

REVISED FINAL Draft ENERGY STAR Program Requirements for Residential Light Fixtures: Version 4.1

Notes: Table 3 includes requirements addressing GU-24 Based Integrated Fluorescent Lamps intended for use with ENERGY STAR qualified fixtures. **Tables 1, 1A, 2A and 2B are not being modified at this time.**

The Required Documentation column has been reorganized throughout this draft to more clearly describe documentation sources, test sample size requirements, passing rates, and conditions for the criteria. Please refer to the list of conditions at the end of this draft for references.

Table 3 – GU-24 Based Integrated Fluorescent Lamps

Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards	Required Documentation
Note: These requirements supersede requirements in preceding tables, only for fixtures using GU-24 based integrated lamps.			
<p>System Efficacy¹</p> <p><i>Per Integrated Lamp in Lumens Per Watt (LPW)</i></p>	<p><u>Bare Lamps:</u> ≥ 50 LPW for all lamp types below 30 total listed lamp watts.</p> <p>≥ 60 LPW for all lamp types that are ≥ 30 total listed lamp watts.</p> <p><u>Covered, Reflector, and Dimmable Lamps:</u> ≥ 40 LPW for all lamp types and wattages</p>	<p>LM-66-00; ANSI C78.5</p>	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples must achieve the required System Efficacy value.</p> <p>Conditions: [2]</p>
<p>Notes: Allowances have been added for covered, reflectorized, and dimmable lamps at lower efficacy levels to account for lower light output from such lamp types. Additionally, reference standards have been revised to harmonize with the ENERGY STAR CFL specification.</p>			

¹ Take performance and electrical measurements at the end of the 100-hour aging period according to ANSI C78.5. The lamp efficacy shall be the average of the total sample size for each testing orientation selected for the submittal. Use wattages placed on packaging, not measured wattage, to select proper specification efficacy in this table.

Efficacies are based on measured values for lumens and wattages from pertinent test data. Wattages and lumens placed on packages may not be used in calculation and are not governed by this criterion.

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Average Rated Lamp Life	<u>Bare Lamps:</u> The average rated life of the lamp must be ≥ 10,000 hours. <u>Covered, Reflector, and Dimmable Lamps:</u> The average rated life of the lamp must be ≥ 8,000 hours.	IESNA LM-65-01; ANSI C78.5	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association; or a test report from an ISO 9000 registered facility. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 50% of the samples must be functioning at the lifetime requirement.</p> <p>Conditions: [2], [9]</p>
<p>Notes: A new header in this section was added to provide clarification to the scope of the 8,000 hour lifetime requirement. This level is intended only for covered, reflector, or dimmable GU-24 Integrated Lamps. Additionally, reference standards have been revised to harmonize with the ENERGY STAR CFL specification and as applicable for Integrated Lamps.</p>			
1,000-hour Lumen Maintenance	Must be greater than 90.0% of initial (100-hour) lumen output at 1,000 hours of rated life.	IESNA LM-65-01; IESNA LM-66-00; ANSI C78.5 Section 4.10	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association; or a test report from an ISO 9000 registered facility. <p>Sample Size: ≥ 10 samples must be tested for each Testing Orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples must achieve the required lumen maintenance value.</p> <p>Conditions: [2], [10]</p>
Lumen Maintenance at 40% of Rated Life	Must be greater than 80.0% of initial (100-hour) lumen output at 40% (4,000 hour minimum) of rated life.		
<p>Note: Reference standards have been revised to harmonize with the ENERGY STAR CFL specification and as applicable for Integrated Lamps.</p>			
Accelerated Cycling, Thermal, and Voltage (ACTV) stress test	GU-24 must remain functional for 2,880 cycles @ 60°C or 720 cycles at 80°C <p>Note: Due to partner feedback and confusion as to the intent, the previously-referenced Accelerated Life Test (ALT) has been renamed to better define the purpose of the test. Additionally, EPA and the LRC are scheduling a workshop for Oct 30, 2007 to provide details of testing equipment and procedures to labs and manufacturers should labs already want to begin developing capabilities for performing this test.</p>	Lighting Research Center (LRC) Test Method	<p>Laboratory requirements have been determined by LRC and replication of the equipment and methods is necessary in order to repeat the tests outside of LRC – this transitional process is underway.</p> <p>Sample Size: 5 or 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: If a sample size of 5 is chosen, then ALL 5 samples must remain functional for the duration of the test. If a sample size of 10 is used then 1 sample failure is permitted.</p>

