Federal Aviation Agency

ADVISORY CIRCULAR

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	AIRPORTS
EFFECTIVE:	8/4/66

SUBJECT: INSTALLATION DETAILS FOR RUNWAY CENTERLINE AND TOUCHDOWN ZONE LIGHTING SYSTEMS

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1. PURPOSE. This advisory circular describes standards for the design and installation of runway centerline and touchdown zone lighting systems. These standards are acceptable for Federal-aid Airport Program projects. Maintenance recommendations are also included.

2. CANCELLATION. AC 150/5340-4, Installation Details for In-Runway Lighting, dated January 27, 1964, and Change No. 1 dated April 23, 1964, are cancelled.

3. REFERENCES. The publications listed under the Bibliography, Appendix 1, are applicable to this advisory circular.

4. EXPLANATION OF REVISIONS. In addition to minor changes in the text and figures, the following changes have been made:

   a. The design and installation instructions were revised to include details for fixtures to be used in the runway centerline with at least a 2000 candlepower output in lieu of fixtures having considerably lower candlepower output.

   b. The longitudinal spacing of the runway centerline light fixtures was changed from 25-foot intervals to 50-foot intervals.

   c. Requirements for taxiway turnoff lights were deleted pending the results of additional evaluation and study relative to configuration, color coding, and lighting equipment.

   d. The size of all pavement saw kerfs was increased.

5. HOW TO GET THIS CIRCULAR. Obtain copies of this circular, AC 150/5340-4A, Installation Details for Runway Centerline and Touchdown Zone Lighting Systems, from the Federal Aviation Agency, **Distribution Unit, HQ-438.** Washington, D.C. 20553.

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1. INTRODUCTION. The runway centerline and touchdown zone (narrow gauge) lighting systems are designed to facilitate landings, rollouts, and takeoffs under adverse day and night visibility conditions. The touchdown zone lights are primarily a landing aid. The centerline lights are most effective for rollout and takeoff.

2. BACKGROUND.

   a. General. In the interest of safety, regularity, and efficiency of aircraft operations, these lighting systems were developed to be used in conjunction with electronic precision approach aids and the standard approach lighting systems under limited visibility conditions.

   b. Fixture Requirements.

      (1) Light fixtures with a light output of 300 candlepower or less were used in the original runway centerline lighting installations. The need for lights brighter than 300 candlepower for operations in very low visibility conditions was presented and generally accepted at an April 7, 1965, Government/Industry Centerline Light Meeting held in Washington, D.C.

      (2) Flight tests and research have indicated that the brighter 2000 candlepower runway centerline fixtures can be spaced at 50-foot intervals in lieu of the 25-foot spacing required for the original 300 candlepower fixtures. The 50-foot spacing of the 2000 candlepower fixtures will provide adequate visual guidance on rollout and takeoff under all visibilities down to and including 700 feet RVR (CAT. III A). The ultimate operating limit for centerline lighting systems with fixtures that have an output of less than 2000 candlepower will be determined by the Agency.

      (3) Existing 300 candlepower centerline light systems will be used at gradually reduced minima until the limit of their operational capability is reached. Initially, the Agency will approve operations down to 1600 foot RVR day minima provided other factors meet criteria. Lower day minima will be evaluated by the Agency on an individual basis. The 300 candlepower fixtures should be adequate for night minima down to 1200 foot RVR conditions.

3. CONFIGURATION.

a. Runway Centerline Lighting. The runway centerline lighting system consists of single lights installed along the runway centerline in a straight line. The longitudinal spacing between light fixtures is 50 feet. The first centerline light is located 75 feet from the landing threshold. These lights extend to a similar point at the opposite end of the runway. The line of lights is offset laterally not in excess of 2 feet from the centerline when viewed from the landing threshold. If the major taxiway turnoffs are to the right of the runway, the runway centerline lights are offset to the left. Conversely, if these turnoffs are to the left of the runway, the reverse applies. The offset can also be used to avoid interference with rigid pavement joints which are frequently located on the runway centerline. Figure 1 is a layout drawing which shows fixture spacing and tolerances for the above dimensions.

b. Touchdown Zone Lighting.

(1) The runway touchdown zone lighting system has, in plan view, two rows of transverse light bars located symmetrically about the runway centerline. The system extends for a distance of 3000 feet along the runway. This is the basic length and it can be reduced to one-half of the runway length for those runways less than 6000 feet. The first pair of light bars should be located 100 feet from the landing threshold, followed by each succeeding pair at 100-foot intervals to the end of the system. The tolerances in Figure 2 can be used to prevent interference with joints in concrete pavement.

(2) The rows of transverse light bars are spaced equidistant from the runway centerline. The spacing or gauge between the innermost light fixtures is 60 feet. Each transverse light bar consists of three unidirectional lights at intervals of 5 feet measured center to center.

4. DESIGN.

a. General. A design drawing indicating the dimensional layout of the centerline and touchdown zone lighting systems should be made prior to construction. This drawing should be compared with the appropriate drawings to assure proper location of the wireways and placement of the equipment.

b. Runway Centerline Lighting.

(1) Light Fixtures and Wires. The light fixtures are designed for installation in rigid or flexible pavement. The pavement may be new or existing. For all types of pavement, the preferred method of installation is to provide holes or drilled recesses for the fixtures. Sawed wireways (saw kerfs) are provided in the pavement for No. 10 AWG wires. The wireways are from the edge of the runway to the light fixture drilled recess. The fixtures and wires are sealed in the pavement with sealer material. The number of light fixtures and quantity of wire required varies with the length of the runway.

(2) Electrical Power and Control.

(a) Electrical Power. The lighting system is designed for a 20.0-ampere series primary circuit. Each lamp load in the series circuit is supplied through a 20.0/6.6-ampere, 200-watt insulating transformer. Figure 5 may be used to estimate the total power requirements for a series circuit and the cable sizes.

(b) Electrical Control. Typical wiring details are shown in Figures 3 and 4 for AC and DC controlled systems. The DC controlled system is adequate for separations between the control panel and auxiliary relay cabinet up to 7900 feet. The maximum separation permissible with AC control can be calculated by determining the line loss between the control panel and regulator. The relay operating characteristics required for the calculations are contained in AC 150/5340-2.

1 AC Control Wires. The control wires between the AC 150/5345-3 remote control panel and the AC 150/5345-10A regulators terminals are No. 12, AWG wires.

2 DC Control Wires. All wires carrying DC energy between the remote control panel and the AC 150/5345-13 auxiliary relay cabinet or regulators are No. 19 AWG wires or larger.

3 Spare Wires. The control cable should have spare wires to permit the addition of new circuits after the initial installation. The spare wires may also be used for maintenance purposes.

(c) Special Consideration. The distance between the light fixture and its 200-watt insulating transformer should not exceed 370 feet. If it is not practical to stay within the 370-foot limitation, consideration should be given to using a 300-watt insulating transformer.

c. Touchdown Zone Lighting.

(1) Light Fixtures and Wires. The design of a touchdown zone lighting system may be for either of two conditions. One condition is when the installation is to be made in conjunction with the initial placement of pavement for a new runway or an extension. The other condition is when the installation is made in existing runway pavement. In the case of new pavements, it is possible to provide access to cables and transformers through the use of conduit and transformer bases in the pavement. In the case of existing pavements, it is not considered economically practicable to remove and replace existing pavement to install bases and conduit. Therefore, the wires are installed and sealed in shallow sawed wireways; and the fixture is sealed in pavement recesses or holes.

(2) Electrical Power. The touchdown zone lighting system is designed for a 20-ampere series primary circuit using a constant current regulator having an adequate kilowatt capacity. Each lamp load is supplied through a 20/6.6-ampere, 200-watt individual lamp insulating transformer. Figure 5 may be used to estimate total power requirement and primary cable size.

(3) Electrical Control. The touchdown zone lighting system has its controls independent of the centerline lighting system. Figures 3 and 4 indicate typical wiring details for AC and DC controlled systems.

5. EQUIPMENT AND MATERIAL.

a. General.

(1) Equipment and material covered by Federal Aviation Agency specifications are referred to by FAA Advisory Circular numbers.

(2) Distribution transformers, oil switches, cutouts, relays, terminal blocks, transfer relays, circuit breakers, and all other regularly used commercial items of electrical equipment not covered by FAA specifications conform to the applicable rulings and standards of the electrical industry.

b. Light Fixtures.

