

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460



**OFFICE OF
AIR AND RADIATION**

Summary of Rationale for Version 3.0 ENERGY STAR® Exit Sign Specification

I. Introduction and Background

This memorandum provides a summary of the rationale and key changes that appear in the Exit Sign Version 3.0 specification. It contains the following information:

- Summary of the Version 3.0 specification and the key changes from the last specification
- Summary of key milestones in the development of the Version 3.0 specification
- Summary of comments provided by stakeholders
- EPA's rationale for deciding on key elements of the final Version 3.0 specification

II. Summary of Version 3.0 Specification

EPA's goal in revising the Version 2.0 exit sign specification was three-fold: (1) revise existing technical requirements to differentiate the market; (2) reference standardized test procedures; and (3) consider inclusion of non-electrically-powered exit signs.

The following key changes were made to the specification:

- The performance specification for input power demand was reduced from 5 watts or less per face to 5 watts or less per sign.
- All of the performance specifications and definitions for visibility characteristics were removed. This included luminance contrast, average luminance, minimum luminance, and luminance uniformity ratio.
- Exit signs that do not contain integral light sources were permitted to qualify, such as photoluminescent and self-luminous.
- UL 924 was referenced as the authoritative standard to which an exit sign should be tested. Successful performance of exit signs to one of the analytical or observation visibility tests in UL 924 was deemed to be a sufficient measure of the exit sign's effectiveness in emergency situations. A definition for UL 924 was added.
- Language was added to clarify that expanded sign legends may qualify for ENERGY STAR, if and when they may be tested to UL 924.

- A power factor performance requirement was added. Any leading power factor or a lagging power factor not less than 0.7 were both determined to be satisfactory. Definitions for power factor, leading power factor, and lagging power factor were added as well as a test procedure for determining power factor.
- The requirement that partners include a statement of luminance depreciation was removed.

III. Key Milestones of Specification Revision

The final Version 3.0 specification was developed and finalized over the course of two years, which included the following key milestones:

- EPA attended Light Fair International in June of 2002, meeting with approximately 25 exit sign stakeholders over three days.
- Throughout the specification revision process, several individual meetings and discussions with existing and potential ENERGY STAR exit sign partners and other industry stakeholders were held to discuss specifications issues, and concerns.
- Three draft specifications were released on October 7, 2002; January 14, 2003; and November 5, 2003 for stakeholder comment prior to finalization.

Industry meeting notes, draft and final versions of the specification and stakeholder comments were posted to the ENERGY STAR Product Development Web site throughout the development process. Note: all stakeholder comments were posted with the approval of the submitter.

IV. Summary of Stakeholder Input

In addition to feedback provided during the partner and stakeholder discussions, EPA received written comments from a number of existing and potential ENERGY STAR partners and other industry stakeholders. The key comments are summarized below, along with EPA's responses:

INCLUSION OF NON-ELECTRICALLY-POWERED SIGNS

- From the very beginning of the exit sign specification revision process, many potential partners urged EPA to broaden its definition of an ENERGY STAR qualified exit sign to include signs with varying light sources, such as those using photoluminescent or self-luminous technology. Advocates of these types of exit signs continually stressed two main points to support their recommendation: 1) such signs do not consume energy directly, which truly offers the most energy-efficient option; and 2) such signs can be listed to UL 924 and are accepted for installation in buildings by NFPA's Life Safety Code. Manufacturers of photoluminescent exit signs also promoted the longevity of their signs, and self-luminous manufacturers noted the ability of their signs to be used in very specialized locations that did not afford access to exit signs requiring electrical wiring.
- Many other stakeholders were strongly opposed to the inclusion of non-electrically-powered signs in ENERGY STAR. They commented that photoluminescent and self-luminous exit signs could not meet the analytical luminance criteria in the Version 2.0 ENERGY STAR specification, nor the analytical luminance test in UL 924. These stakeholders claimed that the inability of such signs to meet these performance characteristics rendered them less fit to

lead building occupants to an exit in the event of an emergency. They urged EPA to retain a focus on product safety and performance.

