

RUNWAY STATUS LIGHTS SYSTEM

**FEDERAL AVIATION ADMINISTRATION
AIRPORT ENGINEERING DIVISION**



Engineering Brief #64D

A handwritten signature in black ink, reading "Michael T. McNerney", written over a horizontal line.

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1. PURPOSE

The Federal Aviation Administration (FAA) is conducting a research and development project to determine the operational suitability of a system of runway status lights (RWSL) in the National Airspace System (NAS). RWSL is designed as an airport surface safety system to reduce runway incursions. The RWSL system is being design to be a FAA owned and maintained system at larger airports. The FAA Advisory Circulars and Engineering Brief will be used to specify the system requirements for equipment and installation. The purpose of this Engineering Brief is to keep a current specification of the system until a final version is affirmed and included in a future version of AC 150/5340-30. This engineering brief defines the in-pavement lighting configurations for two components of a RWSL system. This EB-64D cancels EB-64C.

2. SYSTEM DESCRIPTION

The RWSL system is provided by the Federal Aviation Administration (FAA) and consists of two major subsystems:

RWSL Processor (FAA-E-3001, *Performance Specification Runway Status Lights (RWSL) System*)

Field Lighting System (FLS) (FAA-E-3002, *Performance Specification Runway Status Lights (RWSL) Field Lighting System*)

The FAA envisions the RWSL FLS subsystem to be certified equipment meeting FAA standards in an Advisory Circular (AC) and to be made available by manufacturers for direct purchase by airport authorities. The details of this system will be provided in a future AC. The in-pavement lighting subsystem comprises two components – Runway Entrance Lights (REL) and Takeoff Hold Lights (THL) with associated components, constant current regulators, and cabling.

3. INSTALLATION

The installation of RWSL systems must be per AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*.

4. RUNWAY ENTRANCE LIGHTS (REL)

RELs are installed at taxiway/runway intersections (see Section 4.2 for detailed diagrams of the various REL configurations) and provide an indication to aircrews or vehicles when it unsafe to cross or enter a runway. RELs are traffic red must be in-pavement light fixtures per AC 150/5345-46, *Specification for Runway and Taxiway Light Fixtures*, Type L-852S, Class 2, Mode 1.

4.1. REL Mounting Base

The light base for REL in-pavement light fixtures will be similar to the example in Figure 9. Note the Individual Light Controller is also installed in the light base. Light bases must be type L-868, Class 1, Size B.

4.2. REL Configurations

The following standards apply for the Runway Entrance Light fixtures (Type L-852S) configurations:

- Basic Configuration (straight taxiway perpendicular to the runway)
- Angled Configuration (straight taxiway not perpendicular to the runway)
- Curved Configuration (curved taxiway at a varying angle to the runway)

RELs are installed parallel to the taxiway centerline per Figure 1. RELs are spaced laterally 2 feet (ft.) from the taxiway centerline, on the opposite side of taxiway centerline lights (if installed). The first light in the pattern is installed 2 ft. prior to the runway holding position marking. Longitudinal spacing must conform to the standards detailed in Table 4.1 of AC 150/5340-30. The penultimate light is installed 2 ft. prior to the runway edge stripe, and the last light is installed 2 ft. to the side of the runway centerline lights toward the intersecting taxiway.

4.2.1. Basic (90-degree) Configuration.

This is the most common and simplest form of intersection. Because the taxiway centerline is perpendicular to the runway centerline, the longitudinal line of RELs is also perpendicular to the runway, and all the lights are aimed along the taxiway path, that is perpendicular to the runway centerline.

