



ENERGY STAR® Program Requirements for Residential Ceiling Fans

Partner Commitments

Commitment

The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacturing of ENERGY STAR qualified residential ceiling fans. The ENERGY STAR Partner must adhere to the following program requirements:

- comply with current ENERGY STAR Eligibility Criteria, defining the performance criteria that must be met for use of the ENERGY STAR certification mark on residential ceiling fans and specifying the testing criteria for residential ceiling fans. EPA may, at its discretion, conduct tests 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 EPA's request;
- comply with current ENERGY STAR Identity Guidelines, describing how the ENERGY STAR logos and name may be used. Partner is responsible for adhering to these guidelines and for ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance;
- qualify at least one residential ceiling fan model within one year of activating the residential ceiling fans portion of the agreement. When Partner qualifies the product, it must meet the specification (e.g., Tier 1 or 2, if applicable) in effect at that time;
- provide clear and consistent labeling of ENERGY STAR qualified residential ceiling fans. The ENERGY STAR mark must be clearly displayed on 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;
- provide to EPA, on an annual basis an updated list of ENERGY STAR qualifying residential ceiling fan models. Once the Partner submits its first list of ENERGY STAR qualified residential ceiling fan models, the Partner will be listed as an ENERGY STAR Partner. Partner must provide annual updates in order to remain on the list of participating product manufacturers;
- provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total number of ENERGY STAR qualified residential ceiling fans shipped (in units by model) or an equivalent measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g., capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year should be submitted to EPA, preferably in electronic format, no later than the following March and may be provided directly from the Partner or through a third party. The data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;
- notify EPA of a change in the designated responsible party or contacts for residential ceiling fans within 30 days.

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:

- consider energy efficiency improvements in company facilities and pursue the ENERGY STAR label for buildings;
- 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;
- ensure the power management feature is enabled on all ENERGY STAR qualified monitors 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 product models;
- feature the ENERGY STAR on Partner Web site and in other promotional materials. If information concerning ENERGY STAR is provided on the Partner Web site as specified by the ENERGY STAR Web Linking Policy (this document can be found in the Partner Resources section on the ENERGY STAR Web site at www.energystar.gov). EPA may provide links where appropriate to the Partner Web site;
- 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 Web pages, etc. The plan may be as simple as providing a list of planned activities or planned milestones that Partner would like EPA to be aware of. For example, activities may include: (1) increase the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrate the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) provide information to users (via the Web site and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products, and (4) build awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event;
- 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.



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Eligibility Criteria

Below is the **Version 2.3** product specification for ENERGY STAR qualified residential ceiling fans. A product must meet all of the identified criteria 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 Version 4.2 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 must 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). Airflow is determined from testing done using the Solid State Test Method as defined in EPA's *ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans*.
 - E. **Airflow Efficiency:** The ratio of airflow divided by power at a specific residential ceiling fan setting expressed in CFM per watt (CFM/watt). Airflow and power are determined from testing done using the Solid State Test Method as defined in EPA's *ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans*.
 - F. **Power Consumption:** Defined as the active power and expressed in watts. Power consumption is measured during residential ceiling fan testing at a specific speed using the test procedure described in EPA's *ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans*.
 - G. **Solid State Test Method:** A test method that specifies the apparatus and testing protocol for measuring a residential ceiling fan's airflow and power consumption. The method utilizes a hot-wire anemometer and requires a temperature controlled room and computer for recording test data.

H. **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.

2) **Qualifying Products:** In order to qualify as ENERGY STAR, a residential ceiling fan must meet the definition in Section 1A and the specification requirements provided in Sections 3 through 7, below. Ceiling fan light kits, integral and attachable, must meet the definition in Section 1B and the requirements provided in Appendix A. Hugger fans cannot qualify as ENERGY STAR under this Version 2.3 specification.