(1) Runway centerline light fixtures are in accordance with AC 150/5345-37A.

(2) Touchdown zone light fixtures are in accordance with the equipment specified below:

(a) AC 150/5345-16, Type A or Type B Unit.

(b) AC 150/5345-17, Type I Unit.

(c) AC 150/5345-19, Type III Unit.

c. Insulating Transformers. Insulating transformers conform to the requirements of AC 150/5345-33. The transformers serve as a means for isolating the light unit from the high voltage characteristics of the series circuit. In the event a lamp filament circuit becomes open, the continuity of the primary series circuit is maintained by the insulating transformer.

d. Light Base and Transformer Housing. The bases conform to the requirements of AC 150/5345-32. These bases serve as housings for centerline and touchdown zone lighting insulating transformers. The base consists essentially of a cylindrical body with top flange and cable entrance hubs. Requirements for an internal grounding lug, which may be optionally specified by the user, are included. This internal grounding lug is used where bases are interconnected with the duct and the ground wire is installed through the duct system. Certain applications may require additional entrance hubs. A gasket and suitable cover are required for off runway installation.

e. Regulator. The constant current regulator conforms to the requirements of AC 150/5345-10A. The regulator is designed for stepless brightness control without interrupting load current. The assembly has lightning arrestors, open circuit and overcurrent protective devices, and a local control switch. All parts are suitably enclosed for indoor or outdoor service. The equipment is wired at the factory as a complete assembly. Various sizes and ratings may be obtained in accordance with the specification.

f. Control Panel. The remote control panel conforms to the requirements of AC 150/5345-3. The panel consists of a top panel plate and a housing. In addition, it has toggle switches, terminal boards, and brightness control, as required. The number of components to be mounted on the panel are specified for each installation.

g. Auxiliary Relay Cabinet. The auxiliary relay cabinet assembly for 48-volt DC control conforms to the requirements of AC 150/5345-13. The assembly consists of an enclosure containing a DC power supply, control circuit protection, and 20 pilot relays.

h. Wire. The wire for use in wireways is No. 10 AWG, single conductor wire in accordance with AC 150/5345-30.

i. Cables.

(1) Primary Cable. The primary cable conforms to the requirements of AC 150/5345-7, Type B, and should be of the AWG size shown on the plans.

(2) Control Cable. Control cable containing No. 12 AWG wires conforms to the requirements of AC 150/5345-7. The control cable containing No. 19 AWG wires is in accordance with Rural Electrification Administration Bulletin 345-14.

j. Connectors. Connectors attached to the transformer primary and secondary leads and used to splice the primary cables conform to the requirements of AC 150/5345-26. Preinsulated connectors suitable for installation on wireways are used for splices to the centerline and touchdown zone inset fixture leads.

k. Tape. Plastic electrical insulating tape is the type specified in Item L-108 of AC 150/5370-1 with Change 1.

l. Conduit and Duct. Conduit for connecting the base mounted touchdown zone lights is 2-inch galvanized steel flexible conduit of standard manufacture with a suitable protective covering. All other conduits and ducts are as specified in Item L-110 of AC 150/5370-1 with Change 1.

m. Concrete. Concrete and reinforcing steel conform to the applicable provisions of Item P-501 of AC 150/5370-1 with Changes 1 and 2.

n. Sealer Materials. The materials specified in Item P-606 of AC 150/5370-1 with Change 1 are considered acceptable for the specific applications described herein. Other types of materials providing satisfactory adhesive and waterproofing qualities may be used upon the approval of the engineer in charge.

(1) Wireway Sealer. The wireways (saw kerfs) are sealed with a liquid type sealer in accordance with Item P-606 of AC 150/5370-1 with Change 1.

(2) Inset Fixture Sealer. The centerline and touchdown zone inset type light fixtures are sealed in place with a paste type sealer in accordance with Item P-606 of AC 150/5370-1 with Change 1.

(3) Joint Sealer. Joint sealing material per Item P-605 of AC 150/5370-1 with Change 1 is used only across rigid pavement joints.

6. INSTALLATION.

a. Runway Centerline Lighting.

(1) General. The installation procedure for centerline lights is the same for rigid or flexible pavements that are new or existing. Holes or recesses are drilled in all types of pavements to accommodate the light fixtures. Wireways are sawed in the pavements to accommodate electrical circuits. Typical installation details are shown in Figures 6, 7, and 11.

(2) Pavement Drilling and Sawing. The fixture recesses and wireways are drilled and sawed, respectively, into the pavement surface at the locations shown on the plans. Standard sawing and coring equipment normally used on pavements may not be adaptable. The type coring or sawing equipment for a particular pavement should be in accordance with the equipment manufacturer's recommendations. The alignment of the drilled holes in a longitudinal direction should not vary from an established line more than 1/4 inch. Extra depth and special treatment are required where wireways cross rigid pavement joints. The extra depth and special treatment are in accordance with the appropriate plans.

(3) Light Fixtures.

(a) General.

1 A plywood cover is furnished with each base receptacle to protect the surface of the machine flange of the base. The cover is to be used in lieu of the top fitting during the installation of the base.

2 Prior to placing the receptacle in the drilled hole, all external surfaces of the receptacle are cleaned (sand-blasting may be necessary) to assure an adequate bond between fixture and sealer. The fixtures should not be handled by the lead wires. The arrow provided on the upper surface of the base receptacle should be used to obtain proper alignment of the base. The arrow in the base receptacle should be aligned parallel with the runway centerline. A one-degree deviation of the arrow from the line parallel with the runway centerline is an acceptable installation tolerance. The fixture lead wires are properly arranged with respect to their splicing position in the wireway. It may be necessary to place temporary plugs for blocking the wireway entrance into the drilled hole or recess. The plugs will retain the sealer during the setting of the receptacle.

3 The bottom of the base receptacle is completely covered with a paste type sealer material. A sufficient quantity of paste material is placed in the drilled hole to assure a bond between the bottom of the base receptacle and drilled hole. When the base is placed in the drilled hole, sealer material should be forced up the side of the base at least 1/8 inch. The remainder of the space between the sides of the base and drilled hole should be filled with a liquid sealer to the required height. The liquid sealer is the type used for filling saw kerfs. A jig may be used to hold and position the receptacle. The jig should be left in place until the sealer reaches its initial set. If any voids are present around the receptacle after the initial set, they should be filled and all excess sealer removed from the cover of the base receptacle and pavement.

4 When the fixture is in its final position, the portion at pavement surface should be flush with the surrounding surface.

5 After the sealer has cured and the plywood cover is removed, the unit is cleaned and dried as required.

The top assembly is installed in accordance with the manufacturer's instructions. Care should be taken to properly seal all gaskets. In addition, all screws, bolts, or other securing hardware are tightened with a torque wrench or screwdriver to the manufacturer's recommended torque.

6 There should be approximately a 1/4-inch clearance for sealer material between the bottom of the receptacle and the drilled recess. The clearance for sealer material between the sides of the receptacle and drilled recess should be at least 1/4 inch. The minimum diameter of the drilled hole is 12-1/2 inches.

(b) Deep Base. A hole is drilled in the pavement not less than 12-1/2 inches in diameter. Where runway base and/or subbase is encountered below the drilled portion of the pavement, the hole should be excavated to a minimum of 3-1/2 inches below the level of the bottom of the light base when installed. Using high early-strength cement conforming to Item P-501 of AC 150/5370-1 with Changes 1 and 2, the excavation is then backfilled to a level surface not less than 1/4 inch below the bottom of the light base to allow for sealer material. The clearance for sealer material between the sides of the receptacle and drilled recess should be at least 1/4 inch.

(4) Wireways and Wire.

(a) Wireways.

1 Prior to the installation of the No. 10 AWG wires in the pavement, all vertical edges in the wireways are chamfered at intersections.

2 The wireways are sandblasted, flushed with a high velocity water jet, and blown out with a high velocity air jet or wiped dry to ensure proper bond between the pavement material and the sealer.

(b) Wires.

1 The No. 10 AWG wires from the transformers near the runway edge to the light fixture leads are placed in the wireways. An adequate number of wedges or similar devices are used to hold the wires in place at least

1/2 inch below the pavement surface. The light fixture leads are spliced to the No. 10 AWG wires with suitable preinsulated connectors. The crimped splice is made with a tool that requires a complete crimp before releasing. The splices to the fixture leads are made at staggered locations. No splices are made in the single conductor wires except at each light.