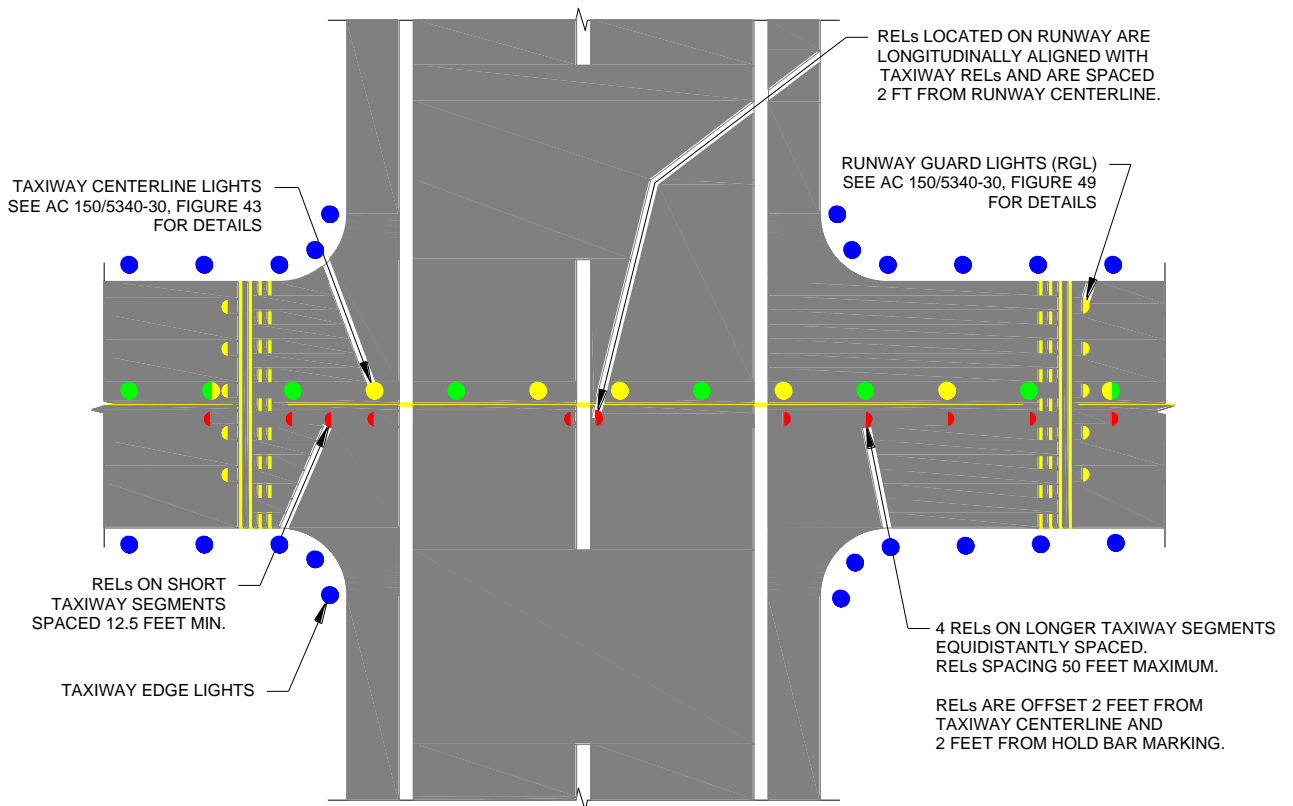
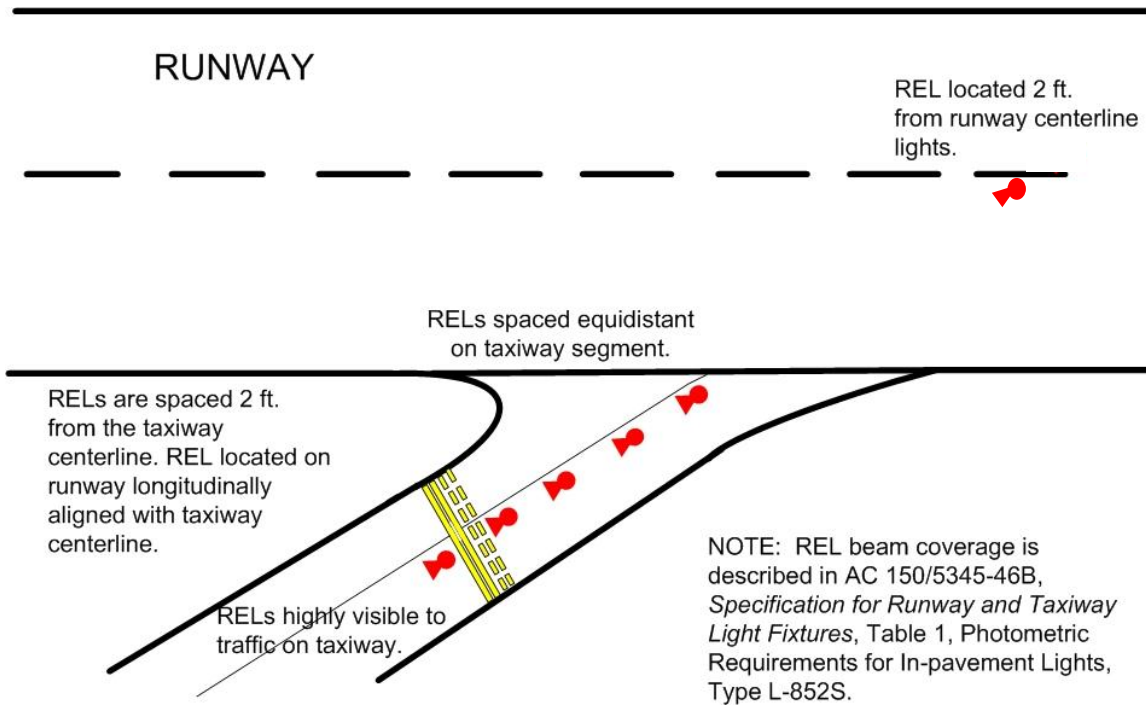


Figure 1. REL Basic Configuration

4.2.2. Angled Configuration.

This configuration is used where the intersecting taxiway is not perpendicular to the runway centerline but not less than 60 degrees from the runway centerline. The location and spacing of the REL lights along the taxiway centerline is identical to the one used for perpendicular intersections. For highly angled taxiways (e.g. less than 60 degrees from the runway centerline heading), the fixtures used and aiming will be determined on a case-by-case basis. Contact AAS-100 for specific guidance.



Angled Configuration (Straight Taxiway Not Perpendicular to Runway.)

Figure 2. Angled Configuration

4.2.3. Curved Configuration.

When the taxiway centerline marking between the holding position marking and the runway is curved, the maximum REL longitudinal spacing must be per Table 1. The runway centerline REL will be located on the extended line of the last two longitudinal lights near the runway edge.

Where a tangent to the curve of the taxiway centerline intersects the runway centerline at not less than 60 degrees, aiming must comply with AC 150/5340-30 for taxiway centerline lights. When the angle is less than 60 degrees, aiming must be determined on a case-by-case basis. Contact AAS-100 for specific guidance.

Table 1. REL Longitudinal Dimensions.

	Longitudinal Spacing	
	1,200 Ft. (365 m) RVR and Above	Below 1,200 Ft. (365 m) RVR
Radius of Curved Centerlines		
75 ft (23 m) to 399 ft (121 m)	25 ft (7.6 m)	25 ft (7.6m)
400 ft (122 m) to 1199 ft (364 m)	50 ft (15 m)	25 ft (7.6 m)
≥1200 ft (365 m)	50 ft (30 m)	50 ft (15 m)

4.2.4. Taxiways with Multiple Entry Paths to a Runway

Some airports may have a taxiway that uses multiple taxiway centerline entrance paths to the runway. This can cause the installation of excessive REL fixtures based on the number of available paths and, if applicable, the radius of the curves. To minimize the number of REL fixtures required, a REL array in the configuration shown in Figure 3 (red lines/circles) will provide the runway status for aircraft entering the runway regardless of the path assigned by air traffic control. The last REL light on the runway (red circle) is installed per the guidance in Figure 1 of this Engineering Brief.



