



ENERGY STAR® Program Requirements for Decorative Light Strings

Partner Commitments

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

Qualifying Products

1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for decorative light strings. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a Certification Body recognized by EPA for decorative light strings. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform decorative light string testing. A list of EPA-recognized laboratories and Certification Bodies can be found at www.energystar.gov/testingandverification.

Using the ENERGY STAR Name and Marks

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

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by EPA for decorative light strings, providing full cooperation and timely responses. EPA/DOE may also, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.
7. Notify ENERGY STAR decorative light string Certification Body recognized by EPA for decorative light strings, within 30 days, if the designated suppliers of any private labeled decorative light strings change to a new supplier.

Providing Information to EPA

8. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:

- 8.1. Partner must submit the total number of ENERGY STAR qualified decorative light strings shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).
- 8.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.
- 8.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner.

9. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
10. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Training and Consumer Education

11. Partner shall comply with the following, product-specific requirements concerning training and education:
 - 11.1. Provide ENERGY STAR sales training to all sales staff. This training shall include:
 - 11.1.1. Identification of ENERGY STAR qualified products;
 - 11.1.2. Tips for selling ENERGY STAR qualified products; and
 - 11.1.3. Tips for answering questions about ENERGY STAR.

Performance for Special Distinction

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

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.

- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.



ENERGY STAR® Program Requirements Product Specification for Decorative Light Strings

Eligibility Criteria Version 1.5

Following is the **Version 1.5** product specification for ENERGY STAR qualified decorative light strings. A product shall meet all of the identified criteria to earn the ENERGY STAR.

1) Definitions: Below are the definitions of the relevant terms in this document.

- A. Decorative Light String (DLS): A string of lamps that operates on AC power in North America (120 V RMS AC, 60 Hz) or via a power adapter or controller that connects directly to AC power, and is used for decorative, residential lighting purposes. The lamps may be replaceable or sealed into the lamp holder/wiring harness.
- B. Decorative Form: A stationary frame onto which an ENERGY STAR qualified decorative light string is attached. The frame has no electromechanical function and consumes no input power. Examples include: bell, heart, star, holiday trees, snowman, snowflake and pumpkin shapes composed of plastic or metal framing with qualified decorative light strings attached.
- C. Failed Lamp: A lamp has failed if the light output is less than half the expected output for a comparable lamp of the same age in good condition. This will normally be determined by comparison with a good lamp of the same color on the same string.
- D. Input Power: The average total power used by the decorative light string during operation, measured in watts, including (if any) the transformer, adapter, controller, etc. For decorative light strings that operate with power adapters that can accommodate more than one string, the input power is defined as the average total power consumed with the rated maximum number of strings attached.
- E. Maintained Light Output: The average light output of a decorative light string after a testing period expressed as a percentage of light output of that same string following a 24-hour seasoning period.
- F. Product Family: A group of product models that are (1) made by the same manufacturer, (2) subject to the same ENERGY STAR qualification criteria, and (3) of a common design and construction delivering similar function and performance, but varying in physical appearance.
- G. Series Block: A number of lamps connected in series, or utilizing a series connection. Additional series blocks can be added to the circuit (i.e., decorative light string) utilizing parallel connections (e.g., a 70-lamp light string could have two 35-lamp series blocks connected in parallel).
- H. Watts per Lamp: The input power divided by the number of lamps on the decorative light string (or strings, in the case of power adapters or controllers that can accommodate multiple strings).
- I. V RMS AC: The measured root-mean-square value of a voltage with alternating current.

2) Scope:

- A. Included Products: Products that meet the definition of a Decorative Light String as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B. ENERGY STAR qualified decorative light strings attached to decorative forms are also eligible for the ENERGY STAR.
- B. Excluded Products: Rope lighting (non-replaceable series and series/parallel connected lamps fully enclosed and sealed within a flexible polymeric tube or extrusion), and replacement lamps are not eligible to earn the ENERGY STAR.

