THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY
(JEFFERSON LAB)

NEWPORT NEWS, VIRGINIA

UTILITIES INFRASTRUCTURE MODERNIZATION

Electrical Distribution Upgrade

SPECIFICATIONS

Final Specifications

April 2014
(REV.1 – Conformed Specification)

U.S. DEPARTMENT OF ENERGY | JSA | Jefferson Lab

Division	Section Title	

SPECIFICATIONS GROUP

DIVISION 01 - GENERAL REQUIREMENTS

DIVISION 03 – CONCRETE

DIVISION 26 – ELECTRICAL

DIVISION 31 – CIVIL

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Work covered by Contract Documents
2. Project information.
3. Phased construction.
4. Work under separate contracts.
5. Furnished Materials
6. Site Access.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and drawing conventions.
10. Terminology
11. Location of Existing Utilities
12. Identification of New Underground Utilities

B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

2. Division 01 Section “Safety and Health Requirements” for additional safety and health requirements.

C. References:

1. American Society of Civil Engineers publication “CI/ASCE 38-02, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data”.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:
1. Replacement of underground 15 kV primary cable and 480 V secondary cables in the Accelerator and End Stations.

1.3 PROJECT INFORMATION

A. Project Identification: Electrical Primary and Secondary Cable Replacement.
1. Project Location: 12000 Jefferson Avenue, Newport News, Virginia.

B. Owner: Jefferson Lab managed and operated by Jefferson Science Associates (JSA) on behalf the Department of Energy, Office of Science.

C. Architect/Engineer: Paul Powers – Jefferson Lab, 757-269-7258 (powersp@jlab.org).

D. SOTR: Michele Solaroli – Jefferson Lab, 757-269-7751 (solaroli@jlab.org)

E. Submittal Exchange: Submittal Exchange will be administered by the Owner for purposes of managing communication and documents during the construction stage.

1.4 PHASED CONSTRUCTION

A. Work shall be conducted during two planned Accelerator shutdowns during summers of FY14 and FY15. Preliminary dates for the Accelerator Shutdown are as follows:

PHASE 1: May 5, 2014 – September 1, 2014

Work task order of precedence during this phase shall include the following:

North Loops
Primary Cables & Associated Secondary Cables/Switchboards
- Unitsub LN1 to Unitsub LN2
- Unitsub LN2 to Unitsub LN3
- Unitsub LN3 to Unitsub LN4
- Unitsub LN4 to MVSW#6

Secondary Cables (in order of importance)
- Unitsub LN1 to NL1 SWBD
- Unitsub LN2 to NL2 SWBD
- Unitsub LN3 to NL3 SWBD
- Unitsub W6 to INJ MDP
- Unitsub W6 to NA2 SWBD
- Unitsub W5 to NA1 SWBD
- Unitsub E3 to E3 SWBD

South Loop
Primary Cables & Associated Secondary Cables/Switchboards
- Unitsub K100 to Unitsub LS1
- Unitsub LS1 to Unitsub LS2
- Unitsub LS2 to Unitsub LS3

Secondary Cables (in order of importance)
- Unitsub LS1 to SL1 SWBD
- Unitsub LS2 to SL2 SWBD
- Unitsub LS3 to SL3 SWBD

Additional work, as possible:
- Unitsub FEL to Unitsub GPB1 (Primary Cables)

End Station Loop
Primary Cables & Associated Secondary Cables/Switchboard
- Unitsub T7 to Unitsub T9 and Unitsub T10/Unitsub T7
- Unitsub T8 to Unitsub T9 and Unitsub T6/Unitsub T8

Unitsub T9/Unitsub T9
Unitsub T6 to Unitsub T5/Unitsub T6
Unitsub T2 to Unitsub T3 and Unitsub T1/Unitsub T2
Unitsub T5 to Unitsub T12/Unitsub T5
Unitsub T1 to Unitsub T12/Unitsub T1
Unitsub T3 to Unitsub T4 and Unitsub T2/Unitsub T3
Unitsub T4 to MVSW #4/Unitsub T4

PHASE 2: June 1, 2015 – August 3, 2015

Work tasks during this phase shall include the following:

All Remaining work on the two North Loops, the South Loop and the End Station Loop that was not completed in Phase I (2014)

All work on the CHL Loop

Primary cable segments to the:
East 37 MVA Substation
West 33 MVA Substation

B. If additive items are awarded, all secondary work and switchboard installation shall occur during the same unitsub outage.

C. JLab anticipates that the contractor will work concurrently on multiple loops. Shift work/extended workdays are acceptable but contractor will be required to provide both site as well as task lighting as required to safely perform their work.

D. Before commencing Work in FY15, submit an updated copy of the Contractor's construction schedule showing the sequence, commencement and completion dates.

1.5 PROJECT CONSTRAINTS

A. Work Constraints
1. Cable segments to be removed out of the East 37 MVA Substation shall be removed and installed in the West 33 MVA Substation before work to remove and replace existing cable segments in the East 37 MVA Substation can begin.
2. Power outages on individual loops (North Loop, South Loop, CHL Loop, and End Station Loop) are not permitted other than one pad mounted transformer at a time while primary and secondary cables are being replaced and terminated.
3. Brief power outages are permitted at pad mounted transformers as primary cables are pulled from/to a pad mounted transformer for termination. Once the cables are pulled, the transformer shall be energized to operate on the segment of cables that is already terminated, whether they are new cables or the existing cables fed from an adjacent transformer on the loop
4. Once a pad mounted transformer is secured for work, the work must be completed, including the replacement of the secondary cables, before work at the next padmounted transformer on the same loop can begin.
5. Pad mounted transformers CHL AUX and CHL AUX2 cannot be down at the same time.

6. All work shall be complete, including testing, before the subcontractor moves to the next pad mounted transformer on the loop.
7. Phase rotation shall be maintained and verified with JLab personnel throughout the project.
8. The order of the unitsub upgrade per loop will be coordinated with end user and may not be sequential. Contractor will meet with Jlab SOTR and end user weekly to prioritize unitsub upgrades to minimize impact to operations. A schedule will be developed and approved prior to starting work. Work shall not begin on the next padmounted transformer until approved and coordinated with JLab.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: JSA has awarded and will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. 33 MVA Substation: To Hitt Electric for Construction of a new 33 MVA substation and access road. Work includes underground ductbank to three existing manholes and one new manhole. Work requires coordination with associated work by Dominion Virginia Power to connect power from the utility substation to the new switchgear that is part of the 33 MVA substation.

2. UIM Process Cooling Tower Upgrade: Contract to be issued Mid-Summer FY14
   a. FY14 – Header Modification, Back-up Towers and End Station Cooling Towers
   b. FY15 – North and South Access Cooling Towers.

1.7 SITE ACCESS

A. ACCESS RESTRICTIONS AND BADGING
Refer to JSA Clause 118 Site Access for registration requirements for any individual needing to access Jefferson Lab. Badging is required for personnel performing work on site.

B. CONSTRUCTION SITE LIMITS

1. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

2. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

   a. Limits: Confine construction operations to sections between substations on each loop on the Accelerator Site.

   b. Driveways, Walkways and Entrances: Keep driveways, loading areas**,** and entrances serving premises clear and available to Owner, Owner's employees, and

emergency vehicles at all times. Do not use these areas for parking or storage of materials.

1) Schedule deliveries to minimize use of driveways and entrances by construction operations.
2) Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

3. Condition of Existing Site: Maintain portions of existing building and grounds affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations to match or exceed original conditions.

1.8 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Subcontracting Officer/SOTR.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

A. WORK SCHEDULE

1. Normal Work Hours – Normal working hours at Jefferson Lab are 7:00 am to 5:00 pm, Monday through Friday, excluding holidays and shutdown period. Work at the Project Site outside of normal working hours requires approval from the Subcontracting Officer. Requests to work outside normal working hours should be submitted at least 48 hours in advance.
2. Jlab is open to extending work schedule to accommodate shiftwork upon request. Contractor will be responsible for providing site lighting and/or temporary lighting to adequately perform their work.
3. Holidays – Ten days are designated as JSA/Jefferson Lab holidays and during the period between Christmas Eve and New Year’s Day Jefferson Lab will be closed. All subcontractor personnel will follow the JSA/Jefferson Lab holiday and shutdown schedule. The following work will be performed during these holidays/closures:

   a. The holidays observed by JSA/Jefferson Lab are:

New Year’s Day	Martin Luther King’s Birthday
Memorial Day	Independence Day
Labor Day	Thanksgiving Day
Day after Thanksgiving	Christmas Eve
Christmas Day	New Year’s Eve

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted by SOTR. Limit under the following conditions:
   1. The Subcontractor shall request each substation outage prior to moving to the next substation on each loop. All testing must be completed and accepted prior to starting next substation. The request is to be submitted to the SOTR.
   2. Work shall be scheduled in a manner to minimize the duration of each utility outage.

C. RESTRICTIONS WITHIN ACCELERATOR SITE

   1. The subcontract work takes place within the Accelerator Site. The Accelerator Site is an electron beam experimental facility and the electron beam is sensitive to vibrations in the ground. The following activities are known to disturb the electron beam:
      a. Vibratory compactor for soil or paving.
      b. Loaded dump truck running on the road at speeds higher than 10 to 15 miles per hour.
      c. Any equipment running relatively fast on tracks.
      d. Pile driving.
      e. Thumping the ground or breaking concrete by impact with a backhoe bucket.
   2. None of the above or any activity producing ground vibrations that will disturb the beam will be permitted except when beam is shut off. The beam is shut down for maintenance periods. Site coordination must be through the SOTR; with the approved progress schedule reflecting planned shutdown times. Close coordination is crucial to beam operations.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

   1. Notify SOTR not less than two days in advance of proposed disruptive operations.
   2. Obtain SOTR’s written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within any building or within 25 feet of entrances, operable windows, or outdoor air intakes.

F. Controlled Substances: Use of tobacco products within buildings and controlled substances, illegal drugs (and associated paraphernalia), and other items prohibited by law anywhere on Lab property is not permitted.

G. Unauthorized Items: weapons (including hunting knives), explosives, pyrotechnics, or other dangerous instruments or materials likely to produce substantial injury or damage to persons or property.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.11 TERMINOLOGY

A. Specification Terminology:

1. Any reference to Architect within this subcontract shall be interpreted as Subcontracting Officer and/or SOTR.

2. Any reference to Contractor shall be interpreted as Subcontractor. Jefferson Science Associates (JSA) is a Contractor to the Department of Energy for the Operation and Maintenance of Thomas Jefferson National Accelerator Facility (Jefferson Lab). Therefore, a Contract issued by JSA is referred to as a Subcontract.

3. Any reference to Owner within this subcontract shall be interpreted as Jefferson Lab/Jefferson Science Associates (JSA).

4. Reference to SOTR refers to the Subcontracting Officer's Technical Representative.

1.12 LOCATION OF EXISTING UNDERGROUND UTILITIES

A. LOCATE

As required in the procedure for obtaining a Jefferson Lab "Dig/Blind Penetration Permit" use locate-industry "Best Methods" to scan the project site with suitable equipment and mark the surface of the ground where existing underground utilities are discovered (see section 013529 for a summary of all required Jefferson Lab permits). Locate utilities to CI/ASCE 38-02 "Quality Level B" requirements unless otherwise indicated. Employ locate-industry standard color system for markings. Verify that the actual locations of all existing utilities are consistent with the locations indicated in the subcontract documents. Report any discrepancies noted, including the presence and location of any utilities that were not indicated in the subcontract documents, as required in the Dig Permit procedures. Determine exact elevations of any existing piping, utilities, or any other type of underground obstructions not indicated or specified to be removed but indicated in the drawings or discovered during scanning in

locations that will be crossed by piping, ducts or other work to be installed under this subcontract. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made. Unidentified existing utilities found in the course of this project shall be traced out to the project limits and reported as required in the Dig Permit procedures. These utilities and any abandoned in place utilities shall be documented on the as-built drawings as described below. Deliver information in the format called for in CI/ASCE 38-02.

B. EXCAVATION

Inform the SOTR at least 24 hours prior to commencement of each separate phase of excavation. No excavation work shall be performed without a signed Dig/Blind Penetration Permit – a copy of which shall be available on site at all times excavation work is in progress. Excavate (including drilling, augering, or driving piles, posts or pegs) to avoid marked utilities, staying outside of customary tolerance zones for each utility. If excavation must be performed within a tolerance zone, or when located utilities must be exposed, use industry best-practice methods to protect people, property, and the utilities – in that order of priority. When conditions change from the original plan re-assessment of the plan is required

C. BURIED WARNING AND IDENTIFICATION OF UTILITIES

For all underground utilities installed under this project, provide warning tape manufactured specifically for warning and identification of buried utility lines. For non-metallic piping also install detection wire.

A. UTILITY AS-BUILTS

Document the following features of new utilities with an accuracy of not less than 0.10 foot (~1 inch) in plan and elevation by providing not less than 3 linier dimensions to adjacent structures or other permanent surface features. Alternatively, these features may be surveyed (to the same or greater precision) using established surveying techniques and reported on Jefferson Lab datum (see subcontract drawings for control point locations):

1. Points where utilities enter or pass under slabs or foundations
2. Location of all surface appurtenances of utilities including but not limited to manholes, hand holes, valve boxes, post indicator valves, fire department connections, backflow preventers, vents.
3. Location of all bends, tees, wyes, sweeps or other changes in direction (either vertical or horizontal) of a utility
4. Points of interconnection with existing utilities
5. Points where installed utilities pass under or over previously existing utilities.

Deliver information in the format called for in CI/ASCE 38-02 and in accordance with Division 01 Section, “Closeout procedures”.

PART 2 - PRODUCTS

2.1 UTILTY IDENTIFICATION

A. BURIED WARNING AND IDENTIFICATION TAPE

Foil backed detectable polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Minimum thickness of tape shall be .003 inch. Tape shall have minimum strength of 1500 psi lengthwise and 1250 psi crosswise, with a maximum 350 percent elongation. .

Warning Tape Color Codes:

Red	Electric
Yellow	Gas
Orange	Telephone and Other Communications
Blue	Water Systems
Green	Sewer Systems
Gray	Compressed Air

B. DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum diameter of 12 AWG.

PART 3 - EXECUTION

3.1 IDENTIFICATION OF UTILITIES

A. BURIED WARNING AND IDENTIFICATION TAPE

Bury tape above the utility and 12 inches below finished grade. Warning tape is not required for utilities installed by the directional bore method.

B. DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

Subcontractor shall test the detection wire utilizing utility locate methods prior to owner acceptance of the pipe installation.

C. ABANDONED UTILITY LINES

All known existing utilities on site are to be removed versus abandoned in place unless indicated on the subcontract drawings to be capped as shown.

END OF SECTION 011000

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment. These procedures supplement Subcontract FAR Clause 52.232-5, “Payments under Fixed-Price Construction Subcontracts.”

B. See Division 01 Section "Construction Progress Documentation" for submitting the construction schedule.

1.2 SCHEDULE OF VALUES

A. The schedule of values shall be prepared in conjunction with the development of the performance schedule. Installed components of work and their associated tasks listed in the Schedule of Values shall match the activities in the construction schedule. Once approved the activity values listed in the Schedule of Values shall not be changed.

B. Format & Content:

1. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each activity listed. Jefferson Lab/JSA will provide the Subcontractor with a MS Excel Spreadsheet electronic file.
   a. ID number – The identification or activity number shall match the identification used on the performance schedule.
   b. Activity Description – The activity description shall match the description used on the performance schedule.
   c. Number of Units
   d. Units – The units identified for an activity shall be suitable to determine the activity’s percent complete on a monthly basis.
   e. Material Unit Value and Total Material Value for each activity
   f. Labor Unit Value and Total Labor Value for each activity
   g. Total Value for each activity

2. Round amounts to nearest whole dollar; total shall equal the Subcontract Sum.

3. Schedule of Values along with schedule shall be subdivided into sections (peg points) for tracking progress. A minimum of four sections shall be utilized and are as follows: North Loop, South Loop, End Station Loop and CHL Loop. Each loop shall identify activities related to that section. The forma of the SOV and schedule should incorporate the additives/alternates in the bid schedule.

4. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

5. Each item in the Schedule of Values and Application for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may not be shown as separate line items in the Schedule of Values. Distribute the cost as general overhead expense across actual work-in-place activities.
    b. The amount of premiums paid for performance and payment bonds may be a line item of the Schedule of Values.
    c. Mobilization line items are acceptable provided there is an equal value demobilization line item.
    d. Items indicated as lump sum for the unit will be paid only when the Item is 100% complete.

6. Updating: Update and resubmit the Schedule of Values before the next Application for Payment when Subcontract Modifications change the Subcontract Sum.

C. Submit the Schedule of Values to SOTR at earliest possible date. No Applications for Payment will be accepted until after the SOTR has approved the Schedule of Values.

D. Schedule of Values will not be approved without an approved construction schedule.

1.3 PAYMENT FOR STORED MATERIALS

A. Typically, Jefferson Lab/JSA doesn't pay for material received but not installed. Upon the Subcontractor's request and the SOTR's concurrence, the Subcontracting Officer may consider payment for materials received but not installed. The authorized payment for stored material will be based on the lesser of the following: (1) The total value of all invoices submitted for the activity or (2) the material value listed in the Schedule of Values.

1. Material invoices shall be legible and clearly document the type, quantity, and cost of the materials covered in the Application for Payment.
2. For material not onsite the Subcontractor payment may be allowed under the following conditions:
    a. Submittal of a legible paid invoice for the material for a quantity not exceeded what is needed for the contract
    b. Material shall be insured and stored in a secure warehouse with the Subcontractor responsible for the costs. The policy shall show JSA as the owner of the material with the policy at least the value of the invoice with no deductable.
    c. The SOTR or their representative will verify the material inventory prior to any payment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 APPLICATIONS FOR PAYMENT

A. Applications for Payment may be submitted no more than monthly. Each Application for Payment shall be consistent with previous applications and payments as certified by the SOTR and paid for by Jefferson Lab/JSA. Use Jefferson Lab/JSA's provided form for Applications for Payment.

B. Prior to preparation and submission of an Application for Payment, the Subcontractor's representative and the SOTR shall meet and agree on the percent complete of each activity in the Schedule of Values.

C. Application Preparation: Submit a signed copy of each Application for Payment to finance@jlab.org for SOTR and Subcontracting Officer approval. The Subcontracting Officer will return incomplete applications without action. With each application, submit the following items:

1. Application for Payment Form
2. Monthly voucher identifying the work complete.
3. Updated Performance Schedule. Percent complete on the performance schedule shall be supported by the Monthly voucher. Use updated schedules if revisions were made.
4. Copies of stored material invoices.

