1000 STREET LIGHTING

ITEM 1000 - STREET LIGHTING

1000.01 Description. This work shall consist of furnishing and installing electrical materials and equipment complete and ready for service, in reasonably close conformity with locations, dimensions, and grades shown on the plans or as ordered by the Engineer. This work shall also include necessary excavation and backfill, and disposal of discarded materials, and restoration of disturbed facilities and surfaces.

1000.02 Materials. New first quality materials shall be furnished. They shall comply with the Underwriters Laboratories requirements. The materials shall also comply with the National Electrical Code and local codes. No materials furnished under this specification shall contain polychlorinated biphenyls. All electrical parts, wire, switches and other elements of the installations shall be of ample capacity to carry the required amperage without excessive heating or causing an excessive drop of potential.

Except as otherwise provided herein, each individual item of equipment shall bear a name plate, or other type of indelible marking or brand that shall identify it as to type, catalog number and manufacturer.

Specific materials and miscellaneous items shall be as identified in the City's Street Lighting Specifications which are supplemental to these specifications.

1000.03 General. In general, definitions of street lighting terms used shall be in accordance with Appendix F of the American National Standard Practice for Roadway Lighting ANSI D12.1.

Each system shall conform as to voltage, amperage, frequency and type specified. The Contractor shall furnish and install all incidentals necessary to provide a complete and practical working unit or system.

All installations shall be in accordance with the National Electrical Code and National Electrical Safety Code, and shall also conform to local laws and codes governing such work.

The Contractor shall obtain and pay for all permits required.

In order to provide all necessary requirements for the proposed lighting system, the Contractor shall cooperate with the agency which will furnish electrical service also hereinafter referred to as the supplying agency.

1000.04 Working Drawings. The Contractor shall submit 6 sets of shop drawings, catalog cuts, specifications, photometric data, brochures, data sheets and wiring diagrams of apparatus and equipment to be furnished, as required for approval by the Director *of Public Utilities*. The submitted documents shall show clearly the design, quality, dimensions, and other such information as may be necessary for a proper evaluation of the items submitted. All submitted documents shall identify the specific project number and year with the bid item reference number to which the apparatus or equipment applies. If more than one catalog number or type is listed on a sheet, the item intended to be furnished shall be identified by an appropriate mark. The working drawing submission shall indicate specific compliance with applicable specifications.

The Contractor shall not install any of the items until written approval is received from the Director. After approval, working drawings shall be considered as supplemental to, but not a substitute for, the original plans. Approval of working drawings shall not relieve the Contractor of responsibility for omissions, erroneous or inconsistent dimensions and notations, other errors or the proper functioning of the completed installation.

1000.05 Light Poles. Light poles conforming to approved shop drawings shall be set in the ground, erected upon the completed concrete foundations or other specified type of mounting. Light poles shall be plumbed. After erection, each light pole shall be adequately grounded and shall have hand hole covers or transformer base doors fastened in place.

Backfill for poles set in ground shall be compacted using Item 304 in thin layers as directed by the Engineer and as indicated in the City's street lighting specifications.

After erection, painted poles shall be inspected for defects in the painted surfaces. Minor scratches shall be given two coats of matching paint. The second coat shall not be applied until after the first coat has adequately dried. Poles having major scratches or defects in the painted surfaces will not be accepted.

1000.06 Foundation. Excavation for foundations shall be completed, as nearly as practicable, to the dimensions shown for the foundations. Concrete shall be cast-in-place, Class C, and construction shall be in accordance with Item 511 except that forms will not be required for portions of foundations extending more than 6 inches (152 mm) below the ground line, unless the soil does not have sufficient stability to stay in place during the placing of the concrete. Where, in the opinion of the Engineer, an excavation for a foundation has revealed an unstable condition at the bottom of the excavation, the foundation shall be deepened or enlarged in size as directed by the Engineer. Payment for additional quantities of excavation and foundation concrete required by the Engineer for this purpose shall be made by supplemental agreement. If a cave-in should occur during excavation, the Contractor may continue excavating using casing, sleeving or other methods, with the approval of the Engineer.

Reinforcing steel as specified shall be placed in accordance with Item 509.

