KOSCIUSKO COUNTY
WARSAW, INDIANA
JUSTICE BUILDING
Parking Lot Exterior Lighting

ADVERTISEMENT FOR BIDS

Invitation to Bidders: Notice is hereby given that the Kosciusko County Commissioners is requesting sealed proposals for work comprised of the Exterior Lighting for the Justice Building Parking Lot that will be reconfigured. Scope of project includes contractor providing all labor, materials, equipment, and incidentals as show, specified, and required to furnish and install lighting fixtures and associated controls as listed in bid document.

Issuing Office for the Bidding Documents: Please see attached documents.

Pre-Bid Meeting: Will be held at 1:00 pm local time on April 8, 2024 at Old Courthouse, Old Courtroom, 3rd Floor, 100 West Center St., Warsaw, IN. Attendance at the pre-bid conference is highly encouraged but is not mandatory.

Bid Submittal: All bids must be submitted to the Owner at the address listed above by 9:00 am on April 23, 2024 to be considered for the work. Bids shall be submitted in an opaque sealed envelope marked with the project title and include the name and address of the Bidder. Bids arriving after the time set will be returned unopened and only complete bids with all required materials will be considered.

Review and Consideration: All bids timely received shall be publicly opened and read aloud during the Kosciusko County Commissioner's meeting at 9:15 am on April 23, 2024. Kosciusko County, Indiana reserves the right to reject all bids, waive defects and amend the Project's scope. It is anticipated that the Kosciusko County Commissioners will take bids received under advisement and that a determination may be made at the County Commissioners May 6, 2024 meeting.

BY: Marsha McSherry
County Administrator Kosciusko County

SECTION 26 05 05 - GENERAL PROVISIONS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to complete the electrical Work.
   2. Contractor shall be responsible for all electrical demolition.
   3. Utility Companies:
      a. Electric Utility Company: Perform the Work in connection with the electric service and utility metering in accordance with requirements of the local electric utility.
   4. Common electrical installation requirements

B. Coordination:
   1. Review installation procedures and schedules under other Specification Sections and coordinate with other trades the installation of electrical items that will be installed with or within formwork, walls, partitions, ceilings, panels, and site work.
   2. Coordinate arrangement, mounting, and support of electrical equipment:
      a. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
      b. To provide for ease of disconnecting the equipment with minimum interference to other installations.
      c. To allow right of way for piping and conduit installed at required slope.
      d. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
   3. Coordination and Intent of Electrical Drawings:
      a. Dimensions on Drawings related to equipment are based on equipment of certain manufacturers. Verify the dimensions of equipment furnished to space available at the Site and allocated to the equipment.
      b. Drawings show the principal elements of the electrical Work, and are not intended as detailed working drawings for the electrical Work. Drawings supplement and complement the Specifications and other Contract Documents relative to principal features of electrical systems.
      c. Equipment and devices provided under this Contract shall be properly connected and interconnected with other equipment and devices for successful operation of complete systems, whether or not all connections and interconnections are specifically mentioned or shown in the Contract Documents.
      d. Drawings are provided for Contractor's guidance in fulfilling the intent of the Contract Documents. Contractor shall comply with Laws and Regulations, including safety and electrical codes, and provide materials, equipment, appurtenances, and specialty items necessary for complete and operable systems.

C. Area Classifications:
   1. Materials, equipment, and incidentals shall be suitable for the area classification(s) shown, specified, and required.

2. Wet Locations: Comply with NEC and NEMA requirements for wet locations. Enclosures in wet locations shall be stainless steel and comply with NEMA 4X unless specified otherwise.

1.2 MEASUREMENT AND PAYMENT

A. Mobilization and Demobilization
1. Payment for Electrical Work shall be a lump sum price.
2. The Contractor shall provide all labor, materials, and equipment, both temporary and permanent associated with: removal and replacement of the existing electrical system. Additionally this item includes salvage of existing power and control panels; disposal of equipment not claimed by plant staff; communication systems installation and adjustment; testing, to include systems demonstrations, start-up services and instruction; and adjustment of equipment.

1.3 QUALITY ASSURANCE

A. Qualifications:
1. Electrical Subcontractor:
a. Electrical Subcontractor shall possess a valid electricians' and contractors' license in the jurisdiction where the Site is located.

B. Component Supply and Compatibility:
1. Materials and equipment similar to each other shall be from the same manufacturer for uniformity.

C. Regulatory Requirements:

1.4 SUBMITTALS

A. Action Submittal. Submit the following:
1. Product Data
a. Electrical Systems - Product Data
1) Manufacturer's name and product designation or catalog number.
2) Electrical ratings.
3) Manufacturer's technical data and specifications.
4) Manufacturer's indication of compliance with applicable reference standards.
5) Painting and coating systems proposed.
2. Shop Drawings
a. Internal Wiring Diagram and Drawings
1) Must indicate all connections to components and numbered terminals for external connections.
b. Dimensioned Plan, Section, Elevations, and Panel Layouts
1) Show means for mounting, conduit connection, and grounding.
c. Components List
1) Include manufacturer's name and catalog number (or part number) for each.

B. Informational Submittals. Submit the following:
1. Certificates

a. Manufacturer's Certificate of Compliance with Applicable Reference Standards.

2. Test and Evaluation Reports
   a. Electrical Systems - Test Procedures
      1) Proposed testing procedures and testing limitations for source quality control testing and field quality control testing.
3. Manufacturers' Instructions
   a. Electrical Systems - Manufacturer's Instructions
      1) Installation data and instructions.
      2) Instructions for handling, starting-up, and troubleshooting.
4. Source Quality Control Submittals
   a. Electrical Systems - Source Quality Control Test Results
      1) Results for required shop testing.
5. Field Quality Control Submittals
   a. Electrical Systems Field Quality Control Test Results
      1) Results for required field testing
6. Qualifications Statements
   a. Electrical Subcontractor Qualification Statement

C. Closeout Submittals. Submit the following:
   1. Record Documentation
      a. Electrical System Record Drawings
         1) One-line wiring diagram of the electrical distribution system.
         2) Actual, in-place conduit and cable layouts with schedule of conduit sizes and number, and size of conductors.
         3) Layouts of the power and lighting arrangements and the grounding system.
         4) Control schematic diagrams, with terminal numbers and control devices identified, for all equipment.
         5) Panel Schedules with circuit numbers and loads.
         6) Record documents shall indicate final equipment and field installation information.

PART 2 PRODUCTS

2.1 Performance Criteria:

A. Unless specified otherwise, electrical equipment shall have ratings based on 75 degrees C terminations.

2.2 Testing Laboratory Labels: Electrical material and equipment shall bear the label of Underwriters' Laboratories, Inc. or other nationally recognized, independent testing laboratory, where standards have been established and label service applies.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which Work will be performed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:
1. Install materials and equipment in accordance with the Contract Documents, Laws and Regulations, approved (and accepted, as applicable) Shop Drawings and other Contractor submittals, and manufacturer's recommendations.
2. Define and identify all wiring, circuit terminations, and equipment to be modified to ensure proper interface of components. The Contract Price includes all costs associated with field services specified for a complete and functional system.
3. Perform work in a neat and workmanlike manner.

B. Common Requirements for Electrical Installation
1. Comply with NECA 1.
2. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
3. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
4. Right of Way: Give to piping systems installed at a required slope.

C. Staging, Sequencing, and Coordination with Existing Facilities:
1. Schedule, sequence, and install materials and equipment in accordance with Section 01 11 00, Summary of Work.

3.3 FIELD QUALITY CONTROL

A. Field Quality Control – General:
1. Perform field quality control for electrical Work in accordance with the Contract Documents.

B. Site Tests:
1. Prior to requesting certificate of Substantial Completion, demonstrate to Engineer that electrical systems and electrically-operated equipment installed or modified under the Contract operates in accordance with the Contract Documents and operates as required.
2. Perform the following operational tests on electrical systems:
   a. Operate lighting systems and receptacle devices to verify proper operation and connections.
3. Prepare and submit report on the equipment demonstration and operating field quality control tests. Report shall include complete information on the tests performed and results.

