

UL TECHNICAL GUIDANCE DOCUMENTS

This Document is prepared and published by UL.

Product Category (CCN): FTBR, FTBV, FWBX, OUST

Standard Number: UL 924

Standard Title: Standard for Emergency Lighting and Power Equipment

Edition Date: May 9, 2016

Edition Number: 10

Section / Paragraph Reference: See Subject Topics

Topic 1: Representative Luminance Measurement Testing for Exit Signs- Section / Paragraph Reference: 43.1.9

Topic 2: Representative Fluorescent Lamp Loads for Emergency Battery Pack Tests (maximum load verification) - Section / Paragraph Reference: 48.6, 54.1, 78.1, 78.2

Topic 3: Equipment with Battery Heaters and Heater Controls- Section / Paragraph Reference: 47.5, 48.2, 54.2

Topic 4: Calculating Extended Operating Time based on Increased Number of Batteries- Section / Paragraph Reference: 73.1.7 (marked operating time)

Topic 5: Transformer Requirements for Canadian (C-UL) Certification- Section / Paragraph Reference: Supplement SD

Topic 6: Thermally-sensitive Components in Exit Signs- Section / Paragraph Reference: 40.2

Topic 7: "EXIT" Text Legend Observation Test as Representative for a Legend in Other Languages- Section / Paragraph Reference: 43.2.3(b)

Topic 8: Alternative / Replacement LED Arrays in Exit Signs- Section / Paragraph Reference: 43.3

Topic 9: Certification of Emergency LED Drivers- Section / Paragraph Reference: Supplements SA and SG

Topic 10: Representative Fluorescent Lamp Loads for Battery / Inverter System Tests (Minimum Light Output) - Section / Paragraph Reference: SA3.5, SG2

Topic 11: Emergency Luminaire Maximum Mounting Height Calculations- Section / Paragraph Reference: SG3.2

Topic 12: Vertically Oriented Exit Signs- Section / Paragraph Reference: N/A

Topic 13: Exit Signs with a Supplemental Directional Arrow- Section / Paragraph Reference: Section 40

Topic 14: Cord and Plug-Connected Emergency Lighting Equipment- Section / Paragraph Reference: Sections 17 and 18

Topic 15: Graphical Symbol Exit Signs with Two Directional Arrows: Section / Paragraph Reference: 42.1

GUIDANCE:

Topic 1: Representative Luminance Measurement Testing for Exit Signs - Section / Paragraph Reference: 41.1.8

Consideration should be given to the proportionate reduction in DC voltage and to the previously recorded luminance measurement data relative to the minimum luminance requirement (8.7 cd/m^2). These data comparisons are only valid where the LED array, its affiliated circuitry, and its physical / optical relationship to the exit sign face are identical. Where a family of exit signs (using the same LED array) has been certified, luminance data at various DC voltage levels may already be available.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM  **Documents**
Document Sharing Hub

As a general rule of thumb, the luminance measurement test need not be repeated if the DC voltage reduction is 5% or less (0.3V on a 6V nominal system; 0.24V on a 4.8V system) for an exit sign whose measured luminance exceeds the minimum requirement by 25% or more (approx. 11 cd/m²). Where the originally measured luminance output is even greater, higher levels of DC voltage reduction can be accommodated (provided that the battery terminal voltage still meets the minimum 87.5% nominal requirement).

As an alternative, a manufacturer can request the luminance measurement test to be conducted at the nominal 87.5% battery voltage. If compliant results are obtained, any subsequent change in battery performance that still complies with the battery discharge test of Section 48 (retaining minimum 87.5% battery voltage) can be permitted without repeating the luminance measurement test.

Topic 2: Representative Fluorescent Lamp Loads for Emergency Battery Pack Tests (maximum load verification))- Section / Paragraph Reference: 46.7, 52A.1, 75.1, 75.2

In lieu of UL conducting battery discharge current measurement tests on all requested lamp types and configurations to determine a representative sample configuration for the battery discharge cycling test, the emergency battery pack manufacturer should be invited to submit their own complete data set. They should have this data to support their claim that their battery system is suitable for operating the requested range of lamp types/configurations for the minimum 90 minute requirement of UL 924. If they do not have supporting data, UL can generate it for them as a preliminary phase of the overall investigation (this would be a separate service from the UL 924 compliance assessment).