Anchor bolts for light poles shall be installed in the foundations in accordance with approved shop drawings and anchor bolt setting templates. The tops of foundations shall be finished smooth and level.

Anchor bolt settings for light poles shall provide that light poles predominantly illuminating a mainline roadway shall be positioned with the arm of the pole perpendicular to the *longitudinal centerline of the* roadway *at that location*.

After forms have been removed, excavated spaces around the foundations shall be backfilled with suitable materials placed and tamped in thin layers as directed by the Engineer.

1000.07 Luminaires. Street light luminaires shall be adjusted vertically and horizontally to provide the required mounting height and the specified alignment with the roadway. At pole locations where the profile grade exceeds 4 percent, the luminaires shall be oriented so that the vertical axis of the luminaires shall be perpendicular to the longitudinal centerline of the roadway at that location.

Lamps shall be compatible with ballasting characteristics of the specified luminaires.

1000.08 Ground Rods. A ground rod unit shall consist of furnishing one ground rod of the specified type and size installed as shown on the plans.

1000.09 Pull Boxes. The types and sizes of pull boxes and covers furnished shall be as specified, and they shall be located where designated on the plans. Excavation shall be performed as nearly as practicable to the outside dimensions of the pull box. A 6 inch (152 mm) gravel base shall be provided below the pull box. After boxes are set to proper grades, excavated spaces around the boxes shall be backfilled with soil and thoroughly tamped in layers not exceeding 4 inches (102 mm) in thickness, loose depth, to the density required in Section 203.12.

When pull boxes are installed in paved areas, an adequate area shall be removed by saw cutting on the sides, or by removal back to an expansion joint. The cover surface shall be adjusted to be slightly above the surrounding pavement.

1000.10 Trench. Trenches located adjacent to and parallel with curbs or pavements shall not deviate more than 6 inches (152 mm) from the lines designated. Trench backfill shall be placed in layers not to exceed 4 inches (102 mm) in thickness and compacted with mechanical tampers or other approved compaction equipment as directed. Backfill material shall consist of suitable soil or specified granular materials except the material around and in the first 4 inches (102 mm) above the top of the conduit not encased in concrete shall not contain pieces larger than 1/2 inch (12.7 mm). *Backfill* material for trenches in areas of pavement and stabilized aggregate shoulders shall be *Item 304*. Trenches shall have a minimum depth of 2 feet (0.6 m) and shall not exceed 12 inches (0.3 m) in width.

1000.11 Conduit. Conduit of the type and size shown on the plans, shall be installed at locations designated by the plans or as directed by the Engineer.

Where underground conduits are to be encased in concrete, the concrete encasement shall be Class C and shall have a minimum 2 inches (50 mm) of cover on all sides. Spacers shall be used as shown on the plans.

Bends in conduit shall be used only when absolutely necessary. The total bending between adjacent junction boxes and/or pull boxes shall not exceed 180 degrees and the total bending between adjacent light poles shall not exceed 270 degrees. The radius of any field bend shall be not less than 12 times the internal diameter of the conduit. Bends in conduit shall be so made that the protective covering will not be injured and the internal diameter at the bend will not be reduced.

No bends shall be permitted between pull boxes in conduit designed for coaxial cable.

All rigid ferrous metal conduit, and fittings and appurtenances thereto, shall be galvanized.

The Contractor shall check each conduit run by rodding or by pushing a mandrel through the conduit run. Any obstructions which may develop in the conduit shall be removed.

After installation, all conduit which will not have circuit wire or cable pulled into it during construction shall have a No. 10 AWG copper-clad, aluminum-clad or galvanized pull wire installed in it. The ends shall be closed with capped bushings or otherwise sealed in an approved manner to completely keep all moisture and foreign matter out of the conduit. Terminal points of all conduits containing wire or cable, shall be completely sealed by the application of heat shrinkable tubing, or pre-molded boots. Equivalent temporary sealing approved by the Engineer shall be provided immediately after placement of conduit where conductors or cable are not installed promptly in the conduit.

Where conduit enters a junction box through a slip hole, locknuts shall be provided to fasten the conduit to the junction box.

1000.12 Cable. Copper wire cables of the types and sizes required shall be installed as designated or as ordered. Cable installed in light poles shall be supported by cable grips attached to J hooks at the tops of the poles. The cable shall not drag against the openings to the bracket arm.