C. Manufacturer's Services:
1. Furnish at the Site qualified, factory-trained representative(s) of equipment manufacturers for the services indicated in the Contract Documents.

+ + END OF SECTION + +

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install low-voltage conductors and cabling.
2. Types of cabling required include:
a. Insulated cable for installation in raceways.

B. Related Sections:
1. Section 26 05 53, Identification for Electrical Systems.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in overall Project cost and not bid as a separate Work item.

1.3 REFERENCES

A. Standards referenced in this Section are:
1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
2. ASTM B3, Specification for Soft or Annealed Copper Wire.
3. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
4. ASTM D3485, Specification for Smooth-Wall Coilable Polyethylene (PE) Conduit (Duct) for Preassembled Wire and Cable.
5. ASTM F2160, Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD).
6. NEMA TC 7, Smooth Wall Coilable Electrical Polyethylene Conduit.
7. UL 44, Thermoset-Insulated Wires and Cables.
8. UL 1277, Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cable according to NEMA WC 26.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:
1. Product Data:
a. Low-Voltage Electrical Power Conductors and Cables – Product Data
1) Manufacturer's literature, specifications, and engineering data for low voltage insulated cable proposed for use.

1.6 QUALITY ASSURANCE

A. Items provided under this Section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
   1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
   2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements: Comply with the following:
   1. NEC Article 300, Wiring Methods.
   2. NEC Article 310, Conductors for General Wiring.
   3. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.1 MATERIALS

A. BUILDING WIRES AND CABLES
   1. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as required to meet application and NEC requirements.
   2. Wire and cable for 600 volts and below: Soft drawn, copper wire with 600 volt insulation.
      a. Conductors:
         1) Annealed, copper in accordance with ASTM B33.
         2) Stranding: Class B in accordance with ASTM B8.
      b. Insulations and Coverings:
         1) Rubber: Conform to NEMA WC 3.
         2) Thermoplastic: Conform to NEMA WC 5.
         3) Cross-Linked Polyethylene: Conform to NEMA WC 7.
         4) Ethylene Propylene Rubber: Conform to NEMA WC 8.
   3. Feeders and service conductors: Single conductor Type XHHW-2.
   4. Branch Circuits:
      a. Single Conductor Type THHN/THWN: Above ground and underfloor conduits.
      b. No. 12 AWG minimum size (unless otherwise noted) for branch circuit wiring,.
      c. Size 120 v branch circuits for length of run on following basis.
         1) 0 to 50 ft Run From Panelboard to first outlet: No. 12 AWG minimum.
         2) 51 to 100 ft Run: Increase one wire size, i.e., No. 12 AWG becomes No. 10 AWG.
         3) 101 to 150 ft Run: Increase two wire sizes, i.e., No. 12 AWG becomes No. 8 AWG.
         4) 151 ft and above: Wiring sized for 3% maximum voltage drop.
      d. For other branch circuits, voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of the NEC 215.

B. Cable Connectors, Solderless Type:
   1. For wire sizes No. 4 AWG and above, use either compression type or bolted type with silver-plated contact faces.
   2. For wire sizes up to and including No. 6 AWG, use compression type. Alarm and control wire shall be terminated using forked type connectors at terminal boards.

3. For wire sizes No. 1/0 AWG and larger, use connectors with at least two cable clamping elements or compression indents and provision for at least two carbon steel bolts with Belleville Washer Nut or approved equal bolts for joining to apparatus terminal.
4. Properly size connectors to fit fastening device and wire size. Connectors shall be rated for 75 degree C, 600 volts.

C. Cable Splices:
1. For wire sizes No. 8 AWG and larger, splices shall be made up with compression type copper splice fittings. Splices shall be taped and covered with materials recommended by cable manufacturer to provide insulation equal to that on conductors.
2. For wire sizes No. 10 AWG and smaller, splices may be made up with pre-insulated spring connectors.
3. For wet locations, splices shall be waterproof. Compression type splices shall be waterproofed by sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring thermosetting resin into mold that surrounds the joined conductor. Spring connector splices shall be waterproofed with sealant filler.
4. Splices shall be suitably sized for cable, rated 75 degrees C, and 600 volts.
5. Splices shall be in accordance with NEC and UL.

D. Wire and Cable Markers:
1. Provide wire and cable markers in accordance with Section 26 05 53, Identification for Electrical Systems.

2.2 SOURCE QUALITY CONTROL

A. Factory Tests:
1. Factory-test wire and cable in accordance with UL and/or NEMA standards.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA "Standard of Installation".

B. Identification:
1. Identify conductors in accordance with Section 26 05 53, Identification for Electrical Systems.
2. Identify power conductors by circuit number and phase at each terminal or splice location.
3. Identify control and status wiring using numeral tagging system.

C. Color-code cables as follows:
1. Colors for power:

System	Conductor	Color
All Systems	Equipment Grounding	Green
240/120 Volts	Grounded Neutral	White

System	Conductor	Color
Single-Phase, Three-Wire	One Hot Leg Other Hot Leg	Black Red

D. Remove existing wire from raceway before pulling in new wire and cable.

E. Bending Radius: Limit to minimum of six times cable overall diameter.
Slack: Provide maximum slack at all terminal points.

F. Run wire and cable in conduit unless otherwise indicated on Drawings. Pull conductors into raceway simultaneously where more than 1 is being installed in same raceway.
1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
3. Do not draw conductor into conduits until building is enclosed, watertight, and work causing cable damage has been completed.

G. Install cable supports for vertical feeders in accordance with NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

H. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie cables in individual circuits.

I. Seal cable and wire entering building from underground or exterior between wire and conduit, where cable exits conduit, with non-hardening approved compound.

J. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL 486A.

K. Drawings do not designate number of conductors in conduit nor does location of branch circuits and switch legs indicated on Drawings designate location or routing. Route branch circuits and switch legs as dictated by construction and these Specifications.

L. Neutral conductors **SHALL NOT** be shared.

3.2 TERMINATIONS AND SPLICES

A. Terminate control, instrumentation, and communication cables on terminal strips in separate terminal cabinets located near conduit entrances of buildings or as shown on Drawings.

B. Power Cable Splices (no splices in cables unless approved by Engineer):
1. Provide continuous lengths of cable without splices in motor circuits and feeders unless otherwise noted. Splices may be installed in motor circuits and feeders with prior approval by ENGINEER.

2. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
3. Use splice and tap connectors that are compatible with conductor material.
4. Where pre-insulated spring connectors are used for equipment connections, tape connector to wire to prevent loosening under vibration.
5. Each tap, joint or splice in conductors No. 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and finish wrap of color coding tape where required by code.
6. Cable splices shall be made only in manholes, handholes, wireways, distribution boxes, and junction boxes. Splices below grade, in manholes, handholes, and wet locations shall be waterproof.

C. Power Cable Terminations:
1. Termination of wires with full compression type lugs installed with appropriate hand or hydraulic tool. Use proper dies to achieve the desired compression.
2. For screw type terminal blocks, terminations for stranded conductors shall be made with T & B lock-on fork connector with insulated sleeves.
3. Motor lead conductor terminations shall be made with a T & B or approved equal, full compression lug, full ring type, bolted, and taped as required. For connecting motor lead to service wiring fasten full ring lugs together with cadmium plated steel cap screws, and cover with a minimum of 2 layers 1/2 lap, 3M Scotch No. 33 tape; option: T & B "Motor Stub Splice Insulator".

3.3 BRANCH CIRCUITS

A. Branch circuits for single phase equipment devices from same panel may be combined. Derating of conductors within conduit is not allowed.

