

## **ELECTRICAL TECHNICAL PAPER 22**

### **AIRFIELD/HELIPORT/HELIPAD PORTABLE LIGHTING REQUIREMENTS IN A THEATER OF OPERATIONS (TO) (FOR ARMY ONLY)**

This Technical Paper provides U.S. Army policy for portable lighting requirements at airfields, heliports, helipads and other landing areas for contingency, training, and temporary use in a TO. It applies to all Army organizations responsible for operating Army airfield/heliports/helipads or employing portable lighting systems. It is intended for 1) Army Acquisition Program Managers responsible for developing, testing, procuring and fielding portable airfield lighting systems, 2) U.S. Army aviation units responsible for deploying portable airfield lighting systems and training personnel in the system's use, 3) construction contractors building and expanding airfields / heliports / helipads, 4) other organizations responsible for airfield construction and, 5) organizations responsible for maintenance and operations of airfields/heliports/helipads.

#### **1.0 LIGHTING REQUIREMENTS**

1.1 The Army has been utilizing portable lighting during contingency operations without standards for many years. This document establishes the lighting requirements and usage of portable lighting on Army airfields/heliports/helipads in a TO. A TO in Joint Publication 3-0, *Joint Operations*, is defined as an operational area defined by the geographic combatant commander for the conduct or support of specific military operations. The paved and unpaved surfaces include Army airstrips, heliports, helipads, landing zones, and field site locations. Portable lighting may also be used on permanent airfield/heliport/helipad surfaces in the event of a failure or repair of the established airfield lighting system in the TO.

1.2 Portable Lighting fixtures are approved for use in TO applications that have VFR, non-precision, and CAT I precision approaches where the lighting system is certified via the FAA-approved, third-party certification laboratory and approved by USACE Transportation System Center of Expertise (TSC). In the case of lighting fixtures not addressed or tested by the FAA, Army Acquisition program managers may certify systems using government test agencies approved by the USACE TSC. Portable lighting used on initial (0 to 6 months), temporary (6 to 24 months), and semi-permanent (sustained) paved or unpaved airfield/heliport/helipad surfaces must comply with Army requirements in UFC 3-535-01 unless otherwise indicated in this Technical Paper.

1.3 The exterior color of non-illuminating surfaces are not required to be aviation yellow.

1.4 Light emitting diode (LED) lights are authorized for use with runway threshold, runway edge, and runway end lights, taxiway lights, and rotary-wing aircraft landing structures such as

the inverted “Y”.

1.5 Portable lighting is out-of-service when the following exist:

a. Runway lights (threshold, end, and edge).

(1) VFR and non-precision runway – 25% or more non-operational.

(2) Precision runway – 15% or more non-operational.

(3) Allowable percentage of unserviceable lights must not be in a pattern that alters the basic pattern of the lighting system.

(4) An unserviceable light must not be adjacent to or across from another unserviceable light.

b. PAPI. Any light non-operational.

c. Taxiway lights (edge). 15% or more non-operational.

d. MALSR.

(1). One light non-operational on centerline bar.

(2). Three or more random lights and no consecutive lights non-operational on threshold or 1000' bar.

(3). Twelve or more lamps/flashers and not more than one flasher non-operational.

e. Obstruction lights must meet the requirements of UFC 3-535-01.

## 2.0 LIGHT CERTIFICATION REQUIREMENTS

Note: In the case of lighting fixtures not addressed by the FAA, the Army Acquisition program managers will certify systems using government test agencies approved by the USACE TSC.

### 2.1 Portable Light Illumination and Intensity.

a. All solar-charged, battery-powered portable lights, with light visible to the unaided eye, are required to be tested by Intertek, the FAA's third-party compliance lab, and meet the following test requirements. Each battery duration time must be measured when the fixture and battery are at each of the following three Fahrenheit temperatures -40 degrees; room temperature (record the exact temperature in the test report); and 131 degrees. The light fixture must produce 100% full-intensity illumination for a minimum of 24 hours at room temperature. The light fixture must produce 100% full-intensity illumination for a minimum of 30 hours at 131 degrees. The light fixture must produce 100% full-intensity illumination for a minimum of 5 hours at -40 degrees. If the light fixture does not meet the 100% illumination for the minimum number of hours, then the batteries are not considered adequate. The light fixtures with inadequate batteries may be used only with another independent source of power such as an external generator or utility power sized adequately for the load.

