Top Ten Airfield Lighting Maintenance and Management Mistakes

By Phil Rakowski

EATON
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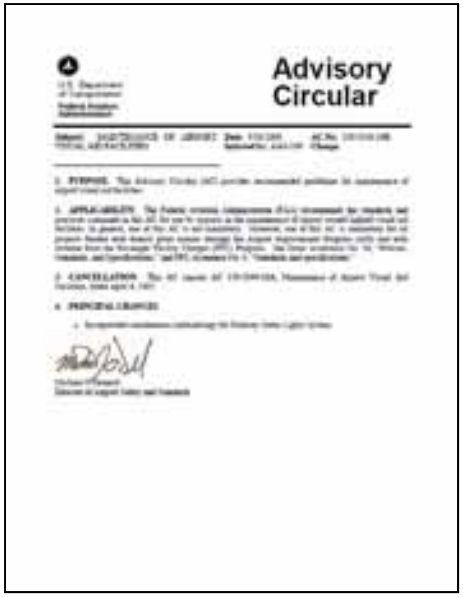
Goal

Review key FAA Advisory Circulars, Equipment Data Pages and materials from our Airfield Maintenance Seminar to show the "TOP TEN" historical mistakes I have seen in the last 30 years in the Airport Lighting Industry.

The Critical FAA Advisory Circulars are as follows:

- 150/5340-26B Maintenance of Airport Visual Aid Facilities.
- 150/5345-53D Airport Lighting Equipment Certification Program


Advisory Circular

NUMBER 10:

Purchasing “Equivalent” airfield lighting lamps on the Internet.

- **Only FAA Approved lamps can be used in FAA Approved Airfield Lighting Fixtures.**
- **FAA approved light fixtures and the lamps that can be used in them are identified in FAA Advisory 150-5345-53D.**
- **Use of lamps not listed in the advisory renders the light fixture "Non Compliant" to FAA specification.**
- **There is no such thing as a "Equivalent" to an FAA approved lamp. <u>Either the lamp is FAA approved or it is not!</u>**

U.S. Department
of Transportation

Federal Aviation Administration

Advisory Circular

Subject: MAINTENANCE OF AIRPORT VISUAL AID FACILITIES

Date: 9/30/2009

Initiated by: AAS-100

AC No: 150/5340-26B

Change:

3.6.6 Use of Original Equipment Manufacturer (OEM) Part.

The use of non-OEM parts or lamps in FAA approved equipment is strongly discouraged. The FAA has strict specifications for approval of all airport lighting equipment and use of non-OEM parts or lamps in such equipment or systems can render the equipment to be functionally non-FAA approved. This could possibly lead to serious liability consequences in case of an aircraft incident at an airport following these practices. In the case of runway and taxiway lighting fixtures, the use of a generic, non-approved lamp can render the photometric output of the fixture out of specification with disastrous results in light output and, consequently, safety of low visibility operations.

U.S. Department
of Transportation

Federal Aviation Administration

Advisory Circular

Subject: AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM

Date: 9/26/2012 **Initiated by:** AAS-100

AC No: 150/5345-53D **Change:**

1. PURPOSE. This advisory circular (AC) describes the Airport Lighting Equipment Certification Program (ALECP). It provides information on how an organization can get Federal Aviation Administration (FAA) acceptance as a third party certification body (third party certifier) and how manufacturers may get equipment qualified under the program. It includes a list of the equipments that are certified under the program. This AC does not impose requirements or mandate participation in the ALECP by any party. This revision to the AC is intended to clarify the criteria that FAA will use to determine whether a certification body qualifies for participation and how equipment may be qualified.

2. CANCELLATION. AC 150/5345-53C, *Airport Lighting Equipment Certification Program*, dated September 30, 2005, is cancelled.

3. BACKGROUND. Until December 31, 1989, the FAA administered the Airport Lighting Approval Program under the Federal airport grant programs. Under this program the FAA inspected equipment to confirm that it met FAA standards and to ensure quality control. The program was discontinued as of December 31, 1989, as a result of declining FAA resources. The listing of equipment in AC 150/5345-1, *Approved Lighting Equipment*, was no longer maintained.

On January 1, 1990, a new program was established which named a commercial testing laboratory under the oversight of an Industry Technical Advisory Committee (ITAC), as the program certification body. On May 15, 1995, the FAA, realizing that there were additional commercial laboratories that may want to participate as certification bodies instituted and established ALECP. This program provided that any commercial laboratory meeting certain criteria may participate as a certification body and provided for FAA oversight and acceptance of certification bodies.