2 If the installation is made in stages, the ends of exposed wires should be adequately taped to prevent the entrance of moisture.

(5) Sealing. The wires should be sealed in the wireways in consecutive steps.

(a) Pour Item P-606 liquid sealer in wireway until the surface of the wires is covered.

(b) Pour clean sand into the liquid sealer until a slight amount of sand shows on the surface.

(c) Fill the remainder of the wireway to pavement level with liquid sealer but in no case above pavement level.

(d) Remove any excess sealer material from pavement surface.

b. Touchdown Zone Lighting.

(1) General.

(a) The applicable installation details covered in paragraph 6a for the inset centerline fixtures can be used to install the inset touchdown zone lights. Typical installation details for inset touchdown zone lights are shown in Figures 8 and 9.

(b) All inset and base mounted touchdown zone light fixtures are installed level in a horizontal plane unless otherwise specified.

(c) The installation of the base mounted touchdown zone lights is as specified in paragraph 6b(2). Typical installation details are shown in Figure 10.

(2) Base Mounted Light Fixtures.

(a) Concrete Encasement Areas. Proper alignment of base mounted fixtures can be accomplished by installing the bases in concrete encasement areas.

1 In rigid pavements, the encasement areas are leave-outs in the paving operation. The leave-outs are 25 feet by 4 feet centered longitudinally in the slab, using 25 feet paving lanes and 20 feet transverse joint spacing.

2 In flexible pavements, the encasement areas are excavated after the runway has been paved. The excavated area in flexible pavement is a minimum 14 feet by 4 feet. Care should be exercised to remove all disturbed material.

3 The excavated openings and/or leave-outs are for the installation of light bases, flexible conduit, and touchdown zone light fixtures. The top of the concrete encasement in the excavated opening or leave-out is flush with the pavement. The concrete should extend approximately 4-1/2 inches below the light base.

4 The concrete used to fill the encasement areas conforms to Item P-501 of AC 150/5370-1 with Change 1.

5 Concrete paving for the encasement areas conforms to the applicable provisions of Item P-501 of AC 150/5370-1 with Change 1.

(b) Installation of Large-Size Base and Transformer Housing.

1 Fill material within the pavement encasement area is excavated to a depth of approximately 4-1/2 inches greater than the depth of the base. The base is supported in the leave-out or excavated area in such a position that the top of the base flange is 1-3/8 inches below the finished pavement at the lowest point. The bases are connected together with 2-inch flexible conduit. In addition, there is a 2-inch flexible conduit installed from the outermost base to the edge of the concrete encasement. This flexible conduit slopes downward to permit drainage. The flexible conduit connects to the 2-inch rigid conduit installed under the pavement as shown in Figure 10.

2 The contractor should exercise care to adequately support the bases when placing the concrete around them to assure proper alignment and elevation of the equipment will be maintained. This may be accomplished with an anchorage system or jig.

3 All bases are installed so that the top fitting of the light fixture will be at the proper elevation with respect to the finished pavement.

(c) Light Fixture. The AC 150/5345-16, Type B or AC 150/5345-19, Type III fixture is assembled on the base and connected in accordance with the manufacturer's instructions. The transformer secondary leads are connected to the fixture leads with a disconnecting plug and receptacle.

(d) Alignment. The contractor aligns and orients each fixture in accordance with the manufacturer's instructions. Final adjustments are made at night and to the satisfaction of the engineer in charge.

(3) Primary Cables. The installation of all primary cables is in accordance with Item L-108 of AC 150/5370-1 with Change 1.

c. Vault.

(1) The airport vault and equipment installed in the vault are in accordance with Item L-109 of AC 150/5370-1 with Change 1.

(2) The contractor should exercise care during installation in the vault to prevent drill deposits, iron filings, insulation stripping, or other foreign matter deposits from collecting on relays, switches, and other operating components. All installation residue should be collected and removed as the installation progresses. Covers or shields may be used during installation and wiring to protect components from foreign matter.

7. TESTS.

a. General.

(1) The inspection and testing of these lighting systems during construction are important. Many components of certain systems may not be accessible for corrective action after the final installation.

(2) A visual inspection is made of the sealer in the wireways and around the fixtures to determine if all voids are filled and that the sealer is at the proper level with respect to the runway surface.

(3) The installed light unit is inspected to determine if the equipment has been installed at the proper elevation.

(4) The alignment of all units is checked to determine if all lighting fixtures have been installed in accordance with design and installation requirements.

(5) The fixtures are checked to determine if the securing screws have been tightened in accordance with manufacturer's recommendations.

(6) The lighting fixtures are visually inspected to determine if the lenses and channels in front of the lenses are clean.

b. Centerline and Touchdown Zone Inset Lights. Inspection and testing for these systems are performed concurrently with the installation because of subsequent inaccessibility of some components. Before filling wireways, the secondary series circuit for each subsector of runway is tested for continuity and insulation resistance to ground. The insulation resistance may be checked with a 500-volt megger. An acceptable circuit has a resistance of at least 50 megohms. After these tests have been performed and the lighting circuits are completed, they are tested by continuous operation for a period of not less than one-half hour as a completed system. The testing includes the operation of each control not less than 10 times.

c. Touchdown Zone Base Mounted Lights. The testing for this installation is accomplished in the manner prescribed under Item L-108 of AC 150/5370-1. The installation is operated not less than one-half hour as a completed system prior to acceptance. The testing includes the operating of each control not less than 10 times.

8. MAINTENANCE.

a. General. A maintenance program is necessary at airports with in-runway lights to insure proper operation and dependable service from the equipment. Although the system may be of the highest order of reliability, its effectiveness will soon depreciate unless it is properly maintained.

(1) A daily operation check should be made of all in-runway lighting fixtures. The runway centerline and touchdown zone lights are energized and visually inspected. If any lamps are out, the location of the fixtures is recorded and the lamps replaced at a time when the circuit is de-energized.

(2) Regular cleaning is necessary in order that in-runway lighting fixtures can operate at maximum efficiency. The lens and channel in front of the lens should be cleaned periodically in accordance with manufacturer's recommendations. The regularity and type of cleaning will be dictated by the weather and the location of the fixtures.

(3) Snowplow operators should exercise extra care not to strike lighting fixtures with snowplow blades. After snow removal operations, inspect all lighting fixtures to locate and replace, if necessary, any damaged light assemblies. Passes over the light rows should be made with a power broom only if practical. Whenever snowplows must traverse in-pavement light fixtures, they should be either traveling at less than 5 m.p.h. or have the blades lifted clear of the fixtures. Recommended snow removal techniques are described in AC 150/5380-2A.

b. Relamping. Turn off the electrical energy to the primary circuit supplying the fixture containing the burned-out lamp and remove the top assembly. Replace the gaskets if they appear to be worn or damaged. Before the top assembly is replaced, the unit should be cleaned and dried. Care should be exercised to properly seal all gaskets. In addition, all screws, bolts, or other securing hardware should be tightened with a torque wrench or screwdriver in accordance with manufacturer's recommended torque.

c. Removal of Water. The runway centerline and touchdown zone lights are designed to exclude both ground and surface water from entering. For varying reasons, water sometimes enters and becomes a serious problem, particularly where temperatures below freezing are encountered. If the bases or receptacles are allowed to fill with water, freezing may result that can cause damage to the fixture by shearing the top assembly holddown hardware or rupturing the base or receptacle. To prevent this from occurring, it is recommended that a regular maintenance schedule be established to inspect each fixture for the presence of water especially during the fall and winter months. A regular schedule for tightening cover holddown bolts is recommended. If any of the fixtures contain water, the water should be removed and the receptacle, lamp, and electrical contacts are cleaned and dried. Properly seal all gaskets and tighten the screws securing the top assembly with a torque wrench or screwdriver in accordance with the manufacturer's recommended torque.

d. Cable. Homeruns of cables should be meggered with a 500-volt megger after the installation has been accepted. Records of the megohm resistance values obtained should be kept. In order to check the condition of the system, monthly megger readings should be obtained and compared with the initial values. In an acceptable system, the initial megohm resistance values are not less than 10 megohms. If the monthly megger checks reveal progressive deterioration or faults, corrective steps should be taken promptly. The most common faults in series underground cables are open circuits or grounded circuits.

