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Federal Aviation Agency

ADVISORY CIRCULAR

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SUBJECT: INSTALLATION DETAILS FOR IN-RUNWAY LIGHTING

1. PURPOSE. This advisory circular presents guidance information to the public concerning the subject material. This information is related to standards for the construction, design, equipment and material, and acceptance tests concerning the installation of in-runway lighting, touchdown zone, runway centerline, and taxiway turnoff lighting systems. The installation details described herein are acceptable for project activity under the Federal-aid Airport Program.

2. REFERENCES. The following publications provide further guidance and detailed technical information as may be required.

   a. Configuration Details of In-Runway Lighting: Touchdown Zone, Runway Centerline, and Taxiway Turnoff Lighting Systems, AC 150/5340-3.

   b. Load Calculations for Airport Runway and Taxiway Lighting Circuits, Airport Engineering Bulletin No. 7.

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

   d. Approved Airport Lighting Equipment, AC 150/5345-1

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

   f. Specification L-823, Plug and Receptacle, Cable Connectors.

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

   h. Specification for L-828 Saturable Reactor Type Constant Current Regulator with Stepless Brightness Control, AC 150/5345-10.

   i. Specification L-834, Individual Lamp Series-to-Series Type Insulating Transformer for 5000 Volt Series Circuit.

   j. Specification L-837, Large-Size Light Base and Transformer Housing.

k. Specification L-838, Semiflush Prismatic Airport Light.

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

m. Specification L-842, Airport Centerline Light, 150/5345-15.

n. Specification L-844, Individual Lamp Series-to-Series Type Insulating Transformer for 5000 Volt Series Circuit 20/6.6 Amperes, 200 Watt.

o. Specification L-845, Semiflush Inset Prismatic Airport Light.

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

q. Airport Design Manual.

r. Standard Specifications for Construction of Airports, with Supplement No. 1 and Amendment No. 1, AC 150/5370-1.

s. Rural Electrification Administration (REA) Bulletin 345-14, REA Specification for Fully Color-Coded, Polyethylene-Insulated, Double Polyethylene-Jacketed Telephone Cables for Direct Burial.

t. Specification for L-847 Circuit Selector Switch, 5000 Volt 20 Ampere, AC 150/5345-5.

3. HOW TO GET THIS PUBLICATION.

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Installation Details for In-Runway Lighting
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1. INTRODUCTION. In-runway lighting consists of touchdown zone (narrow gauge), runway centerline, and taxiway turnoff lighting systems. These systems, when installed, are designed to facilitate landings, rollouts, and takeoffs under adverse day and night visibility conditions. The touchdown zone lights are primarily a landing aid; whereas, the centerline lights are most effective for rollout and takeoff. The turnoff lights aid the pilot in rolling into the taxiway turnoff.

2. BACKGROUND. In the interest of safety, regularity, and efficiency of aircraft operations, the in-runway lighting systems were developed to be used in conjunction with electronic precision approach aids and standard approach lighting systems under limited visibility conditions. In order to present guidance material for the construction and maintenance of the above systems, this circular was developed in accordance with current information and will be subject to improvements gained through operational experience.

3. CONFIGURATIONS.

   a. Touchdown Zone Lighting.

      (1) The runway touchdown zone lighting system presents, in plan view, two rows of transverse light bars located symmetrically about the runway centerline, extending 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 in length. The first pair of light bars are located 100 feet from the landing threshold, followed by each succeeding pair at 100-foot intervals to the end of the system. In consideration of joint location design in concrete pavement, the first pair of light bars may be located within the interval of 75 to 125 feet from the landing threshold.

      (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.

      (3) Figure 1 is a layout drawing which shows spacing and tolerance dimensions.

   b. Runway Centerline Lighting.

      (1) The runway centerline lighting system consists of single bidirectional lights installed at 25-foot intervals along the runway centerline in a straight line. 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. In order to avoid interference with rigid pavement joints which are frequently located on the runway centerline, the line of lights is offset laterally not in excess of two feet when viewed from the landing threshold. If the major taxiway turnoffs for which lighting is planned or contemplated 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.

(2) Figure 2 is a layout drawing which shows spacing and tolerance dimensions.

c. Taxiway Turnoff Lighting.

(1) The taxiway turnoff lighting system consists of single unidirectional lights installed at 12½-foot intervals offset from the curve defining the centerline of the taxiway not in excess of 2 feet. The taxiway centerline curve is established by the "entrance curve" and "central curve" as described in the publication "Airport Design" and as shown on Figure 3 of this publication. If the turnoff is to the left with respect to the runway centerline, the lights are offset to the left. Conversely, if the turnoff is to the right with respect to the runway centerline, the reverse applies.

(2) To provide adequate advance indication of the position of the taxiway turnoff, a section of single unidirectional lights is installed (at 12½-foot intervals) parallel to the runway centerline lights. The lights are installed for 200 feet in advance of the point marking the beginning of the entrance curve. The lights on the straight section are located at right angles to the runway centerline, a distance not in excess of 2 feet. If the taxiway turns to the left from the runway centerline, the lights are located to the left of the runway centerline. Conversely, if the taxiway turns to the right from the runway centerline, the reverse applies.

(3) Figure 3 is a layout drawing which shows the spacing and tolerance dimensions.

4. DESIGN.

a. Touchdown Zone Lighting.

(1) The design of a touchdown zone lighting system may be accomplished to fit one of two conditions. One condition is where installation is to be made in conjunction with the initial placement of pavement for a new runway or an extension. The other condition is where 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 placed in the pavement. Such a provision is highly desirable from a maintenance point of view and technically is considered to provide an added degree of equipment protection. In the case of existing pavements, it is not considered economically practicable to remove and replace existing pavement to install bases and conduit. Therefore, as a matter of necessity, the cables and fixtures are installed and sealed in shallow saw kerfs and drilled recesses or holes, respectively, in the pavement.

(2) The touchdown zone lighting system is designed for a 20 ampere series primary circuit using a constant current regulator having an adequate KW capacity. The lamp load is supplied through 20/6.6 ampere, 200 watt individual lamp insulating transformers. The cable for the primary circuit is 5 KV #8 AWG, except where the length of the homerun leads exceeds 10,000 feet. Where homerun leads are in excess of 10,000 feet, the cable is 5 KV #6 AWG.

(3) The general design for DC control is shown on Figure 10. For AC control circuitry see Advisory Circular No. 150/5340-2, "Airport Lighting Control."

b. Runway Centerline and Taxiway Turnoff Lighting.

(1) An installation of this type of lighting is adaptable to either rigid or flexible pavement and for new or existing pavement. For all types of pavements, the preferred method of installing the cylindrically shaped unit, approximately 8 inches in diameter and 1 inch in depth, is to provide holes or drilled recesses in the completed or existing pavement for the light unit and to provide saw kerfs for wireways. The fixtures and wires are subsequently sealed in the holes or recesses and saw kerfs.

(2) The number of lighting units varies according to the runway length or the number and length of taxiway turnoffs. The design for power supply depends on and is subject to individual requirements for circuiting and control.

(3) The system can be designed for a 20 ampere or 6.6 ampere series primary circuit dependent upon the KW load involved. The lamp loads are supplied through either 20/6.6 ampere or 6.6/6.6 ampere, 200 watt insulating transformers. Each transformer supplies no more than four 45-watt fixtures connected in series. The cable for the primary circuit is 5 KV #8 AWG, except on 20 ampere primary circuits where the length of the homerun leads exceeds 10,000 feet, it is 5 KV #6 AWG. The wire for the

secondary circuits is 600 volt, #10 AWG. The design for circuiting takes into account the operational aspects of the airport. For instance, if lights for the runway centerline and only one taxiway turnoff are involved, they could be on one circuit or on separate circuits if desired. Where multiple turnoffs or operations from two landing directions are involved, it is usually desirable and sometimes necessary to provide two circuits.

(4) The DC control circuits shown on Figure 10 can be used to control equipment where circuit lengths are too long to use AC control. If AC control is desired for shorter control circuit runs, it may be obtained by deleting the L-841, "Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits," and connecting wires as shown in Advisory Circular No. 150/5340-2.

5. EQUIPMENT AND MATERIAL.

a. General. Equipment and material covered by FAA specifications are specified by reference number and title, as noted under "References."

b. Touchdown Zone Lighting.

