



REQUEST FOR BID (RFB) – RE BID

REQUESTOR: City of Georgetown
1134 North Fraser Street
Georgetown, SC 29440
Contact: Daniella Howard, Purchasing Agent
Email: purchasing@cogsc.com
Phone: 843.545.4043

PROJECT: Front Street Underground System Upgrade Project #1919
Specification 171007-03 Phase 1 Construction



PREPARED BY: UTILITY TECHNOLOGY
ENGINEERS - CONSULTANTS
147-B DUBLIN SQUARE ROAD
ASHEBORO, NC 27203

DATE OF ISSUE: Friday, April 5, 2019

DUE: On or before 2:30 pm EST (local time) Wednesday, May 1, 2019

Return by mail or hand deliver only to:

City of Georgetown
Attn: Purchasing
Project #1919
1134 N Fraser Street
Georgetown, SC 29440

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1 BID DOCUMENTS AND INSTRUCTIONS TO BIDDERS

1.1 PURPOSE

The City of Georgetown is accepting bids for the upgrade and replacement of the downtown Front Street electric power distribution system in Georgetown, SC. The work will take place at the downtown section of Front Street between King Street and Queen Street.

1.2 PROJECT DESCRIPTION

These instructions apply to the preparation of proposals for the upgrade and replacement of the Georgetown Downtown Front Street electric power distribution system as indicated on the project drawings and in the project specifications.

The City of Georgetown, South Carolina is hereinafter referred to as the “OWNER” or the “CITY”. Utility Technology Engineers-Consultants is hereinafter referred to as the “ENGINEER”.

Due to the unique nature of goods and or services sought, local vendor preference shall not apply under this RFB.

1.3 BACKGROUND

The City of Georgetown (City) is an incorporated municipality with a population of nearly 10,000 residents. The City is located 60 miles north of Charleston and 36 miles south of Myrtle Beach. It is the end point of the area commonly known as “The Grand Strand”. The City is bordered by the Winyah Bay to the east and the Sampit River to the south. Tourism is a major economic driver in the area, as well as local industries, such as International Paper and Tideland Hospital. The City is the county seat and operates under the Mayor-Council form of government as set forth in the State of South Carolina Code Chapter II, Article I, Section 2-1. Additional information is available on our website at www.cogsc.com.

1.4 PROJECT SCHEDULE OF EVENTS

The following is the schedule of events listed in the order of occurrence, showing the major milestones from issuance of the RFB to the contract award:

MILESTONE EVENT	DATE	TIME EST (LOCAL TIME)
1. Request for Bid (RFB) Re Bid issued	Friday, April 5, 2019	
2. Pre-Bid meeting – at the Fire Station II, 2900 S. Fraser Street, Georgetown, SC 29440	Tuesday, April 16, 2019	10:00 am
3. Deadline for questions - emailed to: hsudduth@utilitytec.com	Tuesday, April 23, 2019	4:00 pm
4. Deadline for addenda to be posted to the City's website, www.cogsc.com, under “Bids”	Friday, April 26, 2019	5:00 pm
5. Bid due date	Wednesday, May 1, 2019	On or before 2:00 pm
6. Approve of contract by City Council (tentative)	Thursday, May 16, 2019	
7. Notice to Proceed (NTP) issued (tentative)	May 2019	
8. Completion date - (tentative)	Friday, October 11, 2019	

Questions

No answers will be given over the phone.

Questions regarding this RFQ should be submitted in writing to hsudduth@utilitytec.com, no later than 4:00 EST (local time), Tuesday, April 23, 2019. No questions will be accepted after the aforementioned deadline. All submittals shall include the following in the subject line:

Questions – Front Street UG System Upgrade Project #1919

You will receive email confirmation that your questions were received on time. If you do not receive confirmation of such within 2 hours, it is the bidder's responsibility to call the purchasing agent at 843.545.4043 to verify that the questions were received before the deadline.

Answers to questions will be posted on the City's website at www.cogsc.com under “Current Bids” as an Addendum no later than 5:00 pm EST (local time), Friday, April 26, 2019.

The City of Georgetown reserves the right to change the project schedule as it deems necessary. In the event of a major date change, the City of Georgetown will notify known participants. The City of Georgetown reserves the right to issue addenda to this RFB up to 3 days before the RFB due date as needed to clarify the City of Georgetown's desires, or to make corrections or changes to the RFB document or submittal process.

When the Procurement Division is closed due to force majeure, bid openings will be postponed to the same time on the next official business day.

The City also reserves the right to cancel or reissue the RFB and/or revise the project schedule at any time.

The City also reserves the right to reject any or all proposals as deemed to be in its best interest, and to accept all or part of the scope of work herein as its project timeline and/or budget allows.

The City reserves the right to reject any or all bids as deemed to be in its best interest, and to accept all or part of the scope of work herein as its project timeline and/or budget allows. All information will be updated and posted on the City's website www.cogsc.com under "Bids". It is the bidder's responsibility to obtain the information directly from the City's website regarding this project.

The bidder will acknowledge receipt of all issued addenda in their submittals, if applicable.

No: _____ Dated: _____

No: _____ Dated: _____

No: _____ Dated: _____

1.5 SCOPE OF SERVICES

The successful candidate must be able to provide materials and labor to perform work at the Georgetown Front Street electric power distribution system in Georgetown, SC. The work will be performed for the City of Georgetown, South Carolina.

The project includes but is not limited to the following work as indicated on the drawings and in the project specifications:

- Remove existing underground three phase 12.47 kV primary underground cables between East dip pole and existing transclosure T1, and between existing transclosures T1 and T2.
- Remove existing three phase 240V and single phase 120/240V secondary underground cables served by existing transclosure T1. Do not remove existing service cables.
- Remove existing transclosure T1, including the enclosed pole-type transformers.
- Clean up and repair areas remaining after existing equipment has been removed. Including removal of unused concrete, wood structures or signs, leveling and grass seeding, and restoration of pavement.
- Clean and drain out water of each existing manhole and pull box. Clean and inspect manhole and pull box interior surfaces. Repair lifting lugs on pull boxes as needed.
- Remove existing cable wall supports and cable support brackets in manholes and replace with new cable wall supports and cable support brackets. Remove existing ground wire and replace with new ground wire. Make ground connections to new cable wall supports.
- Install new pad-mounted transformers TH, TM, T1A, and T1B. Install cast-in-place or precast transformer foundations as indicated on the drawings.
- Provide and install new underground conduits by directional boring as indicated on the drawings.
- Provide, install and test new three phase, 12.47 kV primary underground cables, including terminations at east dip pole, marina area dip pole and at each pad-mounted transformer.
- Provide and install new three phase 240V and single phase 120/240V secondary underground cables from new pad-mounted transformers to existing underground service cables. Connect existing underground service cables to the new secondary underground cables in existing pull boxes and manholes.
- Provide and install new three phase 240V and single phase 120/240V secondary service cables as necessary or as indicated on the drawings.
- Provide and install all ground rods, ground conductors and connections at all equipment.
- Repair any broken lifting lugs on existing pull boxes.
- Provide name labels for all new pad-mounted transformers.
- Perform and document medium voltage cable test as specified.
- Provide all required warning road signs, DOT traffic cones, pedestrian sidewalk safety guards etc. required to maintain a safe working environment as specified herein.
- Provide all necessary equipment and permitting required for confined space entry.

Site Work will include:

- Grade levelling, sloping, seeding as required around new pad-mount transformer installations
- Grade levelling and seeding at underground directional boring pits.

The work must be scheduled in a manner to minimize the electric power outage time. The Contractor shall notify the OWNER at least 5 days before the outage is expected to begin and at least 24 hours before the power is disconnected.

Each bidder shall provide a lump sum bid price for the following options.

1.5.1 Option 1

The successful candidate must provide all materials and labor to perform the work, except for pad-mounted transformers. The new pad-mounted transformers will be provided by the OWNER. The new pad-mounted transformers will be transported, set in place and electrically connected by the Contractor.

1.5.2 Option 2

The materials listed in Section 1.10 will be purchased and provided by the OWNER. The successful candidate must provide all labor and all materials not listed in Section 1.10, including the following materials:

- All conduits and accessories required for directional boring
- All materials necessary to complete project grounding including ground rods, bare copper ground wire, exothermic weld connections, etc.
- All materials necessary to complete project foundations

1.6 PROPOSER'S CONFERENCE

A pre-bid conference will be held on Tuesday, April 16, 2019, at 10 AM EST at the City of Georgetown Fire Department, 1405 Prince Street. The OWNER and the ENGINEER will conduct the conference to review the project scope, specifications and drawings and also to address proposer's questions. A visit to the project site will follow the conference.

1.7 SUBMITTAL INSTRUCTIONS

All procurement procedures are subject to the City's procurement policies as outlined in Section 2-187 of the City's Municipal Code.

To be considered responsive, interested parties must submit the following in a sealed envelope on or before the deadline, 2:00 pm, Wednesday, May 1, 2019 EDT (local time):

1. 2 originals
2. 1 electronic copy (ex. CD rom or USB flash drive)

1. Sealed bids must be received no later than 2:00 pm Wednesday, May 1, 2019, and at said office will be publicly opened and read aloud at that time. No bid proposal will be accepted after the due date and time specified above. Faxed or emailed bid proposals will not be accepted for any reason.
2. The City reserves the right to waive any technicalities or informalities and to accept or reject any and/or all submissions as deemed by its sole judgment to be in its best interest. The City also reserves the right to terminate the selection process without notice, to waive any irregularities in any submittal, and to request additional information from any of the firms submitting a bid proposal.
3. All proposals should be clearly marked on the outside, "Front Street Underground Electrical System Upgrade Project #1919".
4. It is the sole responsibility of the bidder to have their bids delivered to the City of Georgetown before the closing hour and dated. The City assumes no responsibility for delivery of proposals that

are mailed. Late, faxed, or emailed proposals will not be accepted nor considered for any reason and will remain unopened. The official clock shall be that of the City's Purchasing Agent, or designee. The City reserves the right to reject any or all bids and to waive any informalities and technicalities in the bid process.

5. All proposals must be valid for a period of 60 days following the bid opening date.
6. Proposals must be submitted as specified herein and shall address all RFB requirements. Each bidder shall list in the space provided on the proposal form ALL EXCEPTIONS or conflicts between his proposal and this specification. If no exceptions are noted, it will be assumed the bidder is complying with all requirements. If more space is required for this listing, additional pages may be added. Proposals which do not comply with this requirement will be considered irregular and may be rejected at the discretion of the OWNER. All exceptions shall be specific in nature and referenced to the applicable article of these specifications. Conflict notations which make reference to the bidder's descriptive information as a whole will not be acceptable. The bidder shall not alter any part of these specifications in any way, except by stating his exceptions in the space provided on the proposal form. Partial or incomplete bids may be rejected.
7. The bidder shall submit a lump sum cost for all services required, in an itemized format. All costs incurred in preparing the proposal, or costs incurred in any other manner by the bidder in responding to this RFB, will be wholly the responsibility of the bidder. All materials and documents submitted by the respondent in response to this RFB become the property of the City of Georgetown and will not be returned.
8. Any proprietary information contained in the proposal should be so indicated as follows:

Vendor Disclosure

Notice of SC Freedom of Information Act

"The parties acknowledge that all material submitted may be subject to release under the South Carolina Freedom of Information Act (FOIA) and will be released to the public unless exempt from disclosure under the FOIA."

We discourage you from including any information you consider propriety or trade secret, as this material is subject to the FOIA once it's in the City's possession. If you must include any such information in your submission, please identify it by color, labeling, and/or bold font so that it can be readily recognized. In the event the City receives a request for this material, the City will notify those parties who have identified information they believe is proprietary or trade secret of the request. The City has a 10 day deadline to respond to the request. This is your window to file an action challenging the release. Please be on notice that if the City is not served with such an action, the information will be released.

9. Proposals must be made in the official name of the company or individual under which business is conducted (showing official business address) and must be signed in ink by a person duly authorized to legally bind the person, partnership, company or corporation submitting the proposal. Proposals having any erasures or corrections must be initialed in ink by the bidder.
10. Letter of Interest – Must be no more than 2 pages (1 page is 1 side of an 8.5" x 11" paper) in length and include contact information and signature.
11. Summary of Qualifications, Experience, and Availability – Must be no more than 5 pages. It should summarize qualifications, relevant experience, and availability to participate in the RFP process to provide requested services to the City. Key staff members participating should be identified.

12. Proposed Process Approach – Must be no more than 3 pages summarizing the method and approach to providing services to the City.
13. List of Professional References – Must be no more than 1 page listing most recent professional references for similar projects and their contact information.
14. Disqualification and Rejection of Bid – The City of Georgetown reserves the right to reject any bid of a bidder who has failed to perform satisfactorily, or complete on time, or in a manner consistent with the RFB documents, contract of similar nature, or to reject the bid of a bidder who is not in a position to perform such a contract satisfactorily. The City expressly reserves the right to award the contract to the bidder that best meets the requirements as set forth herein.
15. Assignment of Contract – Assignment of any contract to be entered into in accordance with this RFB will not be recognized by the City of Georgetown unless such assignment has prior written approval of the City.
16. Insurance Provisions – The selected bidder will be required to provide and maintain proof of insurance throughout the contract term in the amount of \$1,000,000.00 and as required at point of contract negotiation by the City’s Risk Manager as follows:
 - Comprehensive General Liability (per occurrence);
 - Comprehensive Auto Liability (per occurrence); and
 - Workers’ Compensation Liability
 - Automobile Liability

The City of Georgetown is to be named as “Additional Insured” on the above insurance coverage as respect to the City’s interest under the contract. Certificates showing proof of insurance shall be submitted to the City prior to commencement of services under the Agreement. Further, it shall be an affirmative obligation upon the firm to advise the City’s Risk Management Department at Fax No. 843.527.6173; email, cmcdaniel@cogsc.com, PO Box 939, Georgetown, SC 29442, within 2 days of the cancellation herein, and failure to do so shall be construed to be a breach of the agreement.

17. Indemnification - The selected bidder agrees to indemnify, defend and hold harmless the City of Georgetown and their authorized officers, employees, agents, and volunteers from any and all claims, actions, losses damages, and/or liabilities arising from their acts, errors, or omissions and for any costs or expenses incurred by the City therefore under an agreement.
18. Compliance With Law – The selected bidder and its agents and employees shall be bound and comply with all federal, state and local laws, ordinance rules and regulations, as well as all other governing bodies having legal jurisdiction with respect to the area where such work is performed.
19. City Business License and Permits - (Applicable for work performed on site) - The selected firm shall be required to obtain all applicable City of Georgetown permits and business licenses prior to work commencing. Contact Jestin Gilliard, Revenues Manager, 843.545.4041 for business license information. Contact the Housing & Community Development Department at 843.545.4017 for permitting information. These expenses shall be included in the total proposal cost.
20. Bid and Performance Bonds – Bid and Performance Bonds or other securities may be requested for supply contracts and service contracts as the Risk Manager, Purchasing Agent, and/or Department Head deems advisable to protect the City’s interest. Reference line item #21 under “General Contractual Requirements” for additional information.

21. Proposal Attachments - The bidder shall staple or otherwise bind, with each bound copy of these specifications and documents submitted, a signed copy of each addendum issued for these specifications during the bidding period. The bidder shall assemble all drawings, catalog data, and other supplementary information necessary to thoroughly describe materials and equipment covered by the proposal, and shall attach such supplemental information to the bound copy of these specifications submitted with the proposal.

