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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
SPECIFICATION

SEQUENCED FLASHING LIGHTING SYSTEM, ELEVATED AND SEMIFLUSH WITH DIMMING AND MONITORING

1. SCOPE AND CLASSIFICATION.

1.1 Scope.- The equipment covered by this specification is for a flashing light system for use in conjunction with standard ALSF-1, MALSR, MALSF, ALSF-2, SSALR, dual mode ALSF-2/SSALR approach lighting system, or a runway end identifier light (REIL) system.

1.2 Classification.- Two types of lights and two types of master control units are covered by this specification.

1.2.1 Flasher type.- The dimmable light units are identified as follows:

Type I - Elevated flasher shall be compatible with the mounting requirements of Figure 1.

Type II - Semiflush flasher

Type III - Elevated flasher shall be compatible with the mounting requirements of Figure 1 and be useable in a REIL system with power adapter.

1.2.2 Master control type.- The master control units are of the following types:

Type A - Controller with monitoring and dimming capability for use with ALSF-1, ALSF-2, or dual mode ALSF-2/SSALR.

Type B - Controller with dimming capability without monitoring capability for use with SSALR, REIL, MALSR, and MALSF.

2. APPLICABLE DOCUMENTS.

2.1 FAA documents.- The following FAA specifications, standards, and drawings, of the issues specified in the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.1.1 FAA Specifications.-

FAA-E-1100	Photometric Test Procedures for Condenser Discharge Lamp
FAA-G-2100/1	Electronic Equipment, General Requirements, Part 1, Basic Requirements for all Equipments
FAA-E-2491	Approach Light, Semiflush, Steady-burning
FAA-D-2494/1	Instruction Book Manuscripts, Technical, Equipment and Systems, Requirements; Part I
FAA-D-2494/2	Instruction Book Manuscripts, Technical, Equipment and Systems, Requirements; Part II
FAA-E-1315	Light Base and Transformer Housing
FAA-E-2604	Low-Impact Resistance Structures for Medium-Intensity Approach Lighting Systems
AC 150/5345-26	Plug and Receptacle, Cable Connector
AC 150/5345-7B	Specification L-824, Underground Electrical Cables for Airport Lighting Circuits

2.1.2 FAA standards.-

FAA-STD-012	Paint Systems for Equipment
FAA-STD-013	Quality Control Program Requirements

2.1.3 FAA drawings.-

D-5450-1	Light Base and Transformer Housing, Type LB-1 and LB-4
C-6046	Frangible Coupling, Type I and IA, Details
B-21216	Standard Nameplate

2.2 Military and federal publications.- The following military and federal publications, of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.2.1 Military specifications.-

MIL-C-7989	Covers, Light Transmitting, for Aeronautical Lights, General Specification for
MIL-A-8625	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-E-17555	Electronic and Electrical Equipment, Accessories and Repair Parts, Packaging and Packing of
MIL-C-25050	Colors, Aeronautical Lights and Lighting Equipment, General Requirements for
MIL-C-13924	Coating, Oxide, Black, for Ferrous Metals
MIL-P-26915	Primer Coating, Zinc Dust Pigmented, for Steel Surfaces
MIL-I-46058	Insulating Compounds, Electrical (For Coating Printed Circuit Assemblies)
MIL-T-27	Transformers and Inductors, General Specification for

2.2.2 Military standards.-

MIL-STD-470	Maintainability Program Requirements
MIL-STD-276	Impregnation of Porous, Nonferrous Metal Castings
MIL-STD-726	Packing Requirements Code
MIL-STD-810	Environmental Test Methods
MIL-STD-889	Metals, Definition of Dissimilar

2.2.3 Federal specifications.-

QQ-Z-325	Zinc Coating, Electrodeposited, Requirements for
QQ-P-416	Plating, Cadmium (Electrodeposited)
ZZ-R-765	Rubber, Silicon, Low and High Temperature and Tear Resistant

2.2.4 Federal standards.-

Fed. Std. 595 Colors

2.3 Other publications.- The following publications, of the issue in effect on the date of the invitation for bids or request for proposals, form a part of this specification.

2.3.1 National Fire Protection Association document.-

NFPA No. 70 National Electrical Code

2.3.2 Occupational Safety and Health Act (OSHA).-

National Standards Established by Occupational Safety and Health Act (OSHA)

2.3.3 National Electrical Manufacturers Association.-

NEMA FA1-3.01 Vibration Testing

(Copies of this specification and other applicable FAA documents may be obtained from the Contracting Officer in the office issuing the invitation for bids or request for proposals. The requests should fully identify material desired; i.e., standard, drawing, specification and amendment dates and numbers. Request should cite the invitation for bids, request for proposals, or contract involved or other use to be made of the requested material.)

(Requests for copies of military specification and standards should be addressed to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.)

(Information on obtaining copies of federal specifications and standards may be obtained from General Services Administration office in Washington, D.C.; Atlanta; Auburn, Washington; Boston; Chicago; Denver; Kansas City; New York; San Francisco; and Seattle.)

(Information on obtaining NFPA documents may be obtained from National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachuetts 02210.)

(Information on obtaining OSHA standards may be obtained from Department of Labor, Occupational Safety and Health, Constitution Avenue & 14th Street, N.W., Washington, D.C.).

3. REQUIREMENTS.

3.1 Equipment to be supplied by the contractor.- Each flashing light system supplied by the contractor shall be complete in accordance with all specification requirements and shall include the items tabulated below. Quantities shall be as specified in the contract schedule.

(a) Master control unit, Type A or B
(b) Elevated flasher assemblies, Type I or Type III
(c) Semiflush flasher assemblies, Type II
(d) Mating connectors for all contractor-furnished equipment (CFE)
(e) Aiming device
(f) Flasher tester
(g) Power adapter

3.2 General functional requirements.- The individual flashing lamp assembly to be furnished under this specification will be used as part of a REIL system or as a component of an ALS and shall be suitable for continuous operation. In a REIL configuration, the flashing lamp assemblies are to be used for marking the approach end of a runway. One flashing lamp assembly shall be located on each side of the approach end of the runway and shall be connected so that both will flash simultaneously. In an ALS configuration, the flashing lamp assemblies are to be installed in the outer portion of the ALS at regular intervals, so arranged and connected as to produce a sequenced flashing light signal and having the appearance of a flash traveling down the system from the outer end (farthest from runway threshold) to inner end twice a second. The master control unit provides power and trigger signals to the individual flasher assembly. Where applicable, the master control unit shall also control flasher intensity, monitor operation, and furnish system status data.

3.2.1 Master controller requirements.- The master control unit furnishes power and control signals to the individual flasher assemblies and, depending on the type, monitors the flasher and provides data on flasher performance. There shall be no wiring for control and operation of the flasher other than the wiring between flasher and master control unit. An elapsed time meter shall be installed in all master control units to indicate the number of hours of operation on the high-intensity step position. The meter shall indicate up to 999 hours and indicate total time in hours and tenths of hours. The meter shall be are cycling type and shall be General Electric type 909X85 or equal. A service entrance switch,

used to disconnect incoming 120/240 V power to the master control unit, shall be furnished with the master control unit. If the switch is to be mounted external to the master control unit cabinet, it shall be of the type designed for outdoor application. A 100-watt, 120 V ac, light with a protective wire mesh cover that is grounded shall be installed in the control cabinet to provide adequate illumination for nighttime maintenance operations. The light and receptacle shall each be separately fused and useable although the entrance switch is open. A 120 V, single phase, 15 amp, grounding-type receptacle with built-in ground fault interrupter (GFI), shall be installed in the control cabinet for maintenance purposes. The GFI shall be located adjacent to or in the receptacle. The GFI shall be a specification grade Underwriter's Laboratories listed device with pushbutton switches to permit manual test and reset operations. The two types of master control units are described herein.

3.2.1.1 Type A.- The purpose of the Type A master control unit is to provide control signals and conditioned power to the flasher assembly used in the ALSF-2/SSALR system. The control unit shall also monitor the flasher, shall provide for controlling the intensity of the flasher, and shall be capable of switching between the ALSF-2 and SSALR modes.

3.2.1.1.1 Power.- Primary input power shall enter the master controller through an entrance switch and shall be 120/240 V, 60 hertz, 3 wire, single phase. Maximum current on the power line shall not exceed 100 amp peak.

3.2.1.1.2 Control.- The master controller shall be controlled either by an integral local control panel or a remote control panel. The local control panel shall have the local/remote control switch in addition to other required controls. A summary of the input/output lines is as follows:

(a) Input from remote control panel:

- ALSF-2/SSALR CONTROL (LOGIC 1 = ALSF-2)
- INTENSITY 3 (LOGIC 1 = INTENSITY 3)
- INTENSITY 2 (LOGIC 1 = INTENSITY 2)
- INTENSITY 1 (LOGIC 1 = INTENSITY 1)
- APPROACH SYSTEM ON/OFF (LOGIC 1 = ON)

(b) Output from the master controller to the remote panel:

- ALSF-2/SSALR INDICATION (LOGIC 1 = ALSF-2)
- LOCAL/REMOTE INDICATION (LOGIC 1 = LOCAL)
- INTENSITY 3 (LOGIC 1 = INTENSITY 3)
- INTENSITY 2 (LOGIC 1 = INTENSITY 2)
- INTENSITY 1 (LOGIC 1 = INTENSITY 1)
- ON/OFF (LOGIC 1 = ON)
- CAUTION (LOGIC 1 = CAUTION)
- FAULT (LOGIC 1 = FAULT)

(c) Output to flasher unit. The master control unit shall output the following to the flasher unit:

- Conditioned flasher power
- Trigger signal (one signal for each unit)

(d) The power supply for the transistor-transistor-logic (TTL) is a requirement of this specification and shall be contained within the master control unit.

3.2.1.1.3 Input/output functions.- The following is a description of the operation or function of each input/output line:

(a) The ALSF-2/SSALR shall be a TTL compatible signal level with a +5 V denoting Logic 1 which, if remote operation is selected, causes the master control unit to select the ALSF-2 mode of operation.

(b) Intensities 1, 2, and 3 shall be a TTL compatible signal level with +5 V denoting Logic 1 which shall cause the appropriate intensity mode to be selected. Only one of these lines shall be in the Logic 1 state and, if more than one line is energized, the caution line shall be activated to signify a problem exists and the brightest of the selected modes shall be selected.

(c) Approach system on/off shall be a TTL compatible signal level with +5 V denoting Logic 1 which shall cause sequential light flashing in accordance with the mode and intensity selected.

(d) ALSF-2/SSALR indication signal shall be a TTL compatible signal with +5 V denoting the Logic 1 state. This signal, when Logic 1, shall indicate the ALSF-2 mode of operation is selected by the master control unit.

(e) Local/remote indication signal shall be a TTL compatible signal with +5 V denoting the Logic 1 state. This signal, when Logic 1, shall indicate the local/remote switch is in the local position and the master control unit will not receive commands from the remote control panel.

