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**SECTION 68 – AIRFIELD ELECTRICAL WORK**

**68-1 GENERAL**

**68-1.1 Description.**

The Electrical work to be done under this contract shall include the furnishing of all supervision, labor, materials, tools, equipment and incidentals necessary to install remove, and modify taxiway and runway lighting, taxiway and runway internally illuminated signage, power supply, cabling and electrical conduit and all other electrical work shown on the drawings, as specified herein and in accordance with Federal Aviation Administration Advisory Circular No. 150/5370-10, latest version, "Standards for specifying Construction of Airports," other FAA Advisory Circulars and Specification referred to herein, the Standard Specifications for Public Works Construction as modified herein, and other requirements as specified herein.

The Electrical Contractor and the Electrical Job Superintendent shall be required to have at least 5 years of verifiable experience with installing and modifying airfield electrical systems in order to work on this project. The qualified Electrical Job Superintendent shall be on-site providing supervision of the actual electrical installation when electrical work is occurring.

The Contractor shall obtain and pay for all electrical inspections and permits required. All electrical materials, equipment, assemblies and workmanship shall conform to the requirements of the City of Los Angeles Electrical Code, Latest Edition.

Before any electrical equipment is ordered, the Contractor shall furnish the Engineer a list of the equipment and materials he plans to incorporate in the work. This list shall include the name of each item, the Federal Aviation Administration Specification Number, the manufacturer's name, the manufacturer's catalog number, and the size, type and/or rating of each item.

After the list has been approved, the Contractor shall assemble the equipment and materials at a single location and request inspection by the Engineer. None of the equipment or material, other than duct or conduit, may be used on the job until such an inspection has been completed.

All work shall be performed in strict accordance with these contract specifications, and drawings and any instructions as may be furnished by the Engineer during execution of the work to aid in interpretation of said drawing, and specifications. Installation details and material and equipment specifications shall be in conformance with all applicable FAA advisory circulars. Only airport lighting equipment that is listed on the latest edition of the FAA approved list AC 150/5345-53 shall be acceptable for use on this contract. All other equipment and materials covered by other referenced specifications shall be UL approved labeled by a City



of Los Angeles Recognized Electrical Testing Agency and subject to acceptance through manufacturer’s certification of compliance with applicable specification. The Contractor shall furnish written proof of FAA approval on all equipment covered by FAA specifications.

See the following sections for related airfield electrical work:

- Section 69 - Airport Underground Cable (FAA L-108)
- Section 70 - Airport Transformer Vault and Vault Equipment (FAA L-109)
- Section 71 - Airport Underground Electrical Duct and Pullboxes (FAA L-110)
- Section 72 - Electrical Manholes and Junction Structures (FAA L-115)

The following electrical equipment shall conform to the following FAA specifications. The Contractor shall have and maintain the most current version of these Specifications in his files:

**FAA SPECIFICATION ITEM**

- L-804 Runway Guard Light (Wig-Wag) (Elevated)
- L-804E Runway Guard Light, Quartz (Elevated)
- L-850A Runway Centerline Light (In-Pavement)
- L-850B Runway Touchdown Zone Light (In-Pavement)
- L-850C Runway Edge Light, Quartz (In-Pavement)
- L-852C Taxiway Centerline Light, LED (In-Pavement)
- L-852D Taxiway Centerline Light, LED (In-Pavement)
- L-852E Taxiway Edge Light, LED (In-Pavement)
- L-852G Runway Guard Light, LED (In-Pavement)
- L-852T Taxiway Edge Light, LED (In-Pavement)
- L-858Y, R, L, B Sign Unit
  - 1 Module
  - 2 Module
  - 3 Module
  - 4 Module
  - 5 Module
- L-861T Taxiway Edge Light LED (Elevated)
- L-862 Runway Edge Light, Quartz (Elevated)

**68-1.2 Summary of Work**

The work to be performed shall include furnishing all labor, supplies, materials, equipment, plant, transportation, and services required to augment, move, install, and complete electrical work as specified herein and as shown on the contract.

This work includes but is not limited to the following:



- A. Maintain in operation all existing field electrical facilities and circuits while this improvement work is in progress, including protection of airport personnel, aircraft and vehicles; furnish and maintain temporary circuits, and place augmented airport lighting into operation. Field lighting on active runways and taxiways shall be operable each night, each day when fog conditions exist, or when the airport calls an emergency.
- B. Furnish, install, test and tag underground cable (L-824) in accordance with specifications. Excavate and backfill trenches, place the cable in concrete encased duct bank, and testing all circuit loops in accordance with the testing procedures in contract documents, and all incidentals activities related to them.
- C. Protect the existing airport vaults and control tower from any damage to the building, equipment, and wiring while adding or improving the existing equipment in accordance with the plans and/or specifications.
- D. Furnish and install new signs complete with filters for Airfield Lighting Control and Monitoring System (ALCMS), base can, isolation transformer, connectors, all hardware, cabling, and associated conduits.
- E. Furnish and install special blast resistant signs (Crouse-Hinds) at locations shown on the drawings, complete with filters for ALCMS, base can, isolation transformer, connectors, all hardware, cabling and associated conduits.
- F. In [new][existing] pavement [furnish and] install [new][salvaged] [in-pavement][elevated] [runway][taxiway][centerline][edge][warning][flashing guard][clearance bar][threshold][touchdown zone][other] lights complete with base can, isolating transformer, connectors, [synchronization units][ALCMS filters] all hardware, cabling, and associated conduit.
- G. Remove existing [elevated][in-pavement][runway] [taxiway] [centerline] [edge] [warning][flashing guard][clearance bar][threshold][touchdown zone][signs][other] lights [and install new ] on the existing can and connect to the existing transformer[, logitrac sensors][other].
- H. Install new blank covers on existing base cans that are to remain in place after the removal of the light fixtures.
- I. Furnish and install new pullboxes and manholes in the appropriate locations shown on the drawings.



