

## SECTION 3600 – STREET LIGHTING

### STREET LIGHTING

#### PART 1 – GENERAL

##### 1.01 Section Summary

- A. Street lighting construction requirements and materials.

##### 1.02 References

- A. North Dakota Department of Transportation "Standard Specifications for Road and Bridge Construction," 2014 Edition, as revised.
  - 1. Section 770 – Highway Lighting.
- B. National Electric Code, as revised.
- C. North Dakota State Electrical Board, recommendations as revised.
- D. City of Minot Ordinances, as approved.
- E. Serving franchise utilities, as recommended.

##### 1.03 Submittals

- A. Contractor shall follow submittal instructions found in the General and Supplementary Conditions.
  - 1. Before any of the materials are delivered to the job, submit to Engineer complete Shop Drawings for each item indicated.
  - 2. Include catalog numbers, performance data, dimensions and other descriptive information.
  - 3. Provide Manufacturers warranties and guarantees with the City listed as owner.
  - 4. Shop Drawings may be in the form of printed catalog sheets showing all necessary information and shall be bound together, neatly indexed, and tabbed.
  - 5. Each Shop Drawing folder shall be stamped, initialed, and dated by Contractor to indicate he has thoroughly reviewed them.

6. Shop drawings not in conformance with Specifications will be returned to Contractor without review.
7. Two copies will be retained by Engineer after review and balance will be returned to contractor.
8. Provide Shop Drawing for:
  - a. Feed point cabinet, relays, circuit breakers, switches, panels and photo electric cells.
  - b. Light standard poles, each type, including: All necessary calculations and drawings used in the design of the light standard.
  - c. Luminaires, each type.
  - d. Junction boxes.
9. Provide Product Specifications Sheets for:
  - a. Cable.
  - b. Conduit.
  - c. Splice connectors.

**B. Manuals**

1. Upon completion of Work of this Section and as condition of its acceptance, Contractor shall compile one Manual in 3-ring binder.
2. List project name, date, Contractor's name, address and telephone number on exterior label of Manual.
3. Include an index sheet indicating each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment. All items listed in the Submittals Section above.
4. Manual information shall be included for all equipment/material where Shop Drawings are required. Also include all installation, operation and maintenance data packaged with all equipment.

## PART 2 – PRODUCTS

### 2.01 Feeder and Distribution Circuits

- A. All feeders and distribution circuits shall be of the multiple type, 120/240 volt, single phase and shall consist of two or three conductors constituting one or two 120 volt circuits or a single 240 volt circuit. The Plans will clearly indicate where three wire (2-120 volt circuits) and two wire (1-120 volt circuit) are to be installed.
- B. The system shall be laid out as shown on the Plans and distribution circuits shall be routed as shown. Any changes to this will require "red-lined" plans prior to the initial inspection and drawings to be re-drawn as "As Built."
- C. Individual lamp circuits are to be fused in the base of each lighting standard with Buss type HEB in line fuse holder. Tape fuse kits with ½ lapped layer of scotch 88 for a distance of 1½" each side of joint with conductor. Fuse holders to be complete with proper fuse to protect the system. Provide enough wiring to allow for extraction of the fuse holders from the hand hole without the need to extract the feeder conductor(s), typically 18 to 24 inches. The neutral conductor shall be solidly connected, unfused, throughout system.
- D. Ground Conductors
  1. Type "C" Poles - shall be provided between all metal poles and associated feed points. Bond to metal pole, to ground rod in pole base, feed point enclosure, feed point panels, relay cabinets, and ground rod.
  2. Type "A" Poles - shall be provided from Electrical Service to the street lighting Feed Point cabinet and be grounded inside the cabinet enclosure via the ground rod.