(f) Intensity indication signals, Intensities 1, 2, and 3, shall be TTL compatible signials with +5 V denoting the Logic 1 state. These signals, when Logic 1, shall indicate the brightness mode selected by the master control unit. Only one of these lines shall be energized at a time.

(g) On/off indication signal shall be a TTL compatible signal with +5 V denoting the Logic 1 state. This signal, when Logic 1, shall indicate the master control unit has energized the flashing light sequence.

(h) The caution signal shall be a TTL compatible signal with +5 V denoting Logic 1. It shall be energized when a failure condition, as defined in paragraph 3.2.1.1.7, occurs.

(j) The conditioned flasher power shall be a 240 V, 60 hertz, line capable of supplying 75 amps (peak) at maximum intensity.

(k) The trigger signal shall be a differential output capable of driving not less than 40mA nor more than 100mA into an interface receiver over 3,000 feet of #22 awg twisted pair.

3.2.1.1.4 Trigger timing requirements.- The master controller shall output trigger pulses which are time-synchroinzed with the 60 hertz line. The trigger pulse shall be gated to flash units as follows:

ALSF-2 Mode - All flash units shall be active so the sequence will begin with the station farthest from the threshold (station 24) and advance through station 10, then begin over again with station 24. The time from trigger pulse to trigger pulse on sequential flashers shall correspond to one cycle of the 60 hertz line (16.67 milliseconds). See note.

SSALR Mode - Alternate flash units shall be active, and they shall be the flash units at stations 24, 22, 20, 18, and 16, with the flasher at station 24 being the most distant from the runway threshold. The sequence shall begin with station 24 and continue in descending order through station 16, where the sequence will restart at station 24. The time from trigger pulse to trigger pulse on adjacent flashing stations shall correspond to every other cycle of the 60 hertz line (33.33 milliseconds). See note.

NOTE - Under some conditions, a 3000-foot approach lighting system may be required. Therefore, the master control unit shall be capable of flashing 21 flashers in the ALSF-2 mode and 8 flashers in the SSALR mode.

3.2.1.1.5 Monitoring functions.- In addition to the remote operation as previously described, the master controller shall be operable from an integral local control panel. The panel shall contain, as a minimum, the following controls and indicators:

- Local/remote select switch/indicator

- ALSF-2/SSALR select switch/indicator

- Intensity 1, 2, and 3 select switches/indicators
- On/off select switch/indicator
- Caution indicator
- Fault indicator
- Individual flash unit fault indicators
- Necessary switches and indicators to interrogate status registers and input data to isolate problems and determine system operability
- Reset pushbutton switch (monitor)

3.2.1.1.6 Local control panel monitor capability.- By use of the local control panel, maintenance personnel shall be able to observe mode selected, assume control of the system via the local/remote switch, command, and monitor system operation. Each flash unit shall be monitored and misfires accumulated over a 100-sample interval. When the thumbwheel set misfire threshold is exceeded, the flasher unit shall be considered failed and its corresponding failure indication shall be illuminated. To accomplish this, the system monitoring capability shall have the capability to detect a misfire condition and to accumulate the number of misfires during a 100-trigger sample period. No additional wiring to the flash units shall be required for this function. The data shall be compared to a threshold value set in by thumbwheel switches on the local control panel. The thumbwheel switches shall allow the threshold to be varied, in integer numbers, from 1 to 7. Once the threshold value has been exceeded and the flasher unit failure flag has been set, it shall not be reset until the reset pushbutton has been depressed or recycling of the system on/off select switch has been performed. The output of the flasher until failure logic shall also be routed to the system failure logic for determination of the caution/fault indicator status.

3.2.1.1.7 Remote panel monitoring capability.- Circuitry shall be provided to monitor the operational condition of the flasher system and to provide both an indication of impending failure (caution) and an indication of total fault (failure) to the remote control/monitor panel. The initial fault detection criteria are outlined below for both the ALSF-2 and SSALR modes of operation.

	CAUTION	FAILURE
SSALR	Greater than preset number of misfires of any unit. Any one unit out.	Any two units out.
ALSF-2	Greater than preset number of misfires of any unit. Any two units out.	Any two consecutive units out. Any three nonconsecutive units out.

Two output signals shall be provided for use at the remote control/monitor panel. One of these signals shall indicate CAUTION and the other shall indicate FAILURE. Both signals shall be TTL compatible and shall be Logic HIGH in fault state.

3.2.1.2 Type B.- The purpose of the Type B master control unit is to provide control signals and conditioned power to the flasher assembly used in the REIL and MALSR system. Capability to monitor flasher performance is not a requirement. Master control unit shall be capable of controlling the intensity of the flasher at three different levels.

3.2.1.2.1 Power.- Primary input power shall enter the master control unit through an entrance switch and shall be 120/240 V, 3 wire, single phase, 60 hertz. Maximum current on the power line shall not exceed 100 amps peak.

3.2.1.2.2 MALSR control.- The Type B master control unit shall be capable of both local and remote control and shall contain an integral local control panel. The local control panel shall have a local/remote control switch in addition to the other required controls. Output signals from the remote control to the master control unit are as follows:

INTENSITY 3
INTENSITY 2
INTENSITY 1
SYSTEM ON/OFF

The master control unit shall output to the flasher the following:

- Conditioned flasher power

- Trigger signal - One signal for each flashing unit

Input to the master control unit consists of signals required to control the operation of the flasher system. Following is a description of the MALSR external (remote) control signals:

External control input to the master control unit shall be 120 V ac and shall not exceed 0.02 amps. A terminal block meeting the requirements of paragraph 3.2.1.3.1 shall be provided in the master control unit for remote control input. The terminal block shall have two spare terminals in addition to the six terminals designated below:

(a) Neutral
(b) 120 V ac
(c) Low-intensity
(d) Medium-intensity
(e) High-intensity
(f) Sequenced flashers "on-off"

The neutral terminal (a) shall be connected to the neutral bus of the master control unit. The terminal (b) shall be connected by a properly fused line to a 120 V ac source within the master control unit. Terminal (c) is energized by external control with 120 V ac on low-, medium-, and high-intensity steps. When terminal (c) alone is energized by external control, the flashers shall turn on to the low-intensity step. Terminal (d) is energized by external control with 120 V ac on medium- and high-intensity. When terminal (d) and terminal (c) only are energized, the flashers shall turn on to the medium-intensity step. Terminal (e) is energized by external control with 120 V ac on the high-intensity step. When terminal (e), terminal (c), and terminal (d) only are energized, the flashers shall turn on to the high-intensity step. Terminal (f) is energized by external control with 120 V ac to turn on the sequenced flashers. When terminal (f) is energized, the sequenced flashers shall turn on to the intensity step as determined by inputs to (c), (d), and (e). De-energizing of terminals (c), (d), and (e) shall turn off the entire flasher system. The system, when energized from the off position, shall come on at low-intensity and then switch to a higher intensity if a higher intensity is selected. All intensity changes shall be completed within 1.5 seconds of initiating intensity change. The power output to the sequenced flashers may be interrupted up to a maximum of 1.5 seconds, if required, during intensity step change operations. Circuitry shall prevent intensity step changing during the discharge of a sequenced flasher capacitor.

The power supply for the TTL is a requirement of this specification and shall be contained within the master control unit.

The following is a description of the operation of function of each output line:

(a) Intensities 1, 2, and 3 shall be a TTL compatible signal level with +5 V denoting Logic 1 which shall cause the appropriate intensity mode to be selected. Only one of these lines shall be in the Logic 1 state and, if more than one line is energized, the caution line shall be activated to signify a problem exists and the brightest of the selected modes shall be selected.

(b) Approach system on/off shall be a TTL compatible signal level with +5 V denoting Logic 1 which shall cause sequential light flashing in accordance with the mode and intensity selected.

(c) The conditioned flasher power shall be a 240 V, 60 hertz, power line capable of supplying up to 75 amps peak at maximum intensity.

(d) The flash unit trigger signal shall be a differential output capable of driving not less than 40mA nor more than 100mA into an interface receiver over 3,000 feet of #22 awg twisted pair.

3.2.1.2.3 REIL control.- The REIL external (remote) control signals connected to the input of the Type B master control unit are as follows:

The REIL flasher may be operated in conjunction with an existing runway edge lighting circuit which is a series circuit powered by a constant current regulator. This circuit may be either a high-intensity circuit (HIRL), having five different current steps, or a medium-intensity circuit (MIRL), having three different current steps. Operation of the REIL flashers shall be accomplished automatically by sensing the current in the runway edge lighting circuit so that when the runway edge lights are on, the REIL will be on. The value of current in the runway edge lighting circuit will vary as shown in paragraph 4.5.21.

Current in the runway edge lighting circuit shall be sensed by a series type runway edge lighting transformer (Advisory Circular 150/5345-47), 100-watt, 60 Hz, 6.6/6.6 amp, 5 kV, or 100-watt, 60 Hz, 20/6.6 amp, 5 kV. The primary of the series type transformer will be connected to the edge lighting circuit. The secondary of the series type transformer will provide control input to the master control unit. Current in the runway edge lighting circuit will vary from 0.5 to 0.7 amps RMS. The flasher shall shut off when the current falls below 0.5 amps RMS. The master control unit shall contain a time delay, adjustable from 0 to 4 seconds to permit uninterrupted operation of the flasher when used with runway lighting circuits which are de-energized during intensity step changes. The master control unit may be located up to 1500 feet from the series transformer and connected to it by 2/c #12 awg cable.

In those cases where the REIL flashers are not automatically controlled from the runway edge lighting circuit, control signals shall be identical to the MALSR flashers (paragraph 3.2.1.2.2).

3.2.1.2.4 Trigger timing requirements.- The master control unit shall output trigger pulses which are time synchronized with the 60 hertz line. The trigger pulse shall be gated to the individual flashing light assemblies as follows:

MALSR – System contains as many as eight or as few as three flashing lights; all units are active. The sequence begins with the flasher farthest from the threshold and continues in sequential order through the flasher closest to the threshold, whereupon the sequence starts over with the flasher farthest from the threshold. The time from trigger pulse to trigger pulse on adjacent flashers shall correspond to every other cycle of the 60 hertz line (33.3 milliseconds).

REIL – Both flasher assemblies shall flash simultaneously twice a second. The trigger circuit of the flasher assembly shall be energized from the master control unit. The design of the triggering circuit shall be such that failure of one flasher assembly shall not affect operation of the remaining flasher assembly.

3.2.1.2.5 Monitoring function.- Not a requirement of the Type B master control unit.

3.2.1.2.6 Local control panel capability.- In addition to remote control, the Type B master control unit shall be operable from an integral local control panel. The panel shall contain, as a minimum, a manual selector switch. The switch shall be a labeled five-positioned switch providing for step control of the system starting with the REMOTE function as the selector knob is rotated clockwise as listed below:

Switch Position

REMOTE
OFF
INTENSITY 1
INTENSITY 2
INTENSITY 3

Each functional position shall be identified by a mechanical stop as well as by position.