3) Qualification Criteria:

A. Performance Requirements:

Table 1: ENERGY STAR Requirements for Qualification

Criteria Item	ENERGY STAR Requirements	Sample Size/Specific Requirements
A. Inspection		
Decorative Forms	All decorative light strings attached to a decorative form shall be ENERGY STAR qualified for their intended end use on the decorative form and meet all applicable electrical safety requirements for their intended use. Decorative light strings and decorative forms shall be rated for their intended use. Intended use shall be either indoor-only or indoor/outdoor rated. Indoor/outdoor rated decorative light strings are permitted for use on indoor-only rated decorative forms.	Total power consumption shall be reported, based on power consumption of the attached ENERGY STAR qualified decorative light string on the decorative form.
Number of Lamps per String	For all strings in the sample, the number of lamps indicated on the packaging shall equal the number of lamps on the strings.	3 decorative light strings of the same model shall be used to determine compliance with all of the inspection requirements. This same sample of strings may also be used for one of the three tests (i.e., electrical, output and reliability, or weathering).
Replaceable Lamps	If the string has replaceable lamps, the socket and lamp shall have a marking or means to ensure correct insertion of replacement lamps.	
Safety Requirements	All strings shall comply with UL 588 (for the United States) and/or CSA C22.2 No.37 (for Canada).	UL and/or CSA requirements, as appropriate.
Rated for indoor or indoor/outdoor applications	A label on the string shall indicate whether it is rated for indoor-only or indoor/outdoor use.	3 decorative light strings of the same model shall be used to determine compliance with all of the inspection requirements. This same sample of strings may also be used for one of the three tests (i.e., electrical, output and reliability, or weathering).
Warranty	A warranty shall be provided and may either be printed on the packaging or included as an insert. Warranty statement shall: 1) include minimum 3-year warranty under normal residential seasonal use against all product defects; and 2) provide either a toll-free telephone number, or mailing address, or email and website address for consumer complaint resolution.	

B. Electrical Requirements

Input Power	<p>The input power consumption per lamp on each of the three strings in the sample shall not exceed 0.20 watts.</p> <p>For decorative light strings that modulate in their power use (e.g., flashing, changing color), energy use shall be measured over a time period of 5 or more complete modulation cycles, averaged, and recorded as the input power.</p>	3 decorative light strings of the same model.
Over-Voltage	Average percentage of failed lamps on all three strings in the sample shall be no greater than 3%.	

C. Output and Reliability Requirements (previously referred to as Lifetime Requirements)

Maintained Light Output	For strings with colored lamps, the average maintained light output shall be no less than 70%. For strings with white lamps or any phosphor-based lamps, the average shall be no less than 50%.	<p>3 decorative light strings of the same model.</p> <p>See ENERGY STAR Test Method for Decorative Light Strings, December 2011 (Annex A) for string testing configuration and test steps.</p>
Failed Lamps	The average percentage of failed lamps on all three strings in the sample shall be no greater than 3%.	

D. Weathering Requirements

(NOTE: Strings rated for indoor-only use shall not be subjected to this test.)

Maintained Light Output	For strings with colored lamps, the average maintained light output shall be no less than 70%. For strings with white lamps or any phosphor-based lamps, the average shall be no less than 50%.	<p>3 decorative light strings of the same model.</p> <p>Weathering condition as specified in Cycle 7 of Table X2.1 of ASTM G154-06.</p> <p>See ENERGY STAR Test Method for Decorative Light Strings, December 2011 (Annex A) for string testing configuration and test steps.</p>
Failed Lamps	The average percentage of failed lamps on all three strings in the sample shall be no greater than 3%.	