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Color Rendering Index	≥ 80	IESNA LM-58; CIE 13.3	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples must achieve the required color rendering index value.</p> <p>Conditions: [2]</p>
Correlated Color Temperature	Lamps must have one of the following designated correlated color temperatures (CCT): 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K.	IESNA LM-58; LM-16	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association; or a test report from an ISO 9000 registered facility. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 90% of the samples tested fall within a 7-step ANSI Mac Adam ellipse for the designated CCT.</p> <p>Conditions: [5]</p>
Lamp Base	Lamp Base configuration must utilize the GU-24 base.	For details see: http://www.lrc.rpi.edu/gu-24.asp (or ANSI GU-24 standard, upon its release)	No supplemental documentation is required.
<p>Note: As mentioned in previous drafts, EPA intends to adopt the ANSI GU-24 standard in place of the posted requirements once available.</p>			

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Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards	Required Documentation
<p>Maximum Mercury Content</p>	<p>GU-24 Based Integrated Lamps less than 25 watts: ≤ 5 milligrams (mg) per lamp</p> <p>GU-24 Based Integrated Lamps 25 to 40 watts: ≤ 6 milligrams (mg) per lamp</p> <p>Partners must ensure that GU-24 based lamps are listed with NEMA. Lamp manufacturers of GU-24 based lamps seeking Platform Letters of Approval are responsible for listing lamps with NEMA.</p>	<p>NEMA Voluntary Industry Commitment to Limit Mercury Content in Self-Ballasted CFLs Sold in the U.S.</p> <p>www.cfl-mercury.org</p>	<p>Provide: Reference to lamp manufacturer’s commitment form on file with NEMA. In addition, the product may not be present on the manufacturer’s list of non-conforming products.</p>
<p>Note: There are times when it may be appropriate to add additional environmental criteria to the ENERGY STAR requirements to ensure that energy efficiency is not pursued in a manner that causes larger environmental issues elsewhere. For example, water efficiency requirements have been incorporated in ENERGY STAR specifications when these requirements can be satisfactorily met while maintaining the core principles of the ENERGY STAR program. EPA recognizes the growing public concern about products containing mercury and international movement on consumer education. EPA proposes to adopt mercury content limits that are in line with those voluntary limits promoted by the National Electrical Manufacturers Association and to include further guidance on product packaging and lamp labeling (see Product Packaging and Lamp Labeling requirements below).</p>			
<p>Labeling for Replacement GU-24 Lamps</p> <p><i>(language printed on integrated lamp base)</i></p>	<p><u>Required lamp labeling language for consumer replacement must include a manufacturer designation that encompasses the following:</u></p> <ul style="list-style-type: none"> • lamp manufacturer name • lamp wattage • correlated color temperature • color rendering index <p>Additional packaging requirements for mercury content are included in the Product Packaging and Lamp Labeling for Consumer Awareness Requirements, below.</p>	<p>No Standard Available (Use manufacturer protocol – optionally, manufacturer may use the NEMA or ANSI generic lamp description).</p>	<p>Provide: A copy of the actual language that is included on the base of the GU-24 product.</p>
<p>Note: A reference to the mercury lamp labeling language in the product packaging section has been added.</p>			

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General Ballast Requirement	Integrated lamps are required to meet the general requirement of ANSI C78.5, in addition to the specific requirements listed below.	ANSI C78.5	No supplemental documentation is required.
Lamp Start Time	The time needed after switching on the lamp to start continuously and remain illuminated must be one second or less.	ANSI C78.5 Section 4.7, for test conditions and methodology	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association; or a test report from an OSHA NRTL laboratory. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples tested must meet the required lamp start time.</p>
Run-up Time	<u>Non-amalgam:</u> Average of 10 samples tested must be less than 1.0 minute per ANSI C78.5, Section 3.11 and 4.8.	ANSI C78.5, Section 3.11 and 4.8	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association. <p>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</p> <p>Passing Test: ≥ 80% of the samples tested must achieve the required run-up time.</p> <p>Conditions: [2], [11]</p>
	<u>Amalgam:</u> Average of 10 samples tested must be less than 3.0 minutes per ANSI C78.5, clause 3.11 and 4.8.		
Power Factor	≥ 0.50	ANSI C82.11-3.3.1	<p>Provide:</p> <ol style="list-style-type: none"> a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or EPA-approved documentation from an industry association; or a test report from the manufacturer. <p>Sample Size: ≥ 10 samples must be tested.</p> <p>Passing Test: ≥ 80% of the samples tested must achieve the required power factor.</p>