3.2.1.3 Master control unit mechanical requirements.- The master control unit cabinet contains the circuitry and controls required to operate the system in the remote or local mode. Included in the cabinet are electrical and/or mechanical components which provide power and control outputs for intensity steps of the sequenced flasher lights and the timing sequence of the sequenced flasher lights.

The cabinet shall be an outdoor, rainproof, dust-tight, nonventilated enclosure as specified herein. The cabinet shall be rigidly constructed and shall not distort or bend under normal methods of shipping, handling, and installation. It shall be stainless steel or sheet aluminum. Stainless steel shall be in accordance with FAA-G-2100/1b, paragraph 1-3.15.1.1. Aluminum enclosures shall be anodized in accordance with MIL-A-8625. The cabinet shall be of sufficient size to accommodate all the necessary components and wiring and provide adequate clearance for field installation and maintenance. It shall have mounting means external to the cabinet cavity, and provisions for locking and shall not have conduit hubs or knockouts. Space shall be provided in the cabinet for all external cable connections. Terminal blocks shall be located near the cable entrance to permit terminations of all external power and control wires feeding into the cabinet. Mounting lugs or bolts shall be provided on the back of the cabinet for mounting the cabinet vertically. Internal or external mounting bolts shall not protrude through the cabinet.

3.2.1.3.1 Terminal blocks.- Terminal blocks shall be the enclosed base type terminal blocks for use with pressure type terminal connectors and shall meet the requirements of FAA-G-2100/1b, paragraph 1-3.16.11. Terminal blocks shall have 10 percent unused terminals, but not less than two extra terminals per terminal block unless otherwise specified.

3.2.1.3.2 Door gaskets.- Door gaskets shall be either continuous or strip gaskets. If strip gaskets are used; (a) the total number of strips used shall not exceed four; (b) the vertical and horizontal runs shall be continuous except where the vertical strips meet the horizontal strips; (c) the horizontal strips shall overlap the vertical strip; and (d) the vertical strip shall be butted tightly against the horizontal strip. Gaskets shall be synthetic rubber or neoprene or a composition gasket utilizing these two materials and shall be resistant to deterioration such as cracking, hardening, or softening under the environmental conditions the equipment will operate in.

3.2.1.3.3 Cabinet door.- The cabinet door shall open from the right side of the cabinet. The door hinge may be internally or externally mounted and shall be corrosion resistant. A door-stop shall be provided for locking the door in a 120-degree open position. No electrical components or cables shall be attached to the door.

3.2.1.3.4 Door handle.- The door handle lever shall have provision for padlocking it closed in the vertical position. The holes for the padlock shall be aligned such that a 3/8-inch diameter rod can be passed horizontally through the holes when the door handle is in a locked position. The handle shall activate a two-point shoot bolt to firmly secure the door in the closed position. The door handle shall be within 2 degrees of vertical when locked and shall keep the door completely closed regardless of what type or size of padlock is used.

3.2.1.3.5 Instruction book holder.- An instruction book holder shall be attached to the upper half inside of the control cabinet door. The holder shall form a pocket for an 8-1/2 inch by 11-inch (22 by 28 cm) instruction book and shall be made of the same material as the cabinet door. Provisions shall be made for attaching a removable wiring diagram plate (paragraph 3.2.1.3.6) to the front of the holder.

3.2.1.3.6 Wiring diagram plate.- A wiring diagram plate shall be provided which matches the wiring diagram figure provided in the instruction book manuscript (paragraph 3.3) in accordance with FAA-D-2494/1a, paragraph 1-3.9.2.10. The plate shall be mounted on the instruction book holder per paragraph 3.2.1.3.5. The plate shall be Type A, F, or H and the color style shall be I or IV in accordance with MIL-P-15024.

3.2.2 Flasher unit general requirements.- The elevated and semiflush sequenced flashing lights covered by this specification shall be suitable for continuous operation under the requirements herein specified. The Type I and Type II flasher units shall be interchangeable with both Type A and Type B master control units. The Type III flasher units shall operate with a Type B master controller (paragraph 3.2.1.2) in combination with a power adapter (paragraph 3.10). The Type III flasher unit specified is exempt from interchangeability with Type I and II flasher units specified in this specification. The components of the Type III flasher units shall be interchangeable within the Type III flasher equipment. For all systems, it shall be possible to change flasher intensity level without interrupting system operations.

3.2.2.1 Photometric performance.- After 250 hours of flashing continuously twice per second, the lamp shall produce an effective intensity of no less than 70 percent of initial candlepower and consecutive misses shall be no more than 1 percent. Flash duration shall be not less than 250 nor more than 5,500 microseconds at 50 percent of the peak instantaneous candlepower. The optical system shall be as simple as possible and still meet all other pertinent requirements. The system may consist of reflectors, lenses, prisms, and/or such other elements necessary to

obtain the required light output. All optical elements shall be of highest commercial quality to assure a long life and consistency of photometrics. The lamp and all optical parts shall be firmly held in place to withstand shock and vibration, but shall permit convenient lamp replacement when required. An optical system which cannot become misaligned is required.

3.2.2.1.1 Intensity of elevated flasher.- The elevated flasher head for Type I and Type III shall produce light intensities shown in Table I as follows:

TABLE I

INTENSITY SETTING	MAXIMUM ALLOWABLE EFFECTIVE INTENSITY (CANDELAS)	MINIMUM EFFECTIVE INTENSITY (CANDELAS)
FULL	20,000	8,000
MEDIUM	2,000	800
LOW	450	150

The effective intensity measurements shall be made over a rectangular pattern not less than 10 degrees vertically and 30 degrees horizontally. Corners may be rounded on a 5-degree radius to determine compliance.

3.2.2.1.2 Intensity of inpavement flasher.- The inpavement flasher shall produce the intensities shown in Table II as follows:

TABLE II

INTENSITY SETTING	MAXIMUM ALLOWABLE EFFECTIVE INTENSITY (CANDELAS)	MINIMUM EFFECTIVE INTENSITY (CANDELAS)
FULL	20,000	5,000
MEDIUM	2,000	500
LOW	600	150

The effective intensity measurements shall be made over a rectangular pattern not less than 10 degrees vertically and 30 degrees horizontally. The geometric center of this 10 degree by 30 degree pattern shall be 7 degrees $\pm$1/2 degree above horizontal. Corners may be rounded on a 5-degree radius to determine compliance.

3.2.3 Environmental requirements.- The equipment shall be designed for outdoor installation and operation under the following environmental conditions. Procedures for environmental testing shall be in accordance with the applicable sections of Section 4, Quality Assurance Provisions. Each type of light system shall be capable of performing satisfactorily under the following conditions.

3.2.3.1 Temperature.- Temperatures which range from +55 degrees C to -55 degrees C.

3.2.3.2 Altitude.- A pressure altitude range from sea level to 10,000 feet.

3.2.3.3 Temperature shock.- Exposure of exposed surfaces (including light windows) to sudden application of cold water when the flashing light has reached its ambient temperature.

3.2.3.4 Humidity.- Relative humidity up to 100 percent including conditions where condensation takes place in the form of both water and frost.

3.2.3.5 Vibration.- The light units shall be capable of withstanding vibrations in the frequency range of 10 to 2,000 hertz in accordance with NEMA Standard FA1-3.01.

3.2.3.6 Impact.- Semiflush light fixtures shall be capable of sustaining impact loads (paragraph 4.5.4).

3.2.3.7 Hydraulic impact.- The inpavement flasher shall be designed to withstand, without damage, hydraulic pressures which may be formed by aircraft tires moving at high speeds on the fixture during operations in wet weather.

3.2.3.8 Snowplow impact.- The semiflush flasher shall be designed to withstand, without functional damage, impact by steel blade of snowplows at speeds up to 30 mph (paragraph 4.5.11).

3.2.3.9 Sand and dust.- Exposure to windblown sand and dust particles as may be encountered in arid regions (paragraph 4.5.15).

3.2.3.10 Rain.- Exposure to windblown rain (paragraph 4.5.7).

3.2.3.11 Transient suppression.- The equipment shall be designed to withstand repeated transient increases in the 240 V ac (RMS) line voltage superimposed at the master control unit input for as long as 50 miliseconds on the ac line voltage waveform and reaching a peak voltage which is 120 percent of the peak value of ac line voltage. In addition, the equipment shall be designed to withstand repeated line transients applied at the

master control unit power input which are characterized as a 10 by 20 microsecond current surge of 15,000 amperes with the subsequent power-follow-up; the voltage applied to produce the 10 by 20 microsecond waveform shall have a rise time of 10 kV/microsecond minimum. The equipment shall restart automatically if an interruption or shutdown is experienced due to either type of transient. Equipment operational functions shall be unimpaired by the above transients when each type of transient is imposed a minimum of 10 times each to the master control unit power input terminals.

3.2.3.12 Solar radiation (sunshine).- Exposure to sunshine with ambient temperatures as stated in paragraph 3.2.3.1 (paragraph 4.5.23).

3.2.4 Design and construction requirements.- Each unit (paragraph 3.1) shall be packaged so as not to be effected by rain or any form of atmospheric moisture. The elevated flasher head weight shall not exceed 5 pounds.

3.2.4.1 Circuit design.- The design of the units shall prohibit random flashing and the flashing lights shall produce flashes only when commanded by the master control unit. All printed circuit boards shall have conformal coatings. All printed circuit boards shall be keyed to assure connection or insertion only in the proper place. Extender boards shall be furnished for all printed circuit boards. All interconnecting cables shall be rated for a minimum of 1.5 times the maximum expected voltages in the circuit. The dimming circuit shall be designed to be fail-safe; that is, any failure in the brightness control circuit shall produce full light intensity. Any complete failure to flash shall activate the monitoring circuit in a Type A master control unit.

3.2.4.2 Cable assemblies.- A complete description of the cable assembly shall be included in the instruction sheet for procurement of replacements where necessary. Individual wires within the cable assembly shall be color-coded. Each cable assembly that makes an external connection shall be watertight, easy to assemble and disassemble, and shall not use any material which will corrode when immersed in water for long periods of time. Where possible, connectors shall be of the type shown in FAA A/C 150/5345-26. Good commercial connectors of this style with three or more pins are acceptable upon receipt of written approval from the Contracting Officer. The individual wires required for a Type I flasher shall be capable of installation within two 1-inch conduits.

3.2.4.3 External connections.- Space shall be reserved on one side of the master control unit housing for the connection of conduit. The connection of wires to all other items of equipment listed in paragraph 3.1 shall be made through watertight, weatherproof connectors. Weatherproof connectors for interconnecting cable shall be adequate for the wire size and operating voltage.

3.2.4.4 Components.- All equipment components in a system, as defined herein and furnished under this specificaton, shall be interchangeable without alterations in circuitry for power or control. The components of the entire assembly shall be directly interchangeable with any other like unit of equipment furnished under this specification.

3.2.4.4.1 Transformer.- Power transformers shall conform to MIL-T-27, Type TF5RX02.

3.2.4.4.2 Flash tube.- The flash tube shall have a rated life of 1000 hours when operated in the fixture on the high intensity step. The effective intensity shall not decrease more than 30 percent during the minimum rated life and flash skipping (misfirings) shall be less than 1 percent with no skips occurring consecutively.