All cables, except structure grounding system cables and pole and bracket cable, entering an accessible enclosure such as a pull box, handhole, transformer base, etc. for the purpose of being terminated or connected to another cable shall be identified in such enclosure with tags or bands. No splices will be permitted between terminations.

1000.13 Cable-in-Duct Trenchless Installation. Trenchless installation shall be accomplished by use of a guided directional drilling device.

The cable-in-duct shall be installed, in a straight line, at a minimum depth of 2 feet (0.6 m).

Cable-in-duct shall be installed in sufficient length to allow for splicing loops at light pole foundations, pull boxes, and other locations indicated by the Engineer.

The cable-in-duct, complete with splicing loops, shall be in place prior to the installation of pull boxes and pouring of concrete foundations unless otherwise directed by the Engineer.

Cable-in-duct shall not be installed when the temperature of the duct is below 32°F (0°C), except with permission of the Engineer.

Terminal points and splice locations of duct-cable shall be completely sealed by the application of heat shrinkable tubing or pre-molded boots. Sealing shall be performed promptly upon completion of installation.

1000.14 Connections. Cable connections in the handholes or transformer bases of all light poles, and above pavement elevation, shall be accomplished by the use of the specified preassembled cable connector kits and, in addition, the kit used in the hot leg shall be of a fused type. Where used in handholes or transformer bases, the kits shall be of a quick disconnect type.

Cable connections below ground line, in accessible enclosures shall be accomplished by the use of a permanent water resistant cable splicing kit. Each kit shall provide a splice in compliance with ANSI C 119.1 when applied in accordance with the manufacturer's instructions.

Connector kits used in cable connections installed at the last light pole or pull box on a circuit shall have the vacant wire opening plugged in accordance with the manufacturer's recommendations.

Until cable connections have been completed, all cable connector kits and exposed cable ends shall be adequately protected by heat shrinkable caps, taping, or other approved means.

1000.15 Power Service and Control Site. The Contractor shall furnish and install all equipment necessary to provide complete electrical service to the street lighting and/or other electrical facilities. When the system is complete and ready for service the Contractor shall notify the City or other supplying agency for connections to establish electrical service. Equipment shall include, but is not necessarily limited to, the following items: wood poles, hardware for dead-ending an overhead line, lightning arrestor, weatherhead, conduit riser, meter base, fused main disconnect switch transformer, magnetically held lighting contacts, HOA switch for control of contacts, photoelectric cell, over-current protection devices for each individual branch circuit fed by the control center, enclosures, conduits, fittings, cables, and connectors.

Unless otherwise directed by the Engineer, the components of the lighting control center shall be installed in the enclosure with the fused disconnect switch which is part of the power service.

Branch circuit neutrals shall not be fused. When grounded service is provided, branch circuit neutrals shall be solidly connected and grounded. When ungrounded service is provided, branch circuit neutrals shall be ungrounded and switched simultaneously with their associated line conductors.

At the time of installation, the photoelectric cell shall face due north unless other orientation is required. In no case shall the sensor element be rotated more than 45 degrees east or west of due north, tilted off of horizontal or shielded with auxiliary devices without prior approval by the Engineer.

All equipment housings and conduits shall be connected to a ground rod installed in accordance with Section 1000.10. Lightning arrestors on incoming service shall be connected to equipment ground wire only when grounded neutral service is used and transformation is not required. Otherwise these lightning arrestors shall be separately grounded to a butt ground or to an additional ground rod installed in accordance with Section 1000.10, and located a minimum of 1 foot (0.3 m) from the base of the pole or pad and all other ground rods. Grounding cables installed on a pole shall be protected by wood or plastic ground wire moldings.

Fusing of service neutrals shall not be permitted. Grounded service neutrals shall not be switched, but shall be connected to a neutral bar in the disconnect enclosure with a screw type pressure connector. All ungrounded neutrals shall be switched simultaneously with the associated line conductors.

1000.16 Conduit Jacked or Drilled Under Pavement. Conduit placed under existing pavement or paved shoulder may be installed by jacking or drilling, subject to the approval of the Engineer. If placed by drilling, the bore shall not exceed the conduit diameter by more than 5 percent. The conduit shall be placed with a minimum amount of disturbance to the existing pavement, curb, paved berm, or shoulder of the roadway or street. The conduit shall be extended a minimum of 3 foot (0.9 m) beyond the curb or paved berm.

