SAVE TODAY. SAVE TOMORROW.
SAVE FOR GOOD.

Welcome!

EPA estimates that, if all downlights and downlight retrofit kits sold in the United States were ENERGY STAR certified to the V1.0 specification:

- Energy cost savings would grow to
  - more than **$1 billion** each year, and
- More than **18 billion pounds** of greenhouse gas emissions would be prevented, equivalent to the emissions from
  - more than **1.8 million vehicles**.

SAVE TODAY. SAVE TOMORROW.
SAVE FOR GOOD.

ENERGY STAR ® Downlights Version 1.0 Final Specification Webinar

December 5, 2023

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Today's Agenda

- Timeline
- Document Availability
- Major Revisions from Luminaires V2.2
- Q&A

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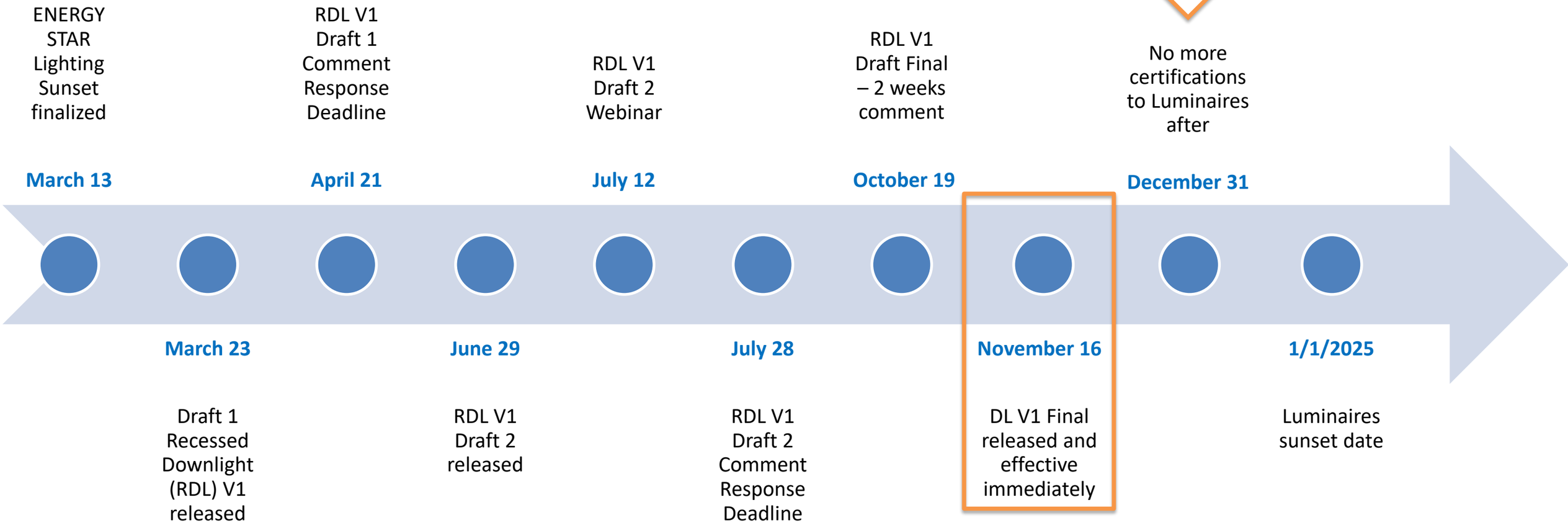
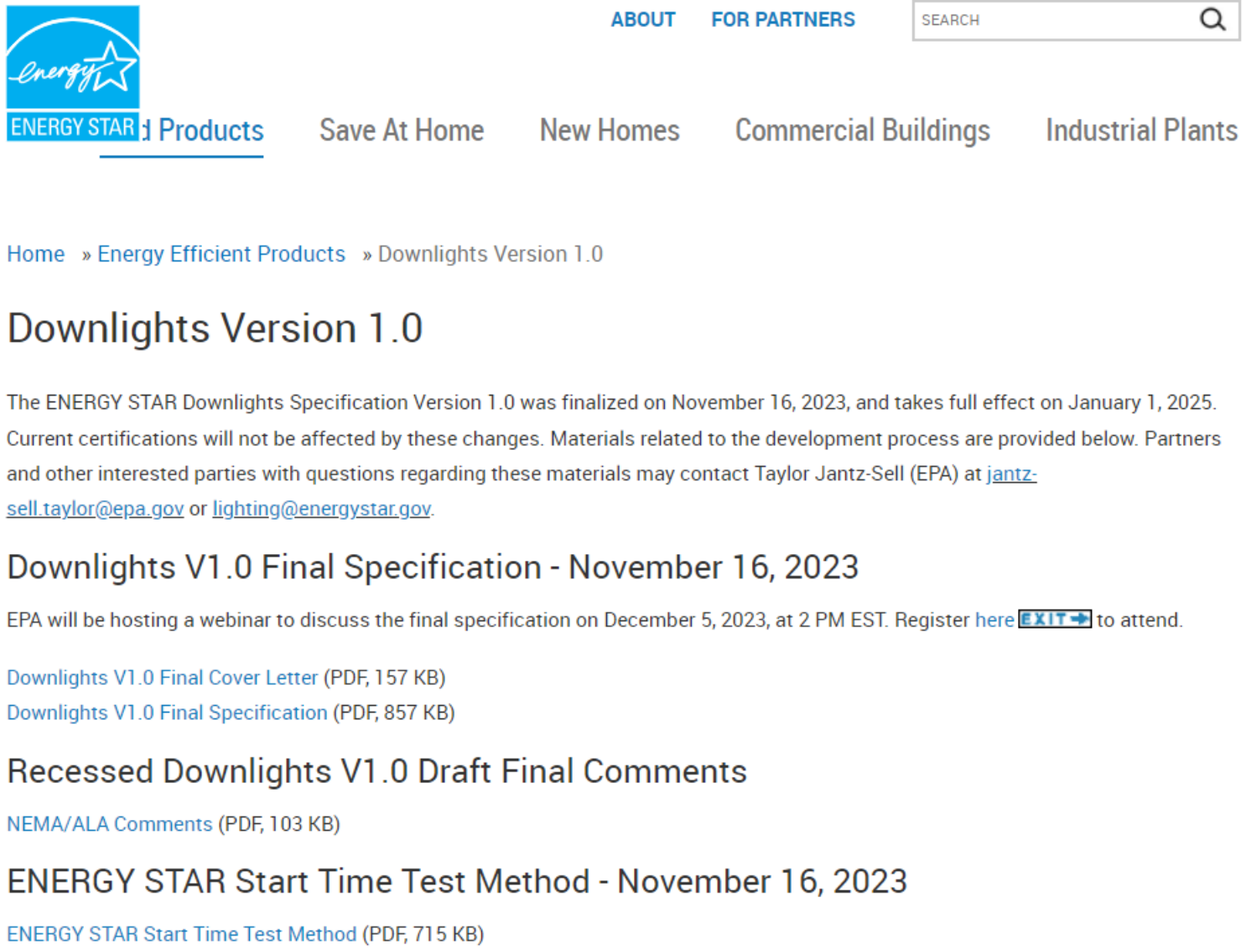
Timeline



