



An Overview of ENERGY STAR® Luminaires V1.0 Specification Draft 1

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Agenda



- Background
- Lighting Integration Proposal
- ENERGY STAR Luminaires V1.0 Draft 1
- ENERGY STAR Laboratory Accreditation, Enhanced Testing and Verification
- Question and Answer Session

Background



- 2009 EPA-DOE [Memorandum of Understanding](#)
 - Enhance the ENERGY STAR program
 - Facilitate better inter-Agency coordination
 - Expand labeling coverage
 - Update specifications regularly
 - Enhanced product testing requirements
 - Recognize super efficient products
 - Governing Council:
 - EPA Assistant Administrator for Air and Radiation
 - DOE Assistant Secretary for Energy Efficiency and Renewable Energy

Lighting Integration Proposal (December 2009)



- [ENERGY STAR Qualified Lighting: An Integration Proposal](#)
 - Luminaires specification proposed
 - To consolidate existing specifications
 - To extend technology neutrality – a key ENERGY STAR principle – to lighting specifications
 - Products using various technologies competing on a level playing field
 - ENERGY STAR label should have the same meaning regardless of technology employed

Scope



 ENERGY STAR® Program Requirements for Luminaires
Eligibility Criteria – Version 1.0, DRAFT 1
PUBLISHED _month_day_, 2010. EFFECTIVE _month_day_, 2011.

Primary Contact Information

Note: For purposes of this specification development process, EPA invites stakeholders to send comments to luminaires@energystar.gov, with "ENERGY STAR Luminaires First Draft Comments" in the subject line.

Your Primary Contact Information

To effectively communicate important news to our partners, the ENERGY STAR program needs your help keeping your company's contact information up to date. It is one of your partner commitments and it's easy to do: please visit www.energystar.gov/partners, and use My Account Login.

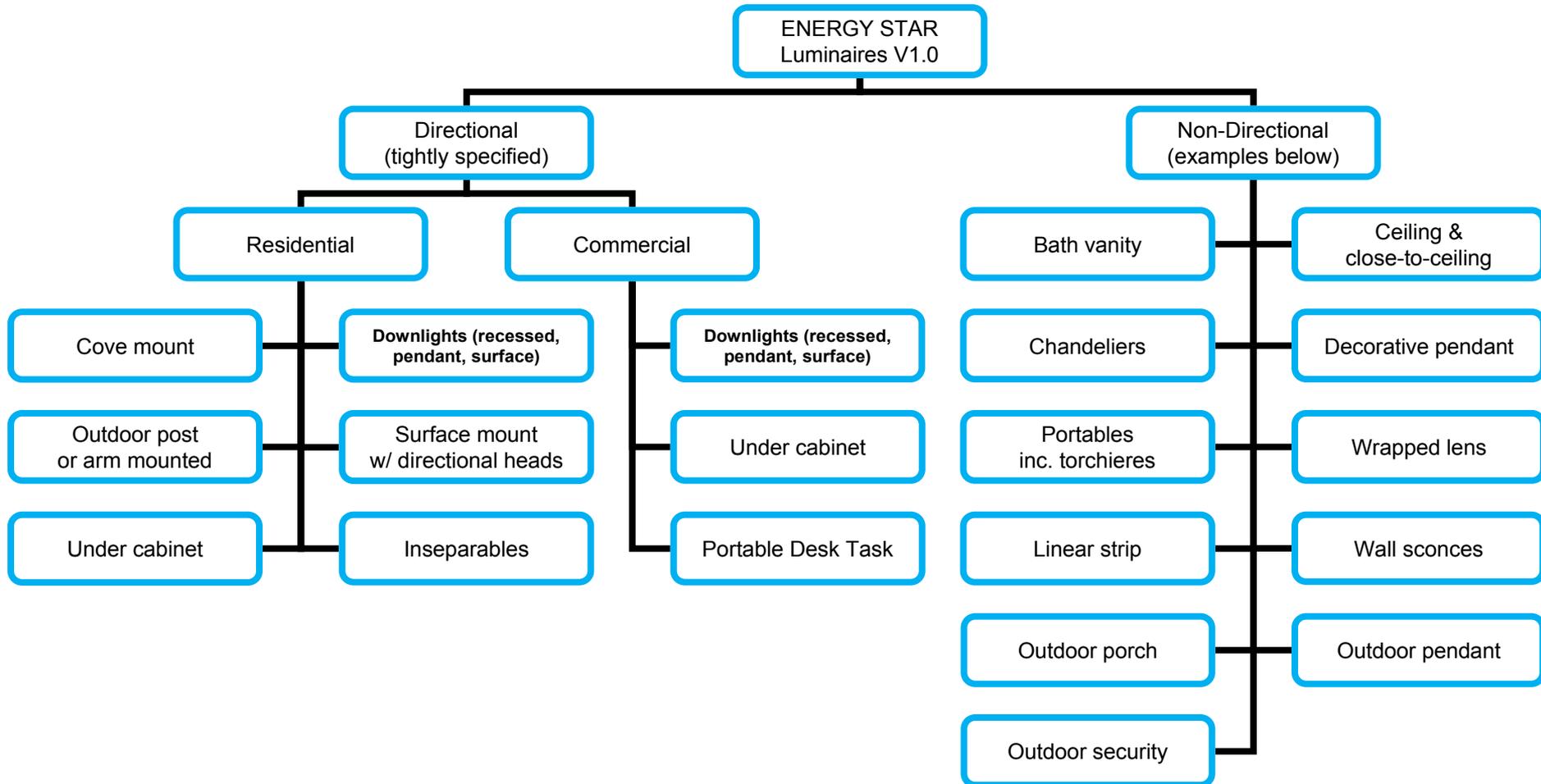
Scope of This Specification

The ENERGY STAR Luminaires specification ("this specification") covers the luminaire types outlined below. Qualification is limited to luminaires below a total input power of 250 watts. This specification replaces the ENERGY STAR Residential Light Fixtures and Solid State Lighting specifications.

- **Directional applications:**
 - Residential grade luminaires, **specifically:**
 - cove mounts
 - downlights (recessed, pendant or surface mount)
 - outdoor post or arm-mounted luminaires
 - surface mount with directional head(s)
 - under cabinet luminaires
 - inseparable luminaires are evaluated as directional, per definitions.
 - Commercial grade luminaires, **specifically:**
 - downlights (recessed, pendant or surface mount) under cabinet shelf-mounted task lighting
 - portable desk task lights
- **Non-directional applications:**
 - Residential grade luminaires only, **examples:**
 - Indoor:
 - bath vanity
 - ceiling and close-to-ceiling mount
 - chandeliers
 - wrapped lens (typ. fluorescent w/ acrylic)
 - linear strips (no secondary optics)
 - pendant mounted
 - portables, including torchieres
 - wall sconces
 - Outdoor:
 - outdoor porch
 - outdoor pendant
 - outdoor security

- Total input power ≤ 250 watts
- Delineates between directional and non-directional luminaire types
- Directional includes some commercial scope

Luminaire Categorization Scheme



LRC / NEMA / ALA Round Table Discussion

March 4, 2010 @ NEMA, Rosslyn, VA



- Luminaire categorization scheme based on industry round table discussions.
- EPA engaged the Lighting Research Center (LRC) at Rensselaer Polytechnic Institute to organize a round table discussion.
- Hosted with National Electrical Manufacturers Association (NEMA) and the American Lighting Association (ALA), attendees (30 total) included:
 - manufacturers of solid state and incumbent light source technologies,
 - luminaire manufacturers, residential and commercial
 - energy efficiency program representatives including
 - Consortium for Energy Efficiency
 - American Council for an Energy-Efficient Economy,
 - testing laboratory representatives, including
 - National Institute of Standards and Technology
 - luminaire designers,
 - lighting retailers,
 - and representatives of LRC, NEMA, ALA, EPA (DOE unable to attend)

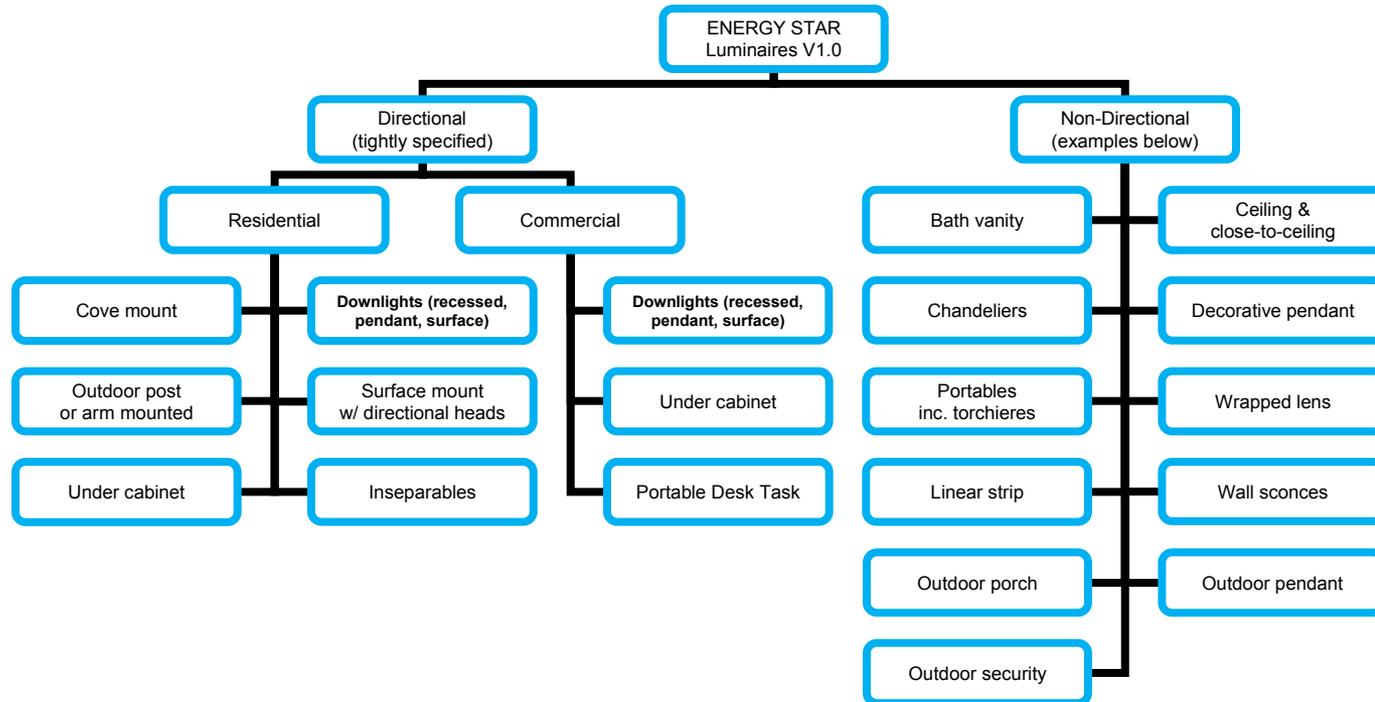
LRC / NEMA / ALA Round Table Discussion

March 4, 2010 @ NEMA, Rosslyn, VA



- Goal: participants to engage in a constructive dialog about testing requirements for the ENERGY STAR Luminaires specification, with careful consideration of the differences between decorative and functional fixtures.
- Full meeting notes available at www.energystar.gov/luminaires

Luminaire Categorization Scheme



- Directional luminaires:

- Designed to illuminate target surfaces
- Conventional to measure & report luminous intensity distributions
- Generally do not feature colorful optics
- Evaluated by luminaire performance including optics

- Non-directional luminaires:

- Not designed to deliver a specific amount of light to a target, or in specific direction
- Luminous intensity distributions seldom measured
- Off-white, stone, colorful optics
- Evaluated by source performance





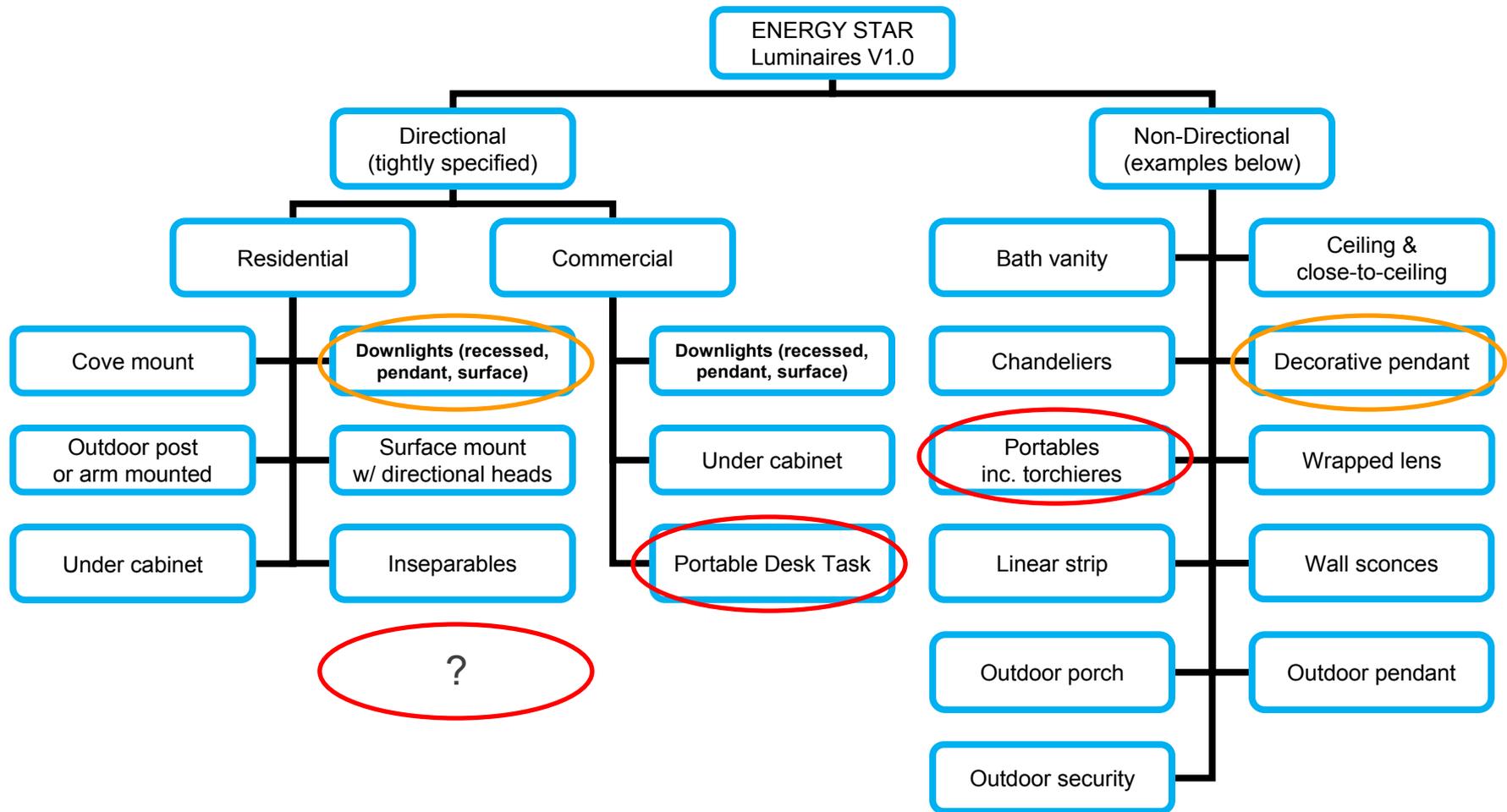








Luminaire Categorization Scheme



How to Use This Document



- Steers user towards applicable performance requirements
- Explains usage of GU24 integrated lamps
- Explains structure of document
- Explains use of exceptions

Note: The above proposed approach to categorization of luminaires by directional versus non-directional performance attributes is the outgrowth of a March 4, 2010 round table discussion organized by Rensselaer Polytechnic Institute's Lighting Research Center (LRC) and hosted by the LRC, the National Electrical Manufacturers Association, and the American Lighting Association. Notes from this discussion are available for partner and stakeholder review. EPA seeks broader comment on the proposed categorization.

