ITEM 1004 POWER TRANSMISSION AND DISTRIBUTION STANDARDS

1004.01 Description. This work consists of furnishing and installing transmission and/or distribution 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, disposal of discarded materials, and restoration of disturbed facilities and surfaces.

1004.02 Material. Provide new material complying with the Underwriters Laboratories requirements when applicable, the National Electric Code, National Electrical Safety Code, and local codes. Provide all materials, poles, insulators, conductor, switches, lightning arresters, etc. for the installation with ample capacity and strength to carry the required amperage and weight for the intended use.

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

The City will identify specific materials and miscellaneous items in the most current Transmission and Distribution Material and Installation Specifications (TDMIS) which are supplemental to these specifications.

1004.03 General. Provide the transmission and/or distribution system conforming to the utilities voltage and current requirements as specified. Provide and install poles, equipment, hardware, conductor and all incidentals necessary to provide a complete and practical working unit or system.

Install in accordance with the National Electric Code, National Electrical Safety Code, and all state and local codes governing such work. When requirements conflict, use the more stringent code for the work. These codes specify the minimum requirements for all transmission and /or distribution construction work.

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

1004.04 Document Submittals. Provide the Engineer with either 1 electronic copy or 6 paper copy sets of all shop drawings with dimensions of 22" x 34", catalog cuts, brochures, data sheets, design calculations, and operation and maintenance manuals of equipment to be furnished. Clearly show on the submitted documents the design, quality, dimensions, and other such information necessary for a proper evaluation of the items submitted. Clearly identify on all submitted documents the specific project number, name, and year with the bid item reference number to which the apparatus or equipment applies. On catalog cuts 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. Indicate specific compliance with applicable specifications on the working drawings submittals.

Provide to the City four copies of complete Operation and Maintenance manuals for all electrical equipment requiring electrical or mechanical adjustments. Provide sufficient detail in the submittals to permit the City to compile a complete and usable operating and maintenance guide. Also, provide the manuals on a CD (compact disc). Use the following as a general guide of what to address in the manual: common operating problems and remedies (Trouble shooting guide); care and preventive maintenance procedures and schedules; spare parts list with recommended spares; descriptive bulletins and detailed drawings; approved shop drawings; and operating instructions.

Submit one hard copy and CD (compact disc) of corrected as built project drawings within four weeks after completion of project. The City will not make a final payment until the Contractor submits and the Engineer approves the as built drawings and Operation and Maintenance Manuals. Ensure that the as built drawings provide an accurate representation of actual field conditions and installations.

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 relieve the Contractor of the responsibility for omissions, erroneous or inconsistent dimensions and notations, other errors or the proper functioning of the completed installation.

1004.05 Poles. Provide and install the class of poles specified in the drawings and approved by the Division of Power and Water (DOPW). Provide thirty five foot (35') poles of Southern Pine treated with Chromated Copper Arsenate (CCA), forty five thru sixty foot (45' thru 60') poles of Southern Pine treated with pentachlorophenol (penta), and sixty five thru one hundred ten foot (65' thru 110') poles of Douglas Fir treated with pentachlorophenol (penta).

Fabricate poles from raw timber as defined by the American National Standards Institute, Inc. (ANSI) in the most recent edition of the American National Standard Specifications and Dimensions for Wood Poles, ANSI 05.1. Strictly adhere to Sections

pertaining to pole classes, prohibited defects, dimensions, manufacturing requirements, and storage and handling, including all applicable tables and figures.

Frame and mark or brand the poles as described in the Transmission and Distribution Material Installation Specifications (TDMIS). Include the inspector's stamp on the pole butt.

Cure poles and complete all manufacturing processes prior to treatment. Cure and treat poles full length in accordance with the latest revision of the American Wood Preservers Association (AWPA) guidelines as published in the latest revision of their Book of Standards. Treat poles using Pentachlorophenol (penta) or Chromated Copper Arsenate (CCA) with methods, preparation, and solvents as directed in the AWPA Book of Standards.

1004.06 Pole Line Hardware. Provide pole line hardware meeting one or more of the following standards: NEC, NESC, NEMA, ANSI/IEEE, and UL. Provide new hardware of high quality material as approved by DOPW(P). Use hardware with ample capacity to carry the required amperage without any excessive heating or operational problems.

Ensure that each individual hardware item bears the manufacturer's name and catalog number on a tag or brand permanently attached to the hardware.

Provide hardware meeting DOPW(P)'s standard hardware specifications or approved equal.