3.2.4.4.3 Flash unit special component requirements.- All material used in the construction and assembly of components, including the insulation of wires which are to be located near or in the lamp chamber, shall be ozone resistant. All components shall be moisture and fungus resistant and suitable for the intended purpose. No components shall be operated beyond the limitations recommended by the manufacturer of the equipment. NO ELECTROLYTIC CAPACITORS OF ANY TYPE SHALL BE USED UNLESS SPECIFICALLY AUTHORIZED IN WRITING BY THE CONTRACTING OFFICER.

3.2.4.4.4 Interlock switches.- Interlock switches shall be incorporated in the flashing assembly and the master controller so that opening the unit shall (1) disconnect all incoming power and (2) discharge all high voltage circuits. This requirement shall apply even if components which normally draw current from the high voltage circuits are removed. In addition, the design shall provide for permanently connected bleeder resistors to discharge the flasher to a maximum value of 50 volts within one minute in the event of failure of the interlock switches. Means shall be provided to enable the interlock switch to be cheated with the door in the open position.

3.2.4.4.5 Lightning protectors.- Lightning protectors shall be provided for all ungrounded conductors and installed as near as possible to their point of entrance to the housing. The arrestors shall be General Electric No. 9LA4C1, Joslyn Model 2301-01, or equal, and properly combined where necessary to meet the circuit voltage requirements. Telephone type or gap arrestors are not acceptable.

3.2.4.4.6 Terminal blocks.- Terminal blocks shall be the enclosed base type with pressure type terminal connectors. All terminals shall meet the requirements of Specification FAA-G-2100/1b.

3.2.4.4.7 Conformal coatings.- Conformal coatings shall be limited to type ~~ER and PUR~~, MIL-I-46058.
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3.2.5 Aiming device for flasher.- The aiming device shall be designed for use on flasher optical head. The aiming device shall permit aiming of the axis of reflector or lamp to any angle from 0.0 degrees to +25 degrees above the horizontal utilizing a scale calibrated in 1-degree intervals. Stainless steel and/or aliminum hardware shall be used in the construction. The aiming device shall be capable of aiming the optical head mounted on a 40-foot hinged base tower. Starting with the tower in the elevated position, only two lowerings of the tower shall be required to accurately aim the optical head. The aiming device shall be useable for aiming optical head in the elevated position also. The aiming device shall be useable on Type I and Type III elevated flashers. The aiming device shall aim the optical head when the support structure is lowered in the direction of the optical axis or opposite the direction of the optical axis.

3.3 Instruction book manuscripts.- A camera-ready instruction book manuscript shall be furnished in accordance with FAA-D-2494/1a and FAA-D-2494/2a.

3.3.1 Instruction books.- The Government will reproduce and prepare instruction books from the manuscript and furnish copies to the contractor for shipment with the equipment. Two instruction books shall be included with each set of equipment comprising a system.

3.4 Assembly and marking.- All components shall be properly assembled and marked. Each electrical component or part thereof shall be identified by a reference designation marked adjacent to the physical location of the part of the equipment and readily visible to maintenance personnel. Such identification shall be identical to reference designations used in instruction books for the equipment. All wiring shall, where possible, be grouped, color-coded, laced into cables, neatly clamped, and properly marked. Marking shall be in accordance with FAA-D-2100/1, paragraph 1-3.12.

3.5 Materials and parts.- Materials and parts shall be as specified herein. Materials and parts not specifically designated shall meet the requirements of FAA-G-2100/1b, paragraphs 1-3.15 through 1-3.16.25. All materials and parts shall be suitable for operation under the environmental conditions specified in 3.2.3.

3.5.1 Metals.- Metals shall withstand the mechanical stress involved and shall be inherently corrosion resistant or suitably protected as specified in paragraph 3.5.2 after fabrication, to prevent corrosion or oxidation under the service conditions. The use of dissimilar metals in contact with one another shall be avoided wherever practicable. However, if their use cannot be avoided, they shall be in accordance with MIL-STD-889.

3.5.1.1 Ductile iron.- Heat-treated ductile iron, if used, shall have the proper tensile and yield strength to meet the requirements set forth herein. Particular attention shall be paid to the proper Brinnell hardness and elongation of the material. Protection plating as specified in paragraph 3.5.2.2 shall be used on all cast and machined ductile iron surfaces.

3.5.1.2 Stainless steel.- Type 18-8 stainless steel shall be used for all bolts, nuts, and washers not subject to high stress requirements. Bolts subject to direct stresses resulting from forces applied to the top surface of the Type II light unit shall be high strength Type 410 stainless steel, heat-treated to Rockwell C-21 to C-23 (110,000 psi tensile strength), and given a black oxide coating per MIL-C-13924, Class 3, after heat treatment.

3.5.1.3 Aluminum.- Aluminum castings, if used, shall be impregnated in accordance with MIL-STD-276.

3.5.2 Protective coatings.- Protective coatings used for prevention of corrosion shall be as specified herein.

3.5.2.1 Anodizing.- Aluminum parts on the exterior of the Type II light unit which would be exposed to continuous moisture, salt-laden atmosphere, or mechanical damage, shall be teflon penetrated, hardcoat anodized, meeting the requirements of MIL-A-8625, Type I or Type II, Class 1 or Class 2, as applicable.

3.5.2.2 Plating.- All iron and steel parts shall be zinc or cadmium-plated in accordance with QQ-Z-325 or QQ-P-416.

3.5.3 Glass.- Glass used as an optical or structural part shall meet all requirements of this specification which includes the requirements of MIL-C-7989 for Class B glass. Class C glass may be used if required for impact strength. The light output shall be of borosilicate glass having an average Young's Modulus of 9.1 x 106 and a Poisson's Ratio of 0.2, or equivalent. The glass shall be tempered to withstand thermal shock (paragraph 3.2.3). Glass parts shall be supported in such a way that they will not be damaged by vibrations, shocks, or defection of any component part.

3.5.4 Silicone rubber.- Gaskets used at separable joints for cushioning and sealing purposes shall be capable of sustained operation at ambient temperatures of -55 degrees C to +55 degrees C. The rubber shall meet the requirements of ZZ-R-765, Class IIB.

3.5.5 Lightning protector.- Lightning protectors shall be installed on all ungrounded conductors entering the master control unit as near as practicable to the point of entrance.

3.5.6 Semiflush light unit top assembly.- Semiflush units shall be designed for mounting on FAA-E-1315, Type LB-4, bases. The top assembly shall be fabricated from high strength metal which is inherently corrosion resistant. The top surface shall have a Brinell hardness of not less than 180, and shall be smooth and free of sharp projections. If not inherently corrosion-proof, the materials used shall be treated for effective, long lasting corrosion resistance. Painting alone will not be considered a sufficient protective coating. Designs employing glass overall or a

substantial portion of the top surface wil not be accepted. The design shall permit pressure from tires, mechanical impact, thermal shock, and vibration without damage or loss of watertight seal. The top assembly shall be the minimum size and weight consistent with good design and compliance with requirements of this description. It shall not have more than 400 square inches of exposed area above the surface of pavement. The maximum lateral dimension of the top shall be 26 inches. No portion of the top assembly shall project more than 1 inch above pavement. The design shall be such that the outer edges of the top assembly will be flush with pavement when properly installed and shall assure mating the base section to form a watertight seal capable of withstanding an internal or external pressure of 10 psi. If entire optical system is in a sealed module, this wateright requirement applies only to the module. The maximum temperature of top assembly shall not be greater than 150 degrees C after an aircraft tire has been on the fixture for 10 minutes. The top surface shall have an average slope not exceeding 10 degrees in a direction parallel to beam axis, not more than 12 degrees transverse to beam axis except for light window and sides of light exist channel. All bolts in top surface shall be recessed to full depth of head and shall permit use of standard thin wall socket wrench. The top assembly shall be held to the type LB-4 base with six bolts. The bolts shall be fabricated from stainless steel (paragraph 3.5.1.2). A means for breaking the seal and lifting top assembly shall be provided. If optical system is attached to top assembly, the optics protective device shall serve as a stand for the light unit when removed from its base. Where possible, the semiflush flashing light unit shall be similar to the inpavement approach light described in FAA-E-2941. Electrical inputs shall be as specified in paragraph 3.2.1.1.2 and 3.2.1.2.2.

3.5.6.1 Static loading.- The light, when installed in a light base, shall be able to support the static loads of paragraph 4.5.3.

3.5.6.2 Window loading.- The window shall be able to support a load equal to 500 psi multiplied by the area of the opening, applied directly to the window surface.

3.5.7 Elevated flasher.- The elevated flasher light unit, including the mounting assembly, shall weigh a maximum of 5 pounds. Electrical inputs shall be as specified in paragraphs 3.2.1.1.2 and 3.2.1.2.2. Each flasher shall be assembled to a mounting base. The mounting base shall have an internal wire way for seven #16 THW wires to the lampholder. The lampholder/mounting base interface shall permit passage of seven #16 THW wires regardless of the lampholder's vertical adjustment angle. The mounting base shall permit rigid mounting of the complete lampholder assembly in either of the following ways:

(a) Capping the open top of a frangible coupling (Drawing C-6046) or a 2-inch EMT conduit. Three equally spaced (120 degrees) 3/8-inch round head stainless steel screws shall be provided for this method of attachment.

(b) Mounting into a 13/16-inch diameter by 1-1/4-inch deep circular hole by means of a 13/16-inch + 0.0 inch, -1/32-inch diameter by 1-inch - ±1/32 inch long shaft. The shaft shall have a concentric 15/16-inch diameter shoulder to prevent the shaft from entering the hole more than 1 inch and have standard pipe threads.

3.6 Maintainability.

3.6.1 Maintaintability design criteria.- The following maintenance parameters shall be met by the system design:

(a) Mean time to restore (MTTR) - The MALSR system shall have an MTTR of not more than 15 minutes with no single restoration exceeding three hours in duration.

(b) Mean periodic maintenance time (MPMT) - The MALSR system shall have a MPMT not exceed two hours per month including routine inspection.

The above values are established under the assumption that spare parts for failed components are available at the site.

3.6.2 Maintainability program.-

3.6.2.1 Maintainablity program management.- The contractor shall have one clearly identified organizational element which shall be responsible for planning, implementing, controlling, and reporting all maintainablity tasks required by this specification.

3.6.2.2 Organization.- The head of the maintainability management organization shall have the necessary authority resources and access to higher management to enable him to implement and enforce the requirements specified herein. The maintainability management organization may be part of the reliablity management organization.

3.6.2.3 Maintainability prediction.- The contractor shall predict maintainability values for the system/equipment. The prediction technique specified shall be used. The prediction technique shall estimate quantitatively the maintainability system/equipment parameter values for the planned design configuration. The quantitative estimates shall be used to judge the adequacy of the proposed design to meet the maintainability quantitative requirements and identify design features requiring corrective action.