(1) Monthly megger checks may be accomplished by first de-energizing the regulator. Disconnect the series cable leads at the regulator. Connect one lead of the megger to the series cable and the other lead of the megger to a proven ground. Operate the test equipment in accordance with instrument instructions.

(2) In view of the fact that high open-circuit voltages may be obtained by opening the primary of a series lighting circuit, only authorized personnel should be allowed to trouble shoot. A series circuit connected across a 50 KW, 20.0 ampere regulator may have an open-circuit voltage as high as 3,500 volts. A regulator with a higher KW capacity and the same current rating will have a greater open-circuit voltage. Trouble shooting for in-runway lighting circuits is complicated by the fact that in some instances the interconnecting wires are sealed in the runway pavements. For this reason, it is important to check the system during the installation and to establish an effective preventive maintenance program.

e. Spare Parts. Stock adequate spare parts for maintenance purposes.

f. Vault. The vault (AC 150/5370-1, Item L-109) should be kept clean and uncluttered to prevent dirt from accumulating in control compartments and to allow equipment to be accessible at all times. Warning signs should be legible and mounted in conspicuous locations.

APPENDIX 1. BIBLIOGRAPHY

1. Obtain copies of the following publications from the Federal Aviation Agency, Printing Branch, HQ-438, Washington, D.C. 20553.

   a. AC 150/5340-2, Airport Lighting Control.

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

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

   d. AC 150/5345-10A, Specification for L-828 Constant Current Regulator With Stepless Brightness Control.

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

   f. AC 150/5345-16, Specification for L-843 Airport In-Runway Touchdown Zone Light.

   g. AC 150/5345-17, Specification for L-845 Semiflush Inset Prismatic Airport Light.

   h. AC 150/5345-19, Specification for L-838 Semiflush Prismatic Airport Light.

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

   j. AC 150/5345-30, Specification for L-846 Electrical Wire for Lighting Circuits to be Installed in Airport Pavements.

   k. AC 150/5345-32, Specification for L-837 Large-Size Light Base and Transformer Housing.

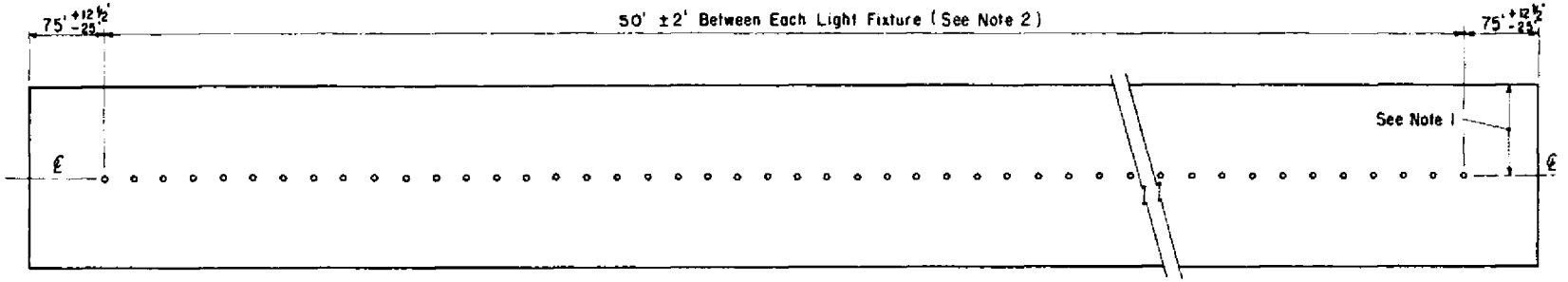
   l. AC 150/5345-33, Specification for L-844 Individual Lamp Series-to-Series Type Insulating Transformer for 5000 Volt Series Circuit 20/6.6 Amperes 200 Watt.

   m. AC 150/5345-37A, FAA Specification L-850, Light Assembly, Airport Runway, Centerline.

   n. AC 150/5380-2A, Snow Removal Techniques Where In-Pavement Lighting Systems Are Installed.

2. Obtain copies of AC 150/5370-1, Standard Specifications for Construction of Airports with Changes 1 and 2, from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Send check or money order with your request made payable to the Superintendent of Documents in the amount of $3.10 for each copy. No c.o.d. orders accepted.

3. Obtain copies of Rural Electrification Administration (REA) Bulletin 345-14, REA Specification for Fully Color-Coded, Polyethylene Insulated, Double Polyethylene-Jacketed Telephone Cables for Direct Burial, from U.S. Department of Agriculture, Rural Electrification Administration, Information Services Division, Washington, D.C. 20250.

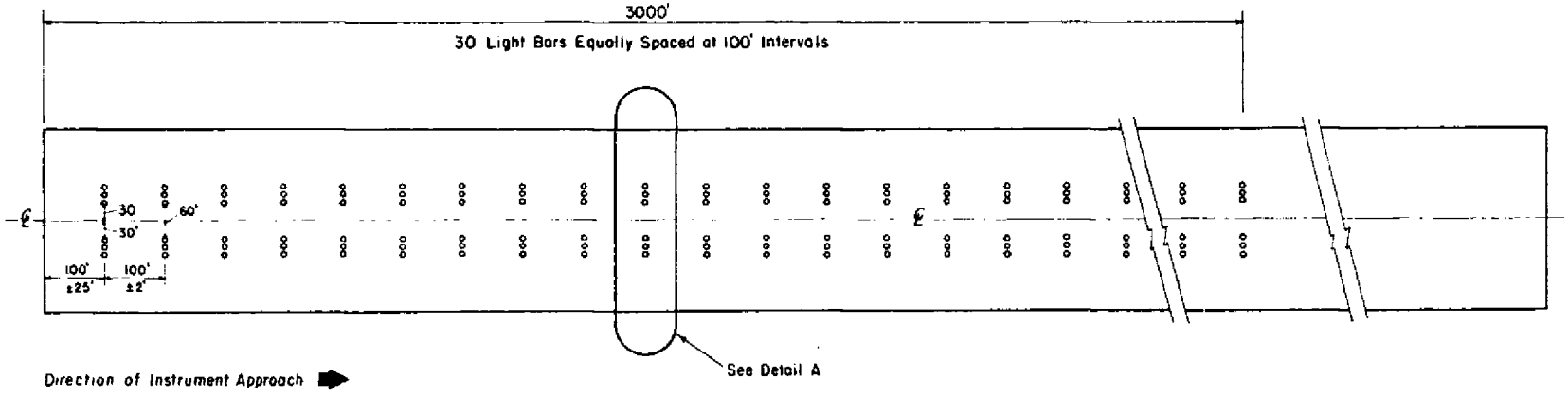


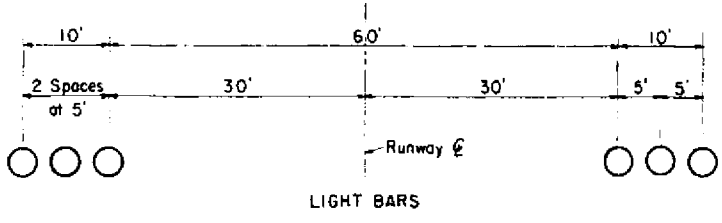
RUNWAY

NOTES:

1. In rigid pavement all centerline lights may be offset 2' to the right or left of the runway centerline to avoid longitudinal joints.
2. In rigid pavement the centerline lights may have only a longitudinal tolerance of ±2' in order to avoid transverse joints.
3. In flexible pavement centerline lights may be installed on the runway centerline at distances shown in above figure.