(1) Light Fixture. The runway touchdown zone lights conform to the requirements of Specification L-838, "Semiflush Prismatic Airport Light," for base mounted installation in new pavement. For installation in existing pavements, the lights conform to requirements outlined in Specification L-845, "Semiflush Inset Prismatic Airport Light." Each unit is furnished complete with an optical system and lamp. The types are specified below:

(a) Semiflush Prismatic Airport Light, Type III, Unidirectional, in accordance with Specification L-838.

(b) Semiflush Inset Prismatic Airport Light, Type I, Unidirectional, in accordance with Specification L-845.

(2) Insulating Transformers. Insulating transformers conform to the requirements of Specification L-844, "Individual Lamp Series-to-Series Type Insulating Transformer for 5000 Volt Series Circuit 20/6.6 Amperes 200 Watt."

(3) Bases. Where required, the bases conform to the requirements of Specification L-837, "Large-Size Light Base and Transformer Housing." Certain applications may require additional entrance hubs, a suitable cover (required for off runway installation), and a proper gasket.

(4) Lamps. The lamps are 200 watt, 6.6 ampere, PAR 56 with lightly stippled cover and screw terminals.

(5) Tape. Plastic electrical insulating tape is Scotch Electrical Tape No. 88 as manufactured by the Minnesota Mining and Manufacturing Company or an acceptable equal all weather tape.

(6) Concrete. Concrete and reinforcing steel conform to the applicable provisions of Item P-501, Portland Cement Concrete Pavement, of "Standard Specifications for Construction of Airports."

(7) Cables. Primary cables conform to Advisory Circular No. 150/5345-7, "Specification for L-824 Underground Electrical Cables for Airport Lighting Circuits," Type B, and should be of the AWG size as shown on the plans.

(8) Wire. The wire for secondary circuits for inset fixtures is #10 AWG, single conductor, 600 volt wire in accordance with Advisory Circular No. 150/5345-30, "Specification for L-846 Electrical Wire for Lighting Circuits to be Installed in Airport Pavements."

(9) Conduit. Conduit installed from the pavement edge to the light base is 2-inch galvanized rigid steel conduit in accordance with Federal Specification WW-C-581, "Conduit; Steel, Rigid, Zinc-Coated." Conduit for connecting light bases is 2-inch galvanized steel, flexible conduit of standard manufacture, with suitable protective covering. All fittings are galvanized steel and designed for the specific use in each case.

(10) Regulator. The regulator is a constant current type of adequate KW capacity, and manufactured in accordance with Specification L-828, "Saturable Reactor Type Constant Current Regulator with Stepless Brightness Control." Regulators may be obtained with either a 6.6 ampere or 20 ampere output. The standard input voltage for the regulator is 2400 volts, but regulators with other input voltages may be ordered if required.

c. Runway Centerline and Taxiway Turnoff Lighting.

(1) Light Fixtures. The runway centerline and taxiway turnoff lights conform to the requirements of Specification L-842, "Airport Centerline Light," and are one of the specified types. Each unit is furnished complete with optical system, top assembly, lamp, and receptacle.

(a) Type I - Unidirectional, Style A, with receptacle for inset installation.

(b) Type II - Bidirectional, Style A, with receptacle for inset installation.

(2) Insulating Transformers. Insulating transformers conform to the requirements of either Specification L-834, "Individual Lamp Series-to-Series Type Insulating Transformer for 5000 Volt Series Circuit," Type II for 6.6 ampere primary circuit or Specification L-844, for 20 ampere primary circuit.

(3) Lamps. The lamps are 45 watt, 6.6 A/T 2½ Q Quartzline.

(4) Cables. Primary cables conform to Advisory Circular No 150/5345-7, Type B, and are of the AWG size as shown on the plans.

(5) Tapes. Plastic electrical insulating tape is Scotch Electrical Tape No. 88 as manufactured by the Minnesota Mining and Manufacturing Company or an acceptable equal all weather tape.

(6) Wire. The wire for the secondary circuits is #10 AWG, single conductor, 600 volt wire in accordance with Advisory Circular No. 150/5345-30.

(7) Regulator. The regulator is a constant current type of adequate KW capacity, and manufactured in accordance with Specification L-828. Regulators may be obtained with either a 6.6 ampere or 20 ampere output. The standard input voltage for the regulator is 2400 volts, but regulators with other input voltages may be ordered if required.

(8) Bases. The bases located near the edge of the runway conform to the requirements of Specification L-837. Certain applications may require additional or special hubs. When necessary, the standard base should be ordered with specified additional entrance hubs, a suitable cover, and a proper gasket.

d. Insulating Connector. Preinsulated connectors suitable for installation in saw kerfs are used for splices to be made to centerline, taxiway turnoff, and touchdown zone inset fixture leads.

e. Sealer Materials. The materials specified in Item P-606 of "Standard Specifications for Construction of Airports," 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. Item P-606 will be contained in Supplement No. 2 to the Standard Specifications for Construction of Airports and will be issued shortly.

(1) Saw Kerf Sealers. The saw kerfs are sealed with a liquid type sealer in accordance with Item P-606.

(2) Inset Fixture Sealer. Inset type fixtures (L-842 and L-845) are sealed in place with a paste type sealer in accordance with Item P-606.

(3) Joint Sealer. Joint sealing material per Item P-605 is used only acrossrigid pavement joints.

6. INSTALLATION.

a. Touchdown Zone Lighting - New Runways - Rigid or Flexible Pavement.

(1) Concrete Encasement Areas. To provide better alignment of bases and lights when installed in new pavements, it is appropriate to provide concrete encasement areas at the designated locations of the transverse bars. For rigid pavements, these areas can be leaveouts in the paving operation. For flexible pavements, in order to maintain proper compaction adjacent to these encasements, it is recommended that the runway first be completely paved. Then encasement areas are excavated at the designated locations, taking care to remove all disturbed material. These excavated openings and/or leaveouts will accommodate the subsequent installation of bases and lights. A prior installed 2-inch rigid conduit should extend from the edge of the pavement a short distance into the encasement area. See Figure 4 for installation details.

(2) Installation of Large-Size Base and Transformer Housing. Any fill material within the pavement encasement area is excavated to a depth of approximately 4½ inches greater than the depth of the transformer base. The bases are installed in the encasement areas at the locations indicated on the plans. The top of the base flange is installed 1-3/8 inches below finished runway pavement. The bases are connected together and to the incoming 2-inch conduit with 2-inch flexible conduit. The contractor should exercise care to adequately support the bases when placing the concrete around them in order to assure proper alignment and elevation of the finished installation. This may be accomplished by an anchorage system or jig that will assure proper positioning. Figure 4 shows typical installation details. Transformer bases are mounted level in all directions, unless otherwise specified.

(3) Paving. Concrete paving for the encasement areas conforms to the applicable provisions of Item P-501, Portland Cement Concrete Pavement, of "Standard Specifications for Construction of Airports." Reinforcing is installed as shown on Figure 4.

(4) Cable Entrance. The primary cable is installed through the rigid conduit stubs and between the touchdown zone runway light bases as a separate item under Item L-108, Installation of Underground Cable for Airports, as contained in the publication "Standard Specifications for Construction of Airports." The contractor brings this cable into the bases as shown on the plans.

(5) Cable Connections.

(a) In making the cable connections to the lights, the contractor pulls cables into each light base and leaves sufficient slack cable inside the base to permit connections to be made above the pavement.

(b) The field attached connectors per Specification L-823, "Plug and Receptacle, Cable Connectors," are installed on the primary supply cables in accordance with manufacturer's instructions. The plug and receptacle of the field attached connector is plugged into the mating connectors of the transformer.

(c) In all cases the joint is wrapped, where the transformer mating connectors come together, with at least two layers of plastic tape, one-half lapped, extending at least 1½ inches on each side of the joint.

(6) Assembling the Unit. The runway touchdown zone light, Specification L-838, Type III, is assembled on the base and connected in accordance with the manufacturer's instructions. The transformer secondary leads are connected to the fixture leads by means of a disconnecting plug and receptacle. A lamp of proper rating is installed in the fixture.

(7) 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.

b. Touchdown Zone Lighting - Existing Runways - Rigid or Flexible.

(1) Pavement Drilling. In rigid or flexible pavements, fixture recesses and wireways are drilled and sawed into the pavement surface at the locations and in accordance with dimensions shown on the plans. Standard sawing and coring equipment normally used on pavement is adaptable and can be used for this work. Extra depth and special treatment are required where wireways cross rigid pavement joints. Figure 5 shows typical drilling and sawing details.