3) **Performance Specification and Lighting Requirements for Qualifying Products:**

A. **Airflow Efficiency**

Qualifying products shall meet or exceed the following minimum requirements for total airflow and airflow efficiency when operating in a downward-blowing direction. Models sold with light kits or integrated light sources must be tested with those light sources mounted in their intended position and switched off. These test results may then be used to represent the performance of all individual units sold under the same brand and model name, including those units sold with different finishes (as listed on the ENERGY STAR qualifying product list). Each individual unit must perform within 5 percent of the tested representative model to be compliant with this specification.

Once a representative model has qualified as ENERGY STAR, all additional units manufactured under the same model name/number, and found in the distribution channel (i.e., retail), must perform within 5 percent of the tested performance levels submitted to EPA and listed on the ENERGY STAR Web site.

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

This specification defines residential ceiling fan airflow efficiency on a performance basis: CFM of airflow per watt of power consumed by the motor and controls. This treats the motor, blades, and controls as a system, allowing multiple approaches to reach a given efficiency level. Efficiency is to be measured on each of three fan speeds (low, medium, high) using the “Solid State Test Method,” which is explained in more detail in EPA’s *ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans*.

For those ceiling fan models that offer more than three speeds (e.g., low, medium, high), manufacturer may choose the three individual speed settings that should be used to comply with the performance levels set forth in Table 1 above. However, at the time of testing measurements should be taken and reported for all discrete operating speeds. If more than three speeds are listed in the Performance Table, required in Section 7 of this specification, manufacturer should indicate which speeds qualify as ENERGY STAR.

B. Lighting

All integral and attachable light kits must meet the requirements found in Appendix A of this ENERGY STAR specification. Partner should use the Ceiling Fan Qualified Product Information (QPI) form to report qualifying light kits.

Qualifying residential ceiling fans sold without integral or attachable light kits must 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.

- 4) **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 must 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 must correspond to downward airflow. For horizontally mounted switches, airflow direction must be clearly identified on the switch housing or within the product literature.
- A wall-mounted switch
- A remote control
- A readily accessible pull chain

- 5) **Sound**: No requirements at this time.

- 6) **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 warranty requirements as listed in Appendix A.

- 7) **Testing and Reporting Procedures**: Manufacturers are required to perform tests and self-certify each representative model that they intend to qualify as ENERGY STAR. In performing these tests, laboratories must use the test method described in EPA’s *ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans*. When testing ceiling fan light kits, manufacturers must meet the testing and documentation requirements included in Appendix A.

A. Laboratory Testing

Under this specification, ceiling fans may only be tested by those laboratories that meet the guidelines provided in EPA’s ENERGY STAR Testing Facility Guidance Manual and have been approved to test for ENERGY STAR qualification. EPA will conduct annual “round-robin” testing of these laboratories (i.e. calibrations), to verify that test results fall within +/- 5 percent¹ of each other. This process will be performed using a reference fan provided by EPA. Laboratories that can test and qualify ceiling fans under ENERGY STAR can be downloaded from the ENERGY STAR Web site

¹ As dictated in the ENERGY STAR Testing Facility Guidance Manual.

at www.energystar.gov/partners. Additional direction regarding the laboratory calibration procedure is provided in EPA's *ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans*.

B. Reporting Requirements

The company whose brand name appears on the product packaging shall, for purposes of this specification, be considered the manufacturer. Manufacturers must complete a QPI form when submitting qualified products to EPA. This form must be accompanied by reports from a qualified laboratory containing airflow, power consumption, airflow efficiency data, and lighting test results (where applicable) for each residential ceiling fan model and light kits proposed for qualification. Families of residential ceiling fan models that are identical in every respect but finish may be qualified through submission of test data for a single representative model. Likewise, models that are unchanged or that differ only in finish from those sold in a previous year may remain qualified without the submission of new test data, assuming the specification remains unchanged. However, separate test data are required for all models that differ in any of the following characteristics:

- motor type or size
- rotational speed
- control type (if included with fan)
- blade weight, number, size, or pitch
- housing (i.e., size, design, ventilation)

C. Product Performance Review Process

To the extent ENERGY STAR is a self-certification program, EPA relies on the integrity of participating companies to ensure all products for which ENERGY STAR claims are made, meet all aspects of the ENERGY STAR performance specification. When mistakes are made and products are mislabeled or fail to perform as expected, EPA is committed to ensuring prompt corrective action.

