Development of an ENERGY STAR Program for Seasonal Decorative Light Strings

Third Stakeholder Meeting Summary Report Toronto, Ontario; January 9, 2007

Prepared for:
Natural Resources Canada

Prepared by:
Navigant Consulting, Inc.

January 2007

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APPENDICES

1.0 Introduction

Natural Resources Canada (NRCan) is working to finalize the development of an ENERGY STAR test procedure and qualification criteria for seasonal decorative light strings. Compared to incandescent decorative light strings, other technologies, such as light emitting diodes (LED), offer energy savings, lower energy consumption during peak hours, longer operating life, high durability, and reasonable payback on the initial investment.

Building on the progress of two one-day stakeholder meetings on this same subject in March and June 2006, NRCan convened a series of technical committee conference calls with two testing laboratories and several manufacturers of decorative light strings. These calls were focused around two issues: 1) to select the decorative light strings that should be tested in order to determine the appropriate performance requirements for ENERGY STAR and 2) to incorporate revisions to the test procedure and qualification criteria. This third meeting re-convened the stakeholders who had participated in the March and June 2006 workshops to revise the ENERGY STAR specification document and select the appropriate qualification requirements. Approximately thirty manufacturers, retailers, and government and utility representatives attended and participated in the review of the draft ENERGY STAR qualification criteria and test procedure. The list of workshop attendees (alphabetical by last name) below includes both people who participated in person in Toronto and who phoned-in.

David Allen, Holiday Creations
Steve Altamura, Seasonal Specialties
Anne Marie Baynton, City of Toronto
Daniel Cao, Hudson's Bay Company
Charles Coimbra, Osram
Eileen Eaton, Consortium for Energy Efficiency
Dino Fazio, Niagara Falls Winter Festival of Lights
Jenny Flores, Pacific Gas and Electric
Ed Grzesik, Ontario Ministry of Energy
Isabelle Guimont, Natural Resources Canada
Gary Hamer, BC Hydro

Jose Luis Hernandez, Canadian Standards Assoc.
John Kiru, Toronto Assoc. of BIAs
Pierrette LeBlanc, Natural Resources Canada
Dejan Lenasi, Canadian Standards Assoc.
Bruce Neilson, Powertech Labs
Conan O'Rourke, Lighting Research Center
Brian Owen, FIRSTeam
Charles Parker, Carillon
Dennis Rittenhouse, Canadian Standards Assoc.
Mike Roseart, Home Hardware
Jim Ruxton, Pharos Innovations
Rachel Schmeltz, U. S. Environmental Protection Agency
Michael Scholand, Navigant Consulting Inc.
Anthony Tassone, Underwriters Laboratory
Michael Vladimer, Navigant Consulting Inc.
Jerry Yu, LEDUP

This report summarizes the proceedings of the workshop, providing copies of the workshop presentations, the draft documents reviewed by the participants and a summary of the meeting discussion.

2.0 Workshop Materials

The purpose of this meeting was to reconvene the stakeholders from the June 2006 workshop to discuss and review the draft revised test procedure and qualification criteria that the technical committee had been developing. Part of that review included studying the results from the decorative light strings that were tested, and selecting the ENERGY STAR performance criteria based on these results. The workshop agenda was structured around a walk-through of the language in the ENERGY STAR documents (see Appendices), to facilitate discussion on the draft proposal.

2.1. Workshop Agenda

ENERGY STAR® Program Requirements for
Decorative Light Strings

Third Plenary Meeting
Doubletree International Plaza Hotel
655 Dixon Rd, Toronto, M9W 1J3

January 9, 2007

8:30-9:00 Registration

9:00-9:10 Welcome and Review of Progress to Date
Update on developments since the Second Plenary Meeting on June 27, 2006
Pierrette LeBlanc – Natural Resources Canada

9:10-9:20 Introductions and Agenda Review
Around the table, Discussion of Agenda and Context for Work Performed
Michael Scholand – Navigant Consulting, Inc.

9:20-10:00 Test Results of Sample Strings Submitted
Presentation of Test Results of decorative light strings
Michael Vladimer – Navigant Consulting, Inc.
Conan O'Rourke – Lighting Research Center
Bruce Neilson – Powertech Laboratories

10:00-10:15 COFFEE BREAK

10:15-12:00 ENERGY STAR Decorative Light Strings version 1.2.1

Walk through the document, detailed discussion on green highlighted topics
Michael Scholand – Navigant Consulting, Inc.

12:00-1:00 LUNCH

1:00-2:30 ENERGY STAR Decorative Light Strings version 1.2.1 (continued)
Walk through the document, detailed discussion on green highlighted topics
Michael Scholand – Navigant Consulting, Inc.

2:30-2:45 COFFEE BREAK

2:45-3:45 Reducing Manufacturer Testing Burden
Proposal on how to reduce testing burden while maintaining programmatic integrity
Michael Scholand – Navigant Consulting, Inc.

3:45-4:00 Next Steps for ENERGY STAR DLS
Planning for the Focus Group; next steps for program adoption in Canada and the US
Isabelle Guimont – Natural Resources Canada
Pierrette LeBlanc – Natural Resources Canada

4:00 ADJOURN

2.2. Materials Provided or Used at the Workshop

This workshop was convened to discuss the draft qualification criteria and performance metrics for the ENERGY STAR Decorative Light Stings document. Participants were issued with an updated draft of the ENERGY STAR document, version 1.2.1 approximately one week before the workshop. This version, 1.2.1, reflected revisions and updates to the document that had been made by NRCan following a series of conference calls with the technical working group.

Due to schedule conflicts, not all members of the technical committee were able to participate in every call over the intervening period between the June and January workshops. Therefore, the draft documents presented in the appendix to this report should not be seen as consensus products from the technical committee. Rather, they are drafts that were developed to enable discussion and refinement of the approach.

The appendices to this report contain all the materials provided or used at the workshop, which included:

A. ENERGY STAR® Program Requirements for Decorative Light Strings, Test Procedure and Eligibility Criteria, Draft Version 1.2.1, (January 3, 2007)
B. ENERGY STAR® Program Requirements for Decorative Light Strings, Test Procedure and Eligibility Criteria, Draft Version 1.2.1, (January 3, 2007) – Tracked Changes
C. ENERGY STAR® Program Requirements for Decorative Light Strings Master Presentation from the Workshop

The tracked-changes version 1.2.1 was provided to participants to enable them to see some of the technical committee's refinement and improvement of the program requirements.

3.0 Workshop Discussion and Decisions

This section of the report summarizes the workshop discussion and identifies the main issues that were raised during the proceedings.

3.1. Overview

This workshop represented the third plenary meeting of the stakeholders to assist NRCan in the development of the ENERGY STAR specification for DLS. Pierrette LeBlanc from NRCan began the meeting with a welcome to all participants and a brief review of work completed since the second workshop, which was held in June 2006. Next, the two testing labs presented their findings after testing the strings. Conan O'Rourke of the Lighting Research Center (LRC) went first, followed by Bruce Neilson of Powertech Labs (Powertech). The focus of the meeting consisted of utilizing the findings from the labs to revise version 1.2.1 of the test procedure and eligibility criteria. Michael Scholand of Navigant Consulting Inc. (NCI) facilitated this part of the agenda, a detailed walk-through of the documents with discussion on language, qualification criteria and appropriate metrics. Finally, Isabelle Guimont of NRCan discussed the next steps of the work with DLS, including NRCan's work planning for a focus group discussion on DLS.

3.2. Welcome and Review of Progress to Date

Pierrette welcomed participants and then reviewed the work NRCan has led since the first meeting on DLS on March 6th, 2006. Pierrette highlighted that the goal of the workshop was to review draft version 1.2.1 and arrive at an appropriate ENERGY STAR specification for DLS.

3.3. Introduction and Agenda Review

Pierrette then turned the podium over to Michael Scholand for introductions and agenda review. Participants in the room and on the phone were asked to state their name, organization, and whether they had been to prior meetings. Finally, Michael walked through the agenda and explained the work of the testing labs and DLS working group leading up to the workshop.

3.4. Test Results of Sample Strings Submitted: Lifetime Test Conducted by the Lighting Research Center

Conan O'Rourke led the testing efforts at the LRC and presented their findings in this section. LRC was tasked by NRCan to conduct the lifetime test of DLS for 1000 hours of operation. LRC seasoned the decorative light strings for 24 hours, and then took an initial light measurement. Supplemental light measurements were taken at 333 hours and 666 hours, in addition to the final light measurement of 1000 hours. The light output values of the DLS were then plotted over this time period and presented to the group.

The characteristics of the strings tested by LRC were:

- Shapes: M5, G3, C6
- Lamp Colours: Red, Yellow, Green, Blue, White, and Multi-coloured
- Lamps per String: 35, 50, 60, 70
- Lamp Types: incandescent and light emitting diode (LED)
- Total Number of Tested Strings: 167

LRC found that there was a clear difference in power between the incandescent lamps and LED lamps - the highest LED power per lamp was around 0.07 W/lamp, where as the lowest incandescent power per lamp was 0.40 W/lamp. The lumen maintenance test showed a clear distinction between white lamps and coloured lamps. The three strings with the lowest lumen maintenance, less than 50% after 1000 hours, were all white[1]. In comparison, the lowest coloured string was above 60%, with the majority of lamps above 80% lumen maintenance. Based on that distinction, LRC proposed two lumen maintenance levels: a 50% level for white and other phosphor-derivative lamps and 70% for other coloured lamps.

LRC also investigated bulb shape and found that it had little affect on lumen maintenance, with C6 bulbs having the lowest lumen maintenance. Based on that finding, LRC suggested testing C6 bulbs to qualify both the C6 and smaller diameter lamps (e.g., M5 and G3) to reduce manufacturer testing burden.

[1] LRC slide 22

LRC conducted the over-voltage test after the lifetime test to mitigate against any effects it might have. LRC suggested including in the test procedure this separation of the over-voltage test. The stakeholders discussed the one-hour duration of the test – some thought one hour was too short. Anthony Tassone of Underwriters Laboratories (UL) said that the standard UL test was for 7 hours; however, that test was for safety, not quality. Ultimately, the stakeholders suggested that NRCan keep the one-hour test, but consider a longer over-voltage test for any revised version of the ENERGY STAR DLS specification.

3.5. Test Results of Sample Strings Submitted: Accelerated-Weathering Test Conducted by Powertech Labs

Bruce Neilson led the testing efforts at Powertech and presented the findings in this section. Powertech was tasked by NRCan to conduct the accelerated-weathering test for DLS for a total of 20 cycles (240 hours)[2]. Powertech also conducted the over-voltage test after the weathering test; Powertech agreed with LRC that the over-voltage test should be separated from the other tests.

During the testing, Powertech was careful to measure light output at 120 ± 0.1 V RMS AC since input voltage has a strong impact on light output. During the accelerated weathering, the strings were kept as close as possible to the UV lamps to ensure even and accurate lighting. Powertech found that a few strings had one or two lamps that failed, with a single string having 36 failed lamps[3]. These results were consistent with lamp failure rates in the LRC testing.

In the accelerated weathering test results, the maintained light output was generally lower for LED lamps than for incandescent lamps. Powertech observed that more than half of the LED lamps had maintained light output greater than 80%. The main reason for decreased light output was discolouring of the diffuser, as observed by Powertech. Powertech also determined that lumen maintenance decreased faster with time[4].