D. Administrative actions and submittals that must precede or coincide with submittal of Application for Payment include the following:
1. List of subcontractors
2. Approved Schedule of Values including updates.
3. Performance Schedule.
4. Submittals Schedule.
5. Technical Submittals up-to-date. Work without approved submittals will not be paid.
6. As-Builts up-to-date.
7. Payroll submissions up-to-date.

3.2 SUBCONTRACT MODIFICATIONS

A. Each subcontract modification shall be added to the end of the approved Schedule of Values. The modification shall be broken into a sufficient number of activities to adequately identify the percent complete of each activity.

END OF SECTION 012900

JEFFERSON LAB/JSA APPLICATION FOR PAYMENT

PART I - To be completed by Subcontractor

From: Subcontractor Name
Subcontractor Address
Subcontract Address

Subcontract No.
Project Title:

Voucher No:
Date:

To: JSA/Jefferson Lab
628 Hofstadter Road, Suite 4 (Accounts Payable)
Newport News, VA 23606

Contract Total:	
Amount of Work Complete to Date:	
Previous Payments:	
Amount Requested for Payment:	$0
Balance to Finish:	$0
% Complete	#DIV/0!

I hereby certify, to the best of my knowledge and belief, that— (1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract; (2) All payments due to subcontractors and suppliers from previous payments received under the contract have been made, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of Chapter 39 of Title 31, United States Code; (3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and (4) This certification is not to be construed as final acceptance of a subcontractor's performance.

(Signature, Title & Date)

PART II - To be completed by SOTR

Subcontractor Requested Payment:	
Minus Work not Complete:	
Minus Safety Fines:	
Minus Retention:	
Other Deductions: _____	
SUBTOTAL OF REDUCTIONS:	
TOTAL RECOMMENDED PAYMENT:	

(Signature & Date)

PART III - To be completed by Subcontracting Officer

TOTAL PAYMENT APPROVED:

(Signature & Date)

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project; including, but not limited to, the following:

1. Project meetings.
2. Requests for Interpretation (RFIs).

B. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Startup and adjustment of systems.
8. Project closeout activities.

1.3 SUBMITTALS

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office numbers. Provide names, addresses and telephone numbers of individuals assigned as standby in the absence of individuals assigned to Project.

1.4 PROJECT MEETINGS

A. Preconstruction Conference: The Subcontractor shall attend a preconstruction conference scheduled by the Subcontracting Officer. The conference will be held at the Project site or another convenient location.

B. Progress Meetings
1. Construction Status Meetings: In accordance with Subcontract JSA Clause 406 "Construction Status Meetings", the Subcontractor shall attend monthly project progress meetings scheduled by Jefferson Lab. The Subcontractor's Superintendent and Project Manager shall attend all scheduled meetings. Other Subcontractor Representatives shall attend as determined needed or upon request of Jefferson Lab.

2. SOTR Progress Meetings: SOTR will conduct progress meetings at biweekly intervals.

1.5 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response. RFI's shall be submitted to the SOTR.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: The content of the RFI Form will be agreed upon by Jefferson Lab and the Subcontractor at the beginning of the subcontract. RFI should include a detailed, legible description of item needing interpretation and the following:

1. Subcontract Number and Project name.
2. Date.
3. Name of Subcontractor and applicable lower tier Subcontractors.
4. RFI number, numbered sequentially.
5. Specification Section number and related paragraphs, as appropriate.
6. Drawing number and detail references, as appropriate.
7. Field dimensions and conditions, as appropriate.
8. Subcontractor's suggested solution(s). If proposed solution(s) impact the Subcontract Time or the Subcontract Sum, Subcontractor shall indicate the impact in the RFI.
9. Subcontractor's signature.

10. Appropriate attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

C. Action: Jefferson Lab will review each RFI, determine action required, and return it. Allow seven working days for response for each RFI.

1.6 SUBMITTAL EXCHANGE

A. Procedure: Submittal Exchange shall be used to forward the following:
1. Contract Documents
2. Meeting Minutes
3. Testing and Inspection Reports
4. Daily Reports
5. Construction site Photos
6. Submittals
7. RFIs
8. Schedule
9. Application for Payment
10. Certified Payrolls

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Subcontractor's Construction Schedule.
2. Daily construction reports.

B. See Division 01 Section "Summary" for work sequence requirements.

C. See Division 01 Section "Payment Procedures" for submitting the Schedule of Values. Refer to 012900-1.2B.3 for set-up of schedule.

D. See Division 01 Section “Project Management and Coordination” for coordination requirements.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either JSA or Subcontractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Subcontract completion date.

E. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

F. Major Area: A story of construction, a separate building, or a similar significant construction element.

1.3 SUBMITTALS

A. Subcontractor's Construction Schedule: Submit initial schedule large enough to show entire schedule for entire construction period and upload to Submittal Exchange.

B. CPM Reports: Concurrent with CPM schedule, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. S-Curve: .Earnings curves showing projected earnings and earnings to date based on work complete.

C. Daily Construction Reports: Submit one copy at daily intervals to JLAB QC/Safety Representative to be uploaded to Submittal Exchange.

PART 2 - PRODUCTS

2.1 SUBCONTRACTOR'S CONSTRUCTION SCHEDULE- GENERAL

A. In accordance with Subcontract Clause “Schedules for Construction Subcontracts”, the subcontractor shall prepare a Construction Schedule and enter actual progress on the approved construction schedule chart for the life of the Subcontract. The Subcontractor is responsible for managing, sequencing and prosecuting the Work to comply with the subcontract requirements and ensure a timely completion. The approved Construction Schedule shall be used to measure the progress of the work and to aid in evaluating time extensions. The Critical Path Method (CPM) of network calculation shall be used to generate the Construction Schedule.

1. Level of Detail: The Construction Schedule shall include an appropriate level of detail. Failure to develop or update the Construction Schedule or provide data to the Subcontracting Officer shall result in the disapproval of the schedule.
2. The Construction Schedule shall extend from the date of the Notice to Proceed to the Subcontract Completion Date.

B. Activities: Treat each loop (North, South, CHL and End Station Loops) or separate area as a separate numbered activity for each principal element of the Work. Installed components of work and their associated tasks listed in the Schedule of Values shall match the activities in the construction schedule. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by SOTR.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule.
4. Startup and Testing Time: Testing to be an activity for each unitsub.
5. Final Inspection and Acceptance – The Construction Schedule shall include sufficient time for the final inspection and correction of the punchlist in advance of the subcontract completion date.

C. Constraints: Include constraints and work restrictions indicated in the Specification 011000-1.5 Project Constraint and a follows in schedule, and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect on the schedule of the following:

a. Coordination with existing construction (33 MVA Substation).
b. Uninterruptible services.
c. Use of premises restrictions.
d. Seasonal variations.

D. Subcontract Modifications: For each proposed change with a potential time extension, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule. Submit this concurrent with the proposed cost breakdown. Each modification shall be incorporated into the approved schedule as separate identifiable activities and inserted appropriately on the first update following issuance of a directive to proceed with the change.

E. Diagram: Show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned. Submit a comprehensive, fully developed, horizontal Gantt-chart-type Initial Construction Schedule within 15 days of the Notice to Proceed. Submit Updated Construction Schedule monthly with each progress payment request. The diagram shall include the following:

1. Activity Number
2. Activity Description
3. Duration in Work Days
4. Early and Late Start Date of Each Activity
5. Early and Late Finish Date of Each Activity
6. Actual Start and Finish Date of Each Activity
7. Clear Identification of the Critical Path Activities
8. Float of Each Activity

F. CPM Reports: Submit with each Construction Schedule submission.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use Microsoft Project or Primavera. for Windows XP or Windows Vista operating system.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Startup Network Diagram: Submit diagram within 5 days of date established for the Notice to Proceed Outline significant construction activities Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 15 days after date established for the Notice to Proceed.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing and commissioning.
j. Punch list and final completion.
k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording events at Project site, including the following:

1. Activities worked on that day.
2. List of subcontractors and number of workers.
3. High and low temperatures and general weather conditions, including presence of rain or snow.

4. Accidents.
5. Stoppages, delays, shortages, and losses.
6. Material delivered to site.
7. Orders and requests of authorities having jurisdiction.
8. Construction Change Directives received and implemented.
9. Services connected and disconnected.
10. Equipment or system tests and startups.
11. Construction equipment on site and hours worked.
12. Partial completions and occupancies.
13. Substantial Completions authorized

PART 3 - EXECUTION

3.1 SUBCONTRACTOR'S CONSTRUCTION SCHEDULE

A. On site work may commence after the construction schedule and site specific safety plan is approved and a work permit is issued.

B. Preliminary Schedule Meeting: At the Subcontractor's request, the SOTR will meet with the Subcontractor to discuss the proposed schedule and requirements of this section. To maximize the efficiency of the meeting, it is recommended that the Subcontractor identify the work activities and duration, long-lead materials and fabrication times prior to meeting with the SOTR.

C. Construction Schedule Updates: At monthly intervals, update the construction schedule to reflect actual start dates, actual completion dates, and percentage complete for each activity on the approved schedule. The updated construction schedule shall be submitted with each progress payment request.

1. Include a report with the Updated Construction Schedule that lists revisions to logic, new activities and changes in activity duration. This report does not need to include changes to activity percentage complete.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals in accordance with Subcontract Clause “Specifications and Drawings for Construction” and the Technical Provisions. Prepare and submit submittals required by individual Specifications Sections.

B. Related Requirements:
1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule and construction photographs.
2. Section 014000 “Quality Requirements” for submitting test and inspection reports and Delegated-Design Submittals.
3. Section 017700 "Closeout Procedures" for submitting project record documents and operation and maintenance manuals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require SOTR’s responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require SOTR’s responsive action. Submittals may be rejected for not complying with requirements.

1.3 TYPES OF SUBMITTALS

A. Shop Drawings: Drawings, schedules, diagrams, and other data prepared specifically for this subcontract to illustrate a portion of the work.

B. Product Data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer’s descriptive literature, MSDS’, catalog data, and other data to illustrate a portion of work, but not prepared exclusively for this subcontract.

C. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to a portion of work, illustrating portion of work or establishing standards for evaluating appearance of finished work or both.

D. Certifications: Statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of subcontract and clearly name the project.

E. Administrative Submittals: Data presented for review and approval to ensure that administrative requirements of the Project are adequately met but not to ensure directly that work is in accordance with design concept and in compliance with subcontract documents. These submittals are typically required by a Division 01 Section.

1.4 SUBMITTAL REGISTER

A. Submittal Register: The project submittal register will be generated by Submittal Exchange prior to NTP.

1. The completed Submittal Register will include the Item No., Specification Section/Paragraph Number, Submittal Description, Submittal Type as defined above, and the Approval Needed By date. The Approval Needed By date shall be input into Submittal Exchange by the contractor and coordinated with the Construction Schedule and the specified review times.

B. Contractor to provide a transmittal for each submittal.
1. Submittals will not be accepted for review until the Submittal Register is complete.
2. Submittals requiring coordination with a different specification section shall be submitted together.
3. Submittals for a given specification section should be submitted simultaneously if possible.

C. Contractor’s Review: The Subcontractor shall review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submission.

D. Submittal Register Input: Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Owner’s Digital Data Files: Electronic copies of digital data files of the Contract Drawings can be provided by SOTR for Contractor's use in preparing submittals.

1. Owner can furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. Owner makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement or Agreement form acceptable to SOTR.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. SOTR reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on SOTR's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 work days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. SOTR will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 7 work days for review of each resubmittal.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Electronic Submittal Summary
    a. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using Submittal Exchange, a website service designed specifically for transmitting submittals between construction team members.
    b. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.

2. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
3. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by SOTR.
5. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name of Subcontractor.

d. Name of firm or entity that prepared submittal.
e. Names of manufacturer and supplier.
f. Specification Section number and title.
g. Specification paragraph number or drawing designation and generic name for each of multiple items.
h. Drawing number and detail references, as appropriate.
i. Location(s) where product is to be installed, as appropriate.
j. Related physical samples submitted directly.
k. Indication of full or partial submittal.
l. Transmittal number**,** numbered consecutively.
m. Submittal and transmittal distribution record.
n. Other necessary identification.
o. Remarks.

6. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

E. Contractor's Review: The Subcontractor shall review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submission.

F. Options: Identify options requiring selection by Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from SOTR's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. Submission: Package each submittal appropriately for transmittal and handling using the Transmittal Form. Transmit submittals required by Division 01 and Divisions 02 through 49 to the SOTR through Submittal Exchange**.**

B. The Subcontractor is responsible to ensure the submittals are complete and coordinated with subsequent submittals to permit proper and timely reviews. Incomplete or improperly prepared submittals may be returned to the Subcontractor without review action. No extension of the Subcontract time will be authorized because of failure to transmit complete submittals enough in advance of the Work to permit processing.

C. Electronic Submittal Procedures:
1. Subcontractor will post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project. Contractor may use any or all of the following options.
   a. Lower tier subcontractors and suppliers provide electronic (PDF) submittals to Subcontractor via the Submittal Exchange website.
   b. Lower tier subcontractors and suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
   c. Lower tier subcontractors and suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
2. Subcontractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
3. Subcontractor shall transmit each submittal to SOTR using the Submittal Exchange website, www.submittalexchange.com.
4. SOTR and Owner review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.
5. Distribution of reviewed submittals to lower tier subcontractors and suppliers is the responsibility of the Subcontractor.

D. Action Submittals: Upload submittals to Submittal Exchange for approval by DOR/SOTR.

E. Informational Submittals: Upload to submittal exchange for review by SOTR.

F. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

G. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data in the following format:

    a. PDF electronic file.

H. Shop Drawings**:** Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.

I. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

J. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures.

K. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

L. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."

R. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to SOTR

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

3.2 SOTR'S ACTION

A. General: SOTR will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: SOTR will review each submittal, make marks to indicate corrections or revisions required, and return it. SOTR will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: SOTR will review each submittal and will not return it, or will return it if it does not comply with requirements. SOTR will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

3.3 Submittal Exchange Costs:

A. The cost of Submittal Exchange services has been paid in full by the Owner.

B. At Subcontractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.

C. Internet Service and Equipment Requirements:
1. Email address and Internet access at Subcontractor's main office.
2. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

END OF SECTION 013300

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE	DATE:		NEW SUBMITTAL
			RESUBMITTAL

(This section to be completed by the subcontractor)

TO:	FROM:	SUBCONTRACT NO.	TRANSMITTAL NO.
		PROJECT NO.	PREVIOUS TRANSMITTAL NO.

SPECIFICATION SEC. NO. (Cover only one section with each transmittal):	PROJECT TITLE AND LOCATION:

ITEM NO.	DESCRIPTION OF ITEM SUBMITTED	SPEC. PARA. NO.	NO. OF COPIES	FOR JSA USE ONLY		
				ACTION CODE	INITIAL (Reviewer)	COMMENTS

REMARKS:	I certify, that the above submitted items have been reviewed in detail and are correct and in strict conformance with the subcontract drawings and specifications, except as otherwise stated and that JSA approval is not required to initiate construction, except for stated deviations.
	NAME AND SIGNATURE OF SUBCONTRACTOR

Jefferson Science Associates, LLC (JSA)

NAME, TITLE, AND SIGNATURE OF APPROVING AUTHORITY	DATE:

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED. (A code letter will be inserted for each item listed above.)

ACTION CODES:	A - Approved	D - Disapproved and Resubmittal Required
	AN - Approved as Noted	RA - Receipt Acknowledged

NOTE: Approval of items does not relieve the subcontractor from complying with all the requirements of the subcontract plans and specifications.

SECTION 013529 - SAFETY AND HEALTH REQUIREMENTS

PART 1 - GENERAL

1.1 JEFFERSON LAB'S ES&H POLICY

Jefferson Lab considers no activity to be so urgent or important that we will compromise our standards for environmental protection, safety, or health (ES&H).

1.2 REFERENCES – The publications listed below form a part of this specification to the extent referenced.

A. 29 CFR 1926, Occupational Safety and Health Standards for Construction
B. 29 CFR 1904, Record Keeping Guidelines for Occupational Injuries and Illnesses
C. 10 CFR 851, Department of Energy Worker Safety and Health Program
D. 10 CFR 835, Occupational Radiation Protection
E. NFPA 70E, Standard for Electrical Safety in the Workplace (2004)
F. JSA/Jefferson Lab (JLab) ES&H Manual. This document is available electronically through Jefferson Lab's www homepage at http://www.jlab.org/ehs/ehsmanual/index.html.
G. 10 CFR 708, Department of Energy Contractor Employee Protection Program
H. American Conference of Governmental Industrial Hygienists (ACGIH), "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices" (2005}

1.3 DEFINITIONS

A. Competent Person: One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
B. Construction: The combination of erection, installation, assembly, demolition, or fabrication activities involved to create a new facility or to alter, add to, rehabilitate, dismantle, or remove an existing facility. It also includes the alteration and repair (including dredging, excavating, and painting) of buildings, structures, or other real property, as well as any construction, demolition, and excavation activities conducted as part of environmental restoration or remediation efforts.
C. Construction Worksite: The area within the limits necessary to perform the work described in this subcontract.
D. Imminent Danger: A hazard which, if allowed to persist, is quite likely to cause an accident that will result in death, serious injury, significant property damage, or environmental impairment.
E. Qualified Person - One who, by possession of a recognized degree, certification, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems relating to the subject matter, the work, or the project.
F. Qualified Person for Electrical Work - One who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.
G. Safety Plan: An official, binding document prepared by a subcontractor, bearing the signature of a responsible manager of the subcontracting company that defines the safety

and health practices and responsibilities necessary to conduct operations on Jefferson Lab property in a safe manner.

H. Safety Program: Company policies and procedures to ensure operations comply with applicable safety and occupational health laws and regulations and to protect the safety and health of employees and members of the public.

I. Stop-Work Order: A definitive statement made openly to another individual that an imminent danger situation exists and thus all related work must stop immediately.

J. Subcontracting Officer's Technical Representative (SOTR): The individual or firm responsible to JSA, for the supervision and administration of the construction project to ensure the construction contractor's compliance with technical specifications, ES&H requirements, and serves as the primary liaison between the subcontractor and Jefferson Lab. Any reference to SOTR within this subcontract shall be interpreted as the Construction Manager in 10 CFR 851.