3.6.2.3.1 Early design predictions.- During the early design and development stages, prediction of mean corrective maintenance time shall be prepared and performed in accordance with Procedure III of MIL-HDBK-472. The prediction shall be submitted 15 days prior to preliminary design review (PDR).

3.6.2.3.2 Final design predictions.- During the final design stages of development, predictions of mean corrective maintenance time shall be in accordance with Procedure II of MIL-HDBK-472. The predicton shall be submitted 15 days prior to critical design review (CDR).

3.7 Reliability design criteria.-

3.7.1 System reliability parameters.- The following reliability parameters shall be incorporated into the system design:

(a) Mean time between failure (MTBF) for the system shall be no less than 2,500 hours. A system failure occurs when output tolerances from the master control unit are exceeded, when intensity step control is lost, when timer signals exceed their voltage or timing tolerances, or when two or more flashers cease to operate within their tolerances.

3.7.2 Reliability program.-

3.7.2.1 Organization.- The head of the reliability management organization shall have the necessary authority, resources, and access to higher management to enable him to implement and enforce the requirements specified herein.

3.7.2.2 Reliability predictions.- Reliablity predictions shall be based on the proposed design and math model of the system element for each mission profile and mode of operation. Predictions shall conform to the requirements for predictions as specified in MIL-STD-785A, paragraph 5.2.2.3, and the following:

(a) Apportion required system probability of mission success to each function.

(b) Determine the reliability of hardware items and other system elements executing or supporting each function.

(c) Reliablity estimates and predictions shall be made relating to the mathematical model such as those contained in MIL-HDBK-217. Current estimates and predictions shall be made for each mission or mode of operation.

(d) The reliablity of the equipment shall be predicted based on the stresses experienced by the parts using the failure rate information contained in MIL-HDBK-217b and in the Nonelectronic Reliablity Notebook, RADC-TR-75-22. No other source of part falure rates shall be used unless specifically approved by the procuring activity. The following prediction techniques shall be implemented by the contractor.

3.7.2.2.1 Average stress prediction.- The reliability of the system shall be predicted using average part failure rates in conjunction with generalized part application assumptions. The prediction shall be submitted in accordance with the contract schedule.

3.7.2.2.2 Detailed stress prediction.- The reliablity for the system shall be predicted based on failure rates determined from either measured or computed stress for each part used in the system. Detailed reliablity stress analysis shall be performed in accordance with MIL-HDBK-217b. The predictions shall be based upon the (maximum temperature rise) specified in the detailed specification. An initial stress analysis prediction shall be submitted 15 days prior to the CDR. The prediction shall be revised, as necessary, during the course of the system development and production effort to reflect any design changes and part substitutions.

3.8 Nameplate.- Each major assembly, such as a light assembly or master controller, shall have a nameplate in accordance with Drawing B-21216, fastened to its outside surface with Type 430 or 18-8 stainless steel rivets or drive screws in accordance with Specification FAA-G-2100/1, paragraph 1-3.13.

3.9 Flasher tester.- Flasher test equipment shall be furnished by the contractor. The tester shall be a single unit, portable, and shall weigh not more than 20 pounds. The tester shall be capable of testing all phases of the Type I, Type II, and Type III flasher operations. A tester instruction book in accordance with paragraphs 3.3. and 3.3.1, shall be furnished.

3.10 Power adapters.- Power adapters for use with Type III flashers shall convert constant current power from available MIRL system and HIRL system circuits to 120/240 V, ±10 percent, 60 hertz, constant potential power. Adequate power, minimum of 0.7 kW, shall be produced to operate the master control unit, Type B, two Type III flashers, and a radio receiver/decoder. Two types of power adapters are required, 6.6 ampere power adapters and 20 ampere power adapters. No modification to the Type B master control unit circuitry or the Type III flashers shall be required when a power adapter is used. The power adapter shall maintain the 120/240 V output over the entire current range of the runway lighting circuit. Reference Figure 2 for the REIL power adapter schematic wiring diagram.

3.10.1 6.6 ampere power adapter.- The 6.6 ampere power adapter shall convert constant current power provided either from a 6.6 ampere MIRL or a 6.6 ampere HIRL.

3.10.2 20 ampere power adapter.- The 20 ampere power adapter shall convert constant current power provided from a 20 ampere HIRL.

3.10.3 Power adapter design conditions.- The power adapters shall be designed to operate as specified without adverse effect on the edge lighting system when used in conjunction with runway edge lighting circuits described in paragraphs 3.10.3.1, 3.10.3.2, and 3.10.3.3. The adapters shall be designed to operate as specified over the full regulator loading range from a minimum of no other connected load (a power adapter and REIL range from a minimum of no other connected load (a power adapter and REIL system only) to a maximum load which is 1.0 kW less than the rated regulator capacity.

3.10.3.1 6.6 ampere MIRL design conditions.- The 6.6 ampere power adapter (paragraph 3.10.1) shall operate as specified when used in conjunction with a MIRL system which has one spare kW of capacity. The constant current reulgator shall be a 4 kW unit, Type L-812, in accordance with AC 150/5345-11. The connected load consists of (a) 9,000 feet (2,750 meters) of 1/c No. 8 cable, type L-824, in accordance with AC 150/5345-7B; (b) 52 each 30/45-watt isolation transformers, Type L-830-1, in accordance with AC 150/5345-47; 40 each, 30-watt, 6.6 ampere lamps; and (d) 12 each, 45-watt, 6.6 ampere lamps. These loads produce a calculated total of 3.0 kW. For power adapter design purposes, assume a maximum of 10 percent of the lamps are burned out.

3.10.3.2 6.6 ampere HIRL design conditions.- The 6.6 ampere power adapter (paragraph 3.10.1) shall operate as specified when used in conjunction with an HIRL system which has one spare kW of capacity. The constant current regulator shall be a 20 kW unit, Type L-828, in accordance with AC 150/5345-10C. The connected load consists of (a) 13,000 feet (4,000 meters) of 1/c No. 8 cable, Type L-824, in accordance with AC 150/5345-7B; (b) 74 each, 200-watt, isolation transformer, Type L-830-6, in accordance with AC 150/5345-47; and (c) 74 each, 200-watt, 6.6 ampere lamps. These loads produce a calculated total of 19.0 kW. For power adapter design purposes, assume a maximum of 10 percent of the lamps are burned out.

3.10.3.3 20 ampere HIRL design conditions.- The 20 ampere power adapter (paragraph 3.10.2) shall operate as specified when used in conjunction with an HIRL which has one spare kW of capacity. The constant current regulator shall be a 30 kW unit, Type L-828, in accordance with AC 150/545-10C. The connected load consists of (a) 17,000 feet (5,200 meters) each, 200-watt, isolation transformers, Type L-830-7, in accordance with AC 150-5345-47; and (b) 94 each, 200-watt, 6.6 ampere lamps. These loads assume a maximum of 10 percent of the lamps are burned out.

3.10.4 Power adapter housing.- The power adapter housing shall be a submersible, minimum 1/3-inch (0.3 cm) thick, welded, galvanized steel container with lid and "O" ring gasket. The housing shall be cylindrical in shape and have a minimum 10-inch (2.5 cm) wide flange at the top. The lid shall be a minimum 1/8-inch (0.3 cm) thick and shall be secured to the housing by a minimum of six bolts. The "O" ring gasket shall be of silicone rubber. Two lifting handles, approximately 1/4-inch (0.6 cm) in diameter by 2 inches (5 cm) high by 5 inches (13 cm) wide shall be welded to the exterior surface of the lid. The housing shall be provided with a removable equipment mounting panel as specified in paragraph 3.10.8. Primary (paragraph 3.10.5) and secondary (paragraph 3.10.6) cables shall enter the housing through the lid via squeeze fittings with waterproof glands. the entire power adapter, including primary and secondary cable leads and installation cables, shall fit into a Type I, 16-inch, nominal diameter L-857, transformer housing with lid manufactured in accordance with AC 150/5345-42A. Ancillary interface equipment or components between the power adapter and the input terminals of the master control unit, shall not be required. The housing design shall provide for heat dissipation required to cool the adapter components when it is operated under the specified environmental conditions and installed underground as described above. No bolts shall pass through the exterior walls, bottom, or lid flange of the power adapter. All nuts, bolts, and washers shall be stainless steel. A minimum of three complete threads shall be used when bolts are in place.

3.10.5 Primary cables.- Primary leads from the power adapters shall be Type L-824 cable in accordance with AC 150/5345-7B. The cables shall be 5 kW, 1/c No. 6, cable for the 20 ampere power adapter; and 5 kW, 1/c No. 8 cable for the 6.6 ampere power adapter. The primary leads shall be 24 inches (0.6 meter) long, and one shall be equipped with a plug, Type L-823, and one with a receptacle, Type L-823, in accordance with AC 150/5345-26A.

3.10.6 Secondary cables.- Secondary leads from both the 6.6 ampere and 20 ampere power adapters shall be Type L-824 cable in accordance with AC 150/5345-7B. The leads shall be two each 600 volt, 2/c No. 12 cables, 48 inches (1.2 meters) long. Both secondary leads shall be equipped with a 2/c, Type L-823, receptacle in accordance with AC 150/5345-26A. Secondary cable conductors shall be permanently identified by brass tags securely attached to the cable adjacent to the receptacles. Four each, 1/c, No. 12, Type L-824, cables up to 100 feet (30 meters) long with Type L-823 plugs will be furnished by another source to connect the power adapter to the control cabinet.

3.10.7 Cable installation.- Primary and secondary cables shall be adequately strain relieved on the inside surface of the power adapter lid to permit lifting of the entire power adapter by anyone of the cables. Adequate slack cable shall be provided within the housing to permit the lid to be removed and placed flat on a work bench (at the same elevation as the bottom of the housing) without disturbing cable passages through the squeeze fittings.

3.10.8 Equipment mounting panel.- All power adapter components may be secured to a removable galvanized steel mounting panel via machine screws and slotted screw mounting holes. The panel shall be a minimum of 18-inch (0.3 cm) thick and shall be attached to the bottom of the housing using a minimum of four standoff studs, which are welded to the bottom of the housing, and lock washers and nuts. The panel shall have adequate clearance to be easily removed through the top of the housing with all components installed. All components shall be removable without the need for removing any other component. All screws, nuts, washers, and bolts shall be of compatible stainless steel. A minimum of three complete threads shall be used when the screw, nut, or bolt is in place. Nuts to receive mounting screws shall be permanently secured to the mounting panel.

3.10.9 Power adapter transformer.- The power adapter transformer shall be the isolating type and shall have a minimum rating of 5 kV. The transformer shall have power factor correction, if required. The PF correction capacitor shall be installed in a separate weatherproof enclosure, stainless steel or aluminum, designed for outdoor application and shall be dust-tight and nonventilated, suitable for wall or floor mounting. The transformer shall be at least 90 percent efficient. Primary leads and windings shall be insulated from the core and secondary windings and all other components of the power adapter. The transformer shall be designed to operate indefinitely under load, short circuit, or open circuit conditions. The primary circuit shall be designed to withstand total immersion (the power adapter housing filled with water) without short circuiting. The transformer shall be designed to operate as specified when installed within the power adapter housing and subjected to the environmental conditions required. Power output shall be 120/240 volts $\pm$10 percent, 60 hertz, and shall be adequate to deliver, through the power adapter circuitry, all power required to operate the system as specified in paragraph 3.10.