1004.07 Crossarms. Manufacture crossarms from Douglas Fir Timber, in accordance with REA specifications 1728H-701. Cure crossarms in accordance with the latest revision of the American Wood Preservers Association (AWPA) guidelines as published in the latest revision of their Book of Standards. Treat crossarms using a solution of pentachlorophenol with methods, preparation, and solvents as directed in the AWPA Book of Standards.

Incise crossarms to a depth of one-eight inch (1/8") on all four (4) sides before treatment. Crossarm dimensions and drilling shall be strictly in accordance with the Transmission and Distribution Material Installation Specifications (TDMIS).

1004.08 Transformers. Provide transformers for pole mounting, pad mounted, or subway installation as required in the plans. Provide primary voltage of 14.4KV or 7.2KV as detailed on the plans. Use distribution type, oil-filled, single or double primary bushing transformers with two (2) taps of two and one half (2 ½) percent above and below the specified primary voltage ratings of KVA capacity, primary and secondary voltage as specified in the plans.

1004.09 Switches. Provide fused disconnect, single pole open blade type, three phase group operated air break type, single or three phase vacuum group operated switches. Provide switches with a minimum BIL rating of 95 for 15KV class, 350 for 69KV class, and 650 KV for 138 KV class.

1004.10 Electrical Enclosures. Provide pull boxes, manholes, or vaults as called for on the drawings.

1. Vaults. Provide precast concrete manufactured vaults meeting ASTM C857 and C858 using ASHTO HS20 wheel loading for design of all construction. Apply

wheel loads at the most critical location for each member. Provide extra reinforcement around all openings and stress points.

Use overall outside dimensions of precast manholes in accordance with Transmission and Distribution Material Installation Specifications (TDMIS). Provide pulling eyes on each wall. Provide window opening sizes and locations as detailed on drawings. See the Transmission and Distribution Material Installation Specifications (TDMIS) for details.

Provide vaults with a sump hole in the bottom floor to accommodate an 18" diameter sump. Construct all vaults with a 2"discharge PVC pipe to a drain and a check valve installed in the horizontal pipe as it exits the vault.

Provide a 36" diameter frame with a vented lid made of heavy duty, cast iron with a total height of 8 5/8" and two inch (2") tall lettering "MELP" centered on lid.

Perform the grading in compliance with ADA requirements and as detailed in TDMIS. Grade the site so as to prevent water and debris from running into the vault. Include a one inch (1") hole in each of the four corners of the bottom floor slab for the installation of ground rods. Install a 2/0 seven strand soft drawn copper ground wire around the inside wall of the vault and exothermally weld to each ground rod.

Place a six inch (6") gravel leveling base below the vaults. After setting the vaults to proper grades, backfill the excavated spaces around the vaults with soil and thoroughly tamp in layers not exceeding six inches (6") in thickness, loose depth, to a density required in 912.03, or backfill with CDF.

Install water stop seal between precast sections. Fill all openings in the vault with a non shrink waterproof grout.

For vaults installed in paved areas, remove an adequate area of pavement by saw cutting, or by pavement removal back to an expansion joint. Adjust the cover surface to an elevation slightly above the surrounding pavement.

2. Manholes. Provide precast concrete manholes meeting ASTM C857 and C858 using ASHTO HS20 wheel loading for design of all construction Apply wheel load at the most critical locations for each member. Provide extra reinforcement around all openings and stress points.

Manufacture precast manholes with outside dimensions in accordance with Transmission and Distribution Material Installation Specifications (TDMIS). Provide pulling eyes for each window. Include window opening sizes and locations as detailed on drawings. See the Transmission and Distribution Material Installation Specifications (TDMIS) for details.

Provide manholes with a sump hole in the bottom floor to accommodate a 12" diameter sump. Construct all manholes with a 2"discharge PVC pipe to a drain and a check valve installed in the horizontal pipe as it exits the manhole.

Provide a 36" or 50" diameter lid as specified in the Contract Documents, vented and made of heavy duty, cast iron with two inch (2") tall lettering "*MELP*" centered on lid. Provide a frame height of 8 5/8" for a 36" lid, or 10" for a 50" lid. Include a one inch (1") hole in each of the four corners of the bottom floor slab for the installation

of ground rods. Install a 2/0 seven strand soft drawn copper ground wire around the inside wall of the manhole and exothermally weld to each ground rod.

Place a six inch (6") gravel leveling base below the manholes. After setting the manholes to proper grades, backfill the excavated spaces around the manholes with soil thoroughly tamp in layers not exceeding six inches (6") in thickness, loose depth, to a density required in 912.03, or backfill with CDF.

Install water stop seal between precast sections. Fill all openings in the manhole with a non shrink waterproof grout.

