



ENERGY STAR® Program Requirements

Product Specification for Luminaires (Light Fixtures)

Eligibility Criteria
Version 2.0 DRAFT 1

Following is the **Version 2.0 Draft 1** product specification for ENERGY STAR certified Luminaires. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

To certify a luminaire for ENERGY STAR, first determine which requirements in this document are applicable to the specific luminaire. ENERGY STAR requirements are specific to luminaires classified by the Program as directional or non-directional. This specification is generally organized by the requirements, not by luminaire type such as 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; for instance, some color exceptions are in place for outdoor luminaires.

Note box 1: Please read the cover letter distributed with this draft, and all note boxes located throughout the draft. EPA invites stakeholders to send comments to lighting@energystar.gov, with the subject "ENERGY STAR Luminaires 2.0 Draft 1 Comments".

Luminaires which do not fall into the specific directional scope default to non-directional classification

- Directional luminaires (**evaluated with luminaire photometry**):
 - **specific scope** itemized in the Specification Scope & Luminaire Classification section
 - evaluated with luminaire photometry (lumens delivered from luminaire per input watt), accounting for luminaire optics
 - shall also meet specified minimum light output and zonal lumen density requirements
 - solid state (LED) luminaire types featuring inseparable components (no user replaceable/upgradeable LED light engine or integrated LED lamp) and not otherwise itemized in the directional scope shall be considered inseparable SSL luminaires and evaluated using luminaire photometry
 - most outdoor luminaires are classified as directional, requiring luminaire photometry to test for uplight
 - luminaire types not meeting the above criteria default to non-directional classification, described below
- Non-directional luminaires (**evaluated by source photometry**):
 - **examples** provided in the Specification Scope & Luminaire Classification section
 - evaluated by source photometry (lumens delivered from the light source per input watt), including system performance of lamp and ballast, LED light engine, ENERGY STAR certified compact fluorescent lamp or LED lamp
 - luminaires not classified above as directional are evaluated as non-directional as long as the light source is removable and can be tested by an applicable test method identified in this specification

Note box 2: As introduced in the Luminaires discussion document, EPA is proposing an additional pathway for luminaire certification, allowing non-directional luminaires to meet specification requirements by shipping with ENERGY STAR certified lamps (of any base type). Consistent with this proposal, EPA has removed references to GU24, self-ballasted compact fluorescent lamps, integrated LED lamps and eligibility restrictions regarding luminaires with screw base lampholders throughout the specification.

Also from the discussion document, EPA is proposing to remove the option to certify luminaires that do not ship with lamps. EPA received feedback inquiring if linear fluorescent lamps were being excluded, or only those that do not ship with lamps, thereby requiring linear fluorescent lamps to be shipped with fixtures. In this draft EPA clarified that the proposal is to remove luminaires that do not ship with lamps, which includes halogen based outdoor products, downlights utilizing multi-wattage ballasts, and linear fluorescent fixtures as well as linear fluorescent lamps as a light source option. The U.S. Department of Energy has very stringent minimum standards for these lamps and ballasts. The 2009 DOE rulemaking which took effect in 2014 requires that the majority of ballast types to be at efficiency levels that are considered the maximum technology, leaving little room for improvement over the mandatory federal standards. DOE estimates, the standard for fluorescent ballasts is anticipated to save approximately 5.6 quads of energy and result in up to \$24.1 billion in energy bill savings for products shipped from 2014-2043. The standard will avoid up to 106 million metric tons metric tons of carbon dioxide emissions, equivalent to the annual greenhouse gas emissions of about 57.3 million automobiles.

Additionally, to simplify the specification, EPA has removed references to High Intensity Discharge (HID) technology throughout the draft since no products have been certified to date that utilize an HID light source, and EPA is not aware of parties interested in certifying products. If stakeholders have an interest in maintaining a path for HID products, please provide comment.

1 SPECIFICATION SCOPE & LUMINAIRE CLASSIFICATION

The ENERGY STAR Luminaires specification (“this specification”) covers luminaire types outlined in this section. This specification is limited to residential type lighting products, however to the extent that products that fall under the scope of this specification are sold into the commercial market, they may be included and listed appropriately for the applicable end user. Certification is limited to luminaires below a total input power of 250 watts intended to be connected directly to the electric power grid. Refer to the Definitions section in [Section 4](#) for definitions of each directional luminaire type detailed below. Questions about scope may be directed to an EPA recognized Certification Body or lighting@energystar.gov

Excluded products

- Commercial outdoor lighting (e.g. street and area, wall packs, canopy)
- High or low bay luminaires
- Recessed troffers and other linear fluorescent fixtures
- Luminaire types typically employed for general office illumination such as linear pendants and panel lighting
- HID sources or their SSL replacements
- Socket adapters or converters

LUMINAIRE TYPES MEASURED WITH LUMINAIRE PHOTOMETRY	
Inseparable SSL Luminaires	Luminaires with inseparable sources not listed below as directional otherwise considered non-directional/decorative
DIRECTIONAL LUMINAIRES	
Limited to the following types:	Includes:
Accent Lights	Line-voltage directional track lighting Track heads Directional ceiling fan light kits
Cove Mount Lights	Asymmetric and other distributions
Downlights	SSL Downlight Retrofit Kits Recessed Surface Mount, Pendant Mount
Outdoor Lighting	Post mount Pendant Mount Porch Lights Wall Mounted Luminaires Security Lighting
Undercabinet Luminaires	Asymmetric and other distributions
Portable Desk Task Lights	
LUMINAIRE TYPES MEASURED WITH SOURCE PHOTOMETRY	
NON-DIRECTIONAL LUMINAIRES (including but not limited to)	
Ventilation or Ceiling Fan Light Kits	Ceiling Mount & retrofits
Wrapped Lens	Chandeliers
Wall Sconces & retrofits	Bath Vanity
Decorative Pendants	Outdoor Ceiling or Close-to-Ceiling Mount (only)
Portable Luminaires	Linear Strip

Note box 3: The intent of this specification remains residentially focused, with the acknowledgement that there are products that will be sold into both markets. To the extent that this applies to products covered by the specification, EPA proposes manufacturers indicate the intended market for informational purposes, but there will not be performance requirement distinctions. Draft one includes an excluded products table to make the scope clearer.

SSL retrofit kits for ceiling and close to ceiling mount lights and wall sconces were added to the scope based on support received from the discussion document proposal. Outdoor luminaire types were clarified to distinguish that anything mounted to a ceiling or close to a ceiling falls under non-directional but other outdoor luminaires fall under directional to avoid light pollution and direct outdoor light only where it is needed.

2 EFFECTIVE DATE

The ENERGY STAR Luminaires Version 2.0 specification shall take effect on TBD. To certify a product for ENERGY STAR, the model shall meet the ENERGY STAR specification in effect on its date of manufacture. The date of manufacture is specific to each unit and is the exact date on which a unit is considered to be completely assembled.

Note box 4: Pursuant to overall ENERGY STAR specification development practices, EPA proposes an effective date of 9 months from the release of the final specification.

3 FUTURE SPECIFICATION REVISIONS

EPA reserves the right to change this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that ENERGY STAR certification is not automatically granted for the life of a product model.

While this document currently refers to industry standards and test procedures for fluorescent 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 requirements, standards, and test procedures.

Note box 5: EPA reminds partners that there is currently an open U.S. Department of Energy rulemaking that will likely impact the test procedures and reporting for ceiling fan light kits. EPA will revise the specification to align with final rulemaking.

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4 DEFINITIONS

Accent Light (Luminaire): A directional luminaire employed to emphasize a particular object or surface feature, or to draw attention to a part of the field of view (adapted from IES RP-16-10: "Accent Lighting"). This includes line-voltage directional track lighting.

ANSI: American National Standards Institute.

Aperture Size (downlights): The maximum distance between the points inside the luminaire where light escapes the luminaire.

ASTM: American Society for Testing of Materials.

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-16-10)

Bath Vanity Luminaire: Wall-mounted luminaires located adjacent to a mirror.

Ceiling / Close-to-Ceiling Mount Luminaire: Ceiling-mounted luminaires that direct less than 90% of light downward and are not intended to accent an object or an area within a space.

Chandeliers: Decorative, often branched, luminaires suspended from the ceiling incorporating multiple light sources.

CIE: Commission Internationale de l'Eclairage (International Commission on Illumination).

Color Rendering Index of a Light Source (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 RP-16-10)

Color Tunable Luminaire: For the purpose of this specification, a color tunable luminaire has functionality that allows the end user to alter the color appearance of the light generated by the luminaire. This tuning must include white light that is capable of meeting the specification's CCT requirements, and can alter the color appearance along the black body curve, or may also extend to colors beyond the ANSI defined correlated color temperature ranges.

Compact Fluorescent Lamp (CFL): A fluorescent lamp with a small diameter glass tube (T5 or less) that is folded, bent, or bridged to create a long discharge path in a small volume. The lamp design generally includes an amalgam and a cold chamber, or a cold spot to control the mercury vapor pressure and light output. (IES RP-16-10)

Connected Luminaire: An ENERGY STAR eligible luminaire or retrofit is a luminaire or retrofit which includes all elements (hardware, software) required to enable communication in response to consumer-authorized energy or performance related commands (not including third-party remote management which may be made available solely at the discretion of the manufacturer).

Correlated Color Temperature of a Light Source (CCT): The absolute temperature of a blackbody whose chromaticity most nearly resembles that of the light source. (IES RP-16-10).

Cove Mount (Luminaire): Lighting comprising light sources shielded by a ledge or horizontal recess, and distributing light over the ceiling and upper wall. For purposes of this specification, cove mount luminaires feature luminaire optics over the lamps, LED packages, arrays or modules, LED light engines or integrated LED lamps. (adapted from IES RP-16-10)

CSA: Canadian Standards Association.

Decorative Pendant (Luminaire): Suspended luminaires that are not intended to accent an object or an area within a space, and typically employ blown glass, or colorful glass elements.

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-16-10)

Directional Applications: See Direct Lighting.

Directional Luminaires: See Direct Lighting.

Down Light or Downlight (Luminaire): A small direct lighting unit that directs the light downward and can be recessed, surface mounted, or suspended (IES RP-16-10). See definition of Direct Lighting for additional information. For purposes of this specification, this definition includes down light luminaire SSL retrofits but does not include linear fluorescent troffers or linear luminaire forms such as linear fluorescent pendants, typically used to illuminate office spaces.

Electronic Ballast: A device which operates at a supply frequency of 50 or 60 Hz and operates the lamp at frequencies greater than 10 kHz. (ANSI standard C82.13-2002)

Floor Lamp (Luminaire): a portable luminaire on a high stand suitable for standing on the floor. (IES RP-16-10)

IEC: International Electrotechnical Commission.

IES: Illuminating Engineering Society.

Input Power: The power consumption in watts of a ballast or driver and a light source system operating in a normal or active mode, as determined in accordance with the test procedure (ANSI Standard 82.2-2002)

Inseparable SSL Luminaire: A luminaire featuring solid state lighting components (i.e. LEDs and driver components) which cannot be easily removed or replaced by the end user, thus requiring replacement of the entire luminaire. Removal of solid state lighting components would require (for instance) the cutting of wires, use of a soldering iron, or damage to or destruction of the luminaire. This definition does not encompass luminaires which feature LED light engines or integrated LED lamps which are user replaceable / upgradeable without the cutting of wires or the use of solder, or the specific residential luminaire types designated "directional" in the scope of this document.

Integrated LED Lamp: An integrated assembly comprised of LED packages (components) or LED arrays (modules), LED driver, ANSI standard base and other optical, thermal, mechanical and electrical components. The device is intended to connect directly to the branch circuit through a corresponding ANSI standard lamp-holder (socket). (IES RP-16-10)

Lamp: A generic term for a man-made source created to produce optical radiation. By extension, the term is also used to denote sources that radiate in regions of the spectrum adjacent to the visible." (IES Handbook 9th Edition)

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.