EPA Response

EPA seriously considered this central issue over two years. EPA's understanding of this situation was furthered through research and literature review; product demonstrations; and conversations with manufacturers, facility managers, testing facilities, and code making bodies. EPA determined that the ENERGY STAR criteria would focus on a product's energy performance, and would otherwise rely on the expert judgment of fire and building code making bodies and testing laboratories to determine and test the safety and fitness of this product.

DEFINING AN EXIT SIGN

- A few stakeholders specifically voiced their concern over the definition of an exit sign that appeared in the draft specifications as a product that was “internally-illuminated” and contained an “integral light source.” They pointed out that this restrictive definition effectively precluded non-electrically-powered exit signs from qualifying as ENERGY STAR, despite EPA's explanation that they were to be included. Other stakeholders urged EPA to retain these conditions, knowing that photoluminescent and self-luminous exit signs would then be unable to fit the definition in the specification.

EPA Response

EPA's ultimate intent was to permit the ENERGY STAR qualification of non-electrically-powered exit signs. Therefore, an “Exit Sign,” as defined in item A. of the Version 3.0 specification, is no longer required to be internally illuminated nor include an integral light source.

- EPA received a suggestion to modify the final sentence of the exit sign definition so that a narrower range of products were required to remain illuminated by an emergency power source upon failure of the normal power supply. The stakeholder pointed out that this requirement was unnecessary for signs that were charged by ambient light.

EPA Response

EPA concurred that the definition required further modifications. The definition of an exit sign has been amended to clarify that this requirement is only applicable for signs that must remain illuminated by an emergency power source per the restrictions in section 7.10.4 of the Life Safety Code.

- One comment received on the Draft 2 specification objected to the removal of the restriction that ENERGY STAR qualified exit signs may not have a transparent or mirrored background.

EPA Response

Since the final Version 3.0 specification no longer addresses analytical measurements of luminance, such as contrast, it is not appropriate for the prohibition of transparent or mirrored backgrounds to appear within this document.

- One comment from a stakeholder suggested that the definition of an exit sign should include the requirement that the sign comply with the Life Safety Code.

EPA Response

The ENERGY STAR defines the performance criteria manufacturers must meet when designing and producing energy-efficient exit signs. It is EPA's general policy to encourage proper installation and maintenance. In this case, EPA did not feel it was appropriate to address either installation or maintenance in the context of the definition of an exit sign.

INPUT POWER DEMAND

- In response to the lowered input power demand of 3 watts or less per sign that was proposed in the first draft specification, some industry stakeholders indicated that this level was too low to allow proper design for long life, and would virtually eliminate the use of transformers. It was suggested that 5 watts per sign was a more appropriate level.
- Other stakeholders commented that 3 watts is an acceptable limit of energy consumption and well within the range of available technology. These stakeholders supported EPA's original analysis, which concluded that 1) 31% of reported ENERGY STAR qualified exit signs would meet the proposed 3-watt specification; and 2) a 3-watt criterion would encourage manufacturers to employ strategies to lower the energy consumption of their products.

EPA Response

To resolve these conflicting comments, EPA conducted further analysis of the energy savings and pollution prevention of a 3-watt specification versus a 5-watt specification. Research indicated that setting such an aggressive 3-watt criterion may in fact, lead to low program participation, and may not serve the overall goals of ENERGY STAR. Additionally, EPA was convinced that there was a correlation between lowered energy consumption and product reliability.

For these reasons, the Version 3.0 specification required that ENERGY STAR qualified exit signs consume no more than 5 watts per sign. Since the existing Version 2.0 criteria permit 5 watts per face, the Version 3.0 specification will still represent an overall reduction in energy consumption of qualified signs.

- Stakeholders who opposed the inclusion of photoluminescent and self-luminous exit signs also doubted that ambient light could charge the product sufficiently, and urged EPA to consider the energy of a dedicated charging light source as part of the exit sign model's energy consumption.

EPA Response

EPA is satisfied that building owners and facility managers will not commonly incur the costs associated with separate installation and operation of a dedicated charging light source for these types of signs. It is believed that these signs will be installed in locations where ambient conditions provide a sufficient charging source of 5 foot-candles of light. Therefore, EPA has removed the requirement in the draft specifications that photoluminescent exit signs must be evaluated for ENERGY STAR qualification with their integral, charging light source.

