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. <u>Electrical Testing</u>: Prior to testing, operate three decorative light strings for a 24 hour (± 1%) seasoning period at 120 V ± 1 V RMS AC. Repeat all steps below for each of the three samples.

Measure input power and current at 120 V ± 0.5 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.

Energize the light string at 132 V ± 1 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. <u>Output and Reliability (previously referred to as Lifetime) and Weathering Testing</u>: Prior to testing, operate three decorative light strings for a 24 hour (± 1%) seasoning period at 120 V ± 1 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 V ± 0.5 V RMS AC, 25°C ± 5°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.

<u>Output and Reliability (previously referred to as Lifetime) Test</u>:
Keeping the testing assemblies intact (i.e., do not remove the tape, or move any of the lamps), operate each assembly for 1000 hours (± 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.

<u>Weathering Test</u>:
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 V ± 3 V RMS AC inside the testing chamber. Each cycle of this test includes 8 hours of UV light (340 nm at 1.55 W/m²/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.