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-16-10)

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-16-10)

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-16-10)

LED Driver Case Temperature Measurement Point (TMP_c): A location on an LED driver case, designated by its manufacturer, which will have the highest temperature of any point on the driver case during normal operation.

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-16-10). For purposes of this specification, light engines that rely on the luminaire for optical control and/or thermal management, and ("non-integrated") assemblies featuring remote-mounted drivers shall also be considered LED light engines. Remote-mounted drivers are allowable so long as interconnecting conductors of appropriate gauge and length are employed between the driver(s) and LED package(s), array(s) or module(s), and electrical interconnects are employed at both ends of the conductors.

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-16-10)

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-16-10)

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-16-10)

Linear Strip Luminaire: Surface mounted luminaires with an elongated aspect ratio and either no optics over the light source(s) or individual optics over each light source.

Line-Voltage Track Light (Luminaire): See Accent Light definition. Includes luminaires interoperable with line-voltage track installed without a transformer or power supply.

Linear Fluorescent Lamp: Commonly made with straight, tubular bulbs varying in diameter from approximately 6 mm (0.25 in. T-2) to 54 mm (2.125 in. T-17) and in overall length from a nominal 100 to 2440 mm (4 to 96 in.), this light source is a low-pressure gas discharge source, in which light is produced predominantly by fluorescent powders activated by UV energy generated by a mercury arc. (adapted from IES Handbook 9th Edition)

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

Lumens per Watt (lm/W): The quotient of the total luminous flux emitted by the total light source power input. It is expressed in lm/W. (adapted from IES RP-16-10: "Luminous Efficacy of a Source of Light")

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-16-10)

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)

Nadir: The angle pointing directly downward from the luminaire, or zero degrees.

NEMA: National Electrical Manufacturers Association.

Non-Directional Application: For purposes of this ENERGY STAR specification, luminaire 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.

Outdoor Pendant Luminaire: An outdoor suspended luminaire.

Outdoor Porch Luminaire: An outdoor ceiling, surface or wall-mounted luminaire.

Outdoor Post-Mounted Luminaire: An outdoor luminaire supported by a post inserted into the ground and mounted between 4 feet and 10.5 feet above grade.

Outdoor Security Luminaire: Wall mounted luminaires intended to light areas immediately adjacent to a building's perimeter.

Photo Control or Light Activated Switch: A photoelectric switch that controls lighting by the level of daylight luminance (IES RP-16-10), also referred to as a photosensor.

Platform: See Lamp-Ballast Platform.

Portable Desk Task Light (Luminaire): A light fixture resting on a desk that directs light to a specific surface or area to provide illumination for visual tasks such as reading and writing, and employs a NEMA 1-15P or 5-15P plug for its electrical connection.

Portable Floor Task Light (Luminaire): A light fixture resting on the floor that directs light to a specific surface or area to provide illumination for visual tasks such as reading and writing, and employs a NEMA 1-15P or 5-15P plug for its electrical connection.

Portable Luminaire: A lighting unit that is not permanently fixed in place. (IES RP-16-10)

Power Factor: The power input in watts divided by the product of ballast input voltage and input current of a fluorescent lamp ballast, as measured under test conditions (ANSI Standard C82.2–2002).

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-16-10)

Rated Lumen Maintenance Life (Lp): 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 marketed and intended to be used in a residential environment notwithstanding use in commercial, business and industrial environments. (adapted from FCC 47 CFR parts 15 and 18)

Run-up Time: The time needed after switching on the supply for the lamp to reach 80.0% of its stabilized luminous flux. (ANSI C78.5-2003)

Secondary Optics: Materials modifying the distribution of light from, but not integral to a light source, including but not limited to lamp envelopes, reflectors, and total internal reflection optics.

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 an 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)

SSL Downlight Retrofits: A type of solid state luminaire intended to install into an existing downlight, replacing the existing light source and related electrical components, typically employing an ANSI standard lamp base, either integral or connected to the downlight retrofit by wire leads.

SSL Surface Mount Retrofit Kits: A type of solid state lighting product intended to replace existing light sources and systems including incandescent and fluorescent light sources in previously installed luminaires that already comply with safety standards. These kits replace the existing light source and related electrical components. This may employ an ANSI standard lamp base, either integral or connected to the retrofit by wire leads. This category does not include self-ballasted lamps, which are covered by the ENERGY STAR Lamps Specification, or products that utilize the existing ballast or transformer.

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)

Table Lamp (Luminaire): A portable luminaire with a short stand suitable for standing on furniture. (IES RP-16-10)

Torchiere (Luminaire): An indirect floor lamp that sends all or nearly all of its light upward. (IES RP-16-10)

TMP_C: see LED Driver Case Temperature Measurement Point.

TMP_{LED}: see LED Temperature Measurement Point.

Trim: 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). A trim can be airtight or non-airtight.

UL: Underwriters Laboratories.

Under-Cabinet Luminaire: Luminaires installed below an upper cabinet to direct light down to the work surface of a countertop or desk for task lighting.

Wall Sconce (Luminaire): Wall mounted luminaires not intended to accent an object or a task area within a space.

Wrapped Lens Luminaire: Surface mounted luminaires with an elongated aspect ratio and a single optic covering the light source that direct less than 90% of light downward.

Note box 6: EPA has removed a number of extraneous definitions that are not referenced later in the draft specification, and has updated the definition of LED Light Engines and Inseparable SSL Luminaires.

Included is a new definition of surface mount SSL retrofit kits, to define the additional product types included in this specification, adapted from the UL standard definition 1598C.

A definition for color tunable luminaires is proposed and added to the specification, and the definition for secondary optics has been carried over from the Lamps specification.

5 TEST CRITERIA

When testing luminaires, the methods of measurement identified for each performance requirement in the “Methods of Measurement and/or Reference Documents” column of the performance requirements tables presented within this specification shall be used to determine ENERGY STAR certification. Where applicable and noted in the specification, certification to the current ENERGY STAR Lamps specification is sufficient to meet testing requirements.

IES LM-9, LM-65 and LM-66 are applied to both hot and cold cathode lamps.

5.1 Testing Color Tunable Luminaires

For the purpose of this specification, a color tunable luminaire has functionality that allows the end user to alter the color appearance of the light generated by the luminaire. This tuning must include white light that is capable of meeting the specification’s CCT requirements, and can include the ability to alter the color appearance along the black body curve, or may also extend to colors beyond the ANSI defined correlated color temperature ranges. If the luminaire or source is capable of operating outside of the ANSI defined CCT ranges. When testing color tunable luminaires, photometric performance testing (per [section 9](#)) shall be performed at:

1. the default setting from the factory
2. the least efficient setting within ANSI white light CCT ranges (if different from the default and/or most consumptive)

The test settings described above shall meet all photometric performance requirements of the specification. All other testing, including lumen and color maintenance testing, shall be tested at the least efficient setting.

The power consumption of the setting with the maximum input power, regardless of chromaticity, shall be reported.

Note box 7: To reflect color tunable functionality, criteria for the testing of color tunable luminaires have been included. Additionally, some sections have supplemental guidance regarding testing of these luminaires.

6 PRODUCT CERTIFICATION

6.1 Product Families

Grouped product submissions for ENERGY STAR certification shall meet the following requirements:

Certified products within a product family shall be identical to the tested, representative model with the exception of allowed variations listed in Table 1, below. The representative model shall be the variation expected to have the greatest difficulty meeting the performance requirements outlined in this specification.

Luminaire Attribute	Allowable Variation	Additional Test Data Required for Each Variant
Housing / Chassis	Allowed so long as the light source or lampholder, ballast or driver, and heat sink (as applicable) are integrated into housing / chassis variations in such a way that the thermal performance of the luminaire is not degraded by changes to the housing / chassis.	Thermal measurements of each variation may be required (e.g. ballast case temperature, TMP _{LED} , or TMP _C).
Heat Sink / Thermal Management Components	Not allowed.	None
Finish	Luminaire body color/pigment.	None
Mounting	Allowed.	None

¹ Partners may not retroactively add variations to a product family unless requirements in Table 1 are still met. For example, if the representative model tested is a SSL product with a 3000 Kelvin nominal CCT, partner may not retroactively add a 2700 Kelvin model, as this was not the lowest CCT initially tested.

	Luminaire photometry test reports generated for outdoor post-mounted luminaires may be used to certify outdoor porch (wall-mounted), outdoor ceiling or close-to-ceiling mounted and outdoor pendant luminaires within the same product family, in place of the source photometry requirements, so long as the bill of materials for each luminaire type is identical except for mounting hardware.	
Electrical Connection (SSL Retrofits)	Allowed (e.g. E26 and GU24).	None
Reflector / Trim	Allowed so long as luminaire light output is not reduced.	<ul style="list-style-type: none"> • Luminous intensity distribution data • Center Beam Intensity • Color Angular Uniformity
Shade / Diffuser	Allowed so long as neither luminaire light output nor air flow are reduced.	None
Light Source (refers to the make and/or model of the source; also review CCT below)	Allowed so long as variations will not negatively impact luminaire's compliance with any performance criteria in this specification.	<ul style="list-style-type: none"> • Certified performance data from additional light source if separable • Integrating sphere test for inseparable product
Correlated Color Temperature (CCT) (also review Light Source above)	<p>Allowed so long as the lamp series or LED package/module/array series (and associated drive current), ballast or driver, and thermal management components are identical, and so long as variations will not negatively impact luminaire's compliance with any performance criteria in this specification.</p> <p>The representative model shall be the version within the product family with the lowest CCT for SSL products and the highest CCT for discharge products.</p> <p>Partner shall use different luminaire model numbers to distinguish between models shipped with light sources of varying CCTs.</p>	<ul style="list-style-type: none"> • Integrating sphere scan to confirm impact on performance
Product Wattage ² (directional luminaires)	<p>For SSL products:</p> <ul style="list-style-type: none"> • The LED package, array, or module model must not change, although CCT remains an allowable variation. • The only performance change to the luminaire is to a driver that provides a different drive current to the LED package, array or module. • The model tested should be the highest wattage, highest CRI , and lowest CCT variant. 	<ul style="list-style-type: none"> • LED current measurement • Integrating sphere scan to represent performance of variants
	<p>For Fluorescent products:</p> <ul style="list-style-type: none"> • The lamp wattage may change, but not the general type or configuration. <p>Example: A 32W triple tube pin based fluorescent representing a 26W triple tube pin based fluorescent would be acceptable, but not representing a 26W twin tube fluorescent.</p> <ul style="list-style-type: none"> • The only performance change to the luminaire is to the lamp (or lamp and ballast) with a lower wattage. • The model tested should be the highest wattage, highest CRI, and highest CCT variant . 	<ul style="list-style-type: none"> • Certified lamp data for variants • Integrating sphere scan to represent performance of variants

² When wattage as a variation is used, changes to optics and LED package, array or module (where applicable) are not permitted to be represented, as these changes would result in a change in distribution which must be re-evaluated against the luminaire specific requirements. The additional models would still require an integrating sphere LM-79 test to verify other photometric and electrical performance requirements.

Ballast / Driver (no change in nominal wattage or current)	Allowed so long as variations will not negatively impact luminaire's compliance with any performance criteria in this specification.	• Thermal measurements of each variation may be required (e.g. ballast case temperature or TMPC).
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6.2 Significant Digits and Rounding

- a. Measurements shall be recorded at the resolution of the test instrumentation for each unit in the sample set.
- b. All calculations shall be carried out on a per unit basis with directly measured (unrounded) values.
- c. Compliance with the specification limits shall be evaluated against the reported value for each model.
- d. Rounding is defined as follows:
 - a. A fractional number at or above the midpoint between two consecutive decimal places or whole numbers shall be rounded up to the higher of the two decimal places or whole numbers; or
 - b. A fractional number below the midpoint between two consecutive decimal places or whole numbers shall be rounded down to the lower of the two decimal places or whole number.