b. L-861 RUNWAY EDGE, L-861E RUNWAY THRESHOLD and RUNWAY END LIGHT fixtures must be tested for photometric performance to meet AC 150/5345-46 while running on battery power only, to simulate intended field conditions. In addition, a "battery duration time" must be measured at each of three intensity steps for the visible light mode. The light output must be monitored until the light intensity falls below the minimum at each intensity step. The time and intensity recorded in the report for each step. Intensity step 1 is 10% of full intensity; intensity step 2 is 30% of full intensity; intensity step 3 is 100% of full intensity.

c. L-861 RUNWAY EDGE, L-861E RUNWAY THRESHOLD and RUNWAY END LIGHT fixtures must be tested and pass all tests in AC 150/5345-46, Chapter 4, Qualification Requirements in addition to other requirements in this document.

d. PAPI systems must be tested for photometric performance to meet AC 150/5345-28, paragraphs 3.9. and 4.9 while running on battery power only, to simulate intended field conditions. In addition the PAPI systems must be tested to meet all qualification requirements of AC 150/5345-28, paragraph 4.

e. PAPI light fixtures must be tested and pass all tests in AC 150/5345-28, Chapter 4, PAPI Qualification Requirements, in addition to other requirements in this document.

f. Approach lights steady burning must meet the minimum intensity requirements of FAA-E-2325 for a MALSR.

g. Approach sequenced flashing lights must meet the minimum intensity requirements of FAA-E-2325 for a MALSR.

h. L-861T taxiway edge and apron edge light fixtures must be tested and pass all tests in AC 150/5345-46, Chapter 4, Qualification Requirements, in addition to all other requirements in this document.

## 2.2 Portable Light Fixture and Cable Security.

a. Light fixture stake foundations. The provided stakes must prevent light fixture overturning from a wind speed of 300 mph for both loose sands (4 to 10 blows per foot in accordance with ASTM D 1586-11) and medium clays (4 to 8 blows per foot in accordance with ASTM D 1586-11). Wind loading tests must be designed to ensure the light fixture receives the full wind load. To simulate wind loading, a static force equivalent to the specified wind velocity 2.0 psi must be uniformly applied to the entire surface of the light fixture for 10 minutes. If there is any overturning exceeding 1 degree, breakage, or permanent deformation, it is considered as a test failure and a cause for rejection. The stakes must be redesigned and test repeated.

b. Anchor power cables to resist wind, rotor wash and jet blast. Stakes and staking instructions must be designed to prevent cable lift off the ground, when subjected to rotor wash/jet blast. Cable attachment to light fixture may serve as anchoring if the cable remains on the ground when subjected to rotor wash/jet blast.

c. The power cable must be staked or secured per Army recommendations. Tests must be conducted for both loose sands (4 to 10 blows per foot in accordance with ASTM D 1586-11) and medium clays (4 to 8 blows per foot in accordance with ASTM D 1586-11). A C-17 aircraft must conduct star turns. If the power cables are lifted off the ground by star turn operations, then stakes and staking instructions must be redesigned to prevent cable lift off the ground and the test repeated. When the stakes and staking instructions prove adequate to prevent the power cables from being lifted off the ground by star turn operations, then the proven stakes and staking instructions must be incorporated into standard operating procedures.

2.3 Battery Health. The battery will be designed to power the light at the highest level of intensity for a minimum of 12 hours and 730 recharge cycles.

a. Diagnostic Commands. The runway aids will have the capability of responding to the following commands:

b. BATTERY HEALTHY: If the remaining battery capacity is 90% or more then the light will turn on highest intensity for 5 seconds. For most of the battery life, "Battery Healthy" means at room temperature more than 12 hours of the highest intensity operation time is remaining.

c. BATTERY USEABLE: If there is approximately 12 hours highest intensity operation time remaining on the battery then the light will turn on highest intensity for 5 seconds. "Battery Usable" means the battery is marginally adequate but action should be taken soon to improve the battery health, i.e. charge with a generator or replace the batteries.

d. AUXILIARY POWER: If the light fixture is connected to auxiliary power then the light will turn on at highest intensity for 5 seconds.

e. AUTOMATIC TEST BATTERY LOW: If there is approximately 2 hours highest intensity operation time remaining on the battery then the light will flash one second on and one second off automatically, until commanded to stop flashing.

f. ALTERNATIVE DIAGNOSTIC TESTS: The manufacturer or Army Acquisition program manager may propose for USACE TSC approval alternative diagnostic tests for battery-powered systems in place of paragraphs 3.1.1 through 3.1.3 and 3.1.5. The alternative test must:

(1) Allow the portable airfield lighting system operator to immediately test and monitor the airfield lights from a central location display.

(2) Indicate if any of the airfield lights are not available for a continuous 12-hour period on battery power.

(3) Indicate if any of the airfield lights are running on generator or utility power.

