



ENERGY STAR® Program Requirements for Luminaires

Eligibility Criteria – Version 1.0, DRAFT 1

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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; see 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

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:

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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.

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Definitions

ALA: American Lighting Association.

ANSI: American National Standards Institute.

Aperture Size (downlights): 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 surface 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 create 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)

LED Light Engine: An integrated assembly comprised of LED packages (components) or LED arrays (modules), LED driver, and other optical, thermal, mechanical and electrical components. The device is intended to connect directly to the branch circuit through a custom connector compatible with the LED luminaire for which it was designed and does not use an ANSI standard base. (IES RP-16-05 Addendum b)

LED Luminaire: A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED-based light emitting elements may take the form of LED packages (components), LED arrays (modules), LED Light Engine, or LED lamps. The LED luminaire is intended to connect directly to a branch circuit. (IES RP-16-05 Addendum b)

LED Module: See "LED Array or Module"

LED Package: An assembly of one or more LED dies that includes wire bond or other type of electrical connections,, possibly with an optical element and thermal, mechanical, and electrical interfaces. Power source and ANSI standardized base are not incorporated into the device. The device cannot be connected directly to the branch circuit. (IES RP-16-05 Addendum b)

LED Platform: See LED Light Engine definition above

LED Temperature Measurement Point (TMP_{LED}): A location on an LED package/module/array, designated by its manufacturer, which provides a surrogate temperature measurement location for the actual LED junction. The TMP_{LED} may be a solder joint at the board attachment site, a point on the LED package case, or a location on the board of an LED module or array.

Light Emitting Diode (LED): A pn junction semiconductor device that emits incoherent optical radiation when forward biased. The optical emission may be in the ultraviolet, visible, or infrared wavelength regions. (IES RP-16-05 Addendum b)

Luminaire (Light Fixture): A complete lighting unit consisting of lamp(s) and ballast(s) (when applicable) together with the parts designed to distribute the light, position and protect the lamps, and to connect the lamp(s) to the power supply (IES RP-16-05)

Linear Fluorescent Lamp: Commonly made with straight, tubular bulbs varying from approximately .25" to 2.125" and in overall length from 4" to 96". The Fluorescent Lamp is a low-pressure mercury electric-discharge lamp in which a fluorescing coating (phosphor) transforms some of the UV energy generated by the discharge into light. (IES Handbook 9th Edition)

Lumen Maintenance: The luminous flux output remaining (typically expressed as a percentage of the maximum output) at any selected elapsed operating time. Lumen maintenance is the converse of lumen depreciation. (IES LM-80-08)

Lumens per Watt (LPW): The quotient of the total luminous flux emitted by the total lamp power input is the luminous efficacy of a source of light, and is expressed in LPW. (IES RP-16-05)

Luminaire Efficacy: The luminous flux delivered by a luminaire, divided by its input power.

MacAdam Color Ellipse: A series of ellipses around the chromaticity coordinates of a number of different colors. Each ellipse sets the boundary at which a given percentage of people are able to determine that two colors, one with the chromaticity coordinates at the center of the ellipse, and one with chromaticity coordinates on the ellipse, are just noticeably different. (IES Handbook 9th Edition)

Magnetic Ballast: A magnetic device used to control the starting and operation of discharge lamps. (IES Handbook 9th Edition)

Manufacturer Designated Temperature Measurement Point (TMP): The temperature measurement point designated by the manufacturer correlating to photometric, life or warranty values.

NEMA: National Electrical Manufacturers Association.

NFPA: The National Fire Protection Association (United States), which develops the National Electrical Code (NEC).

Non-Directional Application: For purposes of this ENERGY STAR specification, luminaire application types which are not designated directional. See Direct Lighting definition.

Non-Directional Luminaire: See Non-Directional Application.

NRTL: Nationally Recognized Testing Laboratory as recognized by OSHA's NRTL Program, which is a part of OSHA's Directorate of Technical Support.

Optics: Include reflectors, baffles, lenses and/or diffusers, all of which control the light distribution and the appearance of the lighted luminaire.

OSHA: Occupational Safety & Health Administration.

Photo Control: A photoelectric switch that controls lighting by the level of daylight luminance (IES RP-16-05)

Photosensor: See Photo Control.

Platform: See Lamp Ballast Platform.

Portable Luminaire: A luminaire whose power supply connection is made by means of a cord with a plug.

Power Factor: The power input divided by the product of ballast input voltage and input current of a fluorescent lamp ballast, as measured under test conditions specified in ANSI Standard C82.2-1984.

Power Source: A transformer, power supply, battery, or other device capable of providing current, voltage, or power within its design limits. This device contains no additional control capabilities (IES RP-16-05 Addendum b)

Rated Lumen Maintenance Life (L_p): The elapsed operating time over which the LED light source will maintain the percentage, p, of its initial light output, e.g. L₇₀ (hours): Time to 70% lumen maintenance. (IES LM-80-08)

Residential Luminaire: A luminaire using a Class B power supply.