6.3 Solid State Lumen Maintenance Performance Data

Content and application of IES LM-80-08 reports for LED lamps shall comply with [ENERGY STAR Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products.](#)

Note box 8: In an effort to streamline, simplify, and reduce testing burden for similar models with different wattages, EPA has proposed a mechanism for performance scaling of directional luminaires as an allowable variation, reducing the number of goniophotometer scans that are required by testing a scenario that is likely to have the most difficulty meeting all of the requirements.

Additionally, EPA had received comments noting a preference for reformatting the allowable variations section similar to the approach used for the Lamps V1.1, so the table has been added for additional clarity on the additional testing necessary to utilize each allowable variation. Note several details have been reflected in footnotes.

The significant digits and rounding section has been updated for consistency with the ENERGY STAR Lamps Specification.

7 METHODS OF MEASUREMENT AND REFERENCE DOCUMENTS

Organization	Identifier	Description
ANSI	<u>C78.376-2001</u>	Specifications for the Chromaticity of Fluorescent Lamps
ANSI/NEMA/ ANSLG	<u>C78.377-2011</u>	Specifications for the Chromaticity of Solid State Lighting Products
ANSI	<u>C78.5-2003</u>	Specifications for Performance of Self-ballasted Compact Fluorescent Lamps
ANSI/ANSLG	<u>C78.81-2010</u>	Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics
ANSI	<u>C78.901-2014</u>	Single-Based Fluorescent Lamps—Dimensional and Electrical Characteristics
ANSI/ANSLG	<u>C81.61-2009</u>	Specifications for Bases (Caps) for Electric Lamps
ANSI/ANSLG	<u>C81.62-2009</u>	Lampholders for Electric Lamps
ANSI	<u>C82.11-2011</u>	High-Frequency Fluorescent Lamp Ballasts
ANSI	<u>C82.2-2002</u>	Method of Measurement of Fluorescent Lamp Ballasts
ANSI	<u>C82.77-2002</u>	Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment
ANSI/IEEE	<u>C62.41.1-2002</u>	IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
ANSI/IEEE	<u>C62.41.2-2002</u>	IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
ANSI/UL	<u>153-2002</u>	Standard for Safety of Portable Electric Luminaires
ANSI/UL	<u>935-2009</u>	Standard for Safety of Fluorescent-Lamp Ballasts
ANSI/UL	<u>1310-2010</u>	Standard for Safety of Class 2 Power Units
ANSI/UL	<u>1574-2004</u>	Standard for Safety of Track Lighting Systems
ANSI/UL	<u>1598-2008</u>	Standard for Safety of Luminaires
ANSI/UL	<u>1598B-2010</u>	Standard for Supplemental Requirements for Luminaire Reflector Kits for Installation on Previously Installed Fluorescent Luminaires
ANSI/UL	<u>1993-2009</u>	Standard for Safety of Self-Ballasted Lamps and Lamp Adapters
ANSI/UL	<u>2108-2004</u>	Standard for Low-Voltage Lighting Systems
ANSI/UL	<u>8750-2009</u>	Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products
ASTM	<u>E283-04</u>	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
CIE	<u>Pub. No. 13.3-1995</u>	Method of Measuring and Specifying Color Rendering of Light Sources
CIE	<u>Pub. No. 15:2004</u>	Colorimetry
EU	<u>Directive 2002/95/EC</u>	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	<u>CFR Title 47 Part 15</u>	Radio Frequency Devices
FCC	<u>CFR Title 47 Part 18</u>	Industrial, Scientific, and Medical Equipment
IEC	<u>60061-1 (2012)</u>	Lamp Caps and Holders Together with Gauges for the Control of Interchangeability and Safety – Part 1: Lamp Caps
IEC	<u>60081 Amend 4 Ed 5.0 (2010)</u>	Double-capped Fluorescent Lamps - Performance Specifications
IEC	<u>60901 (2011)</u>	Single-capped Fluorescent Lamps - Performance Specifications
IEC	<u>61347-2-3-am2 ed1.0 b.2011</u>	Amendment 2 - Lamp Control Gear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps
IEC	<u>62321 Ed. 1.0</u>	Electrotechnical Products - Determination Of Levels Of Six Regulated Substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)
IES	<u>LM-9-09</u>	Electric and Photometric Measurements of Fluorescent Lamps
IES	<u>LM-10-96</u>	Photometric Testing of Outdoor Fluorescent Luminaires
IES	<u>LM-31-95</u>	Photometric Testing of Roadway Luminaires Using Incandescent Filament and High Intensity Discharge (HID) Lamps
IES	<u>LM-40-10</u>	Life Testing of Fluorescent Lamps
IES	<u>LM-41-98</u>	Approved Method for Photometric Testing of Indoor Fluorescent Luminaires (renewal anticipated in 2013)
IES	<u>LM-46-04</u>	Photometric Testing of Indoor Luminaires Using High Intensity Discharge or Incandescent Filament Lamps
IES	<u>LM-49-12</u>	Life Testing of Incandescent Filament Lamps
IES	<u>LM-58-94</u>	Guide to Spectroradiometric Measurements
IES	<u>LM-65-10</u>	Life Testing of Compact Fluorescent Lamps
IES	<u>LM-66-11</u>	Electrical and Photometric Measurements of Single-Ended Compact Fluorescent Lamps
IES	<u>LM-79-08</u>	Electrical and Photometric Measurements of Solid-State Lighting Products
IES	<u>LM-80-08</u>	Measuring Lumen Maintenance of LED Light Sources
IES	<u>LM-82-12</u>	Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature
IES	<u>LM-84-14</u>	Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires
IES	<u>RP-16-10</u>	Nomenclature and Definitions for Illuminating Engineering
IES	<u>TM-21-11</u>	Projecting Long Term Lumen Maintenance of LED Sources
IES	<u>TM-28-14</u>	Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires
NEMA	<u>LL 9-2009</u>	Dimming of T8 Fluorescent Lighting Systems
NEMA	<u>LSD 45-2009</u>	Recommendations for Solid State Lighting Sub-Assembly Interfaces for Luminaires

Note box 9: EPA has removed methods of measurement that are no longer relevant based on the proposals mentioned above, e.g. HID method of measurements, and added new methods proposed in the draft, e.g. IE LM-84, TM-28. EPA requests feedback on additional reference documents that may be appropriate, or if additional updates are necessary.

8 SHIPPING WITH ENERGY STAR CERTIFIED LAMPS: Non-Directional Luminaires

To satisfy the requirements of this specification, non-directional luminaires shall:

- meet the requirements outlined in this section and be shipped with ENERGY STAR certified lamp(s) that meet the requirements in this section, OR
- meet the relevant requirements in Sections 9 through 19

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents
Source Efficacy	<p>≥ 65 lm/W per lamp</p> <p>All lamp permutations (makes and models) employed in a given luminaire model shall meet this requirement.</p>	ENERGY STAR Lamps Specification
Source Minimum Light Output (initial)	<p>Lamp-ballast platform shall provide a minimum of 800 lumens.</p> <p><u>Exception:</u> Outdoor porch, bath vanity luminaires and ceiling fan light kits featuring ≥ 3 heads shall provide a minimum of 450 lumens per head.</p> <p>Chandeliers, decorative pendants, wall sconces, and other multi-head indoor luminaires shall provide a minimum of 250 lumens per head.</p>	ENERGY STAR Lamps Specification
Safety Rating	Lamp must be safety rated for the luminaire type it will be shipped with, e.g. a lamp shipped with an enclosed fixture must be rated for use in an enclosed fixture. Luminaire must meet applicable safety rating in section 14 .	ANSI/UL 1993-2012, and ANSI/UL 8750-2009
Product Packaging & Labeling	Luminaire must comply with section 16 . Unless shipped with lamps directly installed, ENERGY STAR certified lamps shipped with luminaires must comply with lamps packaging requirements.	See Section 16
Warranty	Luminaire must comply with section 17	See Section 17
Toxics	Luminaire must comply with section 18	See Section 18

Note: For this certification pathway, most performance requirements are fulfilled through the certification of the lamp. Lamp efficacy, minimum light output and CCT performance can be referenced on the ENERGY STAR Lamps product listing. Certain luminaire specific requirements (as noted above) still apply to the luminaire. All lamps that ship with a luminaire must meet the ENERGY STAR lamp specification effective on the date of manufacture of luminaire and be included in the luminaire certification documentation.

Note box 10: In this draft EPA proposes allowing an option for luminaires to utilize LED and CFL Lamps certified to the ENERGY STAR Lamps specification to support the majority of the testing required for certification of the luminaire. Included lamps must meet the ENERGY STAR Lamp Specification version effective on the date that the luminaire is manufactured will be the version referenced. A new table has been inserted to explain the certification pathway for luminaires shipping with ENERGY STAR certified lamps. With the addition of the pathway to allow ENERGY STAR certified lamps to support Luminaire certification, the option to use integrated or self-ballasted lamps that are not certified has been removed.

9 PHOTOMETRIC PERFORMANCE REQUIREMENTS

9.1 Luminous Efficacy and Output: NON-DIRECTIONAL Luminaires

Note: Luminaire types not classified as directional in the Scope section of this specification shall be evaluated as non-directional, based on source photometric performance. The performance values in this section pertain to the performance of the source (system including ballast or driver) within a luminaire.

Source Type	ENERGY STAR Requirements		Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
	Source Efficacy (initial)	Source Minimum Light Output (initial)		
Fluorescent <ul style="list-style-type: none"> compact circline 	<p>≥ 65 lm/W per lamp-ballast platform</p> <p>All lamp and ballast permutations (makes and models) employed in a given luminaire model shall meet this requirement.</p>	<p>Lamp-ballast platform shall provide a minimum of 800 lumens.</p> <p><u>Exception:</u> Outdoor porch, bath vanity luminaires and ceiling fan light kits featuring ≥ 3 heads shall provide a minimum of 450 lumens per head.</p> <p>Chandeliers, decorative pendants, wall sconces, and other multi-head indoor luminaires shall provide a minimum of 250 lumens per head.</p>	<p>Methods of Measurement: IES LM-9-09 (circline)</p> <p>IES LM-66-11 (compact non-self-ballasted)</p>	<p>Laboratory test results shall be produced using the specific models of lamp and ballast that will be used in production.</p> <p>Luminaires with ballast(s) capable of operating multiple fluorescent lamp types shall be tested either with the lamp model shipped with the luminaire, or if a lamp is not supplied, with the highest power lamp type detailed on the packaging.</p> <p>Sample Size: 1 sample of each lamp-ballast model combination. Passing Test: Sample shall pass.</p>
Solid State: <ul style="list-style-type: none"> LED Light engine 	<p>Replaceable LED light engine ("source") efficacy shall meet or exceed the values detailed below, as determined by comparing the <i>in situ</i> (installed in the luminaire) T_b value to the source's LM-82 test report.</p> <p>≥ 65 lm/W per source light engines that include secondary optics.</p> <p>≥ 90 lm/W per source for light engines that do not include secondary optics.</p>	<p>Installed in the luminaire, each LED light engine <i>in situ</i> shall provide a minimum of 800 lumens.</p> <p><u>Exceptions:</u> Ceiling fan light kits, outdoor porch, and bath vanity luminaires featuring ≥ 3 heads shall provide a minimum of 450 lumens per head.</p> <p>Chandeliers, decorative pendants, wall sconces, and other multi-head indoor luminaires shall provide a minimum of 250 lumens per head.</p>	<p>Methods of Measurement:</p> <p>IES LM-82-12</p> <p><i>In situ</i> temperature measurement: ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598:2008 (Sections 19.7, 19.10-16)</p>	<p>Laboratory test results shall be produced using the specific models of LED package, LED module or LED array and LED driver (i.e. LED light engine) that will be used in production.</p> <p><i>In situ</i> temperature measurement value shall be determined in accordance with ANSI/UL 153:2002 (Sections 124-128A), ANSI/UL 1574:2004 (Section 54), or ANSI/UL 1598:2008 (Sections 19.7, 19.10-16), as applicable. LM-82 test reports shall detail luminous efficacy, luminous flux, chromaticity coordinates, CCT, and CRI values at all tested temperatures. Linear interpolation shall be employed to determine LED light engine or module ("source") photometric performance at temperatures between the LM-82 reported temperatures higher and lower than the <i>in situ</i> temperature.</p> <p>Luminaires incorporating more than one source shall have all sources installed and operational during <i>in situ</i> temperature testing.</p> <p>Sample Size: 1 sample of each lamp-driver model combination. Passing Test: Sample, tested <i>in situ</i> (installed in luminaire), shall pass.</p>
Solid State: Surface-mounted retrofit for diffused wall sconces	<p>≥ 80 lm/W per source for retrofits that include secondary optics.</p> <p>≥ 100 lm/W per source for retrofits that do not include optical control components.</p>	<p>Retrofit kit shall provide 250 lumens</p> <p>80% between 0-90 degrees from center of the beam</p>	<p>Methods of Measurement:</p> <p>IES LM-79-08</p>	<p>Products in this category should be tested at the line voltage for which the product is rated. If the product is rated for multiple voltages, the product shall be tested at the most consumptive voltage.</p> <p>Sample Size: 1 sample of retrofit kit Passing Test: Sample shall pass.</p>
Solid State: Surface mounted retrofits for diffused ceiling mounted lights	<p>≥ 80 lm/W per source for retrofits that include secondary optics.</p> <p>≥ 100 lm/W per source for retrofits</p>	<p>Retrofit kit shall provide 800 lumens</p> <p>80% between 0-90 degrees from center of the beam</p>	<p>Methods of Measurement:</p> <p>IES LM-79-08</p>	<p>Products in this category should be tested at the line voltage for which the product is rated. If the product is rated for multiple voltages, the product shall be tested at the most consumptive voltage.</p> <p>Sample Size: 1 sample of retrofit kit Passing Test: Sample shall pass.</p>

