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DIVISION 34 - TRANSPORTATION

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AIRFIELD LIGHTING

02/10

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AIRFIELD LIGHTING
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- ASTM B3 (2013) Standard Specification for Soft or Annealed Copper Wire
- ASTM B8 (2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- ASTM D709 (2013) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C2 (2012; Errata 1 2012; INT 1-4 2012; Errata 2 2013; INT 5-7 2013; INT 8-10 2014; INT 11 2015) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA TC 2 (2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
- NEMA TC 3 (2015) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
- NEMA WC 3 (1992; Rev 1 1994) Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
- NEMA WC 7 (1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
- NEMA WC 8 (1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata

3-4 2014; AMD 4-6 2014) National
Electrical Code

NFPA 70B (2016) Recommended Practice for Electrical
Equipment Maintenance

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-T-27535 (1964; Rev A; Supp 1 1964; Am 2 1965;
Notice 1 1993; Notice 3 1999) Transformer,
Power, Isolation, Series Circuit, Airport
Lighting, General Specification for

MS 17814 (1972; Rev C; Am 1 2002; Notice 1 2006;
Notice 2 2012) Coupling, Frangible,
Aviation Ground Lights

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 150/5345-10 (2014; Rev H) Specification for Constant
Current Regulators Regulator Monitors

FAA AC 150/5345-26 (2008; Rev D) FAA Specification for L-823
Plug and Receptacle, Cable Connectors

FAA AC 150/5345-28 (2005; Rev F) Precision Approach Path
Indicator (PAPI) Systems

FAA AC 150/5345-42 (2013; Rev G) Specification for Airport
Light Bases, Transformer Housings,
Junction Boxes and Accessories

FAA AC 150/5345-44 (2007; Rev H) Specification for Runway and
Taxiway Signs

FAA AC 150/5345-46 (2009; Rev D) Specification for Runway and
Taxiway Light Fixtures

FAA AC 150/5345-47 (2005; Rev B) Specification for Series to
Series Isolation Transformers for Airport
Lighting Systems

FAA AC 150/5345-51 (2005; Rev A) Specification for
Discharge-Type Flashing Light Equipment

FAA AC 150/5345-7 (2013; Rev F) Specification for L-824
Underground Electrical Cable for Airport
Lighting Circuits

UNDERWRITERS LABORATORIES (UL)

UL 1 (2005; Reprint Jul 2012) Standard for
Flexible Metal Conduit

UL 1242 (2006; Reprint Mar 2014) Standard for
Electrical Intermediate Metal Conduit --
Steel

UL 360 (2013; Reprint Jan 2015) Liquid-Tight

	Flexible Steel Conduit
UL 44	(2014; Reprint Feb 2015) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 510	(2005; Reprint Jul 2013) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013) Metallic Outlet Boxes
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 6A	(2008; Reprint Nov 2014) Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
UL 797	(2007; Reprint Dec 2012) Electrical Metallic Tubing -- Steel

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. ~~When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.~~ Submittals with an "S" are for inclusion in the ~~Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING.~~ Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

~~Landing signal officer (LSO) control panel~~

~~Approach lighting frangible tower~~

~~Each type of airfield lighting fixture installation~~

Wind cone indicator assembly connection

~~Wave Off system~~

SD-03 Product Data

Control cable

Series airfield lighting cable

~~Obstruction marker lights~~

~~Rotating light beacon~~
~~Heliport light beacon~~
~~High/Medium intensity obstruction lights~~
Wind cone
Isolating transformers
Constant current regulators
Each type of runway and taxiway lighting fixture
Each type of light bases
Frangible couplings
~~FAA Type P-606 sealant~~
FAA Type L-823 connectors
~~Circuit selector cabinets~~
~~Pilot relay panel~~
~~Control transfer panel~~
~~Control panel~~
~~Sequenced flashing light system components~~
~~Wave Off system components complete~~

SD-06 Test Reports

Counterpoise system test

SD-07 Certificates

Installer Qualifications; G{, [_____]}

Construction ~~Outage~~Phasing Plan; G{, [_____]}

SD-10 Operation and Maintenance Data

Constant current regulators, Data Package 5

~~Rotating light beacon assembly, Data Package 3~~

~~Sequenced flashing light system, Data Package 5~~

~~Wave Off system, Data Package 5~~

~~—Submit in accordance with Section 01 78 23 OPERATION AND
MAINTENANCE DATA.~~

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Do not install materials which are not approved as "Approved Airport Equipment" by FAA unless specifically approved by the electrical design engineer. Inspect wire and cable for date of manufacture. Do not use wire and cable manufactured more than one year before delivery to job site.

1.4.2 Regulatory Requirements

Provide materials and equipment listed by FAA, UL, ETL or approved by Factory Mutual Engineering and Research (FM), when such equipment is listed or approved. Do not use askarel, tetrachlorethylene and insulating liquids containing polychlorinated biphenyls (PCBs) in equipment. Provide submersible type equipment installed below grade in vaults, manholes, and handholes. Materials must be certified and listed as "Approved Airport Lighting Equipment" downloadable from:
<http://www.faa.gov/arp/pdf/534553ad.pdf>.

1.4.3 Installer Qualifications

The aviation lighting equipment contractor and installation electricians must be experienced in installing, testing and maintaining aviation lighting systems of a similar complexity. The contractor must provide a list of government projects and 3 years of experience in constructing similar projects. Include written certification that systems have performed satisfactorily for not less than 18 months.

1.4.4 Construction ~~Outage~~ Outage Phasing Plan

The contractor must provide a construction ~~outage~~ outage phasing plan and schedule for installing new and retrofitting the existing lighting system to ensure that aviation lighting circuits are fully operational between dusk and dawn during each day of the construction contract except for those lights in phase under construction. The plan must be submitted to and approved by the Contracting Officer and the Airfield Manager prior to starting construction.

~~1.5 EXTRA MATERIALS~~

~~1.5.1 Oil Fuses~~

~~Provide one spare fuseholder and three spare fuses for each ampere size.~~

~~1.5.2 Sequenced Flashing Light System~~

~~Provide a spare part trunk with parts.~~

~~1.6 EQUIPMENT~~

~~1.6.1 Equipment for Silicone Sealant~~

~~Equipment for silicone sealant shall be air powered pump, components, and hoses as recommended by the sealant manufacturer. Hoses and seals shall be lined to prevent moisture penetration and withstand pumping pressures. Equipment shall be free of contamination from previously used other type sealant.~~

1.5 EXISTING AIRFIELD LIGHTING SYSTEMS

Existing airfield lighting systems in phases not under construction shall remain in operating condition and interruptions shall be held to a minimum. Where interruptions are necessary, they shall be scheduled as approved in writing by the Contracting Officer. Prior to the scheduled time for each interruption, all necessary materials and a sufficient labor force shall be assembled to permit completing the work within the scheduled time interval. Under no circumstances shall any of the existing airfield lighting circuits be left inoperative without making provisions for suitable temporary connections in the affected area or areas. All airfield lighting circuits covered under this Contract shall be replaced in such a manner that they will be operational at dusk each day. The Contractor shall submit to the Contracting Officer a plan for outages and maintaining lighting and lighting control.

PART 2 PRODUCTS

2.1 ELECTRICAL TAPE

UL 510, plastic insulating tape.

2.2 NAMEPLATES

Provide laminated plastic nameplates for equipment, controls, and devices to identify function, and where applicable, position. Provide 1/8 inch thick laminated Melamine plastic conforming to ASTM D709, Grade ES-2, white with black center core. Surface shall be a matte finish with square corners. Align and engrave lettering accurately into the black core. Size of nameplates shall be one by 2 1/2 inches minimum with minimum 1/4 inch high normal block lettering. Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet metal screws or two rivets.