RLF: Residential light fixture.

Run-up Time: The time needed after switching on the supply for the lamp to reach 80.0% of its stabilized luminous flux. (ANSI C78.5)

Solid State Lighting (SSL): The term "solid state" refers to the fact that the light is emitted from a solid object – a block of semiconductor – rather than from a vacuum or gas tube, as in the case of a incandescent and fluorescent lighting. There are two types of solid-state light emitters: inorganic light-emitting diodes (LEDs) or organic light-emitting diodes (OLEDs). (Sandia National Laboratories)

Standardized Color Ellipse: A MacAdam color ellipse defined by center chromaticity coordinates (CIE x, y) and a measure of certainty for detecting a color difference specified in standard deviation units called steps. (ANSI C78.376-2001)

Trim: Trim is the part of a downlight that covers the ragged edge of the ceiling cut-out. The trim may be a separate ring, or trim ring, or it may be integrated with the optics (i.e., a self-flanged reflector). Airtight or non-airtight.

UL: Underwriters Laboratories.

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.

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 submittals. 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 placeholder name).

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.

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

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-ballasted Compact Fluorescent Lamps
ANSI	ANSI/ANSLG 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	ANSI/ANSLG C81.61-2009	Specifications for Bases (Caps) for Electric Lamps
ANSI	ANSI/ANSLG C81.62-2009	Lampholders for Electric Lamps
ANSI	ANSI C82.1-2004	Electric Lamp Ballast - Line Frequency Fluorescent Lamp Ballast
ANSI	ANSI C82.11 Consolidated-2002	High-Frequency Fluorescent Lamp Ballasts—Supplements
ANSI	ANSI C82.2	Method of Measurement of Fluorescent Lamp Ballasts
ANSI	ANSI C82.6-2005	Ballast For High Intensity Discharge Lamps - Methods Of Measurement
ANSI	ANSI C82.77-2002	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 283-2004	Restricted Air Movement
CIE	CIE Pub. No. 13.3:1995	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	60061-1	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 Luminaries
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-58	Guide to Spectroradiometric Measurements
IES	IES LM-58-94	Color Rendering Index and Correlated Color Temperature
IES	IES LM-65-01	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-79-08	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 153-2002	Portable Electric Luminaires
UL	UL 935-2001	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-Ballasted 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.

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: 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 . 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 			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/ALA 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. <u>Exception:</u> 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 reference this new metric. This metric is based on the work of ASSIST (www.lrc.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: <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.

Halogen Incandescent (outdoor only)	<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:</p> <ol style="list-style-type: none"> 1. ANSI lampholder code 2. Applicable sections of luminaire manual(s) that demonstrate control functionality and instructions for use for each luminaire being submitted.
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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

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

Luminaire Type	ENERGY STAR Requirements			Methods of Measurement and/or Reference Standards	Required Documentation
	Luminaire Efficacy	Minimum Light Output	Zonal Lumen Density Requirement		
Cove Mount	45 LPW	<p>Luminaire must deliver a minimum of 200 lumens (initial) per lineal foot.</p> <p>The minimum required light output (in lumens) is calculated by dividing the luminaire length in inches by 12, then multiplying the result by 200.</p> <p>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.</p>	Luminaire must deliver a minimum of 35% of total lumens within the 120°-150° zone.	<p>Fluorescent: IES LM-41-98</p> <p>Solid State: IES LM-79-08</p>	<p>Provide (fluorescent):</p> <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. <p>Provide (solid state):</p> <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] <p>Sample Size: three complete luminaires [1], [7]</p> <p>Passing Test: All luminaires must pass to qualify for ENERGY STAR.</p>
Downlights: • recessed • surface • pendant	42 LPW	<p>≤ 4.5" Aperture: 345 lumens (initial)</p> <p>> 4.5" Aperture: 575 lumens (initial)</p>	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	<p>Luminaire must deliver a minimum of 125 lumens (initial) per lineal foot.</p> <p>The minimum required light output (in lumens) is calculated by dividing the luminaire length in inches by 12, then multiplying the result by 125.</p> <p>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.</p>	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).		

Outdoor Post- or Arm-Mounted Decorative Luminaires (Note: for mounting below 10.5 feet above grade)	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-10-96 Solid State: IES LM-79-08	
Inseparable Luminaires (solid state only)	70 LPW	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.

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 reviewed 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/ALA matrices . 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.
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). Luminaires with asymmetrical distribution must have at least 12.5% of total luminaire lumens in the 60°-90° zone.		
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).		

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.

Light Source Life 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 shipped with luminaires, the average rated life of the source must be ≥ 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. <u>Exception:</u> Covered and dimmable versions of GU24 based integrated lamps are required to meet reduced life requirements as outlined in appendix A.	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) <ul style="list-style-type: none">• metal halide• ceramic metal halide• high pressure sodium		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 ≥ 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.		