Source Type	ENERGY STAR Requirements		Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
	Source Efficacy (initial)	Source Minimum Light Output (initial)		
	that do not include secondary optics.			
Future tiers	TBD lm/W or %	TBD	TBD	TBD

Note box 10: Per the Luminaires V2.0 Discussion document, EPA has expanded the definition for LED light engines and included in this draft the applicability of light engines without optics, and introduced an efficacy level appropriate for those products.

The efficacy exception for dimmable and covered CFL lamps has been removed, as all fluorescent sources are treated the same for the Luminaires Specification and the reference is no longer relevant.

The Agency has proposed an additional efficacy level in consideration for LED light engines and surface mounted retrofit kits that rely on the luminaire for optical control and do not include secondary optics (such as diffusers). This level is set higher as secondary optics can reduce overall output by 20% or more, and today's certified lamps (with secondary optics) can achieve this level of performance.

EPA has proposed a reduced sample size for fluorescent luminaires from three or more lamp ballast combinations to one with a 100% passing requirement to reduce testing burden to manufacturers and make the requirement consistent with SSL luminaires.

Specific future efficacy tiers have not been proposed in draft one. EPA invites stakeholders to provide input on future levels and whether they should be expressed as simple lumen per watt levels or a set percentage increase in efficacy for a given year.

9.2 Luminous Efficacy, Output and Zonal Lumen Density: DIRECTIONAL Luminaires

Note: Luminaire types classified as directional on the second page of this specification shall be evaluated based on luminaire photometry. The performance values in this section pertain to the performance of the entire luminaire, including optical losses.

Luminaire Type	ENERGY STAR Requirements			Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
	Luminaire Efficacy (initial)	Luminaire Minimum Light Output (initial)	Luminaire Zonal Lumen Density Requirement		
Cove Mount	55 lm/W	Luminaire shall deliver a minimum of 200 lumens per lineal foot. The minimum required light output (in lumens) is calculated by dividing the measured luminaire length in inches by 12, then multiplying the result by 200.	Asymmetrically, luminaire shall deliver a minimum of 35% of total lumens within the zone 30° to 60° from the zenith.	Methods of Measurement: IES LM-41-13 (fluorescent; renewal anticipated in 2013) IES LM-79-08 (solid state)	Laboratory test results shall be produced using the specific models of lamp and ballast or LED package, LED module or LED array and LED driver that will be used in production. Fluorescent luminaires with ballast(s) capable of operating multiple fluorescent lamp types shall be tested either with the lamp model shipped with the luminaire. The equation for minimum light output divided by the length of the luminaire 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.
Downlights: • recessed • surface • pendant	60 lm/W	≤ 4.5" aperture: 345 lumens > 4.5" aperture: 575 lumens	Luminaire shall deliver a minimum of 75% of total initial lumens within the 0-60° zone (axially symmetric about the nadir)		For downlights, one trim ring and one reflector may be used with the three luminaire samples. Sample Size: 1 complete luminaire. Passing Test: the luminaire shall pass.
SSL downlight retrofits:	70 lm/W				
Accent Lights • includes track light luminaires	60 lm/W	Luminaire shall deliver a minimum of 200 lumens per head.	Luminaire shall deliver a minimum of 80% of total initial lumens within the 0-40° zone		

Luminaire Type	ENERGY STAR Requirements			Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
	Luminaire Efficacy (initial)	Luminaire Minimum Light Output (initial)	Luminaire Zonal Lumen Density Requirement		
<ul style="list-style-type: none"> includes line voltage track heads includes directional ceiling fan light kits 			(axially symmetric about the center of the beam).		
Under Cabinet	60 lm/W	<p>Luminaire shall deliver a minimum of 125 lumens per lineal foot.</p> <p>The minimum required light output (in lumens) is calculated by dividing the measured luminaire length in inches by 12, then multiplying the result by 125.</p>	<p>Referring to the plane perpendicular to the length of the luminaire, the luminaire shall deliver a minimum of 60% of total initial lumens within the 0-60° zone (symmetric about the nadir) and a minimum of 12.5% of total initial lumens within the 60-90° zone aimed toward the backsplash.</p> <p>Partner shall provide instructions with the luminaire noting which direction to install the luminaire to ensure this performance.</p>		
Outdoor, Wall-, Porch-, Pendant-, Post- Mounted and Security Luminaires (Note: for post mounting between 4 feet and 10.5 feet above grade)	60 lm/W	Luminaire shall deliver a minimum of 300 lumens.	<p>Luminaire shall deliver 95% of total lumens within the 0°- 85° zone (symmetric about the nadir). Luminaire shall not emit more than 0.5% of the overall light output above 90°.</p>	<p>Methods of Measurement: IES LM-10-13 (fluorescent; renewal anticipated in 2013)</p> <p>IES LM-79-08 (solid state)</p>	
Portable Desk Task	50 lm/W	Luminaire shall deliver a minimum of 200 lumens.	Luminaire shall deliver a minimum of 60% of total lumens (initial) within the 0-75° zone (symmetric about the center of the beam).		
Inseparable SSL Luminaire (applies to SSL luminaire types not otherwise noted in this table)	70 lm/W	None.	None.	Method of Measurement: IES LM-79-08	
Future tiers	TBD Lm/W or %	TBD	TBD	TBD	TBD

Note box 11: The Agency has proposed efficacy increases for most directional luminaires, based on analysis of currently certified products and U.S. DOE projections for efficacy increases by 2015 in LED technology. There are a range of products performing to these levels today, and by 2016, when this specification will be effective, significant improvements in source efficacy are expected. EPA has considered the impact of efficacy on high color rendering (CRI 90 and above) products. There are a range of high CRI products currently certified that meet or exceed the proposed efficacy requirements.

For each of the respective categories, an analysis of certified Luminaires shows that the following proportion of products currently meet the proposed efficacy levels:

- Cove Lights – 64%
- Downlights – 29%
- Downlight Retrofits – 35%
- Accent Lights – 30%
- Undercabinet – 52%
- Outdoor, Wall-, Porch-, Pendant-, and Post-Mounted Luminaires – 59%
- Portable Desk Task – 66%

In some of the directional luminaires categories, most notably downlights, the scenarios tested and reported to EPA utilize the least efficient representative models thereby skewing the number of certified model passing the proposed levels. To this point, roughly 58% of downlights found on LED Lighting Facts meet or exceed the 60 lm/W requirement. Comments were received for select fixture types that some desirable light distribution characteristics would cause a reduction in efficacy, such as smoothed lighting for undercabinet linear forms and light source offset (recessing) for downlights for glare reduction. EPA requests data on the impact of these design characteristics on fixture efficacy.

EPA received a variety of feedback on proposed updates to zonal lumen density requirements. Some stakeholders suggested eliminating the requirements altogether, while others suggested allowing and designating alternate requirements to allow for different designs. EPA has maintained the existing zonal lumen density requirements, and is seeking specific proposals for alternate zonal lumen density requirements for each of the directional categories listed above.

EPA received feedback that zonal lumen density requirements for portable desk task lights may not be appropriate, and is proposing to reduce the lumens from 85% to 60% and widen the zone from 0-60 degrees to 0-75 degrees. EPA seeks additional input on this adjustment.

EPA seeks input on whether the existing categories for downlights sufficiently cover desired light outputs, or if additional granularity in aperture and corresponding light output would be beneficial.

The zonal lumen density requirements for outdoor directional luminaires have been updated to allow a very small amount of uplight. This is a result of participating in discussions with the Illumination Engineering Society’s Testing Procedures Committee and the National Institute of Standards and Technology, where despite laboratories taking actions to minimize stray light, it is possible to measure a small fraction of uplight in a fixture that does not emit light in the upward direction as a result of reflections off of measurement equipment. EPA believes this solution will serve the purpose of ensuring fixtures are not designed to allow uplight and continue to be Dark Sky friendly, while acknowledging measurement limitations.

9.3 Correlated Color Temperature (CCT): All Indoor Luminaires (Exemption: Outdoor Luminaires)

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> • compact • circline 	Lamps shipped with luminaires shall have one of the following nominal correlated color temperatures (CCT): <ul style="list-style-type: none"> • 2700 Kelvin • 3000 Kelvin • 3500 Kelvin • 4000 / 4100 Kelvin • 5000 Kelvin Lamps shipped with luminaire shall consistently meet the above requirement, as verified by consistency data provided by the lamp vendor to the luminaire manufacturing partner.	Methods of Measurement: IES LM-9-09 (circline) IES LM-66-11 (compact non-self-ballasted) Calculation: CIE 15.2004 Reference Document: ANSI C78.376-2001	Laboratory test results shall be produced using the specific lamp model that will operate in the luminaire and either the ballast model that will operate in the luminaire or a commercially-available ballast model that meets the applicable ANSI ballast requirements, if applicable, for the light source being tested. Sample Size: ≥ 3 samples of each lamp model shall be tested. Passing Test: 100% of the lamps tested shall fall within a 7-step MacAdam ellipse for the designated CCT, with ellipses constructed using the Objective Chromaticities detailed in Table 1 of ANSI C78.376-2001, and the referenced MacAdam publication.