[2] The accelerated weathering test was ASTM G154-05 which combines UV light, water spray, and a drying cycle.
[3] Powertech slide "Failure Rates"
[4] Powertech slide "10 and 20 Cycle Maintenance"

During the Powertech presentation, the stakeholders debated how much real weathering the accelerated-weathering test represents. This tied into the scope of the project: residential usage versus commercial usage. Since those two settings have different usage patterns, the time required to represent them would be different. For now, stakeholders suggested focusing on residential usage, but not forgetting commercial. Charles Parker of Carillon recommended that a future version of the test procedure include a freezing test.

Based on the test results, Powertech also proposed levels of 70% for all lamps.

3.6. ENERGY STAR Decorative Light Strings version 1.2.1 Review and edit of the test procedure and eligibility criteria

Michael Scholand of NCI facilitated the workshop discussion around revising draft version 1.2.1 of the test procedure and eligibility criteria. Below is the feedback from stakeholders about different parts of the document:

1. Definitions

- Decorative Light String – The expanse of precisely what is and what is not deemed a "decorative light string" was unclear to stakeholders. Specific questions for clarification arose around pre-lit trees that use ENERGY STAR DLS and other decorations such as wire-frame deer wrapped with DLS.
- Failed Lamp – The stakeholders debated this definition because some found it unclear. Ultimately, the stakeholders accepted that the definition was crafted after much debate within the working group and regarded the definition as sufficient.

2. Reference Standards

- No stakeholder comments

3. Qualifying Products

- Isabelle Guimont of NRCan discussed that manufacturers might submit a pass/fail form to NRCan. Stakeholder briefly discussed reducing manufacturer testing burden, but agreed to reserve that debate for a later point.

4. Tests and Energy-Efficient Specifications for Qualifying Products

4.1. Inspection

4.1.1. Michael Vladimer of NCI reported that in the inspection test, some strings did not have consistent lamp counts.

4.1.2. No comment

4.1.3. No comment

4.1.4. No comment

4.1.5. The stakeholders debated two issues associated with packaging. The first is that ENERGY STAR qualified strings might have mislabelled packaging. Related to that was the issue that manufacturers might not be able to submit the final packaging. Stakeholder agreed that mock-up packaging was suitable. The second issue that concerned stakeholders was that manufacturers might include the ENERGY STAR symbol on their product without properly qualifying and registering.

4.2. Seasoning, Power, and Over-voltage Test

- Stakeholders came to a consensus that a one-hour test was sufficient with the maximum amount of failed lamps per string being 3%.

4.3. Lifetime test

- After much discussion, the stakeholders came to a consensus, agreeing to the proposed levels for the 1000-hour duration of 70% for coloured lamps and 50% for white and derivative lamps. However, stakeholders encouraged NRCan to raise the 50% level over time.
- Many stakeholders wanted higher standards; however, one stakeholder pointed out that manufacturers could achieve higher levels in testing, but not in practice. Therefore, the stakeholder proposed beginning with lower levels and increasing the levels over time. All stakeholders came to a consensus around that suggestion.

4.4. Accelerated Weathering Test

- Stakeholders debated the testing duration and came to a consensus at 20 cycles, totalling 240 hours.
- Stakeholders also noted that only multi-coloured strings should need to be tested for reducing manufacturer testing burden.
- Stakeholders came to a consensus on the criteria levels being the same as for the lifetime test: 70% for coloured lamps, 50% for white and derivative lamps.
- Stakeholders came to a consensus that no more than 3% of the lamps on a string shall fail after the 20 cycles of testing.

5. Product Safety Requirements

- The sentence “Strings must be appropriately labelled as either indoor only or indoor/outdoor” was deleted because it was redundant.

6. Warranty

- The “minimum 3-year warranty” should specify under normal residential usage.
- The contact information should specify at least one of four options: website, email, address, or toll-free phone number.

7. Packaging

- The stakeholders did not want to specify lamp-lifetime limits or requirements
- The stakeholders considered, but chose not to recommend requiring package information to include instructions as to the maximum number of strings possible to connect safely
- The packaging should meet a bilingual requirement of being in both French and English

8. Testing Sample

- This section will be revisited with reducing manufacturer testing burden.

9. Effective Date

- The proposed effective date was March 1st, 2007.

10. Future Specification Revisions

- The language in this section is intended to parallel similar language in the ENERGY STAR compact fluorescent lamp (CFL) specification.
- Stakeholders suggested adding a list of intended actions so that manufacturers can begin developing product to meet future requirements. The list is included in section 3.9 of this report.

3.7. Reducing Manufacturer Testing Burden

Due to time constraints, this discussion was omitted from the proceedings, with the plan instead to convene conference calls with the technical committee to review and recommend an approach to NRCan and EPA for reducing the testing burden to a manageable level.

3.8. Next Steps for ENERGY STAR

Isabelle Guimont presented NRCan's ideas for the next steps of the project. Isabelle began by stating that NRCan's goal is to have the ENERGY STAR specification for DLS in place for the 2008 winter season. Isabelle indicated that NRCan intends to gather data on consumer opinions and preferences regarding DLS via a consumer survey. NRCan encouraged stakeholders to assist in developing the survey.

Stakeholders provided NRCan with questions about the survey:

- Once the ENERGY STAR specification is in place, how can consumers verify with NRCan that their product truly is ENERGY STAR?
- Since LED lamps output their own colour, stakeholders wanted to know if consumers want lenses that are coloured too?
- One stakeholder suggested that a key component to the survey will be if the survey participants can see the product in question.

- Another stakeholder asked how NRCan will publish the results of the survey

3.9. Action Items

The workshop concluded with a review of the action items and Pierrette LeBlanc thanking all stakeholders for their participation.

During the meeting a few action items arose that NRCan identified and intends to look into. The items are listed in Table 3.1.

Table 3.1 List of action items based on stakeholder feedback at the workshop.

The "ENERGY STAR Deer"	If a manufacturer uses ENERGY STAR decorative light strings in a product, is that product also deemed ENERGY STAR? For example, if a wire-frame deer is wrapped in ENERGY STAR DLS, is it an "ENERGY STAR deer"?
Validation vs. Qualification	After a DLS qualifies as ENERGY STAR, how can NRCan ensure that the product on the shelf meets the ENERGY STAR criteria?
Qualification Levels	The meeting agreed for the lumen maintenance to be 70% for colour strings and 50% for white and derivative (phosphor-based) strings. Those levels, particularly the 50% level for white strings, are intended to increase. The test currently requires 20 cycles of accelerated weathering; that amount of weathering may change in the future. The duration of the over-voltage test may change from the current requirement of one hour.
Other points to address in the future	Future revisions of the specification may address: • screw-in replacement lamps • commercial application of DLS • rope light • an additional cold-temperature test • a contact number for consumer complaints

Appendix A.

ENERGY STAR® Program Requirements for Decorative Light Strings, Test Procedure and Eligibility Criteria, Draft Version 1.2.1 (January 3, 2007)

Third Stakeholder Meeting Summary Report
Toronto, Ontario; January 9, 2007

ENERGY STAR® Program Requirements for Decorative Light Strings

Test Procedure and Eligibility Criteria

Draft Version 1.2.1

(January 3, 2007)

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ENERGY STAR® Program Requirements for Decorative Light Strings

Test Procedure and Eligibility Criteria

Draft Version 1.2.1

The intent of this initiative is to reduce seasonal peak electricity consumption by encouraging consumers to use quality, energy-efficient decorative light strings.

This document describes the test procedure and eligibility criteria that candidate decorative light strings must undergo to determine eligibility for ENERGY STAR® certification. A light string must meet all of the identified criteria if it is to be labelled as an ENERGY STAR® product by its manufacturer.

This document includes tests that assess both the energy-efficiency and quality of decorative light strings, and is comprised of the following:

- Inspection,
- Seasoning, Power, and Over-Voltage Test,
- Lifetime Test, and
- Accelerated Weathering Test.

1) Definitions:

A. Decorative Light String - String of lamps that operate on 120 V RMS AC (including strings that operate on power adaptors) used for decorative lighting purposes. The lamps may be replaceable or sealed into the lampholder.

B. 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 colour on the same string.

> ***Note**: The technical working group determined that a definition for a failed string or failed series block was not needed, as long as a failed lamp was defined. Some of the tests contained in this document will pass/fail a string based on failed lamps as a percentage of total lamps on the string.*

C. Input Power - The total, or system, power used by the decorative string during operation, measured in watts, including transformers, adaptors, etc. For decorative light strings that operate with power adaptors that can accommodate more than one string, the input power shall be measured with the rated maximum number of strings attached. Light strings that modulate in their power use should have the energy used over a reasonable period of time measured, averaged, and recorded as the input power.

D. Maintained Light Output – The light output of a decorative light string after a 1000-hour testing period expressed as a percentage of light output of that same string following a 24-hour seasoning period.

E. Series Block - A number of lamps connected in series, or utilizing a series connection. Additional series blocks can be added to the circuit (or light string) utilizing parallel connections (e.g., a 70-lamp light string could have two 35-lamp series blocks connected in parallel).

F. Watts per Lamp – The input power divided by the number of lamps on the decorative light string (or strings, in the case of power adaptors that can accommodate multiple strings).

G. V RMS AC – The measured root-mean-square value of a voltage with alternating current.

2) Reference Standards: Relevant standards include, but are not limited to:

ASTM International (ASTM)
ASTM G 154 – 05, *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*

Canadian Standards Association (CSA)
CSA-22.2 No.37-M1989 (R2004) *Christmas Tree and Other Decorative Lighting Outfits*

Commission Internationale de l'Eclairage (CIE)
CIE 84-1989, *The Measurement of Luminous Flux*
CIE 127-1997, *Measurement of LEDs*

Illuminating Engineering Society of North America (IESNA)

IESNA TM-16-05, *IESNA Technical Memorandum on Light Emitting Diode (LED) Sources and Systems*

Underwriters Laboratories Inc. (UL)
UL 588-2004, *Standard for Seasonal and Holiday Decorative Products*

3) Qualifying Products: In order to qualify for ENERGY STAR®, a decorative light string must:

- o comply with the definition in Section 1.A,
- o pass the relevant tests and specifications in Section 4,
- o meet the safety requirements in Section 5,
- o meet the warranty requirements in Section 6, and
- o meet the packaging requirements in Section 7.

This ENERGY STAR® specification applies only to decorative light strings that operate on mains power in North America (120 V AC, 60 Hz) or via a power converter that connects directly to mains power. Section 8 discusses acceptable approaches for testing and qualifying representative samples of a family of decorative light strings.

4) Tests and Energy-Efficiency Specifications for Qualifying Products: A random sample of three (3) strings of the same model shall be tested, and all must meet or exceed the test criteria in this section. Due to the physical impacts of the tests in sections 4.3 and 4.4, different strings of the same model may be used to assess compliance with the ENERGY STAR® requirements. If a decorative light string is labelled for indoor use only, it does not have to pass the Accelerated Weathering Test in section 4.4 in order to qualify for ENERGY STAR®.

4.1. Inspection

4.1.1. Count lamps per string and ensure it is consistent with the packaging label. If the number of lamps on the string are different from the number on the packaging, the model fails this test.