## 2.02 Underground Conductors

- A. Underground circuit conductors shall be stranded copper, Type "RHH/RHW" or "USE," conductors insulated for direct burial and rated 600 volts. Shall not be any smaller than #6 AWG (#4 preferred) regardless of any Calculated Voltage Drop(VDI) This is for the integrity of the underground electrical system itself. Conductor sheath shall be marked as to voltage, AWG, Type (RHH/RHW-USE), and manufacturer. The conductor sheath shall be color coded to indicate red-power, blue-power, and white-neutral.(shall not have more than 1 of each color conductor, per circuit) Underground ground conductor shall be #6 or #8 stranded bare copper or Type TW insulated copper ground conductor. Service conductors from electric utility service point shall be Type RHW-USE, sized as per utility company requirements and electrical loading.
- B. Conductors shall be continuous from pole base to pole base or from feed point to pole base. Splicing conductors underground will not be allowed without specific approval of the Engineer.

## 2.03 Junction Boxes / Pull Boxes

- A. Provide junction boxes at locations shown on drawings. Junction boxes to be installed in boulevard or as shown on drawings. Top of junction boxes to be same elevation as top of adjacent curb or sidewalk. See detail on drawing. Junction boxes shall be made of a lightweight, high density polymer concrete composite, UL listed with knockouts for cable entrance. The box shall comply with ANSI/SCTE 77 with a design load of 22,500 lbs., a test load of 33,750 lbs. and meet ANSI Tier 22 test provisions. The cover shall meet an 8,000 lbs. design load and 12,000 lbs. test load. Boxes shall be resistant to sunlight exposure, weathering, chemicals and unaffected by freeze-thaw cycles to -50 degrees F. Minimum dimensions shall be 24 inch L x 13 inch W x 26 inch D with stackable boxes or extensions allowed to achieve required depth. Box covers shall have stainless steel hex bolts and be stamped with standard logo "Street Lighting". Box manufacturer shall be QUAZITE® (Hubbell Lenoir City, Inc.), model PG, Oldcastle Precast, Inc., model Synertech Heavy-Duty, or approved equivalent.
- B. Provide slack loop in conductors not being spliced so conductor can be pulled up out of junction box to a minimum of 24 inches above ground.

- C. Provide one of the following Blackburn type USL insulated street lighting connectors for all splicing:
  - 1. No. USL-11 Straight splice
  - 2. No. USL-30 Three conductor splice
  - 3. No. USL-40 Four conductor splice
  - 4. No. USL-50 Five conductor splice
  - 5. No. USL-60 Six conductor splice
- D. Tape connector kits with ½ lapped layer of rubber or synthetic rubber tape and one layer of scotch 88 for a distance of 1½-inches each side of joint.

#### 2.04 Splice Connectors

- A. Splice connectors at junction boxes for multiple connections shall be Homac, type RAB-X-URD-BUSS submersible insulated subsurface terminal for copper conductor or approved equivalent. Splice connectors at pole hand hold shall be Penn-Union IPBNA2/OXS or approved equivalent.

#### 2.05 Street Light Feed Points

- A. Pad-Mounted Feed Points
  - 1. Feed point enclosure to be as shown Padlocks to be furnished by City. Enclosure sides and top to be solid - no louvers Pad mounted feed point enclosure shall be made of minimum 1/8-inch aluminum, with a brushed aluminum finish, rated for NEMA 3R and be ETL or UL listed in accordance with UL 50. Dimensions of the enclosure shall be 42"W x 12"D x 51"H and shall have a domed roof with a NEMA 3R drip shield and two doors. The doors shall have an aluminum continuous piano-style hinge, a neoprene gasket, and a stainless steel 3-point latch capable of being padlocked. The enclosure shall be equipped with back panel rails such that equipment may be mounted in the cabinet with no penetrations to the exterior of the cabinet. The back panel shall be galvanized steel. All hardware shall be non-corrosive. The enclosure shall be manufactured by Povolny Specialties or approved equivalent.