1.8 SUBMITTAL EVALUATION

Submittals will be evaluated based on the following criteria:

- Contractor Qualifications
- Past work quality of Contractor
- Price
- Schedule
- Proposal Completion

1.9 GENERAL CONTRACTUAL REQUIREMENTS

1. Force Majeure - The bidder shall not be liable for any excess costs if the failure to perform the contract arises out of causes beyond the control and without the fault or negligence of the bidder. Such causes may include, but are not limited to acts of God or of the public enemy, acts of Governments in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restriction, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the bidder.
2. Governing Law - Except to the extent that this agreement may be governed by any federal law, including federal bankruptcy law, this Agreement shall be governed by, constructed and interpreted under, and enforced exclusively in accordance with the laws of the State of South Carolina, and the courts in the State of South Carolina shall have jurisdiction with respect to any dispute arising hereunder.
3. Bidder Qualifications - Bidder must, upon request of the City, furnish satisfactory evidence of its ability to furnish products and/or services in accordance with the terms and conditions of this RFB. The City of Georgetown reserves the right to make the final determination as to the bidder's ability to provide the services herein.
4. Bidder Responsibility – Each bidder shall fully acquaint him/herself with conditions relating to the scope and restrictions attending the execution of the work under the conditions of this RFB. It is expected that this will sometimes require on-site observation. The failure or omission of the bidder to acquaint him/herself with existing conditions shall in no way relieve him/her of any obligation with respect to this RFB or to a contract.
5. Affirmative Action - The bidder will take affirmative action in complying with all federal and state requirements concerning fair employment and employment of the handicapped, and concerning the treatment of all employees without regard or discrimination by reason of race, color, religion, sex, national origin or physical handicap.

6. WMBE Statement - It is the policy of the City of Georgetown to provide minorities, and women equal opportunity for participating in all aspects of the City's contracting and procurement programs, including but not limited to employment, construction projects, and lease agreements consistent with the laws of the State of South Carolina. It is further the policy of the City of Georgetown to prohibit discrimination against any person or business in pursuit of these opportunities on the basis of race, color, national origin, religion, sex, age, handicap, or veteran status. It is further the policy of the City of Georgetown to conduct its contracting and procurement programs so as to prevent such discrimination and to resolve any and all claims of such discrimination.
7. Termination - Subject to the following provisions, any contract resulting from this request for proposals may be terminated by the City provided a 30 day advance notice in writing by the City Administrator, or his designee, is given to the bidder:
 - Non-Appropriations - Funds for this contract are payable from local appropriations. If the sufficient appropriations are not made to pay the charges under the contract it shall terminate without any obligation to the City.
 - Convenience - In the event that a contract is terminated or canceled upon request and for the convenience of the City without the required 30 day advance written notice, then the City shall negotiate reasonable termination costs, if applicable.
 - Cause - Termination by the City for the cause, default or negligence on part of the bidder, shall be excluded from the foregoing provisions; termination costs, if any shall not apply. The 30 day advance notice requirement is waived and the default provision herein shall apply.
 - Default – In case of default by the bidder, the City reserves the right to purchase any and all items/services in default in open market, charging bidder with any excessive costs. SHOULD SUCH CHARGE BE ASSESSED, NO SUBSEQUENT PROPOSALS OF THE DEFAULTING BIDDER WILL BE CONSIDERED UNTIL THE ASSESSED CHARGE HAS BEEN SATISFIED.
8. Prime Bidder Responsibilities - The bidder will be required to assume sole responsibility for the complete effort as required by this RFB. The City will consider the bidder to be the sole point of contact with regard to all contractual matters.
9. Subcontracting - If any part of the work covered by this RFB is to be subcontracted, the bidder shall identify the subcontracting organization and the contractual arrangements made therewith at the time of the offer. All subcontractors must be approved by the City. The successful bidder will also furnish the corporate or company name and the names of the officers of any subcontractors engaged by the bidder.
10. Ownership of Material – All materials and documents submitted by the bidder in response to this specification become the property of the City of Georgetown and will not be returned to the bidder.
11. Compliance with State and Federal Requirements – State and Federal requirements that are more restrictive than these set forth herein shall be followed by the bidder.

12. Contract Amendments - Amendments to any agreement between the City and the bidder must be reviewed and approved in writing by the City of Georgetown City Administrator or his designee.
13. Assignment - No contract or its provisions may be assigned, sublet, or transferred without the written consent of the City of Georgetown Finance Department.
14. Records Retention and Right to Audit – The City shall have the right to audit the books and records of the bidder as they pertain to this contract. Such books and records shall be maintained for a period of 3 years from the date of final payment under contract.
15. The City may conduct performance audits of the bidder, as determined necessary by the City. Pertaining to all audits, the bidder shall make available to the City, access to its computer files containing the history of the contract performance and all other documents related to the audit. Additionally, any software used by the bidder shall be made available for auditing purposes at no cost to the City.
16. Independent Contractor Status - The parties hereby agree that the contractor is an independent contractor of the City and that nothing in an agreement with the City shall be deemed to place the parties in a relationship of employer/employee, partners, or joint ventures. Neither party shall have the right to obligate or bind the other in any manner. Each party agrees and acknowledges that it will not hold itself out as an authorized agent with the power to bind the other party in any manner. Each party shall only be responsible for any withholding taxes, payroll taxes, disability insurance payments, unemployment taxes, or other similar taxes or charges with respect to its activities in relation to performance of its obligations of an agreement.
17. Representations of Bidder - Bidder represents, warrants, and covenants that:
 - In providing the services bidder shall utilize the care and skill used by members of bidder’s profession practicing under similar circumstances at the same time and in the same locality.
 - All employees provided by the bidder (employees) to the City shall have the qualifications, skills and experience necessary to perform his/her job in accordance with the requirements of the agreement. The City may request removal of any employee for good cause.
 - Bidder is a business, validly existing and in good standing under the Laws of the State of South Carolina.
18. Indemnity Provisions - Bidder agrees to and shall indemnify and hold the City harmless from and against all liability, loss, damages or injury, and all costs and expenses (Including attorney fees and costs of any suit related thereto) suffered or incurred by the City, arising from or related to the terms of this project, or bidder’s performance thereunder.
19. Insurance - The selected bidder will be required to provide and maintain proof of insurance throughout the project term in the amount of \$1,000,000.00, and as required at point of contract negotiation by the City’s Risk Manager as follows:
 - Comprehensive General Liability (per occurrence)
 - Professional Liability
 - Comprehensive Auto Liability (per occurrence)
 - Workers’ Compensation Liability (as required by State of South Carolina statutes)

The City of Georgetown is to be named as “Additional Insured” on the above insurance coverage as respect to the City’s interest under the contract. Certificates showing proof of insurance shall be submitted to the City prior to commencement of services under an Agreement. Further, it shall be an affirmative obligation upon the bidder to advise the City’s Risk Management Office at Fax No. 843.527.6173; email lbell@cogsc.com; PO Box 939; Georgetown, SC 29442, within 2 days of the cancellation herein, and failure to do so shall be construed to be a breach of an agreement.

20. City Business License and permits - The selected bidder shall be required to obtain all applicable City of Georgetown permits and business licenses **prior to work commencing**. Contact Jestin Gilliard, Revenues Manager, jgilliard@cogsc.com or 843.545.4041, for business license information. Contact the Housing & Community Development Department at 843.545.4017 for permitting information. These expenses shall be included in the total proposal cost.
21. Bid and Performance Bonds – Bid and performance bonds or other securities may be requested for supply contracts and service contracts as the Risk Manager, Purchasing Agent, and/or Department Head deems advisable to protect the City’s interest. Any such bonding requirement shall be set forth in the solicitation.

Bid Security: In an amount equal to or at least five percent (5%) of the amount of the bid shall be required for all competitive bidding for construction contracts exceeding \$100,000. Bid security shall be a legitimate bid bond provided by a surety company authorized to do business in South Carolina, or the equivalent in cash, certified check, cashiers’ check, or money order. The City, at its option, may require bid bonds on construction contracts under \$100,000 when the circumstances warrant. Noncompliance with this provision mandates that the City reject the bid. Bid security will be returned to the unsuccessful bidders upon contract award by the Purchasing Agent. When a construction contract is awarded in excess of \$100,000 the following bonds or security shall be delivered by the successful bidder to the City and shall become binding on the parties upon execution of the contract. Bid or performance bonds shall not be used in substitution for determination of bidder’s responsibility.

- A performance bond shall be in an amount equal to one hundred and ten percent (110%) of the contract amount; and
- A payment bond for the protection of all persons supplying labor and material to the contractor or its subcontractors for the performance of the work shall be in an amount equal to one hundred percent (100%) of the contract amount.

The Purchasing Agent shall make the award of bid after obtaining the recommendation from City Council. The award letter shall be issued by the Purchasing Agent or designee to the lowest responsible and responsive bidder meeting the requirements set forth in the Invitation for Bids.

- The division/department head is responsible for obtaining the required insurance certificates and Business License verification for submittal to the Purchasing Agent and Risk Manager for approval.
- A bid may be canceled and/or all bids rejected upon written recommendation of the division/department manager, and approval of the Purchasing Agent.

1.10 MATERIALS FURNISHED BY OWNER FOR OPTION 2

For Option 2, as referenced in Section 1.5.2, the Owner will provide the following materials:

- Single Phase Pad-Mounted Transformers
- Three Phase Pad-Mounted Transformers
- 15 kV, 200 A Loadbreak Elbows
- 15 kV Cable Splices
- 15 kV OH to UG Terminators
- Flood-Seal Multi-port Bus Connectors, 6 outlets, with rubber insulating sleeve covers
- Flood-Seal Dual Adapter Kits
- Flood-Seal Multi-port Bus Connectors, 3 outlets, Y type, with rubber insulating sleeve covers
- Manhole Wall Supports, stainless steel slotted channel, 72" long, 13/16" x 1-5/8", 12 GA
- Pull Box Wall Supports, stainless steel slotted channel, 38" long, 13/16" x 1-5/8", 12 GA
- Cable Support Brackets, stainless steel slotted channel, 18" long, 1-5/8"x1-5/8", 12 GA
- Cable Clamps, 1-7/8", polymer, with stainless steel strap
- 600 V Terminal Lugs, 2-hole NEMA
- 600 V Terminal Lugs, 1-hole NEMA
- 4-hole NEMA Stud Connectors
- 6-hole NEMA Stud Connectors
- 15 kV URD Cable, AL, EPR
- 600 Volt Cable, AL, Single Conductor
- 600 Volt Cable, AL, Quadraplex
- 600 Volt Cable, AL, Triplex

1.11 PROPOSALS

Proposals which are not prepared in accordance with these instructions will imply that the Bidder does not intend to comply with all of the contract conditions and such proposals will be considered irregular.

Each proposal will include the following information and completed forms:

- Bid Form
- Bid Bond
- Proposed date for beginning and completing work on this project.
- List of Subcontractors with name, address, and phone number. The Contractor shall not change Subcontractors without written permission of the Owner.
- Name of manufacturers with part numbers selected to provide the following items:
 - UG 15 kV primary cable _____
 - UG 600 V secondary cable _____
 - 15 kV elbow connectors _____

- 15 kV straight splices _____
- 15 kV cable terminations _____
- 600 V secondary connectors _____
- Grounding connectors _____

Option 2: _____
 _____ Dollars (\$ _____)

The undersigned Bidder agrees to fully complete the work and the Front Street underground electrical system to be on-line and available for the City's operation and control _____ days after receipt of a notice to proceed from the City.

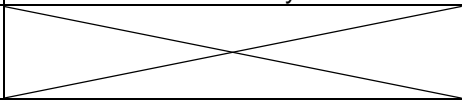
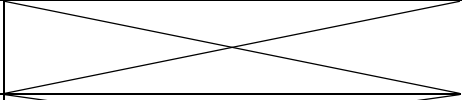
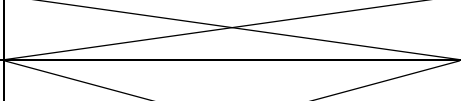
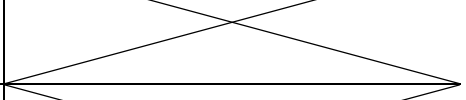
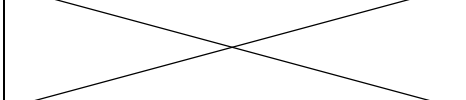
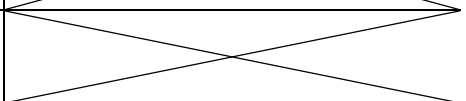
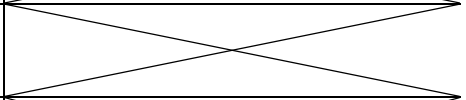
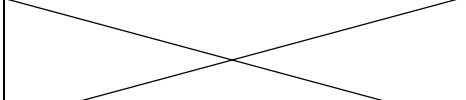
The undersigned Bidder agrees to fully complete the Work under this contract, including all site work and final clean-up, _____ days after receipt of a notice to proceed from the City.

The undersigned Bidder hereby certifies (a) that his Bid is genuine and is not made in the interest of, or in the behalf of, any undisclosed person, firm, or corporation, and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; (b) that he has not directly or indirectly induced or solicited any other Bidder to put in a false or sham Bid; (c) that he has not solicited or induced any person, firm, or corporation to refrain from bidding; and (d) that he has not sought by collusion to obtain for himself any advantage over any other Bidder or over the City.

2.1 UNIT PRICES

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the scope of the work, all in accordance with the contract documents.

The unit adjustment prices will be a major consideration in the bid evaluations.

	Unit Adjustment Price	
	Labor & Material	Labor Only
Conduit trenching, machine dug, per cubic yard		
Conduit trenching, hand dug, per cubic yard		
Rock excavation, per cubic yard		
Cut and replace asphalt pavement (furnish all materials), per square yard		
Cut and replace decorative concrete sidewalk (furnish all materials), per square yard		
Re-seed and mulch (furnish all materials), per square yard		
Re-sod (furnish all materials), per square yard		
Concrete for transformer pads, including reinforcing and formwork, per cubic yard		

Unit Adjustment Price		
	Labor & Material	Labor Only
Bore under roadway, including 4-inch conduit installation, per foot		
Setup for bore, including excavation and backfill of pit, each		
Repair lifting lug on existing pull box, each		
Conduit, including fittings and supports, installed, per foot:		
4 inch PVC schedule 40 direct buried		
1-1/2 inch rigid steel		
2 inch rigid steel		
2 inch flexible liquid-tight conduit		
Furnish and install 5/8 inch by 10 foot ground rod, install, test resistance, and connect to equipment with copper conductor (furnish exothermic welded connections to ground rod), each		
Furnish and install 5/8 inch by 12 foot sectional ground rod, install, test resistance, and connect to equipment with copper conductor (furnish exothermic welded connections to ground rod), each		
No. 2/0 AWG bare copper ground wire, installed, per foot		
No. 2/0 AWG copper exothermic welded connection, each		
Three No. 1/0 AWG aluminum 15 kV URD cables in conduit, installed, per foot		
600 V cable in conduit, installed, per foot:		
Three 750 kcmil and one 350 kcmil copper		

Unit Adjustment Price

	Labor & Material	Labor Only
Three 750 kcmil and one 350 kcmil aluminum		
Four 500 kcmil and one 350 kcmil aluminum 600 V		
Three 500 kcmil and one 350 kcmil aluminum		
Two 500 kcmil and one 350 kcmil aluminum		
Three No. 4/0 AWG and one No. 1/0 AWG aluminum		
Two No. 4/0 AWG and one No. 1/0 AWG aluminum		
Three No. 4/0 AWG and one No. 2/0 AWG aluminum		
Two No. 4/0 AWG and one No. 2/0 AWG aluminum		
15 kV loadbreak elbow, installed, each		
15 kV cable splice, installed, each		
600 V submersible connector, six 2-hole NEMA pad outlets with insulating sleeves, installed, each		
600 V submersible connector, three 1-hole NEMA pad outlets with insulating sleeves, installed, each		
Dual adapter kits for 600 V submersible connectors		
600 V terminal lugs, installed, each:		
750 kcmil aluminum 2-hole NEMA		
500 kcmil aluminum 2-hole NEMA		
350 kcmil aluminum 2-hole NEMA		

Unit Adjustment Price

	Labor & Material	Labor Only
No. 4/0 AWG aluminum 2-hole NEMA		
No. 2/0 AWG aluminum 2-hole NEMA		
No. 1/0 AWG aluminum 2-hole NEMA		
No. 10 AWG aluminum 2-hole NEMA		
No. 12 AWG aluminum 2-hole NEMA		
500 kcmil aluminum 1-hole NEMA		
350 kcmil aluminum 1-hole NEMA		
No. 4/0 AWG aluminum 1-hole NEMA		
No. 2/0 AWG aluminum 1-hole NEMA		
No. 1/0 AWG aluminum 1-hole NEMA		
No. 10 AWG aluminum 1-hole NEMA		
No. 12 AWG aluminum 1-hole NEMA		
Cable support bracket, stainless steel slotted channel, 18" long, 1-5/8" x 1-5/8", 12 GA, installed, each		
Cable clamp, 1-7/8", polymer, with stainless steel strap, installed, each		
Manhole wall support, stainless steel slotted channel, 72" long, 13/16" x 1-5/8", 12 GA, installed, each		
Pull box wall support, stainless steel slotted channel, 38" long, 13/16" x 1-5/8", 12 GA, installed, each		

	Unit Adjustment Price	
	Labor & Material	Labor Only
Perform dc hipot cable test on completed single phase 15 kV cable section, each		
Perform dc hipot cable test on completed three phase 15 kV cable section, each		
Install 10 kVA single phase pad-mounted transformer, each		
Install 50 kVA single phase pad-mounted transformer, each		
Install 75 kVA single phase pad-mounted transformer, each		
Install 100 kVA single phase pad-mounted transformer		
Install 167 kVA single phase pad-mounted transformer		
Install 500 kVA three phase pad-mounted transformer		
Install 750 kVA three phase pad-mounted transformer		
Furnish and install fireproofing tape on 15 kV URD cables, per foot		

2.2 RECEIPT OF ADDENDA

The undersigned Bidder acknowledges receipt of the following Addenda, which have been considered in preparation of this Bid:

No. _____ Dated _____.

