

**NATIONAL
LIGHTING
PRODUCT
INFORMATION
PROGRAM**

Specifier Reports

Exit Signs

Energy-efficient, internally illuminated exit signs and retrofit kits

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Introduction

The lighting that is required for emergency egress from buildings has two components: the lighting of the escape routes to the exits, and the marking of those routes and the exits themselves with exit signs. This issue of *Specifier Reports* is concerned only with the latter.

Many existing exit signs use incandescent lamps. Although the electrical power demand of each sign is small, approximately 24 to 40 watts, each sign typically is operated 24 hours a day, 365 days a year; so, each sign consumes 210 to 350 kilowatt-hours of electricity per year.

By using light source technologies that are more energy efficient than conventional incandescent lamps, the power demand and energy consumption of exit signs can be reduced markedly. Many new exit signs are available that use alternative light source technologies. Retrofit kits are also available for converting existing incandescent-type signs to more energy-efficient light sources. This issue of *Specifier Reports* covers both kinds of products: energy-efficient, internally illuminated exit signs (herein referred to as "exit signs") and energy-efficient retrofit kits (herein referred to as "retrofit kits") for existing internally illuminated exit signs. This report includes manufacturers' product information for 57 products and the results of the National Lighting Product Information Program's (NLPPIP) evaluations of the products' photometric properties, power characteristics, readability, and visibility in smoke.



The production of this report involved important contributions from many staff members at the Lighting Research Center (LRC). C. DeCusatis carried out the photometric measurements; K. Sasiadek conducted the power measurements; L. Canon, N. Babapulle, and R. Strobel measured the readability of the exit signs; and A. Bierman, C. DeCusatis, and J. Raffucci collaborated on the Smoke-Sim software. Other LRC project team members who contributed include J. Ceterski, J. Fan, E. Gillmeister, M. Guilfoyle, D. Larkin, and R. Wolsey.

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Light Source Technologies

Five different light source technologies commonly are used in internally illuminated exit signs. They are: incandescent lamps, fluorescent lamps, light-emitting diodes, electroluminescent panels, and radioluminescent tubes (see Figure 1).

Incandescent lamps. Incandescent lamps produce light by electrically heating a filament. The color of the light that is emitted depends on the temperature of the filament, but it is usually white. The incandescent lamps that are used in exit signs are designed for significantly longer life than common incandescent lamps.

Fluorescent lamps. Fluorescent lamps produce light when an electric discharge occurs through a low-pressure mercury atmosphere. The discharge generates light and ultraviolet radiation; the ultraviolet radiation is absorbed by the phosphor coating

on the walls of the lamp and reradiated as light. The color of the light that is produced is determined largely by the characteristics of the phosphor, but it is usually white. Exit signs use either compact, short linear, or circline fluorescent lamps.

Light-emitting diodes. Light-emitting diodes (LEDs) produce light when low-voltage direct current crosses a suitable semiconductor junction. The color of the light that is produced is determined by the composition of the semiconductor junction. Exit signs typically contain red or green LEDs. Some exit signs use a diffuser to spread the light emitted by the LEDs.

Electroluminescent panels. An electroluminescent panel contains a thin layer of a phosphor-impregnated material that is sandwiched between two layers of conducting material, one of which is clear. The phosphor layer produces light when voltage is applied between the two conductive layers. The luminance depends on the voltage and the frequency of the voltage that is applied. The color of the light is determined by the phosphor that is used. In exit signs, the most common color of light generated is green, but sometimes it is filtered to produce red.

Figure 1. Light Source Technologies Used in Internally Illuminated Exit Signs

Clockwise, from upper left: fluorescent, incandescent, LED, radioluminescent, electroluminescent.



Figure 2a. Exit Sign Formats Tested by NLPIP

Signs displayed in a lit room. From left to right: stencil, panel, matrix.



Figure 2b. Exit Sign Formats Tested by NLPIP

Signs displayed in a darkened room. From left to right: stencil, panel, matrix.

Radioluminescent tubes. Radioluminescent tubes produce light from a phosphor that is irradiated by beta particles emitted by tritium gas. The color of the light is determined by the phosphor that is used; in exit signs the light is usually green. Manufacturers of radioluminescent tubes are licensed by the Nuclear Regulatory Commission in the United States and by the Atomic Energy Control Board in Canada.

Exit signs are also manufactured using photoluminescent materials similar to those used in common, glow-in-the-dark, consumer products. Photoluminescent materials absorb light and reradiate it over time. Photoluminescent signs are not accepted as exit signs by the National Fire Protection Association (NFPA) and thus are not included in this issue of *Specifier Reports*. However, these signs can be used to supplement emergency egress systems that use one or more of the above technologies.

Exit Sign Formats

There are four typical formats for internally illuminated exit signs: edge-lit, matrix, panel, and stencil. The last three are shown in Figures 2a and 2b.

Edge-lit. In an edge-lit sign, light from an enclosed source is directed through a transparent plate that has the letters etched in or attached to its surface. The sign face appears luminous as light leaves the plate. Incandescent, fluorescent, and LED light sources commonly are used for these signs. NLRIP did not study edge-lit signs for this report because none of the manufacturers submitted them as an example of an energy-efficient exit sign.

Matrix. In a matrix exit sign, the letters are formed by points of light. The background (sign face) is opaque. Exposed LEDs are the light source used most commonly in this format.

Panel. In a panel (or open-faced) exit sign, both the letters and the background are luminous. These signs usually use incandescent or compact fluorescent lamps.

Stencil. In a stencil exit sign, the letters are luminous and the background is opaque. Any of the light sources described previously can be used in the stencil format.

Power Supply

The NFPA National Electric Code requires that exit signs operate both with and without utility-supplied power (NFPA 1992). When the utility-supplied power fails, several alternative power supplies are permitted. The three most common are

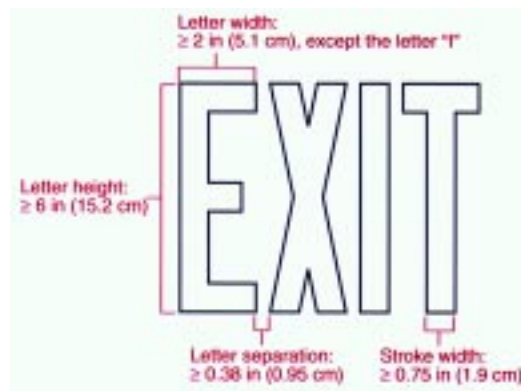
- A generator that supplies power at the same voltage and frequency as the utility;
- A central rechargeable battery unit with or without an inverter that converts direct current into alternating current; and
- An individual rechargeable battery attached to each sign.

NLRIP did not test generators and central battery supply units. The only alternative power supply that this issue of *Specifier Reports* covers is the rechargeable battery attached directly to the exit sign.

Most exit signs use only one light source technology, but some use two, one for use with utility-supplied power and the other, usually incandescent, with the rechargeable battery.

Visibility Standards

Readily visible exit signs are a legal requirement (see sidebar, right). In the United States, what constitutes readily visible exit signs and how they should be applied, are detailed in the NFPA Life Safety Code (NFPA 1991) and in various model building codes, such as the Uniform Building Code published by the International Conference of Building Officials (ICBO 1991). In Canada, the National Building Code is used (National Research Council of Canada 1990). In the NFPA Life Safety Code, exit signs must have plainly legible letters with the following proportionate dimensions:



United States Federal Regulations

United States Occupational Safety and Health Standards (USOSHA 1993) state: "Access to exits shall be marked by readily visible signs in all cases where the exit or the way to reach it is not immediately visible to the occupants . . . Every required sign designating an exit or way of exit access shall be so located and of such size, color, and design as to be readily visible. No decorations, furnishings, or equipment which impair visibility of an exit sign shall be permitted, nor shall there be any brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision to the required exit sign of such a character as to so detract attention from the exit sign that it may not be noticed."

Luminance, Luminance Contrast, and Luminance Uniformity

The luminance of a surface is the luminous intensity in a given direction per unit area of that surface as viewed from that direction. It is the photometric equivalent of perceived brightness. Luminance is measured in candelas per square meter (cd/m²). An older unit for luminance, which is still sometimes used, is footlamberts (1 fL = 3.43 cd/m²). NFPA Life Safety Code requirements for exit signs are given in footlamberts. NLPPI used cd/m² for luminance measurements.

Examples of commonly occurring luminances in an office lit to 50 footcandles (540 lux)

| | Footlamberts | cd/m ² |
|-------------|--------------|-------------------|
| White paper | 40 | 137 |
| Gray carpet | 5 | 17 |

Luminance contrast quantifies the relative brightness of an object against its background. For an exit sign, the relevant contrast is between the luminance of the letters and the luminance of the rest of the sign face (background). The definition of luminance contrast used in Underwriters Laboratories Standard UL 924 and in this issue of *Specifier Reports* is

$$C = \frac{(L_g - L_l)}{L_g}$$

where C = luminance contrast

L_g = greater luminance

L_l = lesser luminance

Luminance contrast calculated with this formula can vary from zero to one. The closer the luminance contrast is to one, the more visible the letters are against the rest of the sign face.

Luminance uniformity can be defined as the range of luminances of a surface. For exit signs, luminance uniformity of both letters and background is important for the visibility of the sign. For exit signs luminance uniformity is of little concern when the viewer is close to the sign but as the distance of the viewer from the sign increases, uniformity becomes more important for the readability of the sign.

Acronyms for Organizations, Standards, and Codes

Product literature for exit signs may contain the following acronyms of organizations, standards, and codes (country of origin in parentheses).

| | |
|-------|--|
| AECB | Atomic Energy Control Board (Canada) |
| BOCA | Building Officials and Code Administrators International (United States) |
| CSA | Canadian Standards Association (Canada) |
| ICBO | International Conference of Building Officials (United States) |
| MSHA | Mining Safety and Health Administration (United States) |
| NBC | National Building Code (Canada) |
| NEC | National Electrical Code (United States) |
| NFPA | National Fire Protection Association (United States) |
| NRC | Nuclear Regulatory Commission (United States) |
| OSHA | Occupational Safety and Health Administration (United States) |
| SBCCI | Southern Building Code Conference International (United States) |
| UL | Underwriters Laboratories (United States) |

The NFPA Life Safety Code also requires that every sign be illuminated by a reliable source. Externally illuminated signs (see p. 8, “Alternatives” section) must have a surface illuminance of 5 footcandles (54 lux) and a luminance contrast of not less than 0.50 (see sidebar, left). Internally illuminated signs must have an equivalent or greater visibility than that of an externally illuminated sign lit to 5 footcandles (54 lux). Exceptions are granted for electroluminescent and radioluminescent exit signs that have letters of uniform luminance. The letters of these types of signs must have a minimum luminance of 0.06 footlamberts (0.21 candelas per square meter). Exit signs should be placed so that no point along the access route to an exit is more than 100 feet (30.5 meters) from the nearest visible sign.

Exit signs that mark escape routes may have one or two directional indicators that point to the right, left, or both right and left. The NFPA Life Safety Code specifies the shape and location of these directional indicators and requires that they be identifiable as directional indicators at 100 feet (30.5 meters).

Underwriters Laboratories Standard UL 924 (1991) gives more detailed specifications of the construction, visibility, and performance of exit signs. Exit signs with a UL *listing* have met the criteria in this standard. For retrofit kits, a UL listing implies that when the kit is used in a UL-listed exit sign that contained incandescent lamps, and when it is installed according to the product instructions, it should not adversely affect the operation of the sign. The UL listing of a retrofit kit does not apply to its use in an edge-lit sign nor to its use in exit signs that are powered by a battery in an emergency. A UL-*classified* retrofit kit meets UL 924 when the retrofit kit is installed in a specific exit sign according to the product instructions. Installing a retrofit kit that is not UL-listed, or not UL-classified for the specific sign, invalidates the UL listing of the sign in which the kit is being installed. For both UL-listed and UL-classified retrofit kits, users should follow precisely the instructions that are supplied by the manufacturer.

Other independent testing laboratories sometimes are cited by manufacturers as having “approved” an exit sign. In this case, the specifier should be sure that the exit sign meets all the relevant requirements of UL 924.

Jurisdictions (states, cities, counties, or towns) adopt or modify model codes or develop their own codes. Some jurisdictions have specific requirements for exit signs that change, clarify, modify, extend, or ignore the requirements of the various model building codes. Exit signs that are used in a specific jurisdiction must meet that jurisdiction’s requirements. Thus, specifiers should check with the officials of the relevant jurisdiction before selecting exit signs or retrofit kits.



The federal regulations, the safety and building codes, and UL 924 specify the required construction and operating characteristics of exit signs. Specifiers should also consider other characteristics.

Materials and Construction

Exit signs are available in a wide range of materials. Plastic, fiberglass, aluminum, or steel are used and are either pressed, cast, or extruded. The materials that are used may limit the types of retrofit kits that can be installed in a sign. For example, some retrofit kits cannot be used in some signs constructed of plastic because of possible thermal damage. Materials differ in weight, fire resistance, and ability to withstand physical abuse. Some exit signs are designed to be impact or tamper resistant. Others can be secured with a wire enclosure. UL 924 specifies additional features for exit signs that are to be used in damp or wet locations.

Some exit signs are positioned to be visible from opposite directions. Thus, exit signs are made in both single-faced and two-faced forms. For this report, NLRIP tested only single-faced signs.

Mounting Positions

Exit signs may be recessed into a wall, surface-mounted on a wall or ceiling, or suspended on a pendant. If surface-mounted on a wall, the sign may be placed flat on the wall or perpendicular to it. Manufacturers offer several mounting options.

Color

Many color combinations are available for exit signs. The most common combinations are red or green letters on a white, black, or aluminum background, or white letters on a red or green background. Some jurisdictions limit the choice of color combinations.

NLRIP suggests that specifiers use the same color combination throughout a building to help occupants identify each sign as an exit sign. To avoid confusion, that same

color combination should not be used to identify anything other than exits in the building.

Background Finish

The choice of background finish is more than just a matter of preference or style; it is an important determinant of the visibility of the exit sign (see sidebar, “Luminance, Luminance Contrast, and Luminance Uniformity,” on p. 4). For stencil and matrix signs, the luminance of the background is determined by the reflectance of the background surface and by the illuminance provided by the ambient lighting on the face of the sign. Therefore, the luminance contrast of stencil and matrix signs varies with the level of ambient lighting. Variations are smallest for dark backgrounds and largest for white backgrounds. Ambient lighting may also affect the luminance contrast of panel signs but to a lesser degree.

Changes Under Emergency Conditions

Some exit signs are designed so that the luminance of the letters increases when the sign is operated on an alternative power supply. This feature is particularly useful for electroluminescent exit signs because most have a low letter luminance when operated on utility-supplied power.

In an emergency, people must quickly identify their way out of a building. To attract attention, some exit signs flash slowly and/or emit an audible signal whenever the utility-supplied power fails and/or a fire alarm is activated. Some codes and jurisdictions restrict or prohibit the use of flashing or audible signals because it is believed that they may confuse occupants.

Battery Inspection and Maintenance

All exit signs should be inspected at the intervals that are specified by the relevant local jurisdiction. To facilitate this inspection, UL-listed exit signs that are designed to operate from a battery when the utility-supplied power fails must be equipped with a readily accessible test switch and a power supply status display. As noted in Table 1, some signs have sophisticated circuitry that limits battery damage following a battery discharge or a utility brownout.



To select an exit sign, the specifier must conform to the requirements of the local jurisdiction. The specifier also must balance cost with the visibility, active power, power quality, reliability, and appearance of the sign.

Installed Cost and Operating Cost

The installed costs of replacement exit signs and retrofit kits vary widely depending on the light source technology used, the quality of the construction, the options selected, and the number of signs purchased.

Installed cost includes both the purchase price of the sign and the cost of installing it. The cost of installing a replacement exit sign is determined mainly by its mounting position and by the amount of wiring or rewiring that must be done. The cost of installing a retrofit kit depends on the ease of access to the exit sign, the difficulty of inserting the kit into the existing sign, and whether or not the kit requires new wiring. Operating costs include energy, lamp replacement, and maintenance costs. The tradeoff between installed cost and operating cost is particularly important when comparing energy-efficient exit signs with less efficient alternatives. Energy-efficient products typically have a higher installed cost, but the difference in installed cost can be recovered over time because they require less energy to operate.

Visibility

The visibility of an exit sign usually is measured by one of the methods described in UL

924. An exit sign that is UL-listed meets the UL visibility requirements, as does an incandescent-type UL-listed exit sign fitted with a UL-listed retrofit kit according to the kit manufacturer's instructions. Specifiers should note that an incandescent-type exit sign fitted with a UL-classified retrofit kit may not meet the visibility requirements of UL 924, unless the sign in which it is installed is one for which the UL-classified status was approved and the kit manufacturer's instructions are followed precisely. NLPPI developed a readability test for exit signs that is described in the section starting on p. 11; the results are given in Tables 3 and 4.

Signs that meet the UL 924 visibility standard are tested in a clear atmosphere. Surprisingly, no visibility standard exists for a smoke-filled atmosphere, an emergency situation for which the visibility of exit signs is critically important. Studies show that the luminance of the sign is the major determining factor for visibility through smoke: the higher the luminance of the sign, the better the visibility of the sign in smoke (Rea *et al.* 1985; Collins *et al.* 1990; Ouellette 1993). NLPPI evaluated the visibility of exit signs in smoke using a smoke simulation computer program described in the section starting on p. 13; the results are given in Tables 5 and 6. None of the exit signs that NLPPI tested were visible at 100 feet (30.5 meters) through gray smoke.

Active Power and Power Quality

Active power is measured in watts; apparent power is the product of the root-mean-square (rms) voltage and current and is measured in volt-amperes. The apparent power and the active power are related by the power factor as follows:

$$\text{Power Factor} = \frac{\text{Active Power (watts)}}{\text{Apparent Power (rms volt-amperes)}}$$

For an electrical device in which the voltage and current are in phase and have identical waveforms, the power factor is unity. If the voltage and current waveforms are not in phase and/or their waveforms are not identical, the power factor will be less than one.

The active power of an exit sign, combined with its hours of use, determines its billed energy consumption and hence affects its operating cost. Apparent power can influence operating costs for customers who also are billed for peak demand, which often is measured in kilovolt-amperes (kVA).

Root-Mean-Square (rms)

The term *root-mean-square* refers to the procedure that is used to calculate the average value of a periodic waveform, such as voltage or current. Mathematically, it is the square root of the mean of the squared values, volts or amps, taken over one complete cycle. Thus, the term *rms voltage* expresses the average voltage.

Mounting Height of Exit Signs

During a fire, smoke does not fill a building uniformly. Often, the smoke is densest near the ceiling and least dense close to the floor. Emergency instructions encourage people to crouch or crawl along the floor. Thus, it may seem odd that exit signs are usually mounted above head height rather than close to the floor. However, mounting the sign above head height has two advantages. First, the sign does not project into the escape route, even if it is mounted perpendicular to the wall. This limits potential harm to occupants from bumping into the sign and limits damage to the sign from accidental or intentional contact. Second, people's view of the sign is not likely to be obstructed by furnishings or other people. The NFPA Life Safety Code requires that, in some applications, an additional exit sign be positioned close to the floor. Some exit signs provide both high- and low-level mounting for two electrically connected signs; one sign (the master) contains all the power and control circuitry to drive the other (the slave).

For safety reasons, specifiers also should consider the influence of the power factor on the current-carrying capacity of the emergency power supply and its associated conductors. For a given active power, an exit sign with a low power factor will draw more current than an exit sign with a high power factor. When replacing an existing exit sign, specifiers should ensure that the replacement exit sign or retrofit kit does not cause the current to exceed the current-carrying capacity of the existing emergency power supply and its conductors. Excess current can cause wires to overheat, which is a fire hazard, or it can affect circuit breakers or controls.

Although the impact of a low power factor device on the circuit current is important, the influence of an exit sign's power factor on the building electricity supply rarely needs to be considered. The active power of exit signs during normal power supply conditions is a small percentage of the total power demand in a building, so even a very low power factor has little influence on the overall power quality. Thus, exit signs that have low power factor will seldom result in utility penalty changes for the overall building power factor. However, if the exit signs are operating on power from a generator or a central battery/inverter system, the exit signs can form a significant part of the load on the building's emergency electrical system. The electrical distortion inherent in a low power factor could affect the control of that system.

NLPIP measured the active power, apparent power, and power factor of exit signs and retrofit kits. These measurements are described on p. 11 and results appear in Tables 3 and 4.

Reliability and Maintenance

The reliability of an exit sign depends on the light source technology and the maintenance procedures for the sign. Generally, fluorescent lamps last one to two years, whereas electroluminescent, radioluminescent, and light-emitting diodes last five years or more. Light-emitting diodes have the longest life. The rated life of incandescent lamps used in exit signs varies from two to twenty years. For light source technologies that have lives of a decade or more, the power circuitry may fail before the light source.

Lamp failure is a common problem for exit signs. To maintain the integrity of the emer-

gency egress system in the event of lamp failure, some jurisdictions require two lamps in each sign, operating simultaneously. Some retrofit kit manufacturers address the lamp failure concern by including two lamps that operate successively, so that if one lamp fails, the other will operate.

Proper maintenance of exit signs requires inspecting them at regular intervals, replacing failed lamps, and correcting any other faults that are discovered. The NFPA Life Safety Code requires monthly inspections by the building's owner or a person designated to be responsible. If the sign has a battery power supply for use in emergencies, the monthly inspection should include a 90-second battery operation check. Once a year, the NFPA Life Safety Code requires that each exit sign equipped with a battery be operated on the battery for 90 minutes. The results of all inspections should be recorded so that they can be reviewed by the appropriate authority.

Only radioluminescent exit signs require no maintenance other than cleaning. However, the entire sign must be replaced by a certain date because the luminance decreases over time. These signs contain very small quantities of radioactive material that emit beta rays, so at the time of purchase the manufacturer should be consulted about appropriate methods of handling and disposal. In the United States, disposal of radioluminescent signs is limited to transfer to organizations that are licensed by the Nuclear Regulatory Commission.

Warranties

Most manufacturers of exit signs and retrofit kits provide warranties for their products that apply to specific signs. This means that placing a retrofit kit into an existing exit sign may invalidate the warranty of the sign in which it is installed. Manufacturers should be consulted if this is a concern.

Appearance

Architects and designers often prefer exit signs that have a neat and unobtrusive appearance and an external finish that coordinates with other building finishes. Specifiers should therefore preview exit signs before installation to evaluate their appearance. This is also important before installing retrofit kits because the outward appearance of the sign may change after the retrofit kit is installed.

Using Retrofit Kits

- Prior to placing a large order, install a sample retrofit kit to establish the ease of installation and to make sure that the sign will be acceptable to the officials of the relevant jurisdiction.
- Retrofit kits installed in exit signs with a high-reflectance (white) interior will generally provide a greater sign luminance than if used in signs with a low-reflectance (black) interior.
- Order retrofit kits with connectors that match the sockets of the existing signs to ease installation.
- Ensure that the sign's apertures, such as the letters and any downlights, are not blocked by components of the retrofit kit.
- Some retrofit kits use incandescent light sources that are distributed along a flexible transparent pipe. Follow the manufacturer's template when aligning the pipe in the sign.



Interior of exit signs, showing retrofit kits. Clockwise, from upper left: side-mounted LEDs, compact fluorescent lamp, electroluminescent panel, incandescent light tube, incandescent lamps, LED replacement faceplate.



Retrofit kits installed in host sign. Clockwise, from upper left: side-mounted LEDs, compact fluorescent lamp, electroluminescent panel, incandescent light tube, incandescent lamps, LED replacement faceplate.



Federal regulations require that exits and routes to exits be marked by readily visible signs. The alternative to the internally illuminated signs evaluated in this issue of *Specifier Reports* is externally illuminated signs. They are illuminated by a light source that is not part of the sign. Typically, such a light source is a luminaire that is used continuously as part of the building's lighting system and one that can light the escape route during an emergency. When deciding between internally and externally illuminated exit signs, specifiers should consider the signs' power consumption and its visibility in smoke.

The power consumption of externally relative to internally illuminated exit signs depends on the specific building situation. If the required location of the exit sign is close to an external light source, which is always on, the externally illuminated sign uses less power because the external light source must also be present even if an internally illuminated sign is used. Such positioning is unusual. If a special luminaire is required to provide the external illumination, an internally illuminated exit sign generally will use less power.

The visibility of externally illuminated exit signs in smoke usually is lower than that of internally illuminated signs because the light from the external light source is absorbed and scattered before it reaches the face of the sign.



Manufacturers' Data

NLPIP identified manufacturers of exit signs through equipment directories and advertisements in *Lighting Design + Application* and *Energy User News* and invited them to participate in this project. Those who agreed to participate were given detailed information about the project and were asked to complete data sheets for their energy-efficient,

internally illuminated, single-faced exit signs and their retrofit kits. In addition, NLRIP asked each manufacturer to provide product literature and one sample of each of the exit signs and retrofit kits for which data sheets were submitted. Samples were accepted until January 31, 1993.

Twenty-six manufacturers submitted information and samples; 28 different exit signs and 28 different retrofit kits were received. Some manufacturers make both exit signs and retrofit kits. Others make only exit signs or only retrofit kits. Some manufacturers supplied exit signs with a battery power supply; others did not.

Table 1 summarizes the information that was supplied by manufacturers for exit signs. The information is categorized by the light source technology that the sign incorporates. Table 1 also shows the options that are available with each exit sign. According to the manufacturers, all the exit signs in Table 1 have been tested to conform with UL 924 by Underwriters Laboratories or an equivalent testing laboratory. Table 2 summarizes the information that was supplied by the manufacturers for retrofit kits, including their UL status.

NLRIP Evaluations

NLRIP evaluated four aspects of the manufacturer-donated exit signs and retrofit kits: photometric characteristics, power characteristics, readability of the sign, and visibility of the sign in smoke. These evaluations were first performed between February and May 1993. The evaluation of the signs' visibility in smoke was revised between June and September 1994. All evaluations were performed at the Niagara Mohawk Lighting Research Laboratory in Watervliet, New York.

The exit signs were evaluated as supplied by the manufacturer. If a battery power supply was submitted with the exit sign, the evaluations of its photometric characteristics and its visibility in smoke were conducted twice: with the sign operating on utility-supplied power and on battery power. All other evaluations were conducted with the exit sign operating on utility-supplied power only.

The majority of the retrofit kits were installed in the same model host sign, the Lithonia Emergency Systems Quantum Model M (catalog number QMSW3R120), following the retrofit kit manufacturers' instructions. This model has a white plastic,

single-faced housing; its stenciled letters are backed by a red filter. It operates two 12-watt incandescent lamps on 120 volts. The host sign was evaluated by NLRIP for comparison purposes; thus, a total of 57 signs and retrofit kits were tested.

This model was selected as the host sign because it easily accommodates retrofit kits and because the high reflectance of its white interior enhances the letter luminances.