- J. Provide temporary airfield lighting and power connections as required, to be used during construction.
- K. Ground all equipment, enclosures, neutrals, and conduits installed under this contract, including grounding to light bases, and all incidentals.
- L. Modify existing site electrical equipment complete with all wire ways, conduits, cabling, panelboards, grounding, and other appurtenant work as show on drawings.
- M. Guarantee as required by the Performance and Maintenance Bond.
- N. **[Replace existing incandescent/quartz taxiway lights with new Light Emitting Diode (LED) light fixtures complete with new isolation transformers and mounting rings on existing base cans. Prior to the procurement of the replacement LED light fixtures, the contractor shall field verify the dimensions and mounting arrangements of the existing light base cans to verify that the replacement LED light fixtures will fit on the existing base cans.]**
- O. Provide temporary panels in the airfield signs to accommodate temporary designations of the taxiways and replace the temporary panels with the permanent panels at the completion of the project, as shown in the drawings.
- P. Reconnect, re-tag and re-identify marking of the existing circuits to match revised airfield lighting circuitry.
- Q. Investigate unknown cables and conduits.

The areas of work under this contract have manholes and pull boxes, which contain existing cables, the functions of which are unknown. The cables are power, signal, lighting circuits, controls, fiber optics and other circuits. Some of the cables are spares, some cables are abandoned, some cables are active, but they are not identified in as-built drawings and other records.

As a part of this contract, the contractor shall investigate these cables and identify if they are operational, abandoned or spare. The cables shall be traced to its origin. All abandoned cables and spare cables shall be removed by the contractor. Cables that are active shall be tagged with their use and shall be reflected in the as-built drawings, from its source to the utilization point.

During the execution of the contract work, upon detection of unknown cables, the contractor shall notify the Engineer about the cables, schedule the detection



and remedial work and furnish man-hour and material required to accomplish the task.

- R. Relocate [ ] electrical items identified on the plans including [ ].
- S. Remove and [dispose of][salvage] electrical items identified on the plans including [ ].
- T. Other items required to complete the work shown on the plans. The omission of expressed reference to any parts necessary for or incidental to the complete installation shall not be construed as releasing the Contractor from furnishing such parts.

All items of general work required, such as excavation, cutting, patching, etc., shall be included in this Contract. Installation shall be performed by experienced and skilled persons to obtain only the best workmanship. All equipment shall be set square and true with constructions. The work shall be under constant supervision by the Contractor and by an authorized and competent foreman.

The Contractor shall at all times keep the construction areas free from accumulations of waste material and rubbish, and prior to completion of work, remove any rubbish from and about the project, and all tools, reels, equipments, and materials not a part of the project. Upon completion of the construction, the Contractor shall leave the work and premises in a clean, neat, and workmanlike condition satisfactory to the Engineer. The Contractor shall be responsible for the proper performance in all respects, in whole and in part, of the electrical equipment until acceptance of the entire work by Engineer.

The electrical construction and installation shall be complete, and the Contractor shall furnish all materials, labor and equipment necessary for the satisfactory installation and operation of electrical apparatus and for the operation of the electrical system as indicated, whether specifically mentioned or not. Material shall bear the Underwriter Laboratories' seal of approval.

### 68-1.3 Temporary Taxiway Lighting

Temporary Taxiway Lighting shall be installed at locations shown on the plans and in conformance with the details. The temporary Taxiway Lighting shall include all new conduit, electrical cans, cables splices, connections, lighting fixtures isolation transformers, concrete weights, required cores and connections, and other appurtenances necessary to construct the



operational Temporary Taxiway Lighting system. The Contractor shall assemble and install lighting elements as shown on the plans.

The temporary lighting shall be installed, relocated and reinstalled to accommodate construction phasing and construction activities.

Installation and testing performed under this item shall be as specified in the applicable advisory circulars. Once the permanent Taxiway lighting improvements are installed and accepted by the Engineer, the Contractor shall remove and salvage the temporary Taxiway lighting. The salvaged equipment shall be delivered to the LAWA C&M as directed by the Engineer.

#### **68-1.4 Phasing**

All existing runway and taxiway lights not included in the construction phasing must be kept in operation, except as permitted otherwise by the Engineer.

The Contractor shall be responsible for troubleshooting and investigative work necessary to install completely operational temporary circuits. These shall be incidental to the other electrical work and no separate payment will be made.

The Contractor shall be responsible for installing, maintaining, and removing all required temporary light fixtures and jumper cables. The use of night floodlights is required for night work.

Contractor shall coordinate with the Airport Operations and Maintenance at the end of each work shift to ensure that all required airfield lighting circuits are operational. Contractor shall provide all labor and material for this work.

Contractor shall provide and maintain on hand sufficient equipment required to provide temporary circuit extensions. This includes, but is not limited to the following:

- A. 1000 LF of two-inch RGS conduit,
- B. 2000 LF L-824 cable and
- C. 100 L-823 connector kits.

These items will not be available from LAWA Maintenance.

#### **68-1.5 Interruptions And Temporary Circuits**



Interruptions of runway and taxiway lighting circuits may be necessary during construction. The Contractor may use salvaged cable to prepare a reliable jumper cable to provide temporary continuity of service to taxiway lights during construction where required. The Contractor shall not interrupt air traffic or perform any work that might endanger any airport operation until approval of the Director of Operations and the Airport's Engineer has been received.

From the permanent installation, all temporary connections and re-routing of circuits shall be replaced with new materials installed in accordance with specifications and as shown on the plans.