No. _____ Dated _____.

No. _____ Dated _____.

Dated in _____,
(Location)

This ____ day of _____, 20____.

2.3 IDENTIFICATION OF BIDDER (Individual, Partnership, Corporation)

If an Individual: _____
(name)

Doing business as: _____
(name)

If a Partnership: _____
(name)

by: _____
Partner

If a Corporation: _____
(NAME)

(a _____ Corporation)
(STATE)

2.4 SIGNATURE OF BIDDER

By: _____
(Signature)

(Print name)

(Title)

Attest: _____
(Signature)

(SEAL)

Business Address of Bidder: _____

Telephone Number: _____
South Carolina Contractor's
License No(s).: _____

3 BID BOND

Date of Execution: _____

Name of Principal:
(Contractor) _____

Name of Surety: _____

Name of Contracting
Body: CITY OF GEORGETOWN

GEORGETOWN, SOUTH CAROLINA

Amount of Bond: _____

Project: FRONT STREET UNDERGROUND ELECTRICAL SYSTEM
UPGRADE #1919

KNOW ALL MEN BY THESE PRESENTS, That We, the Principal and Surety above named, are held and firmly bound unto the above named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal entered into a certain Contract with the Contracting Body, identified as shown above and hereto attached.

NOW, THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term of said Contract and any extensions there of that may be granted by the Contracting Body, with or without notice to the Surety, and during the life of any guaranty required under the Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above bounded parties have executed this instrument under the several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in 3 counterparts.

Witness:

CONTRACTOR:

(Trade or Corporate Name)

(Proprietorship or Partnership)

By: _____

ATTEST:

Title: _____

(Owner, Partner, or Corporate
President or V-President, Only)

By: _____

Title: _____

(Corporate Secretary or
Assistant Secretary, Only)

(CORPORATE SEAL)

SURETY COMPANY:

Witness:

By: _____

Title: _____

Attorney in Fact

Countersigned:

(SURETY CORPORATE SEAL)

S.C. Licensed Resident Agent

(Name and Address - Surety Agent)

Surety Company Name and SC
Regional or Branch Office Address

4 CONTRACT

City of Georgetown
Georgetown, South Carolina

THIS CONTRACT, made this _____ day of _____, 20 _____, by _____
_____, hereinafter called Contractor, and the City of Georgetown,
Georgetown, South Carolina, hereinafter called the City.

WITNESSETH

THAT WHEREAS, a Contract for the construction of

CITY OF GEORGETOWN, SOUTH CAROLINA

FRONT STREET UNDERGROUND ELECTRICAL SYSTEM UPGRADE #1919

HAS RECENTLY BEEN AWARDED TO Contractor by City at and for a total price of

_____ Dollars (\$ _____)

and as named in the Proposal attached hereto;

AND WHEREAS, it was provided in said award that a formal Contract would be executed by and between Contractor and City, evidencing the terms of said award, and that Contractor would commence the work to be performed under this agreement on a date to be specified in a written order of City.

NOW THEREFORE, Contractor doth hereby covenant and agree with City that it well and faithfully perform and execute such work and furnish such work and furnish such materials and equipment, in accordance with each and every one of the conditions, covenants, stipulations, terms, and provisions contained in said Specifications in accordance with the Plans, at the total price named therefore in the Proposal attached hereto, and will well and faithfully comply with and perform each and every obligation imposed upon it by said Plans and Specifications and the terms of said award.

Contractor shall promptly make payments to all laborers and others employed thereon.

Contractor shall be responsible for all damages to the property of the facility that may be consequent upon the normal procedure of its work or that may be caused by or result from the negligence of Contractor, its employees or agents, during the progress of or connected with the prosecution of the work, whether within the limits of the work or elsewhere. Contractor must restore all property so injured to a condition as good as it was when Contractor entered upon the work.

Contractor shall furthermore be responsible for and required to make good at its expense any and all damages of whatever nature to persons or property, arising during the period of the Contract, caused by carelessness, neglect, or want of due precaution on the part of Contractor, its agents, employees, or workmen.

Contractor shall also indemnify and save harmless the City, and the officers and agents thereof, and the officers and agents thereof from all claims, suits, and proceedings of every name and description which may be brought against

FRONT STREET UNDERGROUND
ELECTRICAL SYSTEM UPGRADE
PROJECT #1919
SPEC 171007-03 PH. 1 CONSTR
4/5/2019

the City, or the officers and agents thereof, for or on account of any injuries or damages to persons or property received or sustained by any person or persons, firm or corporation, or by or in consequence of any materials used in said work or by or on account of any accident, or of any other act or omission of Contractor, its agents, employees, servants, or workmen.

It is agreed and understood that the Notice to Prospective Bidders, the Definitions, Instructions to Bidders, Plans and Specifications, the accepted Proposal, and the enumerated addenda are part and parcels of this Contract, to the same extent as if incorporation herein full.

And the City doth hereby covenant and agree with Contractor that it will pay to Contractor, when due and payable under the terms of said Specifications and said award, the above-mentioned sum, and that it will well and faithfully comply with and perform each and every obligation imposed upon it by said Specifications and the terms of said award.

Whenever used herein, the singular shall include the plural, the plural the singular, and the use of any gender shall be applicable to all gender as the context may require.

FURTHER AGREEMENTS

Contractor shall, upon completion of all work awarded under this Contract, furnish to City invoices or copies of invoices for all materials purchased for said work, and such invoices shall state the amount of South Carolina sales tax paid for said materials, and Contractor shall also furnish City an affidavit certifying the total costs of materials purchased for all work performed under the Contract and the total amount of South Carolina sales tax paid for said materials.

IN TESTIMONY WHEREOF, Contractor and City have duly signed and sealed this Contract.

(Imprint Corporate Seal below this line)

By _____

Title: _____

ATTEST:

(Secretary)

CITY OF GEORGETOWN
GEORGETOWN, SOUTH CAROLINA

By _____
City Administrator

ATTEST:

(Secretary)

5 PERFORMANCE BOND

Date of Execution: _____

Name of Principal:
(Contractor) _____

Name of Surety: _____

Name of Contracting
Body: CITY OF GEORGETOWN
GEORGETOWN, SOUTH CAROLINA

Amount of Bond: _____

Project: FRONT STREET UNDERGROUND ELECTRICAL SYSTEM
UPGRADE #1919

KNOW ALL MEN BY THESE PRESENTS, That We, the Principal and Surety above named, are held and firmly bound unto the above named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal entered into a certain Contract with the Contracting Body, identified as shown above and hereto attached.
NOW, THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term of said Contract and any extensions there of that may be granted by the Contracting Body, with or without notice to the Surety, and during the life of any guaranty required under the Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above bounded parties have executed this instrument under the several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in 3 counterparts.

Witness: _____
CONTRACTOR: _____
(Trade or Corporate Name)

(Proprietorship or Partnership) By: _____

ATTEST: Title: _____
(Owner, Partner, or Corporate
President or V-President, Only)

By: _____
Title: _____
(Corporate Secretary or
Assistant Secretary, Only)

(CORPORATE SEAL)

SURETY COMPANY:

Witness: By: _____

Title: _____
Attorney in Fact

Countersigned: _____
(SURETY CORPORATE SEAL)

S.C. Licensed Resident Agent

(Name and Address - Surety Agent)

Surety Company Name and SC
Regional or Branch Office Address

6 GENERAL CONDITIONS

6.1 DEFINITION OF TERMS

6.1.1 PURCHASER

The purchaser is the City of Georgetown, South Carolina, (hereinafter referred to as the City) acting through its manager. Correspondence for the City shall be sent to the following address:

City of Georgetown
Attention: Daniella Howard, Purchasing Agent
PO Box 939
Georgetown, South Carolina 29442

6.1.2 ENGINEER

These SPECIFICATIONS were prepared for the CITY by Utility Technology, Engineers-Consultants (hereinafter referred to as the ENGINEER). Correspondence for the ENGINEER shall be sent to the following address:

Utility Technology
Attention: Heather Sudduth
775 Spartan Blvd, Suite 207
Spartanburg, SC 29301
hsudduth@utilitytec.com

6.1.3 SPECIFICATIONS

The SPECIFICATIONS are the CITY's general and specific conditions, requirements, definitions, and specifications as contained in this document and in its appendices and addenda, if any.

6.1.4 WORK

The WORK includes all materials, documentation, apparatus, equipment, supplies, methods, algorithms, labor, services, installation, and transportation or, other facilities as may be required to furnish, install, and start-up to complete the CONTRACT and any change orders. The WORK includes all materials and services required for the completed project not specifically identified by these SPECIFICATIONS as existing, or provided by the CITY.

6.1.5 BIDDER

The BIDDER is a General Contractor, licensed in South Carolina, or his agent or representative, who submits a proposal for the WORK described in the SPECIFICATIONS.

6.1.6 CONTRACT

The CONTRACT consists of the CITY formal Purchase Order and all documents referenced in the Work Statement, such as the SPECIFICATIONS and any other document made a part of the Contract.

6.1.7 CONTRACTOR

The CONTRACTOR is the successful BIDDER with whom the CITY has entered into the CONTRACT. The CONTRACTOR shall be an independent contractor and not an agent or employee of CITY, and nothing contained in the CONTRACT shall be construed as inconsistent with that status.

6.2 INTERPRETATION OF CONTRACT

The ENGINEER shall act as Project Manager and is authorized on behalf of the CITY to interpret the CONTRACT. In the event that conflicts cannot be resolved between the CITY and the CONTRACTOR before final acceptance, then the dispute will be resolved by binding arbitration under the rules of the American Arbitration Association. All undisputed responsibilities on the part of both parties will continue during the arbitration proceedings.

6.3 FINAL ACCEPTANCE

Whenever, as determined by the ENGINEER, the CONTRACTOR has fulfilled all its obligations under the CONTRACT, the CITY will, in writing, so notify the CONTRACTOR. Such notice will constitute FINAL ACCEPTANCE.

6.4 REFERENCES

Any standard specifications referred to in the CONTRACT, in the successful BIDDER'S proposal, or in a manufacturer's specification subsequently approved by CITY will form a part of the CONTRACT. The publications are referred to in the text by basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE C2 (2017)	National Electrical Safety Code
IEEE Std 81 (2012)	Guided for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
IEEE Std 400 (2012)	Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above

6.5 MATERIALS AND WORKMANSHIP

Materials will be suitable for the WORK, new, unused, and the best of their respective kind; and manufactured, fabricated, assembled, and finished with workmanship of the highest quality and in accordance with the best recognized practice.

6.6 DRAWINGS AND SPECIFICATIONS

The Drawings and Specifications are complementary to each other. That which is shown on the Drawings or called for in the Specifications shall be as binding as if it were both called for and shown. The intention of the Drawings and Specifications is to implicitly include all labor, material, transportation, equipment, and any and all other items necessary to perform a complete job. In case of discrepancy or disagreement in the Contract Documents, the order of precedence shall be: Contract Agreement, Specifications, Detail Drawings, and Line Route Plan Drawings.

6.7 SHOP DRAWINGS

The CONTRACTOR shall submit complete manufacturer's data and drawings to the ENGINEER for review as specified herein. Drawings will be for the exact material or equipment to be supplied or installed and shall be clearly marked to show specific model and any options or modifications. Drawings shall be submitted within 30 days after receipt of Purchase Order.

Drawings and data submitted shall be fully completed and certified by the CONTRACTOR to be in compliance with the requirements of these SPECIFICATIONS.

The ENGINEER'S review of drawings will cover only general conformity of the data to the requirements of this SPECIFICATION, external connections, interfaces with equipment and materials furnished under separate specifications, and dimensions. The ENGINEER'S review does not indicate a thorough review of all dimensions, quantities, and details of the equipment, material device, or item indicated or the accuracy of the information submitted; nor shall review by the ENGINEER be construed as relieving the CONTRACTOR from any responsibility for errors or deviations from the requirements of these SPECIFICATIONS. The ENGINEER will review submitted drawings in a timely fashion.

No material or equipment shall be ordered, shipped, or installed prior to submission and review of manufacturer's drawings. Any material or equipment installed prior to submission and review of drawing shall be removed, replaced, or reinstalled at the CITY's option.

Letters of transmittal shall accompany all submittals of Engineering data.

6.8 WARRANTY

The CONTRACTOR warrants that all of the WORK, furnished by it under the CONTRACT, will be of good workmanship and quality, free from defects in design, workmanship, and materials, and fit for the purpose for which it is intended.

The CONTRACTOR warrants that all of the WORK will fully meet any and all requirements prescribed in the CONTRACT, and in all design documents subsequently approved by the CITY, for a period of twelve (12) months from the date of Final Acceptance as defined in Section 6.3 herein, and agrees, promptly and at his own expense, to remedy or replace in conformity with the CONTRACT, any part of the WORK which during the period of twelve (12) months from Final Acceptance proves defective or otherwise unsuitable for the purposes contemplated by the CONTRACT.

6.9 TERMINATION

6.9.1 TERMINATION FOR CAUSE

The CITY reserves the right, without any liability to the CONTRACTOR, to terminate all or any part of the Contract in the event of any of the following:

- Insolvency of the CONTRACTOR, the filing of voluntary petition in bankruptcy by the CONTRACTOR, the filing of an involuntary petition to have the CONTRACTOR declared bankrupt, the appointment of a receiver or trustee for the CONTRACTOR, the execution by the CONTRACTOR of an assignment for the benefit of creditors;
- Breach by the CONTRACTOR of any of the terms or provisions of the Contract, including delays in completion and breach of any warranty of the CONTRACTOR. Upon any such termination, and for the purpose of completing the Work, CITY may (without limiting any rights which CITY may otherwise possess) take possession of the unfinished Work and may employ any other person, firm or corporation to finish or replace the Work in its entirety, or may relet the same by contract, or otherwise finish or replace the Work in its entirety by whatever method the CITY may deem expedient.

In case of any such termination of the Contract, the CONTRACTOR will not be entitled to receive any further payment until the Work is wholly finished or replaced, at which time if the unpaid balance of the amount agreed to be paid to the CONTRACTOR under the Contract exceeds all the expenses incurred by the CITY in finishing or replacing the Work, such excess will be paid by the CITY to the CONTRACTOR or its legal representatives.

6.9.2 TERMINATION WITHOUT CAUSE

In addition to the foregoing, the Contract is subject to termination without cause at any time at the election of the CITY upon written notice to the CONTRACTOR; and upon such termination the CONTRACTOR will forthwith discontinue all Work and the incurring of any additional expenses relating to the Contract, except as may be directed by the CITY in such termination notice. Title to all material for which the CITY has paid the CONTRACTOR hereunder will vest in the CITY and such material may be disposed of as directed by the CITY.

The CITY will pay the CONTRACTOR for his expenses and a responsible profit based on the percentage of the Work completed at the time of termination, but in no event will the total payment to the CONTRACTOR exceed the total contract price under the Contract. In the event the parties cannot agree on the compensation to be paid, the dispute will be resolved by binding arbitration under the rules of the American Arbitration Association.

