

SECTION 01 01 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. The intended contract is a design-build contract, based on the 30% concept drawings showing in the request for qualifications package. Provide a licensed Electrical Engineer in the State of Utah as part of the Design-Build team.
- B. The intended work encompasses the purchasing, installation, and testing of a new medium voltage underground and overhead power system, three phase upgrade from the existing single phase line.
- C. Time is of the essence. All work shall proceed sequentially and on time, including shop drawing submittals, ordering equipment, installation and testing.
- D. Authorization to proceed may or may not be awarded depending on bid amounts and budgeting. The owner reserves the right to negotiate or remove certain portions of work prior to award.
- E. This contract is subject to liquidated damages as per the General Conditions.

1.2 QUALIFICATIONS:

- A. Any qualified, licensed, and Insured General Contractor or Electrical Contractor may bid.
- B. Use only preapproved factory and products as specified. Alternative material vendors will be considered if submitted in writing at least 8 days prior to bid opening.
- C. Approvals of shop drawings shall be by the Engineer, and the owner.

1.3 ALTERNATES:

Alternate Number 1: Concrete encase the power ductbanks and provide concrete cap for telecommunications ducts.

Alternate Number 2: Provide vacuum fault interrupter switches at vaults 1, 2, and 4

Alternate Number 3: Provide Underground Power from Pistol Range to AT4 Road, pole numbers 101 through 109.

1.4 DELIVERY OF MATERIALS:

- A. It should be noted that the site is on an operating site, and as such the prime contractor must coordinate all activities. The vendor will have the right to ship material to the facilities during normal business hours pending only upon written approval of the prime contractor.

- B. There may be other subcontractors in the area. This vendor shall not impede the progress of other contractors.
- C. Vendor to keep all driveways, and parking accessible to other construction vehicles, staff and the general public as required. Protect occupants from hazards, including items on the ground, with fencing, barriers, or highly visible cones and/or rope/tape. Clean up after each days work.
- D. Protection and security of the staging area after delivery of the materials is the vendors responsibility.

1.5 CHANGE ORDERS

- A. The Owners intent is that all of the design shall be included in the design-build cost proposal by the contractor. However, some modifications, determined to be outside of the scope, may require a change order. Modifications may only be made by Owner or Engineer initiated proposal requests as indicated:
 - 1. A detailed proposal may be issued by the Engineer showing proposed changes. The Vendor shall price the changes, indicate any exceptions, make suggestions for alternatives, and indicate the impact to the schedule (if any), and submit for the Engineers review. Only upon written acceptance will the proposal become part of the contract.
 - 2. The contractor may notify the Engineer of a proposed or recommended change, that may or may not result in a formal proposal request by the Owner/Engineer. A detailed description of the proposed change must be written and given to the Owner for review.

The Owner/Engineer reserves the right to interpret the drawings and specifications, and review the costs associated with the proposed contractor change to determine the appropriateness of the change. If the change request is found to be part of the original contract documents, no change order will be issued. If the change request appears appropriate, and the owner/ Engineer wishes to accept the change, detailed pricing shall be submitted by the contractor, including all additions, or subtractions to the original contract price. Only upon written acceptance will the proposal become part of the contract.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Use only approved manufacturers as listed in the specifications, or those approved by written addenda.

PART 3 - EXECUTION

SUMMARY OF WORK

3.1 REQUEST FOR PAYMENT:

- A. Requests for payment shall be submitted to the Owner for review, no more than monthly. Payment requests shall be submitted with appropriate backup to show how much material has actually been shipped to the jobsite.
- B. The last five percent of the project total will not be made, until all programming, testing functions, testing reports, punchlist items, record drawings, and other items are completely installed and accepted by the owner.

END OF SECTION

SECTION 26 05 00 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the drawings and/or in these specifications, including all labor, services, permits, fees, utility charges, and incidentals necessary and required to perform and complete the electrical work described in this Division. Apply for all permits early in the project to avoid problems due to code revisions.
- B. See the contract conditions (general and supplementary) and Division 1 for requirements concerning this Division including, but not limited to, submittals, shop drawings, substitution requests, change orders, maintenance manuals, record drawings, coordination, permits, record documents and guarantees.
- C. Division 26 Contractor shall be responsible for all work indicated by divisions 26, 27, 28, and the electrical portions of 33 within the drawings and specifications. Any work indicated by Division 16 shall be provided and installed by the Division 26 Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Verify and coordinate all equipment locations and electrical characteristics with other trades involved in work in the vicinity. Coordination shall be done prior to rough-in or ordering equipment.

1.3 QUALITY ASSURANCE:

- A. Do all work in accordance with regulations of serving electric utility, National Electrical Code, state and local codes and amendments, National Fire Codes, National Electrical Safety Code, and all other applicable codes.

1.4 PROJECT CONDITIONS:

- A. The Contractor shall inspect the job site prior to bidding and familiarize himself with existing conditions which will affect the work. Prior to start of work, obtain "As built", "Record", or other Drawings showing existing underground utilities. Ask for Guard to assist in Bluestaking existing utilities.
- B. Electrical drawings are diagrammatic indicating approximate location of poles, boxes, electrical equipment, etc. When required make all deviations from Drawings to make the work conform to the jobsite as constructed, and to related work of others. Minor relocations ordered prior to installation, including relocations of underground lines by up to 15 feet, may be made without added cost to Owner.

- C. Call to the attention of the Engineer/Owner any error, omission, conflict or discrepancy in Drawings and/or Specifications. Do not proceed with any questionable items of work until clarification of same has been made.
- D. Verify the physical dimensions of each item of electrical equipment to fit the available space and promptly notify the Engineer/Owner prior to roughing-in if conflicts appear. Coordination of equipment to the available space and to the access routes through the construction area shall be the Contractor's responsibility.

1.5 SHOP DRAWINGS:

- A. Prior to ordering equipment, and prior to Contractor's first application for payment, the Contractor shall, within 14 days after award of this work, submit complete electronic shop drawings, with electronic indexed tabs, to the Engineer/Owner, of materials and equipment he proposes to furnish. It is preferred that all sections be submitted at once, however, in the event that one or more sections need approvals quickly and others are not prepared yet, the Engineer/owner will agree to review the individual section submittals needing immediate approval. However, each individual submittal section must be complete and remaining submittals that are not a rush shall be submitted all in one package as quickly as possible. Submitting individual sections over many weeks/months is highly discouraged and may result in scheduling delays.
- B. List shall bear Contractor's stamp, signature or other means to show that he has inspected same and certified that submitted material is correct in regard to quantity, size, dimension, quality and is coordinated with the Contract Documents.
- C. See individual sections within this Division for products requiring submittal.
- D. Each shop drawing submittal shall be prepared by the manufacturer, and shall clearly show manufacturer's name, catalog numbers, pictures, details, layout, type, size, rating, style, and all options identified in a permanent fashion. Specific items or options shall be permanently marked on sheets containing more than one option – do not rely on the Engineer to mark options. Yellow highlight will not be an acceptable means of marking.
- E. Large equipment drawings such as switches, enclosures, vaults, and similar large equipment shall include the size, weight, seismic rating, in addition to the product data.
- F. Some sections of this Division may require shop drawings prepared on full size site plans in AutoCAD or other CAD software. Where required, contact the Engineer/Owner for the latest version of the plans and match the size and scale of the construction drawings. Drawings delivered to the contractor from the Engineer may not include addenda changes. Contractor shall only use plans for purposes of the construction on this job, and not for any other use or reuse. Add any required addenda items prior to finishing submittals.
- G. Provide complete materials (all materials) list at the beginning of each tabbed section showing "Specification Section", "Material Item", "Manufacturer's Name and Catalog Number", and all pertinent data.
- H. Provide samples where required in individual sections of this Division.

- I. Contractor agrees that Shop Drawing Submittals processed by the Engineer/Owner are not Change Orders; that the purpose of Shop Drawing Submittals by the Contractor is to demonstrate to the Engineer/Owner that the Contractor understands the design concept, that they demonstrate their understanding by indicating which equipment and material they intend to furnish and install and by detailing the fabrication and installation methods they intend to use.
- J. Contractor further agrees that if deviations, discrepancies or conflicts between Shop Drawings and Specifications are discovered either prior to or after Shop Drawing Submittals are processed by the Engineer/Owner, the design Drawings and Specifications shall control and shall be followed.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. All materials shall be new and bear manufacturer's name, model number, electrical characteristics and other identification. All equipment to be U.L. approved or listed by another testing agency approved by authorities having jurisdiction.
- B. Material and equipment shall be standard product of manufacturer regularly engaged in production of similar material for at least five years (unless specifically exempted) and shall be manufacturer's latest design.
- C. If the description of a product is in conflict with the product as specified in the catalog number, the description shall generally take precedence. Contact the Engineer/Owner for clarification if this occurs.
- D. All equipment for essential or life safety systems must be rated and certified for the appropriate seismic design category or seismic use group for the installed location.