Figure 3. Multiple Entry Paths to a Runway

Considerations for RELs and In-pavement Runway Guard/Stop Bar Lights

FAA Advisory Circular 150/5340-30D (September 30, 2008), Section A7-2.3, notes that the first REL in the array must be installed 2 ft. prior to the runway holding position marking. Sections 4.4 and 4.5 of the same Advisory Circular directs that runway guard light (RGL) and runway stop bar installations be located along an imaginary line parallel to, and 2 ft. from, the holding side of the runway holding position marking.

If runway guard lights or runway stop bar lights exist at a taxiway identified for REL installation, the first light of the REL array will be located on the opposite side of the taxiway centerline as the reference fixture (i.e. the runway guard light or stop bar light located along the taxiway centerline light path). However, coring the pavement for the first fixture of the REL array may conflict with the conduit connecting the existing runway guard/stop bar light cans.

Using the edge of the first REL light fixture as a reference, install it a minimum of 24 in. from the edge of the runway guard light or stop bar to avoid any existing or future installations of runway guard or stop bar lights with a tolerance of +/- 1 ft.

4.2.5. Last REL and Runway Centerline Lights

See Figure 4. FAA Advisory Circular 150/5340-30D (September 30, 2008), Section A7-2.3, notes that the last REL in the array must be installed 2 ft. to the side of the runway centerline lights toward the intersecting taxiway. Section 3.3 of the same Advisory Circular directs that the line of runway centerline lights shall be installed a maximum of 2.5 ft. from the runway centerline.

When the runway centerline lights exist on the opposite side of the runway centerline from the REL array, the last REL will be located on the runway centerline. For concrete runways, a joint typically runs down the centerline, resulting in a conflict with this fixture location. Furthermore, a fixture at this location would be located on the runway centerline marking. To solve the preceding, the last REL should be moved the minimum distance necessary towards the REL array to avoid pavement joints. When the runway centerline lights exist on the opposite side of the runway centerline from the REL array on a concrete runway, the last REL will be 5 ft. offset from the centerline lights.

On runways where no centerline lights currently exist, it is proposed that an imaginary line of centerline lights will be determined based on discussions with the airport, and that the last REL is installed in reference to this imaginary line.

The edge of the last REL fixture will be installed 2 ft. from the marking edge per Figure 4 with a tolerance of + 3 ft., - 0 ft.

For those runway area areas where the threshold stripe markings (not the threshold bar marking) may be affected, the REL is placed 2 ft. from the physical runway centerline with tolerance of + 2 ft., -0 ft. RELs must not be installed within the runway threshold marking.

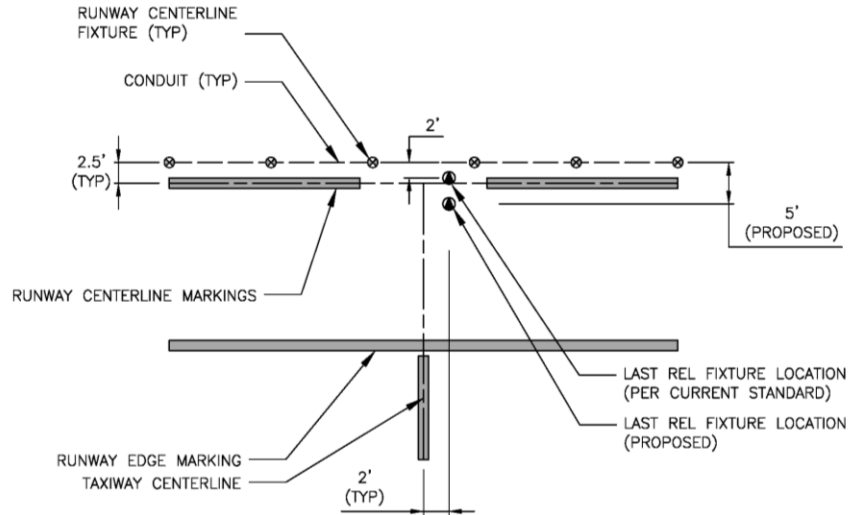


Figure 4. Last REL and Runway Centerline Lights

5. TAKEOFF HOLD LIGHTS (THL)

THLs are used at the runway departure area and provide an indication to aircrews and vehicle operators that the runway is unsafe for takeoff. They are red unidirectional lights installed in a double longitudinal row aligned and offset from either side of the runway centerline lighting. See Section 5.2 for a more detailed THL runway location description and diagrams.

THLs are Type L-850T, Class 2, Style 3, Mode 1, light fixtures.

5.1. THL Mounting Base

THL mounting bases are identical to those used for RELs - see Figure 10.

5.2. General Installation.

See Figure 5. THLs are a double row of in-pavement red lights (L-850T) aligned with the runway centerline lights and aimed toward the approach path to the runway. They begin at a point that is 375 ft. \pm 25 ft. from the runway threshold and are displaced 6 ft. either side of the runway centerline lights.

THLs are placed every 100 feet and located between every other runway centerline light (see AC 150/5340-30D, Figure 33, for runway centerline spacing requirements). THLs should not be longitudinally aligned (in line with the runway centerline light) to the maximum extent possible. There will be 1500 feet of lights (32 lights total) in the THL array. The total length of the system is determined on a case-by-case basis.