6.10 SCHEDULE OF WORK

Within 30 days after award of Contract, the CONTRACTOR shall provide to the ENGINEER the proposed critical path construction schedules for completing the work at the site. Schedules shall provide for proper sequence of construction and include all subcontracts. Updated schedules are to be provided to the ENGINEER with monthly invoices.

The CONTRACTOR shall complete the Work by October 11, 2019.

6.11 DELAYS IN COMPLETION AND EXTENSION OF TIME

Upon receipt of CONTRACTOR's written request, the CITY may grant a request by the CONTRACTOR for additional time to complete the Work required under the Contract, if in the CITY's opinion, the requested extension of time arises from unavoidable delay. No such extension will be allowed unless a claim therefore is presented in writing to the CITY within 15 calendar days of the commencement of such unavoidable delay.

Reasonable loss of time resulting from the necessity of submitting documents to the CITY for approval or receiving drawings and information from the CITY will be taken into consideration by the BIDDER in determining his bid price for and completion date for the Work, and hence will not constitute unavoidable delays within the meaning of the Contract.

6.12 CHANGES IN PLANS AND EXTRA WORK

The CONTRACTOR will submit for approval a quotation covering any change made in the Work which affects the Contract price. Said quotation will be submitted promptly upon receipt of notification of the change. The CONTRACTOR must obtain from the CITY, or his authorized representative, written permission in advance, before performing any Work considered as extra and not included in the Contract price.

6.13 ASSIGNMENT OR SUBLEASE

The CONTRACTOR will not assign, or sublet the Work or any part thereof without first obtaining the CITY's written approval.

Such approval, if given, will not relieve the CONTRACTOR of the full responsibility for the fulfillment of all obligations under the Contract.

Nothing herein shall create any contract between any subcontractor and the CITY or any obligation on the part of the CITY to pay, or see to the payment of, any sums of any subcontractor of the CONTRACTOR.

6.14 SAFETY

The CONTRACTOR alone shall be solely and completely responsible for conditions of the job site in connection with its Work, including safety of all persons and property, preparatory to and during performance of the Work. This requirement shall apply continuously and not be limited to normal working hours.

The Construction Documents and the joint and several phases of construction hereby contemplated are to be governed, at all times, by applicable provisions of local and state laws and regulations and federal laws, including but not limited to the latest amendments of the following:

- Department of Labor, Bureau of Labor Standards, Safety and Health Regulations for Construction, and Williams and Steiger Occupational Safety and Health Act of 1970, including rules and regulations issued pursuant thereto, applicable to the Work and performance of the Contract (OSHA).

The duty of the ENGINEER to conduct construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near to the construction site.

No explosives shall be permitted.

The CONTRACTOR shall submit its safety policies, the practices and guidelines of its safety program, and a record of its safety performance during the last three-year period.

6.15 INDEMNITY BY CONTRACTOR

The CONTRACTOR will defend and indemnify and save the CITY and the employees of the CITY harmless from any and all claims, losses, damages, demands, suits, actions, payments, judgments, costs and expenses, including attorney's fees, arising or alleged to arise from personal injuries, including death, or damage to property, including the loss of use thereof, and resulting from, arising out of or in connection with the Work or alleged to result from or arise out of or in connection with the Work except for loss or damage arising out of the sole active negligence of the CITY, including, without limitation, all liability imposed by virtue of any law designed to protect persons employed at the Work site.

6.16 PATENTS

The CONTRACTOR will pay all royalties and license fees which may be payable on account of the Work or any part thereof. He will at his own expense defend any claim brought by others against the CITY, his successors, assigns or those using the Work, because the sale or use of the Work infringes or is alleged to infringe directly or contributory, rights in, to, or under patents, copyrights, proprietary rights or inventions and will save the CITY harmless from any liability or any nature of kind (including all costs or expenses) arising out of any such infringement or alleged infringement. The CONTRACTOR will reimburse the CITY for all costs and expenses including reasonable attorney's fees incurred by the CITY in defending any such suits or proceedings.

In addition to the foregoing, the CONTRACTOR will save the CITY harmless against, and will pay all awards of damages assessed and all costs of suit adjudged against the CITY in such suits or proceedings provided the CITY gives the CONTRACTOR reasonable notice in writing of the institution of any such proceeding, permits him to defend it, and gives him all such information, assistance, and authority as will be necessary to enable him to do so.

In case any part of the Work is held in any such suit to constitute infringement and its use is enjoined, the CONTRACTOR will within a reasonable time either; (1) secure the perpetual right to continue the use of such part of the Work, or (2) replace at CONTRACTOR's own expense such part of the Work with an adequate non-infringing part or modify it so that it becomes non-infringing.

6.17 COMPLIANCE

CONTRACTOR will at all times be solely responsible for complying with all applicable laws, ordinances and regulations in connection with the WORK, including those relating to safety of all persons and property together with all requests and regulations of the CITY and the CITY's insurance carriers.

Questions relative to the validity, construction, effect and enforcement of the Contract, and the obligations, rights and remedies of the parties thereunder will be governed by the Laws of the State of South Carolina.

6.18 RESTRICT WORK TO RIGHT OF WAY

The CONTRACTOR shall restrict all work, access, movement and materials storage to the CITY's right-of-way easement and to public road rights-of-way as specified. In the event that the CONTRACTOR perceives a need to use or gain access to private property, the CONTRACTOR shall be responsible to obtain written permission of the property owner before moving onto the property.

6.19 SHIPMENT – TRANSPORTING OF MATERIALS

The Contractor shall be responsible for receiving all required cable, conduits, and equipment at the Contractor's place of business. The Contractor shall be responsible for transporting cable, conduits, and equipment to the work site.

The Contractor will be allowed to store materials at the Owner's Electric Operation office with prior agreement with the Owner and as storage space allows as determined by the Owner. The address is:

Georgetown, SC - Electric Operations:

800 Church Street
Georgetown, SC 29440
(843) 545-4600

6.20 TAXES

All applicable Federal, state, local net or gross income or gross receipts taxes, and similar taxes including sales or use taxes are deemed to be included in the Contract price, and the CITY will not reimburse the CONTRACTOR therefore, such taxes being the sole liability and obligation of the CONTRACTOR.

6.21 LIABILITY INSURANCE

Public Liability and Property Damage Liability Insurance: A Comprehensive General Liability Policy shall be required, in the amount of \$1,000,000. A Certificate of Insurance shall be provided by Contractor to the CITY, giving evidence of the following:

FRONT STREET UNDERGROUND
ELECTRICAL SYSTEM UPGRADE
PROJECT #1919
SPEC 171007-03 PH. 1 CONSTR
4/5/2019

General Liability Limits.
Assumption of Contractual Liability for the Work.
A thirty day unconditional notice of cancellation to the CITY.
Certificate holder, named as follows:

City of Georgetown
PO Box 939
Georgetown, South Carolina 29442

The Certificate shall be attached to the executed Contract. This insurance is subject to approval by the CITY prior to any Work being performed.

6.22 BOND

The CONTRACTOR to whom the work is awarded shall furnish a performance bond to the CITY, in an amount equal to 110 percent of the contract amount. The cost of the bond shall be included in the lump sum bid price. The bond shall be executed on the forms provided, copies of which are attached hereto, signed by a surety company authorized to do business in the state of South Carolina and acceptable as surety to the CITY. With the bond shall be filed copies of *Power of Attorney*, certified to include the date of the bond.

6.23 PAYMENTS

No certifications given or payments made will be considered as conclusive evidence of the performance of the Contract, either wholly or in part, nor will any certificate or payment be construed as acceptance of any defective part of the Work.

CONTRACTOR shall submit monthly invoices, based on the percent completion of the WORK, to the ENGINEER, who will forward them to the CITY. The percent completion shall be based on the material and equipment installed, not on the value of material and equipment shipped to the job site. The ENGINEER will prepare monthly project summaries to determine the percent complete.

The CITY will pay monthly invoices to the CONTRACTOR in a timely fashion less ten percent retainage. At the completion of the job and based on the ENGINEER's determination that the job is complete and all punch list items are resolved, the CITY shall pay retainage to the CONTRACTOR and refund the performance bond.

6.24 TIME OF COMMENCEMENT AND COMPLETION

The WORK shall commence, be executed, and completed in accordance with a schedule to be included in the SCHEDULE OF WORK Statement. Failure to comply with the schedule except as intended under Section 6.11 herein will constitute a breach of this agreement.

6.25 NONWAIVER OF RIGHTS

No delay or omission by the CITY to exercise any right hereunder will be construed as a waiver of such right unless such waiver is in writing. No waiver by the CITY of any breach of the CONTRACT on the part of the CONTRACTOR, will be construed as a waiver of any subsequent breach of this agreement.

6.26 EQUAL EMPLOYMENT OPPORTUNITY

Non-Discrimination in Employment: The CONTRACTOR will comply with applicable laws, executive orders and regulations, concerning nondiscrimination in employment, including the Equal Opportunity clause of Section 202, Executive Order 11246, as amended, which is hereby incorporated herein by reference.

6.27 CONDUCT OF FIELD PERSONNEL

The CONTRACTOR's field personnel will conduct themselves in a manner that does not disrupt the CITY's operations, violate its rules concerning conduct on the premises, or engage in unsafe practices. The conduct of the CONTRACTOR's field personnel shall be judged solely by the CITY. If the conduct of the field personnel is determined to be inappropriate, the person may be requested to leave the CITY's premises. CONTRACTOR will not be entitled to additional compensation but shall be entitled to an extension of time of one week to replace such personnel.

6.28 INSPECTIONS

The CITY and/or its agent must be allowed access to all of the CONTRACTOR's facilities to verify the reaching of milestones, the adherence to quality control practices, the performance of extra work (as with Change Orders), and the accuracy of progress reports. This access will be limited to working hours of weekdays. Inspections by the CITY's inspector will not relieve the CONTRACTOR from responsibility for furnishing materials, equipment and software to conform to the requirements of the Specification nor invalidate any claim which the CITY may make because of defective or unsatisfactory material or equipment.

6.29 OPERATION MANUALS

At the completion of the work, the Contractor shall provide 5 sets of manufacturer's literature referencing specifications, operation, and maintenance for all equipment, combined in individual loose-leaf binders: 4 sets shall be provided to the CITY and 1 set shall be provided to the ENGINEER.

7 TECHNICAL SPECIFICATIONS

SECTION 01000 - SUMMARY OF THE WORK

7.1.1 Project Description

The work in this contract consists of the upgrade and replacement of the downtown Front Street electric power distribution system in Georgetown, SC; including all its appurtenances, site work, and any off-site improvement required or necessary; shown on the drawings; all in accordance with the Bidding and Contract Requirements, Specifications and the accompanying Drawings, excepting only those items specifically shown, noted or specified as not in contract.

7.1.2 Location of Underground Utilities

Obtain digging permits prior to start of excavation, and comply with installation requirements for locating and marking underground utilities. Verify existing utility locations indicated on contract drawings, within area of work.

Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed in locations to be traversed by piping, ducts, and other work to be conducted or installed.

7.1.3 Owner Furnished Equipment

The City will furnish the following materials and equipment for installation by the Contractor:

- Pad mounted transformers

7.1.4 Salvage Material and Equipment

Items designated by the Engineer to be salvaged remain the property of the City. Segregate, itemize, deliver and off-load the salvaged property at the City designated storage area located within 5 miles of the construction site.

Provide a salvage plan, listing material and equipment to be salvaged, and their storage location. Maintain property control records for material or equipment designated as salvage. Use a system of property control that is approved by the Engineer. Store and protect salvaged materials and equipment until disposition by the Engineer.

END OF SECTION

**SECTION 01001 – INCORPORATION OF GENERAL CONDITIONS AND SUPPLEMENTARY
GENERAL CONDITIONS**

All requirements of the General Conditions and Supplementary General Conditions apply to all sections of the specifications and drawings for this project.

END OF SECTION

SECTION 01002 – OPERATION MANUALS

An operation manual shall be compiled by the contractor containing instructions, maintenance manuals, test reports and warranties for all material and equipment incorporated in the work.

Reference GENERAL CONDITIONS Paragraph 6.29 OPERATION MANUALS for specific requirements.

END OF SECTION

SECTION 02110 - SITE PRESERVATION

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and other applicable Specification Sections, apply to this Section.

1.2. SUMMARY

This Section includes the following:

- Protection of trees
- Disposal of Undesirable Material Off-Site

Related Sections: The following Sections contain requirements that relate to this Section:

- Seeding Disturbed Areas (02900)

1.3. EXISTING CONDITIONS

Site Conditions:

- Contractor shall visit the site, familiarize himself with actual conditions and verify existing conditions in the field. Contractor shall notify the Engineer immediately upon finding any discrepancies between the existing site conditions and information shown on the plans.
- Record Information: Existing conditions are shown on the Demolition plan and are incorporated into Construction Documents.

1.4. PROTECTION

Bench Marks: Maintain carefully all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed by the Engineer.

Existing Utilities: Should any functioning underground utilities be uncovered during the work, the Contractor shall promptly notify the Engineer immediately in writing. The Contractor shall be held responsible for any damage to underground or overhead utility services and shall immediately repair and restore services at no additional cost to the Owner.

Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing. Any vegetation designated to remain which is damaged by construction work shall be replaced with new vegetation of the same kind by the contractor responsible for such damage.

2. EXECUTION

2.1. CLEARING AND GRUBBING

Disposition: Objects and materials to be removed shall be removed cleanly, completely, and legally disposed of offsite at the expense of the Contractor. Salvageable topsoil to be reused on this project shall be stored at a location designated on site by Owner. Excess topsoil shall be disposed of off-site at the expense of the Contractor.

Limits of Work: Generally, all existing trees, whether shown on the Drawings or not, shall not be removed.

Coordination: Loose sticks, roots, branches, or other debris shall not be left on the site. The Contractor shall avoid the admixture of foreign matter to the topsoil.

2.2. PROTECTION OF EXISTING TREES TO REMAIN AND UNDISTURBED AREAS

Fencing: Trees to remain shall be protected by temporary fences constructed of wood, wire mesh, and metal as required, to provide complete protection. Erect fences at perimeter of spread of trees to protect feeding roots.

Cutting: Do not cut low-hanging branches on trees to be saved, unless approved by the ENGINEER. Any such branches which must be cut to eliminate obstructions shall be pruned by experienced treemen. Any such cuts, or any accidental injuries to the bark or trunk shall be immediately and properly trimmed.

Grading: Grades surrounding trees to remain shall be warped up or down, where possible, between existing grades of root area and new finished grades. Where fills under 2' occur, the fill shall consist of broken stone or washed gravel, for a distance of 3' from the trunk in all directions, the remaining fill being of light, friable topsoil. Do not disturb root system.

Prohibited Work: Stripping of topsoil, cutting, filling, or dumping of materials, will not be permitted within the spread of branches of trees to remain. Burning of combustible material is not permitted on the OWNER'S property

2.3. PROTECTION OF EXISTING SIDEWALKS, WALKWAYS, PARKING LOTS, AND PUBLIC ROADS.

The Contractor shall take preventative measures to ensure existing concrete sidewalks within the project working area are not chipped, stained, cracked, scratched or otherwise damaged. If any concrete sidewalk is damaged, the damaged area shall be repaired as specified.

The Contractor shall take preventative measures to ensure existing walkways, parking lots and public roads within the project working area are not damaged. If any damage occurs the Contractor shall repair the damaged area as specified. This includes gravel or paved parking lots and walkways beyond the street sidewalks.

END OF SECTION 02110

SECTION 02900 – SEEDING DISTURBED AREAS

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and other applicable Specification Sections, apply to this Section.

1.2. SUMMARY

All existing grass areas which are disturbed or denuded during the project by either trenching or otherwise shall be seeded as required and as shown on the Drawings and specified.

1.3. STORAGE OF MATERIALS

Store all materials in weather proof place with care to prevent loss of effectiveness or intrusion of foreign materials.

1.4. MATERIALS

Lime: Lime shall be ground limestone (Dolomite) containing not less than 85% total carbonates and shall be ground to such fineness that 50% will pass through a 100-mesh sieve and 90% will pass through a 20-mesh sieve.

Fertilizer: Commercial fertilizers shall be 16% Nitrogen, 4% Phosphate, 8% potash, and 0-20-0 Superphosphate, and shall conform to the applicable State of South Carolina Board of Agriculture fertilizer laws. It shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged will not be acceptable.