For manholes installed in paved areas, remove an adequate area by saw cutting on the sides, or by removal back to an expansion joint. Adjust the cover surface to an elevation slightly above the surrounding pavement.

3. Pull Boxes. Provide the types and sizes of pull boxes and covers as specified and locate where shown on the plans. Excavate as nearly as practicable to the outside dimensions of the pull box. Place a six inch (6") gravel leveling base below pull boxes. After setting pull boxes to proper grades, backfill excavated spaces around the boxes with soil and thoroughly tamp in layers not exceeding four inches (4") in thickness, loose depth, to a density required in 912.03.

For pull boxes installed in paved areas, remove an adequate area by saw cutting on the sides, or by removal back to an expansion joint. Adjust the cover surface to an elevation slightly above the surrounding pavement.

1004.11 Trench. Locate trenches as shown on the plans. Excavate trenches to the width required to install the conduit with a minimum of 3" clearance on each side for concrete encasement of the conduit.

For trenches installed in paved areas, remove the pavement by saw cutting on each side of the proposed trench. Backfill the trench by placing Item 304 in four inch (4") layers and compact with mechanical tampers or other approved compaction equipment as directed. In paved areas, use backfill material consisting of compacted Item 304 or CDF. In non-paved areas, use backfill material consisting of suitable soil or specified granular materials as directed by the Engineer. For trench lengths over 100', plane the paved area and repave in accordance with Section 259.

1004.12 Duct Bank (Concrete Encased). Provide duct banks with a minimum cover of 36" above the duct bank to grade. Use Class C concrete for concrete encasement. Form duct banks square using forms on the sides or using the earth as the forms. Trowel the top smooth.

Install duct banks to drain into manholes or vaults as much as practical.

Provide the number of ducts as detailed in the plans or in the Division of Power and Water (Power) minimum standards.

1004.13 Horizontal Directional Drilling (HDD). Run directional drilling as straight as possible. Make the bore hole large enough to accommodate the conduits being pulled. Do not use splices in a conduit pull without the approval of the Engineer.

Provide schedule 80 HDPE nonmetallic flexible conduit UL listed to UL 651 and manufactured from high density polyethylene. Provide conduit with grey, black or red color and of sizes as shown on the plans.

Clean all conduits by running a mandrel not less than 12” long and ¼” smaller than the conduit diameter and swab by mechanical means to remove all foreign materials and moisture before pulling wires or installing cables. Use care cleaning the conduit to prevent damage to the interior surface of conduit.

1004.14 Conduit. Install conduit of the types and sizes shown on the plans at the locations designated on the plans, or as directed by the Engineer.

For underground conduits encased in concrete, use Concrete Class C for the concrete encasement with a minimum of 2” separation between conduits and 3” of encasing around the conduit bank. Place PVC spacers a maximum of five feet (5’-0”) apart.

Provide factory manufactured conduit bends or bend conduit in an approved manner. Ensure no reduction of internal diameter at the bend. Do not exceed 270 degrees of total bend in any conduit run, both horizontal and vertical, between electrical enclosures.

Clean all conduits by running a mandrel not less than 12” long and ¼” smaller than the conduit diameter and swab by mechanical means to remove all foreign materials and moisture before pulling wires or installing cables. Use care cleaning the conduit to prevent damage to the interior surface of conduit.

Install a No. 10 AWG copper-clad, aluminum-clad, or galvanized pull wire in all spare conduits. Seal the ends of the conduit in an approved manner to keep all moisture and foreign matter out of the conduit.

1004.15 Wire and Cable. Provide wire and cable as specified in the TDMIS, as shown in the table. The table is not all inclusive. Reference the Contract Documents and the current version of the TDMIS for a complete list.

TDMIS No.	Description
232	Copper 600V Cable XHHW
233	Copper Cable BARE
234	Copper Cable Overhead XLP
235	Aluminum Cable XLP
236	Aluminum Steel Reinforced (ACSR) Bare
237	Aluminum Service Drop Cable 600V XLP
238	Aluminum Tie Wire
239	Aluminum 15KV Aerial Spacer Cable
240	Alumoweld Messenger Wire
241	Alumoweld Guy Strand Wire
242	Galvanized Steel High Strength Static Wire

1004.16 Connectors. Provide connectors with the appropriate voltage and consisting of elbows, splices, terminators, and any other elements required for a complete system. Install correctly sized connectors for the cables they are being installed on and for the ampacity of the switches, transformers, cables, etc. to which they are being connected.