2.3 CONDUIT, CONDUIT FITTINGS, AND BOXES

2.3.1 Rigid Steel or Intermediate Metal Conduit (IMC) and Fittings

~~UL 6, UL 6A and UL 1242, respectively, coated with a polyvinylchloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick, conforming to NEMA RN 1.~~

2.3.2 Flexible Metal Conduit

UL 1, zinc-coated steel. Use UL 360 liquid-tight flexible metal conduit in wet locations.

2.3.3 Outlet Boxes for Use with Steel Conduit, Rigid or Flexible

UL 514A, cast metal with gasketed closures.

2.3.4 Plastic Duct for Concrete Encased Burial

~~[PVC conforming to NEMA TC 6 & 8, Type EB.]~~ Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.3.5 Plastic Conduit for Direct Burial

PVC conforming to NEMA TC 2 (conduit) and NEMA TC 3 (fittings), Type

~~[EPC-40 PVC][EPC-80 PVC].—][Provide as specified in Section 33 71 02—
UNDERGROUND ELECTRICAL DISTRIBUTION.~~

‡2.3.6 Frangible Couplings and Adapters

MS 17814. Provide upper section of frangible coupling with one of the following:

- a. Unthreaded for slip-fitter connections.
- b. 2 13/32 inch: 16N-1A modified thread for nut and compression ring to secure 2 inch EMT.
- c. 2 inch: 11 1/2-N.P.T. (tapered) with 7/32-inch nominal wall thickness to accept rigid conduit coupling.

‡2.3.6.1 Frangible Couplings for Specialized Applications

Acceptable as approved.

‡2.3.6.2 Electrical Metallic Tubing

UL 797. Provide where indicated for use with frangible couplings and adapters.

2.4 WIRE AND CABLE

Do not provide or install wire and cable manufactured more than one year before delivery to the job site. Conductors shall be copper.

2.4.1 Conductor Sizes

Conform to American Wire Gage (AWG).

2.4.2 Low Voltage Wire and Cable

~~[UL 854, Type USE, 600 volts for underground low voltage power cables.] [[UL 83, Type [] [THW][THWN]] [UL 44, Type [XHHW][]] for secondary series lighting circuits. Provide wire with "W" in the type designation in wet or damp locations.] [As specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.~~

‡2.4.3 Power Cables for Use in Airfield Lighting

~~[Rated [5][] kV, [133 percent][] insulation level, with shield and jacket conforming to [NEMA WC 7 for crosslinked polyethylene][or][NEMA WC 8 for ethylene propylene rubber] insulated cables.] [Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.~~

‡2.4.4 Wire and Cable for Airfield Lighting Systems

2.4.4.1 Airfield Lighting Cable

FAA AC 150/5345-7, Type L-824, for ~~[crosslinked polyethylene Type C] [] [600][5000]-volt cable. Series airfield lighting cable shall be unshielded. [Airfield lighting cable in multiple power airfield circuits shall be [shielded][unshielded].]~~

~~2.4.4.2 Cable for Pavement Slot Installation~~

~~UL 83, Type THWN.~~

2.4.4.2 Counterpoise Wire

ASTM B3, ASTM B8. No. ~~4~~ ~~_____~~ AWG bare stranded copper, annealed or soft drawn.

2.4.4.3 Control Cable

~~Multi~~conductor type for 120 V ac control, rated 600 volts, No. 12 AWG, and conforming to the following unless indicated or specified otherwise. Insulate each conductor with a thickness of not less than 30 mils and rate for continuous operation at 90 degrees C. Conductors shall be color coded. An overall jacket of ~~heavy-duty neoprene~~ ~~_____~~ rated for direct burial shall be included. Cable shall conform to NEMA WC 3 for rubber insulation, NEMA WC 7 for cross-linked polyethylene insulation, or NEMA WC 8 for ethylene-propylene rubber insulation. ~~Multi~~conductor type for 48 V dc control, rated 300 volts, No. 19 AWG, conforming to RUS Bull 1751F 205.

~~2.4.4.4 Fused Cable Connectors~~

~~Provide connector consisting of a line side receptacle and a load side plug, each in a molded rubber form and including crimp on fittings for the cable ends to accommodate a 250 volt cartridge type fuse. Provide fuse with rating indicated. Provide connectors in kit form properly sized for the specific cable diameter involved. Completed connection shall be watertight.~~

~~2.4.4.5 Cable for Sequence Flashing Trigger Circuits~~

~~RUS Bull 1751F 205.~~

2.4.5 Cable Tags

Provide cable tags for each cable or wire at duct entrances entering or leaving of manholes, handholes, and at each terminal within the lighting vault. Provide stainless steel, bronze, ~~lead strap~~, or copper strip tags approximately 1/16 inch thick or hard plastic 1/8 inch thick suitable for immersion in salt water and impervious to petroleum products. Provide sufficient length for imprinting the legend on one line using raised letters not less than 1/4 inch in size. Permanently mark or stamp with the identification as directed. Two-color laminated plastic is acceptable. Provide dark colored plastic tags with markings of light color to provide contrast so that identification can be easily read. Provide fastening material of a type that will not deteriorate when exposed to water with a high saline content and petroleum products.

~~2.4.6 Concrete Markers for Direct Buried Cable Systems~~

~~Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.~~

2.5 GROUND RODS

UL 467. Copper-clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and 10 feet long, unless indicated otherwise.

~~2.6 ROTATING LIGHT BEACON~~

~~[MIL L 7158 with double peak white beam] [or] [Type L 802 [A] [S] of
FAA AC 150/5345 12]. Provide duplex type beacon with alternating green and
white beams. White beam shall have a double peak required by MIL L 7158.
[Beacon shall have a low temperature heater package for use in temperatures
below minus 30 degrees C.]~~

~~2.6.1 Power Supply~~

~~Provide weatherproof circuit breaker panelboard having four single pole
120 volt circuits, a ground bus and a solid neutral bus to provide
separately protected circuits for the beacon lamps, motor, [heater circuit]
and obstruction lights. Provide cabinet with a NEMA Type [3R] [_____]
enclosure of zinc coated steel.~~

~~2.7 HELIPORT LIGHT BEACON~~

~~FAA AC 150/5345 12, Type L 801H, with flashing lights coded
white green yellow.~~

~~2.8 OBSTRUCTION MARKER LIGHTS~~

~~FAA AC 150/5345 43, Type L 810, or MIL DTL 7830. Obstruction marker lights
shall emit a steady burning aviation red light. [Provide light assembly
supplied by [120] [240] volt multiple circuit.] [Provide light assembly
supplied by a series circuit power adapter as recommended by the
obstruction light manufacturer.] Provide [single] [or] [double] unit
type obstruction marker lights [as indicated]. Provide control for
obstruction marker lights as indicated.~~

~~2.9 HIGH/MEDIUM INTENSITY OBSTRUCTION LIGHTS~~

~~FAA AC 150/5345 43.~~

~~2.9.1 High Intensity Lighting~~

~~White, flashing light for daytime marking of obstructions in accordance
with FAA AC 70/7460 1, and fixtures in accordance with FAA AC 150/5345 43,
Type L 856.~~

~~2.9.2 Medium Intensity Lighting~~

~~White or red, flashing light for twilight/night marking of obstructions in
accordance with FAA AC 70/7460 1 and fixtures in accordance with
FAA AC 150/5345 43, Type L 866. Photoelectric light control shall meet FAA
requirements.~~

~~2.9.3 Solid State Flasher~~

~~Provide zero voltage switching, at zero point of sine wave, to regulate the
on off cycle of red hazard beacons. Flasher shall supply [one] [two] [three]
circuits [as indicated].~~

2.6 EXTERNALLY LIGHTED WIND CONE

Provide FAA approved LED cone lighting and an obstruction light for each
existing wind cone. FAA AC 150/5345 27, Type L 807, with a frangible

~~support assembly, lighted with four lamps, and [an orange][a white] 12 foot fabric cone. Provide wiring and controls. Supplemental wind cones, where used, shall be Type L 806.~~