Permanent Seed: Seed shall be a 50/50 blend of Rebel and Falcon fescues and shall have a minimum purity of 98%, minimum germination of 90%, and be free of noxious weed seeds. Seed shall be delivered to the site in sealed standard size containers, showing weight, analysis, name of vendor and germination test. Seed which has become wet, moldy, or otherwise damaged will not be accepted.

Topsoil: Topsoil shall be from project stockpile and shall be prepared by the contractor as to be free of sub-soil roots, branches, stones over 2" in diameter and other extraneous material. Waste shall be disposed of offsite by the Contractor.

Water: Water shall be potable and will be provided by the Contractor.

2. EXECUTION

2.1. SITE CONDITIONS

Unless otherwise approved by the Engineer, all other site work required by this Contract shall be complete and in place before grassing operations are begun. Work may be completed in parts if so requested by the Contractor and approved by the Engineer.

The Contractor shall locate, or have located, all public and private underground utilities which may affect work in this Section. Any utility damaged by work under this Section shall be repaired promptly by the Contractor. Repairs shall be done to the satisfaction of the respective utility Owner and all costs shall be borne by the Contractor.

2.2. PREPARATION OF AREAS TO BE SEEDED AND DENUDED AREAS

Prior to redistribution of topsoil and seeding, verify that all denuded areas are at required subgrade and scarify to a 4" depth and pulverize until the surface is smooth, friable and of a uniformly fine texture.

Remove stones and foreign material over 2" in any direction and grade for positive drainage.

Prepared topsoil shall be redistributed to a 4" minimum depth, over denuded areas to be planted with grass, ground covers, shrubs and trees. Pulverize until the surface is smooth, friable and of a uniformly fine texture.

All equipment shall be of size and type required for specified preparation of all areas to be seeded and shall be approved by the Engineer. Upon approval of the Engineer, the method of preparation may be varied by the Contractor under his responsibility to provide optimum conditions for seeding.

2.3. SEEDING AND FERTILIZATION

The following rates shall be applied:

- Lime shall be applied to all areas at the rate of 90 pounds per 1000 sq. ft.
- 16-4-0 fertilizer shall be applied to all areas at the rate of 20 pounds per 1000 sq. ft.
- 0-20-0 superphosphate shall be evenly distributed in all areas at the rate of 12 lbs. per 1000 sq. ft.

Fescue seed shall be evenly distributed over the prepared seed bed of proposed lawn areas, at the rate of 6 pounds per 1000 sq. ft. of area. Apply annual rye grass at the rate of 2 lbs. per 1000 sq. ft. only if seeded between October 15 and February 15.

Asphalt tack-coat shall be applied in the method and quantity required to hold mulch together and prevent displacement by wind or surface drainage.

All areas shall be seeded, and fertilized evenly at the rate specified, rolled once with a roller weighing not less than 100 pounds per lineal foot, tack coated as required, and watered thoroughly with a fine spray.

2.4. ACCEPTANCE

The Engineer shall be the sole judge as to whether or not the seeded areas are acceptable.

GUARANTEE FOR PERMANENT GRASS: The Contractor shall guarantee a live and vigorous stand of permanent grass at the time of acceptance of the work consisting of 90 percent coverage minimum of seeded grass. (No bare spots greater than 5 square feet, the total of which shall not exceed 2% of the lawn area).

CLEANUP: Upon completion of initial seeding work in this Section, the Contractor shall remove all equipment and materials not required for maintenance. All debris and waste material resulting from work in this Section shall be removed from the site.

END OF SECTION 02900

SECTION 03100 - CONCRETE FORMWORK

1. GENERAL

1.1. RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.2. DESCRIPTION OF WORK

Work Included This Section:

Work shall consist of providing all concrete formwork, form coatings and accessories required to complete the formwork for the pad mounted transformer pads as shown on the drawings.

Related Work Specified Elsewhere:

- Concrete Reinforcement (03200)
- Cast-In-Place / Ready-Mix Concrete (03300)
- Concrete Finishes (03350)

1.3. QUALITY ASSURANCE

Codes and Standards:

Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute Standard ACI 347, "Recommended Practice for Concrete Formwork".

1.4. MATERIALS

Forms for Exposed Finish Concrete:

Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel type materials to provide continuous straight, smooth exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

Plywood for formwork for smooth exterior concrete shall be plywood complying with U. S. Products Standard PS-1 "B-B High Density Overlaid Concrete Form" Class I. Plywood for all other exposed concrete formwork shall not be less than 5/8", 5-ply Douglas fir plywood especially processed to resist moisture and conforming to Plyform Class I, B-B Ext-DFPA of U. S. Product Standard PS 1-66.

Forms for Unexposed Finish Concrete:

Form concrete surfaces which will be unexposed in the finished structure with plywood, boards, metal or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side for tight fit.

1.5. ACCESSORIES

Form Ties: Shall be reviewed by the Engineer. Spreaders or wire ties shall not be used. Snap ties will be permitted except on exposed exterior surfaces where pull ties will be required. Ties shall have a minimum working strength when fully assembled of at least 3,000 pounds and shall be adjustable in length as to permit complete tightening of forms and of such type as to leave no metal closer than 1-1/2" to the surface. They shall not be fitted with any lugs, cones, washers or other devices to act as a spreader within the forms or for any other purpose which will leave a hole or depression larger than 7/8" in diameter or a depression in excess of 1/8" back of the exposed surface. Furnish a sample of each exposed type.

Corner Formers: Corner formers shall be plastic with 3/4" radius equivalent to "Green Streak" corner formers, manufactured by:

- Grace Construction Products
- EFCO Corp.
- Vinylex Corporation

Form Releasing Agent: Form releasing agent Commercial Formulation Compounds with a maximum VOC of 350 Mg/L shall be non-staining "Debond" as manufactured by L & M Construction Chemicals or "Nox-Crete" Form Coating by Nox-Crete Chemical Co. or approved equivalent.

1.6. STORAGE OF MATERIALS

All materials shall be properly stored and protected from damage during time of non-use.

2. EXECUTION

2.1. DESIGN FORMWORK

Design, erect, support, brace and maintain formwork so that it will safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Carry vertical and lateral loads to the ground by the formwork system and by the in-place construction that has attained adequate strength for that purpose.

Design formwork to be readily removable without impact, shock or damage to the Cast-In-Place concrete surfaces and adjacent materials.

Side forms of footings may be omitted and concrete placed directly against the neat excavation only when requested by the Contractor and accepted by the Engineer. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed to maintain 3 inch cover at all sides of reinforcing steel. Earth forms shall be wetted (damp), but not muddy before concrete is placed.

2.2. FORM CONSTRUCTION

General Requirements for Form Construction:

Construct forms to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in the finished structures. Provide for openings offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and insets to obtain the required finishes. Formwork shall be constructed sufficiently tight to prevent leakage of concrete; to securely brace, shore and safely support construction loads and to prevent displacements.

CONTRACTOR shall be fully responsible for adequacy of formwork units. CONTRACTOR shall also be responsible for forms in conjunction with any structural steel work. Forms shall support loads that might be applied until concrete structure can support such loads and shall maintain their dimensional and surface correctness to produce members required by drawings.

Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent the loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible, consistent with the requirements of the work.

Provide openings in concrete formwork to accommodate work of other trades. Size and location of openings, recesses and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into forms.

Carefully form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.

Form Ties:

Provide factory fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal. Ties that are to be removed from the wall shall be coated with cup grease or other approved material to facilitate removal.

The rods that are to be entirely removed from the walls shall be loosened 24 hours after the concrete is poured. All but a sufficient number of ties to hold the forms in place may be removed at that time.

Provide shores and struts with positive means of adjustment capable of taking up form work settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, or impede the wetting of surfaces to be cured with water or curing compounds. Thin form-coating compounds only with the thinning agent of the type and in amount and under the conditions of the form-coating compound manufacturer's directions. Do not allow excess form coating material to accumulate in the forms or to come into contact with concrete surfaces or reinforcing steel against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. In no case shall the reinforcing steel and inserts be coated with this material.

2.3. INSTALLATION

Shall be in accordance with ACI 301 with particular attention being given to tolerances.

Inserts, Sleeves and Fastening Devices:

- See drawings, coordinate with all other trades and other Sections of the Specifications for extent, location, and details of materials to be embedded or placed in concrete.
- Sufficient time between erection of forms and placing of concrete shall be given to the various trades to permit the proper installation of their work. All devices installed in the forms shall be maintained in position and protected until the concrete pouring is completed.
- The installation of inserts, miscellaneous pipe sleeves, hangers, ties, angle supports, anchors, bolts, angle guards, dowels, thimbles, anchor slots, reglets blocking, nailers, and other materials for attachment of their work to concrete shall be under this Section under the supervision and at the location furnished by the trades requiring these devices. Do not install sleeves in any concrete footing, slab, or pier without Engineer's approval.

Control Joints: See Section 03300 for treatment of control and construction joints, including wood screeds, metal keyways and sawcuts. Locate as indicated within the drawings and specifications.

Edge Forms and Screeds Strips For Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

Removal of Forms: Forms shall be removed in accordance with requirements of ACI Manual of Concrete Practice without damage to concrete and in a manner to insure complete safety to the structure. Leave shoring in place until concrete member will safely support its own weight plus any live loads that may be

placed upon it or until the concrete has obtained a strength acceptable to the Engineer. Upon removal of forms, the Contractor shall notify the Engineer in order that a review of the newly stripped surfaces may be made prior to patching. Should the forms be removed sooner than 7 days after pouring, the resulting exposed surfaced shall be sprayed with the curing compound specified in Section 03300.

2.4. RESHORING

Reshoring for the purpose of early form removal, where permitted by the Engineer, shall be performed so that at no time will large areas of new construction be required to support their own weight. When reshores are required, they shall be installed not later than the end of the working day in which stripping occurs.

While reshoring is underway, no live loads shall be permitted on the new construction. Reshores shall be tightened to carry their required loads but they shall not be over tightened so that the new construction is overstressed. Reshores shall remain in place until the concrete has reached its specified 28 day strength, unless otherwise specified or permitted.

2.5. RE-USE OF FORMS

Clean and repair the surfaces of forms that are to be reused in the work, except that split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to all concrete contact form surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance and tighten forms to close all joints. Align and secure all joints to avoid offsets. Do not use "Patched" forms for exposed concrete surfaces, except as acceptable to the Engineer. Any form works deemed unacceptable by Engineer shall be rejected.

END OF SECTION 03100

SECTION 03200 - CONCRETE REINFORCEMENT

1. GENERAL

1.1. RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.2. DESCRIPTION OF WORK

Work Included This Section: Work shall include providing the following and all other items related to concrete reinforcement:

- Metal Reinforcement
- Metal Accessories
- Plastic Accessories

Related Work Specified Elsewhere:

- Concrete Formwork (03100)
- Cast-In-Place / Ready-Mix Concrete (03300)
- Concrete Finishes (03350)

1.3. QUALITY ASSURANCE

Standard Reference:

The Standard Reference shall be the ACI 301, hereinafter called ACI; The American Welding Society Structural Welding Code and ASTM Specifications as listed.

The current edition of the following standard reference shall apply to the work of this Section. CONTRACTOR shall be responsible for obtaining latest edition.

1. ASTM A82: Specifications for Cold Drawn Steel Wire for Concrete Reinforcement.
2. ASTM A185: Specification for Welded Steel Wire Fabric For Concrete Reinforcement.
3. ASTM A615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ACI 301: Specifications for Structural Concrete for Buildings.
5. ACI 315: Manual for Standard Practice for Detailing Reinforced Concrete Structures.
6. ACI 318: Building Code Requirements for Reinforced Concrete.
7. AWS D1.1: Structural Welding Code.

1.4. SUBMITTALS

Shop Drawings:

Drawings shall be prepared under supervision of a registered Professional Engineer in the State of South Carolina. Shop Drawings shall show for fabrication, bending, and placement of concrete reinforcement. Comply with ACI SP-66, "ACI Detailing Manual," showing bar schedules, stirrup spacing, diagrams of bent bars, bar lists, and arrangement of concrete reinforcement. placing plans, bending details, and bar lists. Wall reinforcing shall be shown in elevation. Location and arrangement of sleeves, inserts, accessories, etc. shall be clearly indicated.

Reinforcing bars shall not be erected or set in place before the approved shop drawings have been returned to the Contractor.

Only shop drawings completely checked by the Fabricator and General Contractor will be considered by the Designer. Approval of shop drawings is for design only. Contractor is responsible for dimensions, quantities, and coordination with other trades.

As specified and in accordance with Section 03300-1 "Cast-In-Place Concrete". Submit copies of Manufacturer's printed technical literature and performance data on the fiber reinforcing proposed for use in project.

1.5. STORAGE OF MATERIALS:

Reinforcing steel delivered to the job, and not immediately placed in forms, shall be stored under cover and protected from mud, rusting, oil, grease or distortion.

1.6. CLEANING:

At the time of placing concrete, reinforcing shall be free from rust, oil, corrosion, scale or other coatings that will destroy or reduce bond.

2. PRODUCTS

2.1. MATERIALS

Steel Reinforcement: Steel Reinforcement shall be deformed type bars conforming to ASTM A 615. Reinforcement shall be manufactured from new billet steel of American manufacture, and shall conform to ASTM A 615, Grade 60 with a yield strength of 60,000 psi.

Welded Wire Fabric: Welded Wire Fabric shall conform to the requirements of ASTM A 185. Size and gauge shall be as indicated on Drawings.

Steel Accessories: Include all spacers, ties, chairs, bolsters and other devices required to properly support and fasten reinforcing steel in place in accordance with the requirements of ACI 315. Chairs and other accessories shall have plastic-tipped feet. Location and types of supports shall be shown on shop drawings. Accessories and elements required by other trades shall be shown on shop drawings, furnished by those trades, and installed under this Section.

Shop Fabrication: Reinforcing steel shall be fabricated to shapes and dimensions indicated on the Drawings and in compliance with applicable provisions of ACI 315 and ACI 318. Bars shall be bent cold in the shop and no bars shall be bent in the field.

2.2. INSPECTION

The Contractor must examine the conditions under which concrete reinforcement is to be placed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

2.3. INSTALLATION

Placement:

- Reinforcement shall be placed accurately in accordance with the Drawings and adequately secured in position with metal chairs, spacers with ties and other devices to properly support and fasten in accordance with ACI.
- Steel reinforcement, at the time concrete is placed, shall be free from rust, scale, mud or other coatings that will destroy or reduce bond. Bars with kinks or bends not shown on the plans shall not be used. Steel reinforcement shall be accurately placed in accordance with the plans. Secure in position with not less than 16-gauge annealed wire or suitable clips at intersections. Hold securely the required distance from the forms by concrete or metal chairs and spacers. Nails shall not be driven into outside forms or support reinforcement.

Splicing: Splices and offsets of reinforcing shall be in accordance with ACI 318 and as shown and noted on the drawings. All reinforcing splices shall have a minimum lap of 36 bar diameters unless noted otherwise. All reinforcement shall be accurately placed in the forms and securely tied in position prior to placement of concrete.

Wire Fabric: Install as indicated on Drawings. Lap all joints 6" and wire securely. Extend mesh to within 2" of all sides and ends of slabs.

END OF SECTION 03200

SECTION 03300 - CAST-IN-PLACE / READY-MIX CONCRETE

1. GENERAL

1.1. RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.2. DESCRIPTION OF WORK

Work Included This Section:

Work of this Section shall include furnishing all labor and materials required to provide all cast-in-place / ready-mix concrete.

All structural concrete work shall be done in accordance with the applicable sections of ACI 301, Specifications for Structural Concrete. The project superintendent and concrete foreman shall have a copy of the ACI Field Reference Manual, SP-15, on the Project site and shall be familiar with the contents thereof.

Related Work Specified Elsewhere:

- Concrete Formwork (03100)
- Concrete Reinforcement (03200)

1.3. CODES AND STANDARDS

Standards and Specifications: All standards and specifications mentioned in this Section refer to the latest edition, unless otherwise noted, and shall be considered as a part of the specification except where otherwise specified herein.

