

1000 ELECTRICAL

ITEM 1001 STREET LIGHTING

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1001.01 Description. This work consists 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 directed by the Engineer. This work also includes necessary excavation and backfill, and disposal of discarded materials, and restoration of disturbed facilities and surfaces.

1001.02 Materials. Provide new first quality material complying with the Underwriters Laboratories requirements, the National Electrical Code, the National Electrical Safety Code, and local codes. Do not use material containing polychlorinated biphenyls. Provide electrical parts, wire, switches, and other elements of the installations with ample capacity to carry the required amperage without creating excessive heat or causing an excessive drop of potential.

Except as otherwise provided herein, place a name plate or other type of indelible marking or brand on each individual item of equipment identifying the type, catalog number, and manufacturer.

Refer to the City's most current Street Lighting Material and Installation Specifications for specific materials and miscellaneous items. The Street Lighting Material and Installation Specifications are supplemental to these specifications.

1001.03 General. In general, refer to Appendix F of the American National Standard Practice for Roadway Lighting ANSI D12.1 for definitions of street lighting terms.

Provide each system conforming to the voltage, amperage, frequency, and type specified. Provide and install all incidentals necessary to provide a complete and practical working unit or system.

Provide installations in accordance with the National Electrical Code and National Electrical Safety Code and conform to local laws and codes governing such work.

Obtain and pay for all permits required and submit a copy to the City upon request.

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

1001.04 Working Drawings. Submit either 1 electronic copy or 6 paper copy 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 Engineer. Provide documents that show clearly the design, quality, dimensions, and other such information as necessary for a proper evaluation of the items submitted. Ensure that submitted documents identify the specific project number and year with the bid item reference number to which the apparatus or equipment applies. For sheets listing more than one catalog number or type, the item intended to be furnished shall be identified by an appropriate mark. Indicate that submitted working drawings comply with applicable specifications.

Do not install any of the items before receiving written approval from the Engineer. After approval, the City will consider the working drawings as supplemental to, but not a substitute for, the original plans. Approval of working drawings does not relieve the Contractor of responsibility for omissions, erroneous or inconsistent dimensions and notations, other errors, or the proper functioning of the completed installation.

1001.05 Light Poles. Set light poles, conforming to approved shop drawings, in the ground, erected upon the completed concrete foundations or other specified type of mounting. Plumb the light poles. After erection, adequately ground each light pole and fasten hand hole covers or transformer base doors in place.

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

After erection, inspect painted poles for defects in the painted surfaces. Give minor scratches two coats of matching paint. Allow the first coat to adequately dry before applying the second coat.. The Engineer will not accept poles having major scratches or defects in the painted surfaces.

1001.06 Foundation. Excavation for foundations shall be completed, as nearly as practicable, to the dimensions shown for the foundations. Use cast-in-place concrete, Class C, and construct foundations in accordance with Item 511 except the City will not require forms 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. For a foundation excavation showing an unstable condition at the bottom of the excavation, as determined by the Engineer, deepen or enlarge the foundation, as directed by the Engineer. The City will pay for additional quantities of excavation and foundation concrete required by the Engineer for this purpose as provided by supplemental agreement. If a cave-in should occur during excavation, the

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Contractor may continue excavating using casing, sleeving, or other methods, with the approval of the Engineer.

Place reinforcing steel as specified in accordance with Item 509. Install anchor bolts for light poles in the foundations in accordance with approved shop drawings and anchor bolt setting templates. Finish the tops of foundations 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 form removal, backfill excavated spaces around the foundations with suitable materials placed and tamped in thin layers as directed by the Engineer.

1001.07 Luminaires. Adjust street light luminaires 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, position the vertical axis of the luminaires perpendicular to the longitudinal centerline of the roadway at that location.

Provide lamps compatible with ballasting characteristics of the specified luminaires.

1001.08 Ground Rods. Provide ground rod units consisting of one ground rod of the specified type and size installed as per the Street Lighting Material Installation Specification (MIS).