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 NEMA/ALA 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 _{LED}) 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 _{LED} 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 milliamps (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 _{LED} on the LED package(s) / LED module(s) / LED array(s). 2. The TMP _{LED} 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 _{LED} 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>

<p>Solid State Option 2: Luminaire or LED Light Engine Performance</p> <p>(select either option 2 or option 1, above)</p>	<p>Directional luminaires: the luminaire must deliver at 6,000 hours the fraction of initial lumens specified below:</p> <p>Non-directional luminaires: each LED light engine must deliver at 6,000 hours the fraction of initial lumens specified below:</p> <p>Indoor luminaires: ≥ 91.8%</p> <p>Outdoor luminaires: ≥ 94.1%</p> <p>All Commercial: ≥ 94.1%</p> <p>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.</p>	<p>Directional luminaires: IES LM-79-08</p> <p>Non-directional luminaires: IES LM-xx-1x</p> <p>NOTE: EPA is working with industry to develop the above test procedure:</p> <p><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></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>Provide: 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: 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. <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>
<p>Halogen Incandescent (outdoor only)</p>	<p>Exempt</p>		

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.

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) circline 	<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 & circline): 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 NEMA/ALA 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: ≥ 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 (CCTs):</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><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></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.

**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 <ul style="list-style-type: none"> • linear • compact • self ballasted compact (GU24) • circline 	<p>Lamps shipped with luminaires must meet the following requirement:</p> <p>$R_a \geq 80$; and $R_9 > 0$</p> <p>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 specification.</p>	<p>Linear & circline: IES LM-9-09</p> <p>For compact and self ballasted compact: IES LM-66-00</p> <p>Calculation: CIE 13.3-1995</p>	<p>Provide:</p> <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. <p>Sample Size: ≥ 10 lamps must be tested [3], [8]</p> <p>Passing Test: $\geq 80\%$ of the samples must achieve the required color rendering index value in order to qualify for ENERGY STAR.</p>
Solid State	<p>The luminaire (directional luminaires) or LED light engine (non-directional luminaires) must meet the following requirement:</p> <p>$R_a \geq 80$; and $R_9 > 0$</p>	<p>Directional measurement: IES LM-79-08</p> <p>Non-Directional (LED light engine) measurement: IES LM-xx-1x</p> <p>NOTE: EPA is working with industry to develop the above test procedure:</p> <p><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></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 13.3-1995</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; or, • 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 [7]</p>

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.

**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 $\Delta u', v'$ distance must be reported for each vertical angle measured [2]

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.

**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: <ul style="list-style-type: none"> • 0.002 for residential indoor luminaires • 0.001 for residential outdoor and commercial luminaires

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.

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) circline High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> metal halide ceramic metal halide high pressure sodium Halogen Incandescent (outdoor only)	<p>All luminaires must be shipped with a lamp for each lampholder.</p> <p><u>Exceptions:</u></p> <ol style="list-style-type: none"> Linear fluorescent luminaires Solid state luminaires Outdoor luminaires employing ANSI E26 lampholders. <p>Lamps must utilize an ANSI/IEC standardized lamp base configuration, as defined by ANSI C81.61 and IEC 60061-1.</p> <p>Fluorescent and high intensity discharge lamp bases must be labeled with the lamp manufacturer name, wattage, correlated color temperature, and color rendering index.</p> <p>In addition, lamps must either:</p> <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. 	<p>Lamp base configuration: ANSI C81.61- 2005</p> <p>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</p> <p>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)</p>	<p>Provide:</p> <ol style="list-style-type: none"> A copy of the actual language that will be included on the base of the lamp. Lamps Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters): Provide manufacturer data indicating applicable ANSI-IEC lamp data sheet number. 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"> 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 60061-1(i.e., 2G13, GR10q, etc.) Starting Circuit Application (i.e., rapid start, preheat, etc.) Dimensional Characteristics, including diagram Lamp Operating Characteristics, including: <ul style="list-style-type: none"> Approximate wattage (W) Voltage(V) Current (A)

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

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.

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)	<p>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.</p> <p>Note: With the exception of halogen incandescent lamps used in outdoor models, luminaires employing screwbase lampholders (i.e. E26, E26d E12, E17, E39, E39d) are not eligible to earn the ENERGY STAR.</p>	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		

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.

**Photosensor Controls: Directional and Non-Directional Outdoor Luminaires Only
(Exemption: Indoor Luminaires)**

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Standards	Required Documentation
All Source Types (outdoor only)	The luminaire must contain an integrated photosensor that automatically prevents operation during daylight hours. In addition, the control must automatically reactivate within 24 hours of a manual override or testing operation.	No Standard Available (Use manufacturer protocol)	Provide: Applicable sections of luminaire manual(s) that demonstrate a photosensor is integral to each luminaire being submitted. [5]

Note: EPA has received considerable feedback from manufacturing partners questioning the photosensor requirement for non-incandescent luminaires. Some partners have cited concerns including:

- 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

To better understand the potential implications of removing this requirement, EPA evaluated 1,000 homes in 30 neighborhoods located in 10 cities across the United States. Of more than 2,800 luminaires reviewed, fewer than 10% were found to be operating during daylight hours (early afternoon). Based on historical 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 this requirement for halogen incandescent luminaires.