ASTM Standards:

- C33 Specification for Concrete Aggregates.
- C94 Specification for Ready-Mixed Concrete.
- C150 Specification for Portland Cement.
- C233 Testing Air-Entraining Admixtures for Concrete.
- C260 Specification for Air-Entraining Admixture for Concrete.
- C309 Specification for Liquid Membrane Forming Compounds for Curing Concrete.
- C494 Standard Specification for Chemical Admixtures for Concrete.

1.4. DELIVERY AND PROTECTION OF MATERIALS

Deliver ready-mixed concrete in compliance with requirements set forth in ASTM C-94, except as otherwise indicated.

Severe Weather Provisions: Protect concrete from physical damage or reduced strength due to weather extremes. In cold weather, comply with ACI 306.

2. PRODUCTS

2.1. MATERIALS

Portland Cement: ASTM C150, Type 1. Use one brand of cement throughout project. No Fly Ash shall be used.

Aggregate: The maximum size of coarse aggregate for reinforced concrete shall be 3/4 the distance between bars, or 1/5 narrowest dimension between forms, or 1/3 the depth of slabs, whichever is the smallest. Provide aggregates from a single source for exposed concrete.

Normal Weight Aggregates: ASTM C33.

Water: Water shall be potable and free from deleterious amounts of oils, acids, alkalies, and organic matter. (Drinkable).

Ready-Mix Concrete: The concrete shall be mixed in accordance with the recommendations of the National Ready-Mix Concrete Association. Attention is called to Paragraph 14 of ASTM C94; the certification in its entirety, as called for by this paragraph shall be obtained by the Contractor and kept on file at the Project site.

2.2. INSPECTION OF WORK BEFORE PLACING

The Contractor shall inspect the work to receive cast-in-place concrete for deficiencies which would prevent proper execution of the finished work. Do not proceed with placing until such deficiencies are corrected. Do not place concrete on earth until the fill or excavation has been compacted as set forth under Applicable Sections of the Specifications.

Do not place concrete in forms until all foreign matter has been removed from the forms and the reinforcing steel is in proper position for the placement of concrete.

2.3. PLACEMENT OF CONCRETE

Preparation of Equipment and Place of Deposit: Before placing concrete, all equipment for mixing and transporting concrete shall be cleaned, all debris and ice removed from place to be occupied by the concrete, forms thoroughly wetted, except in freezing weather, or coated, and reinforcement thoroughly cleaned of ice or other coatings. Water shall be removed from place of deposit before concrete is placed.

Mixing: Concrete shall be mixed until uniform distribution of materials is obtained, and shall be discharged completely before the mixer is recharged. Ready-mix concrete shall be mixed and delivered in accordance with requirements set forth in the "Standard Specifications for Ready-Mixed Concrete", ASTM C94.

Conveying: Concrete shall be conveyed from mixer to place of deposit by methods which will prevent separation or loss of materials. Equipment for chute, pumping, or pneumatically conveying concrete shall be of such size and design as to assure practically a continuous flow of concrete at delivery without separation of materials.

Depositing: Concrete shall be deposited as near as practical to its final position to avoid segregation due to rehandling or flowing. Depositing shall proceed at such a rate that concrete is at all times plastic and flows readily into space between the bars. No concrete that has partially set or been contaminated by foreign material shall be deposited, nor shall retempered concrete be used. Maximum free-fall of concrete shall not exceed distance specified in ACI 301 and no deviation from the specifications will be permitted. Pouring, when once started, shall be carried on as a continuous operation until the pad is completed. The top surfaces shall be generally level. All concrete shall be thoroughly compacted by suitable means during placing, and thoroughly worked around reinforcement and embedded fixtures and into corners of forms.

2.4. CURING AND PROTECTION

Concrete shall be allowed to cure for 7 days.

END OF SECTION 03300

SECTION 03400 – PRECAST CONCRETE STRUCTURES

1. GENERAL

1.1. RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.2. DESCRIPTION OF WORK

Work Included This Section:

Work of this Section shall include furnishing all labor and materials required to provide all precast concrete structures. Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

1.3. GENERAL

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein.

Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified.

Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2. DESIGN FOR PRECAST STRUCTURES

2.1. ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

- a. Angle of Internal Friction (ϕ) = 30 degrees
- b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf
- c. Coefficient of Lateral Earth Pressure (K_a) = 0.33
- d. Ground Water Level = 3 feet below ground elevation
- e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading per AASHTO HB-17.
- f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 6000 pounds.
- g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

- h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

3. CONSTRUCTION

Structure top, bottom, and wall must be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the precaster.

Size of windows must exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings.

Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes.

Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

3.1. JOINTS

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer.

Seal joints watertight using preformed plastic strip conforming to ASTM C990. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

END OF SECTION 03400

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 16.

1.2. SUMMARY

This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Section 6 - GENERAL CONDITIONS:

- Shop Drawings.
- Record documents.
- Operation manuals.
- Shipment.

1.3. SUBMITTALS

General: Follow the procedures specified in Section 6.7 - SHOP DRAWINGS.

1.4. RECORD DOCUMENTS

The Contractor shall maintain an orderly and adequate file of up-to-date copies of all Engineer's drawings and specifications, manufacturer's prints and specifications, and other contract documents and supplementary data. In addition, the Contractor shall maintain a continuous record of all field changes by means of a set of drawings marked to indicate current "as-built" conditions. This "as-built" set of drawings shall be available for check by the Engineer in order for him to ascertain that it is being kept current. At the conclusion of work, the "as-built" drawings and other engineering data, accurately and neatly marked with field changes, shall be submitted to the Engineer in the required number of copies. The "as-built" drawings and data shall include all revisions to the work made under this Contract, including those made by subcontractors. The installed conditions shall include:

- Major raceway systems underground duct banks, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
- Wood Poles, Electrical Pull Boxes, Man Holes, Pad-mounted Transformers, and Equipment locations (exposed and concealed), dimensioned from prominent building lines.
- Approved substitutions, Contract Modifications, and actual equipment and materials installed.
- A wiring log as described in Section 16195.

1.5. MAINTENANCE MANUALS

Prepare maintenance manuals in accordance with Section 0 - OPERATION MANUALS. In addition to the requirements specified in Section 0, include the following information for equipment items:

- Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
- Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
- Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
- Servicing instructions and lubrication charts and schedules.

1.6. DELIVERY, STORAGE, AND HANDLING

Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.7. ROUGH-IN

Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

1.8. ELECTRICAL INSTALLATIONS

General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

- Verify all dimensions by field measurements.
- Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work.
- Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
- Install systems, materials, and equipment level and plumb, and parallel.
- Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- The Contractor should limit all outages to customers to four (4) hours at a time wherever possible.

1.9. CUTTING AND PATCHING

Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.

Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.

Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

END OF SECTION 16010

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

Requirements specified in Section 16050 "Basic Electrical Requirements" apply to this Section.

1.2. SUMMARY

This Section includes limited scope general construction materials and methods for application with electrical installations as follows:

- Selective demolition including dismantling electrical materials and equipment made obsolete by these installations.
- Excavation for underground utilities and services, including underground raceways, vaults, and equipment.
- Miscellaneous metals for support of electrical materials and equipment.

1.3. DEFINITIONS

The following definitions apply to excavation operations:

- Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
- Subbase: as used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
- Subgrade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.
- Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Engineer.

1.4. SUBMITTALS

General: Submit the following in accordance with General Conditions.

- Product data for the following products:
 1. 15 kV elbow connectors, splices, and terminators
 2. 600 V submersible connectors and terminal lugs
 3. 15 kV underground primary cable
 4. 600 V secondary cable
 5. Cable support brackets and cable clamps
- Shop drawings detailing fabrication and installation for metal fabrications and anchorage for electrical materials and equipment.
- Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of electrical service.

1.5. PROJECT CONDITIONS

Conditions Affecting Selective Demolition: The following project conditions apply:

- Protect adjacent materials indicated to remain.

- Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
- Conditions Affecting Excavations: The following project conditions apply:
 1. Maintain and protect existing building services which transit the area affected by selective demolition.
 2. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
 3. Remove existing underground utilities indicated to be removed.
 4. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
 5. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Engineer prior to utility interruption.
 6. Use of explosives is not permitted.

1.6. SEQUENCE AND SCHEDULING

Coordinate the shut-off and disconnection of electrical service with the Owner and the utility company.

Notify the Engineer at least 5 days prior to commencing demolition operations.

2. PRODUCTS

2.1. SOIL MATERIALS

Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.

Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

3. EXECUTION

3.1. WORK RULES

All electrical work shall be performed in compliance with ANSI C2 "National Electrical Safety Code", Part 4. Clothing and equipment while working on or near energized lines, parts, or equipment shall be arc rated for a minimum of 4 cal/cm² incident energy.

3.2. EXAMINATION

Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3. SELECTIVE DEMOLITION

General: Demolish, remove, demount, and disconnect abandoned electrical materials and equipment.

Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

3.4. EXCAVATION

Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.

Install sediment and erosion control measures in accordance with local codes and ordinances.

Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

- Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
- Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

- Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
- Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- Excavation for Underground Vaults and Electrical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

Trenching: Excavate trenches for electrical installations as follows:

- Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of raceways and equipment.
- Excavate trenches to depth indicated or required.
- Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
- Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
- NO TRENCHES SHALL BE LEFT OPEN OVER NIGHT!

Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F.

- Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 2. Under building slabs, use drainage fill materials.
 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For raceways less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation of raceways, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 5. Other areas, use excavated or borrowed materials.
- Backfill excavations as promptly as work permits, but not until completion of the following:
 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.

Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.

Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

- Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
- Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
- Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
- Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
- Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

END OF SECTION 16050

SECTION 16100 - RACEWAYS, BOXES, AND CABINETS

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

- Raceways include the following:

1. Rigid metal conduit
2. Intermediate metal conduit
3. Electrical metallic tubing (EMT)
4. Liquidtight flexible conduit
5. Rigid nonmetallic conduit
6. Wireway
7. Surface raceways

- Boxes, enclosures, and cabinets include the following:

1. Device boxes
2. Outlet boxes
3. Pull and junction boxes
4. Cabinets and hinged cover enclosures

- Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 16 Section "Supporting Devices" for raceway and box supports.
2. Division 16 Section "Underground Ducts and Utility Structures."
3. Division 16 Section "Wiring Devices" for devices installed in boxes and floor box service fittings.

1.3. SUBMITTALS

General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

Product data for surface raceway, wireway and fittings, floor boxes, hinged cover enclosures, and cabinets.

Shop drawings for nonstandard boxes, enclosures, and cabinets. Include layout drawings showing components and wiring.

1.4. QUALITY ASSURANCE

Comply with NFPA 70 "National Electrical Code" for components and installation.

Listing and Labeling: Provide products specified in this Section that are listed and labeled.

- The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
- Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Comply with NECA "Standard of Installation."

Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

2. PRODUCTS

2.1. MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Metal Conduit and Tubing:

- Monogram Co., AFC.
- Alflex Corp.
- Allied Tube and Conduit, Grinnell Co.
- Anamet, Inc., Anaconda Metal Hose.
- Anixter Brothers, Inc.
- Carol Cable Co., Inc.
- Cole-Flex Corp.
- Flexcon, Inc., Coleman Cable Systems, Inc.
- Spiraduct, Inc.
- Triangle PWC, Inc.
- Wheatland Tube Co.

Nonmetallic Tubing and Conduit:

- Anamet, Inc., Anaconda Metal Hose.
- Arnco Corp.
- Breeze-Illinois, Inc.
- Can-Tex Industries, Harsco Corp.
- Carlon.
- Certainteed Corp, Pipe & Plastics Group.
- Cole-Flex Corp.
- Condux International, Electrical Products.
- Electri-Flex Co.
- George-Ingraham Corp.
- Hubbell, Inc., Raco, Inc.
- R&G Sloan Manufacturing Co., Inc.
- Spiraduct, Inc.
- Thomas & Betts Corp.

Conduit Bodies and Fittings:

- Scott Fetzer Company, Adalet-PLM.
- American Electric, Construction Materials Group.
- Emerson Electric Co., Appleton Electric Co.
- Carlon.
- Hubbell, Inc., Killark Electric Manufacturing Co.
- General Signal, O-Z/Gedney Unit.
- Spring City Electrical Manufacturing Co.

Wireway:

- Hoffman Engineering Co.

- Keystone/Rees, Inc.
- Square D Co.

Surface Metal Raceway:

- Airey-Thompson Co., Inc., A-T Power Systems.
- American Electric, Construction Materials Group.
- Butler Manufacturing Co., Walker Division.
- The Wiremold Co., Electrical Sales Division.

Surface Nonmetallic Raceway:

- Anixter Brothers, Inc.
- Butler Manufacturing Co., Walker Division.
- Hubbell, Inc., Wiring Device Division.
- JBC Enterprises, Inc., Enduro Fiberglass Systems.
- Panduit Corp.
- United Telecom, Premier Telecom Products, Inc.
- Thermotools Co.
- The Wiremold Co., Electrical Sales Division.

Boxes, Enclosures, and Cabinets:

- Scott Fetzer Company, Adalet-PLM.
- Butler Manufacturing Co., Walker Division.
- Cooper Industries, Midwest Electric.
- Electric Panelboard Co., Inc.
- Erickson Electrical Equipment Co.
- American Electric, FL Industries.
- Hoffman Engineering Co., Federal-Hoffman, Inc.
- Hubbell Inc., Killark Electric Manufacturing Co.
- General Signal, O-Z/Gedney.
- Parker Electrical Manufacturing Co.
- Raco, Inc., Hubbell Inc.
- Robroy Industries, Inc., Electrical Division.
- Spring City Electrical Manufacturing Co.
- Square D Co.
- Thomas & Betts Corp.
- Woodhead Industries, Inc., Daniel Woodhead Co.

2.2. METAL CONDUIT AND TUBING

Rigid Steel Conduit: ANSI C80.1.

Intermediate Metal Conduit: ANSI C80.6.

Electrical Metallic Tubing and Fittings: ANSI C80.3 with set-screw or compression-type fittings.

Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

Fittings: NEMA FB 1, compatible with conduit/tubing materials.

2.3. NONMETALLIC CONDUIT AND TUBING

Rigid Nonmetallic Conduit (RNC): NEMA TC 2, Schedule 40 or 80 PVC.

PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2.4. OUTLET AND DEVICE BOXES

Sheet Metal Boxes: NEMA OS 1.

Cast Metal Boxes: NEMA FB 1, type FD, cast ferrous alloy box with gasketed cover.

Nonmetallic Boxes: NEMA OS 2.

2.5. FLOOR BOXES

Floor Box: Cast metal, fully adjustable, rectangular.

2.6. PULL AND JUNCTION BOXES

Small Sheet Metal Boxes: NEMA OS 1.

Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

3. EXECUTION

3.1. EXAMINATION

Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2. WIRING METHODS

Outdoors: Use the following wiring methods:

- Exposed: Rigid metal conduit.
- Concealed: Rigid or intermediate metal conduit.
- Underground, Single Run: Rigid nonmetallic conduit.
- Underground, Grouped: Rigid nonmetallic conduit.
- Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
- Boxes and Enclosures: NEMA Type 3R.

3.3. INSTALLATION

- Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- Install raceways level and square and at proper elevations.
- Complete raceway installation before starting cable installation.
- Use temporary closures to prevent foreign matter from entering raceway.
- Protect stub-ups from damage where conduits rise through pads. Arrange so curved portion of bends is not visible above the finished slab.
- Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
- Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, except as otherwise indicated.

- Run concealed raceways with a minimum of bends in the shortest practical distance except as otherwise indicated.
- Raceways Underneath Slabs: Install below compacted stone. All 90 degree bends shall be below compacted stone with conduit penetrations of slab fully vertical.
- Transition nonmetallic tubing to rigid steel conduit before rising above floor.
- Run parallel or banked raceways together, on common supports where practical.
- Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.
- Join raceways with fittings designed and approved for the purpose and make joints tight.
- Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
- Tighten set screws of threadless fittings with suitable tool.
- Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
- Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- Install pull cord in empty raceways. Use 200 pound test nylon cord.
- Raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install in maximum lengths of 150 feet (45 m) and with a maximum of two 90-deg bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.
- Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
 - Where conduits enter or leave hazardous locations.
 - Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 - Where otherwise required by the NEC.
- Stub-Up Connections: Extend conduits through concrete pad with an adjustable top or coupling threaded inside for plugs, and set flush with the finished pad. Transition to nonmetallic conduit to ridged steel conduit before penetrating pad. Extend cables to equipment with rigid steel conduit. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor. Install grounding hubs for all conduit stub-ups.
- Do not install aluminum conduit embedded in or in contact with concrete.
- Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment

manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.4. PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.