One electroluminescent retrofit kit was installed in a host sign, but the red filter was not used because the electroluminescent retrofit kit emitted green light. Two LED retrofit kits were already mounted on white plates. These plates are designed to replace or cover the existing face of a sign, so they were evaluated as supplied, not installed in a host sign.

Photometric characteristics. The luminance, luminance contrast, and luminance uniformity of an exit sign affect its visibility (see sidebar, "Luminance, Luminance Contrast, and Luminance Uniformity," on p. 4). To evaluate these photometric characteristics of 53 exit signs and retrofit kits, NLRIP used a CapCalc imaging photometer (see sidebar, at right). NLRIP used a Minolta LS 100 luminance meter to evaluate the four radioluminescent signs because the luminances of these signs were close to the absolute sensitivity limits of the imaging photometer (CapCalc).

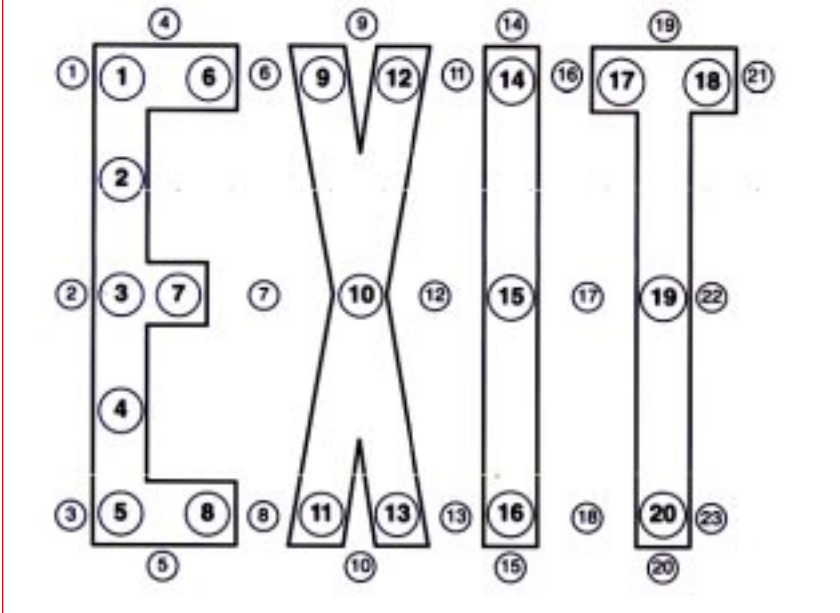
Before measuring luminances with CapCalc, NLRIP operated the 53 products on utility-supplied power for a minimum of 100 hours and a maximum of 1000 hours. This was done to season the light sources and to fully charge any batteries. Then, every exit sign and retrofit kit was placed upright on a horizontal platform against a background of black cloth. Measurements were made with the room lights turned off, to simulate the luminance of the sign during a power interruption. To protect against fluctuations in the utility-supplied power, the products were operated on a regulated 120-volt ac power supply. The stability of the applied voltage was ± 0.1 volt. All the products were operated for at least 20 minutes immediately prior to being placed on the measurement platform. Once on the platform, all products were operated for 5 minutes before luminance measurements were taken.

A similar warm-up procedure was used for battery-operated exit signs, but the luminance pattern of the sign was measured 1 minute after switching to the battery

The CapCalc Imaging Photometer

The CapCalc imaging photometer uses a black and white videocamera interfaced with a computer to instantaneously capture the luminance values of all the pixels within the camera's field of view. CapCalc can report the luminance of any individual pixel or report the average luminance of any selected area within the image. Due to the limits of the videocamera, CapCalc cannot accurately measure low luminances, such as those produced by radioluminescent-type exit signs.

Figure 3. Template Used for Locating Positions for Average Luminance Measurements (Adapted from UL 924)



power supply. NLPiP did not evaluate the battery-powered exit signs as the battery discharged over time.

To record the luminance patterns of the sign faces, CapCalc’s video camera was focused on the face of the incandescent, fluorescent, electroluminescent, and LED-type exit signs and retrofit kits.

NLPiP measured the luminances of 43 circles positioned on the sign face (shown in Figure 3) according to the visibility measurement procedures in UL 924. Twenty circles positioned on the letters and 23 circles positioned on the immediate background of every sign were measured.

To record the luminances of the radioluminescent exit signs, each sign was mounted upright on a horizontal platform surrounded by a black cloth. With the room lights off, the Minolta LS 100 luminance meter was focused on the face of the sign and the luminances of the 43 circles were recorded.

For each sign, the mean luminance for the letters was calculated from the luminances of the 20 circles positioned on the letters in Figure 3. The mean luminance of the background was calculated from the luminances of the other 23 circles. These mean luminances were used to calculate the luminance contrast of the letters against the background, using the definition given in the sidebar on p. 4. The range of luminances within the letters (letter luminance range) was determined by the lowest and highest luminances of the 20 circles positioned on the letters. The range of luminances for the background (background luminance range) was determined by the lowest and highest luminances of the 23 circles positioned on the background.

Tables 3 and 4 list the mean luminances of the letters and the background, the range of luminances occurring within the letters and within the background, and the luminance contrast between the letters and their background, for each sign operated on the regulated power supply and, if available, on battery-supplied power. Table 3 lists the data for the exit signs. Table 4 provides data for the retrofit kits. The measured data for the host sign, prior to installing a retrofit kit, are given at the top of Table 4 for comparison purposes. The trends in the data listed in Tables 3 and 4 are summarized in the table to the left.

When some of the exit signs were operated on battery-supplied power, the mean letter luminance increased, compared to

Summary of Photometric Measurements from Tables 3 and 4

| | Exit Signs on Regulated Power Supply (Table 3) | Retrofit Kits (Table 4) |
|--|--|---|
| Mean letter luminance (in decreasing order by light source) | circline fluorescent, compact fluorescent, LED*, incandescent, electroluminescent, radioluminescent | compact fluorescent, LED*, incandescent, electroluminescent |
| Mean background luminance | Low for the 25 stencil and matrix signs; high for the three panel signs. | Low for all kits in the stencil host sign. |
| Luminance contrast of the letters against background | High for all the signs (all but one were greater than 0.80). | High for all kits (all kits were greater than 0.90). |
| Range of letter luminance (in increasing order by light source) | radioluminescent and electroluminescent, LED and incandescent, circline fluorescent, compact fluorescent | electroluminescent, LED, incandescent, compact fluorescent |

* The luminances of the LED signs can vary substantially because of the differing number and type of LEDs in each measurement area of each sign and the characteristics of any diffuser present.

operation on utility-supplied voltage. Most notably, all the electroluminescent signs showed a marked increase in mean letter luminance after switching to battery power.

Power measurements. NLPIP measured the active power, power factor, and apparent power of the exit signs and retrofit kits using the following procedure. All the signs already had been operated on utility-supplied power for 100 to 1000 hours. When the active power measurements were made, each sign without an installed battery pack was operated on utility-supplied power for at least 20 minutes immediately before the measurements were taken. Exit signs with a battery pack were operated on utility-supplied power for at least 1 hour before measurements were taken. Each sign was then connected to a regulated power supply and operated for at least 5 minutes. The input voltage to the sign was 120 ± 0.1 volts. For each sign, NLPIP measured the magnitude and waveform of the voltage and current, and the phase relationship between them. Then the active power, power factor, and apparent power were calculated from the measured values. Table 3 lists the active power, power factor, and apparent power of each exit sign. Table 4 lists these parameters for each retrofit kit and for a host sign prior to being fitted with a retrofit kit.

Tables 3 and 4 show a wide range of measured active power. The radioluminescent exit signs consumed the least amount of active power (0 watts). One of the compact fluorescent exit signs consumed the most (29 watts). Measured power factor, and hence apparent power, also varied widely.

Readability. Readability of an exit sign is defined as whether or not a person can read and understand the message of an exit sign. Several factors affect the readability of an exit sign:

- Letter size and spacing;
- Luminance of the letters;
- Luminance contrast between the letters and the background;
- Color difference between the letters and the background; and
- Luminance uniformity within the letters and within the background.

NLPIP evaluated the combined effect of these variables on the readability of the exit signs and retrofit kits by asking subjects to identify the orientation of the word “EXIT,” using the procedure described below.

Each sign (exit signs and retrofit kits) was presented to the subject at a height of 5.5 feet (1.67 meters) above the floor at the end of a straight corridor, 165 feet (50 meters) long (see Figure 4). The windows along the corridor were covered with an opaque material. Each sign was placed on a horizontal platform containing two mirrors mounted vertically and at 90° to one another (see Figures 5a and 5b). The floor of the platform was painted matte black and the sides were covered with black cloth. By placing the sign in different positions in front of the mirrors (right-side-up or upside-down, in positions A or B in Figure 5a), the word “EXIT” appeared to the subject in one of the four orientations shown in Figure 6. NLPIP quantified the readability of the exit sign by measuring the distance from the sign at which the subject correctly identified the orientation of the word “EXIT.”

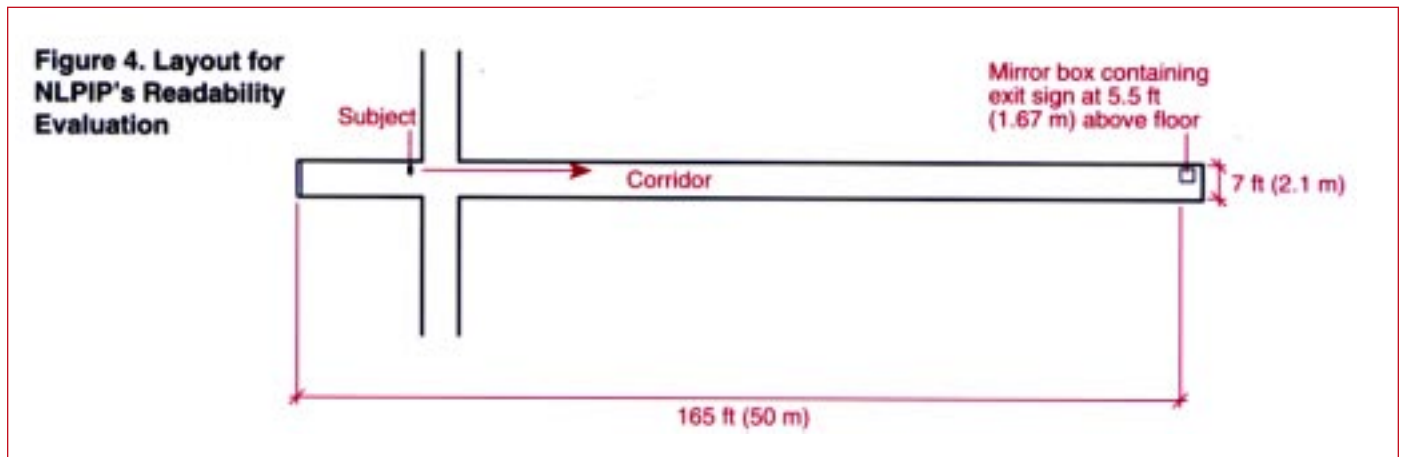


Figure 5a. Plan View of Mirror Box Used for Changing Orientation of Signs

Each sign was placed at either position A or B.

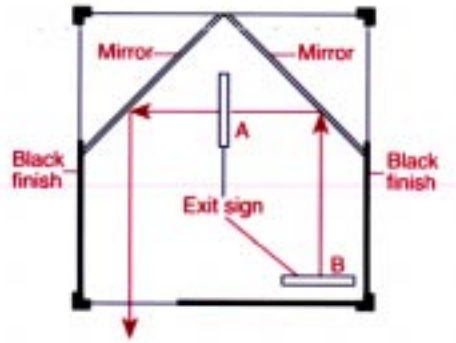


Figure 5b. An NLIPI Researcher Adjusts a Sign in the Mirror Box



Every sign was viewed twice by every subject, first with the corridor lights turned on, and then, on a different day, with the lights turned off. The average illuminance on the floor of the corridor when the corridor lighting was turned on was 32 footcandles (340 lux). The average illuminance on the floor of the corridor when the corridor lighting was turned off was less than 0.03 footcandles (0.3 lux). For both lighting conditions, the signs were operated on utility-supplied power.

Fourteen people, ages 23 to 56, participated in the readability measurements. They all had a corrected distance visual acuity better than 20/30, as measured on a standard distance Snellen letter visual acuity chart lit to 23 footcandles (250 lux) viewed from 20 feet (6.1 meters), and normal color vision as measured by the Ishihara test for color blindness (Ishihara 1964).

To begin the measurement procedure, each subject adapted to the corridor lighting for 5 minutes. Then, starting from a distance of 165 feet (50 meters), the subject viewed the sign. The subject walked toward the

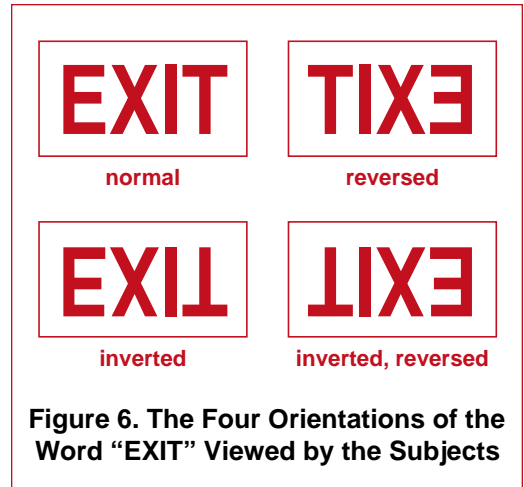


Figure 6. The Four Orientations of the Word “EXIT” Viewed by the Subjects

sign and stopped when he or she was confident that the orientation of the word “EXIT” could be identified. If the subject correctly identified the sign’s orientation, the distance was recorded as the measure of the sign’s readability. If the identification was incorrect, the subject was informed and asked to continue moving toward the sign. This process continued until the subject identified the orientation correctly. The subject then walked back along the corridor to the starting point. The procedure was repeated for the next sign and continued until all the exit signs and retrofit kits were viewed.

For each subject, the signs were presented in random order. The position of the signs relative to the mirrors was also random, except for the signs that use compact fluorescent lamps. These signs had to be viewed right-side-up because the light output of these lamps changes when they are inverted. Subjects were not aware of this restriction on position.

The results of the readability measurements for the exit signs are given in Table 3, and results for the retrofit kits are in Table 4.

Also shown at the top of Table 4 is the readability of the host exit sign, prior to having a retrofit kit installed. The readability is expressed as the number of subjects who could not correctly read the orientation of “EXIT” at 100 feet (30.5 meters) and 150 feet (45.7 meters), with the corridor lights off and on. For example, a “2” in the 150 feet column means that two of the 14 subjects were unable to read the orientation correctly at 150 feet.

There were distinct differences among the different light source technologies for readability at 100 feet. Also, there were differences among signs using the *same* light source technology for readability at 150 feet. Some signs were more difficult to read when the corridor lights were turned on, and others were easier. This difference probably was due to the effect of the corridor illumination on the luminance contrast of the sign.

Calculated luminances and luminance contrast through smoke. None of the standards that are applied to exit signs consider their visibility in smoke. Obviously, fire and smoke can cause an emergency that requires the rapid evacuation of a building. Thus the visibility of exit signs in smoke is crucial.

The visibility of exit signs in smoke is affected by:

- The extent to which the light is absorbed or scattered by the smoke, and
- Visual factors including the irritating effect the smoke has on the eye.

In this issue of *Specifier Reports*, NLP/IP used a mathematical model to evaluate the effect of smoke on the visibility of exit signs (see sidebar, at right). The model incorporates the absorption and scattering of light from the exit sign but not the irritating effect of smoke on the eye.

The application of this model has four stages. First, the luminance pattern produced by each exit sign or retrofit kit, in a clear atmosphere, with the room lights turned off, and operating on the regulated power supply, was measured with CapCalc as described in the “Photometric characteristics” section on p. 9. For exit signs with a battery, the luminance pattern of the sign operating on battery-supplied power also was measured as described on p. 9.

Second, the Smoke-Sim computer software package was applied to the clear-air

luminance pattern to predict the luminance pattern through gray smoke, at distances of 3.28, 6.56, 16.4, 23.0, 32.8, and 39.4 feet (1, 2, 5, 7, 10, and 12 meters).

Third, the mean letter luminance, the mean background luminance, and the luminance contrast after passing a given distance through the defined smoke were calculated for the 53 exit signs and retrofit kits that were evaluated with CapCalc. The measurement points that were used in the calculation of mean letter and background luminances were the same as those used in the absence of smoke (Figure 3). The radioluminescent exit signs were not included in this evaluation because the Smoke-Sim software requires a CapCalc image as its input data and the luminances of these signs were too low to be measured accurately with CapCalc.

Fourth, the photometric information was used to calculate the distance at which the mean letter luminance or mean background luminance, whichever was greater in a clear atmosphere, dropped to 0.06 fL (0.21 cd/m²). This value is the minimum letter luminance permitted by the NFPA Life Safety Code for electroluminescent or radioluminescent exit signs.

Table 5 lists the results of these calculations for the exit signs. Table 6 lists the results for retrofit kits. At the top of Table 6 are the results for the host exit sign before retrofit kits were installed. The following data are reported in Tables 5 and 6:

- The mean letter luminance, the mean background luminance, and the luminance contrast of the exit signs and retrofit kits, operating on a regulated power supply and, if available, a battery power supply, measured in a clear atmosphere (in clear-air conditions, these luminances will not significantly decrease over the relevant distances);

Modeling the Effects of Smoke

Optically, smoke is an aerosol like fog. Aerosols absorb and scatter light, reducing luminance and blurring any object seen through them. Visibility through aerosols has been studied extensively in order to improve the effectiveness of satellite and aerial reconnaissance.

Full details of a mathematical model of the absorption and scattering of light by aerosols can be obtained from Lutomirski (1978) and Kopeika (1985). Bierman *et al.* (1994) detail how this model was applied to exit signs and how it was validated as it applies to smoke. NLP/IP applied the model to exit signs using Smoke-Sim, a software application developed by the Lighting Research Center. The characteristics of the smoke that NLP/IP used in this model, and the basis for the calculations, are described on p. 16.

Smoke-Sim © Rensselaer Polytechnic Institute

- The mean letter luminance, the mean background luminance, and the luminance contrast of the exit signs and retrofit kits operating on a regulated power supply and, if available, a battery power supply, calculated for passage through a uniformly filled volume of the defined smoke, at a distance of 16.4 feet (5 meters); and
- The critical distance, defined as the distance through a uniformly filled volume of smoke at which the mean letter luminance or the mean background luminance, whichever is greater in a clear atmosphere, drops to 0.06 fL (0.21 cd/m²).

Smoke simulation results. The following observations summarize the data reported in Tables 5 and 6. These results should be considered indicative rather than definitive because the calculations were done for only one type of smoke. The sidebar on p. 16, “Using Smoke-Sim to Predict Exit Sign Visibility,” describes the effects that can be predicted if the characteristics of the smoke are changed.

- As expected, the smoke strongly reduced the mean letter and mean background luminances.
- In the smoke, all the signs had mean letter and background luminances of less than 0.06 fL (0.21 cd/m²) at distances greater than 41 feet (12 meters).
- The luminance contrast of all the signs (those for which luminance contrast could be calculated) was reduced in smoke; reduction was greatest for the panel-format signs.
- The letter luminances of the electroluminescent-type exit signs operated on the regulated power supply decreased to the 0.06 fL (0.21 cd/m²) luminance at shorter distances than the other light source technologies. The electroluminescent-type signs had higher luminances when battery-operated and thus decreased to the 0.06 fL (0.21 cd/m²) luminance at greater distances than when they were operated on the regulated power supply.
- The critical distances are primarily determined by the letter and background luminances without smoke; the higher the luminances, the greater the critical distance.
- The critical distances are probably underestimated for the LED-type signs with no diffuser because the letter luminances that were used were luminances averaged over the circles specified in UL 924 (Figure 3). These circles are larger in size than the individual light-emitting diodes. In smoke, the higher luminance of the individual light-emitting diodes would likely remain visible at greater distances. To check the magnitude of this effect, NLRIP performed the calculations again for three LED-type signs with no diffusers using the luminances of the light-emitting diodes themselves, rather than the average luminance over the area of the circles. The result was an increase in critical distance of approximately 2.3 feet (0.70 meters).
- Although the radioluminescent stencil exit signs were not included in these calculations, the low letter luminances of these signs in clear air (see Table 3) suggests that their letter luminances would drop below 0.06 fL (0.21 cd/m²) at relatively short distances in smoke.



The following data tables present information that was supplied by manufacturers (Tables 1 and 2) and data that were collected by NLPPI researchers using the methods described in the “NLPPI Evaluations” section (Tables 3, 4, 5, and 6). All luminance values are reported in candelas per square meter (cd/m^2). For users more familiar with footlamberts (fL), the conversion factor is $1 \text{ cd}/\text{m}^2 = 0.29 \text{ fL}$. Unless otherwise indicated, all measured data are for the signs operating on regulated utility-supplied power. Most of the column headings for these tables are self-explanatory; those that are not are defined below.

Auto discharge/recharge cycle: Indicates whether or not the sign has a circuit that is designed to discharge and recharge the battery at regular intervals. This is an option for some signs. Proponents of this technology claim that it extends battery life. NLPPI did not test this claim.

Battery-operated: In any column heading in Tables 3 and 5, “battery-operated” indicates that the exit sign was operated on its own rechargeable battery when the reported data were collected.

Battery mode: Indicates whether or not an option exists for equipping the exit sign with its own battery. An exit sign that does not have a battery could still be operated on a generator or a central battery unit during an emergency. UL-listed exit signs that have a battery also must include a battery test switch and a battery/power supply status indicator.

Battery operating time: The time for which the battery could operate the exit sign and still fulfill UL 924 requirements.

Battery recharge time: The time required to recharge the battery sufficiently (after a 90-minute discharge) so that it could operate the exit sign for 1 hour. UL 924 allows a maximum battery recharge time of 24 hours.

Brownout circuitry: Indicates whether or not the sign has a circuit that is designed to switch over to battery supply if the voltage of the

utility-supplied power drops below a specified value. This is an option for some signs.

Emergency options: Refers to options available when signs are operated on a non-utility power supply, such as a generator, a central battery unit that operates several exit signs, or an individual rechargeable battery. Options include

Increased sign luminance: Indicates whether or not the exit sign increases the brightness of the light source if the utility-supplied power fails.

Flash: Indicates whether or not the sign flashes on and off when the utility-supplied power fails and/or a fire alarm circuit is activated.

Flash and buzz: Indicates whether or not the sign flashes on and off and produces an auditory signal when the utility-supplied power fails and/or a fire alarm circuit is activated.

Low battery voltage disconnect: Indicates whether or not the sign has a circuit that is designed to disconnect the battery after it is discharged; this prevents damage to the battery. This is an option for some signs. Lead acid and lead calcium batteries need this circuit but nickel cadmium batteries do not.

Luminance contrast: Defined in the sidebar on p. 4.

Rated lamp life: Lamp life in Tables 1 and 2 is given in years (instead of hours). To convert lamp life from hours into years, NLPPI assumed that the lamp would be used 24 hours a day, 365 days a year. Fluorescent lamps may last longer than rated life, because life ratings are based on a three-hour burning cycle. Under continuous operation, fluorescent lamp life may be extended by as much as 80 percent.

Smoke: In any column heading in Tables 5 and 6, “Smoke” indicates that data were obtained from simulations of the sign’s appearance through a uniform gray smoke. The characteristics of the smoke are described on p. 16.

UL 924 Status: In Table 2, this column indicates whether a retrofit kit is UL-listed, UL-classified, or tested. UL-listed and UL-classified are defined on p.4; “tested” means that the product has been tested to the appropriate UL 924 requirements by an independent laboratory.

Appendix: Basis for smoke calculations

Smoke both absorbs and scatters light, so an exit sign seen through smoke is reduced in luminance and blurred in appearance.

To mathematically model the effect of smoke on the spatial-luminance characteristics of an exit sign, NLPPI used a modulation transfer function (MTF) approach. This approach is used widely in physical optics to characterize the fidelity of optical systems, such as lenses. The MTF describes how the spatial characteristics of the object are modified by an optical system. In the model, smoke is considered to be an optical system composed of an aerosol made up of particles of the same size that are uniformly distributed along a path of a given length.

The general aerosol MTF used by NLPPI has been described by Lutomirski (1978) and applied by Kopeika (1985). The mathematical function is beyond the scope of *Specifier Reports* but is given in the above-mentioned papers and in Bierman *et al.* (1994). Factors in the equation include the size of the smoke particles, the distance from the observer to the object, and coefficients for scattering and absorption.

For this project, NLPPI simulated a gray smoke with the absorption and scattering characteristics of smoke generated by evaporating mineral oil (absorption = 0.60/m, scattering = 0.20/m, particle size = 25 μm).

The application of the smoke's MTF to an exit sign's luminance pattern involves three steps. First, the luminance pattern of the exit sign measured in a clear atmosphere is converted into its spatial frequency distribution by means of a Fourier transform. The spacial frequency distribution describes the luminance pattern in terms of the rapidity and magnitude of luminance variations in the pattern. A sharp border or edge in the image is interpreted as a high-frequency signal. Gradual shifts in luminance, such as in a blurry image, are interpreted as low frequency signals.

In the second step, the MTF of the smoke is applied to the spatial frequency distribution of the exit sign measured in a clear atmosphere, resulting in a modified spatial frequency distribution. The MTF models the absorptive characteristic of

smoke by reducing the magnitude of the spatial frequencies. The blurring effects of the smoke's scattering characteristics are modeled by attenuating the high spatial frequencies.

In the third step, the luminance pattern of the exit sign after it passes through the

smoke is constructed from the modified spatial frequency distribution by applying an inverse Fourier transform.

NLPPI implemented this mathematical model of the absorption and scattering of light by smoke in the Smoke-Sim software package.

Using Smoke-Sim to Predict Exit Sign Visibility

Although the calculations of visibility through smoke summarized in Tables 5 and 6 were done for one type of smoke, the effects of different types of smoke can be predicted from changes in the parameters that were used in the calculation.

If the density of the smoke were increased (for the same ratio of absorption to scattering), the mean luminances of the letters and background would decrease so that the distances at which the higher luminance (letter or background) falls below 0.06 fL (0.21 cd/m^2) also would decrease. However, the visibility of each sign relative to all the others would remain constant.

If the ratio between the absorption and scattering coefficients of the smoke were changed, then both the absolute mean luminances and the relative visibility of the exit signs and retrofit kits would change. How much they would change depends on the relative strength of the absorption and scattering of light.

If a perfectly black smoke (one that absorbs but does not scatter light) were used, the visibility of the sign would be determined primarily by the maximum luminance of the letters or the background. The greater the letter or background luminance without smoke, the greater the distance at which the exit sign would remain readable in smoke.