2.2 FUSES:

- A. Provide fuses as indicated on the drawings, sized per NEC, or as required by the equipment manufacturer, whichever provides maximum protection, for a fully operational system.
- B. All fuses shall be furnished of the same manufacturer.
- C. All fuses shall be installed by the electrical contractor at job-site and only when equipment is to be energized. Fuses shall not be installed during shipment.
- D. All fuses to be 200,000 AIC, Current-limiting, U.L., Time Delay, Dual-element Type.
- E. Approved Manufacturers, with catalog numbers listed in order: Bussman, Cooper, Hubble, S&C, Littelfuse, Ferraz Shawmut.
- F. If the electrical contractor wishes to furnish materials other than those specified, a written request, along with a complete short circuit and selective coordination study, shall be submitted to the Engineer/Owner for evaluation at least 8 days prior to the bid date. If the

engineer's evaluation indicates acceptance, a written addendum will be issued listing the other acceptable manufacturer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION METHODS:

- A. All items, articles, materials, and equipment specified under this Division shall be installed per the manufacturer's installation instructions. Where the manufacturer's instructions are in conflict with the directions provided elsewhere in this Contract, the Engineer shall be notified prior to beginning rough-in.
- B. Patch and correct finished surfaces damaged by electrical work.
- C. Switches, Enclosures, and equipment shall be level and plumb and installed parallel with site roadways. All equipment and enclosures shall fit neatly without gaps, openings, or distortions. Provide approved plates or devices for closing all unused openings.
- D. Arrange circuit wiring as shown on the Drawings and do not alter or combine runs or homeruns without the specific approval of the Engineer/Owner.
- E. All materials and equipment installed under this work shall be properly and adequately supported. Support systems shall provide a safety factor of four. This shall apply to hangers, anchors, clamps, screws, structural iron, and all other hardware and appurtenances associated with the support system.
- F. Maintain the following minimum separations from voice and data cables. Power conduit - 12".

3.2 LABELING:

- A. Clearly and properly label the complete electrical system to indicate the loads served or the function of each item of equipment provided under this work.
- B. Permanent Engraved nameplates: shall be 1/16 inch thick, laminated three-ply plastic, center-ply white, outer-ply black (for normal power) "Lamicoid" or equal. Letters shall be formed by engraving outer colored ply, exposing white center-ply, and shall be a minimum of 5/8 inch high. Nameplates shall be secured with screws or pop rivets.
- C. For Power poles, provide screw installed number reflecting the pole number.
- D. Provide permanent engraved nameplates for the equipment listed below as well as all other similar equipment; refer to each section for specific labeling requirements:
 - 1. Manholes and Vaults
 - 2. Medium Voltage Switches, Switchgear and Sectionalizing Cabinets
 - 3. New Power Poles

4. Other similar electrical devices and equipment

E. Self-Adhesive Labels are not allowed.

3.3 SAFETY:

A. The Engineer has not been retained or compensated to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the contractor to perform the work.

3.4 DEMOLITION:

A. It is the intent of these specifications to require the contractor to make all necessary adjustments to the electrical system, required to meet code, and accommodate installation of the new and remodeled work.

B. Remove all existing electrical equipment scheduled for demolition unless specifically shown as retained or relocated on the drawings.

C. Remove abandoned cables and abandon conduit underground.

D. Locations of items shown on the drawings as existing are partially based on as-built and other drawings which may contain errors. The Contractor shall verify the correctness of the information shown prior to bidding and provide such labor and material as is necessary to accomplish the intent of the contract documents. The plans may show some demolition conditions, but are not intended to show all of them.

E. All materials accumulated during the demolition process are the Owners property and shall be removed from the job site as directed by the Owner. If owner does not wish to salvage materials, contractor shall remove from jobsite and dispose, or recycle materials at contractor's discretion, in a lawful manner.

I. Demolish and dispose of hazardous materials in a lawful manner, such as poles that have been treated. All costs for proper disposal shall be paid by the contractor unless specified elsewhere in the general conditions.

3.5 POWER INTERRUPTIONS:

A. Keep outages to occupied areas to a minimum and prearrange all outages with the Owner's representative and utilities involved. Requests for outages shall state the specific dates and hours and the maximum durations, with the outages kept to these specified times.

B. Contractor shall coordinate with the Owner so that work can be scheduled not to interrupt operations, normal activities, site access, etc. Coordinate work with other contractors and trades in the vicinity for proper scheduling.

C. No circuits shall be turned off without prior approval from owner. Coordinate with the Owner any interruptions which affect the operation of the remaining portions of the facility.

- D. This contractor will be liable for any damages resulting from unscheduled outages or for those not confined to the preapproved times. Include all costs for overtime labor as necessary to maintain electrical services in the initial bid proposal. Temporary wiring and facilities, if used, shall be removed and the site left clean before final acceptance. Requests for outages must be submitted at least (5) days prior to intended shutdown time.

3.6 GROUNDING:

- A. Ground all electric equipment, raceways and enclosures in accordance with code rules and established safety practices.
- B. Grounds shall be installed where accessible for future inspection and servicing. Where ground connections are made underground or in inaccessible locations, they shall be made using an exothermic weld process, Cadweld or equivalent, or Ampact pressure connectors.

3.7 EQUIPMENT CONNECTIONS:

- A. The location and method for connecting to each item of equipment shall be verified prior to roughing-in. The voltage and phase of each item of equipment shall be checked before connecting. Verify motor rotation downstream of work and correct phasing as necessary.

3.8 SEISMIC BRACING:

- A. Furnish and install all seismic bracing of equipment, and other electrical items in accordance with prevailing codes. Refer to ASCE 7-05, section 13.6 for calculation methods. Provide and submit the required designs, calculations, certifications, and stamped drawings to the authority having jurisdiction and obtain their approval prior to installation or fabrication.

3.9 PAINTING:

- A. Where paint on electrical equipment is scratched or marred, the contractor shall provide touchup paint and repair surface until the Owner is satisfied.

3.10 PROJECT RECORD DOCUMENTS:

- A. Maintenance of Documents:
 - 1. Maintain at Jobsite, One Record Copy of: Contract Drawings, Specifications, Addenda, Reviewed Shop Drawings, Change Orders, Other Modifications to Contract and Field Test Records.
 - 2. Keep apart from documents used for construction.
 - 3. Keep documents available at all times for inspection by Architect.
- B. Recording:

1. Label each document "PROJECT RECORD."
 2. Keep record documents current. Do not permanently conceal any work until required information has been recorded.
 3. Contract Drawings, legibly mark to record actual construction; including but not limited to the following:
 - a. Depths of various elements; locations of underground items, with dimensions to building walls and corners; changes of dimensions and details; changes made by Addendum, Field Orders or Change Order.
 - b. Specifications and Addenda; legibly mark each Section to record changes made by Addendum, Field Order or Change Order.
- C. As-Built Submittals:
1. On completion of work, request from the Engineer/Owner a set of CAD disks of Electrical Drawings. Revise the files using AutoCAD or similar CAD software to show all changes, addenda items, variations from design drawings and exact routes of all feeders, service conduits, and locations of stubbed conduits. Include dimensions to all buried or concealed conduits to permanent structures.
 2. Deliver the revised files on CD or DVD disks, both in AutoCAD (.dwg) and Acrobat Reader (.pdf) formats, together with 1 set of reproducible prints, to the Engineer/Owner as "As-reported Record" drawings.
- D. Operation and Maintenance Manuals
1. At completion of project, prepare Operation and Maintenance Manuals with operation and Maintenance Data, contractors warranties, and copies of approved electrical permits. Include corrected copies of original submittals and shop drawings.
 2. See Division 1 for additional requirements.
- 3.11 WARRANTIES:
- A. Provide a minimum 1 year warranty on all electrical equipment, devices, labor, and work by Division 26 whether specified or not.
 - B. Provide warranties greater than 1 year as specified in other sections where stated. The warranty requirement most stringent shall be used where conflicts arise.
 - C. The systems listed below require warranties exceeding the minimum warranty:
 1. Medium Voltage (15 kV) Underground Cabling; 5 years refer to Section – 26 05 13
 - D. Provide copies of all warranties to the owner upon completion of the project.

