



ENERGY STAR® Program Requirements Product Specification for Residential Ceiling Fans

Eligibility Criteria Draft 1 Version 4.0

7 Following is the Draft 1 Version 4.0 product specification for ENERGY STAR certified residential ceiling
8 fans. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

9 1 DEFINITIONS

- 10 A. Airflow¹: The rate of air movement at a specific fan-speed setting expressed in cubic feet per
11 minute (CFM)
- 12 B. Basic Model²: All units of a given type of covered product (or class thereof) manufactured by one
13 manufacturer; having the same primary energy source; and, which have essentially identical
14 electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption,
15 energy efficiency, water consumption, or water efficiency.
- 16 C. Belt-Driven Ceiling Fan¹: A ceiling fan with a series of one or more fan heads, each driven by a
17 belt connected to one or more motors that are located outside of the fan head.
- 18 D. Blade Span¹: Measurement of the largest swept circle by any part of the fan blade assembly,
19 including any blade attachments. This equals the lateral distance from the center of the axis of
20 rotation of the fan blades to the furthest fan blade edge from the center of the axis of rotation,
21 multiplied by two. Sometimes referred to as “diameter” in this specification.
- 22 E. Ceiling Fan Efficiency¹: The ratio of the total airflow to the total power consumption, in units of
23 cubic feet per minute per watt (CFM/W).
- 24 F. Ceiling Fan Light Kit² (CFLK): Equipment designed to provide light from a ceiling fan that can be:
25 (1) integral, such that the equipment is attached to the ceiling fan prior to the time of retail sale; or
26 (2) attachable, such that at the time of retail sale the equipment is not physically attached to the
27 ceiling fan, but may be included inside the ceiling fan at the time of sale or sold separately for
28 subsequent attachment to the fan.
- 29 G. CFLK with Integrated Solid-State Lighting Circuitry³: A CFLK that has solid-state lighting (SSL)
30 light sources, drivers, heat sinks, or intermediate circuitry (such as wiring between a replaceable
31 driver and a replaceable light source) that are not consumer replaceable.
- 32 H. CFLK with Separable Light Source (“Separable”): A CFLK featuring lighting components (i.e. light
33 emitting diodes (LEDs) and driver components or non-self-ballasted CFL lamps and ballast)
34 which can be easily removed or replaced by the end user, thus not requiring replacement of the
35 entire CFLK. For the purposes of this specification, this includes “Other SSL Products” as well as
36 CFLKs shipping with ENERGY STAR certified lamps.
- 37 I. Controls: Controls enable the user to turn on/off or adjust the lighting and fan movement (i.e. fan
38 speed and airflow direction). Controls may be in the form of pull chain, slide switch, wall
39 switch/panel, and/or remote control.
- 40 J. Highly-Decorative Ceiling Fan¹: A ceiling fan with a maximum rotational speed of 90 RPM and
41 less than 1,840 CFM airflow at high speed, as determined by 10 CFR Appendix U to Subpart B of
42 Part 430.

¹ 10 CFR 430, Subpart B, Appendix U, *Definitions*

² 10 CFR 430, Subpart A §430.2

³ 10 CFR 430, Subpart B, Appendix V1, *Definitions*

- 43 K. High Speed¹: The highest available ceiling fan speed, i.e., the fan speed corresponding to the
 44 maximum blade revolutions per minute (RPM).
- 45 L. High-Speed Small-Diameter (HSSD) Ceiling Fan¹: A ceiling fan that is not very-small-diameter,
 46 highly decorative, or belt driven, is less than or equal to seven feet in blade span, and has a blade
 47 thickness of less than 1/8 inch (3.2 mm) at the edge or a maximum tip speed greater than the
 48 applicable limit specified in the table below:

Airflow Direction	Blade Edge Thickness (t)		Tip Speed Threshold	
	[mm]	[inch]	[m/s]	[feet/min]
Downward	4.8 > t ≥ 3.2	3/16 > t ≥ 1/8	16.3	3,200
Downward	t ≥ 4.8	t ≥ 3/16	20.3	4,000
Reversible	4.8 > t ≥ 3.2	3/16 > t ≥ 1/8	12.2	2,400
Reversible	t ≥ 4.8	t ≥ 3/16	16.3	3,200

- 49
- 50 M. LED Light Engine: An integrated assembly comprised of LED packages (components) or LED
 51 arrays (modules), LED driver, and other optical, thermal, mechanical and electrical components.
 52 The device is intended to connect directly to the branch circuit through a connector compatible
 53 with the LED luminaire for which it was designed and does not use an ANSI standard base.⁴ For
 54 purposes of this specification, light engines that rely on the luminaire for optical control, and/or
 55 thermal management, assemblies featuring remote-mounted drivers ("non-integrated"), and/or
 56 GU24 based integrated SSL sources not in the scope of the ENERGY STAR Lamps specification
 57 shall also be considered LED light engines.
- 58 N. Low-Mount High-Speed Small-Diameter Ceiling Fan: A high-speed small-diameter ceiling fan
 59 considered safe for mounting in a residential setting (i.e. between 7 and 10 feet from the ground)
 60 per UL 507⁵; with a blade thickness greater than or equal to 1/8 inch at the edge and a maximum
 61 tip speed within the applicable limits in each direction as specified in the table below:

Airflow Direction	Blade Edge Thickness (t)		Tip Speed [feet/min]	
	[mm]	[inch]	>	≤
Downward-blowing	4.8 > t ≥ 3.2	3/16 > t ≥ 1/8	2,400	3,200
Downward-blowing	t ≥ 4.8	t ≥ 3/16	3,200	4,000
Upward-blowing	4.8 > t ≥ 3.2	3/16 > t ≥ 1/8	-	2,400
Upward-blowing	t ≥ 4.8	t ≥ 3/16	-	3,200

- 62 O. Low Speed¹: The lowest available ceiling fan speed, i.e., the fan speed corresponding to the
 63 minimum, non-zero blade RPM.
- 64 P. Low-Speed Small-Diameter (LSSD) Ceiling Fan¹: A ceiling fan that is less than or equal to seven
 65 feet in blade span, has a blade thickness greater than or equal to 1/8 inch (3.2 mm) at the edge
 66 and a maximum tip speed less than or equal to the applicable limit specified in the table below,
 67 and which are considered safe for mounting in a residential setting (i.e., between 7 and 10 feet
 68 from the ground) per UL 507.⁵

Airflow Direction	Blade Edge Thickness (t)		Tip Speed Threshold	
	[mm]	[inch]	[m/s]	[feet/min]
Reversible	4.8 > t ≥ 3.2	3/16 > t ≥ 1/8	12.2	2,400
Reversible	t ≥ 4.8	t ≥ 3/16	16.3	3,200

- 69 Q. Non-Standard Integrated LED Lamps: GU24 based integrated SSL sources that do not conform
 70 to an ANSI standard lamp shape or are not in the scope of the ENERGY STAR Lamps
 71 specification. These light sources shall also be considered LED light engines. See also LED Light
 72 Engine.