(2) Installation of Inset Lights. In rigid or flexible pavements, a required 10-inch diameter by 9-inch minimum deep hole is drilled at the locations as shown on the plans. Where base and/or subbase is encountered below the drilled portion of the pavement, it is excavated to a minimum of 12 inches below the pavement surface and backfilled with concrete conforming to Item P-501 of "Standard Specifications for Construction of Airports," using high early-strength cement. The concrete backfill is brought up to a level of approximately 9 inches below the pavement surface. Figure 5 shows details of fixture installation. The hole and fixture are cleaned and a sufficient quantity of sealer material, of the proper consistency, is placed in the prepared recess hole so that all voids will be completely filled when the base is installed in its final position. The integral base portion of the inset fixture, Type I, is installed to the proper alignment and elevation by means of a jig. This holding and leveling device is left in place until the sealer has reached its initial set. Any excess sealer is wiped clean from the receptacle and pavement. After placing the light base in the drilled hole, the lead wires are properly arranged with respect to their splicing position in the wireways. It may be necessary to place temporary plugs or roving material (hemp, jute, etc.) for blocking wireway entrances into the drilled recesses in order to retain sealer material during setting of the fixture. After curing of sealer, the top assembly is installed in accordance with manufacturer's instructions. The base is installed so that the top fitting is at proper elevation with respect to the pavement, and level in the horizontal plane.

(3) Wireways. Regardless of the type of pavement, saw kerfs are provided for the wireways. A saw kerf is provided from the edge of the pavement transversely to the centerline of the drilled hole located 30 feet from the centerline of the runway as shown in Figure 5. This transverse saw kerf will carry six, one-conductor wires, size #10 AWG, and is cut to the depth and width as shown in Figure 5. Where a saw kerf crosses a construction joint, the cut is the depth and width as shown in Figure 5 to allow for slack wire under the joint which permits movement when the joint opens and closes. Longitudinal saw kerfs are provided from the transverse saw kerf at right angles to the edges of each drilled integral base hole. Each longitudinal saw kerf carries two one-conductor wires, size #10 AWG, and is the depth and width shown in Figure 5.

(4) Wire Placement. Prior to the installation of the wires, all saw kerfs have all vertical edges chamfered at intersections. Further, all saw kerfs are sandblasted, flushed with a high-velocity water jet, and blown out with a high-velocity air jet or wiped dry to insure a good bond. The wires are placed in

the wireways and anchored in the bottom of the saw kerfs with sufficient rubber wedges or other suitable material to hold the wires in place at a depth of at least ½-inch below pavement surface. After the wires have been placed in the saw kerfs, the saw kerfs are filled to the level of the pavement surface with liquid sealer as called for in the specifications.

(5) Joint Crossings. Where saw kerfs cross joints in rigid pavement, their depth is increased as shown on Figure 5. These areas are packed with roving material during the pouring of the sealer into the remaining portions of the saw kerfs. When the sealer has cured, the roving material is removed and the joint area is filled with joint sealing filler to the level of the surrounding pavement. The sealing material conforms to Item P-605 of "Standard Specifications for Construction of Airports."

(6) Series Secondary Conductor Connections. Two single conductor wires, size #10 AWG, are installed between each touchdown zone light and the transformer. No splices are made in the single conductor wires except at each light and at the transformer. The splices to the lamp leads are made with a preinsulated connector sleeve crimped with a crimping tool that requires a complete crimp before the tool can be released. Splices are made at staggered locations. The splices are wrapped with two half-lapped layers of an acceptable insulation tape. The ends of the two single conductor wires, size #10 AWG, entering the transformer base located at the runway edges, are fitted with Elastimold Cable Connector, Style 90P, or an acceptable equal, and plugged directly into the secondary mating connector on the transformer leads. The above connector may be obtained from the Elastimold Division, Elastic Stop Nut Corporation of America, Esna Park, Hackettstown, New Jersey. The joints where these connectors come together are wrapped with at least two layers of an acceptable insulation tape, one-half lapped, extending at least 1½ inches on each side of the joint. Figure 7 shows typical secondary wiring and connection details.

(7) Series Primary Conductor Connections. The two single conductor cables, size #8 AWG, entering the transformer base at the runway edge, are fitted with cable connectors per Specification L-823, Figure 14, and plugged directly into the primary mating connectors on the transformer leads. The joints where these connectors come together are wrapped with at least two layers of an acceptable insulating tape, one-half lapped, extending at least 1½ inches on each side of the joint. Figure 7 shows typical primary wiring and connection details.

c. Runway Centerline and Taxiway Turnoff Lighting - New and Existing Runways - Rigid or Flexible Pavements.

(1) Layout. A dimensional layout of the centerline lights and the taxiway turnoff lights should be made prior to the installation of the fixtures to assure proper equipment placement. If the centerline lights are installed at the allowable two-foot distance from the runway centerline, the centerline paint stripe would be avoided. Special pavement joint designs may be considered.

(2) Pavement Drilling. In both rigid and flexible pavements, fixture recesses and wireways are accomplished by means of drilling and sawing into the pavement surface at the locations and in accordance with dimensions as shown in Figures 2, 3, and 9. Figure 8 shows typical drilling and sawing details. Extra depth and special treatment are required where wireways cross rigid pavement joints. Alignment in a longitudinal direction should not vary more than ½".

(3) Installation of Centerline Lights. To accommodate the 8-inch by 1-inch deep receptacle, a hole is drilled in the pavement at the locations shown on the plans. Into this hole a sufficient quantity of paste sealer material is placed. The top edge of the receptacle is then installed level with the surrounding pavement by means of a jig. This holding and leveling device is left in place until the sealer has reached an initial set. If any voids are present after initial set around the edges of the receptacle, they may be filled with a liquid sealer. Any air bubbles are broken and excess sealer wiped clean from the receptacle and pavement. Precautions are taken to keep the receptacle interior clean during the sealing process.

(4) Orientation. Prior to placing the receptacle in the drilled hole, the lead wires are properly arranged on the receptacle with respect to their splicing position in the wireways. It may be necessary to place temporary plugs for blocking wireway entrances into drilled recesses in order to retain sealer material during setting of receptacle. When installing the receptacles for the curved portion of the taxiway turnoff, the receptacles are oriented to provide the required guidance. To accomplish this orientation, the receptacle is set or placed so that the light beam from each fixture will intersect the path of the aircraft 500 feet ahead of the unit. After curing of sealer, the top assembly is installed in accordance with manufacturer's instructions.

(5) Wireways. Regardless of the type of pavement, the wireways are saw kerfs in the pavement between each group of eight fixtures. This transverse saw kerf, cut to the proper depth and width,

will carry four one-conductor wires, size #10 AWG. Where a saw kerf crosses a rigid pavement joint, the cut is of the proper depth and width to allow for slack wire under the joint which permits movement as the joint opens and closes. Longitudinal saw kerfs are provided from the transverse saw kerf in each direction through the centerline of each bored receptacle hole. The saw kerf continues below and through the recessed hole at a depth sufficient to carry the single #10 AWG return circuit wire. Each saw kerf carries two one-conductor wires, size #10 AWG. Details of these longitudinal and transverse saw kerfs are of the depths and widths shown on Figure 8.

(6) Wire Placement. Prior to the installation of the wires, all saw kerfs have all vertical edges chamfered at intersections. Further, all saw kerfs are sandblasted, flushed with a high-velocity water jet, and blown out with a high-velocity air jet or wiped dry to insure a good bond. The wires are placed in the wireways and anchored in the bottom of the saw kerfs with sufficient rubber wedges or other suitable material to hold the wires in place at a depth of at least ½-inch below pavement surface. After the wires are placed in the saw kerfs, the saw kerfs are filled with a sealer to the level of the surrounding pavement.

(7) Joint Crossing. Where saw kerfs cross joints in rigid pavement, their depth is increased as shown on Figure 8. These areas are packed with roving material during the pouring of the sealer into the remaining portions of the saw kerfs. When the sealer has cured, the roving material is removed and the joint area is filled with joint sealing filler to the level of the surrounding pavement. The sealing material conforms to Item P-605 of "Standard Specifications for Construction of Airports."