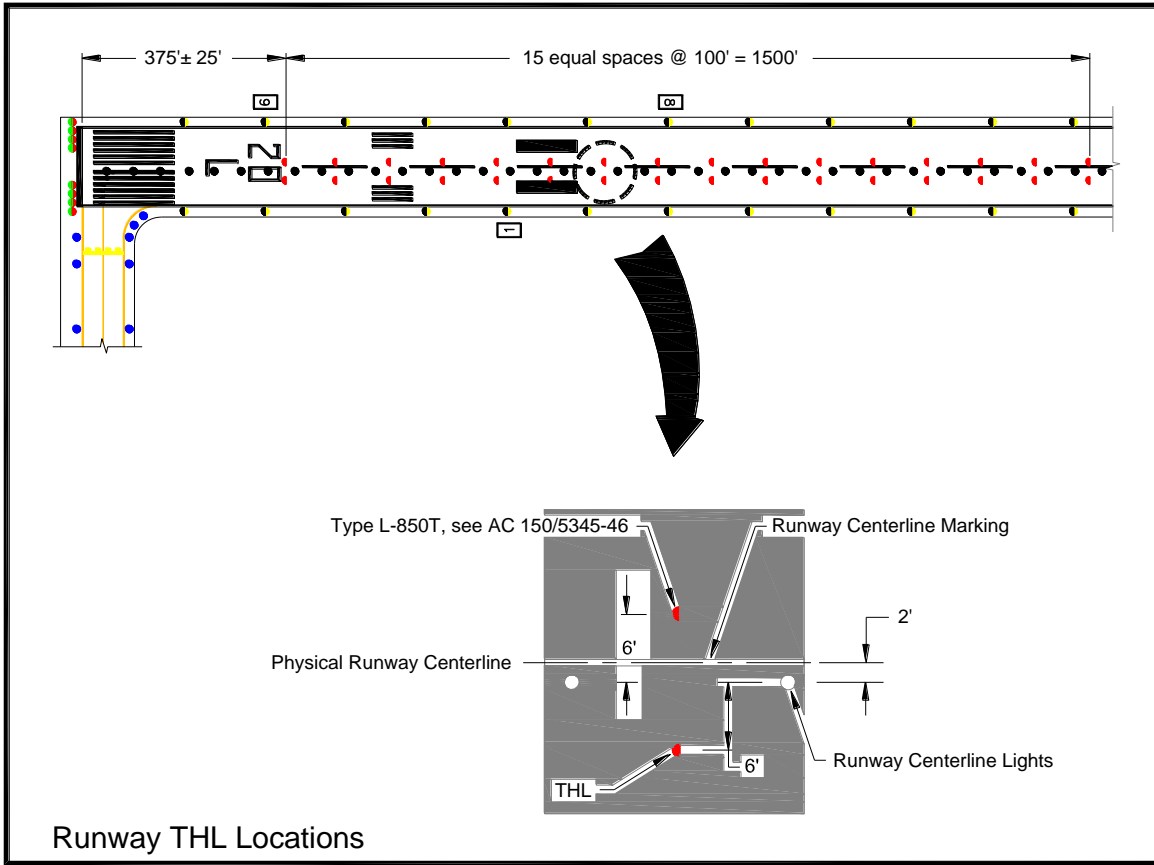


Figure 5. Takeoff/Hold Lights

5.2.1 THL Installation on a Runway With No Centerline Lights

There may be circumstances where THLs are to be installed on a runway that does not have centerline lights. See Figure 6. For these locations, the THL array must accommodate an imaginary line that represents the location of the runway centerline lights (2.5 ft. from the physical centerline of the runway to the centerline of the light fixture). Per Figure 6, The THLs are offset 6 ft. from the physical centerline (both sides) of the runway centerline light fixtures.

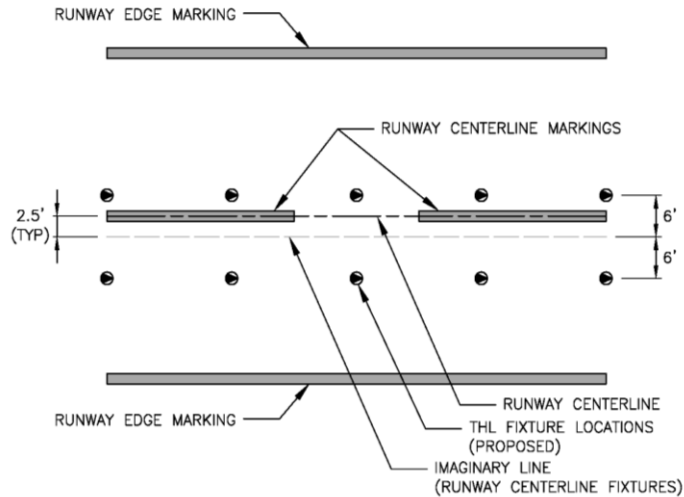


Figure 6. THLs for a Runway Without Centerline Lights.

5.3. Constant Current Regulator Power Supply

This unit provides constant current power to all RWSL lamps (via the lighting cable) and is interfaced to the Master Light Controller (MLC). The CCR is either FAA Type L-828 (no monitoring), Class 1 (6.6 Amps), Style 2 (5 brightness steps) or FAA Type L-829 (with monitoring), Class 1 (6.6 Amps), Style 2 (5 brightness steps) per AC 150/5345-10, *Specification for Constant Current Regulators/Regulator Monitors*.

5.4. Isolation Transformer

The isolation transformer connects the individual light controllers (ILC) to the field lighting series circuit high voltage power cable (Type L-824). The use of an isolation transformer reduces the potential for an open individual lamp circuit fault to cause damage to the resonant CCR distribution system.

The isolation transformers are per: AC-150/5345-47, *Specification for Series to Series Isolation Transformers for Airport Lighting Systems*, FAA Type L-830-18, for THLs and RELs.

5.5. Individual Light Controller (ILC)

The ILC input connects to the secondary side of the isolation transformer. Master lamp control data (power line carrier serial data) is coupled through the isolation transformer from the high voltage primary to secondary windings, demodulated by the RF MODEM, and passed to the processor. The ILC connects to the lamp filaments via the Lamp Switching Circuits and Components section that employs both electro-mechanical and solid state switching devices. Each ILC is assigned a unique serial address that enables the computer control of individual airfield lights:

- Lamp ON or OFF.
- Predefined fail-safe settings - ON/OFF/Flashing (The flashing function is not used in RWSL).