K. Certified Industrial Hygienist: An individual who has me the minimum requirements issued by the American Board of Industrial Hygiene and has been designated as such.

1.4 SUBMITTALS

A. Safety Plan
B. Activity Hazard Analysis (AHA)
C. Initial and Annual Certification of Subcontractor provided Training
D. Material Safety Data Sheets (MSDS)
E. Tabulation of On-site Work Hours
F. Incident Investigation Reports
G. Lift Plans

1.5 GENERAL REQUIREMENTS

A. In addition to the detailed requirements included in the provisions of this subcontract, work performed shall comply with OSHA 29 CFR 1926. The Subcontractor shall take all reasonable precautions in the performance of the work under this subcontract to protect safety and health of employees, of lower tier subcontractors' employees, and of members of the public. During construction, all operations and personnel shall comply with all applicable safety and health regulations and requirements (including reporting requirements) of JSA and the Government. Where the requirements of this specification, applicable regulations, and referenced documents vary, the most stringent requirements shall apply.

B. No work shall commence on the construction worksite until Jefferson Lab issues a work permit based on the approved Safety Plan.

C. Stop-Work Actions and Interventions – In accordance with the JLab ES&H Manual, every Jefferson Lab employee, subcontractor, user, and DOE employee has the authority and responsibility to stop work for conditions that pose imminent hazard or danger.

1. The Subcontractor shall accept and respond immediately to directions from anyone to cease any activity or condition that is deemed unsafe. This applies to work by other subcontractors or by Jefferson Lab staff. This judgment shall be based upon subcontractors' experience, training, or knowledge of Jefferson Lab work-safety rules. Subcontractors shall immediately notify the SOTR or if unavailable contact 269-7400 any time work is stopped under the above described conditions.
2. In the event that the Subcontractor fails to comply with applicable regulations or requirements, JSA may, without prejudice to any other legal or contractual rights, issue

an order stopping all or any part of the work. Thereafter, a start order for resumption of the work may be issued at the discretion of JSA.

1.6 SUBCONTRACTOR'S SAFETY PROGRAM

A. The ultimate responsibility for compliance with all applicable federal, state, and local safety and health laws and regulations and the requirements referenced herein rests with the Subcontractor. It is the Subcontractor's responsibility to provide a safe and healthful place for carrying out the work on this subcontract.

1. To ensure compliance with applicable regulations and project safety requirements, the subcontractor and lower tier subcontractors are subject to periodic scheduled and unscheduled inspections by the SOTR and/or Jefferson Lab ES&H professionals during the course of this subcontract.
2. Failure of the Subcontractor or its subcontractors to comply with the referenced safety regulations contained herein will be considered a safety violation and will result in the action(s) listed below. There shall be no recourse by the Subcontractor for compensation due to lost time, claims for time extensions, or for excess costs or damages resulting from the initiation of these actions.

a. For serious violations, which pose an immediate risk to life or property, an order will be issued to stop immediately part or all of the Subcontractor's work until compliance is achieved.
b. For all other violations, the Subcontracting Officer or SOTR may issue a notice to the Subcontractor, stating the violation and the corrective action required. If the Subcontractor does not correct the violation within a stated abatement period, the following actions may be initiated:

1) Subcontract payment retention may be held until the deficiency is corrected.
2) An order may be issued to stop part or the entire Subcontractor's work until the deficiency is corrected.
3) The Subcontracting Officer may make the necessary arrangements to correct the violation and the cost thereof will be charged to the Subcontractor. Costs of such corrections may be retained and deducted from the final payment amount otherwise due the Subcontractor.

c. Safety performance is taken into account for consideration of future work.

B. SITE SAFETY AND HEALTH REPRESENTATIVE (SSHR)

1. The Subcontractor shall have a designated representative on the construction worksite that is knowledgeable of the project's hazards and has full authority to act on behalf of the Subcontractor and direct lower tier Subcontractor employees regarding Safety and Health in accordance with 10 CFR 851.

a. The designated Site Safety and Health Representative shall have the experience and training to be knowledgeable of the project's hazards and to establish him/her as a qualified person for this duty.

1) The designated Site Safety and Health Representative shall have the 30-Hour OSHA Construction Safety and Health course.
2) At least 3 years of construction experience where safety is at least 50% of duties and where breadth and depth of safety experience covers work to be performed.

b. The designated Site Safety and Health Representative cannot have any other assigned duties.

2. The designated Site Safety and Health Representative must make frequent and regular inspections of the construction worksite to identify and correct any instances of noncompliance with project safety and health requirements. These inspections shall detect and/or verify correction of hazardous conditions or hazardous work that impacts the Subcontractor and lower-tier Subcontractor employees. The inspections and corrective actions shall be documented in writing.
3. No work shall be performed when the designated Site Safety and Health Representative or his approved designee is not present on the construction worksite. Any approved designee shall meet the same requirements as the Site Safety and Health Representative.
4. If the safety and health representative does not have expertise/experience in a particular hazard, the subcontractor is expected to make such expertise readily available.

C. WRITTEN SAFETY PLAN – In accordance with 10 CFR 851 the Subcontractor shall submit a written project specific Safety Plan encompassing all pertinent aspects of the Subcontractor's Safety Program and addressing how the requirements of this specification section will be implemented. The Safety Plan shall encompass the work of any and all lower tier subcontractors involved in activities under this Subcontract, and it shall include the Subcontractor's methods to enforce the elements of the Safety Program for all personnel on the construction worksite.

1. Time for Submissions - Within twenty-one (21) calendar days after receipt of the subcontract award.
2. Work at the construction worksite shall not commence until the Subcontractor's Safety Plan has been approved by the SOTR.
3. Preliminary Safety Plan Meeting: The SOTR and JLab ES&H professionals will meet with the Subcontractor to discuss the elements of the Subcontractor's Safety Program and the requirements of this section. To maximize the efficiency of the meeting, it is recommended that the Subcontractor have a draft of his Safety Plan.
4. The Subcontractor's Safety Plan shall include the following, at a minimum:

a. A statement of the subcontractor's commitment to provide a safe and healthful construction worksite for all employees including subcontractors' employees and Jefferson Lab personnel.

1) Include a policy statement concerning substance abuse on the construction worksite.
2) A signature of a responsible manager of the subcontracting company

b. Name, title and qualifications of the designated Site Safety and Health Representative and designated alternates.

1) Documented evidence of Off-Site Training for the Site Safety and Health Representative
2) Description of the inspections performed by this individual (frequency and format for documentation of inspections).

c. Procedures for coordinating safety and health with lower tier subcontractor's and Jefferson Lab personnel on the construction worksite.
d. Procedures for communicating and coordinating safety and health requirements to non-English speaking subcontractor personnel.
e. Preliminary assessment of hazards and a list of the activity hazard analyses that will be performed for the project.
f. Description of activity hazard analysis process, including

1) How workers are informed of hazards and protective actions
2) How workers will acknowledge being provided the information
3) A disciplinary process for non-compliance with protective measures identified in the AHA.
4) How objective evidence (i. e. monitoring results) is to be used for establishing control measures, including exposure assessments to verify adequacy of control, if necessary as dictated by the hazards expected to be encountered.

g. Identify safety and health training requirements and procedures including but not limited to:

1) New worker Orientation shall occur prior to beginning work on the construction worksite.
2) Each worker acknowledging work hazards.
3) Frequency of tool-box safety meetings.
4) Updates or changes on safety practices relevant to the construction worksite, discussions how corrective actions and lessons learned from incidents at the construction worksite and elsewhere will be incorporated into the project's Safety Program.

h. The Subcontractor's hazard communication program and the specifics for the construction worksite.
1) Process for reporting and investigating recordable injuries for possible cause and corrective action in accordance with 10 CFR 1904.
2) Specific designation of management persons responsible for review of injury and illness reports.
i. Procedures for recording and reporting safety incidents and maintaining safety and health records in accordance with Occupational Safety and Health Administration (OSHA) requirements and in accordance with Jefferson Lab reporting requirements.

1) Procedures for the investigation of job-related incidents to determine possible cause and corrective action.
2) Specific designation of management persons responsible for review of injury and illness reports.

D. ACTIVITY HAZARD ANALYSIS

For each separately definable activity, the Subcontractor shall prepare an Activity Hazard Analysis (AHA) identifying the foreseeable hazards and planned protective measures. Hazards expected on the project which are common to all activities are classified as conventional hazards. Both conventional and special hazards need to be addressed for each definable activity during the course of the project. Additional AHAs shall be required if the nature of work changes or there is a new work task. The Subcontractor shall retain on the construction worksite a copy of all AHA's for the duration of the contract.

a. Conventional Hazards: The Subcontractor's Safety Plan may include the company's standard policies and practices for the following conventional hazards as they pertain to the project. The protective measures for these hazards must be followed by all workers on the construction worksite including all lower tier subcontractor personnel.

Storage & use of compressed gases	Concrete work
Confined space entry*****	Excavation and trenching
Hand & power tools	Floor, roof & wall openings
Construction worksite housekeeping	Ladders
Lockout/tagout*	Material handling & storage
Construction rolling stock	Rigging & hoisting *
Thermal Stress	Welding, cutting & grinding*****
	Scaffolds***** & powered man-lifts

***** Procedures are to be aligned with Jefferson Lab's ES&H Manual.

b. Special Hazards: The AHA for Special Hazards shall be written specifically for the construction worksite conditions. These hazards include, but are not limited to the following activities:

- Work on energized electrical equipment (See NFPA 70E section)
- Use of explosive-cartridge-actuated fastening systems
- Use of chemicals in a quantity or manner such that MSDS or other manufacturer information recommends use of special ventilation and/or respiratory protection
- Confined-space entry
- Excavations ≥ 5 feet in depth
- Other activities in occupied buildings that present a risk to the Laboratory's personnel, equipment, or property
- Silica Exposure (cutting masonry products; installing, cutting, or removing concrete; installing or removing sheet rock compound, or dealing with other silica containing products).

2. AHAs shall define the tasks being performed, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

a. The AHA format shall be as provided in the attached form or an approved alternate.

3. The AHA shall document any special training or certification requirements, JLAB permits, and shall identify by name the competent or qualified person(s) who will be responsible for the safe conduct of the activity. . This includes documentation of CPR and First Aid training for all personnel performing work on energized electrical equipment.

4. When the AHA is approved by the SOTR, and prior to start of work, the Subcontractor shall brief employees involved in or affected by the work activity on the identified hazards and the mitigating measures specified. All briefed employees shall acknowledge briefings on hazards by signing or initialing the AHA activity.

5. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s)

a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
c. If work conditions change for an activity from the approved AHA, the activity shall stop until the AHA is updated to reflect the actual conditions and approved by the SOTR/SSHR. The revised AHA shall be briefed to affected individuals and resigned showing their acknowledgement.

6. Jefferson Lab Hazard(s) – The Subcontractor is responsible for providing personnel protection equipment (PPE) and hazard awareness training to all construction workers for identified hazard(s) located in CHL, North Access and South Access Buildings. JLAB hazard(s) may include:

a. Hearing Protection
b. Oxygen deficiency

E. 100% EYE, HEAD, AND FOOT PROTECTION - All construction workers and other personnel on the construction worksite shall wear at all times eye, head, and foot protection that complies with applicable ANSI Standards. The type of protective eyewear shall be selected as appropriate for the hazard. Gloves shall also be worn when handling sharp objects.

F. OCCUPATIONAL HEALTH –The Subcontractor shall insure the availability of medical personnel for advice and consultation on matters of occupational health. Subcontractors shall work with Jefferson Lab Occupational Medicine to assess occupational medical needs including medical surveillance and occupational case management.

1. All workers shall be physically and medically qualified for performing the duties to which they are assigned.

2. Exposure of workers to inhalation, ingestion, skin absorption, or contact with any material or substance in excess of acceptable limits specified in the American Conference of Governmental Industrial Hygienists (ACGIH), ''Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices,'' (2005) or by OSHA, whichever is more stringent, is prohibited.

    a. The Subcontractor shall comply with all applicable standards and regulation to reduce contaminant concentration levels as low as is reasonably achievable.

3. Thermal Stress Hazards – In situations where heat/cold stress may impact worker safety and health, the Subcontractor shall minimize the associated hazards with one of the following programs:

    a. Company established procedures as documented in the approved Safety Plan, or
    b. Procedures documented in the JLab ES&H Manual Chapter 6670 – Heat and Cold Stress Mitigation Program.

4. First Aid – Jefferson Lab will provide first-aid services for all workers on the construction worksite during normal business hours. Services are available at Building 28, Support Service Center.

G. JEFFERSON LAB PERMITS/PLANS AND INSPECTIONS – The Subcontractor must obtain a permit from Jefferson Lab to specifically authorize an activity to proceed under conditions recognized to be hazardous and requiring additional control. Permits will be issued based on approved Activity Hazard Analysis and completed permit application forms. Display the Permits at the construction worksite during entire duration of the work activity. Not complying with the requirement for a permit may result in JSA stopping work and assessing a penalty. See paragraph 1.8 for safety penalties. Obtain the following permits before the start of the activity at the construction worksite:

1. Work Permit - No work shall commence on the construction site until Jefferson Lab issues a work permit. Issuance of the permit is based upon submission and acceptance of the necessary plans and permits to perform the planned work.
2. Dig/Blind Penetration Permit is required prior to commencement of excavation, digging, boring into soil, drilling or cutting blind penetrations into floors, walls or roofs and demolition. All utilities must be located in accordance with Division 01 Summary section.
3. Hot Work Permit (HWP) – All work activities that use welding, hot cutting, brazing and abrasive grinding require a FHWP (hot work permit). Refer to ES&H Manual Chapter 6900 Appendix T1 Fire Protection/ Hot Work Permit.
4. Lift Plans - Use of mobile cranes on Site or use of Jefferson Lab overhead cranes (if allowed under the contract) requires submission of a lift plan for approval prior to work being performed as described in paragraph J.2 of this section.
5. Construction Equipment Inspection – Prior to use of construction equipment such as, but not limited to, backhoe, skid/steer loaders, pavers, excavators, powered industrial trucks, cranes, well drilling rigs, etc. Jefferson Lab Material Handling Staff will inspect the equipment for compliances with OSHA regulations.

H. MATERIAL SAFETY DATA SHEETS - The Subcontractor shall make available the Material Safety data Sheet (MSDS) for material brought or used on construction worksite to all workers. [Jefferson Lab may request a copy of individual MSDS for any product at

any time.][For any material to be used in occupied spaces, submit a copy of the MSDS to the SOTR before use of the material.]

I. WORK ON ELECTRICAL CIRCUITS AND SYSTEMS – (NFPA 70E)

1. Work on electrical equipment, other than that which is infeasible to perform de-energized such as voltage and current measurements, is not permitted at Jefferson Lab. Energized equipment shall be de-energized and locked and tagged out before work commences in the equipment enclosure.
2. Work on electrical circuits and systems shall be performed in accordance with NFPA 70E. This includes all start-up and commissioning activities.
3. All work on electrical circuits and systems shall be performed by a qualified electrical worker.
4. The qualified electrical worker shall verify zero voltage using a meter before any work is performed on de-energized equipment. Personal protective equipment in accordance with NFPA 70E shall be used until zero voltage has been verified. All electrical connections shall be inspected and approved by a qualified electrical worker prior to testing equipment and installing/reinstalling protective covers.
5. Personal protective equipment (PPE) – non-melting inner and outer garments (per ASTM F1506-00) or untreated natural fibers is required as regular work attire. Additional protective clothing and protective gear shall be worn as specified in NFPA 70E table 130.7(c) (10), Protective Clothing and PPE Matrix.

J. MATERIAL HANDLING AND MANLIFT EQUIPMENT

1. Prior to use of material handling equipment on the construction worksite, the Subcontractor shall ensure:

    a. The equipment meets the requirements of OSHA, ASME, and ANSI.
    b. Operators are trained and qualified to recognize the associated hazards.
    c. A competent person is designated and qualified to perform inspections as required by OSHA.
    d. OSHA required documentation for all material handling equipment must be available on site to the SOTR upon request.
    e. Jefferson Lab Material Handling Staff have inspected the equipment and approved it for use. Notice must be made to the SOTR on the previous business day.
2. Lift plans - Submit lift plans for each use of a mobile crane and when a forklift is used to raise a suspended load in accordance with ES&H Manual Chapter 6141 – Material Handling Program-Rigging, Cranes & Hoists.– The plan shall include the following, as applicable:
    a. The plan shall specify the size and weight of the load to be lifted and all crane and rigging components which add to the weight.
    b. The plan shall specify the lift geometry and procedures including the crane position, height of the lift, and the load radius. When using a mobile crane include outrigger positions.
    c. The plan shall designate the Crane Operator, Lift Supervisor, Rigger, Signal Person, and Assembly/Disassembly Director and provide documentation for their qualifications as per OSHA 29CFR1926 Subpart CC Cranes & Derricks in Construction.

d. The plan shall include a rigging plan that shows the lifts points and describes rigging procedures and hardware requirements (sling specifications, length, angles, shackle size, swivel eye hoist rings, etc.) and details for any below the hook lifting device.
e. The plan shall describe the ground conditions, outrigger or crawler track requirements, and, if necessary, the design of mats necessary to achieve a level, stable foundation of sufficient bearing capacity for the lift.
f. The plan shall list environmental conditions under which lift operations are to be stopped.
g. The plan shall specify coordination and communication requirements for the lift operation.
h. The plan shall specify the lifting area perimeter where those not directly involved with the lift will be kept out.
i. For lifts of personnel the plan shall demonstrate compliance with the requirements of 29 CFR 1926, subpart CC - "Cranes & Derricks in Construction" and 29 CFR 1926 Subpart DD – "Cranes and Derricks Used in Demolition and Underground Construction "

1.7 JEFFERSON LAB TRAINING REQUIREMENTS

A. Subcontractor provided Training – The Subcontractor is responsible for providing and maintaining records for all training required by OSHA, Federal, or state regulations. Examples are provided below. The contractor is responsible for submitting a letter, prior to commencing work on site and annually thereafter while working under this subcontract, certifying each of the workers has received the required training. Training is valid for no more than three years. Training shall be conducted by an organization that has been reviewed and approved by the International Association for Continuing Education and Training (IACET), 1620 I Street NW Suite 615; Washington, DC 20006. Other means of training shall be approved by the Subcontracting Officer.

1. OSHA Confined Space
2. OSHA Fire Safety
3. OSHA Equipment Operator Training (for type of equipment being used)
4. OSHA Ladder Safety
5. NFPA 70E
6. CPR and First Aid

B. Jefferson Lab Provided Training - Subcontractor personnel working at Jefferson Lab on this project are required to attend the following training prior to performance of any work on site. The training is provided at no cost.