(8) Series Secondary Conductor Connections. Two single conductor wires, size #10 AWG, are installed between the centerline receptacles and between the first centerline receptacle and the transformer base. No splices are made in the single conductor wires except at each light receptacle and at the transformer. The splices to the light receptacle leads are made with a pre-insulated connector sleeve crimped with a crimping tool that requires a complete crimp before the tool can be removed. They are wrapped with two half-lapped layers of insulating tape. The ends of the two single conductor wires, size #10 AWG, entering the transformer base located at the runway edges, are fitted with Elastimold Cable Connector, Style 90P, or an acceptable equal, and plugged directly into the mating connector on the transformer secondary leads. The joint where these connectors come together are wrapped with at least two layers of Scotch Electrical Tape, No. 88, or an acceptacle equal all weather tape, one-half lapped, extending at least 1½ inches on each side of the joint. Figure 9 shows wiring details.

(9) Series Primary Conductor Cable Connections. The single conductor primary cables, size #8 AWG, entering the transformer base at the runway edge, are fitted with cable connectors as shown on Figure 14 of Specification L-823, and plugged directly into mating connectors on the transformer primary leads. The joint is wrapped, where these connectors come together, with at least two layers of Scotch Electrical Tape, No 88, or an acceptable equal all weather tape, one-half lapped, extending at least 1½ inches on each side of the joint. Figure 9 shows wiring details.

(10) The top assembly of the centerline and taxiway turnoff lights are installed in accordance with manufacturer's instructions. The unit is cleaned and dried before the top assembly is secured in place. Care should be exercised to properly seat all gaskets. In addition, all screws, bolts, or other securing hardware are tightened with a torque wrench or screwdriver in accordance with manufacturers recommended torque.

d. Primary Cable Homeruns. The installation, splicing, and marking of cable homeruns is in accordance with Item L-108 of "Standard Specifications for Construction of Airports."

7. TESTS.

a. General.

(1) The inspection and testing of these lighting systems during construction are of vital importance due to the many components of certain systems which are not accessible for corrective action after final installation.

(2) A visual inspection is made of the sealer in the saw kerfs and around the fixtures to determine if all voids are filled, that there are no protrusions above the surrounding surface, and that the sealer is at the proper level with respect to the runway or taxiway turnoff surface.

(3) The installed receptacle or housing and top fitting of all lighting fixtures are inspected to determine if the equipment has been installed at the proper elevation.

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

(5) An adequate number of 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 channel in front of the lenses are clean.

b. Touchdown Zone Lighting - Base Mounted Lights. The testing for this type of installation is accomplished in the manner prescribed under Item L-108, "Standard Specifications for Construction of Airports." The installation is operated not less than one-half hour as a completed system prior to acceptance, and these tests include the operating of each control not less than 10 times.

c. Touchdown Zone and/or Centerline Lighting - Inset Lights. Inspection and testing for these types of systems are accomplished in part, concurrent with installation, because of subsequent inaccessibility. Before filling saw kerfs, the secondary series circuit for each subsector of runway and taxiway centerline lights is tested for continuity and insulation resistance to ground. The insulation resistance may be tested by use of a 500-volt megger. An acceptable circuit has a resistance of at least 50 megohms. After these tests have been performed and the taxiway turnoff and runway centerline lighting circuits are completed, they are tested by continuous operation for a period of not less than one-half hour as a completed system.

d. The primary cables are tested in accordance with Item L-108, "Standard Specifications for Construction of Airports."

8. MAINTENANCE.

a. General. A strict and continuing maintenance program is necessary at airports with in-runway lighting to insure proper operation, long life, and dependable service from this type of lighting system. An improperly maintained system may cause equipment failure during a critical aircraft operation and rapid deterioration of system effectiveness.

(1) A daily operational check should be made of all in-runway lighting fixtures. The touchdown zone, runway centerline, and taxiway turnoff lights are energized and visually inspected during this check. 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 the in-runway lighting fixtures can operate at maximum efficiency. The lens and channel in front of the lens should be cleaned periodically in a manner that is in accordance with manufacturers 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 the blade at least ½ inch above the surface followed, if necessary, by a power broom.

b. Relamping. De-energize the electrical energy to the primary circuit of the fixture containing the burned out lamp and remove the top assembly. If the fixture contains a lamp bypass device, replace the lamp bypass device and the lamp. Replace the gasket around the bolts or between the top assembly and housing if they appear to be worn or damaged. Before the top assembly is replaced, the unit is cleaned and dried. Care should be exercised to properly seat all gaskets. In addition, all screws, bolts, or other securing hardware are tightened with a torque wrench or screwdriver in accordance with manufacturer's recommended torque.

c. Removal of Water. The touchdown zone, runway centerline, and taxiway turnoff lights are designed to exclude both ground and surface water from entering. For varying reasons, small amounts of water sometimes enter and can become 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 moisture, 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 is removed and the receptacle lamps and electrical contacts are cleaned and dried, and the gaskets replaced if necessary. Properly seat all gaskets and tighten the screws securing the top assembly with a torque wrench or screwdriver in accordance with manufacturer's recommended torque.

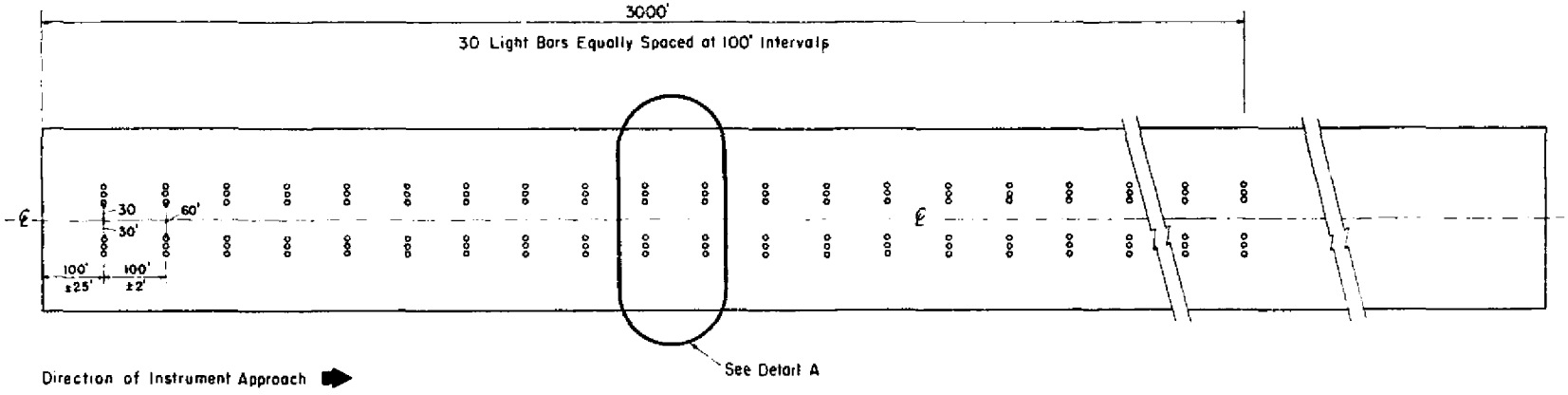
d. Cable. Homeruns of cable are meggered with a 500-volt megger after the installation has been accepted, and records of the megohm resistance values obtained are kept. In order to check the condition of the system, monthly megger readings are obtained and compared with the initial values. In an acceptable 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.

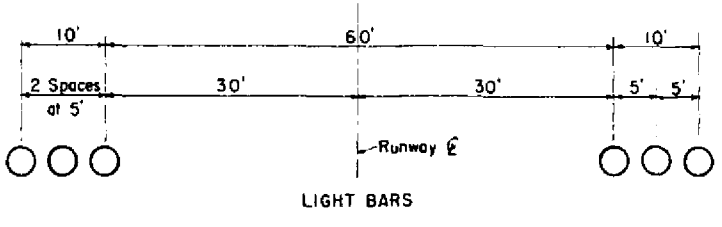
(1) Monthly megger checks may be accomplished by de-energizing the regulator, disconnecting the series cable leads at the regulator, and connecting one lead of the megger to the series cable and the other lead of the megger to a proven ground. Operate the test equipment in accordance with instrument 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 10 KW, 6.6 ampere regulator may have an open-circuit voltage as high as 2,000 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 the interconnecting wires are sealed in the runway pavements. For this reason, it is important to check the system closely during the installation and to establish an effective preventive maintenance program.

e. Adequate spare parts should be made available for maintenance purposes.