3.12 COMPLETION:

- A. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of faults, shorts or unintentional grounds. Demonstrate system in the presence of the Engineer, the Owner or their representative when requested.

3.13 FINAL OBSERVATION:

- A. Contractor shall submit written certification that:
 - 1. Contract Documents have been reviewed.
 - 2. Contractor has inspected Project for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents.
 - 4. Equipment and Systems have been tested and are operational.
 - 5. Project is completed and ready for final inspection.
- B. Engineer/Owner will make final inspection as soon as possible after receipt of Certification.
- C. Should Engineer/Owner consider that work is finally complete in accordance with Contract Document requirements, Contractor shall make Contract Closeout submittals.
- D. Should Engineer/Owner consider that work is not finally complete:
 - 1. He will so notify Contractor, stating reasons.
 - 2. Contractor shall take immediate steps to remedy deficiencies, and send second written notice to Engineer/Owner certifying that work is complete.
 - 3. Engineer/Owner will re-inspect work.
- E. The Engineer/Owner will make two final inspections. The first will determine deficiencies and errors in the work and the second will determine whether or not the noted deficiencies and errors have been satisfactorily corrected.
- F. If additional inspections are required because of the Contractor's failure to complete the deficiencies and errors prior to the second inspection, costs for the successive inspections will be back-charged to the Contractor by the Owner. Charges will be based as follows:
 - 1. Owner/Engineer time at current billing rates.
 - 2. Travel time, and all other expenses incurred in making inspections.
- G. Contractor to provide one (1) journeyman, tools, meters, instruments and other test equipment required by Engineer/Owner. Contractor to remove and replace trims, covers,

etc., for Engineer/Owner to review materials, systems, methods and workmanship.
(Example: Removing Vault Lid covers and pad switch enclosure covers)

END OF SECTION

SECTION 26 05 13 – WIRES AND CABLES OVER 600 VOLTS

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide all medium voltage 15 kV wires and cables as herein specified and shown on the associated drawings.
- B. Provide all required terminations, splices, raceway, mounting equipment as required for a complete medium voltage wiring system.
- C. Provide all required testing and testing reports as herein specified and shown on the associated drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods – Section 26 05 00.
- B. Raceways – Section 26 05 33.
- C. Overhead Medium Voltage Wiring – Section 33 71 49

1.3 QUALITY ASSURANCE:

- A. All cable shall conform to the current standards: Insulated Cable Engineers Association (ICEA), Association of Edison Illuminating Companies (AEIC), National Electrical Code (NEC), and be U.L. listed.
- B. Each reel of cable furnished shall be newly manufactured (no more than 12 months old) and shall bear a tag containing the name of manufacturer, NEC designation and year of manufacture.

1.4 SUBMITTALS:

- A. Submit complete and descriptive shop drawings indicating compliance with the specifications herein as well as any additional information requested by the A/E. Include submittals for all cables, terminations and splices.
- B. Include shop drawings for termination products to each existing switch after field verifying the termination product on the existing switches.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:
WIRES AND CABLES OVER 600 VOLTS

- A. Subject to the final approval and acceptance by the A/E and Owner, provide cable products from one of the following manufacturers:
 - 1. General Cable
 - 2. Okonite
 - 3. Kerite

- B. Subject to the final approval and acceptance by the A/E and Owner, provide molded product deadbreak and loadbreak termination products from one of the following manufacturers:
 - 1. Thomas and Betts Elastimold
 - 2. Cooper
 - 3. 3M

- C. Subject to the final approval and acceptance by the A/E and Owner, provide splice products from one of the following manufacturers:
 - 1. Raychem
 - 2. 3M

- D. Requests for substitution of other products will be considered if submitted in accordance with the General Conditions, Division 01, and Section 26 05 00 to the A/E office within (8) business days prior to the bid opening day.

2.2 MEDIUM VOLTAGE WIRES & CABLES:

- A. Provide single conductor cables only, (3) conductor cables are not allowed.

- B. Conductor shall be stranded, Class B annealed copper, covered with an extruded semi-conducting EPR strand screen, 220 mil ethylene propylene rubber insulation extruded EPR semi-conducting insulation screen, 5 mil bare copper shielding tape with 12-1/2% minimum overlap, with 80 mil flame retardant PVC jacket overall, 15kV type, ungrounded neutral, 133% insulation level.

- C. Conductor strand screen, insulation and insulation screen shall be extruded simultaneously (triple tandem extrusion). Color differentiation shall be accomplished by using black semi-conducting layers and red insulation.

2.3 MEDIUM VOLTAGE TERMINATIONS:

- A. Provide terminations as shown on the associated drawings and as required for the complete installation of the cable system.

- B. Terminations at 200 amp switched ways of VFI switches shall be 200 amp loadbreak molded products. Terminations at 200 amp load taps at VFI switches shall be 200 amp loadbreak molded products.

2.4 MEDIUM VOLTAGE SPLICES:

- A. Provide splices as shown on the associated drawings and as required for installation of the cable based on the conditions of the installation and other factors such as length of remaining cable on reels. Splices may only be located at vaults where accessible. Do not install splices inside of conduit bodies.
- B. Provide Raychem heat shrink splices or 3M cold shrink splices for all through cable splices. Size splices as required for cables, confirm size of all existing cables prior to submittals to ensure compatibility.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION METHODS:

- A. Cable shall be installed in rigid metallic conduit as shown on drawings. All conduits shall have a minimum bending radius of four feet.
- B. Cables shall loop all vaults they enter or exit a minimum of (1) complete 360 degree loop. Cables installed directly through a vault are not acceptable.
- C. Terminate cable in load break elbows at sectionalizing enclosures and pad mounted switchgear as applicable.
- D. Splices shall not be allowed in raceway. Splices in vaults shall be racked to vault walls with insulating clamps located on both sides of the splice within 24 inches of the splice.
- E. All terminations shall be taped and wrapped per manufacturer's instructions and industry standards
- F. All medium voltage cabling within vaults, pad/vaults and other similar exposed areas shall be fire taped per manufacturer's instructions and industry standards for the entire length of cable within the space.
- G. Feeders within manholes shall be color coded, phase 1 Red, phase 2 Yellow, phase 3 Blue.

3.2 LABELING:

- A. Provide a 1/16" thick x 2" tall x 3" wide laminated three-ply plastic, center-ply black, outer-ply yellow "Lamicoid" or equal. Letters shall be formed by engraving outer yellow ply to expose black lettering. Lettering shall be a minimum of 1/2" high. Attach label by drilling a

small hole in one corner of the label and affixing the label to the cable with the use of wire-ties or equivalent.

- B. Labels shall be provided for each cable at the following locations:
 - 1. In the manhole or vault within 12" to 24" of where the cable enters and exits the manhole or vault where easily visible.
 - 2. Within approximately 36" of termination on each switch where easily visible.
 - 3. Each individual phase shall be provided with it's own label at the required locations.
- C. Label information shall be coordinated with the Owner prior to creation of labels and will include at minimum: Feeder name (for example – WEST RNG 6), cable construction type (for example – EPR), cable size (for example #1/0) and date of cable installation (for example - 01/16/2016).

3.3 TESTING:

- A. Prior to the final inspection, test the installed new cables and wires and any existing cables and wires which are reconnected for this contract.
- B. Prior to energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity and insulation.
- C. Test the insulations of the installed cables by standard high potential methods with DC voltages. Exercise suitable and adequate safety measures prior to, during and after the high potential tests including placing warning signs and preventing people and equipment from being exposed to the test voltages. Prior to applying the test voltages to the cables, disconnect all equipment that might be damaged by the test voltages. DC test voltages for the new cables shall be the AEIC and IPCEA standard, final-factory, AC, test voltages for the cables multiplied by 2.4.
- D. DC test voltages for the existing cables shall be the AEIC and IPCEA standard, final-factory, AC, test voltages for the cables multiplied by 1.8.
- E. AEIC and IPCEA standard, final-factory, AC, test voltages are approximately two to four times the AC voltage ratings for the cables. DC test voltages will be approximately two to four times the AC voltage ratings for the cables times the ratios indicated above.
- F. Increase and decrease the test voltages on the cables (between the voltage levels at which the test readings are made) at a rate of not more than 200 volts per second. Monitor the testing equipment closely and stop applying the test voltages when the equipment indicates that the leakage currents are increasing excessively.
- G. Where weak points are detected in the existing cables, notify the Engineer accordingly. The Engineer will determine what should be done about defective existing cables.