3.4 FEEDERS:

A. Extend feeders at full capacity from origin to termination.

B. Each conduit raceway shall contain only those conductors constituting single feeder circuit.

3.5 FIELD QUALITY CONTROL

A. Site Tests:
1. Test each electrical circuit after permanent cables are in place, to demonstrate that circuit and equipment are connected properly and will perform satisfactorily, free from improper grounds and short circuits.
2. Individually test 600-volt cable mechanical connections after installation and before they are put in service, with calibrated torque wrench. Values shall be in accordance with manufacturer's recommendations.
3. Individually test 600-volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service, with Megger for one minute at voltage rating recommended by cable manufacturer or in accordance with ANSI/NETA ATS recommendations.

4. Insulation resistance for each conductor shall not be less than value recommended by cable manufacturer. Cables not meeting recommended value or that fail when tested under full load conditions shall be replaced with a new cable for full length.

+ + END OF SECTION + +

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
1. Contractor shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install complete grounding for electrical systems, structures, and equipment.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in overall Project cost and not bid as a separate Work item.

1.3 REFERENCES

A. Standards referenced in this Section are:
1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
2. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
3. ASTM B 33, Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
4. UL 467, Grounding and Bonding Equipment.
5. National Fire Protection Association 70 (NFPA)

B. Regulatory Requirements
1. National Fire Protection Association 70 (NFPA)

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association (NETA) or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
a. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association (NETA) to supervise on-site testing specified in Part 3.
b. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
c. Comply with UL 467 for grounding and bonding materials and equipment.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:

1. Product Data
   a. Grounding and Bonding for Electrical Systems - Product Data
      1) Manufacturer's technical information for grounding materials proposed for use

PART 2 PRODUCTS

2.1 MATERIALS

A. Bare Ground Cable:
   1. Material: Soft-drawn, bare copper stranded cable complying with ASTM B8. No. 4/0 AWG minimum size unless otherwise shown or indicated on the Drawings.

B. Conductors
   1. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
   2. Bare Copper Conductors:
      a. Solid Conductors: ASTM B 3.
      b. Stranded Conductors: ASTM B 8.
      c. Tinned Conductors: ASTM B 33.
      d. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
      e. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
      f. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
      g. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Ground Rods:
   1. Material: Copper-clad rigid steel rods, 3/4-inch diameter, ten feet long.

D. Grounding Connectors:
   1. Products and Manufacturers: Provide one of the following:
      a. Pressure Connectors:
         1) O.Z./Gedney, Division of Emerson.
         2) Burndy Corporation.
         3) Erico Products, Incorporated.
      b. Welded Connections:
         1) Cadweld by Erico Products, Incorporated.
         2) Therm-O-Weld by Burndy Corporation.
   2. Material:
      a. Pressure connectors shall be copper or copper alloy castings, bolted pressure type, designed and fabricated specifically for items to be connected and assembled with Durium or silicone bronze bolts, nuts, and washers.
      b. Welded connections shall be by exothermic process utilizing molds, cartridges, and hardware designed specifically for connection to be made or Burndy irreversible crimp types recommended by kit manufacturer for materials being joined and installation conditions
      c. Pipe Connectors shall be clamp type, sized for pipe.

E. Ground system components shall comply with UL 467.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions for the Work and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 APPLICATIONS

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
   1. Install equipment grounding conductor with circuit conductors for items below in addition to those required by Code:
      a. Feeders and branch circuits.
      b. Lighting circuits.
   2. Nonmetallic Raceways: Install equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

B. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.

C. Conductor Terminations and Connections:
   1. Underground Connections: Welded connectors or irreversible crimp, except at test wells and as otherwise indicated.
   2. Connections to Ground Rods at Test Wells: Bolted connectors.

3.3 INSTALLATION

A. 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.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

C. When performing exothermic weld to building steel, prepare surface to accept weld.

D. Weld all buried connections except for test points.

E. EQUIPMENT GROUNDING

1. Ground electrical equipment in compliance with Laws and Regulations and the Contract Documents.
2. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where required for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.
3. Control panels grounding conductors shall be bare stranded copper cable of adequate size to ground grid from AC ground bus, and an insulated stranded copper cable of adequate size to ground grid from DC ground bus.
4. Connect ground conductors to conduit with copper clamps, straps, or with grounding bushings.
5. Scrape bolted surfaces clean and coat with conductive oxide-resistant compound.
6. Install insulated equipment grounding conductors with all feeders and branch circuits.
7. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
8. Metal and Wood 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.

F. CORROSION INHIBITORS
1. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used after scraping bolted surfaces clean and coat with conductive oxide resistant compound.

+ + END OF SECTION + +

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install conduit and fittings to form complete, coordinated and grounded raceway systems.
2. When specific, detailed conduit routings for various systems within buildings and other areas are not be shown on the Drawings, Contractor shall establish routings based on single-line, riser, and interconnection diagrams and other information on the Drawings. Contractor shall provide for the proper installation of conduits in each system.
3. Conduit types and the installation methods shall comply with the following, unless otherwise shown or indicated in the Contract Documents:
   a. Use Schedule 40 PVC for service entrance.
   b. Use Schedule 40 PVC or HDPE for raceway runs between light poles.
   c. Use PVC-coated rigid steel for all transitions and sweeps from HDPE or Schedule 40 into pole bases and into power cabinet.

B. Coordination:
1. Conduit runs shown are diagrammatic. Coordinate conduit installation with piping, ductwork, light fixtures, and other systems and equipment and locate to avoid interferences.
2. For conduits to be embedded in concrete slabs, confirm adequate slab thickness and coordinate location of conduits with placement of reinforcing steel, waterstops, expansion joints, and other features of the concrete slab.

C. Related Sections:
1. Section 26 05 05, General Provisions for Electrical Systems.
2. Section 31 00 05 Trenching and Earthwork
3. Section 32 12 16, Asphalt Paving.

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in overall Project cost and not bid as a separate Work item.

1.3 REFERENCES

A. Standards referenced in this Section are:
1. AASHTO, Standard Specifications for Highway Bridges.
2. ANSI C80.1, Standard for Rigid Electrical Steel Conduit (ERSC).
3. ANSI/NEMA FB1, Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
4. NEMA TC3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
5. UL 514B, Conduit, Tubing, and Cable Fittings.

6. UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

B. Regulatory Requirements: Comply with the following:
   1. National Electrical Code: Components and installation shall comply with NFPA 70.
   2. NEC Article 344, Rigid Metal Conduit.
   3. NEC Article 350, Liquid-Tight Flexible Metal Conduit.
   4. NEC Article 352, Rigid Nonmetallic Conduit.
   5. NEC Article 358, Electrical Metallic Tubing.

C. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
   1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
   2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

D. Comply with NECA "Standard of Installation."

1.4 SUBMITTALS

A. Action Submittals. Submit the following:
   1. Product Data
      a. Raceways and Boxes – Product Data
         1) Manufacturer's catalog cuts and product data for conduit, fittings, and appurtenances.

B. Closeout Submittals. Submit the following:
   1. Record Documentation
      a. Raceways and Boxes – Record Drawings
         1) Show actual routing of exposed and concealed conduit runs in record documents in accordance with Section 01 78 39, Project Record Documents.

PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. PVC-coated Rigid Steel Conduit, Elbows, and Couplings:
   1. Manufacturers: Provide products of one of the following:
      a. Robroy Industries.
      b. No "Or Equal"
   2. Material: Rigid, heavy-wall, mild steel, hot-dip galvanized, smooth urethane interior coating, tapered threads, carefully reamed ends, 3/4-inch NPS minimum size with factory exterior coating of 40-mil thick PVC.
   3. Color: Color of coating shall be the same on all conduit and fittings.
   4. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

2.2 METALLIC FITTINGS

A. PVC-coated Conduit Fittings, and Outlet Bodies:

1. Material and Construction: Cast gray iron alloy, cast malleable iron bodies and covers with factory coating of 40-mil thick PVC and smooth urethane interior coating. Units shall be threaded type with five full threads. Material shall comply with ANSI/NEMA FB1 and be listed by UL. Do not use "LB" fittings. Use type "LBD" fittings where use of fittings is unavoidable.
2. Use: Provide PVC-coated or aluminum conduit fittings and outlet bodies in hazardous, wet, and corrosive locations. Fitting material shall be consistent with conduit material.

