



ENERGY STAR® Program Requirements for Residential Ceiling Fans

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

Qualifying Products

1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for residential ceiling fans. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. Obtain certification of ENERGY STAR qualification from a Certification Body recognized by EPA for residential ceiling fans prior to associating the ENERGY STAR name or mark with any product. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform residential ceiling fan testing.

Using the ENERGY STAR Name and Marks

3. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
4. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale.
5. Provide clear and consistent labeling of ENERGY STAR qualified residential ceiling fans. The ENERGY STAR mark must be clearly displayed on the on the product packaging, in product literature (i.e., user manuals, spec sheets, etc.), and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed.

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by EPA for residential ceiling fans.
7. Comply with tests that EPA/DOE may conduct at its discretion on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.

Providing Information to EPA

8. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
 - 8.1. Partner must submit the total number of ENERGY STAR qualified residential ceiling fans shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).

8.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.

8.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;

9. Report to EPA any attempts by laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.

10. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep EPA informed on the progress of these efforts:

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, communicate, and/or promote Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.

- Join EPA's Climate Leaders Partnership to inventory and reduce greenhouse gas emissions. Through participation, companies create a credible record of their accomplishments and receive EPA recognition as corporate environmental leaders. For more information on Climate Leaders, visit www.epa.gov/climateleaders.
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.



ENERGY STAR® Program Requirements Product Specification for Residential Ceiling Fans

Eligibility Criteria

DRAFT Version 2.4

Following is the **Version 2.4** product specification for ENERGY STAR qualified residential ceiling fans. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

- 1) **Definitions:** Below are the definitions of the relevant terms in this document. For lighting or light kit related terminology and definitions, refer to section 1) *Definitions* in the ENERGY STAR Specification for Residential Light Fixtures.
- A. **Residential Ceiling Fan:** A non-portable device designed for home use that is suspended from the ceiling for circulating air via the rotation of fan blades. Some ceiling fans also have an integral or attachable light kit.
 - B. **Light Kit:** A complete lighting unit consisting of lamp(s) and ballasting (when applicable) or LED Light Engine(s), together with the parts designed to distribute the light, position and protect the lamps, and connect the lamps to the mains. Light kits can be:
 - Integral – the light kit is attached to the ceiling fan housing at the time of purchase. This type of a light kit is integrated into the bottom cap of the fan and cannot be removed or replaced with another light kit.
 - Attachable – the light kit is not, at the time of sale, physically attached to the fan. The light kit shall be attached to the ceiling fan for the lights to work. Attachable light kits might be included inside the ceiling fan box at the time of sale or sold separately for subsequent attachment to the fan.
 - C. **Controls:** Controls enable the user to turn on/off or adjust the lighting and fan movement. Controls may be in the form of pull chain, slide switch, wall switch/panel, or remote control.
 - D. **Airflow:** The rate of air movement at a specific fan setting expressed in cubic feet per minute (CFM).
 - E. **Airflow Efficiency:** The ratio of airflow divided by power at a specific residential ceiling fan setting expressed in CFM per watt (CFM/watt).
 - F. **Power Consumption:** Defined as the active power and expressed in watts.
 - G. **Hugger Fan:** A fan style where the motor mounts directly to the ceiling. Hugger fans are most commonly used in rooms with low ceilings. Hugger fans are manufactured and marketed as such and should not be confused with multi-mount (traditional) fans that can be hung without the down rod, giving the same effect as a hugger fan. Hugger fans are designed to allow installations on 7'6" – 8' height ceilings when using a fan light kit in a location where walking under the fan will occur.
 - H. **Product Family:** Models are identical in every respect, with the exception of finish. Differences that would require separate testing include, but may not be limited to: motor type or size; rotational speed; control type; blade weight, number, size, or pitch; and housing (i.e., size, design, ventilation).

2) Scope:

- A. **Included Products:** Products that meet the definitions of a Residential Ceiling Fan and Light Kit as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B
- B. **Excluded Products:** Hugger fans are not eligible for ENERGY STAR.