In the event EPA is provided test data or other product information indicating a performance problem or mislabeling situation, EPA will take the following steps:

1. Inform the product manufacturer about the apparent performance and/or labeling problem.
2. Ask the product manufacturer to withdraw the product (i.e. model number) from the ENERGY STAR qualified product list and stop labeling -OR- affirm the basis for qualification by supplying any relevant test data not already provided.
3. In the event that a definitive conclusion cannot be reached based on the manufacturer's response, EPA will make every effort to test the product in question as part of its in-use screening initiative.
4. If EPA concludes, based on testing performed on behalf of EPA in accordance with the ENERGY STAR specified test procedure, that the product in question does not fully qualify with the ENERGY STAR performance criteria, the product manufacturer will be asked to provide a "corrective action" plan to EPA outlining the process by which the product will be modified and retested so that qualification with the specification will be demonstrated within 90 days. If the product manufacturer fails to submit a corrective action plan or exceeds the deadline for implementing it, the product in question will be removed from the Qualified Product List on the ENERGY STAR Web site.

- 8) **Effective Date:** The date that manufacturers may begin to qualify products as ENERGY STAR, under the Version 2.3 specification, will be defined as the *effective date* of the agreement. The ENERGY STAR Residential Ceiling Fan (Version 2.3) specification shall become effective on **January 1, 2009**.

- A. Qualifying and Labeling Products Under the Version 2.3 Specification: All products, including models originally qualified under Version 2.2, with a **date of manufacture** on or after **January 1, 2009**, must meet the Version 2.3 requirements in order to bear the ENERGY STAR mark in product literature, on Partner promotional materials, on the Partner's Web site, or through Partner

sales channels. (Note: Products qualified under Version 2.2 meet the requirements of Version 2.3 and need not re-qualify). 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.

- B. Elimination of Grandfathering: EPA will not allow grandfathering under this Version 2.3 ENERGY STAR specification. Therefore any product sold, marketed, or identified by the manufacturing partner as ENERGY STAR qualified must meet the current specification in effect at that time.
- 9) **Future Specification Revisions**: ENERGY STAR reserves the right to change the 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.

APPENDIX A: Ceiling Fan Light Kit Requirements

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 must 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 the Eligibility Criteria. 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
Note: Only electronic ballasts may 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.	
<u>Combined Lamp & Ballast Requirements:</u>	
System Efficacy Per Lamp Ballast Platform in Lumens Per Watt (LPW) ² ,	<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>

² 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 must be measured using the lamp and ballast that are shipped with the light kit.

Input Power: Input power must 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 must 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 must be \geq 80.
Correlated Color Temperature	Lamps must have one of the following designated correlated color temperatures (CCT): 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K.
Lamp/Lampholder Compatibility	<p>Lamps must utilize an ANSI/IEC standardized lamp base configuration, as defined by ANSI C81.61 and IEC 60061-1.</p> <p>The lampholder must be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all applicable wattages. For example, if the ballast can operate lamps with multiple wattages (e.g., an 18W, 26W, or 32W lamp) then the lampholder must be designed to accept lamps with ANSI/IEC standardized lamp base configurations for all three applicable wattages.</p> <p>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 must be provided at the time of submittal</i>
Lamp Labeling Requirement	A manufacturer designation that encompasses the lamp manufacturer name, wattage, correlated color temperature, and color rendering index must 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 must be an average of one second or less.
Power Factor	\geq 0.5
Lamp Current Crest Factor	\leq 1.7