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Electromagnetic and Radio Frequency Interference	Integrated Lamp must meet FCC requirements for consumer use, FCC 47 CFR Part 2 (Equipment Authorization) and Part 18 (Consumer Emission Limits)	FCC 47 CFR Part 2 and Part 18	<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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer. <p>Sample Size: 1 sample must be tested.</p> <p>Passing Test: The sample tested must meet the requirement.</p>
Ballast Frequency	20 to 33 kHz or ≥ 40 kHz	Oscilloscope instruction manual	<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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer. <p>Sample Size: ≥ 10 samples must be tested.</p> <p>Passing Test: $\geq 80\%$ of the samples tested must achieve the required lamp current crest factor.</p>
Transient Protection	<p>Per ANSI/IEEE C62.41 (01-May-1991), Category A, 7 strikes</p> <p>Note: One failure to meet 7 strikes will result in test failure and therefore, failure to meet the criteria.</p>	Per ANSI/IEEE C62.41 (01-May-1991), Category A	<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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer. <p>Sample Size: ≥ 10 samples must be tested.</p> <p>Passing Test: $\geq 90\%$ of the samples tested must meet the 7 strike test requirement.</p>

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End of Life Protection	All integrated lamps sized T5 and smaller must contain an end of life protection circuit.	IEC 61347-2-3 Amendment 1 to Edition 1 2004-06 (or ANSI C82.11-2005, upon its release)	<p>Provide: <u>For all T4 and/or T5 sized integrated lamps</u>, demonstrate that the integrated lamp 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. EPA-approved documentation from an industry association; or 3. a test report from the manufacturer. <p><u>For T3 and smaller sized integrated lamps</u>, provide from the integrated lamp manufacturer a circuit diagram and an accompanying engineering description outlining the scheme that is used to achieve the end of life function within the integrated lamp.</p> <p>Sample Size (for T4 or T5): ≥ 3 samples must be tested.</p> <p>Passing Test (for T4 or T5): All samples must pass.</p>
Safety – Ballast 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 UL 1993.	UL 1993	<p>Provide: A cover page of a safety test report or a general coverage statement from an OSHA NRTL laboratory.</p>

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<p>Testing Orientation</p>	<p>When applying for Platform Letters of Approval, GU-24 manufacturers must declare the orientation used for each of the following requirements:</p> <ol style="list-style-type: none"> 1. System Efficacy 2. Average Rated Lamp Life 3. 1,000-hour Lumen Maintenance 4. Lumen Maintenance at 40% of Rated Life 5. ACTV Test 6. Color Rendering Index 7. Correlated Color Temperature 8. Lamp Start Time 9. Run-up Time 	<p>The following options will be presented on Platform Letters of Approval:</p> <ol style="list-style-type: none"> 1. Base Up 2. Base Down 3. 50% Base Up, 50% Base Down 4. Horizontal Operation 	<p>Provide: No supplemental documentation required, but a response is mandatory when submitting a product.</p> <p>Conditions: [7]</p>
<p>Note: EPA understands that CFL positioning in fixture designs can have direct effects on certain performance criteria, including overall lamp life and light output due to varied temperature conditions. To help fixture manufacturers get a clearer idea of expected performance once components are placed in their designs, EPA has added this requirement. While component manufacturers are required to report testing orientation, there is no mandatory orientation.</p>			
<p>Lamp Warranty</p>	<p>Warranty or limited warranty statement must cover at least a minimum of 24 months, or 2 years, from date of purchase based on no less than 3 hour per day of use.</p>	<p>No Standard Available (Use manufacturer protocol)</p>	<p>Provide: A copy of the actual two-year manufacturer written warranty.</p>
<p>Note: A lamp warranty duration of 2 years has been added to align with both the current RLF V4.0 Fixture warranty and the length in the ENERGY STAR CFL specification.</p>			