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/ALA matrices; or 4. a test report from the ballast manufacturer. <p>Sample Size: ≥ 3 ballast samples must be tested [1]</p> <p>Passing Test: All samples must pass in order to qualify for ENERGY STAR.</p>
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/ALA matrices; or 4. a test report from the ballast manufacturer. <p>Sample Size: ≥ 3 ballast samples must be tested [5]</p> <p>Passing Test: All samples must pass in order to qualify for ENERGY STAR.</p>
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.

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) • circline High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> • metal halide • ceramic metal halide • high pressure sodium Solid State	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"> 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. <p>Sample Size: ≥ 3 ballast or driver samples must be tested [1], [5]</p> <p>Passing Test: All samples must pass in order to qualify for ENERGY STAR.</p>
Halogen Incandescent (outdoor only)	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"> 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. <p>Sample Size: ≥ 3 luminaire samples must be tested [5]</p> <p>Passing Test: All samples must pass in order to qualify for ENERGY STAR.</p>

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"> 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; or 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	<p>Luminaires must not draw power in the off state.</p> <p><u>Exception:</u> 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.</p> <p><u>Exception:</u> Power supplies connected to multiple luminaires may draw up to 1.5 watts in the off state.</p> <p><u>Exception:</u> Luminaires employing an external power supply (EPS) must use either:</p> <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)	<p>No documentation required.</p> <p>Test report must be provided to EPA upon request.</p>

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) circline 	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/ALA matrices; or a test report from the ballast manufacturer. <p>Sample Size: ≥ 3 ballast samples must be tested [5]</p> <p>Passing Test: All samples must pass in order to qualify for ENERGY STAR.</p>
High Intensity Discharge (outdoor only) <ul style="list-style-type: none"> metal halide ceramic metal halide high pressure sodium 	Exempt		
Solid State	≥ 120 Hz 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.	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.

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• self 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 self 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			

Thermal Performance Requirements

Maximum Measured Ballast or Driver Case Temperature during Normal Operation Inside Luminaire(s): 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 	<p>Measured ballast case temperature measured at thermal equilibrium not to exceed the ballast manufacturer maximum recommended ballast case temperature during normal operation inside a luminaire.</p> <p>Note: This performance characteristic is separate and distinct from thermal requirements established by UL, which governs safety rather than longevity of the ballast. All qualified luminaires are expected to meet this requirement, including linear, suspended, close-to-ceiling, IC, ICAT and non-IC recessed canisters, etc. as well as those luminaires that may be exempt from UL1598.</p> <p><u>Exceptions:</u></p> <ul style="list-style-type: none"> Indoor portable luminaires using GU24 lamps Outdoor luminaires 	<p>UL 1598-2008</p> <p>(Acceptable when the thermocouple is placed at the hot-spot location indicated by the ballast manufacturer.)</p>	<p>Provide a test report from:</p> <ol style="list-style-type: none"> a laboratory meeting ENERGY STAR laboratory accreditation requirements [2]; or an OSHA NRTL laboratory; or any laboratory registered with UL to perform this test. <p>Provide: A temperature test report containing all of the following information:</p> <ul style="list-style-type: none"> Luminaire model(s) tested Lamp model(s) and ballast model(s) tested Measured maximum ballast case temperatures Ambient temperature Test procedure, including description of luminaire installation, thermocouple location(s), and time that elapsed before readings were taken. Ballast Manufacturer Maximum Recommended Case Temperature During Normal Operation Inside the Luminaire(s) Ballast Hot Spot Location Diagram from the ballast manufacturer <p>Sample Size: 1 luminaire must be tested [1]</p> <p>Passing Test: Measured temperature at the appropriate ballast case test point must be less than the manufacturer recommended maximum.</p> <p>Laboratory test results must be produced using the luminaire with the highest operating temperature among all luminaires being qualified.</p>
Solid State, Directional	<p>Measured driver case temperature measured at thermal equilibrium not to exceed the LED driver manufacturer maximum recommended driver case temperature during <i>in situ</i> operation.</p> <p>Note: This performance characteristic is separate and distinct from safety requirements.</p>		<p>Provide each of the following:</p> <ol style="list-style-type: none"> a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program detailing the temperature measurement point (TMP_C) for the hottest location on the driver case [2] a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program detailing <i>in situ</i> TMP_C temperature measurements for the LED package(s) / LED module(s) / LED array(s) employed in the luminaire [2] <p>Sample Size: 1 luminaire must be tested [1]</p> <p>Passing Test: Measured temperature at the TMP_C must be less than the manufacturer recommended maximum.</p> <p>Laboratory test results must be produced using the luminaire with the highest operating temperature among all luminaires being qualified.</p>