2. Concrete pad to be sized a minimum of 6 inches beyond feed point enclosure on all four sides. Concrete pad shall be 54 inches long by 24 inches wide by 12 inches deep (54"L x 24"W x 12"D). Provide seven (7) 2-inch PVC stub outs down through concrete base and a minimum of 12 inches beyond edge of base. Point one (1) conduit towards power company transformer and six (6) towards direction of outgoing circuits. Provide one 1-inch conduit for ground rod through the base only. All stub outs shall be no closer than 2-inches to the concrete pad surface and shall not protrude above the opening for the cabinet door. Provide 2-inch minimum PVC , conduit for incoming service conductors towards direction of utility transformer. Pad shall have a minimum of 4 each 1/2-inch diameter anchor bolts, poured in place, to bolt anchor the feed point cabinet. Notify Engineer a minimum of 24 hours prior to pouring concrete base such that the form and cable entrance may be inspected. Provide a 1 inch chamfer all around and down vertical sides to minimum of 2 inches below grade. Concrete to have a minimum strength of 3000 PSI in 28 days. Minimum of 5.75 bags cement per cubic yard. Whenever possible, concrete pad shall be placed 5 feet behind the back of curb.
3. Electric panel shall be single-phase load center with enclosure rated NEMA 1 with minimum 12 spaces/24 circuits, rated 120/240 volt, 100-amp two-pole main breaker, copper bus, and a minimum 2,000 amp IR. The load center shall be Square D, model QO120M100, or approved equivalent. Provide 40-amp single pole breakers for each 120 volt street light circuit, one 15 amp single pole breaker for control circuit and one 20 amp single pole breaker for G.F.I outlet receptacle.
4. Street light relays to be RCOC type MR-UD No. 6342 (N.O. contact). Provide one relay for each three-wire street light circuit (2-120V) or one relay for each two wire street light circuit (1-240V).
5. Provide a single pole switch and a 20-amp G.F.I. outlet (1900 box and raised switch cover). Switch to be connected into control circuit to bypass photocell for daytime test of street lights. Mark "Test Switch" with 3/4 inch x 3 inch nameplate. Marker as a means of labeling will not be acceptable.
6. Provide duplex receptacle (1900 box and raised cover).
7. Provide 5/8 inch x a 10 foot ground rod in blocked out area below cabinet. Bond all conduits, relay cabinets, electric panel cabinet, enclosure and neutral.

8. Provide photo cell for control of relays. Hubbell PBT-1 (button type), or traffic department approved equal. Photo cell shall be mounted through the cabinet to face North. At no time shall the photo cell be mounted through a door or below a meter socket.
9. Exact field location of pad mounted and pole mounted feed points, as shown on plans, to be determined by Engineer.
10. Terminal blocks or mechanical connector lugs shall be used for connection within the feedpoint. Wire nuts shall not be permitted in pad mounted feedpoints.
11. Splice kits with silicone shall not be permitted in any place in the lighting system.
12. Nameplates
  - a. Photo off-set printed on thermosetting laminated plastic or phenolic core and melamine surface.
  - b. Mount in front of feed point with combination of aluminum round head screws and 3M adhesive similar to Type EC-847.
  - c. Black background with white characters.
  - d. 2-inch x 6-inch with legend:
    - "Keep Out" (3/8 inch letters)
    - "City of Minot, North Dakota" (1/4 inch letters)
    - "Street Light Control" (1/4 inch letters)
    - "N.E.C. requires 3 ft. clearance in front of this cabinet" (3/8 inch letters)
  - e. Center all legends on nameplate.

B. Service

1. Provide 120/240 volt single phase service from serving utility transformer.
2. Service to be three #2 AWG type USE conductors installed direct burial between feed point and serving utility transformer. Location of this service to be drawn in on 'red-lined' and "As-Built" plans.
3. Install in trench, 36-inches deep, separate from underground street light feeder circuitry. Costs for service lateral to be included with Feed Point bid item.

4. Route 2-inch service entrance stub-out conduit inside of feed point, through meter, to panel main circuit breaker panel. All unfused conductors within the feed point enclosure SHALL be in non-metallic conduit.
5. Meter socket as per serving utility requirements, including manual bypass. All conduits
6. Pad-mounted transformer
  - a. Provide sufficient conductor length for utility company to terminate at transformer secondary bushings.
  - b. Provide pad for utility company transformer as required. Coordinate requirement with utility company.