1000.17 Conductor Safety Policy. When the contract involves work on or near the City's energized or potentially live electrical facilities, the Contractor is required to *notify the Division of Electricity Dispatch Center at (614) 645-7627 and* fully comply with the City's **"CONDUCTOR SAFETY POLICY"**. Copies of this policy are available from the Division of Electricity.

1000.18 Electrical Tests. When electrical tests are specified, the Contractor shall be responsible for furnishing all personnel and equipment required to successfully perform the following tests, and shall furnish three certified copies of complete test records to the Engineer on test reporting forms.

Except for the high voltage tests, all costs of labor, materials, equipment, electrical energy and incidentals required for performing the following electrical tests shall be included in the contract unit prices for the respective items tested.

The Contractor shall submit to the Engineer the types, styles, or catalog numbers of all testing equipment to be used for such tests. At the same time, the Contractor shall include a written certification that the testing equipment was last calibrated by a testing agency, whose qualifications as such are acceptable to the Director, not more than 6 months prior to the date when such tests are performed.

1. **Ground Test.** Each ground rod and ground grid shall be measured for earth resistance immediately after being installed and before the ground wire is attached. The earth resistance measurement shall not exceed 25 ohms.

2. **Cable Continuity Test.** Prior to the performance of any cable insulation tests, a continuity test shall be performed with a volt-ohmmeter or other approved instrument. Continuity tests shall be conducted with electrical loads, power sources and grounds, including earth grounds, disconnected.

   Each conductor shall also be measured against every other conductor and ground, including earth ground, to assure that no short circuits, cross circuits or other improper connections exist. No voltage shall exist between any conductor and another conductor including ground. One at a time, each circuit branch shall then be temporarily shorted at its termination and measured for continuity to assure that no open circuits exist, that the circuit branch is according to plan, that no high resistance connections exist, and that each circuit is properly identified.

3. **Cable Insulation Test.** The insulation resistance shall be measured for each insulated cable of the circuit, including duct-cable. The test shall be performed on each cable of each circuit with all ballasts disconnected and all connections to earth grounds, including ground rods and grounding connections to light poles, disconnected. Units of measure for reporting shall be expressed in megohms. The cable insulation resistance shall exceed 10 megohms.

4. **Voltage Regulation and Current Balance Test.** The circuit shall be energized and a visual check shall be made by the Project Engineer to determine that all lights are in operation. After a ten minute warm-up period, the following data shall be measured and recorded on the test reporting form:

   A. Operating current of each circuit;

   B. Circuit voltage at controller;

   C. Circuit voltage at the end light of each circuit as designated by the Engineer.

1000.19 Methods of Measurement. When the contract stipulates that payment will be made for various elements of an electrical installation on a linear foot (meter), lump sum or each basis, measurement will be made as follows:

1. **Trench.** The number of linear feet (meters) of trench completed will be measured from center to center of foundations, pull boxes, etc. and shall include

all excavation, sawing and removal of pavement, *required* backfill material, compaction, disposal of surplus materials and restoration of disturbed facilities and surfaces.

2. **Conduit.** The number of linear feet (meters) of conduit furnished and installed will be measured from center to center of pull boxes, foundations, etc., and shall include all fittings and appurtenances, joints, bends, grounds, and concrete encasement where specified.

3. **Circuit Cable.** The number of circuit feet (meters) of cable furnished and installed will be measured as the sum of the distances from center to center of foundations, pull boxes, etc., plus 10 feet (3 m) per each spacing to allow for slack and splicing leads.

4. **Cable-in-Duct.** The number of linear feet (meters) of cable-in-duct furnished and installed will be measured from center to center of pull boxes, foundations, etc., plus 10 feet (3 m) per each spacing to allow for splicing leads.

5. The number of light poles and pullboxes furnished and installed will be the actual number of each, complete in place. Bracket arms will be included with the light poles for payment; however, when separate bracket arms are required, they will be measured as the actual number of each, complete in place.

6. **Control Site.** The control site will be measured as one unit for each of the installations specified and shall include all materials, equipment and incidentals, complete in place.