Solid State, Non-Directional	<p>Measured driver case temperature (TMP_C) measured at thermal equilibrium not to exceed the LED driver manufacturer maximum recommended driver case temperature during <i>in situ</i> operation. Note: This performance characteristic is separate and distinct from safety requirements.</p>	<p>IES LM-xx-1x</p> <p>NOTE: EPA is working with industry to develop the above test procedure:</p> <p><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></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)</p> <p>See: ASSIST May 2008</p>	<p>Provide a test report from:</p> <ol style="list-style-type: none"> 1. an ENERGY STAR approved laboratory; or 2. an OSHA NRTL laboratory. <p>Sample Size: One light engine sample must be tested [1]</p> <p>Passing Test: Measured temperature at the TMP_C must be less than the manufacturer recommended maximum.</p>
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**Minimum Operating Temperature: Directional and Non-Directional Outdoor Luminaires
(Exemption: Indoor Luminaires)**

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Standards	Required Documentation
All Source Types	Luminaire must have a minimum operating temperature of -20°C or below.	No Standard Available (Use manufacturer protocol)	<p>No documentation required.</p> <p>Test report must be provided to EPA upon request.</p>

Recessed Downlight Thermal Performance Requirements

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	<p>Recessed downlight luminaires that are either IC-Rated for direct contact with insulation or non IC-Rated may qualify as ENERGY STAR. For luminaires to be considered IC-Rated they must be approved for zero clearance insulation cover (IC) by an OSHA NRTL laboratory. Recessed downlight luminaires that are IC-Rated must also meet the requirements for air tight luminaires, listed below.</p> <p>Recessed downlight luminaires that are either air tight or not air tight may qualify as ENERGY STAR. For luminaires to be considered air tight, the housing or certified/listed accessory must have leakage less than 2.0 cubic feet per minute (CFM) at 75 Pascals (or 1.57 lbs/ft²) when tested in accordance with ASTM E283 and must be sealed with a gasket or caulk.</p> <p>For recessed downlight luminaires that are air tight, the following measures must be taken to ensure that luminaires can be properly installed and inspected:</p> <ol style="list-style-type: none"> 1. Product packaging must meet the requirements set forth in the Product Labeling & Packaging Requirements 2. The luminaire itself must include a label certifying "air tight", or similar designation, to show air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283. The label must be clearly visible to a building inspector. 3. Installation instructions must be included listing all components of the assembly that will be necessary to ensure an airtight installation and how the components should be properly installed. For example, depending on the method used to achieve air-tight operation, the instructions should alternatively show how a gasket is to be attached, what type of caulk to use and how it should be applied, or which certified airtight trim kits are designed to be installed with the luminaire housing. 	ASTM E283-2004	<p>No documentation required.</p> <p>Test report must be provided to EPA upon request.</p>

Safety Requirements

Note: qualified luminaires carrying a UL damp or wet label must meet all applicable outdoor requirements in this specification.

Note: EPA understands that end of life (EOL) requirements for T4 and T5 sized fluorescent lamps are now present in the UL safety standards detailed below. Therefore, there is no EOL requirements section in this specification.

Indoor Luminaire Safety - Portable Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Standards	Required Documentation
Fluorescent <ul style="list-style-type: none">linearcompactself ballasted compact (GU24)circline	Demonstrate compliance with ANSI/UL 153-2002.	ANSI/UL 153-2002	Provide: The cover page of a safety test report or a general coverage statement from an OSHA NRTL laboratory.
Solid State			

Indoor Luminaire Safety - Hardwired Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Standards	Required Documentation
Fluorescent <ul style="list-style-type: none">linearcompactself ballasted compact (GU24)circline	Demonstrate compliance with UL 1598-2008.	UL 1598-2008	Provide: The cover page of a safety test report or a general coverage statement from an OSHA NRTL laboratory.
Solid State			

Outdoor Luminaire Safety

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Standards	Required Documentation
All Source Types	Demonstrate compliance with NFPA 70, the National Electrical Code (NEC), including requirements for wet or damp locations (Articles 410-4a and Article 100).	NFPA 70 (2008 Edition), the National Electrical Code (NEC), including requirements for wet locations when applicable (Articles 410-4a and Article 100)	Provide: The cover page of a safety test report or a general coverage statement from an OSHA NRTL laboratory. Include evidence of a Rain Test for Wet Locations, when applicable. For wet listed luminaires: Provide a copy of the wet location safety test report [1]

Electronic Ballast Requirements - Safety - Ballasts and "Non-Edison base Fluorescent Adapters"

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Standards	Required Documentation
Fluorescent <ul style="list-style-type: none">linearcompactself ballasted compact (GU24)circline	Demonstrate compliance with ANSI/UL 935-2001 or UL 1993-2009, as appropriate.	ANSI/UL 935-2001 or UL 1993-2009	Provide: A cover page of a safety test report or a general coverage statement from an OSHA NRTL laboratory.