Document Availability

All documents related to the development of this specification are posted at www.energystar.gov/luminaires



ABOUT FOR PARTNERS SEARCH

ENERGY STAR Products Save At Home New Homes Commercial Buildings Industrial Plants

Home » Energy Efficient Products » Downlights Version 1.0

Downlights Version 1.0

The ENERGY STAR Downlights Specification Version 1.0 was finalized on November 16, 2023, and takes full effect on January 1, 2025. Current certifications will not be affected by these changes. Materials related to the development process are provided below. Partners and other interested parties with questions regarding these materials may contact Taylor Jantz-Sell (EPA) at jantz-sell.taylor@epa.gov or lighting@energystar.gov.

Downlights V1.0 Final Specification - November 16, 2023

EPA will be hosting a webinar to discuss the final specification on December 5, 2023, at 2 PM EST. Register here EXIT to attend.

Downlights V1.0 Final Cover Letter (PDF, 157 KB)
Downlights V1.0 Final Specification (PDF, 857 KB)

Recessed Downlights V1.0 Draft Final Comments

NEMA/ALA Comments (PDF, 103 KB)

ENERGY STAR Start Time Test Method - November 16, 2023

ENERGY STAR Start Time Test Method (PDF, 715 KB)

Polls

Changes from Luminaires V2.2

- Scope
- Definitions
- Test Criteria
- Product Families
- Methods of Measurement
- Luminous Efficacy
- Correlated Color Temperature
- Luminous Flux Maintenance
- Source Start Time
- Power Factor
- Transient Protection
- Standby Power Consumption
- Operating Frequency
- Flicker
- Serviceability Recommendations
- Products with Connected Functionality
- Labeling & Packaging

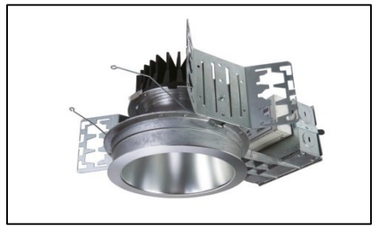
1.1 Included Products

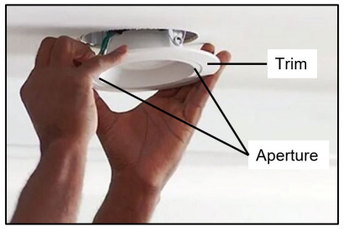
- Downlights* with built-in or integral LED module(s) and apertures ≤ ten (10) inches that:
  - Are intended by the manufacturer to be:
    - Fully or partly recessed into the ceiling, or
    - Surface-mounted to the ceiling, or
    - Mounted to a wall lighting downward, or
  - Are provided with a cord, chain, tube, etc., which permits it to be suspended from a ceiling or wall support.

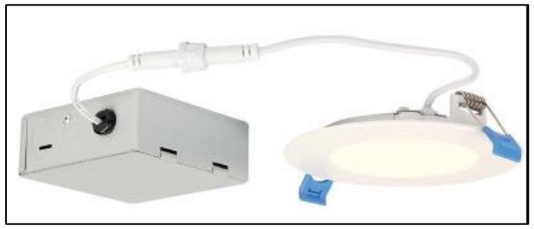
- Recessed downlight retrofit kits* with built-in or integral LED module(s) and aperture ≤ ten (10) inches.

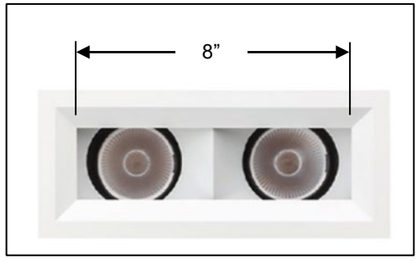
(This includes indoor and outdoor-rated products)