EPA is reviewing the ENERGY STAR program's approach to labeling of commercial luminaires. Qualification activities have centered around the above commercial luminaire types, thus these requirements have been carried forward to this specification with test procedures added so fluorescent luminaires meeting the enclosed performance requirements may also be qualified.

Regarding proposed additions to the SSL specifications, including outdoor pole-mounted area and roadway luminaires, wall packs and parking garage/canopy luminaires, development of an ENERGY STAR specification is currently on hold as DOE & EPA await industry development of a technology-neutral test procedure which will allow for evaluations of high performance luminaires, regardless of technology. NEMA is leading this development effort.

How to Use This Document

To qualify a luminaire for ENERGY STAR, first determine which requirements in this document are applicable to the specific luminaire. ENERGY STAR requirements for are specific to directional and non-directional applications.

- Directional applications:
 - defined in the above Scope section
 - evaluated with luminaire photometry, accounting for luminaire optical performance
 - must also meet specified minimum light output and zonal lumen density requirements
 - residential grade luminaires featuring inseparable solid state (LED) componentry must be tested as directional
 - all other luminaire types default to non-directional, below
- Non-directional applications:
 - defined in the above Scope section
 - evaluated by source photometry
 - luminaires not defined as directional are evaluated as non-directional

Luminaire manufacturers may elect to use ENERGY STAR qualified GU24 based lamps featuring integral ballasts or drivers to meet performance requirements in this specification. See Appendix A for performance requirements for GU24 based integrated lamps. EPA intends to place GU24 requirements in the forthcoming ENERGY STAR Lamps specification, at which time Appendix A of this document will be removed.

This specification is not organized by indoor or outdoor, or by light source technology. Performance requirements comprise each section of this document, thus the first section summarizes efficacy requirements, the second color performance, etc. Partners are advised to review each section, and take note of exceptions where specific performance criteria need not be evaluated; some exceptions are in place, for instance, for outdoor luminaires.

In Chinese:
PUBLISHED SEPTEMBER XX, 2010. EFFECTIVE JUNE XX, 2011.

Primary Contact Information

Scope of This Specification

How to Use This Document

Note: EPA intends to add the above Chinese language in the final specification.

TBD

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- Each heading is a hyperlink to sections of the document

Definitions, Qualification Process



Definitions

ALA: American Lighting Association.
ANSI: American National Standards Institute.
Aperture Size (downlight): The maximum distance between the points inside the luminaire where light escapes the luminaire.
ASSIST: Alliance for Solid State Illumination Systems and Technologies.
ASTM: American Society for Testing of Materials.
Ballast Frequency: The number of waves or cycles of electromagnetic radiation per second, usually measured in Hz. (Lighting Fundamentals Handbook, Electric Power Research Institute, 1992)
Ballast: A device used with an electric-discharge lamp to obtain the necessary circuit conditions (voltage, current, and waveform) for starting and operating. (IES RP-16-05)
CFL: A compact fluorescent lamp (pin based or self-ballasted screw base).
CIE: Commission Internationale de l'Eclairage (International Commission on Illumination).
Color Rendering: A general expression for the effect of a light source on the color appearance of objects in conscious or subconscious comparison with their color appearance under a reference light source. (IES Handbook 9th Edition)
Color Rendering Index (CRI): A measure of the degree of color shift objects undergo when illuminated by the light source as compared with those same objects when illuminated by a reference source of comparable color temperature. (IES Handbook 9th Edition)
Commercial Luminaire: A luminaire using a Class A power supply.
Correlated Color Temperature (CCT): The absolute temperature of a blackbody whose chromaticity most nearly resembles that of the light source. (IES Handbook 9th Edition).
Cove Lighting: Lighting comprising light sources shielded by a ledge or horizontal recess, and distributing light over the ceiling and upper wall (IES RP-16-05)
Covered Lamp: A lamp with an integral ballast and a translucent cover over the bare fluorescent glass tube.
CSA: Canadian Standards Association.
Direct Lighting: Lighting involving luminaires that distribute 90 to 100 percent of the emitted light in the general direction of the light to be illuminated. This term usually refers to light emitted in a downward direction. (IES RP-16-05)
Directional Applications: See Direct Lighting.
Directional Luminaires: See Direct Lighting.
Down Light ("downlight"): A small direct lighting unit that directs the light downward and can be recessed, surface mounted, or suspended. (IES RP-16-05)
Electronic Ballast: A ballast generally involving high-frequency switching that is controlled by active components (transistor, thyristors, etc.), and with the lamp ballasting impedance provided by a series of capacitive or inductive reactance appropriate for the high switching frequency. "Ballast" also refers to other drivers or supplies that operate lamp technologies other than fluorescent. (CSA C22.2 No 1993-09 – UL 1993)
GU24 Based Integrated Lamp: A lamp unit that integrates the lamp and its ballast. It does not include any replaceable or interchangeable parts, and utilizes the ANSI standardized GU24 base type.
GU24 Based Two-Piece Lamp: A term for a lamp-ballast unit that includes a ballast with the ANSI standardized GU24 base type paired with a standard pin based lamp. The ballast and lamp are separable, with the ballast designed to accept replacement pin based lamps.
IEC: International Electrotechnical Commission.
IES: Illuminating Engineering Society.
Initial Performance Values: The photometric and electrical characteristics at the end of the 100-hour aging period in a 25°C test environment.
Input Power: The power consumption in watts of a ballast and fluorescent lamp or lamps, as determined in accordance with the test procedures specified in ANSI Standard C82.2-1984.
Inseparable Luminaires: Luminaires featuring solid state lighting componentry which cannot be replaced and thus require replacement of the entire luminaire.
Lamp Ballast Platform: A pairing of one ballast with one or more lamps that can operate simultaneously on that ballast. A unique platform is defined by the manufacturer and model number of the ballast and lamp(s) and the quantity of lamps that operate on the ballast. A lamp ballast platform also may refer to a lamp with an integral ballast, such as a GU24 based integrated lamp.
Lamp Current Crest Factor: For 60Hz operation, the ratio of peak lamp current to the root mean square (RMS) lamp current. For high-frequency (HF) operation, the highest peak lamp current of the modulation envelope (when evaluated over a full line voltage cycle) to the root mean square (RMS) of the lamp current.
Lamp: A generic term for a man-made source created to produce optical radiation. By extension, the term is also used to denote sources that radiate in regions of the spectrum adjacent to the visible." (IES Handbook 9th Edition)
Lampholder: A component of a luminaire, which supplies power to the lamp and also holds the lamp in place.
LED: See light emitting diode.
LED Array or Module: An assembly of LED packages (components) or dies on a printed circuit board or substrate, possibly with optical elements and additional thermal, mechanical, and electrical interfaces that are intended to connect to the load side of a LED driver. Power source and ANSI standard base are not incorporated into the device. The device cannot be connected directly to the branch circuit. (IES RP-16-05 Addendum b)
LED Control Circuitry: Electronic components designed to control a power source by adjusting output voltage, current or duty cycle to switch or otherwise control the amount and characteristics of the electrical energy delivered to a LED package (component) or an LED array (module). LED control circuitry does include power source. (IES RP-16-05 Addendum b)
LED Driver: A device comprised of a power source and LED control circuitry designed to operate a LED package (component), or an LED array (module) or an LED lamp. (IES RP-16-05 Addendum b)
LED Driver Class II: An LED driver that operates within Class II limits as defined by the latest version of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC). (IES RP-16-05 Addendum b)

Qualification Process

Partner must test qualifying products and obtain necessary documentation to meet the requirements listed in this specification. Refer to the "Methods of Measurement and/or Reference Standards" and "Required Documentation" columns in the performance requirements tables to determine the reference standard and required documentation applicable to each performance characteristic. Partners are advised to carefully review each section, and take note of exceptions where specific performance criteria need not be evaluated.

The following stipulations apply:

A. Directional Luminaire Applications (see front cover of spec for specific applications):

- Qualified products must be essentially identical to the tested product. Only limited variation is allowed. The table below summarizes allowable variations:

| Variations Within Product Groupings | |
|-------------------------------------|------------------------|
| Housing/Chassis | not allowed |
| Heat Sink/Heat Management | not allowed |
| Finish | allowed |
| Reflector/Trim | allowed |
| Shade/Diffuser | allowed |
| Mounting | allowed |
| Light Source | allowed, w/ conditions |
| Power Supply | allowed, w/ conditions |

B. Non-Directional Luminaire Applications (see front cover of spec for examples):

- For multiple luminaire models that use the same lamp ballast platform or LED light engine, only one set of test results is required. For example, two luminaires that use the same lamp and ballast combination or LED light engine, but have different trim, lens and/or finish need only be tested once.
- For fluorescent luminaire models that may use different ballasts (either in terms of the type of ballast or manufacturer), each lamp ballast platform combination must undergo testing and the test results must be submitted for qualification. For example, if a partner plans to use ballasts from several manufacturers in any one luminaire, the luminaire must be tested with each manufacturer's ballast.
- For fluorescent luminaire models with one ballast type that can work with multiple fluorescent lamp types, the luminaires need only be tested with one lamp type. The lamp type must either be the one supplied with the luminaire at shipment or, if a lamp is not supplied, the highest power lamp of the lamp types listed on the packaging. Please note that EPA expects all lamps listed on the packaging to comply with this specification when operating on the luminaire's ballast. To ease the burden on the manufacturer, however, test data need be submitted for only one lamp type operating on the luminaire's ballast.

Note: The following may be used in lieu of testing for certain requirements:

- EPA approved platforms as listed in the Platform Database
- EPA approved documentation from an industry association (i.e. NEMA lamp ballast matrices)
- The model number of an ENERGY STAR qualified GU24 based integrated lamp.

Note: The above Qualification Process section will be completed in subsequent drafts of this specification. Further language regarding product variations and successor LED packages/modules/arrays will be provided.

TBD

Acceptable Sources of Documentation, Verification Testing Program



Acceptable Sources of Documentation

A variety of acceptable sources of documentation are referenced for each performance characteristic. For clarity, these sources are summarized below.

- **A test report from a laboratory accredited by an accreditation body recognized for luminaire testing under the ENERGY STAR Program:** Both public and private accredited laboratories may be used, so long as they meet the ENERGY STAR laboratory requirements. A list of laboratories meeting accreditation requirements will be listed on the ENERGY STAR website. (Spring 2010) Note that these requirements are currently under development - see updates on www.energystar.gov/testingandverification. Partners should ensure that testing is conducted by one of these listed laboratories.)
- **EPA Approved Platform Database:** The approved platform database lists lamp & ballast combinations and GU24 integrated lamps that have been submitted by a manufacturer and pre-approved to meet specific performance characteristics. Partners may cite the performance of approved platforms to satisfy some of the luminaire performance requirements listed in the database; use of an approved platform will not meet all specification requirements to qualify a luminaire. The platform database currently includes approved fluorescent lamp & ballast platforms, and may be expanded in the future to also include approved LED light engines and platforms based on other technologies. The platform database is available at www.energystar.gov/platform
- **EPA approved documentation from an industry association:** In certain instances, EPA has approved documentation from industry associations who take responsibility for specific performance characteristics of lamps and/or ballasts. When using this type of documentation, partners should contact the industry association to obtain the EPA-approved documentation that is required for use with ENERGY STAR submissions. Partners may use the NEMA-ALA Lamp and Ballast Matrices as a source for obtaining required information to qualify luminaires using fluorescent lamps. These matrices can be found at www.nema.org/lampballastmatrix
- **A test report from an OSHA NRTL laboratory:** Documentation for safety requirements must come from an OSHA NRTL laboratory, which may also be used to obtain certain additional performance characteristics.
- **Manufacturer documentation:** Documentation for certain performance characteristics (such as product packaging requirements) may come directly from the original equipment manufacturer.

Note: The ENERGY STAR Laboratory Accreditation Program is currently being developed through a program-wide effort in support of enhanced testing and verification for ENERGY STAR labeled products. These requirements will be developed and finalized in Spring/Summer 2010.

All ENERGY STAR partners will receive email updates regarding the lab accreditation requirements.

If you are not already a partner and would like to receive email updates on this topic, please send an email to ENERGYSTARVerificationProgram@energystar.gov.

The latest information on development of accreditation requirements is also posted at www.energystar.gov/testingandverification.

Finally, the EPA Approved Platform Database and the NEMA-ALA Lamp and Ballast Matrices are under review to determine ways to strengthen these processes. In subsequent drafts of this specification EPA may propose changes for partner and stakeholder review and comment.

Verification Testing Program

Partners of the ENERGY STAR Luminaires program are subject to the requirements of the ENERGY STAR Third Party Lighting Product Verification Testing Program (first draft in development)

TBD

Note: EPA is currently developing a next generation lighting verification testing program intended to consolidate ENERGY STAR's current verification testing programs, including the RLF QA4 program, the CFL Third Party Testing and Verification Program, and the programs planned for the SSL and Integral LED Lamps programs. Details about this manufacturer-funded program, including effective dates, will be developed and finalized through a separate stakeholder process focused on testing requirements across ENERGY STAR products. This process will be run in parallel to the development of the ENERGY STAR Luminaires specification.

- ENERGY STAR Laboratory Accreditation Program being developed
- Next generation lighting verification testing program being developed
 - First draft to be distributed with the second draft of the Luminaires spec
- www.energystar.gov/testingandverification
- Approach to 'approved' platforms, and matrices of lamps & ballasts will be strengthened; details in subsequent draft

Technical Notes, Future Specification Revisions



- EPA encourages careful review of technical notes
- Note #4 refined (from RLF language) to clarify lamp QC responsibilities
- Policy about future specification revisions is outlined

Technical Notes

The list of conditions below is referenced in the "Required Documentation" column for certain performance requirements detailed in this specification.

- [1] Laboratory test results must be produced using the specific lamp and ballast or LED package(s), LED module(s) or LED array(s) and LED driver combination that will be used in production.
- [2] Note: the laboratory used for this test must have a scope of accreditation that includes the method of measurement reference standard for this performance characteristic.
- [3] Laboratory test results must be produced using the specific lamp that will operate in the luminaire and either the ballast that will operate in the luminaire or a commercially-available ballast that meets the applicable ANSI ballast requirements, if applicable, for the light source being tested.
- [4] It is also intended that luminaire manufacturing partners will ensure that their fluorescent lamp vendors meet the following quality requirements during production runs of each lamp model:
 1. The lamp manufacturer must maintain color control such that a minimum of 90% of the ongoing production (as represented by samples tested from each production shift for the same color and when typically evaluated over 12 month period) will fall within the 7-step MacAdam color ellipse associated with the designated (manufacturer declared) target color.
 2. For the purposes of meeting color control, the lamp manufacturer must maintain testing equipment calibrated to international practices and standards and must compile the ongoing color control data in a manner such that it can be easily reviewed upon partner or EPA request.
 3. At a minimum, the lamp manufacturer's color quality control program must maintain the following data for a 3-year period:
 - a. Test dates and sample size (minimum of two lamps per production shift)
 - b. Test results (x,y coordinates) for each sample lamp measured
 - c. Test results (x,y coordinates) for sample lamps plotted graphically against the designated 7-step color ellipse and available for partner or EPA review on at least a quarterly basis
 - d. Records to substantiate that 90 percent of the data points (x,y coordinates) fall within the applicable 7-step MacAdam ellipse. Manufacturers are encouraged to exceed this target.
- [5] Laboratory test results must be produced using the specific ballast that will operate in the luminaire.
- [6] 1,000 hour lumen maintenance and lumen maintenance at 40% of rated life tests must use the same samples.
- [7] For downlights, one trim ring and one reflector may be used with the three luminaire samples.
- [8] GU24 Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.

Note: Technical note #4 has been adjusted to indicate partner responsibility for ensuring that selected lamp vendors meet these quality requirements. The above Technical Notes section will be completed in subsequent drafts.

Future Specification Revisions

EPA will revise this specification should technological and/or market changes affect its value to consumers, industry, or the environment. In keeping with current policy, revisions to this specification will be arrived at through established ENERGY STAR specification revision processes.

While this document currently refers to industry standards and test procedures for fluorescent, high intensity discharge and solid state sources, as new technologies emerge that have equal or better performance to the levels proposed here, consistent with a technology neutral approach, EPA may amend the program requirements by adding additional standards, requirements and test procedures.