Under the ALECP, the FAA has established a list of accepted certification bodies. The certification bodies evaluate and certify airport lighting equipment and license suppliers to mark qualifying products. The FAA maintained a list of certified equipment as part of the AC Addendum. This list was provided to assist airport sponsors in discharging their duty to determine that equipment met the applicable FAA specifications, which is required for eligibility for funding under Federal grant assistance program for airports and to assist the general public in identifying equipment meeting FAA requirements specified in referenced Advisory Circulars.

This AC, as a continuing refinement of the ALECP, institutes and establishes a recertification requirement for the equipment under ALECP (Appendix 2) and a list of the type of equipment with their applicable ACs that are under this program (Appendix 3). The FAA maintains on the Internet lists of currently certified equipment, of manufacturers' addresses, and of third party certifiers that can be used.

4. PRINCIPAL CHANGES. The following changes have been incorporated:

a. Paragraph 5, Acceptance Criteria: Updated to replace ANSI Z34.1, Third Party Certification Programs for Products, Processes, and Services with ISO/IEC Guide 65/ISO 17065.

Certified Lamp Example

L-862—Lights, Runway Edge and Threshold (High Intensity) and Stop Bar (AC 150/5345-46D)		
Manufacturer	**Type**	**Manufacturer's Catalog Number**
ATG Airports Limited	L-862	ZA163-862-WW-150W-M32-14 (425), ZA163-862-WW-200W-M32-14 (66)
	L-862	ZA163-862-WY-150W-M32-14 (425), ZA163-862-WY-200W-M32-14 (66)
	L-862	ZA163-862-GY-150W-M32-14 (425), ZA163-862-GY-200W-M32-14 (66)
	L-862	ZA862-CC-120-XX (36), ZA862-CY-120-XX (36), ZA862-YC-120-XX (36)
	L-862	ZA862E-GR-200-XX (90), ZA862E-RG-200-XX (90)
Crouse-Hinds ALP	L-862	8624X-E-CC-120-XX (254), 8624X-E-CY-120-XX (254)
	L-862	8624X-E-YC-120-XX (254), 8624X-E-CR-120-XX (254), 8624X-E-RC-120-XX (254)
	L-862	8625-ECC-XX-XXX (135)(136)(254), 8625-ECY-XX-XXX (135)(136)(254),
	L-862	8625-EYC-XX-XXX (135)(136)(254), 8625-ECR-XX-XXX (135)
	L-862	8625-ERC-XX-XXX (135), 8625-TYG-XX-XXX(136), 8625-TGY-XX-XXX (136)
	L-862	8625-ERY-XX-XXX (135), 8625-EYR-XX-XXX (135)

Certified Lamp Example

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(10)	6.6A/T10/1P	30		6.6	General Electric, Sylvania, Philips
(10A)	6.6A/T10/1P	30		6.6	General Electric
(10C)	6.6A/T10/1P	30		6.6	Philips
(11)	6.6A/T10/P	45		6.6	General Electric, Sylvania, Philips
(11A)	6.6A/T10/P	45		6.6	General Electric
(11B)	6.6A/T10/P	45		6.6	Sylvania
(11C)	6.6A/T10/P	45		6.6	Philips
(126)	SLC 08065	45		6.6	Alstom Power Ltd
(127)	64341	100		6.6	Osram
(133)	8384329				Flash Technology
(135)	40925	150		6.6	Crouse-Hinds
(136)	20172	200		6.6	Crouse-Hinds
(137)	64317	45		6.6	Osram
(143)	100A21T2	100	120		Osram
(251)	6134 Quartz EXM	45		6.6	Philips
(252)	UHI-S150DW/A/UVP	150			Hali-Brite USHIO
(253)	UHI-S150DM/A/UVP	150			Hali-Brite USHIO
(254)	20058	120		6.6	GE
(255)	48A0382-2 Luxeon LED - Red		120		ADB Airfield Solutions, LLC
(256)	44A6355-10 Blue LED	5			ADB Airfield Solutions, LLC
(257)	FL4-l810-120VAC 5VA Red LED		120		Farlight LLC

Number 9:

Re-Lamping or Replacing Airfield Lighting Fixtures “Hot”.

Re-lamping or replacing airfield lighting fixtures while energized is dangerous!

Not only is this practice dangerous, re-lamping or replacing airfield lighting fixtures while energized, pits the contact surfaces of lamp socket or isolation transformer receptacle. Resulting reduced operating life for those components.

Airfield isolation transformers can and do fail on occasion. When the isolation fails, 5000V potential could be available on the lamp socket or elevated or inset fixture body.