⁴ Derived from IES RP- 16-10

⁵ UL Standard for Safety for Electric Fans, UL 507

- 73 R. Other SSL Product: An integrated unit consisting of a light source, driver, heat sink, and
 74 intermediate circuitry that uses SSL technology (such as light-emitting diodes or organic light-
 75 emitting diodes) and is consumer replaceable in a CFLK. The term does not include LED lamps
 76 with ANSI-standard bases. Examples of other SSL products include OLED lamps, LED lamps
 77 with non-ANSI-standard bases, such as Zhaga interfaces, and LED light engines.³
- 78 S. Power Consumption: Defined as the active (real) and standby power and expressed in watts (W).
- 79 T. Residential Ceiling Fan²: A non-portable device designed for home use that is suspended from
 80 the ceiling for circulating air via the rotation of fan blades. Some ceiling fans are sold with ceiling
 81 fan light kits.
- 82 a) Standard Ceiling Fan¹: A low-speed small-diameter ceiling fan that is not a very-small-
 83 diameter ceiling fan, highly decorative ceiling fan or belt-driven ceiling fan; for which the
 84 lowest point on fan blades is greater than 10 inches from the ceiling.
- 85 b) Hugger Ceiling Fan¹: A low-speed small-diameter ceiling fan that is not a very-small-diameter
 86 ceiling fan, highly-decorative ceiling fan or belt-driven ceiling fan; for which the lowest point
 87 on the fan blades is less than or equal to 10 inches from the ceiling.
- 88 U. Solid-State Lighting³: Source technology where light is emitted from a solid object—a block of
 89 semiconductor – rather than from a filament or plasma, as in the case of incandescent and
 90 fluorescent lighting. This includes inorganic light-emitting diodes (LEDs) and organic light-emitting
 91 diodes (OLEDs).
- 92 V. Standby Mode Power²: The condition in which an energy-using product is connected to a main
 93 power source; and offers one or more of the following user-oriented or protective functions: to
 94 facilitate the activation or deactivation of other functions (including active mode) by remote switch
 95 (including remote control), internal sensor, or timer; or continuous functions, including information
 96 or status displays (including clocks) or sensor-based functions.
- 97 W. Very-Small-Diameter Ceiling Fan¹: A small-diameter ceiling fan that is not a highly-decorative
 98 ceiling fan or belt-driven ceiling fan; and has one or more fan heads, each of which has a blade
 99 span of 18 inches or less.

100 **Note:** In the interest of clarifying requirements for ceiling fans with light kits, EPA has integrated lighting
 101 efficiency and performance testing requirements into the ceiling fan specification. In addition, EPA has
 102 integrated definitions from the new Federal test method for ceiling fan airflow efficiency, including the
 103 definition of Basic Model.

104 2 SCOPE

105 2.1 Included Products

- 106 • Products that meet the definition of a Residential Ceiling Fan (i.e., Standard and Hugger) or Low-
 107 Mount High-Speed Small-Diameter Ceiling Fan as specified herein are eligible for ENERGY
 108 STAR certification.
- 109 • Products that meet the definition of a Ceiling Fan Light Kit as specified herein are eligible for
 110 ENERGY STAR certification.

111 **Note:** EPA understands that most ceiling fans currently sold in the residential market are categorized as
 112 Low-Speed Small-Diameter (LSSD), but some may be categorized as High-Speed Small-Diameter
 113 (HSSD) according to DOE's final rule. As such, EPA intends to recognize Low-Mount HSSD ceiling fans
 114 as specified in Section 1 which are considered safe for mounting in a residential setting (i.e., between 7
 115 and 10 feet from the ground). Low-Mount HSSD ceiling fans will be required to meet the same efficiency
 116 criteria as "Standard" residential ceiling fans as specified herein.

117 2.2 Excluded Products

- 118 • High-Speed Small-Diameter ceiling fans that do not meet the definition of Low-Mount HSSD.

- 119 • Large-Diameter ceiling fans, as defined in 10 CFR Part 430, Subpart B.
- 120 • Very-Small-Diameter, Highly Decorative, and Belt-driven ceiling fans, per Section 1, are not
- 121 covered by the definition of a Residential Ceiling Fan for ENERGY STAR certification.
- 122 • CFLs packaged with bulbs that have an ANSI-standard lamp shape and base type that have not
- 123 been ENERGY STAR certified (e.g., A19 shape and E26 base).
- 124 • CFLs not packaged with a light source.

125 **Note:** In consideration of new Federal definitions of ceiling fan types included in DOE’s minimum
 126 efficiency standards, EPA proposes modest adjustments to the scope of this specification. EPA proposes
 127 the inclusion of LSSD and low-mount high-speed small-diameter ceiling fans recognizing that these are
 128 the most likely to be used in a residential setting, which is in effect an expansion of scope to include
 129 hugger ceiling fans and those with blade span up to 84 inches. Large diameter ceiling fans and small
 130 diameter ceiling fans that must be mounted at greater than 10 feet from the floor are typically used in
 131 commercial or industrial settings, and it is not EPA’s intention to cover those uses with this specification.
 132 A few currently certified fans will be ineligible according to the new categories and scope once this
 133 revision takes effect.

134 3 CERTIFICATION CRITERIA

135 3.1 Ceiling Fan Requirements

136 3.1.1 Ceiling Fan Efficiency Requirements

137 Certified products shall meet or exceed the minimum requirements presented in Table 1, below, when
 138 operating in a downward-blowing direction.

139 Products that can be matched with several blade options shall be tested and meet these requirements
 140 with the blade option resulting in the highest energy consumption. Products that can be configured as
 141 either standard or hugger fans, depending on installation, shall meet the applicable requirements in each
 142 configuration. All Low-Mount HSSD fans must meet the requirements in Table 1, regardless of the
 143 installed configuration.

144 **Table 1: Ceiling Fan Airflow Efficiency Requirements**

Ceiling Fan Type	Minimum Efficiency [†] (cfm/W)	Minimum High Speed Airflow [†] (cfm)	Test Method & Supplemental Testing Guidance
Standard Ceiling Fan	$\geq 2.63 * D - 26.83$	$\geq 21.88 * D + 3096$	10 CFR Part 430, Subpart B, Appendix U Products shipped with ceiling fan light kits shall be tested with those light sources mounted in their intended position and switched off.
Low-Mount HSSD Ceiling Fan	$\geq 2.63 * D - 26.83$	$\geq 21.88 * D + 3096$	
Hugger Ceiling Fan	$\geq 1.75 * D - 15$	$\geq 17.87 * D + 2456$	

145 [†]D represents the fan blade span in inches

146 **Note:** EPA proposes increasing the required airflow efficiency primarily because there is significant
 147 opportunity for differentiation of products above the current ENERGY STAR level, despite low market
 148 shares for products meeting the current specification. Manufacturers have told EPA that the former
 149 requirement to use pin-based bulbs in ENERGY STAR ceiling fans with lighting was a significant barrier
 150 to consumer acceptance. This Version 4.0 specification allows ceiling fans with lights to ship with
 151 ENERGY STAR certified screw-based bulbs. Because of this, EPA expects the ENERGY STAR ceiling
 152 fan market share to grow. In addition to this, with the upcoming DOE fan efficiency standards (compliance
 153 date of January 21, 2020), the entire market will shift towards higher efficiency ceiling fans. This revision
 154 allows EPA to prepare for the shift, while giving consumers the advantage of better differentiation now.

155 The proposed airflow efficiency requirements take into consideration the DOE minimum efficiency with a
 156 compliance date in early 2020. Approximately 50% of ceiling fans meet the airflow efficiency requirements
 157 in the current ENERGY STAR specification, so increasing stringency is called for to maintain the value of
 158 the ENERGY STAR mark. While the ability to determine ratings according to the new metric is limited,
 159 EPA estimates that 18% of fans meet these proposed requirements, with qualifying models available at
 160 every diameter.

161 As in the current specification, EPA proposes minimum high-speed airflow requirements to ensure that
 162 efficiency does not come at a cost of consumer satisfaction. The air speed requirements are not intended
 163 to be highly restrictive, instead setting a floor at a level similar to that in the current specification. The
 164 required level for hugger fans is lower than for standard fans, reflecting overall lower expected airflow.