Performance Characteristic	ENERGY STAR Specification
Maximum Measured Ballast Case Temperature During Normal Operation Inside Light kit(s)	<u>Not</u> to exceed the ballast manufacturer maximum recommended ballast case temperature during normal operation inside a light kit. 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 are expected to meet this requirement
Electromagnetic and Radio Frequency Interference	Ballast must 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 must contain an end of life protection circuit. For ballasts that operate multiple lamps and are required to have end of life protection, the ballast must 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 must 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 must be provided to demonstrate compliance with ANSI/UL 935 or UL 1993, as appropriate.
Light Kit Requirements	
Light Kit Warranty	A written warranty must 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 must be shipped with the lamp(s).
Replaceable ballast	Ballasts in all light kits must 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 ³	The cover page of a safety test report or a general coverage statement must be provided to demonstrate compliance with UL 1598.
Product Packaging for Consumer Awareness Requirements	Product packaging language is required that clearly describes the nominal color designation of the lamp in units of Kelvin (i.e., 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K).

³ Regarding ceiling fans that are intended to be used outdoors, light kits must be compliant with NFPA 70, the National Electrical Code (NEC), including requirements for damp locations (Articles 410-4a and Article 100).

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

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Note: refer to Appendix A, Table 1, as appropriate.		
System Efficacy: Lamp Lumens Input Power	IESNA LM-9; LM-66; ANSI C82.2	<p>Laboratory test results must be produced using the specific lamp and ballast combination that will operate in the light kit. For this test, a sample of three or more lamps must be used. Two of the three samples must pass in order to qualify for ENERGY STAR.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices. <p>Note: If the laboratory used for this test is accredited by NVLAP or one of its MRA signatories it must also have a scope of accreditation that includes the method of measurement reference standard for this performance characteristic.</p>

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Lamp Start Time	ANSI C82.11-5.2	<p>Laboratory test results must be produced using the specific lamp and ballast combination that will operate in the light kit. For this test, a sample of three or more lamps must be used. Two of the three samples must pass in order to qualify for ENERGY STAR.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from an OSHA NRTL laboratory.

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Lamp Life	IESNA LM-40-01; LM-65-01; IEC 60091; IEC 60901; ANSI C82.1; ANSI C82.11	<p>Laboratory test results must be produced using the specific lamp that will operate in the light kit and either the ballast that will operate in the light kit or a commercially available ballast that meets the applicable ANSI ballast requirements for the lamp being tested. For this test, a sample of ten or more lamps must be used.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from an ISO 9000 registered facility. <p>Manufacturers may obtain ENERGY STAR conditional qualification for their light kit if all of the following items are provided:</p> <ol style="list-style-type: none"> 1) A letter on letterhead from a NVLAP laboratory, one of its MRA signatories, or an ISO 9000 registered facility demonstrating lamp life testing has begun. 2) A laboratory report proving that testing has been completed for at least 40% of rated life. 3) The date for testing completion. <p>Conditional approval will only be granted for a period of no longer than 325 days.</p> <p>Note: If the laboratory used for this test is accredited by NVLAP or one of its MRA signatories it must also have a scope of accreditation that includes the method of measurement reference standard for this performance characteristic.</p>

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Lumen Maintenance	IESNA LM-40-01; IESNA LM-9-99; IESNA LM-65-01; IESNA LM-66-00; ANSI C78.5	<p>Laboratory test results must be produced using the specific lamp that will operate in the light kit. For this test, a sample of ten or more lamps must be used to demonstrate that at least 80% of the samples achieved the required lumen maintenance value.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP, one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from an ISO 9000 registered facility.
Color Rendering Index	IESNA LM-58; CIE 13.3	<p>Laboratory test results must be produced using the specific lamp that will operate in the light kit. For this test, a sample of ten or more lamps must be used to demonstrate that at least 80% of the samples achieved the required color rendering index value.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices. <p>Note: If the laboratory used for this test is accredited by NVLAP or one of its MRA signatories it must also have a scope of accreditation that includes the method of measurement reference standard for this performance characteristic.</p>