- H. Where weak points are detected in the new cables, eliminate the weak points and replace the cables.
- I. Maintain the maximum test voltage for five minutes for each test.
- J. Read and record the test voltages and leakage currents for the cables being tested at approximately 4000 volt intervals, starting and finishing with zero test voltages. Allow the charging currents to diminish before reading the meter so that correct values can be determined for the leakage currents.
- K. Plot curves for the test voltages and leakage currents on a separate graph for each test. Use log-log graph paper with time and voltage along the horizontal axis and current along the vertical axis, one curve for current versus voltage, and one curve for current versus time.
- L. Submit four certified copies of each of the graphs to the Engineer, with adequate information shown for identifying the cable locations, types, voltage ratings and sizes.
- M. Furnish certified test reports of all applicable tests per AEIC and IPCEA to the purchaser at the time of delivery. A copy of the original X-Y plot showing discharge levels shall be submitted at time of delivery

3.4 WARRANTY:

- A. Cable shall carry a five-year warranty after shipment.
- B. General 1 year warranty shall apply to installation and other products and installation used under this section.

END OF SECTION

SECTION 26 05 19 – WIRES & CABLES (600V)

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide all wires and cables as herein specified and shown on the associated drawings for service conductors, feeder conductors and branch circuit conductors.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Material & Methods – Section 26 05 00.
- B. Raceways – Section 26 05 33.

1.3 QUALITY ASSURANCE:

- A. All wire and cable shall meet or exceed the following standards:
 - 1. ASTM-B series specifications
 - 2. ICEA S-61-402/NEMA WC 5 - Thermoplastic insulated cables 0-2000 volt
 - 3. UL Standard 62 and 83 – Thermoplastic insulated cable
 - 4. UL VW-1 Flame Test for sizes #12 through #1
 - 5. National Electric Code (NFPA 70) – Latest edition
- B. Manufacturer's shall be engaged in the manufacturing of industry accepted quality wires and cables for a period of no less than 5 years for all types and sizes required.

1.4 SUBMITTALS:

- A. None required.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Provide products of Southwire, Houston Wire, Rome Cable, or similar manufacturer located within the continental North American market. Cables made in Europe, Asia, South America, Africa, or other overseas markets are not acceptable.
- B. Substitutions: Equivalent manufacturers are allowed at contractors option, no submittals or prior approvals are necessary if cable meets specifications.

2.2 MATERIALS:

- A. Application: For use in general wiring applications for lighting and power in ducts, conduits, wireways and other approved raceways with a maximum conductor temperature of 90 degrees C in dry locations and 75 degrees C in wet locations.
- B. Provide wires and cables that are chemical, gasoline, and oil resistant. Provide wires and cables that are sunlight resistant.
- C. Minimum conductor size shall be No. 6 AWG unless otherwise noted.
- D. Where adverse conductor exposure exists, code approved insulation suitable for the conditions encountered shall be used unless shown otherwise on the Drawings.
- E. Wire and cable shall be new, shall have grade of insulation, voltage and manufacturer's name permanently marked on outer covering at regular intervals and shall be delivered in complete coils or reels with identifying size and insulation tags.

2.3 COPPER CONDUCTORS:

- A. For No. 6 AWG provide soft drawn solid copper conductors. Pole applications to use bare copper, others use THHN-THWN insulation.
- F. For in ductbank installation provide 4/0 bare soft drawn stranded, Class B stranded copper conductors with no insulation. For in Vault application provide type THHN/THWN insulation.

2.4 ALUMINUM AND/OR METAL CLAD (MC) CABLING OPTIONS:

- A. Aluminum and MC Cabling not acceptable – Provide copper only conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Inspect exposed cables for physical damage and remove as length allows.
- B. Do not exceed manufacturers minimum bending radius or tension during installation.

3.2 SPLICES AND TERMINATIONS:

- A. Splices are to be made up complete promptly after wire installation.
- B. Torque bolted connections to manufacturers recommendations.
- C. Insulation shall be removed with a stripping tool designed specifically for that purpose. A pocket knife is not an acceptable tool. All conductors shall be left nick-free.
- D. Thermoplastic insulated wire and cable shall not be installed or handled in temperatures below +14 degrees F (-10 C). Cross-linked polyethylene insulated wire and cable may be installed to -40 degrees F (-40 C).

3.3 LABELING:

- A. Feeders – Provide an engraved laminated 3-ply plastic “Lamicoid” or equal label with feeder name attached with a nylon wire tie to the feeder at each entry and exit from pullboxes, wireways and any other similar locations..

3.4 COMMISSIONING AND TESTING:

- A. Contractor shall provide for access and inspection of installed wires and cables by the Architect/Engineer, owner and commissioning agent.
- B. Document all tests and provide written copies in the O&M manuals.
- C. Perform continuity tests and resistance measurements through bolted connections to ensure correct cable connections.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide all grounding and bonding as code required and as herein specified and shown on the associated drawings.

1.2 APPLICATION:

- A. All grounding and bonding shall be by copper only connectors, copper cable and wire, and/or copper braids.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Material & Methods – Section 26 05 00.
- B. Wires & Cables – Section 26 05 19.

1.4 QUALITY ASSURANCE:

- A. All installation of grounding and bonding conductors shall meet or exceed the following standards:
 - 1. ASTM B 8 stranded conductors
 - 2. ICEA S-61-402/NEMA WC 5 - Thermoplastic insulated cables 0-2000 volt
 - 3. UL Standard 62 and 83 – Thermoplastic insulated cable
 - 4. UL VW-1 Flame Test for sizes #12 through #1
 - 4. National Electric Code (NFPA 70) – Latest edition
 - 5. UL listing is required
- B. Manufacturer's shall be engaged in the manufacturing of industry accepted quality grounding connectors for a period of no less than 5 years for all types and sizes required.

1.5 SUBMITTALS:

- A. None required.

PART 2 - PRODUCTS

2.1 GROUNDING CONNECTORS AND GROUND RODS:

- A. ACCEPTABLE MANUFACTURERS: Subject to compliance with all requirements, provide products of one of the following manufacturers for grounding connectors or ground rods:
 - a. Chance/Hubbell
 - b. Copperweld Corporation
 - c. Erico Inc., Electrical Products Group
 - d. Burndy Electrical
 - e. Kearney/Cooper Power Systems
 - f. O-Z/Gedney Co
 - g. Raco/Hubbell
 - h. Thomas & Betts Electrical

- B. Provide products of a quality manufacturer located within the continental North American market. Grounding connectors made in Europe, Asia, South America, Africa, or other overseas markets are not acceptable.

- C. Provide products that are listed and labeled by UL for all applications used, and for specific types, sizes and combinations of conductors and other items connected.

- D. For buried connections, provide crimp style connections or welded type connections. For accessible connections, provide bolted pressure-type, torque as per manufacturers recommendations.

- E. Substitutions: Equivalent manufacturers are allowed at contractor's option, no submittals or prior approvals are necessary if ground connectors and rods meet specifications.

2.2 CONDUCTORS:

- A. Provide copper or tinned-copper wire and cable insulated for 600 volt unless otherwise required by applicable code or authorities with jurisdiction.

- B. Provide minimum of #6 AWG copper stranded grounding electrode conductor for the portion of the conductor which is the sole connection to the ground rod grounding electrode. Where this conductor is not the sole connection to a single ground rod (for example if the conductor connects multiple grounding electrodes in series), then the minimum conductor size shall comply with NEC table 250.66.

- C. Provide minimum of #4/0 AWG copper stranded grounding electrode conductor for the portion of the conductor which is the sole connection to the concrete encased ductbank grounding electrode.

- D. Provide No. 4 and/or No. 6 AWG stranded conductor for bonding conductors.

PART 3 - EXECUTION

3.1 GROUNDING INSTALLATION:

- A. Ground all electric equipment, raceways and enclosures in accordance with code rules and established safety practices.
- B. Route grounding electrode conductors along the shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subject to strain, impact, or damage.
- C. Grounding electrode conductors and bonding jumper connections to grounding electrodes shall be accessible (unless allowed by NEC 250.68(A) exceptions) and provide a continuous effective grounding path.
- D. Where ground connections are made underground or in inaccessible locations, they shall be made using an exothermic weld process, Cadweld or equivalent, or Ampact pressure connectors.

3.2 GROUND RODS

- A. Ground rods shall be installed where accessible for future inspection and servicing.
- B. Where ground rods are driven inside manhole or vault structures, leave 4 inches of exposed ground rod above the concrete floor.

3.3 CONNECTIONS

- A. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturers published torque-tightening values. If manufacturers data is not available, tighten according to UL468A.
- B. For compression type connections, use hydraulic compression tools and dies to provide the correct circumferential pressure for all connectors. Use only tools and dies as recommended by the connector manufacturer. Provide embossing die code or other standard method to make a visible, permanent indication that a connector has been adequately compressed onto the grounding conductor.