Course	**Course Number**	**Approx. Duration**	**Required to Attend**
ES&H Orientation for Construction Subcontractors	SAF 100C	1 hours	All Personnel Valid for 3 years

Course	Course Number	Approx. Duration	Required to Attend
Silica Dust Hazards in Construction	SAF138 Or approved equivalent	1 Hour	Personnel cutting masonry products; installing, cutting, or removing concrete; installing or removing sheet rock compound, or dealing with other silica containing products
General Employee Radiological Training – GERT	SAF 800	2 hours	All Personnel working within the Accelerator Site, certain areas in the existing Test Lab and the EEL Buildings. Any personnel utilizing Radioactive Source Testing Devices. Valid for 2 years
Radiation Worker I	SAF 801	8 hours	All Personnel working in accelerator enclosures (tunnels/halls) and other Radiological Controlled Areas. Valid for 2 years
Oxygen Deficiency Hazards – ODH	SAF 103	2 hours	All Personnel working in ODH areas (CHL, N&S Linacs, and Halls) Valid for 2 years
Jefferson Lab Lock, Tag, and Try	SAF 104	2 hours	All personnel at risk from sudden release of energy
Spill Prevention Control & Counter Measure Plan	SAF 123	0.3 hour	Personnel working with oil products
Activity Hazard Analysis Preparation	GEN133	1 Hour	Individuals preparing an AHA plus the site safety and health representative.
Hall A Worker-Awareness Training/Walk-thru	SAF 110	1 hours	Individuals performing work in Hall
Hall B Worker-Awareness Training/Walk-thur	SAF 111	1 hours	Individuals performing work in Hall
Hall C Worker-Awareness Training/Walk-thru	SAF 112	1 hours	Individuals performing work in Hall

C. Radiological Training

1. General Employee Radiological Training (GERT) is required for all personnel working within the Accelerator site and in designated areas. GERT informs the employee of basic

radiation protection concepts and the Radiological Control Program established at JSA/Jefferson Lab.

2. Radiation Worker training is required for personnel needing unescorted access to radiologically controlled areas, and personnel handling or working with radioactive materials.
3. Radiation Worker Training also fulfills the GERT training requirement for an individual.

D. Oxygen Deficiency Hazards: Some work areas at Jefferson Lab store and/or use compressed gasses, liquefied gasses, and volatile liquids. The uncontrolled release of these gasses and liquids could lead to a reduction in the amount of available oxygen in the work area. Potential oxygen deficiency hazards (ODH) exist in North Linac, South Linac, Hall A, Hall B, Hall C, and End Station. When work is performed in these areas, Subcontractor personnel shall work in pairs, with one worker in each pair carrying an oxygen detector. Members of working pairs shall work within 15 feet of each other.

E. Lockout-Tag Out Training

1. If Subcontractor has their own Lockout Tag Out program, they may submit it to Jefferson Lab for review and approval. If approved by Jefferson Lab ESH&Q Division, workers covered by the program shall be exempt from Jefferson Lab Lockout/Tagout training. In general, Jefferson Lab does not permit "Tag Out-only" as an approved energy control process.

F. Electrical Training – In addition to OSHA required training, workers performing work on energized electrical systems 50 volts and over shall also have CPR and First Aid training and Emergency Victim Release training. Off-Site Safety Training: Electrical workers shall also have CPR and First Aid training and Emergency Victim Release training. Electrical workers

G. Access Escort in Lieu of Training**:** Visitors or escorted personnel to Jefferson Lab are escorted continuously by an individual who is qualified, trained, and authorized to enter the area(s) being visited. A "Visitor" is anyone who is not authorized to access an area without an Escort. The visitor is an individual who has not completed the requisite ES&H training. An "Escort" must have the appropriate training and authorization to enter the area(s) being visited. Subcontract employees are allowed to provide escort services for deliveries of material only. Escorted personnel shall not perform any work not related to deliveries. Non-Lab owned equipment must be inspected and accepted by the Lab Material Handling Department. . Escorted personnel shall remain in sight of the escort at all times. Escorts shall ensure that a safety briefing has been provided to the Visitor, which includes the basic safety information and any additional information relevant to the hazard issues to be encountered on site.

1.8 SAFETY PENALTIES

A. In addition to the other safety provisions of this Subcontract, a financial penalty assessment program will be utilized to reinforce compliance with those safety provisions and reduce the frequency of safety violations and accidents. The determinations regarding assessment of the fines will be made unilaterally by Jefferson Lab/JSA and are not subject to the Disputes clause.

B. Fines for Safety Violations. Monetary penalties will be assessed to the Subcontractor when violations are found based on the associated risk. All violations will be assigned a

risk code between 1 and 4 based on the severity of the potential injury and the likelihood of its occurrence. More information on the risk code assignments can be found in the JSA/Jefferson Lab ES&H Manual.

1. Assessment of Fines - When a violation is noted a determination will be made as to the risk posed by the deficiency. The amount of the fine increases with risk. The time allowed for abating a deficiency decreases with increasing risk. Imminent dangers (risk code 4) are stop-work situations, and immediate mitigation is required. The Subcontracting Officer, SOTR, or their authorized representatives can assess fines. Fines will be assessed to the following schedule:

Risk Code	Fine per Occurrence
1	$200
2	$500
3	$2,500
4	$5,000

2. Common violations are listed in the table below with the risk codes most frequently associated with the deficiency. This list is not comprehensive. The actual risk code assigned to a safety deficiency is dependent on the circumstances at the time of the violation. Risk Codes are assessed based on JLab ES&H Manual Chapter 3210 Appendix T3

	Safety Deficiency	Typical Risk Code
1.	Employee working is not registered or not trained.	3 or 4
2.	Performance of work without an approved plan or permit such as activity hazard analysis, hot work permit, work permit, etc.	3
3.	Failure to follow provisions in an activity hazard analysis, dig permit, and/or hot work permit.	3
4.	No hard hat – working beneath suspended load	3
5.	No hard hat within posted area – no imminent hazard	1
6.	Suitable eye protection not used while engaged in work that presents eye hazards (grinding, power-sawing, chipping, spraying, etc.)	3
7.	Suitable eye protection not worn within posted area	1
8.	No safety shoes	2
9.	Failure to install adequate fall protection	3 or 4
10.	Failure to protect from impalement hazard	3 or 4
11.	Failure to protect swing radius of cranes, excavators, etc.	3 or 4
12.	Worker inadequately protected by fall protection.	3 or 4
13.	Compressed gas bottles not secured	2 or3
14.	Ladder not tied off	2
15.	Employees performing non-permitted energized electrical work	4
16.	Temporary electric panel improperly configured, lacking GFCI protection, or overloaded	2 or3
17.	Unattended or unprotected energized electrical exposure	4

	Safety Deficiency	**Typical Risk Code**
18.	Improper installation and use of electric power systems and/or equipment violation	2
19.	Defective electrical cords – not in use (e.g. in "gang box" or trailer)	1
20.	Defective electrical cords – in use	2
21.	LOTO provisions not being followed/enforced	3 or 4
22.	Incorrect operation or rigging of crane and load	3 or 4
23.	Fire extinguisher not present when needed (e.g. during "hot work") or is not usable	2 or 3
24.	Fire extinguisher… • inspection is out of date • missing seal or pin • too far from required location	1
25.	Inadequate daily housekeeping/cleanup in areas subject to foot traffic	2
26.	Inadequate daily removal of debris from construction worksite	1 or 2
27.	MSDS not available for products on construction worksite	2 or 3
28.	Chemicals being handled in manner inconsistent with manufacturer's recommendations (i.e. MSDS)	2 or 3
29.	Failure to provide/ replace floor or roof opening cover(s)	3 or 4
30.	Excavations without proper shoring/cutbacks – no work in progress	2
31.	Excavations without proper shoring/cutbacks - workers in excavation	3 or 4
32.	Failure to provide protection for open trench/excavation	2 or 3
33.	Tools and other equipment have missing or defective components	2 or 3
34.	Confined space work without adequate hazard-control measures	3 or 4
35.	Imminent danger/ threat of life or permanent disability or threat to loss of property over $100,000	4
36.	Inadequate Erosion & Sediment Control Measures	2 or 3
37.	Inadequate measures for preventing and containing hazmat spills	2
38.	Miscellaneous violations that pose no immediate hazard. Examples: • Incorrect, defaced, or missing construction worksite safety notices • Defective or inappropriate tools and equipment on JLab premises, but not in use for this project	1

3. Payment of Fines - These fines will be assessed to the Subcontractor by deductions on the monthly invoices regardless of whether the safety violations were directly caused by the Subcontractor or were caused by a lower-tier subcontractor.
4. Amount of Work Activity and Fines - Fines for safety violations may be assessed during all months when work is performed on construction worksite, regardless of the value of work that is performed during that monthly period.

5. Correction of Violations - Assessment of fines for any safety violation does not relieve the Subcontractor from its responsibility for correcting the safety violation in a time period that is consistent with the seriousness of the violation.
6. Posting of Violations - The Subcontractor shall post these safety violations and associated fines at the construction worksite in a prominent location.

PART 2 - PRODUCTS – Not used.

PART 3 - EXECUTION

3.1 REPORTING REQUIREMENTS

A. In addition to the reporting and record keeping requirements of OSHA 1904, the Subcontractor shall submit to the Subcontracting Officer original forms of the reports as described below.

1. Each report shall be timely, accurate, legible, and complete with respect to all work performed within the scope of this subcontract – including administrative and subcontracted work. Failure to comply for any reason shall be considered just cause either for issuance of an order to stop all or any part of the work covered by this subcontract and/or the retention of funds in payment for such work.

B. Incident Investigation Worksheet, JLab Form No. 5200-T2 of the JLab ES&H manual. (To be provided electronically by the SOTR). See ES&H Manual Chapter 5200 – Event Investigation & Casual Analysis Process

1. "Incident Investigation Worksheet" shall be completed by the Site Safety and Health Representative and submitted to the SOTR no later than 24 hours following:

a. Fatalities or injuries (other than first aid) regardless of the circumstances,
b. Unplanned Operational Emergencies, Shutdowns, or Evacuations, for any reason,
c. All Stop Work Orders, whether Jefferson Lab, subcontractor or Thomas Jefferson Site Office (TJSO) initiated,
d. Unplanned activation of a Safety System, whether personnel or equipment related,
e. Fires or explosions of any type or severity,
f. Electrical shocks of any severity, regardless of circumstances,
g. Any type of Lock-Out / Tag-Out violation,
h. Abnormal release or loss of control of hazardous materials,
i. Any type of unauthorized entry into a JLab restricted area,
j. Property damage, including unexpected discovery or damage of any type of utility, regardless of energy status,
k. Unexpected discovery of hazardous energy, including pressurized or electrical systems,
l. Discovery of suspect or counterfeit material,
m. Environmental damage or releases of any severity, including those events that occur as a result of offsite transportation,
n. Any DOE or regulatory body initiated non-compliance notification,
o. Any management concern item where the information is deemed valuable for others, either at Jefferson Lab or the DOE complex, or
p. Any item or activity which Jefferson Lab Management directs to be investigated.

2. Telephone notice to the SOTR is required immediately. If you cannot contact the SOTR, call 757-269-7400 to report the incident.
3. The Subcontractor shall provide to the /SOTR updated information at least weekly concerning the lost or restricted workdays status of any Subcontractor employee injured at Jefferson Lab. These updates shall continue until the attending physician has cleared the employee for resumption of unrestricted work.

C. Report first aid cases to the SOTR – no investigation required.
D. "Tabulation of On-Site Work Hours," Form No., PD Form 29, 1 Copy

1. This report is due from Subcontractor five (5) days following each quarter.

3.2 CONCERN REPORTING PROCESS

A. Whistleblower Protection for Subcontractor Employees

1. The Subcontractor shall comply with the requirements of the "DOE Contractor Employee Protection Program" at 10 CFR Part 708.
2. The Subcontractor shall insert or have inserted the substance of this clause, including this paragraph (b), in lower tier subcontracts, at all tiers, with respect to work performed on any construction worksite at a DOE-owned or leased facility, as provided for at 10 CFR part 708.

B. Concern Reporting Processes - Subcontractor employees on the construction worksite are entitled to use any of the means available to communicate concerns about ES&H conditions and practices. Information about concern reporting is available on ES&H bulletin boards throughout Jefferson Lab, and shall be included with Jefferson Lab-provided materials for the construction worksite postings for this project. The options for reporting concerns include:

1. Jefferson Lab Concern-Reporting Process
2. DOE Concern Reporting Processes

3.3 LOWER TIER SUBCONTRACTOR COMPLIANCE

A. In all lower-tier subcontracts involving performance of work at the construction worksite, the Subcontractor shall include the provisions of lower tier subcontractor compliance. However, such provisions in the subcontracts shall not relieve the Subcontractor of its obligations to assure compliance with the provisions of this clause for all aspects of the work.

3.4 PRESERVATION OF INDIVIDUAL OCCUPATIONAL RADIATION EXPOSURE RECORDS

A. Individual occupational radiation exposure records generated in the performance of work under this subcontract shall be subject to inspection by DOE and shall be preserved by JSA until disposal is authorized by DOE or at the option of JSA delivered to DOE upon completion or termination of the subcontract. If JSA exercises the foregoing option, title to such records shall rest in DOE upon delivery.

END OF SECTION 013529

Activity Hazard Analysis

Tracking/Submittal Number	Project			Company Name
Created By	Date	SOTR/CM Approval	Date	Competent Person Assigned
Task Description		Permits/Notification Required ☐Hot Work ☐Confined Space ☐Dig/BP ☐Lift Plan ☐Outage		

Step	Description	Hazard	Control Measures

Identify Specific Training or Certification Required (Attached Proof of Training)

Step(s)	Required Training/Certification	Step(s)	Required Training/Certification

Activity Hazard Analysis

Tracking/Submittal Number	Project	Company Name
Task Description		Competent Person Assigned

I have been briefed on the hazards and control measures that are in place for this task. I also acknowledge that if conditions change or new hazards are discovered I shall stop, place the work in a safe condition and contact my supervisor.

Print Name	Signature	Date

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control. In accordance with Subcontract Clause, "Inspection of Construction", the Subcontractor shall maintain an adequate inspection system to ensure that all work performed conforms to subcontract requirements.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Subcontractor of responsibility for compliance with the Subcontract Document requirements.

1. Specified tests, inspections, and related actions do not limit Subcontractor's quality-control procedures that facilitate compliance with the Subcontract Document requirements.
2. Requirements for Subcontractor to provide quality-control services required by Jefferson Lab/JSA or authorities having jurisdiction are not limited by provisions of this Section.

C. See Divisions 02 through 49 Sections for specific test and inspection requirements.

1.2 REFERENCES – The publications listed below form a part of this specification to the extent referenced.

A. 10 CFR 34, Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that that actual products incorporated into the Work and completed construction complies with requirements. Services do not include subcontract enforcement activities performed by Jefferson Lab/JSA.

C. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Subcontractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to SO for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to SO for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

Submit the following as specified in Division 01 “Submittal Procedures”.

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

E. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
3. Testing agencies that will utilize devices with radioactive sources on site shall obtain approval from Jefferson Lab's Radiation Control Group prior to bringing such devices on the construction worksite.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Jefferson Lab/JSA will engage a qualified testing agency to perform these services.

1. SOTR will furnish Subcontractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
2. Subcontractor is responsible for coordinating the tests and inspection in a manner as to not delay construction progress.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Subcontract Documents will be charged to Subcontractor and the Subcontract Price will be adjusted by modification.

B. Subcontractor Responsibilities: Tests and inspections not explicitly assigned to Owner (Jefferson Lab) are Subcontractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Subcontractor by authorities having jurisdiction, whether specified or not.

1. Engage a qualified testing agency to perform these quality-control services.
    a. Subcontractor shall not employ same entity engaged by Jefferson Lab, unless agreed to in writing by the Subcontracting Officer.
2. Where quality-control services are indicated as Subcontractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
3. Testing and inspecting requested by Subcontractor and not required by the Subcontract Documents are Subcontractor's responsibility.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

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D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Subcontractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with the Subcontract Documents.

E. Testing Agency Responsibilities: Cooperate with Jefferson Lab, Designer of Record and Subcontractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify SOTR and Subcontractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Subcontractor.
5. Do not release, revoke, alter, or increase the Subcontract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Subcontractor.
7. Industrial hygiene surveys and reports must be performed by Certified Industrial Hygienist.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Jefferson Lab promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Jefferson Lab with copy to Subcontractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, this includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Subcontract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSPECTION, SAMPLING AND TESTING

A. Provide all necessary equipment, instruments, qualified personnel, facilities, and test fluids and gases, and perform all inspections, sampling, testing, and certifications specified in the individual sections.

B. Personnel that will be operating testing devices with a radioactive source on site shall attend Jefferson Lab provided training, General Employee Radiological Training – GERT, prior to conducting tests on site. Radiographers and radiographer's assistants are exempt from the GERT training provided their training is current in accordance with 10 CFR 34.

1. Operators of testing devices with a radioactive source will be issued Jefferson Lab dosimeters to be worn only at Jefferson Lab.

C. Advance Notification – Notify the SOTR in writing at least 48 hours in advance of the dates and times scheduled for all field tests.

1. For field tests that will utilize devices with a radioactive source in addition to the SOTR, notify the Jefferson Lab Radiation Control Group in writing 48 hours in advance at radcon_ram@jlab.org. Identify the testing that will be performed, the operator and the testing device to be utilized.

D. Testing with a Radioactive Source Device Clearance – Each time prior to performing testing services at the construction worksite, the Operator shall check-in at the Radiation Control Field Office for clearance. Jefferson Lab Radiation Control Group will verify the Operator's training, inspect the testing equipment to ensure it matches approved documentation, and ensure the Operator is wearing a Jefferson Lab dosimeter. A Jefferson Lab Radiation Control Technician

will accompany the Operator to observe the work area and provide administrative controls as necessary.

3.2 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Jefferson Lab/JSA's SOTR reference during normal working hours.

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Subcontractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Standards: Comply with NFPA 241, "Standard for Safeguarding Construction, Alterations, and Demolition Operations"; ANSI A10 Series standards for "Safety Requirements for Construction and Demolition"; and NECA Electrical Design Library's "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. At the earliest possible time, when acceptable to JSA, change over from use of temporary utility services to use of permanent utilities. Subcontractor shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before JSA's acceptance, regardless of previously assigned responsibilities.