4.1.2. Check whether the lamps are sealed or plug-in. If plug-in, the socket / lamp must have a marking or means to ensure correct insertion of replacement lamps

4.1.3. Ensure that the safety certification and labelling of the string meets the requirements of Section 5.

4.1.4. Ensure that the warranty, whether printed on the box or on an insert, meets the requirements of Section 6.

4.1.5. Ensure that the packaging in which the lamps are sold at the retail level meets the requirements of Section 7.

4.2. Seasoning, Power, and Over-Voltage Test

4.2.1. Operate the decorative light string for a 24 hour (± 1 %) "seasoning" period at 120 V ± 1 V RMS AC.

4.2.2. Measure input power and current at 120 V ± 0.5 V RMS AC. For systems with power adaptors that can accommodate multiple light strings, the input power shall be measured with the rated maximum number of strings attached. Calculate the input power consumed per lamp operated. The input power consumption per lamp shall not exceed 0.2 watts.

> ***Note:*** *Stakeholders commented that a specification of 0.1 W per lamp may exclude energy-efficient strings with 20 or fewer lamps or lamps that have multiple LED die per lamp, including screw-in replacement C-7 or C-9 lamps. A suggested alternative specification would be a 20 mA lamp current.*
> *Natural Resources Canada (NRCan) recognizes that strings with low lamp counts or multiple LEDs per lamp may not qualify for this initial Decorative Light String ENERGY STAR® specification. NRCan needs to evaluate these products more closely, and may establish separate input power consumption per lamp criteria in a future specification.*

4.2.3. Light strings will be energized at 132 ± 1 V RMS AC for one hour and examined for failure. If any have failed, count the number of lamps that have failed and calculate the failed lamps as a percentage of total lamps on the string, rounding up to the nearest whole number. The number of failed lamps on the string shall be less than X%.

4.3. Lifetime Test

A decorative light string shall be tested for maintaining light output as described in the steps below.

4.3.1. Assemble the decorative light string into a testing configuration by bundling the string together so that all lamps are directed outward. The assembly shall be made as compact as possible and taped together with electrical tape to maintain

the relative positioning of the lamps throughout this test. Next, for its optical properties, white Teflon® tape shall be wrapped around the bundle to completely cover the electrical tape. Figure 1 shows a sample test setup.

(a) Top view

(b) Side view

Figure 1. Sample test setup of a DLS bundled and taped.

4.3.2. Measure the light output of the assembly while operating at 120 V ± 0.5 V RMS AC, 25°C ± 5°C and following the guidelines contained in CIE Publication 84-1989, *The Measurement of Luminous Flux.*

4.3.3. Keeping the testing assembly intact (i.e., do not remove the tape, or move any of the lamps), operate the 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 the assembly have been moved relative to each other.

4.3.4. Conduct a second measurement of the light output following the same procedure in step 4.3.2 above. Measure the maintained light output which shall be no less than XX%.

4.3.5. Count the number of failed lamps (as per definition 1.B) and calculate the failed lamps (if any) as a percentage of total lamps on the string, rounding the percentage up to the nearest whole number. The percentage of failed lamps on the string shall be less than X%.

4.4. Accelerated Weathering Test

This test assesses the integrity of lamp mounting sockets and the durability of lamp lenses/diffusers when exposed to simulated weathering conditions using ASTM G154-05. Strings that are labelled for indoor use only shall not be subjected to this test. The steps to follow for this test are outlined below.

4.4.1. Prepare the bundle and measure the light output of the string following steps 4.3.1 and 4.3.2.

4.4.2. Being careful not to disturb the assembly, load it into a testing chamber and subject the string to the exposure conditions contained in Cycle 7 of Table X2.1 of ASTM G154-05. The decorative lamp strings under test shall be operated for the duration of this test at 120 V ± 3 V AC RMS 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 10 consecutive iterations of Cycle 7 under Table X2.1 for a total of 120 hours.

4.4.3. The light string assembly shall then be removed from the testing chamber and inserted into an integrating sphere per step 4.3.2 above, and a second light output measurement taken. Calculate the percent maintained light output, rounding up to the nearest whole number, which shall be no less than XX%.

4.4.4. Count the number of failed lamps (as per definition 1.B) and calculate the failed lamps (if any) as a percentage of total lamps on the string, rounding the percentage up to the nearest whole number. The percentage of failed lamps on the string shall be less than X%.

5) **Product Safety Requirement:** ENERGY STAR® qualified decorative light strings must comply with the applicable safety standards and have certification acceptable to the Standards Council of Canada. Strings must be appropriately labelled as either indoor-only or indoor/outdoor. The light string shall be labelled with the safety certification agency, and whether it is rated for indoor-only or indoor/outdoor use.

6) **Warranty:** All ENERGY STAR® qualified decorative light strings shall be offered with a minimum 3-year warranty against all product defects and will include a contact telephone number for the manufacturer..

7) **Packaging:** The packaging containing the product shall specify:

- Product's suitability for use indoor-only or indoor/outdoor use,
- Number of LED lamps on the string,
- Total lighted length of string in appropriate metric and SAE units, and
- Wattage of light string.

8) **Testing Sample:** Manufacturers are required to perform tests and certify that all decorative light strings marketed as meeting the ENERGY STAR® requirements comply with the requirements outlined in this document. Natural Resources Canada recognizes, however, that many of the decorative light strings produced are electrically identical, with perhaps different lens shapes (e.g., M5, G3, C9) or with a different colour wiring harness (e.g., green, white). Therefore, Natural Resources Canada is allowing manufacturers to create product "families", and then test a sample of three randomly selected strings of one model in a product family from which it may certify the product "family".

Decorative light string models that qualified for ENERGY STAR® in a previous year may remain qualified without the submission of new test data if the light string model designs have not been modified in any way and the ENERGY STAR® specification has not changed. Manufacturers are held accountable for the certification of any decorative light strings marketed as ENERGY STAR®, including models in a product family that were not tested.

[This issue will be discussed by the technical working group and the plenary committee on January 9th once all the test results are available on the samples tested in 4Q 2006. This section of the specification will be expanded to incorporate the decisions made on Jan. 9th]

9) **Effective Date:** The date that a manufacturer begins to qualify products as ENERGY STAR® will be defined as the *effective date* of the agreement.

10) **Future Specification Revisions:** ENERGY STAR® 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 will be arrived at through stakeholder discussion and consultation.

Appendix B.

ENERGY STAR® Program Requirements for Decorative Light Strings, Test Procedure and Eligibility Criteria, Draft Version 1.2.1 (January 3, 2007) – Tracked Changes

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Toronto, Ontario; January 9, 2007

ENERGY STAR® Program Requirements for Decorative Light Strings

Test Procedure and Eligibility Criteria

Draft Version 1.2.1

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ENERGY STAR® Program Requirements for Decorative Light Strings

Test Procedure and Eligibility Criteria

Draft Version 1.2.1

The intent of this initiative is to reduce seasonal peak electricity consumption by encouraging consumers to use quality, energy-efficient decorative light strings.

This document describes the test procedure and eligibility criteria that candidate decorative light strings must undergo to determine eligibility for ENERGY STAR® certification. A light string must meet all of the identified criteria if it is to be labelled as an ENERGY STAR® product by its manufacturer.

This document includes tests that assess both the energy-efficiency and quality of decorative light strings, and is comprised of the following:

- Inspection,
- Seasoning, Power, and Over-Voltage Test,
- Lifetime Test, and
- Accelerated Weathering Test.

1) Definitions:

A. Decorative Light String - String of lamps that operate on 120 V RMS AC (including strings that operate on power adaptors) used for decorative lighting purposes. The lamps may be replaceable or sealed into the lampholder.

B. 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 colour on the same string.

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***Note**: The technical working group determined that a definition for a failed string or failed series block was not needed, as long as a failed lamp was defined. Some of the tests contained in this document will pass/fail a string based on failed lamps as a percentage of total lamps on the string.*

C. Input Power - The total, or system, power used by the decorative string during operation, measured in watts, including transformers, adaptors, etc. For decorative light strings that operate with power adaptors that can accommodate more than one string, the input power shall be measured with the rated maximum number of strings attached. Light strings that modulate in their power use should have the energy used over a reasonable period of time measured, averaged, and recorded as the input power.

D. Maintained Light Output – The light output of a decorative light string after a 1000-hour testing period expressed as a percentage of light output of that same string following a 24-hour seasoning period.

E. Series Block - A number of lamps connected in series, or utilizing a series connection. Additional series blocks can be added to the circuit (or light string) utilizing parallel connections (e.g., a 70-lamp light string could have two 35-lamp series blocks connected in parallel).

F. Watts per Lamp – The input power divided by the number of lamps on the decorative light string (or strings, in the case of power adaptors that can accommodate multiple strings).

G. V RMS AC – The measured root-mean-square value of a voltage with alternating current.

2) Reference Standards: Relevant standards include, but are not limited to:

ASTM International (ASTM)
ASTM G 154 – 05, *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*

Canadian Standards Association (CSA)
CSA-22.2 No.37-M1989 (R2004) *Christmas Tree and Other Decorative Lighting Outfits*

Commission Internationale de l'Eclairage (CIE)
CIE 84-1989, *The Measurement of Luminous Flux*
CIE 127-1997, *Measurement of LEDs*

Illuminating Engineering Society of North America (IESNA)

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Deleted: ENERGY STAR® qualified decorative holiday strings must comply with the applicable safety standards and relevant clauses from the Canadian Standards Association, Underwriters Laboratories and or any at least one other applicable global standards organizations, unless the requirements of the ENERGY STAR® specification are more restrictive.
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IESNA TM-16-05, *IESNA Technical Memorandum on Light Emitting Diode (LED) Sources and Systems*

Underwriters Laboratories Inc. (UL)
UL 588-2004, *Standard for Seasonal and Holiday Decorative Products*

3) Qualifying Products: In order to qualify for ENERGY STAR®, a decorative light string must:

- o comply with the definition in Section 1.A,
- o pass the relevant tests and specifications in Section 4,
- o meet the safety requirements in Section 5,
- o meet the warranty requirements in Section 6, and
- o meet the packaging requirements in Section 7.

This ENERGY STAR® specification applies only to decorative light strings that operate on mains power in North America (120 V AC, 60 Hz) or via a power converter that connects directly to mains power. Section 8 discusses acceptable approaches for testing and qualifying representative samples of a family of decorative light strings.

4) Tests and Energy-Efficiency Specifications for Qualifying Products: A random sample of three (3) strings of the same model shall be tested, and all must meet or exceed the test criteria in this section. Due to the physical impacts of the tests in sections 4.3 and 4.4, different strings of the same model may be used to assess compliance with the ENERGY STAR® requirements. If a decorative light string is labelled for indoor use only, it does not have to pass the Accelerated Weathering Test in section 4.4 in order to qualify for ENERGY STAR®.

4.1. Inspection

4.1.1. Count lamps per string and ensure it is consistent with the packaging label. If the number of lamps on the string are different from the number on the packaging, the model fails this test.

4.1.2. Check whether the lamps are sealed or plug-in. If plug-in, the socket / lamp must have a marking or means to ensure correct insertion of replacement lamps

4.1.3. Ensure that the safety certification and labelling of the string meets the requirements of Section 5.

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4.1.4. Ensure that the warranty, whether printed on the box or on an insert, meets the requirements of Section 6.