**NOTE:** The Contractor shall disconnect all circuit cables from their respective power sources in the vault before working on the cables in the field in coordination with the Airport electrician and the FAA. This work is incidental to the electrical work and no separate payment will be made.

#### **68-1.6 Removals**

The Contractor shall remove all existing cables, conduits, light fixtures, signs, sign foundations isolation transformers, base cans, duct banks, duct bank markers, pull boxes, manholes, and accessories from the areas shown on the removal plans, and as directed by the Engineer. The Contractor shall exercise due care to remove existing light fixtures and transformers, and shall protect the light bases which are to remain free from damage and in good working order.

The Contractor shall core into existing manholes, pullboxes and light cans as required to make conduit connections. Lights installed in or removed from existing PCC pavement shall require a 24" diameter core. At locations where cores will be made in existing PCC pavement and new fixtures not installed the contractor shall backfill void with PCC.

Cables, conduits, ducts, and light bases to be removed shall be disposed of legally, off Airport property, as described in Section 14 of these specifications. All debris shall be removed off Airport property.

All light fixtures airfield signs and isolation transformers, power transformers which are not to be reinstalled, shall be delivered to the Airport Maintenance Yard at 7411 World Way West. Cables, conduits, ducts, and light bases removed shall be disposed of off Airport property as described in Section 14 of these specifications. Lighting fixtures including bases shall be cleaned of all epoxy sealing material, pavement, dirt, etc. by sandblasting if necessary prior to delivery to LAWA. Transformers shall be cleared loose of dirt prior to delivery.

#### **68-1.7 Maintenance During Construction**



Contractor shall maintain all systems and equipment provided under contract from startup of system or equipment to Final Acceptance. The maintenance activity shall include the recommendation of the manufacturers for maintenance of systems and equipment.

### **68-1.8 Drawings**

The drawings, which constitute an integral part of this Contract, are diagrammatic in nature. They indicate the extent and general layout of the lighting system, arrangement of circuits, cables through ducts, connections to existing circuit cables and other work near the construction area. Field verification of scale dimensions is required to determine actual locations, distances, and levels. No extra compensation will be allowed because of differences between work shown on the drawings and as in the field. The Contractor shall check the plans and specifications and, if any portion of the work is found to be omitted, unclear, or in error, the Contractor shall immediately notify the Engineer. The directions of the Engineer shall be followed and the work completed accordingly.

The design drawings may be utilized in the preparation of the shop drawings showing the permanent construction as actually made.

The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.

Where a disagreement exists between the plans and specifications, the item or arrangements of better quality, greater quantity, or higher cost shall be included in the base bid.

Any discrepancies between the drawing, Advisory Circulars, and field condition must be resolved with the Engineer before bidding the job. All agreements shall be verified in writing.

The responsibility for the correct and satisfactory installation and operation of all materials and equipment required herein shall rest with the Contractor. Before any equipment is ordered or commencement of installation of lighting installations and electrical systems, a complete schedule of materials and detailed shop drawings covering all items of equipment and brochures of the lighting fixtures and signs proposed for installation shall be submitted for approval by the Engineer. The schedule of materials and shop drawings shall initially include five sets of catalog cuts; diagrams, drawings, brochures, or other such descriptive data as may be required by the Engineer. No equipment shall be ordered or put into manufacture until these shop drawings or brochures have been approved by the Engineer. Samples of conduit, duct, fittings, cables, splices, tapes, fixtures, etc., shall be required for approval. After they have been approved, samples will be returned in tested condition to the Contractor. In the event any items of material or equipment contained in the schedule fail to comply with specification requirements, such items will be rejected, and shall be returned to the contractor.

### **68-1.9 Site Conditions**





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This subsection as written in the Standard Specifications will apply under the contract.

**68-1.10 Codes**

The Contractor shall comply with all ordinances, laws, regulations, and codes applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations, and codes.

Regular inspections shall be requested by the Contractor as required by any and all regulations. All charges for the inspection called for by the regulating agencies of installation or plans and specifications shall be arranged and shall be paid by the Contractor.

**68-1.11 Maintenance and Operating Instructions**

The Contractor shall provide the Airport's Engineer with complete instructions in the proper care and operation of the equipment installed under this contract. This is considered as part of the final inspection, and final acceptance will not be given until these instructions have been delivered.

**68-1.12 Maintenance and Operating Manual**

The Contractor shall collect and assemble ten (10) hardcover books containing the installation details, repair and operation instructions, schematics of actual equipment and operations, and directions supplied by the manufacturer with all equipment. Three copies of the draft maintenance and operating manuals shall be submitted to the Engineer for review and comments. Final acceptance of the work will be withheld until such data has been presented complete to the Engineer.

**68-1.13 As-Built Drawings**

The Contractor shall mark up one set of black line prints to show the as-built conditions, which differ from the original, including any existing utilities discovered during the course of the work. The Engineer will furnish a newly printed set of black line drawings for this purpose. As-builts shall be revised daily and initialed off by Contractor and Engineers' inspector weekly. There shall be sufficient detail, including station numbers, conduits/duct bank routing, actual location of electrical equipment markers, panel circuit numbers, etc., to allow for easy location and correction of drawings. This work shall be completed and accepted by the Engineer before approval of final payment.

**68-1.14 Spare parts for Airfield Lighting and Signage System**



The contractor shall furnish 5% spare parts to LAWA C&M at the end of the constructions. The spare parts for the light fixtures, signs and obstructions lights as specified on lighting fixture schedule shall include but not limited to the following:

- A. Lamps of all sizes and types.
- B. Lamp holders/sockets of all sizes and types.
- C. Gaskets, seals and O-rings for all light fixtures and signs.
- D. Reflectors for all light fixtures.
- E. Lens replacement kits for all light fixtures.
- F. LED power supply units for taxiway light fixtures.
- G. Heat sink assembly with LED for taxiway light fixtures.
- H. Isolation transformers of all types and sizes.
- I. Breakable couplings for elevated airfield light fixtures.