(4) Indicate if any of the airfield lights have less than 2 hours of high intensity operational time remaining on the battery.

g. Running the AUXILIARY POWER or BATTERY HEALTHY and BATTERY USEABLE tests should be part of the portable airfield lighting system operator check list at the beginning of each duty shift. If power for any of the light fixtures is not available for the 12-hour shift (failed BATTERY USEABLE and AUXILIARY POWER commands) then the associated light fixtures are inoperative until repaired or recharged or powered by generator power.

h. Battery Life Management. Program managers are encouraged to establish procedures for their portable airfield lighting systems that promote battery life management. Examples of battery life management are turning off lights or using the lowest possible intensity setting when not required for aircraft and airfield operations.

2.4 Waivers to this criteria must be submitted in accordance with UFC 3-535-01, para 1-11.

A-5. Portable lighting is out-of-service when the following exist:

a. Runway lights (threshold, end, and edge).

(1) VFR and non-precision runway – 25% or more non-operational.

(2) Precision runway – 15% or more non-operational.

(3) Allowable percentage of unserviceable lights must not be in a pattern that alters the basic pattern of the lighting system.

(4) An unserviceable light must not be adjacent to or across from another unserviceable light.

b. PAPI. Any light non-operational.

c. Taxiway lights (edge). 15% or more non-operational.

d. MALSR.

(1). One light non-operational on centerline bar.

(2). Three or more random lights and no consecutive lights non-operational on threshold or 1000' bar.

(3). Twelve or more lamps/flashers and not more than one flasher non-operational.

e. Obstruction lights must meet the requirements of UFC 3-535-01.

## Appendix B

### Light Certification Requirements.

Note: In the case of lighting fixtures not addressed by the FAA, the Army Acquisition program managers will certify systems using government test agencies approved by the USACE TSC.

#### B-1. Portable Light Illumination and Intensity.

a. All solar-charged, battery-powered portable lights, with light visible to the unaided eye, are required to be tested by Intertek, the FAA's third-party compliance lab, and meet the following test requirements. Each battery duration time must be measured when the fixture and battery are at each of the following three Fahrenheit temperatures -40 degrees; room temperature (record the exact temperature in the test report) and 131 degrees. The light fixture must produce 100% full intensity illumination for a minimum of 24 hours at room temperature. The light fixture must produce 100% full intensity illumination for a minimum of 30 hours at 131 degrees. The light fixture must produce 100% full intensity illumination for a minimum of 5 hours at -40 degrees. If the light fixture does not meet the 100% illumination for the minimum number of hours the batteries are not considered adequate. The light fixtures with inadequate batteries may be used only with another independent source of power such as an external generator or utility power sized adequately for the load.

b. L-861 RUNWAY EDGE, L-861E RUNWAY THRESHOLD and RUNWAY END LIGHT fixtures must be tested for photometric performance to meet AC 150/5345-46 while running on battery power only, to simulate intended field conditions. In addition, a "battery duration time" must be measured at each of three intensity steps for the visible light mode. The light output must be monitored until the light intensity falls below the minimum at each intensity step. The time and intensity recorded in the report for each step. Intensity step 1 is 10% of full intensity; intensity step 2 is 30% of full intensity; intensity step 3 is 100% of full intensity.

c. L-861 RUNWAY EDGE, L-861E RUNWAY THRESHOLD and RUNWAY END LIGHT fixtures must be tested and pass all tests in AC 150/5345-46, Chapter 4, Qualification Requirements in addition to other requirements in this document.

d. PAPI systems must be tested for photometric performance to meet AC 150/5345-28, paragraphs 3.9. and 4.9 while running on battery power only, to simulate intended field conditions. In addition the PAPI systems must be tested to meet all qualification requirements of AC 150/5345-28, paragraph 4.

e. PAPI light fixtures must be tested and pass all tests in AC 150/5345-28, Chapter 4, PAPI Qualification Requirements, in addition to other requirements in this document.

f. Approach lights steady burning must meet the minimum intensity requirements of FAA-E-2325 for a MALSR.

g. Approach sequenced flashing lights must meet the minimum intensity requirements of FAA-E-2325 for a MALSR.

h. L-861T taxiway edge and apron edge light fixtures must be tested and pass all test in AC 150/5345-46, Chapter 4, Qualification Requirements, in addition to all other requirements in this document.