4.1.5. Ensure that the packaging in which the lamps are sold at the retail level meets the requirements of Section 7.

4.2. Seasoning, Power, and Over-Voltage Test

4.2.1. Operate the decorative light string for a 24 hour (± 1 %) "seasoning" period at 120 V ± 1 V RMS AC.

4.2.2. Measure input power and current at 120 V ± 0.5 V RMS AC. For systems with power adaptors that can accommodate multiple light strings, the input power shall be measured with the rated maximum number of strings attached. Calculate the input power consumed per lamp operated. The input power consumption per lamp shall not exceed 0.2 watts.

Note: *Stakeholders commented that a specification of 0.1 W per lamp may exclude energy-efficient strings with 20 or fewer lamps or lamps that have multiple LED die per lamp, including screw-in replacement C-7 or C-9 lamps. A suggested alternative specification would be a 20 mA lamp current. Natural Resources Canada (NRCan) recognizes that strings with low lamp counts or multiple LEDs per lamp may not qualify for this initial Decorative Light String ENERGY STAR® specification. NRCan needs to evaluate these products more closely, and may establish separate input power consumption per lamp criteria in a future specification.*

4.2.3. Light strings will be energized at 132 ± 1 V RMS AC for one hour and examined for failure. If any have failed, count the number of lamps that have failed and calculate the failed lamps as a percentage of total lamps on the string, rounding up to the nearest whole number. The number of failed lamps on the string shall be less than X%.

4.3. Lifetime Test

A decorative light string shall be tested for maintaining light output as described in the steps below.

4.3.1. Assemble the decorative light string into a testing configuration by bundling the string together so that all lamps are directed outward. The assembly shall be made as compact as possible and taped together with electrical tape to maintain

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the relative positioning of the lamps throughout this test. Next, for its optical properties, white Teflon® tape shall be wrapped around the bundle to completely cover the electrical tape. Figure 1 shows a sample test setup.

	
(a) Top view	(b) Side view

Figure 1. Sample test setup of a DLS bundled and taped.

4.3.2. Measure the light output of the assembly while operating at 120 V ± 0.5 V RMS AC, 25°C ± 5°C and following the guidelines contained in CIE Publication 84-1989, *The Measurement of Luminous Flux.*

4.3.3. Keeping the testing assembly intact (i.e., do not remove the tape, or move any of the lamps), operate the 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 the assembly have been moved relative to each other.

4.3.4. Conduct a second measurement of the light output following the same procedure in step 4.3.2 above. Measure the maintained light output which shall be no less than XX%.

4.3.5. Count the number of failed lamps (as per definition 1.B) and calculate the failed lamps (if any) as a percentage of total lamps on the string, rounding the percentage up to the nearest whole number. The percentage of failed lamps on the string shall be less than X%.

4.4. Accelerated Weathering Test

This test assesses the integrity of lamp mounting sockets and the durability of lamp lenses/diffusers when exposed to simulated weathering conditions using ASTM G154-05. Strings that are labelled for indoor use only shall not be subjected to this test. The steps to follow for this test are outlined below.

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4.4.1. Prepare the bundle and measure the light output of the string following steps 4.3.1 and 4.3.2.

4.4.2. Being careful not to disturb the assembly, load it into a testing chamber and subject the string to the exposure conditions contained in Cycle 7 of Table X2.1 of ASTM G154-05. The decorative lamp strings under test shall be operated for the duration of this test at 120 V ± 3 V AC RMS 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 10 consecutive iterations of Cycle 7 under Table X2.1 for a total of 120 hours.

4.4.3. The light string assembly shall then be removed from the testing chamber and inserted into an integrating sphere per step 4.3.2 above, and a second light output measurement taken. Calculate the percent maintained light output, rounding up to the nearest whole number, which shall be no less than XX%.

4.4.4. Count the number of failed lamps (as per definition 1.B) and calculate the failed lamps (if any) as a percentage of total lamps on the string, rounding the percentage up to the nearest whole number. The percentage of failed lamps on the string shall be less than X%.

5) **Product Safety Requirement:** ENERGY STAR® qualified decorative light strings must comply with the applicable safety standards and have certification acceptable to the Standards Council of Canada. Strings must be appropriately labelled as either indoor-only or indoor/outdoor. The light string shall be labelled with the safety certification agency, and whether it is rated for indoor-only or indoor/outdoor use.

6) **Warranty:** All ENERGY STAR® qualified decorative light strings shall be offered with a minimum 3-year warranty against all product defects and will include a contact telephone number for the manufacturer.

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7) **Packaging:** The packaging containing the product shall specify:

- Product's suitability for use indoor-only or indoor/outdoor use,
- Number of LED lamps on the string,
- Total lighted length of string in appropriate metric and SAE units, and
- Wattage of light string.

8) **Testing Sample:** Manufacturers are required to perform tests and certify that all decorative light strings marketed as meeting the ENERGY STAR® requirements comply with the requirements outlined in this document. Natural Resources Canada recognizes, however, that many of the decorative light strings produced are electrically identical, with perhaps different lens shapes (e.g., M5, G3, C9) or with a different colour wiring harness (e.g., green, white). Therefore, Natural Resources Canada is allowing manufacturers to create product "families", and then test a sample of three randomly selected strings of one model in a product family from which it may certify the product "family".

Decorative light string models that qualified for ENERGY STAR® in a previous year may remain qualified without the submission of new test data if the light string model designs have not been modified in any way and the ENERGY STAR® specification has not changed. Manufacturers are held accountable for the certification of any decorative light strings marketed as ENERGY STAR®, including models in a product family that were not tested.

[This issue will be discussed by the technical working group and the plenary committee on January 9th, once all the test results are available on the samples tested in 4Q 2006. This section of the specification will be expanded to incorporate the decisions made on Jan. 9th.]

9) **Effective Date:** The date that a manufacturer begins to qualify products as ENERGY STAR® will be defined as the *effective date* of the agreement.

10) **Future Specification Revisions:** ENERGY STAR® 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 will be arrived at through stakeholder discussion and consultation.

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Deleted: In order to qualify their products for ENERGY STAR®, manufacturers are required to submit three samples of each product model (i.e., Stock Keeping Unit (SKU) number) they wish to qualify to a third-party laboratory approved by Natural Resources Canada. Manufacturers are invited to submit names of candidate testing laboratories to Natural Resources Canada for consideration.

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Count lamps per string and ensure this is consistent with the packaging label. Measure input power and current at 120 volts ± 2% RMS AC. For systems with power adaptors that can accommodate multiple light strings, the input power should be measured with the rated maximum number of strings attached. Calculate the input power consumed per lamp operated. The input power consumption per lamp should not exceed 0.1 watts.

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Those strings labelled for outdoor / exterior use shall

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have a safety certification mark (e.g., CSA

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) approved for outdoor / exterior use

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Appendix C.

ENERGY STAR® Program Requirements for Decorative Light Strings
Master Presentation from the Workshop

Third Stakeholder Meeting Summary Report
Toronto, Ontario; January 9, 2007

ENERGY STAR®
Program Requirements for Decorative Light Strings

Decorative Light Strings

Third Plenary Meeting
Hosted by Natural Resources Canada

Doubletree International Plaza Hotel
Toronto, Ontario
January 9, 2007

1

Welcome Statement

Decorative Light Strings

- ENERGY STAR is a quality certification / brand which is used to encourage market adoption of premium-efficiency products
- In decorative lighting, consumers have technology choices – the two dominant ones being incandescent and light emitting diode (LED)
- LED offers a clear advantage in energy savings potential, particularly today in coloured light, but LED comes at a price premium
- Using an ENERGY STAR label, Natural Resources Canada (NRCan) will encourage the market to migrate toward LED lamps, cutting 80% to 90% of energy used by decorative light strings (DLS)
- Thus, NRCan started work to develop an ENERGY STAR specification for decorative light strings (DLS) in Canada, which may also be adopted in the U.S.

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Chronology of Events

Decorative Light Strings

Date	Event
March 6, 2006	First NRCan meeting in Toronto to review draft test protocol (BC Hydro / Powertech) and eligibility criteria (v.1.0)
April – June 2006	Series of weekly conference calls with Technical Committee to review test protocol issues and develop revised protocol
June 27, 2006	Second NRCan meeting in Toronto to review revised draft test protocol and eligibility criteria (v.1.1.1)
July – Dec 2006	Periodic Technical Committee calls and laboratory testing of sample DLS by Powertech and Lighting Research Center
January 9, 2007	Third NRCan meeting in Toronto to review the revised ENERGY STAR Program Requirements for Decorative Light Strings (v.1.2.1)

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Review of Progress to Date

Decorative Light Strings

- Third plenary meeting, following March and June 2006.
- The second plenary meeting closed with two key action items –
  - Revisions to the specification, based on product testing
  - Initiation of consumer focus groups to study critical issues
- Four manufacturers donated 281 decorative light strings for testing.
- NRCan contracted two laboratories – Powertech Labs and the Lighting Research Center to conduct tests
- NRCan has began work on organizing focus groups, which we will discuss later.
- **Today's Goal: To review the draft specification v1.2.1 and analyze the test data to arrive at an appropriate ENERGY STAR specification for decorative light strings.**

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Introductions: Around the Table / Phone

Decorative Light Strings

- As we go around the table, please state your
  - Name
  - Organizational affiliation, and
  - Whether you participated in either of the prior plenary meetings.
- Then, we'll do the same on the phone

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Today's Agenda

Decorative Light Strings

8:30-9:00	Registration
9:00-9:10	Welcome and Review of Progress to Date *Update on developments since the Second Plenary Meeting on June 27, 2006* *Pierrette LeBlanc – Natural Resources Canada*
9:10-9:20	Introductions and Agenda Review *Around the table, Discussion of Agenda and Context for Work Performed* *Michael Scholand – Navigant Consulting, Inc.*
9:20-10:00	Test Results of Sample Strings Submitted *Presentation of Test Results of decorative light strings* *Michael Vladimer – Navigant Consulting, Inc.* *Conan O'Rourke – Lighting Research Center* *Bruce Neilson – Powertech Laboratories*
10:00-10:15	COFFEE BREAK

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Today's Agenda

Decorative Light Strings

10:15-12:00	ENERGY STAR Decorative Light Strings version 1.2.1 *Walk through the document, detailed discussion on green highlighted topics* *Michael Scholand – Navigant Consulting, Inc.*
12:00-1:00	LUNCH
1:00-2:30	ENERGY STAR Decorative Light Strings version 1.2.1 (continued) *Walk through the document, detailed discussion on green highlighted topics* *Michael Scholand – Navigant Consulting, Inc.*
2:30-2:45	COFFEE BREAK
2:45-3:45	Reducing Manufacturer Testing Burden *Proposal on how to reduce testing burden while maintaining programmatic integrity* *Michael Scholand – Navigant Consulting, Inc.*
3:45-4:00	Next Steps for ENERGY STAR DLS Planning for the Focus Group; next steps for program adoption in Canada and the US *Isabelle Guimont – Natural Resources Canada* *Pierrette LeBlanc – Natural Resources Canada*
4:00	ADJOURN

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Context for Work Performed

Decorative Light Strings

- June 2006 plenary meeting
  - Revisions to the document were agreed, e.g., removing brightness measurement
  - Testing of product called for, so final specification will be based on real product
- The Technical Committee re-convened and outlined an approach which would protect manufacturer's identity, yet enable testing of product to be conducted.
- Sample strings were donated by the four manufacturers on the Technical Committee
- Tests were conducted in accordance with the current version 1.2.1 of the specification
- Results are being reported back today to enable participants to make decisions on values for the ENERGY STAR specification

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The Work Performed (cont.)