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Correlated Color Temperature	IESNA LM-58; LM-16	<p>Laboratory test results must be produced using the specific lamp that will operate in the light kit. For this test, a sample of ten or more lamps must be used. Test results must demonstrate that at least 90% of the lamps tested fall within a 7-step ANSI Mac Adam ellipse.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP, one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from an ISO 9000 registered facility. <p>It is also intended that the lamp manufacturer will meet the following quality requirements during the production runs of each lamp model:</p> <ol style="list-style-type: none"> 1. The lamp manufacturer is required to maintain color control such that a minimum of 90 percent of the ongoing production (as represented by samples tested from each production shift for the same color and when typically evaluated over 12 month period) will fall within the 7 step Mac Adam color ellipse associated with the designated (manufacturer declared) target color. 2. For the purposes of meeting color control the lamp manufacturer must maintain testing equipment calibrated to international practices and standards and must compile the ongoing color control data in a manner so that it can be easily reviewed upon EPA request. 3. At a minimum, the manufacturer's color quality control program must maintain the following information for a 3-year period:

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
		<ul style="list-style-type: none"> a. Test dates and sample size (minimum of two lamps per production shift) b. Test results (x,y) for each sample lamp measured c. Test results (all x,y data) for sample lamps plotted graphically against the designated seven step color ellipse and available for review at least on a quarterly basis d. Records to substantiate that 90 percent of the (x,y) data points fall within the applicable seven (7) step Mac Adam ellipse. Manufacturers are encouraged to exceed this target.
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.	<p>No supplemental documentation required.</p> <p>Note: A laboratory test report must be submitted upon EPA request.</p>
Light Kit Warranty	No Standard Available (Use manufacturer protocol)	Provide a copy of the actual two-year light kit manufacturer written warranty that is included with product packaging.
Dimming	No Standard Available (Use manufacturer protocol)	<p>No supplemental documentation required.</p> <p>Note: A laboratory test report proving the light kit is dimmable from 100% to 30% must be submitted upon EPA request.</p>
Lamp/Lampholder Compatibility: Lamp Base Configuration	ANSI C81.61; IEC 60061-1	Provide manufacturer data indicating the lamp base type used.

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
<p>Lamps Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters)</p> <p>Lamps Not Compliant with an ANSI-IEC Standard (for lamp dimensions and electrical parameters)</p>	<p>ANSI C78.901-2001; ANSI C78.81-2001; IEC 60901; IEC 60081</p> <p>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)</p>	<p>Provide manufacturer data indicating applicable ANSI-IEC lamp data sheet number.</p> <p>Provide a manufacturer lamp specification sheet that describes the following (use the ANSI lamp data sheets found in ANSI C78.901 and C78.81 as a reference for the format and type of information requested):</p> <ol style="list-style-type: none"> 1. Lamp Description, including: <ul style="list-style-type: none"> • Lamp Model Number • Nominal Wattage • Bulb Designation / Lamp Size (i.e., T4, T5, T8, etc.) • Lamp Base Type as defined by ANSI C81.61 or IEC 60061-1(i.e., 2G13, GR10q, etc.) • Starting Circuit Application (i.e., rapid start, preheat, etc.) 2. Dimensional Characteristics, including diagram 3. Lamp Operating Characteristics, including: <ul style="list-style-type: none"> • Approximate wattage (W) • Voltage(V) • Current (A)
Lamp Labeling Requirement	No Standard Available (Use manufacturer protocol)	Provide a copy of the actual language that will be included on the base of the lamp.
Replaceable Ballast	No Standard Available (Use manufacturer protocol)	Provide a copy of the language that includes guidance on ballast replacement and states that the ballast is replaceable with the use of a “qualified electrician.”
<p>Safety: Indoor</p> <ul style="list-style-type: none"> • Hardwired Light kits • Ballasts and “Non-Edison based Fluorescent Adapters” 	<p>UL 1598</p> <p>ANSI/UL 935 or UL 1993</p>	Provide the cover page of a safety test report or a general coverage statement from an OSHA NRTL laboratory.

