SP- 150953
(New)

SPECIAL PROVISIONS
FOR
ROADWAY LIGHTING

Buchanan County
STPN-281-2(10)--2J-10

Effective Date
January 18, 2023

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

PART 1 GENERAL

1.01 SUMMARY:

A. Section Includes:
   1. Basic Electrical Requirements.
   2. Electrical Coordination.
   3. Quality Assurance.
   4. Codes, Ordinances, & Permits.

1.02 DESCRIPTION OF WORK:

A. This part of the specifications includes the furnishing of all materials and equipment necessary to complete, in place and operational, roadway lighting as described in the project plans.

1.03 SUBMITTALS:

A. Shop Drawings:
   1. Submit shop drawings, wiring diagrams, and descriptive literature on all equipment furnished in this contract.
   2. Make submittals as soon as practicable after the signing of the contract. Shipment shall not be released until drawings and literature have been finally approved.
   3. Shop drawings shall be checked by the Contractor for shape, dimensions, and details of attachment to the construction before submittal. Submitted shop drawings will be presumed to have been so checked by the Contractor.
   4. The literature shall be complete, giving materials, gauges, weights, finishes, etc., and in case of lighting fixtures, shall include ETL photometric curves.
   5. Wiring diagrams shall be furnished for all communication and control systems under this contract.
   6. In addition to the foregoing, supply a complete shop drawing portfolio of all equipment indicated under the specific specification section, bound in a single set. Submit this near completion of the project arranged and indexed according to the CSI format.
   7. Luminaire And Pole Submittals
      a. Shop Drawings:
         1) Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
      b. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
      c. LED Luminaires:
         1) Include estimated useful life, calculated based on IES LM-80 test data.
      d. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
      e. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
      f. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.
      g. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to

AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design.

B. Acceptance certificates: Submit written manufacturer, testing agency and/or local Code authority acceptance certificates with project closeout documentation.

C. Warranty: Submit a written warranty statement detailing all system and equipment warranties.
   1. Provide limited 10 year manufacturer warranty for all LED luminaires.
   2. Provide 5 year manufacturer warranty for poles.

D. Operation & Maintenance Instructions:
   1. Furnish approved operation and maintenance instruction booklets covering each listed item of equipment installed under this contract. These booklets shall provide complete instructions on the proper operation, use and periodic maintenance, together with the source of replacement parts and service for the item of equipment covered.
   2. Operation and maintenance manuals shall include copies of test reports, acceptance certificates and warranty information.

E. Record Drawings:
   1. The Engineer will furnish one set of blue line prints of the site plan for the Contractor's use in making a record layout of actual locations of equipment, devices, routing of conduits and locations of pull boxes.
   2. The information shall be neatly marked and the prints delivered to the Engineer.

F. Manufacturer Warranty:
   1. Warranty for drivers and LEDs shall be as follows: Warranty failure shall be deemed to have occurred when 10% or more of the population of drivers or LED boards have failed. Any extended warranties offered by Manufacturers shall not be preempted by this warranty.

1.04 BASIC ELECTRICAL REQUIREMENTS

A. Before bidding, the Contractor shall diligently study and compare all contract documents and promptly report to the Engineer any discrepancies or deficiencies discovered by or made known to the Contractor.

B. Discrepancies: Whenever a discrepancy or inconsistency exists between related information indicated on the contract drawings and/or specifications (such as differences between product descriptions and catalog numbers) this contractor shall obtain additional clarification and direction from the Engineer before proceeding. For bidding purposes, this contractor shall include warranty terms the labor and materials necessary to comply with the alternative that results in the greatest cost to the Contract.

C. Deficiencies: The Contractor and subcontractors shall resolve all known deficiencies and inadvertent omissions, including non-compliance with applicable codes, with the Engineer prior to ordering materials or proceeding with the work. Any work performed prior to receipt of instruction from the Engineer will be done so at the Contractor’s risk.

D. Manufacturer’s Catalog Numbers: Product series, model, or catalog numbers, whether indicated on drawings or specifications, shall not be considered complete. This Contractor shall not order any product based solely upon the stated catalog number. Furnish products including accessories and options necessary to match the full product description and its intended purpose and application based on all information available from the contract documents.

1.05 COORDINATION AND DELIVERY

A. Deliver only materials that fully conform to these specifications, or for which substitution has been approved.
   1. The contractor shall complete the equipment list by writing in the name of the equipment manufacturer and catalog number of each item listed which he proposes to install. Before

beginning work on the project, the contractor shall submit three copies of the equipment list, and three copies of catalog cuts for all materials supplied by the contractor.