If a perfectly white smoke (one that scatters but does not absorb light) were used, the visibility of the sign would be determined primarily by the luminance contrast of the sign. The greater the luminance contrast without smoke, the greater the distance at which the sign would remain readable in smoke. Few types of common fires create such smoke; most create smoke with some absorptive characteristics that will decrease luminance. To simulate both absorption and scattering effects, NLPPI used a gray smoke for the computer simulations of visibility in smoke. Tables 5 and 6 include NLPPI's measurements of luminance contrast for exit signs and retrofit kits in clear air and in simulated gray smoke.



Computer simulation of the visibility of exit signs in smoke. From top to bottom, the types of exit signs shown are electroluminescent stencil, compact fluorescent stencil, LED matrix, and incandescent panel. From left to right, the simulation shows the original sign (no smoke) and the sign "viewed" from 6.56 feet (2 meters), 16.4 feet (5 meters), and 23.0 feet (7 meters) in gray smoke. The brightnesses of the different types of signs were balanced to make them roughly the same in the clear-air condition; thus the apparent brightnesses of the different sign types should not be compared with each other.

Table 1. Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Number of Light Sources | Rated Active Power (W) at | | Power Factor at | | Rated Lamp Life (yrs) | Battery Mode | Battery Type | Battery Operating Time (hrs) | Battery Recharge Time (hrs) | Low Battery Voltage Disconnect | Brown-out Circuitry | Auto Discharge/Recharge Cycle | Emergency Options (a) | Sign Format | Available Color(s) of Letters | Available Color(s) of Background | Housing Material | Weight (lbs) | Mounting | Impact Resistant | Tamper Resistant | Warranty Period (yrs) | Warranty on Internal Battery (yrs) |
|-------------------------------|--------------------------------|-------------------------|---------------------------|------|-----------------|------|-----------------------|--------------|---------------------|------------------------------|-----------------------------|--------------------------------|---------------------|-------------------------------|----------------------------------|----------------|-------------------------------|------------------------------------|-------------------------|--------------|----------------------------------|------------------|------------------|-----------------------|------------------------------------|
| | | | 120V | 277V | 120V | 277V | | | | | | | | | | | | | | | | | | | |
| Circline Fluorescent | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beghelli Inc. | Pratica Bella Exit | 1 | 22.0 | 22.0 | 0.90 | 0.90 | 1.4 | yes | lead acid 6V | 2.5 | 24 | yes | yes | yes | no | panel | white | green, red | plastic (polycarbonate) | 5.3 | ceiling, wall | yes | yes | 3 | 3 |
| Compact Fluorescent | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hetherington Industries, Inc. | Series 132 | 2 | 15.0 | 20.0 | 0.55 | 0.45 | 1.1 | no | N/A | N/A | N/A | N/A | N/A | N/A | (b) | stencil | green, red | aluminum | steel | 3.0 | ceiling, wall | no | no | 1 | N/A |
| INCON INDUSTRIES INC. | INCON | 1 | 9.0 | 9.0 | 0.45 | 0.45 | 1.1 | no | N/A | N/A | N/A | N/A | N/A | N/A | no | stencil | green, red | white | plastic (polycarbonate) | 5.0 | ceiling, wall | yes | no | 2 | N/A |
| KENALL | TRAILMATE | 2 | 16.0 | 16.0 | 0.40 | 0.23 | 1.1 | yes | lead calcium 6V | 1.5 | 24 | yes | yes | yes | flash, flash and buzz (b) | panel | green, red | white | plastic (polycarbonate) | 5.0 | ceiling, wall | yes | yes | 3 | 1 |
| Lithonia Lighting | Titan Fluorescent | 2 | 16.0 | 20.0 | 0.42 | 0.24 | 1.7 | yes | lead calcium 6V | 1.5 | 24 | yes | no | no | flash, flash and buzz (b) | stencil | green, red | black, white | steel | 6.0 | ceiling, pendant, wall | no | yes | 3 | 3 |
| Radiant Illumination Inc. | NXL "Excellence" (c) | 2 | 25.7 | 25.7 | 0.75 | 0.75 | 0.85 | yes | nickel cadmium 7.2V | 2.0 | 12 | yes | yes | no | flash | panel, stencil | green, red, white | aluminum, green, red, white | die cast aluminum | 8.0 | ceiling, pendant, recessed, wall | no | no | 1.5 | 5 |
| Radiant Illumination Inc. | VX "Vandal Proof" (c) | 2 | 21.7 | 21.7 | 0.33 | 0.33 | 0.85 | yes | nickel cadmium 7.2V | 2.0 | 12 | yes | yes | no | no | panel | green, red | white | steel | 14.0 | ceiling, wall | yes | yes | 1.5 | 5 |
| USI Prescolite | Exit Lite | 1 | 10.5 | 12.2 | 0.48 | 0.25 | 1.1 | yes | lead calcium 6V | 1.5 | 24 | yes | yes | no | flash, flash and buzz (b) | stencil | green, red | aluminum, black, white | plastic | 9.5 | ceiling, pendant, wall | yes | yes | 3 | 3 full + 3 prorata (d) |
| USI Prescolite | Exit Lite | 2 | 18.0 | 21.4 | 0.48 | 0.25 | 1.1 | no | N/A | N/A | N/A | N/A | N/A | N/A | no | stencil | green, red | aluminum, black, white | plastic | 5.5 | ceiling, pendant, wall | yes | yes | 3 | N/A |
| Electroluminescent | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur Electroluminescent | 1 | 0.5 | 2.5 | 0.82 | 0.37 | 8.0 | yes | lead acid 6V | 1.5 | 24 | yes | yes | yes | inc. lum., flash, flash and buzz | panel, stencil | green, red | aluminum, black, green, red, white | die cast aluminum | 6.0 | ceiling, pendant, wall | yes | yes | 3 | 3 full + 3 prorata (d) |
| EMERGI-LITE | PRECEPTOR-Electroluminescent | 1 | 1.0 | 1.0 | 0.95 | 0.95 | 8.0 | yes | nickel cadmium 6V | 1.5 | 12 | yes | yes | no | inc. lum., flash, flash and buzz | stencil | green, red | aluminum, black, white | die cast aluminum | 5.0 | ceiling, pendant, recessed, wall | yes | yes | 3 | 5 full + 7 prorata (d) |
| Lithonia Lighting | Signature Electroluminescent | 1 | 0.6 | 0.8 | 0.46 | 0.27 | 5.7 | yes | nickel cadmium 6V | 1.5 | 24 | yes | no | no | inc. lum., flash, flash and buzz | stencil | green, red | aluminum, black, bronze, white | die cast aluminum | 5.0 | ceiling, pendant, recessed, wall | yes | yes | 3 | 3 |
| USI Prescolite | Electroluminescent Exit Series | 1 | 0.8 | 2.1 | 1.00 | 1.00 | 6.8 | yes | nickel cadmium 6V | 1.5 | 24 | yes | yes | no | inc. lum., flash, flash and buzz | stencil | green, red | aluminum, black, white | die cast aluminum | 5.0 | ceiling, pendant, wall | yes | yes | 5 | 5 full + 7 prorata (d) |
| Incandescent | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur Light Panel | 24 | 13.0 | 13.8 | 0.93 | 0.96 | 20 | yes | lead acid 4V | 1.5 | 24 | yes | yes | yes | flash, flash and buzz | panel, stencil | green, red, white | aluminum, black, green, red, white | die cast aluminum | 6.0 | ceiling, pendant, wall | yes | yes | 3 | 3 full + 3 prorata (d) |

N/A = not applicable

Notes

1 lb = 0.45 kg

- (a) All signs use the same lamp for operating under both utility power and emergency power systems unless otherwise noted. The expression "inc. lum." indicates increased sign luminance under emergency conditions; "no" indicates that the sign does not have any of the emergency options described in the "Data Tables" section on p. 15.
- (b) This sign uses an incandescent lamp as an emergency light source.
- (c) This sign uses a linear T5 fluorescent lamp.
- (d) Warranty is prorated based on how many years of the warranty have elapsed.

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Number of Light Sources | Rated Active Power (W) at | | Power Factor at | | Rated Lamp Life (yrs) | Battery Mode | Battery Type | Battery Operating Time (hrs) | Battery Recharge Time (hrs) | Low Battery Voltage Disconnect | Brown-out Circuitry | Auto Discharge/Recharge Cycle | Emergency Options (a) | Sign Format | Available Color(s) of Letters | Available Color(s) of Background | Housing Material | Weight (lbs) | Mounting | Impact Resistant | Tamper Resistant | Warranty Period (yrs) | Warranty on Internal Battery (yrs) |
|---------------------------------|-------------------------|-------------------------|---------------------------|------|-----------------|------|-----------------------|--------------|--------------------|------------------------------|-----------------------------|--------------------------------|---------------------|-------------------------------|----------------------------------|-----------------|-------------------------------|----------------------------------|-------------------------|--------------|----------------------------------|------------------|------------------|-----------------------|------------------------------------|
| | | | 120V | 277V | 120V | 277V | | | | | | | | | | | | | | | | | | | |
| LED (Diffuser) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur LED | 144 | 7.0 | 7.0 | 0.90 | 0.90 | 20 | yes | nickel cadmium 6V | 1.5 | 24 | no | yes | yes | inc. lum., flash, flash and buzz | stencil | green, red | aluminum, black, white | die cast aluminum | 6.0 | ceiling, pendant, wall | yes | yes | 5 | 5 full + 3 prorata (d) |
| Lithonia Lighting | Signature-LE Series (e) | 192 | 6.5 | 8.1 | 0.45 | 0.23 | 25 | yes | nickel cadmium 6V | 1.5 | 24 | yes | no | no | inc. lum., flash, flash and buzz | stencil | green, red | aluminum, black, bronze, white | die cast aluminum | 5.0 | ceiling, pendant, recessed, wall | yes | yes | 5 | 5 |
| Teron Lighting Corp. | ULTRA LED | 67 | 7.0 | 7.0 | 0.74 | 0.74 | 30 | yes | nickel cadmium 6V | 4.0 | 12 | yes | yes | yes | flash | matrix | red | white | plastic (polycarbonate) | 2.3 | ceiling, pendant, wall | yes | yes | 8 | 8 |
| Teron Lighting Corp. | ULTRA LED | 132 | 9.7 | 9.7 | 0.74 | 0.74 | 30 | no | N/A | N/A | N/A | N/A | N/A | N/A | N/A | matrix | red | white | plastic (polycarbonate) | 2.3 | ceiling, pendant, wall | yes | yes | 8 | N/A |
| TLS mfg., inc. | STDx | 72 | 2.5 | 2.5 | 0.50 | 0.40 | 100 | yes | nickel cadmium 12V | 5.0 | 12 | no | yes | no | flash, flash and buzz | matrix | green, red | black, bronze, white | die cast aluminum | 4.3 | ceiling, wall | yes | no | 20 | 7 prorata (d) |
| LED (Prismatic Diffuser) | | | | | | | | | | | | | | | | | | | | | | | | | |
| EMERGI-LITE | PRECEPTOR L.E.D. | 72 | 5.0 | 5.0 | 0.95 | 0.95 | 20 | yes | nickel cadmium 6V | 1.5 | 12 | yes | yes | no | flash, flash and buzz | matrix | green, red | aluminum, black, white | die cast aluminum | 5.5 | ceiling, pendant, recessed, wall | yes | yes | 5 | 5 full + 7 prorata (d) |
| Trace Lite Corporation | SlimLite | 122 | 1.4 | 2.7 | 0.80 | 0.75 | 100 | no | N/A | N/A | N/A | N/A | N/A | N/A | no | matrix, stencil | green, red, yellow (f) | aluminum, black, white | thermo plastic | 2.0 | ceiling, pendant, recessed, wall | yes | yes | 20 | N/A |
| LED (No Diffuser) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Computer Power Inc. | Illuminator-XD | 127 | 5.0 | 5.0 | 0.80 | 0.80 | 100 | yes | nickel cadmium 6V | 2.0 (g) | 16 | no | yes | no | flash, flash and buzz (h) | matrix | green, red, green and red (i) | aluminum, black, white | die cast aluminum | 7.0 | ceiling, wall | yes | yes | 20 | 5 prorata (d) |
| TLS mfg., inc. | LES EXIT | 92 | 2.5 | 2.5 | 0.35 | 0.15 | 100 | yes | lead calcium 6V | 4.0 | 12 | no | no | no | flash, flash and buzz | matrix | green, red | black, white | fiberglass flat panel | 0.5 | ceiling, wall | no | no | 5 | 1 |
| Trace Lite Corporation | Executive Series | 122 | 5.3 | 4.7 | 0.92 | 0.73 | 100 | yes | lead calcium 12V | 4.0 | 8 | yes | yes | yes | flash, flash and buzz | matrix | green, red, yellow (f) | black, green, white | thermo plastic, steel | 5.0 | ceiling, pendant, recessed, wall | yes | yes | 20 | 5 |
| Radioluminescent | | | | | | | | | | | | | | | | | | | | | | | | | |
| EMERGI-LITE | EverLite | 12 | 0.0 | 0.0 | N/A | N/A | 10/20 (j) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | no | stencil | green (k) | green, red | plastic (polycarbonate) | 3.0 | ceiling, pendant, wall | yes | yes | 10/20 (l) | N/A |
| SPL, Inc. | EVERGLO | 4 to 7 (m) | 0.0 | 0.0 | N/A | N/A | 10/12 (j) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | no | stencil | green (k) | black, green, red | aluminum, plastic | 3 to 5 | ceiling, pendant, recessed, wall | yes | yes | 10/12 (l) | N/A |
| SPL, Inc. | Omni-Glo | 4 to 10 (m) | 0.0 | 0.0 | N/A | N/A | 10/12/15/20 (j) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | no | stencil | green (k) | black, green, red | plastic | 3 to 5 | ceiling, pendant, recessed, wall | yes | yes | 10/12/15/20 (l) | N/A |
| SRB Technologies | Betalux-E | 15 | 0.0 | 0.0 | N/A | N/A | 10/15/20 (j) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | no | stencil | green (k) | black, green, red | plastic (polycarbonate) | 1 to 2 | ceiling, pendant, recessed, wall | yes | yes | 10/15/20 (l) | N/A |

N/A = not applicable

1 lb = 0.45 kg

Notes

- (a) All signs use the same lamp for operating under both utility power and emergency power unless otherwise noted. The expression "inc. lum." indicates increased sign luminance under emergency conditions; "no" indicates that the sign does not have any of the emergency options described in the "Data Tables" section on p. 15.
- (b) This sign uses an incandescent lamp as an emergency light source.
- (c) This sign uses a linear T5 fluorescent lamp.
- (d) Warranty is prorated based on how many years of the warranty have elapsed.
- (e) The individual LEDs are readily visible in this sign.

- (f) The LEDs are set within the colored letters
- (g) A range of battery operating times are available.
- (h) This sign offers a digitized voice option.
- (i) This sign is green during normal operation and red during utility power failure and/or fire alarm.
- (j) Desired lamp life is specified at time of purchase.
- (k) In the presence of room lighting, the letters appear white.
- (l) Length of warranty is specified at time of purchase.
- (m) The number of tubes depends on the actual sign that is selected.

Table 2. Manufacturer-Supplied Information: Retrofit Kits (listed by type of retrofit light source)

| Manufacturer | Trade Name | Number of Light Sources per Sign | Color(s) of Light Source | Available Voltages | Rated Active Power (W) at | | Power Factor at 120V | Rated Lamp Life (yrs) | Weight of Kit (oz) | Method of Connection (a) | Width (in) | Height (in) | Depth (in) | UL 924 Status | Warranty Period (yrs) |
|-----------------------------------|----------------------------|----------------------------------|--------------------------|--------------------|---------------------------|------|----------------------|-----------------------|----------------------|--------------------------|------------|-------------|------------|---------------|-----------------------|
| | | | | | 120V | 277V | | | | | | | | | |
| Host Sign | | | | | | | | | | | | | | | |
| Lithonia Lighting | Quantum | 2 | white | 120/277 | 24.0 | 26.0 | 0.95 | 2.2 | N/A | N/A | N/A | N/A | N/A | listed | 3 |
| Compact Fluorescent | | | | | | | | | | | | | | | |
| Brownlee Lighting | Fluorescent Exit Converter | 1 | white | 120/277 | 10.5 | 10.5 | 0.50 | 0.85 | 8 (120V); 9 (277V) | screw-in, rewire | 9.38 | 3.00 | 1.13 | listed | 2 |
| Brownlee Lighting | PL Exit Converter | 2 (b) | white | 120/277 | 13.0 | 13.0 | 0.50 | 1.1 | 11 (120V); 12 (277V) | screw-in, rewire | 9.00 | 5.75 | 1.13 | listed | 2 |
| Brownlee Lighting | PL Exit Converter | 1 | white | 120/277 | 13.0 | 13.0 | 0.50 | 1.1 | 8 (120V); 9 (277V) | screw-in, rewire | 7.25 | 5.75 | 1.13 | listed | 2 |
| Brownlee Lighting | PL Exit Converter | 2 | white | 120/277 | 22.0 | 20.0 | 0.50 | 1.1 | 15 (120V); 17 (277V) | screw-in, rewire | 10.75 | 4.75 | 1.13 | listed | 2 |
| ENERSAVE Co. | Pow-R-Saver (c) | 1 | white | 120/277 | 7.0 | 7.0 | 0.50 | 0.85 | 24 | screw-in, rewire | 9.50 | 3.75 | 1.00 | listed | 1 |
| ENERSAVE Co. | Pow-R-Saver | 1 | white | 120/277 | 11.0 | 11.0 | 0.50 | 1.1 | 16 | screw-in, rewire | 7.50 | 3.50 | 1.25 | listed | 1 |
| ENERSAVE Co. | Pow-R-Saver (c) | 2 (b) | white | 120/277 | 7.0 | 7.0 | 0.50 | 0.85 | 24 | screw-in, rewire | 9.50 | 4.00 | 1.00 | listed | 1 |
| ENERSAVE Co. | Pow-R-Saver | 2 (b) | white | 120/277 | 11.0 | 11.0 | 0.50 | 1.1 | 24 | screw-in, rewire | 9.50 | 4.75 | 1.25 | listed | 1 |
| Hetherington Industries, Inc. | Series 107 | 2 | white | 120 | 16.0 | N/V | 0.55 | 0.85 | 16 | screw-in, rewire | 10.00 | 7.00 | 1.00 | not tested | 1 |
| INCON INDUSTRIES INC. | INCON | 1 | white | 120/277 | 9.0 | 9.0 | 0.45 | 1.1 | 12 | screw-in, rewire | 5.75 | 2.25 | 1.13 | listed | 2 |
| JANMAR Lighting | Series 230 | 2 | white | 120 | 15.6 | N/V | 0.47 | 1.1 | 7 (no lamp) | screw-in, rewire | 6.00 | 5.50 | 1.13 | listed | 3 |
| JANMAR Lighting | Series 230 | 2 | white | 120 | 17.6 | N/V | 0.57 | 1.1 | 7 (no lamp) | screw-in, rewire | 6.00 | 5.50 | 1.13 | listed | 3 |
| JANMAR Lighting | Series 230 | 1 | white | 120 | 10.0 | N/V | 0.65 | 1.1 | 7 (no lamp) | screw-in, rewire | 7.50 | 5.00 | 1.13 | listed | 3 |
| Mule Emergency Lighting, Inc. | Retro-X | 1 | white | 120/277 | 9.0 | 9.0 | 0.50 | 1.1 | 16 | screw-in, rewire | 7.50 | 7.00 | 1.50 | listed | 1 |
| ProLight | ProLight | 1 | white | 120 | 11.0 | N/V | 0.62 | 1.1 | 16 | screw-in, rewire | 10.00 | 6.50 | 1.50 | listed | 3 |
| ProLight | ProLight | 2 (b) | white | 120 | 11.0 | N/V | 0.62 | 1.1 | 16 | screw-in, rewire | 10.00 | 6.50 | 1.50 | listed | 3 |
| ProLight | ProLight | 2 | white | 120 | 12.0 | N/V | 0.58 | 1.1 | 16 | screw-in, rewire | 10.00 | 6.00 | 1.50 | listed | 3 |
| OSRAM SYLVANIA INC. | EX120/9TT | 1 | white | 120 | 11.0 | N/V | 0.55 | 1.1 | 11 | screw-in | 11.00 | 7.00 | 1.50 | listed | 1 |
| Teron Lighting Corp. | Tee Shot | 2 (b) | white | 120/277 | 12.0 | 12.0 | 0.58 | 1.1 | 16 | screw-in, rewire | 9.25 | 3.38 | 1.13 | listed | 1 |
| Teron Lighting Corp. | Tee Shot | 1 | white | 120/277 | 12.0 | 12.0 | 0.58 | 1.1 | 16 | screw-in, rewire | 9.25 | 3.38 | 1.13 | listed | 1 |
| Electroluminescent | | | | | | | | | | | | | | | |
| Loctite Luminescent Systems, Inc. | E.R.K.ONIMIZER | 1 | green | 120 | < 1 | N/V | 0.28 | 10 | < 4 | rewire | 10.00 | 6.25 | 0.25 | classified | 5 |
| Incandescent | | | | | | | | | | | | | | | |
| Flexlite, Inc. | Exlite | 20 | white | 120/277 | 8.1 | 11.2 | 0.99 | 5.2 | 3 | screw-in | (d) | N/A | N/A | classified | 3 |
| Martek Industries, Inc. | Permalite | 2 | white | 120 | 9.0 | N/V | 1.00 | 17 | 3 | screw-in | (e) | N/A | N/A | not tested | 10 |
| Standard Enterprises, Inc. | EternaLamp | 2 | white | 120/277 | 18.0 | 18.0 | 1.00 | 15 | 2 | screw-in | (e) | N/A | N/A | tested (f) | 3 |
| Teron Lighting Corp. | FLEX | 20 | white | 120/277 | 10.0 | 12.0 | 1.00 | 3.4 | 8 | screw-in, rewire | (d) | N/A | N/A | tested (f) | 1 |
| LED | | | | | | | | | | | | | | | |
| Computer Power Inc. | AstraLite | 32 | red | 120/277 | 1.8 | 1.8 | 0.40 | 100 | 8 | screw-in | 6 to 14 | 6.00 | 0.50 | listed | 25 |
| Energy-Wise Lighting, Inc.(g) | Retro-Ex.87 Universal | 64 | green, red | 120 | 0.9 | N/V | 0.10 | 20 | 16 | screw-in | 10.00 | 7.00 | N/A | listed | 10 |
| Teron Lighting Corp. (g) | ULTRA Retrofit | 132 | green, red | 120/277 | 9.7 | 9.7 | 0.74 | 30 | 35 | screw-in, rewire | 11.88 | 7.38 | N/A | tested (f) | 8 |

N/A = not applicable

Notes

N/V = not available

1 in = 2.54 cm

1 oz = 28 gm

- (a) Retrofit kits that use a rewire connection cannot be UL listed. Thus the UL 924 listed status shown only applies to the screw-in connections.
- (b) This retrofit kit contains two lamps, but only one operates at a time.

- (c) This kit uses a linear T5 fluorescent lamp.
- (d) This kit is 0.5 inches in diameter by 20 inches long.
- (e) Each lamp is 5 inches long.

- (f) This retrofit kit has been tested by ETL Testing Laboratories, Inc. to the applicable requirements of UL 924.
- (g) This retrofit kit consists of a replacement face plate.