Expiration of ENERGY STAR Qualification: During future specification revisions EPA may choose to require complete new test data and documentation for all performance characteristics in order for a luminaire to remain ENERGY STAR qualified. New test data may be required for new, revised and/or existing ENERGY STAR performance characteristics.

Reference Standards and Test Procedures



Reference Standards and Test Procedures

| Organization | Identifier | Description |
|--------------|--------------------------|--|
| ANSI | ANSI C78.376-2001 | Specifications for the Chromaticity of Fluorescent Lamps |
| ANSI | ANSI C78.377-2008 | Specifications for the Chromaticity of Solid State Lighting Products |
| ANSI | ANSI C78.5-2003 | Specifications for Performance of Self-Balasted Compact Fluorescent Lamps |
| ANSI | ANSI/ANSI/IG C78.81-2010 | Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics |
| ANSI | ANSI/IEC C78.901-2005 | Single-Based Fluorescent Lamps—Dimensional and Electrical Characteristics |
| ANSI | AN J51.61-2009 | Specifications for Bases (Caps) for Electric Lamps |
| ANSI | AN J51.62-2009 | Lampholders for Electric Lamps |
| ANSI | AN J54 | Electric Lamp Ballast - Line Frequency Fluorescent Lamp Ballast |
| ANSI | AN J54 consolidated | High-Frequency Fluorescent Lamp Ballasts—Supplements |
| ANSI | AN J54 Z02 | |
| ANSI | ANSI J54-2009 | Method of Measurement of Fluorescent Lamp Ballasts |
| ANSI | ANSI C92.6-2005 | Ballast For High Intensity Discharge Lamps - Methods Of Measurement |
| ANSI | ANSI C92.77-2002 | Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment |
| ANSI | ANSI/IEEE C62.41-1991 | Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits |
| ASSIST | ASSIST May 2008 | ASSIST Recommends: Recommendations for Testing and Evaluating White LED Light Engines and Integrated LED Lamps Used in Decorative Lighting Luminaires. Vol. 4, Issue 1, May 2008. |
| ASTM | ASTM E 783-2004 | Restricted Air Movement |
| CIE | CIE Pub. No. 13.3-1996 | Method of Measuring and Specifying Color Rendering of Light Sources |
| CIE | CIE Pub. No. 15-2004 | Colorimetry |
| EU | EU Directive 2002/95/EC | Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment |
| FCC | FCC 47 CFR | Electromagnetic Interference |
| FTC | FTC 16 CFR | Commercial Practices |
| IEC | 60081-1 | Lamp Caps and Holders Together with Gauges for the Control of Interchangeability and Safety - Part 1: Lamp Caps |
| IEC | 60081 | Double-capped Fluorescent Lamps - Performance Specifications |
| IEC | 60901 | Single-capped Fluorescent Lamps - Performance Specifications |
| IEC | 61347-2-3-am2 ed1.0 | Amendment 2 - Lamp Control Gear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps |
| IEEE | C62.41 | Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits |
| IES | IES LM-9-09 | Electric and Photometric Measurements of Fluorescent Lamps |
| IES | IES LM-10-96 | Photometric Testing of Outdoor Fluorescent Luminaires |
| IES | IES LM-16-93 | Correlated Color Temperature |
| IES | IES LM-40-01 | Approved Method for Life Performance Testing of Fluorescent Lamps |
| IES | IES LM-41-98 | IES Approved Method for Photometric Testing of Indoor Fluorescent Luminaires |
| IES | IES LM-47-01 | Life Testing of High Intensity Discharge (HID) Lamps |
| IES | IES LM-49-01 | Life Testing of General Lighting Incandescent Filament Lamps |
| IES | IES LM-51-00 | Electrical and Photometric Measurements of HID Lamps |
| IES | IES LM-54 | Guide to Spectroradiometric Measurements |
| IES | IES LM-58-94 | Color Rendering Index and Correlated Color Temperature |
| IES | IES LM-66-01 | Life Testing of Single-Ended Compact Fluorescent Lamps |
| IES | IES LM-66-00 | Electrical and Photometric Measurements of Single-Ended Compact Fluorescent Lamps |
| IES | IES LM-78-08 | Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products |
| IES | IES LM-80-08 | Approved Method: Measuring Lumen Maintenance of LED Light Sources |
| IES | IES RP 16-05 | Nomenclature and Definitions for Illuminating Engineering |
| IES | IES TM-21-11 | Projecting Long Term Lumen Maintenance of LED Packages (in draft 5/2010) |
| LRC | ACTV Test 2007 | Accelerated Cycling Thermal Voltage Stress Test |
| NFPA | NFPA 70-2005 | National Electric Code |
| UL | UL 152-2002 | Portable Electric Luminaires |
| UL | UL 834-2001 | Fluorescent-Lamp Ballasts |
| UL | UL 1012-2005 | Power Units Other Than Class 2 |
| UL | UL 1310-2005 | Class 2 Power Units |
| UL | UL 1598-2008 | Luminaires |
| UL | UL 1838-2003 | Low Voltage Landscape Lighting Systems |
| UL | UL 1993-2009 | Self-Balasted Lamps and Lamp Adapters |
| UL | UL 1994-2004 | Luminous Egress Path Marking Systems |
| UL | UL 8750-2009 | Light Emitting Diode (LED) Light Sources for Use in Lighting Products |

Measurement Tolerances

Note: In a subsequent draft EPA will detail acceptable tolerances for measurement values required in this specification.

TBD

- Summarizes all references
- Each identifier is a hyperlink to the standard or test procedure; many are free
- Measurement tolerances will be defined in a subsequent draft

Photometric Performance Requirements

Photometric Performance: Luminous Efficacy and Output Requirements: Non-Directional Luminaires



Photometric Performance Requirements

Luminous Efficacy and Output Requirements: Non-Directional Luminaires

| Source Type | ENERGY STAR Requirements | | Methods of Measurement and/or Reference Standards | Required Documentation |
|---|---|---|--|--|
| | Source Efficacy | Minimum Light Output | | |
| Fluorescent <ul style="list-style-type: none"> linear compact self ballasted compact (GU24) circline | ≥ 70 LPW per lamp/ballast platform <u>Exception:</u> Covered and dimmable versions of GU24 based integrated lamps are required to meet reduced efficacy requirements as outlined in appendix A. | Lamp-ballast platform must provide a minimum of 850 lumens. <u>Exception:</u> chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | Linear & circline: IES LM-9-09 Compact & self ballasted compact: IES LM-66-00 | Provide: <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or a Platform Approval Number from the <u>EPA Approved Platform Database</u>; or EPA-approved documentation from an industry association, such as the <u>NEMA/ALA matrices</u>. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1], [8] Passing Test: All samples must pass to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> metal halide ceramic metal halide high pressure sodium | ≥ 70 LPW per lamp/ballast platform <u>Exception:</u> Covered and dimmable versions of GU24 based integrated lamps are required to meet reduced efficacy requirements as outlined in appendix A. | Lamp-ballast platform must provide a minimum of 850 lumens. <u>Exception:</u> chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | IES LM-51-00 | Provide: <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or a Platform Approval Number from the <u>EPA Approved Platform Database</u>; or EPA-approved documentation from an industry association, such as the <u>NEMA/ALA matrices</u>. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1] Passing Test: All samples must pass to qualify for ENERGY STAR. |
| Solid State: LED Light Engine | ≥ 70 LPW per LED light engine | Each LED light engine must provide a minimum of 850 lumens. | IES LM-xx-1x Note: EPA is working with... | Provide: <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2] |

Review carefully



Photometric Performance: Luminous Efficacy and Output Requirements: Non-Directional Luminaires



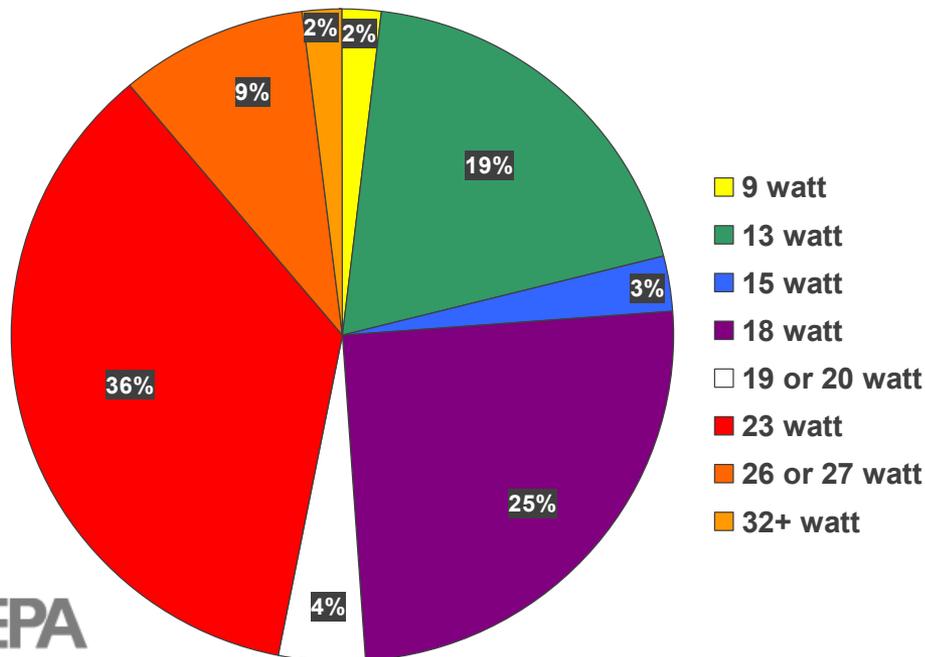
- Requirements are based on source efficacy
 - $\geq 70 \text{ lm/W}$, a 40% increase in nominal RLF efficacy requirement
 - Exception: $\geq 50 \text{ lm/W}$ for dimmable or covered GU24 integrated lamps (25% increase over RLF)
- Minimum light output requirements:
 - 850 source lumens
 - 450 source lumens per head for chandeliers with > 5 heads

| Photometric Performance Requirements | | | |
|--|--|--|--|
| Luminous Efficacy and Output Requirements: Non-Directional Luminaires | | | |
| Source Type | ENERGY STAR Requirements | | Methods of Measurement and/or Reference Standards |
| | Source Efficacy | Minimum Light Output | |
| Fluorescent <ul style="list-style-type: none"> • linear • compact platform • self ballasted compact (GU24) • circline | $\geq 70 \text{ LPW per luminaire}$ Exception: Covered and dimmable versions of GU24 based integrated lamps are required to meet reduced efficacy requirements as outlined in appendix A. | Lamp-ballast platform must provide a minimum of 850 lumens. Exception: chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | Linear & circline: IES LM-9-09 Compact & self ballasted compact: IES LM-66-00 Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2], or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1], [8]. Passing Test: All samples must pass to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | Requirements as outlined in appendix A. | | IES LM-51-00 Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2], or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1]. Passing Test: All samples must pass to qualify for ENERGY STAR. |
| Solid State: LED Light Engine | $\geq 70 \text{ LPW per luminaire}$ | Each LED light engine must provide a minimum of 850 lumens. Exception: chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | IES LM-xx-1x Note: EPA is working with industry to develop the above test procedure: IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature Upon its publication, EPA intends to reference this new metric. This metric is based on the work of ASSIST (www.irc.rpi.edu/assist) See: ASSIST May 2008 Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2] Sample Size: • 1 complete luminaire sample (LED light engine installed) [1], and • 2 additional LED light engine samples external to luminaire; and • Any components and/or materials required to install additional LED light engines in luminaire. Passing Test: All LED light engine samples, tested in the luminaire, must pass to qualify for ENERGY STAR. |

Photometric Performance: Luminous Efficacy and Output Requirements: Non-Directional Luminaires



- 50% of qualified GU24 lamps meet 70 lm/W requirement
- 70+ lm/W GU24:



| Photometric Performance Requirements | | | |
|---|--|---|--|
| Luminous Efficacy and Output Requirements: Non-Directional Luminaires | | | |
| Source Type | ENERGY STAR Requirements | | Methods of Measurement and/or Reference Standards |
| | Source Efficacy | Minimum Light Output | |
| Fluorescent <ul style="list-style-type: none"> linear compact platform self ballasted compact (GU24) circline | ≥ 70 LPW per lamp <i>Exception:</i> Covered and dimmable versions of GU24 based integrated lamps are required to meet reduced efficacy requirements as outlined in appendix A. | Lamp-ballast platform must provide a minimum of 850 lumens. <i>Exception:</i> chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | Linear & circline: IES LM-9-09 Compact & self ballasted compact: IES LM-66-00 Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1], [8]. Passing Test: All samples must pass to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> metal halide ceramic metal halide high pressure sodium | requirements as outlined in appendix A. | | IES LM-51-00 Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1]. Passing Test: All samples must pass to qualify for ENERGY STAR. |
| Solid State: LED Light Engine | ≥ 70 LPW per lamp/light engine | Each LED light engine must provide a minimum of 850 lumens. <i>Exception:</i> chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | IES LM-xx-1x Note: EPA is working with industry to develop the above test procedure: IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature Upon its publication, EPA intends to reference this new metric. This metric is based on the work of ASSIST (www.irc.rpi.edu/assist). See: ASSIST May 2008 Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2] Sample Size: <ul style="list-style-type: none"> • 1 complete luminaire sample (LED light engine installed) [1]; and • 2 additional LED light engine samples external to luminaire; and • Any components and/or materials required to install additional LED light engines in luminaire. Passing Test: All LED light engine samples, tested in the luminaire, must pass to qualify for ENERGY STAR. |

Photometric Performance: Luminous Efficacy and Output Requirements: Non-Directional Luminaires



- LED light engine measurement:
 - IES LM-xx-1x
 - *IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature*
 - Based upon [ASSIST](#) Recommends Volume 4
 - LM-xx-1x references IES LM-79-08 for photometric and electrical measurement methods
 - To be completed prior to the effective date of the Luminaires specification

| Photometric Performance Requirements | | | | |
|--|--|---|---|--|
| Luminous Efficacy and Output Requirements: Non-Directional Luminaires | | | | |
| Source Type | ENERGY STAR Requirements | | Methods of Measurement and/or Reference Standards | Required Documentation |
| | Source Efficacy | Minimum Light Output | | |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline | ≥ 70 LPW per lamp/ballast platform <i>Exception:</i> Covered and dimmable versions of GU24 based integrated lamps are required to meet reduced efficacy requirements as outlined in appendix A. | Lamp-ballast platform must provide a minimum of 850 lumens. <i>Exception:</i> chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | Linear & circline: IES LM-69-09 Compact & self ballasted compact: IES LM-66-00 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2], or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1], [8]. Passing Test: All samples must pass to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | as outlined in appendix A. | | IES LM-51-00 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2], or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1]. Passing Test: All samples must pass to qualify for ENERGY STAR. |
| Solid State LED Light Engine | ≥ 70 LPW per LED light engine | Each LED light engine must provide a minimum of 850 lumens. <i>Exception:</i> chandeliers featuring more than 5 heads must provide a minimum of 450 lumens per head. | IES LM-xx-1x Note: EPA is working with industry to develop the above test procedure: <i>IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature</i> Upon its publication, EPA intends to update this new metric. This metric is based on the work of ASSIST (www.irc.rpi.edu/assist). See: ASSIST May 2008 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2] Sample Size: <ul style="list-style-type: none"> • 1 complete luminaire sample (LED light engine installed) [1], and • 2 additional LED light engine samples external to luminaire; and • Any components and/or materials required to install additional LED light engines in luminaire. Passing Test: All LED light engine samples, tested in the luminaire, must pass to qualify for ENERGY STAR. |



Photometric Performance: Luminous Efficacy and Output Requirements: Non-Directional Luminaires



- Time-limited incandescent requirements:
 - Halogen only
 - In-line motion sensor must:
 - ensure shut-off within 15 minutes
 - not include any form of override
 - not include instructions for defeat of sensor
 - Luminaires meet Off-State Power Consumption Requirements
 - Photosensor requirement detailed elsewhere in spec