B. PVC-coated Conduit Hubs:
1. Manufacturers: Provide products one of the following:
   a. Robroy Industries.
   b. No "Or Equal"
2. Material: Threaded conduit hub, vibration-proof, weatherproof, with captive O-ring seal, zinc metal with insulated throat and bonding screw, and factory coating of 40-mil thick PVC and smooth urethane interior coating.
3. Use: Provide for PVC-coated steel or aluminum conduit terminations to boxes, cabinets, and other enclosures in areas designated as corrosive location.

2.3 NONMETALLIC CONDUIT AND FITTINGS

A. Non-metallic Conduit and Fittings: Nonmetallic Conduit
1. Rigid Nonmetallic Polyvinyl Chloride (PVC) Conduit:
   a. NEMA TC 2, Schedule 40 or 80 PVC.Rated for 90 degrees C, complying with UL 514B and 651.
   b. Elbows and Fittings shall comply with NEMA TC3
   c. Match conduit to type of material
   d. Fittings: Form elbows, bodies, terminations, expansions, and fasteners of same material and manufacturer as base conduit. Provide cement by same manufacturer as base conduit.

2.4 PULL JUNCTION, AND TERMINAL BOXES:

A. General – Applicable to All Boxes:
1. Description and Performance Criteria:
   a. Boxes shall be appropriate for each location in accordance with NEMA requirements and as required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems.
2. Materials: Pull boxes embedded in concrete slabs shall be polymer concrete.
3. Terminal strips and terminal blocks in terminal boxes shall be mounted on terminal box sub-panels.

2.5 ACCESSORIES

A. Duct Sealing Compound
1. Soft, fibrous, slightly tacky, non-hardening sealing compound.
2. Remains workable at all temperatures.
3. Compound shall not slump at temperature of 300°F and shall readily adhere to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

B. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit passing through concrete floors, walls, or boxes. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be performed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Underground Conduits:
   1. Install individual, underground conduits minimum of 36 inches below grade, unless otherwise shown or indicated.
   2. Perform excavation, bedding, backfilling, and surface restoration, including pavement replacement where required, in accordance with Section 31 00 05 Trenching and Earthwork, and Section 32 16 00, Asphalt Paving.
   3. Install traceable warning tape 12 inches below finished grade over buried conduits.
   4. Installation shall be in accordance with requirements of section 26 05 43 Underground Ducts and Raceways for Electrical Systems

B. Field Bends: No indentations. Diameter of conduit shall not vary more than 15 percent at bends.

C. Joints:
   1. Apply conductive compound to joints before assembly.
   2. Make up joints tight and ground thoroughly.
   3. Use standard tapered pipe threads for conduit and fittings.
   4. Cut conduit ends square and ream to prevent damaging wire and cable.
   5. Use full threaded couplings. Split couplings are not allowed.
   6. Use strap wrenches and vises to install conduit. Replace conduit with wrench marks.
   7. Apply zinc-rich paint to exposed threads and other areas of galvanized conduit system where base metal is exposed.

D. Terminations:
   1. Install insulated bushings on conduits entering boxes or cabinets, except when threaded hubs are used.
   2. Provide locknuts on both inside and outside of enclosure, except when threaded hubs are used.
   3. Use of bushings in lieu of locknuts is not allowed.
   4. Install conduit hubs on conduits entering boxes or cabinets in wet and corrosive areas.

E. Moisture Protection:

1. Plug or cap conduit ends at time of installation to prevent entrance of moisture and foreign materials.
2. Underground and embedded conduit connections shall be watertight.
3. Thruwall Seals and Conduit Sealing Bushings: Install for conduits passing through concrete slabs, floors, walls, or concrete block walls.
4. Drainage: Conduit runs shall be fully drainable. Where possible install conduit runs to drain to one end and away from building. Avoid pockets or depressions in conduit runs.
5. Seal conduit openings within control and instrumentation panels and distribution equipment with duct sealing compound to provide watertight seal.
6. Use threaded hubs when entering top of enclosures.
7. Use sealing type locknuts when entering sides or bottom of enclosures.

F. Non-metallic Conduit:
1. Install in accordance with manufacturer's recommendations.
2. Provide manufacturer's recommended adhesives or sealants for watertight connections.
3. Provide expansion fittings for expansion and contraction to compensate for temperature variations. Fittings shall be watertight and suitable for direct burial.
4. Use PVC coated rigid steel elbows in concrete encasements and duct banks.
5. Transition to PVC-coated rigid steel conduit before making turn up to enclosures.

G. PVC-coated Rigid Steel Conduit:
1. Install in accordance with manufacturer's recommendations.
2. Install with manufacturer's installation tools to avoid damage to PVC coating.
3. Repair damaged PVC coating with manufacturer's recommended touch-up compound.
4. Use only manufacturer approved threading equipment and tools

H. Conduit bends
1. Make bends and offsets so inside diameter is not reduced. Unless otherwise indicated, keep legs of bend in same plane and straight legs of offsets parallel.

I. Conduit Seals: Install seals for conduit penetrations of slabs below grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

J. Conduit extending through roof shall be sealed and integrated into the roofing system and made water tight.

3.3 FITTINGS

A. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. Install raceway sealing fittings at following points and elsewhere as indicated:
1. Where otherwise required by NEC.

B. Install automatic breather drain fittings according to manufacturer's written instructions. Locate fittings to drain conduit system and prevent condensate from entering device enclosures. Install automatic breather drain fittings at following points and elsewhere as indicated.
1. Where vertical seals are installed.
2. Low points in conduit system.

3. Below field instruments at junction of flexible and rigid conduit.
4. Where otherwise required by NEC.

3.4 GROUNDING

A. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to torques requirements specified in UL 486A.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.
   1. Repair damage to PVC or paint finishes with matching touch-up coating recommended by manufacturer.

3.6 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

+ + END OF SECTION + +

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install manholes, handholes, and underground ductbanks for electrical systems Work.

B. Coordination:
1. Coordinate manhole, handhole, and underground ductbank installation with piping, sheeting other excavation supports, and other Underground Facilities, and locate clear of interferences.
2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before manhole, handhole, and underground ductbanks for electrical systems Work.
3. Notify other contractors in advance of installing manholes, handholes, and underground ductbanks for electrical systems to provide other contractors with sufficient time for installing items included in their contracts that will be installed with or before manhole and handhole for electrical systems Work.
4. Coordinate locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Engineer.

C. Related Sections:
1. Section 03 30 00, Cast in Place Concrete.
2. Section 26 05 26, Grounding and Bonding for Electrical Systems.
3. Section 26 05 53, Identification for Electrical Systems.
4. Section 31 00 05, Trenching and Earthwork

1.2 MEASUREMENT AND PAYMENT

A. This item is to be included in overall Project cost and not bid as a separate Work item.

1.3 REFERENCES

A. Standards referenced in this Section are:
1. AASHTO, Specifications for Highway Bridges.
2. ANSI/SCTE 77, Specification for Underground Enclosure Integrity.
3. ASTM A48/A48M, Specification for Gray Iron Castings.
4. ASTM C478, Specification for Precast Reinforced Concrete Manhole Sections
5. ASTM C 858, Specification for Underground Precast Concrete Utility Structures
6. ASTM C 1037, Standard Practice for Inspection of Underground Precast Concrete Utility Structures

1.4 SUBMITTALS

A. Action Submittals. Submit the following:
   1. Product Data
      a. Underground Ducts and Raceways - Manufacturer's Technical Information
         1) Specifications, and literature for manholes, handholes, castings, and accessories proposed for use.
         2) Ducts and Conduits and Their Accessories - Include elbows, end bells, bends, fittings, and solvent cement.
         3) Warning Tape - Product information including markings and selected color.