3.4 COMMISSIONING AND TESTING:

- A. Contractor shall provide a time for access and inspection of grounding system for the Owner/Engineer. Correct all defects and flaws found prior to testing.
- B. Test all grounding systems per NETA 7.13 Inspection and Test Procedures.
- C. Demonstrate electrical continuity at selected connections to the owner/engineer using an electrical ohmmeter. Point to point resistance values shall not exceed 0.5 ohms. Provide additional bonding as necessary to ensure these resistance values are less than 0.5 ohms.
- D. Demonstrate that electrical ground does not exceed 5 ohms. If it does, provide additional electrode conductor, ground rods, and other mitigation methods to ensure that grounding electrode will read below 5 ohms to ground.

END OF SECTION

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide all raceways, wireways, and associated fittings as herein specified and shown on the associated drawings.

1.2 APPLICATION:

- A. Galvanized rigid conduit (GRC), intermediate metal conduit (IMC), and PVC conduit may be used.
- B. Schedule 40 PVC conduit may only be used below grade and below slabs on grade. PVC shall not be used above grade except for riser on power poles. Type EB and DB utility duct and fiberglass conduit may only be substituted for Schedule 40 PVC if the concrete encasement alternative is accepted.
- C. GRC and IMC shall be used in locations subject to mechanical injury, for penetrations of Vault walls, or for bends exceeding 30 degrees. GRC and IMC may be used: outside, where exposed to weather, in wet locations. Schedule 80 PVC may not be substituted for GRC and IMC.
- D. Drawing notes requiring a specific type of raceway shall take precedence over the specifications.
- E. Electrical wiring shall be in U.L. approved raceways and enclosures throughout.
- I. 4" and larger conduits intended for use on primary services shall have minimum 48" radius sweep on all bends.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Material & Methods – Section 26 05 00.
- B. Wires and cables (600V) – Section 26 05 19.
- C. Ductbanks – Section 26 05 39

1.4 QUALITY ASSURANCE:

- A. All installation of conduits and raceways shall meet or exceed the following standards:
 - 1. Polyvinyl Chloride (PVC): in accordance with ANSI C80.1 and NEMA Std. Pub. No. RN 1.
 - 2. Rigid Metal Conduit (RMC): in accordance with ANSI C80.1.
 - 3. National Electric Code (NFPA 70) – Latest edition

- 4. UL listing is required
 - B. Manufacturer's shall be engaged in the manufacturing of industry accepted quality raceway for a period of no less than 5 years for all types and sizes required.
- 1.5 SUBMITTALS:
- A. Not required.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Provide products of a quality manufacturer located within the continental North American market. Conduit and Raceways made in Europe, Asia, South America, Africa, or other overseas markets are not acceptable.
- B. Substitutions: Equivalent manufacturers are allowed at contractor's option, no submittals or prior approvals are necessary if conduit and fittings meet specifications.

2.2 RACEWAYS:

- A. Galvanized Rigid Metal Conduit (GRC): Provide zinc-coated, hot-dipped galvanized, rigid metallic conduit in sizes indicated on the drawings. Provide RMC in ¾ inch minimum size.
- B. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in sizes indicated on the drawings. Provide IMC in ¾ inch minimum size.
- C. Provide Schedule 40 PVC conduit (where installed below grade or below slab on grade) in one inch minimum size.
- D. Aluminum conduit is not acceptable.
- E. Provide PVC conduit in one inch minimum size.

2.3 FITTINGS:

- A. Connectors larger than 1-1/4 inch shall utilize equivalent of O-Z/Gedney type SBT/SB insulated bushings.
- B. GRC and IMC shall be coupled and terminated with threaded fittings. Provide fully-threaded, malleable steel fittings, rain-tight and concrete-tight as applicable. Provide double locknuts and metal bushings at all conduit terminations. Ends shall be bushed with insulating bushings (OZ Gedney type B or equal).
- C. PVC shall be provided with matching schedule 40 fittings.
- D. Sealing bushings are to be provided equal to O-Z/Gedney Type FSK, WSK or CSMI as required by application. Provide equal to O-Z/Gedney Type CSB for internal sealing bushings.
- E. Expansion fittings shall be equal to O-Z/Gedey AXDX.
- H. Aluminum conduit fittings are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Provide vaults where shown or required to limit the number of bends in any run to not more than two 90 degree bends.
- B. 4" and larger conduits intended for use on primary services and communications services shall have minimum 48" radius sweep on all bends.
- C. Field bends and offsets shall be made without flattening, kinking, rippling or destroying the smooth internal bore or surface of the conduit and to not less than NEC minimum radius. Conduit that shows signs of rippling or kinking shall not be installed. Any conduits installed with wrinkles or kinks or otherwise in an unworkmanlike manner shall be replaced at no additional cost to owner.
- D. Precaution shall be exercised to prevent accumulation of water, dirt, concrete, or other foreign matter in the conduits during the execution of the project. Conduits in which water or foreign matter has been permitted to accumulate shall be thoroughly cleaned or the conduits runs replaced where such accumulation cannot be removed by methods approved the engineer.
- E. Permanently cap all spare conduits. Cap or plug conduit ends during construction to prevent entrance of foreign material.

3.2 FIELD CUTS AND THREADS:

- A. Cut all conduits perpendicular and square. Remove all sharp or rough edges and ream all burrs, inside and outside.
- B. Provide clean sharp threads on RMC and IMC. Engage at least five full threads on all RMC and IMC fittings.
- C. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of RMC or IMC.
- D. Apply coat of red lead, zinc chromate or special compound recommended by manufacture to conduit where conduit protective coating is damaged.

3.3 CONDUITS BURIED BELOW GRADE (SINGLE CONDUITS LESS THAN 3 INCHES)

- A. Refer to Ductbanks section 26 05 34 where concrete encasement in Alternate is called out. All multi-conduit medium voltage base power distribution shall be concrete encased if Alternate is accepted, and Telecommunication ducts shall have at minimum a concrete cap if Alternate is accepted.
- B. Elbows larger than 30 degrees and one inch shall be galvanized rigid conduit, wrapped with PVC tape.
- C. Provide trenching, backfilling, compaction, or other site restoration as required by the work done in this division. Minimum trench depth shall be as required to install conduit at 36" below grade to top of conduit unless otherwise noted.
- D. Install a detectable 6 inch wide yellow vinyl tape with letter "Caution: Buried Electrical Line Below" 12 inches above all buried service conduit and wire not under structures.

- F. Backfill material for all trenches under all areas shall be coarse sand around conduits, then native fill installed in layers not to exceed eight inches and compacted to 90% of maximum density at optimum moisture content to preclude subsequent settlement. Compaction by water method is not allowed.
- G. The top 18 inches of trench shall be backfilled with native soil and tamped.
- H. All underground conduits which enter the vault shall be sloped to drain away from the vault and shall be water sealed to prevent moisture from passing through the conduit into the vault. All joints to be threaded and taped or glued to prevent entry of water into the conduits.

3.6 CLEANING:

- A. Pull a mandril and swab through all conduits before installing conductors. Raceways shall be left clean and free of debris.
- B. Provide a pull string in all empty conduits.

3.7 COMMISSIONING AND FINAL INSPECTION:

- A. Contractor shall provide a time for access and inspection of raceway system for the Owner/Engineer, and telecommunications installer. Correct all defects and flaws found prior to wall and ceiling installation and prior to cabling installation.

END OF SECTION

SECTION 26 05 34 – DUCTBANKS – ALTERNATE NUMBER 1

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Provide all underground non-metallic duct lines for certain underground raceways, for extent shown.

PART 2 - PRODUCTS

2.1 DUCT LINES AND ACCESSORIES:

- A. Ducts: Rigid polyvinyl chloride conduit; Schedule 40, Type I, conforming to UL Article 651.
- B. Couplings: Slip-on, solvent sealed to pipe; solvent, Western No. 715.
- C. Adapters to Underground Conduit: Conduit ends shall be closely fitted without any rough edges or offsets. Maintain existing line and grade.
- D. Spacers and Bindings on Multiple Conduit Runs: Plastic, same manufacturer as raceways; embedded in the concrete; 1-1/2" clearance between raceways.
- E. Reinforcing Steel: Conform to ASTM 0615.
- F. Concrete: 2500 psi concrete to ASTM C94; maximum aggregate size, 1"; purchased from source approved by the Owner's representative.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT LINES:

- A. Depth of Conduit Installed Underground: 3'-0" minimum below finished grade to top of conduit.
- B. Grade: Install with uniform gradient between end pulling points; 3" in 100', minimum. Slope away from vaults.
- C. Couplings: Provide for slip-on, solvent cement sealed to pipe and make waterproof according to manufacturer instructions.
- D. Provide ductbank spacers made of plastic, Carlon Snaploc or similar. Space the spacers no further than 5 foot on center, and anchor to ground to prevent concrete floating. Tie all spacers to conduit with fabric or nylon ties to avoid creating conductive or magnetic loops.
- E. Provide 10 foot rigid galvanized steel conduit at ends and bends, and for entering vaults. Connections to underground steel conduit shall be closely fitted without any rough edges or offsets. Maintain line and grade.