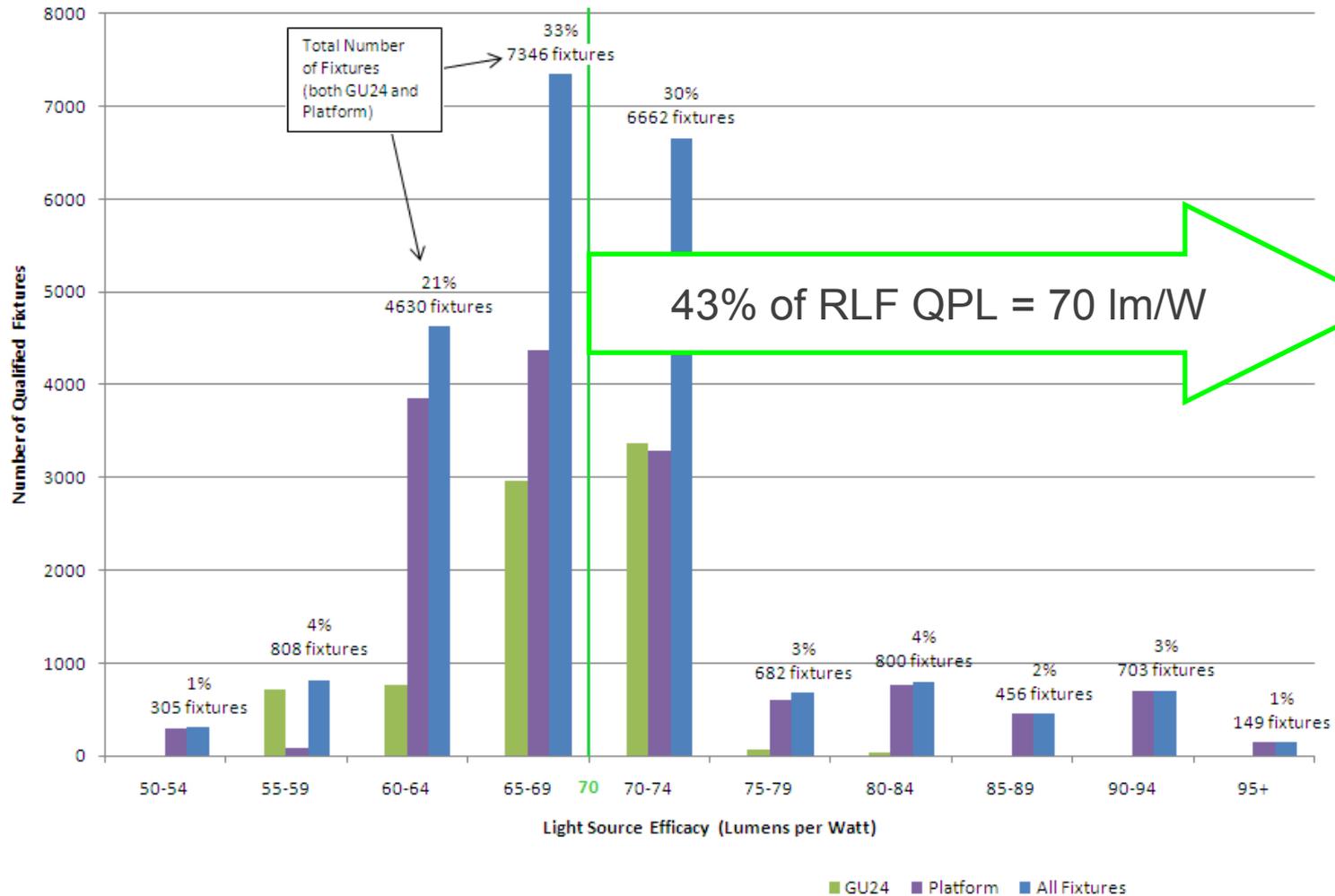
| | | | |
|---|---|---|---|
| <p>Halogen incandescent (outdoor only)</p> | <p>Qualification using halogen incandescent lamps is available for outdoor luminaires employing the following lampholders: E11, E26, G4, GX5.3, GY6.35.</p> <p>Improved product efficiency is achieved through minimized operating time. Qualifying luminaire must operate with an integral in-line motion sensor device that meets the following criteria:</p> <ul style="list-style-type: none"> • ensures automatic shut-off of the lamp within 15 minutes of being manually activated by a switch or automatically activated by the sensor, and • has an indicator that visibly or audibly informs the device operator that the motion sensor is operating properly, or that it has failed or malfunctioned • meets Off-State Power Consumption Requirements in this specification <p>Halogen luminaires may not feature any form of continuous operation. Luminaires may not offer any form of motion sensor override. Additionally, instructions provided with luminaire may not detail methods of defeat.</p> | <p>Lampholder: ANSI C81.62-2009</p> | <p>Provide: 1. ANSI lampholder code 2. Applicable sections of luminaire manual(s) that demonstrate control functionality and instructions for use for each luminaire being submitted.</p> |
|---|---|---|---|

Note: Recognizing that luminous efficacy requirements for ENERGY STAR qualification of luminaires have remained largely unchanged since the original program's inception in 1997, and consistent with increases in baseline performance of general service lamps mandated by the Energy Independence and Security Act of 2007, EPA proposes the increased efficacy values detailed in the table above with the understanding that products meeting these levels are both broadly accessible and cost effective. EPA welcomes stakeholder comments on the proposed values.

Consumers are unable to modify the light output of solid state luminaires, or fluorescent or HID luminaires featuring dedicated-wattage ballasts. For this reason EPA has proposed the above minimum light output requirements. The proposed requirements are intended to provide source output comparable to a 60 watt incandescent lamp, the most commonly used consumer lamp. An exception is allowed for chandeliers with more than 5 heads, where lower wattage lamps are often used.

Also, EPA is determining lab accreditation requirements across the suite of ENERGY STAR labeled products through the enhanced testing and verification efforts, and in a separate process will propose a set of laboratory accreditation requirements for luminaires in May 2010. **ENERGY STAR partners will automatically receive a copy of the draft laboratory requirements** by email when they are distributed in May. In the meantime, more information is available at www.energystar.gov/testingandverification

Source Efficacy of Currently Qualified Residential Light Fixtures



Source: ENERGY STAR Residential Lighting Fixtures Qualified Product Information as of 4/1/2010

Photometric Performance: Luminous Efficacy and Output Requirements: Directional Residential Luminaires



RESIDENTIAL

Luminous Efficacy Requirements: Directional Luminaires Residential: Fluorescent and Solid State Sources Only

| Luminaire Type | Luminaire Efficacy | ENERGY STAR Requirements | | Methods of Measurement and/or Reference Standards | Required Documentation |
|---|--------------------|---|--|--|--|
| | | Minimum Light Output | Zonal Lumen Density Requirement | | |
| Cove Mount | 45 LPW | Luminaire must deliver a minimum of 200 lumens (initial) per lineal foot. The minimum required light output (in lumens) is calculated by dividing the luminaire length in inches by 12, then multiplying the result by 200. Note: The equation applies to all luminaire configurations. For rectangular geometries the "measured luminaire length" is the longest dimension of the luminaire. For circular geometries the "measured luminaire length" is the diameter. For linear track luminaires the "measured luminaire length" is the track length. | Luminaire must deliver a minimum of 35% of total lumens within the 120°-150° zone. | Fluorescent: IES LM-41-98 Solid State: IES LM-79-08 | Provide (fluorescent): 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMAVALA matrices. Provide (solid state): 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2] Sample Size: three complete luminaires [1], [7] Passing Test: All luminaires must pass to qualify for ENERGY STAR. |
| Downlights: • recessed • surface • pendant | 42 LPW | ≤ 4.5' Aperture: 345 lumens (initial) > 4.5' Aperture: 575 lumens (initial) | Luminaire must deliver a minimum of 75% of total lumens (initial) within the 0-60° zone (bilaterally symmetrical). | | |
| Surface Mount With Directional Head(s) | 35 LPW | Luminaire must deliver a minimum of 200 lumens (initial) per head. | Luminaire must deliver a minimum of 85% within the 0-90° zone (bilaterally symmetrical). | | |
| Under cabinet | 29 LPW | Luminaire must deliver a minimum of 125 lumens (initial) per lineal foot. The minimum required light output (in lumens) is calculated by dividing the luminaire length in inches by 12, then multiplying the result by 125. Note: The equation applies to all luminaire configurations. For rectangular geometries the "measured luminaire length" is the longest dimension of the luminaire. For circular geometries the "measured luminaire length" is the diameter. For linear track luminaires the "measured luminaire length" is the track length. | Luminaire must deliver a minimum of 60% of total lumens (initial) within the 0-60° zone and a minimum of 25% of total lumens (initial) within the 60-90° zone (bilaterally symmetrical). | | |

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- Residential; commercial listed separately
- Requirements are based on luminaire efficacy
 - IES LM-41-98 for fluorescent
 - IES LM-79-08 for solid state
- Requirements largely the same as SSL v1.1 except:
 - Expanded to include fluorescent
 - 42 lm/W for downlights
 - 29 lm/W for under cabinet
 - Outdoor post- or arm-mounted zonal lumen density requirements designed for dark sky compliance

Photometric Performance: Luminous Efficacy and Output Requirements: Directional Residential Luminaires



RESIDENTIAL

| | | | | |
|---|--------|---|--|--|
| Outdoor Post- or Arm-Mounted Decorative Luminaires <small>(Note: for mounting below 90 degrees from the grade)</small> | 35 LPW | Luminaire must deliver a minimum of 300 lumens (initial). | Luminaire must deliver 95% of total lumens within the 0°- 85° zone (bilaterally symmetrical). Luminaire must not emit any light above 90°. | Fluorescent: IES LM-10-98 Solid State: IES LM-79-08 |
| Inseparable Luminaires (solid state only) | 70 PW | None | None | |

Note: The proposed luminaire efficacy values above are in some instances the same values carried over from the SSL V1.1 specification, and in other instances represent increases which market research indicates are both broadly accessible and cost effective for consumers. The luminaire efficacy value proposed for inseparable luminaires (see Definitions section) is carried over from the proposed category B luminous efficacy value detailed in the SSL V1.1 specification. EPA seeks feedback on the proposed requirements.

EPA recognizes that the fluorescent test procedure referenced above, IES LM-41-98, is based on relative photometry rather than absolute photometry as detailed in IES LM-79-08, and is working with industry to develop a resolution to ensure that both procedures provide equivalent utility in the evaluation of directional luminaires.

EPA also requests stakeholder comment on the above zonal lumen density requirements, carried over from the SSL V1.1 specification (with the exception of Outdoor Post- or Arm-Mounted) along with the minimum light output requirements. EPA understands that zonal lumen density requirements may ensure performance comparable to those luminaires using incumbent light source technologies, but recognizes also that the requirements could limit the flexibility of manufacturers to design luminaires to address specific tasks, thus limiting the range of products available to consumers. Based on testing currently underway, in subsequent drafts EPA may propose further refinements to the zonal lumen density requirements for under cabinet and downlights.

Finally, in support of efforts to reduce light pollution, EPA proposes the above intensity distribution requirements for Outdoor Post- or Arm-Mounted Decorative Luminaires. Among outdoor decorative luminaire types, these luminaires are deemed most likely to be installed not under a structure but under the open sky, therefore, the proposed requirement is intended to prevent light emissions above 90 degrees.

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- “Inseparable luminaires”
 - Luminaires featuring solid state lighting componentry which cannot be replaced and thus require replacement of the entire luminaire.
 - Performance requirement based on SSL v1.1 “category B” proposed requirement of ≥ 70 lm/W luminaire efficacy

Photometric Performance: Luminous Efficacy and Output Requirements: Directional Commercial Luminaires



- Commercial requirements
- Similar to SSL v1.1 requirements, except:
 - Expanded to include fluorescent
 - Scope is limited to those luminaire types already qualified
 - 42 lm/W for downlights

COMMERCIAL

Luminous Efficacy Requirements: Directional Luminaires
Commercial: Fluorescent and Solid State Sources Only
Note: at this time the ENERGY STAR program is offering qualification of only the following commercial luminaire types. Other luminaire types will not be tested for qualification at this time. Long term, EPA is evaluating the potential for expansion of ENERGY STAR labeling of commercial luminaires.)

| Luminaire Type | ENERGY STAR Requirements | | | Methods of Measurement and/or Reference Standards | Required Documentation |
|---|--------------------------|---|---|--|---|
| | Efficacy | Minimum Light Output | Zonal Lumen Density Requirement | | |
| Portable Desk Task | 29 LPW | Luminaire must deliver a minimum of 200 lumens (initial). | Luminaire must deliver a minimum of 85% of total lumens (initial) within the 0-60° zone (bilaterally symmetrical). | Fluorescent: IES LM-41-98 Solid State: IES LM-79-08 | Provide (fluorescent): 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database ; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices . |
| Downlights: • recessed • surface • pendant | 42 LPW | ≤ 4.5" Aperture: 345 lumens (initial) > 4.5" Aperture: 575 lumens (initial) | Luminaire must deliver a minimum of 75% of total lumens (initial) within the 0-60° zone (bilaterally symmetrical). | | |
| Under cabinet | 29 LPW | Luminaire must deliver a minimum of 125 lumens (initial) per lineal foot. The minimum required light output (in lumens) is calculated by dividing the luminaire length in inches by 12, then multiplying the result by 125. Note: The equation applies to all luminaire configurations. For rectangular geometries the "measured luminaire length" is the longest dimension of the luminaire. For circular geometries the "measured luminaire length" is the diameter. For linear track luminaires the "measured luminaire length" is the track length. | Luminaire must deliver a minimum of 60% of total lumens (initial) within the 0-60° zone and a minimum of 25% of total lumens (initial) within the 60-90° zone (bilaterally symmetrical). Luminaires with asymmetrical distribution must have at least 12.5% of total luminaire lumens in the 60°-90° zone. | | Provide (solid state): a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2] Sample Size: three complete luminaires [1], [7] Passing Test: All luminaires must pass to qualify for ENERGY STAR. |

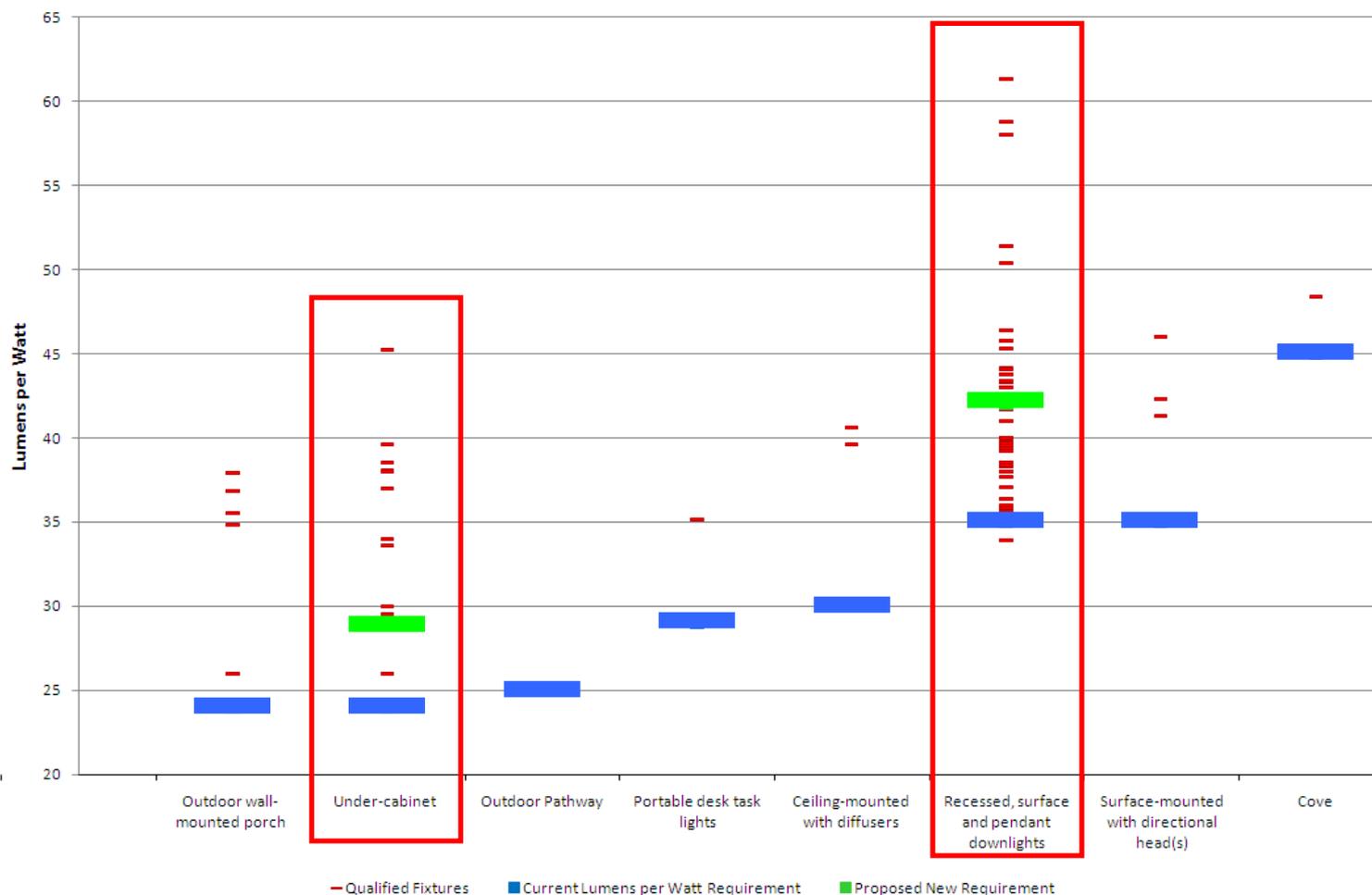
Note: The proposed luminaire efficacy values above are in some instances the same values carried over from the SSL V1.1 specification, and in other instances represent increases which EPA has concluded are both broadly accessible and cost effective for end users. EPA seeks feedback on the proposed requirements.