#### 2.06 Street Light Standard Foundations

- A. Shall conform to NDDOT Specifications Section 770.04 C. except:
  1. Concrete shall have a minimum 28-day design compressive strength of 4000 psi.
  2. All stub outs shall be no closer than 1-inch to the concrete foundation and shall not protrude above the opening for the hand hole cover.
  3. All concrete foundations shall have two 2-inch PVC conduits installed.

#### 2.07 Street Light Standards

- A. Self-Adhesive Numbering: The Contractor shall supply numbering for street light poles as directed by the City of Minot Traffic Division.
  1. Shall be Black on silver reflective, 2-inch characters on a 6.5-mil thick Mylar sticker, with the overall length and width being 2-3/8-inches Tall by 1-1/2-inches wide, Hillman Group self-adhesive, series 839380-839xxx, or approved equal.
- B. Type A – Fiberglass Round Tapered Anti Rotation Direct Burial Pole 14-foot Mounting Height
  1. Fiberglass lighting pole shall be round, hollow and of uniform taper along its length. The pole shall be non-conductive and chemically inert.



2. A hand hole shall be provided in shaft opposite the road side of the pole. Hand holes to be a minimum of 4-inch x 6-inch with reinforced frame and removable cover. Cover to be secured in place with hex head screws.
3. The butt-end of the fiberglass pole shall be enlarged and square to increase resistance to rotation and provide maximum ground bearing resistance.
4. The pole shall be designed with a minimum safety factor of 2:1 and have no more than a 10% deflection at full wind loading.
5. The pole shall be capable of supporting 1.3 EPA (Effective Projected Area) at 80 mph with a 1.3 gust factor.
6. The pole shall deflect no more than 5% of the above-ground length with 100 pounds of lateral top load. The pole shall be capable of withstanding 450 pounds of top load before failure.
7. The surface of the pole shall have a smooth finish. The finish color shall be Federal Standard Color No. 36231-grey. Coloration will be throughout the entire wall thickness of the pole.

C. Types C & C-1 – Steel Galvanized Standards

1. Steel light standards shall be galvanized steel of one- or two-piece construction. Galvanizing shall be in accordance with ASTM A-123. The shaft shall have only one longitudinal weld and shall have a minimum yield strength of 50,000 P.S.I. Shaft may be round or octagonal.
2. The Davit type mast arm shall be constructed of same material and by same method as the shaft. Mast arm shall have a Tenon adaptor for luminaire mounting.
3. The anchor shall be a one-piece steel casting secured to the lower end of the shaft by two continuous welds. One weld shall be inside the base at the bottom of the shaft and the other shall be on the outside of the shaft at the top of the anchor base. The welded connection shall develop the full strength of the adjacent shaft section. The anchor base shall be complete with bolts, washers, shims and bolt covers with cap screws for attaching covers to base. Grounding lug to be provided inside of base.
4. Install a 1/2-inch X 10-foot ground rod in each street light base.

5. A hand hole shall be provided in shaft opposite the road side of the pole. Hand holes to be a minimum of 4-inch x 6-inch with reinforced frame and removable cover. Cover to be secured in place with hex head screws.
6. All Type C poles shall be installed with a breakaway type transformer base.

#### 2.08 Street Light Luminaire

- A. Type A Light Efficient Diode (LED) Luminaire
  1. Holophane Utility Postop LED Series. Cat. No. PTUE 70 4K AS G3 BB or approved equal.
- B. Type C Light Efficient Diode (LED) Luminaire - steel pole/Davit arm.
  1. American Electric Lighting Cat. No. ATB2-80B LED E 70M VOLTR2.
- C. Heads to be of aluminum casting designed for internal wiring and shall be furnished with 2-inch slip fitter for horizontal mounting. Luminaires shall be adjustable plus or minus five degrees from horizontal.