~~2.7 RUNWAY DISTANCE AND ARRESTING GEAR MARKERS~~

~~Runway distance markers shall conform to FAA AC 150/5345-44, Type L 858B, Size 4, Style 3 with white or yellow numerals on a black background. Provide markers to withstand a static wind load of 0.28 pound per square inch, and suitable for connection to the secondary of the isolation transformers specified. Provide internally illuminated markers with illumination of the face not significantly decreasing when the series-lighting circuit is operated at the lowest brightness step. Construct marker housing of fiber reinforced epoxy, with information face of high impact acrylic or ultraviolet stabilized polycarbonate.~~

~~2.7.1 Power Supply and Lamps~~

~~Style 3, [Class 1][Class 2][as indicated][as recommended by the sign manufacturer].~~

~~2.7.2 Arresting Gear Markers~~

~~Markers shall have a 3.25 foot translucent yellow circle in place of numerals as specified above.~~

2.7 TRANSFORMERS

2.7.1 Encapsulated Isolating Transformers

FAA AC 150/5345-47, Type (G) L-830 or MIL-T-27535. Provide each transformer with rating as indicated. Insulation Level Primary voltage rating 5000 volts RMS, Secondary 600 V RMS. Operating Temperature range minus 55 degrees Celsius to plus 65 degrees Celsius. Resistant to UV exposure and ozone. Suitable for areas contaminated with oils, aircraft fuels, soil acids, alkalis, and deicing fluids. Compatible with FAA Style 2 and Style 9 connectors.

~~2.7.1.1 Transformers for Frangible Towers~~

~~FAA E 2690. Encapsulated, submersible type with lifting handles and rating of 1500 watts, 2400 volts, 20 amp primary, [6.6][20] amp secondary, [as indicated,] single phase, 60 Hz. Primary and secondary leads shall conform to FAA AC 150/5345-7, Type L 824.~~

~~[2.7.2 Power Transformers~~

~~As specified in [_____].~~

+2.8 LIGHT BASES

FAA AC 150/5345-42 Type ~~[L-867]~~ or L-868 as indicated on drawings. ~~[L 869][or]~~ [FAA E 1315 Type [LB 1A] [_____]]. Provide steel bases, Class 1, ~~[Size [A][B][C][D] or as indicated]~~ for as required to accommodate the fixture or device installed thereon if diameter is not shown.

2.8.1 Accessories

Provide base plates, cover plates, and adapter plates to accommodate

various sizes of fixtures. Bolts shall be stainless steel.

~~2.9 SEALING FIXTURES AND WIRES IN DRILLED HOLES OR SAW KERFS~~

~~FAA AC 150/5370 10, Type P 606.~~

~~2.9.1 Sealant Type~~

~~FAA Type P 606 sealant for use in asphaltic concrete (AC) or Portland-cement concrete (PCC) pavement compatible with AC pavement and having a minimum elongation of 50 percent. Formulations of Type P 606 which are compatible with PCC pavement only are prohibited.~~

~~2.9.2 Single Component Cold Applied Silicone~~

~~Silicone sealant shall be self leveling, non acid curing, and meet the following requirements.~~

<u>TEST</u>	<u>TEST METHOD</u>	<u>REQUIREMENTS</u>
Weight Loss	ASTM C792 Modified- (See Note 1)	10 percent max.
Flow	ASTM C639 (Type I)	Smooth and level
Extrusion Rate	ASTM C603	30 sec. max.
Tack Free Time	ASTM C679	5 hours max.
Hardness (Shore 00)- (See Note 2)	ASTM C661	30 — 80
Tensile Stress at 150- Percent Elongation (See- Note 2)	ASTM D412 (Die C)	30 psi max.
Percent Elongation (See- Note 2)	ASTM D412 (Die C)	700 min.
Accelerated Weathering	ASTM C793	Pass 5000 hours
Bond and Movement- Capability	ASTM C719	Pass 10 cycles at plus- 50 percent movement (no adhesion or cohesion- failure)
Flame Resistant	FS SS S 200	Pass
NOTES: 1. Percent weight loss of wet (uncured) sample after placing in forced draft oven maintained at 158 degrees F plus 1 degree F for two hours.		

<u>TEST</u>	<u>TEST METHOD</u>	<u>REQUIREMENTS</u>
2.	Specimen cured 21 days at 73 degrees F plus 1 degree F and 50 percent.	
ACCELERATED WEATHERING FACTORY TEST REPORT. For Accelerated Weathering test, in lieu of testing of actual joint sealant to be used on the project, a report of a factory test, performed within two years of contract award, may be submitted.		

2.9 CONSTANT CURRENT REGULATORS

FAA AC 150/5345-10, Type L-~~829828~~, without monitor system and with ratings as indicated.

2.9.1 Regulator

Regulators shall operate on ~~{60}{_____}~~ Hz, have internal primary switch ~~{included}{excluded}~~, have input voltage of ~~{240}{480}{2400}{_____}~~ volts and be controlled by 120-volt external control voltage. Provide ~~{three}{_or_ five}~~ brightness steps~~{ as indicated}~~. ~~{Provide monitors as indicated.}~~

2.9.2 Basic Impulse Level (BIL)

Provide 60-kV series circuit BIL except that 4-kW, 7.5-kW and 10-kW regulator series circuits may have a BIL of 25 kV.

2.10 LED LAMPS AND FILTERS

Provide lamps of size and type indicated, or required by fixture manufacturer for each lighting fixture required under this contract. Provide filters as indicated and conforming to the specification for the light concerned or to the standard referenced.

~~2.11 SUMP PUMPS FOR MANHOLES AND VAULTS~~

~~Provide submersible type with a capacity of not less than [_____] gal/min at a total dynamic head of [10][_____] feet. Motor shall include automatic thermal overload protection. Provide an internal magnetic float switch, stainless steel shaft, bronze impeller, and cast iron motor housing and volute. Provide a continuous waterproof cable with watertight plug of sufficient length to include slack and allow connection to receptacle shown.~~

~~2.12 OIL FUSE CUTOUTS~~

~~ANSI C37.44. [Provide subway type oil fuse cutouts.] Rate cutouts [_____] volts, [_____] amperes, [_____] kV BIL. Provide hermetically sealed cutouts with expansion chambers for full rating. Provide with [gang operating mechanism,] mounting channel, oil, compound, and fuse links rated [_____] amperes. Mount cutout on galvanized steel junction boxes with bolted on covers, unless indicated otherwise.~~

~~2.13 TRANSFORMERS, SUBSTATIONS AND SWITCHGEAR~~

~~Provide as specified in Section 26 11 16 SECONDARY UNIT SUBSTATIONS and Section 26 12 19.10 THREE PHASE PAD MOUNTED TRANSFORMERS.~~

~~2.14 EMERGENCY GENERATOR AND AUTOMATIC TRANSFER SWITCH SYSTEM~~

~~Provide as specified in [____]. [26 32 13.00 20 SINGLE OPERATION GENERATOR SETS]~~

~~2.15 CIRCUIT SELECTOR CABINETS~~

~~FAA AC 150/5345 5, Type L 847, for (K) [one] [two] [three] [four] circuit control [as indicated], Class [A, indoor] [B, outdoor], Rating [1, for 6.6 amp] [2, for 20 amp].~~

~~2.16 PILOT RELAY PANEL~~

~~[MIL P 8944 for 120 volt control (L) systems, [Type I, 24 circuit DPST] [Type II, 16 circuit DPST and 8 circuit DPDT].] [FAA AC 150/5345 13, Type L 841, for 48 V dc control systems.~~

~~]2.17 CONTROL TRANSFER PANEL~~

~~Transfer panel, 120 volt, 60 Hz, with eight pole, double throw, continuous duty, industrial control type relay, in NEMA Type 1 enclosure. Relay contacts shall have a rating of not less than 10 amp for continuous noninductive loads.~~

~~2.18 CONTROL PANEL~~

~~[MIL P 8944, Class [____]] [or] [FAA AC 150/5345 3, Type L 821, Type [____], Class [____], Style [____]]. Quantity and color of lenses shall conform to [MIL P 8944] [or] [FAA AC 150/5345 3] and shall correspond to the actual circuits indicated.~~

2.11 LIGHTNING ARRESTERS

These lightning arrestors shall be for series circuits. They shall be rated 25,000 P peak (8/20 microsecond discharge). IEEE C62.11 and IEEE C62.41.1 and IEEE C62.41.2 as applicable with ratings as indicated.