RWSL INDIVIDUAL LIGHT CONTROLLER (ILC)

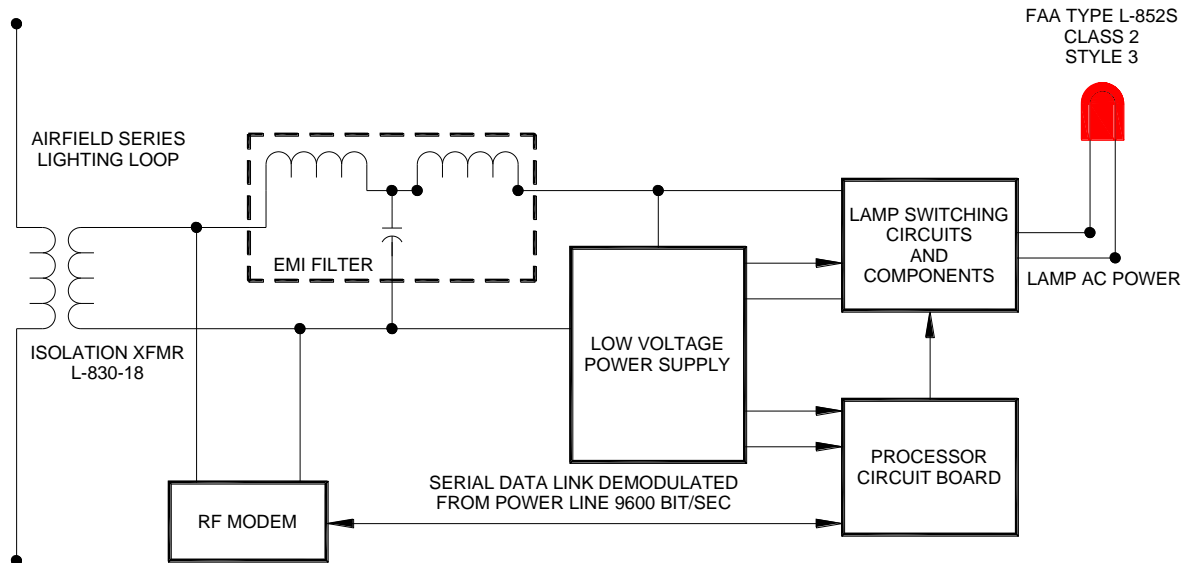


Figure 7. ILC

The ILC also provides monitoring of lamp current, voltage, and load status, including a lamp out detection when it is not processing commands. If a lamp fails, the ILC places a short across the secondary side of the isolation transformer to maintain light system loading.

6. RUNWAY INTERSECTION LIGHTS (RIL)

RILs are used at runway/runway intersections and provide an indication to aircrews and vehicle operators that there is high-speed traffic on the intersecting runway and that it is unsafe for to enter or cross. They are red unidirectional lights installed in a double longitudinal row aligned and offset from either side of the runway centerline lighting in the same fashion as THLs. See Section 5.2 for a more detailed THL runway location description and diagrams.

RIL light fixtures are the same as those used for THLs: Type L-850T Class 2, Style 3, Mode 1.

6.1. RIL Mounting Base

RIL mounting bases are identical to those used for RELs and THLs (see paragraph 4.1 and Figure 10).

6.2. General Installation

See Figure 8. RILs are a double row (31 pairs) of in-pavement red lights that are aligned with the runway centerline lights and aimed toward an aircraft or vehicle that is approaching an intersecting runway. They begin at the Land and Hold Short (LAHSO) in pavement lights or the runway holding position marking and extend toward the approach end of the runway for 3000 feet. In the absence of either LAHSO lights or a runway holding position marking, the equivalent

point of the runway holding position must be determined (see AC 150/5340-1 for additional information about the location of the runway holding position marking).

See Figure 8 detail. The first pair of RIL light fixtures is located 8 feet (measured to the centerline of the RIL light fixture) from the outer edge of the first solid line of the runway holding position marking toward the approach end of the runway. If LAHSO in-pavement lights are installed, the first pair of RIL light fixtures is located 6 feet (measured to the centerline of the RIL light fixture) from the centerline of the LAHSO light bar. The tolerance for both installation cases is plus 25 feet or less toward the approach end of the runway to achieve the RIL spacing requirement. RILs are installed every 100 feet and displaced 6 ft. either side of the runway centerline lights in the same manner as THLs.