Even under normal conditions, the voltage on an open isolation transformer receptacle can exceed 200 Volts!

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of Transportation
Federal Aviation Administration

Advisory Circular

Subject: MAINTENANCE OF AIRPORT VISUAL AID FACILITIES **Date:** 9/30/2009 **Initiated by:** AAS-100 **AC No:** 150/5340-26B **Change:**

2.3.3 Re-lamping.

The most common lighting maintenance task on the airfield is re-lamping of runway and taxiway lighting fixtures. Depending on the type of fixture, this may be accomplished in the field or, as in the case of most inset lights, the entire fixture is removed, replaced, and brought to the maintenance shop for refurbishing. The greatest unseen danger to you is re-lamping or removing the fixture with the circuit energized. This has always been a common practice by airport electricians for convenience and the dangers are often overlooked. There are two primary hazards associated with this practice. The first occurs when an isolation transformer has a primary to secondary short in the windings. Remember that even though these are referred to as isolation transformers, they were not designed for personnel protection. They are

merely designed to isolate the secondary from the primary circuit to allow the circuit to continue to operate with a lamp burned out. A transformer with a primary to secondary short may not cause a circuit malfunction and could therefore remain unnoticed in normal operation with a live primary. This exposes you to the full voltage present on the primary circuit and can be especially dangerous if another short is present on the primary circuit. When that happens, you can become the path to ground for the full primary current, a circumstance which is almost always fatal. This condition is especially dangerous when working with inset lights and removing them from the light base can while the circuit is energized. As soon as the fixture is unbolted and lifted from the can, you become the path to ground. Some have tried to alleviate this hazard by attaching a ground wire from the bottom of the light fixture to a grounding lug on the inside of the can. However, you cannot know if the wire is truly connected until you remove the fixture, at which time it is too late.

The second hazard encountered when re-lamping an energized light fixture is from the open circuit voltage present at the secondary of the transformer. The open circuit voltage present on the secondary of the transformer is proportional to the size of the transformer. The open-circuit secondary voltage on a 300 watt transformer is approximately 110 volts. Moreover, depending on the materials used in the design of the isolation transformer and the type of regulator powering the circuit, relatively high voltage peaks can be generated. Once again, the larger the transformer, the higher the peaks with as much as 200 volts being generated in some circumstances. The duration of this peak varies inversely with the size of the transformer (i.e. larger transformers have shorter durative spikes). Because of their size and duration, the peak voltages can create an unsafe condition for maintenance personnel. Therefore, we recommend that you perform re-lamping of the series lighting circuits with the circuits de-energized, especially during the re-lamping of fixtures with exposed contacts. If this is not practical, wear appropriate insulating gloves with leather gauntlets during re-lamping procedures.

A final hazard that is present when re-lamping any type of fixture, whether in the field or at the maintenance shop, is the danger of cuts from broken lamps. Many times when an airfield lamp fails, the

Number 8:

Not having a “Lockout – Tagout” procedure.

All airport facilities, large and small, should have a viable and strictly enforced “Lockout-Tagout” program.

The unintentional energizing of circuits that are being worked on, is a leading cause of electrical fatalities.

Figure 2-2 Danger Tag

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2.10.2 Lock-Out/Tag-Out and Danger Tags.

Each airport electrical maintenance department should have a written lock-out/tag-out procedure. Equipment or circuits should never be worked on unless locked out and tagged by the person performing the work. Never trust anyone but yourself. Have your partner check behind you to make sure the proper equipment is turned off. The lock-out tag should only be removed by the person who signed it except in some circumstances when verbal permission has been granted to another person or when the worker who signed the tag is on vacation, etc. Never rely on the tower controllers to assure electrical safety. The controllers in the tower are relieved periodically and the next person may not know of the work that is going on. Always take whatever time is necessary to make sure that the circuit or equipment you are working on is safe. One of the primary reasons for accidents is when workers get in too great a hurry and don't take proper precautions and follow proper safety procedures. The other main reason is when the electrician lets his/her guard down because they are working in a familiar environment and becomes negligent about safety procedures.

Number 7:

Needlessly Operating Airfield Lighting at the High Intensity.