Decorative Light Strings

- The sample strings submitted included the following:

Lamp Shape	Red	Yellow	Green	Blue	Multi-Colour	White
C6/C7 	3 strings	3 strings	3 strings	3 strings	7 strings*	7 strings*
G3 	3 strings	3 strings	3 strings	3 strings	7 strings*	7 strings*
M5 	3 strings	3 strings	3 strings	3 strings	7 strings*	7 strings*

* Of the seven strings, three are for testing at the Lighting Research Center, three strings are for testing at Powertech Labs and one string is for calibration testing between the two laboratories. At least three of the seven strings should be labelled for indoor/outdoor use (for Powertech Labs).

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The Work Performed (cont.)

Decorative Light Strings

- Navigant Consulting received all the strings and:
  - Removed any tags that might identify the manufacturer, assigned unique number to each of the strings
  - Conducted the Inspection Test and sent the numbered samples to the two laboratories for testing
- The Lighting Research Center conducted the following tests:
  - Seasoning, Power, and Over-Voltage Test
  - Lifetime Test
- Powertech Laboratories conducted the:
  - Seasoning, Power, and Over-Voltage Test
  - Accelerated Weathering Test

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Technical Committee

Decorative Light Strings

Company	Technical Expert
3H and Company Ltd.	David Weiss
British Columbia Hydro	Gary Hamer
Canadian Standards Association International	Dejan Lenasi
Fiber Optic Design	David Allen
LEDUp Enterprises, Inc.	Jerry Yu
Lighting Research Center	Conan O'Rourke
Powertech Labs	Bruce Neilson
Seasonal Specialties	Stephen Altamura
Underwriters Laboratories	Anthony Tassone

- In addition to Natural Resources Canada and Navigant Consulting, Inc. who facilitated the conference calls.

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Decorative Light Strings

Test Results of Sample Strings Submitted

Michael Vladimer
Navigant Consulting, Inc.

Conan O'Rourke
Lighting Research Center

Bruce Neilson
Powertech Labs Inc

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Decorative Light String Testing

Conan O'Rourke

January 09, 2007

Overview

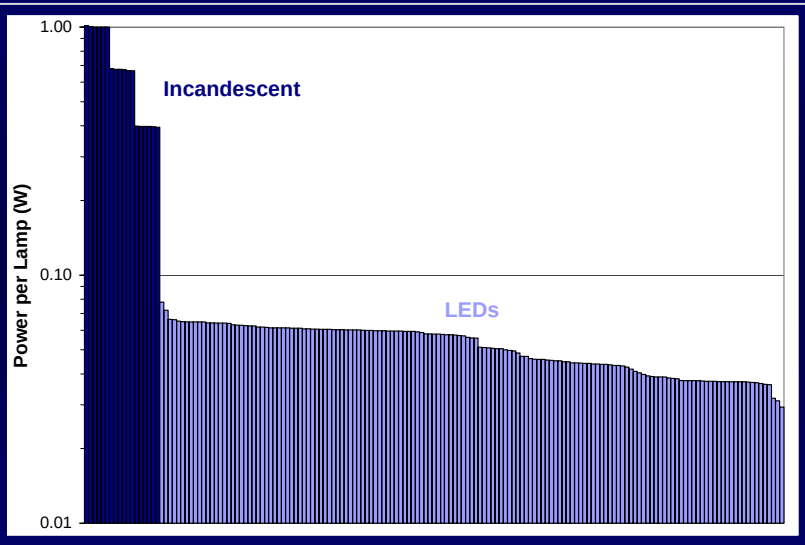
- Overview
- Power Test
- Lifetime Test
- Over-voltage Test
- Recommendations

Overview

Products Tested

- M5, G3, and C6 shapes
- Red, yellow, green, blue, white, and multi-colors
- Three samples of each for most models
- 167 SLED strings from four manufacturers
- 35, 50, 60 and 70 bulb SLED strings
- 35, 50 and 70 bulb incandescent strings

Power Test



Power Test

- All SLEDs* were below 0.2 watt per bulb
  - The highest was ~0.07 watt
  - Incandescent strings were 0.4 to 1.0 watts per bulb

*SLEDs refers to Seasonal LEDs, another term for Decorative Light Strings (DLS)

Lifetime (Reduction in Light)

- Depreciation test procedure
  - Use existing lighting standards as a guide
    - IES LM-45, LM-66 or CIE 84-1989
  - Seasoned strings for 24 hours
  - Measured light output at 24, 333, 666, and 1000 hours
    - Used an integrating sphere
  - Evaluated using photometric results

Lifetime (Reduction in Light)

- Evaluated whole SLED string
  - Simplified measurement
  - Repeatable positioning for initial and 1000-hr measurements
    - could lead to large differences for individual LEDs
  - If there are broad depreciation issues we look at the next step

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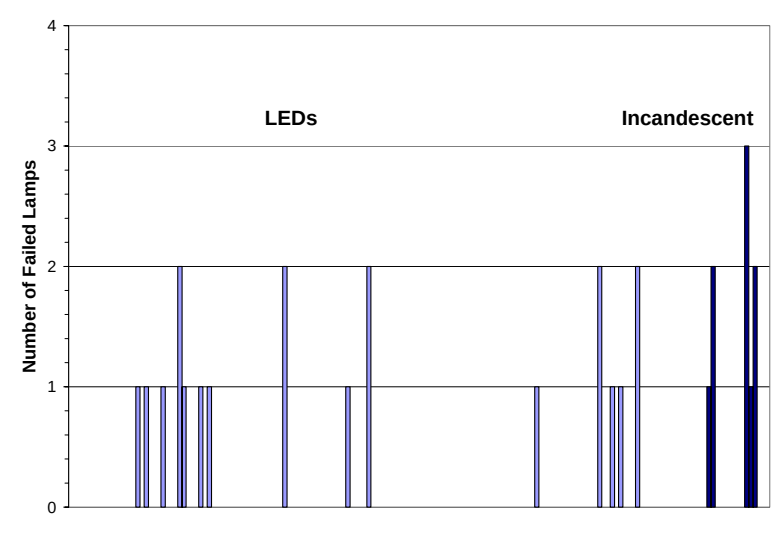
Bulb Failure Results



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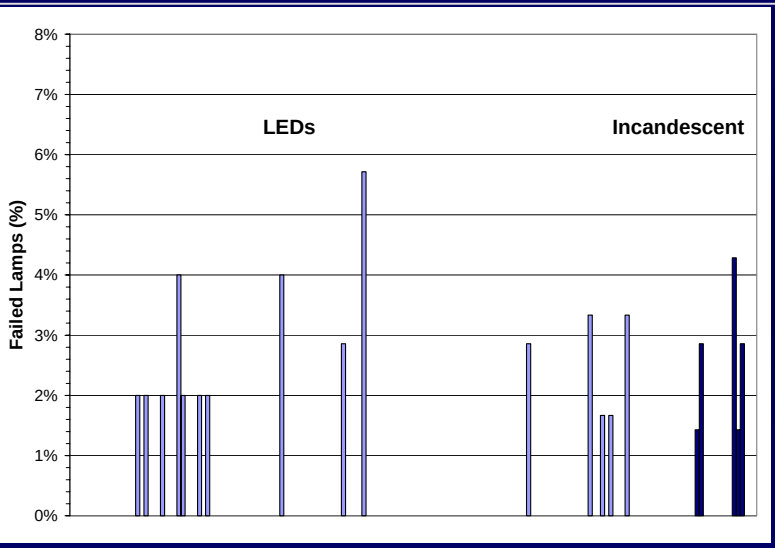
Bulb Failure Results



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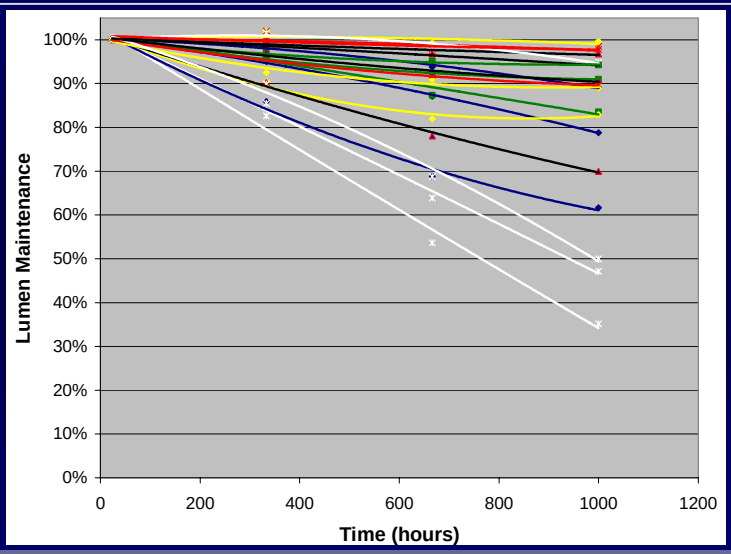
Lumen Maintenance Results

All C6 Shapes from All Manufacturers



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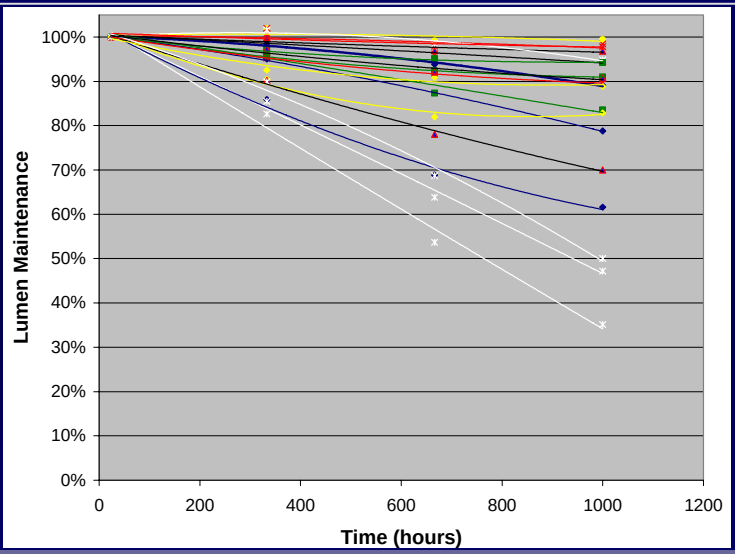
Lumen Maintenance Results
All C6 Shapes from All Manufacturers



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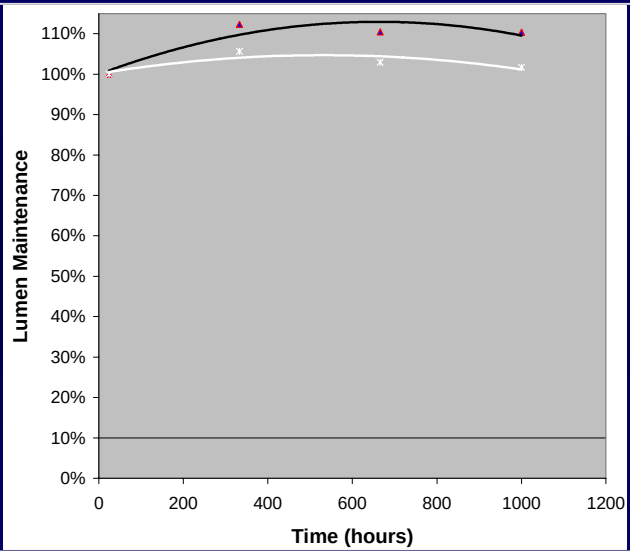
Lumen Maintenance Results
Incandescent Strings