If the manufacturer submits data, UL should countercheck at least two but no more than five of the data points by conducting its own independent measurements of battery discharge current (note - this activity would typically be considered integral to the UL 924 compliance assessment project). Unless there is reason to do otherwise, the data points selected for counterchecking should be among the highest current levels shown in the manufacturer's data.

A DC supply adjusted to nominal battery terminal voltage should be used for these measurements. The current drawn from the supply by each load should be measured no sooner than one minute after energizing the supply. This one-minute delay allows for dissipation of any transients and stabilization of the lamp condition. The lamps used for the measurements should be acquired by UL (not provided by the manufacturer) and, if fluorescent, seasoned (operated) for at least 100 hours prior to taking measurements.

All data collected during this process (whether from UL or the manufacturer) should be retained. If at some subsequent time the manufacturer requests to further increase the range of eligible lamps, or submits an alternative battery or charging system, this data set can be used to determine the extent of retesting, if any, that will be needed.

Topic 3: Equipment with Battery Heaters and Heater Controls- Section / Paragraph Reference: 45.2.3, 46.2, 52A.2

The minimum operational reliability investigation for a heater control is its performance during the extreme low ambient phase of the referenced test programs. If the heater does not activate but the equipment is able to comply with the requirements, the heater circuit is only supplemental relative to equipment compliance with UL 924. If the heater fails to turn on and the battery is unable to comply with any of the referenced test requirements, the equipment would be considered non-compliant.

If a heater control known to comply with requirements that evaluate its calibration and reliability (such as UL 353, UL 873, or UL 60730) does turn on during a low ambient phase of one of the referenced tests, the most severe low temperature condition would be at the point just prior to activation of the heater. The low temperature phase of the program should be conducted at an ambient just prior to activation of the heater circuit.

If a heater control NOT known to comply with requirements that evaluate its calibration and reliability turns on during a low ambient phase of one of the referenced tests, two supplemental evaluations are needed (in addition to conducting the low ambient phase of the referenced tests at the point just prior to activation of the heater):

First, to determine whether the heater control represents a potential risk of fire to the overall equipment if it does not deactivate at sufficient intervals or temperature levels, a fault test should be conducted wherein the control is maintained in a closed (heater "on") position until stabilized results are obtained. Stabilized results, in this context, would be an open (broken) heater element or stable temperatures throughout the product not exceeding the known / rated temperature limits of any critical components or combustible parts. The equipment is not required to remain operational at the end of this abnormal test but should not present a risk of fire or electric shock (similar to the compliance criteria for the Component Breakdown Test).

Second, to determine whether the heater control will consistently activate the heater at this ambient level, two additional end product samples should be subjected to the same low ambient exposure condition. Heater activation should occur within ± 5 C of the ambient temperature activation point of the original test sample.

Topic 4: Calculating Extended Operating Time based on Increased Number of Batteries- Section / Paragraph Reference: 73.1.7 (marked operating time)

An extended operating time rating (2 hours, 4 hours, etc.) can be authorized for central battery systems that have been evaluated and found to comply with a 90 minute (or other) operating time criteria, by establishing a capacity-to-demand ratio (R). This ratio then provides the basis for extending the operating time rating, based on additional strings of batteries and chargers to supply the same VA load for additional time.

This methodology is not applicable to requests for higher load ratings since the rate of battery capacity drainage is typically non-linear in relation to load current changes. The methodology is only applicable where a single battery type (mfr and model) is used. Actual battery amp-hour ratings from the manufacturer are not relied upon.

The established VA-hr capacity of an individual battery is determined through the following formula:

$$C = (T)(VA) / (\#)$$

where

T = time (in hours) of original test (typically 1.5)

VA = load rating for original test

= number of batteries used in original test

The VA-hr demand of the extended operating time system is expressed as

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents
 Document Sharing Hub

$$D = (T)(VA)$$

where

T = requested operating time (in hours)

VA = load rating

The ability of the proposed system to supply the load for the requested time is expressed as a ratio of capacity-to-demand:

$$R = (\#)(C) / (D)$$

where

$R \geq 1$ indicates adequate capacity

$R < 1$ indicates capacity needs to be determined

If an individual battery type has been tested and found to comply with the 90 minute (or other) discharge test program for more than one VA load, the highest VA load for which complying results have been obtained may be used to determine "C". If the request is to establish extended operating times for a series of similar systems all of which have a ratio (R value) of less than 1, the system with the lowest ratio can be tested as representative.