~~2.12 WHEELS UP SYSTEM~~

~~[Include wheels up lights, handholes, equipment vault, control panel, and the associated equipment and interconnecting wiring to provide a complete system as indicated and as specified herein.~~

~~]2.12.1 Wheels Up Light Fixtures~~

~~FAA E 982 or MIL L 26764 Type MB 2 for 120 volt, 500 watt lamp (Q500 PAR56/MFL). Fixtures shall include a positioning arrangement to adjust light with a locked position after installation. Provide lamps as indicated. Provide a clear filter to protect lamp from direct contact with rain.~~

~~2.12.2 Light Dimmer~~

~~As indicated and as specified below. Provide a single NEMA Type 6 housing for assembly, submersible to a 3 foot head. Enclosure shall have limiting dimensions of 2 1/2 by 2 1/2 by 4 feet in height. Provide enclosure finish in accordance with the manufacturer's standard practice for the intended service. Provide dimmer designed for continuous full load operation in an~~

~~ambient temperature of 40 degrees C. Dimmer shall control rated circuit load from full bright to blackout, 12 volts or less, on any load from 3 to 100 percent of rated circuit load. Provide output voltage not less than 120 volts at maximum controller setting and at maximum rated circuit load. For an input variation of plus or minus 10 percent, output voltage shall vary within plus or minus 5 percent. Provide dimmer capable of handling suddenly applied cold tungsten lamp loads of full circuit load rating at maximum dimmer output setting without failure or without degradation of components. When equipped with branch circuit protection, dimmer shall handle a short circuit on load terminals without failure or degradation of components. Dimmer shall employ the principle of a variable transformer with output voltage continuously adjustable from zero to maximum proportionately over the full range. Provide motor driven unit with built in limit switches, controlled from a lever action, spring return to "off" switch. Solid state controls or equipment are prohibited.~~

~~2.12.3 Wheels Watch Control Panel~~

~~Construct as indicated and conform to UL 50. Provide cabinet and hinged cover of No. 14 gage sheet steel, zinc coated by the hot dip process, and NEMA Type 4 suitable for outdoor use. Provide cabinet and cover treated, primed, and finish painted with color as directed and suitable for the intended service. Provide weatherproof receptacle on cabinet with threaded cap and chain as indicated. Controls on the face of the panel shall have clearly identified engraved nameplates. Provide panel with components necessary for complete operation of the lighting system as indicated.~~

~~2.13 WAVE OFF SYSTEM~~

~~Include wave off strobe lights (flashhead), equipment pad, control panel, transformers, safety switches, panelboard and the associated equipment and interconnecting wiring to provide a complete system as indicated and as specified herein.~~

~~2.13.1 Wave off Strobe Lights~~

~~Provide capacitance discharge, flashing lights (strobe) for wave off lighting system. Each light includes a flash head (FH) optical assembly unit, a power converter unit (PCU), and the interconnecting cable.~~

~~a. MIL L 29575~~

~~b. Acceptable Source:~~

~~(1) Flash Technology of America, 55 T Lake Street, Nashua, N.H., 03060, phone 603/883 6500~~

~~Flash Technology Beacon (FTB) 622~~

~~(2) Another Wave Off Strobe Light System by another reputable manufacturer will be acceptable, subject to approval by the Contracting Officer.~~

~~2.13.2 Wave Off Control Cabinet~~

~~Provide cabinet with components necessary for complete operation of the lighting system as indicated.~~

~~a. Enclosure~~

- ~~(1) UL 50~~
- ~~(2) 14 gage, sheet steel, NEMA [3R] [____], enclosure per NEMA ICS 6, with hinged cover~~
- ~~(3) Hot dip, zinc coated~~
- ~~(4) Solvent clean per SSPC SP 1. If the galvanized metal has been "passivated" or "stabilized", the coating shall be completely removed by brush off abrasive blast or other treatment, or the surface shall be primed with a primer which is specifically recommended by the paint manufacturer for use on passivated or stabilized galvanized steel.~~
- ~~(5) Immediately after cleaning, coat surfaces with a pretreatment coating or a crystalline phosphate coating.~~
- ~~(6) As soon as practicable after the pretreatment coating has dried, prime treated surfaces with a coat of zinc chromate primer and one coat of synthetic exterior gloss green enamel paint. The color shall be [Munsell 7GY3.29/1.5 green per ASTM D1535] [____].~~

~~b. Nameplates~~

~~Provide nameplates for controls as specified in Section 26 00 00.00 20-BASIC ELECTRICAL MATERIALS AND METHODS.~~

~~e. Terminal Board~~

~~NEMA ICS 4~~

~~d. Relays~~

- ~~(1) Provide as indicated.~~
- ~~(2) Coil: [120] [277] [____] Volt, 60 Hz.~~
- ~~(3) Contacts: [10] [____] Amperes~~

~~e. Receptacle~~

- ~~(1) UL listed for use in wet locations~~
- ~~(2) Weatherproof on cabinet with threaded cap and chain as indicated.~~

~~2.13.3 Pad mounted Transformer, [15] [____] kVA, [1] [3] Phase, Low Profile [As specified in Section 26 12 21 SINGLE PHASE PAD MOUNTED TRANSFORMERS.] [As specified in Section 26 12 19.10 THREE PHASE PAD MOUNTED TRANSFORMERS.]~~

~~2.13.4 Safety Switches, Panelboard, and Transformer~~

- ~~a. Provide as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.~~
- ~~b. Provide enclosure as specified for Wave Off Control Panel.~~

~~2.13.5 Photo Electric Switch~~

- ~~a. UL 773 or UL 773A~~
- ~~b. Hermetically sealed cadmium sulfide cell~~
- ~~c. Single throw contacts~~
- ~~d. On below 3 footcandles, off 3 — 10 footcandles~~
- ~~e. Time delay to prevent switching from transient light sources~~
- ~~f. Directional lens to prevent turnoff condition from fixed lights.~~

~~2.13.6 Equipment Pad~~

~~Provide as shown on construction drawings.~~

~~2.14 APPROACH LIGHTING SYSTEM~~

~~Provide approach, centerline, crossbar, threshold bar, side row barrette, centerline barrette, bar lights, sequenced flashing lights, frangible towers, and associated equipment and interconnecting wiring to provide a complete system as shown on construction drawings.~~

- ~~a. centerline lights: FAA AC 150/5345 46 Type L 850~~
- ~~b. centerline barrettes: FAA E 982~~
- ~~c. sequence flashing: FAA E 982 or FAA AC 150/5345 51 Type L 849, Style E~~
- ~~d. 1000 ft crossbar: FAA E 982~~
- ~~e. terminating bar lights: FAA E 982~~
- ~~f. pre threshold wingbar: FAA E 982~~
- ~~g. approach threshold center bar: FAA AC 150/5345 46 Type L 850, Style D or E~~
- ~~h. outer threshold bar: FAA E 982~~
- ~~i. economy approach REIL: FAA AC 150/5340 30~~

~~2.14.1 Lighting Fixtures Except Flashing Units~~

~~MIL L 26764, Type MB 2, or FAA E 982 unidirectional, for elevated mounting at cross bar, centerline bars, threshold and side row barrettes; FAA AC 150/5345 46, Type L 850, Class E or Class D bidirectional or unidirectional, for semiflush mounting; and MIL L 26990, Type MB 1, for elevated mounting bidirectional lights. Provide class of light and lamp, filter, and transformer as indicated. Include lamps. Mounting shall conform to the details indicated. Mount bases level and recess as required by thickness of fixture to provide installation in accordance with manufacturer's instructions.~~