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Safety: Outdoor	NFPA 70, the National Electrical Code (NEC), including requirements for wet locations when applicable (Articles 410-4a and Article 100)	Provide the cover page of a safety test report or a general coverage statement from an OSHA NRTL laboratory. Include evidence of a Rain Test for Wet Locations, when applicable.
Power Factor	ANSI C82.11-3.3.1	<p>Laboratory test results must be produced using the specific ballast that will operate in the light kit. For this test, a sample of three or more ballasts must be used. At least two of the three samples must pass in order to qualify for ENERGY STAR.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from the manufacturer

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Lamp Current Crest Factor	ANSI C82.11-3.3.3 and 5.6 ANSI C82.1-5.6.1	<p>Laboratory test results must be produced using the specific ballast that will operate in the light kit. For this test, a sample of three or more ballasts must be used. At least two of the three samples must pass in order to qualify for ENERGY STAR.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from an OSHA NRTL laboratory.

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Measured Maximum Ballast Case Temperature During Normal Operation Inside Light kit(s)	<p>UL 1598, Section 11 (Acceptable when the thermocouple is placed at the hot-spot location indicated by the ballast manufacturer.)</p> <p style="text-align: center;">-OR-</p> <p>Lighting Research Center (LRC) "Proposed Durability Testing Method: Temperature" available at http://www.lrc.rpi.edu/programs/lightingTransformation/pdf/durabilityTestingFinalReport.pdf</p> <p>Note: All qualified light kits are expected to meet the Measured Maximum Ballast Case Temperature During Normal Operation Inside Light kit(s) requirement.</p>	<p>Laboratory test results must be produced using the light kit with the highest operating temperature among all light kits being qualified, the specific ballast that will operate in the light kit, and a lamp with the same wattage and lamp type (e.g., triple-tube, quad tube, spiral) that will operate in the light kit. For this test, a sample of one or more light kits must be used.</p> <p>The supplemental documentation should include the following:</p> <ul style="list-style-type: none"> • Light kit model(s) tested • Lamp model(s) and ballast model(s) tested • Measured maximum ballast case temperatures • Ambient temperature • Test procedure, including description of light kit installation, thermocouple location(s), and time that elapsed before readings were taken. • Ballast Manufacturer Maximum Recommended Case Temperature During Normal Operation Inside the Light kit(s) • Ballast Hot Spot Location Diagram from the ballast manufacturer <p>Provide a test report from:</p> <ol style="list-style-type: none"> 1. a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an OSHA NRTL laboratory; or 3. the light kit or ballast manufacturer
Electromagnetic and Radio Frequency Interference	Consumer Limits Per FCC 47 CFR Part 18.305 and 18.307	<p>No supplemental documentation required.</p> <p>Note: A laboratory test report must be submitted upon EPA request.</p>

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
Ballast Frequency	Oscilloscope instruction manual	<p>Laboratory test results must be produced using the specific ballast that will operate in the light kit. At least two of the three samples must pass in order to qualify for ENERGY STAR.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from the manufacturer
Transient Protection	ANSI C82.11b, paragraph 5.10.1	<p>Laboratory test results must be produced using the specific ballast that will operate in the light kit. For this test, a sample of three or more ballasts must be used. All samples must pass in order to qualify for ENERGY STAR.</p> <p>Provide:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from the manufacturer

Performance Characteristic	Methods of Measurement Reference Standards	Required Documentation (to be attached to QPI Form)
End of Life Protection	IEC 61347-2-3 Amendment 1 to Edition 1 2004-06 (or ANSI C82.11-2005, upon its release)	<p>Laboratory test results must be produced using the specific ballast that will operate in the light kit. For this test, a sample of one or more ballasts must be used.</p> <p>For all ballasts that that operate T4 and/or T5 sized lamps, demonstrate that the ballast is in compliance with the referenced standards by providing:</p> <ol style="list-style-type: none"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Qualification that lists the lamp/ballast combination used in the light kit and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; or 4. a test report from the ballast manufacturer <p>For all ballasts that operate T3 and smaller sized lamps, provide from the ballast manufacturer a circuit diagram and an accompanying engineering description outlining the scheme that is used to achieve the end of life function within the ballast.</p>
Product Packaging for Consumer Awareness Requirements	No Standard Available (Use manufacturer protocol)	Provide a written copy or a PDF graphic of the language that will be displayed on the product packaging.