1004.17 Removals. Follow the requirements of TDMIS for removal of all overhead and underground systems.

1004.18 Minimum Standards. Follow the Division of Power and Water’s (Power) minimum standards for material and construction requirements. If the plans and the TDMIS require material of greater size or quality than the minimum standards, follow

the requirements in the plans and the TDMIS. Obtain copies of this policy from the Division of Power and Water (Power).

1004.19 Safety. Follow the Division's Safety and Hold Card Policies when working on or near the Division of Power and Water (Power) facilities.

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

   The Division of Power and Water (Power) will provide training to any contractor not certified by the Division.

2. **Hold Card Policy.** Follow the DOPW(P) Hold Card Policy when working on any electrical equipment. Obtain copies of this policy from the Division of Power and Water (Power).

1004.20 Electrical Tests. When electrical tests are specified, provide all personnel and equipment required to successfully perform the following electrical tests, and furnish three certified copies of completed test records to the Engineer on test reporting forms.

Include all costs of labor, materials, equipment, and incidentals required for performing 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 use in the tests. At the same time, include a written certification that the testing equipment was last calibrated by a testing agency, whose qualifications as such are acceptable to the Engineer, not more than 6 months prior to the date when such tests are performed.

1. **High Potential (Hi-Pot) Test.** Perform the test one phase at a time in dry weather. Ground phases not being tested. Perform tests on 15KV cable in accordance with the requirements in the TDMIS.

2. **Cable Continuity Test.** Perform the test on one cable at a time to all secondary underground cables with a 1000 volt D.C. megger. Disconnect the cable at both ends during the test.

3. **Grounding.** Ground each pole or structure. 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 measured earth resistance still exceeds the required value after driving and interconnecting the last rod, install additional ground rods and grid until achieving 25 ohms or less, or until the Engineer accepts the grounding. Submit a grounding report for each ground location. For locations where rock is encountered and the Contractor cannot drive ground rods sufficiently to allow for acceptable earth grounds, install a grid system. The City will pay for these changes in accordance with 109.05.

1004.21 Guidelines. Provide project signs as detailed in the TDMIS for all projects that require signage.

1004.22 Method of Measurement. Measurement will be made for specific items, furnished and in place, complete and accepted, in accordance with the following:

A. Poles. Shall be measured as complete units for each size and class, and will include excavation and backfilling.

B. Pole Line Hardware. All pole line hardware shall be measured as the accepted number furnished and installed.

C. Crossarms. Shall be measured as complete units for each length of crossarm with framing, and will include brackets, bolts, etc.

D. Transformers. The number and size of transformers installed including cable elbows, pole bands, etc. to install the transformer.

E. Switches. The accepted number of switches furnished and installed will be the actual number of each. Switches include all 15KV, 69KV, and 138KV fused disconnects, solid blade disconnects, groupe air break switches, vacuum switches, SF_6 switches, etc.

F. Electrical Enclosures. Shall be measured as complete units for each type of enclosure, and will include frames and lids, grounding, excavation and backfilling.

G. Trench. The number of linear feet of trench completed will be measured from center to center of foundations, manholes, vaults, etc., and shall include all excavation, shoring, sawing and removal of pavement, granular and other backfill material, compaction, disposal of surplus materials and restoration of disturbed facilities and surfaces.

H. Conduit. The number of linear feet of conduit furnished and installed will be measured from center to center of manholes, vaults, pull boxes, etc., and shall include all fittings and appurtenances, joints, bends, and concrete encasement where specified.

I. Horizontal Directional Drilling of Conduit. The number of linear feet of conduit furnished and installed will be measured before being pulled into the bore hole. Installation shall be from starting bore pit to receiving pit for manholes, vaults, pull boxes, etc., and shall include all fittings and appurtenances, joints, and bends.

J. Underground Primary Cable. The number of linear feet of cable completed will be measured using the footage indicating markings on the cable from manholes, vaults, etc., and shall include all extra cable warps in manholes, vaults and equipment.

K. Overhead Bare Primary Cable. The total number of linear feet of bare overhead conductor installed between poles plus a multiplier of 0.025 to cover the sag in the conductor.

L. Overhead Spacer Cable. The total number of linear feet of spacer cable conductor installed between poles plus a multiplier of 0.05 to cover the sag in the conductor. The number of linear feet of messenger cable installed between poles plus a multiplier of 0.01 to cover the sag in the cable.