~~2.14.2 Sequenced Flashing Light System~~

~~FAA E 2628. [Provide as a complete and integrated part of the approach system including individual power supply units, elevated flashing units,~~

~~master timer, remote control and monitor units, interconnecting wiring, and support structures. Master timer cabinet shall provide timed flashing signals to 21 lamp power supplies. System shall monitor individual lamp flashes and report via normally open contacts a condition of two, three, or more malfunctioning lamps or power supplies. The master timer cabinet can be a solid state type. Major components of this system shall be the product of a single manufacturer. Install junction boxes as indicated on concrete foundations and on the platform of elevated structures. Junction boxes shall have conduit tappings in the bottom and top as required to accommodate the incoming and outgoing power and control circuits for the flashing lights. Provide terminal strips in each junction box as indicated for termination and connection of the power and control circuits. Provide signal and monitor cables as recommended by the system manufacturer.]~~

~~2.14.2.1 Pad Mounted Transformer~~

~~Provide as indicated on the drawings and as specified in [] [Section 26 12 19.10 THREE PHASE PAD MOUNTED TRANSFORMERS].~~

~~2.14.2.2 Surge Protection~~

~~Provide surge protection in the form of metal oxide varistors (MOV) for power and signal circuits with ratings as recommended by the system manufacturer.~~

~~2.14.3 Low Impact Resistant Towers~~

~~Provide fiberglass reinforced low impact resistant (LIR) towers conforming to FAA E 2702. Provide anchor bolts, lowering devices and fixture mounting accessories as required by tower manufacturer.~~

~~2.14.4 Semi Frangible Supports~~

~~For lights supported more than 40 feet above the ground, provide a two element structure; the lower element being a rigid structure and the upper element being a 20 foot LIR structure in accordance with FAA E 2702.~~

2.12 RUNWAY AND TAXIWAY LIGHTING SYSTEMS

~~{ Include runway edge lights, runway threshold and end lights, runway end identification lights, circling guidance lights, runway centerline lights, taxiway guidance signs at intersecting taxiway, and intersecting runways and adjacent to arresting gears, runway touchdown zone lights, runway distance and arresting gear markers, taxiway edge lights, taxiway centerline lights, taxiway guidance signs, mounting structures, controls, and the associated equipment and interconnecting wiring to provide complete systems as indicated and specified herein. Provide in pavement light fixtures able to withstand a minimum static single wheel load of 50,000 pounds.~~

~~+2.12.1 Runway Edge Lights~~

~~{FAA AC 150/5345-46, Type L-862(L)} [MIL DTL 5904, Type C 1], for elevated mounting; and FAA AC 150/5345-46, Type L-850(L) Class C, for semiflush mounting at intersecting taxiways, at intersecting runways and adjacent to arresting gear. Provide filters as indicated conforming to requirements of fixture specifications.~~

2.12.2 LED Runway Threshold and End Lights

The LED threshold lights shall use aviation green filter and the end lights shall use aviation red filters. These lights shall be combined in a single bidirectional fixture with the appropriate color filters if so indicated on the contract drawings. The runway threshold/end light fixtures shall meet the requirements of FAA AC 150/5345-46, Type L-862(L), elevated high-intensity, bidirectional, airfield and heliport lights as indicated.

2.12.3 LED Runway End Identifier Lights (REIL)

The LED REIL fixtures shall meet the requirements of FAA AC 150/5345-51, Type L-849(L), Style E. The REIL shall include the master and slave fixture, the power supply, remote control by the CCR, frangible mounts, and interconnecting wiring. The REIL units shall flash in unison twice per second. They shall be current driven.

~~2.12.4 Runway Threshold Lights~~

~~Elevated FAA E 982 for mounting outboard of edge lights; and MIL L 26990, Type MB 1, for mounting inboard of edge lights.~~

~~2.12.5 Circling Guidance Lights~~

~~Fixtures shall have 503 watt, 20A/T20/3 lamps. Lens shall be glass-aviation white, heat resistant.~~

~~2.12.6 Runway End Identification Lights~~

~~FAA AC 150/5345 51, Type L 849. Provide fixtures, power and control equipment [Style E unidirectional][and][Style F omnidirectional]- fixtures. [Provide fixtures as indicated.]~~

~~2.12.7 Runway Centerline Lights~~

~~FAA AC 150/5345 46, Type L 852, Class N (Navy), bidirectional, narrow beam, Type [V][VI][VII][VIII], [with shorting device for failed lamp,] modified to resist damage from aircraft tailhooks. Modify fixture as follows to resist damage from aircraft tailhooks. Stainless steel for top assembly shall conform to SAE AMS5351 with Rockwell hardness of C40 plus or minus 5. Provide casting thickened from 3/8 to 1/2 inch, and optical plate thickened as required to maintain flushness. Height of fixture shall be 1/2 inch above pavement in lieu of 3/8 inch. Light channel width shall be one inch at the lens, with a divergence of 14 degrees on each side. Secure optical assembly with 410 or 416 stainless steel bolts.~~

~~[2.12.7.1 Standard Duty Centerline Lights~~

~~FAA AC 150/5345 46, Type L 850A, [Class 1 for insetting directly into pavement][Class 2 for installation on mounting bases]. Provide filters as indicated and conforming to requirements of fixture specifications.~~

~~]2.12.8 Runway Touchdown Zone Lights~~

~~[FAA AC 150/5345 46, Type L 850B] [or] [QPL 26202, Class BB25, with top casting having extra rib for protection against damage from aircraft tailhooks.~~

~~2.12.4 Taxiway Edge Lights~~

~~{ FAA AC 150/5345-46, Type L-861(L) for elevated taxiway edge lights with LED 45 watt, 6.6A lamp and blue lens or yellow lens as indicated} and { FAA AC 150/5345-46, Type L-862T(L) 52E, Class [1][2] for semiflush taxiway edge lights with a 115 watt, 6.6A lamp and blue filter.~~

~~2.12.5 Taxiway Centerline Lights~~

~~FAA AC 150/5345 46, Type L 852.~~

~~2.12.5.1 Straight Centerline Sections~~

~~Provide Type L 852A with green/green filters. At hold bars, provide yellow filter facing the holding aircraft.~~

~~2.12.5.2 Curved Centerline Sections~~

~~Provide Type L 852B with green/green filters.~~

~~2.12.5.3 Taxiway Intersections~~

~~Provide Type L 852E with green filter.~~

~~2.12.5.4 Hook Resistant Lights~~

~~Provide fixtures as required for simulated carrier deck lighting system as specified except with 65 watt lamps and green filters.~~

~~2.12.6 Taxiway Hold Lights~~

~~FAA AC 150/5345 46, Type L 852A unidirectional with yellow filter toward the taxiway.~~

2.12.5 LED Taxiway Guidance Signs

FAA AC 150/5345-44. {Informational signs Type L-858Y} and {mandatory signs Type L-858R}. Provide size as indicated. Provide series circuit power supply adapters approved by the sign manufacturer. Location signs located adjacent and connected to existing Lumacurve mandatory signs shall be by Lumacurve.