165 EPA welcomes stakeholder comments on these proposed requirements.

166 **3.2 Ceiling Fan Light Kit Requirements**

167 **3.2.1 CFLK Efficacy Requirements (Applies to all CFLKs)**

168 **Table 2: Ceiling Fan Light Kit Efficacy Requirements**

CFLK Type	Minimum Efficacy (lumens/W)	Minimum Light Output (lumens)	Methods of Measurement and/or Reference Documents
CFLK with Separable Light Sources: ENERGY STAR Certified Lamps	See ENERGY STAR Lamps Specification		ENERGY STAR Lamps Specification in effect on the CFLK's model date of manufacture
CFLK with Separable Light Sources: Other	65.0	All CFLK types shall deliver a minimum total light output of 800 lumens.	10 CFR Part 429 and 430, Subpart B, Appendix V1 (Fluorescent Lamp and Ballast Combinations: circline) 10 CFR Part 429 and 430, Subpart B, Appendix W (Fluorescent Lamp and Ballast Combinations: compact non-integrated) IES LM-82-12 (CFLKs with LED light engines) with energy efficiency measurements at room temperature determined in accordance with 10 CFR Part 429 and 430 Subpart B, Appendix V1 IES LM-82-12 (CFLKs with non-standard integrated LED lamps) with energy efficiency measurements at room temperature determined in accordance with CFR 429 and 430, Subpart B, Appendix BB.

CFLK with Integrated SSL Circuitry	70.0	10 CFR Part 429 and 430, Subpart B, Appendix V1 CFLK shall be evaluated based on luminaire photometry. Values shall be derived from the complete luminaire, including optical losses.
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Supplementary Testing Guidance for Products Using LED Light Engines

Laboratory test results shall be produced using the specific models of LED package, LED module or LED array and LED driver (i.e. LED light engine) that will be used in production. In situ temperature measurement value shall be determined in accordance with ANSI/UL 153:2002 (Sections 124-128A), ANSI/UL 1574:2004 (Section 54), or ANSI/UL 1598-2012 (Sections 19.7, 19.10-16), as applicable. Light output, input power and resulting efficacy at room temperature shall be determined in accordance with 10 CFR Part 429 and 430, Subpart B, Appendix V1; measurements at the in situ Tb value shall be determined in accordance with IES LM-82. Product shall meet requirements at both temperatures.

169 **Note:** These lighting efficacy requirements were established to be as consistent with the source and
170 luminaire based evaluation methodologies used in the ENERGY STAR Luminaires Version 2.0
171 specification as possible, while integrating the DOE test procedures for CFLKs. The difference is how
172 LED light engine performance will be tested and evaluated. This specification references the DOE test
173 method and IES LM-82; therefore, light engines will be evaluated at room temperature and at the in-situ
174 temperature. Minimum light output requirements were simplified from the ENERGY STAR Luminaires
175 specification to offer flexibility and deliver at minimum comparable light output to a single traditional 60W
176 light bulb. This minimum level for light output was chosen because CFLKs are typically used to provide
177 general illumination or be the primary light source in a given room, in place of a ceiling light.

178 **3.2.2 Option 1 Performance Requirements: for CFLKs Shipping with ENERGY STAR**
179 **Certified Light Bulbs**

180 For this certification pathway, CFLKs must ship with bulbs certified to the ENERGY STAR Lamp
181 Specification effective on the date of manufacture of CFLK and be included in the CFLK certification
182 documentation. Sections 3.2.3-3.2.4 do not apply as lighting performance requirements are fulfilled
183 through the certification of the lamp and the following five requirements listed in this section. Lamp
184 efficacy, light output, correlated color temperature, and ratings can be referenced on the ENERGY STAR
185 Lamps product listing. Certain CFLK specific requirements (as noted below) still apply to the CFLK.

186 To satisfy the requirements of this specification, ceiling fan light kits (CFLKs) shipping with ENERGY
187 STAR certified lamps shall:

- 188 1. Be packaged with light bulb(s) certified to the ENERGY STAR Lamps Specification in effect on
189 the CFLK's model date of manufacture. ENERGY STAR certified lamp model information for all
190 potential lamp models shipping with the CFLK must be included in the CFLK certification.
- 191 2. Be shipped with lamps suitable for the CFLK type. For example, a lamp shipped with an enclosed
192 CFLK must be safety tested in a totally enclosed situation and may not be rated or labeled "not
193 for use in totally enclosed fixtures," or similar.
- 194 3. Have in situ temperature of the ambient air inside of the enclosure measured to verify that the air
195 temperature does not exceed 45°C; in situ temperature shall be measured by placing a
196 thermocouple halfway between the surface of the bulb and the interior surface of the CFLK
197 enclosure.
- 198 4. Meet applicable safety ratings ANSI/UL 1993-2012, and ANSI/UL 8750-2009.
- 199 5. Be shipped with lamps directly installed or the ENERGY STAR certified lamps shipped with
200 CFLKs must comply with the packaging requirements of the lamps specification.

201 **Note:** As in the Luminaires specification, partners may include an appropriate ENERGY STAR certified
 202 bulb in their ceiling fan light kit and rely on the qualification of the bulb for most of the lighting
 203 requirements for certification. In addition to being easier for manufacturers, this provides an option for
 204 consumers to purchase products with the efficient performance of ENERGY STAR in the convenience of
 205 standard screw based sockets. EPA believes use of this option will significantly increase the consumer
 206 appeal of ENERGY STAR certified ceiling fans with lighting.

207 **3.2.3 Option 2 Performance Requirements: for CFLKs with Integrated Solid-State**
 208 **Lighting Circuitry and CFLKs with Separable Light Sources Other than ENERGY**
 209 **STAR Certified Lamps**

210 For all applicable requirements below, unless otherwise noted, laboratory test results shall be produced
 211 using the specific models of lamp and ballast or LED package, LED module or LED array and LED driver
 212 that will be used in production. Unless otherwise noted (e.g. minimum rated lifetime for fluorescent
 213 products), one sample of each lamp-ballast model combination, or LED package/LED module/LED array
 214 and LED driver model combination shall be tested. Sample must pass the following requirements.

215 **Table 3: Ceiling Fan Light Kit Performance Requirements**

CFLK Performance criteria	Requirement	Methods of Measurement and/or Reference Documents
Color Consistency	<p>Correlated Color Temperature (CCT): CFLK must correlate to at least one of the following ANSI nominal CCTs and fall within the designated 7-step quadrangle or ellipse using the Objective Chromaticities detailed in the reference publications.</p> <ul style="list-style-type: none"> • 2700 Kelvin • 3000 Kelvin • 3500 Kelvin • 4000 / 4100 Kelvin • 5000 Kelvin 	<p>Methods of Measurement: IES LM-9-09 (Fluorescent Lamp and Ballast Combinations: circline) 10 CFR Part 429 and 430, Subpart B, Appendix W (Fluorescent Lamp and Ballast Combinations: compact non-integrated) IES LM-79-08 (CFLKs with Integrated Solid-State Lighting Circuitry) IES LM-82-12 (CFLKs with LED light engines) IES LM-82-12 (CFLKs with non-standard integrated LED lamps) with energy efficiency measurements at room temperature determined in accordance with CFR 429 and 430, Subpart B, Appendix BB.</p> <p>Calculation: CIE 15.2004</p> <p>Reference Documents: ANSI C78.376-2001 (Fluorescent Lamp and Ballast Combinations: circline) ANSI/NEMA/ANSLG C78.377-2015 (CFLKs with Integrated Solid-State Lighting Circuitry & Other SSL Products Using Consumer Replaceable LED Light Engines)</p> <p>Testing Color Tunable CFLKs: The requirements of this section do not apply to products that only have color shifting dimmable (dim-to-warm) functionality because they are only evaluated at the highest wattage or voltage setting.</p> <p>For full-color-tunable and white-tunable CFLKs:</p> <ul style="list-style-type: none"> • All tests and evaluations included in this specification shall be performed at the most consumptive white light setting covered by this specification; and