EPA recognizes that the fluorescent test procedure referenced above, IES LM-41-98, is based on relative photometry rather than absolute photometry as detailed in IES LM-79-08, and is working with industry to develop a resolution to ensure that both procedures provide equivalent utility in the evaluation of directional luminaires.

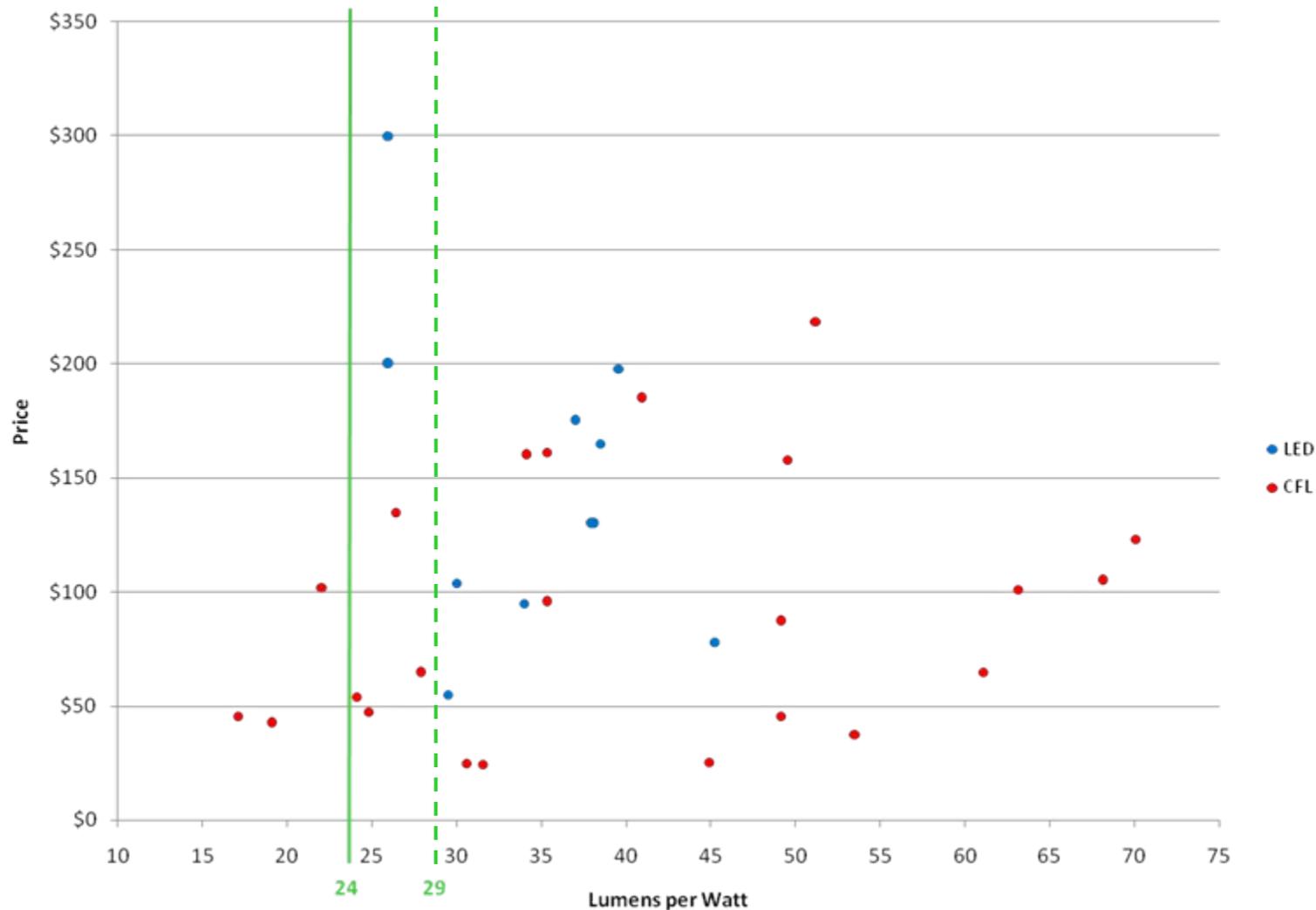
EPA also requests stakeholder comment on the above zonal lumen density requirements, carried over from the SSL V1.1 specification along with the minimum light output requirements. EPA understands that zonal lumen density requirements may ensure performance comparable to those luminaires using incumbent light source technologies, but recognizes also that these requirements could limit the creativity of manufacturers to design luminaires to address specific tasks, thus limiting the range of products available to consumers.

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Luminaire Efficacy of Currently Qualified Solid State Light Fixtures

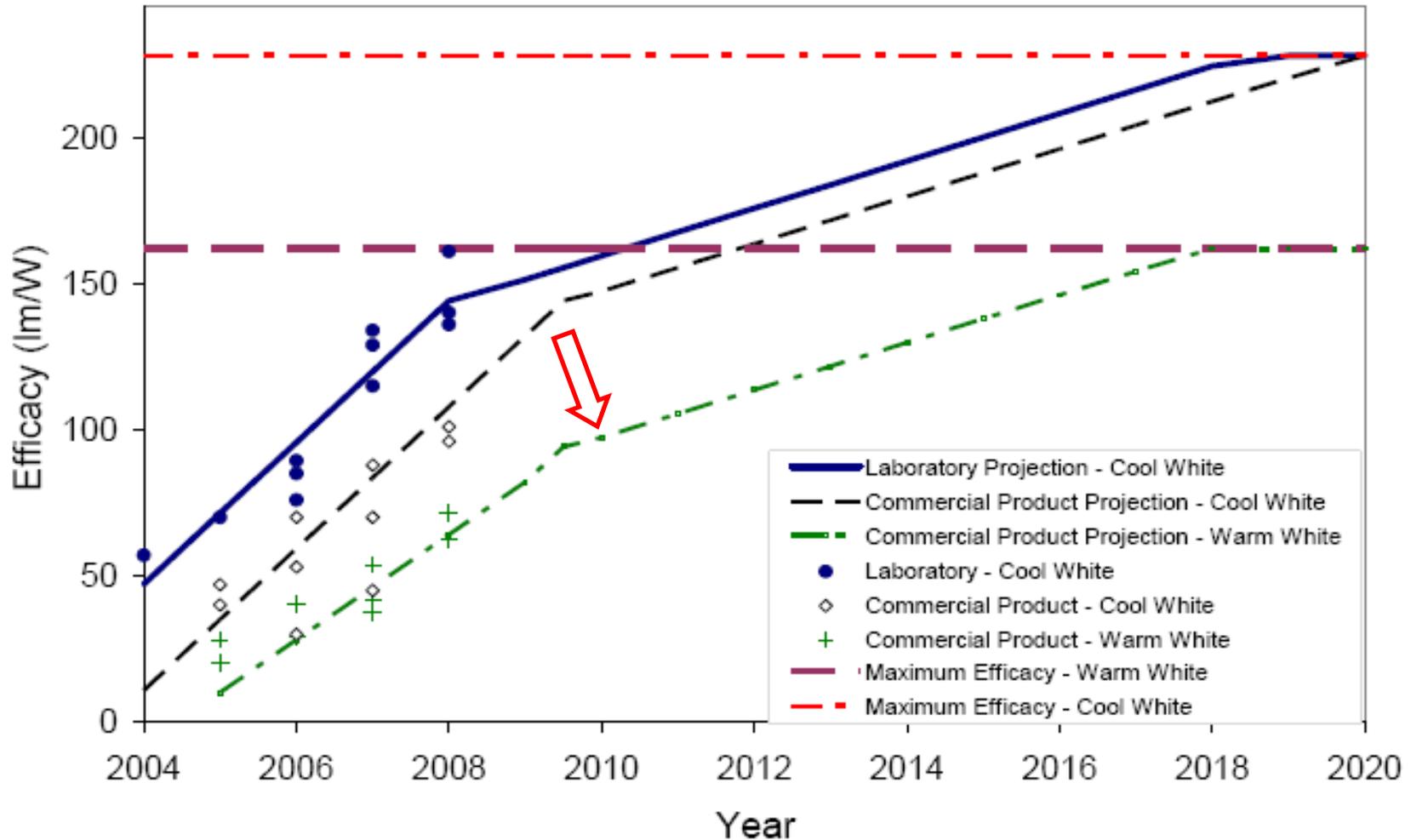


Luminaire Efficacy vs. Price: Under Cabinet Luminaires



Sources: ENERGY STAR Solid State Lighting Qualified Product Information as of 3/23/2010.
ICF Consulting Research

DOE White-Light LED Package Efficacy Targets (Lab and Commercial)



Photometric Performance: Light Source Life Requirements



| Light Source Life Requirements: Directional and Non-Directional Luminaires | | | |
|--|---|---|--|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent • linear • compact • self ballasted compact (GU24) • circline | For lamps shipped with luminaires, the average rated life of the source must be $\geq 10,000$ hours. If the lamp is not shipped with the luminaire, product packaging must meet the requirements set forth in the "Product Labeling & Packaging Requirements" section of this spec. | Linear & circline: IES LM-40-01 Compact & self ballasted compact: IES LM-65-01 | Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database ; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices . |
| High Intensity Discharge (outdoor only) • metal halide • ceramic metal halide • high pressure sodium | Exception: Covered and dimmable versions of GU24 based integrated lamps are required to meet reduced life requirements as outlined in appendix A. | IES LM-47-01 | Sample Size: ≥ 10 lamps must be tested [3] Passing Test: 50% of the sample set must be functioning at the lifetime requirement in order to qualify for ENERGY STAR. Manufacturers may obtain ENERGY STAR conditional qualification for their luminaire if all of the following items are provided: 1. A letter on letterhead from a laboratory meeting ENERGY STAR laboratory accreditation requirements. 2. A laboratory report proving that testing has been completed for at least 40% of rated life. 3. The date for testing completion. |
| Halogen Incandescent (outdoor only) | Lamps shipped with luminaires must feature a rated life of $\geq 3,000$ hours. | IES LM-49-01 | Conditional approval will only be granted for a period of no longer than 325 days. |
| Solid State | On product packaging and all marketing materials related to a qualified luminaire, partners may claim luminaire life not exceeding: <ul style="list-style-type: none"> • 25,000 hours for residential grade indoor luminaires • 35,000 hours for residential grade outdoor luminaires or commercial grade luminaires Refer to Lumen Maintenance Requirements in the next section. | | |

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- Technology neutrality is not extended to life requirements
- Requirements are tailored to expectations for various technologies
 - we don't require 35,000 hours for integrated compact fluorescent
 - we don't require only 10,000 hours for SSL
- Solid state luminaire "life" claims are limited to 25,000 or 35,000 hours
 - based on likely recommendation in forthcoming IES TM-21-11 technical memorandum: *Projecting Long Term Lumen Maintenance of LED Packages*
 - "6 times rule" states projections should be limited to no more than 6 times the duration of LM-80 testing
- Solid state requirements refer to next section, lumen maintenance

Photometric Performance: Lumen Maintenance Requirements



- Discharge sources:
 - Same fluorescent requirement carried forward from RLF specification
 - Applies to outdoor luminaires
 - Applies to HID luminaires

| Lumen Maintenance Requirements: Directional and Non-Directional Luminaires | | | |
|--|---|---|---|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| <p>Fluorescent</p> <ul style="list-style-type: none"> • compact • self ballasted compact (GU24) • circline | For lamps indicated on the luminaire packaging or shipped with the luminaires, the lamp must have an average rated lumen maintenance of at least 80% of initial lamp lumens at 40% (4,000 hours minimum) rated lamp life. | Linear & circline: IES LM-40-01 IES LM-09-99 Compact & self ballasted compact: IES LM-65-01 IES LM-66-00 | Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program (2), or 2. a Platform Approval Number from the EPA Approved Platform Database ; or 3. EPA-approved documentation from an industry association, such as the IlluminAire matrices . Sample Size: ≥ 10 lamps must be tested [3] Passing Test: ≥ 80% of the samples must achieve the required lumen maintenance value in order to qualify for ENERGY STAR. |
| <p>High Intensity Discharge (outdoor only)</p> <ul style="list-style-type: none"> • ceramic metal halide • high pressure sodium | | IES LM-47-01 IES LM-51-00 | |
| <p>Solid State Option 1: Component Performance (select either option 1 or option 2, below)</p> | <p>The manufacturer of the LED package(s) / LED module(s) / LED array(s) must have LM-80 test data available for the devices employed in the luminaire, with a sample size of 25 units for LED packages, or 10 units for LED modules or arrays.</p> <p>Sample sizes are for each temperature measured.</p> <p>For residential grade indoor luminaires: <i>(language to be provided in a subsequent draft)</i></p> <p>For residential grade outdoor luminaires and all commercial luminaires: <i>(language to be provided in a subsequent draft)</i></p> | <p>Measurement: IES LM-80-08</p> <p>Lumen maintenance projection: IES TM-21-11</p> <p>Note: EPA is following industry efforts to develop the above test procedure.</p> <p><i>Projecting Long Term Lumen Maintenance of LED Packages</i> Upon its publication, EPA intends to reference this technical memorandum.</p> | <p>Provide each of the following:</p> <ol style="list-style-type: none"> 1. an LM-80 test report for the LED package(s) / LED module(s) / LED array(s) employed in the luminaire; and, 2. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program (2), detailing the temperature measurement point (TMP₁₀₀) for the hottest LED in the luminaire, including a diagram or picture of its location with an arrow indicating the thermocouple attachment point; and, 3. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program (2), detailing <i>in situ</i> TMP₁₀₀ temperature measurements for the LED package(s) / LED module(s) / LED array(s) employed in the luminaire; and, 4. a written statement indicating the forward drive current in milliamperes (mA) applied to each LED package(s) / LED module(s) / LED array(s) employed in the luminaire. <p>Sample Size: three complete luminaires [7]</p> <p>Passing Test: all of the conditions below must be met. If any of the conditions are not met, the component performance option may not be used and the applicant must use Option 2, below, for compliance.</p> <ol style="list-style-type: none"> 1. The LED package(s) / LED module(s) / LED array(s) manufacturer indicates a TMP₁₀₀ on the LED package(s) / LED module(s) / LED array(s). 2. The TMP₁₀₀ is accessible to allow temporary attachment of a thermocouple for measurement of <i>in situ</i> temperature. Access via a temporary hole in the luminaire housing, tightly resealed during testing with putty or other flexible sealant is allowable. 3. The TMP₁₀₀ temperature, measured <i>in situ</i>, is less than or equal to the temperature(s) specified in the LM-80 test report for the corresponding drive current or higher, within the manufacturer's specified operating current range. 4. The drive current measured in the luminaire is less than or equal to the drive current specified in the LM-80 test report at the corresponding temperature or higher. 5. <i>(language to be inserted relating LM-80 data to TM-21-11 projection instructions)</i> |

