

Worldwide Quality Specifications for LED Lamps



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Image source: Evolution Magazine

What is a “quality” light bulb?

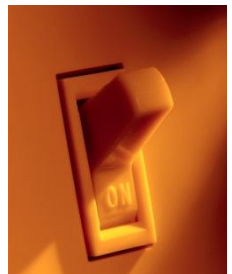


The Need for Guidance

Wide Range of Performance:

- Lumen Output
- Longevity
- Dimmability
- Color Rendering (CRI)
- Color Appearance and Consistency
- Light Distribution

- Flicker
- Power factor
- Total harmonic distortion
- Warranty
- Operating voltage
- Run-Up Time
- Many more...





The Need for Guidance

Examples:

- Low CRI versus high CRI

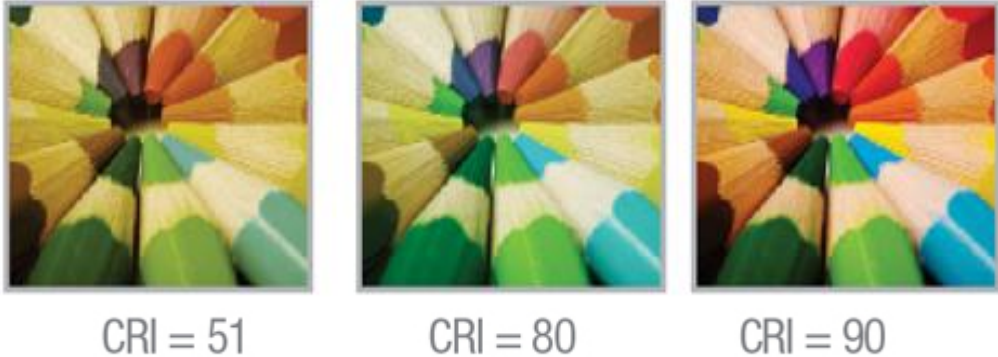


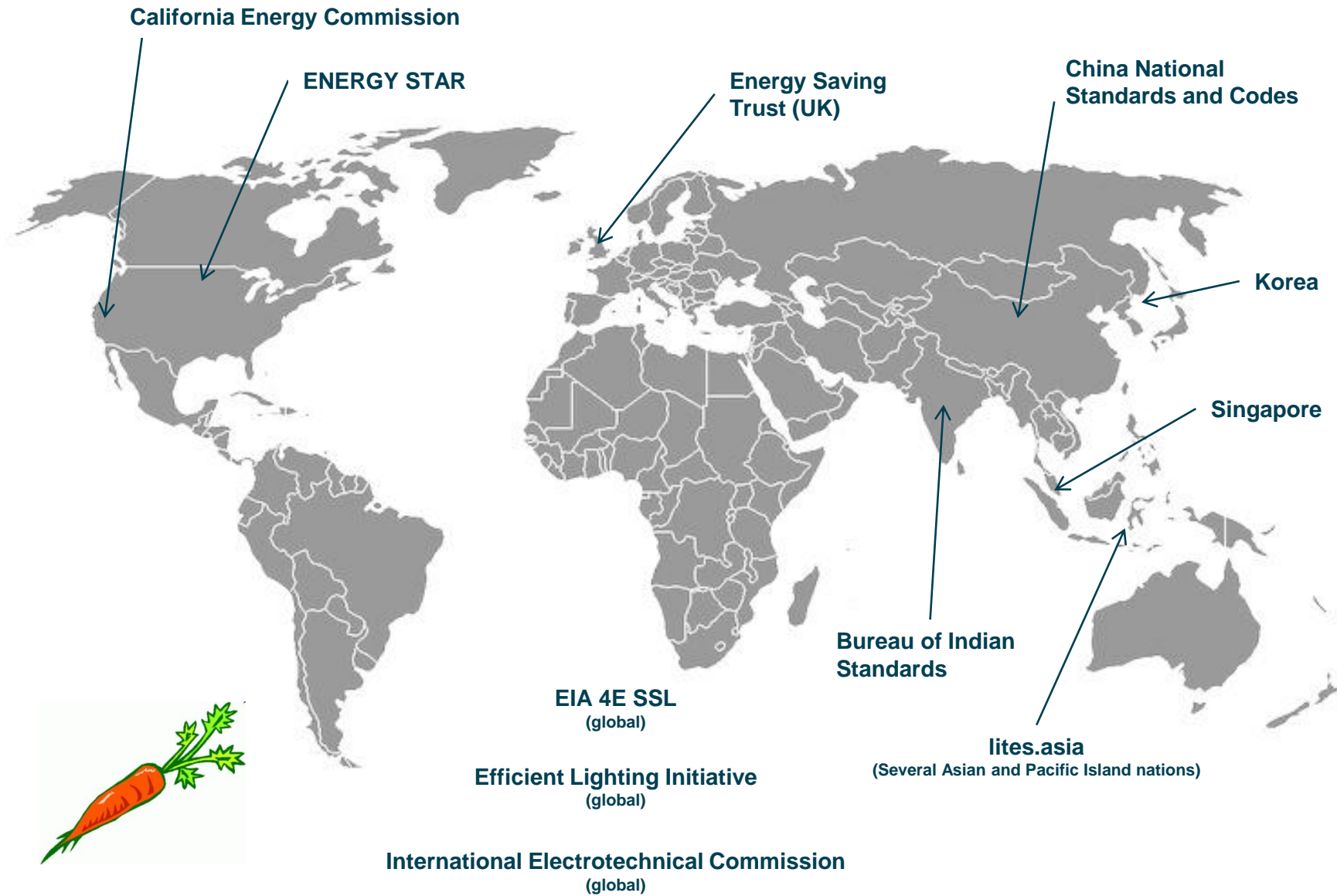
Image source: Lighting Matters' LED Blog, lightingmatters.com.au/blog/ledlight-quality-cri/