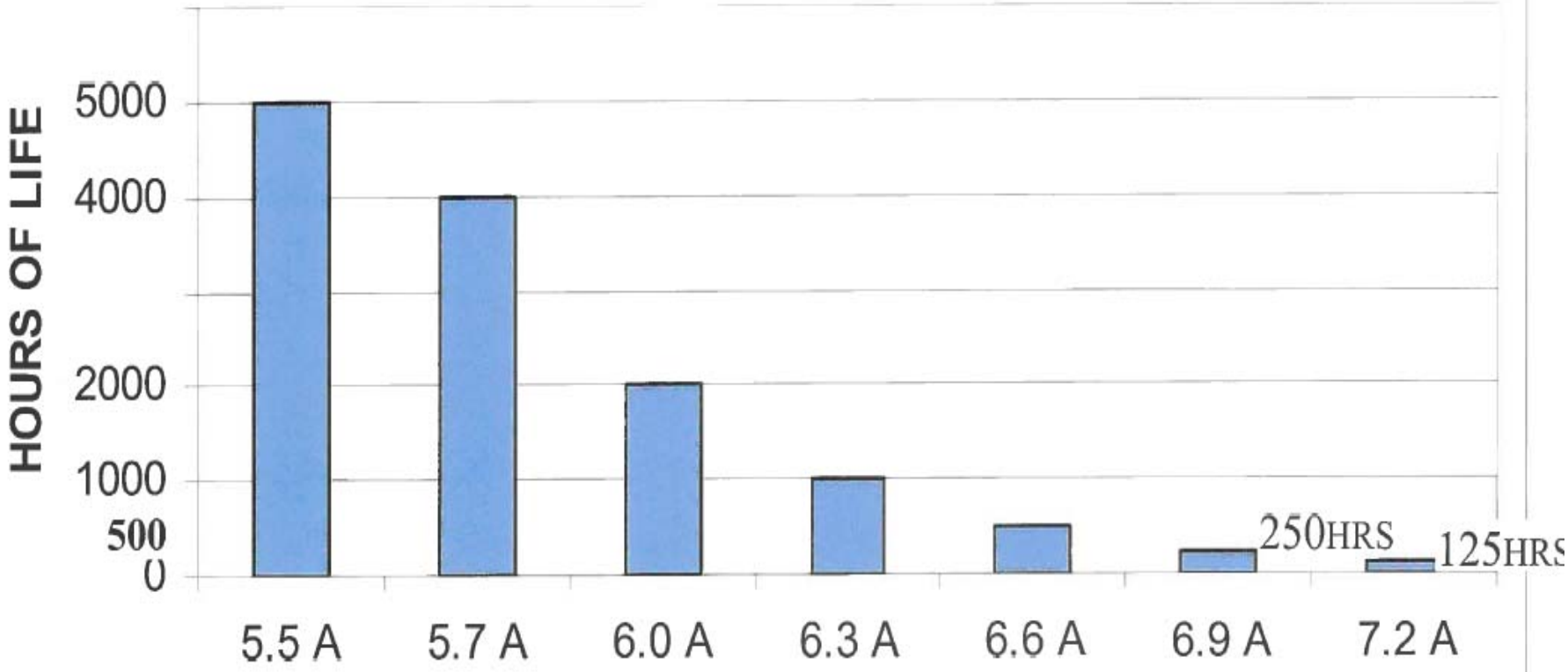
- **The service life of an airfield lighting lamp is directly related to the average current that flowed through the lamp filament.**
- **Staying out of the maximum brightness level will dramatically improve lamp life.**
- **Operating airfield lighting lamps at 5.5 Amps (B30) vs 6.6 Amps (B100) increases the lamp life by a factor of 10!**
- **Stay out of the high brightness setting unless visibility conditions require it or pilots request it.**

Do not set the lighting to the maximum setting for “Lamp Checks”. Always use any lower brightness setting.

Work with all those individuals that have access to the airfield brightness controls. Make this a initiative throughout your location.

Airports that have minimized operation in the maximum brightness setting have reduced replacement lamp budget by 66%!

LAMP LIFE vs. OPERATING CURRENT ON A 6.6 AMP 500 HOUR LAMP



$$\text{GE CALCULATED FILAMENT LIFE} = \left(\frac{\text{RATED AMPS}}{\text{ACTUAL AMPS}}\right)^{24.1} \times \text{RATED LIFE}$$

LAMP CURRENT	FILAMENT OPERATING HOURS
6.9	171
6.8	243
6.7	347
6.65	416
6.6	**500**
6.55	600
6.5	722
6.4	1,049
6.3	1,534

GE Stage/Studio Lamp Characteristics

Actual Lamp Current	Percent of Rated Lamp Life	Estimated life of 500 Hour Lamp
7.5 Amps	0% (Instant Failure)	0 Hours
7.2 Amps	25%	125 Hours
6.9 Amps	50%	250 Hours
6.6 Amps	**100%**	**500 Hours**
6.3 Amps	200%	1000 Hours
6.0 Amps	400%	2000 Hours
5.7 Amps	800%	4000 Hours
5.5 Amps	1000%	5000 Hours
Actual Lamp Current	Percent of Rated Lamp Life	Estimated life of 500 Hour Lamp

Number 6:

Not Conducting Periodic Maintenance on CCR's and Circuit Selector Switches

L-828 Constant Current Regulators (CCR's) and L-847 Circuit Selector Switches are often overlooked for routine maintenance intervals.