Product Labeling & Packaging Requirements

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)	<p>For luminaires shipped with lamps:</p> <ul style="list-style-type: none"> Packaging must clearly describe the nominal color designation of the lamp in units of Kelvin (i.e., 2700K, 3000K, 3500K, 4100K). <p>Note: for luminaires shipped with GU24 based integrated lamps:</p> <ul style="list-style-type: none"> Language for mercury content on both luminaire and luminaire packaging must include the following: www.epa.gov/bulbrecycling or www.lamprecycle.org <p>For luminaires not shipped with lamps:</p> <ul style="list-style-type: none"> Packaging must include a list of lamp types that would ensure ENERGY STAR quality and performance when paired with the qualifying luminaire. This list must be clearly visible to the consumer on the luminaire packaging. These can be generic NEMA or ANSI lamp descriptions, including a color designation (e.g., F32T8/830 or CFQ26W/G24q/827) Packaging must suggest that consumers select a lamp with a rated life of 10,000 hours or more. <p>For recessed downlight luminaires that are Insulation-Contact (IC) rated:</p> <ul style="list-style-type: none"> Product packaging must clearly state this rating. Sample language: "IC-rated for direct contact with insulation". <p>For recessed downlight luminaires that are Air-Tight (AT) certified:</p> <ul style="list-style-type: none"> Packaging must clearly show that the luminaire produces less air leakage than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283. Sample language: "Certified Air Tight per ASTM E283." <p>For outdoor luminaires: Packaging must indicate the minimum (lowest) starting temperature for the lamp and ballast platform of the luminaire.</p> <p>Dimming capability and compatibility: External packaging must state any known incompatibilities with dimmers, occupancy or vacancy sensors, timing devices or any other external lighting controls.</p>	No Standard Available (Use manufacturer protocol)	<p>Provide:</p> <ol style="list-style-type: none"> Language or a graphic of the language that will be displayed on product packaging and within the packaging, as required (e.g., installation instructions for air-tight rated luminaires). If product is marketed as dimmable, a copy of the language that includes dimming range and known lighting control incompatibilities. Included documentation must clearly state any known incompatibility with photo-controls, dimmers or timing devices.
Solid State	<p>Packaging must clearly describe the nominal color designation in units of Kelvin (i.e., 2700K, 3000K, 3500K, 4000K).</p> <p>For recessed downlight luminaires that are Insulation-Contact (IC) rated:</p> <ul style="list-style-type: none"> Product packaging must clearly state this rating. Sample language: "IC-rated for direct contact with insulation". <p>For recessed downlight luminaires that are Air-Tight (AT) certified: Packaging must clearly show that the luminaire produces less air leakage than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283. Sample language: "Certified Air Tight per ASTM E283."</p> <p>For outdoor luminaires: Product packaging must indicate the minimum (lowest) starting temperature of the luminaire.</p> <p>Dimming capability and compatibility: External packaging must state any known incompatibilities with dimmers, occupancy or vacancy sensors, timing devices or any other external lighting controls.</p>		

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.	<u>EU Directive 2002/95/EC</u>	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

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)	<p>Provide:</p> <p>A copy of the actual luminaire manufacturer written warranty that is included with product packaging.</p>

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.

Appendix A:

GU24 Integrated Lamp Requirements For ENERGY STAR Qualification

Note: At this time these requirements apply to self-ballasted compact fluorescent lamps only; expansion of requirements for GU24 based lamps to other technologies will take place with the development of the ENERGY STAR Lamps specification.

Note: EPA intends to move performance requirements for GU24 based integrated lamps to the forthcoming ENERGY STAR Lamps specification, development of which is slated to begin in the fall of 2010. In the interim, requirements for GU24 based integrated lamps will be located in this appendix. Partners may continue to use qualified GU24 lamps in their luminaire designs toward fulfillment of numerous performance requirements of ENERGY STAR.

At this time, these requirements apply to self-ballasted compact fluorescent lamps only; expansion of requirements for GU24 based lamps to other technologies will take place with the development of the ENERGY STAR Lamps specification.