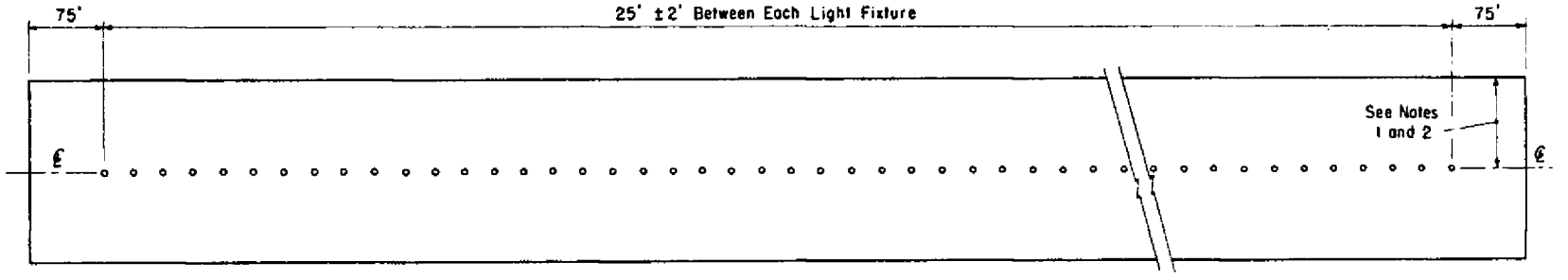
f. The vault should be kept clean and uncluttered to prevent dirt from accumulating in control compartments and to allow equipment to be accessible at all times.





DETAIL A

FIGURE 1. TOUCHDOWN ZONE LIGHTING LAYOUT

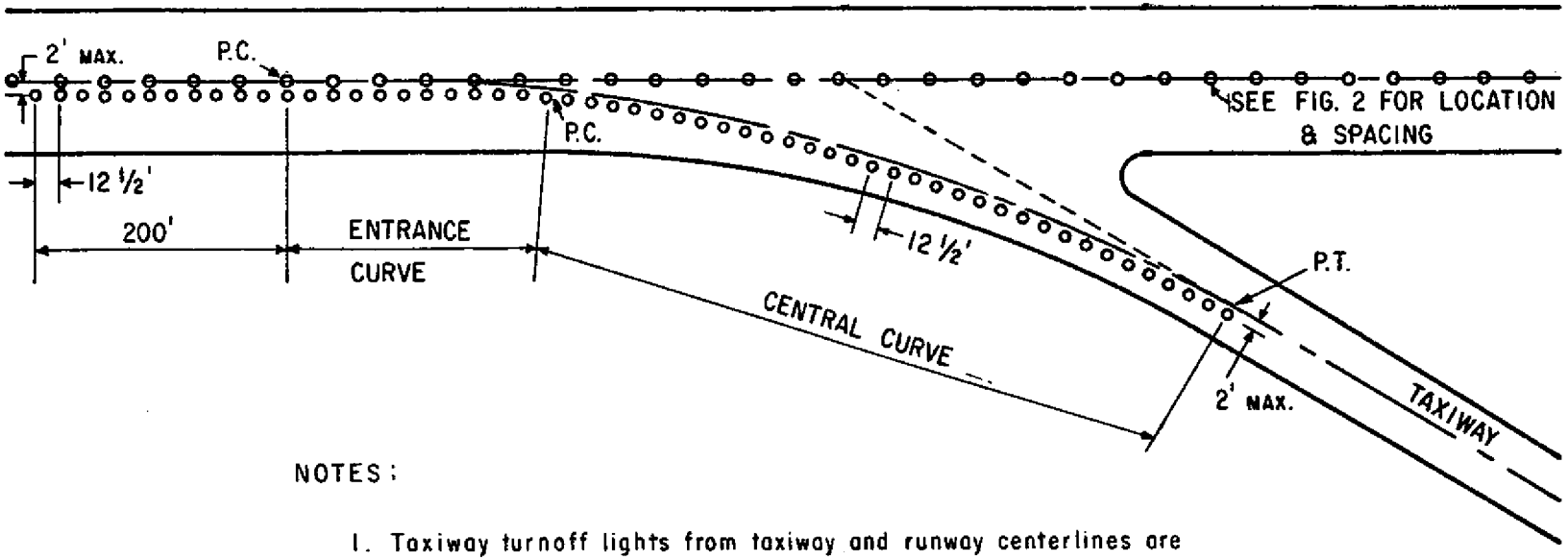


RUNWAY

NOTES:

1. In rigid pavement all centerline lights may be offset ±2' from the centerline of the runway in order to avoid longitudinal joint.
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.

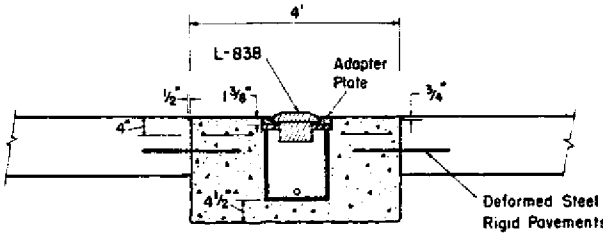
FIGURE 2. RUNWAY CENTERLINE LIGHTING LAYOUT



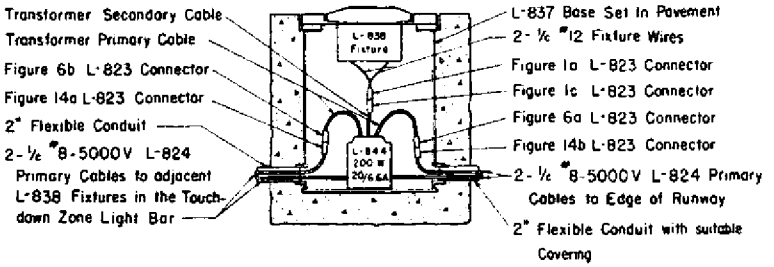
NOTES:

1. Taxiway turnoff lights from taxiway and runway centerlines are offset a distance not in excess of 2 feet
2. A longitudinal tolerance of ± 2' may be necessary to avoid rigid pavement joints
3. Standard "entrance" and "central" curve design information per FAA Manual "Airport Design"

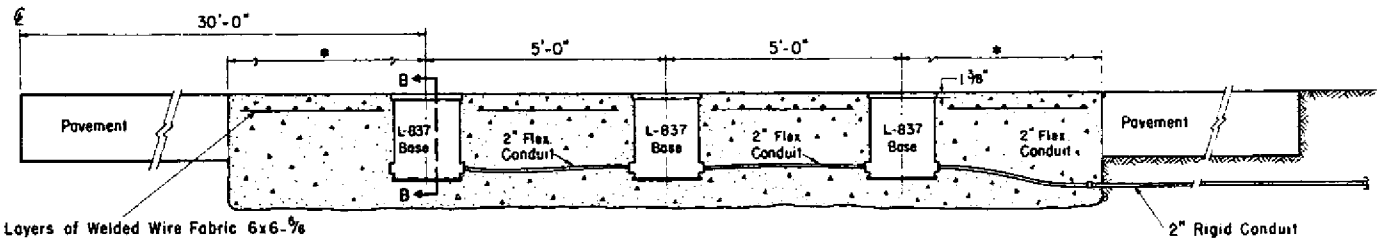
FIGURE 3. TAXIWAY TURNOFF LIGHTING LAYOUT



SECTION B-B



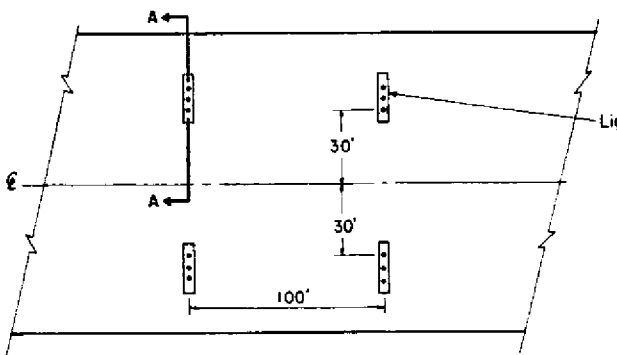
TOUCHDOWN ZONE PRIMARY AND SECONDARY WIRING DETAILS



Two Layers of Welded Wire Fabric 6x6-⅝ or a Cross Sectional Area of Reinforcing Steel of approximately 0.12 Square Inches Per Foot of Width. Discontinue 2" to 4" from Light Bases and Edge of Slab.