B. Closeout Submittals. Submit the following:
   1. Record Documentation
      a. Underground Ducts and Raceways – Record Drawings
         1) Include actual routing of underground raceway runs on record documents in accordance with Section 01 78 39, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Component Supply and Compatibility:
   1. Obtain all manholes and handholes furnished under this Section from a single Supplier, unless otherwise acceptable to Engineer.
   2. Manhole and handhole Supplier shall review and approve the Shop Drawing submittals for the manholes and handholes furnished.
   3. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

PART 2 PRODUCTS

2.1 MATERIALS

A. Duct: Provide conduit and fittings in accordance with Section 26 05 33, Raceways and Boxes for Electrical Systems. Conduit types shall be as follows:
   1. Schedule 40 PVC or HDPE conduits for power circuits.
   2. PVC-Coated Rigid conduit for transition sweeps from PVC or HDPE into pole bases and above grade.

B. Backfill: Provide backfill, including select backfill, in accordance with Section 31 00 05 Trenching and Earthwork.

C. Concrete: Provide ductbank concrete in accordance with Section 03 30 00, Cast-in-Place Concrete.

D. Duct Sealing Compound:
   1. Products and Manufacturers: Provide one of the following:
      a. 0-Z/Gedney, Type DUX.

b. Or equal.

E. Detectable Underground Warning Tape:
1. Construction: Aluminum core encased with polyethylene
2. Width: Six inches.
3. Color Finish: Red
4. Detectable Underground Warning Tape: "CAUTION: BURIED ELECTRICAL LINE BELOW"

2.2 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.
1. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
2. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
4. Cover Legend: Molded lettering, "ELECTRIC."
5. Handholes **12 inches wide by 24 inches long** and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION FOR MANHOLES AND HANDHOLES

A. Excavation and Backfill for Manholes and Handholes:
1. Provide manholes and handholes for electrical systems where shown or indicated and verify at the Site the required locations.
2. Perform excavation and filling required for installing manholes and handholes for electrical systems, in accordance with Section 31 00 05 Trenching and Earthwork.
3. Provide manholes and handholes on granular subbase course as shown or indicated. If not shown, provide layer of compacted select fill not less than six inches deep on which manhole or handhole for electrical systems will be installed.
4. Carefully set, level, and align at proper grade manhole bases and handholes.

B. Manhole and handhole structures shall be watertight. Provide grout collar to seal all penetrations into manholes and handholes for electrical systems.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, 36 inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and concrete paving and subject to occasional, non-deliberate, heavy-vehicle loading, provide concrete ring encircling, and in contact with, enclosure and with top surface of box cover frame. Bottom of ring shall rest on manhole.

3.4 INSTALLATION OF UNDERGROUND DUCTBANKS

A. Underground Duct Application
   1. Raceways for Electrical Feeders and branch circuits 600 V and Less: RNC, NEMA Type EPC-40 - PVC, or HDPE

B. Excavation and Backfilling:
   1. Provide excavation and backfilling for ductbank installation in accordance with Section 31 00 05 Trenching and Earthwork.
   2. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials that can damage or contribute to corrosion of ducts or cables, or prevent adequate compaction of backfill.

C. Stub-Ups:
   1. Use manufactured PVC Coated Rigid duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.

2. Stub-Ups: Use manufactured PVC Coated Rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

D. Curves and Bends:
1. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at transformer enclosures.
2. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, for all fiber optic cable runs.
3. Use manufactured long sweep bends with a minimum radius of 36 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
4. Use PVC coated Rigid Conduit elbows for 90 degree turns in Rigid Non-metallic Conduit within concrete encasement.

E. Conduit Transitions:
1. Conduit installations shall be watertight throughout entire length of ductbank.
2. Terminate conduits with insulated grounding bushings.
3. If ducts are not concrete-encased, provide expansion and deflection fittings.
4. Plug and seal empty spare conduits entering structures. Conduits in use entering structures shall be sealed watertight with duct sealing compound.
5. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.

F. Detectable Underground Warning Tape:
1. Provide detectable underground warning tapes, over the full length of each underground raceway.

G. Direct-Buried Conduits:
1. Only single run conduit shall be direct buried unless otherwise indicated.
2. Conduit shall be Schedule-40 PVC or HDPE.
3. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottoms as specified in Section 31 00 05 Trenching and Earthwork
4. After installing conduit, backfill and compact. Start at tie-in point and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly tamp backfill around conduit to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill, make final connections at end of run and complete backfilling with normal compaction as specified in Section 31 00 05 Trenching and Earthwork.
5. Depth: Install top of conduit at least 36 inches below finished grade, unless otherwise indicated.
6. Install manufactured PVC Coated Rigid elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Watertightness:

1. Manholes and handholes for electrical systems shall be free of visible leakage. Inspect each manhole and handhole accompanied by Engineer, and repair leaks.

B. Perform the following tests and inspections and prepare test reports:
   1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
   2. Pull test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
   3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Correct deficiencies and retest as specified above to demonstrate compliance.

3.6 CLEANING

A. Pull rag swab through duct to remove water and to clean conduits prior to installing new cable.

B. Repeat swabbing until all foreign material is removed.

C. Clean internal surfaces of manholes, including sump. Remove foreign material.

+ + END OF SECTION + +

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install lighting fixtures and associated controls.

B. Section Includes:
1. Exterior lighting fixtures.
2. Pole standards.

C. Coordination:
1. Coordinate location of fixtures with piping, ductwork, openings, and other systems and equipment and locate clear of interferences.

D. Related Sections:
1. Section 26 05 05, General Provisions for Electrical Systems.

1.2 MEASUREMENT AND PAYMENT
1. This item is to be included in overall Project cost and not bid as a separate Work item.

1.3 REFERENCES

A. Standards referenced in this Section are:
1. ANSI C2, Safety Code
2. ANSI C78.51, Electric Lamps - LED
3. ANSI C82.16, LED Drivers
4. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
7. NEC Article 410, Luminaires, Lampholders, and Lamps.
8. National Fire Protection Association (NFPA) 70.
9. NEMA SSL 1, Electronic Drivers for LED Devices, Arrays, or Systems.
10. UL 773, Plug-In Locking Type Photocontrols for Use with Area Lighting
11. UL 8750, Standard for LED Equipment for Use in Lighting Products

1.4 DEFINITIONS

A. Fixture: Complete lighting device. Fixtures include lamp or lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply.

B. Lighting Unit: Fixture or assembly of fixtures with common support, including pole or bracket plus mounting and support accessories.

C. Luminaire: Fixture.

1.5 SUBMITTALS

A. Action Submittals. Submit the following:
   1. Product Data
      a. Exterior Lighting – Product Data
         1) For proposed fixtures, lamps, ballasts, poles, and accessories. Arrange Product Data for fixtures in order of fixture designation.
         2) Include data on features, poles, accessories, finishes, and following:
            - Outline drawings indicating dimensions and principal features of fixtures and poles.
            - Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.
   2. Shop Drawings
      a. Nonstandard Fixtures and Poles Shop Drawings
         1) Indicating dimensions, weights, method of field assembly, components, and accessories.
      b. Wiring Diagrams
         1) Detailing wiring for control system showing both factory-installed and field-installed wiring for specific system of this Project, and differentiating between factory-installed and field-installed wiring.
      c. Anchor-Bolt Templates
         1) Keyed to specific poles and certified by manufacturer.

B. Closeout Submittals. Submit the following:
   1. Operation and Maintenance Data
      a. Exterior Lighting – Operation and Maintenance Data
         1) Maintenance data for products to include operation and maintenance information.
         2) Submit in accordance with Section 01 78 23.