Photometric Performance: Lumen Maintenance Requirements



- **Solid state: option 1: component performance:**
 - Same option 1 as detailed in SSL v1.1
 - Based on LM-80 test data and in situ temperature measurements
 - Exception: lumen maintenance projections to be based on forthcoming IES TM-21-11
- **Weakness of this approach:**
 - Does not evaluate performance degradation of:
 - LED driver circuit components
 - LED driver printed circuit boards
 - Intermediate electrical connections
 - Mechanical connections
 - Thermal adhesives and other thermal pathway components
 - Secondary optics

| Lumen Maintenance Requirements: Directional and Non-Directional Luminaires | | | |
|--|--|--|---|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline | For lamps indicated on the luminaire packaging or shipped with the luminaires, the lamp must have an average rated lumen maintenance of at least 80% of initial lamp lumens at 40% (4,000 hours minimum) rated lamp life. | Linear & circline: IES LM-40-01 IES LM-09-99 Compact & self ballasted compact: IES LM-65-01 IES LM-66-00 | Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program (2), or 2. a Platform Approval Number from the EPA Approved Platform Database ; or 3. EPA-approved documentation from an industry association, such as the IlluminAIA matrices . Sample Size: ≥ 10 lamps must be tested [3] Passing Test: ≥ 80% of the samples must achieve the required lumen maintenance value in order to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | | IES LM-47-01 IES LM-51-00 | |
| Solid State Option 1: Component Performance (select either option 1 or option 2, below) | The manufacturer of the LED package(s) / LED module(s) / LED array(s) must have LM-80 test data available for the devices employed in the luminaire, with a sample size of 25 units for LED packages, or 10 units for LED modules or arrays. Sample sizes are for each temperature measured. For residential grade indoor luminaires: <i>(language to be provided in a subsequent draft)</i> For residential grade outdoor luminaires and all commercial luminaires: <i>(language to be provided in a subsequent draft)</i> | Measurement: IES LM-80-08 Lumen maintenance projection: IES TM-21-11 Note: EPA is following industry efforts to develop the above test procedure. <i>Projecting Long Term Lumen Maintenance of LED Packages</i> Upon its publication, EPA intends to reference this technical memorandum. | Provide each of the following: 1. an LM-80 test report for the LED package(s) / LED module(s) / LED array(s) employed in the luminaire; and, 2. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program (2), detailing the temperature measurement point (TMP ₁₀₀) for the hottest LED in the luminaire, including a diagram or picture of its location with an arrow indicating the thermocouple attachment point; and, 3. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program (2), detailing <i>in situ</i> TMP ₁₀₀ temperature measurements for the LED package(s) / LED module(s) / LED array(s) employed in the luminaire; and, 4. a written statement indicating the forward drive current in milliamperes (mA) applied to each LED package(s) / LED module(s) / LED array(s) employed in the luminaire. Sample Size: three complete luminaires [7] Passing Test: all of the conditions below must be met. If any of the conditions are not met, the component performance option may not be used and the applicant must use Option 2, below, for compliance. 1. The LED package(s) / LED module(s) / LED array(s) manufacturer indicates a TMP ₁₀₀ on the LED package(s) / LED module(s) / LED array(s). 2. The TMP ₁₀₀ is accessible to allow temporary attachment of a thermocouple for measurement of <i>in situ</i> temperature. Access via a temporary hole in the luminaire housing, tightly resealed during testing with putty or other flexible sealant is allowable. 3. The TMP ₁₀₀ temperature, measured <i>in situ</i> , is less than or equal to the temperature(s) specified in the LM-80 test report for the corresponding drive current or higher, within the manufacturer's specified operating current range. 4. The drive current measured in the luminaire is less than or equal to the drive current specified in the LM-80 test report at the corresponding temperature or higher. 5. <i>(language to be inserted relating LM-80 data to TM-21-11 projection instructions)</i> |

Photometric Performance: Lumen Maintenance Requirements



- **Solid state: option 2: luminaire or LED light engine performance**
 - Similar to option 2 detailed in SSL v1.1
 - Based on LM-79 testing of whole luminaire, or LM-xx testing of LED light engine, at 0 and 6,000 hours
 - Testing lumen maintenance of whole luminaire captures nearly all potential failure and lumen depreciation mechanisms
 - Testing lumen maintenance of LED light engine alone would not capture degradation of decorative optical components, however,
 - Metal and glass degradation are unlikely to be noticed by consumer

| | | | |
|---|--|--|---|
| Solid State Option 2: Luminaire or LED Light Engine Performance (select either option 2 or option 1, above) | Directional luminaires: the luminaire must deliver at 6,000 hours the fraction of initial lumens specified below: Non-directional luminaires: each LED light engine must deliver at 6,000 hours the fraction of initial lumens specified below: Indoor luminaires: ≥ 91.9% Outdoor luminaires: ≥ 94.1% All Commercial: ≥ 94.1% These percentages are based on exponential decay functions for 25,000 hours and 35,000 hours to determine the 6,000 hour lumen maintenance necessary to achieve those rated lumen maintenance life values. | Directional luminaires: IES LM-79-08 Non-directional luminaires: IES LM-xx-1x NOTE: EPA is working with industry to develop the above test procedure: <i>IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature</i> Upon its publication, EPA intends to reference this new metric. This metric is based on the work of ASSIST (www/irc.rpi.edu/assist) See: ASSIST May 2008 | Provide: A test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]: <ul style="list-style-type: none"> • Directional luminaires: one IES LM-79-08 test report for the entire luminaire at the beginning of life, and one IES LM-79-08 data sheet for the entire luminaire at 6,000 hours • Non-directional luminaires: one IES LM-xx-1x test report for each LED light engine model at the beginning of life, and one IES LM-xx-1x data sheet for each engine model at 6,000 hours. Luminaire must be operated continuously in accordance with UL 1598-2008 or UL 153-2002 during the interim 6,000 hours; any deviations from this must be reported. Sample Size: three complete luminaires, or three LED light engines. Technical Notes: [7] Passing Test: All luminaires must pass to qualify for ENERGY STAR. |
| Halogen Incandescent (outdoor only) | Exempt | | |

Note: For lumen maintenance projections for solid state luminaires, two approaches similar to options 1 and 2 from the SSL V1.1 specification have been inserted above for stakeholder comment.

While LED packages themselves may operate reliably for decades under the right conditions, driver components are generally regarded as the weak link in solid state luminaire designs. While option 1 may ensure that LED package(s) / LED module(s) / LED array(s) maintain greater than 70% of initial lumen output over 25khrs or 35 khrs, EPA is concerned that with this option, driver components are not tested over an extended period of time, and optical degradation is not accounted for. For this reason EPA proposes elimination of option 1 in favor of option 2 which provides for extended testing of luminaires (directional) or LED light engines (non-directional), inclusive of any degradation or failure of driver componentry and/or secondary optics. It is recognized that testing LED light engines per option 2 would not account for degradation of decorative optical components of luminaires. EPA seeks comment on this proposal to require option 2 for all qualified luminaires.

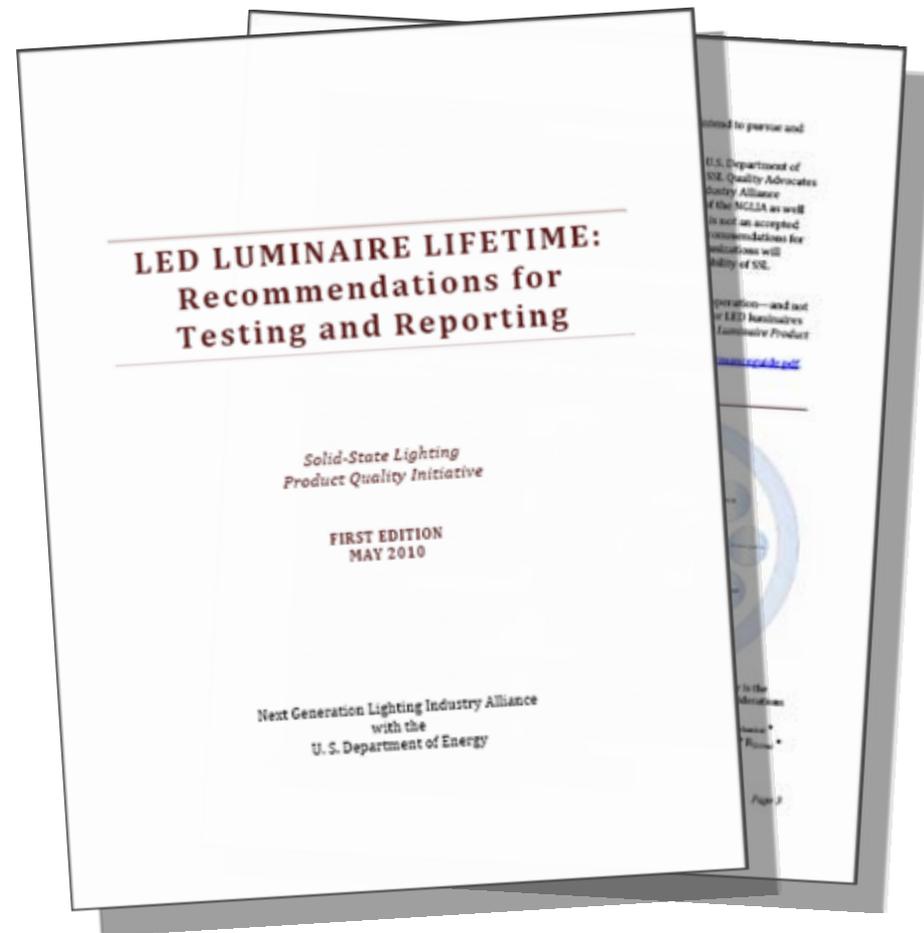
Regarding lumen maintenance projection methods, if option 1 is to remain, EPA understands that work on IES TM-21-11, a standardized method for projecting long term lumen maintenance performance based on 6,000 hours of collected data, will be completed in early 2011 in time for the effective date of this specification. Should delays occur, EPA proposes to employ the extrapolation methodology outlined in the SSL V1.1 specification, until TM-21-11 is completed.

Language referencing TM-21-11 will be further refined in a subsequent draft of this specification

Photometric Performance: Lumen Maintenance Requirements



- The DOE Lifetime and Reliability Working Group
 - Recommends LM-79 testing of the complete luminaire to determine lumen output over time
 - [Download](#)



Photometric Performance: Correlated Color Temperature (CCT) Requirements



Correlated Color Temperature (CCT) Requirements: Directional and Non-Directional Indoor Luminaires
(Exemption: Outdoor Luminaires)

| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
|--|---|--|---|
| Fluorescent <ul style="list-style-type: none"> linear compact self ballasted compact (GU24) circuline | <p>Lamps shipped with luminaires must have one of the following nominal correlated color temperatures (CCT):</p> <ul style="list-style-type: none"> 2700K 3000K 3500K 4100K <p>If the lamp is not shipped with the luminaire, product packaging must meet the requirements set forth in Product Labeling & Packaging Requirements.</p> | <p>Measurement (linear & circuline): IES LM-9-09</p> <p>Measurement (compact & self ballasted compact): IES LM-66-00</p> <p>Calculation: CIE 15.2004</p> | <p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or a Platform Approval Number from the EPA Approved Platform Database; or EPA-approved documentation from an industry association, such as the IESNA/IALA matrices; or a test report from an ISO 9000 registered facility. <p>Sample Size: ≥ 10 lamps must be tested [3], [8]</p> <p>Passing Test: $\geq 90\%$ of the lamps tested fall within a 7-step ANSI MacAdam ellipse for the designated CCT in order to qualify for ENERGY STAR [4]</p> |
| Solid State | <p>The luminaire (directional luminaires) or LED light engine (non-directional luminaires) must have one of the following nominal correlated color temperatures (CCT):</p> <ul style="list-style-type: none"> 2700K 3000K 3500K 4000K <p>The luminaire or LED light engine must also fall within the corresponding 7-step chromaticity quadrangles as defined in ANSI C78.377-2008.</p> | <p>Chromaticity specifications: ANSI C78.377-2008</p> <p>Measurement (directional): IES LM-79-08</p> <p>Measurement (non-directional): IES LM-xx-1x</p> <p>NOTE: EPA is working with industry to develop the above test procedure.</p> <p>IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature</p> <p>Upon its publication, EPA intends to reference this new metric. This metric is based on the work of ASSIST (www.lrc.rpi.edu/assist) See: ASSIST May 2008</p> <p>Calculation: CIE 15.2004</p> | <p>Provide:</p> <p>A test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2];</p> <ul style="list-style-type: none"> Directional luminaires: IES LM-79-08 test report for each luminaire. Non-directional luminaires: IES LM-xx-1x test report for each LED light engine. <p>Sample Size: three complete luminaires, or three LED light engines. Technical Notes: [7]</p> <p>Passing Test: All luminaires must pass to qualify for ENERGY STAR.</p> |

Note: EPA proposes to eliminate target correlated color temperature values greater than 4100K due to historically low interest in qualification of high CCT luminaires. Fewer than 1% of all qualified luminaires in the RLF and SSL programs combined feature high CCT values. EPA seeks comment on this effort to simplify this specification.

- Target CCT values limited to 4100 Kelvin or below
 - $< 1\%$ of currently qualified luminaires (RLF + SSL) are $> 4100K$
 - Need to avoid shifts toward higher CCT values to achieve compliance with increased efficacy requirements

Photometric Performance: Color Rendering Requirements



- Expanded requirement to improve color performance:
 $R_a \geq 80$; and $R_9 \geq 0$
- Aligns with precedent in Integral LED Lamps spec
- NIST: most fluorescent lamps currently used to meet RLF requirements will meet this new requirement

Color Rendering Requirements: Directional and Non-Directional Indoor Luminaires (Exemption: Outdoor Luminaires)

| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
|--|---|--|--|
| Fluorescent • linear • compact • self ballasted compact (GU24) • circline | Lamps shipped with luminaires must meet the following requirement: $R_a \geq 80$; and $R_9 > 0$ | Linear & circline: IES LM-9-09 For compact and self ballasted compact: IES LM-65-00 Calculation: CIE 13.3-1995 | Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database ; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices . Sample Size: ≥ 10 lamps must be tested [3], [8] Passing Test: $\geq 80\%$ of the samples must achieve the required color rendering index value in order to qualify for ENERGY STAR. |
| Solid State | The luminaire (directional luminaires) or LED light engine (non-directional luminaires) must meet the following requirement: $R_a \geq 80$; and $R_9 > 0$ | Directional measurement: IES LM-79-08 Non-Directional (LED light engine) measurement: IES LM-xx-1x NOTE: EPA is working with industry to develop the above test procedure. <i>IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature</i> Upon its publication, EPA intends to reference this new metric. This metric is based on the work of ASSIST (www.frc.ut.edu/assist/). See: ASSIST May 2008 Calculation: CIE 13.3-1995 | Provide: A test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; • Directional luminaires: IES LM-79-08 test report for each luminaire; or • Non-directional luminaires: IES LM-xx-1x test report for each LED light engine. Sample Size: three complete luminaires, or three LED light engines [7] |

Note: Seeking to improve the overall color performance of ENERGY STAR qualified luminaires, EPA proposes to extend to all qualified lighting products the positive R_9 requirement established by DOE in the ENERGY STAR Integral LED Lamps specification. While the general color rendering index ("CRI", R_a) provides a mean score of a source's color rendering performance across a range of eight pastel test color samples, these samples are known to provide a limited understanding of a source's color rendering performance with strong red objects; the R_9 testing requirement is designed to address this shortcoming.

In consultation with the National Institute of Standards and Technology (NIST), EPA anticipates that most fluorescent lamps currently used to meet the Residential Light Fixture specification ($R_a \geq 80$) have positive R_9 values.