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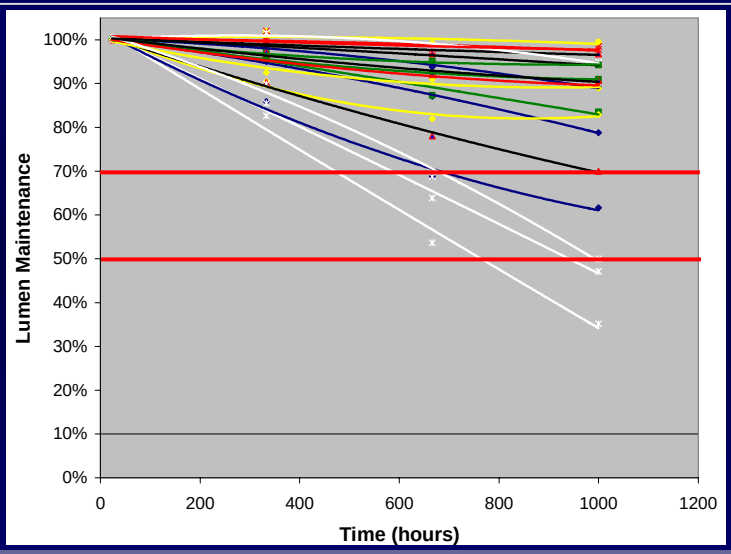
Lumen Maintenance Results
Incandescent Strings

- Incandescent lumens surprisingly increased
- LRC had not tested these types of lamps before

- Performed additional testing
  - Tested new strings and monitored continuously for 1 week
  - Light output did go up
  - Also found that failures caused light output to go up

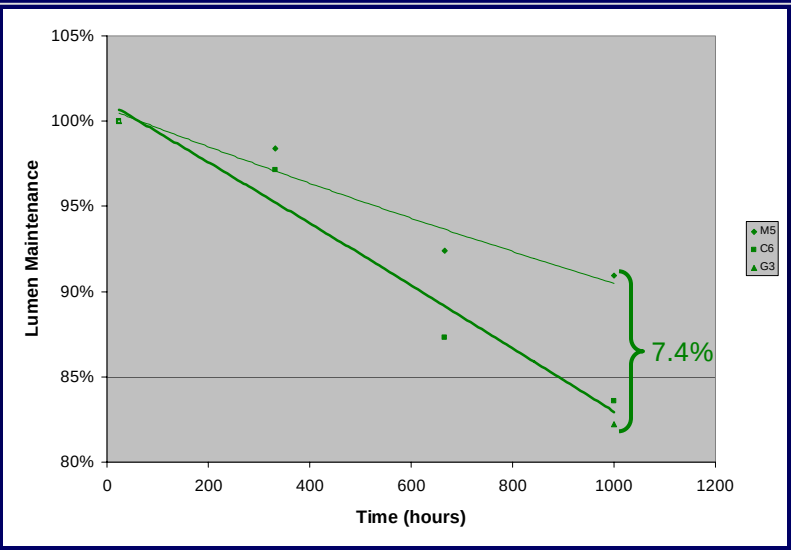
$$\Phi = \Phi_O \left(\frac{I}{I_O} \right)^{6.259}$$

Lumen Maintenance Results
All C6 Shapes from All Manufacturers



Difference between Bulb Shapes

For Strings where all 3 types were tested



Lighting Research Center

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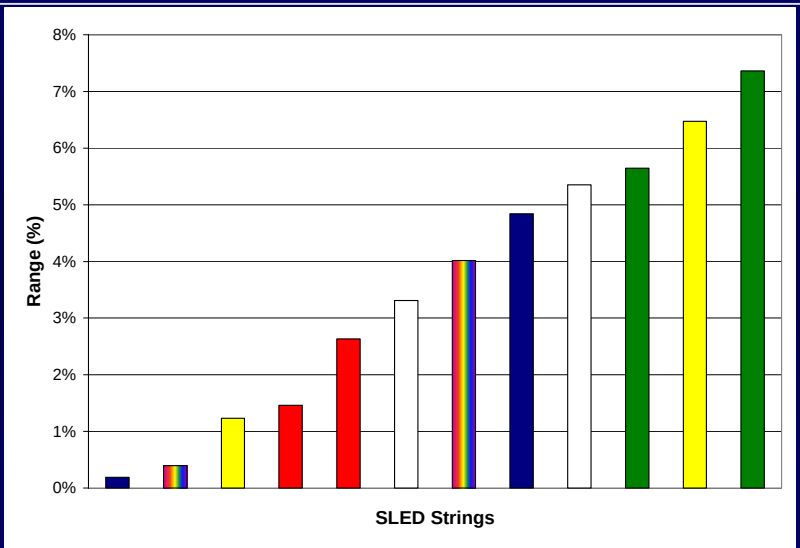
Rensselaer

Difference between Bulb Shapes

For Strings where all 3 types were tested



Lighting Research Center

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Rensselaer

Difference between Bulb Shapes

- Does not appear to be large enough difference
- Suggest only testing C6 shapes to reduce manufacturer's burden

Over-Voltage Test

- Performed this test after lumen maintenance test to minimize impact
- 3 new bulb failures on 3 separate strings
- 1 hour test may be too short
  - Might consider longer test

Recommendations

4.2.1 Operate the decorative light string for a **24** hour (± 1 %) "seasoning" period at 120 V ± 1 V RMS AC.

4.2.2 Measure input power and current at 120 V ± 0.5 V RMS AC. For systems with power adaptors that can accommodate multiple light strings, the input power shall be measured with the rated maximum number of strings attached. Calculate the input power consumed per lamp operated. The input power consumption per lamp shall not exceed **0.2** watts.

4.2.3 Light strings will be energized at 132 ± 1 V RMS AC for one hour and examined for failure. If any have failed, count the number of lamps that have failed and calculate the failed lamps as a percentage of total lamps on the string, rounding up to the nearest whole number. The number of failed lamps on the string shall be less than **2**%.

Recommendations

4.3.3 Keeping the testing assembly intact (i.e., do not remove the tape, or move any of the lamps), operate the 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 the assembly have been moved relative to each other.

4.3.4 Conduct a second measurement of the light output following the same procedure in step 4.3.2 above. Measure the maintained light output which shall be no less than **70**%. **(may consider 50% for white SLEDs)**

4.3.5 Count the number of failed lamps (as per definition 1.B) and calculate the failed lamps (if any) as a percentage of total lamps on the string, rounding the percentage up to the nearest whole number. The percentage of failed lamps on the string shall be less than **5**%.

POWERTECH

We find a better way

Initial Weathering Test Experience with Decorative Light Strings

Bruce Neilson, *Powertech Labs Inc*

ENERGY STAR ® Workshop on Decorative Light Strings

Toronto, Canada, January 2007

POWERTECH

We find a better way

Background

- BC Hydro Power Smart started a program around 2003 to promote seasonal LED strings (SLEDS)
- Initial experience revealed some reliability problems
- Powertech weathering tests in 2004 raised corrosion concerns with products available at that time
- A weathering test was incorporated in the new draft ENERGY STAR® criteria
- Powertech has carried out preliminary weathering tests on a range of LED and incandescent sample strings

POWERTECH

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Components of Test Protocol

1. Initial inspection
2. 24 hour burn-in
3. Light output measurement
4. 10 weathering cycles (120 hr)
5. Light output measurement
6. 10 weathering cycles (120 hr)
7. Light output measurement
8. Overvoltage test (1 hour at 132V)

POWERTECH

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Light Output Measurement

- Samples were first prepared by wrapping them around a plastic board and covering the wires with white teflon tape
- Samples were then mounted inside a reflective optical integrator to measure the total light output
- The light meter used a standard photopic weighting curve

POWERTECH

Light Output Measurement

- The input voltage was regulated by an electronic supply to 120 ±0.1 V
- The temperature was controlled at 25 °C

POWERTECH

Weathering Test

- Standard UV/corrosion weathering test was applied from ASTM G154-05. The test alternates UV light, water spray, and a drying cycle, at 50 to 60°C.
- Twenty cycles (12 hours each) were applied.
- Strings were checked for burnout after 5 and 15 cycles, and light output was measured after 10 and 20 cycles.
- Due to size limitations, the strings were tested in two batches.

POWERTECH

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Weathering Chamber

POWERTECH

We find a better way

Inside Weathering Chamber

POWERTECH

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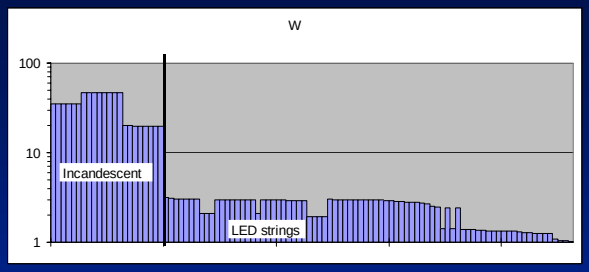
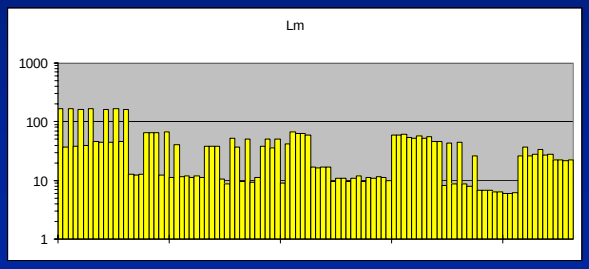
Initial Measurements

Power (W)



Light output (lm)



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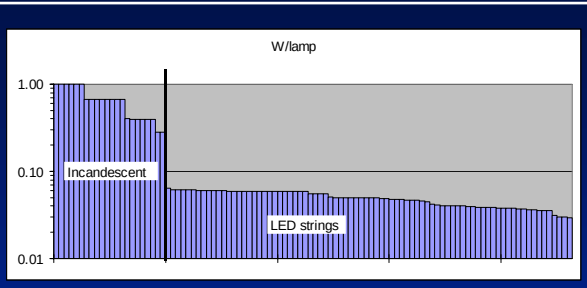
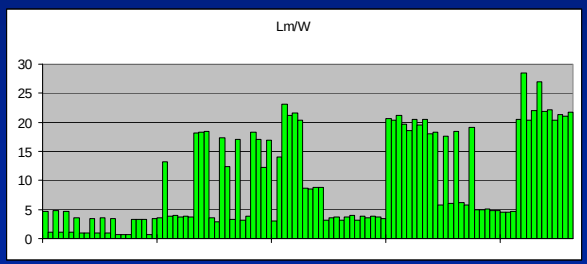
Relative Efficacy

Power per lamp (W)



Efficacy (lm/W)



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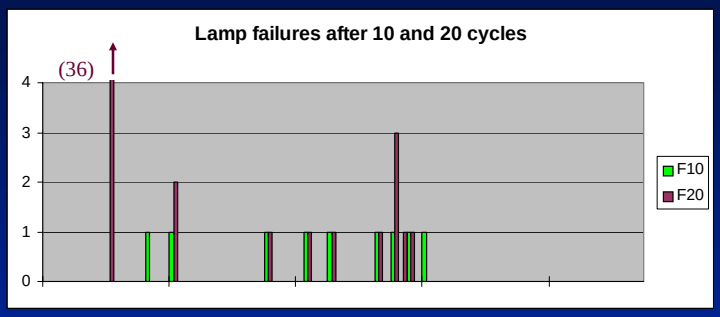
Failure Rates