POWER FACTOR

- In general, stakeholders supported EPA's efforts to include a power factor criterion in the Version 3.0 specification. Several industry representatives indicated that the proposed limits were appropriate.

- Upon reviewing the first draft specification, one manufacturer suggested that permitting any leading power factor was too lenient, and that even exit signs with a leading power factor should need to meet a specific limit in order to earn the ENERGY STAR.

EPA Response

EPA appreciates that stakeholders support the intent to lessen the effect of exit signs with low power factor ratings on the overall system power factor in buildings. Since the majority of comments on specific power factor limits indicated support for the original proposed value, the final Version 3.0 specification retained the requirement that a qualified exit sign may not have a lagging power factor less than 0.7, and that any leading power factor was acceptable.

- A few comments received from industry indicated that the language conveying the power factor requirement was unclear and needed modification.

EPA Response

EPA suggested revised language in a subsequent draft and did not receive further comment. It is therefore believed that the clarified language addressed the comments received.

VISIBILITY CHARACTERISTICS

- Many stakeholders urged EPA to retain the visibility specifications and measurement protocol in the Version 2.0 specification, suggesting that this method offered the greatest consistency in measuring the fitness of exit signs. Some manufacturers of electrically-powered signs questioned the safety and effectiveness of signs that could not meet a specific, measurable luminance standard. They cautioned EPA not to consider UL 924 as a nationally accepted standard, as the current edition had not earned ANSI accreditation.
- Conversely, manufacturers of self-luminous and photoluminescent exit signs attested that successful performance of signs to one of the observation visibility tests in UL 924 was a sufficient measure of the exit sign's effectiveness in emergency situations. They urged EPA to defer to national codes and standards on this matter, and not to mandate specific luminance levels for ENERGY STAR qualified exit signs.

EPA Response

EPA shared industry concern about the effectiveness of qualified exit signs, and devoted considerable time and effort to resolving the singular issue of whether or not to include analytical visibility criteria in the final Version 3.0 specification. EPA continued to speak with building managers, fire officials, and representatives of NFPA, and failed to obtain sufficient support to develop explicit criteria or test standards that specify the safety performance of an exit sign beyond the detailed test procedure outlined in UL 924. EPA decided to continue to reference UL 924 as the method to determine that a qualified exit sign meets minimum safety standards. EPA has deferred to the experts at NFPA and accepted their decision to permit installation and use of signs listed to UL 924.

SIGN LEGEND

- Stakeholders who chose to comment on EPA's broadened list of acceptable sign legends in the draft Version 3.0 specifications indicated support for this decision.

EPA Response

EPA hoped that a robust list of acceptable sign legends would give the ENERGY STAR specification an international presence, and would permit the shipment of ENERGY STAR qualified products in markets other than the US.

TEST PROCEDURE

- One comment received from industry suggested the inclusion of criteria to specify ambient temperature conditions in the Test Conditions.

EPA Response

EPA concurred that this would add clarity and included this additional guidance in section B. The second and third paragraphs in this section were amended to include an ambient testing and recording temperature of 25 deg. C +/- 10 deg. C.

REFERENCING SAFETY CODES AND CODE MAKING BODIES

- One stakeholder commented that EPA should reference the test method or building code applicable to the ENERGY STAR specifications, rather than referencing the administrative entity behind the document. In addition, EPA was informed of the correct terminology when describing a product that is listed to UL 924.

EPA Response

EPA agreed that there is value in referencing the method or code directly and accommodated this recommendation throughout the Version 3.0 specification. The definitions section was changed to refer to NFPA 101 - the Life Safety Code, rather than to NFPA as an entity. Similarly, the definition has been changed to reference the UL 924 standard, rather than UL as an entity.

WARRANTY

- EPA received only one comment in opposition to the requirement of a five-year manufacturer warranty.

EPA Response

EPA retained the requirement that qualified exit signs have a five year manufacturer warranty. Discussions with industry indicate that a five year warranty is more than sufficient to ensure a reliable, high-quality exit sign.

EFFECTIVE DATE

- Stakeholders recommendations to EPA about effective date ranged from immediate to one year from the time of publication of the Version 3.0 specification. In general, manufacturers of electrically-powered signs wanted a longer timeframe to allow sufficient lead time to re-qualify existing products or qualify new products. Manufacturers of non-electrically-powered signs were previously precluded from joining ENERGY STAR and were eager to begin to qualify products.

EPA Response

The final draft specification was distributed on November 5, 2003 and contained an effective date of August 1, 2004. Explanatory text boxes were removed and the final Version 3.0

specification was distributed on April 1, 2004. Since the August 1, 2004 effective date was made known to stakeholders nine months in advance, EPA believes stakeholders' requests for sufficient lead time were met.

V. EPA Rationale for Specification

EPA uses a consistent set of criteria in the development and revision of specifications for ENERGY STAR qualified products. These criteria guide EPA in its decision making and help EPA ensure that the ENERGY STAR will continue to be a trustworthy symbol for consumers to rely upon as they purchase products for the home or business and so that their purchases will deliver substantial environmental protection. These criteria include:

- Significant energy savings and environmental protection potential on a national basis;
- Product performance is maintained or enhanced;
- Qualified products will be cost-effective to the consumer;
- Efficiency can be achieved with several technology options, at least one of which is non-proprietary (i.e., not exclusive to proprietary technology);
- Product differentiation and testing are feasible; and
- Labeling would be effective and recognizable in the market.

Below EPA addresses the Version 3.0 exit sign specification relative to each of these criteria.

- *Expected Energy Savings and Environmental Benefits.* EPA believes that this amendment ensures the energy savings and quality that consumers have come to expect from ENERGY STAR qualified exit signs. Furthermore, the inclusion of non-electrically-powered exit signs provides the opportunity for additional nationwide energy savings. The following table shows an example of the energy savings associated with replacing one incandescent exit sign with a comparable ENERGY STAR qualified LED or photoluminescent exit sign.

Table 1 - LED and Photoluminescent Exit Sign Energy Savings Potential

	Conventional Incandescent Exit Sign	ENERGY STAR Qualified LED Exit Sign	ENERGY STAR Qualified Photoluminescent Exit Sign
Total Sign Wattage ¹	30 watts	.61 watts	0 watts
Assumed Usage/yr ²	8,760 hours	8,760 hours	8,760 hours
Total kWh/yr	262.8 kWh/yr	5.34 kWh/yr	0 kWh/yr
Annual energy savings over conventional (kWh/yr)	NA	257.46 kWh/yr	262.8 kWh/yr

¹ Wattages based on product specification sheets.

² Assumes exit signs are used 24 hours/day, 365 days/year.

- *Product Performance is Maintained or Enhanced.* EPA believes that four key elements of the Version 3.0 specification will ensure that product performance is maintained or enhanced:

- The Version 3.0 specification follows the guidance in NFPA’s Life Safety Code by requiring qualified exit signs to be listed to UL 924. Rather than setting the performance and safety levels for these important life safety products, EPA has relied on the experience of fire and safety officials.
 - A realistic input power demand of 5 watts or less per sign allows partners to continue to design their products for quality and longevity.
 - A criterion to prevent the qualification of signs with low lagging power factors contributes to overall power factor correction for commercial facilities.
 - A five-year manufacturer warranty assures against defects in materials and manufacturing.
- *Cost-effectiveness.* Purchasers will surely realize savings over the life of a qualified exit sign and many ENERGY STAR qualified signs do not have a higher purchase price when compared to conventional models. Paybacks will vary depending on electricity rates, wattage replaced, and cost of the replacement exit sign. The following chart provides two simple payback scenarios, based on Table 1 above.