1.6 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
   1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
   2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

C. Regulatory Requirements:
   1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.
   2. NEC Article 410, Luminaires, Lampholders, and Lamps.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Upon delivery, inspect equipment for evidence of water that may have entered equipment during transit.

B. Storage:
   1. Store lighting fixtures, controls, related materials and equipment in clean, dry location with controls for uniform temperature and humidity. Protect materials and equipment with coverings and maintain environmental controls.
   2. Store materials and equipment for easy access for inspection and identification. Keep materials and equipment off ground, using pallets, platforms, or other supports. Protect materials and equipment from corrosion and deterioration.

C. Store poles on decay-resistant treated skids at least 12 in. (300 mm) above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.

D. Metal Poles: For poles with nonmetallic finishes, handle with web fabric straps.

E. Remove protective wrapping on aluminum poles upon installation.

1.8 WARRANTY

A. LED Drivers and lamps shall be warranted for a minimum of 5 years as a unit.

PART 2 – PRODUCTS

2.1 FIXTURES AND FIXTURE COMPONENTS

A. Metal Parts: Free from burrs, sharp edges, and corners.

B. Sheet Metal Components: Corrosion-resistant aluminum, except as otherwise indicated. Form and support to prevent warping and sagging.

C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.

D. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast.

E. Exposed Hardware Material: Stainless steel.

F. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:
   1. White Surfaces: 85%
   2. Specular Surfaces: 83%
   3. Diffusing Specular Surfaces: 75%

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

H. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.

I. Photoelectric Relays: Conform to UL 773.
   1. Contact Relays: Single throw, arranged to fail in ON position and factory set to turn light unit on at 1.5 to 3 foot-candles (16 to 32 lux) and off at 4.5 to 10 foot-candles (48 to
   2. 108 lux) with 15 sec minimum time delay.
   3. Relay Mounting: In fixture housing.
   4. Photocell shield deflector to minimize nuisance activation.

J. Light Emitting Diodes (LED)
   1. Driver shall be accessible for easy replacement.
   2. Weatherproof fixture housing shall be sealed completely against moisture and environment contaminants.
   3. 4000K temperature, Color rendering index (CRI) greater than 70.
   4. LED driver shall have power factor greater than 90% and THD less than 20%.
   5. CSA Certified to US standards for 40°C ambient.

K. LED Fixtures:
   1. Conform to UL 8750 and UL 8752.
   2. LED fixtures shall be modular and allow for separate replacement of lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.
   3. Dimmable LED fixtures shall have either a 0-10 volt, three wire dimming driver or a two-step (50%, 100%) dimming driver.

L. LED Drivers: Electronic type, labeled as compliant with RFI requirements of FCC Title 47, Part 15, Level "A" sound rating, minimum of 0.8 power factor, and THD less than 20%.
   1. Conform to UL 8753.
   2. Certification by Electrical Testing Laboratory (ETL).
   3. Dimming Drivers shall be 0-10 volt dimming with low end dimming to 10%.
   4. Dimming drivers shall be strobe and flicker-free across the full dimming range.
   5. Voltage: 120-277 volt unless listed on fixture schedule.
   6. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.

M. Outdoor Fixtures: Provide each fixture to be installed outdoors with cut-off lens to reduce the fixture's light pollution emissions.

2.2 FIXTURE SUPPORT COMPONENTS

A. Pole-Mounted Fixtures: Conform to AASHTO LTS-3.

B. Wind-load strength of total support assembly, including pole, arms, appurtenances, base, and anchorage, is adequate to carry itself plus fixtures indicated at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mi./h (160 km/h) with gust factor of 1.3.

C. Arm, Bracket, and Tenon Mount Materials: Match poles' finish.

D. Mountings, Fastenings, and Appurtenances: Corrosion-resistant items compatible with support components. Use materials that will not cause galvanic action at contact points. Use mountings that correctly position luminaire to provide indicated light distribution.

E. Steel Poles: Provide square steel poles having minimum 11-gauge steel with minimum yield strength of 48000 psi and (--1--) steel poles shall comply with ASTM A123 and A153.

F. Aluminum Poles: ASTM B209 (ASTM B209M), 5052-H34 alloy. Provide access handhole in pole wall.

G. Pole Bases: Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts, and bolt covers. Height exposed above grade shall be between 12" to 30" based upon installation location.

H. Metal Pole Grounding Provisions: Welded 1/2 in. (12 mm) threaded lug, accessible through handhole.

I. Pole-Top Tenons: Fabricated to support fixture or fixtures and brackets indicated and securely fastened to pole top.

J. Concrete for Pole Foundations:
   1. Comply with Section 03 30 00.
   2. Use 3000 psig strength, 28 day concrete.

K. Aluminum Mast Arms: Tapered oval arms continuously welded to pole attachment plate with span and rise as indicated.

L. Metal Pole Brackets: Designed to match pole metal. Provide cantilever brackets without underbrace, in sizes and styles indicated, with straight tubular end section to accommodate fixture.

2.3 FINISHES

A. Metal Parts: Manufacturer's standard finish, except as otherwise indicated, applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

B. Other Parts: Manufacturer's standard finish, except as otherwise indicated.

PART 3 – EXECUTION

3.1 TEMPORARY LIGHTING

A. New lighting fixtures **SHALL NOT** be used for temporary lighting.

3.2 INSTALLATION

A. General:
   1. Fixture mounting heights and locations indicated on the Drawings are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.
   2. Mounting Heights: Mounting heights or elevations are to bottom of fixture or to centerline of device.
   3. Install fixtures in accordance with Laws and Regulations, the Contract Documents, and manufacturer instructions and recommendations.
   4. Mount fixtures so that sufficient access is available for ready and safe maintenance.
   5. Securely fasten equipment to walls or other surfaces on which equipment is mounted.

B. Set units plumb, square, level, and secure according to manufacturer's written instructions and approved submittals.

C. Concrete Foundations: Construct according to Section 03 30 00.
   1. Comply with details and manufacturer's recommendations for reinforcing, anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual pole bases furnished.
   2. Finish: Trowel and rub smooth parts exposed to view.

D. Pole Installation: Use web fabric slings (not chain or cable) to raise and set poles.

E. Fixture Attachment: Fasten to indicated structural supports.

F. Fixture Attachment with Adjustable Features or Aiming: Attach fixtures and supports to allow aiming for indicated light distribution.

G. Lamp fixtures with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

3.3 GROUNDING

A. Ground fixtures and metal poles according to Section 26 05 26.
   1. Poles: Install 10 ft (3 m) driven ground rod at each pole.
   2. Nonmetallic Poles: Ground metallic components of lighting unit and foundations. Connect fixtures to grounding system with No. 6 AWG conductor.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged fixtures and components.

B. Tests and Observations:
   1. Give advance notice of dates and times for field tests.
   2. Provide instruments to make and record test results.
   3. Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Include following:
      a. Photometric Tests: Measure light intensities at night at locations where specific illumination performance is indicated. Use photometers with calibration referenced to National Institute of Standards and Technology (NIST) standards.
      b. Check for intensity of illumination.

c. Check for uniformity of illumination.
d. Prepare written report of tests indicating actual illumination results.

4. Replace or repair damaged and malfunctioning units, make necessary adjustments, and retest. Repeat procedure until units operate properly.

3.5 ADJUSTING AND CLEANING

1. Clean units after installation. Use methods and materials recommended by manufacturer.
2. Adjust aimable fixtures to provide required light intensities.