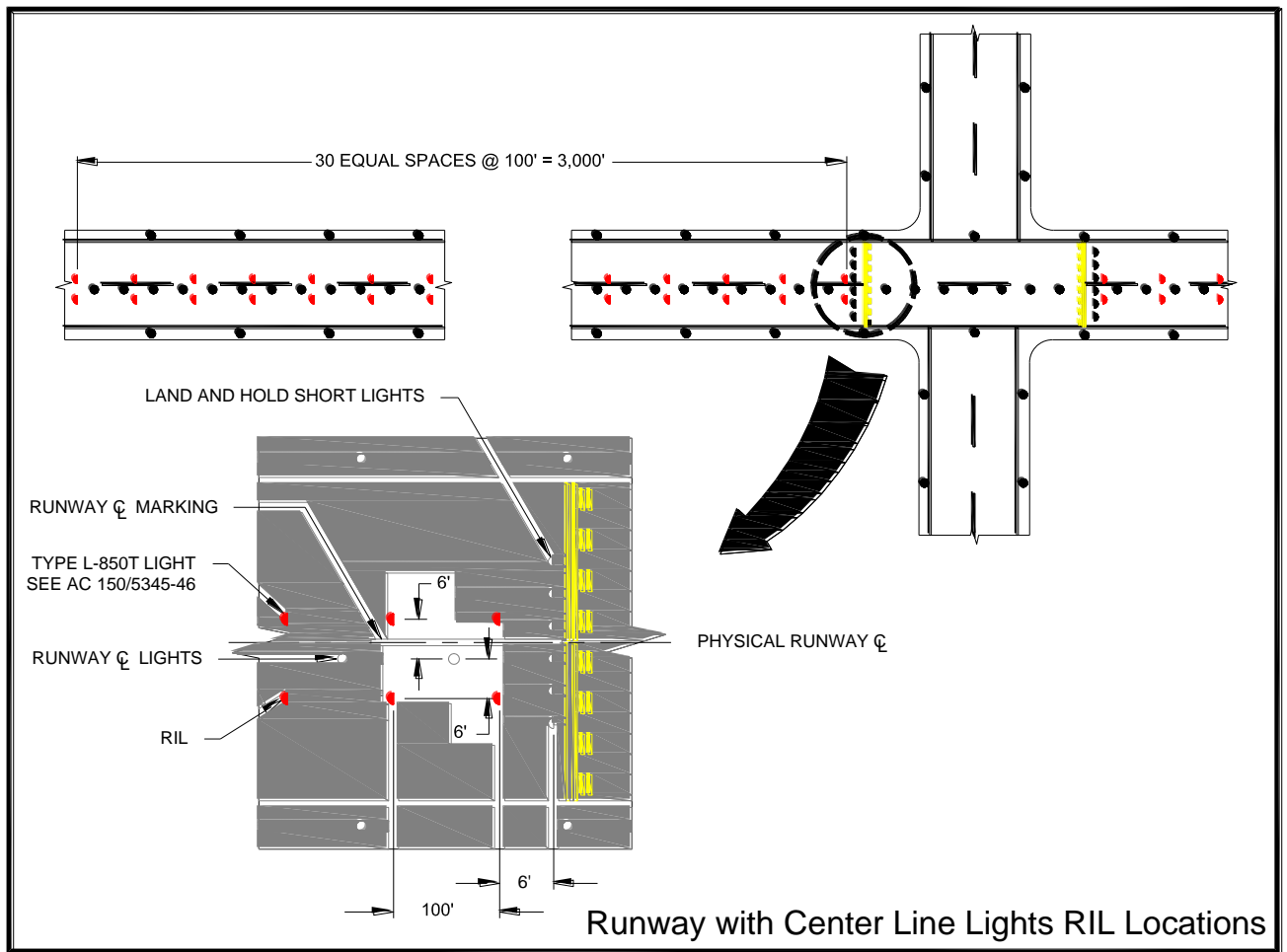


Figure 8. Runway Intersection Lights

6.3. RIL Installation on a Runway With No Centerline Lights.

There may be circumstances where RILs are to be installed on a runway that does not have centerline lights. For these locations, the RIL array must accommodate an imaginary line that would represent the location of the runway centerline lights (2.5 ft. from the physical centerline

of the runway to the centerline of the light fixture). Per Figure 9, the RILs are offset 6 ft. from the physical centerline (both sides) of the imaginary runway centerline light fixtures.

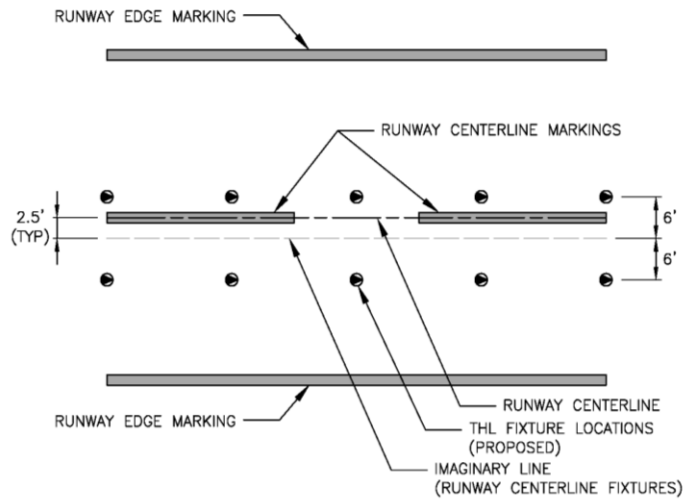


Figure 9. RILs for a Runway Without Centerline Lights.

6.4. Overlapping RILs and THLs

In some situations, RIL and THL light fixtures may overlap. When there is overlapping, first determine the layout of the RILs. Then continue with the THL light fixtures (using the last pair of RIL fixtures as a point of reference) until the last pair of THL fixtures is 375 ± 25 feet from the runway threshold (departure end).

7. DESIGN

7.1. General Guidelines

The RWSL will be installed using new conduit where possible for existing runways/taxiways. Future installations of in-pavement L-868 light bases and conduit should be done, if possible, while the pavement is under construction or when an overlay is made. Installation of conduit and light bases after paving is very costly and requires a lengthy shutdown of the taxiway or runway.

7.2. Layout

A design drawing must be developed prior to construction, showing the dimensional layout of each lighting system to be installed. It is preferable to use dedicated conduits and duct banks to reduce the possibility of potential interference with existing systems. However, this may not be possible at all RWSL installations. In the instances where dedicated conduits and duct banks cannot be used, correlate the intended design with current airport drawings to utilize available ducts and utilities and to avoid conflict with existing or planned facilities.

7.3. In-Pavement Light Fixtures and Electrical Cables

Design each in-pavement lighting system for one of the conditions listed below:

7.3.1. New Rigid and Flexible Pavements

THL, RIL, and REL fixtures installed in new pavement must be designed for installation into L-868 load bearing light bases per AC 150/5345-42, *Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories*. A type L-830-18 isolation transformer per AC 150/5345-47, *Isolation Transformers for Airport Lighting Systems*, must be provided for each light. See AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*, for drawings and guidance regarding the installation of light bases, isolation transformers, and conduit.

In-pavement THLs, RILs, and RELs will be either: 1) direct-mounted light fixtures (Class 1 per AC 150/5345-46, *Specification for Runway and Taxiway Light Fixtures*) with wire connections made in junction boxes or, 2) installed on L-868 bases (Class 2 light fixtures per AC 150/5345-46) with wire connections made in the bases. See AC 150/5340-30 detailed drawings and guidance regarding the installation of direct mounted fixtures.