1001.09 Pull Boxes. Provide the types and sizes of pull boxes and covers as specified and locate where designated on the plans. Excavate as nearly as practicable to the outside dimensions of the pull box. Place a 6 inch (152 mm) gravel base below the pull box. After setting boxes to proper grades, backfill excavated spaces around the boxes with soil and thoroughly tamp in layers not exceeding 4 inches (102 mm) in thickness, loose depth, to the density required in 203.12.

1001.10 Trench. Do not deviate more than 6 inches (152 mm) from the lines designated for trenches located adjacent to and parallel with curbs or pavements. Place trench backfill in layers not to exceed 4 inches (102 mm) in thickness and compacted with mechanical tampers or other approved compaction equipment as directed. Use backfill material consisting of suitable soil or specified granular materials. Ensure the material the around and in the first 4 inches (102 mm) above the top of the conduit not encased in concrete does not contain pieces larger than 1/2 inch (12.7 mm). Use backfill material for trenches in areas of pavement and stabilized aggregate shoulders in accordance with Item 304. Excavate trenches at least 2 feet (0.6 m) deep and not more than 12 inches (0.3 m) wide.

1001.11 Conduit. Install conduit of the type and size shown on the plans at locations designated by the plans or as directed by the Engineer.

For underground conduits encased in concrete, provide Class C concrete encasement with a minimum 3 inches (50 mm) of cover on all sides. Use spacers as shown on the plans.

Use bends in conduit only when absolutely necessary. Do not exceed 180 degrees of total bending between adjacent junction boxes and/or pull boxes and do not exceed 270 degrees of total bending between adjacent light poles. Provide a minimum radius of any field bend of not less than 12 times the internal diameter of the conduit. Make field

bends in conduit without injuring the protective coating and without reducing the internal diameter at the bend.

Galvanize all rigid ferrous metal conduit, fittings, and appurtenances.

Check each conduit run by rodding or by pushing a mandrel through the conduit run. Remove any obstructions found in the conduit.

Close the ends of all conduit not having circuit wire or cable pulled into it during construction with capped bushings or otherwise seal in an approved manner to completely keep all moisture and foreign matter out of the conduit. Seal terminal points of all conduits containing wire or cable 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.

Provide locknuts to fasten the conduit to the junction box where conduit enters a junction box through a slip hole,

1001.12 Cable. Install copper wire cables of the types and sizes required as designated or as ordered. Support cable installed in light poles by cable grips attached to J hooks at the tops of the poles. Do not allow the cable to drag against the openings to the bracket arm.

For the purpose of termination or connection to another cable, identify all cables, except structure grounding system cables and pole and bracket cable, entering an accessible enclosure such as a pull box, handhole, or transformer base, etc. with tags or bands. Do not splice cable between terminations.

1001.13 Cable-in-Duct Trenchless Installation. Use a guided directional drilling device for trenchless installations.

Install the cable-in-duct in a straight line at a minimum depth of 2 feet (0.6 m).

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

Place the cable-in-duct, complete with splicing loops, prior to installing pull boxes and pouring concrete foundations, unless otherwise directed by the Engineer.

Do not install cable-in-duct when the temperature of the duct falls below 32°F (0°C), except with permission of the Engineer.

Completely seal terminal points and splice locations of duct-cable by the application of heat shrinkable tubing or pre-molded boots. Seal promptly upon completion of installation.

1001.14 Connections. Make cable connections in the handholes or transformer bases of all light poles, and above pavement elevation, using the specified preassembled cable connector kits. Use a fused-type kit for the hot leg. Use quick disconnect type kits for hand holes or transformer bases.

Use a permanent water resistant cable splicing kit for cable connections below ground line in accessible enclosures. Use kits that provide splices in compliance with ANSI C 119.1 when applied in accordance with the manufacturer's instructions.

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Use connector kits for cable connections installed at the last light pole or pull box on a circuit with the vacant wire opening plugged in accordance with the manufacturer's recommendations.

Adequately protect all cable connector kits and exposed cable ends with heat shrinkable caps, taping, or other approved means until completion of cable connections.