Photometric Performance: Color Angular Uniformity & Color Maintenance



| Color Angular Uniformity: Directional Solid State Indoor Luminaires Only (Exemption: Outdoor Luminaires) | | |
|---|--|---|
| ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| The variation of chromaticity in different directions (i.e., with a change in viewing angle) must be within 0.004 from the weighted average point on the CIE 1976 (u',v') diagram. | Measurement: IES LM-79-08 & IES LM-58-94 Calculations: CIE 15: 2004 | Provide: an IES LM-79-08 test report for the luminaire from a laboratory meeting ENERGY STAR laboratory accreditation requirements. Vertical angular scanning resolution must be 1 degree on the 0 and 90 degree vertical planes, and Δu',v' distance must be reported for each vertical angle measured [2] |
| <p>Note: Variation in chromaticity by viewing angle is not found in fluorescent sources but can be a problem with LEDs and solid state luminaires. The above requirement is for directional luminaires only since the projection of color striations onto a work surface (from a downlight, under cabinet luminaire or desk task light) would be potentially noticeable and distracting. While this phenomenon is most pronounced and potentially problematic in the near field, standards only provide for far field measurements, therefore, this approach may only address luminaires with the most obvious deficiencies. EPA requests partner input on the utility of this approach.</p> | | |
| Color Maintenance: Solid State Indoor Luminaires Only (Exemption: Outdoor Luminaires) | | |
| ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| The change of chromaticity over the rated lumen maintenance life of the luminaire must be within 0.007 on the CIE 1976 (u',v') diagram. | IES LM-80-08 IES LM-79-08 | Provide: A test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]. 1. An IES LM-80-08 test report for the LED packages, LED array or modules [1]. or 2. An IES LM-79-08 test report for the entire luminaire at the beginning of life, and one IES LM-79-08 data sheet for the entire luminaire at 6,000 hours [1] Passing Test: at 6,000 hours the distance of the average chromaticity coordinates from the initial chromaticity coordinates must not be greater than: • 0.002 for residential indoor luminaires • 0.001 for residential outdoor and commercial luminaires |
| <p>Note: EPA proposes to evaluate chromaticity shift over the first 6,000 hours as a measure of a luminaire's progress toward a 0.007 threshold. LM-80 test reports for LED packages or LED arrays/modules include chromaticity shift reported over the measurement time. The passing values above are portions of the failure threshold (0.007) based on the first 6,000 hours, a portion of the rated lumen maintenance life (see Lumen Maintenance requirements). EPA seeks comment on this approach to improving long term color maintenance performance of qualified solid state luminaires.</p> | | |

- Technology neutrality is not extended to these requirements
- Color angular uniformity:
 - Pronounced in some LED luminaires
 - Near field problem measured by standards written for far-field
 - Requirement intended to eliminate worst offenders
- Color maintenance:
 - Solid state luminaires only
 - During the first 6,000 hours, evaluates trend towards 0.007 (CIE 1976 u',v') lifetime limit

Photometric Performance: Lamp Shipment Requirements



- Lamps must be provided with all qualified fixtures
- Exceptions:
 - Linear fluorescent luminaires
 - Solid state luminaires
 - Outdoor luminaires employing screw base (E26) lampholders
- Lamp labeling requirements within

| Lamp Shipment Requirements: Directional and Non-Directional Luminaires | | | |
|---|---|--|---|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circine | All luminaires must be shipped with a lamp for each lampholder. | Lamp base configuration: ANSI C81.61-2005 Lamps Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters): ANSI C78.901-2005; ANSI C78.81-2010; IEC 60901; IEC 60081 Lamps Not Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters): ANSI C78.901-2005; ANSI C78.81-2010 (used as a reference for the format and type of information required on a custom lamp specification sheet) | Provide: <ol style="list-style-type: none"> 1. A copy of the actual language that will be included on the base of the lamp. 2. Lamps Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters): Provide manufacturer data indicating applicable ANSI-IEC lamp data sheet number. 3. Lamps Not Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters): provide a manufacturer lamp specification sheet that describes the following (use the ANSI lamp data sheets found in ANSI C78.901 and C78.81 as a reference for the format and type of information requested): <ol style="list-style-type: none"> 1. Lamp Description, including: <ul style="list-style-type: none"> • Lamp Model Number • Nominal Wattage • Bulb Designation / Lamp Size (i.e., T4, T5, T8, etc.) • Lamp Base Type as defined by ANSI C81.61 or IEC 60061-10 (e.g., 2G13, GR10q, etc.) • Starting Circuit Application (i.e., rapid start, preheat, etc.) 2. Dimensional Characteristics, including diagram 3. Lamp Operating Characteristics, including: <ul style="list-style-type: none"> • Approximate wattage (W) • Voltage(V) • Current (A) |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | Lamps must utilize an ANSI/IEC standardized lamp base configuration, as defined by ANSI C81.61 and IEC 60061-1. Fluorescent and high intensity discharge lamp bases must be labeled with the lamp manufacturer name, wattage, correlated color temperature, and color rendering index. | In addition, lamps must either: <ul style="list-style-type: none"> • Meet the requirements of an ANSI/IEC standardized lamp specification sheet, as defined by ANSI C78.901-2001 and IEC 60901 (for compact fluorescent lamps) or ANSI C78.81-2001 and IEC 60081 (for linear lamps) if an applicable standard exists, or, • If no ANSI/IEC lamp standard exists (e.g., a spiral compact fluorescent lamp), a custom lamp specification sheet must be provided at the time of submittal. Specific lamp characteristics that should be included in the lamp specification sheet are detailed in the Required Documentation column. | |
| Halogen Incandescent (outdoor only) | | | |

Note: Lamp labeling requirements have been placed within the lamp shipment requirements.

Electrical Performance Requirements

Electrical Performance: Source Start Time & Run-up Time Requirements



| Electrical Performance Requirements | | | |
|---|---|---|--|
| Source Start Time: Directional and Non-Directional Luminaires | | | |
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline | The time needed after switching on the lamp to start continuously and remain illuminated must be an average of one second or less. | ANSI C82.11-2002 Section-5.2 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from an OSHA NRTL laboratory. Sample Size: ≥ 3 lamp/ballast combination samples must be tested [1] Passing Test: All samples must pass in order to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | Exempt | | |
| Solid State Halogen Incandescent (outdoor only) | Not applicable | | |
| Source Run-up Time: Directional and Non-Directional Luminaires | | | |
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline | The time needed after switching on the lamp to reach full rated lumen output must be an average of: <ul style="list-style-type: none"> • ≤ 1 minute for non-amalgam lamps • ≤ 3 minutes for amalgam lamps | ANSI C78.5, clauses 3.11 and 4.8. | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from an OSHA NRTL laboratory. Sample Size: ≥ 3 lamp/ballast combination samples must be tested. [1] Passing Test: All samples must pass in order to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | Exempt | | |
| Solid State Halogen Incandescent (outdoor only) | Not applicable | | |
| <p>Note: EPA recognizes run-up time as a performance criterion of importance to consumers and therefore proposes to, at minimum, implement the same performance requirement (above) found in the ENERGY STAR compact fluorescent lamp specification. EPA seeks comment on this approach, and the potential for further strengthening this requirement.</p> | | | |

- Technology neutrality is not extended to these requirements
- Applied to fluorescent only
- Source Start Time from RLF specification
- Source Run-up Time from CFL specification
 - EPA seeks comment on the potential for further strengthening the run-up requirement

Electrical Performance: Lampholder & Dimming Requirements



- Dimming requirements are TBD
- EPA monitoring development of new industry standards
- More available for stakeholder review in subsequent drafts

| Lampholder Requirements: Directional and Non-Directional Luminaires | | | |
|---|---|---|--|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium Halogen Incandescent (outdoor only) | The lampholder must be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all applicable wattages. For example, if the ballast can operate lamps with multiple wattages (e.g., an 18W, 26W, or 32W lamp) then the lampholder must be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all three applicable wattages. Note: With the exception of halogen incandescent lamps used in outdoor models, luminaires employing screw-base lampholders (i.e. E26, E26d E12, E17, E39, E39d) are not eligible to earn the ENERGY STAR. | Lampholder configuration: ANSI/IEC C82.62-2005 | Provide: A test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program confirming the lampholder configuration. |
| Solid State | Exempt | | |

Note: EPA supports the development of electrical connectors allowing for user replacement of solid state lighting componentry at end of life. As standards for SSL electrical connections are not yet available, solid state luminaires are exempt from this requirement. EPA may implement requirements as standards become available.

| Dimming: Directional and Non-Directional Luminaires | | | |
|--|--------------------------|---|------------------------|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline Solid State | To be determined | | TBD |

Note: EPA intends to develop dimming performance requirements for luminaires offering dimming features, and is monitoring industry efforts to develop standards for dimming compatibility between controls and lighting products. Dimming requirements for this specification are to be determined, and will be available for stakeholder review and comment in a subsequent draft of this specification.

Electrical Performance: Photosensor Controls



| Source Type | ENERGY STAR Requirements | Metric of Measurement and Reference | Required Documentation |
|-----------------------------|---|--|--|
| All Basic Type outdoor edge | The luminaire must contain an integrated photosensor that automatically prevents operation during daylight hours. In addition, the control must automatically deactivate within 30 hours of manual start-up or testing operation. | No photosensor function. Use manufacturer artwork. | Photos: Multiple sections of luminaire housing that demonstrate a photosensor is integral to each luminaire being submitted. (2) |

Note: EPA has received considerable feedback from manufacturing partners questioning the photosensor requirements for outdoor luminaires. Some concerns include:

- availability of photosensors listed by UL for outdoor applications
- interactions between qualified luminaires due to installation problems (e.g. one luminaire is turned off due to the light output of another luminaire)
- lack of photosensor requirements in state building codes featuring more stringent lighting requirements (e.g. California, Oregon, Washington)
- inability to apply photosensor controls to certain popular luminaire designs due to geometrical constraints
- aesthetic concerns
- photosensor reliability concerns

To better understand the potential implications of removing this requirement, EPA evaluated 1,000 homes in 10 neighborhoods located in 10 cities across the United States. Of more than 2,000 luminaires reviewed, those that 100% were found to be operating during daylight hours (early afternoon). Based on national market share data, a small percentage of the luminaires found to be off may be qualified models, and may have been found in the off state due to operation of photosensors.

EPA seeks stakeholder feedback on the potential for removing the Photosensor Control requirement, with the goal of increasing market penetration through reduced luminaire design constraints in order to expand the number of qualified luminaires available to consumers.

EPA does not propose to eliminate the requirement for halogen incandescent luminaires.

- EPA proposes to remove this requirement
 - To increase market penetration through increased and diversified product availability
 - To minimize consumer frustration
- EPA does not propose to eliminate this requirement for halogen incandescent

- availability of photosensors listed by UL for outdoor applications
- interactions between qualified luminaires due to installation problems (e.g. one luminaire is turned off due to the light output of another luminaire)
- lack of photosensor requirements in state building codes featuring more stringent lighting requirements (e.g. California, Oregon, Washington)
- inability to apply photosensor controls to certain popular luminaire designs due to geometrical constraints
- aesthetic concerns
- photosensor reliability concerns
- installations that would be better served by one central photosensor controlling outdoor circuits

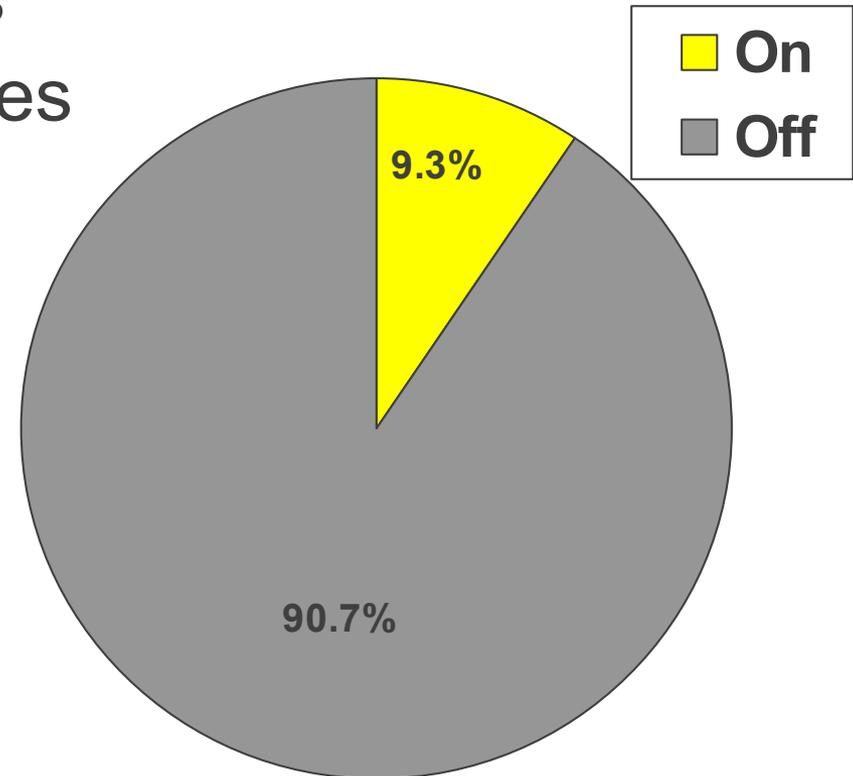
Outdoor Luminaire Consumer Habits Study



Outdoor Luminaire Consumer Habits Study



- 30 communities in 10 cities
- Communities of varying ages
- Found 2,818 units installed
- Luminaire types:
 - 44% wall mount
 - 22% ceiling mount
 - 13% post top
 - 8% suspended
- Few SCFLs, photocells or motion sensors identified



Electrical Performance: Power Factor Requirements



- Technology neutrality is not extended to these requirements
- ≥ 0.5 for self ballasted compact fluorescent
- ≥ 0.9 for HID
- ≥ 0.7 for residential SSL,
 ≥ 0.9 for commercial

| Power Factor: Directional and Non-Directional Luminaires | | | |
|--|---|---|--|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline | ≥ 0.5 | ANSI C82.2 - 2002 ANSI C82.77-2002 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or, 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices; or 4. a test report from the ballast manufacturer. Sample Size: ≥ 3 ballast samples must be tested [1] Passing Test: All samples must pass in order to qualify for ENERGY STAR! |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | ≥ 0.90 | ANSI C82.6-2005 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or, 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices; or 4. a test report from the ballast manufacturer. Sample Size: ≥ 3 ballast samples must be tested [5] Passing Test: All samples must pass in order to qualify for ENERGY STAR! |
| Solid State | Residential: ≥ 0.70 Commercial: ≥ 0.90 | ANSI C82.77-2002 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [1] |
| Halogen Incandescent (outdoor only) | Exempt | | |

Note: EPA proposes the above power factor requirements after consultation with various industry stakeholders. The above values pose no significant tradeoffs for utilities, and represent what is both broadly accessible in the market and cost effective for consumers.