Metric	ENERGY STAR Requirements	Methods of Measurement and/or Reference Standards	Required Documentation
System Efficacy Per Integrated Lamp in Lumens Per Watt (LPW)	Bare Lamps: ≥ 70 LPW Covered, Reflector, and Dimmable Lamps: ≥ 50 LPW for all lamp types and wattages	LM-66-00 ANSI C78.5 - 2003	Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. EPA-approved documentation from an industry association. Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal. Passing Test: ≥ 80% of the samples must achieve the required System Efficacy value.
Average Rated Lamp Life	Bare Lamps: The average rated life of the lamp must be ≥ 10,000 hours. Covered, Reflector, and Dimmable Lamps: The average rated life of the lamp must be ≥ 8,000 hours.	IES LM-65-01 ANSI C78.5 - 2003	Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. EPA-approved documentation from an industry association. Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal. Passing Test: ≥ 50% of the samples must be functioning at the lifetime requirement [6]
1,000-Hour Lumen Maintenance	Must be greater than 90.0% of initial (100-hour) lumen output at 1,000 hours of rated life.	IES LM-65-01 IES LM-66-00 ANSI C78.5 - 2003 Section 4.10	Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. EPA-approved documentation from an industry association. Sample Size: ≥ 10 samples must be tested for each Testing Orientation selected for the submittal. Passing Test: ≥ 80% of the samples must achieve the required lumen maintenance value [6]
Lumen Maintenance at 40% of Rated Life	Must be greater than 80.0% of initial (100-hour) lumen output at 40% of rated life.	IES LM-65-01 IES LM-66-00 ANSI C78.5 - 2003 Section 4.10	Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. EPA-approved documentation from an industry association. Sample Size: ≥ 10 samples must be tested for each Testing Orientation selected for the submittal. Passing Test: ≥ 80% of the samples must achieve the required lumen maintenance value[6]
Accelerated Cycling, Thermal, and Voltage (ACTV) Stress Test	Lamp must remain operational for 2,880 cycles @ 60°C or 720 cycles at 80°C	<u>Lighting Research Center (LRC) Test Method</u>	Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program. [2] Sample Size: 5 or 10 samples must be tested for each testing orientation selected for the submittal. Passing Test: If a sample size of 5 is chosen, then ALL 5 samples must remain functional for the duration of the test. If a sample size of 10 is used then 1 sample failure is permitted.
Color Rendering Index	$R_a \geq 80$; and $R_9 > 0$	IES LM-58-94 IES LM-16-93	Provide: 1. a test report from a laboratory recognized by EPA to conduct testing for the ENERGY STAR program [2]; or 2. EPA-approved documentation from an industry association.

		CIE 13.3-1995	<p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples must achieve the required color rendering index value.</p>
Correlated Color Temperature	Lamps must have one of the following designated correlated color temperatures (CCT): 2700K, 3000K, 3500K, or 4100K	<p>IES LM-58-94</p> <p>LM-16-93</p> <p>CIE 15:2004</p>	<p>Provide:</p> <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. EPA-approved documentation from an industry association. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 90% of the samples tested fall within a 7-step ANSI MacAdam ellipse for the designated CCT [4]</p>
Lamp Base	Lamp base configuration must utilize the GU24 base.	ANSI C81.61-2005	No supplemental documentation is required.
Lighting Toxics Reduction Requirements	<p>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.</p> <p>Fluorescent lamps (all types) must not contain more than 5 milligrams of mercury.</p>	<u>EU Directive 2002/95/EC</u>	To be determined (see page 36).
Labeling for Replacement GU24 Lamps (language printed on integrated lamp base)	<p>Required lamp labeling language for consumer replacement must include a manufacturer designation that encompasses the following:</p> <ul style="list-style-type: none"> • lamp manufacturer name • lamp wattage • correlated color temperature • color rendering index <p>Additional packaging requirements for mercury content are included in the Product Packaging and Lamp Labeling for Consumer Awareness Requirements, below.</p>	No Standard Available (Use manufacturer protocol – optionally, manufacturer may use the NEMA or ANSI generic lamp description).	<p>Provide:</p> <p>A copy of the actual language that is included on the base of the GU24 product.</p>
General Ballast Requirement	Integrated lamps are required to meet the general requirement of ANSI C78.5, in addition to the specific requirements listed below.	ANSI C78.5 -2003	No supplemental documentation is required.
Lamp Start Time	The time needed after switching on the lamp to start continuously and remain illuminated must be one second or less.	ANSI C78.5 -2003 Section 4.7, for test conditions and methodology	<p>Provide:</p> <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. EPA-approved documentation from an industry association; or 3. a test report from an OSHA NRTL laboratory. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples tested must meet the required lamp start time.</p>
Run-up Time	<p>Non-amalgam: Average of 10 samples tested must be less than 1.0 minute per ANSI C78.5, Section 3.11 and 4.8.</p> <p>Amalgam: Average of 10 samples tested must be less than 3.0 minutes per ANSI C78.5, clause 3.11 and 4.8.</p>	ANSI C78.5 -2003 Section 3.11 and 4.8	<p>Provide:</p> <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. EPA-approved documentation from an industry association. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples tested must achieve the required run-up time.</p> <p>Partners must specify if their product contains amalgam mercury during the qualification submission process to meet this requirement.</p>
Power Factor	≥ 0.5	ANSI C82.11-2002 Section-3.3.1	<p>Provide:</p> <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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer.