C. Remove temporary facilities and controls before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to JSA.

D. Division 01 Section "Temporary Environmental Controls" to plan for and provide environmental protective measures to control pollution that develops during normal construction practice.

1.2 SUBMITTALS

A. Construction Site Plan – Prior to the start of work, submit a site plan showing the locations of temporary facilities, utility hookups, equipment and material storage area, and access and haul routes used for this subcontract. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.3 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TEMPORARY UTILITIES

A. The Subcontractor shall provide his own temporary lighting to provide adequate light for performing the work. Coordinate temporary lighting/generators with Jlab.

B. Reasonable amounts of the following utilities will be provided to the subcontractor from existing services at the specified charges. The subcontractor shall carefully conserve utilities furnished without charge. Points of connection are as indicated.

1. Electricity – No Charge
2. Water – No Charge

C. The Subcontractor shall install and maintain all necessary temporary connections and distribution lines to provide temporary utility service to the Project for use during construction. The Subcontractor shall make connections, including providing backflow-preventing devices on connections to domestic water lines; providing meters; and providing transformers; and make disconnections. See Division 01 Section "Summary" for utility outages.

D. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures

E. HVAC Equipment - Only those heating appliances listed and/or approved by a recognized national testing organization shall be permitted for work under this subcontract. Such heating devices shall be installed in accordance with the manufacturer's instructions. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

F. Communication Services: Any necessary telephone and electronic communication services shall be procured from public services and paid for by the Subcontractor.

3.2 CONSTRUCTION FACILITIES

A. Provide field offices, storage trailers, and other support facilities as necessary for efficient prosecution of the Work.

1. Temporary facilities located within the construction area or within 30 feet of building lines shall be of noncombustible construction according to ASTM E 136. Comply with NFPA 241.

B. Provide temporary sanitary facilities, properly secluded from public observation. Comply with regulations and health codes for type, number, location, and maintenance of facilities.

C. Provide temporary enclosures for protection of construction and workers from exposure and inclement weather and for containment of heat.

D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

E. Furnish and install within 10 days of mobilization a construction safety sign near the project in a location approved by the SOTR. The sign shall be adequate in size to post safety and labor standards information as required by this Subcontract and the Subcontracting Officer.

F. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of stormwater per the VAR10 construction permit that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities. Most of the stormwater flow from the site is discharged to Big Bethel Reservoir.
2. Dewatering of manholes - pump to nearest stormwater ditch
3. Remove snow and ice as required to minimize accumulations.

3.3 TEMPORARY CONTROLS

A. Provide temporary barricades, warning signs, and lights to protect the public and construction personnel from construction hazards.

1. Enclose construction areas with fences with lockable entrance gates, to prevent unauthorized access.

B. Jefferson Lab is a Smoking-Restricted Workplace. Smoking shall only be permitted outdoors. Smoking is also prohibited in the immediate vicinity of the main entrances to CEBAF Center, the VARC Building, the Test Lab and the CEBAF Center deck. Smoking shall not be permitted in any JSA or government-owned vehicle assigned to JSA/Jefferson Lab, either on or off the Laboratory grounds. All tobacco waste products shall be placed in proper receptacles.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Comply with requirements found in Section 015719 “Temporary Environmental Controls”.

C. Stormwater Control: Comply with requirements of the VAR10 and the Virginia Erosion and Sedimentation Control Manual. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion. See Virginia Erosion and Sedimentation Control Manual for details.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

B. Temporary Environmental Controls: Remove each temporary environmental controls as directed by a JSA's DCR Certified E&S C Inspector.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 015719 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 INTRODUCTION

A. Protect the environment and preserve the natural resources during construction. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Comply with Federal, State, and Local regulations that pertain to the environment.

Unless otherwise indicated, all vegetative and structural erosion and sediment control practices will be constructed and maintained according to the minimum standards and specifications of the Virginia Erosion and Sediment Control Handbook (VESCH) and Virginia Regulations 4VAC50-30 Erosion and Sediment Control Regulations.

1.2 APPLICABLE AND REGULATORY DOCUMENTS

A. 40 CFR Protection of Environment

B. 33 U.S.C. 1251 Clean Water Act

C. 42 U.S.C. 7401 Clean Air Act

D. 40 CFR 261 Identification and Listing of Hazardous Waste

E. 4VAC50-30 Virginia Erosion and Sediment Control Regulations; Title 10.1, Chapter 5, Article 4 Virginia Erosion and Sedimentation Control Law; and 4VAC 50-50 Virginia Erosion and sediment Control Certification Regulations which forms the Virginia Erosion and Sediment Control Law and Regulations (VESCLR)

F. 4VAC50-30-40 Virginia Erosion and Sediment Control Minimum Standards

G. 4VAC50-60 Virginia Stormwater Management Program (VSMP): Permit Regulations

H. General Permit for Discharges of Stormwater from Construction Activities Authorization to Discharge under the Virginia Stormwater Management Program and the Virginia Stormwater Management Act, General Permit No. VAR10 (http://www.dcr.virginia.gov/stormwater_management/documents/vsmpgenpermvar10.pdf).

I. General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (VAR04) – Authorization to Discharge Under the Virginia Stormwater Management Program and the Virginia Stormwater Management Act .

J. 9VAC25-31 Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulations

VPDES Industrial Minor Individual Permit (VA0089320) – Authorization to Discharge Under the VPDES and the Virginia State Water Control Law.

K. 9VAC25-610-10 Virginia Ground Water Withdrawal Regulation

L. Virginia Department of Environmental Quality (DEQ) Permit to Withdraw Ground Water (GW0047200) – Authorization to withdraw and use ground water in accordance with the Ground Water Management Act of 1992 and the Ground Water Withdrawal Regulation.

M. Hampton Roads Sanitation District (HRSD) – Industrial Wastewater Discharge Regulations HRSD Industrial Wastewater Discharge Permit (No. 0117) – Permission to contribute industrial wastes into the HRSD (as specified in permit).

N. JSA Spill Prevention, Control, and Countermeasures (SPCC) PlanThe Virginia Erosion and Sediment Control Handbook. (http://www.dcr.virginia.gov/stormwater_management/e_and_s-ftp.shtml) or copies may be obtained from the State of Virginia Soil and Water Conservation Division in Richmond at (804) 786-2064).

1.3 SUBMITTALS

A. PRECONSTRUCTION SURVEY

1. Perform a preconstruction survey of the project site with the SOTR and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record

1.4 CLASS 1 ODS PROHIBITION

A. Class 1 ODS as defined in Section 602 (a) of the Clean Air Act shall not be used in the performance of this subcontract, nor be provided as part of the equipment associated with the work. This prohibition shall be considered to prevail over any other provisions, specification, drawing, or referenced document.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING FACILITIES

A. Protection of Existing Facilities: Protect existing vegetation, equipment (including groundwater monitoring wells, radiation monitors, etc.), structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations. Prevent possible contamination of existing air, water and soils on-site.

C. Temporary E&SC: Provide measures to prevent downstream erosion and sedimentation per requirements of VESCLR. E&SC measures can also be applicable to land disturbances less than 10,000 square ft if discharges to downstream storm drain or work near site stormwater drainage ditches is anticipated.

D. Stormwater Management: Comply with requirements of VSMP regulations and stormwater management requirements of Minimum Standard 19. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

3.2 PROTECTION AND PRESERVATION OF NATURAL RESOURCES

A. Burnoff Prohibited – Burnoff of the ground cover is not permitted.

B. Restoration – Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

C. Protection of Natural Vegetation – Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the SOTR's permission. Do not fasten or attach ropes, cables or guys to existing nearby trees for anchorages unless authorized by the Subcontracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Subcontractor shall be responsible for any resultant damage. Replace trees and other landscaping features damaged by activities. Remove displaced rocks from uncleared areas. Refer to VESCH Chapter 6 – Standard/Specification 3.38 for further guidance on Tree Preservation and Protection.

D. Protection of Jurisdictional Wetlands – Jurisdictional wetlands protected by Section 404 of the Clean Water Act exist in the forested area located in the southwestern portion of the TJNAF site. Proper coordination with the SOTR must be conducted when any work is planned with 100' of the limits of f the wetland area.

E. Protection of Historical and Archaeological Resources – Per the results of a previous survey and coordination with the Virginia Department of Historical Resources (DHR), no architectural or archaeological resources are documented to exist on-site. However, if cultural materials are encountered during the course of work, carefully leave undisturbed and report immediately to the SOTR. Stop work in the immediate area of the discovery until directed by the Subcontracting Officer to resume work.

F. Protected Species – Per previous coordination with the Virginia Department of Game and Inland Fisheries (DGIF), protected species are unlikely to be encountered during work activities. However, a canebrake rattlesnake (a species listed as protected by the Commonwealth of Virginia) has been documented within 2 miles of the project area. In the event that a protected species is encountered during the course of work, do not disturb the species and notify the SOTR immediately.

G. Temporary Construction – Remove traces of temporary construction such as haul roads, work areas, and stockpiles of materials. Restore areas of temporary construction to an equivalent or improved condition as existed before construction activities occurred.

H. Seeding – Grade, till and seed all areas disturbed by construction. Include topsoil and nutriment during seeding. Refer to VESCH Chapter 3 – Standard/Specifications 3.31 and 3.32 for further guidance on seeding.

I. Water resources – Perform work in a manner that minimizes adverse environmental impacts on water resources. Take precautions necessary to prevent, contain, and collect a release of fuels, oils, or other hazardous substances on the water. Notify the SOTR immediately in the event of a fuel, oil, or other hazardous substance spill.

3.3 EROSION AND SEDIMENT CONTROL MEASURES DURING CONSTRUCTION

A. Maintenance and Inspection – The subcontractor shall maintain the control measures in good and effective operating condition by performing routine inspections and conducting repairs in a timely manner.

B. Removal of Temporary Environmental & Sediment Controls: Removal of E&S Controls shall be authorized by a JSA Certified DCR Inspector. Subcontractor shall request a walk-through through the SOTR. E&SC measures will be authorized for removal after the site is stabilized.

3.4 PETROLEUM PRODUCTS

A. The Subcontractor and all tier subcontractors are required to comply with the JSA Spill Prevention, Control, and Countermeasures (SPCC) Plan.

1. Fuel and lubricate equipment in a manner that protects against spills and evaporation. Provide a temporary berm around temporary fuel and liquid chemical storage tanks to contain the tank contents in the event of a leak or spill. Subcontractor is to provide spill kits in the event of an emergency.

2. Portable aboveground storage tanks (AST) greater than 660 gallons used for equipment fuel must be registered with Virginia Department of Environmental Quality (DEQ). Subcontractor shall submit AST Registration Form 7570-AST and the registration fee to DEQ prior to mobilization of the AST to the project site.

3. Secondary containment shall be required around buckets and drums of chemicals stored on site.

3.5 NOISE CONTROL

A. Make the maximum use of low-noise emission products, as certified by the EPA.

END OF SECTION 015719

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Recycling nonhazardous demolition and construction waste.
   2. Disposing of nonhazardous demolition and construction waste.
   3. Control and disposal of hazardous waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Hazardous wastes: As defined in 40 CFR 261

E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

1.3 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste recycled, both estimated and actual in tons.

B. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

C. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.2 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

B. Conduit: Reduce conduit to straight lengths and store by type and size.

3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE –

A. Hazardous wastes are defined in 40 CFR 261. The Subcontractor shall identify all activities that may generate hazardous waste and provide documented waste determination for the waste stream to the Subcontracting Officer. Hazardous wastes that are produced as a result of performing work under this subcontract shall be handled, stored, transported, and disposed of according to 40 CFR 262, where applicable. Prevent hazardous wastes from entering the ground, drainage areas, and surface waters. Immediately notify the Subcontracting Officer of hazardous material spills. Hazardous wastes generated within the confines of Government facilities shall be identified as being generated by the Government. All necessary documentation including hazardous waste manifests shall be signed by an authorized representative of Jefferson Lab prior to removal of waste from the site. No hazardous waste shall be brought onto Jefferson Lab property

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Final cleaning.
4. Return Badges.

B. Related Sections:
1. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
2. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
3. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
5. Complete startup testing of systems.
6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
7. Complete final cleaning requirements.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, SOTR will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Engineer’s Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, SOTR will either proceed with inspection or notify Contractor of unfulfilled requirements. SOTR will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of distribution sections per loop in sequential order.
2. Submit list of incomplete items in the following format:

    a. PDF electronic file.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
c. Remove tools, construction equipment, machinery, and surplus material from Project site.
d. Remove snow and ice to provide safe access to building.

3.2 RETURN BADGES

A. All Badges issued to personnel working under this Subcontract must be returned to JLab prior to authorization of the final payment. For each badge not returned, the Subcontracting Officer will assess a nominal charge against the final payment.

END OF SECTION 017700

SECTION 033053 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Action Submittal:

1. Design Mixtures: For each concrete mixture.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Comply with ACI 301.

C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, Type I or Type II, may be supplemented with the following:

a. Fly Ash: ASTM C 618, Class C or F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.

C. Water: ASTM C 94/C 94M.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. White, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 CONCRETE MIXTURES

A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
4. Slump Limit: 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
5. Air Content: Not less than 5% and maintained within range permitted by ACI 301.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Contraction Joints in Slabs-on-Grade: Form weakened-plane sawed contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness.

C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. Comply with ACI 301for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment.

3.6 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding 1/2 inch.

1. Apply to concrete surfaces exposed to public view.

3.7 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections if required.

3.10 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 033053

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section is intended to describe the basic materials and installation methods for electrical work; it applies in general to all Sections under DIVISION 26. All materials and equipment specified and/or shown on Drawings are new unless noted otherwise.

B. All new materials, equipment and systems shall be listed and labeled by a licensed nationally recognized testing laboratory as defined by OSHA and used for the specific purpose, environment or application for which it was tested and approved. No field modifications and/or noncompliant installation whatsoever shall be made to any materials, equipment and systems that would violate the listing and labeling.

C. This section includes the following:

1. Electrical equipment coordination and installation
2. Sleeve seals
3. Grout
4. Common electrical installation requirements

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 REFERENCES

A. Provide work in accordance with all applicable international, state and local, codes, rules, regulations, and standards, including but not limited to, requirements of the following:

1. Underwriters' Laboratories, Inc. (UL)
2. National Electrical Manufacturer's Association (NEMA)
3. National Electrical Contractors Association (NECA)
4. The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
5. Applicable NFPA 70-2008.

B. Conflicts

1. Nothing stated or shown in Specifications or on Drawings is intended to conflict with the above standards and regulations. Should Contractor find any apparent conflict, it shall be his responsibility to notify Architect before any of the work in question is performed or material purchased.

1.5 SUBMITTALS

A. None Required.

1.6 WARRANTY AND CONTRACT CLOSEOUT

A. Provide manufacturer’s certificates of supervision and startup service as specified in the various sections of Division 26.

B. Upon completion of work and tests, and at a time mutually agreed to by Contractor, Architect and Owner, operate all systems installed, in all parts, at Contractor's expense for sufficient length of time to demonstrate the mode of operation and definitely determine whether systems as a whole are in first class working condition. Defects and malfunctions that may develop during this period of operation shall be immediately corrected by Contractor at his own expense, and systems placed in first class working condition before being finally turned over to Owner.

C. Include information for all products specified in the operation and maintenance manual.

D. Provide electrical certificate(s) from electrical inspection agency - see Article titled "Inspections".

E. Provide manufacturer's certification and warranty of system operation - see Article titled "Tests".

1.7 QUALITY ASSURANCE

A. The specifications for certain products and alternative materials may appear in more than one section of Division 26. Work of Division 26 shall be coordinated for all sections of Division 26 to assure that where two or more items of any given product are furnished under Division 26 that they are of the same manufacturer and type and that alternative material is consistent throughout the work of Division 26.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle all material and equipment in accordance with manufacturer's instructions and recommendations. Such instructions and recommendations are hereby made part of these specifications.

B. Deliver products and equipment properly labeled and tagged. Maintain products in original shipping containers and store in a dry area until ready for installation.

C. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.9 PHASE ARRANGEMENT

A. Exercise great care in maintaining a uniform and consistent arrangement of phase conductors on all systems. Throughout the entire wiring systems, each phase conductor must always be in the same physical position with respect to the other phase wires at equipment terminals.

B. Identify phase wires by color coded conductors. Refer to Sections 260519.

C. Determine the existing established phase arrangement and use it throughout the new addition and renovation. Use special care in determination and execution.

1.10 INSPECTIONS

A. Before starting any Work under this Subcontract, procure the services of an independent third party to perform electrical inspections of switchgear and switchboards. Upon completion of the work, furnish electrical certificates from said agency for all electrical equipment and systems installed or furnished and installed as part of the work.

B. Electrical equipment or systems that are modified in the field shall be reinspected. Furnish a new electrical certificate covering such modifications.

C. Work under this Subcontract shall be subject to field inspections of work progress by Jefferson Lab Construction Inspectors. It is the responsibility of the Subcontractor to coordinate the inspection schedule so that inspections do not delay progress of work.

1.11 GENERAL COORDINATION.

A. The electrical systems are indicated on the Electrical Drawings. Become familiar with all drawings and incorporate all pertinent requirements

B. Drawings are diagrammatic and indicate general arrangement of systems and requirements of the Electrical work. Do not scale the drawings to obtain dimensional requirements. Exact locations of equipment must be coordinated and obtained prior to starting the work.

C. Coordinate scheduling, sequencing, movement and positioning of large equipment into the building during construction.

D. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

E. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

1.12 EQUIPMENT LOCATIONS

A. Locations are subject to changes in order to avoid obstacles in building construction. Verify all dimensions and conditions at site. Check layout for sizes and clearances, so that the apparatus and material may be installed and operated satisfactorily in space provided. Install equipment and raceways to preserve headroom and to keep openings and passageways clear.

B. Install equipment, boxes and outlets in accessible locations.

C. Install conduit to avoid mechanical and/or structural obstructions, minimizing crossovers.

D. Install all exposed conduits parallel or perpendicular to building lines.

E. Locations of electrical equipment and connections to all other equipment are approximately correct, and are subject to such modifications as are required at time of installation, in order to meet field conditions or the dimensions of equipment actually being supplied.