- F. Reinforcing Steel: Provide reinforcing bars in duct banks including longitudinal No. 4 bars in all 4 corners, or as shown on the drawings; Ends of bars shall be lapped 40 diameters and tied with No. 20 gage soft annealed steel wire. Corner Reinforcing bars shall extend full length of underground raceways and be supported by the spacers and the U-Bar traverse ties.
- G. Reinforcing Steel: Provide reinforcing and supportive U-Bar transverse ties on 5'-0" centers, half way between the plastic ductbank spacers, formed from No. 3 bars. The ends of the U shall extend 6 inches past the ductbank and be pounded into the ground to prevent ductbank from floating. Tie the U-Bar transverse ties to all corner reinforcing bars with No. 20 gage soft steel wire.
- H. Where ductbank ends at a foundation wall or manhole or vault wall, dowell #3 rebar into wall prior to concrete ductbank pour at 8 inch spacing, minimum 3 locations, to tie ductbank to wall concrete at the cold joint. Depth of dowels shall be minimum 3-1/2 inches into the wall prior.
- I. Concrete Encasement: For all duct-lines and connection conduit, encasement thickness 4" minimum, 2500 psi concrete, placement per ASTM C94.
- J. Pull Wires: Install 1/32 minimum polypropylene rope, Jet-Line "Poly Rope" or Ideal "Pro-Pull" rope in all ducts and conduits, except where wiring is installed under this contract; approximately 3'-0" of free rope left at each cabinet and pullbox and outlet.

END OF SECTION

SECTION 26 05 37 - CONCRETE PAD VAULTS

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Furnish and install all concrete pad vault and accessories as herein specified and shown on the drawings.
- B. Submit detailed drawings showing applicable dimensions, imbedded struts, pulling irons, rings, cover, and drain grate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Amcor Precast, Duracrete Inc., Eagle, Oldcastle, or approved equal
- B. Requests for substitution of other products will be considered if submitted in accordance the General Conditions, Division 1, and Section 26 05 00.

2.2 MATERIALS:

- A. Pad/Vault shall be semi-custom and shall not be of the type used for the local utility. Follow guidelines on drawings.
- B. Concrete pad vaults shall be constructed of precast or poured in place concrete. Precast materials shall be shipped to the jobsite as a unit assembly. Lid assembly shall be sealed with suitable material.
- C. Provide vault interior dimensions and height as detailed on the drawings.
- D. Easily removed knockouts shall be provided to permit conduit entrance. Locate knockouts only where conduits will be installed in this contract. Do not install future knockouts.
- E. Vault floor shall be pitched for drainage and one or more drain holes shall be provided.
- F. Superstrut C300 series mounting channel, or equal of Unistrut, shall be cast into interior walls.
- G. Pulling-in irons shall be included inside each manhole as detailed.
- H. Embedded metal parts such as channels, pulling-in inserts and cable supports, and bell ends on conduit shall have grounding connection.
- I. Frame and cover for manholes shall be standard manhle entries, troffer pattern, non-ventilated, cast iron with clear opening size as detailed on drawings; cast-in inscriptions "ELECTRIC".
- J. Provide one ground rod for each manhole; copperweld 5/8" diameter, 10'-0" long driven just inside the finished wall with top 4" above the finished floor. Ground all metal items within the manhole with No. 6 bare stranded soft drawn copper wire.

- K. Provide ladder access into pad/vault as detailed on the drawings. Provide stainless steel rungs.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Location of pad vault shall be coordinated with the owner/engineer prior to excavation and setting regardless of where the drawings indicate to locate it. The owner/engineer will be reviewing location as it relates to their required clearances, easements, and accessibility of trucks. Relocate vault up to 15 feet at no extra cost to the owner. For requests exceeding a 15 foot relocation, consult with Owner/Engineer.
- B. Do not install the pad vault above existing buried utilities.
- C. Seal surfaces between sections on multi-section vaults and lid must be clean and all gaskets must be in place. Excavation hole must not contain water when setting vault. Excavation must provide a minimum of 18 inches clearance around the side walls of each vault for ease of installation and for compaction of backfill.
- D. Backfill around all vaults with engineered fill, pea gravel or sand to within 24 inches of final grade. No voids should remain between the vault walls and native soil. Backfill must be progressively compacted from the bottom to the top surface. Provide backfill of native material for final 24 inches of backfill.
- E. Provide 12 inches of compacted gravel or crushed rock, graded level, under each vault for drainage, with landscape fabric to separate native soil from the gravel.
- F. Seal all joints between vault sections, lid, risers, covers, etc. with appropriate gasket or sealant. Apply in a manner to insure filling of all voids in the joint being sealed.

END OF SECTION

SECTION 26 05 48 – SEISMIC RESTRAINT FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. This section includes seismic restraints and other earthquake damage reduction measures for electrical systems, and electrical components. It complements seismic construction requirements located in other sections of the specification.
- B. Provide seismic anchoring and support design for all electrical components. Provide structural design of all components by a licensed structural engineer in the State of Utah, designed in accordance to the IBC Chapter 16 and the ASCE 7-10 section 13.3, calculation method. Shop drawings and all calculations shall be submitted to the Authority Having Jurisdiction at the State of Utah as a deferred submittal.
- C. It should be noted that the design of the seismic bracing depends heavily on the components purchased in the various electrical divisions. Other electrical divisions will need to have approved submittals prior to completing the submittals for this section. Time is of the essence in providing submittals promptly to avoid construction delays.
- D. Provide all seismic supports, and associated fittings as herein specified and shown on the associated drawings.

1.3 DEFINITIONS

- A. The IBC: International Building Codes

1.3 RELATED WORK SPECIFIED ELSEWHERE:

- B. Basic Material & Methods – Section 26 05 00.
- C. Raceways – Section 26 05 33.

1.4 QUALITY ASSURANCE:

- A. Comply with seismic restraint requirements of the IBC and the ASCE, unless requirements of this section are more stringent.

B. PERFORMANCE CRITERIA

- 1. Seismic restraint loading criteria
 - a. Site Class as calculated by the Structural Engineer and/or Geotechnical report: D, E, or F
 - b. Assigned Seismic Building Occupancy Category as calculated by the Structural Engineer and/or Geotechnical report: I, II, III, or IV
 - c. Life Safety Component Importance Factor 1.5
 - d. Other Component Importance Factor (increased

- for components needed for continued operation of the facility whose failure could impair the continued operation of the facility): 1.25
- e. Other component Importance factor (non-critical): 1.0
- f. Design Spectral Response acceleration at short periods: Reference USGS site mapping tool for specific latitude and longitude of the site: <http://earthquake.usgs.gov/hazards/designmaps/javacalc.php>
- g. Manufacturers of all submitted equipment shall provide data indicating that their equipment has met a shake table test as per IEEE method or has been calculated to withstand the forces expected at the site of installation. It is required for the manufacturers to submit a certificate or letter indicating the Importance Factor and S_{DS} factor that the equipment is tested or calculated to withstand.