The contractor shall submit a schedule of spare parts for airfield lighting to the Engineer for review and comments.

The contractor shall submit a schedule of airfield lighting to the Engineer for review and comments.

#### **68-1.15 Installation Methods**

The method used for the installation of electrical system and equipment shall conform to the National Electrical Contractors Association (NECA) published "Standard of Installation," except where specifically specified or shown otherwise, and to any state and local codes.

All electrical materials, construction methods, and installation shall be in accordance with applicable Federal Aviation Administration's Advisory Circulars, the latest editions, including amendments, of the City of Los Angeles Electrical Code, and the American National Standards Institute Standard C2.

All ferrous metal work shall be galvanized. If any galvanizing is damaged, the metal work shall be refinished by cleaning, treating with one coat of wash primer conforming to Federal (military) specification MIL-P-152388, and shall be given one shop coat of zinc-rich base paint



(zinc duct paint) conforming to Federal specification TT-P-641F Type II immediately when the wash primer is dry.

In order to prevent deterioration due to corrosion, all bolts, nuts, studs, washers, pins, terminals, springs, hangers, and similar fastenings, and fittings shall be, where practicable, of an approved corrosion-resisting material such as stainless steel, brass, or bronze, or of a material treated in a proved manner to render in adequately resistant to corrosion. Hot-dip galvanizing per ASTM Specification A153 will be considered such approved treatment for all ferrous hardware. Cap screws, setscrews, and tap bolts shall be of stainless steel, brass or bronze.

For grounding of all new devices, Contractor shall maintain electrical continuity throughout the system, by using the metallic conduits, threaded metallic couplings, bonding jumpers, and ground conductors in PVC conduits.

#### **68-1.16 Quality Assurances**

**A. Workmanship.** Workmanship shall be of consistent with the best commercial practices for installation of this type.

**B. Materials.** Materials and equipment shall be UL and/or FAA approved as specified herein. When material are used that are not specifically designate herein, they shall be in accordance with the best industry standards and practices for equipment of this type. All components and parts shall be suitable for operation under the environmental conditions specified herein. Metal parts shall be either inherently corrosion-resistant or shall be suitably protected to resist corrosion or oxidation during extended service life.

**C. Parts Rating.** All parts shall be of adequate rating for the application and shall not operate above the parts manufacturers recommended ratings.

**D. Environmental Conditions.** The equipment **installed in vault** and outdoors shall be designated for continuous outdoors operation under the following environmental conditions:

- (1) Temperature: Any ambient temperature from minus 20°F to plus 120°F.
- (2) Altitude: 800 Ft above MSL.
- (3) Humidity: Up to 100 percent.
- (4) Sand and Dust: Exposure to windblown sand and dust particles.
- (5) Wind: Operation at wind velocities up to 200 miles per hour.



(6) Water: Components provided for underground installation, or installed in underground housing, shall be suitable for continuous operation submerged in water.

#### **68-1.17 Testing**

The Contractor shall furnish all materials, labor, equipment and appliances necessary to test all contractor furnished equipment and the completed cable systems. A "Burn" test will be required for the lights. It shall be the Contractor's responsibility to demonstrate to the satisfaction of the Engineer that the lighting circuits are continuous and free from short and open circuits and unspecified grounds, that the circuits are properly connected, that the circuits are operable and automatic, and the resistance to ground of each non-grounded conductor is less than 50 megohms. All cables shall be tested in accordance with the requirements of Section 55 of these Specifications.

#### **68-1.18 Inspection**

At the completion of the electrical work, the Contractor shall secure approval from the FAA, Engineer and Owner for final payment.

#### **68-1.19 Safety Procedures for Working on airport Lighting System**

The Contractor shall follow the safety procedures set by Los Angeles International Airport for working on the airfield power and lighting as specified below:

##### **A. Procedures for Taking Circuits out of Service**

- (1) Contractor shall notify the Inspector which circuits are to be taken out of service and the specified portions to be worked on.
- (2) Inspector shall notify Operations, who will notify the Tower, to verify that the circuits can be removed from the Tower control.
  - a. If the Tower relinquishes control, Operation will notify the Airport electrician.
  - b. If the Tower does not relinquish control, no work can be done on the circuits at this time. (With the Tower in control, the circuits can be energized at any time.)
- (3) If the Tower relinquishes control, the Airport electrician and the Contractor's electrician **will proceed to the vault** where the regulator will be taken out of service by the Airport electrician and tagged by the contractor's electrician.
- (4) **The Airport electrician will log – time, circuits and Contractor – into the vault log.**



(5) After shutdown, the Contractor shall field test the circuits to verify that they are not energized before starting work on the circuits in the field.

**B. Procedures for Placing Circuits Back in Service**

(1) The Contractor will notify the Inspector when circuits are ready to be tested.

(2) The Inspector will contact all other inspectors who are working with the Contractor's electricians and notify them that the lighting circuits are about to be energized. When it has been verified that all personnel are clear, the Inspector will call Operations requesting a "burn".

(3) Operations will notify the Airport electrician. The Airport Electrician and contractor's electrician will meet at the vault, where the contractor's electrician will remove its tag. The Airport electrician will then energize the circuits.

a. If all lights are operating, control of the lights will be given back to the tower.

b. If all the lights are not operating, the Airport electrician will work with the contractor's electrician to rectify the problem.

**68-2 AIRPORT LIGHTING SYSTEM**

**68-2.1 General**

This item consists of airport lighting systems furnished and installed in accordance with this specification, the reference specifications and the applicable advisory circulars. The systems shall be installed at the general locations and in accordance with the dimensions, design, and details shown in the plans. This item includes the furnishing of all equipment, material, services, and incidentals necessary to place the system in operation as completed units.