SECTION A-A

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



PLAN

Light Bar – 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 4. INSTALLATION DETAILS - TOUCHDOWN ZONE LIGHTING - BASE MOUNTED - NEW RIGID AND FLEXIBLE PAVEMENTS

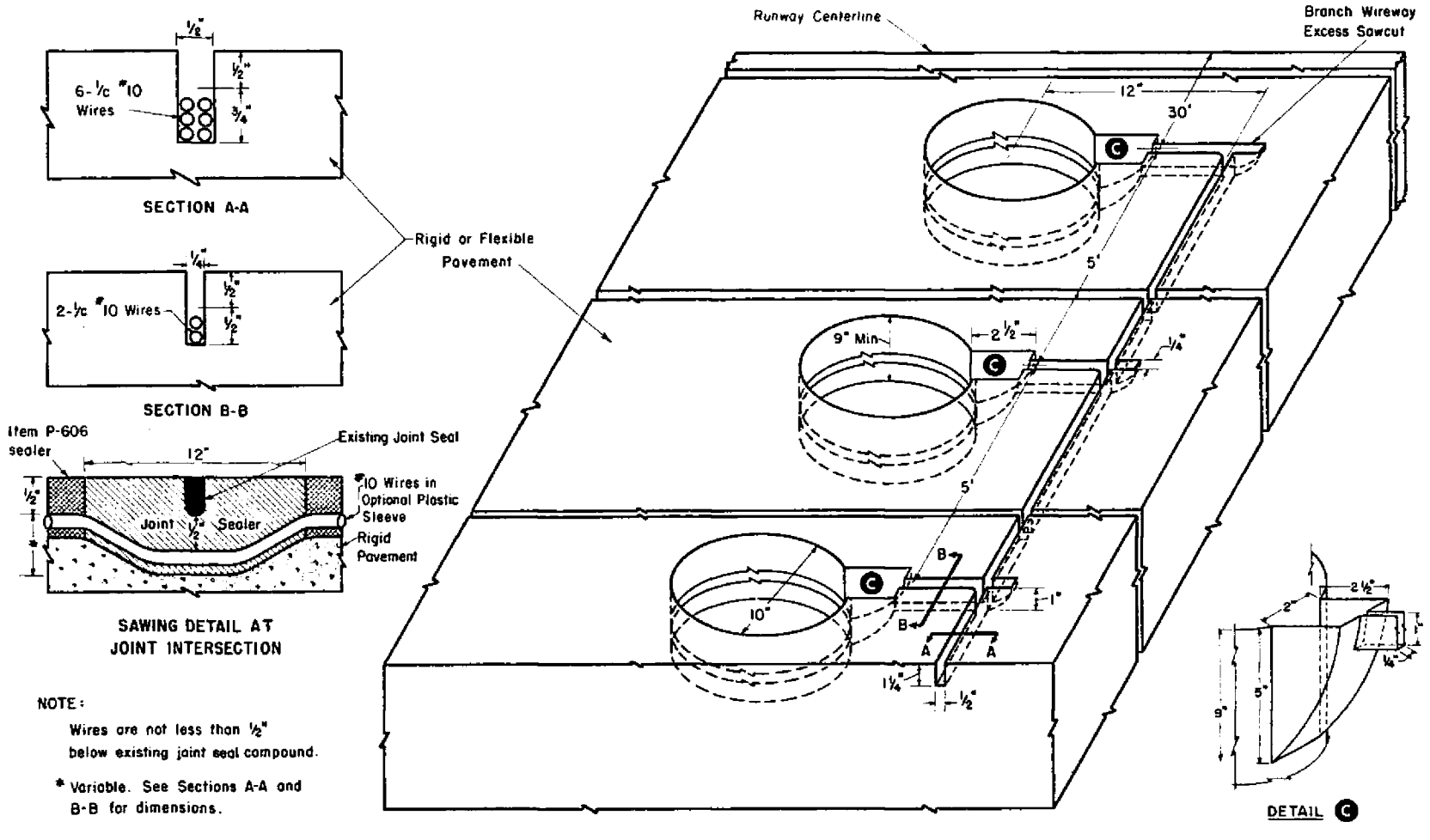
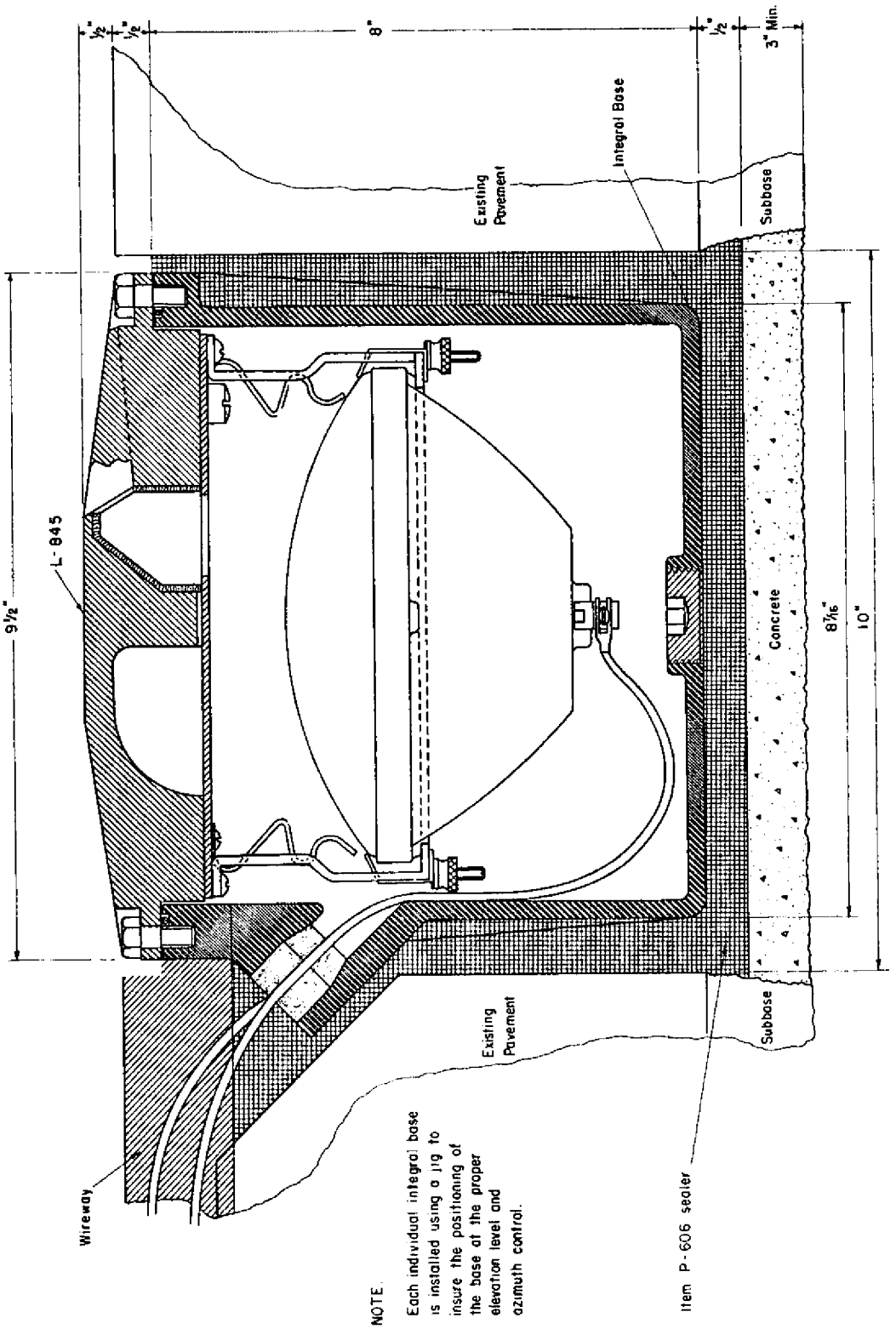


FIGURE 5. DRILLING AND SAWING DETAILS - L-845
INSET PRISMATIC AIRPORT LIGHT


½"
½"
8"
½"
3" Min.
Existing Pavement
Integral Base
Subbase
9½"
L-845
Concrete
8 7/16"
10"
Existing Pavement
Subbase
Wireway
Item P-606 sealer
NOTE.
Each individual integral base is installed using a jig to insure the positioning of the base at the proper elevation level and azimuth control.