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Performance Characteristic	ENERGY STAR Requirements	Methods of Measurement Reference Standards	Required Documentation
<p>Product Packaging and Lamp Labeling for Consumer Awareness Requirements</p>	<p>Required lamp labeling language for <u>mercury content</u> must include one (1) of the following:</p> <ul style="list-style-type: none"> • the symbol “Hg” within a circle • “Contains Mercury” <p>Additional information may also be printed as required by applicable state laws.</p> <p>Required fixture and fixture packaging language for mercury content must include the following:</p> <ul style="list-style-type: none"> • www.epa.gov/bulbrecycling <p>Additional websites such as www.lamprecycle.org may also be printed as required by applicable state laws.</p> <p>Required lamp product packaging language for mercury content when lamp is not included with a light fixture must include the following:</p> <ul style="list-style-type: none"> • the symbol “Hg” within a circle • “Contains Mercury” • www.epa.gov/bulbrecycling <p>Additional websites such as www.lamprecycle.org may also be printed as required by applicable state laws.</p>	<p>No Standard Available (Use manufacturer protocol)</p>	<p>Provide: A written copy or a PDF graphic of the language that will be displayed on lamps and product packaging.</p>
<p>Note: To further educate consumers, EPA has added a packaging and lamp labeling requirement that includes guidance on where to find more information on mercury containing products and recycling. Both the lamps themselves and fixture packaging must comply with the above requirements.</p>			

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	<p><u>Required lamp product packaging language for warranty when lamp is not included with a light fixture:</u></p> <p>Product packaging must state "Warranty" or "Limited Warranty" and have one of the following for consumer complaint resolution (as applicable):</p> <ul style="list-style-type: none"> • A company phone number; or • mailing address; or • web site address. 	<p>No Standard Available (Use manufacturer protocol)</p>	
	<p><u>Required lamp product packaging language for FTC labeling requirements when lamp is not included with a light fixture:</u></p> <p>ENERGY STAR qualified compact fluorescent lamps and lamp systems must comply with the labeling requirements of the U.S. Federal Trade Commission Packaging Laws - FTC 16CFR Part 305.1-19.</p>	<p>FTC 16CFR Part 305.1-19</p>	
	<p><u>Required lamp product packaging language for starting temperature when lamp is not included with a light fixture:</u></p> <p>Package must state the minimum starting temperatures or geographic zone of use and any other conditions for reliable starting to meet the starting time requirements of ANSI C78.5, clause 4.8.</p>	<p>ANSI C78.5 clause 4.8</p>	<div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p>Note: To aid consumers in selecting GU-24 products, packaging requirements for Warranty, FTC Packaging laws, minimum starting temperature, and control compatibility have been added for GU-24 Integrated lamps packaged separately from a fixture. These requirements are consistent with existing ENERGY STAR CFL Specifications.</p> </div>
	<p><u>Required lamp product packaging language for control compatibility when lamp is not included with a light fixture:</u></p> <p>Lamp package must clearly state any known incompatibility with photo controls, dimmers or timing devices. In addition, packaging should state specific application exceptions.</p>	<p>No Standard Available (Use manufacturer protocol)</p>	

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	<p><u>Packaging language requirement:</u></p> <p>Packaging and lamp labeling language must be in English or English with additional languages.</p> <p>For products that will be sold in Canada, packaging must include both English & French.</p>	<p>No Standard Available (Use manufacturer protocol)</p>	

Note: The list of documentation conditions below is referenced in the Required Documentation column and will be referenced by other tables of the specification. Only documentation conditions applicable to the GU-24 requirements above are reproduced below. Documentation conditions not appearing in this draft consist of language previously used in Version 4.0.

Documentation notes: The list of documentation conditions below is referenced in appropriate sections of the requirement Tables.

- [2] 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.

- [5] It is also intended that the fluorescent lamp manufacturer will meet the following quality requirements during the production runs of each lamp model:
 1. The lamp manufacturer is required to maintain color control such that a minimum of 90% 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 such 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:
 - 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 7 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 7 step Mac Adam ellipse. Manufacturers are encouraged to exceed this target.

- [7] A laboratory test report must be submitted upon EPA request.

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- [9] Manufacturers may obtain ENERGY STAR conditional qualification if at 40% of rated life, 8 or more lamps are operational.
- Two sample failures, acceptable.
 - Three sample failures, does not qualify.
- In addition, manufacturers must supply a letter on letterhead from a NVLAP accredited laboratory, one of its MRA signatories, or an ISO 9000 registered facility demonstrating lamp life testing has begun and the date of testing completion. Conditional approval will be granted for a period of no longer than 325 days. Interim and final average rated lifetime tests must use the same samples.
- [10] 1,000 hour lumen maintenance and lumen maintenance at 40% of rated life tests must use the same samples.
- [11] Partners must specify if their product contains amalgam mercury during the qualification submission process to be eligible for this requirement.