1.1 Included Products (Examples – Appendix A)

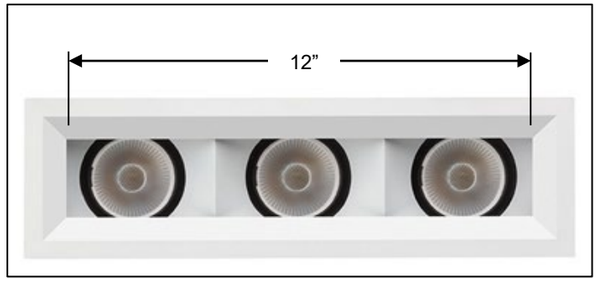


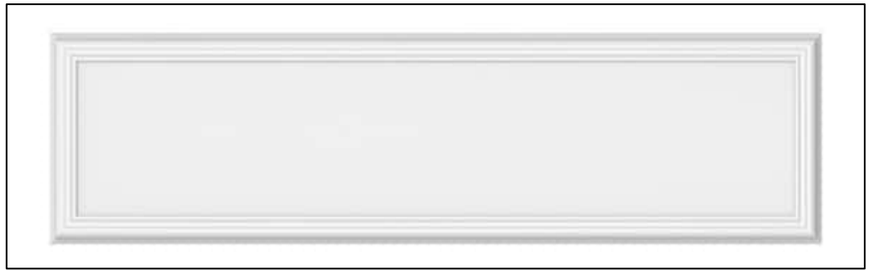


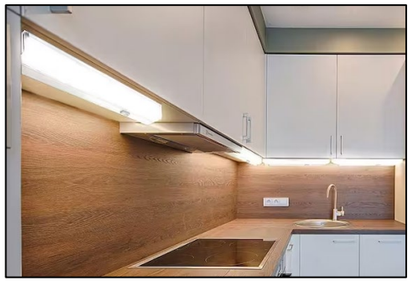


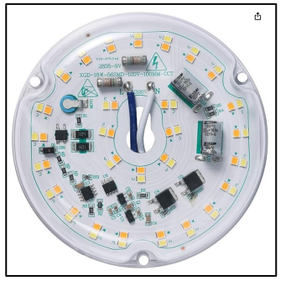


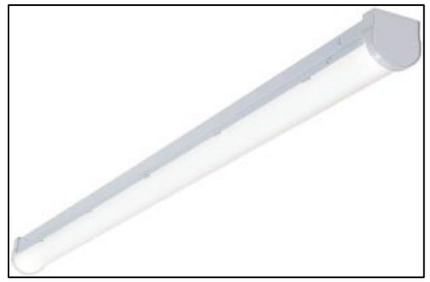
1.2 Excluded Products (Examples – Appendix A)











4 Definitions

- **Aperture:** The planar opening through which light passes out of the downlight into the lighted space.
- **Color Tunable Downlight:** For the purpose of this specification, a color tunable downlight has functionality that allows the end user to alter the color appearance of the light generated by the downlight, including any of the following features:
  - **Color Shifting Dimmable (aka Dim-to-Warm):** dimming capability designed to simulate the behavior of incandescent lamps where the chromaticity gradually shifts to a lower value as the product is dimmed.
  - **Full-Color-Tunable:** A feature allowing the end user to adjust the light output to create white or colored light. This tuning must include white light that is capable of meeting the specification's color requirements and can alter the color appearance along the black body curve, and also extend to colors beyond the ANSI defined correlated color temperature ranges (e.g., 2700K and 6500K) outside of the ANSI quadrangles.
  - **White-Tunable:** A feature allowing the end user to adjust the light output over a range of CCTs. This tuning must include white light that is capable of meeting the specification's color requirements along the black body curve.
- **Communication Link:** The product shall include a communication link that is capable of bidirectional data transfer between the product and one or more external applications, devices, or systems. This link shall use open standards, as defined in this specification, for all communication layers.

4 Definitions

- **Connected Downlight:** A downlight or retrofit which includes elements or instructions (hardware and software or firmware) required to enable communication in response to consumer-authorized energy or performance related commands and complies with all requirements for connected in the specification. These elements may be resident inside or outside of the base downlight or retrofit.
- **Consumer Authorized Third Party:** Any entity for which the consumer has provided explicit permission to access the product connected functionality, in whole or in part, via a Communication Link.
- **Down Light or Downlight:** A small luminaire that concentrates light downward towards the working plane and can be recessed (with only the trim and aperture showing) or surface mounted or suspended. (Adapted from CIE S 017:2020 ILV: “downlight”; ANSI/IES LS-1-22: "downlight"; and the ALA description of recessed lighting) For purposes of this specification, this definition includes downlight retrofit kits, recessed adjustable accent lights, and recessed models offering wallwash distribution that are under 150W, with aperture less than or equal to ten inches, and deliver a minimum of 75% of total lumens within the zone 0-60 degrees from nadir.
- **Downlight Retrofit:** A small luminaire intended to install into an existing downlight (with only the trim and aperture showing), 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, and is a retrofit kit classified or certified to UL 1598C. This category does not include integrated LED lamps, or products that utilize an existing fluorescent ballast or transformer.

4 Definitions

- **Input Power:** The power consumption in watts of the unit under test operating in a normal or active mode, as determined in accordance with the relevant test procedure.
- **Integral LED Module:** LED module designed to form a non-replaceable part of a luminaire. (CIE S 017:2020 ILV: “integral LED module”)
- **Interface Specification:** A document or collection of documents that contains detailed technical information to facilitate access to relevant data and product capabilities over a communications interface.
- **Luminous Flux Maintenance (sometimes referred to as “lumen maintenance”):** The remaining luminous flux output (typically expressed as a percentage of the initial luminous flux output) at any selected elapsed operating time. Luminous flux maintenance (or “lumen maintenance”) is the converse of luminous flux depreciation (or “lumen depreciation”). (ANSI/IES LM-80-15).
- **Luminous Efficacy:** The total emitted luminous flux divided by the total source electrical input power; expressed in lumens per watt (lm/W). (ANSI/IES LS-1-22: “Luminous Efficacy of a Source”)
- **Open Standards:** Standards that are: 1) Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,6 and/or 2) Included in the National Institute of Standards and Technology (NIST) Smart Grid framework Tables 4.1 and 4.2,7 and/or 3) 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).