E. Product Packaging for Consumer Awareness Requirements

Product Suitability	Packaging shall state product's suitability for use indoor-only or indoor/outdoor use.	Electronic draft or hard copy of packaging for the specific model or product family. One copy per family if the labeling is the same for all models.
Product Description	1) Number of lamps on the decorative light string, 2) Total lighted length of string in metric and imperial units, and 3) Total rated wattage of decorative light string.	
Correlated Color Temperature for White-light Strings	Packaging shall indicate if "warm-white," "pure-white" or "cool-white" lamps. These three terms pertain to the correlated color temperature (CCT) of the white-light lamps: Warm-white < 3500 CCT Pure-white 3500 – 5000 CCT Cool-white > 5000 CCT	

B. Significant Digits and Rounding:

- a. All calculations shall be carried out with directly measured (unrounded) values.
- b. Unless otherwise specified, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.
- c. Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

4) Test Requirements:

- A. When testing decorative light strings, the following test methods shall be used to determine ENERGY STAR qualification:

Table 2: Test Methods for ENERGY STAR Qualification

ENERGY STAR Requirement	Test Method Reference
Electrical	ENERGY STAR Test Method for Decorative Light Strings, December 2011 (Annex A)
Output and Reliability (previously referred to as Lifetime)	ENERGY STAR Test Method for Decorative Light Strings, December 2011 (Annex A) and CIE 084-1989, <i>The Measurement of Luminous Flux</i>
Weathering	ENERGY STAR Test Method for Decorative Light Strings, December 2011 (Annex A); ASTM G 154 – 06, <i>Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials</i> ; and CIE 084-1989, <i>The Measurement of Luminous Flux</i>
Safety	UL 588, <i>Standard for Seasonal and Holiday Decorative Products</i> or CSA C22.2 No.37, <i>Christmas Tree and Other Decorative Lighting Outfits</i>

- B. Different samples shall be used for the electrical test, the output and reliability test, and the weathering test. The samples used for inspection may also be used for one of the subsequent tests.
- C. Representative Models shall be selected for testing per the following requirements:
- a. For qualification of an individual product model, the representative model shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR.
 - b. For qualification of a product family, representative models shall meet the following requirements.
 - o **Test Group A. Electrical Tests:** Decorative light string models meeting all of the following criteria may share the same electrical test data for purposes of product family qualification.
 - Utilize the same light source technology – all decorative light strings shall be of the same light source.
 - Have the same number of lamps per series block – the decorative light strings may have different total lamps overall, but shall all share the same number of lamps per series block.
 - Have the same wattage per series block.
 - Are otherwise equivalent electrical circuits – there are no other features in the electrical circuit that affect the power consumption / efficiency of the string.
 - o **Test Group B. Output and Reliability (previously referred to as Lifetime) Test:** Decorative light string models meeting all of the following criteria may share the same output and reliability test data for purposes of product family qualification.
 - Produce the same color light – all decorative light strings shall be of the same lamp color. For multiple colored strings, the string shall be qualified by testing and qualifying solid color strings, one for each color contained in the multi-colored string.

- Have the same RMS current per series block.
 - Have a lamp lens cover of equivalent or smaller size, meaning less surface area and a smaller diameter. For example, if a manufacturer tests and qualifies a C6 shape, an M5 or a G3 could be included in the same product family; however, testing and qualifying a G3 would not enable C6 lamps to be included in the same output and reliability test family.
 - Half-wave and full-wave may be grouped together in the same family, but only if half-wave strings are tested. If full-wave strings are tested, these results shall not be used to qualify half-wave strings.
- **Test Group C. Weathering Test:** For the weathering test, phosphor-based lamps and non-phosphor-based lamps shall be treated in separate families. In addition, multi-colored decorative light strings may be used to qualify solid-color decorative light strings having those colors represented on the multi-colored string. Decorative light string models meeting these requirements and all of the following criteria may share the same weathering test data for purposes of product family qualification.
- Be either all phosphor-based lamps or all non-phosphor-based lamps.
 - Have the same socket types (i.e., replaceable versus non-replaceable).
 - Incorporate the same material in the lamp lens cover / diffuser, wire and socket.
 - Have a lamp lens cover of equivalent or smaller size, meaning less surface area and a smaller diameter. For example, if a manufacturer tests and qualifies a C6 shape, an M5 or a G3 could be included in the same product family and be qualified without testing; however, testing and qualifying a G3 would not enable C6 lamps to be included in the same family.
- 5) **Effective Date:** The ENERGY STAR Decorative Light Strings Specification shall take effect on March 1, 2008. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.
- 6) **Future Specification Revisions:** EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that the ENERGY STAR qualification is not automatically granted for the life of a product model.