+ + END OF SECTION + +

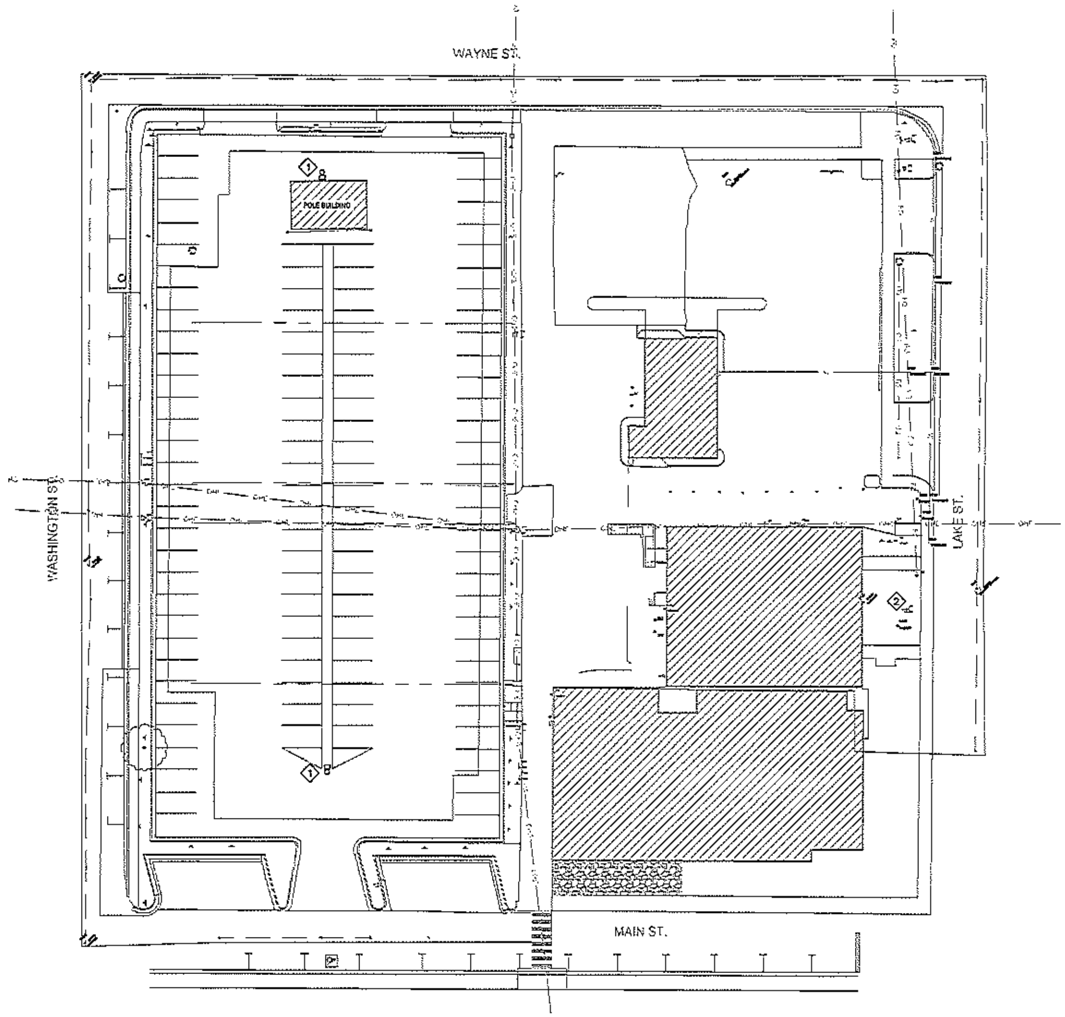
GENERAL ELECTRICAL DEMOLITION NOTES

1. REFER TO ELECTRICAL SPECIFICATIONS FOR EQUIPMENT INSTALLATION REQUIREMENTS.
2. CONTRACTORS TO COORDINATE THEIR WORK W/ ALL OTHER TRADES ON SITE. EXTRAS WILL NOT BE GIVEN FOR FORESEEABLE WORK COORDINATION.
3. PROTECT ALL EXISTING EQUIPMENT AND FINISHES FROM DUST, DEBRIS AND DAMAGE.
4. ALL WORK TO BE IN ACCORDANCE TO LOCAL, STATE AND NATIONAL ELECTRIC CODES.
5. E.C. SHALL DISCONNECT AND REMOVE ALL ELECTRICAL DEVICES IN WALLS TO BE DEMOLISHED.
6. E.C. SHALL DISCONNECT ALL MECHANICAL DEVICES TO BE DEMOLISHED.

ELECTRICAL DEMOLITION PLAN WORK DESCRIPTION NOTES

(1) DISCONNECT AND REMOVE EXISTING POLE LIGHT, POLE BASE, CONDUCTORS, EXPOSED CONDUIT AND ALL APPURTENANCES IN THEIR ENTIRETY. ALL CONDUIT EXPOSED DURING EXCAVATION SHALL BE REMOVED.

(2) UNDER ALTERNATE BID, DISCONNECT AND REMOVE EXISTING POLE LIGHT, POLE BASE, CONDUCTORS, EXPOSED CONDUIT AND ALL APPURTENANCES IN THEIR ENTIRETY. ALL CONDUIT EXPOSED DURING EXCAVATION SHALL BE REMOVED.



ELECTRICAL DEMOLITION PLAN
SCALE: 1" = 20'-0"
NORTH

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KOSCIUSKO COUNTY EMPLOYEE PARKING LOT

215 North Lake Street
Warsaw IN, 46580

ERI PROJECT NUMBER: 5584
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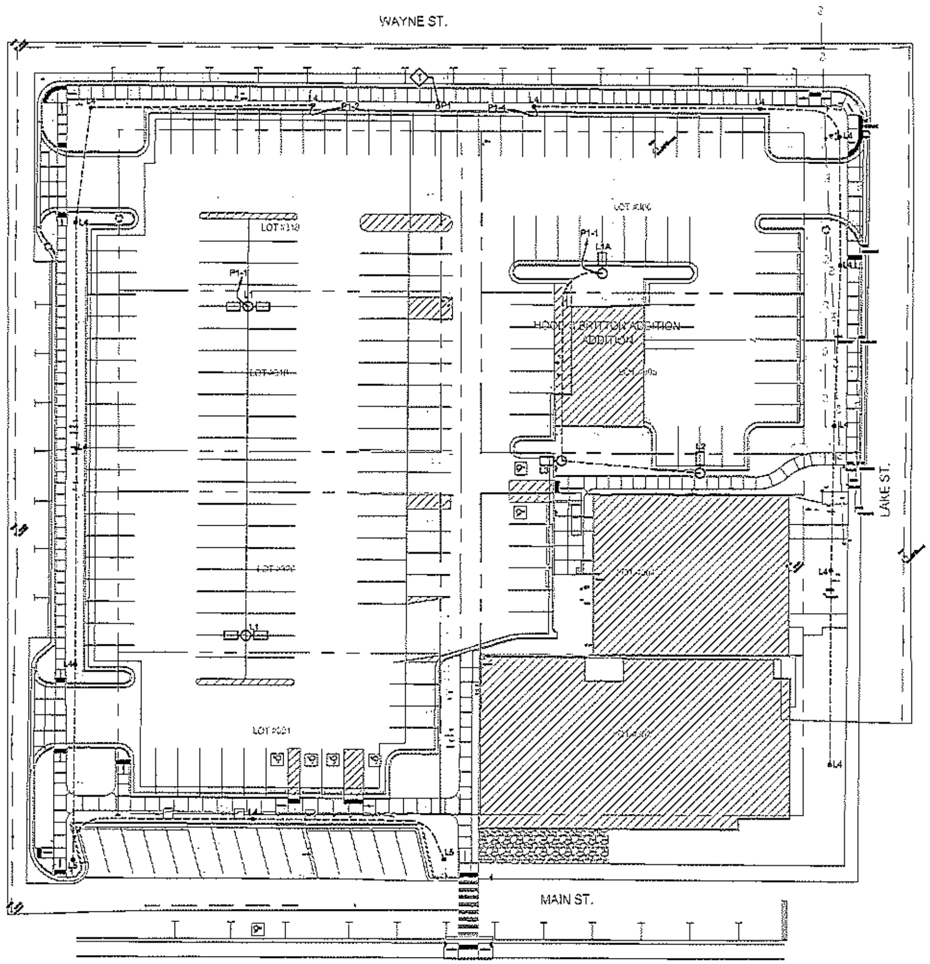