Table 3. NLP-IP-Measured Data: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Catalog No. | Sign Format | Letter Color | Background Color | Regulated Power Supply | | | | | Battery-Operated | | | | | Active Power (W) at 120V (a) | Power Factor at 120V | Apparent Power (rms VA) at 120V | Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance) | | | |
|---------------------------------|---|----------------|-------------|--------------|------------------|--|---|--|---|--------------------|--|---|--|---|--------------------|------------------------------|----------------------|---------------------------------|--|--------|-----------|--------|
| | | | | | | Mean Letter Luminance (cd/m ²) | Letter Luminance Range (cd/m ²) | Mean Background Luminance (cd/m ²) | Background Luminance Range (cd/m ²) | Luminance Contrast | Mean Letter Luminance (cd/m ²) | Letter Luminance Range (cd/m ²) | Mean Background Luminance (cd/m ²) | Background Luminance Range (cd/m ²) | Luminance Contrast | | | | Lights Off | | Lights On | |
| | | | | | | | | | | | | | | | | | | | 100 ft | 150 ft | 100 ft | 150 ft |
| Circline Fluorescent | | | | | | | | | | | | | | | | | | | | | | |
| Beghelli Inc. | Pratica Bella Exit | 8320-SA2PX/US | panel | white | green | 2400 | 590 – 4400 | 400 | 160 – 760 | 0.83 | 1500 | 350 – 2500 | 260 | 94 – 420 | 0.83 | 21 | 0.67 | 31 | 2 | 8 | 2 | 8 |
| Compact Fluorescent | | | | | | | | | | | | | | | | | | | | | | |
| Hetherington Industries, Inc. | Series 132 | 132-(2)PL7-SF | stencil | red | aluminum | 310 | 31 – 1200 | 6.9 | 2.2 – 20 | 0.98 | N/A | N/A | N/A | N/A | N/A | 18 | 0.52 | 35 | 0 | 2 | 0 | 4 |
| INCON INDUSTRIES INC. | INCON | EX 100 | stencil | red | white | 270 | 23 – 1100 | 12 | 6.5 – 26 | 0.96 | N/A | N/A | N/A | N/A | N/A | 11 | 0.54 | 20 | 1 | 2 | 0 | 1 |
| KENALL | TRAILMATE | 6501-T | panel | red | white | 140 | 25 – 280 | 700 | 80 – 1800 | 0.80 | N/A | N/A | N/A | N/A | N/A | 14 | 0.42 | 33 | 0 | 5 | 0 | 3 |
| Lithonia Lighting | Titan Fluorescent | F2XS1R 120 | stencil | red | black | 420 | 210 – 1300 | 10 | 2.8 – 27 | 0.98 | N/A | N/A | N/A | N/A | N/A | 20 | 0.43 | 47 | 0 | 1 | 0 | 0 |
| Radiant Illumination Inc. | NXL "Excellence" (b) | ENXL-R | stencil | red | black | 220 | 110 – 470 | 6.6 | 3.0 – 13 | 0.97 | 130 | 55 – 270 | 4.0 | 1.9 – 7.0 | 0.97 | 29 | 0.57 | 51 | 0 | 2 | 0 | 1 |
| Radiant Illumination Inc. | VX "Vandal Proof" (b) | EVX-RA | panel | red | white | 51 | 19 – 110 | 520 | 160 – 1200 | 0.90 | 21 | 8.7 – 46 | 210 | 64 – 530 | 0.90 | 25 | 0.50 | 50 | 0 | 4 | 0 | 3 |
| USI Prescolite | Exit Lite | EX3PL1-REMFA | stencil | red | white | 110 | 20 – 880 | 4.4 | 2.3 – 11 | 0.96 | 35 | 6.1 – 220 | 2.9 | 1.7 – 4.0 | 0.92 | 10 | 0.55 | 19 | 0 | 4 | 1 | 5 |
| USI Prescolite | Exit Lite | EX3PL2-R | stencil | red | white | 120 | 17 – 530 | 4.8 | 2.6 – 10 | 0.96 | N/A | N/A | N/A | N/A | N/A | 14 | 0.39 | 36 | 0 | 6 | 5 | 9 |
| Electroluminescent | | | | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur Electroluminescent | CWGBB-I-LME | stencil | green | black | 12 | 10 – 13 | 0.27 | 0.13 – 0.61 | 0.98 | 61 | 53 – 73 | 1.7 | 0.58 – 3.4 | 0.97 | 4.3 | 0.76 | 5.7 | 0 | 4 | 0 | 6 |
| EMERGI-LITE | PRECEPTOR-Electroluminescent-master | ELPXN1R | stencil | red | aluminum | 3.5 | 3.2 – 3.7 | 0.08 | 0.05 – 0.12 | 0.98 | 20 | 18 – 22 | 0.42 | 0.26 – 0.68 | 0.98 | 3.2 | 0.48 | 6.7 | 0 | 2 | 5 | 10 |
| EMERGI-LITE | PRECEPTOR-Electroluminescent-slave | ELP1R-LL | stencil | red | aluminum | 2.9 | 2.7 – 3.1 | 0.08 | 0.05 – 0.10 | 0.97 | 11 | 10 – 12 | 0.23 | 0.14 – 0.49 | 0.98 | N/T | N/T | N/T | N/T | N/T | N/T | N/T |
| EMERGI-LITE | PRECEPTOR-Electroluminescent-master with slave attached | | stencil | red | aluminum | 3.5 | 3.1 – 3.7 | 0.08 | 0.04 – 0.12 | 0.98 | 13 | 12 – 14 | 0.26 | 0.15 – 0.79 | 0.98 | N/T | N/T | N/T | N/T | N/T | N/T | N/T |
| Lithonia Lighting | Signature Electroluminescent | ELES 1R120 | stencil | red | aluminum | 2.2 | 1.7 – 2.3 | 0.05 | 0.03 – 0.10 | 0.98 | N/A | N/A | N/A | N/A | N/A | 0.40 | 0.38 | 1.1 | 0 | 1 | 3 | 7 |
| USI Prescolite | Electroluminescent Exit Series | EL1516 | stencil | red | white | 2.8 | 2.5 – 2.9 | 0.07 | 0.03 – 0.21 | 0.98 | N/A | N/A | N/A | N/A | N/A | 0.40 | 0.36 | 1.1 | 0 | 1 | 0 | 4 |
| USI Prescolite | Electroluminescent Exit Series | EL1216-EN | stencil | red | white | 1.5 | 1.2 – 1.7 | 0.11 | 0.07 – 0.14 | 0.93 | 7.6 | 5.9 – 9.3 | 0.24 | 0.15 – 0.45 | 0.97 | 3.6 | 0.82 | 4.4 | 0 | 1 | 1 | 5 |
| Incandescent | | | | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur Light Panel | CWRNB-I-LP | stencil | red | aluminum | 15 | 9.4 – 27 | 0.95 | 0.75 – 1.3 | 0.94 | N/A | N/A | N/A | N/A | N/A | 13 | 0.95 | 14 | 0 | 3 | 2 | 8 |
| LED (Diffuser) | | | | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur LED | CSGBB-LED | stencil | green | black | 25 | 20 – 33 | 0.88 | 0.64 – 2.0 | 0.96 | N/A | N/A | N/A | N/A | N/A | 8.0 | 0.85 | 9.4 | 0 | 4 | 0 | 3 |
| Lithonia Lighting | Signature LE Series | LES 1R120/277 | matrix | red | aluminum | 38 | 18 – 53 | 3.8 | 3.0 – 5.7 | 0.90 | N/A | N/A | N/A | N/A | N/A | 6.0 | 0.41 | 15 | 0 | 1 | 0 | 3 |
| Teron Lighting Corp. | ULTRA LED | U12SN-SF-NA | stencil | red | white | 43 | 25 – 58 | 0.56 | 0.27 – 0.85 | 0.99 | N/A | N/A | N/A | N/A | N/A | 9.2 | 0.57 | 16 | 0 | 1 | 1 | 6 |
| TLS mfg., inc. | STDX | STDX-1X-R/A-BP | matrix | red | aluminum | 24 | 16 – 33 | 0.60 | 0.47 – 0.88 | 0.97 | 33 | 24 – 43 | 0.57 | 0.33 – 1.2 | 0.98 | 2.9 | 0.26 | 11 | 0 | 2 | 0 | 8 |
| LED (Prismatic Diffuser) | | | | | | | | | | | | | | | | | | | | | | |
| EMERGI-LITE | PRECEPTOR L.E.D. | LEDPXN1RCM | stencil | red | aluminum | 43 | 28 – 71 | 1.3 | 0.89 – 2.1 | 0.97 | 32 | 20 – 63 | 1.1 | 0.83 – 1.9 | 0.96 | 8.0 | 0.66 | 12 | 0 | 2 | 0 | 0 |
| Trace Lite Corporation | SlimLite | 1TRKND1 | stencil | red | black | 29 | 19 – 47 | 0.59 | 0.23 – 1.5 | 0.98 | N/A | N/A | N/A | N/A | N/A | 2.3 | 0.92 | 2.5 | 0 | 1 | 0 | 0 |
| LED (No Diffuser) | | | | | | | | | | | | | | | | | | | | | | |
| Computer Power Inc. | Illuminator-XD | XDNSP1RASVAA | matrix | red | aluminum | 150 | 58 – 230 | 6.2 | 3.7 – 9.3 | 0.96 | 140 | 75 – 230 | 6.5 | 5.0 – 8.9 | 0.96 | 8.0 | 0.87 | 9.2 | 0 | 2 | 0 | 0 |
| TLS mfg., inc. | LES EXIT | LES-1X-R/W-120 | matrix | red | white | 63 | 32 – 97 | 1.4 | 0.78 – 1.7 | 0.98 | N/A | N/A | N/A | N/A | N/A | 2.4 | 0.28 | 8.6 | 0 | 1 | 0 | 0 |
| Trace Lite Corporation | Executive Series | 1RKND8 | matrix | red | white | 100 | 63 – 150 | 2.8 | 2.1 – 4.3 | 0.97 | 100 | 57 – 150 | 2.7 | 1.9 – 4.0 | 0.97 | 4.8 | 0.93 | 5.2 | 0 | 1 | 0 | 4 |
| Radioluminescent | | | | | | | | | | | | | | | | | | | | | | |
| EMERGI-LITE | EverLite | W-SLX-20-61-R | stencil | green (c) | green | 0.41 | 0.23 – 0.48 | 0.00 | 0 – 0.03 | 1.00 | N/A | N/A | N/A | N/A | N/A | 0.00 | N/A | N/A | 4 | 11 | 0 | 9 |
| SPL, Inc. | EVERGLO | 710A | stencil | green (c) | red | 0.34 | 0.19 – 0.47 | 0.00 | 0 – 0.01 | 1.00 | N/A | N/A | N/A | N/A | N/A | 0.00 | N/A | N/A | 7 | 13 | 5 | 12 |
| SPL, Inc. | Omni-Glo | 700C-1(10) | stencil | green (c) | red | 0.26 | 0.19 – 0.29 | 0.00 | 0 – 0.01 | 1.00 | N/A | N/A | N/A | N/A | N/A | 0.00 | N/A | N/A | 9 | 13 | 0 | 5 |
| SRB Technologies | Betalux-E | 171-R-20 | stencil | green (c) | red | 0.35 | 0.28 – 0.47 | 0.00 | 0 – 0.02 | 1.00 | N/A | N/A | N/A | N/A | N/A | 0.00 | N/A | N/A | 5 | 13 | 1 | 9 |

N/A = not applicable
 N/T = not tested
 1 ft = 0.30 m
 1 cd/m² = 0.29 fL

Notes

- NLP-IP measured data for one sample of each sign. All luminance and power measurements are rounded to two significant figures, except where this would exceed the measurement precision.
- (a) The presence of a battery may increase the active power of a sign.
- (b) This sign uses a linear T5 fluorescent lamp.
- (c) In the presence of room lighting, the letters appear white.

Table 4. NLP-IP-Measured Data: Retrofit Kits (listed by type of retrofit light source)

| Manufacturer | Trade Name | Catalog No. | Mean Letter Luminance (cd/m ²) | Letter Luminance Range (cd/m ²) | Mean Background Luminance (cd/m ²) | Background Luminance Range (cd/m ²) | Luminance Contrast | Active Power (W) at 120V | Power Factor at 120V | Apparent Power (rms VA) at 120V | Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance) | | | |
|-------------------------------|----------------------------|------------------|--|---|--|---|--------------------|--------------------------|----------------------|---------------------------------|---|--------|-----------|--------|
| | | | | | | | | | | | Lights Off | | Lights On | |
| | | | | | | | | | | | 100 ft | 150 ft | 100 ft | 150 ft |
| Host Sign | | | | | | | | | | | | | | |
| Lithonia Lighting | Quantum | QMSW3R120 | 110 | 44 – 210 | 3.9 | 1.1 – 27 | 0.96 | 23 | 1.0 | 23 | 0 | 3 | 0 | 2 |
| Compact Fluorescent | | | | | | | | | | | | | | |
| Brownlee Lighting | Fluorescent Exit Converter | 3080-6 | 140 | 39 – 340 | 3.6 | 1.2 – 7.9 | 0.97 | 11 | 0.50 | 22 | 0 | 0 | 0 | 5 |
| Brownlee Lighting | PL Exit Converter | 3090-2x9 (a) | 430 | 66 – 3200 | 13 | 3.7 – 57 | 0.97 | 12 | 0.58 | 21 | 1 | 5 | 0 | 6 |
| Brownlee Lighting | PL Exit Converter | 3150-9 | 400 | 65 – 1600 | 12 | 4.3 – 37 | 0.97 | 10 | 0.58 | 17 | 0 | 4 | 0 | 2 |
| Brownlee Lighting | PL Exit Converter | 3170-2x5 | 390 | 120 – 1500 | 15 | 8.4 – 33 | 0.96 | 17 | 0.45 | 38 | 0 | 2 | 0 | 2 |
| ENERSAVE Co. | Pow-R-Saver (b) | PSE/SC | 140 | 30 – 520 | 3.9 | 2.0 – 9.7 | 0.97 | 8.9 | 0.46 | 19 | 0 | 1 | 0 | 4 |
| ENERSAVE Co. | Pow-R-Saver | PSE/TT/SC | 440 | 48 – 2100 | 11 | 4.4 – 36 | 0.97 | 10 | 0.55 | 18 | 0 | 2 | 0 | 2 |
| ENERSAVE Co. | Pow-R-Saver (b) | PSE/2F/SC (a) | 170 | 23 – 650 | 5.0 | 2.2 – 13 | 0.97 | 9.5 | 0.45 | 21 | 0 | 1 | 1 | 4 |
| ENERSAVE Co. | Pow-R-Saver | PSE/2TT/SC (a) | 440 | 98 – 1200 | 17 | 5.2 – 52 | 0.96 | 10 | 0.58 | 17 | 0 | 4 | 0 | 5 |
| Hetherington Industries, Inc. | Series 107 | 107-012D-504 | 270 | 43 – 870 | 6.7 | 1.7 – 20 | 0.98 | 19 | 0.48 | 40 | 0 | 4 | 2 | 4 |
| INCON INDUSTRIES INC. | INCON | ER 64 | 260 | 23 – 1700 | 8.0 | 2.9 – 29 | 0.97 | 11 | 0.48 | 23 | 0 | 1 | 0 | 1 |
| JANMAR Lighting | Series 230 | 230-5-L | 420 | 56 – 1200 | 14 | 5.0 – 48 | 0.97 | 15 | 0.43 | 35 | 0 | 3 | 0 | 1 |
| JANMAR Lighting | Series 230 | 230-7-L | 590 | 79 – 1800 | 27 | 9.0 – 76 | 0.95 | 17 | 0.48 | 35 | 0 | 4 | 0 | 1 |
| JANMAR Lighting | Series 230 | 230-9-L | 420 | 97 – 1700 | 22 | 11 – 67 | 0.95 | 9.3 | 0.58 | 16 | 0 (c) | 3 (c) | 0 | 2 |
| Mule Emergency Lighting, Inc. | Retro-X | 963020 | 330 | 51 – 1900 | 9.5 | 2.6 – 37 | 0.97 | 8.9 | 0.56 | 16 | 0 | 5 | 0 | 4 |
| ProLight | ProLight | EMX1-SIC | 520 | 49 – 2900 | 14 | 6.5 – 37 | 0.97 | 11 | 0.53 | 21 | 0 | 1 | 0 | 1 |
| ProLight | ProLight | EMX21-SIC (a) | 220 | 47 – 1600 | 8.6 | 4.8 – 23 | 0.96 | 11 | 0.55 | 20 | 0 | 4 | 1 | 3 |
| ProLight | ProLight | EMX22-SIC | 290 | 64 – 1500 | 11 | 5.7 – 24 | 0.96 | 16 | 0.41 | 39 | 1 | 1 | 0 | 0 |
| OSRAM SYLVANIA INC. | EX120/9TT | 29094 | 490 | 110 – 2100 | 14 | 4.3 – 44 | 0.97 | 11 | 0.58 | 19 | 0 | 4 | 0 | 1 |
| Teron Lighting Corp. | Tee Shot | TL9-FF-SC (a) | 400 | 110 – 1200 | 15 | 3.0 – 54 | 0.96 | 9.5 | 0.53 | 18 | 0 | 2 | 0 | 4 |
| Teron Lighting Corp. | Tee Shot | TL9-SC | 450 | 41 – 2700 | 11 | 3.5 – 44 | 0.98 | 8.9 | 0.58 | 15 | 0 | 5 | 0 | 5 |
| Electroluminescent | | | | | | | | | | | | | | |
| Loctite Luminescent Systems | E.R.K.ONOMIZER (d) | 6983-1 | 21 | 20 – 23 | 0.59 | 0.22 – 1.2 | 0.97 | 0.39 | 0.27 | 1.4 | 1 | 3 | 11 | 13 |
| Incandescent | | | | | | | | | | | | | | |
| Flexlite, Inc. | Exlite | FL 120-C | 36 | 16 – 65 | 0.84 | 0.30 – 1.8 | 0.98 | 8.4 | 1.0 | 8.4 | 0 | 2 | 3 | 9 |
| Martek Industries Inc. | Permalite | PML | 23 | 8.6 - 53 | 0.92 | 0.53 – 1.7 | 0.96 | 9.7 | 1.0 | 9.7 | 0 | 0 | 2 | 5 |
| Standard Enterprises, Inc. | EternaLamp | ETS/120 | 33 | 12 – 73 | 1.9 | 1.4 – 2.5 | 0.94 | 17 | 1.0 | 17 | 0 | 4 | 0 | 6 |
| Teron Lighting Corp. | FLEX | FT10-C | 26 | 5.3 – 64 | 0.69 | 0.30 – 2.0 | 0.97 | 7.8 | 1.0 | 7.8 | 0 | 4 | 4 | 7 |
| LED | | | | | | | | | | | | | | |
| Computer Power Inc. | AstraLite | RETRO-I1R6AAA | 25 | 16 – 34 | 1.2 | 0.87 – 1.9 | 0.95 | 1.6 | 0.16 | 10 | 0 | 3 | 1 | 4 |
| Energy-Wise Lighting, Inc. | Retro-Ex.87 Universal (e) | Retro-Ex.87 Univ | 460 | 290 – 630 | 8.4 | 3.2 – 18 | 0.98 | 0.84 | 0.10 | 8.4 | 0 | 2 | 0 | 1 |
| Teron Lighting Corp. | ULTRA Retrofit (e) | U12R-SF-NA | 47 | 27 – 72 | 0.78 | 0.51 – 1.1 | 0.98 | 9.4 | 0.57 | 16 | 0 | 1 | 1 | 6 |

1 ft = 0.30 m

1 cd/m² = 0.29 fL

Notes

NLP-IP measured data for one sample of each retrofit kit. All luminance and power measurements are rounded to two significant figures.

- (a) This retrofit kit contains two lamps, but only one operates at a time.
- (b) This kit uses a linear T5 fluorescent lamp.
- (c) Data are from 13 subjects only.

- (d) This retrofit kit did not use the red filter of the host sign because the retrofit kit emits green light.
- (e) This retrofit kit was not installed within the host sign because it consists of a replacement faceplate; it was evaluated as submitted.

Table 5. Calculated Data: Visibility in Smoke for Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Catalog No. | Sign Type | Letter Color | Background Color | Clear-Air Conditions | | | | | | Smoke Simulations | | | | | | | |
|---------------------------------|---|----------------|-----------|--------------|------------------|--|--|--------------------|--|--|--------------------|---|---|-----------------------------|------------------------|---|---|-----------------------------|------------------------|
| | | | | | | Regulated Power Supply | | | Battery-Operated | | | Regulated Power Supply | | | Battery-Operated | | | | |
| | | | | | | Mean Letter Luminance (cd/m ²) | Mean Background Luminance (cd/m ²) | Luminance Contrast | Mean Letter Luminance (cd/m ²) | Mean Background Luminance (cd/m ²) | Luminance Contrast | Mean Letter Luminance at 16 ft (cd/m ²) | Mean Background Luminance at 16 ft (cd/m ²) | Luminance Contrast at 16 ft | Critical Distance (ft) | Mean Letter Luminance at 16 ft (cd/m ²) | Mean Background Luminance at 16 ft (cd/m ²) | Luminance Contrast at 16 ft | Critical Distance (ft) |
| Circline Fluorescent | | | | | | | | | | | | | | | | | | | |
| Beghelli Inc. | Pratica Bella Exit | 8320-SA2PX/US | panel | white | green | 2400 | 400 | 0.83 | 1500 | 260 | 0.83 | 75 | 35 | 0.53 | 41 | 47 | 23 | 0.52 | 40 |
| Compact Fluorescent | | | | | | | | | | | | | | | | | | | |
| Hetherington Industries, Inc. | Series 132 | 132-(2)PL7-SF | stencil | red | aluminum | 310 | 6.9 | 0.98 | N/A | N/A | N/A | 9.5 | 3.3 | 0.66 | 35 | N/A | N/A | N/A | N/A |
| INCON INDUSTRIES INC. | INCON | EX 100 | stencil | red | white | 270 | 12 | 0.96 | N/A | N/A | N/A | 8.6 | 3.3 | 0.62 | 35 | N/A | N/A | N/A | N/A |
| KENALL | TRAILMATE | 6501-T | panel | red | white | 140 | 700 | 0.80 | N/A | N/A | N/A | 20 | 27 | 0.28 | 40 | N/A | N/A | N/A | N/A |
| Lithonia Lighting | Titan Fluorescent | F2XS1R 120 | stencil | red | black | 420 | 10 | 0.98 | N/A | N/A | N/A | 13 | 4.3 | 0.67 | 36 | N/A | N/A | N/A | N/A |
| Radiant Illumination Inc. | NXL "Excellence" (a) | E-NXL-R | stencil | red | black | 220 | 6.6 | 0.97 | 130 | 4.0 | 0.97 | 6.9 | 2.3 | 0.66 | 34 | 3.9 | 1.3 | 0.66 | 31 |
| Radiant Illumination Inc. | VX "Vandal Proof" (a) | EVX-RA | panel | red | white | 51 | 520 | 0.90 | 21 | 210 | 0.90 | 10 | 18 | 0.42 | 38 | 4.3 | 7.3 | 0.41 | 35 |
| USI Prescolite | Exit Lite | EX3PL1-REMFA | stencil | red | white | 110 | 4.4 | 0.96 | 35 | 2.9 | 0.92 | 3.6 | 1.2 | 0.67 | 31 | 1.1 | 0.42 | 0.63 | 25 |
| USI Prescolite | Exit Lite | EX3PL2-R | stencil | red | white | 120 | 4.8 | 0.96 | N/A | N/A | N/A | 4.0 | 1.5 | 0.62 | 32 | N/A | N/A | N/A | N/A |
| Electroluminescent | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur Electroluminescent | CWGBB-I-LME | stencil | green | black | 12 | 0.27 | 0.98 | 61 | 1.7 | 0.97 | 0.31 | 0.05 | 0.84 | 19 | 1.8 | 0.56 | 0.69 | 28 |
| EMERGI-LITE | PRECEPTOR-Electroluminescent-master | ELPXN1R | stencil | red | aluminum | 3.5 | 0.08 | 0.98 | 20 | 0.42 | 0.98 | 0.0 | 0.0 | — | 14 | 0.59 | 0.16 | 0.73 | 21 |
| EMERGI-LITE | PRECEPTOR-Electroluminescent-slave | ELP1R-LL | stencil | red | aluminum | 2.9 | 0.08 | 0.97 | 11 | 0.23 | 0.98 | 0.0 | 0.0 | — | 14 | 0.30 | 0.04 | 0.87 | 18 |
| EMERGI-LITE | PRECEPTOR-Electroluminescent-master with slave attached | | stencil | red | aluminum | 3.5 | 0.08 | 0.98 | 13 | 0.26 | 0.98 | 0.0 | 0.0 | — | 14 | 0.30 | 0.05 | 0.84 | 18 |
| Lithonia Lighting | Signature Electroluminescent | ELES 1R120 | stencil | red | aluminum | 2.2 | 0.05 | 0.98 | N/A | N/A | N/A | 0.0 | 0.0 | — | 13 | N/A | N/A | N/A | N/A |
| USI Prescolite | Electroluminescent Exit Series | EL1516 | stencil | red | white | 2.8 | 0.07 | 0.98 | N/A | N/A | N/A | 0.0 | 0.0 | — | 13 | N/A | N/A | N/A | N/A |
| USI Prescolite | Electroluminescent Exit Series | EL1216-EN | stencil | red | aluminum | 1.5 | 0.11 | 0.93 | 7.6 | 0.24 | 0.97 | 0.0 | 0.0 | — | 11 | 0.29 | 0.0 | 1.0 | 18 |
| Incandescent | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur Light Panel | CWRNB-I-LP | stencil | red | aluminum | 15 | 0.95 | 0.94 | N/A | N/A | N/A | 0.46 | 0.15 | 0.67 | 21 | N/A | N/A | N/A | N/A |
| LED (Diffuser) | | | | | | | | | | | | | | | | | | | |
| Dual Lite | Excalibur LED | CSGGB-LED | stencil | green | black | 25 | 0.88 | 0.96 | N/A | N/A | N/A | 0.63 | 0.13 | 0.79 | 22 | N/A | N/A | N/A | N/A |
| Lithonia Lighting | Signature LE Series | LES 1R120/277 | matrix | red | aluminum | 38 | 3.8 | 0.90 | N/A | N/A | N/A | 1.1 | 0.39 | 0.64 | 26 | N/A | N/A | N/A | N/A |
| Teron Lighting Corp. | ULTRA LED | U12SN-SF-NA | stencil | red | white | 43 | 0.56 | 0.99 | N/A | N/A | N/A | 1.0 | 0.24 | 0.77 | 23 | N/A | N/A | N/A | N/A |
| TLS mfg., inc. | STDX | STDX-1X-R/A-BP | matrix | red | aluminum | 24 | 0.60 | 0.97 | 33 | 0.57 | 0.98 | 0.62 | 0.14 | 0.78 | 22 | 0.85 | 0.23 | 0.73 | 23 |
| LED (Prismatic Diffuser) | | | | | | | | | | | | | | | | | | | |
| EMERGI-LITE | PRECEPTOR L.E.D. | LEDPXN1RCM | stencil | red | aluminum | 43 | 1.3 | 0.97 | 32 | 1.1 | 0.96 | 1.1 | 0.30 | 0.73 | 25 | 0.85 | 0.27 | 0.68 | 23 |
| Trace Lite Corporation | SlimLite | 1TRKND1 | stencil | red | black | 29 | 0.59 | 0.98 | N/A | N/A | N/A | 0.81 | 0.26 | 0.69 | 23 | N/A | N/A | N/A | N/A |
| LED (No Diffuser) | | | | | | | | | | | | | | | | | | | |
| Computer Power Inc. | Illuminator-XD | XDNSP1RASVAA | matrix | red | aluminum | 150 | 6.2 | 0.96 | 140 | 6.5 | 0.96 | 3.8 | 1.0 | 0.73 | 31 | 3.6 | 0.91 | 0.74 | 31 |
| TLS mfg., inc. | LES EXIT | LES-1X R/W-120 | matrix | red | white | 63 | 1.4 | 0.98 | N/A | N/A | N/A | 1.6 | 0.36 | 0.77 | 27 | N/A | N/A | N/A | N/A |
| Trace Lite Corporation | Executive Series | 1RKND1 | matrix | red | white | 100 | 2.8 | 0.97 | 100 | 2.7 | 0.97 | 2.5 | 0.65 | 0.75 | 30 | 2.5 | 0.60 | 0.76 | 30 |

N/A = not applicable
 1 ft = 0.30 m
 1 cd/m² = 0.29 fL

Notes

Calculated smoke simulation values are based on measurements in clear-air conditions.
 All luminance measurements are rounded to two significant figures, except where this would exceed the measurement precision.

Luminance contrast was not calculated where either mean letter luminance or mean background luminance was 0.00.

(a) This sign uses a linear T5 fluorescent lamp.