CFLK Performance criteria	Requirement	Methods of Measurement and/or Reference Documents
		<ul style="list-style-type: none"> Watts, lumens, chromaticity, and CRI shall be tested and reported for default and most consumptive white light setting covered by this specification. <p>In order to facilitate compliance testing, the partner shall provide detailed instructions for the control settings or control signals (as applicable) for reaching the default, and most consumptive white light modes as applicable.</p>
	<p>Color Maintenance: Luminaire change in chromaticity coordinates from 0-hour measurement, at any measurement point during operation, shall be \leq a total linear distance of 0.007 on the CIE 1976 u'v' diagram.</p>	<p>Methods of Measurement: IES LM-79-08 (CFLKs with Integrated Solid-State Lighting Circuitry & Other SSL Products Using Consumer Replaceable LED Light Engines) IES LM-80-08 and its Addendum A or IES LM-80-15 (CFLKs with Integrated Solid-State Lighting Circuitry & Other SSL Products Using Consumer Replaceable LED Light Engines) IES LM-84-14 (Other SSL Products Using Consumer Replaceable LED Light Engines)</p> <p>Reference Documents: CIE 13.3-1995</p> <p>In situ temperature measurements (CFLKs with Integrated Solid-State Lighting Circuitry & Other SSL Products Using Consumer Replaceable LED Light Engines): ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598-2012 (Sections 19.7, 19.10-16)</p>
<p>Color Accuracy</p>	<p>CFLK shall be capable of meeting or exceeding CIE Color Rendering Index values as follows, Ra \geq 80 and R9 > 0</p>	<p>Methods of Measurement: CIE 13.3-1995 IES LM-9-09 (Fluorescent Lamp and Ballast Combinations: circline)</p> <p>10 CFR Part 429 and 430, Subpart B, Appendix W (Fluorescent Lamp and Ballast Combinations: compact non-integrated) IES LM-79-08 (CFLKs with Integrated Solid-State Lighting Circuitry) IES LM-82-12 (CFLKs with LED light engines) IES LM-82-12 (CFLKs with non-standard integrated LED lamps) with energy efficiency measurements at room temperature determined in accordance with CFR 429 and 430, Subpart B, Appendix BB.</p> <p>Reference Documents: CIE 13.3-1995</p> <p>In situ temperature measurements (separable): ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598-2012 (Sections 19.7, 19.10-16)</p> <p>Supplemental Testing Guidance: LED light engine ("source") CRI shall meet the requirement as determined by comparing the in</p>

CFLK Performance criteria	Requirement	Methods of Measurement and/or Reference Documents
		<p>situ (installed in the luminaire) T_b value to the LM-82 test report. In situ temperature measurement value shall be determined in accordance with ANSI/UL 153:2002 (Sections 124-128A), ANSI/UL 1574:2004 (Section 54), or ANSI/UL 1598-2012 (Sections 19.7, 19.10-16), as applicable. LM-82 test reports shall detail luminous efficacy, luminous flux, chromaticity coordinates, CCT and CRI values for all tested temperatures. Linear interpolation shall be employed to determine source photometric performance at temperatures between the LM-82 reported temperatures higher and lower than the in situ temperature. Luminaires incorporating more than one source shall have all sources installed and operational during in situ temperature testing.</p>
<p>Minimum Rated Life</p>	<p>10,000 hours (Fluorescent Lamp and Ballast Combinations: compact non-integrated)</p> <p>Passing Test: $\geq 50\%$ of the sample set shall be functioning at the lifetime requirement.</p>	<p>Methods of Measurement: IES LM-40-10 (circline) 10 CFR Part 429 and 430, Subpart B, Appendix W (Fluorescent Lamp and Ballast Combinations: compact non-integrated)</p> <p>Sample Size: ≥ 3 samples of each CFLK model shall be tested.</p> <p>Supplemental Testing Guidance: Conditional certification may be granted if both of the following are met:</p> <ol style="list-style-type: none"> 1. Testing has been completed for at least 40% of rated life. 2. A date for testing completion has been established by the test laboratory. <p>Conditional certification shall be immediately withdrawn if final testing results do not meet the requirement.</p>
	<p>25,000 hours (Indoor Separable CFLKs using LED Light Engines) 35,000 hours (Outdoor Separable CFLKs using LED Light Engines) 50,000 hours (CFLKs with Integrated Solid-State Lighting Circuitry)</p>	<p>SSL CFLK Rated Life is determined by a lumen maintenance projection of L_{70}. See section 3.2.4 below for more related SSL Rated Life testing requirements.</p>
<p>Start Time</p>	<p>Light source shall remain continuously illuminated within 750 milliseconds of application of electrical power</p> <p>Exception: CFLKs meeting the connected criteria shall remain continuously illuminated within 1000 milliseconds of application of electrical power.</p>	<p>Method of Measurement: ENERGY STAR Start Time Test Method or 10 CFR Parts 429 and 430, Subpart B, Appendix W</p> <p>Reference Document: ANSI C82.11 Consolidated-2002, Section-5.2</p>
<p>Run Up Time</p>	<p>Only applicable to Fluorescent CFLKs</p> <p>Reported value of time for lamps to reach 80% of stabilized lumen output after application of electrical power shall be ≤ 45 seconds</p>	<p>Method of Measurement: ENERGY STAR Run-Up Time Test</p> <p>Reference Document: IES LM-54-12 IES LM-66-14</p>

CFLK Performance criteria	Requirement	Methods of Measurement and/or Reference Documents
Power Quality	Total CFLK input power \leq 5 watts: Power Factor \geq 0.5 Total CFLK input power > 5 watts: Power Factor \geq 0.7	Method of Measurement: C82.77-10:2014
Transient Protection	CFLK integrated light source, ballast or driver shall comply with ANSI/IEEE C62.41.1-2002 and ANSI/IEEE C62.41.2-2002, Category A operation. The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode. Units shall be fully operational at the completion of testing.	Methods of Measurement: ANSI/IEEE C62.41.1-2002 and ANSI/IEEE C62.41.2-2002, Category A operation
Operating Frequency: 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.	Fluorescent 20 to 33 kHz or \geq 40 kHz SSL \geq 120 Hz	Fluorescent Method of Measurement: ANSI C82.2-2002 SSL Method of Measurement: None referenced Reference Document: IEEE PAR1789 Supplemental Testing Guidance: Laboratory test results shall be produced using the specific luminaire, or LED light engine used in the luminaire. Light output waveform shall be measured with a photodetector with a rise time of 10 microseconds or less, transimpedance amplifier and oscilloscope. Employed equipment models and method of measurement shall be documented. Temporal response, amplification and filtering characteristics of the system shall be suitably designed to capture the photometric waveform. Digitized photometric waveform data and an image of the relative photometric amplitude waveform shall be recorded. Measured data shall be recorded to a digital file with an interval between each measurement no greater than 0.00005 sec (50 microseconds) corresponding to an equipment measurement rate of no less than 20kHz, and capture at least 1 second of data. Sample Size: 1 luminaire, LED light engine, or retrofit kit shall be tested.
Serviceability	Light sources and ballasts or drivers shall be accessible and removable by an electrician without the cutting of wires and without damage to the luminaire housing, trim, decorative elements or the carpentry (e.g., ceiling drywall) to which the luminaire is attached. Instructions shall be provided with the luminaire, detailing guidance on ballast or driver replacement by a "qualified electrician" Exceptions: CFLKs shipping with ENERGY STAR certified lamps, light engines with integrated drivers, and CFLK with Integrated Solid-State Lighting Circuitry.	
Thermal Performance: This performance characteristic is separate and distinct from safety requirements and	Ballast or driver shall not exceed the maximum recommended case temperature, as provided by ballast or driver manufacturer, during in situ (installed in the luminaire) operation.	Reference Documents: ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598-2012 (Sections 19.7, 19.10-16). Supplemental Testing Guidance: Fluorescent: Ballast case temperature shall be