Additional details pertaining to a specific system covered in this item are contained in the following Advisory Circulars. Advisory Circulars carry an alpha character at the end of the number to designate editions. In this specification, and in the drawings, the intent has been to list only the number of the Advisory Circular - the latest version of that document controlling. Should an older version of the document be listed, and there exists a later edition (150/5345-47B instead of 150/5345-47A, for example), the later edition shall govern. The Contractor shall have a copy of the latest edition of these in his files:

**[ADD / DELETE / UPDATE AS APPROPRIATE]**

**A. FAA A C 150/5340-18: Standard for Airport Sign Systems.**



- B. FAA AC 150/5340-30: Design and Installation Details for Airport Visual Aids.
- C. FAA AC 150/5345-7: Specifications for L-824, Underground Electrical Cables for Airport Lighting Circuits.
- D. FAA AC 150/5345-26: Specifications for L-823, Plug and Receptacle, Cable Connectors.
- E. FAA AC 150/5345-42: Specifications for Airport Light Bases, Transformer Houses, Junction Boxes and Accessories.
- F. FAA AC 150/5345-44: Specifications for Taxiway and Runway Signs.
- G. FAA AC 150/5345-46: Specifications for Runway and Taxiway Light Fixtures Including FAA LED requirements, Document -2001.
- H. FAA AC 150/5345-47: Isolation Transformer for Airport Lighting Systems.
- I. FAA AC 150/5345-2: Standards for In-Pavement Runway Guard Lights
- J. [OTHER]

Codes and Regulations applicable to the project include, but are not limited to:

- A. FAA Advisory Circulars
- B. National Electrical Code (NEC)
- C. City of Los Angeles, Building Safety Code (Electrical)
- D. Underwriters Laboratories (UL) Listing requirements for Airfield Lighting products.

## 68-2.2 Equipment and Materials

### A. General

(1) Airport lighting equipment and materials covered by FAA specification shall have the prior approval of the Federal Aviation Administration, Airports Service, Washing, D.C. 20591, and shall be listed in Advisory Circular 150/5345-53, Approved Airport Lighting Equipment.



(2) All other equipment and material covered by other referenced Specifications shall be subject to acceptance through the manufacturer's certification of compliance with the applicable specifications.

(3) List of the equipment and materials required for a particular system are contained in the applicable advisory circulars.

**B. Tape**

Rubber and plastic Electrical tapes shall be Scotch Electrical Tapes – number Scotch 88 (1-1/2" wide) and Scotch 130C linerless rubber splicing tape (2" wide), as manufactured by the Minnesota Mining and Manufacturing Company, or approved equivalent.

**C. Concrete**

Concrete shall conform to the requirements of Section 54 of these Specifications.

**D. Colored Filters**

Colored filters or colored lenses to be used for runway and taxiway Lights shall conform to the requirements of Military Specification MIL-C-25050 Type I.

**E. Squeeze Connectors**

Squeeze connectors, shall be equal to Crouse-Hinds Company, Type CGB cable connector with neoprene rubber bushing, or approved equal.

**F. Lamps**

All lamps installed in existing units shall be new. Lamps shall be of size and type to provide the distributions and minimum output requirements of isocandela curves shown for each size in AC 150/5345-46.

**G. Isolating Transformers**

Isolating transformers installed in all units shall be new L-830 conforming to requirements of Advisory Circular 150/5345-47, Isolating Transformers for Airport Lighting Systems.

**H. Airfield Light Fixture Identification**

All new airfield light shall be identified with new Painted identification/circuit numbers as indicated on the plans. Painted numbers shall be 4" high applied with stencils, black in color. Background shall be white, 6" high, of length required for identification/circuit numbers.



Location of painted ID numbers for elevated fixtures shall be immediately adjacent to the fixtures. Location of painted ID numbers for runway and centerline fixtures shall be 2 feet away from the painted edge stripe. On East/west direction runways and taxiways, locate the stencil on the north side. On north/south or angled runways or taxiways, locate the stencil on the west side. At intersections where centerline fixtures occur, place the stencil adjacent to the fixture as directed by the Engineer.

**I. Identification Number Plates**

The identification number plates for all lights shall be non-corrosive metal disc of 2-inch minimum diameter, with numbers permanently stamped with steel dies or cut out, installed on the cable, inside of the light bases. The identification tag shall contain the ID/Circuit Number corresponding to the indications shown on the plans.

**68-2.3 CONSTRUCTION METHODS**

**A. General**

The installation and testing to be performed under this item shall be as specified in AC 150/5340-30 and other applicable advisory circulars. Light fixtures with Light Emitting Diode (LED) technology shall be certified to meet the most recent publication of the FAA Advisory Circular 150/5345-46 including any relevant addendums. All lighting products shall have warrantee for workmanship and photometric performance for a minimum of five (5) years.

**B. Light Placement**

The light fixtures shall be installed at the location and in conformance with the details shown on the plans. The exact location shall never be closer than 2'-6" on center to a joint. Each light fixture in all lines of light shall be positioned with use of survey instruments as it is being installed so as to ensure that all lights are in straight alignments. All lines upon completion shall be true to line and uniform as judged by the Engineer.

**C. Airfield Lighting Fixtures**

Airfield lighting fixtures shall conform to FAA specification for the particular type and application of the lights. The light fixtures shall be as shown in the light fixtures schedules in the drawings.

**D.** The installation and testing details for the system shall be as specified in the FAA Advisory Circular AC 150/5340-30.

**E. Orientation of Light Beam for Taxiway Centerline Lights**





Taxiway centerline lights should be oriented as follows with a horizontal tolerance of plus or minus 1 degree.