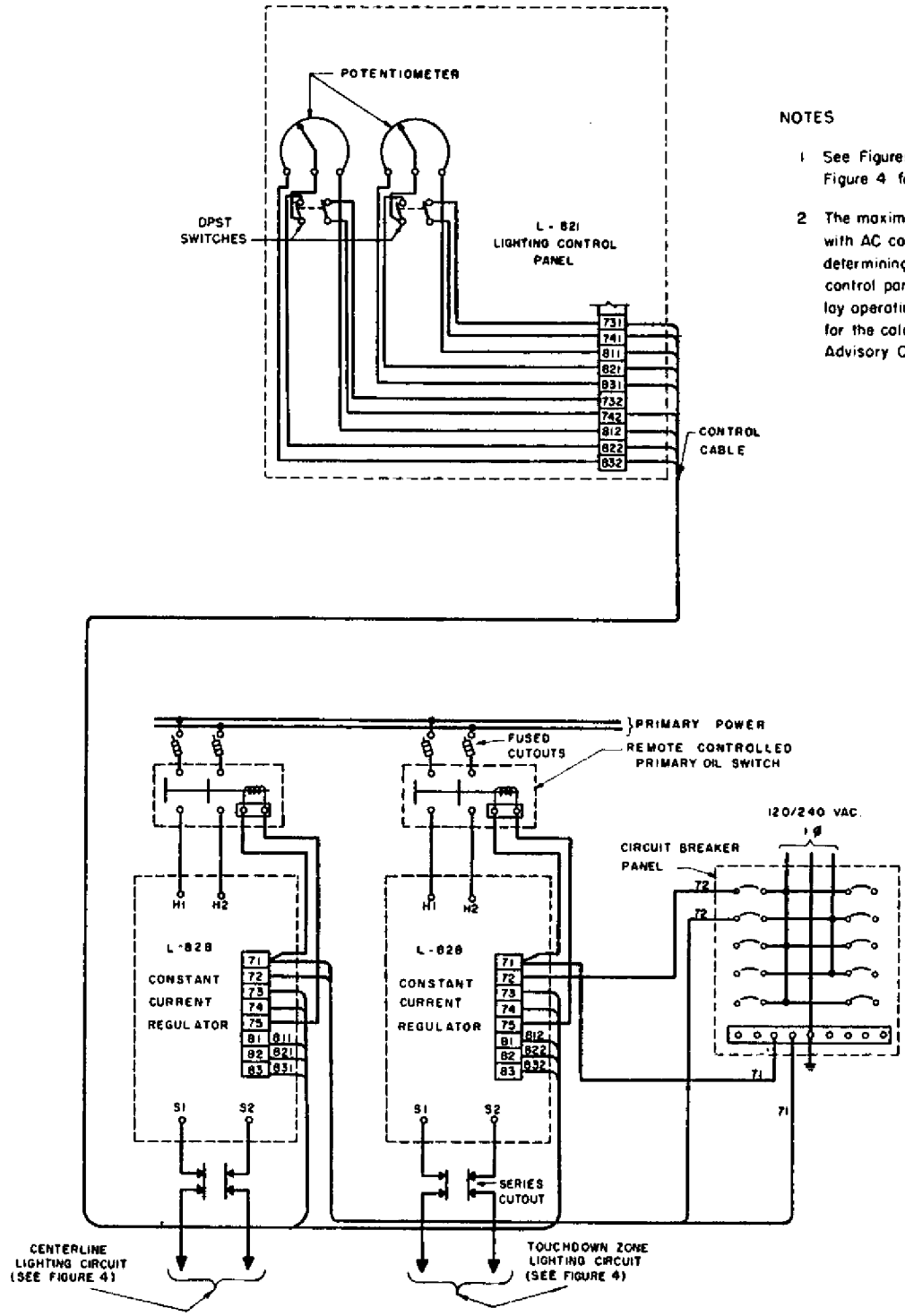
FIGURE 1. RUNWAY CENTERLINE LIGHTING LAYOUT





DETAIL A

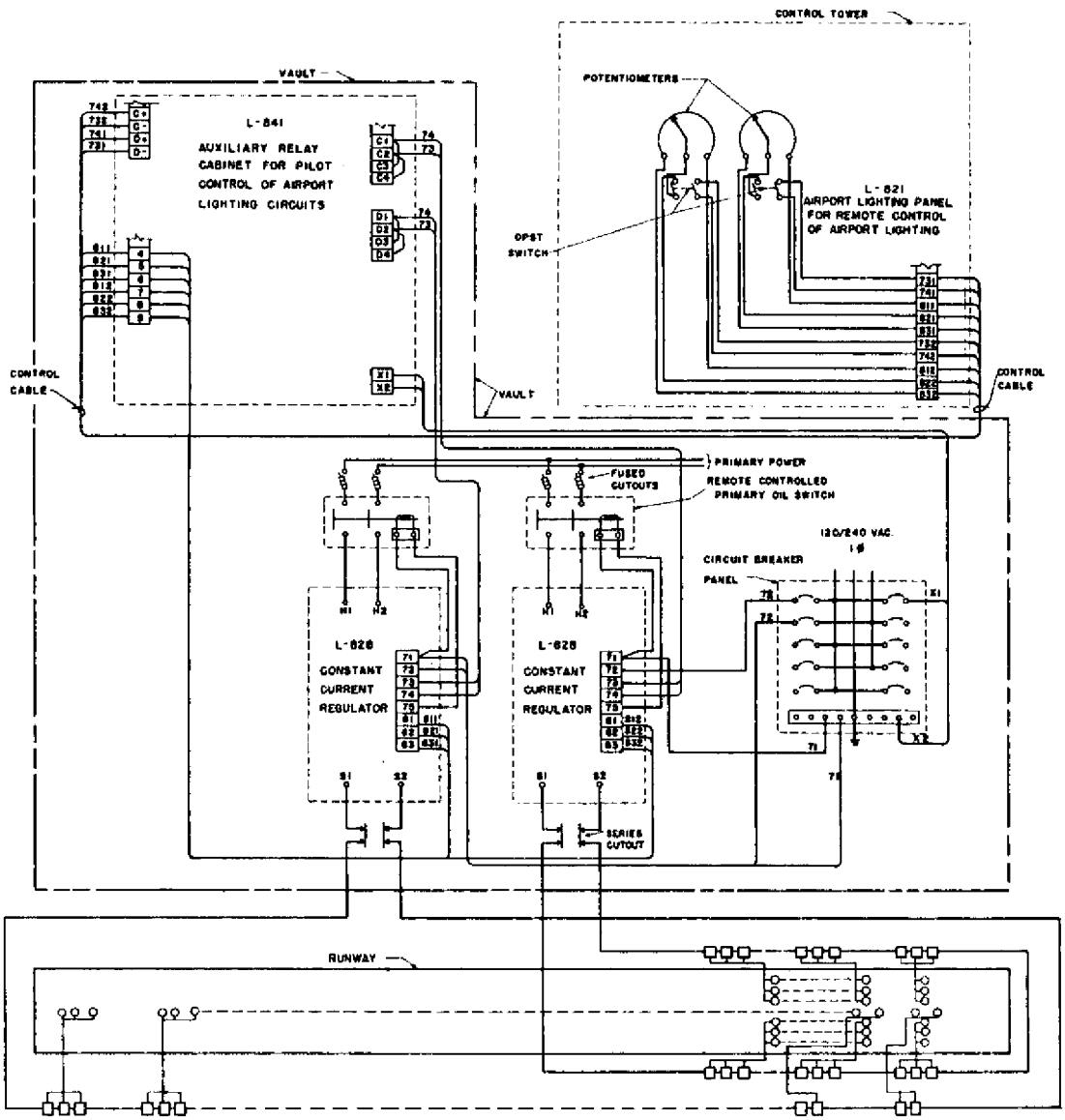
FIGURE 2. TOUCHDOWN ZONE LIGHTING LAYOUT



NOTES

1. See Figures 1 and 2 for layout and Figure 4 for applicable notes.
2. The maximum separation permissible with AC control can be calculated by determining the line loss between the control panel and regulator. The relay operating characteristics required for the calculations are contained in Advisory Circular No. 150/5340-2.