CFLK Performance criteria	Requirement	Methods of Measurement and/or Reference Documents
can be measured by an EPA recognized laboratory.		<p>measured at thermal equilibrium, at the hot spot location provided by the ballast manufacturer.</p> <p>SSL: Driver case temperature shall be measured at thermal equilibrium, at the temperature measurement point for the hottest location on the driver case (TMPC as detailed by the driver manufacturer).</p>
Safety	<p>CFLKs and their key components (light source and driver or ballasts) must comply with the appropriate safety certifications.</p> <p>Connected products must continue to comply with the applicable product safety standards – the addition of the functionality shall not override existing safety protections and functions.</p>	<p>Fluorescent CFLKs must demonstrate compliance with ANSI/UL 1598, ANSI/UL 2108, ANSI/UL 935-, ANSI/UL 1310, and ANSI/UL 1993, as applicable.</p> <p>SSL CFLKs must demonstrate compliance with ANSI/UL 1598, ANSI/UL 2108, ANSI/UL 8750, ANSI/UL 1310, ANSI/UL 2108, and ANSI/UL 8750, as applicable.</p> <p>Documentation shall be produced by an OSHA NRTL laboratory.</p>
<p>Dimmability: This applies to any CFLK marketed as dimmable; if not marketed as dimmable, packaging and marketing materials must identify that the CFLK is “not dimmable”</p>	<p>A dimmable CFLK shall provide continuous dimming from 100% to 20% of light output.</p> <p>Exception: Step dimming CFLKs</p> <p>At minimum claimed light output, CFLK shall not emit noise above 24dBA when measured at a distance of one meter or less.</p> <p>See packaging section for related marking requirements.</p> <p>A dimmable SSL CFLK shall meet NEMA SSL 7A and NEMA 77-2017 for compatibility and temporal light modulation limits respectively.</p>	<p>Methods of Measurement:</p> <p>NEMA 77-2017</p> <p>NEMA SSL7A</p> <p>ENERGY STAR Recommended Practice - Light Output on a Dimmer</p> <p>ENERGY STAR Test Method - Noise</p> <p>Reference Documents:</p> <p>ISO 7574-4:1985, B.2.1</p> <p>ANSI S12.55- 2012/ISO3745:2012</p>

216 **Note:** All performance requirements above were carried over from the ENERGY STAR Luminaires
 217 Version 2.0 specification. Where no test methods were referenced in the Luminaires specification for
 218 dimming, EPA has carried over the relevant test methods and recommended practices from the ENERGY
 219 STAR Lamps Version 2.0 specification. EPA is also proposing to include a new standard to address
 220 temporal light modulation for dimmable CFLKs. This test method is under development. Stakeholders
 221 interested in this development process can contact lighting@energystar.gov. This test method is
 222 expected to be completed prior to the effective date of this specification.

223 **3.2.4 Option 2 Lumen Maintenance Requirements: CFLKs with Integrated Solid-State**
 224 **Lighting Circuitry and CFLKs with Separable Light Sources Other than ENERGY**
 225 **STAR Certified Lamps**

226 **Table 4: Ceiling Fan Light Kit Lumen Maintenance Requirements**

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Fluorescent: non-self-ballasted fluorescent lamps shipped with the CFLK	Lamp shall have an average rated lumen maintenance of at least 80% of initial lamp lumens at 40% of rated lamp life.	Methods of Measurement: IES LM-40-10 IES LM-09-09 (Circline) 10 CFR Part 429 and 430, Subpart B, Appendix W to Subpart B (Fluorescent Lamp and Ballast Combinations: compact non-integrated) Reference Documents: ANSI C82.1 ANSI C82.3 ANSI C78.901 IES LM-66-14	Sample Size: ≥ 3 samples of each lamp model shall be tested and all units must pass.
Solid-State Option 1: CFLK, LED Light Engine, LED Package, Module, or Array	The LED package(s)/ module(s)/array(s) and LED light engines used in CFLKs with Integrated Solid-State Lighting Circuitry or Separable CFLKs, shall meet the following L ₇₀ rated lumen maintenance life values, in situ: <ul style="list-style-type: none"> • L₇₀(6k) ≥ 25,000 hours for indoor Separable CFLKs using LED Light Engines • L₇₀(6k) ≥ 35,000 hours for outdoor Separable CFLKs using LED Light Engines • L₇₀ ≥ 50,000 hours for all CFLKs with integrated Solid-State Lighting circuitry 	Option 1 Methods of Measurement: Lumen Maintenance: IES LM-80-08 and its Addendum A or IES LM-80-15 Lumen Maintenance Projection Method: IES TM-21-11 and its Addendum B CCT Calculation: CIE 15:2004 Reference Documents: ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598-2012 (Sections 19.7, 19.10-16)	Sample Size: 1 complete luminaire or LED light engine. LM-80 Sample Size: Minimum sample size of 20 units for LED packages, or 10 units for LED arrays or LED modules, for each T _s and drive current combination (refer to IES TM-21-11, section 4.2). Important guidance regarding LM-80 test reports, their application, and provisions for successor subcomponents are detailed in ENERGY STAR Requirements for the Use of LM-80 Data . Passing Test: All of the conditions below shall be met. If any of the conditions are not met, the component performance option may not be used, and Option 2, below, must be used for compliance. <ol style="list-style-type: none"> 1. In the sample luminaire, the <i>in situ</i> TMP_{LED} temperature is less than or equal to the temperature specified in the LM-80 test report for the corresponding or higher drive current, within the manufacturer's specified operating current range. 2. The drive current measured in the luminaire is less than or equal to the drive

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
	<p>Lifetime claims shall be substantiated with a TM-21 lumen maintenance life projection report.</p>	<p>Chromaticity Specifications: ANSI/NEMA/ANSLG C78.377-2015</p> <p>Lumen Maintenance: ENERGY STAR TM-21 Calculator</p>	<p>current specified in the LM-80 test report at the corresponding temperature or higher.</p> <p>3. The TM-21 calculator report projects lumen maintenance life (i.e. L₇₀) meeting or exceeding requirements.</p> <p>Lumen maintenance projections must support all LED colors used.</p> <p>Compliance with the above shall be documented with a TM-21 lumen maintenance life projection report as detailed in TM-21, section 7. The report shall be generated using data from the LM-80 test report for the employed LED package/module/array model (“device”), the forward drive current applied to each device, and the in situ TMP_{LED} temperature of the hottest device in the luminaire. In addition to LM-80 reporting requirements, the following information shall be reported:</p> <ul style="list-style-type: none"> • Sampling method and sample size (per LM-80 section 4.3) • Test results for each T_s and drive current combination • Description of device including model number and whether device is an LED package, module or array (see Definitions) • ANSI target, and calculated CCT value(s) for each device in sample set • Δ u’v’ chromaticity shift value on the CIE 1976 diagram for each device in sample set • A detailed rationale, with supporting data, for application of results to other devices (e.g. LED packages with other CCTs) <p>Access to the TMP_{LED} for the hottest LED may be accomplished via a minimally sized hole in the luminaire housing, tightly resealed with a suitable sealant if created for purposes of testing.</p> <p>All thermocouple attachments and intrusions to luminaire housing shall be photographed.</p>
<p>Solid-State</p> <p>Option 2:</p> <p>CFLK or LED Light Engine</p>	<p>CFLKs with integrated Solid-State Lighting circuitry and Separable CFLKs using LED light engines shall meet the following L₇₀ rated lumen maintenance life values, in situ:</p> <ul style="list-style-type: none"> • L₇₀(6k) ≥ 25,000 hours for indoor Separable CFLKs using LED Light Engines 	<p>Option 2</p> <p>Methods of Measurement:</p> <p>Lumen Maintenance: IES LM-84-14</p> <p>Lumen Maintenance Projection Method: IES TM-28-14 – Projection Method 1, Direct Extrapolation</p> <p>CCT Calculation: CIE 15.2004</p>	<p>CFLK shall be operated continuously in accordance with ANSI/UL 1598-2012, ANSI/UL 1574-2004 or ANSI/UL 153-2002 during the testing; any deviations from this shall be reported. LED light engines (“source”) shall be operated continuously in situ (installed in the luminaire), with the luminaire operating in accordance with the appropriate safety standard for the product type during the testing. Luminaires incorporating more than one source shall have all sources installed and operational during the testing. During initial and final measurements, T_b temperature shall be controlled to match T_b temperature</p>