3.10.10 Site spare parts.- Each master control unit (1.2.2) shall include one spare printed circuit board assembly of each type, complete with all components tested and operable, and one spare module of each type used in the master control unit plus one spare printed circuit board assembly of each type and one spare module of each type used in flashers for the elevated flasher, Type I; semiflush flasher, Type II; and elevated flasher, Type III. These parts shall be packed separately from the master control unit. These spare parts shall be packaged and shipped with the master control unit. The site spare parts package for the Type A master controller shall not contain Type III elevated flasher spare parts.

3.10.10.1 Module.- A module is defined as being two or more basic parts which form a functional assembly which is a portion of a larger assembly or unit. The module is easily removed intact and replaced by plug-in, unsoldering, quick-disconnect, fastener or equivalent means. It may or may not contain printed circuitry, and it may contain active or passive devices.

3.10.10.2 Printed circuit board assembly.- Printed circuit board assembly shall mean the board and all mounted components which have been electrically connected and tested.

4. QUALITY ASSURANCE PROVISIONS

4.1 General.- The contractor shall provide and maintain a quality control program which fulfills the requirements of FAA-STD-013, Quality Control Programs. Unless otherwise specified in this specification or in the contract, all tests and inspections to determine compliance with the requirements of the contract specifications shall be made by the contractor and shall be subject to Government inspection. The term "Government inspection" as used in this specification, means that an FAA representative will witness the contractor's testing and inspection and will carry out such visual and other inspection as deemed necessary to assure compliance with contract requirements. The Government reserves the right to waive Government inspection at the contractor's plant. If Government inspection is waive, the contractor shall furnish to the Contracting Officer two copies of test data, certified by an independent testing agency, describing the results obtained during the inspection and tests required by the contract specification. The test data must demonstrate that the equipment meets contract requirements and shall include the statement "This certifies that this unit fully meets all technical requirements of the contract," and be dated and signed by a responsible official of the contractor or testing agency. Certified test data shall be furnished to the Contracting Officer. Shipment shall not be made until the contractor receives written Government approval of the test data.

4.2. Maintainability demonstration test plan.- Four copies of detailed proposed test procedures to be used for maintainability demonstration testing (paragraph 4.5.18) shall be submitted to the Contracting Officer at least 30 days in advance of the scheduled test start dates. The test plans do not have to be provided in extensive detail in the maintainability program plans (paragraph 3.6.2).

4.3 Notification of readiness for inspection.- After receipt of approval of test procedures (paragraph 4.1 and 4.2) and test data forms (FAA-STD-013), the contractor shall notify the Government Contracting Officer in writing that he is ready for Government inspection. Such notification shall be given in time to reach the Contracting Officer not less than five workdays before the contractor desires inspection to start.

4.3.1 Invoice submission.- Prior to the first inspection, the contractor shall submit to the FAA representative copies of invoices covering shipment of each item from the supplier's plant to that of the primary contractor. Each invoice shall carry the vendor's certification that each item furnished meets the requirements of this specification. The certification shall be traceable to the part or material manufacturer's quantitative test data pertaining to the specific part or material. Vendor certification does not constitute FAA acceptance of any part or unit of equipment provided under this specification nor releases that part or unit from acceptance testing by the contractor.

4.4 Test methods.- Testing of the equipment shall be performed as follows.

4.4.1 Design qualification test.- The first unit of production of each component is designated as the production model. Where the complement of a system and the prescribed manner of testing requires the initial production of a group of identical units; e.g., five sequenced flasher assemblies, then all members of that group will be referred to hereinafter as part of the production model. The production model shall be subjected to the tests specified in subparagraphs of 4.5, as required by Table III. The production model and revalidation production units, after passing the design qualification tests, shall be deliverable items under the contract after replacing all flashtubes with new accepted flashtubes in accordance with paragraph 4.5.16.1.

4.4.2 Production unit tests.- Testing of the production units shall start after acceptance of the production model. Tests on production units shall be as specified in subparagraphs of 4.5, as required by Table III.

4.4.3 Revalidation test.- Testing of the revalidation unit shall be as specified in subparagraphs of 4.5, as required by Table III, and with components selected by the FAA representative from any production units produced after 50 percent of the total units ordered have been manufactured and accepted. In event of a unit failure, the contractor shall take corrective action as directed by the Contracting Officer to resolve the problem. If analysis of the failure indicates potential defects in previously shipped equipment, the contractor shall correct these deficiencies at his expense in a manner directed by the Contracting Officer. The failure shall be applied to all previous maintainability and reliability calculations and revised values forwarded to the Contracting Officer. No further equipment will be accepted until such deficiencies are resolved.

4.5 Tests

4.5.1 Visual inspection.- The light units shall be visually inspected for workmanship, fabrication, finishing, painting, and adequatcy of selected parts.

4.5.2 Photometric tests.- Photometric and like tests shall be conducted on the production model to determine compliance with the requirements as specified. Photometric tests shall be conducted in accordance with FAA-E-1100, Photometric Test Procedures for Condenser Discharge Lights. A flash lamp of the types used in this system shall be calibrated by the National Bureau of Standards as used as a calibration standard for the tests. The photometric tests may be conducted with a Module 580-20 Radiometer Systems as manufactured by EG&G. Test results shall include a

TABLE III

Test	Flasher Type I	Flasher Type II	Flasher Type III	Master Control Type A	Master Control Type B	Aiming Device	Power Adapter	Flasher Tester
Visual Inspection 4.5.1	XR*	XR*	XR*	XR*	XR*	XR*	XR*	XR*
Photometric 4.5.2	XR*	XR*	XR*					
Static Load 4.5.3, 4.5.3.1, 4.5.3.2		XR						
Impact 4.5.4		XR						
Window Loading 4.5.5		XR						
Thermal Shock 4.5.6	XR	XR	XR					
Rain 4.5.7	XR	XR	XR	XR	XR	XR	X	X
Leakage 4.5.8		XR*						
Salt Spray 4.5.9	XR	XR	XR	XR	XR	XR	X	X
Vibration 4.5.10	XR	XR	XR					

TABLE III (CONTINUED)

Test	Flasher Type I	Flasher Type II	Flasher Type III	Master Control Type A	Master Control Type B	Aiming Device	Power Adapter	Flasher Tester
Snow Plow 4.5.11		X						
Dielectric 4.5.12	XR*	XR*	XR*	XR*	XR*		XR*	
Continuous Operation 4.5.13		XR		XR				
Temperature 4.5.14	XR	XR	XR	XR	XR		XR	
Sand and Dust 4.5.15	XR	XR	XR	XR	XR		XR	X
Operational 4.5.16	XR*	XR*	XR*	XR*	XR*		XR*	
150-hour 4.5.16.1	XR	XR	XR	XR	XR		XR	
Two-hour 4.5.16.2	*	*	*	*	*		*	
Aiming Device 4.5.17	XR*		XR*			XR*		
Maintainability Demonstration 4.5.18	X	X	X	X	X		X	

TABLE III (CONTINUED)

Test	Flasher Type I	Flasher Type II	Flasher Type III	Master Control Type A	Master Control Type B	Aiming Device	Power Adapter	Flasher Tester
Transient Suppression 4.5.19	XR	XR	XR	XR	XR		XR	
Submersion 4.5.20							XR*	
Power Adapter Operation 4.5.21							XR*	
Altitude 4.5.22	XR	XR	XR	XR	XR			
Solar Radiation 4.5.23	XR	XR	XR	XR	XR			
Flasher Tester Operational 4.5.24								XR*

X = DESIGN QUALIFICATION TESTS (PRODUCTION MODEL)
R = REVALIDATION TESTS
* = PRODUCTION UNIT TESTS

graph showing the effective isocandela curve for each intensity setting and oscilloscope photographs of the pulse shape and deviation. Production units shall be checked at the beam center, ±15 degrees horizontally from the beam axis and ±5 degrees vertically from the beam axis. Photometric tests shall be conducted on the semiflush production model before and after the static load, impact, vibration, and snowplow tests to determine the ability of the semiflush approach light assembly to comply with the requirements as specified when submitted to the tests.

4.5.3 Static load tests.- The semiflush production model shall be subjected to the load tests of paragraphs 4.5.3.1 and 4.5.3.2 and show no evidence of cracking or breaking of the top assembly or of any other component which would cause leaks. There shall be no permanent distortion to cause shifting of the light output.

4.5.3.1 Distributed load test.- The semiflush production model shall be mounted in a test machine on a supporting ring equivalent to the LB-4 light base flange. A compressive load shall be applied to the entire top surface of the light assembly through a rubber pad having a Shore A hardness of 55 to 65. The rubber pad shall have a diameter equal to the diameter of the top assembly and a thickness of 1-1/2 inches. No filling material or support shall be used in the light output window cavity. A load of 160,000 pounds shall be applied to the rubber pad through a flat steel plate at least 1-inch thick and a diameter equal to the top assembly. The load shall be applied at the rate of 20,000 pounds per minute and held at the computed load for five minutes.

4.5.3.2 Concentrated load test.- The semiflush production model shall be mounted on a light base flange as in paragraph 4.5.3.1 above. A compressive load shall be applied to the center of the top surface of the light assembly through a 6-inch diameter by 1-1/4-inch thick steel plate. The steel plate will be directly in contact with the light assembly. A pad between the steel plate and the light assembly will not be permitted. Theload shall be applied at the rate of 20,000 pounds per minute to a total of 250,000 pounds. The total load shall be held for five minutes.

4.5.4 Impact test.- The semiflush light unit, complete with all parts, shall be installed in an LB-4 light base imbedded in concrete. A 5-pound ball shall be dropped from a height of 6 feet on the top of the light unit at various locations. Impact drops at not less than six different locations, including one directly over the light output window, shall be made. The ball shall be steel and case hardened to Rockwell C50-C53. There shall be no cracking or breaking of parts which could cause leaks or shift the light output pattern.

4.5.5 Window loading test.- The semiflush production model light output window shall be subjected to an uniformly distributed load of 500 psi of the area of the exposed window opening. Either a static load or a hydrostatic pressure test may be used. The static load, if used, shall be applied through a 1-inch thick rubber pad having a Shore A hardness of 55 to 65. A contour of the rubber block shall be similar to but not larger than the exposed glass window. The test load shall be applied to the rubber pad and window through a steel plate 1-inch thick with a spare similar to but not larger than the rubber pad. The load shall be applied perpendicular to the exposed window face at the rate of 1,000 pounds per minute and the total load maintained for not less than two minutes. The hydrostatic pressure test, if used, shall require a compartment to enclose the window and a section of the top of the light be attached to the top surface of the test light unit in a manner to prevent leaking. The compartment shall have sufficient height to contain not less than 1-inch depth of the test fluid above any enclosed part of the light unit. The test pressure shall be applied at a rate not to exceed 200 psi per minute and the total pressure shall be maintained for not less than two minutes. The window shall not crack or be permanently displaced or damaged by the test.