4 Definitions

- **Rated Luminous Flux Maintenance Life (L_p; sometimes referred to as Rated Lumen Maintenance Life):** The elapsed operating time over which the LED light source will maintain the percentage, *p*, of its initial light output, e.g., L_{70} (hours): Time to 70% luminous flux maintenance. (Adapted from ANSI/IES TM-21-21)
- **Recessed Accent Light (Recessed Adjustable Accent Light):** A recessed downlight with internal adjustable/aimable secondary optics designed to emphasize a particular object or surface feature, or to draw attention to a part of the field of view. (Adapted from ANSI/IES LS-1-22: “Accent Lighting”)
- **Secondary Optics (“Optics”):** Materials modifying the distribution or amount of light from, but not integral to a light source, including but not limited to diffusers, reflectors, baffles, lenses, and total internal reflection optics.
- **Trim:** The part of a recessed downlight—most often a flat rim—that covers the ragged edge of the ceiling cut-out and creates an aperture through which light passes out of the downlight into the lighted space. The trim may be a separate ring, or trim ring, or it may be integrated with secondary optics (i.e., a self-flanged reflector). A trim can be airtight or non-airtight. For the purposes of ENERGY STAR certification, decorative trims and recessed adjustable accent lights with secondary optics that extend below the ceiling without fully concealing the aperture are included.
- **Wallwash Distribution:** Luminous intensity distribution designed to deliver uniform illumination on an adjacent wall or vertical surface. (Adapted from ANSI/IES LS-1-22: “Wash”)

4 Definitions Removed

- The **LED Light Engine** definition and all references to light engines in other sections were removed since a complete unit of the representative model must be tested.
- The **Inseparable & Inseparable Other SSL Luminaire** definitions and all distinctions between products with separable and inseparable light sources were removed.
- Definitions related to excluded products types were removed:
  - Bath Vanity
  - Chandelier
  - Cove Mount
  - Floor Lamp
  - Linear Strip
  - Portable Desk/Floor Task Lights
  - Table Lamp
  - Torchiere
  - Undercabinet
  - Wall Sconce
  - Wrapped Lens

5.1 Testing Color Tunable and Multi-Output Downlights

For the purpose of this specification, a multi-output downlight offers multiple discrete light output settings that allow the end user to select a discrete output during or after installation.

When testing color tunable or multi-output downlights, **all tests and evaluations must be performed at the *most consumptive* white light setting**.

[The requirement for testing color tunable and multi-output models at the default white light setting and reporting input power, light output, CCT, and CRI at that setting have been removed.]

~~**Luminaires V2.2 Section 5.2 (Certified Lighting Subcomponent Database)**~~

6 Product Certification

Note: Partners must ensure that all configurations certified as ENERGY STAR continue to meet the certification criteria through subsequent firmware, software, or other changes to the certified product.

6.1 Product Families

- **The representative tested model must be the variation reported to have the *highest input power*.**
- The downlight variation expected to have the *highest operating temperature* must be represented.
- Recessed downlight retrofit kits must be tested in the *worst-case thermal environment* that it is rated for.

8” Aperture Downlight	CCT Setting	Watts	Reflector	Lumens	Efficacy (lm/W)	Notes
Color tunable model offered with reflector options and available with non-IC and Type IC airtight housings	3000K	20.20	White	1,636	81	Default setting *(no testing)*
	4000K	20.40	White	1,693	83	
	5000K	20.50	Black	1,435	70	Least efficient *(no testing)*
	5000K	20.50	Silver	1,599	78	
	5000K	20.50	White	1,722	84	Representative tested model (Type IC-AT)

6.1 Product Families – Verification Testing

- During verification testing, any sampled configuration from a product family that
  1. Has measured input power greater than the reported input power for the representative model, or
  2. Fails to meet another verification testing criteria

  will result in a failed determination for all models whose certification is tied to the representative tested model.
- Note, units that undergo verification testing **will not be evaluated for luminous efficacy**.

5” Aperture Downlight	CCT	Watts	Reflector	Lumens	Efficacy (lm/W)	Notes
Model offered with reflector options and available with non-IC and Type IC airtight housings	3000K	9.90	Black	594	60	Least efficient *(no testing)*
	3000K	9.90	Silver	713	72	
	3000K	10.00	White	830	83	Reported values of representative tested model (Type IC-AT)

6.1 Product Families – Verification Testing

- During verification testing, any sampled configuration from a product family that
  1. Has measured input power greater than the reported input power for the representative model, or
  2. Fails to meet another verification testing criteria

  will result in a failed determination for all models whose certification is tied to the representative tested model.
- Note, units that undergo verification testing **will not be evaluated for luminous efficacy**.