7. **Foundations.** The accepted number of light pole foundations furnished and installed will be the actual number of each, complete and in place, and shall include reinforcing steel, anchor bolts, and conduit ells as specified in the plans.

8. **Conduit Jacked or Drilled Under Pavement.** The length of conduit to be paid for will be the actual number of linear feet (meters) installed, measured in place, as accepted by the Engineer, and including excavation, conduit, jacking or drilling, and restoration.

When the contract stipulates that payment will be made for specific complete electrical equipment installation on a lump sum basis, the pay item stipulated will include all electrical materials, equipment and incidentals, including specified tests required at the locations and within the limits specified on the plans, complete in place.

1000.20 Basis of Payment. Payment will be made at the contract price for:

Item	Unit	Description	MIS Numbers *
1000	*Each*	*Alley Lighting*	*36, 37*
1000	*Each*	*Anchors*	*1, 2, 3*
1000	*Each*	*Brackets*	*5, 6, 7, 8, 9, 10, 64, 136, 138, 164*
1000	Linear Feet (Meters)	Cable-In-Duct (Trenchless Installation)	124, 128
1000	*Linear Feet (Meters)*	*Circuit Cable (Underground)*	*14, 73, 94*
1000	*Linear Feet (Meters)*	*Circuit Cable (Overhead Conductor)*	*11, 12, 13, 61*
1000	Linear Feet (Meters)	Trench/Conduit	15, 16, 17, 18, 20, 59, 60, 63, *78*, 83, 89, 97, 102, *125*
1000	*Each*	*Control Sites (Controllers)*	*19, 119, 120, 157*
1000	*Each*	*Door (Aluminum Access Door for 20' Standard)*	*66*
1000	*Each*	*Expansion Joint (Rigid Conduit)*	*71*
1000	Each	Foundations	21, 22, 24, 25, 81, 112,123, 127, 161
1000	*Each*	*Ground (Overhead & Underground)*	*26, 111*
1000	*Each*	*Junction Box (Underpass)*	*72*
1000	*Each*	*Luminaire (Cobra)*	*27, 28, 30, 32, 33, 101, 115, 116*
1000	*Each*	*Luminaire (Cut-Off Cobra)*	*144, 148, 149, 160*

1000	Each	Luminaire (Miscellaneous)	*31*, 34, 47, 54, 55, 62, *92*
1000	*Each*	*Luminaire (Misc. Cut-Off)*	*113, 118, 122, 135, 151, 156, 163*
1000	*Each*	*Luminaire (Post Top or Decorative Styles)*	*29, 51, 65, 70, 76, 80, 98, 103, 142, 159*
1000	*Each*	*Luminaire (Tear Drop)*	*130, 139, 140, 141, 165, 166, 167*
1000	*Each*	*Pole (Aluminum Standards)*	*35, 38, 43, 50, 56, 57, 58, 74, 82, 84, 93, 109, 114, 129, 133, 137, 152, 168*
1000	*Each*	*Pole (Aluminum Bronze)*	*39, 85, 86, 87, 88, 90*
1000	*Each*	*Pole (Cast Iron/Aluminum) Lamp Posts*	*49, 79, 150, 158*
1000	*Each*	*Pole (Fiberglass) Lamp Posts*	*52, 91, 100, 153*
1000	*Each*	*Pole (Refurbished or Reconditioned)*	*40, 67, 162*
1000	*Each*	*Pole (Street Light Standard Relocation)*	*107*
1000	*Each*	*Pole (To Be Wired)*	*41*
1000	*Each*	*Pole (Wood)*	*42*
1000	*Each*	*Primary Pole Replacement*	*53*
1000	Each	Pull Box	4, 48, 121
1000	*Each*	*Re-Lamp (Clean & Change HPS Lamps in Luminaires)*	*68,69*

1000	*Each*	*Safety Policies*	*95*
1000	Each	Secondary Riser	44
1000	*Each*	*System Removal*	*23, 46, 75, 126*

* *MIS - Material and Installation Specifications of the City of Columbus, Division of Electricity, are subject to change by the Division of Electricity. Prior to bidding the work based on these specifications, the contractor/consultant should contact the Division of Electricity to verify current specifications are being used.*