ENERGY STAR® Program Requirements Product Specification for Decorative Light Strings

Test Method Annex A

1) OVERVIEW

The following test method shall be used for determining product compliance with requirements in the ENERGY STAR Product Specification for Decorative Light Strings.

2) APPLICABILITY

This test protocol is applicable for the evaluation of ENERGY STAR electrical, output and reliability (previously referred to as lifetime), and weathering requirements for decorative light strings.

3) DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions contained in the ENERGY STAR Product Specification for Decorative Light Strings.

4) TEST CONDITIONS AND METHOD

- A. Electrical Testing: Prior to testing, operate three decorative light strings for a 24 hour ($\pm 1\%$) seasoning period at $120\text{ V} \pm 1\text{ V}$ RMS AC. Repeat all steps below for each of the three samples.

Input Power. Measure input power and current at $120\text{ V} \pm 0.5\text{ V}$ RMS AC. For light string systems with power adapters or controllers that can accommodate multiple light strings, the input power shall be measured with the rated maximum number of strings attached. Divide the measured input power by the number of lamps on the tested string to calculate the input power consumption per lamp.

Over-Voltage. Energize the light string at $132\text{ V} \pm 1\text{ V}$ RMS AC for one hour and examine for failure. Count any lamps that have failed (as per definition 1.C in Eligibility Criteria). Calculate the failed lamps as a percentage of total lamps on the three strings.

- B. Output and Reliability (previously referred to as Lifetime) and Weathering Testing: Prior to testing, operate three decorative light strings for a 24 hour ($\pm 1\%$) seasoning period at $120\text{ V} \pm 1\text{ V}$ RMS AC. Assemble the three decorative light strings into three flat test configurations, as illustrated in Figure 1. For each, wrap the string around a rigid board or frame so that all are mechanically supported and oriented with the lamps directed outward. Tape the assembly together with electrical tape to maintain the relative positioning of the lamps throughout the test. Next, for its optical properties, white Teflon® tape shall be wrapped around the assembly to completely cover the electrical tape and wiring harnesses. Ensure that the Teflon tape does not cover any part of the lamp or lamp socket.



(a) Top view



(b) Side view

Figure 1. A mounted decorative light string prepared for testing.

Measure the light output of the assemblies while operating at $120\text{ V} \pm 0.5\text{ V RMS AC}$, $25^\circ\text{C} \pm 5^\circ\text{C}$ and following the guidelines contained in CIE Publication 084-1989, *The Measurement of Luminous Flux*. For decorative light strings that modulate their light output (e.g., flashing, changing color), light output shall be measured over at least five (5) complete cycles.

Output and Reliability (previously referred to as Lifetime) Test:

Keeping the testing assemblies intact (i.e., do not remove the tape, or move any of the lamps), operate each assembly for 1000 hours ($\pm 1\%$) continuously. This period of operation (41 days, 16 hours) may be conducted using a test bench facility (i.e., outside the measuring device), provided that none of the lamps in any of the assemblies have been moved relative to each other.

Weathering Test:

Keeping the testing assemblies intact, load them into the testing chamber. The decorative light strings under test shall be operated for the duration of this test at $120\text{ V} \pm 3\text{ V RMS AC}$ inside the testing chamber. Each cycle of this test includes 8 hours of UV light (340 nm at $1.55\text{ W/m}^2/\text{nm}$) at 60°C , 0.25 hours of water spray, and 3.75 hours of condensation at 50°C . The strings shall be subjected to 20 consecutive iterations of Cycle 7 under Table X2.1 of ASTM G154-06 for a total of 240 hours.

After completing the output and reliability (previously referred to as lifetime) test or weathering test, conduct a second measurement of the light output on the respective sample of lamps following the same procedure above. Calculate the average maintained light output for the three strings tested relative to the initial average measurement for those same strings.

Count the number of failed lamps (as per definition 1.C in Eligibility Criteria) and calculate the failed lamps (if any) as a percentage of total lamps on the three strings, rounding the percentage up to the nearest whole number.