Example:

Model A includes 12 type X batteries and is listed for 90 minutes operating time with a rated load of 5000 VA. Model B uses 15 type X batteries with a rated load of 6000 VA. Model C uses 18 type X batteries with a rated load of 7500 VA.

The capacity of each type X battery, based on the previous listings, is:

$$C = (5000)(1.5) / 12 = 625 \text{ VA-hr}$$

or

$$C = (6000)(1.5) / 15 = 600 \text{ VA-hr}$$

or

$$C = (7500)(1.5) / 18 = 625 \text{ VA-hr}$$

The established capacity of type X is 625 VA-hr per battery.

The manufacturer is now requesting a 4 hour rating on Model A. The minimum number of model X batteries needed to establish the rating without tests (i.e., $R=1$) would be:

$$1 = (\#) (C) / (D)$$

$$\# = (5000 \text{ VA})(4 \text{ hr}) / (625 \text{ VA-hr}) = 32 \text{ batteries}$$

Since the charger associated with the original (90 minute) listing covered only 12 batteries, the 32 battery system requires 3 parallel chargers, with no one charger covering more than 12 batteries.

Topic 5: Transformer Requirements for Canadian (C-UL) Certification- Section / Paragraph Reference: Supplement SD

A transformer found to comply with Supplement SD of UL 924 can be considered to also comply with the relevant requirements of CSA C22.2 No. 66.1, as required by clause 5.13 of CSA C22.2 No. 141-15.

Topic 6: Thermally-sensitive Components in Exit Signs- Section / Paragraph Reference: 40.2

EXIT signs are intended to remain functional at all times of building occupancy. While more advanced electronics can enhance certain functions, the sometimes delicate nature of these electronics should not be permitted to impede the basic required function of the sign. Where electronics are employed to regulate EXIT sign performance, they must be designed in a manner that is reliable under single fault conditions and does not fail in a manner that renders the sign inoperable.

Exit signs with electronics that monitor and regulate critical performance functions must be assessed and tested to ensure compliance with clause 23.4. The existence and function of these electronics may not be obvious. If such electronics are employed and perform as permitted by the standard, adequate product descriptive controls should be put into place to provide for continued compliance. Production surveillance can be achieved by such means as specifying a bill of materials that includes the revision date for embedded software or microprocessor architecture.

Topic 7: "EXIT" Text Legend Observation Test as Representative for a Legend in Other Languages- Section / Paragraph Reference: 43.2.3(b)

Clause 43.2.3(b) prescriptively describes how to alter an exit sign with the text legend "EXIT" for conduct of the observation visibility test. It then states "For other text legends, visual elements of comparable size and significance shall be altered to distinguish between the two sample sets."

The basis conceptual requirement of this clause is to have 10 - 15% of the legend different between the signs used for observation, as a means to gauge whether the observers can adequately distinguish between the signs from the marked viewing distance. Once this distinguishability has been established, however, it should not be necessary to repeat the test for a different configuration of text symbols.

Compliant observation visibility test results on an "EXIT" text legend are considered representative for other text legends (such as "SORTIE" or "SALIDA") of comparable letter dimensions.

Topic 8: Alternative / Replacement LED Arrays in Exit Signs- Section / Paragraph Reference: 43.3

A full range of luminance measurements across the face of an exit sign are required to initially determine compliance of an EXIT sign with Section 43.3. The specific measurement locations are determined based on the legend design, per Figures 43.1 - 43.5. At some point in the lifetime of the sign's production run, the sign manufacturer may want to make available an alternative or replacement LED array (typically, 4 - 8 LEDs and associated circuit components mounted on a printed circuit board). Provided that the number of LEDs is comparable to the previously tested array and the current drawn by the array does not exceed that of the previously tested array, a sampling of luminance measurements should be sufficient to conclude the adequacy of the alternative array.

The input current drawn by the exit sign should first be measured to determine if the alternative / replacement LED array represents a greater load on the battery. Care should be exercised to compare the results to the appropriate original data - either current drawn during battery charging (per clause 49.2)