3.5. CLEANING

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

END OF SECTION 16100

SECTION 16119 – UNDERGROUND DUCTS & UTILITY STRUCTURES

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

This Section includes underground conduits and ducts, pull boxes, handholes, concrete-encased duct banks, and other underground utility structures.

Related Sections: The following Sections contain requirements that relate to this Section:

- Division 2 Section “Earthwork” for general requirements for excavation, backfill and related items for ducts, manholes, and handholes.
- Division 3 Section “Cast-In-Place / Ready Mix Concrete” for cast-in-place concrete requirements.

1.3. DEFINITIONS

Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground, embedded in earth or concrete.

1.4. SUBMITTALS

General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

Product data for metal accessories for conduit and miscellaneous components.

1.5. QUALITY ASSURANCE

Comply with NFPA 70 “National Electric Code” and ANSI C2 “National Electrical Safety Code” for components and installation.

Listing and Labeling: Provide products specified in this Section that are listed and labeled.

- The Terms “Listed” and “Labeled”. As defined in the “National Electrical Code,” Article 100.
- Coordinate layout and installation of ducts with final arrangement of other utilities as determined in the field.

1.6. DELIVERY, STORAGE, AND HANDLING

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

2. PRODUCTS

2.1. MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- Nonmetallic Ducts:
 1. Arcco Corp.
 2. Breeze-Illinois, Inc.
 3. CANTEX, Inc.
 4. Carlon; Lamson & Sessions Company

5. Pipe & Plastic Group; Certaineed Products Corp.
6. Cole-Flex Co.
7. Electri-Flex Co.
8. Spiraduct, Inc.

2.2. CONDUIT AND DUCT

Rigid Steel Conduit: ANSI C80.1, galvanized.

Plastic Conduit for Direct Burial and Riser Applications: EPC-40-PVC UL 651 and NEMA TC 2.

Plastic Conduit for Concrete Encasement: DB-60-PVC UL 651 and NEMA TC 6 & 8.

Manufactured Bends: Not less than 36 inch (900 mm) radius.

High Density Polyethylene (HDPE) Electrical Conduit for Directional boring. Smoothwall, approved/listed for directional boring, minimum Schedule 80 UL 651 and NEMA TC 7.

2.3. ACCESSORIES

Duct Supports: Rigid PVC spacers selected to provide minimum duct spacings.

Duct Sealing Compound: Nonhardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 deg F (1 deg C), withstands temperature of 300 deg F (149 deg C) without slump, and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and the common metals.

3. EXECUTION

3.1. APPLICATION

Direct buried or concrete encased PVC conduit.

3.2. EXAMINATION

Examine site to receive ducts for compliance with installation tolerances and other conditions affecting performance of the underground ducts. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3. EARTHWORK

Excavation and Backfill: Conform to Section 16050, 3.3 "EXCAVATION", but do not use heavy-duty, hydraulic-operated compaction equipment.

Restore surface features at areas disturbed by excavation, and re-establish original grades except as otherwise indicated. Replace removed sod as soon as possible after backfilling is completed. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

Paving: Where cuts are made in any paving, the paving and subbase shall be restored to their original condition. South Carolina Department of Transportation (SCDOT) standards shall be followed wherever applicable.

Utilities: Where existing utilities are shown or noted on the Drawings to be altered or removed by others, or by a local utility company or municipality for installation of the new construction, give sufficient notice to applicable parties so that such alteration can be made.

3.4. CONDUIT & DUCT INSTALLATION

Install nonmetallic conduit and duct as indicated according to manufacturer's written instructions.

Depths to the top of conduits shall not be less than 24 inches for conduits with secondary and service cables and not less than 30 inches for conduits with primary cables. Conduits shall slope toward manholes or pull boxes and shall not have low points between ends.

Direct buried conduits shall be PVC schedule 40 or Schedule 80.

All underground concrete-encased conduits shall be Type DB encased in a 4,000 minimum psi concrete, to a minimum thickness of 3 inches from any conduit. Concrete encasement shall be reinforced with ½" steel rebar. The top of the encasement shall be a minimum of 21" below earth grade and a magnetically detectable tape (minimum width 1") is to be buried 6" below finished grade and following the centerline of the encasement. Conduits' outer edges within the encasement are to be spaced a minimum of 1" apart as shown on the drawings. All conduit segments are to be supplied with a nylon pull rope or ribbon of sufficient tensile strength to facilitate the installation of cables.

Rigid PVC interlocking spacers shall be used in concrete, selected to provide minimum conduit spacings and cover depths indicated while supporting conduits during concreting and backfilling; produced by the same manufacturer as the conduits.

Provisions shall be taken to prevent conduits from floating during concreting process, either by fastening spacers to trench bottom or by placing weights on entire conduit and spacer assembly. Ensure that conduits are adequately spaced to allow concrete to fill all voids between conduits.

All concrete-encased conduits shall be plugged during the concreting and backfilling processes. Duct plugs shall be manufactured from high impact plastic components and shall be corrosion proof. Duct plugs shall contain a durable elastic compressible gasket which will make it effective as a long term or temporary seal. They shall be removable and reusable. They shall meet or exceed the following mechanical requirements:

- a. Air Pressure 7.5 psi
- b. Water Head 15 ft.
- c. Pull Out 100 Kgf

Duct plugs used on spare conduits shall be equipped with a rope tie device on the back compression plate to allow the securing of a pull rope. This will allow excess rope slack to be stored within the conduit.

Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. Use manufactured long sweep bends with a minimum radius of 36" both horizontally and vertically at other locations.

- Make joints in ducts and fittings watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

3.5. CONNECTIONS TO EXISTING CONCRETE PADS

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.6. CONNECTIONS TO EXISTING DUCTS

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks.

3.7. DIRECTIONAL BORING

HDPE conduits must be installed below the frostline and as specified herein.

3.8. FIELD QUALITY CONTROL

Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and utility structures.

Duct Integrity: Rod ducts with a mandrel $\frac{1}{4}$ inch (6 mm) smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest.

Correct installations where possible, and retest to demonstrate compliance. Otherwise, remove and replace defective products and retest.

3.9. CLEANING

Pull brush through full length of ducts. Use round bristle brush with a diameter $\frac{1}{2}$ inch (12 mm) greater than internal diameter of duct.

END OF SECTION 16119

SECTION 16120 - WIRES AND CABLES

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

This Section includes wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.

Related Sections: The following Sections contain requirements that relate to this Section:

- Division 16 Section 16124 "Medium-Voltage Cables."
- Division 16 Section 16190 "Supporting Devices" for supports and anchors for fastening cable directly to building finishes.
- Division 16 Section 16195 "Electrical Identification" for insulation color coding and wire and cable markers.

1.3. SUBMITTALS

General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

Field test reports indicating and interpreting test results relative to compliance with performance requirements of testing standard.

Submit manufacturer's catalog descriptions of each wire, cable, or conductor for engineer's approval before ordering cable.

1.4. QUALITY ASSURANCE

Comply with NFPA 70 "National Electrical Code" for components and installation.

Listing and Labeling: Provide products specified in this Section that are listed and labeled.

The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.

1.5. SEQUENCING AND SCHEDULING

Coordination: Coordinate layout and installation of cable with other installations.

Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

1.6. DELIVERY, STORAGE, AND HANDLING

Deliver wire and cable according to NEMA WC-26.

2. PRODUCTS

2.1. MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Wires and Cables:

- American Wire Group

- Houston Wire & Cable
- Prysmian Group
- Southwire Co.
- Okonite Co.

Connectors for Wires and Cables:

- AFC, Monogram Co.
- AMP, Inc.
- Anderson, Square D Co.
- Electrical Products Division, 3M Co.
- O-Z/Gedney Unit, General Signal
- Thomas & Betts
- Burndy

2.2. LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements, or in accordance with NEMA WC 70. Service entrance conductors must conform to UL 854, type USE.

2.3. CONNECTORS AND SPLICES

UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated. Select to comply with Project's installation requirements and as specified in Section 3.2 "Applications" Article. All control circuits are to be terminated with "ring tongue" insulated compression lugs.

Low voltage cables in manholes or pull boxes shall be terminated with compression NEMA spade terminals with insulated sleeves. Connectors shall be submersible insulated multi-port bus, Thomas & Betts Homac Flood-Seal, 125 Series or 175 Series as noted on the drawings, or acceptable equal.

3. EXECUTION

3.1. EXAMINATION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

Examine raceways to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2. APPLICATIONS

Primary 12.47 kV distribution: Refer to Medium Voltage Cables Section 16124

Secondary and Services: Refer to Section 2.2 above.

3.3. INSTALLATION

- Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation."
- Pull cables into raceway simultaneously where more than one is being installed in same raceway.
- Use pulling compound or lubricant where necessary; compound used must not deteriorate cable or insulation.

- Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- Cable Splices: Splices are not allowed unless noted on drawings.
- Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.
- Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

4. FIELD QUALITY CONTROL

4.1. TESTING

Secondary or service low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations of conductors in the same trench, duct, or cable, with other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 \div (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable shall then be retested until failures have been eliminated.

4.2. PROCEDURES

Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.3.2. Certify compliance with test parameters.

4.3. CORRECTIONS

Correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

END OF SECTION 16120

SECTION 16124 – MEDIUM VOLTAGE CABLES

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

This Section includes cables and related splices, terminations, and accessories for electrical distribution systems rated above 2,000 volts.

This Section also includes medium voltage cable testing and acceptance requirements.

Related Sections: The following Sections contain requirements that relate to this Section:

- Division 16 Section 16190 "Supporting Devices" for cable and termination supports.
- Division 16 Section 16195 "Electrical Identification" for cable markers.

1.3. SUBMITTALS

General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

- Product data for cables and cable accessories, including splices and terminations including warranty statement.
- Product certificate signed by manufacturer that its products comply with the specified requirements.
- Product Test Reports: Certified reports of manufacturers' design and production tests indicating compliance of cable and accessories with referenced standards.
- Field test reports indicating and interpreting test results relative to compliance with performance requirements specified. Include certified copies of field test records.
- Maintenance Data: For cables and accessories, to be included in the "Project Manual" specified in Division 1.
- In-Service Data: Include periodic tests of cables in service.
- Provide certification of compliance with the Engineer's design requirements for each directional bore, including: HDPE conduit size and type, bend radius, elevation changes, and vertical and horizontal path deviations. Record location and depth of all directional-bore installed HDPE conduits using Global Positioning System (GPS) recording means with "resource grade" accuracy

1.4. QUALITY ASSURANCE

Installer Qualifications: Engage an experienced and certified cable splicer to install, splice, and terminate medium voltage cables.

Manufacturer Qualifications: Firm experienced in manufacturing medium voltage cable and accessories similar to those indicated for this project, with a record of successful in-service performance.

Comply with NFPA 70 "National Electric Code" for components and installation.

Listing and Labeling: Provide products specified in this Section that are listed and labeled.

The terms "listed and labeled": As defined in the "National Electrical Code", Article 100.

Single-Source Responsibility: All medium voltage cable shall be the product of a single manufacturer.

2. DELIVERY, STORAGE & HANDLING

2.1. CABLE REELS

Deliver medium voltage cables on factory reels conforming to NEMA WC26.

The Contractor shall inspect each reel of cable upon delivery. At this time, the cable protective covering shall be inspected for damage. Any damage found shall be reported to the Engineer without delay.

Loading and unloading shall be accomplished so that the lifting equipment does not contact the cable protective wrap or the cable surface. If a crane is used, the either a cradle supporting the reel flanges or a shaft through the arbor hole shall be used. If a fork lift is used, the forks shall lift the reel at 90 degrees to the reel flanges and the fork shall be long enough to make complete lifting contact with the flanges. Under no circumstances shall the forks contact the cable surface or the protective wrap. If an inclined ramp is used, the ramp shall be at the bottom of the ramp shall be accomplished by using the reel flanges and not the surface of the cable.

Under no circumstances shall the reels be dropped from any vehicle or equipment onto the ground or any other surface.

Reels shall be stored, standing on the flange edges, on a rigid surface to ensure that the flanges do not sink into the earth and do not allow the weight of the reel and cable to rest on the cable surface. Reels shall not be stored resting on the flat side of the flanges.

Cable shall not be stored in any area where it may be contacted by vehicles, equipment, falling objects, chemicals, petroleum, or other harmful materials, or where it may be damaged by high heat.

When the cable is to be installed at ambient temperatures 32 F (0 C), it shall be stored in a heated area at least 24 hours prior to installation. The cable shall not be installed at temperatures below 14 F (-10 C).

Whenever cable reels are moved by rolling, roll in the correct direction to avoid loosening the cable on the reel. Clear the rolling area of objects which could contact or possibly damage the cable or the protective wrap.

2.2. CABLE END SEALING

All cable ends shall be sealed when in storage or when installed and temporarily not terminated.

Procedure: The cable end shall be cleanly and squarely cut off. To the cable end apply a 3 ¾ inch square section on vinyl plastic seal over the exposed tape shall be applied lengthwise over the end of the cable first, and then wrapped tightly over the length of the cable for 3 inches to completely cover the seal material. The wrapping tape shall be overlapped by at least half the tape width.

The vinyl plastic seal shall be Aqua Seal or equivalent.

3. PRODUCTS

3.1. MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- Power Cable:
 1. Cablec Corp.
 2. Hubbell Inc., The Kerite Co.
 3. The Okonite Co.
 4. Power Cable Division, Pirelli Cable Corp.

- Cable Splicing and Terminating Products and Accessories:
 1. Cooper Power Systems, Inc., RTE Components
 2. Elastimold
 3. Raychem Electrical Products Division
 4. 3M Electrical Products Division
- Separable Insulated Connector Components and Accessories:
 1. Cooper Power Systems, Inc., RTE Components
 2. Elastimold
 3. Joslyn Manufacturing Co.

3.2. CABLE

Type: MV105, Primary UD EPR cable

Conductor: Aluminum phase conductor, stranded

Conductor Stranding: Filled with water swellable agent meeting or exceeding ICEA T-31-610 water penetration resistance and ANSI/NEMA class A connectorability requirements.

Rated System Voltage Class: for 12.47 kV application: 15 kV, Primary UD

Insulation: Discharge resistant ethylene propylene rubber (EPR) conforming to ANSI/ICEA S-94-649, UL 1072, RUS 1728F-U1 and AEIC CS8. Insulation shall be of a color contrasting with the extruded semi-conducting shield. Insulation rating shall equal or exceed 100 percent of the rated system voltage class. The cable shall be heat, moisture, ozone and corona resistant, for use at 105 C conductor temperature. The insulation compound shall be compounded by the manufacturer in its own facility.

Concentric Neutral: Bare copper wires.

Jacket: Insulating linear low density polyethylene applied over the insulation shield. The jacket shall be oil, acid, alkali and sunlight resistant and meet or exceed NEMA WC74 and UL 1072.

Standards: The cable shall meet or exceed the following standards: ANSI/ICEA S-94-649, UL 1072, RUS 1728F-U1 and AEIC CS8

3.3. SPLICE KITS

Connectors: IEEE 404, compression type, as recommended by cable or splicing kit manufacturer for the application.

Splicing Products: As recommended in writing by the splicing kit manufacturer for the specific sizes, ratings, and configurations of cable conductors and splices specified. Include all components required for complete splice, with detailed instructions.

Heat-shrink splicing kit of uniform cross-section polymeric construction with outer heat-shrink jacket.

Premolded, cold-shrink rubber, inline splicing kit.

3.4. LOAD BREAK ELBOW CONNECTORS

The molded rubber 15 kV class, fused, load break, elbow cable connector termination kits shall be designed and manufactured for terminating the specified power cables. Contractor shall coordinate with manufacturers' data to determine exact diameters. Insulation class shall be equivalent to that of the cable.

Elbow connectors shall meet ANSI and IEEE standards C37.40, C37.41, C37.47, and 386-2006. Elbow connectors shall be fully shielded and insulated capable of full range current limiting fuse protection. Molded

materials shall of high quality peroxide-cured insulating and semi-conducting EPDM rubber. Standard features shall include a copper probe adapter, coppertop connector, copper load break probe with an ablative arc-follower tip and stainless steel reinforced pulling eye. Feed-thru elbow connectors shall be provided where indicated on the drawings.