F. No changes are to be made in the original design without written approval by Subcontracting Officer.

PART 2 - PRODUCTS

2.1 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.2 DUCT SEALS

A. All active and spare underground power and communication ducts leaving manholes and entering building foundation walls and floor slabs shall be provided with an inflatable bladder as manufactured by Tyco-Raychem, Product No. RDSS. Refer to manufacturer's recommendations for bladder size and installation methods.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. General

1. Comply with NECA 1.
2. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
3. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
4. Furnish, deliver, erect, connect and finish in every detail, all materials, equipment and accessories required for the Work. Select and arrange to fit properly into the building spaces.
5. Perform all work in accordance with the drawings, specifications, including manufacturer's installation instructions, all applicable codes and NECA's Standard of Installation guidelines.
6. Include in the Work and in the bid proposal minor details not shown or specified, but manifestly necessary for the proper installation and operation of the various systems, as if specified or shown.
7. Position and install all material and equipment to permit proper access and in such a manner that maintenance, adjustment, calibration, inspection, repair and replacement of the material and equipment can be accomplished with minimum effort and cost.
8. Perform the installation, wiring, cleaning, testing, calibration and startup of all material and equipment in accordance with the manufacturers' instructions and recommendations. Such instructions and recommendations are hereby made a part of these Specifications.
9. If any departures from Contract Documents are deemed necessary, submit details of such departures and the reasons there for to Architect for approval.
10. Pull and junction boxes shall be located and sized by the electrical contractor in accordance with NEC, EIA/TIA, utility company requirements and/or owner standards, unless otherwise noted on the drawings.

B. Layout and Coordination

1. Lay out all work from approved building and property lines and benchmarks. Verify and be responsible for the correctness of all measurements in connection with work. Any change made in major overall dimensions as shown which affect the physical size, shape, or location of any part of the Work, whether due to field check or changes due to the use

of equipment of a manufacturer other than that used as the basis of design shall not cause any interference with other work.

2. Examine the drawings of other trades and initiate cooperation and coordination of the Work with the work of other trades to insure that the Work can be installed properly as designed and planned without interference with other work or delay. Furnish all necessary templates, patterns, measurements, etc., for installing work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.
3. Investigate existing conditions and existing equipment. Provide protection for existing equipment. No equipment is planned to be removed to accomplish this work.
4. Investigate the structural and finish conditions affecting the Work.
5. Install conduit, fittings, etc., to provide not less than 1/2 inch between their finished covering and the structure or adjacent work of any kind.
6. Electrical equipment shall not interfere in any way with other material or equipment and shall be provided with adequate working space; see the National Electrical Code working space requirements.
7. Make reasonable modifications in the layout of the Work, as directed, to provide proper clearances or accessibility, or to prevent conflict with the work of other trades, at no increase in the Contract sum.

C. Excavation, Trenching, Backfilling

1. Provide all other excavation, trenching and backfilling including shoring, sheeting, pumping, grading, barricading and other related work necessary for installation of electrical work.

D. Painting

1. Touch up or paint out damage done to items having a factory applied finish, and which are installed under Division 26.

E. Foundations

1. Provide concrete foundations required for the work specified under Division 26, unless specifically noted otherwise. Be responsible for preparing foundation drawings and setting foundation anchor bolts in time so as not to delay the work. Concrete foundations shall be of the types detailed or as specified.
2. Reinforce concrete foundations to suit the loads placed on them; foundations shall be in strict accordance with the equipment manufacturers' recommendations. Concrete materials and methods shall be as specified in Division 260529.
3. Unless otherwise indicated, concrete equipment pads shall be provided under all switchgear, motor control centers, substations, etc., and shall extend a minimum 4 inches above the finished floor, at least 4 inches beyond the equipment base in all directions, shall have the top edges and vertical corners chamfered and shall have the same surface finish as the adjacent and surrounding floor.
4. Securely anchor concrete foundations to the floor slab with steel dowels. When so indicated or where required, concrete foundations or concrete footings for structural steel supports for equipment too heavy to be placed in the floor slab shall be extended not less than 12 inches below the underside of the floor slab, except where bearing rock is encountered at a lesser depth. In such cases, after inspection and approval, concrete foundations may be set on bearing rock.
5. Furnish and set, with proper templates, anchor bolts and inserts required for the proper attachment of the equipment to the concrete foundations. Anchor bolts shall be of the

size and number required by the equipment or as recommended by the equipment manufacturer and shall be in accordance with the requirements detailed or specified. Anchor bolts shall also be compatible with vibration isolation requirements specified for the equipment.

6. Set equipment anchor bolts in pipe sleeves at least two sizes larger than the anchor bolt. Length of pipe sleeve shall be the same as the imbedded length of the anchor bolt. After the equipment is set in place and adjusted to its proper position, completely fill the annular space between the anchor bolt and the inside of the pipe sleeve for the full length of the pipe sleeve with Embeco, or equivalent, nonshrink cement grout.
7. Grout any openings between the top of the concrete foundation and the base of the equipment using nonshrink cement grout.

3.2 CONSTRUCTION INSPECTIONS

A. All work shall be subject to an ongoing inspection process. Inspections shall be coordinated and requested at least one day before the work is ready for inspection. Each of the following shall be inspected and approved by JLab Construction Inspectors prior to advancing the work to the next step in the process:
   1. Replacement of manhole cable racks.
   2. Installation of underground conduit and ductbanks.
   3. Ground rods and connections to ground rods.
   4. Formwork for concrete slabs.
   5. Verification of proper phasing of medium and low voltage cables.

3.3 PROTECTION OF WORK

A. Protect all conduit, fittings, panelboards, switchgear, transformers and other equipment before and during installation and keep clean.

B. Protect factory finished equipment, switchgear and devices with approved temporary protective material where these items are subject to accidental damage or abuse. Electrical equipment and switchgear shall be stored indoors or otherwise securely protected and kept free of condensation by adequate electric heat. Contractor shall remove all temporary protective material at the conclusion of the Work or as directed.

C. The Contractor shall assume full responsibility for the cost of repairing or replacing any damaged Work or material caused by employees working under this Division.

3.4 TESTS

A. Test equipment, including switchboards and all other equipment to verify that items are free from unintended grounds, short circuits, and open circuits and that equipment will operate as specified. Test feeders for insulation resistance and for overall operation of systems. Furnish labor and material required for making such tests and make corrections necessary to obtain proper operation.

B. Test all 15 kV wiring systems for insulation resistance with a Very Low Frequency (VLF) AC Hi-Pot in accordance with the IEEE Standard 400.

C. Test all wiring systems up to 600 volts, for insulation resistance with a megger in accordance with the NEC and to NETA Standards for low voltage wire and cable. Determine values with switchboards and overcurrent devices in place.

D. Determine existing phase rotation and phase arrangement before disconnecting any equipment. Transformers are fed from two sources and both sources are in-phase (A, B, C) and have the same rotation to allow both sources to be connected together at once.

E. Arrange for each system to be fully tested and adjusted by manufacturer or his authorized representative. Each element of each system shall be individually operated to insure that it will function as intended. Furnish all labor and material required to correct all defects.

F. Submit to the Architect a letter from manufacturer (or authorized representative) of each system, attesting to the fact that all necessary tests and adjustments have been made and that the entire system is functioning properly in every respect.

G. This article shall not be construed as deleting other tests specifically outlined in other sections of this Specification.

3.5 WORKMANSHIP

A. Electrical equipment shall be installed in a neat and workmanlike manner in accordance with latest and best practices of the trade.

B. Only mechanics skilled in this type of Work shall be employed and utilized by Contractor for this Division in the execution of this Work.

3.6 REFINISHING

A. All surfaces of boxes, cabinets and equipment shall have suitable lacquer, enamel or plated finishes. Touch up any finishes marred during construction. Supports and other metal work not furnished with a protective coating, shall be given two coats of approved paint after completion of the work.

3.7 CONTINUITY OF EXISTING SERVICES

A. Perform alterations and connections to existing facilities with a minimum of interruption. Where interruption is necessary, prepare a time schedule for same, coordinate with Project Manager.

B. Where power is disrupted, work shall progress to restore power via fastest method.

3.8 ALTERATIONS AND CONNECTIONS TO EXISTING FACILITIES

A. Make all necessary alterations to existing DIVISION 26 systems to permit connecting or extending these systems to new work. New materials used to alter existing systems shall match existing materials unless otherwise indicated. Record modifications for Owner's future use.

B. Remove exposed conduit, hangers and supports made obsolete due to this modification.

C. Unless otherwise specified, all materials and equipment removed or disconnected by Contractor which are not to be reused shall be turned over to the Owner for his future use. Turn over to Owner all existing circuit breakers removed. Contractor shall recycle all removed electrical cable and equipment.

D. Where excavation for new electrical work disturbs support of any existing underground services, materials, equipment and structures, provide new and suitable concrete, steel and brick supports as required. Review supports and supporting methods with Architect before beginning work.

END OF SECTION 260500

SECTION 260513 - MEDIUM-VOLTAGE CABLES – Rev. 1

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cables, splices, terminations, and accessories for medium-voltage electrical distribution systems.

1.2 SUBMITTALS

A. Product Data: For each type of cable, splice and termination.

B. Field quality-control test reports.

C. Manufacturer's Tests.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2 and NFPA 70.

C. Manufacturer's Tests. The conductor shall meet the electrical resistance requirements of ICEA S-93-639. The following tests shall be done at the factory.

1. Cable shall be subjected to and pass all production tests as required by ICEA S-93-639 and UL 1072 standards.
2. The shield resistance shall be measured and recorded from end to end on the completed cable.
3. Certified test reports shall be furnished for all cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Cables:

a. Prysmian Cables and Systems
b. Kerite Co. (The); Hubbell Incorporated.

c. Okonite Company (The).

2. Cable Splicing and Terminating Products and Accessories:

a. Engineered Products Co.
b. G&W Electric Co.
c. MPHusky.
d. Raychem Corp.; Telephone Energy and Industrial Division.
e. RTE Components; Cooper Power Systems, Inc.
f. Thomas & Betts/Elastimold.
g. 3M Company; Electrical Products Division.
h. Cooper Power Systems
i. Prysmian Cables and Systems

2.2 CABLES

A. Cable Type: MV105, with copper conductor and compressed, concentric lay, class B stranding.

B. Comply with UL-1072, AEIC CS8-07, ICEA S-93-639 and ASTM B-496.

C. Conductor: The conductor shall be uncoated soft copper, Class B stranded, compact round in accordance with ASTM B-496.

D. Conductor Screen: An extruded layer of black thermosetting semiconducting compound shall be applied over the conductor. The thickness of the conductor screen shall be per ICEA S-93-639 and UL 1072, latest editions.

~~E. Strand Filling: Conductor interstices are filled with impermeable compound.~~

F. Conductor Insulation: The insulation shall be a thermosetting ethylene-propylene (EPR) based elastomer that meets or exceeds the electrical and physical characteristics of ICEA S-93-639, Class III type insulation, and AEIC CS8. The color of the insulation material will shall contrast with the color of the conductor shield and insulation shields. The thickness shall be at the 133% level as applicable and in accordance with the latest edition of ICEA S-93-639, ICEA S-97-682 and UL 1072. The diameters over the insulation shall be in accordance with ICEA S-97-682. The EPR insulation shall be compounded in-house by the cable manufacturer, commercially purchased compounds are not acceptable.

1. Voltage Rating: 15 kV.
2. Insulation Thickness: 133 percent insulation level.

G. Insulation Screen: An extruded layer of black thermosetting semiconducting compound shall be applied over the insulation. The thickness of the conductor screen shall be per ICEA S-93-639 and UL 1072, latest editions. The insulation shield shall be free stripping from the insulation, leaving the insulation free from any significant residue or semi-conducting material.

H. Shielding: The outer semiconducting screen shall be covered with copper metallic tape shielding applied within the guidelines of the applicable ICEA and UL standards.

I. Cable Jacket: The overall jacket shall be black non-conducting polyvinyl chloride and shall meet the requirements of ICEA S-93-639 and UL 1072.

J. Temperature Rating: Cable shall be capable of operating continuously at a conductor temperature of 105°C for normal operations, 140°C under emergency conditions and 250°C under short circuit conditions.

K. Identification: An identifying legend shall be printed on the jacket with contrasting ink or by indent printing and repeated at manufacturer's intervals. The minimum information shall include: Manufacturer's Name - Conductor Size - Conductor Material (copper or aluminum) - Insulation Type & Thickness - Voltage Rating and applicable UL Ratings (MV-105).

L. Cables shall be manufactured not in excess of 9 months prior to installation.

2.3 SOLID TERMINATIONS

A. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap.

1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer non-tracking tubes; multiple, molded, non-tracking skirt modules; and compression-type connector.

2.4 SPLICE KITS

A. Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application. All splices in manholes shall be suitable for use in a submerged location.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Heat-shrink splicing kit, polymeric construction with outer heat-shrink jacket.

2.5 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture. Terminators shall be submersible.

B. Non-load-Break Cable Terminators and splices: Elbow-type units with 600-A non-load make/break and continuous-current rating. Include test point on terminator body that is capacitance coupled. For use at transformers.

C. Surge Arrestor: Elbow type units rated for the system voltage, 12.47 kV (9 kV elbow arrestors). Include 600-200 A reducing bushings equal to Cooper Power Systems T-OP II as required. Provide 3 per transformer, 1 per phase.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Provide new separable insulated connectors for all cable terminations in padmount type transformers.

C. Provide solid terminations at 15 kV switchgear and at the two 5 MVA station type transformers.

D. Provide splices in cable using splice kits as required.

E. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

F. Support cables according to Division 26 Section "Common Work Results for Electrical." Provide PVC or fiberglass cable racks in manholes as required.

G. Install cables in conduits.
   1. Install "buried-cable" warning tape 12 inches above cables.

H. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit.

I. Install separable insulated-connector components as follows:
   1. Portable Feed-Through Accessory: Three.
   2. Standoff Insulator: Three.

J. Ground shields of shielded cable at terminations, splices, and separable insulated connectors.

K. Identify cables according to Division 26 Section "Identification for Electrical Systems."

L. Wrap cables in manholes with fireproofing tape. Wrap each conductor separately.

M. Where transformer pad conduit terminations are installed farther than 14” from the face of the transformer, provide bushing extensions. Do not bend cable such that “T” body of separable connector appears deformed. Provide 6 ea of these bushing extensions at transformer CHL-AUX1 and another 6 ea for other locations as required. Turn over unused materials to Owner.

N. Provide cable supporting racks, arms and insulators, as noted, to support new cables. Racks and arms shall be PVC or fiberglass.

O. Provide identification tags on cables in manholes and at transformers.
   1. At manholes, tags shall be labeled “TO TRANSFORMER _____” on each end of cable.

2. At transformers, tags shall be labeled either “TO TRANSFORMER _____ ” or “TO MANHOLE _____.”

3.2 SPARE PARTS

A. Provide 3 ea. of each type of spanner wrench and/or other special tool required by manufacturer to install or remove separable insulated conductors and all commponents.

3.3 FIELD QUALITY CONTROL

A. Testing: Subcontractor shall have an independent testing agency perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters. Cables shall be tested using Very Low Frequency AC Hipot method in accordance with IEEE 400.2.

END OF SECTION 260513

SECTION 260513 - MEDIUM-VOLTAGE CABLES – Rev. 1

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cables, splices, terminations, and accessories for medium-voltage electrical distribution systems.

1.2 SUBMITTALS

A. Product Data: For each type of cable, splice and termination.

B. Field quality-control test reports.

C. Manufacturer's Tests.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2 and NFPA 70.

C. Manufacturer's Tests. The conductor shall meet the electrical resistance requirements of ICEA S-93-639. The following tests shall be done at the factory.

1. Cable shall be subjected to and pass all production tests as required by ICEA S-93-639 and UL 1072 standards.
2. The shield resistance shall be measured and recorded from end to end on the completed cable.
3. Certified test reports shall be furnished for all cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Cables:

a. Prysmian Cables and Systems
b. Kerite Co. (The); Hubbell Incorporated.

c. Okonite Company (The).

2. Cable Splicing and Terminating Products and Accessories:

a. Engineered Products Co.
b. G&W Electric Co.
c. MPHusky.
d. Raychem Corp.; Telephone Energy and Industrial Division.
e. RTE Components; Cooper Power Systems, Inc.
f. Thomas & Betts/Elastimold.
g. 3M Company; Electrical Products Division.
h. Cooper Power Systems
i. Prysmian Cables and Systems

2.2 CABLES

A. Cable Type: MV105, with copper conductor and compressed, concentric lay, class B stranding.

B. Comply with UL-1072, AEIC CS8-07, ICEA S-93-639 and ASTM B-496.

C. Conductor: The conductor shall be uncoated soft copper, Class B stranded, compact round in accordance with ASTM B-496.

D. Conductor Screen: An extruded layer of black thermosetting semiconducting compound shall be applied over the conductor. The thickness of the conductor screen shall be per ICEA S-93-639 and UL 1072, latest editions.

~~E. Strand Filling: Conductor interstices are filled with impermeable compound.~~*(AMENDMENT 6)*

F. Conductor Insulation: The insulation shall be a thermosetting ethylene-propylene (EPR) based elastomer that meets or exceeds the electrical and physical characteristics of ICEA S-93-639, Class III type insulation, and AEIC CS8. The color of the insulation material will shall contrast with the color of the conductor shield and insulation shields. The thickness shall be at the 133% level as applicable and in accordance with the latest edition of ICEA S-93-639, ICEA S-97-682 and UL 1072. The diameters over the insulation shall be in accordance with ICEA S-97-682. The EPR insulation shall be compounded in-house by the cable manufacturer, commercially purchased compounds are not acceptable.

1. Voltage Rating: 15 kV.
2. Insulation Thickness: 133 percent insulation level.

G. Insulation Screen: An extruded layer of black thermosetting semiconducting compound shall be applied over the insulation. The thickness of the conductor screen shall be per ICEA S-93-639 and UL 1072, latest editions. The insulation shield shall be free stripping from the insulation, leaving the insulation free from any significant residue or semi-conducting material.

H. Shielding: The outer semiconducting screen shall be covered with copper metallic tape shielding applied within the guidelines of the applicable ICEA and UL standards.

I. Cable Jacket: The overall jacket shall be black non-conducting polyvinyl chloride and shall meet the requirements of ICEA S-93-639 and UL 1072.

J. Temperature Rating: Cable shall be capable of operating continuously at a conductor temperature of 105°C for normal operations, 140°C under emergency conditions and 250°C under short circuit conditions.

K. Identification: An identifying legend shall be printed on the jacket with contrasting ink or by indent printing and repeated at manufacturer's intervals. The minimum information shall include: Manufacturer's Name - Conductor Size - Conductor Material (copper or aluminum) - Insulation Type & Thickness - Voltage Rating and applicable UL Ratings (MV-105).