<p>Solid State</p>	<p>The luminaire (directional luminaires), or replaceable LED light engine or module (non-directional luminaires) shall be capable of providing at least one of the following nominal correlated color temperatures (CCTs):</p> <ul style="list-style-type: none"> • 2700 Kelvin • 3000 Kelvin • 3500 Kelvin • 4000 Kelvin • 5000 Kelvin <p>The luminaire, LED light engine shall also fall within the corresponding 7-step chromaticity quadrangles as defined in ANSI/NEMA/ANSI C78.377-2008.</p>	<p>Methods of Measurement: IES LM-79-08 (directional) IES LM-82-12</p> <p>Calculation: CIE 15.2004</p> <p>Reference Document: ANSI/NEMA/ANSI C78.377-2008</p>	<p>For downlights, one trim ring and one reflector may be used with the three luminaire samples.</p> <p>Non-directional: LED light engine or module (“source”) CCT shall meet the requirement as determined by comparing the <i>in situ</i> (installed in the luminaire) T_b value to the LM-82 test report. <i>In situ</i> temperature measurement value shall be determined in accordance with ANSI/UL 153:2002 (Sections 124-128A), ANSI/UL 1574:2004 (Section 54), or ANSI/UL 1598:2008 (Sections 19.7, 19.10-16), as applicable. LM-82 test reports shall detail luminous efficacy, luminous flux, chromaticity coordinates, CCT and CRI values for all tested temperatures. Linear interpolation shall be employed to determine source photometric performance at temperatures between the LM-82 reported temperatures higher and lower than the <i>in situ</i> temperature. Luminaires incorporating more than one source shall have all sources installed and operational during <i>in situ</i> temperature testing.</p> <p>Sample Size: 1 complete luminaire (directional), or 3 sources and 1 luminaire (non-directional).</p> <p>Passing Test: the luminaire (directional), or all three sources (when installed in the luminaire, non-directional) shall pass.</p>
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Note box 12: EPA is proposing a reduced sample size for CCT and a 100% passing requirement for fluorescent to be consistent with SSL and reduce testing burden to manufacturers. Some language has been modified to accommodate color tunable luminaires.

9.4 Color Rendering Index: All Indoor Luminaires (Exemption: Outdoor Luminaires)

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> • compact • circline 	Lamps shipped with luminaires shall meet or exceed $R_a \geq 80$ and $R_9 \geq 0$.	Methods of Measurement: IES LM-9-09 (linear & circline) IES LM-66-11 (compact & self-ballasted compact) CIE 13.3-1995	Laboratory test results shall be produced using the specific lamp model that will operate in the luminaire and either the ballast model that will operate in the luminaire or a commercially-available ballast model that meets the applicable ANSI ballast requirements, if applicable, for the light source being tested. Sample Size: ≥ 3 samples of each lamp model shall be tested. Passing Test: 100% of the samples shall achieve the required color rendering index value.
Solid State	The luminaire (directional luminaires), or replaceable LED light engine (non-directional luminaires) shall be capable of meeting or exceeding $R_a \geq 80$ and $R_9 > 0$.	Methods of Measurement: IES LM-79-08 (directional) IES LM-82-12 Reference Document: <i>In situ</i> temperature measurements (non-directional): ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598:2008 (Sections 19.7, 19.10-16) CIE 13.3-1995	For downlights, one trim ring and one reflector may be used with the three luminaire samples. Non-directional: LED light engine ("source") CRI shall meet the requirement as determined by comparing the <i>in situ</i> (installed in the luminaire) T_b value to the LM-82 test report. <i>In situ</i> temperature measurement value shall be determined in accordance with ANSI/UL 153:2002 (Sections 124-128A), ANSI/UL 1574:2004 (Section 54), or ANSI/UL 1598:2008 (Sections 19.7, 19.10-16), as applicable. LM-82 test reports shall detail luminous efficacy, luminous flux, chromaticity coordinates, CCT and CRI values for all tested temperatures. Linear interpolation shall be employed to determine source photometric performance at temperatures between the LM-82 reported temperatures higher and lower than the <i>in situ</i> temperature. Luminaires incorporating more than one source shall have all sources installed and operational during <i>in situ</i> temperature testing. Sample Size: 1 complete luminaire (directional), or 3 sources and 1 luminaire (non-directional). Passing Test: the luminaire (directional), or all 3 sources (when installed in the luminaire, non-directional) shall pass.

Note box 13: EPA is proposing a reduced sample size for CCT and a 100% passing requirement for fluorescent to be consistent with SSL and reduce testing burden to manufacturers and adjusted language to account for color tunable luminaires. EPA is proposing adding a requirement for deep red rendering, $R_9 > 0$, to be consistent with the Lamps specification and to support other standards efforts.

9.5 Color Angular Uniformity: Directional Solid State Indoor Luminaires Only (Exemption: Outdoor Luminaires)

ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Throughout the zonal lumen density angles, the variation of chromaticity shall be within 0.006 from the weighted average point on the CIE 1976 (u',v') diagram.	Methods of Measurement: IES LM-79-08 IES LM-58-13 CIE 15: 2004	Vertical angular scanning resolution shall be 1 degree on the 0 and 90 degree vertical planes, and $\Delta u',v'$ distance shall be reported for each vertical angle measured. Sample Size: 1 complete luminaire. Downlights that utilize interchangeable trims may be tested without a trim to demonstrate compliance with the color angular uniformity requirement. This applies to the color angular uniformity requirement only and does not extend to other photometric requirements. Passing Test: the luminaire shall pass.

Note box 14: As proposed in the discussion document and widely supported by stakeholder commentary, EPA adjusted Color Angular Uniformity requirements to be consistent with the Lamps specification and modified the area of interest to only the angles included in the zonal lumen density requirements.

10 LUMEN MAINTENANCE AND RATED LIFE REQUIREMENTS

10.1 Lumen Maintenance: All Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent Option 1 <ul style="list-style-type: none"> compact circline 	For lamps indicated on the luminaire packaging or shipped with the luminaire, the lamp shall have an average rated lumen maintenance of at least 80% of initial lamp lumens at 40% rated lamp life.	Methods of Measurement: Circline: IES LM-40-10 IES LM-09-09 Compact non self-ballasted: IES LM-65-10 IES LM-66-11	Laboratory test results shall be produced using the specific lamp model that will operate in the luminaire and either the ballast model that will operate in the luminaire or a commercially-available ballast model that meets the applicable ANSI ballast requirements, if applicable, for the light source being tested. Sample Size: ≥ 3 samples of each lamp model shall be tested. Passing Test: ≥ 100% of the samples shall achieve the required lumen maintenance value.
Solid State Option 1: LED Package, Module or Array (select either option 1, 2 or 3, below)	The LED package(s) / module(s) / array(s), including those incorporated into LED light engines, shall meet the following L ₇₀ (6k) rated lumen maintenance life values, <i>in situ</i> : <ul style="list-style-type: none"> L₇₀(6k) ≥ 25,000 hours for indoor L₇₀(6k) ≥ 35,000 hours for outdoor L₇₀(6k) ≥ 50,000 hours for inseparable luminaires 	Method of Measurement: Option 1: Lumen Maintenance: IES LM-80-08 Lumen Maintenance Projection Method: IES TM-21-11 Option 2: Lumen Maintenance: IES LM-84-14 Lumen Maintenance Projection Method: IES TM-28-14 CCT Calculation: CIE 15.2004 ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598:2008 (Sections 19.7, 19.10-16) Reference Documents: Chromaticity Specifications: ANSI/NEMA/ANSLG C78.377-2008	Luminaire Sample Size: 1 complete luminaire. LM-80 Sample Size: minimum sample size of 20 units for LED packages, or 10 units for LED arrays or LED modules, for each T _S and drive current combination (refer to IES TM-21-11, section 4.2). Each sample set may be composed entirely of one nominal CCT, or may be split between no more than two adjacent nominal CCT values as outlined in ANSI C78.377 (e.g. 2700 and 3000K, or 3000K and 3500K). Passing Test: all of the conditions below shall be met. If any of the conditions are not met, the component performance option may not be used and the applicant shall use Option 2, below, for compliance. <ol style="list-style-type: none"> In the sample luminaire, the <i>in situ</i> T_{MLED} temperature is less than or equal to the temperature specified in the LM-80 test report for the corresponding or higher drive current, within the manufacturer's specified operating current range. 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. The TM-21 lumen maintenance life projection report projects an L₇₀ meeting or exceeding requirements. For color tunable luminaires, the TM-21-11 projection for all LED colors used shall meet the requirement. Compliance with the above shall be documented with a TM-21 lumen maintenance life projection report as detailed in TM-21, section 7. The report shall be generated using data from the LM-80 test report for the employed LED package/module/array model ("device"), the forward drive current applied to each device, and the <i>in situ</i> T _{MLED} temperature of the hottest device in the luminaire. In addition to LM-80 reporting requirements, the following information shall be reported: <ul style="list-style-type: none"> sampling method and sample size (per LM-80 section 4.3) test results for each T_S and drive current combination description of device including model number and whether device is an LED package, module or array (see Definitions) ANSI target, and calculated CCT value(s) for each device in sample set Δ u'v' chromaticity shift value on the CIE 1976 diagram for each device in sample set a detailed rationale, with supporting data, for application of results to other devices (e.g. LED packages with other CCTs)

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
			<p>Access to the TMP_{LED} for the hottest LED may be accomplished via a minimally sized hole in the luminaire housing, tightly resealed with a suitable sealant if created for purposes of testing.</p> <p>All thermocouple attachments and intrusions to luminaire housing shall be photographed.</p> <p>Important additional guidance regarding LM-80 test reports, their application, and provisions for successor subcomponents are detailed in ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products.</p>
<p>Solid State Option 2: Luminaire or LED Light Engine</p> <p>(select either option 1, 2 or 3, below)</p>	<p>The LED luminaires, including those incorporated into LED light engines, shall meet the following L₇₀ rated lumen maintenance life values, <i>in situ</i>.</p> <ul style="list-style-type: none"> • L₇₀(6k) ≥ 25,000 hours for indoor • L₇₀(6k) ≥ 35,000 hours for outdoor • L₇₀(6k) ≥ 50,000 hours for inseparable luminaires 	<p>Methods of Measurement :</p> <p>Directional luminaires: Lumen Maintenance: IES LM-84-14</p> <p>Lumen Maintenance Projection Method: IES TM-28-14 – Projection Method 1, Direct Extrapolation</p>	<p>For downlights, one trim ring and one reflector may be used with the 3 luminaire samples.</p> <p>For color tunable luminaires, test at the highest power consumption setting that is the least efficacious.</p> <p>Directional: luminaire shall be operated continuously in accordance with ANSI/UL 1598-2008, ANSI/UL 1574-2004 or ANSI/UL 153-2002 during the interim 3,000 hours; any deviations from this shall be reported.</p> <p>Non-directional: LED light engines (“source”) shall be operated continuously <i>in situ</i> (installed in the luminaire), with the luminaire operating in accordance with ANSI/UL 153-2002, ANSI/UL 1574-2004 or ANSI/UL 1598-2008 during the interim 6,000 hours. Luminaires incorporating more than one source shall have all sources installed and operational during the interim 6,000 hours. During initial and final measurements, T_b temperature shall be controlled to match T_b temperature measured when source is operated <i>in situ</i>.</p> <p>Test reports shall detail efficacy, luminous flux, chromaticity coordinates, CCT and CRI values at all tested temperatures.</p> <p>Sample Size: Directional: 3 or more complete luminaires.</p> <p>Non-directional: 3 or more sources and the necessary number of luminaires required to operate the sources continuously <i>in situ</i>.</p> <p>Passing Test: all luminaires or sources shall pass.</p>

Note box 15: EPA has proposed raising the minimum rated lifetime and lumen maintenance requirements for inseparable SSL luminaires to 50,000 hours which reflects trends already present in certified inseparable SSL luminaires and supports longer lasting luminaires that do not have serviceable parts.

In this draft EPA has proposed a reduced sample size and a 100% passing requirement for fluorescent lumen maintenance to be consistent with SSL and to reduce testing burden. IES LM-84 and TM-28 have been added as an option for lumen maintenance testing and projection of SSL luminaires in place of the previous specification’s option 2. Testing requirements for lumen maintenance testing of color tunable luminaires have also been added for clarity.