- One incandescent string: 36/70
- LED strings 3/60, 2/50, 6 singles
- One incandescent and one LED restarted after 20 cycles

POWERTECH

We find a better way

Maintained Light Output

- Incandescent string MLO 95% to 122%
- LED string MLO 37% to 100%
- UV damage to diffusers was obvious in some cases

POWERTECH

We find a better way

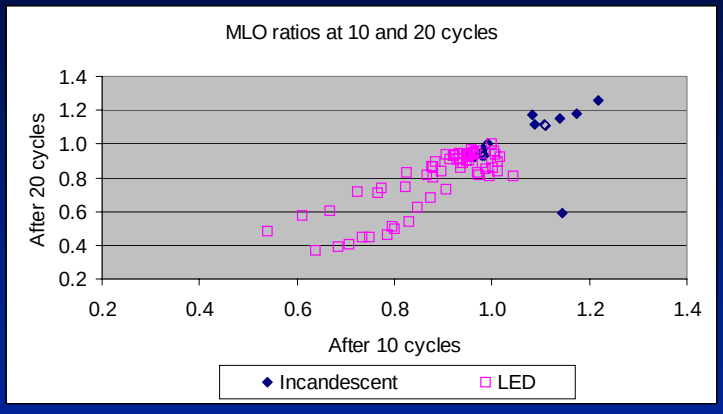
Output Maintenance

- Much of the loss in output may be from UV damage to diffusers (see sample photos above)
- No detailed investigation of causes was performed

POWERTECH

We find a better way

10 and 20 Cycle Maintenance



- About half the samples age uniformly
- Half degrade faster from 10-20 cycles

POWERTECH

We find a better way

Proposed Criteria

- Test duration: 20 cycles (240 hours)
- Allow 3% lamp failures (1 per string) (2/60 failed)
- Maintained light output >70% (14/60 failed)
- Interim MLO >50% (7/60 failed)
- Proposed levels include 5% uncertainty (e.g. we require 75%, but measured value must be >70% to allow for uncertainty)

POWERTECH

We find a better way

For Further Study

- Investigate separate tests for UV resistance and corrosion resistance as a less expensive alternative
- Study the correlation between weathering test and real life
- Investigate the contributions to loss of output:
  - Temperature
  - UV
  - Diode deterioration
  - Diffuser deterioration

Decorative Light Strings

ENERGY STAR®
Decorative Light Strings
version 1.2.1 (dated: 2007.01.03)

Test Procedure and Eligibility Criteria

Michael Scholand
Navigant Consulting, Inc.

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Decorative Light Strings

Preamble

The intent of this initiative is to reduce seasonal peak electricity consumption by encouraging consumers to use quality, energy-efficient decorative light strings.

This document describes the test procedure and eligibility criteria that candidate decorative light strings must undergo to determine eligibility for ENERGY STAR® certification. A light string must meet all of the identified criteria if it is to be labelled as an ENERGY STAR® product by its manufacturer.

This document includes tests that assess both the energy-efficiency and quality of decorative light strings, and is comprised of the following:

- Inspection,
- Seasoning, Power, and Over-Voltage Test,
- Lifetime Test, and
- Accelerated Weathering Test.

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Decorative Light Strings

1) Definitions

A. Decorative Light String - String of lamps that operate on 120 V RMS AC (including strings that operate on power adaptors) used for decorative lighting purposes. The lamps may be replaceable or sealed into the lampholder.

B. 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 colour on the same string.

> ***Note**: The technical working group determined that a definition for a failed string or failed series block was not needed, as long as a failed lamp was defined. Some of the tests contained in this document will pass/fail a string based on failed lamps as a percentage of total lamps on the string.*

C. Input Power - The total, or system, power used by the decorative string during operation, measured in watts, including transformers, adaptors, etc. For decorative light strings that operate with power adaptors that can accommodate more than one string, the input power shall be measured with the rated maximum number of strings attached. Light strings that modulate in their power use should have the energy used over a reasonable period of time measured, averaged, and recorded as the input power.

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Decorative Light Strings

1) Definitions (continued)

D. Maintained Light Output – The light output of a decorative light string after a 1000-hour testing period expressed as a percentage of light output of that same string following a 24-hour seasoning period.

E. Series Block - A number of lamps connected in series, or utilizing a series connection. Additional series blocks can be added to the circuit (or light string) utilizing parallel connections (e.g., a 70-lamp light string could have two 35-lamp series blocks connected in parallel).

F. Watts per Lamp – The input power divided by the number of lamps on the decorative light string (or strings, in the case of power adaptors that can accommodate multiple strings).

G. V RMS AC – The measured root-mean-square value of a voltage with alternating current.

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2) Reference Standards

Decorative Light Strings

2) **Reference Standards:** Relevant standards include, but are not limited to:

ASTM International (ASTM)
ASTM G 154 – 05, *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*

Canadian Standards Association (CSA)
CSA-22.2 No.37-M1989 (R2004) *Christmas Tree and Other Decorative Lighting Outfits*

Commission Internationale de l'Eclairage (CIE)
CIE 84-1989, *The Measurement of Luminous Flux*
CIE 127-1997, *Measurement of LEDs*

Illuminating Engineering Society of North America (IESNA)
IESNA TM-16-05, *IESNA Technical Memorandum on Light Emitting Diode (LED) Sources and Systems*

Underwriters Laboratories Inc. (UL)
UL 588-2004, *Standard for Seasonal and Holiday Decorative Products*

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3) Qualifying Products

Decorative Light Strings

3) **Qualifying Products:** In order to qualify for ENERGY STAR®, a decorative light string must:

- comply with the definition in Section 1.A,
- pass the relevant tests and specifications in Section 4,
- meet the safety requirements in Section 5,
- meet the warranty requirements in Section 6, and
- meet the packaging requirements in Section 7.

This ENERGY STAR® specification applies only to decorative light strings that operate on mains power in North America (120 V AC, 60 Hz) or via a power converter that connects directly to mains power. Section 8 discusses acceptable approaches for testing and qualifying representative samples of a family of decorative light strings.

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4) Tests and Energy-Efficient Specifications for Qualifying Products

Decorative Light Strings

4) **Tests and Energy-Efficiency Specifications for Qualifying Products:** A random sample of three (3) strings of the same model shall be tested, and all must meet or exceed the test criteria in this section. Due to the physical impacts of the tests in sections 4.3 and 4.4, different strings of the same model may be used to assess compliance with the ENERGY STAR® requirements. If a decorative light string is labelled for indoor use only, it does not have to pass the Accelerated Weathering Test in section 4.4 in order to qualify for ENERGY STAR®.

Discussion: Is three (3) the appropriate sample size? Should these be confined to be the same model (same SKU number) or could/should they be three different models from within a product family (three different SKU numbers)? (Product family discussion is in section 8, and later today, on reducing manufacturer testing burden)

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4.1 Inspection

Decorative Light Strings

4.1. Inspection

4.1.1. Count lamps per string and ensure it is consistent with the packaging label. If the number of lamps on the string are different from the number on the packaging, the model fails this test.

4.1.2. Check whether the lamps are sealed or plug-in. If plug-in, the socket / lamp must have a marking or means to ensure correct insertion of replacement lamps

4.1.3. Ensure that the safety certification and labelling of the string meets the requirements of Section 5.

4.1.4. Ensure that the warranty, whether printed on the box or on an insert, meets the requirements of Section 6.

4.1.5. Ensure that the packaging in which the lamps are sold at the retail level meets the requirements of Section 7.

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4.2 Seasoning, Power and Over-Voltage Test

Decorative Light Strings

4.2. Seasoning, Power, and Over-Voltage Test

4.2.1. Operate the decorative light string for a 24 hour (± 1 %) "seasoning" period at 120 V ± 1 V RMS AC.

Discussion: Is twenty-four (24) hours sufficiently long for the 'seasoning' period for decorative light strings?

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4.2 Seasoning, Power and Over-Voltage Test (continued)

Decorative Light Strings

4.2.2. Measure input power and current at 120 V ± 0.5 V RMS AC. For systems with power adaptors that can accommodate multiple light strings, the input power shall be measured with the rated maximum number of strings attached. Calculate the input power consumed per lamp operated. The input power consumption per lamp shall not exceed 0.2 watts.

Note: *Stakeholders commented that a specification of 0.1 W per lamp may exclude energy-efficient strings with 20 or fewer lamps or lamps that have multiple LED die per lamp, including screw in replacement C 7 or C 9 lamps. A suggested alternative specification would be a 20 mA lamp current. Natural Resources Canada (NRCan) recognizes that strings with low lamp counts or multiple LEDs per lamp may not qualify for this initial Decorative Light String ENERGY STAR® specification. NRCan needs to evaluate these products more closely, and may establish separate input power consumption per lamp criteria in a future specification.*

Discussion: Is 0.2 watts the appropriate average input power per lamp, or should it be a different metric (e.g., lamp current)? Test results show a gap between incandescent M5 (0.4 watts) and LED tested (<0.1 watts). What about multi-chip lamps and screw-in replacements?

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4.2 Seasoning, Power and Over-Voltage Test (continued)

ENERGY STAR
Decorative Light Strings

4.2.3. Light strings will be energized at 132 ± 1 V RMS AC for one hour and examined for failure. If any have failed, count the number of lamps that have failed and calculate the failed lamps as a percentage of total lamps on the string, rounding up to the nearest whole number. The number of failed lamps on the string shall be less than X%.

Discussion: What's the appropriate maximum percentage of failed lamps on the string after the over-voltage test?

LRC: 2% (50 lamp string = 1 lamp)

Powertech:

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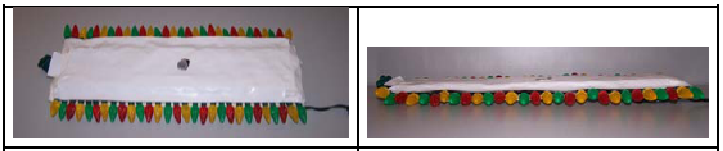
4.3 Lifetime test

4.3. Lifetime Test

A decorative light string shall be tested for maintaining light output as described in the steps below.

rative Strings

4.3.1. Assemble the decorative light string into a testing configuration by bundling the string together so that all lamps are directed outward. The assembly shall be made as compact as possible and taped together with electrical tape to maintain the relative positioning of the lamps throughout this test. Next, for its optical properties, white Teflon® tape shall be wrapped around the bundle to completely cover the electrical tape. Figure 1 shows a sample test setup.



(a) Top view (b) Side view

Figure 1. Sample test setup of a DLS bundled and taped.

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4.3 Lifetime test (continued)

Decorative Light Strings

4.3.2. Measure the light output of the assembly while operating at 120 V ± 0.5 V RMS AC, 25°C ± 5°C and following the guidelines contained in CIE Publication 84-1989, *The Measurement of Luminous Flux*.

4.3.3. Keeping the testing assembly intact (i.e., do not remove the tape, or move any of the lamps), operate the 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 the assembly have been moved relative to each other.