4.5.6 Thermal shock test.- The production model shall be installed as in normal use and operated at maximum intensity until the temperatures have stabilized. At least three gallons of water at a temperature of 0 to +5 degrees C shall be sprayed on the top surface. There shall be no cracking of glass or metal.

4.5.7 Rain test.- The test shall be in accordance with Procedure I, Method 506, of MIL-STD-810B.

4.5.8 Leakage test.- This test shall be conducted only on the Type II semiflush production model after successfully passing the vibration test, load test, and impact test. The optical assembly shall be submerged in water at least 3 inches below the surface and subjected to an internal air pressure of 10 psi and maintained for a period of 10 minutes. There shall be no evidence of leakage. Leakage tests on production units may be accomplished by using a mass spectrometer, freon leak detector, or other acceptable leak checking method.

4.5.9 Salt spray test.- The test shall be in accordance with Procedure I, Method 509, of MIL-STD-810B, not less than 168 hours, salt build-up as a result of test may be removed with tap water. Deterioration of any part preventing the fixture from meeting function, service, and maintenance requirements shall be cause for rejection.

4.5.10 Vibration test.- The Type I, Type II, and Type III flashers shall be vibration tested to meet paragraph 3.2.3.5 as described below. The Type II semiflush production model light unit, complete with all parts and lamp, shall be installed on an LB-4 lightbase and mounted securely on the test machine in a manner to simulate installed conditions.

(1) Vibration planes - The test assembly shall be vibrated in three places or directions as follows:

a. In direction perpendicular to the test table (vertically).
b. Horizontally, parallel to the light beam axis.
c. Horizontally, at right angles to the light beam axis.

(2) Frequencies - The test assembly shall be vibrated through a frequency range of 10 to 2,000 cps, in each plane, until the accelerations shown in Table IV are reached. Duration of each sweep shall be 10 minutes. Electrical continuity through the lamp shall be continuously monitored under full load conditions. If the filament or lamp envelope or both fail at any point in the range of frequencies, the test shall be continued and completed on the fixture alone. Then a new lamp shall be installed and the fixture assembly shall again be vibrated in three planes through the frequencies of 55 to 2,000 cycles at 3 g's. Failure of meeting these requirements shall be cause for rejection of the fixture or the lamp mounting method or both.

TABLE IV

Acceleration in G's	Frequency Hertz
0.020 inch double amplitude (DA)	10-70
5	70-200
10	200-500
15	500-2,000

After the vibration test, the fixture shall be thoroughly examined for mechanical failure of any component, loosening of any part, cracked or broken seals, continuity of electrical circuits, possible damage to the lamp filaments, supports, etc.

4.5.11 Snow plow test.- The Type II semiflush light unit shall be installed inpavement and tranversed five times, at speeds up to 30 mph, by a Walters Snow Fighter, Model FBCS, or similar vehicle, with its blade set to scrape the pavement. The blade shall pass over the unit from different directions five times. There shall be no damage which would render the fixture unfit for service.

4.5.12 Dielectric test.- The production model shall be subjected to 60 hertz dielectric tests using twice circuit voltage plus 1,000 volts for a period of one minute. Any evidence of current leakage in excess of one milliampere shall be cause for rejection. After completion of the dielectric test, a 1,000 V dc insulation tester shall be used to check the

same points. The resistance to ground, as observed with the insulation tester, shall not be less than 30 megohms. Components not designed for this high voltage, such as small capacitors, rectifiers, etc., may be disconnected for this test. Production units shall be checked with the insulation tester.

4.5.13 Continuous operation test.- The production model flashing light unit shall be operated for a period of 24 hours with the master control unit. To simulate actual conditions, the semiflush Type II lights shall be installed in a base which is in turn embedded in dry builders sand at least 6 inches on the sides and bottom. The test area shall be shielded from wind. Temperatures shall be measured as follows:

(1) On the outside surface of the Type II light at point of maximum temperature. Temperature in excess of 75 degrees C shall be cause for rejection.

(2) Air temperature inside light unit. Temperature in excess of 160 degrees C shall be cause for rejection.

(3) Flash lamp seal temperature in excess of 200 degrees C shall be cause for rejection.

(4) Record ambient temperature in vicinity of test. Ambient temperature should be between 20 degrees and 30 degrees C.

4.5.14 Temperature test.- All components of the production model shall be subjected to a cold temperature test. The low temperature test shall be in accordance with Procedure I, Method 502, of MIL-STD-810B, except the temperature shall be -55 degrees C, two-hour operational test, to start two hours after temperature stabilization. Do Procedure I three times. The high temperature test shall be in accordance with Procedure II, Method 501.1, of MIL-STD-810C, except the temperature shall be +55 degrees C. A 1-inch thick black rubber blanket shall be pressed over the top of the light unit for 10 minutes during the second high temperature test. If light unit top temperature exceeds 150 degrees C, with the rubber blanket installed, the unit has failed.

4.5.15 Sand and dust test.- The test shall be in accordance with Procedure I, Method 510, of MIL-STD-810B, delete Steps 2 and 3, rotate equipment 120 degrees twice, air velocity shall be 2,500 $\pm$500 feet per minute.

4.5.16 Operational test.- All components which will be part of a particular system shall be connected together when undergoing operational tests. The convenience outlet shall undergo three tests using an externally faulted source to verify proper operation of the ground fault interrupter and reset operations. Operation of the flasher shall be attempted with the interlock switches in the open position to verify proper operation of the interlock. All operating requirements of the equipment shall be checked over the full range of voltage input variations at the master control unit power input terminal. The step operation of the components shall be verified through the remote control inputs provided in the master control unit.

4.5.16.1 150-hour test.- A 150-hour continuous operation test shall be performed on the production model and on the production unit used for revalidation. All intensities shall be checked using the remote control inputs to cycle the system as follows:

(a) Low intensity - 5 minutes, ±1 minute
(b) Off - 2 seconds, maximum
(c) Medium intensity - 5 minutes, ±1 minute
(d) Off - 2 seconds, maximum
(e) High intensity, 5 minutes, ±1 minute
(f) Off - 60 seconds, ±10 seconds
(g) Repeat cycle, starting with (a).

The local control switch shall be manually cycled through the off, low, medium, and high-intensity step positions a minimum of 20 times at the completion of the 150-hour test. Flashtubes used in the 150-hour test shall not be a part of the FAA procurement and shall be replaced with new flashtubes prior to system delivery.

4.5.16.2 Two-hour test.- All production units not tested under paragraph 4.5.16.1 shall have a two-hour continuous operation test performed on them using the remote control inputs as follows:

(a) High intensity - 1 hour, ±2 minutes
(b) Cycle 4.5.16.1(a) through (g) - 1 hour, ±2 minutes

The local control switch shall be manually cycled through the off, low, medium, and high intensity positions a minimum of 20 times at the completion of the two-hour test.

4.5.17 Aiming device test.- The contractor shall provide an aiming platform for mounting the lampholder assembly and the remote optical head and testing each remote aiming device. The platform shall be calibrated to the same tolerances specified for the aiming devices and shall permit verification of the angular readings taken from the mounted aiming devices from 0 degrees to 25 degrees in 5-degree increments.

4.5.18 Maintainability demonstration tests.- Maintainability demonstration tests shall be performed in accordance with MIL-STD-471 to verify all quantitative maintenance values required by the specification.

4.5.19 Transient suppression test.- The master control cabinet and one flasher unit shall be tested for transient suppression conformance with the requirements specified in paragraph 3.2.3.12. The test method shall be developed using ANSI C37.90a as a guide and shall be approved by the Contracting Officer.

4.5.20 Submersion test.- The production model 6.6 and 20 ampere power adapters shall be submersion tested in accordance with MIL-STD-810C under 24 inches (0.6 meters) of water for eight hours. The adapter shall be operating for the first four hours of the test and shall be off for the last four hours. The power adapter transformer shall be submersion tested alone (out of adapter)as specified above, to demonstrate the primary circuit is waterproof and insulated per paragraph 3.10.9.

4.5.21 Power adapter operation test cycle. Each production unit power adapter shall be operated through the following cycles during a two-hour continuous test. Power input shall be provided by a constant current edge light curcuit as specified in paragraph 3.10.3.2 for a 6.6 ampere adapter and as specified in paragraph 3.10.3.3 for a 20 ampere adapter. The adapters shall be connected to a REIL system with Type III set at the 100 percent intensity step. The power adapter output voltage shall be measured at each intensity step of the runway edge lighting curcuit and shall be 240 V, ±24 V ac. Show below are values of current which will be encountered in series runway edge lighting circuits.

	REIL	Edge Circuit Current Value*	Duration
(a)	Off	6.6/20.0 amperes	1 minute, ± 1 minute
(b)	On	6.6/20.0	10 minutes, ±1 minute
(c)	On	5.2/15.8	10 minutes, ±1 minute
(d)	On	4.1/12.4	10 minutes, ±1 minute
(e)	On	3.4/10.3	10 minutes, ±1 minute
(f)	On	2.8/8.5	10 minutes, ±1 minute
(g)	Repeat (a) through (f) one time		

*Values at left for a 6.6 ampere circuit; values at right for a 20 ampere circuit.

4.5.22 Altitude test.- The test shall be in accordance with Procedure I, Method 504.1, of MIL-STD-810C. The equipment shall be tested at atmospheric pressures corresponding to sea level and 6,600 feet (2,000 meters) altitude at both -55 degrees C (-67 degrees F) and +55 degrees C (+131 degrees F).

4.5.23 Solar radiation (sunshine) test.- The test shall be conducted in accordance with Procedure II, Method 505.1, of MIL-STD-810C. The equipment shall be operated for one hour during the third cycle when the test item has reached its peak temperature.

4.5.24 Flasher tester operational test.- The test shall demonstrate the operation of all the test functions provided in the flasher tester (3.9). The test shall shown that the flasher tester (3.9) is calibrated.

4.6 Test instruments.- The manufacturer or the testing laboratory performing preproduction and production tests shall provide adequate instrumentation for these tests. All instruments shall have calibration labels indicating that the instruments have been calibrated by a reliable laboratory within a period of six months prior to the beginning of tests of the flasher equipment. Oscilloscopes and photometric equipment shall be calibrated at the time of the tests. Indicating instruments, voltmeters, and ammeters shall be of the 1/2 of 1 percent classification or better. Alternating current instruments shall be true RMS types. Temperature sensing elements shall be thermocouples. Each thermocouple shall be pretested by inserting it in a chamber of known temperature. The thermocouples shall be installed at points determined by the FAA representative. The thermocouples shall be secured in place with high temperature cement manufactured for this purpose (Sauereisen cement or equal). Light output shall be recorded. A typical photometric test has a gonimeter table driven by a synchronous motor between predetermined index points to provide definite correlation between degrees of rotation and light measurement. Where power required for testing is not maintained with ± 2 V of nominal voltage, a regulated supply shall be provided. The regulator shall be automatic in operation and of a type which will not distort waveform.