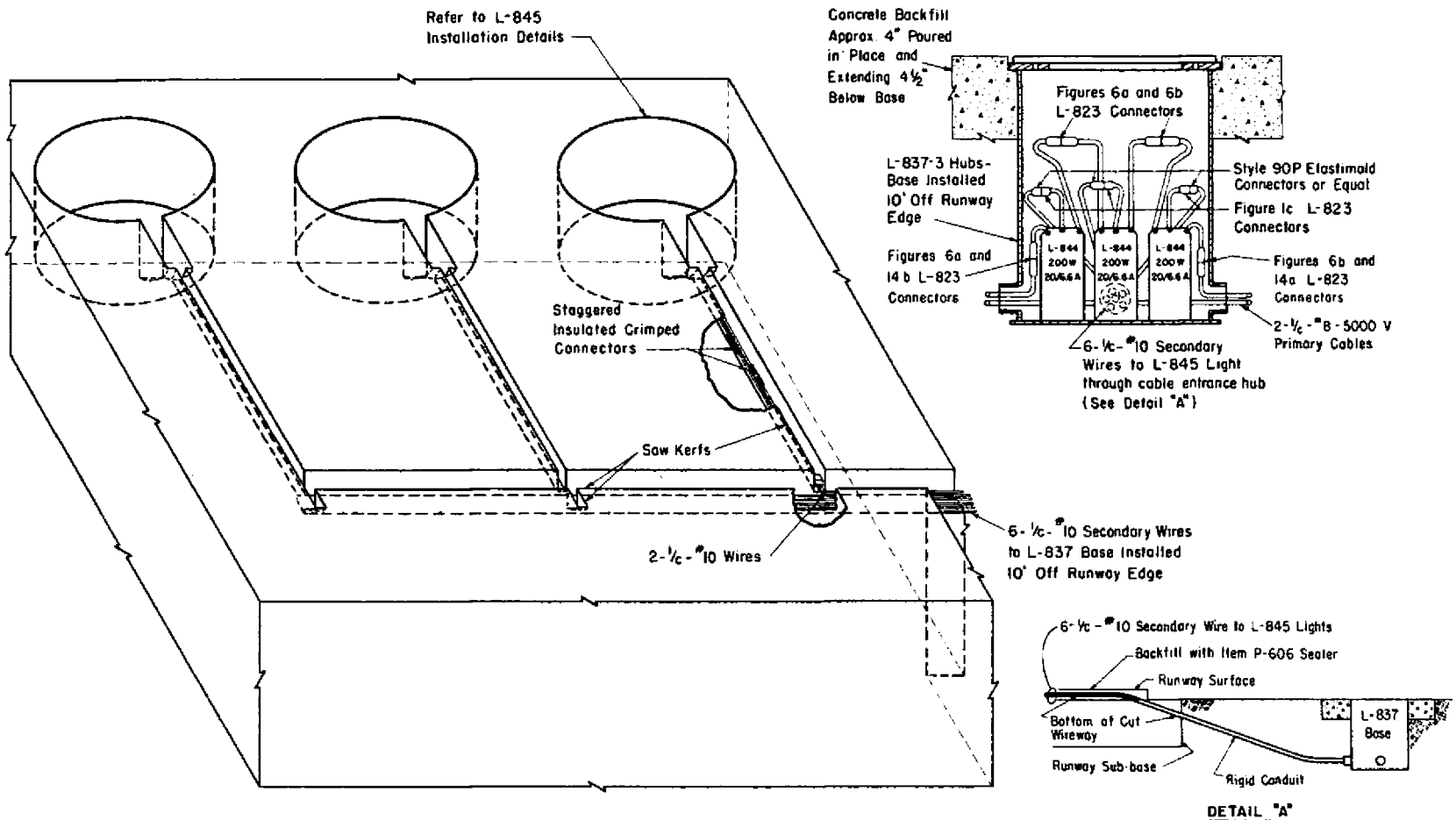
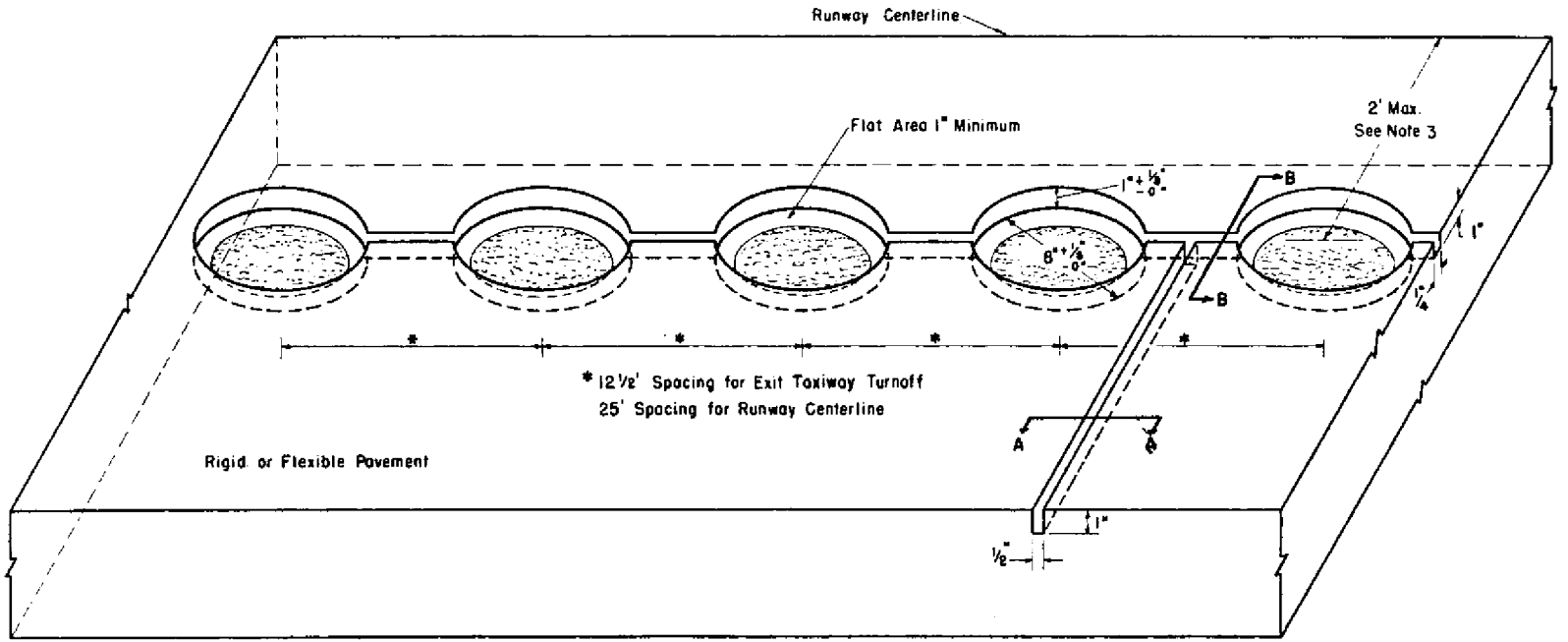
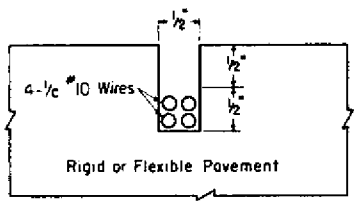
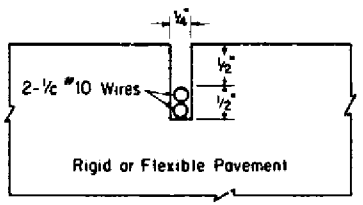