Table 6. Calculated Data: Visibility in Smoke for Retrofit Kits (listed by type of retrofit light source)

| Manufacturer | Trade Name | Catalog No. | Clear-Air Conditions | | | Smoke Simulations | | | |
|-------------------------------|----------------------------|------------------|--|--|--------------------|---|---|-----------------------------|------------------------|
| | | | Mean Letter Luminance (cd/m ²) | Mean Background Luminance (cd/m ²) | Luminance Contrast | Mean Letter Luminance at 16 ft (cd/m ²) | Mean Background Luminance at 16 ft (cd/m ²) | Luminance Contrast at 16 ft | Critical Distance (ft) |
| Host Sign | | | | | | | | | |
| Lithonia Lighting | Quantum | QMSW3R120 | 110 | 3.9 | 0.96 | 3.4 | 1.2 | 0.64 | 31 |
| Compact Fluorescent | | | | | | | | | |
| Brownlee Lighting | Fluorescent Exit Converter | 3080-6 | 140 | 3.6 | 0.97 | 4.6 | 1.6 | 0.65 | 32 |
| Brownlee Lighting | PL Exit Converter | 3090-2x9 (a) | 430 | 13 | 0.97 | 14 | 5.3 | 0.63 | 37 |
| Brownlee Lighting | PL Exit Converter | 3150-9 | 400 | 12 | 0.97 | 13 | 5.0 | 0.63 | 37 |
| Brownlee Lighting | PL Exit Converter | 3170-2x5 | 390 | 15 | 0.96 | 12 | 3.8 | 0.68 | 36 |
| ENERSAVE Co. | Pow-R-Saver (b) | PSE/SC | 140 | 3.9 | 0.97 | 4.2 | 1.4 | 0.68 | 31 |
| ENERSAVE Co. | Pow-R-Saver | PSE/TT/SC | 440 | 11 | 0.97 | 14 | 4.8 | 0.66 | 37 |
| ENERSAVE Co. | Pow-R-Saver (b) | PSE/2F/SC167 (a) | 170 | 5.0 | 0.97 | 5.0 | 1.6 | 0.69 | 32 |
| ENERSAVE Co. | Pow-R-Saver | PSE/2TT/SC (a) | 440 | 17 | 0.96 | 15 | 6.1 | 0.59 | 38 |
| Hetherington Industries, Inc. | Series 107 | 107-012D-504 | 270 | 6.7 | 0.98 | 8.7 | 3.0 | 0.66 | 35 |
| INCON INDUSTRIES INC. | INCON | ER 64 | 260 | 8.0 | 0.97 | 9.2 | 3.7 | 0.60 | 36 |
| JANMAR Lighting | Series 230 | 230-5-L | 420 | 14 | 0.97 | 13 | 5.0 | 0.63 | 37 |
| JANMAR Lighting | Series 230 | 230-7-L | 590 | 27 | 0.95 | 19 | 7.5 | 0.61 | 38 |
| JANMAR Lighting | Series 230 | 230-9-L | 420 | 22 | 0.95 | 14 | 5.3 | 0.61 | 37 |
| Mule Emergency Lighting, Inc. | Retro-X | 963020 | 330 | 9.5 | 0.97 | 11 | 4.4 | 0.60 | 36 |
| ProLight | ProLight | EMX1-SIC | 520 | 14 | 0.97 | 16 | 4.7 | 0.70 | 37 |
| ProLight | ProLight | EMX21-SIC (a) | 220 | 8.6 | 0.96 | 7.0 | 2.5 | 0.64 | 35 |
| ProLight | ProLight | EMX22-SIC | 290 | 11 | 0.96 | 9.4 | 3.4 | 0.64 | 36 |
| OSRAM SYLVANIA INC. | EX120/9TT | 29094 | 490 | 14 | 0.97 | 16 | 5.6 | 0.65 | 37 |
| Teron Lighting Corp. | Tee Shot | TL9-FF-SC (a) | 400 | 15 | 0.96 | 14 | 6.4 | 0.56 | 37 |
| Teron Lighting Corp. | Tee Shot | TL9-SC | 450 | 11 | 0.98 | 14 | 4.7 | 0.67 | 37 |
| Electroluminescent | | | | | | | | | |
| Loctite Luminescent Systems | E.R.K.ONOMIZER (c) | 6983-1 | 21 | 0.59 | 0.97 | 0.60 | 0.21 | 0.65 | 22 |
| Incandescent | | | | | | | | | |
| Flexlite, Inc. | Exlite | FL 120-C | 36 | 0.84 | 0.98 | 1.1 | 0.37 | 0.67 | 26 |
| Martek Industries Inc. | Permalite | PML | 23 | 0.92 | 0.96 | 0.69 | 0.25 | 0.64 | 22 |
| Standard Enterprises, Inc. | EternaLamp | ETS/120 | 33 | 1.9 | 0.94 | 1.0 | 0.41 | 0.59 | 25 |
| Teron Lighting Corp. | FLEX | FT10-C | 26 | 0.69 | 0.97 | 0.70 | 0.27 | 0.62 | 23 |
| LED | | | | | | | | | |
| Computer Power Inc. | AstraLite | RETRO-I1R6AAA | 25 | 1.2 | 0.95 | 0.75 | 0.33 | 0.56 | 25 |
| Energy-Wise Lighting, Inc. | Retro-Ex.87 Universal (d) | Retro-Ex.87 Univ | 460 | 8.4 | 0.98 | 11 | 1.9 | 0.82 | 33 |
| Teron Lighting Corp. | ULTRA Retrofit (d) | U12R-SF-NA | 47 | 0.78 | 0.98 | 1.1 | 0.26 | 0.77 | 24 |

1 ft = 0.30 m

1 cd/m² = 0.29 fL

Notes

Calculated smoke simulation values are based on measurements in clear-air conditions. All luminance measurements are rounded to two significant figures, except where this would exceed the measurement precision.

- (a) This retrofit kit contains two lamps, but only one operates at a time.
- (b) This retrofit kit uses a linear T5 fluorescent lamp.

(c) This retrofit kit did not use the red filter of the host sign because the retrofit kit emits green light.

(d) This retrofit kit was not installed within the host sign because it consists of a replacement faceplate; it was evaluated as submitted.

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NATIONAL LIGHTING PRODUCT INFORMATION PROGRAM

Specifier Reports

Exit Signs

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Specifier Reports *Supplements*

Exit Signs

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This publication is a supplement to *Specifier Reports: Exit Signs*, published in January 1994. It contains information on energy-efficient, single-faced exit signs and retrofit conversion kits that presently are on the market, but that the National Lighting Product Information Program (NLPIP) did not test in the original *Specifier Reports*, either because the manufacturer did not submit them or because they had not yet been introduced to the market. The tables in this supplement contain information supplied by the manufacturers of the products and the results of product tests conducted by NLPIP. Manufacturers that submitted product information and sample products to NLPIP by October 1, 1994, are included. NLPIP performed product testing from October to December 1994 at the Lighting Research Center's Niagara Mohawk Lighting Research Laboratory in Watervliet, New York.

The tables in this supplement contain data for the same performance characteristics that were presented in the original publication. To facilitate comparisons between products in this report and products in the earlier publication, the format and testing procedures are identical to those of the earlier publication, with one exception. For this supplement, exit signs were operated on a regulated power supply at 120 ± 0.5 volts (V) ac, not 120 ± 0.1 V ac; NLPIP believes that this difference in voltage tolerance is negligible.

Each retrofit kit was installed (according to the manufacturer's instructions) in the same brand and model host sign used in the earlier report. As in the earlier publication, all of the full exit signs in Table 1 conform to Underwriters Laboratories Standard 924 (Underwriters Laboratories 1991). The UL status of the retrofit kits is listed in Table 2.

A noteworthy addition in this supplement is the evaluation of three edge-lit exit signs. For edge-lit exit signs that have a clear (see-through) backing, the contrast of the sign letters to the surrounding material is affected by what is behind the sign. NLPIP therefore evaluated the performance of the edge-lit signs with the signs placed in front of a matte black background.

For information regarding the application of exit signs and retrofit kits and an explanation of the terms used in the tables, consult *Specifier Reports: Exit Signs*.

Table 1. Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Number of Light Sources | Rated Active Power (W) at | | Power Factor at | | Rated Lamp Life (yr) | Battery Mode | Battery Type | Battery Operating Time (h) | Battery Recharge Time (h) | Low Battery Voltage Disconnect |
|----------------------------------|--|-------------------------|---------------------------|-------|-------------------|-------|----------------------|--------------|------------------------------------|----------------------------|---------------------------|--------------------------------|
| | | | 120 V | 277 V | 120 V | 277 V | | | | | | |
| Compact Fluorescent | | | | | | | | | | | | |
| Sure-Lites | ELX Series Fluorescent Edgelit Exit ^b | 2 | 23.0 | 25.0 | 0.56 | 0.6 | 0.86 | yes | nickel cadmium 6 V | 1.5 | <24 | yes |
| Sure-Lites | Pinnacle Die Cast Exit | 2 | 27.0 | 24.0 | 0.59 | 0.66 | 1.1 | yes | lead calcium or nickel cadmium 6 V | 1.5 | <24 | yes |
| Sure-Lites | Steel Compact Fluorescent Exit | 2 | 15.0 | 23.0 | 0.39 | 0.30 | 1.1 | yes | lead calcium or nickel cadmium 6 V | 1.5 or 2 | <24 | yes |
| Incandescent | | | | | | | | | | | | |
| Big Beam Emergency Systems, Inc. | DLWX | 2 | 12.5 | 13.8 | 0.92 | 0.98 | 2.3 | no | NA | NA | NA | NA |
| Big Beam Emergency Systems, Inc. | EDLWX | 2 | 16.0 | 16.0 | 0.95 | 0.95 | 2.3 | yes | nickel cadmium 4.8 V | 1.5 | 24 | yes |
| Big Beam Emergency Systems, Inc. | ELWX | 2 | 16.0 | 16.0 | 0.95 | 0.95 | 2.3 | yes | nickel cadmium 4.8 V | 1.5 | 24 | yes |
| Big Beam Emergency Systems, Inc. | LWX | 2 | 12.5 | 13.8 | 0.92 | 0.98 | 2.3 | no | NA | NA | NA | NA |
| LED (Diffuser) | | | | | | | | | | | | |
| ALKCO | LED EDGE-GLO | 24 | NS | NS | NS | NS | 11.4 | yes | lead acid | 2 | 24 | NS |
| Big Beam Emergency Systems, Inc. | DXLS | 24 | 1.7 | 1.7 | 0.24 ^e | 0.10 | 100 | no | NA | NA | NA | NA |
| Big Beam Emergency Systems, Inc. | EDXLS | 24 | 1.7 | 1.7 | 0.24 ^e | 0.10 | 100 | yes | nickel cadmium 7.2 V | 3 | 24 | yes |
| Big Beam Emergency Systems, Inc. | EXFL | 24 | 1.7 | 1.7 | 0.24 ^e | 0.10 | 100 | yes | nickel cadmium 7.2 V | 3 | 24 | yes |
| Big Beam Emergency Systems, Inc. | XFL | 24 | 1.7 | 1.7 | 0.24 ^e | 0.10 | 100 | no | NA | NA | NA | NA |
| Chloride Systems | Infinity Series II (ac only) | 60 | 1.8 | 3.6 | 0.87 | 0.77 | NS | no | NA | NA | NA | NA |
| Chloride Systems | Infinity Series II | 30 | 8.6 | 8.5 | 0.90 | 0.88 | NS | yes | nickel cadmium | 1.5 | 72 | yes |
| Emergi-Lite | Escort Series | 40 | 1.7 | 1.7 | 0.16 | 0.16 | 20 | yes | lead calcium 6 V | 1.5 | 168 | yes |

NA = not applicable

NS = not supplied

1 lb = 0.45 kg

^a All signs use the same lamp for operating under both utility power and emergency power systems unless otherwise noted. The expression "inc. lum." indicates increased sign luminance under emergency conditions; "no" indicates that the sign does not have any of the emergency options described in the "Data Tables" section of *Specifier Reports: Exit Signs* (p. 15).

^b This sign uses a linear T5 fluorescent lamp.

^c Warranty is prorated based on how many years of the warranty have elapsed.

^d This sign uses an incandescent lamp as an emergency light source.

^e High power factor is available on this sign.

| Brown-out Circuitry | Auto Discharge/ Recharge Cycle | Emergency Options ^a | Sign Format(s) | Available Color(s) of Letters | Available Color(s) of Background | Housing Material | Weight (lb) | Mounting | Impact Resistant | Tamper Resistant | Warranty Period (yr) | Warranty on Internal Battery (yr) |
|---------------------|--------------------------------|------------------------------------|--------------------|-------------------------------|--|-------------------------|-------------|---|------------------|------------------|----------------------|-----------------------------------|
| yes | no | no | edge lit | green, red, white | clear, green, mirror, red, white | aluminum, steel | 20.0 | bracket, ceiling, wall | no | no | 1 | 1 full + 14 prorata ^C |
| yes | no | inc. lum. | stencil, panel | green, red, white | aluminum, black, bronze, green, red, white | aluminum | 10.0 | bracket, ceiling, recessed, universal, wall | yes | yes | 1 | 1 full + 14 prorata ^C |
| yes | no | flash, flash and buzz ^d | stencil, panel | green, red, white | aluminum, black, green, red, white | steel | 6.0 | bracket, ceiling, pendant, universal, wall | yes | yes | 1 | 1 full + 14 prorata ^C |
| NA | NA | no | stencil, open face | green, red, white | aluminum, black, green, red, white | die-cast aluminum | 10.0 | bracket, ceiling, wall | no | yes | lifetime | NA |
| yes | no | flash ^d | stencil, open face | green, red, white | aluminum, black, green, red, white | die-cast aluminum | 11.0 | bracket, ceiling, wall | no | yes | lifetime | 1 full + 10 prorata ^C |
| yes | no | flash ^d | stencil, open face | green, red, white | black, green, matte chrome, red, white | steel | 5.0 | bracket, ceiling, pendant, universal, wall | no | yes | lifetime | 1 full + 10 prorata ^C |
| NA | NA | no | stencil, open face | green, red, white | black, green, matte chrome, red, white | steel | 4.0 | bracket, ceiling, pendant, universal, wall | no | yes | lifetime | NA |
| NS | NS | no | edge lit | red | clear, white | steel | 5.0 | bracket, ceiling, recessed, wall | NS | no | lifetime | NS |
| NA | NA | no | stencil | red | aluminum, black | die-cast aluminum | 10.0 | bracket, ceiling, wall | no | yes | lifetime | NA |
| yes | no | inc. lum. | stencil | red | aluminum, black | die-cast aluminum | 11.0 | bracket, ceiling, wall | no | yes | lifetime | 1 full + 10 prorata ^C |
| yes | no | inc. lum. | stencil | red | black, matte chrome, white | steel | 5.0 | bracket, ceiling, pendant, universal, wall | no | yes | lifetime | 1 full + 10 prorata ^C |
| NA | NA | no | stencil | red | black, matte chrome, white | steel | 4.0 | bracket, ceiling, pendant, universal, wall | no | yes | lifetime | NA |
| NA | NA | no | stencil | green, red | black, white | thermoplastic | 2.0 | bracket, ceiling, universal, wall | yes | yes | 5 | NA |
| yes | no | inc. lum., flash, flash and buzz | stencil | green, red | black, white | thermoplastic | 2.5 | bracket, ceiling, universal, wall | yes | yes | 5 | 1 full + 7 prorata ^C |
| yes | yes | flash | stencil | red | aluminum, black, white | plastic (polycarbonate) | 2.5 | bracket, ceiling, pendant, universal, wall | yes | yes | 3 (sign), 5 (lights) | 3 full + 3 prorata ^C |

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Number of Light Sources | Rated Active Power (W) at | | Power Factor at | | Rated Lamp Life (yr) | Battery Mode | Battery Type | Battery Operating Time (h) | Battery Recharge Time (h) | Low Battery Voltage Disconnect |
|-----------------------------------|---------------------------|-------------------------|---------------------------|------------------------|--------------------------|--------------------------|----------------------|--------------|------------------------------------|----------------------------|---------------------------|--------------------------------|
| | | | 120 V | 277 V | 120 V | 277 V | | | | | | |
| LED (Diffuser) (continued) | | | | | | | | | | | | |
| Emergi-Lite | Preceptor Series | 40 | 1.7 | 1.7 | 0.16 | 0.16 | 20 | yes | lead calcium 6 V | 1.5 | 168 | yes |
| Emergi-Lite | X10 Series | 40 | 1.7 | 1.7 | 0.16 | 0.16 | 20 | yes | lead calcium or nickel cadmium 6 V | 1.5 | 168 | yes |
| Emergi-Lite | X40 Series | 76 | 3.8 | 3.8 | 0.47 | 0.47 | 20 | yes | nickel cadmium 6 V | 1.5 | 168 | yes |
| Exide Lightguard | E700/750 Series (ac only) | 60 | 1.8 | 3.6 | 0.87 | 0.77 | NS | no | NA | NA | NA | NA |
| Exide Lightguard | E700/750 Series | 30 | 8.6 | 8.5 | 0.90 | 0.88 | NS | yes | nickel cadmium | 1.5 | 72 | yes |
| Kenall Mfg. Company | Trailmate | NS | 3.2 | 3.2 | NS | NS | 25 | yes | lead calcium 6 V | 5 | 24 | yes |
| Mule | Embassy | 32 | 1.8 | 1.9 | 0.15 | 0.15 | 85.6 | yes | lead calcium 6 V | 1.5 | 12 | yes |
| Sure-Lites | Pinnacle Die Cast Exit | 147 (red), 125 (green) | 7.6 (red), 7.0 (green) | 7.9 (red), 7.2 (green) | 0.77 (red), 0.76 (green) | 0.76 (red), 0.75 (green) | >28.5 | yes | nickel cadmium 6 V | 1.5 | <24 | yes |
| Sure-Lites | Pinnacle Die Cast Exit | 147 (red), 125 (green) | 8.8 (red), 8.5 (green) | 9.2 (red), 8.8 (green) | 0.81 (red), 0.82 (green) | 0.81 (red), 0.82 (green) | >28.5 | yes | nickel cadmium 6 V | 1.5 | <24 | yes |
| Sure-Lites | Standard Steel LED Exit | 40 | 1.8 | 2.6 | >0.17 | >0.09 | 28.5 | yes | lead calcium or nickel cadmium 6 V | 1.5 or 2 | <24 | yes |
| Sure-Lites | Thin Profile LED Exit | 147 (red), 125 (green) | 8.8 (red), 8.5 (green) | 9.2 (red), 8.8 (green) | 0.81 (red), 0.82 (green) | 0.81 (red), 0.82 (green) | >28.5 | yes | nickel cadmium 6 V | 1.5 | <24 | yes |
| LED (Prismatic Diffuser) | | | | | | | | | | | | |
| Self-Powered Lighting, Inc. | HJ-5 | 66 | 5.0 | 5.0 | 0.80 | 0.80 | 80 | yes | lead calcium or nickel cadmium 6 V | 3 | 24 | no |
| Self-Powered Lighting, Inc. | SW-1 | 86 | 1.0 | 1.0 | 0.30 | 0.30 | 80 | no | NA | NA | NA | NA |
| Radioluminescent | | | | | | | | | | | | |
| Self-Powered Lighting, Inc. | 700c-Omniglo | 10 | 0.0 | 0.0 | NA | NA | 10 to 20 | NA | NA | NA | NA | NA |

NA = not applicable

NS = not supplied

1 lb = 0.45 kg

^a All signs use the same lamp for operating under both utility power and emergency power systems unless otherwise noted. The expression "inc. lum." indicates increased sign luminance under emergency conditions; "no" indicates that the sign does not have any of the emergency options described in the "Data Tables" section of *Specifier Reports: Exit Signs* (p. 15).

^b Warranty is prorated based on how many years of the warranty have elapsed.

^c This sign uses an incandescent lamp as an emergency light source.

^d Length of warranty is specified at time of purchase.

| Brown-out Circuitry | Auto Discharge/ Recharge Cycle | Emergency Options ^a | Sign Format(s) | Available Color(s) of Letters | Available Color(s) of Background | Housing Material | Weight (lb) | Mounting | Impact Resistant | Tamper Resistant | Warranty Period (yr) | Warranty on Internal Battery (yr) |
|---------------------|--------------------------------|---|----------------|-------------------------------|---|------------------|-------------------------|--|------------------|------------------|--------------------------------|-----------------------------------|
| yes | yes | flash | stencil | red | aluminum, black, bronze, white | aluminum | 4.1 | bracket, ceiling, pendant, recessed, wall | yes | yes | 3 (sign), 5 (lights) | 3 full + 5 prorata ^b |
| yes | yes | flash | stencil | red | aluminum, black, bronze, white | steel | 2.5 | bracket, ceiling, universal, wall | yes | yes | 3 (sign), 5 (lights) | 3 full + 3 prorata ^b |
| yes | no | flash | edge lit | green, red | clear, white | aluminum, steel | 7.0 | bracket, ceiling, pendant, recessed, wall | no | no | 5 | 5 full + 7 prorata ^b |
| NA | NA | no | stencil | green, red | black, white | thermoplastic | 2.0 | bracket, ceiling, universal, wall | yes | yes | 5 | NA |
| yes | no | inc. lum., flash, flash and buzz | stencil | green, red | black, white | thermoplastic | 2.5 | bracket, ceiling, universal, wall | yes | yes | 5 | 1 full + 7 prorata ^b |
| yes | yes | flash, flash and buzz | matrix | green, red | white | polycarbonate | 4.5 | bracket, ceiling, universal, wall | yes | yes | 3 | 0 |
| yes | no | inc. lum., flash, flash and buzz ^c | stencil | red | aluminum, black, bronze, green, white | aluminum, steel | 2.0 | bracket, ceiling, pendant, recessed, universal, wall | yes | yes | 1 | 1 |
| yes | no | flash, flash and buzz | stencil | green, red | aluminum, black, bronze, white | aluminum | 8.0 | bracket, ceiling, universal, wall | yes | yes | 1 | 1 full + 14 prorata ^b |
| yes | no | flash, flash and buzz | stencil | green, red | aluminum, black, bronze, white | aluminum | 9.0 | bracket, ceiling, universal, wall | yes | yes | 1 | 1 full + 14 prorata ^b |
| yes | no | inc. lum., flash, flash and buzz ^c | stencil, panel | red | black, white | steel | 5.0 | bracket, ceiling, pendant, universal, wall | yes | yes | 1 | 1 full + 14 prorata ^b |
| yes | no | flash, flash and buzz | stencil | green, red | aluminum, black, bronze, white | aluminum | 14.0 | recessed | yes | yes | 1 | 1 full + 14 prorata ^b |
| yes | yes | flash, flash and buzz | matrix | green, red | aluminum, black, bronze, white (other colors special order) | steel | 3.75 (4.5 with battery) | bracket, ceiling, pendant, recessed, universal, wall | no | no | 25 | 5 |
| NA | NA | no | stencil | green, red | aluminum, black, white | steel | 2.25 | wall | yes | yes | 10 | NA |
| NA | NA | no | matrix | green | black, green, red | thermoplastic | 1.5 | bracket, ceiling, pendant, universal, wall | yes | yes | 10, 12, 15, or 20 ^d | NA |

Table 2. Manufacturer-Supplied Information: Retrofit Kits (listed by type of retrofit light source)

| Manufacturer | Trade Name | Number of Light Sources per Sign | Color(s) of Light Source | Available Voltages | Rated Active Power (W) at | | Power Factor at 120 V |
|------------------------------|----------------------------------|----------------------------------|--------------------------|--------------------|---------------------------|------------|-----------------------|
| | | | | | 120 V | 277 V | |
| Host Sign | | | | | | | |
| Lithonia Lighting | Quantum | 2 | white | 120/277 | 24.0 | 26.0 | 0.95 |
| Compact Fluorescent | | | | | | | |
| Area Lighting Research Inc. | Enviro-Lite | 1 | white | 120/277 | 9.0 | NS | 0.60 |
| Sure-Lites | Compact Fluorescent Retrofit Kit | 1 or 2 | white | 120 | 8.1 | NA | >0.40 |
| Electroluminescent | | | | | | | |
| Loctite Luminescent Systems | Exit Saver | 1 | green | 120 | 0.3 | NA | 0.19 |
| Loctite Luminescent Systems | Exit Saver | 1 | green | 120/277 | 1.3 | 1.4 | 0.66 |
| Incandescent | | | | | | | |
| Flexlite, Inc | Exlite | 2 | white | 120 | 5.0 | NA | 0.99 |
| Flexlite, Inc | Exlite | 1 | white | 120/277 | 8.1 | 11.2 | 0.99 |
| Standard Enterprises, Inc. | Eterna Lamp™ | 2 | white | 120 | 5.0 | NA | 1.00 |
| LED | | | | | | | |
| Area Lighting Research Inc. | Enviro-Lite | 1 | green, red | 120/277 | 3.0 | NS | 0.11 |
| Chloride Systems | Infinity Series II | 2 | red | 120/277 | 2.0 | 3.6 | 0.84 |
| Dioptrics Technologies, Inc. | Di-TECH | 16 | red | 120/277 | 3.0 | 3.0 | 1.00 |
| Dioptrics Technologies, Inc. | Di-TECH | 16 | red | 120/277 | 4.0 | 4.0 | 1.00 |
| Emergi-Lite | LED-RX | 40 | red | 120 | 1.7 | NA | 0.16 |
| Emergi-Lite | LED-RX | 40 | red | 120/277 | 1.7 | 1.7 | 0.16 |
| Exide Lightguard | E700/750 Series | 2 | red | 120/277 | 2.0 | 3.6 | 0.84 |
| Mule | Embassy | 32 | red | 120/277 | 1.8 | 1.9 | 0.15 |
| Prolight, Inc. | Prolight | 36 | red | 120/277 | 2.5 (±10%) | 2.1 (±10%) | 0.21 |

NA = not applicable

NS = not supplied

1 in. = 2.54 cm

1 oz = 28 g

^a Retrofit kits that use a rewire connection cannot be UL listed. Thus the UL 924 status shown only applies to the double-contact bayonet, quick-connector, and screw-in connections.

^b This retrofit kit has been tested by ETL Testing Laboratories, Inc. to the applicable requirements of UL 924.

^c This kit is a tube 0.5 inches in diameter by 10 inches long.

^d This kit is a tube 0.5 inches in diameter by 20 inches long.

^e Each lamp is 0.75 inches in diameter by 4 inches long.

^f Only the red sign is UL listed.