- (1) On Straight Segments: On all straight portions of taxiway Centerlines, the axis of the light beam should be parallel to the Centerline of the taxiing path.
- (2) On Curved Portions (Excluding High Speed Exit Taxiways with Standard Fillets): Orient the axes of the two beams of bidirectional lights parallel to the tangent of the nearest point of the curve designated as the true centerline of the taxiway path. Orient the axis of the un-directional light beam so that it is “toe-in” to intersect the centerline at a point approximately equal to four times the spacing of lights on the curved portion. Measure this spacing along the chord of the curve.
- (3) High speed Exit Taxiways: Orient the axis of a unidirectional Light beam so that it is “toed-in” to intersect the centerline at a point approximately equal to four times the spacing of the lights on the curved portion. Measures this spacing along the chord of the curve. Orient the Axis of the two beams of bidirectional lights parallel to the tangent of the nearest point of the curve designated as the true centerline of the taxiing path with a tolerance of plus or minus one-half a degree.

#### **68-2.4 Lighted Guidance Signs**

##### **A. General**

Signs shall be “Lumacurve” with low voltage quart lamps, to match existing airfield signs, or approved equal. In specific locations as indicated in the drawings, Crouse-Hinds blast-proof signs with fluorescent lamps shall be used. Internally lighted guidance signs for series circuits shall be furnished and installed in accordance with this specification and with the dimensions, locations, and details as shown on the plans. This work includes furnishing and installing filters, transformers, base cans, mounting assemblies, including base plate and mounting flanges and concrete footing. Also included are all cable connections, all lamps, testing of the installations, and all incidentals necessary to place these signs in operation as completed units.

##### **B. Sign Construction**

- (1) The signs shall be constructed of lightweight, nonferrous materials. Mounting hardware and fasteners may be ferrous if adequately protected from corrosion. The signs shall meet the current FAA standards for frangibility. All signs shall be designed for installation on a concrete pad, and all required mounting hardware shall be supplied with the sign. The signs shall be as light as possible.
- (2) Airfield Sign Volt-Ampere (VA) shall not exceed the maximum VA specified. Lights shall work from variable constant current source (2.8A to 6.6A). All signs connected to 5



step (High Intensity System) or to 3 step (Medium Intensity System) regulators, must maintain full brightness throughout all steps. All signs shall be provided with externally mounted (on the unit) on/off power switch, which on “off” position should short the secondary of the transformer. The switch shall be “Make before break” type.

(3) The signs shall be single or double face, as indicated on the plans. Single face and double face signs shall have identical construction, except that the single face signs shall only have one side visible to pilot reading and the other side shall be blanked off. This is done so at a later date the single face signs may easily be used as double face signs.

(4) The signs shall be 1, 2, 3, or 4-modules in length as indicated in the Sign Legend Table. The 1 and 2-module signs shall be supported by 4 legs and the 3 and 4-module signs shall be supported by 8 legs, as shown on details.

(5) All signs shall be provided with the proper power cord and plug, and two restraining tethers. Each sign shall be equipped with a ground lug. The ground cable shall be able to break away when the sign falls down.

(6) Signs shall be of modular construction; 1, 2 and 3 module signs must be designed and constructed so that additional modules may be used to add additional characters without replacing the entire sign, and, characters may be removed by adding a blanking panel without replacing the entire legend. Sign faces shall be curved in shape and made of acrylic plastic; single face panels shall not exceed 42” in length to allow safe removal and replacement of panels by a single workman.

**C. Wind Loading**

Signs shall be designed and manufactured in accordance with The FAA-requirements for wind load and fragility as set in FAA Advisory Circular 150/5345-44, latest edition.

**D. Isolation Transformers**

Isolation transformers shall conform to FAA Specification L-830, AC 150/5345-47 “Isolation Transformers for Airport Lighting Systems.”

**E. Transformer Bases**

Transformer bases shall conform to FAA Specification L-867 and L-868, AC 150/5345-42 “Specification for Airport Light Bases, Transformer Houses, Junction Boxes and Accessories.”

**F. Sign Placement**

Install signs at the locations shown on the plans.



### **G. Concrete Pads**

Concrete pads shall be constructed to the dimensions as detailed on the drawings. Exposed concrete surface shall be finished smooth with a street trowel or rubbed to a smooth finish. All horizontal edges shall be chamfered  $\frac{3}{4}$  inch at 45 degrees. Install a minimum of one transformer base in each concrete pad. Place anchor bolts for additional flange supports in concrete pad in correct position.

### **H. Nameplate**

Each sign shall have a nameplate giving the sign name and number as shown on the plans, Type, Size, Style, Class, manufacturer's name, address, catalog number, and the total load and power factor of the sign, including required adapter units.

### **I. Leveling**

During construction of pad, transformer base shall be adjusted and firmly held in place so that the machined upper surface of the base flange will be level within 2 degrees and shall not protrude above the surface of pad. All other bearing areas for additional flange supports shall be in the same horizontal plane as transformer base flange.

### **J. Identification Tags**

Tags shall consist of a copper metal disc of 2 inches minimum diameter, with numbers permanently stamped. Attach to sign housing with two sheet metal screws.

### **K. Cable Entrance**

Seal cable entrance to the base (or to conduit or tee leading into the base) by squeeze connectors. Use galvanized conduit reducers where required. Provide squeeze connectors with a rubber bushing of correct size to fit outside diameter of cable. Tighten connectors sufficiently to provide a watertight seal without deforming insulation and sheath of cable.

### **L. Cable Connection**

In making cable connections to airfield signs, pull underground supply cable into each light base, leaving 5'-0" slack cable inside the base to permit all connections to be made above ground. Cable connections to be made to the transformer or fixture by the following method.