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
	<ul style="list-style-type: none"> • $L_{70}(6k) \geq 35,000$ hours for outdoor Separable CFLKs using LED Light Engines • $L_{70} \geq 50,000$ hours for all CFLKs with integrated Solid-State Lighting circuitry <p>Lifetime claims shall be substantiated with a TM-28 lumen maintenance life projection report.</p>	<p>Reference Documents: Chromaticity Specifications: ANSI/NEMA/ANSLG C78.377-2015 ANSI/UL 153:2002 (Sections 124-128A) ANSI/UL 1574:2004 (Section 54) ANSI/UL 1598-2012 (Sections 19.7, 19.10-16) ANSI/UL 1598C-2014</p> <p>Chromaticity Specifications: ANSI/NEMA/ANSLG C78.377-2015</p> <p>Lumen Maintenance: ENERGY STAR TM-28 Calculator</p>	<p>measured when source is operated in situ.</p> <p>Test reports shall detail efficacy, luminous flux, chromaticity coordinates, CCT, and CRI values at all test intervals. Test intervals shall be conducted according to IES TM-28-14 §4.2 with a maximum interval length of 1,000 hours. Lumen maintenance projections must support all LED colors used.</p> <p>Sample Size: According to IES TM-28-14 – §5.1.5 CFLK with Integrated Solid-State Lighting Circuitry: 3 or more complete CFLKs. Separable: 3 or more sources and the necessary number of luminaires required to operate the sources continuously in situ.</p> <p>Passing Test: All luminaires or sources shall pass.</p>

227 **Note:** Section 3.2.4 is virtually identical to the current ENERGY STAR requirements for ceiling fans with
228 lighting but has been edited in this Draft 1 specification in an effort to simplify navigating this specification.

229 4 CONTROL AND STANDBY REQUIREMENTS

230 4.1 Wired and Remote Controls

231 Certified products shall permit convenient consumer adjustment of fan speed and lighting source control.
232 This may be accomplished by means of one or more wall-mounted switch(es), readily accessible pull
233 chain(s), remote controls or mobile device applications.

234 For purposes of this specification, “readily accessible” shall be defined as a chain length sufficient to
235 reach a height of no more than 80 inches (203 cm) above the floor when the residential ceiling fan is
236 mounted according to the residential ceiling fan’s installation instructions.

237 Certified products that offer wireless remote signal control must provide at least one hard-wired (i.e., wall-
238 mounted switch or readily accessible pull chain) control as a backup in case of wireless signal failure.
239 For those residential ceiling fans that can accommodate ceiling fan light kits, the lights and the fans shall
240 be able to be controlled separately, allowing users to switch off lights during fan operation or operate the
241 lights without using the residential ceiling fan.

242
243 Certified products shall also provide for consumer adjustment of airflow direction (upward or downward)
244 by one of the following means:

- 245 • A vertically or horizontally mounted slide switch on the motor housing. For vertically mounted
246 switches, the downward position shall correspond to downward airflow. For horizontally mounted
247 switches, airflow direction shall be clearly identified on the switch housing or within the product
248 literature.
- 249 • A wall-mounted switch
- 250 • A readily accessible pull chain
- 251 • A remote control or mobile device application

252 **4.2 Products with Connected Functionality – Optional**

253 **4.2.1 Connected Product Criteria**

254 Connected functionality is optional and products may be certified as ENERGY STAR without meeting
255 these requirements. Those that meet these connected criteria will be identified as connected in the
256 ENERGY STAR Product Finder.

257
258 To be identified as connected, a certified product shall include the base product plus elements (hardware
259 and software or firmware) or instructions required to enable communication in response to consumer-
260 authorized energy or performance related commands (e.g. instructions for downloading a mobile
261 application, Bluetooth syncing guidance) and shall meet the requirements in sections 4.2.2-4.2.6. These
262 elements may be resident inside or outside of the base product. Connected products typically
263 communicate with controls via a radio frequency system (e.g., Wi-Fi, DALI, ZigBee, Bluetooth), although
264 some versions use other methods (e.g., DMX).

265 The specific design and implementation of the connected product is at the partner's discretion provided it
266 enables economical, consumer-authorized third party access to the functions provided for in sections
267 4.2.3, 4.2.4, and 4.2.5. Compliance with connected functionality requirements shall be demonstrated
268 through examination of product and/or product documentation.

269 **4.2.2 Open Access**

270 The certified product shall enable connectivity by one of following means:

- 271 1. Open-standards communications from the certified product, or
- 272 2. Open-standards communications from an external controller, included with the product or
273 available separately.
- 274 3. Where no suitable open standards communications method exists (e.g., an IP interface), an
275 available and documented communication method must be used. In these cases, a manufacturer-
276 specific method to implement the functions in sections 4.2.3, 4.2.4 and 4.2.5 shall be published
277 for use with the product.

278 To enable interconnection with the product, an interface specification, Application Programming Interface
279 (API) or similar documentation shall be made available to interested parties that enables section 4.2.3,
280 4.2.4 and 4.2.5 connected functionality, and includes accuracy, units and measurement intervals for
281 Energy Consumption Reporting.

282 **4.2.3 Energy Consumption Reporting**

283 The product, or the gateway device or cloud service connected to it, shall be capable of interconnecting
284 with consumer authorized entities to communicate data representative of its interval energy consumption.
285 It is recommended that data be reported in watt-hours for intervals of 15 minutes; however, representative
286 data may also be reported in alternate units and intervals as specified in the product manufacturer's
287 interface specification or API. If the product does not provide power consumption directly in watts, the
288 manufacturer shall make available a method for estimating power consumption, in watts, from the
289 representative data that is provided by the product.

290 **4.2.4 Operational Status Reporting**

291 At a minimum, the product, or the gateway device or cloud service connected to it, shall be capable of
292 providing the operational status (e.g., on/off status, speed, direction) to energy management systems and
293 other consumer authorized devices, services or applications via a communication link.

294 **4.2.5 Remote Management**

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

298 **4.2.6 Information to Consumers**

299 If additional devices, services, and/or infrastructure are required to activate the product’s connected
300 capabilities, prominent labels, or other forms of consumer notifications shall be displayed at the point of
301 purchase and in the product literature. (e.g. “This product has Z-wave control capability and requires
302 interconnection with a Z-wave controller to enable local control.”)
303

304 **Note:** A growing number of ceiling fans are available that offer control via a mobile device application,
305 often in conjunction with the ability to work with a third party home control hub like Apple Homekit or other
306 connected devices such as the Nest Learning Thermostat. EPA believes that along with the additional
307 convenience such integration offers consumers, it has the potential to support energy savings as well.
308 EPA has included optional connected criteria in specifications for many ENERGY STAR product types to
309 recognize growing consumer interest in such products and encourage features that support energy
310 savings to be offered in them.

