

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.			
System Efficacy ¹ <i>Per Integrated Lamp in Lumens Per Watt (LPW)</i>	Bare and Covered Lamps: ≥ 50 LPW for all lamp types below 30 total listed lamp watts. ≥ 60 LPW for all lamp types that are ≥ 30 total listed lamp watts.	IESNA LM-9; LM-66; ANSI C78.5	Provide: <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 Approval that lists the lamp/ballast combination used in the fixture and the test result for this performance characteristic; or 3. EPA-approved documentation from an industry association, such as the NEMA/ALA matrices. <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>
Average Rated Lamp Life	<u>Bare Lamps:</u> The average rated life of the lamp must be ≥ 10,000 hours. <u>Covered Lamps, all types:</u> The average rated life of the lamp must be ≥ 8,000 hours.	IESNA LM-40-01; LM-65-01; ANSI C78.5	Provide: <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 Approval that lists the lamp/ballast combination 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>Sample Size: ≥ 10 samples must be tested for each testing orientation selected for the submittal.</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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			<p>Passing Test: ≥ 50% of the samples must be functioning at the lifetime requirement.</p> <p>Conditions: [2], [9]</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-40-01; IESNA LM-9-99; 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 an EPA approved Platform Letter of Approval that lists the lamp/ballast combination used in the fixture and the test result for this performance characteristic; or EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; 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: The lumen maintenance performance requirement includes the ISO 9000 testing option to harmonize with other fluorescent sources in the RLF program.</p>			
Accelerated Life/Stress Test (ALT)	GU-24 must remain functional for 2,880 cycles @ 60°C or 720 cycles at 80 °C	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 strategy is being developed.</p> <p>Sample Size: 5 or 10 ballast 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 ballasts must remain functional for the duration of the test. If a sample size of 10 is used then 1 ballast failure is permitted.</p>
<p>Note: Following continued research by the LRC, including numerous rounds of tests run in support of ALT development, the ALT test is available for stakeholder review. EPA and the LRC are scheduling a workshop for fall 2007 to provide details of testing equipment and procedures to labs and manufacturers.</p>			
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 an EPA approved Platform Letter of Approval that lists the lamp/ballast combination used and the test result for this performance characteristic; or EPA-approved documentation from an industry association, such as the NEMA/ALA matrices.

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			<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"> 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Approval that lists the lamp/ballast combination 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>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/Ballast 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: EPA intends to adopt the ANSI GU-24 standard in place of the posted requirements once available. EPA understands that the draft standard completed an industry comment period earlier this summer and is currently under ANSI internal review. EPA will continue to monitor GU-24 standardization efforts as it proceeds toward finalization and potential international adoption.</p>			
Labeling for Replacement GU-24 Lamps	A manufacturer designation that encompasses the lamp manufacturer name, wattage, correlated color temperature, and color rendering index must be labeled on the GU-24 lamp base. Once available, manufacturer	No Standard Available	<p>Provide:</p> <p>A copy of the actual language that is included on the base of the GU-24 product.</p>

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	may use the ANSI generic lamp description describing the items above.		
General Ballast Requirement	Ballasts 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 an EPA approved Platform Letter of Approval that lists the lamp/ballast combination and the test result for this performance characteristic; or EPA-approved documentation from an industry association, such as the NEMA/ALA matrices; 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 an EPA approved Platform Letter of Approval that lists the lamp/ballast combination and the test result for this performance characteristic; or EPA-approved documentation from an industry association, such as the NEMA/ALA matrices. <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. Partners submitting GU-24 products for labeling must specify if their product contains amalgam mercury during the submission process to be eligible for this requirement.		
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 an EPA approved Platform Letter of Approval that lists the lamp/ballast

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			combination 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. Sample Size: ≥ 10 samples must be tested. Passing Test: ≥ 80% of the samples tested must achieve the required power factor.
Electromagnetic and Radio Frequency Interference	Ballast 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	Provide: 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Approval that lists the lamp/ballast combination 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. Sample Size: 1 sample must be tested. Passing Test: The sample tested must meet the requirement.
Ballast Frequency	20 to 33 kHz or ≥ 40 kHz	Oscilloscope instruction manual	Provide: 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Approval that lists the lamp/ballast combination used in the fixture 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. Sample Size: ≥ 10 samples must be tested. Passing Test: ≥ 80% of the samples tested must achieve the required lamp current crest factor.
Transient Protection	Per ANSI/IEEE C62.41 (01-May-1991), Category A, 7 strikes Note: One failure to meet 7 strikes will result in test failure and therefore, failure to meet the criteria.	Per ANSI/IEEE C62.41 (01-May-1991), Category A	Provide: 1. a test report from a laboratory accredited by NVLAP or one of its MRA signatories; or 2. an EPA approved Platform Letter of Approval that lists the lamp/ballast combination 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.

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			<p>Sample Size: ≥ 10 samples must be tested.</p> <p>Passing Test: ≥ 90% of the samples tested must meet the 7 strike test requirement.</p>
End of Life Protection	All ballasts that operate 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 ballasts that operate T4 and/or T5 sized lamps</u>, 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 Approval that lists the lamp/ballast combination 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><u>For all ballasts that operate T3 and smaller sized lamps</u>, 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> <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>
Testing Orientation	When applying for Platform Letters of Approval, GU-24 manufacturers must declare the orientation used for each of the following requirements: <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. ALT Test 6. Color Rendering Index 7. Correlated Color Temperature 	The following options will be presented on Platform Letters of Approval: <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>

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	8. Lamp Start Time 9. Run-up Time		
<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>			

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 if 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.