## B-2. Portable Light Fixture and Cable Security.

a. Light fixture stake foundations. The provided stakes must prevent light fixture overturning from a wind speed of 300 mph for both loose sands (4 to 10 blows per foot in accordance with ASTM D 1586-11) and medium clays (4 to 8 blows per foot in accordance with ASTM D 1586-11). Wind loading tests must be designed to ensure the light fixture receives the full wind load. To simulate wind loading, a static force equivalent to the specified wind velocity 2.0 psi must be uniformly applied to the entire surface of the light fixture for 10 minutes. If there is any overturning exceeding 1 degree, breakage or permanent deformation, it is considered as a test failure and a cause for rejection. The stakes must be redesigned and test repeated.

b. Anchor power cables to resist wind, rotor wash and jet blast. Stakes and staking instructions must be designed to prevent cable lift off the ground, when subjected to rotor wash/jet blast. Cable attachment to light fixture may serve as anchoring if the cable remains on the ground when subjected to rotor wash/jet blast.

c. The power cable must be staked or secured per Army recommendations. Tests must be conducted for both loose sands (4 to 10 blows per foot in accordance with ASTM D 1586-11) and medium clays (4 to 8 blows per foot in accordance with ASTM D 1586-11). A C-17 aircraft must conduct star turns. If the power cables are lifted off the ground by star turn operations, then stakes and staking instructions must be redesigned to prevent cable lift off the ground and the test repeated. When the stakes and staking instructions prove adequate to prevent the power cables from being lifted off the ground by star turn operations, then the proven stakes and staking instructions must be incorporated into standard operating procedures.

B-3. Battery Health. The battery will be designed to power the light at the highest level of intensity for a minimum of 12 hours and 730 recharge-cycles.

a. Diagnostic Commands. The runway aids will have the capability of responding to the following commands:

b. BATTERY HEALTHY: If the remaining battery capacity is 90% or more then the light will turn on highest intensity for 5 seconds. For most of the battery life, "Battery Healthy" means at room temperature more than 12 hours of the highest intensity operation time is remaining.

c. BATTERY USEABLE: If there is approximately 12 hours highest intensity operation time remaining on the battery then the light will turn on highest intensity for 5 seconds. "Battery Usable" means the battery is marginally adequate but action should be taken soon to improve the battery health i.e. charge with a generator or replace the batteries.

d. AUXILIARY POWER: If the light fixture is connected to auxiliary power then the light will turn on at highest intensity for 5 seconds.

e. AUTOMATIC TEST BATTERY LOW: If there is approximately 2 hours highest intensity operation time remaining on the battery then the light will flash one second on and one second off automatically, until commanded to stop flashing.

f. ALTERNATIVE DIAGNOSTIC TESTS: The manufacturer or Army Acquisition program manager may propose for USACE TSC approval alternative diagnostic tests for battery-powered systems in place of paragraphs 3.1.1 through 3.1.3 and 3.1.5. The alternative test must:

(1) Allow the portable airfield lighting system operator to immediately test and monitor the airfield lights from a central location display.

(2) Indicate if any of the airfield lights are not available for a continuous 12-hour period on battery power.

(3) Indicate if any of the airfield lights are running on generator or utility power.

(4) Indicate if any of the airfield lights have less than 2 hours of high intensity operational time remaining on the battery.

g. Running the AUXILIARY POWER or BATTERY HEALTHY and BATTERY USEABLE tests should be part of the portable airfield lighting system operator check list at the beginning of each duty shift. If power for any of the light fixtures is not available for the 12 hour shift (failed BATTERY USEABLE and AUXILIARY POWER commands) then the associated light fixtures are inoperative until repaired or recharged or powered by generator power.

h. Battery Life Management. Program managers are encouraged to establish procedures for their portable airfield lighting systems that promote battery life management. Examples of battery life management are turning off lights or using the lowest possible intensity setting when not required for aircraft and airfield operations.

B-4. Waivers to this criteria must be submitted in accordance with UFC 3-535-01, para 1-11.



### 3.0 APPROVED LIGHTING FIXTURES

As reports are received and approved by the TSC this listing will be updated.

Manufacturer	Catalog Number	Type System	Restrictions
Avlite Systems See Note	01301001-01 Eagle W	L-861	Must be operated with backup generator or utility power unless used exclusively by the US Army. In the event of US Army-only aviation operations, the emergency power source need only be readily available for connection.
Avlite Systems See Note	13011191-09 Eagle R/G	L-861E	Must be operated with backup generator or utility power unless used exclusively by the US Army. In the event of US Army-only aviation operations, the emergency power source need only be readily available for connection.
Avlite Systems	AV-72	L-861T	Must be operated with backup generator or utility power unless used exclusively by the US Army. In the event of US Army-only aviation operations, the emergency power source need only be readily available for connection.
Laser Guidance Inc.	LG-LED-PAPI Mk II	PAPI 24VDC	Must be operated with backup generator or utility

			power unless used exclusively by the US Army. In the event of US Army-only aviation operations, the emergency power source need only be readily available for connection.
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