5” Aperture Downlight	CCT	Watts	Reflector	Lumens	Efficacy (lm/W)	Notes
Model offered with reflector options and available with non-IC and Type IC airtight housings	3000K	9.95	Black	570	57.3	Undergoes VT
	3000K	9.90	Silver	713	72	
	3000K	10.00	White	830	83	Reported values of representative tested model (Type IC-AT)

6.1 Product Families – Verification Testing

- During verification testing, any sampled configuration from a product family that
  1. Has measured input power greater than the reported input power for the representative model, or
  2. Fails to meet another verification testing criteria

  will result in a failed determination for all models whose certification is tied to the representative tested model.
- Note, units that undergo verification testing **will not be evaluated for luminous efficacy**.

5” Aperture Downlight	CCT	Watts	Reflector	Lumens	Efficacy (lm/W)	Notes
Model offered with reflector options and available with non-IC and Type IC airtight housings	3000K	9.90	Black	594	60	
	3000K	10.10	Silver	727	72	Undergoes VT
	3000K	10.00	White	830	83	Reported values of representative tested model (Type IC-AT)

6.1 Product Families – Allowable Variations

No additional testing required for:

- Correlated Color Temperature (CCT)
- Electrical Connection
- Diffuser
- Exterior Housing Color/Pigment

Table 1: Allowable Variations Within Product Families

Downlight Attribute	Allowable Variation	Additional Test Data Required for Each Variant
The representative tested model must be the variation reported to have the highest input power. Testing required to document the additional required test data listed in this table must be performed by an EPA-recognized laboratory. However, testing to support a partner's engineering rationale for each variant does not.		
Light Source[1] (Refers to the make and/or model of the source; also review CCT below)	Allowed so long as the input power of the variant does not exceed the representative tested model and provided that the variant meets the minimum efficacy requirement when used at highest input power and with at least one optics/reflector/trim set and does not negatively impact the downlight's compliance with any other performance criteria in this specification.	Certified performance data for each additional light source: • In situ TMP_{LED} temperature • LM-79 and LM-80 test reports. • TM-21 luminous flux maintenance life projection
LED Driver (No change in nominal input power or current)	Allowed, provided that the variant meets the minimum efficacy requirement when used at highest input power and with at least one optics/reflector/trim set and does not negatively impact the downlight's compliance with any other performance criteria in this specification.	• LM-79 test report. Provide engineering rationale or thermal measurements (e.g., LED driver case temperature or TMP_C) for each variation.
Product Input Power[2]	The representative tested model must be the variation reported to have the highest input power. The LED package, array, or module model must not change, although CCT remains an allowable variation. The only permissible performance change to the downlight is to a LED driver that provides a different drive current to the LED package, array, or module.	• LED drive current measurement • Integrating sphere measurements per ANSI/IES LM-79-19 Section 7 or IES LM-79-08 Section 9 as required to represent performance of each variant including: ○ CCT ○ Light Output ○ CRI ○ Power Consumption ○ Chromaticity
Housing/Chassis/ Mounting	Allowed, provided that the light source, LED driver, and heat sink (as applicable) are integrated into the housing/chassis/mounting variation(s) in such a way that the thermal performance of the downlight is not degraded.	Provide engineering rationale or thermal measurements (e.g., TMP_{LED}, or TMP_C) for each variation.
Reflector/Trim	Allowed, provided that the applicable minimum light output requirement is met, and input power is not increased.	Provide engineering rationale or luminous flux measurements for the reflector variation with the smallest aperture and darkest or least efficient finish (as applicable) showing that it meets the applicable minimum light output requirement.

6.1 Product Families – Listing Input Power Variations

- The initial idea is to list each input power variation within the **Additional Models Represented by Family, Series, or DOE Basic Model** section of the representative tested model's listing.

Additional Models Represented by Family, Series, or DOE Basic Model	
Additional Models Represented by Family, Series, or DOE Basic Model	Additional Models Represented by Family, Series, or DOE Basic Model allows the listing of multiple additional models that are part of the same certification where performance characteristics are the same. The additional models may be identified by multiple sets of a model name and/or model number and/or additional identifying information. Each uniquely identified additional model name/number/identifier set must be listed as a separate entry within this field and must not be a comma-separated list. The use of wildcards is allowed, but may limit the ability to search for specific additional model names/numbers/identifiers.
▪ Additional Model Name	Provide each Additional Model Name as a separate data entry.
▪ Additional Model Number	Provide each Additional Model Number as a separate data entry.
▪ Additional Identifying Information	Provide any Additional Identifying Information associated with the Model Name and/or Model Number. The identifying information may be used by consumers, incentive programs, or retailers to identify this model or model family. This includes, but is not limited to, SKUs and retail numbers. UPC codes should not be included in this field. Provide each Additional Identifying Information as a separate data entry along with the corresponding model name and model number.

[1] Partners may not retroactively add variations to a product family unless requirements in Table 1 are still met.
[2] When input power as a variation is used, changes to optics and LED package, array, or module (where applicable) are not permitted, as these changes would result in a change in distribution which must be re-evaluated against the downlight specific requirements. The additional models would still require an integrating sphere LM-79 test to verify other photometric and electrical performance requirements. Each input power variation should be listed individually.

7 Methods of Measurement and Reference Documents

- ANSI/IES LM-58-20 **or** IES LM-58-13
- ANSI/IES LM-79-19 **or** IES LM-79-08
- ANSI/IES LM-80-21 **or** ANSI/IES LM-80-15 **or** LM-80-08 and its Addendum A
- ENERGY STAR Start Time Test Method *(updated to **allow** testing per ANSI/IES LM-79-19)*

8.1 Luminous Efficacy, Output and Zonal Lumen Density

- **Luminous Efficacy:** reported light output divided by reported input power must be **≥ 82 lm/W**.
- **Zonal Lumen Density:** downlights and recessed adjustable accent lights aimed at nadir must deliver a minimum of 75% of total lumens within the zone 0-60° from nadir.

8.2 Correlated Color Temperature (CCT)

- **2200K**, **2500K**, 2700K, 3000K, 3500K, 4000K, 5000K

9.1 Luminous Flux Maintenance & 9.2 Light Source Life

- L_{70}(6k) **≥ 25,000 hours** for all product types.
- Luminous flux maintenance per **ANSI/IES TM-21 Calculator** *(ENERGY STAR TM-21 Calculator will be retired at the end of 2023)*
- Luminaires Option 2 (i.e., LM-84 and TM-28) removed.

10.1 Source Start Time

- **ANSI C82.16-2022, sections 3.7 and 13** added as an alternative method of measurement.

10.2 Power Factor

- Power Factor must be **≥ 0.7**

10.3 Transient Protection

- **ANSI C82.77-5-2017** added as an alternate reference document

10.4 Standby Power Consumption

- **ANSI C82.16-2022, section 15** added as an alternative method of measurement.

10.5 Operating Frequency

- **ANSI C82.18** added as a method of measurement

10.6 Flicker

- **ANSI C82.18** added as an alternative method of measurement

11 SERVICEABILITY RECOMMENDATIONS

11.1 Light Source Serviceability

When possible, make use of electrical interconnects that allow for consumer replacement of the engine or kit without the cutting of wires or the use of solder, including wire nuts and other reusable connectors

11.2 LED Driver Replaceability

When possible, enable LED drivers to be accessible and removable by an electrician without the cutting of wires and without damage to the downlight housing, trim, or the carpentry (e.g., ceiling drywall) in which the downlight is recessed. Instructions must be provided with the downlight, detailing guidance on LED driver replacement by a “qualified electrician.”

14.2 Products with Connected Functionality – Optional

- EPA reorganized this section and updated terminology consistent with current program-wide ENERGY STAR connected criteria.
- **Edits do not change requirements.**

15.1 Labeling & Packaging

- For units of certified models not intended for retail shelf stocking, these requirements may be fulfilled by providing a **supplemental performance summary** that includes all of the applicable requirements below. This performance summary must be provided for certification and to any online reseller to help ensure online marketing is consistent with ENERGY STAR certification.
- Recommended CCT nomenclature and certification marking requirements previously marked as “optional” were removed.
- Requirements for the use of the ENERGY STAR mark which previously appeared only in the Partner Commitments are now included.
- Requirements that were redundant with existing safety standards were removed.

Q&A