Table 2 - LED and Photoluminescent Exit Sign Cost Savings Potential

	Conventional Incandescent Exit Sign	ENERGY STAR Qualified LED Exit Sign	ENERGY STAR Qualified Photoluminescent Exit Sign
Initial Price ¹	\$130.40	\$66.75	\$175.00
Price Differential from Conventional	NA	-\$63.65	\$44.60
Total Sign Wattage ²	30 watts	.61 watts	0 watts
Assumed Usage/yr ³	8,760 hours	8,760 hours	8,760 hours
Total kWh/yr	262.8 kWh/yr	5.34 kWh/yr	0 kWh/yr
Lamp Replacements/yr ⁴	2.92	.04	0
Lamp Cost ¹	\$2.99	\$106.56	\$0
Annual Operating Costs ⁵ (Electricity + Lamp Replacements)	\$27.39	\$4.64	\$0
Annual Savings from Conventional	NA	\$22.75	\$27.39
Simple Payback (Price Differential/Annual Savings)	NA	Instant	1.6 years

¹ Incandescent price and lamp costs as found in the current Grainger distributor’s catalog; Photoluminescent prices per the manufacturer.

² Wattages based on product specification sheets.

³ Assumes exit signs are used 24 hours/day, 365 days/year.

⁴ Lamp replacement assumes 3,000 hours for an incandescent and 219,000 for an LED panel.

⁵ Assumes electricity rate of \$.071/kWh.

EPA believes that the changes to the Version 3.0 specification are easily attainable without increased cost to the manufacturer. As the testing procedures have been greatly reduced, the process for qualifying a product has become even less burdensome than under the previous specification.

- *Several Technology Options.* The Version 3.0 specification differentiates products based on performance and not technology. In fact, modifications to the definitions and performance specifications permit the qualification of exit signs with two new light sources. Exit signs employing these light sources do not consume direct energy, and are expected to increase as the exit sign of choice in many applications. EPA continues to believe that there are several technology options, all of which are non-proprietary, that exist for improving the energy performance of exit signs.

- *Product Differentiation and Testing Procedure.* As was the case when EPA initially established ENERGY STAR efficiency criteria for exit signs, product performance varies within a sufficient range to allow for meaningful differentiation to the consumer. The revised input power demand and new power factor criteria further differentiate the market and convey meaning to the ENERGY STAR brand. The inclusion of photoluminescent and self-luminous exit signs provide even more choices for purchasers. The testing and documentation procedure developed for verifying exit sign performance continues to be effective and feasible.

- *Labeling.* EPA believes the ENERGY STAR mark serves an important role in the marketplace due to the absence of any other objective basis for buyers to identify and manufacturers to promote highly efficient exit signs. Examples of the impact made to date by ENERGY STAR qualified exit signs are provided below:
 - There are currently more than 60 partners offering more than 540 exit sign models, 83 of which are photoluminescent or self-luminous.
 - ENERGY STAR qualified exit signs are sold in many different distribution channels, including wholesalers, electrical and lighting distributors, safety and industrial equipment distributors, showrooms, mass retailers, and e-tailers, which provides a number of opportunities for the ENERGY STAR mark to impact purchasing decisions in the marketplace.
 - EPA continues to receive interest in ENERGY STAR exit signs from manufacturers who want to join as partners.

VI. Noteworthy Aspects of the Specification

- Inclusion of Non-Electrically-Powered Exit Signs: The decision to include non-electrically-powered exit signs in the Version 3.0 ENERGY STAR specification was a momentous one. When installed properly and used in accordance with their charging light source specifications, NFPA has approved use of these signs in buildings across the country. Replacing a conventional incandescent exit sign with one that consumes no energy can have a significant impact on a facility's bottom line.

- Requirement of Listing to UL 924: EPA took an important step in deciding that a listing in accordance with UL 924 was an adequate indication of an exit sign's fitness. EPA relied on fire and safety experts to evaluate the necessary safety and performance characteristics for this life safety equipment, and did not attempt to modify testing procedures that are practiced in industry.

- Expansion of Sign Legend: In the likely event that UL permits the testing of various exit sign legends, these signs will be able to qualify for ENERGY STAR immediately. Egress markers such as the international "running man" or signs that direct occupants to exits in French or Spanish can earn the ENERGY STAR in the same way as an English language sign. This gives the ENERGY STAR specification international appeal, and prevents the need for frequent revisions.

- Inclusion of a Power Factor Requirement: Including a criterion for lagging power factor shows that EPA is concerned with how efficiently a product uses power, in addition to the amount of energy it takes to operate. The lagging power factor specification for ENERGY STAR qualified exit signs will support offsetting a building's overall lagging power factor.