3.5. CABLE TERMINATIONS

The terminations shall be Class 1 for shielded cable, meeting the latest release of IEEE Standard 48, and suitable for use outdoors on underground circuit dip poles. The terminations shall be of the molded elastomer, prestretched elastomer, or heat-shrinkable elastomer.type, with multiple molded nontracking skirt modules, and compression-type connector. Terminations for shielded cables shall include a shield ground strap.

Terminations, must be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding. Terminations must be provided in a kit, including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations must be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated.

3.6. SOURCE QUALITY CONTROL

Test and inspect cables according to NEMA WC74 before shipping.

3.7. MEDIUM VOLTAGE CABLE WARRANTY

The cable manufacturer shall warrant each reel of cable to be free from defects in material, design and workmanship to provide reliable performance for a twenty-five (25) year life.

The warranty assumes the cable is installed, spliced, terminated and maintained in accordance with manufacturer's recommendations.

Prior to termination or splicing of cable, the contractor responsible for same shall submit qualifications of his personnel responsible for this work and their qualification to do same. Upon approval by the engineer in writing, contractor may proceed with this portion of the work.

Defective cable shall be replaced at no cost to the owner.

- When the manufacturer and the owner mutually determine a portion of or all the cable is defective, the cable manufacturer shall furnish replacement of said cable without charge.
- The replacement cable shall comply with these requirements and be delivered to the original delivery point free of any charge to the owner or the state of North Carolina.

Contractor shall state on his bid form the name of the cable manufacturer he intends to supply. Failure to do this places the contractor at risk of rejection of his bid.

Cable shop drawings shall include said described warranty from the cable manufacturer properly signed, and having the manufacturer's corporate seal affixed thereto.

4. EXECUTION

4.1. EXAMINATION

Examine raceways to receive medium voltage cables for compliance with installation tolerances and other conditions affecting performance of the cable. Do not proceed with installation until unsatisfactory conditions have been corrected.

4.2. INSTALLATION

Install medium voltage cable as indicated, according to manufacturer's written instructions and IEEE 576.

Pull cables simultaneously where more than one cable is indicated in same raceway. Use NRTL-listed and manufacturer-approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

Use pulling means including fish tape cable, rope, and basket-weave wire/cable grips that will not damage cables or raceways. Do not use rope hitches for pulling attachment to cable.

In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.

Install splices at pull points and elsewhere as indicated using standard kit. Conform to kit manufacturer's written instructions.

Install terminations at ends of cables and seal multiconductor cable ends with standard kits. Conform to manufacturer's written instructions. Comply with classes of terminations indicated.

4.3. GROUNDING

Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated connector fittings, and hardware according to manufacturer's written instructions.

4.4. IDENTIFICATION

Identify cable in accordance with Division 16 Section "Electrical Identification".

4.5. FIELD QUALITY CONTROL

Testing: Upon installation of medium voltage cable and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.3.3. Certify compliance with test parameters.

Correct malfunctioning units at site, where possible, and retest to demonstrate compliance, otherwise, remove and replace with new units and retest.

4.6. PROTECTION

Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer, to prevent entrance of moisture into the cable and ensure that medium voltage cable is without damage or deterioration at Substantial Completion.

4.7. TESTING AND ACCEPTANCE

After installation, prior to connection to an existing system, and before the operating test, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors at one terminal and connecting grounds or metallic shieldings or sheaths of the cable at the other terminal for each test. Prior to the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with IEEE 400.1 for the particular type of cable installed, and shall not exceed the recommendations of IEEE 404 for cable joints unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

Test work method and data sheet, including test date, time, and voltages shall be submitted to and approved by the Engineer prior to test voltage being applied to cables.

If new cable is spliced into existing cable, the new cable should be tested as specified prior to splice. After completing the splice, the completed connection shall be tested at the system operating voltage.

END OF SECTION 16124

SECTION 16190 - SUPPORTING DEVICES

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

Requirements of the following Division 16 Sections apply to this section:

- Division 16 Section 16010 "Basic Electrical Requirements."
- Division 16 Section 16050 "Basic Electrical Materials and Methods."

1.2. SUMMARY

This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

Related Sections: The following Sections contains requirements that relate to this Section:

- Refer to other Division 16 sections for additional specific support requirements that may be applicable to specific items.

1.3. SUBMITTALS

General: Submit the following in accordance with General Conditions.

Product data for each type of product specified.

Shop drawings indicating details of fabricated products and materials.

1.4. QUALITY ASSURANCE

Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

2. PRODUCTS

2.1. MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- Slotted Metal Angle and U-Channel Systems:
 1. Allied Tube & Conduit
 2. American Electric
 3. B-Line Systems, Inc.

4. Cinch Clamp Co., Inc.
 5. GS Metals Corp.
 6. Haydon Corp.
 7. Kin-Line, Inc.
 8. Unistrut Diversified Products
- Conduit Sealing Bushings:
 1. Bridgeport Fittings, Inc.
 2. Cooper Industries, Inc.
 3. Elliott Electric Mfg. Corp.
 4. GS Metals Corp.
 5. Killark Electric Mfg. Co.
 6. Madison Equipment Co.
 7. L.E. Mason Co.
 8. O-Z/Gedney
 9. Producto Electric Corp.
 10. Racco, Inc.
 11. Red Seal Electric Corp.
 12. Spring City Electrical Mfg. Co.
 13. Thomas & Betts Corp.

2.2. COATINGS

Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.3. MANUFACTURED SUPPORTING DEVICES

Raceway Supports: Riser clamps, conduit straps, threaded C-clamps with retainers, and spring steel clamps.

Fasteners: Types, materials, and construction features as follows:

- Expansion Anchors: Carbon steel wedge or sleeve type.
- Toggle Bolts: All steel springhead type.
- Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

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

Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of cable gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

U-Channel Systems: 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.4. FABRICATED SUPPORTING DEVICES

General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

3. EXECUTION

3.1. INSTALLATION

Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

Raceway Supports: Comply with the NEC and the following requirements:

- Conform to manufacturer's recommendations for selection and installation of supports.

Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

- Support individual horizontal raceways by separate pipe hangers. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
- Space supports for raceway in accordance with NEC.
- Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

END OF SECTION 16190

SECTION 16195 - ELECTRICAL IDENTIFICATION

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

Requirements of the following Division 16 Sections apply to this section:

- Division 16 Section 16050 "Basic Electrical Requirements."
- Division 16 Section 16010 "Basic Electrical Materials and Methods."

1.2. SUMMARY

This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:

- Buried electrical line warnings.
- Identification labeling for raceways, cables, and conductors.
- Operational instruction signs.
- Warning and caution signs.
- Equipment labels and signs.

Related Sections: The following Sections contain requirements that relate to this Section:

- Division 16 Section 16120 "Wires and Cables" for requirements for color coding of cables for phase identification.

Refer to other Division 16 sections for additional specific electrical identification associated with specific items.

1.3. SUBMITTALS

General: Submit the following in accordance with General Conditions.

Product Data for each type of product specified.

Schedule of identification nomenclature to be used for identification signs and labels.

Samples of each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

Cable schedule for inclusion in Project Maintenance Manual.

Proof copy of one line diagram sign for approval before production.

1.4. QUALITY ASSURANCE

Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

ANSI Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems," with regard to type and size of lettering for raceway and cable labels.

2. PRODUCTS

2.1. MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- American Labelmark Co.
- Calpico, Inc.
- Cole-Flex Corp.
- Emed Co., Inc.
- George-Ingraham Corp.
- Ideal Industries, Inc.
- Kraftbilt
- LEM Products, Inc.
- Markal Corp.
- National Band and Tag Co.
- Panduit Corp.
- Radar Engineers Div., EPIC Corp.
- Seton Name Plate Co.
- Standard Signs, Inc.
- W.H.Brady, Co.

2.2. ELECTRICAL IDENTIFICATION PRODUCTS

Underground Line Marking Tape: Permanent, bright-colored, continuous-printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below and as indicated on the drawings.

Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 inches by 2 inches by 19 gage.

Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color coding.

Heat Shrink Sleeves: Premanufactured heat shrinkable sleeves installed at each cable end, yellow or orange color with indelible marking.

3. EXECUTION

3.1. INSTALLATION

Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker. Install line marker for all underground cable and wiring, both direct-buried and in raceway.

Cable Color Coding: Provide color coding for secondary cables throughout the project secondary electrical system as follows:

- Cables connected to open-wye/open-delta transformer banks – black
- Cables connected to single phase transformers - red

Use cables with color factory-applied the entire length of the cables.

Phase Identification: Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration. Use red tape for Phase A, blue tape for Phase B, black tape for Phase C, and white tape for Neutral.

Power Circuit Identification: Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders, and power circuits in pull boxes, manholes, and transformer enclosures with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb test monofilament line or one-piece self-locking nylon cable ties.

Tag or label cables as follows at the conduit entry:

- Primary and Secondary Cables – manhole, pull box, or transformer number
- Service Cables – service address

END OF SECTION 16195

SECTION 16320 – PAD MOUNTED TRANSFORMERS

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

1.2. SUMMARY

This section describes the setting and installation of the Owner supplied pad mounted transformers. The use of the term “pad mounted transformer” describes all transformers to be installed with medium voltage windings on the primary and low voltage windings on the secondary.

Related Sections: The following Section contains requirements that relate to this Section.

- Division 2 Section 02110: “Site Preservation”
- Division 3 Section 03300: Cast in Place / Ready Mix Concrete for equipment pads.
- Division 16 Section 16124: “Medium Voltage Cables”

1.3. QUALITY ASSURANCE

Comply with NFPA 70, “National Electrical Code”.

2. EXECUTION

2.1. INSTALLATION

The Contractor shall set and anchor all owner supplied transformers as indicated on the drawings.

The Contractor shall make all medium voltage, low voltage power, neutral, and ground connections necessary for proper operation of each pad mounted transformer. This shall include the installation of all necessary underground ducts and raceways

Contractor shall install transformers and accessory items according to manufacturer’s written installation instructions and the following specifications.

2.2. IDENTIFICATION

Identify field-installed wiring and components and provide warning signs according to Division 16 Section “Electrical Identification”.

Transformer labels: Stencil the transformer number and primary phase in durable, long lasting paint on each new pad-mounted transformer and existing pad-mounted transformer. Three-phase pad-mounted transformers should be listed as ØABC.

2.3. GROUNDING

Connections: Ground transformers to grounding system as indicated on the drawings and in Division 16 “Grounding”.

2.4. CONNECTIONS

Install medium voltage, low voltage, neutral and ground connections.

Tighten all electrical connectors and terminals according to manufacturer’s published torque-tightening values. Where these values are not indicated, use those specified in UL 486A and UL 486B.

2.5. CLEANING

Inspect exterior of installed transformers. Remove paint splatters and other spots, dirt, and debris and thoroughly clean finish to restore a new appearance. Touch up scratches and mars of finish to match original finish.

Ensure transformer enclosure open and close properly with no binding or excessive force required. Ensure all enclosure safety locks and anti-tamper devices are working properly.

2.6. PROTECTION

Protect transformer finish and components during construction work by covering with tarpaulins or other appropriate cover.

END OF SECTION 16320

SECTION 16452 – GROUNDING

1. GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

Requirements of the following Division 16 Sections apply to this Section:

- Division 16 Section 16010 "Basic Electrical Requirements."
- Division 16 Section 16050 "Basic Electrical Materials and Methods."

1.2. SUMMARY

This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.3. SUBMITTALS

General: Submit the following in accordance with General Conditions.

Product data for ground rods, connectors and connection materials, and grounding fittings.

Report of field tests and observations certified by the testing organization.

1.4. QUALITY ASSURANCE

Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code" (NEC).

2. PRODUCTS

2.1. MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

- Anixter Bros., Inc.
- Bashlin Industries, Inc.
- Buckingham Mfg. Co.
- A.B. Chance Co.
- Dossert Corp.
- Engineered Products Co.
- Erico Products, Inc.
- Galvan Industries, Inc.
- GB Electrical, Inc.

- General Machine Products Co., Inc.
- Hastings Fiber Glass Products, Inc.
- Ideal Industries, Inc.
- Kearney-National.
- McGill Mfg.
- O-Z/Gedney Co.
- Post Glover Resistors, Inc.
- Racco, Inc.
- Thomas & Betts Corp.
- W.H. Salisbury & Co.
- Utilco Co.
- DMC Power

2.2. GROUNDING AND BONDING PRODUCTS

Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

Conductor Materials: Copper.

2.3. WIRE AND CABLE CONDUCTORS

General: Comply with Division 16 Section "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

Equipment Grounding Conductor: Green insulated.

Grounding Electrode Conductor: Bare Stranded cable.

Bare Copper Conductors: Conform to the following:

- Solid Conductors: ASTM B-3.
- Assembly of Stranded Conductors: ASTM B-8.
- Tinned Conductors: ASTM B-33.

2.4. MISCELLANEOUS CONDUCTORS

Ground Bus: Bare annealed copper bars of rectangular cross section.

Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.

Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.5. CONNECTOR PRODUCTS

General: Listed and labeled as grounding connectors for the materials used.

Pressure Connectors: High-conductivity-plated units.

Bolted Clamps: Heavy-duty units listed for the application.

Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

Swage Compression Connections: Swage ground connection system as manufactured by DMC Power may be installed as an alternative to exothermic welded connections.

2.6. GROUNDING ELECTRODES

Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.

Size: 5/8 inch by 8 feet.

3. EXECUTION

3.1. APPLICATION

Install grounding at transformers in accordance with drawings. Bond transformer enclosures to the grounding system.

Install grounding in manholes and pull boxes to bond all wall support channels to existing grounding electrodes. If the existing grounding electrodes are corroded such that the copper cladding is not intact or it is not practicable to make exothermic weld connections to the ground conductors, notify the Engineer.

3.2. GROUNDING ELECTRODES

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.

If the specified ground resistance is not met, an additional ground rod must be provided in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Engineer immediately.

3.3. CONNECTIONS

General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.

Make connections with clean bare metal at points of contact.

Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

Exothermic Welded or Swage Compression Connections: Use for connections to structural steel and for underground connections. Install at connections to ground rods and plate electrodes. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

3.4. FIELD QUALITY CONTROL

Tests: Measure the resistance of each ground rod using the fall-of-potential method defined in IEEE 81. If the resistance is greater than 25 ohms, notify the Engineer. Maintain records of all resistance tests.

END OF SECTION 16452

8 DRAWINGS

The following drawings for the Front Street Underground Electrical System Upgrade Project #1919 are included as a part of this specification:

Drawing No.	Sheet No.	Title
G1001	1	Front Street Electric Upgrade Ph. 1 Title Sheet
G1002	1	Front Street Electric Upgrade Ph. 1 Legend, Abbreviations & General Notes
E1001	1	Front Street Electric Upgrade Ph. 1 Overall Equipment Location Plan
E1002	1 - 2	Front Street Electric Upgrade Ph. 1 Electrical Plan Existing
E1003	1 - 2	Front Street Electric Upgrade Ph. 1 Electrical Plan New
E1004	1 - 2	Front Street Electric Upgrade Ph. 1 Construction Sequence Steps 1-3, 4
E1005	1	Front Street Electric Upgrade Ph. 1 Bill of Materials
E1011	1	Front Street Electric Upgrade Ph. 1 Miscellaneous Details
E1012	1	Front Street Electric Upgrade Ph. 1 Cable Racking Details Manhole T1A
E1013	1	Front Street Electric Upgrade Ph. 1 Cable Racking Details Manhole T1B
E1021	1	Front Street Electric Upgrade Ph. 1 Cable Racking Details Pullbox 1
E1022	1	Front Street Electric Upgrade Ph. 1 Cable Racking Details Pullbox 2
E1023	1	Front Street Electric Upgrade Ph. 1 Cable Racking Details Pullbox 3
E1040	1	Front Street Electric Upgrade Ph. 1 Conduit and Cable Schedule
E1050	1 - 2	Front Street Electric Upgrade Ph. 1 Transformer Details
E1100	1 - 2	Front Street Electric Upgrade Ph. 1 One-Line Diagram Existing, New
S1001	1	Front Street Electric Upgrade Ph. 1 Structural Transformer Pads