L. Cables shall be manufactured not in excess of 9 months prior to installation.

2.3 SOLID TERMINATIONS

A. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap.

1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer non-tracking tubes; multiple, molded, non-tracking skirt modules; and compression-type connector.

2.4 SPLICE KITS

A. Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application. All splices in manholes shall be suitable for use in a submerged location.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Heat-shrink splicing kit, polymeric construction with outer heat-shrink jacket.

2.5 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture. Terminators shall be submersible.

B. Non-load-Break Cable Terminators and splices: Elbow-type units with 600-A non-load make/break and continuous-current rating. Include test point on terminator body that is capacitance coupled. For use at transformers.

C. Surge Arrestor: Elbow type units rated for the system voltage, 12.47 kV (9 kV elbow arrestors). Include 600-200 A reducing bushings equal to Cooper Power Systems T-OP II as required. Provide 3 per transformer, 1 per phase.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Provide new separable insulated connectors for all cable terminations in padmount type transformers.

C. Provide solid terminations at 15 kV switchgear and at the two 5 MVA station type transformers.

D. Provide splices in cable using splice kits as required.

E. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

F. Support cables according to Division 26 Section "Common Work Results for Electrical." Provide PVC or fiberglass cable racks in manholes as required.

G. Install cables in conduits.
   1. Install "buried-cable" warning tape 12 inches above cables.

H. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit.

I. Install separable insulated-connector components as follows:
   1. Portable Feed-Through Accessory: Three.
   2. Standoff Insulator: Three.

J. Ground shields of shielded cable at terminations, splices, and separable insulated connectors.

K. Identify cables according to Division 26 Section "Identification for Electrical Systems."

L. Wrap cables in manholes with fireproofing tape. Wrap each conductor separately.

M. Where transformer pad conduit terminations are installed farther than 14” from the face of the transformer, provide bushing extensions. Do not bend cable such that “T” body of separable connector appears deformed. Provide 6 ea of these bushing extensions at transformer CHL-AUX1 and another 6 ea for other locations as required. Turn over unused materials to Owner.

N. Provide cable supporting racks, arms and insulators, as noted, to support new cables. Racks and arms shall be PVC or fiberglass.

O. Provide identification tags on cables in manholes and at transformers.
   1. At manholes, tags shall be labeled “TO TRANSFORMER _____” on each end of cable.

2. At transformers, tags shall be labeled either “TO TRANSFORMER _____ ” or “TO MANHOLE _____.”

3.2 SPARE PARTS

A. Provide 3 ea. of each type of spanner wrench and/or other special tool required by manufacturer to install or remove separable insulated conductors and all commponents.

3.3 FIELD QUALITY CONTROL

A. Testing: Subcontractor shall have an independent testing agency perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters. Cables shall be tested using Very Low Frequency AC Hipot method in accordance with IEEE 400.2.

END OF SECTION 260513

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. The intent of this section is to define the service entrance cables (copper), feeders (copper) and branch circuits (copper).

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW and SO.

2.2 CONNECTORS AND SPLICES

A. 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:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.

5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Service Entrance: Copper, stranded.

B. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. On drawings, all conduit sizes have been developed using copper conductors.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

F. Class 1 Control Circuits: Type THHN-THWN, in raceway.

G. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.4 FIELD QUALITY CONTROL

A. Independent agency shall perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. UFER Ground Connection: Mechanical or compression type as listed for this application.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum. Bury at least 24 inches below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. UFER Ground: Provide UFER ground in the new switchgear pad. Bond ground pad to encased concrete rebar using #4/0 cable and listed connector.

3.4 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

3.5 FIELD QUALITY CONTROL

A. Independent agency shall perform tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.

B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. None required.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment. Hot-dipped galvanized after fabrication.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. To Existing Concrete: Expansion anchor fasteners.

C. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 4000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Provide for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

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

B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks and manholes, and underground handholes, boxes, and utility construction.

1.2 SUBMITTALS

A. None Required.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. Fittings for Conduit: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed. Die cast zinc fittings and connectors are not acceptable.

2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

B. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Underground Conduit: RNC, Type EPC-40-PVC, in concrete encasement.
3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

D. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

F. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for concrete-encased duct banks.

2. Cable racks in existing manholes.

1.2 ACTION SUBMITTALS

1. None Required.

1.3 INFORMATIONAL SUBMITTALS

A. None Required

1.4 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. 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:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.

5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 011000.

2.3 UTILITY STRUCTURE ACCESSORIES

A. 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:

1. Bilco Company (The).
2. Campbell Foundry Company.
3. Carder Concrete Products.
4. Christy Concrete Products.
5. East Jordan Iron Works, Inc.
6. Elmhurst-Chicago Stone Co.
7. McKinley Iron Works, Inc.
8. Neenah Foundry Company.
9. NewBasis.
10. Oldcastle Precast Group.
11. Osburn Associates, Inc.
12. Pennsylvania Insert Corporation.
13. Riverton Concrete Products; a division of Cretex Companies, Inc.
14. Strongwell Corporation; Lenoir City Division.
15. Underground Devices, Inc.
16. Utility Concrete Products, LLC.
17. Utility Vault Co.
18. Wausau Tile, Inc.

B. Cable Rack Assembly: Cables shall be well supported on walls by heavy duty, non-metallic cable racks. The cable racks consist of a stanchion that shall be attached to the manhole wall in accordance with the manufacturer’s recommendations and adjustable arms that lock into the stanchion. Unless otherwise specified:
1. At least six stanchions shall be installed in each manhole.
2. Cable rack arm lengths shall be appropriate for the manhole size and amount of cable being installed.
3. At least one spare arm shall be installed at each stanchion position.

4. Cable Rack: Stanchions and arms shall be made from 50% glass reinforced nylon or a non-metallic material having equal mechanical strength, thermal resistance, chemical resistance, dielectric strength and physical properties. The stanchion shall be 36 inches long, shall incorporate multiple arm mounting holes that are 4 inches apart and recessed bolt mounting holes. Holes or slots shall be provided in the arms for cable wire ties. The cable racks shall be marked with the manufacturer's name, plant location and date manufactured.
5. Cable Rack Mounting Hardware. The following corrosion resistant hardware sets may be used to secure the stanchion to the manhole wall.
6. Drop-in anchors shall have a 1/2-13 thread, a rated pullout working capacity of 2100 lbs. and shall be made from either 303 or 316 stainless steel. A 316 stainless steel 1/2-13 hex head cap screw and a 316 stainless steel .562 ID x 1.250 OD x .078 THK. Flat washer shall be used with each drop-in anchor.

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

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

3.2 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and away from equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius to accommodate bending radius of cable to be installed, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

E. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

F. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than **4** spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
5. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
6. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
7. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.

3.3 CABLE RACK ASSEMBLIES

A. Remove existing metal rack assemblies in manholes as shown on drawings.

B. Provide new non-metallic cable rack assemblies. Fasten new cable rack assemblies in accordance with manufacturer's instructions. Provide additional components as required for new and existing cables. For purposes of bidding, assume that each manhole requires six sets of stanchions. Assume that each stanchion is 8 ft. in length. Assume that each cable goes around each manhole one time before exiting to determine number of arms.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.5 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for conductors.
2. Underground-line warning tape.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.
6. Miscellaneous identification products.

1.2 SUBMITTALS

A. None Required.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. Arc Flash and Shock Warning Label.

2.3 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with white letters on red face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Pre-drilled, laminated acrylic, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch. Attach with self tapping machine screws.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Refer to Section 011000 for utility identification and location prior to beginning work under this section.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use

multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall. See Section 011000.

3.2 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 15 kV and 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

C. Conductors to Be Extended in the Future: Attach write-on tags or marker tape to conductors and list source.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

E. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 261316 - MEDIUM VOLTAGE LOAD INTERRUPTER SWITCHGEAR

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the medium voltage load interrupter switchgear as specified herein and as shown on the contract drawings.

1.02 RELATED SECTIONS

1.03 REFERENCES

A. The medium voltage load interrupter switchgear and all components shall be designed, manufactured and tested in accordance with the latest applicable standards as follows:
   1. ANSI/IEEE C37.20.3
   2. ANSI/IEEE C37.20.4
   3. ANSI C37.22
   4. ANSI C37.57, C37.58
   5. NEMA SG5
   6. NEMA SG6
   7. CSA 22.2 No.31-M89 (5/15 kV ratings only)
   8. EEMAC G8-3.3

B. Listing by Underwriters Laboratories (UL) or Canadian Standards Association (CSA) shall be provided for 5 kV or 15 kV class medium voltage load interrupter switchgear.

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:
   1. Master drawing index
   2. Front view elevation
   3. Floor plan
   4. Top view
   5. Single line
   6. Nameplate schedule
   7. Component list
   8. Conduit entry/exit locations
   9. Assembly ratings including:
      a. Short-circuit rating
      b. Voltage
      c. Continuous current
      d. Basic Impulse Level
   10. Major component ratings including:
      a. Voltage

b. Continuous current
c. Interrupting ratings

11. Cable terminal sizes

B. Where applicable or required by the Engineer the following additional information shall be submitted to the Engineer:

1. Electrical schematic diagram
2. Descriptive bulletins
3. Product data sheets
4. Operation and Maintenance Manuals.

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Certified production test reports
4. Installation information including equipment anchorage provisions
5. Seismic certification as specified

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.07 REGULATORY REQUIREMENTS

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment. Each switchgear assembly shall be split into shipping groups for handling as indicated on the drawings or per the manufacturer's recommendations. Shipping groups shall be designed to be shipped by truck, rail or ship. Shipping groups shall be bolted to skids. Accessories shall be packaged and shipped separately. Each switchgear shipping group shall be equipped with lifting eyes for handling solely by crane.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Basis of Design Manufacturer: The Basis of Design Product for this specification is the Cutler Hammer MVS series outdoor metal enclosed switchgear. Other manufacturers which may comply include:

A. Eaton / Cutler-Hammer products

B. ABB products

C. Siemens products

D. GE products

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date with submittal of shop drawings and product data.

2.02 RATINGS

A. Switchgear assembly ratings shall be as follows:

1. Nominal System Voltage 12.47 kV three-phase three wire
2. System Grounding solid
3. Main Cross Bus Continuous Current 800 A
4. Maximum Design Voltage 15 kV
5. BIL 95kV
6. Main Cross Bus Momentary Current (10 Cycle) 40 kA Asymmetrical RMS
7. Main Cross Bus 2-Second Short Circuit Current 25 kA Symmetrical RMS
8. Non-Fused Switch (Continuous and Load Break) 600 Amperes
9. Non-Fused Momentary withstand 40 kA Asym RMS
10. Non-Fused Switch Fault close (3 times minimum, for 4.76 & 15 kV) 40 kA Asymmetrical
11. Non-Fused Switch 2-Second Short Circuit Current 25 kA Sym RMS
12. Fuse Rating 200 & 400 Ampere (see drawings)
13. Type of Fuse RBA
14. Fuse Interrupting Rating 14.4 & 25 kA Sym RMS (see drawings)
15. Fused Switch Fault close 23 & 40 kA Asym RMS (see drawings)

2.03 15 KV CONSTRUCTION

A. The metal-enclosed load interrupter switchgear shall consist of deadfront, completely metal-enclosed vertical sections containing load interrupter switches and fuses (where shown) of the number, rating and type noted on the drawings or specified herein.

B. The following features shall be supplied on every vertical section containing a three-pole, two-position open-closed switch:

1. A minimum 8-inch x 16-inch high-impact viewing window that permits full view of the position of all three switch blades through the closed door. The window shall not be more than 58-inches above the switch pad level to allow ease of inspection

2. The door shall be interlocked with the switch so that:
   a. The switch must be opened before the door can be opened.
   b. The door must be closed before the switch can be closed.

3. A hinged grounded metal barrier that is bolted closed in front of every switch to prevent inadvertent contact with any live part, yet allows for a full-view inspection of the switch blade position

4. Provision for padlocking the switch in the open or closed position

5. Green OPEN, Red CLOSED switch position indicators with the words “Open” and “Closed” in French, Spanish and English

6. A hinged cover with rustproof quarter turn nylon latches over the switch operating mechanism to discourage casual tampering

7. The switch shall be removable from the structure as a complete operational component

C. Vertical section construction shall be of the universal frame type using die-formed and bolted parts. All enclosing covers and doors shall be fabricated from steel with thickness equal to or greater than that specified in ANSI/IEEE C37.20.3. No owner removable hardware for covers or doors shall be thread-forming type. To facilitate installation and maintenance of cables and bus in each vertical section, a split removable top cover and ✉[split removable rear covers with rustproof nylon handles] [padlockable hinged rear door held closed by bolts] shall be provided. A G90 grade galvanized base shall isolate equipment from contact with the concrete pad providing protection from rust. Heavy-duty hot dipped galvanized anchor clips shall be provided to anchor the switchgear to the concrete pad.

D. Each vertical section containing a switch shall have a single, full-length, flanged front door and shall be equipped with two (2) rotary latch-type padlockable handles. Provision shall be made for operating the switch and storing the removable handle without opening the full length door.

E. Each load interrupter switch shall have the following features:

1. Three-pole gang-operated mechanism

2. Manual quick-make, quick-break over-toggle-type mechanism that does not require the use of a chain or a cable for operation, and utilizes a heavy-duty coil spring to provide opening and closing energy.

3. The speed of opening and closing the switch shall be independent of the operator, and it shall be impossible to tease the switch into any intermediate position under normal operation.

4. Separate main and break contacts to provide maximum endurance for fault close and load interrupting duty
5. Insulating barriers between each phase and between the outer phases and the enclosure
6. A maintenance provision for slow closing the switch to check switch blade engagement and slow opening the switch to check operation of the arc interrupting contacts

2.04 BUS

A. All phase bus conductors shall be tin-plated copper.

B. Ground bus shall be silver-plated copper and be directly fastened to a galvanized metal surface of each vertical section, and be of a size sufficient to carry the rated (2-second) current of the switchgear assembly.

C. A neutral bus shall be provided only when indicated on the drawings. It shall be insulated for 1000 Vac to ground. The current rating of the neutral bus shall be 600 amperes.

2.05 BUS INSULATION SYSTEM

A. All bus shall be supported utilizing a high strength and high creep support providing 10.5-inch of creep distance between phases and ground. The molded fins shall be constructed of high track resistant cycloaliphatic epoxy.

B. All standoff insulators on switches and fuse mountings shall be glass polyester or cycloaliphatic epoxy.

2.06 WIRING/TERMINATIONS

A. One (1) terminal pad per phase shall be provided for attaching contractor-supplied cable terminal lugs for a maximum of two (2) conductors per phase of the sizes indicated on the drawings. Sufficient space shall be allowed for contractor supplied electrical stress relief termination devices.

B. Small wiring, fuse blocks and terminal blocks within the vertical section shall be furnished as indicated on the drawings. Each control wire shall be labeled with wire markers. Terminal blocks shall be provided for owner’s connections to other apparatus.

2.07 FUSES

A. Fault protection shall be provided by fuses with continuous ratings as shown in the contract documents. Any fuse/switch integrated momentary and fault close ratings specified shall have been verified by test and UL and CSA certified.

2.08 ACCESSORIES

Furnish distribution class surge arresters with ratings in accordance with manufacture’s recommendations. Provide for both incoming sections (opposite ends of the switchgear, see drawings).

2.09 MISCELLANEOUS DEVICES

A. Low Voltage Distribution Section. Provide a 15 kVA, 12.47:208/120 V control power transformer in the low voltage section as shown on drawings. Provide primary fusing and a secondary 3 pole Main Circuit Breaker. Provide 6 each, 120 V, 20 A single pole circuit breakers (spare); 120 V, 15 or 20 A circuit breakers as required for cubicle heat strips and receptacle; and 2 each, spare, 208 V, 30 A circuit breakers. Mount all circuit breakers on a

DIN rail mounted on a backplane in the low voltage compartment. Low voltage compartment shall be separated from high voltage wiring. Provide a 120 V, 20 A duplex GFI receptacle on the enclosure with a NEMA 3R cover for use in-place.

2.10 ENCLOSURES

A. Enclosures shall be constructed per IEEE/ANSI C37.20.3 Outdoor specifications.

B. Each vertical section shall have a sloped weatherproof roof with labyrinth shaped joints. Use of gasket or caulking to make roof joints weatherproof shall not be permitted. All exterior openings shall be screened to prevent the entrance of small animals and barriered to inhibit the entrance of snow, sand, etc. A minimum of one (1) 250-watt, 120-volt space heater shall be provided in each vertical section. Power for the space heater(s) shall be furnished by a control power transformer mounted in the switchgear. The design shall be non-walk-in type.

C. Each vertical section shall be ventilated at the top and bottom, both front and rear, to allow airflow to provide cooling and help prevent buildup of moisture within the structure. The ventilated covers shall be externally removable to allow safe maintenance of the filter media without providing access to live parts.

D. Enclosure shall be Dust Resistant. All ventilated openings shall be filtered to inhibit the ingress of dust. The ventilated covers shall be externally removable to allow safe maintenance of the filter media without providing access to live parts. All external doors and covers shall be gasketed.

E. Provide a light and switch in the low voltage distribution section.

F. Provide thermostats to control all of the space heaters in the tie switch cabinet.

G. Provide rodent proof protection.

2.11 NAMEPLATES

A. A nameplate shall be mounted on the front door of each switch vertical section in accordance with the drawings.

2.12 FINISH

Prior to assembly, all enclosing steel shall be thoroughly cleaned and phosphatized. A powder coating shall be applied electrostatically, then fused-on by baking in an oven. The coating is to have a thickness of not less than 1.5 mils. The finish shall have the following properties:

Impact resistance (ASTM D-2794)	60 direct/60 indirect
Pencil hardness (ASTM D-3363)	H
Flexibility (ASTM D-522)	Pass 1/8-inch mandrel
Salt spray (ASTM B117-85 [20])	600 hours
Color	ANSI 61 gray

3.0 EXECUTION

3.01 INSTALLATION

A. The Subcontractors shall install all equipment per the manufacturer’s recommendations and the contract drawings and per NECA 430, Standard for Installing Medium-Voltage Metal-Clad Switchgear.

B. All necessary hardware to secure the assembly in place shall be provided by the Subcontractor.

3.02 FIELD TESTING

A. Field Testing Standard field tests shall be performed by manufacturer on the equipment under this section. All tests shall be in accordance with the latest version of NETA Acceptance Test Standards.