10.2 Light Source Life: All Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
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Fluorescent <ul style="list-style-type: none"> • compact • circline 	<p>≥ 10,000 hours for luminaires shipping with other fluorescent lamps</p> <p>Conditional certification may be granted if both of the following are met:</p> <ol style="list-style-type: none"> 1. Testing has been completed for at least 40% of rated life. 2. A date for testing completion has been established by the test laboratory. <p>Conditional certification shall be immediately withdrawn if final testing results do not meet the above requirement.</p>	<p>Methods of Measurement: IES LM-40-10 (circline)</p> <p>IES LM-65-10 (compact non self-ballasted)</p>	<p>Laboratory test results shall be produced using the specific lamp model that will operate in the luminaire and either the ballast model that will operate in the luminaire or a commercially-available ballast model that meets the applicable ANSI ballast requirements, if applicable, for the light source being tested.</p> <p>Sample Size: ≥ 3 samples of each lamp model shall be tested.</p> <p>Passing Test: ≥ 50% of the sample set shall be functioning at the lifetime requirement.</p>
Solid State	<p>The LED package(s) / LED module(s) / LED array(s), including those incorporated into LED light engines, shall meet the following L₇₀ lumen maintenance life values (refer to Lumen Maintenance Requirements in the next section):</p> <ul style="list-style-type: none"> • ≥ 25,000 hours for indoor luminaires • ≥ 35,000 hours for outdoor luminaires • ≥ 50,000 hours for inseparable luminaires <p>Lumen maintenance life projection claims in excess of the above requirements shall be substantiated with a TM-21 or TM-28 lumen maintenance life projection report.</p>		

Note box 16: As noted above, EPA has proposed higher minimum rated lifetime and lumen maintenance requirements for inseparable SSL luminaires which reflects trends already present in certified inseparable SSL luminaires and supports longer lasting luminaires that do not have serviceable parts.

10.3 Color Maintenance: Solid State Indoor Luminaires Only (Exemption: Outdoor Luminaires)

ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
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<p>The change of chromaticity over the first 6,000 hours of luminaire operation shall be ≤ 0.007 on the CIE 1976 (u', v') diagram, as demonstrated by either:</p> <ul style="list-style-type: none"> the IES LM-80 test report for the employed LED package/array/module model, or as demonstrated by a comparison of luminaire chromaticity data in LM-79 reports at zero and 6,000 hours, or as demonstrated by a comparison of LED light engine chromaticity data in LM-82 reports at zero and 6,000 hours 	<p>Methods of Measurement: IES LM-80-08</p> <p>IES LM-79-08</p> <p>IES LM-82-12</p> <p>IES LM-84-14</p> <p>Reference Document: Interim operation: ANSI/UL 153-2002 ANSI/UL 1574-2004 ANSI/UL 1598-2008</p>	<p>Laboratory test results shall be produced using the specific models of lamp and ballast or LED package, LED module or LED array and LED driver that will be used in production.</p> <p>For the LM-79 option, luminaire shall be operated continuously in accordance with ANSI/UL 1598-2008, ANSI/UL 1574-2004 or ANSI/UL 153-2002 during the interim 6,000 hours; any deviations from this shall be reported.</p> <p>For the LM-82 option, LED light engines ("source") shall be operated continuously <i>in situ</i> (installed in the luminaire) in accordance with ANSI/UL 153-2002, ANSI/UL 1574-2004 or ANSI/UL 1598-2008 during the interim 6,000 hours. During initial and final LM-82 measurements, T_b value shall be controlled to match T_b value measured when source is operated <i>in situ</i>. Luminaires incorporating more than one source shall have all sources installed and operational during <i>in situ</i> temperature testing and during the interim 6,000 hours.</p> <p>LM-82 test reports shall detail luminous efficacy, luminous flux, chromaticity coordinates, CCT and CRI values for all tested temperatures.</p> <p>Sample Size (LM-80 option): same as Lumen Maintenance, Option 1.</p> <p>Sample Size (LM-84 option): same as Lumen Maintenance, Option 2</p> <p>Passing Test (LM-80 option): for all LM-80 samples, at any measurement point from zero through 6,000 hours, the distance of the chromaticity coordinates from the initial (zero-hour) chromaticity coordinates shall not exceed 0.007 at the temperature(s) adjacent to the measured <i>in situ</i> TMP_{LED} temperature, and at the corresponding drive current.</p> <p>Example 1: an LM-80 test report provides data at $T_s = 55^\circ C, 85^\circ C$ and $105^\circ C$, and the measured <i>in situ</i> TMP_{LED} temperature value is $89^\circ C$. Neither the $85^\circ C$ nor the $105^\circ C$ LM-80 data may show chromaticity shift exceeding 0.007 at any measurement point from zero through 6,000 hours, for the corresponding drive current. The LM-80 chromaticity data at $55^\circ C$ is disregarded.</p> <p>Example 2: an LM-80 test report provides data at $T_s = 58^\circ C, 87^\circ C$ and $106^\circ C$, and the measured <i>in situ</i> TMP_{LED} temperature value is $53^\circ C$. The LM-80 data at $58^\circ C$ may not show chromaticity shift exceeding 0.007 at any measurement point from zero through 6,000 hours, for the corresponding drive current. The LM-80 chromaticity data at $87^\circ C$ and $106^\circ C$ is disregarded.</p> <p>Passing Test (LM-84 option): at 6,000 hours the distance of the chromaticity coordinates from the initial chromaticity coordinates shall not exceed 0.007. The output at zero degrees on both vertical planes shall be compared.</p>
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Note box 17: The test methods referenced have been updated to include IES LM-84.

11 ELECTRICAL PERFORMANCE REQUIREMENTS

11.1 Source Start Time: All Luminaires (Exemption: Outdoor Luminaires)

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> compact circline 	Light source shall remain continuously illuminated within 0.5 seconds of application of electrical power.	Method of Measurement: ENERGY STAR Start time Test Method	Laboratory test results shall be produced using the specific models of lamp and ballast or LED package, LED module or LED array and LED driver that will be used in production.
Solid State			Reference Documents: ANSI C82.11 Consolidated-2002 Section-5.2

Note box 18: Based on stakeholder feedback voicing the importance of a quick start time to consumers and the longer start times of luminaires that cannot achieve certification, EPA has decided to maintain the start time requirement. In an effort to reduce test burden and improve consistency, EPA is proposing reducing the required sample size from three samples to one sample, and referencing the Start Time Test Method from the ENERGY STAR Lamps specification since no method was previously referenced. Additionally, EPA seeks comment on reducing start time requirement to 0.5 seconds, as the majority of certified products today perform at this level and shorter start times are preferable to end users.

11.2 Source Run-Up Time: All Fluorescent Luminaires (Exemption: Solid State and Outdoor Luminaires)

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> • compact • circline 	Reported value of time for lamps to reach 80% of stabilized lumen output after application of electrical power shall be: <ul style="list-style-type: none"> • ≤ 60 seconds for bare lamps • ≤ 120 seconds for covered lamps 	Method of Measurement: ENERGY STAR Run Up Time Test Method	Laboratory test results shall be produced using the specific models of lamp and ballast or LED package, LED module or LED array and LED driver that will be used in production. Sample Size: 1 sample of each lamp-ballast model combination. Passing Test: Sample shall pass.

Notebox 19: In an effort to streamline the test and improve consistency, EPA has proposed aligning run-up time requirements with those in the ENERGY STAR lamps specification including referencing the Run-Up Time Test Method from the ENERGY STAR Lamps specification. In addition EPA proposes reducing the required sample size from three samples to one sample for luminaires not shipping with ENERGY STAR certified lamps.

11.3 Power Factor: All Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> • compact • circline 	Total luminaire input power less than or equal to 5 watts: PF ≥ 0.5 Total luminaire input power greater than 5 watts: Residential: PF ≥ 0.5	Method of Measurement: ANSI C82.2-2002	Laboratory test results shall be produced using the specific models of lamp and ballast or LED package, LED module or LED array and LED driver that will be used in production. Sample Size: ≥ 1 samples of each model combination shall be tested. Passing Test: all samples shall pass.
Solid State	Total luminaire input power less than or equal to 5 watts: PF ≥ 0.5 Total luminaire input power greater than 5 watts: Residential: PF ≥ 0.7	Method of Measurement: ANSI C82.77-2002 sections 6 and 7	

11.4 Transient Protection: All Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> • compact • circline 	Ballast or driver shall comply with ANSI/IEEE C62.41.1-2002 and ANSI/IEEE C62.41.2-2002, Category A operation. The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode.	Method of Measurement: None referenced	Laboratory test results shall be produced using the specific models of ballast, LED package, LED module or LED array and LED driver combination that will be used in production. Sample Size: ≥ 1 samples of each ballast model, LED package, LED module or LED array and LED driver model combination, or LED light engine shall be tested. Passing Test: all samples shall pass. Unit power may be cycled as necessary to determine if UUT is still operational.
Solid State		Reference Documents: ANSI/IEEE C62.41.1-2002 ANSI/IEEE C62.41.2-2002 Category A Location.	

Notebox 20: To reduce testing burden, EPA has reduced the sample size from three to one luminaires or light source combination.

11.5 Standby Power Consumption: All Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
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<p>All Source Types</p>	<p>Luminaires incorporating an integral method of switching shall not draw power in the off state.</p> <p><u>Exception:</u> Luminaires with integral motion sensors, photosensors, or connected functionality shall consume no more than 0.5 watt 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> External power supplies (EPS) employed to power luminaires shall meet the level V or higher performance requirements under the International Efficiency Marking Protocol and include the level V or higher marking on the EPS.</p> <p>Additional information on the Marking Protocol is available at http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0005-0218</p>	<p>Method of Measurement: U.S. Department of Energy Test Procedures for Integrated Light-Emitting Diode Lamps</p> <p>Federal Register, 79 FR 32019</p>	<p>Laboratory test results shall detail off-state power consumption to the tenth of a watt.</p> <p>To be recognized as connected, a “connected luminaire, or retrofit” shall include the base luminaire or retrofit plus all elements (hardware, software) required to enable communication in response to consumer-authorized energy related commands (not including third-party remote management which may be made available solely at the discretion of the manufacturer). These elements may be resident inside or outside of the base luminaire. This capability shall be supported through one or more means, as identified in Section 15.2.</p>
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Notebox 21: EPA has updated the off-state power requirements to be consistent with market trends and DOE rulemaking by referring to it as “standby power” and proposing to lower the standby allowance from 1 watt to half a watt. The DOE test method for standby power has been added where no method was referenced previously. A simplified reference for connected functionality has been included to replace the old reference to “individually addressable luminaires with external control and intelligence”.

The requirement has been updated to allow level V or higher (allowing level VI supplies), and updated the link to the EPS Marking Protocol has been added.

The requirement for Lamp Current Crest Factor has been removed based on stakeholder feedback from the discussion document.

11.6 Operating Frequency: All Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
<p>Fluorescent</p> <ul style="list-style-type: none"> • compact • circline 	<p>20 to 33 kHz or ≥ 40 kHz</p>	<p>Method of Measurement: ANSI C82.2-2002</p>	<p>Laboratory test results shall be produced using the specific ballast model that will operate in the luminaire.</p> <p>Sample Size: 1 samples of each ballast model shall be tested.</p> <p>Passing Test: Sample shall pass.</p>
<p>Solid State</p>	<p>Frequency ≥ 120 Hz</p> <p>Note: This performance characteristic addresses problems with visible flicker due to low frequency operation and applies to steady-state as well as dimmed operation. Dimming operation shall meet the requirement at all light output levels.</p>	<p>Method of Measurement: None referenced</p>	<p>Laboratory test results shall be produced using the specific luminaire, or LED light engine used in the luminaire. Light output waveform shall be measured with a photodetector, transimpedance amplifier and oscilloscope. Employed equipment models and method of measurement shall be documented. Temporal response, amplification and filtering characteristics of the system shall be suitably designed to capture the photometric waveform. Digitized photometric waveform data and an image of the relative photometric amplitude waveform shall be recorded.</p> <p>Sample Size: 1 luminaire, LED light engine, or retrofit kit shall be tested.</p>

Notebox 22: To reduce testing burden, EPA has proposed reducing the sample size from three or more to one. The noise requirement for non-dimmable luminaires has been removed, but maintained for dimmable luminaires, see Dimming note box.