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 must 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 (see page 8)
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

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.	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 and are 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
Electromagnetic and Radio Frequency Interference	Power supplies must meet FCC requirements for consumer use (FCC 47 CFR Part 15/18 Consumer Emission Limits)	Consumer Limits per FCC 47 CFR Part 15/18
Light Kit Requirements		
<p>Minimum Operating Temperature</p> <p><i>Required for Outdoor Light Kits Only</i></p>	Light kit shall have a minimum operating temperature of -20°C or below.	No Standard Available (Use manufacturer protocol)
Warranty	<p>A written warranty must 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 must 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 must 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 must clearly state the percentage range of dimming.</p> <p><u>Minimum Operating Temperature (outdoor light kits only):</u> Product packaging must 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 must 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 928 1633"> <thead> <tr> <th data-bbox="477 1381 701 1476">Luminous Flux (Lumens)</th> <th data-bbox="701 1381 928 1476">Incandescent Equivalency (W)</th> </tr> </thead> <tbody> <tr> <td data-bbox="477 1476 701 1518">≥ 40</td> <td data-bbox="701 1476 928 1518">6</td> </tr> <tr> <td data-bbox="477 1518 701 1560">≥ 70</td> <td data-bbox="701 1518 928 1560">10</td> </tr> <tr> <td data-bbox="477 1560 701 1602">≥ 250</td> <td data-bbox="701 1560 928 1602">25</td> </tr> <tr> <td data-bbox="477 1602 701 1633">≥ 450</td> <td data-bbox="701 1602 928 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											

Performance Characteristic	Required Documentation
<ul style="list-style-type: none"> • Efficacy • Color Rendering Index (CRI) • Correlated Color Temperature (CCT) 	<p>Provide: A test report from a laboratory:</p> <ul style="list-style-type: none"> • trained by a representative of the Lighting Research Center (RPI) on behalf of the Alliance for Solid-State Illumination Systems and Technologies (ASSIST); or • qualified to participate in the Department of Energy's CALiPER program. <p><i>Note: Upon availability of NVLAP accreditation for LED test methods, EPA will investigate test procedures under the proposed NVLAP scope and evaluate for inclusion here as an additional test report option.</i></p> <p>Sample Size:</p> <ul style="list-style-type: none"> • 1 complete light kit sample (light engine installed); and • 2 additional light engine samples external to the light kit; and • Any components and/or materials required to install additional LED light engines in light kit.
<ul style="list-style-type: none"> • Lumen Maintenance • Color Stability 	<p>Provide:</p> <ul style="list-style-type: none"> • Lumen maintenance and color stability data declared by LED package manufacturer, in accordance with ASSIST Sample Data Sheet for High-Power LEDs (Issue 4); or • LED package datasheets conforming to IESNA LM-80 protocols, once the metric is available.
<ul style="list-style-type: none"> • Maximum Measured Driver/Driver Case Temperature • Power Factor • Transient Protection 	<p>Provide:</p> <ul style="list-style-type: none"> • Laboratory test report <p>Sample Size:</p> <ul style="list-style-type: none"> • One light engine sample must be tested.
<p>Warranty</p>	<p>Provide: A copy of the actual light kit manufacturer written warranty that is included with product packaging.</p>
<p>Additional Requirements for Light Kits</p>	<p>Refer to Appendix A, table 1 - light kit requirements:</p> <ul style="list-style-type: none"> • Safety - Hardwired Light kits
<p>Product Packaging for Consumer Awareness</p>	<p>Provide: A written copy or a PDF graphic of the language that will be displayed on product packaging, and within the packaging as required.</p> <p>If product is marketed as dimmable, a copy of the language that includes dimming range and known lighting control incompatibilities.</p>