The absence of routine maintenance allows preventable circumstances to go unchecked and take down critical airfield lighting equipment.

Spread the work load across the calendar year so all the maintenance isn't due the same week or month.

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3.3.4 Preventive Maintenance Inspection Program.

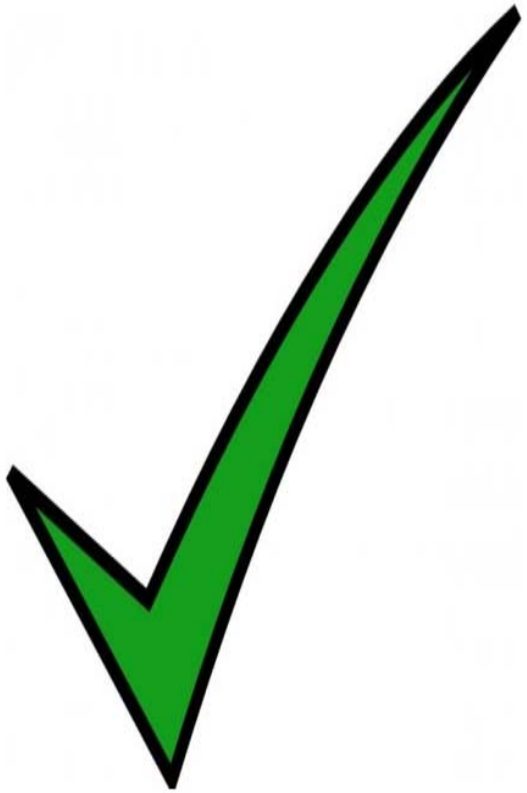
The fourth element in a preventive maintenance program is an effective preventive maintenance inspection schedule for each visual aid. This schedule should also include all cable systems. The preventive maintenance inspection (PMI) schedule is the foundation for the successful maintenance of the equipment. If the PMI is performed properly and at the scheduled time, it will ensure top system performance and will minimize unscheduled interruptions and breakdowns. Review of the inspection records, checks, tests, and repairs provides a constant awareness of the equipment condition and gives maintenance personnel advanced warning of impending trouble.

3.3.5 Preventive Maintenance Inspection Schedule.

Scheduled inspections and tests are those accomplished on specific types of equipment on a periodic basis. The schedule may be based either on calendar or on hourly-use increments. The PMI schedules, based upon recommendations from the manufacturers and users of the equipment, are considered to be the typical requirements to keep the equipment in good condition. Adjust the frequency of a particular PMI after experience is gained under local operating conditions.

Maintenance Requirement	DAILY	WKLY	MTHLY	SMANLY	ANNLY	UNSCH
1. Check control circuits on all brightness steps	X					
2. Check condition and operation of regulator		X				
3. Check input voltage and current			X			
4. Check output current on each brightness step			X			
5. Check output load on regulator if needed				X		
6. Check relays, wiring and insulation				X		
7. Check dielectric strength of cooling oil (if used)					X	
8. Perform a short-circuit test					X	
9. Perform an open-circuit test (only on regulators with open circuit protection.					X	
10. Clean rust spots and repaint as necessary.						X

Table 5-5. Preventive Maintenance Inspection Schedule for Constant Current Regulators



Number 5:

Using Pneumatic/Electric Wrenches to Mount Inset Fixtures.

Inset fixture mounting bolts are tightened to very specific torque values.

Pneumatic and electric wrenches are not capable of the precision required and will damage the bolts and threads in the base.

Inset mounting bolts should always be installed using calibrated torque wrenches.

Inset fixtures coming loose creates a extremely hazardous risk to flight safety.

Leave the Pneumatic Wrenches on the Racetrack!

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5.3.4.1.4 Bi-Monthly Checks.

(a) **Bolt Torque.** The torque of the bolts attaching the light to its base should be checked. The impact of aircraft wheels can loosen mounting bolts and cause misalignment or fixture damage; this is particularly troublesome in the touchdown zone.

The importance of proper inset fixture mounting and maintenance of the fixtures mounting integrity should not be under estimated.