- (1) Plug the transformer primary lead connectors directly into matching connectors of field-attached or factory-molded, plug-in splices on the supply cables. Attach splices to supply cables as specified in section on underground cable.



(2) Wrap joint where transformer mating connectors come together with at least two layers of plastic tape, one-half lapped, extending at least 1 ½ inches beyond each end of connector.

### **M. Assembling Unit**

Assemble signs and connect in accordance with manufacturer's Installation instructions. Connect transformer secondary leads to fixture leads by means of a disconnecting plug and receptacle and do not tape connection. Install lamps of proper rating in the fixture.

### **N. Special Electrical Filters**

Existing airport light system control and monitoring system (ALCMS) is Digitrac/Logitrac as manufactured by Crouse-Hinds Airfield Lighting Products. Special filters are required in the sign unit base cans for the monitoring and control system to operate trouble free. Contractor shall coordinate with Crouse-Hinds to obtain technical data and filter units that are required.

### **O. Testing**

After installation of the signs, the current to the lamps shall be checked with a true RMS ammeter. The current shall be adjusted to the value recommended by the manufacturer. Fully test installation by continuous operation for a period of not less than ½ hour as completed until prior to acceptance. These tests shall include functioning of each control not less than ten times. Test completed circuit in accordance with applicable provisions of section specifying underground cable.

## **68-3 ELECTRICAL POWER WORK**

### **68-3.1 Product Delivery, Storage and Handling**

Provide factory-wrapped water-proof flexible barrier material for covering wire and cable on wood reels, where applicable; and weather resistant fiberboard containers for factory-packaging of cable, wire and connectors; remove from project site.

Store cables and connectors in factory-installed covering in a clean, dry indoor space, which provides protection against the weather.

### **68-3.2 Grounding.**

Furnish labor and materials to provide grounding facilities for the entire electrical installation as required by all inspecting and jurisdictional authorities as herein specified. Grounding system components shall be UL approved and the installation shall conform to the NEC.



**A. Inspection**

Installer must examine the areas and conditions under which conduit and fittings are to be installed and notify the Contractor in writing of conditions detrimental unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

**B. Installation**

Install conduit and fittings as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of the NEC and the National Electrical Contractors Association's "Standard of Installation" and in accordance with recognized industry practices to ensure that products service the intended functions.

All new conduit **installed in Vaults** and Electrical Equipment Rooms shall be rigid, hot-dip steel meeting requirements of ANSI C80 and UL6.

Conduit shall be run at right-angles or parallel to walls and ceilings.

Grounding shall include but not limited to the following:

- (1) Electrical service neutral conductor.
- (2) Neutral conductor of all transformer secondaries.
- (3) Conduits, boxes and other conductor enclosures. Neutral or identified conductor of interior wiring system.
- (4) Distribution panels, power and lighting panelboards.
- (5) Non-current-carrying parts of fixed equipment, such as transformers, motors, starter, control cabinets, disconnects, lighting fixtures, stand-by generator, telephone cabinets, and auxiliary systems cabinets, etc..
- (6) Manholes, pullboxes, and hand holes.
- (7) Electrical service neutral conductor.
- (8) Neutral conductor of all secondary for all transformers.
- (9) Conduits, boxes and other conductor enclosures. Neutral or identified conductor of interior wiring system.
- (10) Distribution panels, power and lighting panel boards.



(11) Non-current-carrying parts of fixed equipment, such as transformers, motors, starter, control cabinets, disconnects, lighting fixtures, stand-by generator, telephone cabinets, and auxiliary systems cabinets, etc..

(12) Conduit Grounding: All grounding bushings with all enclosures including equipment enclosures, shall be wired together and connected internally to the enclosure Grounding conductors sized in accordance with NEC shall be used with all grounding bushings.

(13) Equipment Grounding: All electrical equipment shall be grounded. Large Equipment such as metal-clad or metal-enclosed panel will be furnished with a grounding bus. Most other equipment will be furnished with grounding pads or grounding lugs. All ground connections shall be cleaned immediately prior to connection. Contractor shall provide all grounding material required but not furnished with the equipment. No grounding conductor shall be smaller in size than 12 AWG unless it is a part of an acceptable cable assembly.

### **68-3.3 Dry Type Power Transformer**

Dry type power transformers shall be NEMA 3R, weatherproof type, enclosed and ventilated. Transformer shall be designed constructed and rated in accordance with UL, NEMA, ANSI, IEEE and OSHA standards. The ratings shall be as indicated in the plans. The transformers shall have a 220 degrees Celsius insulation system and be designed not to exceed 115 degrees Celsius temperature rise above a 40 degree Celsius ambient under full load conditions. In addition, the transformer shall have the ability to carry a continuous 15% overload without exceeding a 150 degree Celsius rises above ambient.

Two 2.5% above normal full capacity and two 2.5% below normal full capacity primary taps shall be provided.

Transformer enclosure finish shall be ASA 61 gray powder polyurethane paint. Transformer enclosure temperature shall not exceed 50 degrees C plus the ambient under any condition of loading at any specified temperature rise at or below 150 degrees C.

Transformer enclosure shall be UL/NEMA Type 2 and UL 3R Listed with the addition of weather shield and shall be so marked on the transformer.

Transformer must operate at and audible sound levels below NEMA standard ST-20.

Copper termination bus bars or lugs shall be provided for all terminations.

Complete shop drawings and typical performance test data shall be submitted to the Engineer for approval. Factory tests shall conform with ANSI Test Code C57.12.91.



#### 68-3.4 Surge Arrester

Surge Arrester shall be UL listed and conforming to ANSI/IEEE C.62. The rating shall be as indicated in the plans.