1001.15 Power Service and Control Site. Provide and install all equipment necessary to provide complete electrical service to the street lighting and/or other electrical facilities. After completing the system and making ready for service, notify the City or other supplying agency for connections to establish electrical service. Provide the following equipment including but 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, install the components of the lighting control center in the enclosure with the fused disconnect switch.

Do not fuse branch circuit neutrals. For grounded service, solidly connect and ground branch circuit neutrals. For ungrounded service, unground and simultaneously switch branch circuit neutrals with their associated line conductors.

At the time of installation, face the photoelectric cell due north, unless other orientation is required. Do not rotate the sensor element more than 45 degrees east or west of due north, tilt off of horizontal, or shield with auxiliary devices without prior approval by the Engineer.

Connect all metal equipment housings and conduits to a ground rod installed in accordance with 1001.08. Connect lightning arrestors on incoming service to equipment ground wire only when using grounded neutral service with no required transformation. Otherwise, separately ground these lightning arrestors to a butt ground or to an additional ground rod installed in accordance with 1001.08, and located a minimum of 1 foot (0.3 m) from the base of the pole or pad and all other ground rods. Protect grounding cables installed on poles with wood ground wire moldings.

Do not fuse service neutrals. Do not switch grounded service neutrals. Connect grounded service neutrals to a neutral bar in the disconnect enclosure with a screw type pressure connector. Simultaneously switch all ungrounded neutrals with the associated line conductors.

1001.16 Conductor Safety Policy. When the contract involves work on or near the City's electrical facilities, notify the Division of Power and Water (Power) Dispatch Center at (614) 645-7627 and fully comply with the Division's "**CONDUCTOR SAFETY POLICY**". Obtain copies of this policy from the Division of Power and Water (Power).

Follow the most current safety requirements listed in the Street Lighting Materials Installation Specifications (MIS). The relevant safety-related MIS items include, but are not limited to, Item 95.

1001.17 Guidelines. Use the following guidelines on each street lighting project.

1. Acceptance and Inspection Guidelines. The City will inspect all street lighting systems that the City of Columbus, Division of Power and Water will maintain, including work in progress to ensure that design and installation of facilities and materials comply with the Division of Power and Water's current "Material and Installation Specifications" (MIS). The City will inspect per 109.11 and MIS-177.

2. Guidelines for Signage. Provide project signs as detailed in MIS-180 for all projects that require signage.

1001.18 Electrical Tests. For specified electrical tests, provide all personnel and equipment required to successfully perform the following tests, and submit to the Engineer three certified copies of complete test records on test reporting forms.

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

Submit to the Engineer the types, styles, or catalog numbers of all testing equipment planned for such tests. Include a written certification stating the date the of testing equipment's last calibration by a testing agency with qualifications acceptable to the Engineer. Use testing equipment calibrated no more than 6 months prior to performing the required electrical tests.

1. Ground Test. Measure each ground rod and ground grid for earth resistance immediately after installation and before attaching the ground wire. Do not exceed an earth resistance measurement of 25 ohms.

If the earth resistance measurement exceeds 25 ohms, install additional ground rods until achieving measurements less than 25 ohms. If the earth resistance exceeds 25 ohms, permanently connect the first two rods using the same type of cable used for the grounding conductor and continue to add rods one at a time as directed by the Engineer.

Where rock prevents driving of ground rods, develop an earth connection by constructing a grid from the partially driven rods supplemented by buried bare cable as directed by the Engineer.

2. Cable Continuity Test. Prior to cable insulation tests, perform a continuity test with a volt-ohmmeter or other approved instrument. Conduct continuity tests with electrical loads, power sources, and grounds, including earth grounds, disconnected.

Measure each conductor against every other conductor and ground, including earth ground, to ensure that no short circuits, cross circuits, or other improper connections exist. Ensure that no voltage exists between any conductor and another conductor, including ground. One at a time, temporarily short each circuit branch at its termination and measure for continuity to ensure no open circuits exist, the circuit branch complies with the plan, no high resistance connections exist, and proper identification of each circuit.