12 LUMINAIRE SERVICEABILITY REQUIREMENTS

12.1 Light Source Replaceability: Directional and Non-Directional Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents
Fluorescent <ul style="list-style-type: none"> linear compact circline 	The luminaire's lampholder(s) shall be designed to accept lamps with ANSI/IEC standardized lamp base configurations for each lamp input power for which the luminaire and packaging is labeled.	Reference Document: Lampholder configuration: ANSI/IEC C81.62-2009
Solid State: Non-Directional <ul style="list-style-type: none"> LED light engine 	<p>LED light engines shall make use of electrical interconnects that allow for consumer replacement of the engine without the cutting of wires or the use of solder. For the purpose of this specification, wire nuts are not an acceptable connection method.</p> <p>Luminaires that cannot meet this requirement are to be evaluated as inseparable SSL luminaires (see directional luminaire requirements below and throughout this specification).</p>	Reference Document: Recommendations outlined in NEMA LSD 45-2009 shall be followed.
Inseparable SSL Luminaires	Exempt.	

12.2 Ballast/Driver Replaceability: All Luminaires (Exemption: Inseparable SSL Luminaires)

Source Type	ENERGY STAR Requirements
Fluorescent <ul style="list-style-type: none"> compact circline 	<p>Ballasts or drivers shall 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.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> luminaires employing self-ballasted lamps line voltage directional track lights solid state cove mount luminaires under cabinet luminaires
Solid State: Directional	Instructions shall be provided with the luminaire, detailing guidance on ballast or driver replacement by a "qualified electrician".
Solid State: Non-Directional	See Source Replaceability Requirements.

Notebox 23: The lamp and ballast replaceability guidelines have been moved into a new section titled Serviceability. Since the intent of the replaceability requirement is to make the fixture is serviceable by the end user, EPA has clarified that wire nuts are not a consumer friendly method of connection.

13 THERMAL PERFORMANCE REQUIREMENTS

13.1 Maximum Measured Ballast or Driver Case Temperature: All Luminaires

This performance characteristic is separate and distinct from safety requirements and can be measured by an EPA recognized laboratory.

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> compact circline 	<p>Ballast case temperature measured at thermal equilibrium, at the hot spot location provided by the ballast manufacturer, shall not exceed the maximum recommended ballast case temperature, as provided by ballast manufacturer, during <i>in situ</i> (installed in the luminaire) operation.</p> <p><u>Exceptions:</u></p> <ul style="list-style-type: none"> Indoor portable luminaires using lamps, where the lamp is centered between a shade that is open on the top and bottom 	Reference Document: ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598:2008 (Sections 19.7, 19.10-16).	<p>Laboratory test results shall be produced using the specific lamp and ballast models that will be used in production.</p> <p>Laboratory test results shall be produced using the luminaire with the highest operating temperature among all luminaires in a product family being certified (as applicable).</p> <p>Sample Size: 1 luminaire shall be tested.</p> <p>Passing Test: Measured temperature at the hot spot location provided by the ballast manufacturer shall be less than or equal to the manufacturer recommended maximum.</p>

Solid State: Directional Non-Directional <ul style="list-style-type: none"> • replaceable LED light engine 	At the temperature measurement point for the hottest location on the driver case (TMP _C as detailed by the driver manufacturer), the measured driver case temperature at thermal equilibrium shall not exceed the driver manufacturer's maximum recommended temperature during <i>in situ</i> (installed in the luminaire) operation.	Reference Document: ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598:2008 (Sections 19.7, 19.10-16)	Laboratory test results shall be produced using the specific models of LED package, LED module or LED array and LED driver that will be used in production. Laboratory test results shall be produced using the luminaire with the highest operating temperature among all luminaires in a product family being certified (as applicable). Sample Size: 1 luminaire shall be tested, or 1 source sample shall be tested <i>in situ</i> (installed in the luminaire). Passing Test: Measured temperature at the TMP _C shall be less than or equal to the manufacturer recommended maximum.
Solid State: <ul style="list-style-type: none"> • retrofit kits (surface mounted and recessed) 	At the temperature measurement point for the hottest location on the driver case (TMP _d as detailed by the driver manufacturer), the measured driver case temperature at thermal equilibrium shall not exceed the driver manufacturer's maximum recommended temperature during <i>in situ</i> (installed in the luminaire) operation.	Reference Document: ANSI/UL 1598C	Laboratory test results shall be produced using the specific models of LED package, LED module or LED array and LED driver (i.e. LED light engine) ("source") that will be used in production. Luminaires incorporating more than one source shall have all sources installed during testing. Luminaire retrofit kit shall be tested in the worst case thermal condition for which it is rated. Sample Size: 1 sample shall be tested <i>in situ</i> per the included manufacturer provided installation instructions in a representative luminaire per UL1598C. Passing Test: Measured temperature at the TMP _d shall be less than or equal to the manufacturer recommended maximum.

Notebox 24: Thermal performance requirements for the new product categories of SSL surface mounted retrofit kits have been added. EPA has also proposed testing recessed downlight retrofit kits in the worst case thermal environment to ensure performance and longevity, over concerns that these products may be installed by untrained individuals that are unfamiliar with the rating of airtight and installed ceiling cans.

13.2 Recessed Downlight Thermal Performance

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
All Source Types	Insulation contact (Type IC): Recessed downlights marketed as Type IC shall be approved for zero clearance insulation cover by an OSHA NRTL laboratory, and shall also meet the requirements for airtight luminaires, listed below. Airtight construction: Recessed downlight housings or certified/listed accessories marketed as airtight shall exhibit leakage less than 2.0 cubic feet per minute (CFM) at 75 Pascals (or 1.57 lbs/ft ²) when tested in accordance with ASTM E283-04, and shall be sealed with a gasket or caulk.	Reference Documents: ANSI/UL 1598-2008 ASTM E283-04	See packaging section for packaging requirements related to IC and airtight products.

Notebox 25: This section has been simplified to clarify confusion with old language that was unclear on whether both IC and airtight ratings were required or only if marketed as such. All language regarding packaging has been moved to the packaging requirements section. The requirements for minimum operating temperature has been removed but the reporting requirement in the packaging section remains, which is consistent with the ENERGY STAR Lamps specification.

14 SAFETY REQUIREMENTS

14.1 Indoor Luminaire Safety: Portable Luminaires

Luminaire Type	Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Portable Luminaires	Fluorescent <ul style="list-style-type: none"> compact circline 	Demonstrate compliance with ANSI/UL 153-2002.	Reference Documents: ANSI/UL 153-2002	Documentation shall be produced by an OSHA NRTL laboratory . Connected products must continue to comply with the applicable product safety standards – the addition of the functionality described below shall not override existing safety protections and functions.
	Solid State	Demonstrate compliance with ANSI/UL 153-2002 and ANSI/UL 8750-2009.	Reference Documents: ANSI/UL 153-2002 and ANSI/UL 8750-2009	
Indoor & Outdoor Hardwired Luminaires	Fluorescent <ul style="list-style-type: none"> compact circline 	Demonstrate compliance with ANSI/UL 1574-2004, ANSI/UL 1598-2008, ANSI/UL 2108-2004, as applicable.	Reference Documents: ANSI/UL 1574-2004 ANSI/UL 1598-2008 ANSI/UL 2108-2004	
	Solid State	Demonstrate compliance with ANSI/UL 1574-2004, ANSI/UL 1598-2008, ANSI/UL 1598B-2010, ANSI/UL 2108-2004, ANSI/UL 8750-2009, as applicable.	Reference Documents: ANSI/UL 1574-2004 ANSI/UL 1598-2008 ANSI/UL 1598B-2010 ANSI/UL 2108-2004 ANSI/UL 8750-2009	
SSL Retrofit Kits		Demonstrate compliance with UL8750 – LED Component UL1598C – LED Retrofit	Reference Documents: UL8750 – LED Component UL1598C – LED Retrofit	

14.2 Electronic Ballast or Driver Safety: Ballasts, Drivers and “Non-Edison Base Fluorescent Adapters”

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> compact circline 	Demonstrate compliance with ANSI/UL 935-2009, ANSI/UL 1310-2010, ANSI/UL 1993-2009, as applicable. Demonstrate compliance with CSA 22.2 Number 74, or IEC 61374-2-3-am2 ed1.0 b.2006, as appropriate.	Reference Documents: ANSI/UL 935-2009 ANSI/UL 1310-2010 ANSI/UL 1993-2009 End of life (linear T5): CSA 22.2 Number 74, or IEC 61374-2-3-am2 ed1.0 b.2006	Documentation shall be produced by an OSHA NRTL laboratory . Connected products must continue to comply with the applicable product safety standards – the addition of the functionality described below shall not override existing safety protections and functions.
Solid State: Non-Directional <ul style="list-style-type: none"> replaceable LED light engine 	Demonstrate compliance with ANSI/UL 1310-2010, ANSI/UL 2108-2004, ANSI/UL 8750-2009, as applicable.	Reference Documents: ANSI/UL 1310-2010 ANSI/UL 2108-2004 ANSI/UL 8750-2009	
Solid State: Directional	Demonstrate compliance with ANSI/UL 1310-2010, ANSI/UL 2108-2004, ANSI/UL 8750-2009, as applicable.	Reference Documents: ANSI/UL 1310-2010 ANSI/UL 2108-2004 ANSI/UL 8750-2009	

Notebox 26: Safety sections have been condensed into one table and safety requirements for surface mounted SSL retrofits have been added to ensure proper safety certification for these products.

15 CONTROL REQUIREMENTS: Luminaires Employing any Control Mechanism

15.1 Dimming: All Luminaires Marketed as Dimmable (Exemption: Non-Dimmable Luminaires)

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent <ul style="list-style-type: none"> • compact • circline 	The luminaire and its components shall provide continuous dimming from 100% to 20% of total light output. Luminaire shall not emit noise above 24dBA at 1 meter or less.	Method of Measurement: None Referenced	Laboratory test results shall be produced using the specific lamp and ballast models that will be used in production. Sample Size: 1 sample of each lamp-ballast model combination shall be tested. Passing Test: the sample shall pass.
Solid State	The luminaire and its components shall provide continuous dimming from 100% to 20% of total light output. Luminaire shall not emit noise above 24dBA at 1 meter or less.		Laboratory test results shall be produced using the models of LED package, LED module or LED array and LED driver combination that will be used in production. Sample Size: 1 sample of each model combination or LED light engine shall be tested. Passing Test: the sample shall pass.

Notebox 27: EPA has adjusted the minimum required light output for dimming luminaires for luminaires from 35% to 20% to be consistent the ENERGY STAR Lamps specification. EPA received feedback from laboratories and certification bodies that noise was not typically a problem with luminaires that were not dimmable, but is an occasional problem with models designed with dimming capabilities. With the goal of streamlining the specification, EPA has proposed removing the noise requirement for non-dimmable luminaires, and only requiring testing for dimmable luminaires. EPA requests feedback regarding the test methodology for determining Luminaire dimming performance and noise while dimmed.

Specific guidelines for step dimming, have been removed consistent with efforts to streamline and simplify requirements, as the agency believes it is no longer necessary to be so prescriptive in this instance.

15.2 Products with Connected Functionality – Optional

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
All source types	Product must continue to comply with the applicable product safety standards – the addition of the functionality shall not override existing safety protections and functions. May not consume more than 0.5 watts when in standby mode.	Method of Measurement: None	Test Requirements: Connected products without color tuning capabilities shall be tested at full power for all applicable requirements. Connected products with color tuning capabilities shall be tested under the conditions specified under Section 5.1 . Compliance with connected functionality requirements shall be demonstrated through examination of product and/or product documentation.

15.2.1 Connected Product Criteria:

To be recognized as connected, a “connected luminaire” (or retrofit) shall include the base luminaire or retrofit plus all elements (hardware, software) required to enable communication in response to consumer-authorized energy related commands (not including third-party remote management which may be made available solely at the discretion of the manufacturer). These elements may be resident inside or outside of the base luminaire.