By Toshihiko Sato, AP

113 killed: Fire trails Air France Concorde Flight 4590 as it takes off July 25, 2000, from Charles de Gaulle Airport. A court on Monday found Continental Airlines and one of its mechanics guilty of manslaughter.

Number 4:

Not Having Clear and Concise Emergency Procedures in Place.

<u>Many facilities have predefined methods to alert others that you or your location needs an emergency response.</u>

In the event of an emergency personal should be able to get the maximum response by initiating "Action Plans" with key phrases.

For example the phrase "Man Down Emergency" and location "at RW 36 Approach" relayed to the tower. Would roll all available rescue equipment to that location without any further discussion. Because the "Man Down Emergency" phrase initiated a preset and understood "Action Plan".

Number 3:

Working with Electrical Systems and Not Having CPR and First Responder Training.

- ✓ All individuals working in Airport Lighting environments should have CPR and basic first responder training annually.
- ✓ The distances and logistics involved with airport lighting and actually being out on the airfield will delay responses to the location of the incident.
- ✓ Electrical rescue equipment should be prominently displayed in all lighting vaults. These are often referred to as “Safety boards”.

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2.16 FIRST AID.

First aid is what to do before the doctor comes. It is never a substitute for the medical help. The maintenance technician should take the lifesaving measures necessary in emergencies, but avoid doing harm. Many first-aid measures are quite simple and do not require "split-second speed" in their application. Haste without knowing what one is doing can be worse than doing nothing at all. At other times, immediate action is essential to save a life or prevent serious complications; this action can only be taken by someone who is on the scene when minutes are vital. Learn about first aid before emergencies happen. Be prepared to give help safely and beneficially when necessary. Contact the American Red Cross to provide refresher first-aid courses to maintenance personnel to keep them proficient.

Number 2:

Not understanding Airfield Light Fixture “Toe-In”, Leveling and Setting angle .

All airfield light fixtures must be oriented correctly to place the fixtures light output in the correct location in relation to the airfield. This is known a fixture “Coverage”

The light output of the lighting fixtures is directed properly by a combination of lenses, levels and in the case of approach lights a digital protractor.

By design many airfield light fixtures have what is called “Toe-In”. Which directs the light output in a predetermined location.

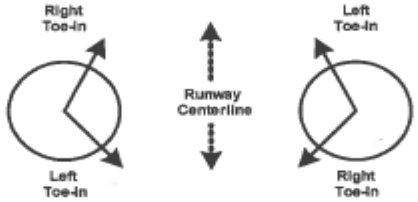
Often fixtures are found to be aimed or toed-in incorrectly during airfield inspections.

COVERAGE

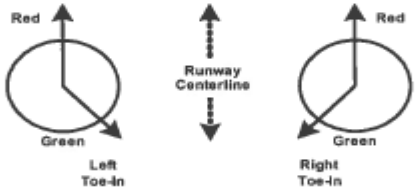
Each type of light fixture on the airport has a specified height, width and elevation of light output. This is known as coverage. The color and candelas must be in the correct location in order to do the intended job. Light fixtures used in approach and high intensity runway lighting applications have their light patterns referenced to the runway centerline. This means that any fixture not on the centerline, directs its light output towards the centerline. Visual aids that fall into this category are aid to be "toed-in" or have "toe". It is extremely important to be able to identify the toe-in of a fixture, (toe-left or toe-right). Also, all airfield light fixtures are classified as either omni directional, bidirectional, or unidirectional.