2. Prior to ordering any materials the contractor shall provide certification from the manufacturers of all electrical equipment, conduit, and cable stating said material complies with the specifications.

B. Store material in accordance with the manufacturers' recommendations and in locations which will minimize the interference with operations, minimize environmental damage, and protect adjacent areas.

C. Remove and dispose of unacceptable materials in accordance with the contract documents.

D. Contractor shall coordinate routing and installation of conduit system with existing and proposed utilities, structures and equipment. Contractor shall be responsible to obtain locates on all underground utilities and verify clearances before boring, trenching or excavation.

E. Schedule work to minimize disruption of public streets and facilities.

F. Discontinue work which will be affected by any conflicts discovered or any changes needed to accommodate unknown or changed conditions and notify the engineer.

G. Contractor shall coordinate routing and installation of conduit system with existing and proposed utilities, structures and equipment. Contractor shall be responsible to obtain locates on all underground utilities and verify clearances before boring, trenching or excavation.

1.06 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

B. Tests & Adjustments
1. Contractor shall perform at his own expense, except for electrical energy, any tests that the Engineer may order to prove the performance of any device(s) and/or equipment supplied under this contract.
2. Such tests will be limited to non-destructive test and will involve only direct reading(s) of the parameter(s) involved, i.e., actual trip rating or time delay of a circuit breaker may be required but coordination study is beyond the scope of this requirement.
3. Provide adjustments such as branch circuit re-arranging, circuit breaker trip settings, final selection of fuse sizes, motor starter overload element settings, and the like that may be indicated by the tests and/or to suit equipment to be installed.

1.07 CODES, ORDINANCES, & PERMITS

A. All governmental codes and ordinances that are applicable and in effect at the time and location of this work are hereby referenced as an integral part of the specification to establish minimum standards of design detail, materials, and workmanship. Extra payment will not be allowed for work or changes required by local code enforcement authorities and/or utility companies. This is not to preclude the establishment of non-conflicting higher standards as may be specified herein and/or indicated on the drawings. In case of conflict between any of the standards established herein and a governmental code or ordinance, refer to the Engineer and obtain instructions before proceeding with the work involved.

B. Apply for, obtain, and pay for required permits and certificates of inspection

C. Particular attention is directed to:
1. National Electrical Code
2. Local electric wiring ordinances
3. Requirements of the electric utility company
4. IEEE National Electrical Safety Code

PART 2 MATERIALS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or prior approved product substitution. No product manufacturer will be accepted after this bid unless approved through a contractual change or written acceptance by Engineer. See “Substitutions” article herein.

2.02 PROPRIETARY REFERENCES

A. Except where there is indication to the contrary, the intent of this specification is to be open to all brand names and suppliers that offer equipment that complies with the stated requirements of capacity, function, quality configuration, size, shape, and operating characteristics that are compatible with the design objectives of the system and interfacing equipment.

B. Stated requirements are minimum in the case of unit output and maximum in the case of input requirements.

C. The perceived operational limitations and maintenance requirements as well as the availability of suitable maintenance support will be evaluated in comparison to competing equipment as an important factor in deciding if an item of equipment is acceptable or not acceptable.

D. The product manufacturers listed are manufacturers that are believed to be producers of like equipment or materials and locally represented, with service capability and otherwise meeting the requirements of the contract documents. Reference to a brand name is not to be construed as a representation that the named supplier has available the equipment or materials that meet the detailed requirements of the contract documents.

2.03 SUBSTITUTIONS

A. The materials, products and equipment described in the contract documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Engineer at least 5 days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Engineer's decision of approval or disapproval of a proposed substitution shall be final. Refer to Division 1 for additional requirements.

C. If the Engineer approves a proposed substitution prior to receipt of bids, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.

D. No substitutions will be considered after the contract award unless specifically provided in the contract documents.

2.04 UL LABEL

A. All materials, devices, etc. installed under this contract shall bear the UL label, or be UL listed as applicable except those specified items not covered by existing UL Standards.

2.05 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

A. Conductor And Cable Applications
   1. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
   2. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

B. Conductor And Cable General Requirements
   1. Provide products that comply with requirements of NFPA 70.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended.
   3. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
   4. Comply with NEMA WC 70/ICEA S-95-658.
   5. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
   6. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
   7. Conductor Material:
      a. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
      b. Copper Conductors: Soft drawn annealed, 98% conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   8. Minimum Conductor Size:
      a. Branch Circuits: No. 10 AWG.
   9. Conductor Color Coding:
      a. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

C. Single Conductor Building Wire
   1. Description: Single conductor insulated wire.
   2. Conductor Stranding:
      a. Feeders and Branch Circuits:
         1) Size No. 10 AWG and Smaller: Solid.
         2) Size No. 8 AWG and Larger: Stranded.
   3. Insulation Voltage Rating: 600 V.
   4. Insulation:
      a. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

D. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
   2. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
      b. Where bare copper conductors are used for grounding systems, they shall comply with the following:
         1) Solid Conductors: ASTM B 3.
         2) Stranded Conductors: ASTM B 8.

3) Tinend Conductors: ASTM B 33.
4) Bonding Cable: 28 KCMIL, 14 strands of No. 17 AWG conductors, 1/4 inch in diameter.
5) Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6) Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1 5/8 inches wide and 1/16 inch thick.
7) Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1 5/8 inches wide and 1/16 inch thick.

3. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
   c. Comply with NEMA GR 1.
   d. Material: Copper-bonded (copper-clad) steel.
   e. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

E. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

F. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

G. Wiring Connectors
1. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
2. Wiring Connectors for Splices and Taps:
   a. Copper Conductors: Use mechanical connectors or compression connectors.
3. Mechanical Connectors: Provide bolted type or set-screw type.
4. Compression Connectors: Provide circumferential type or hex type crimp configuration.

H. Accessories
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electrical Tape:
   a. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mils; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0°F and suitable for continuous temperature environment up to 221°F.

b. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mils.

3. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

4. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

5. Cable Ties: Material and tensile strength rating suitable for application.

2.06 ELECTRICAL IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
a. Time Switches:
1) Identify load(s) served and associated circuits controlled.

B. Identification for Conductors and Cables:
1. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
a. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
1) Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2) Colors for 240/120-V Circuits:
(a) Phase A: Black.
(b) Phase B: Red.
3) Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

C. Identification for Raceways:
1. Use underground warning tape to identify underground raceways.
a. Underground Warning Tape
1) Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
(a) Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mils.
(b) Legend: Type of service, continuously repeated over full length of tape.
(c) Color:
(1) Tape for Buried Power Lines: Black text on red background.

D. Identification Nameplates:
1. Materials:
a. Outdoor Locations: Use stainless steel or aluminum nameplates suitable for exterior use.
2. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

3. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

2.07 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

E. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts or expansion anchors.
   3. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Comply with MFMA-4.
      b. Channel Material: Use galvanized steel.
   4. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

2.08 UNDERGROUND CONDUITS

A. Conduit Applications
   1. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
   2. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
   3. Underground:
      a. Under Slab on Grade: Use rigid PVC conduit or HDPE.
      b. Exterior, Direct-Buried: Use rigid PVC conduit or HDPE.
      c. Where rigid PVC conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

4. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
5. Concealed, Exterior, Not Embedded in Concrete or in Contact with Earth: Use galvanized steel rigid metal conduit or IMC.

B. Conduit Requirements
1. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
2. Provide products listed, classified, and labeled as suitable for the purpose intended.
3. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

C. Galvanized Steel Rigid Metal Conduit (RMC)
1. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
2. Fittings:
a. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
b. Material: Use steel.
c. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

D. Intermediate Metal Conduit
1. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
2. Fittings:
a. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
b. Material: Use steel.
c. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

E. Rigid Polyvinyl Chloride Conduit
1. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
2. Fittings:
a. Manufacturer: Same as manufacturer of conduit to be connected.
b. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 WIRING DEVICES

A. Weather-Resistant Receptacles, 125 V, 20 A
1. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:
a. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
b. Configuration: NEMA WD 6, Configuration 5-15R.
c. Standards: Comply with UL 498 and UL 943 Class A.
d. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2. Wall Plates
    a. Single and combination types shall match corresponding wiring devices.
        1) Plate-Securing Screws: Metal with head color to match plate finish.
        2) Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.
3. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

PART 3 CONSTRUCTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Examine the site and all the drawings before proceeding with the layout and installation of this work.

B. Obtain and follow manufacturer's installation instructions in the installation of all electrical equipment. Observe all restrictions imposed by the equipment manufacturer, UL label, NEC, or other applicable code in regard to setting; anchoring; hanging; clearances; electric, magnetic or thermal separation; shielding; weather and moisture protection. In case of conflict between the specifications herein and instructions or code governing the installation, notify the Engineer and receive his instructions before proceeding.

C. Install all work in a neat and workmanlike manner by workmen thoroughly qualified in the trade or duties they are to perform. Rough work will be rejected.

3.02 EXCAVATING & BACKFILLING

A. Provide excavating and backfilling necessary for installation of this work.

B. Dig trenches to proper depth, graded for fall and to give solid bearing for each length of conduit or wire. Underground conduit or wire shall not be covered until inspected and the installation approved.

C. Trenches under the building and under concrete slabs around the building shall be backfilled with mechanically tamped sand to level with surrounding earth. Dirt backfill shall not be used for these trenches.

D. If public streets, alleys, sidewalks, etc. are excavated, the Contractor shall obtain necessary permits and arrange for refilling and resurfacing in accordance with governing ordinances, and shall pay all expenses incurred therefor.

E. Sod and/or any surfacing (sidewalks, drives, parking, etc.) shall be replaced and restored to original condition where disturbed by excavations.

F. Before starting any excavation, use every reasonable means (examination of drawings, check with local utility companies and completed site work, local inquiry and check of surface indications) to determine the presence of underground piping, wiring, etc. in the area to be excavated. If such are, or are suspected to be existing, obtain instructions from the Engineer before proceeding.

3.03 UNDERGROUND ELECTRICAL WORK

A. Circuiting Requirements:
    1. Unless dimensioned, circuit routing indicated is diagrammatic.
    2. When circuit destination is indicated without specific routing, determine exact routing required.
    3. Arrange circuiting to minimize splices.

4. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

F. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

G. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

H. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
      c. Insulate ends of spare conductors using vinyl insulating electrical tape.

I. Bonding and Grounding
   1. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches deep in accordance with NFPA 70.
      a. Outdoor Installations: Unless otherwise indicated, install with top of rod 2 inches below finished grade.
      b. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
   2. Make grounding and bonding connections using specified connectors.
      a. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

b. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
c. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
1) Applications:
(a) Underground connections (except at test wells and as otherwise indicated.
d. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
1) Applications:
(a) Pipe and equipment grounding conductor terminations

3. Install insulated equipment grounding conductors with all feeders and branch circuits.

J. Electrical Identification

1. Install identification products centered, level, and parallel with lines of item being identified.
2. Unless labels and nameplates are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
3. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
4. Install underground warning tape above buried lines with one tape per trench at 6 inches below finished grade.
5. Mark all handwritten text, where permitted, to be neat and legible.

3.04 CONDUIT ROUTING:

A. Place conduit to a maintained depth of 30 inches. When conduit is placed behind the curb, place to a minimum depth of 24 inches and a maximum depth of 36 inches below top of curb. Critical crossings with other site utilities shall be reviewed with survey drawings and site conditions prior to rough-in.
B. Unless dimensioned, conduit routing indicated is diagrammatic.
C. When conduit destination is indicated without specific routing, determine exact routing required.
D. Conceal all conduits unless specifically indicated to be exposed.
1. Install raceways square to enclosures and terminate with locknuts.
2. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
3. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.

E. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction.

F. Connections and Terminations:
1. Use approved conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs for dry locations and raintight hubs for wet locations.

5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
7. Cut conduit perpendicular to the length. For conduits 2 inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

G. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of the Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.

H. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
a. Underground, Exterior: 30 inches.
b. Under Slab on Grade: 24 inches to bottom of slab.

3.05 CONCRETE BASES:

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of ten bolt diameters from edge of the base.

B. Anchor equipment to concrete base as follows:
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.06 LUMINAIRES AND POLES:

A. Coordinate locations of outlet boxes as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Pole-Mounted Luminaires:
1. Grounding:
a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
b. Provide supplementary ground rod electrode at each pole bonded to grounding system as indicated.

F. Install accessories furnished with each luminaire.

G. Bond products and metal accessories to branch circuit equipment grounding conductor.

H. Inspect each product for damage and defects.

I. Operate each luminaire after installation and connection to verify proper operation.

3.07 CLEANING & RUBBISH:

A. During the work, keep the premises clear of unnecessary accumulation of debris.

B. Plug or cap open ends of conduits to prevent the entrance of dirt and/or moisture during construction. Protect boxes, panel enclosures, etc. against the entrance of mortar, plaster, moisture, and other foreign material during construction, and thoroughly clean these spaces before pulling wires, and again, if necessary, before installing covers of fronts.

C. On completion of the work, remove all rubbish and debris resulting from the work or the work of subcontractors and dispose of same.

D. All equipment, fixtures, etc. shall be thoroughly cleaned of accumulated dust or dirt and left in a satisfactory condition for use.

3.08 TESTING:

A. Grounding Systems:

1. Tests and Inspection: After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
    a. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions
    b. Grounding system will be considered defective if it does not pass tests and inspections.

PART 4 METHOD OF MEASUREMENT

Lump sum item; no measurement will be made.

PART 5 BASIS OF PAYMENT:

Payment will be lump sum price for roadway lighting.