1.5 SUBMITTALS:

- A. Deferred Submittals: Provide Seismic Certificate from manufacturer of all electrical equipment indicating that the equipment will withstand the forces, and has been tested using the IEEE method or calculated with the ASCE method using appropriate site acceleration and importance factors for the installed location and occupancy classification expected. Simply labeling it "Seismic Zone 4" under the old Uniform Building Code or "California Seismic approved" is not acceptable and will be rejected. Certificate shall be by an independent testing laboratory or licensed structural engineer.
- B. Deferred Submittals: Provide drawings and details showing sizes, types, and assemblies of all seismic bracing and anchoring in sufficient detail to submit to the authority having jurisdiction at the State of Utah. Include stamped and signed calculations from a professional structural engineer licensed in the State of Utah.
- C. Product Data: Submit product data that illustrates and indicates type, styles, materials, strength rating, fastening provisions, and finish for each type and size of seismic restraint component used.
 - 1. Anchor bolts and studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by an independent agency.
 - 2. Details: Contractor shall provide details of assembly arrangement, including attachment to differing types of structures. Show attachment locations, methods, spacing's, identifying components and listing their strengths. Indicate direction and value of forces (calculated or tested) transmitted to structure during seismic events.
 - 3. The support seismic – restraint designs must be signed and sealed by a qualified professional structural engineer, licensed in the State of Utah, paid for by the contractor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Provide products of a quality manufacturer located within the continental North American market. Supports made in Europe, Asia, South America, Africa, or other overseas markets are not acceptable. The following manufacturer's products may be incorporated into the work:
1. Amber/Booth Company, Inc.
 2. B-Line Systems, a division of Cooper
 3. Erico, Inc.
 4. California Dynamics Corporation
 5. Hilti, Inc.
 6. Loos&Co: Seismic Earthquake Division
 7. Mason Industries
 8. TOLCO Incorporated; a brand of NIBCO Inc
 9. Unistrut; Tyco International, Ltd.
 10. GS Metals Corp.
 11. Powerstrut
 12. Thomas and Betts Corp.
- B. Substitutions: Equivalent manufacturers are allowed at contractor's option, no submittals or prior approvals are necessary if supports meet specifications and are detailed in the deferred submittal by the licensed structural engineer.

2.2 COMPONENTS:

- A. Bushings for Floor Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

2.3 ANCHOR BOLTS:

- A. Mechanical Anchor: Drilled in and stud-wedge or female-wedge type in zinc-coated steel for interior applications. Provide Stainless steel for exterior applications. Select anchors with strength required for anchor and as tested in accordance with ASTM E 488. Minimum length shall be eight times the diameter.
- B. Adhesive Anchors: Drilled in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injection polymer or hybrid mortar adhesive. Verify that Adhesive meets all LEED requirements. Provide anchor bolts in zinc-coated steel for interior applications. Provide stainless steel for exterior applications. Select anchors with strength required for anchor and as tested in accordance with ASTM E 488.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install seismic restraints in accordance to applicable codes and regulations as approved by authorities having jurisdiction.

3.2 SUPPORT INSTALLATION:

- A. Install anchors according to manufacturers written instructions.

3.7 COMMISSIONING AND FINAL INSPECTION:

- A. Contractor shall provide a time for access and inspection of seismic support system for the Owner/Engineer, and the commissioning agent. Correct all defects and flaws found prior to ceiling installation and prior to cabling installation.

END OF SECTION

SECTION 26 08 00 – COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide all materials, equipment, documentation, submittals, testing, and training as specified herein as well as within all Divisions 26, 27 and 28.
- B. See the contract conditions (general and supplementary) and Division 1 for requirements concerning this Division including, but not limited to, commissioning, submittals, shop drawings, maintenance manuals, and guarantees.

1.2 SCOPE OF COMMISSIONING:

- A. Commissioning shall be provided for all electrical systems as stated below. For the specific commissioning requirements of each system refer to the indicated section.
 - 1. SF6 loadbreak switches 15kV (26 13 19)
 - 2. Medium voltage cabling
- B. Schedule work so that required electrical installations are completed, and systems verification checks and functional performance tests can be carried out on schedule. Inspect, check and confirm in writing the proper installation and performance of all electrical services provided.

1.3 RESPONSIBILITIES:

- A. Refer to Section 1 for responsibilities of the: Owner, and Contractor.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT:

- A. Provide all materials and equipment required for the commissioning of all items to be commissioned.
- B. Material and equipment shall be standard product of manufacturer regularly engaged in production of similar material for at least five years (unless specifically exempted) and shall be manufacturer's latest design.

PART 3 - EXECUTION

3.1 COMMISSIONING:

- A. Division 26 is responsible to ensure required systems are commissioned according to their particular guidelines as stated in each individual section.

- B. Training shall be provided as required in the specific section specifications.

3.2 COMPLETION:

- A. Contractor shall submit written certification that all commissioning has been completed as indicated within the specifications.

END OF SECTION

SECTION 26 13 19 – SF6 LOAD BREAK PAD MOUNT SWITCHES – 15 KV

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide UL listed deadfront, sealed construction, non-fused load break switches utilizing sulphur hexafluoride gas (SF6) as the arc control medium.
- B. Refer to drawings for switch configurations and fusing requirements. Switches shall be manually operated, three-phase unless otherwise noted on drawings.

1.2 RELATED WORK:

- A. Section 26 05 00: Basic Materials and Methods
- B. Section 26 05 33: Raceways
- C. Section 26 05 19: Wires and Cables

1.3 REFERENCES:

- A. ANSI/NFPA 70-National Electrical Code
- B. UL-Underwriter's Laboratories, Inc.
- C. NEMA-National Electrical Manufacturers Association

1.4 SUBMITTALS:

- A. Submit shop drawings showing outline dimensions, switch and enclosure construction, weight, mounting provisions, one line diagram and electrical ratings.

1.5 OPERATION AND MAINTENANCE DATA:

- A. Provide as-installed wiring and interconnection diagram of each switch.
- B. Provide fuse replacement and equipment lubrication instructions.

1.6 STANDARDS:

- A. Equipment design standards: In accordance with ANSI C37.71, Standard for subsurface load interrupter switches; ANSI C37.72, Standard for padmount load interrupting switches; ANSI/IEEE 386, Standard for separable connectors and bushings; ASTM D-2472-69 specification of commercial type electrical grade SF6.

1.7 QUALITY ASSURANCE:

- A. The installation, connection, testing and performance of the equipment shall be the responsibility of one contractor.

- B. Manufacturer: company specializing in load break switch manufacture with five years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING:

- A. Accept equipment on site and inspect for shipping damage. Store equipment in accordance with manufacturer's instructions.
- B. Protect equipment stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering.

1.9 EXTRA MATERIALS:

- A. Special tools: specific purpose tools required for routine maintenance or replacement of fuses shall be delivered with equipment.
- B. Provide SF6 refill cylinder with regulator, valves and hose for connection to the fill valve of the switch.

1.10 WARRANTY:

- A. Provide one year warranty for all equipment and workmanship.
- B. Manufacturer and installer jointly and separately shall guarantee the equipment to be free from defects in operation for the specified period, beginning from the date of Owner's acceptance.
- C. Guarantee covers repair or replacement of equipment which fails to perform as specified during the warranty period. Repair rather than replacement will be accepted only if it does not compromise the longevity of the equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Provide products of one of the following:
S&C Vista or approved equal

Other manufacturers' equipment may be considered if the proposed substitute equipment data is submitted to the engineer at least 10 working days prior to bid date and sufficient data is submitted to verify conformance with the specifications.

2.2 EQUIPMENT SPECIFICATIONS:

- A. Switch Ratings at 15kV, 60Hz, with SF6 fuses:

BIL impulse withstand:	95 kV
Load interrupting, loop switching:	200 Amp
Assymmetrical fault closing:	12 kA
Continuous current (switch only):	200 Amp
Maximum fuse size:	200 Amp

- B. Switch construction: Welded stainless steel tank, containing switching mechanism and factory filled with SF6; tank to be leak-free, without gasketing or O-ring seals. Spring operated manual switching, with 200 Amp bushing wells with inserts for 200 Amp elbow connectors or with fuse holders and fuses as shown on drawings.
- C. Required features: SF6 pressure gauge and fill valve; blown fuse indication (neon); visible break (neon); hold down bail adapter and bail on fuses; wall mounted parking stands.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not proceed with installation until approved shop drawings have been received.

3.2 EXAMINATION:

- A. Verify that site is ready for installation and connection of equipment. Advise engineer in writing if proposed location is not suitable.
- B. Beginning of installation means acceptance of existing conditions.

3.3 INSTALLATION:

- A. Install equipment in accordance with equipment manufacturer's instructions and in conformance with the drawings, specifications and reviewed shop drawings.

3.4 TESTING:

- A. Factory testing: switches shall be completely fabricated and tested at the factory during manufacturer and upon completion.
- B. Field testing: verify that SF6 gas pressure level is as directed by manufacturer and switch operates properly. Verify that correct size fuses are installed in fuse holders. All switches shall be field tested and the test shall be witnessed by the engineer or his representative. A Factory Representative shall demonstrate and provide training on the equipment.