IDENTIFYING TOE-IN

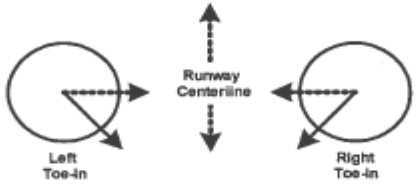
BIDIRECTIONAL RUNWAY EDGE LIGHT

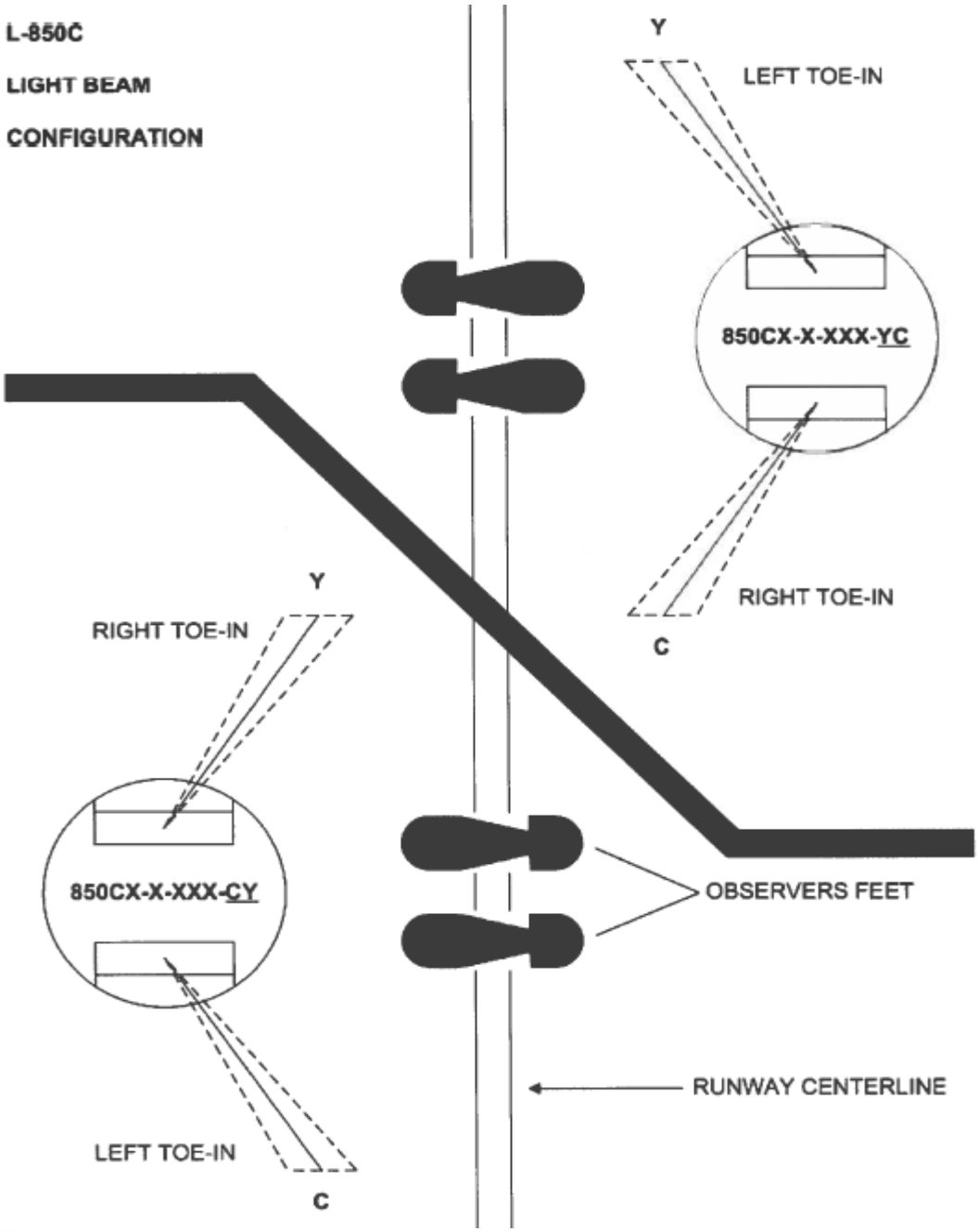


BIDIRECTIONAL TRESHOLD / ENDLIGHT



UNIDIRECTIONAL TOUCHDOWN LIGHT





Example

Approach Clip (minute 3:00)

Number :1

Airfield Electricians and Maintenance Men are not using the proper TRUE-RMS Ammeters.

- The accurate measurement of airfield current levels can only be done with high quality “True-RMS” Multi-Meter/Ammeters.
- Unfortunately these meters are expensive but are necessary to validate, calibrate and troubleshoot airfield lighting systems.
- The tolerances in airfield lighting are very tight and require very accurate meters.
- Using typical low cost ammeters will introduce large errors and misinformation that will result in incorrectly calibrated or misdiagnosed equipment.
- The following four are of acceptable True RMS Multi-Meters and Current Clamp Probes accessories.

FLUKE

80 Series V Industrial True-RMS Multimeter with Temperature

Accuracy and diagnostic functions for maximum industrial productivity

The new Fluke 87V has improved measurement functions, trouble-shooting features, resolution and accuracy to solve more problems on motor drives, in plant automation, power distribution, and electro-mechanical equipment. The 87V operates very similar to the classic 87, but with more problem-solving power, safety, convenience and impact protection.

Features for maximum productivity

- Unique function for accurate voltage and frequency measurements on adjustable speed motor drives and other electrically noisy equipment (87V)
- Built-in thermometer conveniently allows you to take temperature readings without having to carry a separate instrument (87V)
- Large digit display with bright, two-level backlight makes the 80 Series V significantly easier to read than older models

NEW! 87V/E2 Industrial Electrician Combo Kit makes troubleshooting more productive with standard meter hanging accessory for hands-free operation, soft case for protection and storage, 1.5 m heat resistant silicone test leads and more.