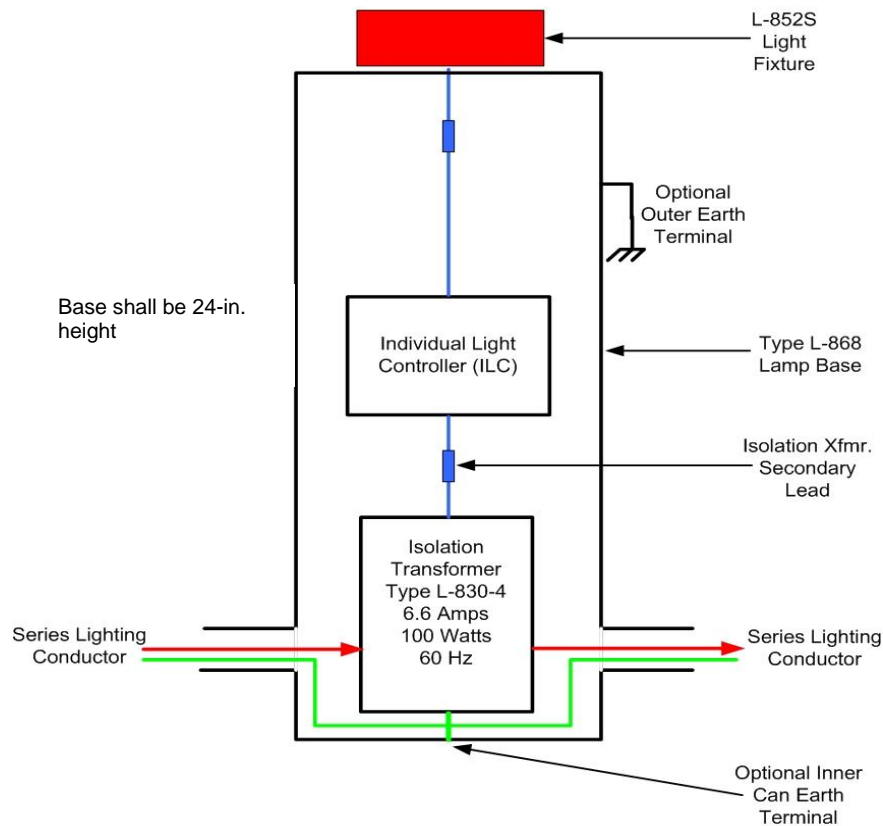


Figure 10. REL Mounting Base Detail

7.3.2. Overlay Rigid and Flexible Pavements

A light base and conduit system per described in paragraph 7.3.1. may be used. Light base extensions and spacer rings to reach proper elevation may be required. See AC 150/5340-30 for installation guidance and information.

7.3.3. Existing Pavements

Provide recesses or holes for direct-mounted light fixtures or fixtures installed on bases. Isolation transformers and local control devices are located at the side of the taxiway. Only one runway entrance light may be operated from a single L-830-18 isolation transformer. See AC 150/5340-30 drawings and installation guidance for wiring kerfs, wiring and junction box locations.

Alternatively, L-868 light bases and conduit systems for THL and REL systems may be retrofitted into existing pavements. Isolation transformers and/or local control devices are located within the light bases.

7.4. SMGCS

Any potential impacts of the RWSL system on airport SMGCS operation must be evaluated and resolved prior to commencing any installation activities at the airport.

7.5. Takeoff Hold and Runway Entrance Lighting Systems

7.5.1. Fixture Selection

L-852S, Class 2, Style 3, Mode 1 fixtures will be installed on taxiways per paragraph 4 of this document. L-850T, Class 2, Style 3, Mode 1, RIL fixtures will be installed on runways per paragraph 5 of this document.

7.5.2. Power Supply

Series circuits for THL and REL systems will be powered with separate, dedicated constant current regulators per AC-5345-10E, *Specification for Constant Current Regulators and Regulator Monitors*.

7.5.3. THL and REL Control Methods

7.5.3.1. General

Where possible, simple switching to energize and de-energize the circuits or to control lamp brightness will be used.

7.5.3.2. Control System & Electromagnetic Interference (EMI)

The airport design engineer is responsible for ensuring that the FLS is reliable and electromagnetic interference does not cause unintended switching of the RWSL lighting system. In addition, the FLCS must cause minimal radiated or conducted electromagnetic interference to other FAA equipment on or near the airport.

7.5.3.3. 120 Volts AC

Where the distance between the remote control panel and the vault is not great enough to cause excessive voltage drop in the control leads, use standard control panel switches to operate the control relays directly. Operating relays supplying power to the taxiway centerline regulators must have coils rated for 120 volts AC. A No. 12 AWG control cable should be used to connect the control panel to the power supply equipment in the vault.

8. EQUIPMENT AND MATERIAL

8.1. General

Equipment and material used in the RWSL system listed below will conform to the AC or specification indicated, and must be listed in the addendum to AC 150/5345-53, *Airport Lighting Equipment Certification Program*.

ACs and specifications are referenced by number and title in Appendix B.

Equipment and Material Used for RWSL Systems

<u>Equipment and Material</u>	<u>Advisory Circulars</u>
L-850T Light Fixtures	AC 150/5345-46
L-852S Light Fixtures	AC 150/5345-46
L-847 Circuit Selector Switch	AC 150/5345-5
L-824 No. 8 AWG Cable	AC 150/5345-7
L-824 No. 10 AWG THWN Cable	AC 150/5345-7
L-824 No. 12 AWG Cable	AC 150/5345-7
L-828 Constant Current Regulator	AC 150/5345-10
L-823 Plug and Receptacle, Cable Connectors	AC 150/5345-26
L-868 Light Bases, Size B, Class 1	AC 150/5345-42
L-869 Junction Box	AC 150/5345-42
L-830 Isolation Transformer	AC 150/5345-47
L-108 Counterpoise Cable	AC 150/5370-10
L-109 Transformer Vault	AC 150/5370-10
L-110 Conduit and Duct	AC 150/5370-10
P-605 Joint Sealer, Type III	AC 150/5370-10
P-606 Sealer Material (Liquid and Paste)	AC 150/5370-10
P-610 Concrete Backfill	AC 150/5370-10

8.2. Vault

The vault must be of the type shown on the design plans. Construction is to be reinforced concrete, concrete masonry, brick wall, or prefabricated steel, as specified. Use of distribution transformers, oil switches, cutouts, and all regularly used commercial items of equipment not covered by FAA specifications must conform to applicable standards of the electrical industry.