4.7 Test performance.- All tests described above shall be performed at the contractor's expense at the contractor's facility or at an FAA approved independent testing laboratory. All tests shall be witnessed by an FAA representative. Minimum of 10 days notice of inspection readiness should be given. Tests shall be conducted on preproduction model and on production units as outlined above to provide compliance with this specification.

5. PREPARATION FOR DELIVERY.

5.1 General.- Unless otherwise specified in the contract, each light unit shall be prepared for domestic shipment in accordance with the following subparagraphs.

5.1.1 Packaging.- Packaging shall be in accordance with Specification MIL-E-17555, Method III. Separate packaging shall be provided for each optical assembly and outer ring assembly.

5.1.2 Packing.- Packing shall be in accordance with Specification MIL-E-17555, Level A.

5.1.3 Marking.- Packages shall be durably and legibly marked with the following information:

Item - Elevated Sequenced Flashing Light Type
Item - Master Control Unit Type
Item - Semiflush Approach Light (if optical assembly and outer ring assembly packed in separate cartons, add appropriate part name)
Item - Power Adapter
Item - Aiming Device
Item - Tester

Each of the above items shall be marked with the following data as applicable.

Quantity _____
Type _____
Style _____
Specification Number _____
Contract Number _____
Federal Stock Number _____
Manufacturer's Name or Trademark _____

6. NOTES. The contents of the subparagraphs below are only for the information of the Contracting Officer. They are not contract requirements, and are not binding on either the Government or the contractor except to the extent that they may be specified elsewhere in the contract as such. Any reliance placed by the contractor on the information is wholly at the contractor's own risk.

6.1 Deliverable items.- The following items are to be called out in the contract documents as deliverable items under this specification:

(a) Type I, elevated flasher assembly
(b) Type II, semiflush flasher assembly
(c) Type III, elevated flasher assembly
(d) Type A, master control unit
(e) Type B, master control unit
(f) Power adapter, 6.6 ampere
(g) Power adapter, 20 ampere
(h) Aiming device for Type I and Type III flasher
(i) Manuscript plan for equipment instruction book
(j) Validation plan for equipment instruction book
(k) Draft manuscript for equipment instruction book
(l) Reproducible (camera-ready) copy of equipment instruction book
(m) Flasher tester
(n) Manuscript plan for flasher tester instruction book
(o) Validation plan for flasher tester instruction book
(p) Draft manuscript for flasher tester instruction book
(q) Reproducible (camera-ready) copy of equipment instruction book
(r) Early design predictions, maintainability predictions
(s) Final design predictions, maintainability predictions
(t) Average stress prediction, reliability predictions
(u) Detailed stress prediction, reliability predictions
(v) Invoice submission
(w) Quality assurance test procedures
(x) Maintainability demonstration test plan

6.2 Scheduled events.- The following scheduled events are to be included in the contract: (a) preliminary design review and (b) critical design review.

* * * * * *

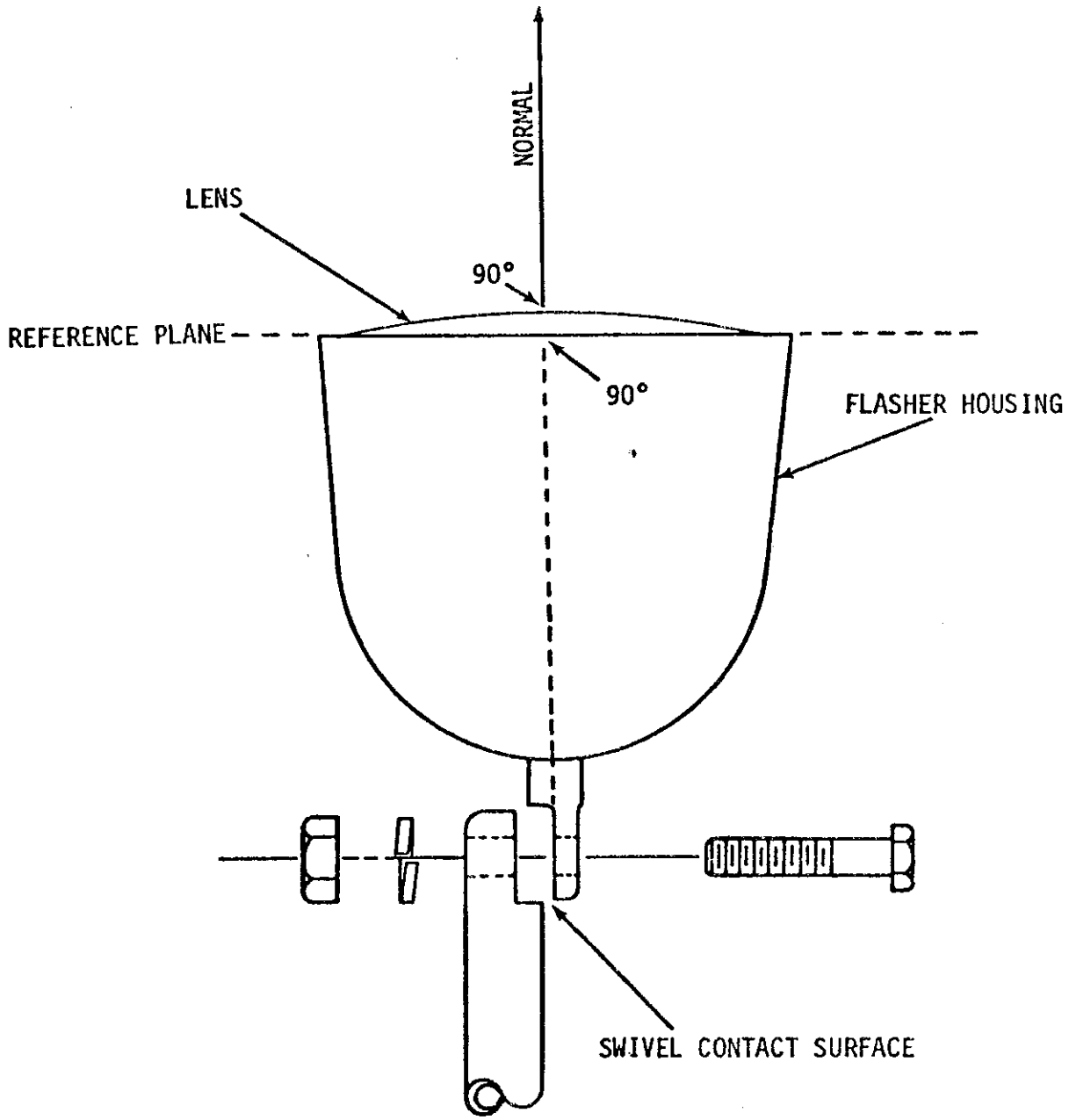

Figure 1. Mechanical/Optical Alignment

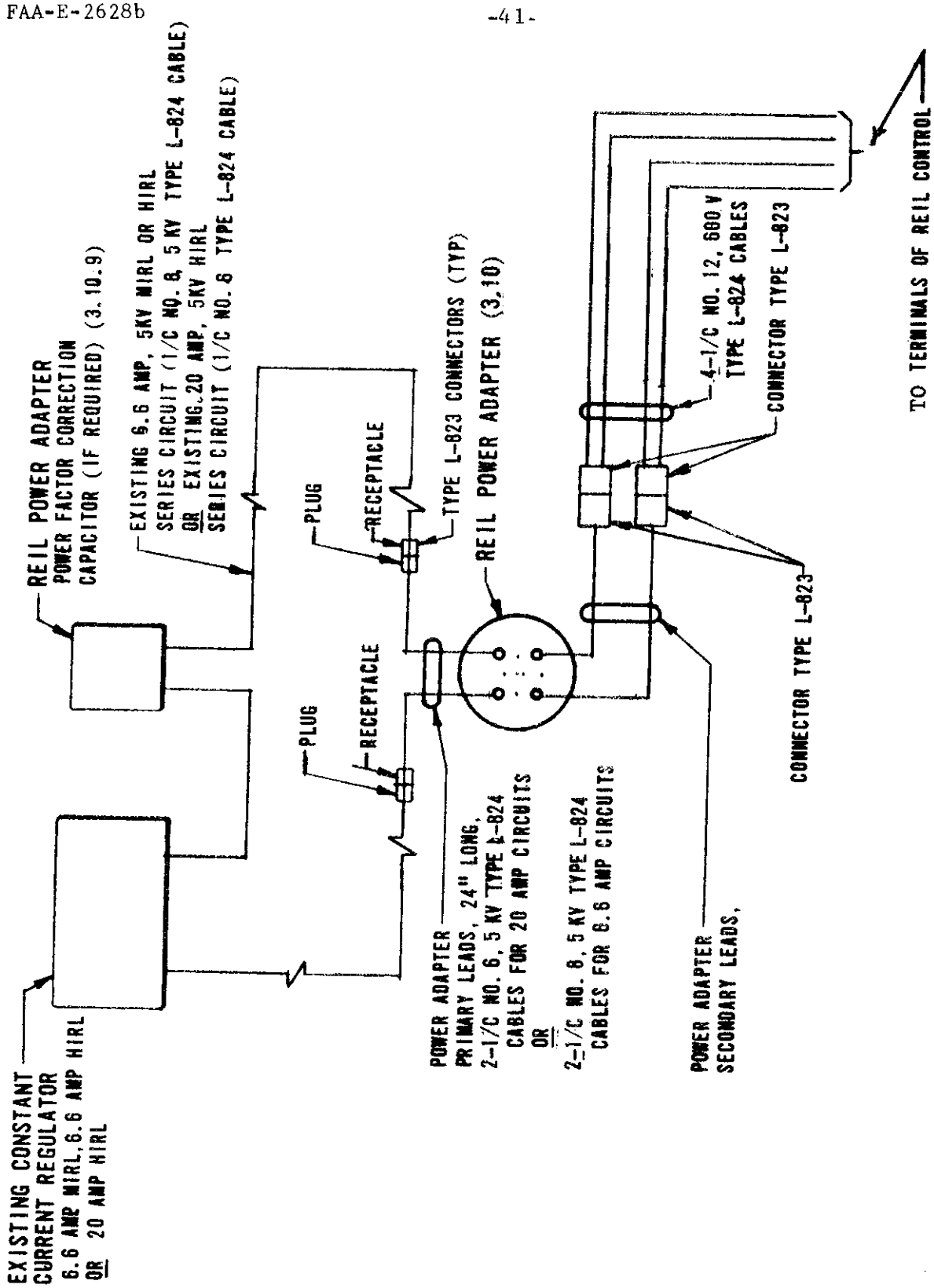

FIGURE-2 REIL POWER ADAPTER SCHEMATIC WIRING DIAGRAM

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