Electrical Performance: Transient Protection Requirements



| Transient Protection: Directional and Non-Directional Luminaires | | | |
|---|--|---|---|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> linear compact self ballasted compact (GU24) circuline | Ballast or driver must comply with ANSI/IEEE C62.41, Class A operation. The line transient must consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode. | ANSI/IEEE C62.41.2 -2002 | Provide: <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or a Platform Approval Number from the EPA Approved Platform Database; or EPA-approved documentation from an industry association, such as the NEMA/ALA matrices. Sample Size: ≥ 3 ballast or driver samples must be tested [1], [5] Passing Test: All samples must pass in order to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> metal halide ceramic metal halide high pressure sodium | | | |
| Solid State | Whole luminaire, including photosensor and motion sensor, must comply with ANSI/IEEE C62.41, Class A operation. The line transient must consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode. | | Provide: <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or a Platform Approval Number from the EPA Approved Platform Database; or EPA-approved documentation from an industry association, such as the NEMA/ALA matrices. Sample Size: ≥ 3 luminaire samples must be tested [5] Passing Test: All samples must pass in order to qualify for ENERGY STAR. |
| Halogen Incandescent (outdoor only) | | | |

- No changes in performance requirements from existing specifications

Electrical Performance: Lamp Current Crest Factor & Off-State Power Consumption Requirements



- $\leq 0.5W$ total per luminaire for photosensors and/or motion sensors
- $\leq 1.5W$ total per power supply connected to multiple luminaires
- Exception: external power supplies

| Lamp Current Crest Factor: Directional and Non-Directional Luminaires | | | |
|---|---|--|--|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline | ≤ 1.7 | ANSI C82.11-2002 Sections 3.3.3 and 5.6 ANSI C82.1-2004 Section 5.6.1 | Provide: <ol style="list-style-type: none"> 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. a Platform Approval Number from the EPA Approved Platform Database; or 3. EPA-approved documentation from an industry association, such as the NEMA/IALA matrices; or 4. a test report from an OSHA NRTL laboratory. Sample Size: ≥ 3 ballast samples must be tested [5] Passing Test: All samples must pass in order to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | Exempt | | |
| Solid State Halogen Incandescent (outdoor only) | | | |
| Off-State Power Consumption Requirements: Directional and Non-Directional Luminaires | | | |
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| All Source Types | Luminaires must not draw power in the off state. Exception: Luminaires with integral motion sensors, photosensors or individually addressable luminaires with external control and intelligence must consume no more than 0.5 watts in the off state. Exception: Power supplies connected to multiple luminaires may draw up to 1.5 watts in the off state. Exception: Luminaires employing an external power supply (EPS) must use either: <ul style="list-style-type: none"> • an EPS that is ENERGY STAR qualified; or • an EPS that meets the applicable no-load mode limits, active mode efficiency levels, and power factor requirements provided in the latest version of the ENERGY STAR Program Requirements for Single Voltage External AC-AC and AC-DC Power Supplies. | No Standard Available (Use manufacturer protocol) | No documentation required. Test report must be provided to EPA upon request. |

Electrical Performance: Operating Frequency Requirements



| Operating Frequency: Directional and Non-Directional Luminaires | | | |
|---|-------------------------------|---|---|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> linear compact self ballasted compact (GU24) circuline | 20 to 33 kHz or ≥ 40 kHz | ANSI C82.2 | Provide: <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or a Platform Approval Number from the EPA Approved Platform Database; or EPA-approved documentation from an industry association, such as the NEMA/IALA matrices; or a test report from the ballast manufacturer. Sample Size: ≥ 3 ballast samples must be tested [5] Passing Test: All samples must pass in order to qualify for ENERGY STAR. |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> metal halide ceramic metal halide high pressure sodium | Exempt | | |
| Solid State <p>Note: This performance characteristic addresses problems with visible flicker due to low frequency operation and applies to steady-state as well as dimmed operation. Dimming operation must meet the requirement at all light output levels.</p> | ≥ 120 Hz | Oscilloscope or frequency counter | No supplemental documentation required. Test report must be provided to EPA upon request. |
| Halogen Incandescent (outdoor only) | Exempt | | |

Note: EPA recognizes that frequency alone may not be sufficient to avoid flicker and/or stroboscopic effects with all end users, particularly with solid state luminaires. An [IEEE working group](#) is underway to provide recommended practices to aid in the design of LED products. Once more conclusive research is available with comprehensive recommendations for operating frequency, modulation depth and other related performance criteria, EPA will explore strengthening the above frequency requirement for solid state luminaires.

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- No changes in performance requirements from existing specifications
- [IEEE working group](#) to provide recommended practices to aid in the design of SSL products

Electrical Performance: Ballast/Driver Replaceability, RFI and Noise Requirements



- RFI: no changes in performance requirements from existing specifications
- Ballast/Driver Replaceability & Noise requirements cover all source types

| Ballast/Driver Replaceability: Directional and Non-Directional Luminaires | | | |
|--|---|---|---|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact ballasted compact (GU24) • circline | Ballasts or drivers in all luminaires must be accessible and removable by an electrician without the cutting of wires and without damage to the luminaire housing, trim, decorative elements or the carpentry (e.g., ceiling drywall) to which the luminaire is attached. | No Standard Available (Use manufacturer protocol) | Provide: A copy of the language that includes guidance on ballast or driver replacement and states that the ballast or driver is replaceable with the use of a "qualified electrician." |
| High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium | | | |
| Solid State | | | |
| Halogen Incandescent (outdoor only) | Not applicable | | |

| Electromagnetic and Radio Frequency Interference: Directional and Non-Directional Luminaires | | | |
|--|--|--|--|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| All Source Types | Power supplies must meet FCC requirements: <ul style="list-style-type: none"> • Consumer Emission Limits for power supplies designated for residential use • Non-consumer Emission Limits for power supplies designated for commercial use | Code of Federal Regulations: FCC 47 CFR Part 15/18 | No documentation required. Test report must be provided to EPA upon request. |

| Noise: Directional and Non-Directional Luminaires (Exemption: Outdoor Luminaires) | | | |
|--|---|---|--|
| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
| Fluorescent <ul style="list-style-type: none"> • linear • compact ballasted compact (GU24) • circline | Class A sound rating for electronic ballasts & drivers within the luminaire, not to exceed a measured level of 24 dBA (audible) when the ballast or driver is installed in the luminaire. | Noise must be measured using a sound meter (similar in performance to B&K type 2209) where the microphone is located 12 inches from the luminaire in any direction. | No documentation required. Test report must be provided to EPA upon request. |
| Solid State | | | |

Please Review and Comment



**Thermal Performance
Requirements (p. 30-32)**

Safety Requirements (p. 33)

**Product Labeling & Packaging
Requirements (p. 34)**

Lighting Toxics Reduction Requirements

Lighting Toxics Reduction Requirements



Lighting Toxics Reduction Requirements: Directional and Non-Directional Luminaires

| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
|------------------|--|---|------------------------|
| All Source Types | Luminaires must not exceed hazardous substance concentration limits set forth in the European Union's (EU) Restriction of the Use of Certain Hazardous Substances (RoHS) directive. Fluorescent lamps (all types) must not contain more than 5 milligrams of mercury. | EU Directive 2002/95/EC | To be determined. |

Note: Consistent with its mission to protect human health and the environment, EPA is proposing to apply the above requirement to all ENERGY STAR qualified luminaires.

EPA is proposing a 5 milligram mercury content limit for all fluorescent lamp types including linear, circline, and compact fluorescent lamps, both self ballasted and otherwise.

Documentation requirements are under development; in a subsequent draft EPA will detail requirements for stakeholder review and comment.

ENERGY STAR Labeling of Luminaire

While not a requirement for qualification, EPA strongly recommends manufacturers provide a conspicuous ENERGY STAR certification mark (e.g. sticker, hangtag) on qualified luminaires themselves:

- to facilitate building inspectors confirming qualification status of installed luminaires
- to provide out-of-the-box marketing of the luminaire's ENERGY STAR qualification
- to demonstrate to consumers a partner's commitment to advancing energy efficiency in lighting

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- European Union's Restriction of the Use of Certain Hazardous Substances (RoHS) Directive
- Fluorescent lamps (all) must contain ≤ 5 mg mercury
- ENERGY STAR luminaire labeling is optional

Warranty Requirements

Warranty Requirements



- EPA proposes a 3 year warranty for all qualified luminaires
- Exceptions:
 - Luminaires employing GU24 integrated lamps
 - Luminaires employing replaceable LED light engines
- Manufacturer is solely responsible for honoring warranty requirements

Warranty Requirements: Directional and Non-Directional Luminaires

| Source Type | ENERGY STAR Requirements | Methods of Measurement and/or Reference Standards | Required Documentation |
|------------------|--|---|--|
| All Source Types | <p>A written unconditional warranty must be included with luminaire packaging at the time of shipment, which covers repair or replacement of defective parts of the luminaire housing, optics, trim and electronics for a minimum of three years from the date of purchase.</p> <p>Lamps which are not self-ballasted are not included in this requirement.</p> <p>Manufacturer is solely responsible for honoring warranty, intermediate parties (e.g. showrooms, electrical distributors, retailers) are not responsible for meeting manufacturer's warranty requirements.</p> <p><u>Exceptions:</u> for the following, the above requirements are limited to two years:</p> <ul style="list-style-type: none"> • Luminaires employing GU24 based integrated lamps • Luminaires employing LED light engines which can be replaced manually or with a screwdriver | No Standard Available (Use manufacturer protocol) | Provide: A copy of the actual luminaire manufacturer written warranty that is included with product packaging. |

Note: Seeking parity for warranty requirements, EPA proposes to apply to all qualified luminaires the strongest ENERGY STAR warranty requirement to date: three years, per the SSL V1.1 specification. Recognizing that replacement of the light source may resolve many warranty issues, EPA proposes shorter required warranty terms - two years - for luminaires with the simplest means of source replacement: GU24 based integrated lamps, and luminaires with replaceable LED light engines. EPA requests comment on this approach.

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Appendix A: GU24 Integrated Lamp Requirements



ENERGY STAR

Laboratory Accreditation, Enhanced Testing and Verification

Eamon Monahan

U.S. EPA

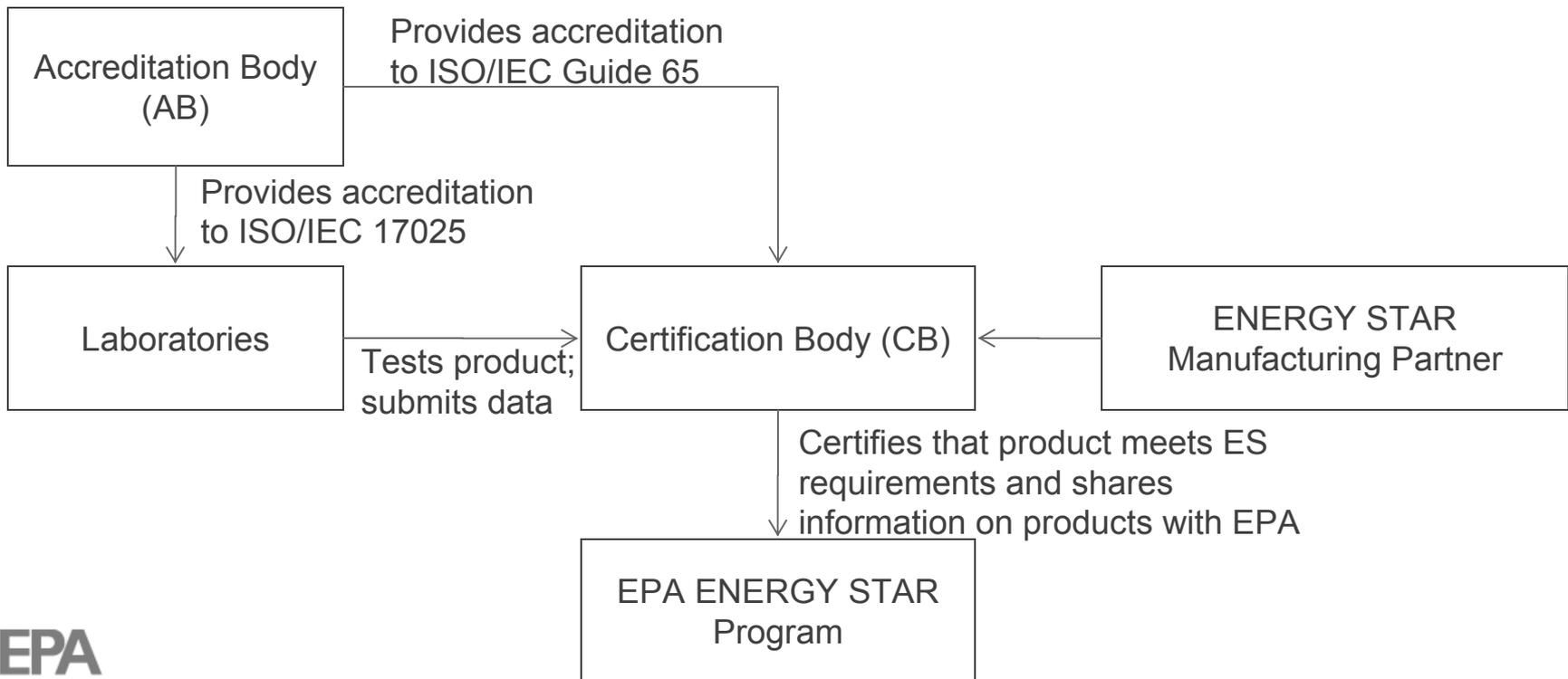
June 8, 2010

ENERGY STAR Enhanced Testing and Verification Overview



New Requirements for all ENERGY STAR Products
Scope: All ENERGY STAR Product Categories

- Third-party certification
- Testing conducted in EPA-recognized labs



Accreditation Bodies (AB)



- Key Responsibilities:
 - Attest to the technical competence of laboratories to perform tests as outlined in the ENERGY STAR Laboratory Accreditation Requirements.
 - Assure the list of specific test procedures is included within the scope of accreditation for the laboratory.
 - Conduct onsite assessments of each laboratory per the ILAC MRA and ISO/IEC 17011 requirements.
 - Publish current list of accredited laboratories on Web site.

EPA-Recognized Labs



- Key Responsibilities:
 - Maintain accreditation to ISO/IEC 17025
 - Have recorded in its Scope of Accreditation its specific competence to carry out the test methods as outlined in the ENERGY STAR program.
 - Agree to participate in relevant and available inter-laboratory comparison testing when EPA/DOE deems it necessary.
 - Submit documentation demonstrating impartiality if an in-house lab.
 - Also considering option for in-house labs that are covered by a CB's accreditation
 - Labs would need to meet the same criteria, but CB rather than AB would have oversight of the lab.

Certification Bodies (CB)



- Key Responsibilities:
 - Maintain accreditation to ISO/IEC Guide 65
 - Provide EPA with third party written certification for each model intended for ENERGY STAR qualification by reviewing test results.
 - Maintain product design specifications for the products it certifies, and conduct random inspections at the manufacturing location.
 - Consider having in place a challenge testing procedure that meets EPA requirements.
 - Oversee competency of in-house labs through supervised or witnessed testing program (optional)

Lighting Product Verification



- Third party to administer testing; centralized process.
- Selected by EPA/DOE through a competitive proposal process.
- Administrator responsibilities include:
 - Coordinating the Product Selection Working Group.
 - Managing participating labs and verification process.
 - Delivering final test results to EPA/DOE.

Timeline



- June 21: Finalize requirements and begin accepting applications for laboratories and accreditation bodies.
- July: Finalize requirements for certification bodies and qualification and verification testing, and begin accepting applications for CBs.
- July-December: Recognize certification programs and accredited labs.
- September: Finalize new partner commitments to require independent testing, and require current partners to sign agreement to continue partnership.

Contact Information



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Web site: www.energystar.gov/testingandverification
Email: ENERGYSTARVerificationProgram@energystar.gov

Timeline for Lighting Integration



- Luminaires Draft 1 release: May 7, 2010
- Luminaires Draft 1 comment period close: COB June 21, 2010
- Luminaires Draft 2 release: July 2010
- Luminaires Draft 2 comment period
- Luminaires Draft 3 release: August 2010
- Luminaires Draft 3 comment period
- Luminaires Final specification: September 2010
- Luminaires specification effective date: June 2011
- ENERGY STAR Lamps specification
 - To replace CFL v4.0 & Integral LED Lamps v1.1
 - Kick off in September 2010 (draft 1 in the fall 2010)
 - Three drafts, three comment periods
 - Final specification: Summer 2011
 - Effective date: Spring 2012

Luminaires TBD Summary



- Qualification process
- Categorization of various portable luminaire types
- Treatment of 'approved' platforms and lamp/ballast matrices
- Dimming requirements
- Measurement tolerances
- Product variations & grouping
- Treatment of successor LED packages/arrays/modules
- LM-80 sampling
 - Correlated color temperatures to test
 - Sample size
- Potential for expansion of ENERGY STAR commercial luminaire labeling
- Lighting toxics reduction documentation requirements

ENERGY STAR

Outdoor Lighting Specification



- Draft requirements issued in July 2009 for SSL outdoor lighting
 - SSL V1.2 draft
 - Area, roadway, wall packs, garage/canopy luminaires
- Technology neutral test procedure under development
- DOE will complete specification development when procedure is available
- Specification will be separate from ENERGY STAR Luminaires

Question and Answer Session



- Please dial *1 to be placed in the queue
- Q&A will be extended until 3 PM eastern
- Questions may also be directed offline to:
 - Alex Baker
 - baker.alex@epa.gov
 - (202) 343 - 9272
 - Eamon Monahan
 - monahan.eamon@epa.gov
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Thank You



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