			<p>Sample Size: ≥ 10 samples must be tested.</p> <p>Passing Test: $\geq 80\%$ of the samples tested must achieve the required power factor.</p>
Electro-magnetic and Radio Frequency Interference	Integrated Lamp must meet FCC requirements for consumer use, FCC 47 CFR Part 2 (Equipment Authorization) and Part 18 (Consumer Emission Limits)	FCC 47 CFR Part 2 and Part 18	<p>Provide:</p> <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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer. <p>Sample Size: 1 sample must be tested.</p> <p>Passing Test: The sample tested must meet the requirement.</p>
Ballast Frequency	20 to 33 kHz or ≥ 40 kHz	Oscilloscope or frequency counter	<p>Provide:</p> <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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer. <p>Sample Size: ≥ 10 samples must be tested.</p> <p>Passing Test: $\geq 80\%$ of the samples tested must achieve the required ballast frequency.</p>
Transient Protection	Per ANSI C82.11b, paragraph 5.10.1 (100kHz Ring Wave, 2.5kV, both common mode and differential mode, 7 strikes)	ANSI C82.11, Section 5.11	<p>Provide:</p> <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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer. <p>Sample Size: ≥ 5 samples must be tested.</p> <p>Passing Test: $\geq 90\%$ of the samples tested must meet the 7 strike test requirement.</p>
Safety	Demonstrate compliance with UL1993-2009.	UL 1993-2009	<p>Provide:</p> <p>File number for the respective product as listed by the appropriate OSHA NRTL laboratory and one of the following:</p> <ol style="list-style-type: none"> 1. Letter or statement from an OSHA NRTL facility indicating that the product meets the requirements of UL1993-2009. 2. Internet hyperlink to the manufacturer's listed product at the OSHA NRTL laboratory that carried out the safety tests. 3. Print out of the OSHA NRTL webpage showing the listed product.
Testing Orientation	<p>GU24 manufacturers must declare the orientation used for each of the following requirements:</p> <ol style="list-style-type: none"> 1. System Efficacy 2. Average Rated Lamp Life 3. 1,000-hour Lumen Maintenance 4. Lumen Maintenance at 40% of Rated Life 5. ACTV Test 6. Color Rendering Index 7. Correlated Color Temperature 8. Lamp Start Time 9. Run-up Time <p>The following options will be presented in the Approved Platform Database</p> <ol style="list-style-type: none"> 1. Base Up 2. Base Down 3. 50% Base Up, 50% Base Down 4. Horizontal Operation 	No Standard Available (Use manufacturer protocol)	<p>Provide:</p> <p>No supplemental documentation required, but a response is mandatory when submitting a product.</p>
Lamp Warranty	Warranty or limited warranty statement must cover at least a minimum of 24 months, or 2 years, from date of purchase based on no less than 3 hour per day of use.	No Standard Available (Use manufacturer protocol)	<p>Provide:</p> <p>A copy of the actual two-year manufacturer written warranty.</p> <p>Product packaging must state "Warranty" or "Limited Warranty" and have one of the following for consumer complaint resolution (as applicable):</p> <ul style="list-style-type: none"> • a company phone number; or • mailing address; or • webwite address.

Product Packaging and Lamp Labeling for Consumer Awareness Requirements	<p>Note: Please review all of the following to determine applicability of various requirements below.</p> <p>Lamp labeling: Language for mercury content on the lamp itself must include one (1) of the following :</p> <ul style="list-style-type: none"> • the symbol “Hg” within a circle • “Contains Mercury” <p>Additional information may also be printed as required by applicable state laws.</p> <p>Lamp product packaging: Language for mercury must include the following:</p> <ul style="list-style-type: none"> • the symbol “Hg” within a circle; • “Contains Mercury”; and • www.epa.gov/bulbrecycling or www.lamprecycle.org <p>Required lamp product packaging language for FTC labeling requirements when lamp is not included with a light luminaire: ENERGY STAR qualified compact fluorescent lamps and lamp systems must comply with the labeling requirements of the U.S. Federal Trade Commission Packaging Laws - FTC 16CFR Part 305.1-.19.</p> <p>Required lamp product packaging language for starting temperature when lamp is not included with a light luminaire: Packaging must state the minimum starting temperatures or geographic zone of use and any other conditions for reliable starting to meet the starting time requirements of ANSI C78.5, clause 4.8.</p> <p>Control incompatibilities: Lamp package must clearly state any known incompatibility with photo controls, dimmers or timing devices. In addition, packaging should state specific application exceptions.</p> <p>Required languages: Lamp packaging and lamp labeling language must be in English; translations to other languages may also be printed. For products that will be sold in Canada, packaging must include both English & French language.</p>	<p>No Standard Available (Use manufacturer protocol)</p> <p>FTC 16CFR Part 305.1-.19</p> <p>ANSI C78.5 -2003 clause 4.8</p>	<p>Provide: A written copy or a PDF graphic of the language that will be displayed on lamps and product packaging.</p>
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Note: In addition to the above requirements, EPA is exploring defining dimensional limitations and tolerances for qualified GU24 based integrated lamps, in the interest of ensuring that qualified replacement lamps will be broadly compatible with qualified luminaires. Further details will be provided in subsequent drafts, and EPA seeks partner input towards this effort.