^g This kit comprises two strips of LEDs, which are mounted at either end of the host sign. Dimensions are given for each strip.

| Rated Lamp Life (yr) | Weight of Kit (oz) | Method of Connection ^a | Width (in.) | Height (in.) | Depth (in.) | UL 924 Status | Warranty Period (yr) |
|----------------------|--------------------|--|-------------------|-------------------|-------------------|-----------------------|----------------------|
| 2.2 | NA | NA | NA | NA | NA | listed | 3 |
| 1.1 | 5 | rewire, screw in | 6.00 | 6.00 | 1.00 | listed | 2 |
| 1.1 | 25 | screw in | 5.00 | 5.00 | 1.50 | classified | 1 |
| 30 | 7 | rewire | 9.78 | 6.47 | 1.30 | tested ^b | 5 |
| 30 | 7 | rewire | 9.78 | 6.47 | 1.30 | tested ^b | 5 |
| 13 | <1 | screw in | ^c | NA | NA | classified | 5 |
| 13 | <1 | screw in | ^d | NA | NA | classified | 5 |
| 15 | 7 | double-contact bayonet, screw in | ^e | NA | NA | classified | 5 |
| 69 | 8 | rewire, screw in | 9.50 | 4.50 | 0.75 | listed ^f | 25 |
| 30 | 10 | quick connector, screw in | 0.88 ^g | 6.00 ^g | 1.13 ^g | listed | 25 |
| 80 | 7 | rewire, screw in | 0.50 | 0.60 | 0.75 | listed | 25 |
| 80 | 13 | rewire, screw in | 0.50 | 0.60 | 0.75 | listed | 25 |
| 20 | 6 | rewire, screw in | 9.50 | 3.13 | 0.75 | listed | 5 |
| 20 | 12 | quick connector, rewire | 9.50 | 6.19 | 0.75 | classified and listed | 5 |
| 30 | 10 | quick connector, screw in | 0.88 ^g | 6.00 ^g | 1.13 ^g | listed | 25 |
| 86 | 8 | double-contact bayonet, rewire, screw in | 10.00 | 7.00 | 1.50 | listed | 25 |
| 25 | 8 | screw in | 10.75 | 7.00 | <2.50 | listed | 25 |

Table 3. NLP-Measured Data: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Catalog No. | Sign Format | Letter Color | Background Color | Regulated Power Supply | | | | |
|----------------------------------|-------------------------------------|-----------------|-------------|--------------|------------------|--|---|--|---|--------------------|
| | | | | | | Mean Letter Luminance (cd/m ²) | Letter Luminance Range (cd/m ²) | Mean Background Luminance (cd/m ²) | Background Luminance Range (cd/m ²) | Luminance Contrast |
| Compact Fluorescent | | | | | | | | | | |
| Sure-Lites | ELX Series Fluorescent Edgelit Exit | ELX-5170-BSRARC | edge lit | red | clear | 28 | 13–49 | 7.5 | 3.0–14 | 0.73 |
| Sure-Lites | Pinnacle Die Cast Exit | CAX-510000-R | stencil | red | aluminum | 200 | 56–810 | 3.9 | 0.77–10 | 0.98 |
| Sure-Lites | Steel Compact Fluorescent Exit | PLX-5200-RP | stencil | red | white | 290 | 89–740 | 8.8 | 4.0–15 | 0.97 |
| Incandescent | | | | | | | | | | |
| Big Beam Emergency Systems, Inc. | DLWX | DLWXIRAB | stencil | red | aluminum | 30 | 11–69 | 0.63 | 0.22–1.2 | 0.98 |
| Big Beam Emergency Systems, Inc. | EDLWX | EDLWXIRAB | stencil | red | aluminum | 49 | 11–220 | 1.0 | 0.19–2.5 | 0.98 |
| Big Beam Emergency Systems, Inc. | ELWX | ELWXIRWW | stencil | red | white | 39 | 8.5–110 | 0.85 | 0.25–2.3 | 0.98 |
| Big Beam Emergency Systems, Inc. | LWX | LWXIRWW | stencil | red | white | 30 | 4.9–180 | 0.52 | 0.12–1.9 | 0.98 |
| LED (Diffuser) | | | | | | | | | | |
| ALKCO | LED EDGE-GLO | RC-LED | edge lit | red | clear | 11 | 8.6–15 | 0.29 | 0.18–0.43 | 0.97 |
| Big Beam Emergency Systems, Inc. | DXLS | DXLSIRAB | stencil | red | aluminum | 8.3 | 2.7–19 | 0.18 | 0.07–0.67 | 0.98 |
| Big Beam Emergency Systems, Inc. | EDXLS | EDXLSIRAB | stencil | red | aluminum | 6.7 | 2.4–15 | 0.16 | 0.07–0.48 | 0.98 |
| Big Beam Emergency Systems, Inc. | EXFL | EXFLIRWW | stencil | red | white | 10 | 5.5–18 | 0.19 | 0.09–0.43 | 0.98 |
| Big Beam Emergency Systems, Inc. | XFL | XFLIRWW | stencil | red | white | 13 | 6.9–23 | 0.29 | 0.14–0.91 | 0.98 |
| Big Beam Emergency Systems, Inc. | XFL-HPF | XFLIRWW-HPF | stencil | red | white | 8.1 | 4.3–16 | 0.19 | 0.09–0.47 | 0.98 |
| Chloride Systems | Infinity Series II (ac only) | LACWP1R | stencil | red | white | 19 | 11–33 | 0.47 | 0.16–0.73 | 0.97 |
| Chloride Systems | Infinity Series II | LSPNWP1R | stencil | red | white | 18 | 7.8–37 | 0.43 | 0.23–0.77 | 0.98 |
| Emergi-Lite | Escort Series | LEDWX32R-EI | stencil | red | white | 13 | 3.2–16 | 0.30 | 0.10–0.76 | 0.98 |
| Emergi-Lite | Preceptor Series | LEDPXLIR-EI | stencil | red | aluminum | 12 | 8.0–17 | 0.25 | 0.11–0.65 | 0.98 |
| Emergi-Lite | X10 Series | LEDWX12R-120 | stencil | red | white | 16 | 9.1–22 | 0.40 | 0.18–1.0 | 0.98 |
| Emergi-Lite | X40 Series | LX42RW | edge lit | red | white | 15 | 7.3–28 | 0.78 | 0.24–1.9 | 0.95 |
| Exide Lightguard | E700/750 Series (ac only) | E700WPSR | stencil | red | white | 19 | 11–33 | 0.47 | 0.16–0.73 | 0.97 |
| Exide Lightguard | E700/750 Series | EPN700WPSR | stencil | red | white | 18 | 7.8–37 | 0.43 | 0.23–0.77 | 0.98 |
| Kenall Mfg. Company | Trailmate | 6504 | stencil | red | white | 20 | 14–27 | 0.66 | 0.26–1.7 | 0.97 |
| Mule | Embassy | PSX | stencil | red | white | 8.6 | 4.3–17 | 0.12 | 0.07–0.18 | 0.99 |
| Sure-Lites | Pinnacle Die Cast Exit | CAX-610000-RB | stencil | red | black | 58 | 52–72 | 1.5 | 0.82–2.6 | 0.97 |
| Sure-Lites | Pinnacle Die Cast Exit | CAX-717000-RB | stencil | red | black | 47 | 39–54 | 0.87 | 0.35–2.3 | 0.98 |
| Sure-Lites | Standard Steel LED Exit | R-1-CLED | stencil | red | white | 15 | 8.3–21 | 0.36 | 0.12–0.85 | 0.98 |
| Sure-Lites | Thin Profile LED Exit | TPX-717000-R | stencil | red | aluminum | 50 | 36–65 | 0.96 | 0.32–1.8 | 0.98 |
| LED (Prismatic Diffuser) | | | | | | | | | | |
| Self-Powered Lighting, Inc. | HJ-5 | HJ5-AC1-RBA | matrix | red | aluminum | 12 | 6.6–21 | 0.44 | 0.20–1.3 | 0.96 |
| Self-Powered Lighting, Inc. | SW-1 | SW1-RWW | stencil | red | aluminum | 73 | 28–150 | 0.66 | 0.16–1.5 | 0.99 |
| Radioluminescent | | | | | | | | | | |
| Self-Powered Lighting, Inc. | 700c-Omniglo | 700c-1-10-BR | stencil | green | red | 0.38 ^b | 0.31–0.48 ^b | 0.00 ^b | 0.00–0.01 ^b | 0.99 ^b |

1 ft = 0.30 m 1 cd/m² = 0.29 fL NA = not applicable NT = not tested because the sign that was submitted did not include a battery

NLP-IP measured data for one sample of each sign. All luminance and power measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form (L₁-L₂)/L₁, where L₁ and L₂ are the mean letter and mean background luminances, with L₁ being the greater of these two values.

8 Specifier Reports Supplements: Exit Signs

| Battery-Operated | | | | | | | | Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance) | | | |
|--|---|--|---|--------------------|--|-----------------------|----------------------------------|--|--------|-----------|--------|
| Mean Letter Luminance (cd/m ²) | Letter Luminance Range (cd/m ²) | Mean Background Luminance (cd/m ²) | Background Luminance Range (cd/m ²) | Luminance Contrast | Active Power ^a (W) at 120 V | Power Factor at 120 V | Apparent Power (rms VA) at 120 V | Lights Off | | Lights On | |
| | | | | | | | | 100 ft | 150 ft | 100 ft | 150 ft |
| 7.3 | 4.1–13 | 2.5 | 0.96–6.7 | 0.66 | 23 | 0.54 | 43 | 8 | 13 | 3 | 12 |
| NT | NT | NT | NT | NT | 11 | 0.41 | 28 | 0 | 5 | 0 | 3 |
| NT | NT | NT | NT | NT | 16 | 0.44 | 37 | 0 | 3 | 0 | 1 |
| NA | NA | NA | NA | NA | 12 | 0.94 | 13 | 0 | 4 | 1 | 10 |
| 19 | 2.8–69 | 0.35 | 0.12–1.3 | 0.98 | 15 | 0.93 | 17 | 1 | 4 | 0 | 6 |
| 51 | 8.0–210 | 1.2 | 0.23–8.5 | 0.98 | 15 | 0.92 | 16 | 0 | 2 | 0 | 2 |
| NA | NA | NA | NA | NA | 13 | 0.97 | 13 | 0 | 7 | 1 | 8 |
| NT | NT | NT | NT | NT | 5.1 | 0.74 | 7.0 | 1 | 3 | 1 | 4 |
| NA | NA | NA | NA | NA | 1.9 | 0.24 | 7.8 | 0 | 3 | 4 | 10 |
| 12 | 4.3–27 | 0.30 | 0.11–0.95 | 0.98 | 2.2 | 0.30 | 7.2 | 1 | 2 | 3 | 7 |
| 19 | 10–34 | 0.42 | 0.18–0.97 | 0.98 | 1.6 | 0.22 | 7.1 | 0 | 2 | 0 | 3 |
| NA | NA | NA | NA | NA | 1.8 | 0.23 | 7.7 | 0 | 2 | 0 | 2 |
| NT | NT | NT | NT | NT | 5.1 | 1.0 | 5.2 | 0 | 1 | 0 | 3 |
| NA | NA | NA | NA | NA | 2.3 | 0.90 | 2.5 | 0 | 1 | 0 | 0 |
| 16 | 6.9–34 | 0.39 | 0.16–0.71 | 0.98 | 8.3 | 0.89 | 9.4 | 0 | 2 | 0 | 3 |
| NT | NT | NT | NT | NT | 1.5 | 0.09 | 16 | 0 | 2 | 1 | 5 |
| 16 | 9.8–20 | 0.34 | 0.14–0.82 | 0.98 | 4.3 | 0.46 | 9.4 | 0 | 2 | 0 | 3 |
| NT | NT | NT | NT | NT | 1.8 | 0.17 | 11 | 0 | 2 | 1 | 4 |
| NT | NT | NT | NT | NT | 3.9 | 0.47 | 8.3 | 0 | 1 | 0 | 2 |
| NA | NA | NA | NA | NA | 2.3 | 0.90 | 2.5 | 0 | 1 | 0 | 0 |
| 16 | 6.9–34 | 0.39 | 0.16–0.71 | 0.98 | 8.3 | 0.89 | 9.4 | 0 | 2 | 0 | 3 |
| NT | NT | NT | NT | NT | 2.9 | 0.35 | 8.3 | 0 | 1 | 0 | 2 |
| 120 | 40–800 | 2.0 | 1.1–4.5 | 0.98 | 2.9 | 0.30 | 9.7 | 0 | 1 | 0 | 3 |
| NT | NT | NT | NT | NT | 7.6 | 0.83 | 9.2 | 0 | 1 | 0 | 0 |
| 41 | 33–48 | 1.1 | 0.49–2.6 | 0.97 | 9.2 | 0.83 | 11 | 0 | 2 | 0 | 0 |
| NT | NT | NT | NT | NT | 1.6 | 0.15 | 10 | 2 | 3 | 0 | 6 |
| 50 | 36–65 | 0.98 | 0.36–1.8 | 0.98 | 9.4 | 0.81 | 12 | 0 | 5 | 0 | 3 |
| NT | NT | NT | NT | NT | 1.0 | 0.22 | 4.7 | 0 | 1 | 2 | 9 |
| NA | NA | NA | NA | NA | 8.7 | 0.84 | 10 | 0 | 2 | 1 | 3 |
| NA | NA | NA | NA | NA | NA | NA | NA | 3 | 8 | 2 | 9 |

^a The presence of a battery may increase the active power of a sign.

^b The luminances of this sign were too low to be measured accurately with CapCalc. The luminances reported for this sign were measured using a Minolta LS 100 luminance meter. As a result, this sign's visibility in smoke could not be evaluated because NLPiP's calculation method requires a CapCalc input file; this sign therefore is not listed in Table 5.

Table 4. NLP-IP-Measured Data: Retrofit Kits (listed by type of retrofit light source)

| Manufacturer | Trade Name | Catalog No. | Mean Letter Luminance (cd/m ²) | Letter Luminance Range (cd/m ²) | Mean Background Luminance (cd/m ²) |
|--------------------------------|----------------------------------|----------------------|--|---|--|
| Host Sign | | | | | |
| Lithonia Lighting ^a | Quantum | QMSW3R120 | 110 | 50–210 | 3.2 |
| Compact Fluorescent | | | | | |
| Area Lighting Research Inc. | Enviro-Lite | EXU-120 | 370 | 94–1900 | 9.2 |
| Sure-Lites | Compact Fluorescent Retrofit Kit | RKX-7-U | 370 | 48–1800 | 5.9 |
| Electroluminescent | | | | | |
| Loctite Luminescent Systems | Exit Saver | 2001-AA-120-H-02 | 16 | 16–17 | 0.23 |
| Loctite Luminescent Systems | Exit Saver | 2001-AA-120/277-H-02 | 15 | 14–15 | 0.29 |
| Incandescent | | | | | |
| Flexlite, Inc | Exlite | FL120(9)-B,C,E,I | 18 | 6.5–38 | 0.40 |
| Flexlite, Inc | Exlite | FL120-B,C,E,I | 32 | 10–58 | 0.62 |
| Standard Enterprises, Inc. | Eterna Lamp | ETS5/120 | 22 | 12–64 | 0.51 |
| LED | | | | | |
| Area Lighting Research Inc. | Enviro-Lite | LED-120 | 10 | 3.9–18 | 0.26 |
| Chloride Systems | Infinity Series II | ILRKIT1 | 13 | 8.4–21 | 0.23 |
| Dioptrics Technologies, Inc. | Di-TECH | DT-1000 | 19 | 12–34 | 0.46 |
| Dioptrics Technologies, Inc. | Di-TECH | DT-2000 | 16 | 9.2–28 | 0.32 |
| Emergi-Lite | LED-RX | LED-RX-1 | 9.2 | 3.9–20 | 0.20 |
| Emergi-Lite | LED-RX | LED-RX-120-F | 22 | 15–29 | 0.53 |
| Exide Lightguard | E700/750 Series | E50LR1 | 13 | 8.4–21 | 0.23 |
| Mule | Embassy | 941002 | 8.7 | 5.0–12 | 0.18 |
| Prolight, Inc. | Prolight | XLEDR-QLC | 19 | 13–42 | 0.42 |

1 ft = 0.30 m

1 cd/m² = 0.29 fL

NLP-IP measured data for one sample of each retrofit kit. All luminance and power measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form $(L_1 - L_2) / L_1$, where L_1 and L_2 are the mean letter and mean background luminances, with L_1 being the greater of these two values.

^a NLP-IP measured the performance of a new host sign specimen of the same broad and catalog number as that used in *Specifier Reports: Exit Signs*.

| Background Luminance Range (cd/m ²) | Luminance Contrast | Active Power (W) at 120 V | Power Factor at 120 V | Apparent Power (rms VA) at 120 V | Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance) | | | |
|---|--------------------|---------------------------|-----------------------|----------------------------------|---|--------|-----------|--------|
| | | | | | Lights Off | | Lights On | |
| | | | | | 100 ft | 150 ft | 100 ft | 150 ft |
| 1.6–8.8 | 0.97 | 23 | 1.0 | 23 | 0 | 4 | 0 | 2 |
| 2.4–27 | 0.98 | 11 | 0.53 | 21 | 0 | 5 | 0 | 0 |
| 2.3–16 | 0.98 | 11 | 0.53 | 20 | 0 | 4 | 0 | 0 |
| 0.07–0.46 | 0.99 | 1.5 | 0.23 | 6.6 | 0 | 1 | 1 | 3 |
| 0.08–0.79 | 0.98 | 1.2 | 0.67 | 1.8 | 0 | 1 | 0 | 4 |
| 0.09–0.92 | 0.97 | 8.9 | 1.0 | 8.9 | 0 | 3 | 1 | 5 |
| 0.16–1.6 | 0.97 | 7.9 | 1.0 | 7.9 | 0 | 1 | 0 | 1 |
| 0.21–1.3 | 0.98 | 11 | 1.0 | 11 | 0 | 2 | 0 | 3 |
| 0.10–0.47 | 0.97 | 2.9 | 0.52 | 5.6 | 1 | 3 | 5 | 10 |
| 0.10–0.46 | 0.98 | 2.4 | 0.94 | 2.5 | 1 | 1 | 0 | 4 |
| 0.19–0.92 | 0.98 | 3.7 | 0.94 | 4.0 | 0 | 1 | 0 | 2 |
| 0.13–0.63 | 0.98 | 4.1 | 0.95 | 4.3 | 0 | 2 | 0 | 2 |
| 0.07–0.54 | 0.98 | 1.3 | 0.17 | 7.8 | 1 | 5 | 1 | 7 |
| 0.23–1.2 | 0.98 | 1.8 | 0.17 | 10 | 0 | 1 | 0 | 2 |
| 0.10–0.46 | 0.98 | 2.4 | 0.94 | 2.5 | 1 | 1 | 0 | 4 |
| 0.07–0.54 | 0.98 | 1.5 | 0.14 | 11 | 0 | 1 | 0 | 2 |
| 0.16–0.73 | 0.98 | 2.8 | 0.21 | 13 | 0 | 1 | 0 | 0 |

Table 5. Calculated Data: Visibility in Smoke for Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Catalog No. | Sign Format | Letter Color | Background Color | Clear-Air Conditions | | |
|----------------------------------|-------------------------------------|-----------------|-------------|--------------|------------------|--|--|--------------------|
| | | | | | | Regulated Power Supply | | |
| | | | | | | Mean Letter Luminance (cd/m ²) | Mean Background Luminance (cd/m ²) | Luminance Contrast |
| Compact Fluorescent | | | | | | | | |
| Sure-Lites | ELX Series Fluorescent Edgelit Exit | ELX-5170-BSRARC | edge lit | red | clear | 28 | 7.5 | 0.73 |
| Sure-Lites | Pinnacle Die Cast Exit | CAX-510000-R | stencil | red | aluminum | 200 | 3.9 | 0.98 |
| Sure-Lites | Steel Compact Fluorescent Exit | PLX-5200-RP | stencil | red | white | 290 | 8.8 | 0.97 |
| Incandescent | | | | | | | | |
| Big Beam Emergency Systems, Inc. | DLWX | DLWXIRAB | stencil | red | aluminum | 30 | 0.63 | 0.98 |
| Big Beam Emergency Systems, Inc. | EDLWX | EDLWXIRAB | stencil | red | aluminum | 49 | 1.0 | 0.98 |
| Big Beam Emergency Systems, Inc. | ELWX | ELWXIRWW | stencil | red | white | 39 | 0.85 | 0.98 |
| Big Beam Emergency Systems, Inc. | LWX | LWXIRWW | stencil | red | white | 30 | 0.52 | 0.98 |
| LED (Diffuser) | | | | | | | | |
| ALKCO | LED EDGE-GLO | RC-LED | edge lit | red | clear | 11 | 0.29 | 0.97 |
| Big Beam Emergency Systems, Inc. | DXLS | DXLSIRAB | stencil | red | aluminum | 8.3 | 0.18 | 0.98 |
| Big Beam Emergency Systems, Inc. | EDXLS | EDXLSIRAB | stencil | red | aluminum | 6.7 | 0.16 | 0.98 |
| Big Beam Emergency Systems, Inc. | EXFL | EXFLIRWW | stencil | red | white | 10 | 0.19 | 0.98 |
| Big Beam Emergency Systems, Inc. | XFL | XFLIRWW | stencil | red | white | 13 | 0.29 | 0.98 |
| Big Beam Emergency Systems, Inc. | XFL-HPF | XFLIRWW-HPF | stencil | red | white | 8.1 | 0.19 | 0.98 |
| Chloride Systems | Infinity Series II (ac only) | LACWP1R | stencil | red | white | 19 | 0.47 | 0.97 |
| Chloride Systems | Infinity Series II | LSPNWP1R | stencil | red | white | 18 | 0.43 | 0.98 |
| Emergi-Lite | Escort Series | LEDWX32R-EI | stencil | red | white | 13 | 0.30 | 0.98 |
| Emergi-Lite | Preceptor Series | LEDPXLIR-EI | stencil | red | aluminum | 12 | 0.25 | 0.98 |
| Emergi-Lite | X10 Series | LEDWX12R-120 | stencil | red | white | 16 | 0.40 | 0.98 |
| Emergi-Lite | X40 Series | LX42RW | edge lit | red | white | 15 | 0.78 | 0.95 |
| Exide Lightguard | E700/750 Series (ac only) | E700WPSR | stencil | red | white | 19 | 0.47 | 0.97 |
| Exide Lightguard | E700/750 Series | EPN700WPSR | stencil | red | white | 18 | 0.43 | 0.98 |
| Kenall Mfg. Company | Trailmate | 6504 | stencil | red | white | 20 | 0.66 | 0.97 |
| Mule | Embassy | PSX | stencil | red | white | 8.6 | 0.12 | 0.99 |
| Sure-Lites | Pinnacle Die Cast Exit | CAX-610000-RB | stencil | red | black | 58 | 1.5 | 0.97 |
| Sure-Lites | Pinnacle Die Cast Exit | CAX-717000-RB | stencil | red | black | 47 | 0.87 | 0.98 |
| Sure-Lites | Standard Steel LED Exit | R-1-CLED | stencil | red | white | 15 | 0.36 | 0.98 |
| Sure-Lites | Thin Profile LED Exit | TPX-717000-R | stencil | red | aluminum | 50 | 0.96 | 0.98 |
| LED (Prismatic Diffuser) | | | | | | | | |
| Self-Powered Lighting, Inc. | HJ-5 | HJ5-AC1-RBA | matrix | red | aluminum | 12 | 0.44 | 0.96 |
| Self-Powered Lighting, Inc. | SW-1 | SW1-RWW | stencil | red | aluminum | 73 | 0.66 | 0.99 |

1 ft = 0.30 m

NA = not applicable

1 cd/m² = 0.29 fL

NT = not tested because the sign that was submitted did not include a battery

Calculated smoke simulation values are based on measurements in clear-air conditions.

All luminance measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form $(L_1 - L_2) / L_1$, where L_1 and L_2 are the mean letter and mean background luminances, with L_1 being the greater of these two values.

| Clear-Air Conditions | | | Smoke Simulations | | | | | | | |
|--|--|--------------------|---|---|-----------------------------|------------------------|---|---|-----------------------------|------------------------|
| Battery-Operated | | | Regulated Power Supply | | | | Battery-Operated | | | |
| Mean Letter Luminance (cd/m ²) | Mean Background Luminance (cd/m ²) | Luminance Contrast | Mean Letter Luminance at 16 ft (cd/m ²) | Mean Background Luminance at 16 ft (cd/m ²) | Luminance Contrast at 16 ft | Critical Distance (ft) | Mean Letter Luminance at 16 ft (cd/m ²) | Mean Background Luminance at 16 ft (cd/m ²) | Luminance Contrast at 16 ft | Critical Distance (ft) |
| 7.3 | 2.5 | 0.66 | 7.3 | 7.5 | 0.00 | 36 | 0.47 | 0.37 | 0.23 | 20 |
| NT | NT | NT | 5.8 | 2.0 | 0.66 | 33 | NT | NT | NT | NT |
| NT | NT | NT | 8.6 | 3.0 | 0.65 | 35 | NT | NT | NT | NT |
| NA | NA | NA | 0.93 | 0.34 | 0.63 | 25 | NA | NA | NA | NA |
| 19 | 0.35 | 0.98 | 1.4 | 0.45 | 0.68 | 27 | 0.46 | 0.16 | 0.66 | 21 |
| 51 | 1.2 | 0.98 | 1.1 | 0.37 | 0.66 | 26 | 1.4 | 0.45 | 0.68 | 26 |
| NA | NA | NA | 0.80 | 0.20 | 0.76 | 23 | NA | NA | NA | NA |
| NT | NT | NT | 0.28 | 0.03 | 0.91 | 18 | NT | NT | NT | NT |
| NA | NA | NA | 0.20 | 0.01 | 0.93 | 16 | NA | NA | NA | NA |
| 12 | 0.30 | 0.98 | 0.15 | 0.00 | 1.0 | 16 | 0.35 | 0.08 | 0.76 | 19 |
| 19 | 0.42 | 0.98 | 0.32 | 0.05 | 0.83 | 19 | 0.50 | 0.15 | 0.70 | 21 |
| NA | NA | NA | 0.36 | 0.08 | 0.76 | 19 | NA | NA | NA | NA |
| NT | NT | NT | 0.24 | 0.00 | 0.99 | 17 | NT | NT | NT | NT |
| NA | NA | NA | 0.53 | 0.17 | 0.69 | 21 | NA | NA | NA | NA |
| 16 | 0.39 | 0.98 | 0.54 | 0.16 | 0.70 | 21 | 0.47 | 0.12 | 0.74 | 21 |
| NT | NT | NT | 0.37 | 0.10 | 0.74 | 19 | NT | NT | NT | NT |
| 16 | 0.34 | 0.98 | 0.34 | 0.06 | 0.81 | 19 | 0.43 | 0.11 | 0.76 | 20 |
| NT | NT | NT | 0.42 | 0.11 | 0.74 | 20 | NT | NT | NT | NT |
| NT | NT | NT | 0.42 | 0.13 | 0.69 | 20 | NT | NT | NT | NT |
| NA | NA | NA | 0.53 | 0.17 | 0.69 | 21 | NA | NA | NA | NA |
| 16 | 0.39 | 0.98 | 0.54 | 0.16 | 0.70 | 21 | 0.47 | 0.12 | 0.74 | 21 |
| NT | NT | NT | 0.58 | 0.20 | 0.66 | 22 | NT | NT | NT | NT |
| 120 | 2.0 | 0.98 | 0.23 | 0.00 | 1.0 | 17 | 3.0 | 0.70 | 0.76 | 30 |
| NT | NT | NT | 1.6 | 0.45 | 0.71 | 26 | NT | NT | NT | NT |
| 41 | 1.1 | 0.97 | 1.3 | 0.37 | 0.70 | 26 | 1.1 | 0.35 | 0.70 | 25 |
| NT | NT | NT | 0.43 | 0.14 | 0.68 | 20 | NT | NT | NT | NT |
| 50 | 0.98 | 0.98 | 1.3 | 0.40 | 0.70 | 26 | 1.3 | 0.40 | 0.70 | 26 |
| NT | NT | NT | 0.25 | 0.00 | 0.98 | 18 | NT | NT | NT | NT |
| NA | NA | NA | 1.7 | 0.39 | 0.77 | 28 | NA | NA | NA | NA |

Table 6. Calculated Data: Visibility in Smoke for Retrofit Kits (listed by type of retrofit light source)

| Manufacturer | Trade Name | Catalog No. | Clear-Air Conditions | | |
|--------------------------------|----------------------------------|----------------------|--|--|--------------------|
| | | | Mean Letter Luminance (cd/m ²) | Mean Background Luminance (cd/m ²) | Luminance Contrast |
| Host Sign | | | | | |
| Lithonia Lighting ^a | Quantum | QMSW3R120 | 110 | 3.2 | 0.97 |
| Compact Fluorescent | | | | | |
| Area Lighting Research Inc. | Enviro-Lite | EXU-120 | 370 | 9.2 | 0.98 |
| Sure-Lites | Compact Fluorescent Retrofit Kit | RKX-7-U | 370 | 5.9 | 0.98 |
| Electroluminescent | | | | | |
| Loctite Luminescent Systems | Exit Saver | 2001-AA-120-H-02 | 16 | 0.23 | 0.99 |
| Loctite Luminescent Systems | Exit Saver | 2001-AA-120/277-H-02 | 15 | 0.29 | 0.98 |
| Incandescent | | | | | |
| Flexlite, Inc | Exlite | FL120(9)-B,C,E,I | 16 | 0.40 | 0.97 |
| Flexlite, Inc | Exlite | FL120-B,C,E,I | 24 | 0.62 | 0.97 |
| Standard Enterprises, Inc. | Eterna Lamp | ETS5/120 | 22 | 0.51 | 0.98 |
| LED | | | | | |
| Area Lighting Research Inc. | Enviro-Lite | LED-120 | 10 | 0.26 | 0.97 |
| Chloride Systems | Infinity Series II | ILRKIT1 | 13 | 0.23 | 0.98 |
| Dioptrics Technologies, Inc. | Di-TECH | DT-1000 | 19 | 0.46 | 0.98 |
| Dioptrics Technologies, Inc. | Di-TECH | DT-2000 | 16 | 0.32 | 0.98 |
| Emergi-Lite | LED-RX | LED-RX-1 | 9.2 | 0.20 | 0.98 |
| Emergi-Lite | LED-RX | LED-RX-120-F | 22 | 0.53 | 0.98 |
| Exide Lightguard | E700/750 Series | E50LR1 | 13 | 0.23 | 0.98 |
| Mule | Embassy | 941002 | 8.7 | 0.18 | 0.98 |
| Prolight, Inc. | Prolight | XLEDR-QLC | 19 | 0.42 | 0.98 |

1 ft = 0.30 m

1 cd/m² = 0.29 fL

Calculated smoke simulation values are based on measurements in clear-air conditions.