~~2.13 SIMULATED CARRIER DECK LIGHTING SYSTEM~~

~~{ Include deck edge lights, deck centerline lights, athwartship and ramp lights, isolating transformers, control panels, the associated equipment and interconnecting wiring to provide a complete system as indicated and specified herein.~~

~~2.13.1 Light Fixtures~~

~~FAA AC 150/5345 46, Type L 852, Class N (Navy), unidirectional, narrow beam, Type [V][VI][VII][VIII], [with shorting device for failed lamp,] modified to resist damage from aircraft tailhooks. Modify fixture as follows to resist damage from aircraft tailhooks. Stainless steel for top assembly shall conform to SAE AMS5351 with Rockwell hardness of C40 plus or minus 5 with casting thickened from 3/8 to 1/2 inch, and optical plate thickened as required to maintain flushness. Provide fixture height of 1/2 inch above pavement in lieu of 3/8 inch. Provide light channel width one~~

~~inch at the lens, with a divergence of 0.24 rad</MET 14 degrees on each side. Secure the optical assembly with 410 or 416 stainless steel bolts.~~

~~2.13.2 Junction Boxes and Terminal Boxes in Manholes or Handholes~~

~~NEMA Type 6 submersible in accordance with NEMA ICS 6. Provide boxes with threaded hubs for conduit or watertight cable connectors.~~

~~2.13.3 Landing Signal Officer (LSO) Control Panel~~

~~Portable and suitable for use on paved area adjacent to the LSO handhole. Provide control panel, cabinet, and cover of 1/8 inch aluminum alloy 5052 H32 conforming to ASTM B209 and constructed as indicated. Rigidly construct entire assembly spraytight in accordance with MIL STD 108. Provide a hinged cover with two or more positive closing latches to protect panel face when not in use, with cover arranged so that it can be opened to all positions. Identify controls on panel face clearly by engraved nameplates. Panel shall contain components and controls necessary for complete operation of lighting systems indicated. Provide receptacles as indicated and in accordance with the Military Standards indicated. Provide panel in close fitting cabinet, removable from front.~~

2.13 CONNECTORS

FAA AC 150/5345-26, FAA Type L-823 connectors for use with FAA Type L-824 airfield lighting cable.

~~2.14 MEDIUM INTENSITY APPROACH LIGHTING SYSTEM~~

~~{ Medium intensity approach lighting system with runway alignment indicator lights (MALSR) includes centerline light bars, a 1000 foot light bar, sequenced flashing lights, control equipment and power supplies. Provide threshold lights as part of the runway lighting system.~~

~~]2.14.1 Semiflush Steady Burning Lights~~

~~FAA AC 150/5345-46, Type L-850B. Clear fixture without toe in. Provide 200 watt, 6.6A lamp.~~

~~2.14.1.1 Encapsulated Stepdown Transformer~~

~~Provide 200 watt, 240 volt/30.3 volt transformer approved by the fixture manufacturer. Connectors shall comply with Type L-823 as specified.~~

~~2.14.2 Elevated Fixtures~~

~~FAA E-2980. Provide 120 volt, 150 watt PAR-38 or 120 watt PAR-38 lamps meeting FAA photometric requirements of FAA E-2980.~~

~~2.14.3 Sequenced Flasher Units~~

~~FAA E-2980.~~

~~2.14.4 Accessory Equipment~~

~~FAA E-2980, power supplies, junction boxes, distribution panel, transformer, control cabinet and spare parts trunk.~~

~~2.14.5 Low Impact Resistant Towers~~

~~As specified.~~

~~2.15 HELIPAD LIGHTING SYSTEM~~

~~{ Consists of perimeter lights, landing direction lights, approach direction lights, pad floodlights, and related facilities.~~

~~2.15.1 Perimeter Lights and Landing Direction Lights~~

~~FAA AC 150/5345-46. [Provide Type L 861 elevated fixtures with yellow filters] [and] [Type L 852E semiflush fixtures with yellow filters.]~~

~~2.15.2 Approach Direction Lights~~

~~Provide elevated fixtures, Type L 861[, or semiflush fixtures, Type L 852E,] with clear lenses.~~

~~2.15.3 Floodlights~~

~~Provide outdoor heavy duty type with baffles or hoods as applicable for uniform illumination and to reduce shadows.~~

2.14 LED PRECISION APPROACH PATH INDICATOR (PAPI)

{ Consists of four light units mounted in the area of the ground point of intercept of the glide slope and aimed in the direction of the approach.

2.14.1 Light Units

FAA AC 150/5345-28, Type L-880(L) ~~or FAA E 2756~~. Connect light units to series current circuits via appropriate isolation transformers as recommended by the system manufacturer. Provide tilt switches and relays to de-energize all light units when one unit exceeds tilt requirements.

~~{2.15 PAINTING~~

~~As specified in Section 09 90 00 PAINTS AND COATINGS.~~

3 PART 3 EXECUTION

3.1 ELECTRICAL REQUIREMENTS

Electrical installation shall conform to IEEE C2, NFPA 70, NFPA 70B and requirements specified herein. Underground electrical work shall be as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.1 Electrical Metallic Tubing

Do not install underground or encase in concrete.

3.2 CONCRETE

Unless otherwise specified, provide 3000 psi concrete for below grade and 4000 psi concrete for above grade use with one inch maximum aggregate { conforming to the requirements of Section 03 30 ~~5300~~ MISCELLANEOUS CAST-IN-PLACE CONCRETE }.

~~3.3 AIRFIELD [MANHOLES] [AND] [HANDHOLES]~~

~~Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.~~

3.3 EARTHWORK

Provide excavation, backfilling, and reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.4 GROUNDING

Ground non-current carrying metallic parts associated with electrical equipment as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.5 CABLE MARKERS

Provide cable markers or tags for each cable at duct entrances entering or leaving manholes or handholes and at each termination within the lighting vault. Tag cables in each manhole or handhole with not less than two tags per cable, one near each duct entrance hole. Immediately after cable installation, permanently attach tags to cables and wires so that they cannot be accidentally detached.

3.6 FRANGIBLE REQUIREMENTS

Install frangible supports, couplings, and adapters as indicated and specified. Install with the type conduit indicated.

~~3.6.1 Approach System Frangibility~~

~~At the 1000 foot cross bar and beyond, mount approach lights up to 6 feet above concrete foundation on threaded frangible couplings and 2 inch electrical metallic tubing (EMT). For mounting heights greater than 6 feet, install approach lights on low impact resistant frangible towers.~~

3.7 ELEVATED AIRFIELD LIGHTS

Frangibly mount normally not exceeding 14 inches in height unless higher mounting is permitted in snow accumulation areas. Frangibly mount equipment exceeding 14 inches in height as indicated.

3.8 SEMIFLUSH AIRFIELD LIGHTS

Remove water, debris, and other foreign substances prior to installing semiflush light base and light.

~~3.9 WIRES, FIXTURES, AND ENCLOSURES IN SAW KERFS OR DRILLED HOLES~~

~~Sealant is specified in paragraph entitled "Sealing Fixtures and Wires in Drilled Holes or Saw Kerfs."~~

~~3.9.1 Holes for Light Fixtures~~

~~Bore holes in pavement to dimensions indicated. Use a diamond edged bit to provide a smooth, straight cut. Bottom of hole shall be flat or slightly concave, except that an area at least one inch wide around the perimeter shall be flat. Fill surfaces deeper than the prescribed depth with sealant~~

~~to the level of the flat area and allow to cure before further placement.~~

~~3.9.2 Holes for Transformer Enclosures~~

~~Drill holes through concrete pavement and remove loose material. Fill hole with concrete to depth indicated. Provide a minimum of 3 inches of concrete at bottom of hole.~~

~~3.9.3 Saw Kerfs and Splice Chambers~~

~~Cut saw kerfs and splice chambers in pavements where indicated. Provide saw cuts in straight lines and with vertical sides. Provide width and depth of saw cuts adequate for the required number of wires as indicated. Saw kerfs shall have the vertical edges chamfered at intersections. Where a saw kerf crosses a construction joint, increase the depth sufficiently to allow for slack wire under the joint.~~

~~3.9.4 Sandblasting~~

~~Sandblast saw kerfs, grooves, and holes to remove foreign or loose material. Accomplish sandblasting by using approved equipment maintained in good working order at all times. Provide sand used for blasting of the proper size and quality as necessary to perform the work. Provide nozzles used for sandblasting of the proper size in relation to the groove or holes to be cleaned. Replace nozzles enlarged by wear as necessary. Sandblast at an air pressure of not less than 90 psi.~~