M. Connectors. All connectors shall be measured as the accepted number furnished and installed.

1004.23 Basis of Payment. The City will pay the contract price for:

Item	Unit	Description	TDMIS Numbers*
		Poles CMS Section 1004.05	
1004	Each	Wood Pole	TDMIS-1
1004	Each	Steel Pole (Future)	TDMIS-2
1004	Each	Composite Material Pole (Future)	TDMIS-3
1004	Each	Laminated Wood Pole (Future)	TDMIS-4
		Pole Line Hardware CMS Section 1004.06	
1004	Each	Overhead Distribution Circuit Grounding	TDMIS-7
1004	Each	Overhead Transmission Circuit Grounding (3'0" Insulator spacing)	TDMIS-8
1004	Each	Overhead Transmission Circuit Grounding (6'0" Insulator spacing)	TDMIS-9
1004	Each	Single Down Guy & Anchor	TDMIS-12
1004	Each	Double Down Guy & Anchor	TDMIS-13
1004	Each	Single Down Guy & Anchor with Insulator	TDMIS-14
1004	Each	Double Down Guy & Anchor with Insulator	TDMIS-15
1004	Each	Span Guy	TDMIS-18
1004	Each	Span Guy with Strain Insulator	TDMIS-19
1004	Each	Span Guy with Strain Insulator & Guy Plate	TDMIS-20
1004	Each	Down Guy Fittings, 20M lbs.	TDMIS-23
1004	Each	Guy Wire	TDMIS-24
1004	Each	Fiberglass Guy Insulator and Grips	TDMIS-25
1004	Each	Screw Anchor (Helix)	TDMIS-26
		Crossarms CMS Section 1004.07	
1004	Each	Wood Crossarm	TDMIS-200
1004	Each	Composite Material Crossarm (Future)	TDMIS-201
		Transformers CMS Section 1004.08	
1004	Each	Overhead Transformer	TDMIS-204
1004	Each	Padmount Transformer	TDMIS-205
1004	Each	Subway Transformer	TDMIS-206
		Switches CMS Section 1004.09	
1004	Each	Group Operated Air Break Switch	TDMIS-207
1004	Each	Solid Blade Switch	TDMIS-208
1004	Each	Fused Cutout Switch	TDMIS-209
1004	Each	Bypass Switch	TDMIS-210
1004	Each	SF6 Switch	TDMIS-211
1004	Each	Automatic Transfer Switch	TDMIS-212
1004	Each	Padmount Switch	TDMIS-213
1004	Each	Recloser	TDMIS-214
		Electrical CMS Section 1004.10	
1004	Each	Vault with Frame and Grate	TDMIS-217
1004	Each	Manhole with 50" Lid	TDMIS-218
1004	Each	Manhole with 36" Lid	TDMIS-219

1004	Each	Concrete Pull Box	TDMIS-220
1004	Each	Composite Material Pull Box	TDMIS-221
1004	Each	50” Manhole Lid and Frame	TDMIS-222
1004	Each	36” Manhole Lid and Frame	TDMIS-223
		Duct Bank CMS Section 1004.12	
1004	Each	Duct (Non Concrete Encased)	TDMIS-226
1004	Each	Duct (Concrete Encased)	TDMIS-227
		Horizontal Drilling CMS Section 1004.13	
1004	Each	Horizontal Directional Drilling	TDMIS-229
		Wire and Cable CMS Section 1004.15	
1004	Each	Copper 15KV Cable Shielded TRXLPE	TDMIS-231
1004	Each	Copper 600V Cable THHW	TDMIS-232
1004	Each	Copper Cable Bare	TDMIS-233
1004	Each	Copper Cable Overhead XLP	TDMIS-234
1004	Each	Aluminum Cable XLP	TDMIS-235
1004	Each	Aluminum Conductor Steel Reinforced (ACSR)	TDMIS-236
1004	Each	Aluminum Service Drop Cable 600V XLP	TDMIS-237
1004	Each	Aluminum Tie Wire	TDMIS-238
1004	Each	Aluminum 15KV Aerial Spacer Cable	TDMIS-239
1004	Each	Alumoweld Messenger Wire	TDMIS-240
1004	Each	Alumoweld Guy Strand Wire	TDMIS-241
1004	Each	Galvanized Steel High Strength Static Wire	TDMIS-242
		Connectors CMS Section 1004.16	
1004	Each	Elbow 200A	TDMIS-247
1004	Each	Elbow 600A	TDMIS-248
1004	Each	Splice- Heat Shrink	TDMIS-249
1004	Each	Splice- Cold Shrink	TDMIS-250
1004	Each	Terminator- Heat Shrink	TDMIS-251
1004	Each	Terminator- Cold Shrink	TDMIS-252
		System Removal CMS Section 1004.17	
1004	Each	Existing Overhead Removal	TDMIS-257
1004	Each	Existing Underground Removal	TDMIS-258

** TDMIS – Transmission and Distribution 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 Transmission and Distribution Material and Installation Specifications.*