Connected luminaires typically communicate with controls via a radio frequency system, although some versions utilize other methods (such as DMX or DALI). The specific design and implementation of the connected luminaire is at the manufacturer’s discretion provided it is interoperable with other devices via open communications protocol and enables economical, consumer-authorized third party access to the functionalities provided for in sections 15.2.3 and 15.2.4.

15.2.2 Open-standards & Open-access

1. Communication that enables connected functionality, (sections 15.2.3-15.2.5). must use, for all communication layers, standards that are:
 - a. included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards³, and/or
 - b. included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or
 - c. adopted by the American National Standards Institute (ANSI) or another well-established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), or Internet Engineering Task Force (IETF).

³ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

2. The product shall enable connectivity by one of following means:
 - d. open-standards communications from the luminaire, or
 - e. open-standards communications from an external controller, included with the product or available separately.
3. To enable interconnection with the product; an interface specification, Application Programming Interface (API) or similar documentation shall be made available to interested parties that enables section 15.2.3, 15.2.4 and 15.2.5 connected functionality, and includes accuracy, units and measurement interval for Energy Consumption Reporting

15.2.3 Energy Consumption Reporting

The product shall be capable of interconnecting with consumer authorized entities to communicate data representative of its interval energy consumption. It is recommended that data be reported in watt-hours for intervals of 15 minutes, however, representative data may also be reported in alternate units and intervals as specified in the product manufacturer's interface specification or API.

15.2.4 Operational Status Reporting

At a minimum, the product shall be capable of providing the following information to energy management systems and other consumer authorized devices, services or applications via a communication link: operational status; e.g. on/off, and luminous intensity.

15.2.5 Remote Management

The product shall be capable of receiving and responding to energy management system or other consumer authorized remote requests, via devices, services or applications, similar to hard-wired consumer controllable functions.

15.2.6 Information to Consumers

If additional devices, services, and/or infrastructure are required to activate the product's connected capabilities, prominent labels, or other forms of consumer notifications shall be displayed at the point of purchase and in the product literature. (e.g. "This product has Z-wave control capability and requires interconnection with a Z-wave controller to enable local lighting control. An Internet connected Z-wave controller is required to enable off-premises control and a suitable utility adapter may be necessary to enable Demand Response.")

Notebox 28: EPA has introduced a special section for Luminaires with connected functionality, borrowing guidance from other ENERGY STAR specifications for connected products such as refrigerators and pool pumps.

16 PRODUCT LABELING & PACKAGING REQUIREMENTS:

16.1 Labeling & Packaging: All Luminaires

Source Type	ENERGY STAR Requirements
All	<ul style="list-style-type: none"> • Packaging shall clearly describe the nominal color designation of the lamp in units of Kelvin (e.g. 2700K, 3000K) and the corresponding nomenclature as outlined below. <ul style="list-style-type: none"> • 2700 - Warm White • 3000 - Soft White • 3500 - Neutral White • 4000/4100K - Cool White • 5000K - Daylight <p>For luminaires shipped with lamps containing mercury:</p> <ul style="list-style-type: none"> • Both the lamp and the luminaire packaging shall have a label indicating mercury content which must be managed and disposed of properly, and shall reference: www.epa.gov/cfl <p>For outdoor luminaires: Packaging shall indicate the minimum (lowest) starting temperature for the lamp and ballast platform of the luminaire.</p> <p>For luminaires marketed as dimmable:</p> <ul style="list-style-type: none"> • Luminaire packaging shall indicate dimming range (as applicable), a list or URL with compatible dimmers or other controls, and known incompatibilities with dimmers, occupancy or vacancy sensors, timing devices or other external lighting controls, or a message noting limitations and URL to find out more specific information. Partner shall periodically review this packaging language to determine if updates are needed. Partner is encouraged to also maintain an up to date web address where additional compatibility information is detailed. • Step dimming capability, if employed, shall be clearly indicated. <p>Optional certification marking: While not a requirement for certification, EPA recommends partners provide a conspicuous ENERGY STAR certification mark (e.g. sticker, hangtag) on certified luminaires themselves:</p> <ul style="list-style-type: none"> • to facilitate building inspectors confirming certification status of installed luminaires • to provide out-of-the-box marketing of a luminaire's ENERGY STAR certification • to demonstrate to consumers a partner's commitment to advancing energy efficiency in lighting
All directional luminaires	Designate in a simple picture on cut sheet or packaging the light distribution for your luminaire.

Source Type	ENERGY STAR Requirements
Recessed downlight fixtures	<p>For recessed downlight luminaires that are insulation-contact (Type IC) rated: Packaging shall clearly state this rating. Sample language: "IC-rated for direct contact with insulation".</p> <p>For recessed downlight luminaires that are airtight (AT) certified: Packaging shall indicate that the luminaire permits air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283-04. Sample language: "Certified airtight per ASTM E283-04."</p> <p>If marketed as airtight, the luminaire itself shall include a label certifying "airtight", or similar designation, to show air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283-04. The label shall be clearly visible to a building inspector.</p> <p>Installation instructions shall 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 airtight installation, 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.</p> <p>Partners selling recessed downlights are strongly encouraged to employ a packaging method ensuring that shipped lamps remain with the luminaire during drywall installation and painting (e.g. taping the lamp carton to the inside of the canister, employing shrink wrapping of the canister aperture to enclose the lamp carton within, employing a compression-fitted cardboard insert to enclose the lamp carton within the canister).</p>

Notebox 29: Nomenclature for communicating color temperature to consumers consistently across brands has been introduced in Draft one. References to halogen products have been removed from this section. Dimming labeling guidance has been updated to be more consistent with ENERGY STAR lamps in providing a URL and maintaining an up to date web site that lists compatible controls. Light distribution depictions for directional SSL products has been added based on suggestions from stakeholders during the in person working session Oct 30th.

16.2 Light Source Shipment: Directional and Non-Directional Luminaires

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents
Fluorescent <ul style="list-style-type: none"> • compact • circline 	<p>All luminaires shall be shipped with a lamp for each lampholder. All lamps that ship with a luminaire must be included in the certification documentation.</p> <p>Lamps shall utilize an ANSI/IEC standardized lamp base configuration.</p> <p>In addition, lamp dimensions and electrical parameters shall either:</p> <ul style="list-style-type: none"> • Meet the requirements of an ANSI/IEC standardized lamp specification sheet if an applicable standard exists; or, • If no ANSI/IEC lamp standard exists, provide a lamp manufacturer specification sheet that describes the following (use the ANSI lamp data sheets found in ANSI/IEC C78.901-2005 and ANSI/ANSLG C78.81-2010 as a reference for the format and type of information requested): <ol style="list-style-type: none"> 1. Lamp description, including lamp model number, nominal wattage, bulb designation / lamp size (e.g. T4, T5, T8) and lamp base type as defined by ANSI/ANSLG C81.61-2009; <ul style="list-style-type: none"> or IEC 60061-1 (e.g. 2G13, GR10q), starting circuit application (i.e., rapid start, preheat, etc.) 2. Dimensional characteristics, including diagram 3. Lamp operating characteristics, including: approximate wattage (W), voltage(V), current (A) 	<p>Reference Documents: Lamp base configuration: ANSI/ANSLG C81.61-2009</p> <p>Lamps compliant with an ANSI-IEC standard (for lamp dimensions and electrical parameters):</p> <p>For compact fluorescent lamps: ANSI/IEC C78.901-2005; IEC 60901</p> <p>Lamps not compliant with an ANSI-IEC standard (for lamp dimensions and electrical parameters): ANSI/IEC C78.901-2005; (used as a reference for the format and type of information required on a custom lamp specification sheet)</p>
Solid State: Non-Directional <ul style="list-style-type: none"> • LED light engine 	<p>Complete light source components shall be provided with the luminaire.</p>	<p>Reference Document: Recommendations outlined in NEMA LSD 45-2009 shall be followed.</p>
Solid State: Directional		<p>None.</p>

17 WARRANTY REQUIREMENTS: All Luminaires

Note: Partners must provide a copy of the actual luminaire warranty that is included with the product packaging. Partner is solely responsible for honoring warranty; intermediate parties (e.g. showrooms, electrical distributors, retailers) are not responsible for warranty requirements.

Source Type	ENERGY STAR Requirements
Fluorescent <ul style="list-style-type: none"> • compact • self-ballasted compact • circline 	<p>For luminaires incorporating replaceable ballasts, a written warranty shall be included with luminaire packaging at the time of shipment which covers repair or replacement of defective parts of the luminaire housing, mounting hardware, optics, ballast and trim for a minimum of 3 years from the date of purchase. Self-ballasted lamps shipped with the luminaire shall carry a minimum 3 year warranty, based on usage of no less than 3 hours per day.</p> <p>For luminaires incorporating non-replaceable ballasts, the above warranty requirement is extended to 5 years.</p>
Solid State	<p>For luminaires incorporating replaceable drivers, a written warranty shall be included with luminaire packaging at the time of shipment which covers repair or replacement of defective parts of the luminaire housing, mounting hardware, optics, driver and trim for a minimum of 3 years from the date of purchase. Integrated LED lamps shipped with the luminaire shall carry a minimum 3 year warranty.</p> <p>For luminaires incorporating non-replaceable drivers, the above warranty requirement is extended to 5 years.</p> <p>Warranty language shall place no limitations on coverage based on duration of luminaire operation (e.g. hours per day).</p>

18 Lighting Toxics Reduction Requirements: All Luminaires

Source Type	ENERGY STAR Requirements	Method of Compliance
All Source Types	<p>Luminaires and lamps shall not exceed hazardous substance concentrations set for in the European Union's (EU) Restriction of the Use of Certain Hazardous Substances (RoHS) Directive, 2003.</p> <p>Luminaires and lamps shall not exceed:</p> <ul style="list-style-type: none"> • 0.1% by weight in homogenous material (1000 ppm): Mercury, Lead, Hexavalent Chromium, PBB (polybrominated biphenyls), and PBDE (polybrominated diphenyl ethers) • 0.01% by weight in homogenous material (100 ppm): Cadmium <p>A list of RoHS exemptions that will be accepted by the ENERGY STAR program that may be relevant to luminaires and lamps is detailed below:</p> <p><u>Exemptions:</u></p> <ol style="list-style-type: none"> 1. Mercury in single capped (compact) fluorescent lamps not exceeding (per burner): <ol style="list-style-type: none"> a. Lamps \leq 23.0 rated watts shall contain \leq 2.5 milligrams (mg) mercury per lamp Lamps \geq 23.0 rated watts shall contain \leq 3.0 milligrams (mg) mercury per lamp 2. Lead in glass of fluorescent tubes not exceeding 0.2% by weight 3. Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or more lead) 4. Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound 5. Cadmium and its compounds in electrical contacts 6. Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages 7. Lead with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and with PbSn-Hg as auxiliary amalgam in very compact energy saving lamps. 8. Cadmium in color-converting II-IV LEDs ($< 10 \mu\text{g Cd per mm}^2$ of light-emitting area) for use in solid state illumination or display systems. 	<p>For purposes of third-party certification, lamp toxics documentation shall not be reviewed when products are initially certified or during verification testing. Instead manufacturer shall maintain documentation on file to demonstrate that certified products meet these requirements. EPA reserves the right to request this documentation at any time. For the purposes of documenting mercury content, the following test procedure shall be used: IEC 62554 Ed 1.0 Sample Preparation for Measurement of Mercury Level in Fluorescent Lamps (2011-08-19).</p> <p>For materials other than mercury, manufacturer may rely on component suppliers to provide certification or declaration documents to show that homogenous materials used in lamps comply with the requirement. Alternatively, manufacturer may have components tested in accordance with IEC 62321 or other appropriate analytical technique to verify that homogenous materials do not exceed the concentration limits of the six regulated substances. Handheld XRF analyzers/scanners may also be used to verify compliance.</p>

Notebox 30: The mercury requirements have been updated to be consistent with the Lamps specification. Requirements linked to technologies that have been removed from the specification have been removed. Stakeholders may provide relevant updates to this guidance.

END OF SPECIFICATION