~~3.9.5 Cleaning~~

~~Immediately prior to installation of wire or light fixtures, flush saw kerfs and holes with a high velocity water jet or steam, and clean and dry with a high velocity air jet to remove dirt and foreign material.~~

~~3.9.6 Lighting Fixture Installation~~

~~Sandblast sides and bottom of each light fixture immediately prior to installation. Cover inside faces of bored hole and bottom and sides of light fixture with a coating of sealant that will completely fill the void between concrete and fixture. Use a jig or holding device for installing each light fixture to ensure positioning to the proper elevation, alignment, level control, and azimuth control. Orient light fixture with light beam parallel to flight deck centerline or runway centerline and facing in the particular direction required. Level outermost edge of fixture with the surrounding pavement. Remove surplus sealant or flexible embedding material. Leave the holding device in place until sealant has reached its initial set. Properly arrange fixture lead wires with respect to their connecting position. Block the wire way entrance into the light recess to retain the sealant material during curing.~~

~~3.9.7 Installation of Circuit Wires in Pavement~~

~~Place the wires in saw kerfs and anchor at bottom by means of rubber or plastic wedges or noncorrosive metal clips placed every 2 or 3 feet or as often as necessary to hold the wire down. Where wires cross existing joints, encase wires in a 12 inch length of flexible tubing of polyethylene material conforming to ASTM D1248, Type II or Type III, to break the bond between the wires and the sealing material. Provide tubing centered on the joint and of sufficient size to accommodate the wires to allow for movement of the wires as the joint opens and closes. Wrap ends of tubing with tape~~

~~to prevent entrance of sealing materials. Pack the adjacent joint area temporarily with roving material, such as hemp, jute, cotton or flax, to prevent sealing material from flowing into the open joint. Carefully mix and apply sealing materials in accordance with the manufacturer's instructions and at the recommended temperature. Remove surplus or spilled material.~~

3.9 SPLICES FOR AIRFIELD LIGHTING CABLE

3.9.1 Connectors

Use kit type connectors to splice 5 kV single-conductor series lighting cables. During installation and prior to covering with earth, keep mating surfaces of connectors covered until connected and clean when plugged together. At joint where connectors come together, install ~~heat shrinkable tubing with waterproof sealant. [Alternately, the Contractor may provide~~ ~~two~~~~four~~ half lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

3.9.2 Splicing Fixtures to the Wires in Pavement Saw Kerfs

Make splices with preinsulated watertight connector sleeves crimped with a tool that requires a complete crimp before tool can be removed.

3.10 GROUNDING SYSTEMS

3.10.1 Counterpoise Installation

Lay counterpoise wire for entire length of circuits supplying airfield lighting. Provide wire in one piece, except where distance exceeds the length usually supplied, and install on top of the envelope of concrete-encased duct and approximately 6 inches above direct burial cables and duct lines. Where trenches or duct lines intersect, electrically interconnect counterpoise wires by exothermic welding. Connect counterpoise wires together and to existing counterpoise wires. Connect counterpoise to earth ground at every ~~[2,000]~~ ~~[]~~ 500 feet of cable run, at lighting vault, and at feeder connection to light circuit by means of ground rods as specified.

3.10.2 Fixture Grounding

Ground each fixture or group of adjacent fixtures to the counterpoise system. Connect fixtures, steel light bases or grounding bushings on steel conduits to the counterpoise system by a No. 6 AWG bare-stranded copper wire. ~~Semiflush (pancake) fixtures for direct mounting in pavement may not be grounded.~~ Connect copper wire to the counterpoise by exothermic weld.

~~3.11 MARKING AND LIGHTING OF AIRWAY OBSTRUCTIONS~~

~~Mark and light towers, poles, smokestacks, buildings of certain shapes and sizes, and other obstructions in accordance with FAA AC 70/7460-1 and as indicated.~~

~~3.11.1 Painting of Airway Obstructions~~

~~Patterns and colors to mark obstructions shall conform to FAA AC 70/7460-1 and be as indicated.~~

~~3.11.2 — Obstruction Marker Lights~~

~~Install obstruction marker lights on radio towers, elevated water tanks, smokestacks, buildings, and similar structures with one inch zinc coated rigid steel conduit stems using standard tees and elbows, except that where lowering devices are required, install in accordance with equipment manufacturer's recommendations.~~

~~3.12 — ROTATING LIGHT BEACON~~

~~Install with manufacturer's instructions, including those for cleaning, lubrication, adjustment, and other special instructions. Provide foundations and supports as indicated.~~

~~3.12.1 — Beam Adjustment~~

~~Adjust beam during hours of darkness. Aim beam to provide a minimum of 5.5 degrees above the horizontal, but not higher than necessary to clear principal obstructions.~~

~~3.12.2 — Power Supply and Wiring~~

~~Install panelboard at top of structure to provide separately protected circuits for beacon lamps, [heaters,] motor, and obstruction lights. Locate cabinet on side of platform opposite ladder. Install conduit riser on tower in a corner angle and do not locate near the ladder.~~

~~3.13 — HELIPORT LIGHT BEACON~~

~~Install in accordance with specifications and manufacturer's instructions, including those for cleaning, lubrication, adjustment, and other special instructions. Provide foundations and supports as indicated.~~

~~3.13.1 — Beam Adjustment~~

~~Adjust beam during hours of darkness. Aim beam to provide a minimum of 5.5 degrees above the horizontal, but not higher than necessary to clear principal obstructions.~~

~~3.13.2 — Power Supply and Wiring~~

~~Install panelboard at top of structure to provide separately protected circuits for beacon lamps, [heaters,] motor, and obstruction lights. Locate cabinet on side of platform opposite ladder. Install conduit riser on tower in a corner angle and do not locate near ladder.~~

3.11 WIND DIRECTION INDICATORS

Include in the installation a concrete mowing pad constructed on the ground with center at center of the base. The wind cone illumination lights and obstruction lights shall be energized from multiple circuits as shown by the contract drawings or as required otherwise. ~~Installation shall include a 25 foot black circle constructed on the ground with center at center of the base. Construct circle of an emulsified asphalt sand mixture or of a cut back asphalt sand mixture and not less than 5 inches in thickness. Asphalt sand mixture shall contain not less than 6 percent bitumen. Provide well graded sand with not more than 10 percent material which will pass through a No. 200 mesh sieve. Compact asphalt sand mixture thoroughly and slope for drainage from center to outer rim from one side to the~~

~~other. [Guy wind cone direction indicator as indicated.]~~

3.12 ISOLATION TRANSFORMERS

Make connections of transformer primary leads to primary cables with connectors conforming to FAA AC 150/5345-26. Make connection to transformer secondary with connectors conforming to FAA AC 150/5345-26 and plug directly into a mating connector on the transformer secondary leads. During installation, keep mating surfaces of connectors covered until connected and clean when plugged together. At joint where connectors come together, install ~~heat shrinkable tubing with waterproof sealant. [— Alternatively, the Contractor may provide twofour~~ half-lapped layers of tape over the entire joint.] Joint shall prevent entrapment of air which might subsequently loosen the joint.