311 The criteria proposed in section 4.2 reflect EPA’s interest in working with ceiling fan stakeholders to
312 develop such criteria for ceiling fans. The proposed requirements are modeled on those in the ENERGY
313 STAR Luminaires Version 2.0 and Lamps Version 2.0 specifications. Note that EPA considers products
314 using a traditional IR or RF remote wall switch or remote control alone very different than those intended
315 for integration into a home automation system, and does not expect them to be identified as connected.

316 In ENERGY STAR product categories that include optional connected criteria, EPA highlights products
317 that meet the criteria on the ENERGY STAR Product Finder, so end-users interested in products that
318 could be integrated into a home automation system can better identify them. Products do not need to
319 meet section 4.2 to be certified as ENERGY STAR.

320 EPA welcomes stakeholder feedback on this proposal, and looks forward to a robust discussion. Settling
321 on these requirements need not delay the schedule to finalize the revision. If additional discussion is
322 needed to complete these criteria, EPA will finalize with a “TBD” for the connected requirements and
323 follow up with a dot 1 revision to finalize the requirements. This will allow partners to certify products using
324 the new Federal test method and metric as soon as possible.

325 **4.3 Standby Power Consumption**

326 **Table 5: Standby Power Consumption Requirements**

ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents
Standby power consumptions of certified ceiling fans and ceiling fan light kits shall be reported separately. Laboratory test results shall detail standby power consumption to at least the tenth of a watt.	10 CFR Part 430, Subpart B, Appendix U

327 **Note:** EPA proposes standby power as a reporting requirement in order to help evaluate the standby
328 energy cost of features that may decrease total power used (e.g. occupancy sensors, home automation
329 integration).

330 **5 MINIMUM WARRANTY**

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

334 Certified ceiling fans shall provide a warranty of at least 10 years for the motor and associated driver
335 electronics and at least one year for all other non-lighting components of certified residential ceiling fans.

- 336 For ceiling fan light kits that:
- 337 • Incorporate replaceable drivers, a written warranty shall be included with CFLK packaging at the
- 338 time of shipment which covers repair or replacement of defective parts of the CFLK housing,
- 339 mounting hardware, optics, driver and trim for a minimum of 3 years from the date of purchase.
- 340 • Incorporate non-replaceable drivers, the above warranty requirement is extended to 5 years.

341 6 PRODUCT CERTIFICATION

342 6.1 CFLK Product Families

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

344 Certified products within a product family shall be identical to the tested, representative model with the

345 exception of allowed variations listed in the table below. The representative model shall be the variation

346 expected to have the greatest difficulty meeting the performance requirements outlined in this

347 specification.

348

349

Table 6: Allowable Variations within Product Families

CFLK Attribute	Allowable Variation	Additional Test Data Required for Each Variant
Housing / Chassis	Allowed so long as the light source or lampholder, ballast or driver, and heat sink (as applicable) are integrated into housing / chassis variations in such a way that the thermal performance of the CFLK is not degraded by changes to the housing / chassis.	Engineering rationale or thermal measurements of each variation may be required (e.g. ballast case temperature, TMP_{LED} , or TMP_C).
Heat Sink / Thermal Management Components	Not allowed.	None
Finish	CFLK body color/pigment.	None
Mounting	Allowed.	None
Electrical Connection (SSL Retrofits)	Allowed (e.g. E26 and GU24).	None
Reflector / Trim	Allowed so long as CFLK light output is not reduced.	Luminous flux for each basic trim or reflector variation of the darkest or least efficient finish may be required.
Shade / Diffuser	Allowed so long as neither CFLK light output nor airflow are reduced.	None
Light Source ⁶ (refers to the make and/or model of the source; also review CCT below)	Allowed so long as variations will not negatively impact CFLK's compliance with any performance criteria in this specification.	<ul style="list-style-type: none"> • Certified performance data from additional light source if separable • Integrating sphere test for CFLK with Integrated Solid-State Lighting Circuitry

⁶ Partners may not retroactively add variations to a product family unless requirements in Table 1 are still met. For example, if the representative model tested is a SSL product with a 3000K nominal CCT, partner may not retroactively add a 2700K model without additional testing, as this was not the lowest CCT initially tested.

Correlated Color Temperature (CCT)	Allowed so long as the lamp series or LED package/module/array series (and associated drive current), ballast or driver, and thermal management components are identical, and so long as variations will not negatively impact CFLK's compliance with any performance criteria in this specification.	None
(also review Light Source above)	The representative model shall be the version within the product family with the lowest CCT for SSL products and the highest CCT for discharge products.	
	Partner shall use different CFLK model numbers to distinguish between models shipped with light sources of varying CCTs.	
Product Wattage ⁷	For CFLK with Integrated Solid-State Lighting Circuitry: <ul style="list-style-type: none"> The only product wattage variation allowed to the CFLK is a change that provides a different drive current to the LED package, array or module. The LED package, array, or module model must not change, although CCT remains an allowable variation. The model tested should be the highest wattage, highest CRI, and lowest CCT variant. 	<ul style="list-style-type: none"> LED drive current measurement Integrating sphere scan to represent performance of variants including: <ul style="list-style-type: none"> CCT Lumen Output CRI Power Consumption Chromaticity
	For Fluorescent products: <ul style="list-style-type: none"> The lamp wattage may change, but not the general type or configuration. <p>Example: A 32W triple tube pin based fluorescent representing a 26W triple tube pin based fluorescent would be acceptable, but not representing a 26W twin tube fluorescent.</p> <ul style="list-style-type: none"> The only performance change to the CFLK is to the lamp (or lamp and ballast) with a lower wattage. The model tested should be the highest wattage, highest CRI, and highest CCT variant. 	<ul style="list-style-type: none"> Certified lamp data for variants Integrating sphere scan to represent performance of variants including: <ul style="list-style-type: none"> CCT Lumen Output CRI Power Consumption Chromaticity
Ballast / Driver (no change in nominal wattage or current)	Allowed so long as variations will not negatively impact CFLK's compliance with any performance criteria in this specification.	Thermal measurements of each variation may be required (e.g. ballast case temperature or TMP _c).

350 **6.2 Solid-State Lumen Performance Data**

351 Content and application of IES LM-80-08 reports for CFLKs shall comply with the [ENERGY STAR](#)
352 [Requirements for the Use of LM-80 Data.](#)

⁷When wattage 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 CFLK specific requirements. The additional models would still require an integrating sphere LM-79 test to verify other photometric and electrical performance requirements. Each wattage variation should be listed individually.

353 **6.3 Significant Digits and Rounding**

- 354 1. All calculations shall be carried out with directly measured (unrounded) values.
355 2. Unless otherwise specified, compliance with specification limits shall be evaluated using directly
356 measured or calculated values without any benefit from rounding.
357 3. Directly measured or calculated values that are submitted for reporting on the ENERGY STAR
358 website shall be rounded to the nearest significant digit as expressed in the corresponding
359 specification limit.
360 4. Ceiling Fan Efficiency shall be expressed as a whole number in accordance with Section 3.1 of
361 10 CFR 430, Subpart B, Appendix U.
362 5. Ceiling Fan Light Kit efficacy shall be rounded to the nearest tenth of a lumen per watt in
363 accordance with 10 CFR 429, Subpart B §429.33.