- Warm CCT versus cool CCT



Image source: EcoWonk, www.ecowonk.com

Voluntary Quality Specifications Around the World



IEC PAS 62612



Type

Test Procedure

Effective Date

2009

Scope of Coverage

Self-Ballasted LED Lamps

Overview

- This document provides testing requirements that can be used to generate manufacturer claims
- Follow up 62717 (2011) addresses LED modules

For More information:

http://webstore.iec.ch/preview/info_iecpas62717%7Bed1.0%7Den.pdf

IEA 4E SSL



Type

Voluntary specification - International

Effective Date

August 2012

Scope of Coverage

1) Indoor, residential non-directional 2) Indoor Resi directional 3) Downlights, 4) linear fluorescent replacement LEDs (not yet complete)

Overview

- Defines three performance tiers (acceptable, better, best):
 - Efficacy: 50lpw, 65lpw, 80lpw
 - Color Rendering: 70, 80, 80 CRI
- Unique specifications for color consistency, longevity, color maintenance, light distribution, lag start time, flicker, power factor, harmonic distortion

For More information:

<http://ssl.iea-4e.org/task-1---quality-assurance>

Efficient Lighting Initiative



Type

Voluntary specification in developing and transition economies

Effective Date

Issued March 2011, Effective June 2011

Scope of Coverage

Non-directional self-ballasted LEDs for general lighting

Overview

- Manufacturers submit product test results for certification and listing
- Utilizes IEC test methods
- Lumen and Color Maintenance requirements
- 7 Step color consistency, 80 CRI, PF .5
- Labeling requirements for expected replacement lamp equivalency

For More information:
info@efficientlighting.net
<http://www.efficientlighting.net/>



Type

Voluntary specification for tropical climates

Region

Tropical climates in member countries of Asia-Pacific Region

Effective Date

In development; expected by ~2013

Scope of Coverage

Omnidirectional and directional LEDs, downlights

Overview

- Sets performance specifications for LED lamps to be used in tropical environments (higher heat, higher humidity)
- Proposes adjustments to industry test procedures (e.g. LM-79) that allow products to be tested under harsher ambient conditions

For More information:

info@lites.asia

<http://www.lites.asia/>

Energy Saving Trust (UK)



Type

Voluntary specification

Effective Date

Version 2 adopted December 2009, effective 2010

Scope of Coverage

Directional and non-directional LEDs with integral and non-integral drivers

Overview

- Specification designed to help consumers make informed purchasing decisions
- Aims to identify top 10-20% of the market
- 6 CCT bins: 2700K, 3000K, 3500K, 4000K, 5000K, 6000K
- More aggressive specs were targeted for future revisions:
 - Color Rendering 80; *2011: 85CRI, 2012: 90CRI*
 - Color Consistency 7MPCD; *2011: 4MPCD, 2012: 2MPCD*

For More information:

<http://www.energysavingtrust.org.uk/>



Bureau of Indian Standards

Type

Voluntary standards, performance and safety requirements

Effective Date

2008

Scope of Coverage

IS16102 (part 2): Self-ballasted LED lamps for general lighting

Overview

- First national standards for general lighting LEDs
- Aimed at preventing consumer dissatisfaction with early market, low quality products and products that don't meet quality claims
- 6 CCT Bins
- Tiered approach to color consistency: Range from 2 to 7 Step consistency
- Power Factor $>.9$
- No minimum CRI (labeling requirements only)
- No minimum efficacy

For More information:

<http://www.bis.org.in/>

China National Standards and Codes



Type

Voluntary standards

Adoption Date / Effective Date

June 2010 / February 2011

Scope of Coverage

GB/T 24908: Self-ballasted LED lamps for general lighting

GB/T 24823: LED modules for general lighting

Overview

- 6 CCT bins: 2700K, 3000K, 3500K, 4000K, 5000K, 6500K
- Efficacy
- CRI 80

For More information:

<http://www.cn-standard.net/ebzdetail/545/DED3D541.shtml>

ENERGY STAR (US EPA / DOE)



Type

Voluntary specification

Effective Date

Integral LED Lamps Spec: Effective since August 2009

ENERGY STAR Lamps Spec: Under development, likely adoption 2013

Scope of Coverage

New specification combining CFL and LED replacement lamps into one spec

Overview

- Very robust specification
 - Efficacy, light output
 - Start time / Run-Up Time
 - Color / Light Quality (7 Step consistency, 4 color bins, 80 CRI)
 - Longevity (TBD, 3 year warranty)
 - Light Distribution
 - Power Factor (.7)
 - Toxics
 - Dimensional requirements

For More information:

http://www.energystar.gov/index.cfm?fuseaction=products_for_partners.showLightbulbs

California Voluntary Quality LED Lamp Specification (CEC)



Type

Voluntary specification

Approval Date

In development; expected approval late 2012

Scope of Coverage

Directional and omni-directional replacement LED lamps (A, G, R, PAR, BR, etc.)

Overview

- Requires ENERGY STAR equivalence, plus improved performance on other on specific parameters:
 - Color Quality
 - Longevity
 - Dimmability
 - Light Distribution
 - Power Factor
- Only 2 color bins: 2700K & 3000K

For More information:

http://www.energy.ca.gov/appliances/led_lamp_spec/documents/

Mandatory Quality Standards Around the World

California Energy Commission

European Union

Mexico
Ministry of Energy



Mexico Ministry of Energy



Type

Mandatory standards – NOM (Norma Oficial Mexicana)

Effective Date

August 2012

Scope of Coverage

Omnidirectional and directional LEDs

Overview

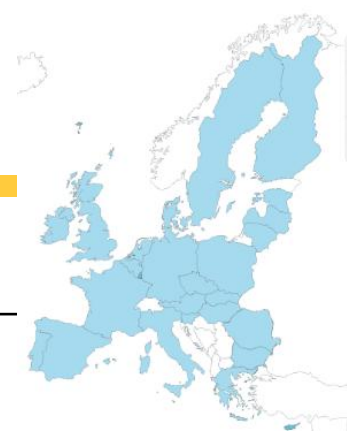
- First Mandatory standards in the world for LED lamps
- Color Rendering (CRI 77)
- Efficacy, Power Factor (.5 - .7 depending on wattage)
- 6 color bins, Minimal color consistency requirements
- Lumen Maintenance – labeling requirements only. 3 year warranty.
- Thermal heat shock test procedure

For More information:

<http://www.economia-noms.gob.mx/noms/inicio.do>

<http://en.presidencia.gob.mx/government/estructura-del-gobierno-federal/>

European Union



Type

Mandatory performance and labeling standards

Region

EU member states plus the European Economic Area countries (Luxembourg, Norway and Iceland): 30 countries total

Adoption Date

Adopted July 2012, *publication pending (with effective date)*

Scope of Coverage

Non-directional and directional LED Replacement Lamps

Overview (based on early drafts)

- Includes 4 different lifetime related metrics
- CRI 80
- 6 Color Steps
- Start Time, Warm Up Time, Power Factor

For More information:

http://www.eceee.org/Eco_design/products/directional_lighting/

Proposed California Title 20 Mandatory Standard



Type

Mandatory Standard

Approval Date

Proposal in early development stages; possible effective date 2015/2016

Scope of Coverage

Non-directional and directional replacement LED lamps

Overview

- All levels still TBD:
 - Color Quality
 - Longevity
 - Dimmability
 - Directionality
 - Efficacy
 - Power Factor

For More information:

<http://www.energy.ca.gov/appliances/2012/rulemaking/>

Coordination

Opportunities

Test Procedures

Dimming, Life Time (catastrophic failure), Stress Testing, Flicker

Rulemaking and Analysis

Feasibility Analysis, Cost-effectiveness Analysis, Product Testing, Human Factors Research, Stakeholder Comments

Challenges

The world isn't that small after all

Distance / Time Zones; Language Barriers; Cultural Differences

Confidentiality

Rulemaking efforts often involve sensitive information

Resources

CLASP – The Collaborative Labeling & Appliance Standards Program

Mission:

To serve as the primary resource and voice for appliance, lighting and equipment energy efficiency worldwide.

Resources:

Global S&L Database – An online resource that allows policy makers and S&L practitioners to compare policies and regulations across countries.

http://www.clasponline.org/ResourcesTools/Tools/SL_Search

Assessment of Opportunities for Global Harmonization of Minimum Energy Performance Standards and Test Standards for Lighting Products

<http://www.clasponline.org/en/ResourcesTools/Resources/StandardsLabelingResourceLibrary/2011/Global-Harmonization-Lighting-MEPS-TestStandards>



<http://www.clasponline.org/>



Questions?

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