FIGURE 7. PRIMARY AND SECONDARY WIRING DETAILS - L-845 INSET PRISMATIC AIRPORT LIGHT

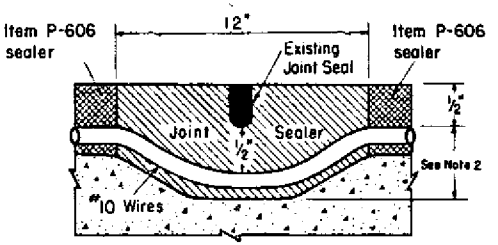




SECTION A-A



SECTION B-B

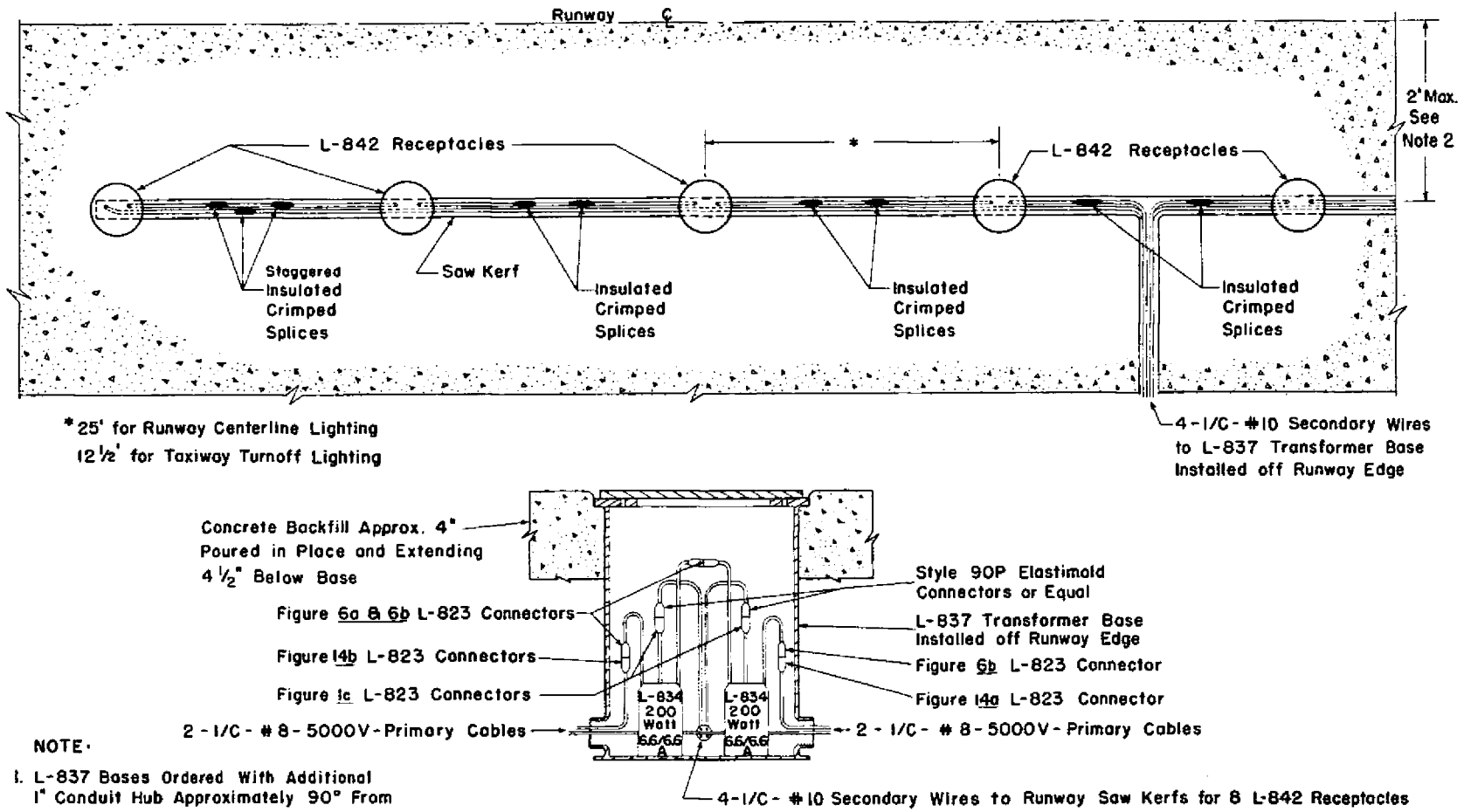


SAWING DETAIL AT
JOINT INTERSECTION

NOTES:

1. Wires are not less than ½" below existing joint seal compound.
2. Variable. See Sections A-A and B-B for dimensions.
3. 2' offset applies only to rigid pavement.
4. Transformer Housing to be the same as Detail "A" Fig. 7

FIGURE 8. PAVEMENT SAWING AND DRILLING DETAILS FOR RUNWAY CENTERLINE AND TAXIWAY TURNOFF LIGHTING



NOTE:

1. L-837 Bases Ordered With Additional 1" Conduit Hub Approximately 90° From Main Entrance Hubs
2. 2' Offset applies only to Rigid Pavement

FIGURE 9. WIRING DIAGRAM RUNWAY CENTERLINE AND TAXIWAY TURNOFF LIGHTING

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.

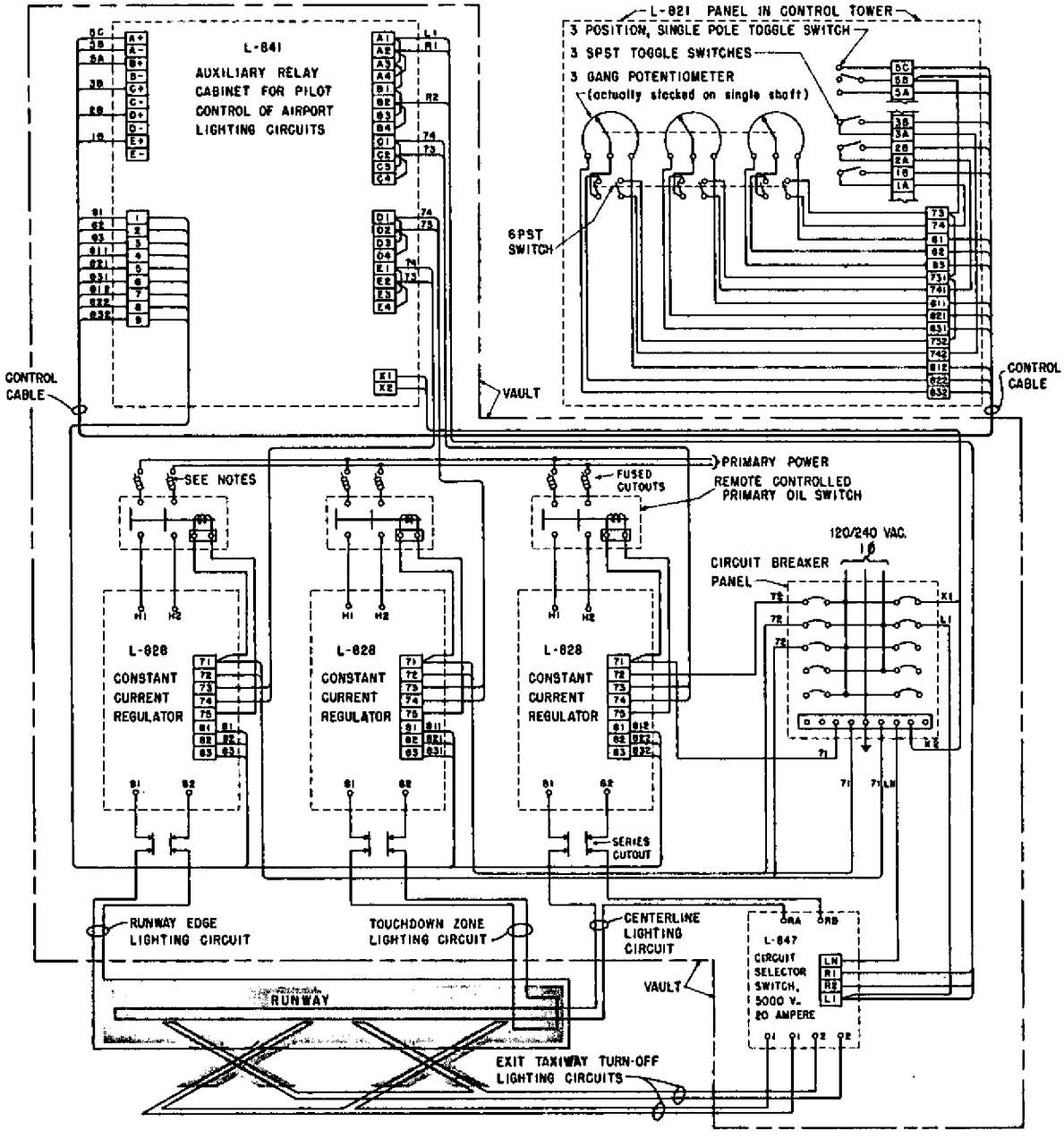


FIGURE 10. TYPICAL IN-RUNWAY LIGHTING SYSTEM WIRING DIAGRAM WITH DC CONTROL