8.3. Light Base and Transformer Housing

Use a light base and transformer housing per AC 150/5345-42C, *Specification for Airport Light Bases, Transformer Houses, Junction Boxes and Accessories*. If the secondary wires are fed to the in-pavement lights through a saw kerf, a one-inch hub is welded to the light base at 90 degrees from the two existing two-inch hubs that are 180 degrees apart. A gasket and suitable cover are also required for off-taxiway installation.

8.4. Pre-insulated Connectors

When splicing the fixture leads to the No. 10 AWG type THWN wires, use pre-insulated connectors suitable for installation in the wire ways in accordance with AC 150/5345-26C, *Specification for L-823 Plug and Receptacle, Cable Connectors*.

8.5. Optional Sealer Material

Other types of sealer material that provide satisfactory adhesive and waterproofing qualities may be used in lieu of sealer materials P-605 and P-606 upon approval of the airport engineer in charge. Any sealer to be used with asphalt pavements must be compatible.

9. OPERATIONAL TESTING

9.1. General

Before connecting and energizing the regulator, make a 24-hour recording of the primary input voltage to determine which regulator voltage tap to use. If the maximum input voltage exceeds the 480-volt maximum tap, correct the input voltage. Install lamps in all light fixtures for check out. Note: Operations with excessive open isolation transformer loads can damage a monocyclic type resonant circuit regulator. A short will be placed at the ILC.

9.2. Open-Circuit Protection

Check the open-circuit protective device only once, then allow a five-minute cooling period before rechecking. Continuous cycling of the protective device can overheat and burn out the thermal relay.

9.3. Complete System Operation

Test the installation by continuous operation for not less than one-half hour as a complete system including the functioning of each control not less than ten times. Test the completed circuits in accordance with the applicable provisions of Item L-108.

9.4. Transformer and Feeder Fusing

Check to determine the primary (high voltage) fuses for transformers and feeders do not exceed 200 percent of the rating of the transformer. Secondary (low voltage) fuses for transformers and feeders must not exceed 125 percent of the transformer rating.

9.5. Vault Equipment

Test the vault equipment specified in Item L-109 and FLS system components manufacturer's recommendation. Include a check to determine that the resistance to ground of any part of the grounding system will not exceed 10 ohms.

9.6. Equipment

Subject all regulators and other applicable equipment to performance tests specified in the manufacturer's instructions.

9.7. Cables, Wiring and Splices

Check all cables, wiring, and splices to obtain assurance the installation is in accordance with Item L-108. Check underground cables and wire in saw kerfs before the installation is completed.

9.8. Ducts and Duct Markers

Ensure that all ducts and duct markers are installed in accordance with Item L-110. Check underground ducts before installation is completed.

10. REFERENCES

RWSL Research Management Plan, Version 2.0, dated December 2002

RWSL Systems Requirements Document, Revision 2.3, dated February 21, 2002

Operational Concept Document for RWSL, dated January 29, 2002

RWSL Human Factors Study, v5.5c3 Runway Entrance Light (REL) Configuration, dated May 21, 2003

FAA-STD 020b, *Transient Protection, Grounding, Bonding and Shielding Requirements for Electronic Equipment*, dated May 11, 1992

RWSL OpEval Plan, TBA

RWSL Human Factors Plan, TBA

NOTAMS, TBA

11. ACRONYMS

AC	Advisory Circular
ADO	Airports District Office
AFLC	Airfield Lighting Computer
AMASS	Airport Movement Safety System (part of ASDE-3)
ASDE-3	Airport Surface Detection Equipment – 3
ASDE-X	Airport Surface Detection Equipment – X
AWG	American Wire Gauge
BRITE	Siemens proprietary second generation individual lamp control/monitoring
BOS	Boston/Logan International Airport
CCR	Constant Current Regulator
DFW	Dallas Ft. Worth International Airport
DOT	Department of Transportation

FAA	Federal Aviation Administration
FLS	Field Lighting System
Hz	Hertz
ILC	Individual Light Controller
LCC	Light Control Computer
MALSR	Medium Intensity Approach Lighting System
MIT/LL	Massachusetts Institute of Technology/Lincoln Lab
MLAT	Multilateration
MLC	Master Light Controller
MODEM	Modulator/Demodulator
NAS	National Airspace System
NTSB	National Transportation Safety Board
REL	Runway Entrance Lights
RF	Radio Frequency
RWSL	Runway Status Lights system
RWY/TWY	Runway/Taxiway
SAN	San Diego International Airport
SMGCS	Surface Movement Guidance and Control System
SMR	Surface Movement Radar
SPDT	Single Pole Double Throw
TDZ	Touchdown Zone
THL	Takeoff Hold Lights
W	Watt
XFMR	Isolation Transformer

12. LIST OF ADVISORY CIRCULARS

AC 120-57, *Surface Movement Guidance and Control System (SMGCS).*

AC 150/5000-13, *Announcement of Availability--RTCA Inc., Document RTCA-221, Guidance and Recommended Requirements for Airport Surface Movement Sensors.*

AC 150/5200-30, *Airport Winter Safety and Operations.*

AC 150/5300-13, *Airport Design.*

AC 150/5340-26, *Maintenance of Airport Visual Aid Facilities.*

AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*

AC 150/5345-3, *Specification for L-821 Airport Lighting Panels for Remote Control of Airport Lighting.*

AC 150/5345-5, *Circuit Selector Switch.*

AC 150/5345-7, *Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits.*

AC 150/5345-10, *Specification for Constant Current Regulators and Regulator Monitors.*

AC 150/5345-13, *Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits.*

AC 150/5345-26, *Specification for L-823 Plug and Receptacle, Cable Connectors.*

AC 150/5345-42, *Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories.*

AC 150/5345-46, *Specification for Runway and Taxiway Light Fixtures.*

AC 150/5345-47, *Specification for Series to Series Isolation Transformers for Airport Lighting Systems.*

AC 150/5345-53, *Airport Lighting Equipment Certification Program.*

AC 150/5370-10, *Standards for Specifying Construction of Airports.*