B. Field tests as outlined above shall be witnessed by the owner's representative.

1. The Subcontractor shall notify the owner two (2) weeks prior to the date the tests are to be performed

C. The manufacturer shall provide three (3) certified copies of field test reports.

3.03 TRAINING

A. The Subcontractor shall provide a training session for up to five (5) owner's representatives for one normal workday at a job site location determined by the owner.

B. The training session shall be conducted by a manufacturer's qualified representative and consist of instruction on the assembly, switches and major components.

END OF SECTION 261316

SECTION 262413 - SWITCHBOARDS – LOW VOLTAGE - REV 2

PART 1 GENERAL

1.1 SCOPE

A. The subcontractor shall furnish and install, where indicated, a free-standing, dead-front type low voltage distribution switchboard, utilizing group mounted circuit protective devices as specified herein, and as shown on the contract drawings.

1.2 REFERENCES

A. The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:

1. NEMA PB-2
2. UL Standard 891

1.3 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Master drawing index
2. Front view elevation
3. Floor plan
4. Top view
5. Single line
6. Schematic diagram
7. Nameplate schedule
8. Component list
9. Conduit entry/exit locations
10. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
11. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
12. Cable terminal sizes
13. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Busway connection
2. Connection details between close-coupled assemblies

3. Composite floor plan of close-coupled assemblies
4. Key interlock scheme drawing and sequence of operations

1.4 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Certified production test reports
4. Installation information
5. Seismic certification and equipment anchorage details as specified

1.5 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code.

1.6 REGULATORY REQUIREMENTS

A. The low-voltage switchboard shall be UL labeled.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton / Cutler-Hammer products

B. General Electric products

C. Siemens products

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 RATINGS

A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 AIC.

B. Voltage rating to be as indicated on the drawings.

2.3 CONSTRUCTION

A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

B. All sections of the switchboard shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided.

C. The assembly shall be provided with adequate lifting means.

D. The switchboard shall be equal to Cutler-Hammer type Pow-R-Line C utilizing the components herein specified and as shown on the drawings.

E. The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.4 BUS

A. All bus bars shall be tin-plated aluminum or tin plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).

B. Provide a full capacity neutral bus.

C. A copper ground bus (minimum 1/4 x 2 inch) shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.

D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.5 WIRING/TERMINATIONS

A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the drawings.

C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.6 MAIN PROTECTIVE DEVICES

A. POWERINSULATED CASE CIRCUIT BREAKERS

1. Protective devices shall be stationary ~~low-voltage power air-~~insulated case circuit breakers, Eaton type Magnum ~~DS~~SB or equal. Frame ratings shall be 2500 amperes or 1600 amperes (for Unitsub E3). The 2500 ampere frame power circuit breakers shall be provided in the same physical frame size. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.
2. Breakers shall be manually operated (MO).
3. All circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes. ~~To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.~~
4. Provide CTs or other means in the switchboard to initiate a ground fault trip.
5. Main power circuit breakers shall be provided with trip units as specified in Paragraph 2.7 A through F.
6. The ~~power~~ circuit breaker shall clearly indicate any electrical accessories that are mounted in the breaker. The accessory shall have a label that will indicate its function and voltage. The accessories shall be UL listed for easy field installation. They shall be modular in design and shall be common to all frame sizes and ratings.
7. ~~The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a "Positive On" feature. The breaker flag will read "Closed" if the contacts are welded and the breaker is attempted to be tripped or opened.~~
8. ~~The current sensors shall permit viewing the sensor rating on the back of the breaker. A rating plug will offer indication of the rating on the front of the trip unit.~~
9. ~~Each power circuit breaker shall offer front mounted dedicated secondary wiring points. Each wiring point shall have finger-safe contacts, which will accommodate #10 AWG maximum field connections with ring tongue or spade terminals or bare wire.~~

2.7 TRIP UNITS

A. Each ~~low-voltage power circuit breaker and~~ insulated case circuit breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True rms sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker. The trip unit shall provide adjustable LSIG trip functions.

B. The trip unit shall have an information system that ~~provides LEDs to~~ indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the ~~LED~~ indication after an automatic trip.

C. The trip unit shall be provided with a display panel that will indicate the protection functions. The unit shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.

D. ~~The trip unit shall be provided with a making current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.~~

E. Trip unit shall have selectable thermal memory for enhanced circuit protection.

F. Protective device coordination shall be provided by the addition of the following individually adjustable time/current curve shaping solid-state elements:

1. All circuit breakers shall have adjustments for long delay pickup and time, for short delay pickup and time, and include I^2t settings, for adjustable instantaneous pickup and individually adjustable ground fault current pickup and time, and include I^2t settings.

G. The trip unit shall have provisions for a single test kit to test each of the trip functions.

H. The trip unit shall have an information system that utilizes battery backup LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A test pushbutton shall energize a LED to indicate the battery status.

I. The trip unit shall have a 4-character LCD display showing phase, neutral, and ground current. The accuracy of these readings shall be +/- 2% of full scale.

2.8 MISCELLANEOUS DEVICES

A. Control power transformers with primary and secondary protection shall be provided as required for proper operation of the equipment. Control power transformers shall have adequate capacity to supply power to the future transformer cooling fans and switchboard heaters.

B. Each section of the switchboard shall be provided with a space heater thermostatically controlled. Power for the space heaters shall be obtained from a control power transformer within the switchboard. Supply voltage shall be 120 volts AC.

C. Provide one breaker test kit.

D. Provide two each of each device required for programming the circuit breaker unless the breaker has means to change the settings manually without such a device.. If the circuit breaker trip mechanism is programmed using a laptop computer, provide two each copies of the programming software.

2.9 ENCLOSURES

A. Outdoor NEMA 3R Enclosure

1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R UL requirements. Enclosure and transition shall be no wider than 48 inches.
2. Enclosure shall have flat roof.
3. The enclosure shall be provided with bolt-on rear covers for each section
4. Doors shall have provisions for padlocking
5. Ventilating openings shall be provided complete with replaceable fiber glass air filters.
6. Enclosure shall have 20 A, NEMA 5-20R GFCI protected receptacle installed in the rear cover of the switchboard. Receptacle shall be installed on a panel which can be left in place when other panels are removed to inspect and repair connections to rear of circuit breaker. Alternatively, the Subcontractor can provide an external receptacle on the side of the switchboard. Provide a waterproof, in-use cover over the receptacle.
7. Provide space heaters thermostatically controlled for each structure with adequate wattage to prevent the accumulation of moisture.
8. Provide a 3 kVA control power transformer to supply power for switchboard auxiliaries. Power for space heaters, transformer fans and receptacles shall be obtained from the control power transformer within the switchboard. Supply voltage shall be 120 volts AC. Provide supply side fuses and a disconnect switch on the supply side.
9. Provide a single pole circuit breaker for each of the 120 V loads; the fans, the receptacle and the heater.
10. Enclosures shall have a steel bottom plate. No bottom entry or exit is required.
11. Enclosures shall have provisions for cables to enter the left side of the switchboards (when viewed from the front of the switchboard) with appropriate transition pieces.
12. Enclosure shall have a 3 inch, minimum, stainless steel base.
13. Enclosure door shall be gasketed.

~~11.~~14.

2.10 NAMEPLATES

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard

designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.

B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.11 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 MANUFACTURER'S CERTIFICATION

A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.3 INSTALLATION

A. The Subcontractor shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.

B. The Subcontractor shall remove the existing 2000 or 2500 A breaker in the low voltage section of the pad-mounted transformer. The Subcontractor shall record the breaker settings and the ratings plug rating before removing the circuit breaker so that the setting can be duplicated on the new circuit breaker. Subcontractor shall turn over old breakers to Owner.

C. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted to 3"x1" galvanized steel channel anchored to the existing concrete transformer pads. Once the installation is complete, the Subcontractor shall grout the space between the pad and the bottom of the switchgear. All necessary hardware to secure the assembly in place shall be provided by the Subcontractor.

D. The Subcontractor shall furnish transition pieces fabricated from galvanized steel to be used between the existing padmounted transformer low voltage compartment and the new switchgear section for the purpose of providing a horizontal pathway for Line Side and Load Side conductors to and from the new switchboard circuit breaker. Steel shall match or exceed thickness of switchboard exterior material.

3.4 FIELD ADJUSTMENTS

A. The Subcontractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall closely match the settings of the circuit breakers removed.

B. Necessary field settings of devices, adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Subcontractor at no additional cost to the owner.

END OF SECTION 262413

SECTION 262413 - SWITCHBOARDS – LOW VOLTAGE

PART 1 GENERAL

1.1 SCOPE

A. The subcontractor shall furnish and install, where indicated, a free-standing, dead-front type low voltage distribution switchboard, utilizing group mounted circuit protective devices as specified herein, and as shown on the contract drawings.

1.2 REFERENCES

A. The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
   1. NEMA PB-2
   2. UL Standard 891

1.3 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:
   1. Master drawing index
   2. Front view elevation
   3. Floor plan
   4. Top view
   5. Single line
   6. Schematic diagram
   7. Nameplate schedule
   8. Component list
   9. Conduit entry/exit locations
   10. Assembly ratings including:
      a. Short-circuit rating
      b. Voltage
      c. Continuous current
   11. Major component ratings including:
      a. Voltage
      b. Continuous current
      c. Interrupting ratings
   12. Cable terminal sizes
   13. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:
   1. Busway connection
   2. Connection details between close-coupled assemblies

3. Composite floor plan of close-coupled assemblies
4. Key interlock scheme drawing and sequence of operations

1.4 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Certified production test reports
4. Installation information
5. Seismic certification and equipment anchorage details as specified

1.5 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:
1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code.

1.6 REGULATORY REQUIREMENTS

A. The low-voltage switchboard shall be UL labeled.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton / Cutler-Hammer products

B. General Electric products

C. Siemens products

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 RATINGS

A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 AIC.

B. Voltage rating to be as indicated on the drawings.

2.3 CONSTRUCTION

A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

B. All sections of the switchboard shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided.

C. The assembly shall be provided with adequate lifting means.

D. The switchboard shall be equal to Cutler-Hammer type Pow-R-Line C utilizing the components herein specified and as shown on the drawings.

E. The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.4 BUS

A. All bus bars shall be tin-plated aluminum or tin plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).

B. Provide a full capacity neutral bus.

C. A copper ground bus (minimum 1/4 x 2 inch) shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.

D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.5 WIRING/TERMINATIONS

A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the drawings.

C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.6 MAIN PROTECTIVE DEVICES

A. POWER CIRCUIT BREAKERS

1. Protective devices shall be stationary low-voltage power air-circuit breakers, Eaton type Magnum DS or equal. Frame ratings shall be 2500 amperes or 1600 amperes (for Unitsub E3). The 2500 ampere frame power circuit breakers shall be provided in the same physical frame size. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.
2. Breakers shall be manually operated (MO).
3. All circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes. To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.
4. Provide CTs or other means in the switchboard to initiate a ground fault trip.
5. Main power circuit breakers shall be provided with trip units as specified in Paragraph 2.7 A through F.
6. The power circuit breaker shall clearly indicate any electrical accessories that are mounted in the breaker. The accessory shall have a label that will indicate its function and voltage. The accessories shall be UL listed for easy field installation. They shall be modular in design and shall be common to all frame sizes and ratings.
7. The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a “Positive On” feature. The breaker flag will read “Closed” if the contacts are welded and the breaker is attempted to be tripped or opened.
8. The current sensors shall permit viewing the sensor rating on the back of the breaker. A rating plug will offer indication of the rating on the front of the trip unit.
9. Each power circuit breaker shall offer front mounted dedicated secondary wiring points. Each wiring point shall have finger safe contacts, which will accommodate #10 AWG maximum field connections with ring tongue or spade terminals or bare wire.

2.7 TRIP UNITS

A. Each low-voltage power circuit breaker and insulated case circuit breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True rms sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker. The trip unit shall provide adjustable LSIG trip functions.

B. The trip unit shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.

C. The trip unit shall be provided with a display panel that will indicate the protection functions. The unit shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.

D. The trip unit shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.

E. Trip unit shall have selectable thermal memory for enhanced circuit protection.

F. Protective device coordination shall be provided by the addition of the following individually adjustable time/current curve shaping solid-state elements:

1. All circuit breakers shall have adjustments for long delay pickup and time, for short delay pickup and time, and include I^2t settings, for adjustable instantaneous pickup and individually adjustable ground fault current pickup and time, and include I^2t settings.

G. The trip unit shall have provisions for a single test kit to test each of the trip functions.

H. The trip unit shall have an information system that utilizes battery backup LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A test pushbutton shall energize a LED to indicate the battery status.

I. The trip unit shall have a 4-character LCD display showing phase, neutral, and ground current. The accuracy of these readings shall be +/- 2% of full scale.

2.8 MISCELLANEOUS DEVICES

A. Control power transformers with primary and secondary protection shall be provided as required for proper operation of the equipment. Control power transformers shall have adequate capacity to supply power to the future transformer cooling fans and switchboard heaters.

B. Each section of the switchboard shall be provided with a space heater thermostatically controlled. Power for the space heaters shall be obtained from a control power transformer within the switchboard. Supply voltage shall be 120 volts AC.

C. Provide one breaker test kit.

D. Provide two each of each device required for programming the circuit breaker. If the circuit breaker trip mechanism is programmed using a laptop computer, provide two each copies of the programming software.

2.9 ENCLOSURES

A. Outdoor NEMA 3R Enclosure

1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R UL requirements. Enclosure and transition shall be no wider than 48 inches.
2. Enclosure shall have flat roof.
3. The enclosure shall be provided with bolt-on rear covers for each section
4. Doors shall have provisions for padlocking
5. Ventilating openings shall be provided complete with replaceable fiber glass air filters.
6. Enclosure shall have 20 A, NEMA 5-20R GFCI protected receptacle installed in the rear cover of the switchboard. Receptacle shall be installed on a panel which can be left in place when other panels are removed to inspect and repair connections to rear of circuit breaker. Alternatively, the Subcontractor can provide an external receptacle on the side of the switchboard. Provide a waterproof, in-use cover over the receptacle.
7. Provide space heaters thermostatically controlled for each structure with adequate wattage to prevent the accumulation of moisture.
8. Provide a 3 kVA control power transformer to supply power for switchboard auxiliaries. Power for space heaters, transformer fans and receptacles shall be obtained from the control power transformer within the switchboard. Supply voltage shall be 120 volts AC. Provide supply side fuses and a disconnect switch on the supply side.
9. Provide a single pole circuit breaker for each of the 120 V loads; the fans, the receptacle and the heater.
10. Enclosures shall have a steel bottom plate. No bottom entry or exit is required.
11. Enclosures shall have provisions for cables to enter the left side of the switchboards (when viewed from the front of the switchboard) with appropriate transition pieces.

2.10 NAMEPLATES

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.

B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.11 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 MANUFACTURER'S CERTIFICATION

A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.3 INSTALLATION

A. The Subcontractor shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.

B. The Subcontractor shall remove the existing 2000 or 2500 A breaker in the low voltage section of the pad-mounted transformer. The Subcontractor shall record the breaker settings and the ratings plug rating before removing the circuit breaker so that the setting can be duplicated on the new circuit breaker. Subcontractor shall turn over old breakers to Owner.

C. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted to 3"x1" galvanized steel channel anchored to the existing concrete transformer pads. Once the installation is complete, the Subcontractor shall grout the space between the pad and the bottom of the switchgear. All necessary hardware to secure the assembly in place shall be provided by the Subcontractor.

D. The Subcontractor shall furnish transition pieces fabricated from galvanized steel to be used between the existing padmounted transformer low voltage compartment and the new switchgear section for the purpose of providing a horizontal pathway for Line Side

and Load Side conductors to and from the new switchboard circuit breaker. Steel shall match or exceed thickness of switchboard exterior material.

3.4 FIELD ADJUSTMENTS

A. The Subcontractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall closely match the settings of the circuit breakers removed.

B. Necessary field settings of devices, adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Subcontractor at no additional cost to the owner.

END OF SECTION 262413

SECTION 311200 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Virginia Department of Transportation (VDOT), Road and Bridge Specifications (RBS), 2007 edition, applies to this section.

C. Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, Virginia Erosion and Sediment Control Handbook, 1992 (VSWC VESCH) applies to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades and fills for pads (slabs) on grade.
2. Excavating and backfilling for utility trenches.
3. Excavating and backfilling for buried utility structures.

B. Related Sections include the following:
1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Structures: Man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:
1. Each type of plastic warning tape.

B. Qualification Data: For qualified testing agency.

C. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locate existing utilities in accordance with Division 01 Section, “Work Restrictions”.

B. Dig Permit: See Division 01 for existing utility location and excavation permitting requirements.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Engineered Fill: ASTM D 2487 Soil Classification Groups GW, GP, SW, SP, and SM, with no more than 25 percent passing the No. 200 sieve, with dimensions not to exceed 2 inches in diameter, having a liquid limit less than 20 and plastic limit less than 6, and should be free of rubble, organics, clay, debris, and other unsuitable material. Engineered fill shall be maintained within 2 percent of optimum moisture content at time of compaction.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; conform to VDOT RBS, Section 203, coarse aggregate grading size 57.

F. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations includes removal of vegetation, topsoil and deleterious materials from ground surface.

C. Protect and maintain erosion and sedimentation controls as specified in Division 01.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include soil materials and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials, replace with engineered fill as directed by the Architect.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavation for Underground Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.5 EXCAVATION FOR PAVEMENTS AND CONCRETE PADS

A. Excavate surfaces under pavements and concrete pads to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated.

A. Trench Bottoms: Excavate trenches as indicated to allow for bedding course. Hand-excavate deeper for bells of pipe.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under other construction or utility pipe with engineered fill as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill of engineered fill, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Backfill voids with engineered fill while installing and removing shoring and bracing.

E. Place and compact final backfill of engineered fill to final subgrade elevation.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under pavements, use engineered fill. Extend pavement fills 2 feet beyond pavement lines.
3. Under utility structures, use bedding material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under utility structures and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
3. For utility trenches, compact each layer of backfill material as specified in subparagraphs 1 and 2 above depending on location of trench.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Pavements: Plus or minus 1/2 inch.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing in accordance with Specification Section 014000.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Note: Jefferson Lab has special requirements in their general permits related to use of nuclear soil density gages on site. Tests shall be performed in accordance with permit requirements; see Division 01. Tests will be performed at the following locations and frequencies:

1. Paved Areas and Pads: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area, but in no case fewer than 3 tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000