All luminance measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form $(L_1 - L_2) / L_1$, where L_1 and L_2 are the mean letter and mean background luminances, with L_1 being the greater of these two values.

^a NLPPIP measured the performance of a new host sign specimen of the same brand and catalog number as that used in *Specifier Reports: Exit Signs*.

Smoke Simulations

| Mean Letter Luminance at 16 ft (cd/m ²) | Mean Background Luminance at 16 ft (cd/m ²) | Luminance Contrast at 16 ft | Critical Distance (ft) |
|---|---|--------------------------------|---------------------------|
| 3.3 | 1.2 | 0.64 | 31 |
| 11 | 4.1 | 0.62 | 36 |
| 9.8 | 2.7 | 0.73 | 35 |
| 0.52 | 0.11 | 0.78 | 21 |
| 0.44 | 0.10 | 0.78 | 20 |
| 0.48 | 0.14 | 0.71 | 21 |
| 0.69 | 0.25 | 0.64 | 23 |
| 0.65 | 0.22 | 0.66 | 22 |
| 0.32 | 0.08 | 0.75 | 19 |
| 0.36 | 0.07 | 0.81 | 19 |
| 0.58 | 0.17 | 0.71 | 22 |
| 0.45 | 0.12 | 0.74 | 20 |
| 0.32 | 0.04 | 0.89 | 19 |
| 0.64 | 0.20 | 0.68 | 23 |
| 0.36 | 0.07 | 0.81 | 19 |
| 0.28 | 0.02 | 0.93 | 18 |
| 0.58 | 0.16 | 0.72 | 22 |

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This second supplement to *Specifier Reports: Exit Signs* (1994) contains information about energy-efficient, single-faced exit signs and retrofit conversion kits. Most of the exit signs and retrofit kits described in this supplement use light emitting diodes (LEDs) to illuminate the signs. The tables contain information supplied by the manufacturers of the products as well as the results of testing conducted by NLPIP. Exit signs from manufacturers that responded to NLPIP's request for product information and product samples by April 1, 1997 are included. NLPIP tested these exit signs during June and July 1997 at the Lighting Research Center Laboratory in Watervliet, New York.

This supplement differs from *Specifier Reports: Exit Signs* and the first supplement in the following ways:

- NLPIP did not perform readability tests using human observers for this report because the data previously presented clearly showed that higher luminance, greater contrast, and greater letter and background uniformity increase sign readability. As a guideline, for signs to be readable at 100 feet (ft), they should have a luminance of at least 15 candelas/square meter (cd/m^2), a contrast between letters and background of at least 0.8, and a letter luminance uniformity of less than 20:1.
- NLPIP used a new digital camera system (Photometrics, Series 200) for photometric testing and calibrated the images captured with this system using luminance measurements of each sign taken with a Pritchard 703A spectroradiometer. For previous reports NLPIP used a CapCalc video photometer.
- The "Impact Resistant" and "Tamper Resistant" columns have been combined into a "Vandal Resistant" column.
- Most manufacturers submitted two versions of the same exit sign: one with red LEDs and one with green LEDs. Unlike broad band (white) light sources such as incandescent and compact fluorescent lamps, which only vary photometrically depending on the color of the diffuser, LEDs vary both photometrically and electrically depending on the color of the LEDs used. NLPIP tested both versions wherever two were submitted.

ENERGY STAR Exit Signs

The US Environmental Protection Agency (US EPA) and the US Department of Energy (US DOE) administer a labeling program, called ENERGY STAR, for products that meet defined energy efficiency specifications. The ENERGY STAR program for exit signs began on September 1, 1996. Specifications are detailed on the US EPA's web site (<http://www.epa.gov>). To contact the ENERGY STAR office by telephone, call 1-888-STAR YES (782-7937), by fax 1-202-233-9575, or by mail, Manager ENERGY STAR Program, US EPA Atmospheric Pollution Prevention Division, 401 M St., Washington, DC 20460.

UL 924 Standard

Underwriters Laboratory (UL) has revised the standard for exit signs (UL 924). The first phase of the revised standard took effect on August 27, 1996. Additional requirements will become effective in phases through May 2001. The new standards will include changes in visibility testing protocols and the size, shape, and visibility of the directional indicators (chevrons). There are also changes in testing protocols and visibility requirements for exit sign retrofit kits. For a copy of UL 924, contact Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112. Telephone: 1-800-854-7179, e-mail: global@ihs.com.

Table 1. Manufacturer-Supplied Information: Exit Signs (listed by light source)

| Manufacturer | Trade Name | Identification | Number of Light Sources | Rated Active Power (W) at | | Power Factor at | | Rated Lamp Life (yr) | Battery Type ^a | Battery Life (yr) | Battery Operating Time (h) | Full Battery Recharge Time (h) |
|--|---------------------|-----------------------|-------------------------|---------------------------|-------|-----------------|-------|----------------------|---------------------------|-------------------|----------------------------|--------------------------------|
| | | | | 120 V | 277 V | 120 V | 277 V | | | | | |
| LED | | | | | | | | | | | | |
| Chloride Systems tel 910-259-1000 fax 800-258-8803 | Reference Series II | RLN1RW | 64 | 10.8 | NS | NS | NS | 25 | PbCa NiCAD | 8 | 1.5 | 24 |
| | Reference Series II | RLN1GW | 64 | 3.04 | NS | 0.46 | NS | 25 | PbCa NiCAD | 8 | 1.5 | 24 |
| Dynaray tel 860-388-3007 fax 860-388-6550 | PDQ82 Series | 82W14 | 64 | NS | NS | NS | NS | 10 | NiCAD | 15 | 2 | 168 |
| | PDQ82 Series | 82W14G | 64 | NS | NS | NS | NS | 10 | NiCAD | 15 | 2 | 168 |
| Exide Lightguard tel 910-259-1131 fax 800-403-6927 | E800 | E803WSR | 64 | 10.8 | NS | NS | NS | 25 | PbCa NiCAD | 8 12 | 1.5 | 24 |
| | E800 | E803WSG | 64 | 3.04 | NS | 0.46 | NS | 25 | PbCa NiCAD | 8 12 | 1.5 | 24 |
| Hubbell Lighting tel 540-382-6111 fax 540-382-1526 | C Series | CWARAL9 | 36 | 1.37 | 1.56 | 0.14 | 0.06 | 80 | NA | NA | NA | NA |
| | C Series | CWPGWL9 | 36 | 6.57 | 6.80 | 0.85 | 0.77 | 80 | NiCAD | 10 | 1.5 | 24 |
| | Pathfinder | PUPRWL9 | 36 | 8.3 | 8.5 | 0.74 | 0.72 | 80 | PbCa | 8–10 | 1.5 | 24 |
| | Pathfinder | PUPGWL9 | 36 | 9.4 | 9.5 | 0.77 | 0.75 | 80 | PbCa | 8–10 | 1.5 | 24 |
| Juno Lighting tel 847-827-9880 fax 847-296-4056 | Universal Voltage | EXR51-WH | 16 | 4.2 | 4.6 | 0.66 | 0.54 | 25 | PbCa | 10 | 2.0 | <24 |
| | Universal Voltage | EXG51-WH | 28 | 6.3 | 6.6 | 0.70 | 0.55 | 25 | PbCa | 10 | 2.0 | <24 |
| Lithonia Emergency Systems tel 770-987-4200 fax 770-981-8141 | Quantum | LQMSW1R 120/277ELN | 14 | 0.75 | 0.95 | 0.14 | 0.07 | 25 | NiCAD | 7–9 | 1.5 | 168 |
| | Quantum | LQMSW1G 120/277ELN | 8 | 0.77 | 1.0 | 0.15 | 0.07 | 25 | NiCAD | 7–9 | 1.5 | 168 |
| | Extreme | LVSW1R120 /277ELN | 54 | 2.3 | 2.2 | 0.20 | 0.10 | 25 | NiCAD | 7–9 | 1.5 | 168 |
| | Extreme | LVSW1G120 /277ELN | 24 | 1.7 | 1.9 | 0.18 | 0.10 | 25 | NiCAD | 7–9 | 1.5 | 168 |

NA = not applicable
NS = not supplied

^a NiCAD = nickel cadmium
PbCa = lead calcium

^b FL = flasher
Bz = buzzer
BF = buzzer and flasher
FAI = fire alarm interface
ER = extended battery-run time
2CKT = 120 V and 277 V operation

^c W = white
B = black
BrAl = brushed aluminum
Al = aluminum
Cl = clear
Br = bronze
S = silver
M = mirror

^d DCAI = diecast aluminum
TP = thermoplastic
Al = aluminum
DCST = diecast steel
PC = polycarbonate
ExAl = extruded aluminum
SS = stainless steel
ST = steel

^e U = universal
W = wall
C = conduit
VW = vertical wall
E = end
B = back
T = top
F = flush
R = recessed

| Low Battery Voltage Disconnect | Brownout Circuitry | Auto Discharge/ Recharge Cycle | Emergency Options ^d | Sign Format(s) | Available Background Color(s) ^c | Housing Material ^d | Weight (lb) | Mounting ^e | Vandal Resistant | Sign Warranty Period (yr) | Warranty on Internal Battery ^f (yr) |
|--------------------------------|--------------------|--------------------------------|--------------------------------|------------------|--|-------------------------------|-------------|-----------------------|------------------|---------------------------|--|
| yes | yes | yes | FL, Bz, BF, ER, 2CKT, FAI | stencil | W, B, BrAl | DCAI | 7 | U | yes | 5 | 5 |
| yes | yes | yes | FL, Bz, BF, ER, 2CKT, FAI | stencil | W, B, BrAl | DCAI | 7 | U | yes | 5 | 5 |
| no | yes | no | FAI, FL, Bz | stencil | W, B, Al | TP | 5 | U | yes | 5 | 5 + 7PR |
| no | yes | no | FAI, FL, Bz | stencil | W, B, Al | TP | 5 | U | yes | 5 | 5 + 7PR |
| yes | yes | yes | FL, Bz, BF, ER, 2CKT, FAI | stencil | W, B | DCAI | 7 | U | yes | 5 | 5 |
| yes | yes | yes | FL, Bz, BF, ER, 2CKT, FAI | stencil | W, B | DCAI | 7 | U | yes | 5 | 5 |
| yes | yes | yes | NA | diffused stencil | W, B, S | DC | 3.5 | T, B, E | yes | 3 | 3 + 5PR |
| yes | yes | yes | FAI, FL, Bz | diffused stencil | W, B, S | DCAI | 4.5 | T, B, E | yes | 3 | 3 + 5PR |
| yes | yes | yes | FAI | stencil | W | TP | 5.5 | W, U | yes | 3 | 3 + 5PR |
| yes | yes | yes | FAI | stencil | W | TP | 5.5 | W, U | yes | 3 | 3 + 5PR |
| yes | yes | no | 2CKT | stencil | W, B | PC | 3 | U | yes | 1 | 1 + 5PR |
| yes | yes | no | 2CKT | stencil | W, B | PC | 3 | U | yes | 1 | 1 + 5PR |
| no | no | no | FAI, FL | stencil | W, B | PC | 1.3 | U | no | 5 | 5 |
| no | no | no | FAI, FL | stencil | W, B | PC | 1.3 | U | no | 5 | 5 |
| no | no | yes | FL | stencil | W, B, Al | DCAI | 9 | T, B, E, C | yes | 5 | 5 |
| no | no | yes | FL | stencil | W, B, Al | DCAI | 9 | T, B, E, C | yes | 5 | 5 |

^f PR = prorated

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by light source)

| Manufacturer | Trade Name | Identification | Number of Light Sources | Rated Active Power (W) at | | Power Factor at | | Rated Lamp Life (yr) | Battery Type ^a | Battery Life (yr) | Battery Operating Time (h) | Full Battery Recharge Time (h) |
|--|-----------------|-------------------|-------------------------|---------------------------|-------|-----------------|-------|----------------------|---------------------------|-------------------|----------------------------|--------------------------------|
| | | | | 120 V | 277 V | 120 V | 277 V | | | | | |
| LED | | | | | | | | | | | | |
| Prescolite tel 510-562-3500 fax 510-577-5019 | Exit Lite | EX1LEDREMFA | 72 | 8 | 8 | 0.81 | 0.81 | NS | PbCa | 6–10 | 1.5 | 24 |
| | Exit Lite | EX1LEDGEMFA | 72 | 9.4 | 9.2 | 0.85 | 0.87 | NS | PbCa | 6–10 | 1.5 | 24 |
| | PEX Exit Series | PEXLIRENW | 12 | 3.6 | 3.5 | 0.86 | 0.84 | NS | NiCAD | 12 | 1.5 | 24 |
| | PEX Exit Series | PEXLIGENW | 78 | 13 | 13 | 0.92 | 0.92 | NS | NiCAD | 12 | 1.5 | 24 |
| Sure-Lites tel 847-806-3859 fax 847-956-8423 | CAX Series | CAX717000RWLP | 99 | 7.4 | 7.5 | 0.72 | 0.72 | 25 | NiCAD | 15 | 1.5 | 24 |
| | CAX Series | CAX717000GW | 100 | 8.5 | 8.7 | 0.79 | 0.79 | 25 | NiCAD | 15 | 1.5 | 24 |
| | CAX Series | CAX1LEDSPRW | 40 | 8.4 | 8.3 | 0.92 | 0.92 | NS | PbCa NiCAD | 8–10 15 | NS | 24 |
| | CCX Series | CCX70GWH | NS | 10.8 | 10.4 | 0.97 | 0.95 | NS | PbCa | 8–10 | 1.5 | 24 |
| | CCX Series | CCX71RWHDH | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| Yorklite Electronics tel 215-244-4201 fax 215-244-4208 | Sentor | ALXSPWR1U | 30 | 4.5 | 4.5 | 0.85 | 0.85 | 25 | NiCAD | 10 | 2.0 | 24 |
| Edgelit LED | | | | | | | | | | | | |
| Chloride Systems | Sterling Series | STELSW1RW3 | 14 | 5.19 | 5.55 | 0.86 | 0.83 | 25+ | NiCAD | 12 | 1.5 | 24 |
| | Sterling Series | STELSW1GW3 | 12 | 4.24 | 4.24 | 0.79 | 0.79 | 25+ | NiCAD | 12 | 1.5 | 24 |
| Dynaray | 91 Series | D91R14LEDRC | 75 | NS | NS | NS | NS | 10 | NiCAD | 15 | 1.5 | 168 |
| | 91 Series | D91R14LEDGC | 95 | NS | NS | NS | NS | 10 | NiCAD | 15 | 1.5 | 168 |
| Exide Lightguard | Slim Line | SLELSWSRW3 | 14 | 5.19 | 5.55 | 0.86 | 0.83 | 25+ | NiCAD | 12 | 1.5 | 24 |
| | Slim Line | SLELSWSGW3 | 12 | 4.24 | 4.24 | 0.79 | 0.79 | 25+ | NiCAD | 12 | 1.5 | 24 |
| Lithonia Emergency Systems | Precise | LRPW1RW120/277ELN | 30 | 2.3 | 2.7 | 0.21 | 0.10 | 25 | NiCAD | 7–10 | 1.5 | 168 |
| | Precise | LRPW1GW120/277ELN | 18 | 1.7 | 1.9 | 0.20 | 0.10 | 25 | NiCAD | 7–10 | 1.5 | 168 |

NA = not applicable
NS = not supplied
^a NiCAD = nickel cadmium
PbCa = lead calcium

^b FL = flasher
Bz = buzzer
BF = buzzer and flasher
FAI = fire alarm interface
ER = extended battery-run time
2CKT = 120 V and 277 V operation

^c W = white
B = black
BrAl = brushed aluminum
Al = aluminum
Cl = clear
Br = bronze
S = silver
M = mirror
R = red

^d DCAI = diecast aluminum
TP = thermoplastic
Al = aluminum
DCST = diecast steel
PC = polycarbonate
ExAl = extruded aluminum
SS = stainless steel
ST = steel

^e U = universal
W = wall
C = conduit
VW = vertical wall
E = end
B = back
T = top
F = flush
R = recessed

| Low Battery Voltage Disconnect | Brownout Circuitry | Auto Discharge/Recharge Cycle | Emergency Options ^b | Sign Format(s) | Available Background Color(s) ^c | Housing Material ^d | Weight (lb) | Mounting ^e | Vandal Resistant | Sign Warranty Period (yr) | Warranty on Internal Battery ^f (yr) |
|--------------------------------|--------------------|-------------------------------|--------------------------------|-----------------|--|-------------------------------|-------------|-----------------------|------------------|---------------------------|--|
| yes | yes | NS | FAI, FL, Bz | matrix | W, B, BrAl | TP | 7.2 | U | yes | 12 | 6 |
| yes | yes | NS | FAI, FL, Bz | matrix | W, B, BrAl | TP | 7.2 | U | yes | 12 | 6 |
| yes | yes | NS | FAI, FL, Bz | stencil, matrix | W, B | TP | 6.5 | U | yes | 12 | 12 |
| yes | yes | NS | FAI, FL, Bz | stencil, matrix | W, B | TP | 6.5 | U | yes | 12 | 12 |
| yes | yes | no | FAI, FL, Bz | stencil | W, B, Bz, BrAl | DCAI | NS | U | yes | 1 | 15 |
| yes | yes | no | FAI, FL, Bz | stencil | W, B, Bz, BrAl | DCAI | NS | U | yes | 1 | 15 |
| yes | yes | no | FAI, FL, Bz | stencil | W, B, Bz, BrAl | DCAI | NS | C, B, E | yes | 1 | 5 10 |
| yes | yes | no | FAI, FL, Bz | stencil | W, B | PC | NS | U | yes | 1 | 5 PR |
| NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| yes | yes | no | FAI, FL, Bz | stencil | W, B, BrAl | DCAI | 4.8 | U | yes | 5 | 5 |
| yes | yes | no | 2CKT | edgelit | Cl, W | ST, Al | 12 | C, W, VW | NS | 3 | 5 |
| yes | yes | no | 2CKT | edgelit | Cl, W | ST, Al | 12 | C, W, VW | NS | 3 | 5 |
| no | yes | no | FAI, 2CKT | edgelit | Cl, W, M | DCAI | 12 | C, W | yes | 5 | 7 PR |
| no | yes | no | FAI, 2CKT | edgelit | Cl, W, M | DCAI | 12 | C, W | yes | 5 | 7 PR |
| yes | yes | no | 2CKT | edgelit | Cl, W | ST, Al | 12 | C, W, VW | NS | 3 | 5 |
| yes | yes | no | 2CKT | edgelit | Cl, W | ST, Al | 12 | C, W, VW | NS | 3 | 5 |
| no | no | no | FL, FAI, BF | edgelit | Cl, W, M | ACR | 5.8 | T, E, B | no | 5 | 5 |
| no | no | no | FL, FAI, BF | edgelit | Cl, W, M | ACR | 5.8 | T, E, B | no | 5 | 5 |

^f PR = prorated

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by light source)

| Manufacturer | Trade Name | Identification | Number of Light Sources | Rated Active Power (W) at | | Power Factor at | | Rated Lamp Life (yr) | Battery Type ^a | Battery Life (yr) | Battery Operating Time (h) | Full Battery Recharge Time (h) |
|--------------------------------|-------------------------|----------------|-------------------------|---------------------------|-------|-----------------|-------|----------------------|---------------------------|-------------------|----------------------------|--------------------------------|
| | | | | 120 V | 277 V | 120 V | 277 V | | | | | |
| Edgelit LED (continued) | | | | | | | | | | | | |
| Prescolite | Edge-Lit Series | LERR6EMEW | 12 | 3.6 | 3.5 | 0.86 | 0.84 | NS | NiCAD | 12 | 1.5 | 24 |
| | Edge-Lit Series | LERG6EMEW | NS | 13 | 13 | 0.92 | 0.92 | NS | NiCAD | 12 | 1.5 | 24 |
| Sure-Lites | ELX Series | ELX7170RWDAC | 56 | 7.3 | 7.5 | 0.91 | 0.90 | NS | NiCAD | NS | 1.5 | 24 |
| | ELX Series | ELX7170GWDAC | 96 | 9.7 | 9.9 | 0.93 | 0.92 | NS | NiCAD | NS | 1.5 | 24 |
| Yorklite Electronics | CLX Series | CLXSPCR1WR | 14 | <8 | <8 | 0.85 | 0.85 | 25 | NiCAD | 5 | 1.5 | 24 |
| | CLX Series | CLXSPCR1WG | 12 | <6 | <6 | 0.85 | 0.85 | 25 | NiCAD | 5 | 1.5 | 24 |
| Direct View LED | | | | | | | | | | | | |
| Chloride Systems | Infinity | ISPLWP1R | 88 | 6 | NS | NS | NS | 25+ | NiCAD | 12 | 1.5 | 24 |
| | Infinity | ISPLWP1G | 88 | 6 | NS | NS | NS | 25+ | NiCAD | 12 | 1.5 | 24 |
| Exide Lightguard | Miser | MSPLWP1WR | 88 | 6 | NS | NS | NS | 25+ | NiCAD | 12 | 1.5 | 24 |
| | Miser | MSPLWP1WG | 88 | 6 | NS | NS | NS | 25+ | NiCAD | 12 | 1.5 | 24 |
| Hubbell Lighting | Freedom Series | LED1ACRWW | 90 | 5.7 | 5.8 | 0.81 | 0.80 | 80 | NA | NA | NA | NA |
| Radioluminescent | | | | | | | | | | | | |
| Exide Lightguard | LS Self-Luminous Series | L3GU10SBK | 1 | NA | NA | NA | NA | 10+ | NA | NA | NA | NA |

NA = not applicable
 NS = not supplied
^a NiCAD = nickel cadmium
 PbCa = lead calcium
^b FL = flasher
 Bz = buzzer
 BF = buzzer and flasher
 FAI = fire alarm interface
 ER = extended battery-run time
 2CKT = 120 V and 277 V operation
^c W = white
 B = black
 BrAl = brushed aluminum
 Al = aluminum
 Cl = clear
 Br = bronze
 S = silver
 M = mirror
 R = red
^d DCAI = diecast aluminum
 TP = thermoplastic
 Al = aluminum
 DCST = diecast steel
 PC = polycarbonate
 ExAl = extruded aluminum
 SS = stainless steel
 ST = steel
^e U = universal
 W = wall
 C = conduit
 VW = vertical wall
 E = end
 B = back
 T = top
 F = flush
 R = recessed

| Low Battery Voltage Disconnect | Brownout Circuitry | Auto Discharge/Recharge Cycle | Emergency Options ^b | Sign Format(s) | Available Background Color(s) ^c | Housing Material ^d | Weight (lb) | Mounting ^e | Vandal Resistant | Sign Warranty Period (yr) | Warranty on Internal Battery ^f (yr) |
|--------------------------------|--------------------|-------------------------------|--------------------------------|----------------|--|-------------------------------|-------------|-----------------------|------------------|---------------------------|--|
| yes | yes | NS | none | edgelit | Cl, W, M | DCST | 8 | R | NS | 12 | 12 |
| yes | yes | NS | none | edgelit | Cl, W, M | DCST | 8 | R | NS | 12 | 12 |
| no | yes | no | FAI, FL, Bz | edgelit | Cl, W, M | ACR | NS | C, E, W | NS | 1 | 15 |
| no | yes | no | FAI, FL, Bz | edgelit | Cl, W, M | ACR | NS | C, E, W | NS | 1 | 15 |
| yes | no | no | none | edgelit | Cl, W | SS | 5.75 | U | yes | 3 | 3 |
| yes | no | no | none | edgelit | Cl, W | SS | 5.75 | U | yes | 3 | 3 |
| yes | yes | yes | FAI, FL, Bz, BF, 2CKT | matrix | W, B, BrAl | TP, DCAI | 5 | U | yes | 5 | 7 |
| yes | yes | yes | FAI, FL, Bz, BF, 2CKT | matrix | W, B, BrAl | TP, DCAI | 5 | U | yes | 5 | 7 |
| yes | yes | yes | FAI, FL, Bz, BF, 2CKT | matrix | W, B, BrAl | TP, DCAI | 5 | U | yes | 5 | 7 |
| yes | yes | yes | FA, FL, Bz, BF, 2CKT | matrix | W, B, BrAl | TP, DCAI | 5 | U | yes | 5 | 7 |
| yes | yes | yes | NS | stencil | W, B, BrAl | ExAl | 4.75 | U | yes | 5 | 3+5PR |
| NA | NA | NA | NA | stencil | R, G, B | ABS | 2.0 | C, W, F | yes | 10 | NA |