364 **6.4 Ceiling Fan Sampling**

365 One of the following sampling plans shall be used for purposes of testing for ENERGY STAR certification
366 of ceiling fans:

- 367 1. A single unit is selected, obtained, and tested. The measured performance of this unit and of
368 each subsequent unit manufactured must be equal to or better than the ENERGY STAR
369 specification requirements. Results of the tested unit may be used to certify additional individual
370 model variations within a basic model group as long as the definition for basic model group
371 provided in Section 1, above, is met; or
372 2. Units are selected for testing and results calculated according to the sampling requirements
373 defined in 10 CFR 429, Subpart B §429.32 for ceiling fans and 10 CFR 429, Subpart B §429.33
374 for ceiling fan light kits. The certified rating must be equal to or better than the ENERGY STAR
375 specification requirements. Results of the tested unit may be used to certify additional model
376 variations within a basic model group as long as the definition for basic model group provided in
377 Section 1, above, is met. Further, all individual models within a basic model group must have the
378 same certified rating. Based on the applicable sampling criteria, this rating must be used for all
379 manufacturer literature, the qualified product list, and certification of compliance to DOE
380 standards.

381 **Note:** EPA has updated sampling language to align with its usual language for DOE-covered products.
382 For such products, EPA accepts any rating that DOE accepts. That means, for instance, that the
383 qualification of all members of a basic model based on one member works the same for ENERGY STAR
384 certification as for DOE compliance.

385
386 EPA proposes to pull in relevant language from the Luminaires specification further defining product
387 families for the purpose of CFLK certification.

388 **7 LABELING & PACKAGING**

389 **7.1 Ceiling Fans Sold without Ceiling Fan Light Kits**

390 Certified residential ceiling fans sold without ceiling fan light kits shall provide information on product
391 packaging or with product instructions regarding ENERGY STAR certified ceiling fan light kits that may be
392 used with that particular residential ceiling fan.

393 **7.2 Ceiling Fan Light Kit Packaging Requirements (sold with a fan or separately)**

- 394 1. Packaging and marketing claims shall represent the product consistent with its certification.
395 2. Packaging shall clearly describe the nominal color designation of the lamp in units of Kelvin (e.g.
396 2700K, 3000K) and may display recommended corresponding nomenclature as outlined below.
397 This can also be met through use of a Lighting Facts label (as applicable). If packaging includes a

- 398 color descriptor term, EPA recommends the following corresponding nomenclature as outlined
 399 below.
- 400 a. 2700K – Soft White
 - 401 b. 3000K – Warm White
 - 402 c. 3500K – Neutral White
 - 403 d. 4000/4100K – Cool White
 - 404 e. 5000K – Daylight
- 405 3. **For CFLKs shipped with lamps containing mercury:** Both the lamp and the CFLK packaging
 406 shall have a label indicating mercury content which must be managed and disposed of properly,
 407 and shall reference: www.epa.gov/cfl
 - 408 4. **For outdoor CFLKs:** Packaging shall indicate the minimum (lowest) starting temperature for the
 409 lamp and ballast platform of the CFLK.
 - 410 5. **For CFLKs marketed as dimmable:** CFLK packaging shall indicate dimming range (as
 411 applicable), a list or web site address with compatible dimmers or other controls or NEMA
 412 light+dimmer compatibility marking, and known incompatibilities with dimmers, occupancy or
 413 vacancy sensors, timing devices or other external lighting controls, or a message noting
 414 limitations and web site address to find out more specific information. Partner shall periodically
 415 review this packaging language to determine if updates are needed. Additionally, Partner is
 416 encouraged to maintain an up to date web address where additional compatibility information is
 417 detailed. Step dimming capability, if employed, shall be clearly indicated.
 - 418 6. While not a requirement for certification, EPA recommends partners provide a conspicuous
 419 ENERGY STAR certification mark (e.g. sticker, hangtag) on certified CFLKs themselves: to
 420 facilitate building inspectors confirming certification status of installed CFLKs and to provide out-
 421 of-the-box marketing of a CFLK's ENERGY STAR certification and to demonstrate to consumers
 422 a partner's commitment to advancing energy efficiency in lighting

423 8 LIGHTING TOXICS REDUCTION REQUIREMENTS: ALL CFLKS

424 CFLKs shall not exceed hazardous substance concentrations set forth in the European Union's (EU)
 425 Restriction of the Use of Certain Hazardous Substances ([RoHS](#)) Directive, 2003.

426 CFLKs shall not exceed:

- 427 • 0.1% by weight in homogenous material (1000 ppm): Mercury, Lead, Hexavalent Chromium, PBB
 428 (polybrominated biphenyls), and PBDE (polybrominated diphenyl ethers)
- 429 • 0.01% by weight in homogenous material (100 ppm): Cadmium

430 A list of RoHS exemptions that will be accepted by the ENERGY STAR program that may be relevant to
 431 CFLKs and lamps is detailed below:

432 Exemptions:

- 433 1. Mercury in single capped (compact) fluorescent lamps not exceeding (per burner):
 434 a. Lamps \leq 23.0 rated watts shall contain \leq 2.5 milligrams (mg) mercury per lamp
 435 Lamps \geq 23.0 rated watts shall contain \leq 3.0 milligrams (mg) mercury per lamp
- 436 2. Lead in glass of fluorescent tubes not exceeding 0.2% by weight
- 437 3. Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or
 438 more lead)
- 439 4. Electrical and electronic components containing lead in a glass or ceramic other than dielectric
 440 ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound
- 441 5. Cadmium and its compounds in electrical contacts
- 442 6. Lead in solders to complete a viable electrical connection between semiconductor die and carrier
 443 within integrated circuit flip chip packages
- 444 7. Lead with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and with PbSn-
 445 Hg as auxiliary amalgam in very compact energy saving lamps.
- 446 8. Cadmium in color-converting II-IV LEDs ($< 10 \mu\text{g Cd per mm}^2$ of light-emitting area) for use in
 447 solid-state illumination or display systems.

448 For purposes of third-party certification, lamp toxics documentation shall not be reviewed when products
449 are initially certified or during verification testing. Instead, partner shall maintain documentation on file to
450 demonstrate that certified products meet these requirements. EPA reserves the right to request this
451 documentation at any time. For the purposes of documenting mercury content, the following test
452 procedure shall be used: IEC 62554 Ed 1.0 Sample Preparation for Measurement of Mercury Level in
453 Fluorescent Lamps (2011-08-19).

454 For materials other than mercury, partner may rely on component suppliers to provide certification or
455 declaration documents to show that homogenous materials used in lamps comply with the requirement.
456 Alternatively, partner may have components tested in accordance with IEC 62321 or other appropriate
457 analytical technique to verify that homogenous materials do not exceed the concentration limits of the six
458 regulated substances. Handheld XRF analyzers/scanners may also be used to verify compliance.
459

460 **Note:** Sections 7 and 8 are identical to the current ENERGY STAR requirements for ceiling fans with
461 lighting but have been edited in this Draft 1 specification in an effort to simplify navigating this document.

462 **9 EFFECTIVE DATE**

463 The ENERGY STAR Residential Ceiling Fan Version 4.0 specification shall take effect on **TBD**. To be
464 certified as ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the
465 model's date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month
466 and year) on which a unit is considered to be completely assembled.

467 **Note:** EPA will work with stakeholders to finalize this revision as soon as possible, with a goal of July
468 2017. Once the specification is final, CBs will be able to certify products using it immediately.
469 Approximately 9 months later the specification will become effective and only those fans certified to new
470 specification will be listed.

471 **10 FUTURE SPECIFICATION REVISIONS**

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