3. Cable Insulation Test. Measure the insulation resistance for each insulated cable of the circuit, including duct-cable. Perform the test 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. Express the units of measure for reporting in megohms. Ensure the cable insulation resistance exceeds 10 megohms.

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4. **Voltage Regulation and Current Balance Test.** Energize the circuit and the Engineer will make a visual check to confirm operation of all lights. After a ten minute warm-up period, measure and record the following data 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.

1001.19 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) 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) to allow for splicing leads.

5. **Light Poles and Pull Boxes.** The number of light poles and pull boxes 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.

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.

1001.20 Basis of Payment. The City will pay the contract price for:

Item	Unit	Description	MIS Numbers *
1001	Each	Alley Lighting	36, 37

1001	Each	Anchors	1, 2, 3
1001	Each	Brackets	5, 6, 7, 9, 10, 136, 138, 183
1001	Each	Betterment	178
1001	Linear Feet (Meters)	Cable-In-Duct (Trenchless Installation)	124, 128
1001	Linear Feet (Meters)	Circuit Cable (Underground)	14
1001	Linear Feet (Meters)	Circuit Cable (Overhead Conductor)	11, 12, 13, 61, 73, 143
1001	Linear Feet (Meters)	Trench/Conduit	15, 16, 17, 18, 20, 59, 60, 63, 78, 83, 89, 97, 102, 125
1001	Each	Control Sites (Controllers)	19, 119, 157
1001	Each	Current Detector	184
1001	Each	Door (Aluminum Access Door for 20' Standard)	66
1001	Each	Expansion Joint (Rigid Conduit)	71
1001	Each	Foundations	21, 22, 23, 24, 25, 81, 112, 123, 127, 161
1001	Each	Ground (Overhead & Underground)	26, 111
1001	Each	Junction Box (Underpass)	72
1001	Each	Luminaire (Cobra)	27, 28, 30, 32, 33, 101, 115, 116
1001	Each	Luminaire (Cut-Off Cobra)	144, 148, 149, 160, 170
1001	Each	Luminaire (Miscellaneous)	31, 34, 47, 55, 62, 92, 179
1001	Each	Luminaire (Misc. Cut-Off)	113, 118, 122, 135, 151, 156, 163
1001	Each	Luminaire (Post Top or Decorative Styles)	29, 51, 65, 70, 76, 80, 98, 103, 142, 159, 171
1001	Each	Luminaire (Tear Drop)	130, 139, 140, 141, 164, 165, 166, 176, 182, 185
1001	Each	Pole (Aluminum Standards)	35, 38, 43, 50, 56, 57, 58, 74, 77, 82, 84, 109, 114, 129, 133, 137, 152, 168, 181
1001	Each	Pole (Aluminum Bronze)	39, 85, 86, 87, 88, 90
1001	Each	Pole (Aluminum Black)	175
1001	Each	Pole (Cast Iron/Aluminum)	49, 79, 145, 150,

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		Lamp Posts	158
1001	Each	Pole Downtown	172
1001	Each	Pole (Fiberglass)	91, 100, 153
		Lamp Posts	
1001	Each	Pole (Refurbished or Reconditioned)	40, 67, 162
1001	Each	Pole (Street Light Standard Relocation)	107
1001	Each	Pole (To Be Wired)	41
1001	Each	Pole (Wood)	42
1001	Each	Primary Pole Replacement	53
1001	Each	Pull Box	4
1001	Each	Re-Lamp (Clean & Change HPS Lamps in Luminaires)	68, 69
1001	Each	Secondary Riser	44
1001	Each	System Removal	46, 75
1001	Each	Specification Guidelines for Signage	180

** MIS – Street Lighting Material and Installation Specifications of the City of Columbus, Division of Power and Water (Power), are subject to change by the Division of Power and Water (Power). Prior to bidding the work based on these specifications, contact the Division of Power and Water (Power) to verify use of the current specifications. The Division of Power and Water (Power) can provide the most current copy of the Street Lighting Material and Installation Specifications.*