (JA8.6)

Submit

- Submit test data to the Energy Commission

Format

- Format specified in Table JA-8 (in JA8.6)

Records

- Test data and compliance documentation must be retained by submitter for at least two years

Request

- Copies to be provided to Energy Commission within 10 days of written request

Certification to California Energy Commission

Instruction Packet Available Online

Data Reporting Fields – Required Info

2016 Title 24, Part 6 – Joint Appendix JA8 (JA8.6)

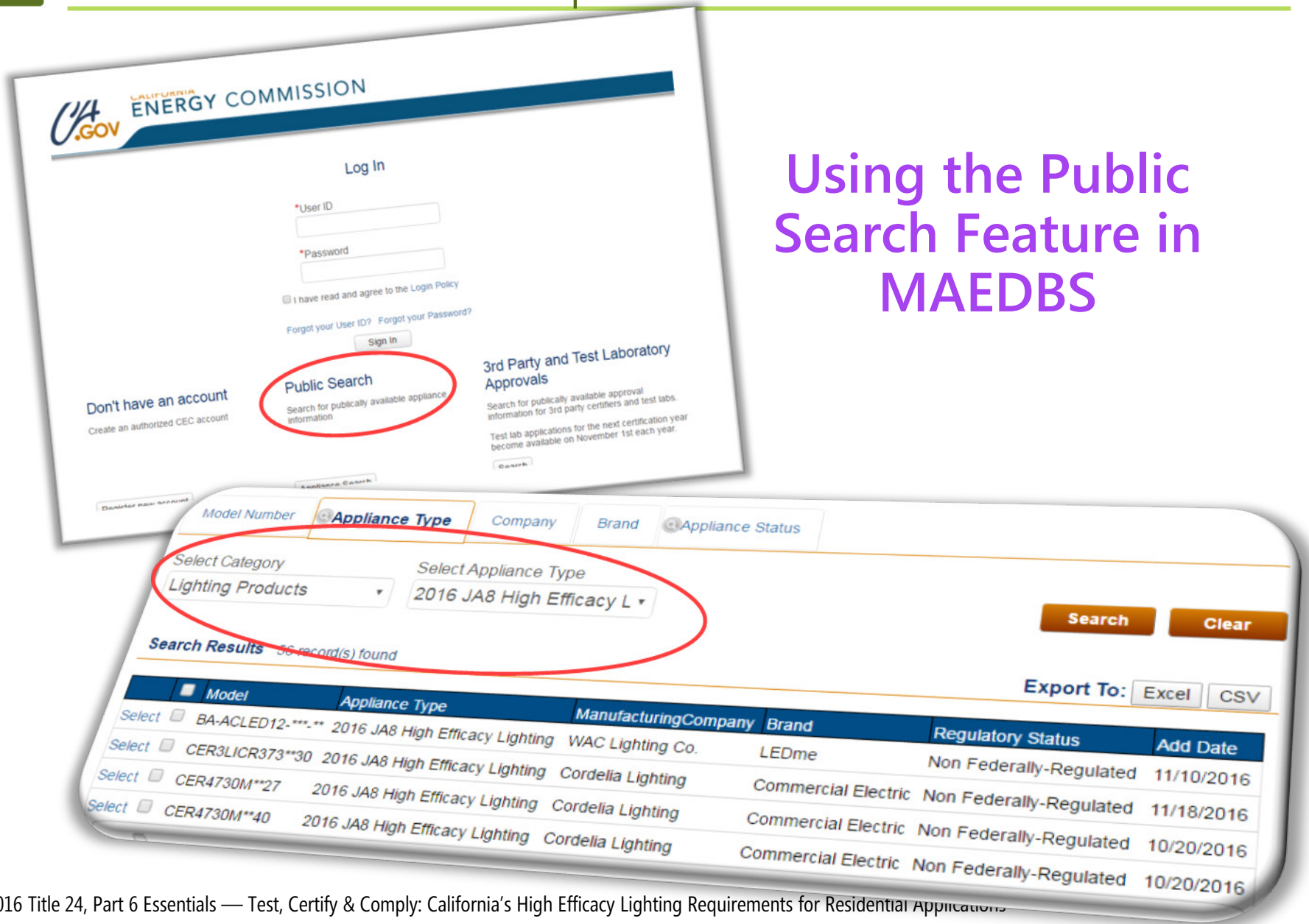
✓ Manufacturer, Model Number, Description	✓ 6,000 Hour Lumen Maintenance
✓ Light Source Type	✓ LM-80 and TM-21 Projected Time to L70
✓ Product Type	✓ Rated life; 6,000 Survival Rate
✓ Lab accreditation	✓ Minimum Dimming Level
✓ Efficacy	✓ Dimming Control Compatibility
✓ Power Factor at Full Rated Power	✓ NEMA SSL 7A Compatible?
✓ Start Time	✓ Flicker (at 100% and 20% Light Output, and at 200 Hz or below)
✓ CCT; Duv; CRI; Color Rendering R9 (red)	✓ Audible Noise (at 100% and 20% Light Output)
✓ Ambient or Elevated Temperature Test (Rated Life, Lumen Maintenance & Survival Rate)	✓ Marking

How to Comply

Builders and designers are also responsible for compliance

- Designers ensure that:
  - Homes and other applicable dwelling spaces are designed to meet JA8
  - This is communicated clearly in plans
- Builders ensure that:
  - JA8-compliant products are installed at time of inspection
  - New homeowners are provided with a luminaire schedule that includes list of installed lamps and luminaries

How to Find Compliant Products



Using the Public Search Feature in MAEDBS

Check Your Understanding

Wrap Up

Summary

- 2016 Title 24 JA8 and JA10 requirements go into effect on January 1, 2017
- JA8-compliant products must meet performance, testing & marking requirements in Title 24
- Manufacturers can certify products to CA Energy Commission before January 1, 2017 effective date
- Lighting products can be designed to meet requirements in 2016 Title 24 JA8, Title 20 (Tier 1 LED (2018) & Tier 2 LED (2019)), and CA Voluntary LED Quality Specification
- Contact CA Energy Commission's Title 24 hotline for certification and MAEDBS inquiries
- Energy Code Ace is here to help!
  - Tools: Reference Ace and Navigator Ace
  - Resources: Fact Sheets
  - Training: Online learning events and training

Click the purple box below to open the evaluation survey in a new window

Thank you for participating today

Please remember to complete the Course Evaluation form

We welcome your opinions about what you liked about this class and your suggestions for improving it

Contact	Role	Email
Kelly Cunningham	Host	KACV@pge.com
California Energy Commission	Title 24 Hotline	1-800-772-3300 Title24@energy.ca.gov
Energy Code Ace	Online Training Support	online.training@energycodeace.com

Look for future events on California's Title 20 LED requirements!

Answers to Check Your Understanding

CYU 1: High Efficacy Requirements

1.1. For certification of compliant light sources under Title 24, Part 6, what credentials does the test lab need? (Check as many — or as few — as apply.)

a. Approval by the California Energy Commission

b. ISO/IEC accreditation

c. Approval by the California Public Utilities Commission

1.2 What "legacy" high efficacy products do NOT need to be certified with the Energy Commission? (Check all that apply.)

a. Pin-based linear fluorescent or CFL with electronic ballasts

b. Screw-based CFLs

c. Non-LED Lamps with GU24 base

d. LED lamps with GU24 base

e. Pulse-start metal halide lamps

f. Induction lamps

g. High-pressure sodium lamps

h. Type T halogen lamps

1.3. How would a building inspector know if a lamp installed in an enclosed luminaire is allowed in the 2016 code?

The lamp will have the "JA8-2016-E" marking.

NOTE: Building inspectors also can look for the marking in open luminaires, such as wall sconces.

CYU 2: Flicker Testing and Reporting

2.1. JA10 quantifies flicker from light sources. What components might this test include? (Check all that apply.)

a. Lamps

b. Light engines

c. Low-voltage transformers

d. Ballasts or drivers

e. Dimming controls

f. Wiring

2.2. When conducting a flicker test per JA 10.3, what this the constant temperature range required for the test enclosure?

a. 20°C ±1°C

b. 20°C ±5°C

c. 25°C ±1°C

d. 25°C ±5°C

2.3-a. What do you think?

Would you (or the appropriate people in your organization) use an online tool to help conduct the Fourier Transform if one were available?

a. Yes, this would be helpful

b. No, we already have a tool we use to filter raw flicker data

c. I'm not sure because we have not determined how we will do our filtering

d. I'm not sure because I'm not involved in this and do not know what those responsible would choose

Responses will vary

2.3-b. Do you currently have access to and use MatLab?

a. Yes, we have access and use it

b. We have access, but don't use it

c. We don't have access

d. I'm not sure

Responses will vary

CYU 3: Compliance

3.1. We have completed the testing and certification process for our JA8-compliant products and are ready to apply the required "JA8-2016" or "JA8-2016-E" marking. According to the JA8 requirements, where MUST the marking appear?

a. On the product packaging

b. On product literature

c. On the product itself

d. All of the above

3.2. It is important that builders provide new homeowners with a luminaire schedule because it provides homeowners with important benefits:

- When they take possession of their new home, they know that the lighting products installed in their newly built home meet the 2016 JA8 requirements.
- When they need to service or replace lamps or light fixtures, it helps ensure they can easily replace like with like — avoiding mismatched lighting situations.

What is another benefit of builders providing a luminaire schedule?

It provides a useful reference to the inspector who needs to verify the installation meets the requirements, helping to ensure the inspection is straightforward.

California Energy Commission

- **2016 Title 24 Building Energy Efficiency Standards**
  http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037-CMF.pdf
- **2016 Reference Appendices (including JA8 and JA10)**
  http://www.energy.ca.gov/2015publications/CEC-400-2015-038/CEC-400-2015-038-CMF.pdf
- **Instructions for Submitting High-Efficacy Light Sources for Title 24 Appliance Data**
  http://www.energy.ca.gov/appliances/database/forms_instructions_cert/Lighting_Products/2016%20JA8%20High%20Efficacy%20Lighting%20(JEFF).zip
- **2016 JA8 Compliance for Test Laboratories Fact Sheet**
  http://energy.ca.gov/2016publications/CEC-400-2016-018/CEC-400-2016-018-FS.pdf

California Lighting Technology Center

- **Residential Lighting Guide for 2016 Building Energy Efficiency Standards**
  http://cltc.ucdavis.edu/publication/residential-lighting-design-guide-2016-standards
- **Lighting Appliance Efficiency Regulations: What's New in the Title 20 Code?**
  http://cltc.ucdavis.edu/publication/title-20-lighting-appliance-efficiency
- **Residential Lighting: What's New in the 2016 Title 24, Part 6 Code?**
  http://cltc.ucdavis.edu/publication/2016-title-24-code-changes-residential
- **CLTC Publications**
  http://cltc.ucdavis.edu/publications

Energy Code Ace

- **JA8 in the Reference Ace**
  http://energycodeace.com/site/custom/public/reference-ace-2016/Documents/appendixja8qualificationrequirementsforhighefficacylightsources.htm
- **JA10 in the Reference Ace**
  http://energycodeace.com/site/custom/public/reference-ace-2016/Documents/appendixja10testmethodformeasuringflickeroflightingsystemsandrep.htm
- **Fact Sheet: High Efficacy Lighting for Manufacturers**
  http://energycodeace.com/download/15357/file_path/fieldList/FactSheet.Res-JA8.Manufacturers.2016
- **Energy Code Ace JA10 Flicker Test Best Practices**
  (coming soon)
- **Energy Code Ace Resources**
  http://energycodeace.com/site/custom/public/reference-ace-2016/Documents/appendixja10testmethodformeasuringflickeroflightingsystemsandrep.htm