END OF SECTION

SECTION 26 13 23 –MEDIUM VOLTAGE SECTIONALIZING ENCLOSURES

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Furnish and install low profile medium voltage sectionalizing enclosures and ground sleeves as herein specified and shown on the associated electrical drawings. Material shall be fiberglass for the sectionalizing cabinet.
- B. Unit shall be mounted by anchoring to a pad/vault enclosure. No ground sleeve is required.
- C. For sectionalizing enclosure locations, fully equip with loadbreak junctions.

1.2 QUALITY ASSURANCE:

- C. Equipment shall be designed, manufactured, installed, and tested according to the latest revision of the following standards:
 - 1. ANSI C57.12.28 Pad Mounted Enclosure Integrity Standard
 - 2. IEEE
 - 3. NEMA
 - 4. ASTM
 - 5. NEC
 - 6. UL
 - 7. NETA
- D. Prepare equipment for shipment, including weatherproofing, blocking, and supports so equipment will withstand expected domestic shipping and handling, shocks and vibration. Close any openings to prevent entrance of foreign materials during shipping and storage.
- E. The installation, connection, testing and performance of the equipment shall be the responsibility of one contractor.
- F. Manufacturer shall be ISO 9001 or ISO 9002 certified.

1.3 SUBMITTALS:

- A. Submit product data including rated capacities, operation characteristics, and accessories.
- B. Submit complete descriptive shop drawings indicating junction plate arrangement, labeling, dimensions, and other pertinent data. Show method of field connection and assembly.

- C. Provide Seismic Qualification Certification showing that enclosure will withstand seismic forces defined in section 26 05 48 in installed geographical location. Indicate whether certification is based on actual shake table test or based on calculation method approved by ASCE. Provide plan view showing location and sizes of anchor bolt holes, weight, and center of gravity, for use in calculating proper anchors required in section 26 05 48 Seismic restraint.
- D. Submit in accordance with the General Conditions, Division 1, and Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Nordic Fiberglass, Inc.
- B. Requests for substitution of other products will be considered if submitted in accordance with the General Conditions, Division 1, and Section 26 05 00.

2.2 ENCLOSURE:

- A. The medium voltage sectionalizing enclosure shall consist of a single self-supporting fiberglass enclosure, containing all components required to provide a junction point using molded product load break elbows and the necessary accessory components, all completely factory assembled and operationally checked.
- B. Provide fire-retardant resin with woven glass reinforcement. Coat the exterior with Munsell green Gel-coat, with UV stabilizer and resistance to Ultraviolet degradation.
- C. The enclosure and doors shall be designed and constructed to guard against unauthorized entry. Door handles and switch-operating-hub access covers shall have provisions for padlocking that shall incorporate a means to protect the padlock shackle from tampering. Provide stainless steel locking system with penta-head bolt for double locking.
- D. Provide doors with stainless steel continuous hinge. Doors shall be provided with door holders to prevent the doors from closing inadvertently while work is being performed within the enclosure.
- E. Provide 3/8 inch solid copper rod grounding system accessory. Bond to mounting plates, elbow drain wires, and ground rod.
- F. Provide hot-dipped galvanized mounting plate to accommodate 3 or 4 point 15 kV 200 amp loadbreak junctions with U-straps.
- G. Provide in-line parking standoffs.

2.3 RATINGS:

- A. Voltage: 12.47 KV Nominal, 15 kV maximum.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Sectionalizing cabinet shall be free from surface and finish defects, and cleaned of dust and construction debris.
- B. All nameplates, labels, screws, bolts, or other hardware shall be in place prior to acceptance.
- C. Prior to installation of switchgear, layout the exact location and obtain approval of the engineer and Owner.
- D. Meet all requirements of NEC article 110 for Dedicated Electrical Space and Working space about equipment.
- E. Install a ground rod at each pullbox and sectionalizing enclosure location.
- F. Provide concrete filled pipe bollards on corners of sectionalizing enclosure, located at a diagonal from corners, a minimum of 6 inches away from enclosure measured diagonally. Do not impede working clearance in front of enclosure with pipe bollards.

3.2 LABELING:

- A. Provide an engraved permanent master nameplate at the main distribution to identify the project, the Engineer and the date.
- B. Provide engraved nameplate for all switchboards permanently mounted on the outside face of switchboard; include the following minimum information:
 - 1. Enclosure or pullbox name
 - 2. Source feeding enclosure
 - 3. Voltage, Size (amps), number of phases, number of wires, and AIC rating
- C. Engraved nameplates shall be have a black back ply, an inner white ply with outer colored ply as follows: Black for normal power.

END OF SECTION

SECTION 26 28 01 – COORDINATED POWER SYSTEM PROTECTION

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Provide selective coordination of overcurrent devices as herein specified and shown on the associated electrical drawings.

1.2 SUBMITTALS:

- A. Submit complete coordination study.

PART 2 - PRODUCTS

1.3 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

- A. The electrical equipment manufacturer shall perform protective device time-current coordination analysis of the specified electrical power distribution system. This analysis shall include:
 - 1. A determination of settings, ratings, or types for the overcurrent protective devices supplied. Where necessary, an appropriate compromise shall be made between system protection and service continuity with system protection considered more important than service continuity. The time-current coordination analysis shall be performed with the aid of computer.
 - 2. Computer generated log-log plots containing the time-current characteristics of series connected overcurrent devices. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination. The log-log plots shall include transformer ANSI withstand points and inrush currents of transformers where appropriate.
 - 3. Computer printouts to accompany the log-log plots containing descriptions for each of the devices shown on the plot, setting of the adjustable devices, device numbers to simplify location of the devices on the system one-line diagram, and short-circuit currents where known.
 - 4. A tabular computer printout of the suggested settings of the adjustable overcurrent protective devices, the equipment where the device is located, the device number corresponding to the device on the system one-line diagram, and the number of the time-current log-log graphs where they are illustrated.
 - 5. A computer generated system one-line diagram clearly identifying individual equipment basics, the bus numbers, the device numbers, and the maximum available short-circuit current at each bus which shall include short-circuit current motor contribution.

6. A discussion section evaluating the degree of system protection and service continuity with overcurrent devices, with recommendations as required for increased protection or coordination.
7. Any inadequacies shall be called to the attention of the Architect, and recommendations made for improvements.
8. Provide Six (6) bound copies of the completed protective device time-current coordination analysis for the Architect.
9. Electrical distribution equipment SHALL NOT BE RELEASED FOR MANUFACTURING until AFTER the Analysis has been reviewed by the Engineer. If the Contractor fails to abide by this requirement, the Contractor will be responsible for the cost of any and all required changes to the distribution equipment resulting from findings within the Analysis.

PART 3 - EXECUTION

2.1 SETTINGS:

- A. Verify that all overcurrent device settings match the recommended settings defined in the time current coordination analysis report and provide written proof that the overcurrent devices have been set properly. Fix any improperly set overcurrent devices prior to acceptance and written proof of correct setting.

END OF SECTION

SECTION 33 71 01 –OVERHEAD DISTRIBUTION MEDIUM VOLTAGE WIRING

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Conductors, wood poles and crossarms, hardware and accessories, lightning arrestors, cutouts and fuses.

1.2 QUALITY ASSURANCE:

- A. Equipment shall be designed, manufactured, installed, and tested according to the latest revision of the following standards:
 - 1. NESC
 - 2. IEEE
 - 3. NEMA
 - 4. ASTM
 - 5. NEC
 - 6. UL
 - 7. NETA

1.3 SUBMITTALS:

- A. Submit product data including rated capacities, operation characteristics, and accessories.
- B. Submit in accordance with the General Conditions, Division 1, and Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Any north American pole hardware company will be acceptable.
- B. Requests for substitution of other products will be considered if submitted in accordance with the General Conditions, Division 1, and Section 26 05 00.

2.2 CONDUCTORS:

- A. Provide ACSR Bare aluminum conductor, steel reinforced, complying with ASTM B232/B 232M.

- B. Include wire clamps, ties, conductor armor, fittings, connectors, and terminals listed for specific applications and combinations of materials used.

2.3 WOOD POLES:

- A. Comply with ATIS O5.1 and RUS Bulletin 1728F-700 for wood poles pressure treated with various chemicals.
- B. Provide dougles fir, or Western Red Cedar wooden poles, with manufacturers mark 10 feet from pole butt for poles 50 feet or less.

2.4 OTHER HARDWARE MATERIALS

- A. Provide wooden crossarms, guys, anchors, lightning arrestors, cutouts and fuses, hardware and accessories as required.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Clear right away of small trees and shrubs. Leave native grasses and plants not exceeding 2 feet in height.
- B. Use proper grounding procedures at each pole, ground each pole to butt wrap as detailed on the plans.

3.2 LABELING:

- A. Provide pole numbers complying with camp standards.

END OF SECTION