NEW LIGHTING PLAN

SCALE: 1" = 20'-0"

NORTH

GENERAL NOTES

1. REFER TO ELECTRICAL SPECIFICATIONS FOR EQUIPMENT INSTALLATION REQUIREMENTS.
2. CONTRACTORS TO COORDINATE THEIR WORK W/ ALL OTHER TRADES ON SITE. EXTRAS WILL NOT BE GIVEN FOR FORESEEABLE WORK COORDINATION.
3. PROTECT ALL EXISTING EQUIPMENT AND FINISHES FROM DUST, DEBRIS AND DAMAGE.
4. ALL WORK TO BE IN ACCORDANCE TO LOCAL, STATE AND NATIONAL ELECTRIC CODES.
5. ALL MECHANICAL EQUIPMENT IS SHOWN IN APPROXIMATE LOCATION, VERIFY EXACT LOCATION WITH MECHANICAL CONTRACTOR.
6. EXCEPT WHERE NOTED OTHERWISE, SIZE BRANCH CIRCUIT CONDUCTORS WITHIN THE FOLLOWING MAXIMUM LENGTH LIMITS (MEASURE TO THE CENTER OF THE LOAD FOR LIGHTING AND MOST REMOTE OUTLET FOR RECEPTACLE CIRCUITS).

CIRCUIT BREAKER	CIRCUIT LENGTH	CONDUCTOR SIZE
120V,20A	65 FEET	#12
	110 FEET	#10
	165 FEET	#8
	270 FEET	#6

PROVIDE #12 AWG MINIMUM FOR ALL 120 VOLT CIRCUITS. PROVIDE ADDITIONAL DERATING PER NEC SECTION 310 FOR ALL HOME RUNS WITH MORE THAN THREE CURRENT CARRYING CONDUCTORS IN A SINGLE RACEWAY.

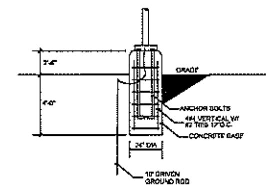
7. ALL 120 VOLT BRANCH CIRCUITS SHALL BE WIRED WITH 2#12,1#12G,3/4"C UNLESS OTHERWISE NOTED ON DRAWINGS. SHARING OF NEUTRALS SHALL NOT BE PERMITTED.
8. E.C. TO PROVIDE BACKBOX, AND 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING WITH PULLWIRE FOR ALL TELEPHONE/DATA/AUDIO OUTLETS.

NEW ELECTRICAL PLAN WORK DESCRIPTION NOTES

(1) PROVIDE SINGLE METER POWER PEDESTAL, TESCO 20-105 OR PRE-APPROVED EQUAL, 100A MAIN BREAKER, 240V, 1Ø,3W, SERVICE ENTRANCE RATED. SEE CONTROL WIRING DIAGRAM ON THIS SHEET. SEE MOUNTING DETAIL ON THIS SHEET. PROVIDE NEW SERVICE ENTRANCE FROM LOCAL UTILITY. COORDINATE ALL REQUIREMENTS WITH LOCAL UTILITY.

FIXTURE SCHEDULE				
LABEL	TYPE	MOUNTING	LAMP	DESCRIPTION
L1	CURRENT LIGHTING EVP-3-[illegible]-160-4K7-4W OR APPROVED EQUAL	POLE	160W [illegible] 4000K	MULTI-VOLT, VIPER SERIES, DUAL-HEAD SIZE 2, AREA LIGHT, TYPE 4 FORWARD THROW DISTRIBUTION, 25' SQUARE STEEL POLE, DARK BRONZE FINISH L1A: SAME EXCEPT SINGLE-HEAD
L2	CURRENT LIGHTING EVP-1-[illegible] OR APPROVED EQUAL	POLE	[illegible] [illegible] 4000K	MULTI-VOLT, VIPER SERIES, SINGLE-HEAD, SIZE 1 AREA LIGHT, TYPE 4 FORWARD DISTRIBUTION, 25' SQUARE STEEL POLE, DARK BRONZE FINISH
L3	BEACON EVP-1-[illegible] OR APPROVED EQUAL	POLE	[illegible] [illegible] 4000K	MULTI-VOLT, VIPER SERIES, SINGLE-HEAD, SIZE 1 AREA LIGHT, TYPE 3 DISTRIBUTION, 25' SQUARE STEEL POLE, DARK BRONZE FINISH
L4	STERNBERG [illegible]LED-12[illegible]-MOD[illegible]-A/[illegible]PS-[illegible]VG	POLE	[illegible] [illegible] 4000K	MULTI-VOLT, OLD-TOWN ACORN LED POST-TOP, POLYCARBONATE LENS, VERDE GREEN FINISH, TYPE 3 DISTRIBUTION, 14' TALL, 5" DIA. STRAIGHT FLUTED ALUMINUM POLE, 0.188 WALL THICKNESS
L5	STERNBERG [illegible]LED-12[illegible]-MOD[illegible]-A/[illegible]PS-[illegible]VG	POLE	[illegible] [illegible] 4000K	SAME AS L4 WITH T5 DISTRIBUTION

NOT TO SCALE



PARKING LOT POLE BASE DETAIL

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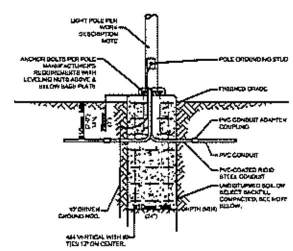

DECORATIVE POLE BASE DETAIL

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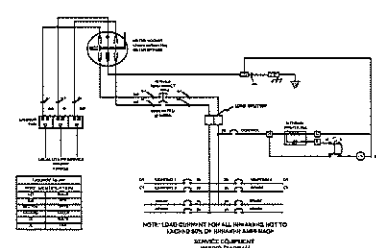
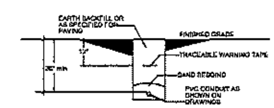


NOTE: LOAD CURRENT FOR ALL BRANCHES NOT TO EXCEED 80% OF BRANCH AMPERAGE

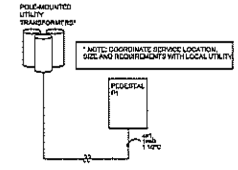
SERVICE EQUIPMENT WIRING DIAGRAM

ENCLOSURE CONSTRUCTION NOTES

1. EXTERIOR 12 GA. H.D. GALV. STEEL AND INTERIOR 14 GA. COLD ROLLED STEEL ELECTRICALLY WELDED AND REINFORCED WHERE REQUIRED.
2. CONSTRUCTION WILL BE TYPE 3R, RAINTIGHT.
3. ALL NUTS, BOLTS AND SCREWS WILL BE STAINLESS STEEL.
4. NUTS, BOLTS & SCREWS WILL NOT BE VISIBLE FROM OUTSIDE OF ENCLOSURE.
5. NAMEPLATES WILL BE PROVIDED AS REQUIRED.
6. CONTROL WIRING WILL BE MARKED AT BOTH ENDS BY PERMANENT WIRE MARKERS.
7. A PLASTIC COVERED WIRING DIAGRAM WILL BE ATTACHED TO THE INSIDE OF THE FRONT DOOR.
8. ENCLOSURE WILL BE FACTORY WIRED AND CONFORM TO REQUIRED NEMA AND UL 508A STANDARDS.
9. COLOR TO BE BY OWNER.



TRENCH BASE DETAIL



RISER DIAGRAM

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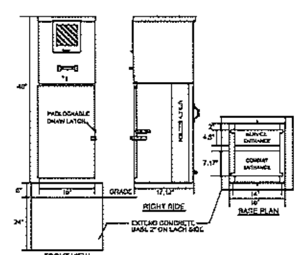

POWER PEDESTAL DETAIL

NOT TO SCALE

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C-H ENGINEERING

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