Discussion: Is 1000 hours the appropriate duration of the lifetime operating test? Could it be shorter (i.e., less expensive, shorter test)? Should it be longer (i.e., some manufacturers have very long life claims)? If the typical user operates the lights for 8 hours per day for 30 days per year, this represents just over four years of use.

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4.3 Lifetime test (continued)

Decorative Light Strings

4.3.4. Conduct a second measurement of the light output following the same procedure in step 4.3.2 above. Measure the maintained light output which shall be no less than XX%.

Discussion: What's the appropriate minimum maintained light output expected after the lifetime test duration? Should there be different values for different colours? Should there be one value, even if it eliminates all white-strings from qualifying (with today's technology)? Would a two-tiered value, phased-in over time be more reasonable?

LRC: 70% (may consider 50% for white DLS)

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4.3 Lifetime test (continued)

Decorative Light Strings

4.3.5. Count the number of failed lamps (as per definition 1.B) and calculate the failed lamps (if any) as a percentage of total lamps on the string, rounding the percentage up to the nearest whole number. The percentage of failed lamps on the string shall be less than X%.

Discussion: What's the appropriate maximum percentage of failed lamps on the string after the lifetime test duration?

LRC: 5% (60 lamp string = 3 lamps)

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4.4 Accelerated Weathering Test

Decorative Light Strings

4.4. Accelerated Weathering Test

This test assesses the integrity of lamp mounting sockets and the durability of lamp lenses/diffusers when exposed to simulated weathering conditions using ASTM G154-05. Strings that are labelled for indoor use only shall not be subjected to this test. The steps to follow for this test are outlined below.

4.4.1. Prepare the bundle and measure the light output of the string following steps 4.3.1 and 4.3.2.

4.4.2. Being careful not to disturb the assembly, load it into a testing chamber and subject the string to the exposure conditions contained in Cycle 7 of Table X2.1 of ASTM G154-05. The decorative lamp strings under test shall be operated for the duration of this test at 120 V ± 3 V AC RMS 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 10 consecutive iterations of Cycle 7 under Table X2.1 for a total of 120 hours.

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4.4 Accelerated Weathering Test (continued)

Decorative Light Strings

Discussion: Are 10 cycles the appropriate number of cycles?

Powertech: 20 cycles for 240 hours of testing

1. Intensity of UV light during winter months (when lights tend to be outside) is not as strong as the summer. Do 10 cycles give enough of an indication of quality?
2. Could fewer cycles be relied upon to ensure quality construction / plastics?
3. Are additional cycles needed to run the strings to their limit – i.e., the value of destruction testing?

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4.4 Accelerated Weathering Test (continued)

Decorative Light Strings

4.4.3. The light string assembly shall then be removed from the testing chamber and inserted into an integrating sphere per step 4.3.2 above, and a second light output measurement taken. Calculate the percent maintained light output, rounding up to the nearest whole number, which shall be no less than XX%.

Discussion: What's the appropriate minimum maintained light output expected after the accelerated weathering test? Should there be different values for different colours? Should there be one value, even if it eliminates all white-strings from qualifying (with today's technology)? Would a two-tiered value, phased-in over time be more reasonable?

Powertech: Maintained light output >70% (14/60 failed)
Interim MLO >50% (7/60 failed)

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4.4 Accelerated Weathering Test (continued)

ENERGY STAR
Decorative Light Strings

4.4.4. Count the number of failed lamps (as per definition 1.B) and calculate the failed lamps (if any) as a percentage of total lamps on the string, rounding the percentage up to the nearest whole number. The percentage of failed lamps on the string shall be less than X%.

Discussion: What's the appropriate maximum percentage of failed lamps on the string after the accelerated weathering test?

Powertech: 3% (70 lamp string = 2 lamps)

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5. Product Safety Requirement

ENERGY STAR
Decorative Light Strings

5) **Product Safety Requirement**: ENERGY STAR® qualified decorative light strings must comply with the applicable safety standards and have certification acceptable to the Standards Council of Canada. Strings must be appropriately labelled as either indoor-only or indoor/outdoor. The light string shall be labelled with the safety certification agency, and whether it is rated for indoor-only or indoor/outdoor use.

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6. Warranty

ENERGY STAR
Decorative Light Strings

6) **Warranty:** All ENERGY STAR® qualified decorative light strings shall be offered with a minimum 3-year warranty against all product defects and will include a contact telephone number for the manufacturer..

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7. Packaging

ENERGY STAR
Decorative Light Strings

7) **Packaging**: The packaging containing the product shall specify:

- Product's suitability for use indoor-only or indoor/outdoor use,
- Number of LED lamps on the string,
- Total lighted length of string in appropriate metric and SAE units, and
- Wattage of light string.

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8. Testing Sample

Decorative Light Strings

8) **Testing Sample:** Manufacturers are required to perform tests and certify that all decorative light strings marketed as meeting the ENERGY STAR® requirements comply with the requirements outlined in this document. Natural Resources Canada recognizes, however, that many of the decorative light strings produced are electrically identical, with perhaps different lens shapes (e.g., M5, G3, C9) or with a different colour wiring harness (e.g., green, white). Therefore, Natural Resources Canada is allowing manufacturers to create product "families", and then test a sample of three randomly selected strings of one model in a product family from which it may certify the product "family".

Decorative light string models that qualified for ENERGY STAR® in a previous year may remain qualified without the submission of new test data if the light string model designs have not been modified in any way and the ENERGY STAR® specification has not changed. Manufacturers are held accountable for the certification of any decorative light strings marketed as ENERGY STAR®, including models in a product family that were not tested.

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8. Testing Sample

Decorative Light Strings

[This issue will be discussed by the technical working group and the plenary committee on January 9th once all the test results are available on the samples tested in 4Q 2006. This section of the specification will be expanded to incorporate the decisions made on Jan. 9th]

Discussion: How can manufacturer testing burden be reduced?

1. Please postpone main discussion until detailed afternoon presentation.

Discussion: NRCan approved testing laboratories.

1. Want to insert a new paragraph between the first and second paragraphs of section 8 that reads:

   "In order to qualify their products for ENERGY STAR®, manufacturers will be required to submit three samples of each product (i.e., unique SKU number) or product family (i.e., any of group of SKU numbers classified together as a family) they wish to qualify to a third-party laboratory approved by Natural Resources Canada."

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9. Effective Date & 10. Future Specification Revisions

Decorative Light Strings

9) **Effective Date:** The date that a manufacturer begins to qualify products as ENERGY STAR® will be defined as the *effective date* of the agreement.

10) **Future Specification Revisions:** ENERGY STAR® 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 will be arrived at through stakeholder discussion and consultation.

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Decorative Light Strings

Reducing Manufacturer Testing Burden

Michael Scholand
Navigant Consulting, Inc.

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Reducing Manufacturer Testing Burden

Decorative Light Strings

- Manufacturers are expected to self-certify those products that meet the ENERGY STAR specification
- For DLS, one manufacturer can have literally thousands of different models (SKU numbers) – see next slide
  - Without reducing burden, a huge cost / barrier to participation and testing labs would be overloaded
- Is there some way the testing burden could be reduced through the creation of product families?
  - Precedent set in ENERGY STAR with Imaging Equipment
- Critical Objective: Striking a balance between reducing testing burden while preserving the integrity of the ENERGY STAR label

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Scope of the Problem

Decorative Light Strings

- Possible variables between manufacturer strings can be:
  - Strings with 25, 35 and 50 lamps in series blocks
  - Strings with a range of solid colours, white and multicolour
  - Strings with many different lens styles
  - Strings rectified and non-rectified
  - Strings for indoor only and indoor/outdoor
  - Strings with different AWG wire size
- The matrix consists of potentially thousands of models

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Classification of ENERGY STAR Tests

Decorative Light Strings

- The draft ENERGY STAR DLS specification v.1.2.1 has three basic tests:
  - Electrical – Seasoning, Power and Over-Voltage Test
  - Optical – Lifetime Test
  - Mechanical – Accelerated Weathering Test
- In the next few slides, we look at each of these individually and try to identify characteristics about the various models (SKUs) that may or may not be impacted by the test

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Electrical – Seasoning, Power and Over-Voltage Test

Decorative Light Strings

- DLS will have the same test results if they have the same:
  - Number of lamps per series block
  - Current and voltage drop for each LED in a series block
- Characteristics that will not affect this electrical test:
  - Plugs, sockets, wires and harnesses
  - Lens / Lamp shape
  - Number of series blocks

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Optical – Lifetime Test

Decorative Light Strings

- DLS will have the same test results if they have the same:
  - LED lamp colour
  - Current and voltage drop for each LED in a series block (possibly the same for different colours)
  - Lens / Lamp shape
- Characteristics that will not affect this optical test:
  - Plugs, sockets, wires and harnesses
  - Number of series blocks

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Mechanical – Accelerated Weathering Test

Decorative Light Strings

- DLS will have the same test results if they have the same:
  - Plugs, sockets, wires and harnesses
  - Lens / Lamp shape
- Characteristics that will not affect this mechanical test:
  - Number of series blocks

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Discussion – Ideas to Reduce Burden

Decorative Light Strings

- **Electrical – Seasoning, Power and Over-Voltage Tests**
  - **Grouping around 1) Nitrides; 2) Phosphides, Arsenides, etc.?**
- **Optical – Lifetime Test**
  - **Could the duration be reduced to 500 hours?**
  - **Could qualification of C6/C7 lamps be applied to all shapes?**
- **Mechanical – Accelerated Weathering Test**
  - **Already not required for indoor only strings**
  - **Could the testing be reduced to 5 or 10 cycles?**
  - **Could qualification of C6/C7 lamps be applied to all shapes?**
- **Apply concept of Worst Case for grouping product families…**
  - **E.g., Large lens / lamp cover – e.g., C6/C7**
  - **Others?**

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Discussion

Decorative Light Strings

- Strawman concept for discussion
  - One paper filing for each model / SKU classified as an ENERGY STAR Decorative Light String
  - Filing would detail testing results that were conducted and/or assumed to be equivalent for each of the three main tests
    - One string could belong to multiple product families, some formed around for example the lamp colour and others formed around the number of lamps in a series block.
- Other approaches?

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Decorative Light Strings

Next Steps for ENERGY STAR DLS

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Decorative Light Strings

Next Steps

Once DLS specifications are final, NRCan will:

- Finalize program logistics with US EPA/ENERGY STAR
- Post the specifications in both languages on the web.
- Finalize procedures/qualifying product document (in both languages) for Participants/manufacturers to get their DLS ENERGY STAR qualified.
- Start recruiting ENERGY STAR Participant among DLS manufacturers
- Develop a database listing all ENERGY STAR qualified DLS
- Notify all ENERGY STAR Participants on upcoming specifications on seasonal lights

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Next Steps

Decorative Light Strings

Retailers and end-users surveys

The objectives include:

- Addressing the issues of brightness and pricing for LED decorative lights;
- Determining consumers' attitudes towards and knowledge of LED technology;
- Exploring barriers to their use and access;
- Determining labeling expectations; and
- Understanding the availability of LED lights in the retail sector.

We will conduct 2 surveys:

1. **National telephone** surveys across the country with major **retailers** and small independents to determine lighting availability.
2. **National internet** survey of **end users** of these LED lights from **all** provinces and territories. End-users can be either user or not user of decorative LED lights. A mix of urban and rural residents should be selected.

The **final report** is expected in **March 2007**.

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