~~3.13 RUNWAY AND TAXIWAY LIGHTING SYSTEMS~~

~~3.13.1 Runway and Taxiway Centerline Lights~~

~~Provide a transformer for each group of four 45 watt or three 65 watt centerline lights and install in a handhole as indicated. Connect lights to secondary circuit wires at fixture leads using preinsulated watertight connector sleeves crimped with tool that requires a complete crimp before tool can be removed. Make connection at staggered locations and wrap with one layer of half lapped plastic electrical insulating tape. Install light fixtures in holes drilled in the pavement as indicated.~~

~~3.13.2 Touchdown Zone Lighting Installation~~

~~Provide a light base for traffic bearing areas specified for each light and transformer as indicated. In making cable connections, provide sufficient slack cable in each base to permit connection to be made above ground, or as indicated.~~

~~3.13.3 Circuit Selector Cabinets~~

~~Install as indicated and in strict accordance with manufacturer's instructions.~~

~~3.14 SIMULATED CARRIER DECK LIGHTING SYSTEM~~

~~3.14.1 Light Fixtures~~

~~Install in runway pavement as indicated, with centerline of unidirectional light beam aimed toward the nearer runway threshold and parallel to runway centerline.~~

~~3.14.2 Isolation Transformers~~

~~Except where indicated otherwise, provide a transformer for each group of four 45 watt lights and install in handhole or manhole as indicated.~~

~~3.14.3 Equipment in Control Tower, Vault, Manhole, and Handholes~~

~~Provide nameplates to match and fit existing lighting control panels in locations as directed. Provide equipment, wiring, and nameplates in runway field lighting vault, in system brightness control manhole, and in handholes as indicated.~~

~~3.14.4 Wire and Connectors~~

~~Provide THWN insulation for secondary conductors between isolation transformers and simulated carrier deck fixtures. Provide two pin connectors in accordance with FAA AC 150/5345-26.~~

~~3.15 APPROACH LIGHTING SYSTEM~~

~~Install approach lighting system as indicated and specified. Provide nameplates for equipment, controls, devices, and for each lighting circuit.~~

~~3.15.1 Frangible Requirements~~

~~At the 1,000 foot crossbar and beyond, mount overrun lights up to 6 feet above concrete foundations on threaded frangible couplings and 2 inch electrical metallic tubing (EMT). For mounting heights greater than 6 feet, install lights on LIR frangible supports. When rigid towers, trestles, and similar structures are required, mount the light unit at least 20 feet above the rigid structure with support unit between the two being frangible.~~

~~3.15.2 Alignment~~

~~Align lights in azimuth, with beams axes parallel to the approach lighting system centerline. Aim elevated lights vertically at a point on the glide path with the angular elevation of each light as indicated. Semiflush lights have a preset vertical aiming angle and require alignment in azimuth only.~~

3.13 FIELD QUALITY CONTROL

Give the Contracting Officer {5}{_____} working days notice prior to {each}{_____} test{s}. Correct deficiencies found and repeat tests.

3.13.1 Operating Test

After installation has been completed, conduct an operating test. Demonstrate equipment to operate in accordance with the requirements of this section. Conduct tests {one}{_____} day and {one}{_____} night for the Contracting Officer.

~~{3.13.2 Electromagnetic Interference~~

~~Conduct tests for electromagnetic compatibility in accordance with [MIL STD 461] [Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS]. Conduct tests for [_____] equipment.~~

+3.13.2 Distribution Conductors, 600-Volt Class

Test to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts providing a direct reading in resistance.

3.13.3 Counterpoise System Test and Inspection

Make a visual inspection of continuity of counterpoise system at accessible locations. Test continuity of counterpoise system to the vault grounding system in manhole closest to the vault.

3.13.4 Progress Testing for Series Airfield Lighting Circuits

Conduct a megger test on each section of circuit or progressive combinations of sections as they are installed. Check each section or progressive combination of sections with a megohmmeter providing a voltage of approximately 1000 volts to provide a direct reading in resistance, and document results. Locate any faults indicated by these tests and eliminate before proceeding with the circuit installation.

3.13.5 Electrical Acceptance Tests

Perform acceptance tests for series and multiple airfield lighting circuits only on complete lighting circuits. Subject each series and multiple lighting circuit to a high voltage insulation resistance test.

3.13.5.1 Low Voltage Continuity Tests

Test each series circuit for electrical continuity. Locate faults indicated by this test and eliminate before proceeding with the high voltage insulation resistance test.

3.13.5.2 High Voltage Insulation Resistance Test

Subject each series lighting circuit to a high voltage insulation resistance test by measurement of the insulation leakage current. Provide a suitable high voltage test instrument which has a steady, filtered direct current output voltage and limited current. High voltage tester shall include an accurate voltmeter and microammeter for reading voltage applied to the circuit and resultant insulation leakage current. Do not apply voltages in excess of test values specified below.

- a. Test Procedure: Disconnect both leads from regulator output terminals and support so that air gaps of several inches exist between bare conductors and ground. Clean and dry cable sheaths, for a distance of one foot from ends of cables and exposed insulation at ends of cables. Connect ends of both conductors of the circuit together and to high-voltage terminals of test equipment, and apply test voltage specified in the following tabulation between conductors and ground for a period of 5 minutes.

<u>Series Lighting Circuits</u>	<u>Test Voltage, dc</u>	
	<u>First Test on New Circuits</u>	<u>Test on Existing Circuits</u>
High intensity series lighting circuits (5000-volt leads, 500- and 200-watt transformers)	9000	5000
Medium intensity series lighting circuits (5000-volt leads, 30/45-watt transformers)	6000	3000

<u>Series Lighting Circuits</u>	<u>Test Voltage, dc</u>	
	<u>First Test on New Circuits</u>	<u>Test on Existing Circuits</u>
600-volt circuits	1800	600

When additions are made to existing circuits, test only new sections in accordance with "First Test on New Circuits" in table above. †To ensure reliable operation, test complete circuit at reduced voltages indicated above.†

b. Leakage Current: Measure and record insulation leakage current in microamperes for each circuit for each minute application of test voltage. Do not exceed the value of the insulation leakage current calculated on the basis of the following leakage current allowances for cable and connected equipment for each circuit:

- (1) 3 microamperes for each 1000 feet of cable.
- (2) 2 microamperes for each 200-watt and each 500-watt 5000-volt series transformer.
- (3) 2 microamperes for each 30/45-watt 5000-volt series transformer.

Note: The above values include allowances for the normal number of connectors and splices.

If measured value of insulation leakage current exceeds calculated value, sectionalize the circuit and repeat specified test for each section. Locate defective components and repair or replace until repeated tests indicate an acceptable value of leakage current for the entire circuit.

3.13.5.3 Operating Test

Upon completion of tests, show by demonstration in service that circuits, control equipment, and lights covered by the contract are in good operating condition. Operate each switch in the control tower lighting panels so that each switch position is engaged at least twice. During this process, observe lights and associated equipment to determine that each switch controls properly corresponding circuit. Provide telephone or radio communication between the operator and the observers. Repeat tests from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Test each lighting circuit by operating the lamps at maximum brightness for not less than 30 minutes. Visually examine at the beginning and at the end of this test to ensure that the correct number of lights are burning at full brightness. Conduct †one† [] day and †one† [] night operating test for the Contracting Officer.

3.13.6 Constant Current Regulators

3.13.6.1 Visual Examination

Examine each constant current regulator to ensure that porcelain bushings

are not cracked, no shipping damage has occurred, internal and external connections are correct, switches and relays operate freely and are not tied or blocked, fuses, if required, are correct, and oil level of oil-filled regulators is correct. Remove relay panel covers only for this examination; it is not necessary to open the main tank of oil-filled regulators. Accomplish the instructions on the plates attached to the regulators. Replace covers tightly after completing examinations and tests.

3.13.6.2 Electric Tests

Ensure that supply voltage and input tap correspond. With load disconnected, energize regulator and observe the open circuit protector to ensure that it de-energizes the regulator within 3 seconds. After testing circuits for open connections and grounds and after determining that lamps are good and in place, apply circuit load to the regulator and measure the voltage and current simultaneously on brightness taps. Voltmeter and ammeter shall have an accuracy of plus or minus one percent. Record readings and make readings during the day and night in order to obtain the average supply voltage. Output current on each brightness tap shall be within plus or minus 2 percent of the nameplate values after making necessary correction in the supply voltage. Late model regulators have automatic supply voltage correction in lieu of input taps, and output current does not change as supply voltage varies. When output current on tap 5 deviates from nameplate value by more than 2 percent, and regulator is not overloaded, check internal adjustment as described on regulator instruction plate. Since adjustment may be rather delicate, allow a deviation of up to plus or minus 5 percent on taps 1 through 4 before attempting to readjust the regulator.

-- End of Section --