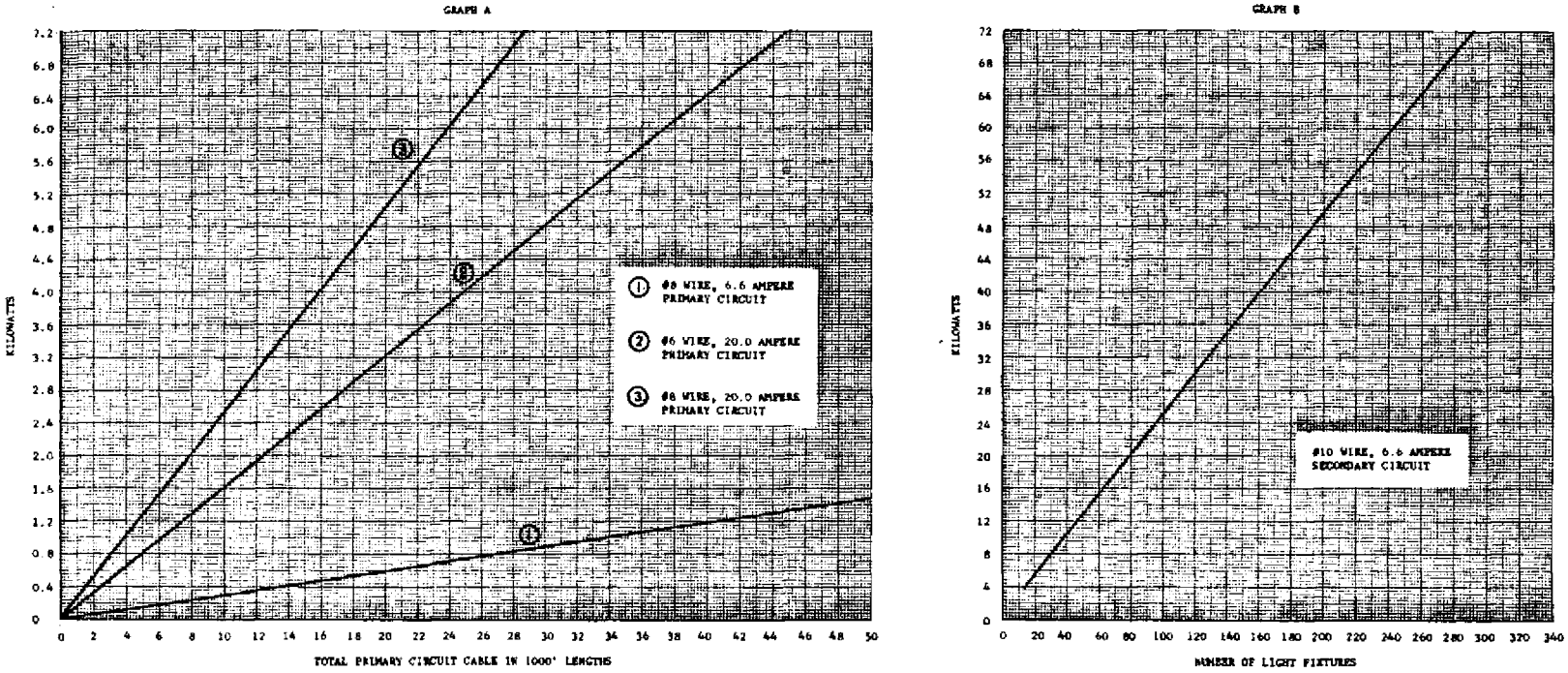
FIGURE 3. TYPICAL WIRING DIAGRAM WITH AC CONTROL FOR TOUCHDOWN ZONE AND BIDIRECTIONAL CENTERLINE LIGHT FIXTURES



NOTES

1. The installation should conform to applicable sections of National Electrical Code and Local Codes.
2. Lightning arresters for Power and Control Lines should be installed as required.
3. Additional isolating devices should be installed as required.
4. Fuses, Circuit Breakers and Cutouts should be in accordance with equipment ratings.
5. Use solid link in fused cutout in ground circuit when wye connected.
6. The size regulators required for the runway centerline and touchdown lights can be determined from Figure 5.
7. The 48 volt DC controlled system is adequate for separations between the control panel and auxiliary relay cabinet of up to 7900 feet.

FIGURE 4. TYPICAL WIRING DIAGRAM WITH DC CONTROL FOR TOUCHDOWN ZONE AND BIDIRECTIONAL CENTERLINE LIGHT FIXTURES



HOW TO ESTIMATE TOTAL LOAD (DESIGN FOR 200-WATT LIGHT FIXTURE INSTALLATION)

1. Determine the total length of the series primary circuit. The circuit may consist of No. 6 AWG wire for feeder cables and No. 8 AWG Cable for the remainder of the circuit.

2. Determine the KW power required for the series primary cable by getting the coordinate point on the applicable "kilowatts--total primary circuit cable" line of graph A.

3. Determine the KW power required for the number of fixtures to be installed by getting the coordinate point on the "kilowatts-number of light fixtures" line of graph B.

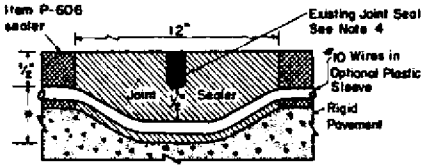
4. Add Kilowatts Obtained from graphs A and B to determine total KW load.

FIGURE 5. LOAD CURVES FOR 200-WATT CENTERLINE OR TOUCHDOWN ZONE FIXTURE INSTALLATIONS

NOTES

Wires are not less than ½" below existing joint seal compound

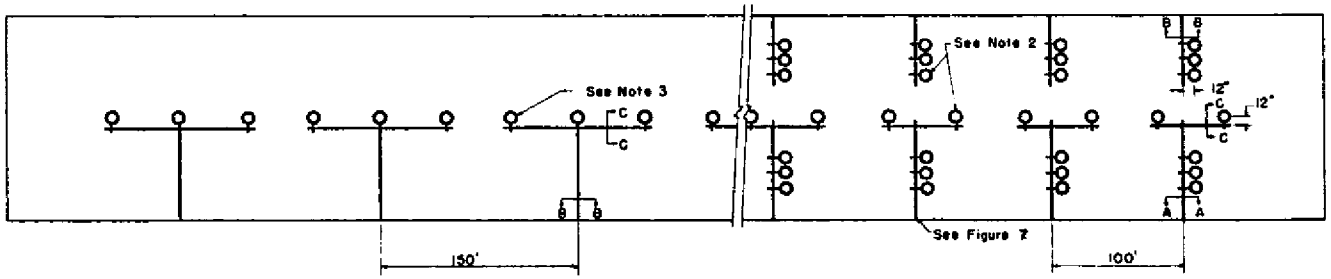
* Variable. See Sections A-A, B-B and C-C for dimensions.



SAWING DETAIL AT
JOINT INTERSECTION
DETAIL "A"

GENERAL NOTES

1. The installation details shown are for rigid or flexible pavement unless otherwise specified.
2. The diameters and depths of holes for the inset lighting fixtures are in accordance with Figures 9 and 11.
3. The alignment of drilled holes for centerline fixtures should not vary more than ¼ inch.
4. Where saw kerfs cross joints in rigid pavement, their depth is increased as shown on plans. See Detail "A" for a typical detail at a joint intersection.



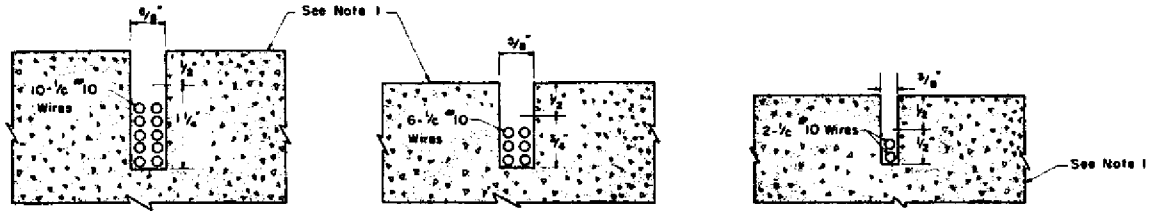
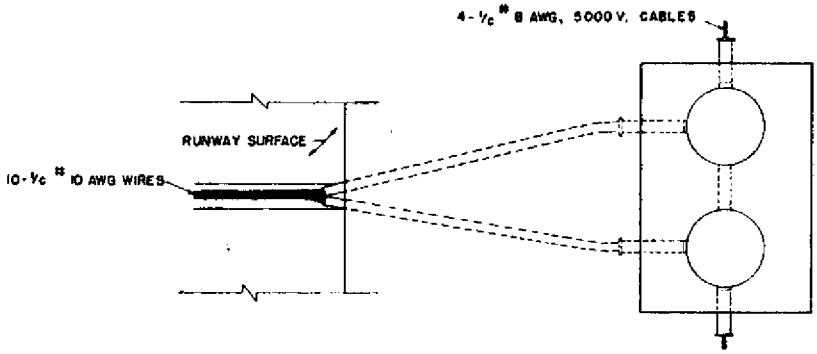
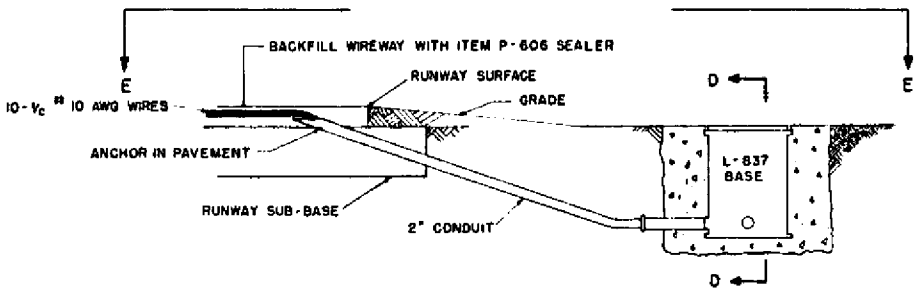