Electrical safety

All inputs are protected to Category III, 1000 V and Category IV 600 V. They can withstand impulses in excess of 8,000 V and reduce risks related to surges and spikes.

True-rms

Specifications

Function	Range and resolution	Basic accuracy	
		83V	87V
DC Volts	600.0 mV, 6.000 V, 60.00 V, 600.0 V, 1000 V	0.1 %	0.05 %
AC Volts	600.0 mV, 6.000 V, 60.00 V, 600.0 V, 1000 V	0.5 %	0.7 % (True-rms)
DC Current	600.0 µA, 6000 µA, 60.00 mA, 600.0 mA, 6.000 A, 10.00 A	0.8 %	0.2 %
AC Current	600.0 µA, 6000 µA, 60.00 mA, 600.0 mA, 6.000 A, 10.00 A	1.2 %	1.0 % (True-rms)
Temperature (with probe)	-200 to 1090 °C (-328 to 1994 °F)	–	1.0 %
80BK Temperature Probe	-40 to 260 °C (-40 to 500 °F)	–	2.3 °C or 2 %
Resistance	600.0 Ω, 6.000 kΩ, 60.00 kΩ, 600.0 kΩ, 6.000 MΩ, 50.00 MΩ	0.4 %	0.2 %
Capacitance	10.00 nF, 100.0 nF, 1.000 µF, 10.00 µF, 100.0 µF, 9.999 µF	1.2 %	1.2 %
Frequency	100.00 Hz, 1.0000 kHz, 10.000 kHz, 100.00 kHz	0.005 %	0.005 %

AMEC Brand Current Probe.

FLUKE

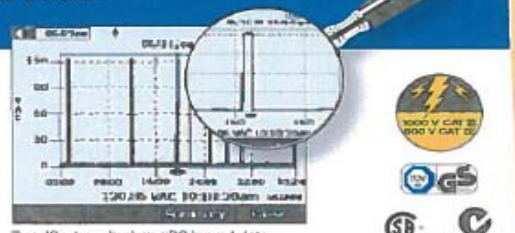
New Fluke 287

True-rms Electronics Logging Multimeter with TrendCapture

Technical Data

The Best Just Got Better.

The Fluke 287 True-rms Electronics Logging Multimeter with TrendCapture quickly documents design performance and graphically displays what happened. Its unique logging and graphing capabilities mean you no longer need to download logged readings to a PC to detect a trend. The Fluke 287 packs more accuracy and convenience into a handheld multimeter than ever before.



TrendCapture displays vDC logged date.

Equipped with new functionality

- **New** – TrendCapture quickly graphically displays logged data session to quickly determine whether anomalies may have occurred
- **New** – Zoom on trend provides unprecedented ability to view and analyze TrendCapture data; zoom in up to 14 times
- **New** – Selectable ac filter (Smoothing mode) helps display a steadier reading when the input signal is changing rapidly or noisy
- **New** – Adjustable recording and auto hold thresholds, specify a percentage change in the readings that begins a new event
- **New** – Large 50,000 count, 1/4 VGA display with white backlight. Multiple sets of measurement information can be simultaneously displayed at the same time.
- **New** – Logging function with expanded memory for unattended monitoring of signals over time. Using on-board TrendCapture users can graphically review logged readings without needing a PC. Store up to 15,000 recorded events.
- **New** – ⓘ button. On board help screens for measurement functions
- **New** – Saved measurements allow you to name and recall measurements made in the field
- **New** – Multi-lingual interface
- Multiple logging sessions possible without download
- 0.025 % basic dc accuracy
- 100 kHz ac bandwidth
- Real time clock for automatic time stamping of saved readings
- True-rms ac voltage and current for accurate measurements on complex signals or non linear loads. AC bandwidth specified to 100 kHz.
- Measure up to 10 A (20 A for 30 seconds)
- 100 mF capacitance range
- Temperature function
- Relative mode to remove test lead resistance from low ohms or capacitance measurements
- Peak capture to record transients as fast as 250 µs
- Premium test leads and alligator clips included
- Optional FlukeView forms enables you to document, store and analyze individual readings or a series of measurements, then convert them into professional-looking documents
- Optional magnetic hanger allows you to hang the meter for easy viewing while freeing your hands to focus on the job
- Limited lifetime warranty

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i800 AC Current Clamp Probe

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