^f PR = prorated

Table 2. Manufacturer-Supplied Information: Retrofit Kits

| Manufacturer | Trade Name | Model Number | Number of Light Sources | Rated Active Power (W) at | | Rated Lamp Life (yr) | Weight of Kit (lb) | Method of Connection |
|--|------------------------|--------------------------------|-------------------------|---------------------------|-------|----------------------|--------------------|----------------------|
| | | | | 120 V | 277 V | | | |
| Dynaray | NS | DLITE-B1 | 60 | 3 | NS | 20 | NS | screw in |
| Emergi-Lite tel 860-399-7991 fax 860-399-7996 | Quickswitch | QSC | 60 | 3 | NS | 25 | 0.17 | screw in |
| Flexlite, Inc. tel 800-932-9899 fax 732-417-2129 | White Light Star Burst | STAR-white | 18 | 8 | 11 | 13.2 | 0.21 | screw in plug in |
| | Red Star Burst | STAR-red | 36 | 2 | NS | 25 | 0.29 | screw in plug in |
| Standard Enterprises tel 703-490-3300 fax 703-497-2316 | Wattman | SWR120C with red diffuser | 56 | 2 | NS | 50–80 | 0.13 | screw in |
| | Wattman | SWG120C with green diffuser | 6 | 2 | NS | 50–80 | 0.08 | screw in |
| Sure-Lites | NS | RKX7U with red diffuser | NS | NS | NS | NS | NS | screw in, plug in |
| Teron Lighting tel 513-858-6004 fax 513-858-6038 | Ultra II | UA2C RED | 40 | 2 | NS | 25 | 0.21 | screw in |
| | Ultra II | UA2C GREEN | 40 | 2 | NS | 25 | 0.21 | screw in |
| Yorklite Electronics | Convertalite | YLAR-U | 30 | 2.1 | 2.1 | 25 | 0.25 | rewire |

NS = not supplied

Table 3. NLPIP-Measured Data: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Identification | Directly Measured | | Power Type |
|------------------|---------------------|----------------|--|-----------------------|---------------|
| | | | Rated Active Power at 120 V ^a (W) | Power Factor at 120 V | |
| LED | | | | | |
| Chloride Systems | Reference Series II | RLN1RW | 7.2 | 0.63 lag | ac battery |
| | Reference Series II | RLN1GW | 12.9 | 0.84 lag | ac battery |
| Dynaray | PDQ82 Series | 82W14 | 5.2 | 0.40 lag | ac battery |
| | PDQ82 Series | 82W14G | 7.3 | 0.57 lag | ac battery |
| Exide Lightguard | E800 | E803WSR | 7.2 | 0.63 lag | ac battery |
| | E800 | E803WSG | 12.9 | 0.84 lag | ac battery |

Note: Column headings and NLPIP testing procedures are described in *Specifier Reports: Exit Signs*.^a Measurements are accurate to within $\pm 2\%$. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.^b Measurements are accurate to within $\pm 5\%$. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.^c Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.^d Results of simulations are reported with the same number of significant digits as the corresponding measured values.

| Width (in.) | Height (in.) | Depth (in.) | Warranty Period (yr) |
|-------------|--------------|-------------|----------------------|
| 4.7 | 0.83 | 0.83 | 5 |
| NS | NS | NS | 5 |
| 5.7 | 5.7 | 0.63 | 10 |
| 5.9 | 5.9 | 0.65 | 30 |
| 5.1 | 0.75 | 0.75 | 25 |
| 4.5 | 0.75 | 0.75 | 25 |
| 4.75 | 5.6 | 1.48 | NS |
| 5.3 | 0.9 | 0.9 | 10 |
| 5.1 | 0.85 | 0.85 | 10 |
| 6.4 | 2.24 | 1.5 | 10 |

| Luminance Contrast | Clear-Air Conditions | | | | Smoke Simulations | | | |
|--------------------|---|--|---|--|--------------------|---|---|------------------------|
| | Mean Letter Luminance ^b (cd/m ²) | Letter Luminance Range ^b (cd/m ²) | Mean Background Luminance ^c (cd/m ²) | Background Luminance Range ^c (cd/m ²) | Luminance Contrast | Mean Letter Luminance ^d (cd/m ²) | Mean Background Luminance ^d (cd/m ²) | Critical Distance (ft) |
| >0.99 | 14.7 | 8.4–22 | <0.1 | <0.3 | 0.69 | 0.41 | 0.13 | 21 |
| >0.99 | 17.5 | 9.8–26 | <0.2 | <0.3 | 0.69 | 0.49 | 0.15 | 21 |
| >0.99 | 13.4 | 7.5–22 | <0.1 | <0.2 | 0.71 | 0.36 | 0.11 | 20 |
| >0.99 | 17.3 | 9.5–29 | <0.1 | <0.2 | 0.71 | 0.47 | 0.14 | 21 |
| >0.99 | 24 | 16.8–30 | <1 | <1 | 0.69 | 0.68 | 0.21 | 22 |
| >0.99 | 18.2 | 12.5–23 | <0.2 | <0.3 | 0.69 | 0.51 | 0.16 | 21 |
| >0.99 | 9.5 | 6.3–11.9 | <0.1 | <0.1 | 0.71 | 0.26 | 0.08 | 18 |
| >0.99 | 8.2 | 5.4–10.2 | <0.1 | <0.1 | 0.71 | 0.22 | 0.06 | 17 |
| >0.99 | 14.7 | 8.4–22 | <0.1 | <0.3 | 0.69 | 0.41 | 0.13 | 21 |
| >0.99 | 17.5 | 9.8–26 | <0.2 | <0.3 | 0.69 | 0.49 | 0.15 | 21 |
| >0.99 | 13.4 | 7.5–22 | <0.1 | <0.2 | 0.71 | 0.36 | 0.11 | 20 |
| >0.99 | 17.3 | 9.5–29 | <0.1 | <0.2 | 0.71 | 0.47 | 0.14 | 21 |

Table 3 (continued). NLP-IP-Measured Data: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Identification | Directly Measured | | |
|------------------------|--------------------|-------------------|--|-----------------------|---------------|
| | | | Rated Active Power at 120 V ^a (W) | Power Factor at 120 V | Power Type |
| LED (continued) | | | | | |
| Hubbell Lighting | C Series (ac only) | CWARAL9 | 1.48 | 0.16 lead | ac |
| | C Series | CWPGWL9 | 6.7 | 0.85 lag | ac battery |
| | Pathfinder | PUPRWL9 | 8.2 | 0.83 lag | ac battery |
| | Pathfinder | PUPGWL9 | 8.8 | 0.81 lag | ac battery |
| Juno Lighting | Universal Voltage | EXR51-WH | 4.15 | 0.44 lead | ac battery |
| | Universal Voltage | EXG51-WH | 6.0 | 0.46 lead | ac battery |
| Lithonia Lighting | Quantum | LQMSW1R120/277ELN | 0.75 | 0.14 lead | ac battery |
| | Quantum | LQMSW1G120/277ELN | 0.80 | 0.15 lead | ac battery |
| | Extreme | LVS1R120/277ELN | 3.45 | 0.21 lead | ac battery |
| | Extreme | LVS1G120/277ELN | 2.29 | 0.22 lead | ac battery |
| Prescolite | Exit Lite | EX1LEDREMFA | 7.0 | 0.82 lag | ac battery |
| | Exit Lite | EX1LEDGEMFA | 8.6 | 0.87 lag | ac battery |
| | PEX Exit Series | PEXL1REXW | 3.34 | 0.86 lag | ac battery |
| | PEX Exit Series | PEXL1GENW | 11.6 | 0.93 lag | ac |
| Sure-Lites | CAX Series | CAX717000RWLP | 3.86 | 0.70 lag | ac battery |
| | CAX Series | CAX717000GW | 8.3 | 0.81 lag | ac battery |
| | CAX Series | CAX1LEDSPRW | 5.3 | 0.74 lag | ac battery |
| | CAX Series | CCX70GWH | 5.2 | 0.68 lead | ac battery |
| | CCX Series | CCX71RWHDH | 4.11 | 0.53 lead | ac battery |
| Yorklite Electronics | Sentor | ALXSPWR1U | 4.61 | 0.77 lag | ac battery |

Note: Column headings and NLP-IP testing procedures are described in *Specifier Reports: Exit Signs*.

^a Measurements are accurate to within $\pm 2\%$. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

^b Measurements are accurate to within $\pm 5\%$. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

^c Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

^d Results of simulations are reported with the same number of significant digits as the corresponding measured values.

| Luminance Contrast | Clear-Air Conditions | | | | Smoke Simulations | | | |
|--------------------|---|--|---|--|--------------------|---|---|------------------------|
| | Mean Letter Luminance ^b (cd/m ²) | Letter Luminance Range ^b (cd/m ²) | Mean Background Luminance ^c (cd/m ²) | Background Luminance Range ^c (cd/m ²) | Luminance Contrast | Mean Letter Luminance ^d (cd/m ²) | Mean Background Luminance ^d (cd/m ²) | Critical Distance (ft) |
| >0.99 | 57 | 26–82 | <1 | <1 | 0.71 | 1.53 | 0.44 | 28 |
| 0.99 | 14.9 | 7–21 | <0.2 | <0.3 | 0.70 | 0.41 | 0.12 | 21 |
| 0.99 | 19.3 | 9–28 | <0.2 | <0.3 | 0.70 | 0.52 | 0.16 | 22 |
| 0.99 | 12.0 | 9.1–15.6 | <0.1 | <0.2 | 0.67 | 0.35 | 0.11 | 20 |
| 0.99 | 38 | 17.4–118 | <1 | <1 | 0.69 | 1.12 | 0.35 | 25 |
| 0.99 | 6.6 | 3.1–12.0 | <0.1 | <0.1 | 0.68 | 0.18 | 0.06 | 16 |
| >0.99 | 350 | 63–2300 | <10 | <10 | 0.76 | 9.6 | 2.3 | 35 |
| >0.99 | 21 | 15.3–32 | <1 | <1 | 0.69 | 0.61 | 0.19 | 22 |
| >0.99 | 17.6 | 12.7–27 | <0.1 | <0.2 | 0.69 | 0.51 | 0.16 | 21 |
| >0.99 | 12.6 | 8.8–17.7 | <0.1 | <0.1 | 0.69 | 0.36 | 0.11 | 20 |
| >0.99 | 8.9 | 6.2–12.6 | <0.1 | <0.1 | 0.69 | 0.25 | 0.08 | 18 |
| >0.99 | 13.2 | 7.3–25 | <0.1 | <0.2 | 0.69 | 0.37 | 0.12 | 20 |
| >0.99 | 6.6 | 3.6–12.5 | <0.1 | <0.1 | 0.69 | 0.19 | 0.06 | 16 |
| >0.99 | 11.0 | 8.1–15.9 | <0.1 | <0.1 | 0.68 | 0.31 | 0.10 | 19 |
| >0.99 | 5.8 | 4.3–8.5 | <0.1 | <0.1 | 0.67 | 0.17 | 0.05 | 16 |
| 0.96 | 60 | 43–75 | 2 | 1–3 | 0.67 | 1.68 | 0.55 | 28 |
| 0.96 | 55 | 39–68 | 2 | 1–3 | 0.67 | 1.54 | 0.50 | 28 |
| 0.97 | 20 | 13.6–30 | 1 | <1 | 0.68 | 0.58 | 0.19 | 22 |
| 0.97 | 26 | 17–38 | 1 | <1 | 0.68 | 0.73 | 0.23 | 23 |
| >0.99 | 28 | 19.1–40 | <1 | <1 | 0.70 | 0.80 | 0.24 | 23 |
| >0.99 | 45 | 30–65 | <1 | <1 | 0.70 | 1.28 | 0.38 | 27 |
| >0.99 | 8.6 | 6.8–11.9 | <0.1 | <0.1 | 0.71 | 0.24 | 0.07 | 17 |
| >0.99 | 8.3 | 6.6–11.5 | <0.1 | <0.1 | 0.71 | 0.23 | 0.07 | 17 |
| >0.99 | 21 | 17–27 | <1 | <1 | 0.67 | 0.62 | 0.20 | 22 |
| >0.99 | 25 | 19.5–32 | <1 | <1 | 0.67 | 0.72 | 0.23 | 22 |
| >0.99 | 4.5 | 3.7–5.7 | <0.1 | <0.1 | 0.68 | 0.13 | 0.04 | 15 |
| >0.99 | 24 | 17.8–30 | <1 | <1 | 0.70 | 0.67 | 0.20 | 22 |
| >0.99 | 62 | 46–77 | <1 | <1 | 0.70 | 1.73 | 0.52 | 28 |
| >0.99 | 18.6 | 14.6–27 | <0.2 | <0.2 | 0.70 | 0.52 | 0.16 | 22 |
| >0.99 | 21 | 16.3–31 | <1 | <1 | 0.70 | 0.59 | 0.18 | 22 |
| 0.99 | 24 | 6.2–52 | <1 | <1 | 0.66 | 0.72 | 0.24 | 23 |
| 0.99 | 146 | 38–600 | <2 | <4 | 0.72 | 4.2 | 1.2 | 32 |
| >0.99 | 9.7 | 6.7–14.6 | <0.1 | <0.1 | 0.68 | 0.28 | 0.09 | 19 |
| >0.99 | 230 | 77–780 | <10 | <10 | 0.70 | 6.7 | 2.0 | 33 |
| >0.99 | 17.8 | 10.5–24 | <0.2 | <0.2 | 0.68 | 0.52 | 0.17 | 22 |
| >0.99 | 154 | 49–710 | <2 | <3 | 0.71 | 4.5 | 1.3 | 32 |
| >0.99 | 15.1 | 9.3–19.5 | <0.1 | <0.2 | 0.69 | 0.43 | 0.13 | 21 |
| >0.99 | 17.1 | 10.6–22 | <0.1 | <0.2 | 0.69 | 0.49 | 0.15 | 21 |

Table 3 (continued). NLP-IP-Measured Data: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Identification | Directly Measured | | Power Type |
|----------------------|-----------------|-------------------|--|-----------------------|---------------|
| | | | Rated Active Power at 120 V ^a (W) | Power Factor at 120 V | |
| Edgelit LED | | | | | |
| Chloride Systems | Sterling Series | STELSW1RW3 | 9.3 | 0.85 lag | ac battery |
| | Sterling Series | STELSW1GW3 | 14.7 | 0.92 lag | ac battery |
| Dynaray | 91 Series | D91R14LEDRC | 4.60 | 0.39 lag | ac battery |
| | 91 Series | D91R14LEDGC | 6.7 | 0.48 lag | ac battery |
| Exide Lightguard | Slim Line | SLELSWSRW3 | 9.3 | 0.85 lag | ac battery |
| | Slim Line | SLELSWSGW3 | 14.7 | 0.92 lag | ac battery |
| Lithonia Lighting | Precise | LRPW1RW120/277ELN | 2.16 | 0.21 lead | ac battery |
| | Precise | LRPW1GW120/277ELN | 1.77 | 0.23 lead | ac battery |
| Prescolite | Edge-Lit Series | LERR6EMEWLH | 4.79 | 0.90 lag | ac battery |
| Sure-Lites | ELX Series | ELX7170RWDAC | 8.2 | 0.92 lead | ac battery |
| | ELX Series | ELX7170GWDAC | 9.4 | 0.94 lag | ac battery |
| Yorklite Electronics | CLX Series | CLXSPCR1WR | 9.3 | 0.90 lag | ac battery |
| | CLX Series | CLXSPCR1WG | 15.2 | 0.92 lag | ac battery |

Note: Column headings and NLP-IP testing procedures are described in *Specifier Reports: Exit Signs*.

^a Measurements are accurate to within ±2%. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

^b Measurements are accurate to within ±5%. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

^c Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

^d Results of simulations are reported with the same number of significant digits as the corresponding measured values.

| Luminance Contrast | Clear-Air Conditions | | | | Smoke Simulations | | | Critical Distance (ft) |
|--------------------|---|--|---|--|--------------------|---|---|------------------------|
| | Mean Letter Luminance ^b (cd/m ²) | Letter Luminance Range ^b (cd/m ²) | Mean Background Luminance ^c (cd/m ²) | Background Luminance Range ^c (cd/m ²) | Luminance Contrast | Mean Letter Luminance ^d (cd/m ²) | Mean Background Luminance ^d (cd/m ²) | |
| 0.95 | 7.7 | 4.9–12.3 | 0.4 | 0.1–1.4 | 0.58 | 0.26 | 0.11 | 18 |
| 0.95 | 8.3 | 5.2–14 | 0.4 | 0.1–1.5 | 0.58 | 0.28 | 0.12 | 19 |
| 0.66 | 2.5 | 1.06–5.0 | 0.9 | 0.2–2.3 | 0.35 | 0.12 | 0.079 | 14 |
| 0.65 | 3.7 | 1.55–7.3 | 1.3 | 0.3–3.3 | 0.34 | 0.18 | 0.120 | 16 |
| 0.98 | 13.2 | 7.8–20 | 0.3 | 0.1–0.5 | 0.67 | 0.38 | 0.12 | 20 |
| 0.98 | 9.6 | 5.7–14.6 | 0.2 | 0.1–0.4 | 0.67 | 0.27 | 0.09 | 18 |
| 0.97 | 4.4 | 2.6–7.1 | 0.1 | 0.1–0.2 | 0.64 | 0.13 | 0.048 | 15 |
| 0.97 | 3.7 | 2.2–6.0 | 0.1 | <0.2 | 0.64 | 0.11 | 0.040 | 14 |
| 0.95 | 7.7 | 4.9–12.3 | 0.4 | 0.1–1.4 | 0.58 | 0.26 | 0.11 | 18 |
| 0.95 | 8.3 | 5.2–14 | 0.4 | 0.1–1.5 | 0.58 | 0.28 | 0.12 | 19 |
| 0.66 | 2.5 | 1.06–5.0 | 0.9 | 0.2–2.3 | 0.35 | 0.12 | 0.079 | 14 |
| 0.65 | 3.7 | 1.55–7.3 | 1.3 | 0.3–3.3 | 0.34 | 0.18 | 0.120 | 16 |
| 0.92 | 14.3 | 8.3–21 | 1.1 | 0.4–2.0 | 0.57 | 0.47 | 0.20 | 21 |
| 0.92 | 18.7 | 10.8–27 | 1.4 | 0.5–2.6 | 0.58 | 0.62 | 0.26 | 22 |
| 0.88 | 37 | 20–67 | 4.5 | 1.3–8.2 | 0.49 | 1.40 | 0.72 | 28 |
| 0.88 | 47 | 25–83 | 5.8 | 1.6–12.5 | 0.48 | 1.75 | 0.90 | 29 |
| 0.93 | 11.6 | 4.6–23 | 0.9 | 0.2–3.1 | 0.48 | 0.45 | 0.24 | 21 |
| 0.93 | 24 | 9.8–46 | 2 | <6.3 | 0.49 | 0.92 | 0.47 | 24 |
| 0.90 | 9.6 | 6.1–2.3 | 1.0 | 0.3–2.0 | 0.51 | 0.33 | 0.16 | 20 |
| 0.89 | 11.8 | 7.5–15.2 | 1.2 | 0.4–2.4 | 0.51 | 0.41 | 0.20 | 21 |
| 0.77 | 5.7 | 3.0–8.0 | 1.3 | 0.5–4.5 | 0.32 | 0.27 | 0.18 | 18 |
| 0.78 | 6.2 | 3.3–8.6 | 1.4 | 0.5–5.2 | 0.32 | 0.30 | 0.20 | 19 |
| 0.95 | 7.9 | 4.7–13.5 | 0.4 | 0.1–1.1 | 0.62 | 0.25 | 0.10 | 18 |
| 0.95 | 8.6 | 4.9–15.2 | 0.4 | 0.1–1.2 | 0.61 | 0.28 | 0.11 | 18 |
| 0.55 | 1.83 | 0.97–3.4 | 0.83 | 0.26–2.2 | 0.23 | 0.11 | 0.086 | 14 |
| 0.56 | 2.5 | 1.31–4.7 | 1.1 | 0.3–2.9 | 0.24 | 0.16 | 0.119 | 15 |

Table 3 (continued). NLP-IP-Measured Data: Exit Signs (listed by type of light source)

| Manufacturer | Trade Name | Identification | Directly Measured | | |
|----------------------------|-------------------------|----------------|--|-----------------------|---------------|
| | | | Rated Active Power at 120 V ^a (W) | Power Factor at 120 V | Power Type |
| Direct View LED | | | | | |
| Chloride Systems | Infinity | ISPLWP1R | 11.3 | 0.90 lag | ac battery |
| | Infinity | ISPLWP1G | 10.6 | 0.91 lag | ac battery |
| Exide Lightguard | Miser | MSPLWP1WR | 11.3 | 0.90 lag | ac battery |
| | Miser | MSPLWP1WG | 10.6 | 0.91 lag | ac battery |
| Hubbell Lighting (AC only) | Freedom Series | LED1ACRWW | 5.2 | 0.76 lag | ac |
| Radioluminescent | | | | | |
| Exide Lightguard | LS Self-Luminous Series | L3GU10SBK | NA | NA | self |

Note: Column headings and NLP-IP testing procedures are described in *Specifier Reports: Exit Signs*.

^a Measurements are accurate to within $\pm 2\%$. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

^b Measurements are accurate to within $\pm 5\%$. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

^c Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

^d Results of simulations are reported with the same number of significant digits as the corresponding measured values.

Table 4. NLP-IP-Measured Data: Retrofit Kits

| Manufacturer | Trade Name | Identification | Directly Measured | |
|--------------------------|------------------------|-------------------------------|--|-----------------------|
| | | | Rated Active Power at 120 V ^a (W) | Power Factor at 120 V |
| Retrofit Kits | | | | |
| Base Case RED Diffuser | NA | NA | 23.1 | 1.0 |
| Base Case GREEN Diffuser | NA | NA | 23.0 | 1.0 |
| Dynaray | NS | DLITE-B1 | 3.0 | 0.40 lead |
| Emergi-Lite | Quickswitch | QS-C | 3.1 | 0.49 lead |
| Flexlite | White Light Star Burst | STAR-C (with red diffuser) | 9.5 | 1.0 |
| | White Light Star Burst | STAR-C (with green diffuser) | 9.5 | 1.0 |
| | Red Star burst | BURST-R | 1.9 | 0.99 lead |
| Standard Enterprises | Wattman | SWR120C (with red diffuser) | 4.00 | 0.47 lead |
| | Wattman | SWG120C (with green diffuser) | 0.64 | 0.12 lead |
| Sure-Lites | NS | RKX7U (with red diffuser) | 10.7 | 0.52 lag |
| | NS | RKX7U (with green diffuser) | 10.7 | 0.51 lag |
| Teron Lighting | Ultra II | UA2C GREEN | 3.35 | 0.23 lead |
| Yorklite Electronics | Convertalite | YLAR-U | 2.19 | 0.39 lead |

Note: Column headings and NLP-IP testing procedures are described in *Specifier Reports: Exit Signs*.

NA = not applicable

NS = not supplied

^a Measurements are accurate to within $\pm 2\%$. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

^b Measurements are accurate to within $\pm 5\%$. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

| Clear-Air Conditions | | | | | Smoke Simulations | | | |
|----------------------|---|--|---|--|--------------------|---|---|------------------------|
| Luminance Contrast | Mean Letter Luminance ^b (cd/m ²) | Letter Luminance Range ^b (cd/m ²) | Mean Background Luminance ^c (cd/m ²) | Background Luminance Range ^c (cd/m ²) | Luminance Contrast | Mean Letter Luminance ^b (cd/m ²) | Mean Background Luminance ^d (cd/m ²) | Critical Distance (ft) |
| >0.99 | 130 | 57–290 | <1 | <1 | 0.79 | 3.2 | 0.67 | 31 |
| >0.99 | 187 | 81–410 | <1 | <1 | 0.79 | 4.7 | 0.97 | 32 |
| >0.99 | 94 | 49–146 | <1 | <1 | 0.77 | 2.4 | 0.55 | 30 |
| >0.99 | 104 | 58–157 | <1 | <1 | 0.77 | 2.6 | 0.60 | 30 |
| >0.99 | 130 | 57–290 | <1 | <1 | 0.79 | 3.2 | 0.67 | 31 |
| >0.99 | 187 | 81–410 | <1 | <1 | 0.79 | 4.7 | 0.97 | 32 |
| >0.99 | 94 | 49–146 | <1 | <1 | 0.77 | 2.4 | 0.55 | 30 |
| >0.99 | 104 | 58–157 | <1 | <1 | 0.77 | 2.6 | 0.60 | 30 |
| >0.99 | 39 | 24–64 | <1 | <1 | 0.77 | 0.96 | 0.22 | 24 |
| >0.99 | 0.37 | 0.26–0.48 | <0.01 | <0.01 | 0.75 | 0.0097 | 0.0025 | <3 |

| Clear-Air Conditions | | | | | Smoke Simulations | | | |
|----------------------|---|--|---|--|--------------------|---|---|------------------------|
| Luminance Contrast | Mean Letter Luminance ^b (cd/m ²) | Letter Luminance Range ^b (cd/m ²) | Mean Background Luminance ^c (cd/m ²) | Background Luminance Range ^c (cd/m ²) | Luminance Contrast | Mean Letter Luminance ^d (cd/m ²) | Mean Background Luminance ^d (cd/m ²) | Critical Distance (ft) |
| 0.98 | 100 | 43–180 | 2 | 1–4 | 0.63 | 3.2 | 0.12 | 31 |
| 0.98 | 77 | 32–143 | 1.5 | 0.9–3.3 | 0.63 | 2.4 | 0.90 | 30 |
| 0.99 | 35 | 15.3–176 | <1 | <1 | 0.64 | 1.08 | 0.39 | 26 |
| 0.94 | 24 | 10.4–107 | 1 | 1–2 | 0.60 | 0.78 | 0.31 | 23 |
| 0.99 | 19.7 | 7.5–54 | <0.3 | <0.6 | 0.68 | 0.58 | 0.18 | 22 |
| 0.98 | 10.6 | 4.2–25 | 0.2 | 0.1–0.4 | 0.68 | 0.32 | 0.10 | 19 |
| >0.99 | 14.2 | 5.1–32 | <0.1 | <0.2 | 0.66 | 0.42 | 0.14 | 21 |
| >0.99 | 40 | 25–65 | <1 | <1 | 0.66 | 1.19 | 0.40 | 26 |
| >0.99 | 8.7 | 5–15.7 | <0.1 | <0.1 | 0.67 | 0.25 | 0.08 | 18 |
| >0.99 | 480 | 96–3400 | <10 | <10 | 0.69 | 14.6 | 0.45 | 38 |
| >0.99 | 460 | 90–2900 | <10 | <10 | 0.68 | 14.2 | 0.45 | 38 |
| 0.99 | 2.8 | 1.41–5.0 | <0.1 | <0.1 | 0.61 | 0.1 | 0.036 | 13 |
| >0.99 | 21 | 14.3–38 | <1 | <1 | 0.68 | 0.60 | 0.19 | 22 |

^c Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

^d Results of simulations are reported with the same number of significant digits as the corresponding measured values.

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