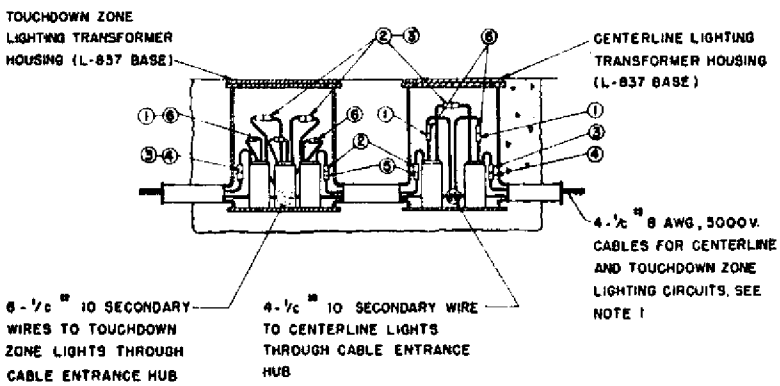
FIGURE 6. TYPICAL WIREWAY INSTALLATION DETAILS FOR TOUCHDOWN ZONE AND BIDIRECTIONAL CENTERLINE LIGHTS



VIEW E-E



TYPICAL TRANSFORMER HOUSING INSTALLATION DETAILS



CONNECTOR	SPECIFICATION L-823 FIGURE NUMBER
1	1c
2	6a
3	6b
4	14a
5	14b
6	15

SECTION D-D

NOTES:

1. The primary cables are installed in accordance with Item L-108 of Standard Specifications for Construction of Airports.
2. The L-837 large-size light base and transformer is installed in accordance with Item L-123 of Standard Specifications for Construction of Airports.