#### 2.09 Post Wiring, Bonds and Grounds

- A. All post wiring between cable or neutral wires, and the luminaires or convenience outlet, shall be No. 12 A.W.G. copper stranded, (THWN/THHN) 600-volt cable of the same type specified for the underground distribution circuits.
- B. In each post, one feeder lead (hot wire) and one neutral wire shall be run from the cable in the base to each luminaire.
- C. The feeder leads to the luminaire shall extend from the cable in the post base through a Buss type HEB in line fuse holder with a type FNM 10 ampere fuse. The fuse housing shall be supported by the conductors at the level of the post hand hole. Sufficient excess conductor (12-inches to 24-inches) in length shall be provided to permit withdrawal of the fuse holder through the hand hole for purposes of fuse installation and inspection, without having to pull out feeder wire. The neutral wire shall not be fused.
- D. Ground all metal standards. Bond to ground conductor and to ground rod.
- E. Fuse holders shall be connected directly, via the crimped ends to the feeder leads and the luminaire wiring. There is to be no other connection.

## PART 3 – EXECUTION

### 3.01 Lighting System Installation

- A. The 120-volt or 240-volt distribution circuits, consisting of single conductor cables, quantity and size as designated on the drawings and these specifications, installed direct burial underground in boulevards, shall be installed in conduits under the streets and drives and when rising up into feed points.
- B. Conductors installed direct burial in trench or in conduit shall be installed to a depth of not less than twenty-four inches (24 inches) below finished grade. Under streets, drives and sidewalks conductor shall be installed not less than 24 inches below underside of concrete, asphalt or hard surface.
- C. Provide 2-inch PVC (heavy wall - Schedule 40) in trench areas designated on plans.
- D. Provide steel rigid galvanized conduits under existing hard surfaced driveways, streets and alleys by jacking or heavy wall plastic (PVC) installed with "mole" or drilling device. Conduits shall extend 12 inches beyond each side of roadway or alley surface. Rigid conduit shall be complete with plastic bushings; PVC conduits to be complete with bell end fittings. Conduits under gravel or dirt driveways or streets to be laid in trench a minimum of 24 inches" below bottom of hard surface or grade.
- E. If an obstruction is encountered when "jacking" or "drilling" conduit under a concrete or asphalt street, driveway or alley or for any other reason it becomes impractical to install the conduit in this manner, the Engineer or his authorized representative may grant the contractor permission to cut the street, drive or sidewalk with a concrete saw so conduit can be trenched into place. The width of the concrete or asphalt to be removed and the depth of the saw cutting shall be performed as directed by the Engineer or his authorized representative. No extra payment will be made for cutting the concrete or asphalt. Cost of installing conduit by this method shall be included in the price for 2-inch conduit jacked or pulled in place. Street "cuts" shall not be started until permission is granted by Engineer - in writing.
- F. Where conduits cross streets, drives, and other paved surfaces, a maximum of six (6) conductors may be installed in a single 2-inch conduit.
- G. Conduit shall be sloped to provide drainage. Provide sand pocket at lower end.

- H. Rigid steel conduit ends shall be carefully reamed to provide a smooth surface for conductor. Provide plastic bushing on all rigid steel conduit ends. PVC conduit ends shall be terminated with bell type fittings. Close up conduit by inserting a loose stopper plug of 'dry oakum' or similar material to prevent earth from entering the conduit.
- I. 2-inch PVC conduit shall be provided for the risers at the pad mounted feed points and 2-inch rigid steel galvanized at pole mounted feed points. Do not seal lower end of conduits at pole mounted feed points.
- J. During installation, cables shall be handled with care. Do not bend or kink cables to a radius of less than six (6) times cable diameter.
- K. All cables run through conduit shall be pulled by hand and shall not be strained in any manner in so doing. Provide a slack loop in conductors prior to entering any conduit that rises vertically.
- L. The street light branch circuit feeders consist of two 120-volt circuits or one 240-volt circuit routed underground from pole to pole. Street lights that are alternated on circuits shall be brought up into pole for splicing and marking.
- M. Where conduit or pipe is not used, cable shall be packed in sand to provide a cushion and to facilitate drainage in the following manner; Excavate trench to required depth minimum of 27 inches (Exception: 48 inches from feed points in residence back yards to boulevards) then fill with 3 inches of clean, washed sand, leveled and lightly tamped; single conductor cables shall be laid loosely in the trench and spaced. Conductor crossovers shall be avoided. Contractor shall use a paddle template just ahead of 3-inch sand cover operation to insure proper spacing. Cover conductors with not less than 3 inches of sand. Sand shall be leveled and lightly tamped about the sides and over the cable. The trench shall then be filled and finished in the regular manner. Exception: If Engineer approves specific excavation as being free of rock and debris, Contractor may use said backfill without sand cushion.
- N. Where excavations for cables or conduits are made as above provided, the backfill shall be compacted in 4-inch lifts or layers.
- O. Provide 6-inch wide red plastic marker tape near top of trench (6 inches below final grade) in all trenches. Tape to read "Caution - Buried Electric Cable."
- P. The arrangement of circuits requires no splicing of cable underground. Splicing will only be allowed in junction boxes, pole bases or feed point cabinets.