3) Qualification Criteria:

- A. Airflow Efficiency Requirements:

Fan Speed	Minimum Airflow	Minimum Efficiency Requirement
Low	1,250 CFM	155 CFM/watt
Medium	3,000 CFM	100 CFM/watt
High	5,000 CFM	75 CFM/watt

- a. Qualifying products shall meet or exceed the minimum requirements presented in Table 1, above, when operating in a downward-blowing direction.
- b. Efficiency shall be measured on each of three fan speeds (i.e., low, medium, high). For those ceiling fan models that offer more than three speeds manufacturer may choose the three individual speed settings (representative of low, medium, and high) that should be used to comply with the performance levels set forth in Table 1, above.
- B. Lighting Requirements: To qualify for ENERGY STAR, all integral and attachable light kits shall meet the requirements found in Appendix A of this ENERGY STAR specification.

Qualifying residential ceiling fans sold without integral or attachable light kits shall provide information on product packaging or with product instructions regarding ENERGY STAR qualifying light kits that may be used with that particular residential ceiling fan.

- D. Controls: Qualifying products shall permit convenient consumer adjustment of fan speed. This may be accomplished by means of one or more wall-mounted switch(es), a remote control, or readily accessible pull chains. For purposes of this specification, “readily accessible” shall be defined as a length sufficient to reach a height of no more than 80 inches (203 cm) above the floor when the residential ceiling fan is mounted according to the residential ceiling fan’s installation instructions. For those residential ceiling fans that can accommodate light kits, the lights and the fans shall be able to be controlled separately, allowing users to switch off lights during fan operation or operate the lights without using the residential ceiling fan.

Qualifying products shall also provide for consumer adjustment of airflow direction (upward or downward) by one of the following means:

- A vertically or horizontally mounted slide switch on the motor housing. For vertically mounted switches, the downward position shall correspond to downward airflow. For horizontally mounted switches, airflow direction shall be clearly identified on the switch housing or within the product literature.
- A wall-mounted switch
- A remote control
- A readily accessible pull chain

E. **Minimum Warranty:** Qualifying products shall provide a warranty of at least 30 years for the motor and at least one year for all other components of qualifying residential ceiling fans. All ceiling fan light kits (i.e., integral and sold separately) also shall meet applicable lighting warranty requirements as listed in Appendix A of this specification.

F. **Significant Digits and Rounding:**

- a. All calculations shall be carried out with actual measured or observed values. Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.
- b. Unless otherwise specified, compliance with specification limit shall be evaluated using exact values without any benefit from rounding.

4) **Test Requirements:**

A. **Representative Models** shall be selected for testing per the following requirements:

- a. For qualification of an individual product model, the representative model shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR.
- b. For qualification of a product family, any model within that product family can be tested and serve as the representative model.

B. When testing residential ceiling fans, the following test methods shall be used to determine ENERGY STAR qualification:

Table 2: Test Methods for ENERGY STAR Qualification	
Energy Efficiency Requirement	Test Method Reference
Airflow and Airflow Efficiency	ENERGY STAR Testing Facility Guidance Manual Version 1.2: <i>Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans</i>
Lighting Requirements	See Appendix A for List of Test Methods

- a. At time of testing, measurements shall be taken at all discrete operating speeds.
- b. Products sold with light kits or integrated light sources shall be tested with those light sources mounted in their intended position and switched off.

5) **Effective Date:** This ENERGY STAR Residential Ceiling Fan specification shall take effect on **January 1, 2009**. To qualify for ENERGY STAR, a product 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 date (e.g., month and year) on which a unit is considered to be completely assembled.

6) **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 the ENERGY STAR qualification is not automatically granted for the life of a product model.

APPENDIX A: Ceiling Fan Light Kit Requirements

Note: EPA is in the process of revising ceiling fan light kit requirements through the ENERGY STAR luminaires specification development process. Once the luminaires specification goes into effect (planned for mid-2011), this Appendix A will be removed and ceiling fan light kits will be required to meet the luminaires specification. In the meantime, EPA has ensured that test method references are complete in this Appendix A for purposes of qualification prior to the luminaires effective date. For more information on the luminaire specification development process visit: www.energystar.gov/newspecs.

Exclusion of magnetic ballasts: Light kits that use magnetic ballasts cannot be ENERGY STAR qualified under this specification.

Self-ballasted pin based lamps: Light kits that use a self-ballasted pin based lamp can be ENERGY STAR qualified light kits if all applicable requirements for qualifying products are met. This includes the requirement that the average rated life of the lamp shall meet or exceed 10,000 hours and that the maximum measured ballast case temperature during normal operation inside the light kit does not exceed the ballast manufacturer maximum recommended temperature.

Allowance for decorative-only LEDs (LED Hybrid Light Kits): LEDs used only as decorative lighting elements in ceiling fan light kits are allowed as long as the total wattage of the LEDs does not exceed five (5) watts, the average LED system (LED and driver) efficacy is at least 20 lumens per watt, and the LED is used to supplement a primary light source that meets all of the applicable performance characteristics outlined in this specification. This requirement applies to LED “hybrid” light kits. For documentation requirements, please send an email request to RLF@icfi.com.

Table 1 - Ceiling Fan Light Kits: Requirements for Light Kits Employing Conventional Lighting Technologies (see table 3 for kits employing LED light kits)

Performance Characteristic	ENERGY STAR Specification
<p>Note: Only electronic ballasts shall be used to meet the requirements of this table. In addition, light kits that utilize compact fluorescent lamps that do not have a plug-in base (i.e use a mogul, medium, or other screw base) are not eligible to earn the ENERGY STAR.</p>	
<p><u>Combined Lamp & Ballast Requirements:</u></p>	
<p>System Efficacy Per Lamp Ballast Platform in Lumens Per Watt (LPW)¹,</p>	<p>≥ 50 LPW for all lamp types below 30 total listed lamp watts.</p> <p>≥ 60 LPW for all lamp types that are ≤ 24 inches and ≥ 30 total listed lamp watts.</p> <p>≥ 70 LPW for all lamp types that are > 24 inches and ≥ 30 total listed lamp watts.</p>

¹ Efficacy shall be determined by the following equation:

$$\text{Efficacy [Lumens per Watt]} = \frac{\text{Measured Lamp Lumens [Lumens]}}{\text{Measured Input Power [Watts]}}$$

Lamp Lumens: Lamp lumens shall be measured using the lamp and ballast that are shipped with the light kit.

Input Power: Input power shall be measured with the lamp and ballast that are shipped with the light kit.

Performance Characteristic	ENERGY STAR Specification
<u>Lamp Requirements:</u>	
Lamp Life	For lamps shipped with the light kits, the average rated life of the lamp shall be \geq 10,000 hours.
Lumen Maintenance	Lamp shall have an average rated lumen maintenance of at least 80% of initial lamp lumens at 40% (4,000 hours minimum) rated lamp life.
Color Rendering Index (CRI)	CRI for lamps used in light kit shall be \geq 80.
Correlated Color Temperature	Lamps shall have one of the following designated correlated color temperatures (CCT): 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K.
Lamp/Lampholder Compatibility	<p>Lamps shall utilize an ANSI/IEC standardized lamp base configuration, as defined by ANSI C81.61 and IEC 60061-1.</p> <p>The lampholder shall be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all applicable wattages. For example, if the ballast can operate lamps with multiple wattages (e.g., an 18W, 26W, or 32W lamp) then the lampholder shall be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all three applicable wattages.</p> <p>In addition, lamps shall either:</p> <ul style="list-style-type: none"> • <i>Meet the requirements of an ANSI/IEC standardized lamp specification sheet, as defined by ANSI C78.901-2001 and IEC 60901 (for compact fluorescent lamps) or ANSI C78.81-2001 and IEC 60081 (for linear lamps) if an applicable standard exists, or,</i> • <i>If no ANSI/IEC lamp standard exists (e.g., a spiral compact fluorescent lamp), a custom lamp specification sheet shall be made available</i>
Lamp Labeling Requirement	A manufacturer designation that encompasses the lamp manufacturer name, wattage, correlated color temperature, and color rendering index shall be labeled on the lamp or lamp base.
<u>Electronic Ballast Requirements</u>	
<u>(Note: Magnetic Ballasts May Not Be Used in Light Kits):</u>	
General	Per ANSI C82.11 Section 5 except paragraph 5.3.1.
Lamp Start Time	The time needed after switching on the lamp to start continuously and remain illuminated shall be an average of one second or less.
Power Factor	\geq 0.5
Lamp Current Crest Factor	\leq 1.7
Maximum Measured Ballast Case Temperature During Normal Operation Inside Light kit(s)	<p><u>Not</u> to exceed the ballast manufacturer maximum recommended ballast case temperature during normal operation inside a light kit.</p> <p>Note: This performance characteristic is separate and distinct from thermal requirements established by UL, which governs safety rather than longevity of the ballast. All qualified light kits shall meet this requirement.</p>

Performance Characteristic	ENERGY STAR Specification
Electromagnetic and Radio Frequency Interference	Ballast shall meet FCC requirements for consumer use (FCC 47 CFR Part 18 Consumer Emission Limits)
Ballast Frequency	20 to 33 kHz or ≥ 40 kHz
Transient Protection	Per ANSI C82.11b, paragraph 5.10.1 (100kHz Ring Wave, 2.5kV, both common mode and differential mode, 7 strikes)
End of Life Protection	All ballasts that operate lamps sized T5 and smaller shall contain an end of life protection circuit. For ballasts that operate multiple lamps and are required to have end of life protection, the ballast shall shut down no more than two lamps when one of the lamps has reached end of life. For example, a light kit with one ballast and five lamps shall not shut down more than the lamp that has reached end of life plus one additional lamp.
Dimming	Light kits that utilize dimmable ballasts shall be dimmable from 100% to 30%, or less, of maximum light output, or be switchable to three levels of brightness, not including the off position.
Safety - Ballasts and “Non Edison base Fluorescent Adapters”	The cover page of a safety test report or a general coverage statement shall be provided to demonstrate compliance with ANSI/UL 935 or UL 1993, as appropriate.
<u>Light Kit Requirements</u>	
Light Kit Warranty	A written warranty shall be included with light kit packaging at the time of shipment, which covers repair or replacement of defective parts of the light kit housing and electronics (excluding the lamp) for a minimum of two years from the date of purchase.
Noise	Class A sound rating for electronic ballasts within the light kit, not to exceed a measured level of 24 dBA (audible) when the ballast is installed in the light kit.
Lamp Shipment Requirement	All light kits shall be shipped with the lamp(s).
Replaceable ballast	Ballasts in all light kits shall be accessible and removable by an electrician without the cutting of wires and without damage to the housing or decorative elements of the light kit.
Safety - Hardwired Light kits	Compliance with UL 1598. For ceiling fans that are intended to be used outdoors, light kits shall be compliant with NFPA 70, the National Electrical Code (NEC), including requirements for damp locations (Articles 410-4a and Article 100).
Product Packaging for Consumer Awareness Requirements	Product packaging language shall clearly describe the nominal color designation of the lamp in units of Kelvin (i.e., 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K).

Table 2 – Reference Standards for Light Kits Employing Conventional Lighting Technologies (see Table 3 for kits employing LED light kits)

Performance Characteristic	Methods of Measurement Reference Standards
Note: refer to Appendix A, Table 1, as appropriate.	
System Efficacy: Lamp Lumens Input Power	IESNA LM-9-09; LM-66-00; ANSI C82.2-2002
Lamp Start Time	ANSI C82.11-5.2 (2002)
Lamp Life	IESNA LM-40-01; LM-65-01; IEC 60091 (1958); IEC 60901 (2001); ANSI C82.1-2004; ANSI C82.11-2002
Lumen Maintenance	IESNA LM-40-01; IESNA LM-9-99; IESNA LM-65-01; IESNA LM-66-00; ANSI C78.5-2003
Color Rendering Index	IESNA LM-58-94; CIE 13.3:1995
Correlated Color Temperature	IESNA LM-58-94; LM-16-93
Noise	Class A sound rating for electronic ballasts within the light kit, not to exceed a measured level of 24 dBA (audible) when the ballast is installed in the light kit and is measured using a sound meter (similar in performance to B&K type 2209) where the microphone is located 12 inches from the light kit in any direction.
Light Kit Warranty	No Standard Available (Use manufacturer protocol)
Dimming	No Standard Available (Use manufacturer protocol)
Lamp/Lampholder Compatibility: Lamp Base Configuration	 ANSI C81.61-2009; IEC 60061-1 (1975)
Lamps Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters)	ANSI C78.901-2001; ANSI C78.81-2001; IEC 60901 (2001); IEC 60081 (2002)
Lamps Not Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters)	ANSI C78.901-2001; ANSI C78.81-2001 (used as a reference for the format and type of information required on a custom lamp specification sheet)
Lamp Labeling Requirement	No Standard Available (Use manufacturer protocol)

Performance Characteristic	Methods of Measurement Reference Standards
Replaceable Ballast	No Standard Available (Use manufacturer protocol)
Safety: Indoor <ul style="list-style-type: none"> • Hardwired Light kits • Ballasts and “Non-Edison based Fluorescent Adapters” 	UL 1598-2008 ANSI/UL 935-2001 or UL 1993-2009
Safety: Outdoor	NFPA 70 (2005), the National Electrical Code (NEC), including requirements for wet locations when applicable (Articles 410-4a and Article 100)
Power Factor	ANSI C82.11-3.3.1 (2002)
Lamp Current	ANSI C82.11-3.3.3 (2002) and 5.6
Crest Factor	ANSI C82.1-5.6.1 (2004)
Measured Maximum Ballast Case Temperature During Normal Operation Inside Light kit(s)	UL 1598-2008, Section 11 (Acceptable when the thermocouple is placed at the hot-spot location indicated by the ballast manufacturer.) -OR- Lighting Research Center (LRC) “Proposed Durability Testing Method: Temperature” available at http://www.lrc.rpi.edu/programs/lightingTransformation/pdf/durabilityTestingFinalReport.pdf Note: All qualified light kits are expected to meet the Measured Maximum Ballast Case Temperature During Normal Operation Inside Light kit(s) requirement.
Electromagnetic and Radio Frequency Interference	Consumer Limits Per FCC 47 CFR (1985) Part 18.305 and 18.307
Ballast Frequency	Oscilloscope instruction manual
Transient Protection	ANSI C82.11b, paragraph 5.10.1 (2002)
End of Life Protection	IEC 61347-2-3 Amendment 1 to Edition 1 2004-06 (or ANSI C82.11-2005, upon its release)
Product Packaging for Consumer Awareness Requirements	No Standard Available (Use manufacturer protocol)

Table 3 - Ceiling Fan Light Kits: Requirements for Light Kits Employing LED Light Engines

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
Note: These requirements apply only to light kits to be qualified using LED light engines.		
LED Light Engine Requirements		
LED Light Engine Efficacy <i>Per LED light engine in lumens per watt (LPW)</i>	≥ 50 LPW for uncovered LED light engines ≥ 40 LPM for covered LED light engines (engines featuring integral secondary optics)	<i>ASSIST Recommends: Recommendations for Testing and Evaluating White LED Light Engines and Integrated LED Lamps Used in Decorative Lighting Luminaires. Vol 4, Issue 1, May 2008. (ASSIST, May 2008)</i> ^{1,2}
LED Light Engine Color Rendering Index (CRI) <i>Required for indoor light kits only</i>	≥ 75	ASSIST, May 2008; ANSI C78.377-2008
LED Light Engine Correlated Color Temperature (CCT) <i>Required for indoor light kits only</i>	Light output shall meet one of the following nominal correlated color temperature (CCT) values: 2700K, 3000K, 3500K, 4000K, 4500K, 5000K, 5700K, 6500K.	ASSIST, May 2008; ANSI C78.377-2008
LED Light Engine Maximum Measured Driver/Driver Case Temperature (During <i>in situ</i> Operation)	T_c not to exceed the LED driver manufacturer maximum recommended case temperature when measured during <i>in situ</i> operation. Note: This performance characteristic is separate and distinct from safety requirements.	ASSIST, May 2008 (<i>see page 8</i>)
Lumen Maintenance	Indoor light kits: $\geq 25,000$ hours to 70% Lumen Maintenance (L_{70}) Outdoor light kits: $\geq 35,000$ hours to 70% Lumen Maintenance (L_{70})	<i>ASSIST Recommends: LED Life for General Lighting Vol. 1, February 2005, rev. August 2007 (ASSIST, rev. August 2007)</i> ^{3,4}
Color Stability	Chromaticity shift for LED packages over time shall not exceed 0.007 on the CIE 1976 (u' , v') diagram (corresponds with a 7-step MacAdam ellipse).	
Power Factor	≥ 0.7	ANSI C82.77 (2002)

¹ ASSIST, May 2008: Available at <http://www.lrc.rpi.edu/programs/solidstate/assist/pdf/AR-LEDLightEngine-May2008.pdf>.

² Note: EPA understands that IESNA LM-79 (“IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products”) may in the future incorporate LED light engine test procedures; as such EPA may reference LM-79 in future revisions of this specification.

³ ASSIST, rev. August 2007: Available at <http://www.lrc.rpi.edu/programs/solidstate/assist/pdf/ASSIST-LEDLife-revised2007.pdf>.

⁴ Note: EPA understands IESNA LM-80 (“IESNA Approved Method For Measuring Lumen Maintenance of LED Light Sources”) to be under development as of June 2008, and may reference LM-80 in future revisions of this specification.

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards
Output Operating Frequency	<p>≥ 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>	Oscilloscope instruction manual
Noise	Class A sound rating for power supplies within the light kit, not to exceed a measured level of 24 dBA (audible) when the power supplies are installed in the light kit.	Measured using a sound meter (similar in performance to B&K type 2209) where the microphone is located 12 inches from the light kit in any direction.
Transient Protection	<p>Power supply shall comply with ANSI/IEEE C62.41, Class A operation.</p> <p>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.</p>	ANSI/IEEE C62.41 (1991)
Electromagnetic and Radio Frequency Interference	Power supplies shall meet FCC requirements for consumer use (FCC 47 CFR Part 15/18 Consumer Emission Limits)	Consumer Limits per FCC 47 CFR Part 15/18 (Ch. I, 10-1-05 Edition)
Light Kit Requirements		
Minimum Operating Temperature <i>Required for Outdoor Light Kits Only</i>	Light kit shall have a minimum operating temperature of -20°C or below.	No Standard Available (Use manufacturer protocol)
Warranty	<p>A written warranty shall be included with packaging at the time of shipment, covering repair or replacement of replaceable defective electrical parts:</p> <p>Indoor light kits: for a minimum of three years from the date of purchase.</p> <p>Outdoor light kits: for a minimum of four years from the date of purchase.</p>	No Standard Available (Use manufacturer protocol)

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards										
Additional Requirements for Light Kits	Light kits shall also meet the following performance characteristics outlined in Appendix A, table 1: <ul style="list-style-type: none"> • Safety - Hardwired Light kits 	Refer to Appendix A, table 1.										
Product Packaging for Consumer Awareness	<p><u>CCT Labeling:</u> Product packaging language is required that clearly describes the nominal color designation of the LED light engine in units of Kelvin.</p> <p><u>Dimming Capability and Compatibility:</u> External packaging shall state any known incompatibilities with dimmers, occupancy or vacancy sensors, timing devices or any other external lighting controls. For LED light kits that are dimmable, external packaging shall clearly state the percentage range of dimming.</p> <p><u>Minimum Operating Temperature (outdoor light kits only):</u> Product packaging shall indicate the minimum (lowest) starting temperature of the light kit.</p> <p><u>Incandescent Equivalency:</u> Light kits incorporating LED light engines generating < 800 lumens shall clearly state on product packaging the incandescent light output equivalency of the LED light engine based on the table below:</p> <table border="1" data-bbox="477 1381 930 1633"> <thead> <tr> <th data-bbox="477 1381 703 1474">Luminous Flux (Lumens)</th> <th data-bbox="703 1381 930 1474">Incandescent Equivalency (W)</th> </tr> </thead> <tbody> <tr> <td data-bbox="477 1474 703 1516">≥ 40</td> <td data-bbox="703 1474 930 1516">6</td> </tr> <tr> <td data-bbox="477 1516 703 1558">≥ 70</td> <td data-bbox="703 1516 930 1558">10</td> </tr> <tr> <td data-bbox="477 1558 703 1600">≥ 250</td> <td data-bbox="703 1558 930 1600">25</td> </tr> <tr> <td data-bbox="477 1600 703 1633">≥ 450</td> <td data-bbox="703 1600 930 1633">40</td> </tr> </tbody> </table> <p>Example packaging declaration: "This light kit produces light equivalent to a 25 watt incandescent bulb."</p>	Luminous Flux (Lumens)	Incandescent Equivalency (W)	≥ 40	6	≥ 70	10	≥ 250	25	≥ 450	40	<p>No Standard Available (Use manufacturer protocol)</p> <p>Note: EPA seeks to ensure that light kits for qualified ceiling fans meet consumer expectations for light output. This consumer awareness requirement is intended to help consumers understand the limitations of LED light engines producing less than 800 lumens (equivalent to 60 watts incandescent).</p>
Luminous Flux (Lumens)	Incandescent Equivalency (W)											
≥ 40	6											
≥ 70	10											
≥ 250	25											
≥ 450	40											