#### 68-3.5 Fused Disconnect Switches

Fused disconnect switches shall be heavy duty type with quick-make, quick-break operating mechanism, dual cover interlock and color coded indicator handle.

Heavy duty fused disconnect switches shall be UL listed and conform to NEMA standard KS1. Fused disconnect switches shall have NEMA 3R enclosures.

#### 68-3.6 Medium Voltage Power Cables

Medium voltage power cable shall be Ethylene-Propylene-Rubber insulated (EPR) with PVC jacket. Cables shall be single conductor 5kV nominal rated, consisting of Class B stranded copper conductors, and extruded semi-conducting shield over the conductor, ethylene propylene rubber insulation, an extruded semi-conducting shield with copper tape shield wrapped helically with minimum 12.5 percent overlap and a PVC jacket.

EPR cable shall conform to NEMA WC8 and UL listed.

Manufacturer's instructions shall be provided showing recommended sequence and method of installation and termination of medium voltage power cables.

Personnel performing termination and splices shall have at least 3 years experience in cable termination. Engineer my request proof of experience of cable terminators.

Field testing of cable, termination and splices shall be performed by the Contractor in accordance with NEMA WC 5 and NETA standards.

#### 68-4 METHOD OF MEASUREMENT

The quantity of **[signs,] [temporary panels for the designated signs,] [lights,] [temporary fixtures][L-868 cans with 3/4" steel cover][other]** complete with transformer housing, isolation transformer, concrete foundation, and other bid items to be paid for under this item shall be the number of each type **[signs,] [lights,][base cans,]** or other items installed as complete units in place, ready for operation, and accepted by the Engineer. This price shall be full compensation for furnishing all material and for all preparation, assembly, and installation of these materials, and for all labor, supervision, equipment, tools, and incidentals necessary to complete this item.



“Standing Red” barricade lights will be measured for payment as lump sum items which shall include all costs for fixtures, cable, conduit, sandbags, relocating as needed, including connecting, disconnecting, and all incidentals necessary for providing and maintaining standing red barricade lighting throughout the project duration to the satisfaction of the Engineer.

Temporary circuits and fixtures will be measured for payment as lump sum items which shall include all costs for fixtures, cable, conduit, sandbags, relocating as needed, including connecting, disconnecting, and all incidentals necessary for providing and maintaining standing temporary lighting throughout the project duration to the satisfaction of the Engineer.

All vault and electrical equipment room work as shown on the plans shall be measured as a lump sum item for a completed installation as shown on the plans and approved by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, labor, supervision, equipment, tools, and incidentals necessary to complete this item.

Relocation of [ ] shall be measured for payment as a lump sum item, which shall include field measurement, mounting bolts, concrete pad, coordination with FAA, and all other incidental items necessary to provide a functional facility in the relocated position.

The investigation of unknown cables shall be measured as a lump sum and shall be paid and prorated out of an allowance, stipulated in the “ Schedule of Work and Prices” as a part of the Bid Package. Contractor shall furnish actual material and man-hours expended in this item of work for payment up to the allowance amount.

Removals shall be measured as a single lump sum item, including demolition, removal, legal disposal off the airport, and cleanup.

#### 68-5 BASIS OF PAYMENT

Payment will be made at the contract unit for each complete [sign,] [temporary panel for the designated signs,] [light,] [temporary fixture][L-868 can with ¾” steel cover][other] of the type and size indicated, installed in place by the contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools, testing, maintenance and incidentals necessary to complete this item.

Payment will be made at the contract lump sum price for “Standing Red” barricade lights. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.





Payment will be made at the contract lump sum price for temporary circuits and fixtures barricade lights. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.

Payment will be made at the contract lump sum price for temporary circuits and fixtures barricade lights. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.

Payment for electrical power work in vaults, electrical equipment rooms and site will be made at the contract lump sum price for all work, including providing and installing power transformers, disconnect switches and power cables. No separate payment will be made equipment concrete pads, grounding system, connections and testing. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor equipment, supervision, tools and incidentals necessary to complete this item.

Payment will be made at the contract lump sum price for relocation of [ ]. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.

The investigation of unknown cables shall be measured as a lump sum and shall be paid and prorated out of an allowance, stipulated in the "Schedule of Work and Prices" as a part of the Bid Package. Contractor shall furnish actual material and man-hours expended in this item of work for payment up to the allowance amount.

Payment for all removals shall be made at the contract lump sum price for all work necessary to complete the removals as shown on the plans. This price shall be full compensation for all demolition, removals, disposal and cleanup, and for all labor, equipment, supervision, tools and incidentals necessary to complete this item.

No separate payment shall be made for reconnecting, re-tagging and re-identifying markings of the existing circuits to match revised airfield lighting circuitry, which should be considered as incidental to airfield lighting work.

No additional payment will be made for difficulties encountered when accomplishing work required by this section of the specifications in areas of night construction, or in other areas subject to constructions phasing restrictions.

Payment will be made under:



- Item 68.1 Sign [1]2][3][4]-module, size [3][4] , [single][double] face ..... per each
- Item 68.2 Temporary Sign [1]2][3][4]-module, size [3][4] , [single][double] faceper each
- Item 68.3 [In- Pavement][Elevated][runway][taxiway][centerline][edge][guard] [other] light with base can, and isolation transformer in [new][existing] [PCC][AC] pavement ..... per each
- Item 68.4 “Standing Red” barricade lights ..... per lump sum
- Item 68.5 Temporary Lighting ..... per lump sum
- Item 68.6 Electrical power work at [ ] ..... per lump sum
- Item 68.7 Relocate [ ] ..... per lump sum
- Item 68.8 Investigation of unknown cables .....per allowance
- Item 68.9 Removal of electrical items ..... per lump sum
- Item 68.10 [Other] ..... per [each][lump sum][allowance]

END OF SECTION 68



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