FIGURE 7. TYPICAL TRANSFORMER HOUSING INSTALLATION DETAILS FOR TOUCHDOWN ZONE AND BIDIRECTIONAL CENTERLINE LIGHTS

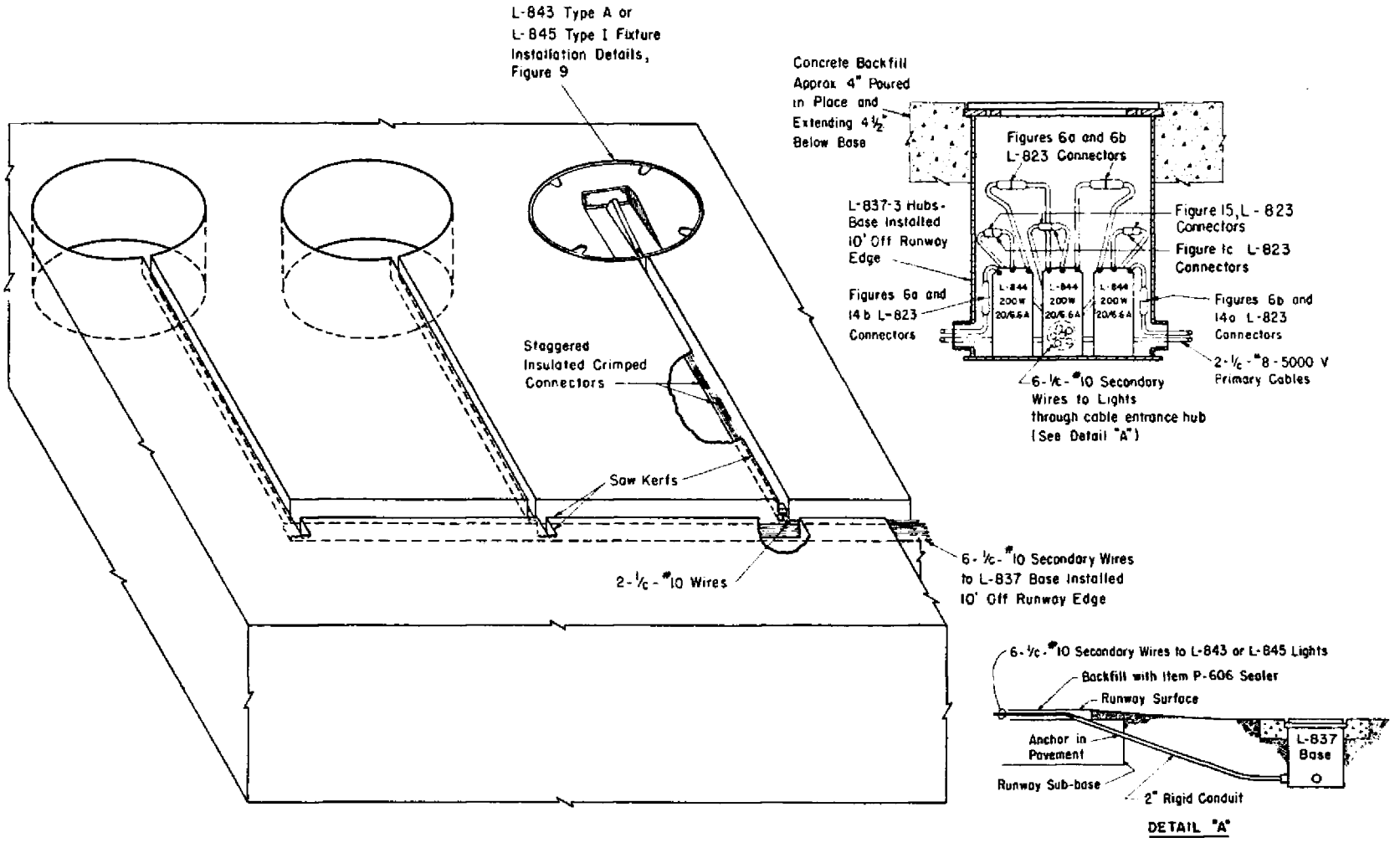


FIGURE 8. TYPICAL INSET TOUCHDOWN ZONE LIGHT EQUIPMENT LAYOUT

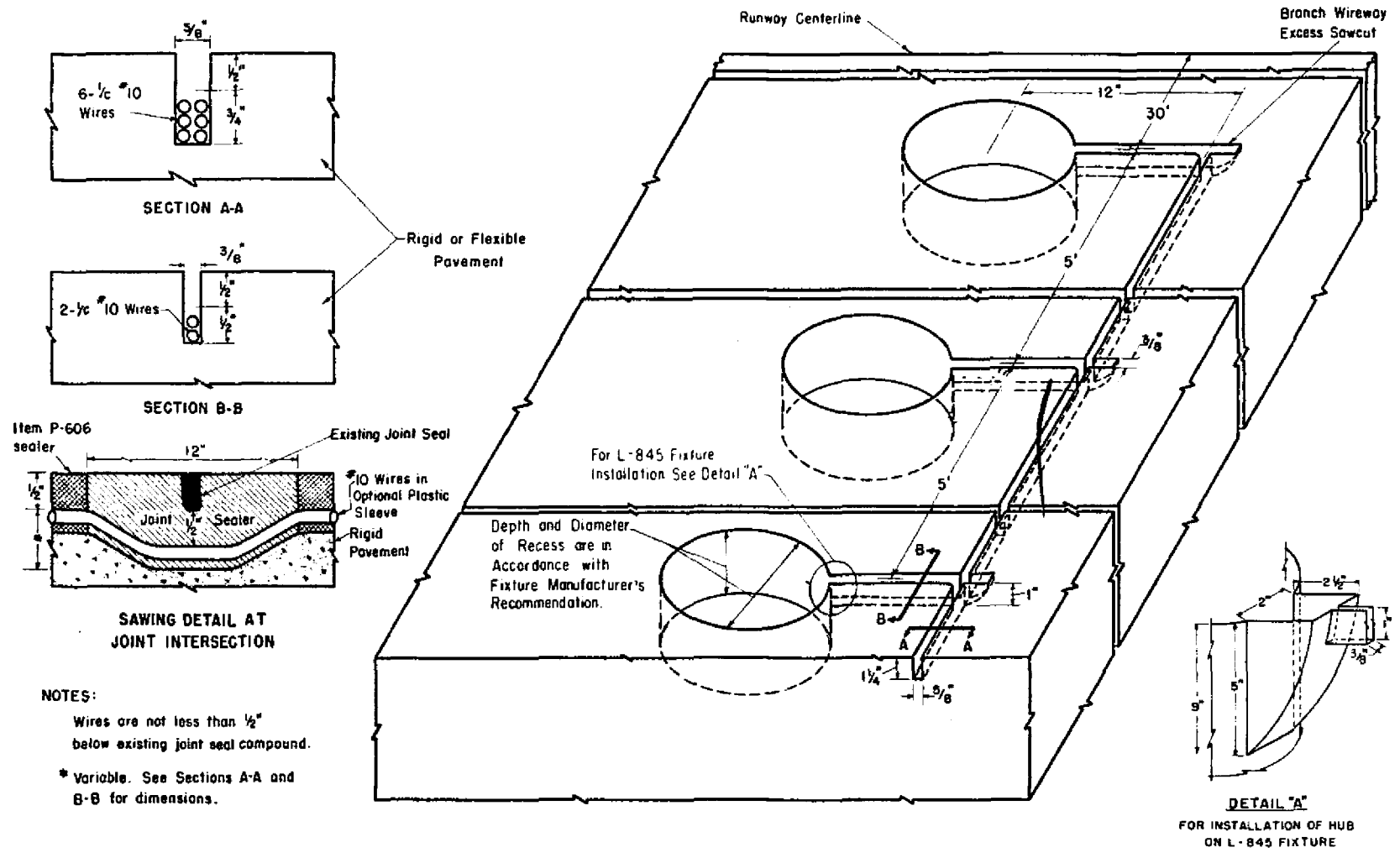
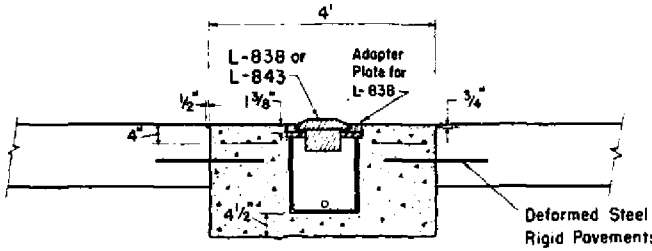
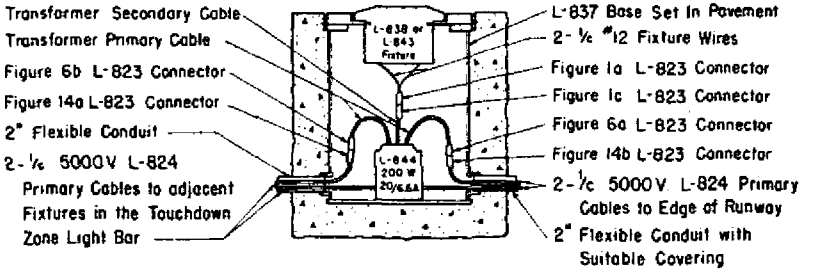


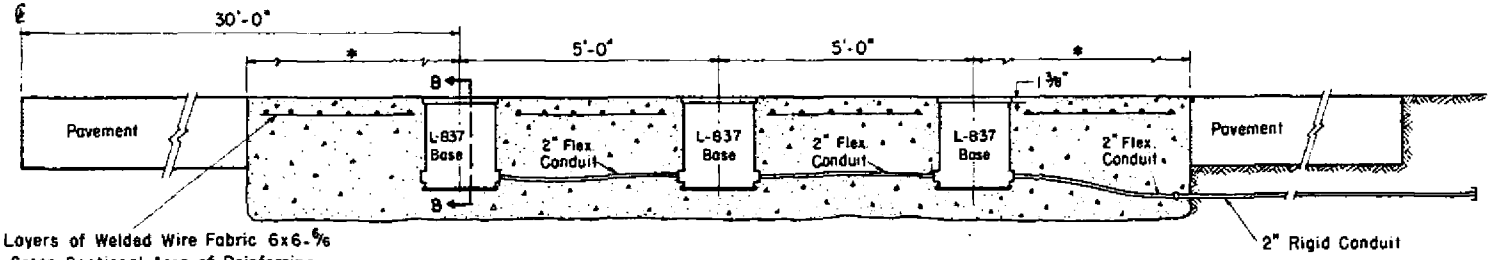
FIGURE 9. TYPICAL INSET TOUCHDOWN ZONE LIGHT INSTALLATION DETAILS



SECTION B-B

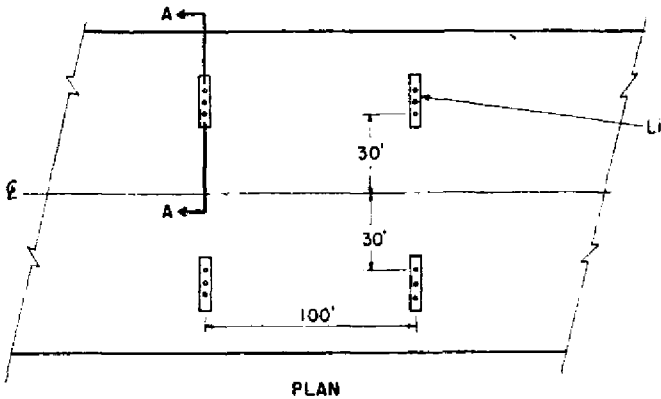


TOUCHDOWN ZONE PRIMARY AND SECONDARY WIRING DETAILS



SECTION A-A

*Variable Depending on Type of Pavement but Not Less Than 2 Feet



PLAN

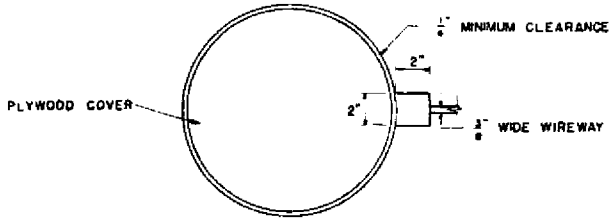
NOTE 1: Leave-outs for Rigid Pavements are 25' x 4' Centered Longitudinally in the Slab, Using 25' Paving Lanes and 20' Transverse Joint Spacing.

NOTE 2: The Concrete Encasement in Flexible Pavement is a minimum of 14' x 4'.

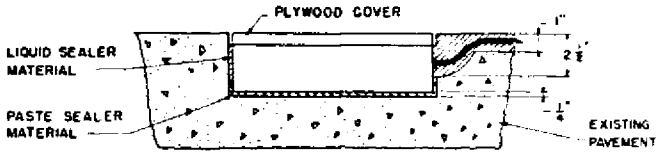
SIZE AND SPACING OF DEFORMED STEEL TIE BARS

THICKNESS OF SLAB (INCHES)	TIE BARS		
	Bar No	Length (in.)	Spacing (in.)
6-7	6	16	12
8-10	8	16	12
11-15	10	20	15

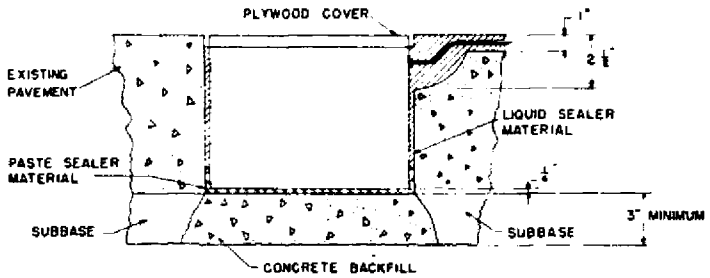
FIGURE 10. TYPICAL DETAILS - TOUCHDOWN ZONE LIGHTING - BASE MOUNTED - NEW RIGID AND FLEXIBLE PAVEMENTS



TOP VIEW OF L-850 BASE
INSTALLATION TYPE I OR TYPE II



L-850 TYPE I BASE



L-850 TYPE II BASE

NOTES

1. All dimensions are a minimum unless otherwise specified.
2. Sealer materials are in accordance with Item P-606 of AC 150/5370-1, Supplement No. 2.

67-3407

FIGURE 11. TYPICAL INSTALLATION DETAILS FOR L-850 BASE RECEPTACLE