- Q. A minimum of 10-percent spare pole/luminaire/lamp assemblies and transformer bases, rounded up to the nearest whole number shall be delivered to the City of Minot unless otherwise stated in the Plans.
- R. Self-adhesive numbering supplied by the Contractor shall be installed by the City of Minot Traffic Department.

### 3.02 Street and Sidewalk Crossings

- A. When it is necessary to cross under a street or sidewalk, the Contractor shall bore underneath and install a conduit for the utility. If conditions do not allow for a bore, the utility may be open cut but only after written permission is obtained from the City Engineer.
- B. All damage caused by utility installation shall be repaired by the Contractor including all settlements caused by open cut or trenchless methods.

### 3.03 Field Quality Control and Acceptance

- A. Each segment of underground circuitry shall be tested with a megohm-meter prior to termination in order to ensure no damage to the conductors or insulation has occurred during installation. Meter shall read infinite resistance at a minimum of 500 volts. Contractor shall provide the Engineer with a meter reading for each segment.
- B. The Contractor shall be responsible for the lighting system and any damage or maintenance required prior to final acceptance by the City of Minot. Completion of the inspection checklist and submittal of record drawings to the Engineer shall constitute acceptance by the City of Minot.

## PART 4 – MEASUREMENT AND PAYMENT

- A. Type \_ Street Light: Shall be paid for by each (EA) as specified on the Plan. Price for each unit shall include the following:
  - 1. Type \_ Luminaire specified for the type of pole or as shown on the Plans.
  - 2. Type \_ pole as specified or shown on the Plans with appropriate mounting Tenon adaptor for luminaire mount as required.
  - 3. Pole wiring and connections to underground circuits.
  - 4. Fuse holder and fuse.
  - 5. Tamped backfill and trim ring.
  - 6. Unit set in place and ready for operation.

- B. Conductor: Shall be paid for by the linear foot (LF) for the size and type specified on the Plan. Measurement shall be made from center to center of pole, box, or feed point.
- C. \_\_\_-Inch Conduit: Shall be paid for by the linear foot (LF) installed by the method specified on the Plan. Cost shall include all materials and labor necessary for installation.
- D. Trenching: Shall be paid for by the linear foot (LF). Price shall include all materials and labor necessary for completion of the work including sand cushion, marking tape, excavation and backfill.
- E. Feed Point: Shall be paid for by each (EA) as specified on the Plan. Price for each Feed Point shall include the following:
  - 1. Concrete foundation/pad.
  - 2. Aluminum enclosure.
  - 3. Panel board with breakers.
  - 4. Relays.
  - 5. Photocell and bypass switch.
  - 6. Servicing receptacle.
  - 7. Conduit, wire and inter-connections.
  - 8. Meter socket.
- F. Spare Pole: Shall be paid for by each (EA) unit delivered to the City of Minot. Typically, 10 percent of the number installed, rounded up.
- G. Spare Luminaire: Shall be paid for by each (EA) unit delivered to the City of Minot. Typically, 10-percent of the number installed, rounded up.
- H. Junction Box / Pull Box: Shall be paid for by each (EA) as specified on the Plan.
- I. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION