

# T-Plant 13.8kV Electrical System Upgrade Construction Specification

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy  
under Contract 89303320DEM000030



**P.O. Box 1464  
Richland, Washington 99352**

# T-Plant 13.8kV Electrical System Upgrade Construction Specification

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Cleanup Company  
P.O. Box 1464  
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**APPROVED**

*By Dorcas Kosgei at 12:16 pm, Sep 18, 2025*

Release Approval

Date

**DATE:**

**Sep 18, 2025**

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Release Stamp

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## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent, scope, and location of “General Electrical & Support Work” Section of this work is shown in the Design Documents which includes Drawings and Specifications. This section provides a summary of the scope of work by this Construction Specification and specifies general electrical work requirements. Specific requirements for each item is listed in this Construction Specification sub-sections as listed in Section 1.01 (B) of this document. The following is a summary of the overall work required per this specification:
1. Installation of a pair of pad-mount 1500kVA, 13.8kV-480V transformers for 221-T Building (T-Plant), located in 200W area, in Hanford WA.
  2. Installation of a pair of 480V switchboards (SWBDs) outside and around the perimeter of the 221-T Building
  3. Installation of 13.8kV power poles/lines on the south side of 221-T to extend the existing and available 13.8kV service nearby.
  4. Installation of 13.8kV power poles/lines on the South/Southeast of 291-T to extend the existing and available 13.8kV service nearby.
  5. Installation of a three (3) single phase 167kVA, 13.8kV-480V transformers (to form a 3 phase bank) on a power pole at 291-T Building, located in 200W area, in Hanford WA
  6. Installation a 480V Service Panelboard outside of the 291-T Building
  7. Installation of all metering equipment at service locations
  8. Installation of equipment house keeping pads.
  9. Interconnecting the equipment described above
  10. Disconnecting the existing power to both 291-T and 221-T Buildings
  11. Tie-in to the existing equipment to the new upgraded system.
- B. This Construction Specification contains the following Sub-sections:
1. 01 33 00 - Submittals
  2. 01 64 00 – Government Furnished Equipment (GFE)
  3. 01 78 39 – Project Record Documents
  4. 03 30 00 – Cast-in-Place Concrete
  5. 05 12 00 – Structural Steel Framing
  6. 26 05 13 - Medium Voltage Cables
  7. 26 05 19 – 600V or Less Wire and Cables
  8. 26 05 26 - Grounding and Bonding for Electrical Systems
  9. 26 05 29 - Hangers and Supports for Electrical Systems
  10. 26 05 33 - Raceway and Boxes for Electrical Systems

11. 26 05 53 - Identification for Electrical Systems
12. 26 08 00 - Commissioning of Electrical Systems
13. 26 12 00 - Liquid Filled, Medium-Voltage Transformers
14. 26 22 13 – Dry Type Transformers 600 V or Less
15. 26 24 16 - Panelboards
16. 26 24 13 - Switchboards
17. 26 28 16 - Safety Switches
18. 31 23 33 – Excavation -Trenching
19. 31 23 23 - Fill
20. 33 71 73 – Electrical Utility Services
21. 33 71 16 - Poles for Electrical Systems

#### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. The entire electrical installation shall be made in strict accordance with the requirements of State or Federal codes of Law having jurisdiction, as well as the project requirements as documented in Drawings and Specifications. Specific codes and requirements, as applicable to work as specified by each section of this Specification, are listed in the applicable Sub-sections.
- B. Should any work shown on the drawings or herein specified be construed as being contrary to or not conforming to the previously mentioned codes, laws, etc., it shall be brought to the attention of the Customer or Owner's Representative to be reviewed, and/or corrected prior to final bid date.
- C. Permits, inspections and fees: The Contractor shall obtain all permits and inspections required for the work, and shall pay all costs and fees thereof.

#### 1.03 SUBMITTALS

- A. Submit materials data in accordance with Section 01 33 00 – Submittals and the Statement of Work submittal registry.

#### 1.04 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical construction products of types required for this project, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: A firm with not less than 5 years of successful experience in installation of products similar to those required for this project.
- C. Nationally Recognized Testing Laboratory (NRTL) Compliance: Comply with applicable portions of NRTL safety standards pertaining to electrical equipment and installation required for this project.
- D. NFPA 70, NFPA 70E, NESC Compliance: Comply with NFPA and NESC as applicable to installation of the equipment required for this project.
- E. Comply with all construction work safety rules and regulations as well as the Owner's safety requirements and regulations.

- F. Refer to additional Quality Assurance requirements specified in each Sub-section of this Construction Specification.

1.05 ELECTRICAL REQUIREMENTS

- A. Drawings indicate the general character, scope, and arrangements of the electrical installation. Approval of any change or departure from the drawings must be obtained from the Owner's Representative.
- B. Equal Products: Those items on the drawings or in these specifications designating particular product numbers limit their use only as to design, workmanship and quality, not manufacturer. Approval for alternate or substitute items shall be secured from the Owner's Representative, and submittals for approval must be accompanied by all necessary descriptions, catalog sheets, etc. Authority over such submittals shall rest with the Owner's Representative.
- C. Workmanship: All work shall be performed by skilled workmen in a manner reflecting the best modern construction practices. It shall present, upon completion, a neat, orderly, finished appearance. All evidence of debris associated with the work shall be removed from the premises. Conform to all OSHA and Hanford Specific workplace requirements.
- D. Coordination with other trades to the fullest of ability in relation with others to result in a professional installation shall be complete, and more specifically, as follows:
  - 1. The drawings and specifications are based on the best information available when prepared. Frequently minor changes occur with respect to the construction, and the requirements of equipment furnished by others. The electrical contractor shall recognize this in bidding, supervising, and in planning construction.
  - 2. Before locating conduit runs, boxes, etc., the drawings shall be carefully checked to see that they are in accordance with the electrical drawings. Required adjustments may be made with the Contractor's superintendent and with concurrence with the Facility's electrical Design Authority (DA)
  - 3. Before proceeding with installation of Government Furnished Equipment (GFE), the equipment information shall be reviewed with those responsible for their installation. The electrical contractor shall become well acquainted with their characteristics, location and arrangement for mounting. Changes in wiring arrangements and other adjustments necessary or desirable shall be reviewed with the Owner's Representative for authorization.
- E. Allowances for Contingencies: No change in contract price will be allowed for alternate work which requires approximately the same work to adjust or relocate electrical components or devices as part of the construction coordination work. An adequate allowance shall be included in the bid price for such coordination contingencies and for the additional work required by these coordination adjustments.
- F. Coordinate the proposed locations of major raceway systems, equipment, and materials. Include the following:

1. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance. Comply with code requirements for working space about electrical equipment.
  2. Exterior wall and foundation penetrations.
  3. Fire-rated wall and floor penetrations.
  4. Equipment connections and support details.
  5. Sizes and location of required concrete pads and bases.
  6. Scheduling, sequencing, movement, and positioning of large equipment around the perimeter of the building during construction.
- G. Materials shall be new and unused and shall be listed where applicable.
- H. Retain two sets of all equipment or device installation instructions and submit to the Owner's Representative prior to project completion.

## PART 2 EXECUTION

### 2.01 ELECTRICAL REQUIREMENTS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate electrical systems, equipment, and materials installation with other building components.
- B. Verify all dimensions by field measurements.
- C. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to installation.
- E. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, and the Facility's controlling organization.
- F. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Owner's Representative.
- G. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

### 2.02 TESTING:

- A. The Contractor shall perform, prior to final acceptance, an operations test to all electrical equipment. The entire installation shall be free from ground faults and short circuits.

- B. Warranty-Guarantee: The electrical contractor shall warrant that all work executed under this Division of the specifications will be free from defects in materials and workmanship for a period of one year from the date of final acceptance of the building. The above parties agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the warranty-guarantee.

2.03 PROTECTION OF MATERIAL:

- A. All work, equipment, and materials shall be protected at all times. Equipment shall be tightly covered and protected against dirt, water, chemical, or mechanical damage. At final completion, all work shall be thoroughly cleaned and delivered in an unblemished condition.
- B. Touch up all damaged painted surfaces on equipment to match original paint.

2.04 SHOP DRAWINGS AND MAINTENANCE MANUALS:

- A. Shop Drawings: Furnish, in accordance with each specific section of this Specification, shop drawings and wiring diagrams for items not specified as Government Furnished Equipment (GFE).
- B. Materials and Equipment Submittals: Furnish catalog sheets or cuts for all items furnished.
- C. Maintenance Manuals: Upon completion of the work, deliver to the Customer two copies of each of complete operation and maintenance instructions and data for the electrical equipment furnished under the electrical contract work. Data shall include catalog pages or data sheets for each piece of equipment, wiring diagrams showing the internal and external elements and their connections, manufacturer's maintenance manuals, bills of materials showing necessary data for ordering replacement parts, and approved shop drawings.

PART 3 MEASUREMENT AND PAYMENT

3.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the Contract.

End of Section
----------------

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent of "Submittals" as related to this work is summarized in this section of the specification as follows.
  - 1. In this "Submittal" section of the specification, the owner (CPCCo) is referred to as "Customer" and the construction contractor performing the installations/construction is referred to as "Contractor".
  - 2. Where equipment is furnished by the Contractor as specified in other sections of this construction specification, Contractor shall submit descriptive information that will enable the Customer's Construction Point of Contact (POC) to determine whether Contractor's proposed materials, equipment, and work methods are, in general, in conformance to the design requirements and in accordance with the Drawings and Specifications. The information submitted may consist of Drawings, descriptive data, certificates, test results, product data, and such other information specifically required by the Drawings and Specifications.
  - 3. All information about Government Furnished Equipment (GFE), as defined in Section 01-64-00 of this Specification, will be provided to the Contractor for review and prior to initiation of work activities and per the Contractor's request.

### 1.02 SUBMITTALS PROCEDURE

- A. Direct all submittals to Customer's Construction POC unless specified otherwise.
- B. Transmittal of Submittal:
  - 1. Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall ensure that the material, equipment, or work method will be as described in the project documents.
    - a. Contractor shall verify that all features of all products conform to the requirements of the Drawings and Specifications.
    - b. Contractor shall ensure that there is no conflict with other submittals and notify Customer's Construction POC in writing where its submittal may adversely affect or deviate from the work as defined by Drawings and the project specifications.
    - c. Contractor shall ensure coordination of submittals among the Subcontractors working under their contract.
  - 2. Unless a different number is called for in the individual Specification sections, two (2) copies of each submittal are required.
    - a. Electronic copy of the submittals are acceptable unless hard copies are specifically requested by the Customer.
    - b. Faxed submittals will not be accepted.
  - 3. Contractor shall complete and sign a transmittal Form A-6004-757 with each submittal package as designated by CPCCo per their Statement of Work.

- C. Format:
  - 1. Submittals regarding material and equipment shall be presented directly to Customer and be accompanied by a transmittal form.
    - a. A separate form shall be used for each specific item,, equipment, and items specified in separate correspondences for which the submittal is required.
    - b. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency requires checking or review of the group or package as a whole.
  - 2. Submittals that are related to or affect each other shall be forwarded simultaneously as a package to facilitate coordinated review. Uncoordinated submittals will be rejected.
  - 3. When catalog pages are submitted, applicable items must be clearly identified.
  - 4. Submittals that do not have all the information required are not acceptable and will be returned as "not approved-revise and resubmit" without review.
- D. Timeline: Schedule and submit in accordance with the Construction Schedule, and requirements of individual specification sections.
- E. Resubmittals: Clearly identify each correction or change made to the original submittal.
- F. Review Procedure:
  - 1. Submittals are required for those materials, equipment, and work methods that can be selected, based on contractor's judgment, that are suitable and in conformance to the project drawings and specifications and as requested by the SOW submittal registry.
  - 2. The basis for the submittal process is based on Contractor's guarantee that all materials, equipment, and work methods not requiring submittals conform to the Drawings and Specifications.
  - 3. Review will not extend to means, methods, techniques, sequences, or procedures of construction or to verifying quantities, dimensions, weights of separate items, and as such, will not indicate approval of the assembly. It is Contractor's sole responsibility to ensure accuracy of this information.
  - 4. Customer will review submittals for overall design intent and return to Contractor with suggested or necessary revisions.
  - 5. Request for Clarification or Information (RCI), deviations, or changes to the contract will be initiated by completing an RCI form as specified by the buyer.

6. If the items or system proposed are acceptable, but the major part of the individual project Drawings or documents would require revision, such revision shall be approved by Customer and the design documents/Drawings shall be revised and or redlined as determined by the Customer prior to proceeding with the change.
7. The response to submittal reviews will indicate one of the following:
  - a. If the review determines that the material, equipment, or work method complies with the Drawings and Specifications, submittal response will be "Conforms to the Contract Requirements" and be approved. In this event, Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
  - b. If the review determines minor comments or corrections are required, submittal response will be marked "Minor Comments-Approved With Exceptions as Corrected". Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted changes while still required to resubmit the corrected submittal.
  - c. If the review indicates that the submittal is insufficient or contains incorrect data, submittal response will be "Not Approved-Revise and Resubmit". Any work performed without prior approval by Customer may be rejected and require rework at the Contractor's expense.
  - d. If the review indicates that the material, equipment, or work method does not comply with the Specification, the submittal will be "rejected". It will be the Contractor's responsibility to resubmit an alternatives that is acceptable by the Customer.
8. It shall be Contractor's responsibility to ensure that required items are corrected and resubmitted. Any work done before approval shall be at Contractor's own risk.
9. Processing Time: Unless otherwise specified, Customer will review the submittal and return copies with comments/required actions in the time frames documented on the SOW submittal registry.
- G. Certificates: When required in each Specification section and as directed by the SOW submittal registry, Contractor shall furnish certificates of compliance from manufacturers or suppliers certifying that materials or equipment being furnished comply with the requirements of these Drawings and Specifications.
- H. Effect of review of Contractor's submittals:
  1. Review of Shop Drawings, data, work methods, or information regarding materials or equipment that Contractor proposes to provide shall not relieve

Contractor of the responsibility for errors therein and will not be regarded as an assumption of risks or liability by the Customer.

2. An approval of the submittal with no comments will mean that Customer has no objection to Contractor, upon its own responsibility, using the work method proposed, or providing the materials or equipment proposed.

#### 1.03 SHOP DRAWINGS/VENDOR DATA

- A. Contractor shall coordinate all Shop Drawings and/or Vendor Data with Customer and review them for legibility, accuracy, completeness, and compliance with Contract requirements and shall indicate this approval thereon as evidence of such coordination and review.
  1. Shop Drawings/Vendor Data will be submitted to the Customer for approval through the Customer's submittal process.
  2. Any Shop Drawings/Vendor Data supplied by Customer as part of GFE equipment shall be reviewed by the contractor for suitability prior to use. Any discrepancy or evidence of unsuitability shall be brought up to Customer's attention in writing prior to use and installation. Customer will not be responsible for rework or replacement once installed in the field.
- B. Contractor shall stamp approval on Shop Drawings/Vendor DATA prior to submission to Customer as an indication that dimensions and coordination with interrelated items have been checked and verified.
- C. Should Contractor propose any item on the Shop Drawings/Vendor DATA or incorporate an item into the work which subsequently proves to be defective or otherwise unsatisfactory, (regardless of Customer's preliminary review) Contractor shall, at Contractor's own expense, replace the item with another item that will perform re-work satisfactorily.

### PART 2 EXECUTION

2.01 Not Used

### PART 3 MEASUREMENT AND PAYMENT

#### 3.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as determined by the contract.

End of Section
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**PART 1 GENERAL**

1.01 Section includes:

- A. Government owned (CPCo furnished) equipment for Contractor installation referred to as Government Furnished Equipment (GFE).
- B. Contractor performed work.

1.02 GFE Furnished Equipment for Contractor Installation

- A. CPCo will furnish the following Government Furnished Equipment, identified in Contract Documents as GFE, to be installed by the Contractor.

Quantity	Tag Number	Description	Reference
1	E-SWBD-N17-001	Switchboard #1	Drawing H-2-841273-001 CPC-00865
1	E-SWBD-N07-002	Switchboard #2	Drawing H-2-841273-001 CPC-00865
1	E-TR-N17-001	Transformer #1	Drawing H-2-841273-001 CPC-00864
1	E-TR-N17-002	Transformer #2	Drawing H-2-841273-001 CPC-00864
3	TBD	Pole Mounted Transformers  Single phase  167kVA  13.8kV-480V	Drawing H-2-841273-020, SHT 4
2	E-TR-N09-007 E-TR-N13-004	Transformer  Single Phase  100kVA  480-240/120V	Drawing H-2-841273-001
4	E-TR-N15-006 E-TR-N05-005	Transformer  Single Phase	Drawing H-2-841273-001

	E-TR-N03-008 E-TR-N17-003	37.5kVA 480-240/120V	
1	E-PP-291T-001	Power Panel 3 phase 480V	Drawing H-2-841273-002
3	TBD	Utility Metering	Drawing H-2-841273-001 & 002
As needed	All 3" & 4" Conduits	EMT	Drawing H-2-841273-001 & 002
As needed	All 600, 500, & 250kcmil Cables	Cable	Drawing H-2-841273-001 & 002

- B. CPCCo will deliver GFE to project site.
- C. Notify Contract Administrator, in writing, 5 calendar days prior to desired date of delivery.
- D. Upon receipt, verify quantity and condition of GFE. Report any shortages or damages in writing to Contract Administrator within 24 hours.
- E. Install or incorporate all GFE into the work unless otherwise noted. Uncrate, assemble, perform all prestart-up activity, and place in operation all GFE as recommended by the manufacturer(s).
- F. Coordinate with the contractor's quality assurance staff for performing QC inspection of the equipment prior to installation and inspection of labeling in the field.

1.03 CPCCo WORK

- A. CPCCo will provide oversight of the work performed by the contractor only.

1.04 Contractor WORK/responsibilities.

- A. Furnish and install all other equipment as listed on the drawings and this specification not noted as GFE.
- B. Receive products at site and give written receipt for product at time of delivery, noting visible defects and omissions; if such declaration is not given, the Contractor shall assume responsibility for such defects and omissions.
- C. Protect products until ready for installation and protect from loss and damage.
- D. Uncrate, assemble and set products in place.
- E. Install products in accordance with manufacturer's recommendations, instructions and shop drawings under supervision of manufacturer's representative where specified, supplying labor and material required and making electrical connections necessary to operate equipment.

- F. Where so specified, installation shall be only by installer approved by manufacturer. If known, approved installer is identified on the Drawings or in the Specifications.
- G. Treat all Owner or Vendor supplied products with the same care as all Contractor furnished items

PART 2 PRTODUCTS

2.01 PRODUCT OPTIONS AND SUBSTITUTIONS

Not Applicable

PART 3 EXECUTION

3.01 PERFORMANCE

- A. Prior to commencing work, Contractor shall verify that work specified in other Sections has been properly completed and installed as specified to allow for installation of all materials and methods required of this Section.
- B. Contractor shall verify that new and existing products and conditions are satisfactory for installation of CPCCo equipment. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected.
- C. In the event of discrepancy, Contractor shall immediately notify CPCCo's Representative.
- D. Contractor shall not proceed with installation in areas of discrepancy until all such discrepancies have been resolved.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the Contract.

End of Section
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PART 1 GENERAL

1.01 SUMMARY OF WORK

- A. The extent of "Project Record Documents" as related to this work is summarized in this section of the specification.
  - 1. This section includes the following:
    - a. Project Record Management
    - b. Project Record Submittal Requirements

1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. None

1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry.
- B. Deliver the Project Record Documents to the Contract Administrator. Submit electronic files and paper copies as specified in Sections 1.05 and 1.06.
- C. Transmit the Project Record Documents with a cover letter listing:
  - a. Date
  - b. Project title and number
  - c. Contractor's name, address, and telephone number
  - d. Number and title of each Record Document
  - e. Signature of Contractor or authorized representative.

1.04 MAINTENANCE OF DOCUMENTS

- A. During construction, maintain at project site a record copy of the following Project Record Documents.
  - a. Construction Drawings.
  - b. Specifications.
  - c. Amendments or revisions to project documents
  - d. Change orders and other modifications to the Contract.
  - e. Reviewed shop drawings, product data, and samples.
  - f. Field test records.
  - g. Inspection certificates.
  - h. Manufacturer's certificates.
  - i. Specified installer/tradesman certificates.
- B. Store Project Record Documents in Field Office apart from other documents. Provide separate files, racks, and secure storage for Project Record Documents.

- C. Label and file Project Record Documents in accordance with Section number listings in Table of Contents of these Specifications. Label each document "PROJECT RECORD DOCUMENTS" in large, legible, printed letters.
- D. Maintain Project Record Documents in a clean, dry and legible condition.
- E. Keep Project Record Documents available for periodic inspection by the CPCCo Construction point of contact/Inspectors and other applicable parties.

#### 1.05 RECORDING

- A. Use red pen to clearly record information or changes on the drawings.
- B. Use different colors for the overlapping changes if required for clarification.
- C. Record information concurrently with construction progress. Do not conceal any work until required information is recorded (i.e., in process field inspection reports).
- D. Legibly mark each item on the drawings to record actual construction changes.
  - 1. Field changes of dimension and detail.
  - 2. Changes made by Contract modifications.
  - 3. Details not on original Drawings.
  - 4. References to related shop drawings and Contract modifications.
- E. Specifications: Legibly mark each item to record actual construction, including changes made by amendment and Contract modifications.

#### 1.06 FINAL RECORD DOCUMENTS (AS-BUILTS)

- A. At completion of construction activities, verify accurate transposition of all site information onto Final Record Documents and deliver to Contract Administrator:
- B. Verify accurate transposition of all site information onto the Final Record Documents.
  - 1. Record Drawings: Provide Final Record Drawings in both reproducible (full-sized paper) and electronic media in accordance with the CPCCo Drafting Manual and Electronic CAD File Conventions requirements.
  - 2. Specifications: Provide single sided paper copy and electronic copy of changes to the specification in Microsoft Word and on Thumb drives.

### PART 2 EXECUTION

2.01 Not Used

### PART 3 MEASUREMENT AND PAYMENT

#### 3.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the Contract.

End of Section

PART 1 GENERAL

1.01 SUMMARY OF WORK

- A. See applicable drawings for Cast-In-Place Concrete construction information

End of Section

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. The extent and location of “Structural Steel framing” work is shown in the Contract Drawings.

1. The section includes the following:
  - a. Structural shapes.
  - b. Channels and angles.
  - c. Hollow structural sections.
  - d. Structural plates.
  - e. Bolts, connectors, and anchors.

1.02 GOVERNING CODES, STANDARDS AND REFERENCES

A. American Institute of Steel Construction (AISC)

1. AISC 303 Code of Standard Practice for Steel Buildings and Bridges
2. AISC 341 Seismic Provisions for Structural Steel Buildings
3. AISC 360 Specification for Structural Steel Buildings

B. ASTM International (ASTM)

1. ASTM A 6 General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
2. ASTM A 36 Carbon Structural Steel
3. ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
4. ASTM A 108 Steel Bar, Carbon and Alloy, Cold-Finished
5. ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
6. ASTM A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
7. ASTM A 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
8. ASTM A 325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
9. ASTM A 500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
10. ASTM A 529 High-Strength Carbon-Manganese Steel of Structural Quality
11. ASTM A 563 Carbon and Alloy Steel Nuts

12. ASTM A 572 High-Strength Low-Alloy Columbium-Vanadium of Structural Steel
13. ASTM A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment
14. ASTM A 780 Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
15. ASTM A 992 Structural Steel Shapes
16. ASTM B 695 Coatings of Zinc Mechanically Deposited on Iron and Steel
17. ASTM F 436 Hardened Steel Washers
18. ASTM F 959 Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
19. ASTM F 1554 Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
20. ASTM F 1852 Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

C. American Welding Society (AWS)

1. AWS D1.1 Structural Welding Code - Steel

D. Master Painters Institute (MPI)

1. MPI #18 Single Component Organic Zinc-Rich Primer
2. MPI #18 Inorganic Zinc-Rich Primer
3. MPI #79 Alkyd Anti-Corrosive Metal Primer

E. Research Council on Structural Connections (RCSC)

1. RCSC SPEC\* Specification for Structural Joints Using ASTM A325 or A490 Bolts

\* Some documents refer to this as AISC 348.

F. The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers International (NACE)

1. SSPC-PA 1 Shop, Field, and Maintenance Painting of Steel
2. SSPC-PAINT 20 Paint Specification No. 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
3. SSPC-PAINT 23 Paint Specification No. 23 Latex Primer for Steel Surfaces.
4. SSPC-PAINT 25 Paint Specification No. 25 Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II.
5. SSPC-PAINT 25 BCS Paint Specification No. 25 BCS Zinc Oxide, Alkyd, Linseed Oil Primer for Use over Blast Cleaned Steel.

6. SSPC-PS GUIDE 7.00 Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems.
7. SSPC-SP 1 Solvent Cleaning
8. SSPC-SP 2 Hand Tool Cleaning
9. SSPC-SP 3 Power Tool Cleaning
10. SSPC-SP 7/ NACE No. 4 Brush-off Blast Cleaning
11. SSPC-SP 11 Power Tool Cleaning to Bare Metal
12. SSPC-SP 14/NACE No. 8 Industrial Blast Cleaning
13. SSPC-SP 6/ NACE No. 3 Commercial Blast Cleaning

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 - Submittals and the Statement of Work (SOW) submittal registry.
- B. Submittals shall be submitted as required by the SOW submittal registry and include the following:
  1. Product Data: For each type of product.
  2. Shop Drawings:
    - a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
    - b. Include embedment Drawings.
    - c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
    - d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- C. The following documents shall be submitted and approved by the CPPCo Welding Program SME prior to the start of welding.
  1. Welding Procedure Specification (WPS) and supporting Procedure Qualification Record (PQR).
  2. Welder Performance Qualification Records (WPQR) including continuity
  3. Inspector qualification records
  4. Inspection procedures
  5. Weld inspection report(s) and weld map(s)

### 1.04 QUALITY ASSURANCE

- A. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
  2. AISC 360.
  3. RCSC SPEC.
  4. AISC 341
- B. Quality Fabricator Qualifications: The fabricator shall be approved by CPCCo.
- C. Quality Control Inspector (QCI) Qualifications: The qualifications of the QCI(s) engaged by the fabricator and/ or the erector shall comply with AISC 360 Chapter N, paragraph N4.1.
- D. Welding Qualifications:
1. Shop.
    - a. Prior to shop welding, submit WPQR certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

#### 1.05 COORDINATION

- A. Structural steel framing details are shown on drawings in approximate locations. Do not interfere and or obstruct access to existing equipment when installing new frames.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with any /applicable portions of AISC 303 Chapter 6, Shop Fabrication and Delivery.
- B. Package, mark, and load steel products in accordance with ASTM A700.
- C. Deliver, store and handle materials:
1. With equipment of adequate capacity.
  2. Without overstressing or permanently deflecting material or any supporting structures.
  3. Without damaging finish.
- D. Deliver manufactured materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.
1. Fasteners may be repackaged provided CPCCo's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
- E. Inspect fasters and structural steel upon receipt at site including the following:
1. Item identification and marking
  2. Shipping damage has not occurred
  3. Required documentation has been provided and is acceptable.
  4. Suspect/counterfeit items have not been provided.

- F. Store materials in designated areas that are well drained (preferably gravel covered or paved), off ground, under cover, and away from damp surfaces.
- G. Store materials in areas reasonably removed from the actual construction area and traffic so that the possibility of damage from construction equipment is minimized.
- H. Store primer materials in accordance with manufacturer's recommendations.
- I. Remove damaged, unlabeled or unsatisfactory materials which do not meet this specification from the job site

## PART 2 PRODUCTS

### 2.01 STRUCTURAL STEEL

- A. Non-W-Shapes, Plates, and Bars
  - 1. ASTM A 36
- B. W-Shapes
  - 1. ASTM A 992
- C. Steel Pipe
  - 1. ASTM A 53, Grade B
- D. Hollow Structural Steel (HSS)/Structural Steel Tubing
  - 1. ASTM A 500, Grade B, Minimum Yield Strength = 46ksi.
- E. Welding Filler Metals/ Electrodes and Rods
  - 1. AWS D1.1 Table 3.1

### 2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

### 2.03 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

### 2.04 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, and to AISC 360.
  - 1. Mark and match-mark materials for field assembly.
  - 2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. [Do not thermally cut bolt holes or enlarge holes by burning.]
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.05 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC SPEC for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.06 SHOP PRIMING

- A. Shop prime steel surfaces.

## 2.07 SOURCE QUALITY CONTROL

- A. Fabricator's QCI: Perform the monitoring, and shop tests and inspections required by the fabricator's quality control procedures.
  - 1. Provide QCI with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. The QCI shall monitor material identification procedures in order to ensure compliance with AISC 303 Section 6.1.
- C. The QCI shall inspect the following as a minimum, as applicable:
  - 1. Shop welding, high-strength bolting, and details in accordance with AISC 360 Section N5, except paragraph N5.5.
  - 2. Shop cut and finished surfaces in accordance with AISC 360 Section M2.
  - 3. Shop heating for straightening, cambering and curving in accordance with AISC 360 Section M2.1.
  - 4. Tolerances for shop fabrication in accordance with AISC 303 Section 6.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength

### 3.03 ERECTION

- A. Erect structural steel per OSHA 29 CFR Part 1926, Subpart R-Steel Erection.
  - 1. Regardless of what is indicated on the Project drawings, no column shall be erected with fewer than four anchor rods. In the event that fewer than four rods are indicated on the drawings, and the column base plate and/ or the plate bearing surface will not accommodate the installation of four rods, stop work and notify CPCCO and the Engineer of Record (EOR).
- B. Set structural steel accurately and to elevations indicated and according to AISC 360 and AISC 303.
- C. Unless otherwise indicated, nuts on cast-in-place anchor rods shall be snug-tightened without using an impact wrench. In addition, the nuts shall have full thread engagement.
- D. Baseplates, Bearing plates, and Leveling Plates:
  - 1. Clean bottom surface of plates of all dirt, oil, grease, and other foreign material that would hinder bond between metal and concrete or grout.
  - 2. The bearing surfaces of concrete shall be cleaned of bond-reducing materials, and roughened prior to setting plates.
  - 3. Align, level and maintain final positioning of components to be grouted or embedded.
    - a. Set plates for structural members and equipment supports on wedges, shims, or leveling nuts as required.
    - b. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if they protrude, cut off flush with edge of plate before packing with grout.
  - 4. In a swift manner, pack grout solidly between plate and bearing surface to the extent that all air pockets are removed.
  - 5. Neatly finish exposed surfaces, protect grout and allow to cure.

6. Comply with the more stringent of either the grout manufacturer's installation instructions, or the following:
    - a. Moist cure grout.
    - b. Remove forms after grout is set. Trim grout edges to form smooth surface, splayed 45 degrees.
  7. Tighten anchor rods after grout has cured for a minimum of 3 days.
- E. Baseplates for Post-Installed Anchors:
1. Non-grouted baseplates installed with anchors may have a maximum 1/8 inch gap as evidenced under exterior edges around the plate provided that (1) the plate exhibits bearing contact within its interior against the concrete surface, and (2) the uneven bearing does not prevent application of the prescribed torque.
  2. If an unacceptable bearing contact condition exists, follow one of these two procedures:
    - a. Rework the concrete surface to obtain a proper fit.
    - b. For gaps of up to 1 inch, the baseplate may be grouted instead using the following technique:
- HOLD POINT: Facility DA must be notified before proceeding so that post-installed anchor design can be checked, and if necessary, modified.
- (1) Insert anchors and set the baseplate.
  - (2) Install nuts to finger tight condition.
  - (3) Install shims positioned < 1/2 inch away from the anchors to reduce gaps between baseplates and shims to < 1/8 inch at anchor locations.
  - (4) Apply tightening torque. The bolt tightening shall not be performed when interior shims under the baseplates have been placed away from anchors, so that downward bending of the baseplate would result upon tightening. Shims shall be moved as close as possible to the anchors before applying the installation torque.
  - (5) Fill the gap with non-shrink grout leaving the shims in place. For baseplates on walls, where grouting is not feasible, the gap may be filled with shim plates. The shims may be stacked, but no more than four shims shall be stacked.
- F. Maintain erection tolerances of structural steel within AISC 303.
- G. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure

#### 3.04 FIELD CONNECTIONS

- A. High--Strength Bolts: Install high-strength bolts according to RCSC SPEC for type of bolt and type of joint specified.
  1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1. for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs [where indicated], back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

#### 3.05 FIELD/ERECTOR QUALITY CONTROL

HOLD POINT: The Facility DA shall verify the placement of all steel weldments prior to final placement. The Facility DA shall record the acceptability of the placement of the weldment in the work record.

If welding in the field is required, examination is to be in accordance with AWS D1.1.

### PART 4 MEASUREMENT AND PAYMENT

#### 4.01 GENERAL

- A. No separate measurement or payment will be made for the Work required by this section. The cost for this portion of the Work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified in the Contract.

End of Section
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## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of “Medium-Voltage Cables/Overhead line” work is shown in the Contract Documents. This Section includes requirements for single-conductor 15 kV shielded power cables suitable for use in wet or dry locations and underground conduits. It also includes installation of the Aluminum Conductor Steel Reinforced (ACSR) overhead lines as specified and shown on the Drawings.
- B. All portions of the work covered by this Section is to be conducted in 200W area and in the perimeter of the 291-T and 221-T facilities.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. ANSI/IEEE C2 National Electrical Safety Code
- B. ASTM B232/B232M-17 Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated Steel reinforced (ACSR)
- C. ASTM (American Society for Testing and Materials) - for components and installation
- D. IEEE 48 - Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminations.
- E. ANSI/NEMA WC 70 (National Electrical Manufacturers Association) – Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
- F. ANSI/NEMA WC 74 (National Electrical Manufacturers Association) – 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy
- G. NETA ATS-2021 – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems (International Electrical Testing Association)
- H. NFPA 70 (National Fire Protection Association) - National Electrical Code
- I. ICEA S-93-639 -2022-(Insulated Cable Engineers Association Inc.) – 5-46kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.
- B. Submittals shall include the following:
  - 1. Product data for cables and cable accessories, including splices and terminations.
  - 2. Qualifications of Splicer.
    - a. Qualified by Elastimold, 3M Cooper Medium Voltage.
  - 3. Electrical Contractor Experience.

- a. Provide a list of personnel names including certifications, significant projects they have worked in the past three years, and listing the approximately number and type of termination and connector installations they performed or assisted.
  - b. Minimum of one person on crew must have worked on at least five medium voltage and overhead power line installations. Crew member with experience on five medium voltage projects must be present on site at all times while work is being performed.
  - c. Include list of completed projects with project names, addresses, names of Engineers and Owners, and other contact information such that verification can be made. Provide qualification data for Independent Testing Agency as applicable.
4. Submittal of pulling product and installation data including, but not limited to:
- a. Shims
  - b. Pulleys
  - c. Crimping tools
  - d. Calibration reports
  - e. Take-up reels
  - f. Lubricant – type and quantity
  - g. Clean-up Plan
  - h. Lifting Equipment/Devices
5. Product certificate signed by Manufacturer that its products comply with the specified requirements.
6. Qualification data for firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineers and Owners, and other information specified.
7. Product Test Reports: Certified reports of Manufacturers’ design and production tests indicating compliance of cable and accessories with referenced standards. Cables with the manufacturing date exceeding 12 months prior to the date of delivery to the Project site will not be accepted.
8. Schedule of cable pulls showing calculated pulling tension and sidewall pressure values.
9. Field test reports indicating and interpreting test results relative to compliance with performance requirements specified. Include certified copies of field test records.

#### 1.04 QUALITY ASSURANCE

- A. Single Supply/Source Requirement: The manufacturer of the overheadlines and the insulated medium voltage power cables may be different. However, the associated accessories for each item shall be the product of the same manufacturer.

- B. Manufacturer Qualifications: Firm with 10 years experience in manufacturing medium-voltage cable with triple extrusion EPR insulation and accessories similar to those indicated for this Project. Same requirement applies to the supplier of the ACSR overhead power conductors, with a record of successful in-service performance and having ISO-9000 approval certification.
- C. Manufacturer Warranty: Provide 30-year design service life statement.
- D. Listing and Labeling: Provide medium-voltage cables and overhead power conductors and accessories that are Listed and Labeled as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Laboratory (NRTL) approved by OSHA and acceptable to the Authority Having Jurisdiction, as applicable, and marked for intended use for the location and environment in which they are installed.
  - 1. Cable shall comply with UL Standard 1072 for Type MV-105.
  - 2. Overhead ACSR overhead cables shall meet ASTM B232 requirements
- E. Comply with the following standards:
  - 1. NFPA 70, as adopted and administered by the Authority Having Jurisdiction.
  - 2. ANSI C2 "National Electrical Safety Code" for components and installation.
  - 3. Insulated Cable Engineers Association (ICEA) for components and installation.
  - 4. ASTM for components and installation.
- F. Installer: Engage an experienced and certified cable splicer to install terminations and connectors for medium voltage cable. Provide a list of personnel names including certifications. Significant projects they have worked in the past three years, and listing the approximate number and type of termination and connector installations they performed or assisted.
- G. Pulling Crew: Engage an experienced cable pulling crew to install medium voltage cables.
- H. Overhead Power Cable Crew: Engage an experienced Overhead Power Cable Installation crew to install overhead power conductors from pole to pole.
- I. Identification: Cables shall be new and of recent manufacturer (no more than 12 months old) and shall have label showing the name of cable manufacturer, size, insulation type, insulation thickness, voltage rating, insulation level, sequential footage year of manufacturer and UL designations.
- J. Schedule of inspection during work, by T-plant Electrical Design Authority (DA) and HMIS Hanford Electric Utility (EU) per their request. Items inspected may include the following:
  - 1. Transformer cable connections

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver medium-voltage cable on factory reels conforming to NEMA WC 26.

- B. Deliver overhead power conductors in a manner that minimizes damage to the conductors.
- C. Store cables on reels on elevated platforms in a dry location.
- D. Provide end-caps for all cable ends.

1.06 SOURCE QUALITY CONTROL

- A. Inspect cables before shipping. Testing of the cables will be done by Hanford Electric Utility (HMIS).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cables:
    - a. The Okonite Co.
    - b. BICC Cables/General Cable.Unishield series.
    - c. Kerite.
    - d. Southwire.
    - e. Or Approved Equal.
  - 2. Cable Splicing and Terminating Products and Accessories:
    - a. Elastimold.
    - b. 3M Company; Electrical Products Division.
    - c. Cooper Power Systems.
    - d. Or Approved Equal.
  - 3. ACSR Overhead Power Conductors :
    - a. Southwire
    - b. Houston Wire & Cable.
    - c. Or Approved Equal.
- B. Source Limitations:
  - 1. Cables: All cables in single run shall be from the same manufacturer.
  - 2. Terminations and Accessories: Each type of cable or overhead power cable termination/support or accessory product shall be of a single manufacturer.

2.02 CABLES

- A. Type: 15kV AXNJ UD Cable or approved equal
- B. Conductor: Copper single-conductor.
- C. Conductor Stranding: Compact Class B conductor stranding.

- D. Insulation: Ethylene-propylene rubber (EPR) conforming to AEIC CS8. Manufacturer to specify maximum percent by weight of ethylene in the elastomer. Insulation compound shall not contain any polyethylene EPR semi-conducting insulation screen
- E. Insulation: Ethylene propylene rubber (EPR) conforming to NEMA WC 74 (ICEA S-93-639-2012).
  - 1. Voltage Rating: 15 kV.
  - 2. Insulation Thickness: 133 percent insulation level with thickness per manufacturer's standard.
- F. Shielding: 5-mil uncoated copper tape, helically applied over semiconducting insulation shield with minimum 25% overlap.
- G. Cable Pulling Eyes: on 15 kV pulls greater than 250 linear feet. Factory installed, one per phase.
- H. End Seals: Factory sealed ends.
- I. Lengths: add a minimum of 5% to True Tape measurements when ordering cable.

#### 2.03 SOLID TERMINATIONS

- A. Conductor Terminations: Comply with IEEE 48, as indicated. Insulation class to be equivalent to that of the cable. Terminations for shielded cables shall include a shield grounding strap.
  - 1. Class 1 Termination for Shielded Cable: Heat-shrinkable type with heat-shrinkable inner stress control and outer nontracking tubes, multiple molded nontracking skirt modules, and compression-type connector.

#### 2.04 ARC-PROOFING MATERIALS

- A. Tape for First Course on Metal Objects: 10-mil thick, corrosion-protective, moisture-resistant PVC pipe-wrapping tape.
- B. Arc-Proofing Tape: NRTL-listed fireproofing tape, flexible, conformable, intumescent to 0.03 inch thick, and compatible with the cable jacket on which used. 3M Scotch No. 77, Plymouth 53 Plyarc, Or Approved Equal.
- C. Glass Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch wide.

#### 2.05 HEAT SHRINK PRODUCTS

- A. Furnish heat shrink insulation that meets all manufacturer-published material properties in accordance with applicable ANSI, ASTM and IEEE testing methods.
- B. Sealing End Caps: Raychem Type HVES-1520D, 3M ICEC, Or Approved Equal, sized for the cable furnished.
- C. Heat Shrink Insulation: Raychem HVIS sheet insulation, BPTM or BBIT tubing or HVBT tape, 3M products, Or Approved Equal, sized appropriately for the insulation of bus bars and attachments.
- D. Heat Shrink termination seals: Raychem HVBC kit 3M products, Or Approved Equal, sized for the termination.

#### 2.06 FIRE PROOFING PRODUCTS

- A. Furnish 3M fire proofing wrap E-5A-4 mat, Or Approved Equal.

#### 2.07 MEDIUM-VOLTAGE TAPES

- A. Linerless Rubber Splicing Tape. 3M Scotch 130C. Or Approved Equal. Size per application requirements.
- B. Silicone rubber-based, Scotch 70 self-fusing electrical tape Or Approved Equal .
- C. Insulating-putty, 3M Scotchfil electrical insulation putty Or Approved Equal .

#### 2.08 PHASE TAPE

- A. Premium grade, 7 mil, flame retardant, cold and weather resistant, ¾ inch minimum width. Meets requirements of UL 510. Recommended for use on PVC jacketed cable.

#### 2.09 Overhead Power Conductors

- A. Type/Size: Osprey 556 ACSR, as specified on the Drawings
- B. Number of Strands; (Aluminum/Steel) 18/1,
- C. Outside Diameters: 0.8790 Inches

#### 2.10 SOURCE QUALITY CONTROL

- A. Inspect cables according to ICEA S-93-639 before shipping.
- B. New Medium Voltage cables shall have documentation of Very Low Frequency (VLF) and Insulation Resistance testing performed at the factory. Documentation will be delivered to the T-Plant Construction point of contact for review and acceptance prior to shipment to the facility.
- C. Exposure of conductor to air can cause oxidation to form on the ACSR conductors. The conductor shall be brushed in the oxidized areas (as necessary) prior to installing hardware to ensure adequate metal-to-metal contact is maintained.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Medium-Voltage Cables - General
  1. Upon arrival at the facility, perform Insulation Resistance Testing on new medium voltage cable while cable is still on the reel.
  2. Verify protocols for shipping and handling of cables were performed. This includes end caps on cables, cable reels stored vertically, no sudden drops or laydowns of cable reels, or other careless handling that could result in damage to cable.
  3. Engage an experienced cable pulling crew to install medium voltage cable.
  4. Excavate conduit trench per details shown on the Drawing and per Section 31 23 23, "Excavation & Trenching.
  5. Install conduits per the Drawings.
  6. Install medium-voltage cable as indicated on the Drawings, according to manufacturer's written instructions.

7. Perform True-Tape measurement for all installation in concealed and underground conduit. Note distance to elbows and bends as perceived by pulling Resistance.
  8. Perform cable pull tension and side-wall calculations using true-tape measurement results from the Engineer of Record.
  9. Pull conductors simultaneously where more than one cable is indicated in same raceway. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
    - a. Where applicable, use NRTL-listed and manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
      - (1) Pre lubricate conduit using front-end packs or other means.
      - (2) Lubricate the cable throughout the pull using, as a minimum, the amount of lubricant recommended by the lubricant manufacturer.
      - (3) Where cable pull route passes through accessible enclosures, set up additional lubrication stations if necessary.
    - b. Use pulling means that will not damage cables such as fish tape, cable, rope, and basket-weave/cable grips. Pulling eyes attached to conductors are recommended as they have higher allowed pulling tension than basket-weave/cable grips.
    - c. Use pulleys, sheaves, low-stretch rope and pulling equipment intended for medium voltage cable installation. Ensure bend radius limit of cable is not exceeded.
    - d. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
    - e. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.
    - f. Routing cable up through manholes and then back in intermediate manholes (looping) in order to obtain slack shall not be permitted.
  10. Ground shields and metal bodies of shielded cable at terminations, and splices.
  11. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.
  12. Ensure Electrical inspection is performed prior to back fill.
  13. Backfill trench according to Section 31 23 23, "Fill"
  14. Ensure Meggering of all cables will be performed by Electric Utility (HMIS).
- B. Medium-Voltage Overhead ACSR Power Conductors - General
1. Coordinate and consult with Hanford Electric Utility (HMIS) prior to installation

2. Install overhead power conductors per manufacture's and HMIS guides for installation
3. Avoid Damaging the conductors during installation.

### 3.02 FIRE PROOFING (WHERE APPLICABLE)

1. Apply fireproofing tape to cables when installed in manholes and enclosures as applicable.
2. Smooth out irregularities, at splices or other locations, with insulation putty before applying fireproofing tape.
3. Apply fireproofing tape tightly around cables spirally in half-lapped wrapping or in butt jointed wrapping with second wrapping covering joints first.
4. Extend fireproofing 1 inch (25 mm) into conduit or duct.
5. Install tape with coated side toward cable.
6. Install random wrappings of plastic tape around fireproofing tape to prevent unraveling.
7. Install fireproofing to withstand a 200-ampere arc for 30 seconds.

### 3.03 GROUNDING

- A. Ground equipment in accordance with Section 26 05 26 – Grounding.
- B. Ground shields of shielded cable at terminations, and splices.

### 3.04 IDENTIFICATION

- A. Identify medium-voltage cables in accordance with Section 26 05 53 – Electrical Identification.
- B. Label cables, feeders, and power circuits in vaults, pull boxes, manholes, and at all terminations. Include operating voltage, circuit number and phase designation.
- C. Cable Tags
  1. Cable tags shall display a unique cable number for each phase of each section of cable.
  2. Cable tags shall be located at points of termination, and at least once in each accessible enclosure, i.e. manhole.
  3. Cable tags for each feeder shall be located adjacent to each other.
- D. Circuit Tags:
  1. Circuit tags shall display the feeder number, ex. "FDR C8-L3".
  2. Circuit tags shall be located at points of termination, on either side of each splice, at the entry/exit of each manhole, and at least once in other accessible enclosures.
- E. Phase Tape:

1. Apply phase tape to exposed medium-voltage cable at each penetration of each manhole.

### 3.05 CONDUCTOR COLOR CODING

- A. Comply with the phase color standard in Section 26 05 53 – Electrical Identification.

### 3.06 FIELD QUALITY CONTROL

- A. Coordinate installation and final testing with the DA. Notify the DA at least 48 hours in advance of testing.
- B. Perform the following tests and inspections:
  1. Perform each visual and mechanical inspections. Electrical tests shall be performed by Electric Utility (HMIS).
  2. After installing medium-voltage cables and before electrical circuitry has been energized, coordinate with EU to test and ensure for compliance with requirements.
  3. Perform visual and mechanical inspection at each end of cable and at any exposed transitional area.
  4. Perform VLF Withstand and VLF Tan-Delta test of each new conductor per EU request/instructions. Do not exceed cable manufacturer's recommended maximum test voltage.
  5. Shield Continuity Test on each power cable shall be performed by HMIS, if required.
  6. Neither end of the cable to be tested shall be connected to any equipment except as required for performing the test.
    - a. For cables having terminations with built-in surge protection devices or similar, the protective devices shall be removed during testing to prevent damage.
    - b. Placing a plastic bag over a cable termination during testing to reduce corona is a standard testing practice.
  7. Medium-voltage cables will be considered defective if they do not pass tests and inspections.
    - a. Correct deficiencies per HMIS directions and initiate a retest by HMIS to demonstrate compliance.
    - b. Submit test and inspection reports to Electrical Facility Design Authority.

### 3.07 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to Manufacturer and Installer, to prevent entrance of moisture into the cable and ensure that medium-voltage cable is without damage or deterioration at Substantial Completion.
  - 1. End Caps: If cables are not to be immediately terminated, inspect protective waterproof caps on cable ends, and replace if damaged. Water infiltration of cable will result in reject of cable.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in the Schedule of Unit Prices as specified by the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of “600 Volt or Less Wire and Cable” work is shown in the Contract Documents. This section includes requirements for insulated copper stranded conductors and associated connections for general power use at voltages below 600 volts, for sizes #14 AWG through 750 kcmil.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. ASTM B3 (American Society for Testing and Materials) – Standard Specification for Soft or Annealed copper Wire
- B. ASTM B8 (American Society for Testing and Materials) – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. NECA (National Electrical Contractors Association) - National Electrical Installation Standards
- D. ANSI/NEMA WC 70/ICEA S-95-658 – Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- E. NFPA 70 (National Fire Protection Association) – National Electrical Code
- F. NETA ATS-2021 (International Electrical Testing Association) – Standard for Acceptance Testing Specifications for Electrical Equipment
- G. UL 44 (Underwriters Laboratories) – Thermoset-Insulated Wires and Cables
- H. UL 854 (Underwriters Laboratories) – Service-Entrance Cables

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for each type of product.
- B. Submittals shall include the following:
  - 1. Product Data: For each type of product as specified on Drawings.
  - 2. Field Test Reports: Submit reports on tests required in Part 3.

### 1.04 QUALITY ASSURANCE

- A. All wire and cable shall be new and made of copper. No aluminum wire and cable allowed, unless otherwise noted.
- B. Listing and Labeling: Provide wire and cable that are listed and labeled as defined in NFPA 70, Article 100 and marked for specific types, sizes, and combinations of conductors and connected items.
- C. Comply with NFPA 70 during installations.

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cables and store in a location where not subject to damage.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allied Wire and Cable
  - 2. General Cable: Carol Brand.
  - 3. Southwire Company.
  - 4. Or Approved Equal

## 2.02 PRODUCTS

- A. Provide wire and cable with conductor material and insulation type as specified in Part 3.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2, Type THHN-2-THWN-2, Type XHHW-2.
- D. Flexible Metal Clad (Type MC) wiring shall not be used for general wiring purposes.

## 2.03 CONNECTORS AND SPLICES

- A. UL listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3.02 "Wire and Insulation Applications" Article.
- B. For #14 through #10 AWG wire sizes, provide insulated spring wire connectors or insulated compression connectors.
- C. For #8 AWG wire, use solderless pressure connectors with insulating sleeves.
- D. For #6 AWG and larger cable, use split bolt connectors with manufactured insulation covers or tape sufficient to provide 150% insulation level unless otherwise note on the Drawings. Provide insulating sleeves manufactured specifically for the connector being used.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine cables and wiring for compliance with requirements for installation tolerances and other conditions affecting performance of wire and cable. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 WIRE AND INSULATION APPLICATIONS

- A. Use XHHW/THWN stranded copper for all exterior locations unless shown otherwise on the Drawings.
- B. Service Entrance: Type SE or Type USE multiconductor cable.
- C. Grounding conductors: #6 AWG and larger shall be stranded copper, bare soft drawn #8 and smaller shall be stranded copper with green insulation.
- D. NO ALUMINUM WIRE ALLOWED.
- E. Provide lead-free jacketing and/or insulation where available.

3.03 INSTALLATION

- A. Remove existing wire from raceway before pulling in new wire and cable, where applicable.
- B. Install wire and cable as indicated and according to manufacturer's recommendations. Use NECA's "National Electrical Installation Standards" where applicable.
- C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary. Compound used must not deteriorate conductors or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. For parallel conductors of a single phase, ensure that conductor size, types, lengths are equal before installation.
- F. Provide separate raceways for 480V feeders/circuits and 240/120V feeders/circuits.
- G. Provide phase testing for proper rotation.
- H. All cables shall have their ends protected during installation.

3.04 CONNECTIONS

- A. Splices in raceways are not allowed. Splice only in junction boxes in accessible locations.
- B. 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 (per the National Electrical Code Handbook Article 110.14).
  - 1. For bolted connections in equipment, mark lugs after torquing with red paint such that paint will be visibly disturbed if lugs are disturbed. Use copper lugs only on main circuit breakers and feeder breakers. No CU/AL lugs allowed.
- C. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.05 COLOR CODING AND PHASING

- A. Provide colored insulation for wires #4 AWG or smaller.
- B. Color code conductors for all feeders as indicated in subparagraphs below. Provide a 2" wide minimum band of colored plastic tape, at terminations when colored insulation is not available. Tape shall be UL listed, and flame retardant, UV resistant, all weather vinyl plastic tape manufactured specifically for the purpose of electrical conductor identification.
  - 1. 480V olt, 3-phase, 3-wire systems (B-Phase Corner Grounded Δ):

Phase A (left or top)	Brown
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Phase B (Grounded)	White
Phase C (right or bottom)	Yellow
Ground	Green

2. 240/120-Volt, 1-phase, 3-wire systems:

Phase A (left or top)	Black
Phase B ((right or bottom)	Red
Neutral	White
Ground	Green

3.06 IDENTIFICATION

- A. Identify wires and cables according to Section 26 05 53 - Electrical Identification.
- B. Provide wire markers on each conductor in pull boxes, junction boxes and at all load connections.

3.07 FIELD QUALITY CONTROL

- A. Wire and Cable Tests: Test feeder and control circuits before they are placed in service.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS-2021. Certify compliance with test parameters.
  - 2. 600-Volt Power Cable: Perform a continuity test for all cables. Megger testing for one half minute is required for all 600-volt insulated wire #2 AWG and larger using a 500-volt megger for 240-volt systems, and a 1000-volt megger for 480-volt systems. Test between phase conductors and from each conductor to ground before energizing service equipment, switchboards, and panelboards. Determine the values with cable disconnected at both ends. Megger wire and cable only after installation, not on the cable reel. Replace cables that do not meet insulation resistance requirements.
    - a. Provide phasing tests:
      - (1) Test and make all changes necessary to assure proper phase rotation of all motor loads.
      - (2) Correct phasing and phase sequence of all circuits.
    - b. Using a volt/ohm meter, test all power conductors below #2 AWG for possible continuity to ground.
  - 3. Correct deficiencies and retest to demonstrate compliance.

4. Record test information for all cables tested, and provide Engineer with a copy.

**PART 4 MEASUREMENT AND PAYMENT**

**4.01 GENERAL**

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in the Schedule of Unit Prices as specified by the Contract.

End of Section
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## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of "Grounding and Bonding of Electrical Equipment" work is shown in the Contract Documents which includes drawings and specifications. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this section may be supplemented by special requirements of systems described in other Sections as applicable.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. ASTM B8 (American Society for Testing and Materials) - Standard Specification for Concentric-Lay-Stranded Copper conductors, Hard, Medium-Hard, or Soft.
- B. NFPA 70 (National Fire Protection Association) - National Electrical Code (NEC).
- C. ANSI/UL 467 (Underwriter's Laboratory) - Grounding and Bonding Equipment.
- D. IEEE Standard 142 Grounding of Industrial and Commercial Power Systems
- E. IEEE C2 National Electrical Safety Code (NESC)

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry. Furnish manufacturers' technical literature, standard details, product specifications, calibration reports, and installation instructions for all products.
- B. Submittals shall include the following:
  - 1. Submit product data for the following:
    - a. Grounding conductors and cables.
    - b. Grounding connectors.
    - c. Grounding electrodes.
    - d. Ground bus.
    - e. Ground Lugs
    - f. Exothermic weld kit.
  - 2. Identify locations where Contractor will bond the new grounding system to to structural steel/grounding point of the existing facility.
  - 3. Field Test Reports: Submit written test reports to include the following:
    - a. Test procedures used.
    - b. Test results that comply with requirements.
    - c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

### 1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide electrical components, devices, and accessories that are Listed and Labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authority Having Jurisdiction, and marked for specific types, sizes, and combinations of conductors and connected items.

- B. Comply with IEEE Std. 142 (Green Book).
- C. Comply with NFPA 70.
- D. Comply with IEEE C2 for overhead-line construction and medium-voltage underground construction.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grounding Conductor Fittings:
    - a. Erico Inc.
    - b. Burndy Electrical; Division of Hubbell.
    - c. ILSCO.
    - d. Lyncole XIT Grounding; Division of VFC.
    - e. O-Z/Gedney Co.
    - f. Thomas & Betts, Electrical; Division of ABB.
    - g. Or Approved Equal.
  - 2. Grounding Connectors and Rods:
    - a. Harger.
    - b. Galvan.
    - c. Erico.
    - d. Or Approved Equal.
  - 3. Acceptable Manufacturers Ground Bars
    - a. Harger GBI series.
    - b. Erico EGBA series.
    - c. Or Approved Equal.

### 2.02 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Section 26 05 19 - 600 Volt or Less Wire and Cable.
- B. Material: Stranded Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation in sizes available.
- D. Grounding Electrode Conductors: Bare, stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- F. Bare Copper Conductors: Assembly of stranded conductors, ASTM B8.
- G. Copper Bonding Conductors:

1. Bonding Conductor: #4 or #6 AWG, stranded copper conductor, unless sized per drawings or larger conductor needed per NFPA 70 Article 250.
2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

H. Bonding Straps: Soft copper.

### 2.03 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. Pressure Connectors: High-conductivity-plated units.
- C. Bolted Connectors: Heavy-duty, copper, bolted-pressure type only.
- D. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

### 2.04 GROUNDING ELECTRODES

- A. Ground Rods: Solid copper clad steel, 5/8-inch diameter by 8-foot length minimum.
- B. Plate Electrodes: Copper/Iron/Steel Plate, 2 ft<sup>2</sup> in surface and 1/4" thick minimum.

## PART 3 EXECUTION

### 3.01 APPLICATION

- A. Use Copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps at Manholes: Use bolted pressure clamps with at least two bolts.
- F. Underground Grounding Conductors: Install bare stranded copper conductor, size as indicated on drawings.
  1. Copper conductor, #2/0 AWG minimum unless shown otherwise on the drawings. Bury at least 24 inches below grade.
  2. Ground ring conductors are to be buried at least 2-1/2 feet (30 inches) below grade unless otherwise noted on the drawings.

### 3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes conductors than required by NFPA 70 are indicated on the Drawings.
- B. Install equipment grounding conductors in raceways with all feeders and branch circuits unless otherwise noted.

- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways.

### 3.03 BUILDING PERIMETER GROUND

- A. Metal fences around electrical equipment shall be bonded to the ground system compliant with NEC.

### 3.04 SEPERATELY DERIVED SYSTEM

- A. Connect ground bus of first disconnecting means for separately derived systems (e.g. dry type transformers) to the main grounding electrode; use grounding conductor sized as shown on the Drawings or as required by the NEC.
- B. At the first system overcurrent device or disconnecting means, connect the neutral bus to the ground bus using a bonding jumper sized as required by the NEC. Do not use a bonding screw for this purpose. Make no other neutral-to-ground connections on the load side of the separately derived system disconnect.

### 3.05 INSTALLATION

- A. Ground Rods: Install at least two rods spaced at least 6 feet from each other unless otherwise shown on the drawings and connect to the existing grounding electrode system nearby.
  - 1. Drive ground rods until tops are 2 inches below finished floor or final grade.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Size per NFPA 70, Article 250, if not shown on the drawings specifically, and route along shortest and straightest paths possible. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment.
  - 1. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp.
  - 2. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe (if applicable): Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building.
  - 1. Connect grounding conductors to main metal water service pipes by grounding clamp connectors.
  - 2. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting.
  - 3. Bond metal grounding conductor conduit or sleeve to conductor at each end.

- E. Metallic Fence and Railing: Comply with the requirements of IEEE C2, current edition.
  - 1. Grounding conductor shall be bare copper not less than 6 AWG.

### 3.06 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For #8 AWG and larger, use pressure-type grounding lugs. #10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Non-contact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Provide flexible grounding strap mounted to raceway exterior where raceway crosses a seismic joint.
  - 1. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing.
  - 2. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.07 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Vaults, Pull boxes, Manholes and Handholes: Install 4 driven ground rods at corners of manhole. Set rod depth so 4 inches will extend above finished floor. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout. Provide continuous #4/0 AWG bare copper ground loop conductor, unless shown otherwise on the drawings) all around manhole and attached to all ground rods. Locate at plus 6 inches above manhole floor.
- B. Connections to Manhole Components: Connect all exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole to ground loop conductors.
  - 1. Make connections with #2 AWG minimum, stranded, hard-drawn copper conductor.
  - 2. Make connection to cable shield as recommended by manufacturer of splicing and termination kits.
- C. Pad-Mounted Transformers and Switches: Install four ground rods and counterpoise circling pad unless shown otherwise on the drawings. Ground pad-mounted equipment and noncurrent-carrying metal items by connecting them to underground cable and grounding electrodes. Install copper conductor not less than #2 AWG for taps to equipment ground pad unless shown otherwise on the drawings.

### 3.08 IDENTIFICATION

- A. Identify grounding system components as required by the Authority Having Jurisdiction and as specified in Section 26 05 53 - Electrical Identification.

### 3.09 FIELD QUALITY CONTROL

- A. Notify the facility's electrical Design Authority of all ground system checks. The facility's Design Authority to witness all or some ground measurements at their discretion.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform ground resistance testing in accordance with IEEE 142.
- D. Perform continuity testing in accordance with IEEE 142.
- E. Where improper grounding is found, correct, and perform retest.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of “Hangers and Supports for the Electrical Systems” work is shown in the Contract Drawings. This section includes components associated with this support system.
  - 1. The section includes the following:
    - a. Conduit supports.
    - b. Formed steel channel.
    - c. Spring steel clips.
    - d. Sleeves.
    - e. Mechanical sleeve seals.
    - f. Equipment bases and supports.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- C. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- E. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- F. UL 263 - Fire Tests of Building Construction and Materials.
- G. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- H. UL 1479 - Fire Tests of Through-Penetration Firestops.
- I. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- J. MFMA 4 - Metal Framing Standard
- K. MFMA - 103 - Guidelines for the Use of Metal framing
- L. NFPA 70 (National Fire Protection Association) - National Electrical Code (NEC)

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.
- B. Submittals shall include the following:
  - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Hangers and Supports: Submit special procedures and assembly of components.
3. Indicate load carrying capacity of hangers and supports.
4. Qualification data for installers and inspectors specified in "Quality Assurance" for anchors. (Refer to Section 03 30 00)

1.04 QUALITY ASSURANCE

- A. Furnish and install hangers and supports that conform to the requirements of the following codes and standards:

1. NFPA 70, National Electric Code (NEC)

1.05 COORDINATION

- A. Raceway and Enclosure boxes are shown on Drawings in approximate locations. Locate hangers and conduit supports at spaces meeting the NFPA 70 requirements. Do not interfere and or obstruct access to existing piping and equipment, and any other existing system.

PART 2 PRODUCTS

2.01 CONDUIT SUPPORTS:

- A. MANUFACTURES: As specified on the Drawings. Otherwise,
- (1) Unistrut; Atkore International.
  - (2) or approved equal.

2.02 RACEWAY SUPPORTING DEVICES

- A. Furnish supports as shown on Drawings for the installation of raceway systems with parts identified on the Drawings or otherwise note in this specification.
- B. Use pressed steel, single bolt hangers to support individual RMC, or EMT raceways from threaded rods or beam clamps. Manufacturer: Steel City "6H\_ B Series," or equivalent unless otherwise noted on the Drawings.
- C. Use malleable iron conduit clamps to secure individual RMC, or EMT raceway runs across, parallel, or perpendicular to beams, channels and angle supports. Manufacturer: Steel City "RC, EC, and PC Series," or equivalent unless otherwise noted on the Drawings.
- D. Use two-piece carbon steel riser clamps for individual vertical raceways passing through floors. Manufacturer: Kindorf, or equivalent.
- E. Use Zinc plated steel snap-on type, one-hole steel straps to secure individual raceways up to trade size 2 to flat surfaces suitable for outdoor.

1. Manufacturer: T&B “HS 100 Series” for RMC, and “TS 100 Series” for EMT, or approved equivalent.

#### 2.03 FORMED STEEL CHANNEL

- A. Manufacturers: As specified on the Drawings. Otherwise,
  - (1) B-line; Eaton, Electrical Sector.
  - (2) Unistrut; Atkore International.
  - (3) or approved equal

#### 2.04 SPRING STEEL CLIPS

- A. Manufacturers: As specified on the Drawings. Otherwise,
  - (1) B-line; Eaton, Electrical Sector.
  - (2) or approved equal

#### 2.05 FASTENERS

- A. Pre-set Concrete Inserts
  - (1) Furnish pre-set concrete inserts as shown on the Drawings.
  - (2) Manufacturers: As specified on the Drawings. Otherwise,
    - (a) Continuous inserts for wood forms: B-Line “B22I-12” or longer.
    - (b) Spot inserts for wood forms or metal decks: B-Line “B2500” with “N2500” nut, “B2501”
- B. Post-installed Concrete Anchors
  - (1) Furnish post-installed expansion, adhesive, or undercut concrete and masonry anchors as shown on the Drawings. Power-actuated threaded studs: Use zinc-plated carbon steel or stainless steel suitable for the intended service:
    - (a) 1/4-20 threaded stud: Manufacturer: Hilti X-W6
    - (b) 3/8-16 threaded stud: Manufacturer: Hilti W10

#### 2.06 BEAM CLAMP

- A. Furnish beam clamps that are NRTL-listed and compliant with Federal Specification WW-H-171E Type 23 or Manufacturers’ Standardization Society SP-69 and SP-58 Type 23.

- B. Provide beam clamps with a locknut on the setscrew.
- C. Provide NRTL-listed restraining strap for each beam clamp. Strap shall be not less than 16-gauge thickness, not less than 1 inch wide, and of sufficient length to wrap around the beam flange not less than 1 inch.

## 2.07 FRAMING CHANNEL SYSTEMS

- A. Furnish U-channel framing systems that conform to MFMA-4 and are fabricated using minimum 12-gage steel.
- B. Furnish fittings and accessories that mate and match with U-channel and are of the same manufacturer. Use two-piece, single bolt type conduit straps on U-channel supports. In existing buildings, where items from the same manufacturer are not available, fittings and accessories that mate and match are acceptable.
- C. Manufacturers: Unistrut, B-Line, Superstrut unless otherwise noted on the Drawings.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine surfaces to receive hangers and supports for compliance with installation tolerances and other conditions affecting performance of hanger and support installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 GENERAL

- A. Install hangers and supports according to the NEC, IBC, NECA 1, the requirements in this Section, and specific supporting requirements in other Sections.
- B. Conform to manufacturer's instructions and recommendations for selection and installation of hangers and supports.
- C. Do not use wire or perforated strap for permanent supports.
- D. Do not support conduits, boxes, or raceways from ceiling suspension structures.

### 3.03 INSTALLATION (HANGERS AND SUPPORTS)

- A. Anchors and Fasteners:
  - 1. Concrete Structural Elements: Provide expansion anchors.
  - 2. Steel Structural Elements: Provide spring steel clips.
  - 3. Concrete Surfaces: Provide expansion anchors.
  - 4. Solid Masonry Walls: Provide expansion anchors.
  - 5. Sheet Metal: Provide sheet metal screws.
- B. Inserts

1. Install inserts for placement in concrete forms.
  - C. Install conduit and raceway support and spacing in accordance with NEC.
  - D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
  - E. Install multiple conduit runs on common hangers.
  - F. Supports:
    1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
    2. Install surface mounted Enclosures and panelboards with minimum of four anchors.
    3. In wet and damp locations install steel channel supports to stand Enclosures and panelboards 1 inch off wall.
- 3.04 INSTALLATIONS (EQUIPMENT BASES AND SUPPORTS)
- A. Provide housekeeping pads of concrete as directed by the Drawings. Refer to Section 03 30 00.
  - B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
  - C. Construct supports of steel members and formed steel channel. Brace and fasten with flanges bolted to structure.
- 3.05 RACEWAY SUPPORTS
- A. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
  - B. Support individual horizontal raceways by separate conduit hangers.
- 3.06 BOXES AND ENCLOSURES
- A. Support sheet metal boxes directly from the building structure, or by approved brackets or bar hangers, as shown on the Drawings or as required. Where bar hangers are used, attach the bar to structure on opposite sides of the box.
  - B. Install surface-mounted Enclosures and panelboards as shown on the Drawings or as required.
- 3.07 FRAMING CHANNEL SYSTEMS
- A. Select and install framing channel systems in accordance with MFMA-103.
  - B. Use framing channel to support electrical equipment that is mounted free of walls.
  - C. Use framing channel to support equipment mounted on walls that do not have sufficient strength to resist pull-out or wallowing out of equipment mounting bolts.

#### PART 4 MEASUREMENT AND PAYMENT

##### 4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified in the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of "Raceways and Boxes" work is shown in the Contract Drawings. This section includes raceways, fittings, and boxes for electrical wiring.
  - 1. Raceways include the following:
    - a. Rigid Metal Conduit (RMC).
    - b. Electrical Metallic Tubing (EMT).
    - c. Liquidtight Flexible Metal Conduit (LFMC)
    - d. Rigid Nonmetallic Conduit (RNC).
    - e. Metal Wireway.
  - 2. Boxes include the following:
    - a. Pull and junction boxes.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated
- C. NECA (National Electrical Contractors Association) - National Electrical Installation Standards
- D. NEMA FB 1 (National Electrical Manufacturers Association) - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing (EMT) and Cable.
- E. NEMA TC 2 (Electrical Polyvinyl Chloride (PVC) Conduit)
- F. NEMA TC 3 (National Electrical Manufacturers Association) - PVC Fittings for Use with Rigid PVC Conduit and Tubing
- G. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum)
- H. NFPA 70 (National Fire Protection Association) - National Electrical Code

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.
- B. Submittals shall include the following:
  - 1. Product Data: For surface raceways, conduit, wireways, and hinged-cover/screw-cover enclosures.
  - 2. Conduit and enclosure fittings.
  - 3. Termination blocks and cable splice kits

### 1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways, termination blocks, and boxes that are Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authority Having Jurisdiction, and marked for intended use for the location and environment in which they are installed.
- B. Comply with NECA's "National Electrical Installation Standards."
- C. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

#### 1.05 COORDINATION

- A. Raceway and boxes are shown on drawings in approximate locations. Field locate raceways and boxes as shown on Drawings and at other locations where required for splices, taps, wire pulling, and equipment connections while complying with NFPA 70 requirements. Ensure raceways and boxes have adequate working clearance, and are accessible.
- B. Galvanized electrical equipment installed and exposed outdoors shall be painted with a minimum 3 mil coating of paint to prevent rust unless already painted by the manufacturer. Paint application by manufacturer is preferred to field painting for coverage and quality.

### PART 2 PRODUCTS

#### 2.01 METAL CONDUIT AND TUBING SUITABLE FOR USE IN OUTDOORS

- A. Rigid Steel Conduit (RMC): ANSI C80.1.
- B. Electrical Metallic Tubing (EMT): ANSI C80.3.
- C. Intermediate Metallic Conduit (IMC) is not allowed.
- D. Liquidtight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket.
- E. Fittings: NEMA FB 1; compatible with conduit/tubing materials.
  - 1. Fittings for EMT: Water tight Compression type. Setscrew type is not allowed.

#### 2.02 NONMETALLIC CONDUIT AND TUBING

- A. Rigid Nonmetallic Conduit (RNC/PVC), Schedule 40 or 80 PVC.
- B. RNC Fittings: NEMA TC 3; Match to conduit or conduit/tubing type and material.

#### 2.03 METAL WIREWAYS

- A. Material: Sheet metal size and shape as indicated on drawings. Comply with UL 870 and NEMA 250, Type 3R unless otherwise indicated.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70 (NEC), as applicable.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.
- C. Select features, where not indicated, as required to complete wiring system and to comply with NFPA 70 (NEC).
- D. Wireway Covers: Hinged type.

- E. Finish: Manufacturer's standard enamel finish, ANSI 61 gray color.
- 2.04 PULL AND JUNCTION BOXES SUITABLE FOR OUTDOOR
- A. Furnish the exact Pull Boxes and Junction boxes if specifically, specified on the project drawings. Otherwise, they shall meet requirements in section 2.04 (B-D).
  - B. Small Sheet Metal Boxes: NEMA 3R, galvanized steel.
  - C. Cast-Metal Boxes: NEMA 3R, cast aluminum with gasketed cover, ground flange and stainless steel cover screws.
  - D. Sheet Steel Gauge Requirements (Any Direction):
    - 1. Less than 24": 14 USS gauge.
    - 2. 24" to 36": 12 USS gauge.
    - 3. 36" or larger: 10 USS gauge.
- 2.05 ENCLOSURES
- A. Hinged 110° Swing Opening Cover Enclosures:
    - 1. Comply with UL 50. Suitable for outdoor applications, NEMA 3R, 4 or 4X as indicated in contract documents.
  - B. Panelboard Enclosures: Panelboard enclosure criteria are addressed separately. Refer to Criteria Section 26 24 16 - Panelboards.
  - C. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- 2.06 TERMINAL BLOCKS
- A. Size/Type: As specified on the Drawings.
  - B. Minimum 600-volt rating for 480-volt circuits and minimum 240V for 240V or less circuits.
  - C. Clamp or screw terminals sized for maximum conductor size or as specified on the Drawings
  - D. Separate connection point for each conductor
  - E. Individual identification for each terminal block
- 2.07 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING
- A. Description:
    - 1. General Requirements for Handholes and Boxes:
      - a. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70 (NEC), for intended location and application.
      - b. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70 (NEC), by a qualified testing agency, and marked for intended location and application.
    - 2. Fiberglass Handholes and Boxes: Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of reinforced concrete or cast iron.

- a. Standard: Comply with SCTE 77.
  - b. Color of Frame and Cover: Gray.
  - c. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
  - d. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - e. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - f. Cover Legend: Molded lettering, "ELECTRIC."
  - g. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure installation.
3. Manufacturers:
- a. Armorcast Products Company.
  - b. Carson Industries LLC.
  - c. NewBasis.
  - d. Hoffman
  - e. Nordic Fiberglass, Inc.
  - f. Oldcastle Precast, Inc.; Christy Concrete Products.
  - g. Quazite: Hubbell Power System, Inc.; Hubbell Power Systems.
  - h. Or Approved Equal.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine surfaces to receive raceways and boxes for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.02 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway to facilitate new installations to the extent practical and as applicable. Cut raceway flush with walls and floors and patch surfaces.
- B. Ensure access to existing boxes and other installations which remain active and which require access.
- C. Extend existing raceway and box installations using same type materials and methods as specified.
- D. Clean and repair existing raceway and boxes which remain or are to be reused/reinstalled.

#### 3.03 WIRING METHODS

- A. Outdoors: Use the following wiring methods:

1. Exposed: Electrical Metal Tubing conduit (EMT) or Rigid Metal Conduit (RMC).
2. Concealed: PVC Schedule 40 is the standard for use in rebar reinforced duct banks if applicable.
3. Boxes: Type shall be as specified on the Drawings. NEMA 3R in non-corrosive, non-dusty outdoor locations, NEMA 4 or 4X in exterior dusty or dirty locations to the extent practical.

### 3.04 INSTALLATION

- A. Install raceways and boxes as indicated, according to manufacturer's written instructions. Use raceway fittings compatible with raceways and suitable for use and location.
- B. Seal all conduits which pass through the building walls, roof, and through outside walls of the building above or below grade.
- C. Clip type conduit fasteners are not allowed. All fasteners and clamps for conduit and raceway support shall be bolted mechanical hardware type.
- D. Raceways:
  1. Minimum Raceway Size:
    - a. Use conduit sizes as shown on the Drawings.
  2. Cut conduit square using a saw or pipe cutter and ream to remove burrs.
  3. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size.
  4. Conduits shall not be supported from ducts, pipes or other systems foreign to the electrical installation. The entire electrical installation shall be kept independent from any other trade.
  5. Provide separate conduits for 480V, and 240/120V systems.
  6. Planning: the layout of all raceways shall be carefully planned by the Contractor to ensure an installation which is neatly done and workmanlike. Any work showing improper care in planning will be ordered removed by the facility's Design Authority, and shall be replaced in a neat and proper manner, without any additional cost to the owner. Any problems with the design shown on the drawings and proposed solutions shall be submitted in writing and shall be approved by the facility's Design Authority before implementation.
  7. Install raceways parallel and perpendicular to structure and at proper elevations. Group multiple conduit runs and neatly rack and support from the structure and specifically per the Drawings, if shown.
    - a. Maintain 6-inches minimum clearance between raceways and mechanical piping and 12-inches minimum to heat sources such as heating appliances. Install horizontal raceway runs above water piping.
    - b. Give right of way to raceways and piping systems installed at a required slope.

- c. Keep electrical conduits free from contact with other dissimilar metals.
  - d. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
8. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment.
  - a. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
  - b. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor.
  - c. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor as applicable.
  - d. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
9. Sleeves: Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install sleeves during erection of concrete and masonry walls.
10. Avoid moisture traps. Provide junction box with drain fitting at low points in conduit system.
11. Install listed expansion-deflection fitting or other approved means shall be used where a raceway crosses a structural joint for expansion, contraction or deflection.
12. Install expansion joints where direct-buried conduit is subject to Earth Movement by settlement or frost per NEC 300.5(J), especially where conduit exits the ground exposed and enters a box, cabinet, or enclosure attached to a building or structure.
13. Conduits in Concrete Slab Above Grade are to be installed as shown on the contract drawings.
14. Provide 1/8-inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
15. Provide bushings for the ends of all conduit not terminated in box walls. Refer to NFPA 70.
16. Provide insulated bushings where raceways contain 4 AWG or larger conductors. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
17. All conduit installed underground (exterior to building) shall be buried a minimum of 24 inches below finished grade, or as indicated on the contract documents, whether or not, the conduit is concrete encased. Install warning tape 12" below finish grade over all buried conduits. Underground warning tape shall be detectable, 2" wide minimum, 5 mil thickness,

containing a foil core. Tape color shall be red and labeled with the words "CAUTION-BURIED ELECTRIC LINE BELOW" as manufactured by Presco or similar.

18. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    - a. Where conduits pass from warm to cold locations, such as inside/outside boundaries.
    - b. Where otherwise required by NFPA 70 (NEC).
  19. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box.
    - a. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
  20. Use temporary closures to prevent foreign matter from entering raceways.
  21. Complete raceway installation before starting conductor installation.
- E. Pull, Splice, and Junction Box Installation:
1. Provide as required to facilitate installation of the work or as required by NFPA 70 (NEC).
  2. Locate so that covers are accessible at all times.
  3. Support boxes independently of raceway. Fasten junction and pull boxes to or support from building structure.
  4. No junction, splice box or pull boxes shall be located where it will be obstructed by other equipment, piping, etc.

### 3.05 GROUNDING/BONDING

- A. Provide grounding connections for raceway, boxes, and components as specified in Section 26 05 26 - Grounding and as required by NFPA 70 (NEC).

### 3.06 SUPPORT

- A. Support raceways as required by NFPA 70 and Section 26 05 29.

### 3.07 IDENTIFICATION

- A. Provide labels for raceway, boxes, and components as specified in Section 26 05 53 - Electrical Identification.
- B. Raceways for medium-voltage circuits:

1. Apply self-adhesive labels on raceways leaving equipment and at 25-foot intervals indicating system voltage. Use 1-1/4" minimum black letters on yellow background.
  2. Label raceways entering concealed locations from exposed locations as to the destination via the concealed area.
  3. Apply self-adhesive labels on exterior door or cover of enclosures indicating system voltage. Use 1-1/4" minimum black letters on orange background.
- C. Raceways for low-voltage circuits:
1. System Identification Color-Coding Bands for Raceways: 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 (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
  2. 240/120V Blue
  3. 480V Yellow
  4. Provide labels on all junction and pull boxes indicating feeder circuit designation and circuit number for all cables in a box.
  5. Conduit labeling is not required.
  6. Provide labels on all junction and pullboxes.
  7. Label power junction and pull boxes with power source and circuit numbers.
  8. Label raceways entering concealed locations from exposed locations as to the destination via the concealed area.

### 3.08 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure coatings and finishes are without damage or deterioration at the time of project completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.09 CLEANING

- A. Upon completion of installation, inspect exposed finished work. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

## PART 4 MEASUREMENT AND PAYMENT

### 4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to and

included in the payments made for the applicable bid items in Schedule of Unit Prices as specified in the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent of “Electrical Identification” work is shown in the Contract Drawings. This section includes requirements for identification of electrical components.
  - 1. This section include the following:
    - a. Component identification tags.
    - b. Equipment nameplates.
    - c. Wire markers.
    - d. Voltage markers.
    - e. Warning signs.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. Conform to requirements of the National Electrical Code (NEC) and OSHA.

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 - Submittals and Statement of Work submittal registry. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.
- B. Catalog Data: Submit manufacturer’s catalog literature for each product required.
- C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

### 1.04 QUALITY ASSURANCE

- A. Coordinate with the facility’s quality assurance staff for performing QC inspection of the equipment labeling in the field.

## PART 2 PRODUCTS

### 2.01 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. If specific product specified, alternate products may be accepted with prior approval.

### 2.02 COMPONENT IDENTIFICATION TAGS

- A. Furnish component identification tags as specified below and scheduled on the Drawings to identify electrical equipment using the system designation, equipment identification, and building number.
- B. Coordinate electrical component identification tag schedule with final equipment identification scheme for project.
- C. Provide component identification tags with black letters on white background with 2 in. by 3 in. dimensions or larger as applicable.
- D. Provide minimum 48 point size lettering.
- E. Provide tags made of one of the following materials:

1. Two-ply plastic nameplate with letters engraved through white surface showing black core.
2. Provide UV stabilized material for outdoor applications. Outdoor conditions are as follows:
  - a. Temperature: -15.0 Deg. F to 115 Deg. F
  - b. Humidity: 100%
  - c. Wind: 115 MPH.
  - d. Elevation: 735'
3. Manufacturer: Seton Nameplate Corp.

#### 2.03 EQUIPMENT NAMEPLATES

- A. Furnish equipment nameplates as specified and scheduled on the Drawings to indicate the following information:
  1. Nameplates: circuit directory information including circuit number, equipment identification, and location of equipment serving the item, plus the voltage, number of phases, and number of wires.
  2. Clear identification of the corner grounded  $\Delta$  connections on the applicable equipment and clear identification of phase B, being the grounded phase.
- B. Provide nameplates made of one of the following materials listed in 2.02 (E).
- C. Furnish equipment nameplates as specified and scheduled on the Drawings.

#### 2.04 WIRE MARKERS

- A. Description: PVC plastic extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections using plastic fasteners.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints,
- C. Locate a wire marker on each conductor at switchboard, panelboards, pull boxes, and junction boxes, and each load connection.
- D. Provide typewritten lettering on wire markers as follows:
  1. Power circuits: feeder circuit number.

#### 2.05 VOLTAGE MARKERS

- A. Furnish voltage markers for transformers, switchboard, panelboards, safety switches, pull boxes, and conduits.
- B. Provide flexible pressure sensitive vinyl markers with minimum 1-1/8 inch X 4-1/4 inch on white background and black letters.
- C. Provide voltage markers with lettering indicating the highest voltage present as follows:
  1. 208Y/120 volt system: 208 VOLTS
  2. 120/240 and 240 volt system: 240 VOLTS

3. 480 Volt system: 480 VOLTS
  4. 13.2 kV systems: 13200 VOLTS
- D. Manufacturer: Electromark, LEM Products, Inc. or approved equal.

#### 2.06 WARNING SIGNS

- A. Furnish warning signs for low-voltage and medium-voltage transformers, switchboards, panelboards, safety switches, and pull boxes.
- B. Use warning signs that conform to ANSI Z535.4 and OSHA Danger and Caution specifications.
- C. Provide minimum 2 inches X 4 inches warning signs.
- D. Materials: UV resistance and weatherproof.
- E. Manufacturer: Seton Name Plate Co., Safety Label Solutions, Hazard Communication Systems, Electromark or approved equal.

#### 2.07 ARC FLASH WARNING LABELS

- A. None. This will be provided by the facility's Engineering department upon completion of the project.

#### 2.08 UNDERGROUND WARNING TAPE

- A. Furnish underground warning tape for underground cables, conduits and duct banks.
- B. Use 6 inch wide, 0.004 inch thick, polyethylene underground warning tape black lettering and the following background colors:
  1. Electric: Red color
- C. Provide lettering that indicates the type service buried below.
- D. Manufacturer: Utility Safeguard, LLC.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine surfaces to receive identification products for compliance with installation tolerances and other conditions affecting performance of the identification products. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION - GENERAL

- A. Install electrical identification products after completion of painting.
- B. Install electrical identification products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.
- C. Clean surface where electrical identification product is to be placed.

- D. Use manufacturer's recommended adhesive for engraved tags and nameplates.
- E. Place electrical identification products centered and parallel to equipment lines.

### 3.03 COMPONENT IDENTIFICATION TAGS

- A. Install component identification tag on the front of each piece of electrical equipment including switchboards, transformers, panelboards, and safety switches.
- B. Position tags so they can be read from floor.

### 3.04 EQUIPMENT NAMEPLATES

- A. Install equipment nameplate or nameplates [as indicated on the Drawings on the front of each piece of electrical equipment including transformers, switchboards, panelboards, and safety switches.
- B. Position nameplates so they can be read from floor.

### 3.05 WIRE MARKERS

- A. Install wire markers on powerconductors at each entry in locations such as pull boxes, junction boxes, panelboards, switchboards safety switches, and load connections.
- B. Position markers so they can be read from the front of the enclosure.

### 3.06 VOLTAGE MARKERS

- A. Install voltage markers at the following locations and position markers so they can be read from floor:
  - 1. Front of each low-voltage transformer, panelboard, safety switch, and switchboards..
  - 2. Cover of each pull box containing low-voltage or medium-voltage conductors.

### 3.07 WARNING SIGNS

- A. Install warning signs at the following locations and position signs so they can be read from floor:
  - 1. Front of each low-voltage transformer, panelboard, safety switch, and switchboards.
  - 2. Cover of each pull box containing exposed low or medium-voltage conductors.

## PART 4 MEASUREMENT AND PAYMENT

### 4.01 GENERAL

- A. No separate measurement or payment will be made for the Work required by this section. The cost for this portion of the Work will be considered incidental to, and

included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of “Testing and Commissioning” work is shown in the Contract Documents which includes drawings and specifications. This section includes testing and commissioning requirements of the newly installed electrical system and all associated equipment. Testing and commissioning requirements specified in this section may be supplemented by special requirements of systems described in other Sections as applicable.
  - 1. The testing and commissioning of the newly installed electrical system as shown on the Project Drawings on the low voltage (600V or below) is the responsibility of the Contractor or its designated Subcontractor.
  - 2. The testing and commissioning of the newly installed electrical system as shown on the Project Drawings on the Medium Voltage (601V or more) will primarily be the responsibility of the Hanford Electrical Utility (HMIS). The Contractor may assist the EU testing team during this commissioning process at HMIS’s discretion and direction.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. International Electrical Testing Association - NETA ATS-2021, Standard for Acceptance Testing Specifications for Electrical Systems (ANSI).
- B. NFPA 70 (National Fire Protection Association) - National Electrical Code (NEC).
- C. NFPA 70E (National Fire Protection Association) – Standard for Electrical Safety in WorkPlace
- D. DOE 0359 Hanford Electrical Safety Program

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 - Submittals and the Statement of Work submittal registry. Furnish the following as part of testing and commissioning plan for the project.
- B. Submittals shall be submitted as required by the SOW submittal registry and include the following:
  - 1. Certifications: Qualifications of the Testing Personnel.
  - 2. Certifications: Instrument calibration program.
  - 3. Certifications: Submit name and qualifications of the lead engineer or engineering technician performing the required testing services.
  - 4. Electrical Safety Program of the electrical testing Contractor/Subcontractor.
  - 5. Acceptance Test Procedure: Acceptance and system functions test procedure that covers each item of equipment or system to be field tested shall be submitted. Include applicable procedures, forms, and lists of test equipment. Do not perform testing until test plan and procedures have been approved.
  - 6. Test Reports: Certified copies of inspection reports, test reports, and system function tests. Reports shall include certification of compliance with

specified requirements including test instrument calibration, identification of deficiencies, and recommendation of corrective action when appropriate. Submit written test reports to include the following:

- a. Test procedures used.
- b. Test results that comply with requirements.
- c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

#### 1.04 QUALITY ASSURANCE

- A. Quality assurance program of the testing and commission Procedure.
  1. The testing agent (Contractor) or its designated Subcontractor shall have a Quality assurance/Quality Control program to ensure testing and commissioning is performed in a safe, compliant, and adequate manner meeting industry accepted testing and commissioning requirements for electrical Systems.

### PART 2 PRODUCTS

#### 2.01 Not Used

### PART 3 EXECUTION

#### 3.01 Formal Acceptance Testing Procedure

- A. A formal Acceptance Testing Procedure (ATP) for testing of all the newly installed electrical equipment (for low voltage side [600V or below] only) shall be prepared by the Contractor or its designated Subcontractor and submitted to Customer (CPCCo) as required by the SOW submittal registry prior to testing activities for review and approval. The ATP shall include as a minimum the following:
  1. Testing Standard used, if different from reference in Section 1.02 (A)
  2. The scope of the testing
  3. Test methods to be used for each component
  4. Equipment & components to be tested
  5. Type of test to be performed (Ground Continuity checks, Voltage checks, Phase Rotation tests, breaker functionality checks, interlock test, etc.)
  6. Acceptance Criteria for the tests to be performed
  7. Test equipment to be used
  8. QA/QC requirements for each test to be performed
- B. The tests shall be performed with strict adherence to the test plan as stated in 3.01 (A). Exceptions to the test plan shall be communicated to the Customer and approved prior to field test changes.
- C. All tests shall be coordinated with Facility's management to ensure there won't be any impact on the day to day facilities without facility's approval.
- D. All tests shall be coordinated with Hanford Electrical Utilities (HMIS) to ensure there won't be any impact or interference with the test activities on the Medium Voltage side performed by HMIS.

- E. All tests shall be performed with strict adherence to Hanford DOE 0359, "Hanford Electrical Safety Program" to ensure safe execution of the test activities.

### 3.02 TEST REPORT

- A. The final test report shall include the following information:
  1. Project name.
  2. Description of equipment inspected and tested.
  3. Description of inspections and tests.
  4. Data record resulting from each inspection and test.
  5. Results of system function tests.
  6. Analysis of the tests, identification of deficiencies, and recommendations for corrective action.

### 3.03 FIELD QUALITY CONTROL

- A. Notify the facility's electrical Design Authority of all tests scheduled to be performed. The facility's Design Authority to witness all or some of the test activities at its discretion.
- B. Report to the Facility's electrical Design Authority, within three working days, any component construction that is found defective based on acceptance tests or inspections.
- C. Within 15 days of direction from the Facility's electrical Design Authority, rework, repair, or replace any electrical equipment or component that is found defective based on acceptance tests or inspections.

## PART 4 MEASUREMENT AND PAYMENT

### 4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the contract.

End of Section
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## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of "Liquid-Filled Medium-Voltage Transformers" work is shown in the Contract Documents. This section includes requirements for delivery, installation, and testing of of medium-voltage, liquid-filled, padmounted, and pole-mounted transformers.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. ANSI C37.47 - Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses
- B. ANSI C57.12.28 - Switchgear and Transformers - Pad-Mounted Equipment - Enclosure Integrity
- C. NETA ATS-2021 – Standard for Acceptance Testing Specifications for Electrical Power Equipment (International Electrical Testing Association)
- D. NFPA 70 (National Fire Protection Association) - National Electrical Code
- E. CPC-00864, T-plant Substation Transformers Purchase Specifications

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 - Submittals and Statement of Work submittal registry. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.
- B. The transformers are Government Furnished Equipment (GFE). Ensure the following is available prior to start of work.
  - 1. Product Data: Data on features, components, ratings, and performance for each type of transformer specified.
    - a. Dimensioned plans, sections, and front elevation views showing all devices.
    - b. Transformer outline drawing with actual transformer dimensions and weights.
    - c. minimum clearance requirements and installed devices and features.
    - d. Transformer component list.
    - e. Conduit entry and exit locations.
  - 2. Transformer ratings, including percentage impedance.
  - 3. Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting field-installed wiring.
    - a. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
    - b. Detailed description of equipment anchorage devices and their installation requirements.

1.04 QUALITY ASSURANCE

- A. During installation, comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ensure transformers are staged in a location where they are not subject to physical damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: The GFE will be from the following manufacturers:
  - 1. EATON
  - 2. Cooper
  - 3. or approved equal

2.02 TRANSFORMERS, GENERAL

- A. Windings: 2-winding type, designed for operation with 13.8kV high-voltage connected to a 3-phase, 3-wire, 60-Hz, ungrounded  $\Delta$  distribution system on the primary, Corner-Grounded (B-Phase)  $\Delta$  on the secondary.
- B. Winding Material: Copper insulation, Class H.
- C. Busses and Terminals: Copper.

PART 3 EXECUTION

3.01 (221-T) PAD-MOUNTED TRANSFORMERS INSTALLATION

- A. Receive and stage (221-T) Pad-mount Transformers.
- B. Coordinate with the facility's management and HMIS EU to ensure cranes and lifting devices do not infringe on or interfere with the live existing power lines nearby.
- C. Install transformers on concrete bases per specified drawings.
  - 1. Construct concrete bases of dimensions indicated.
  - 2. Anchor transformers to concrete bases according to manufacturer's written instructions, and requirements in Section 20 05 29 - Hangers and Supports and Section 03 30 00 – Cast in Place Concrete.
  - 3. Install epoxy-coated anchor bolts, for supported equipment, that extend through concrete base and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be installed.
- D. 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.

3.02 (291-T) POLE-MOUNT TRANSFORMERS

- A. Receive and stage (291-T) Pole-mount transformers
- B. Coordinate with the facility's management and HMIS EU to ensure cranes and lifting devices do not infringe on or interfere with the live existing power lines nearby.
- C. Install transformers on the pole per specified Drawings.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be installed.
- D. 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.

3.03 IDENTIFICATION

- A. Provide labels for enclosures and components as specified in Section 26 05 53 - Electrical Identification.
- B. General: Provide label on the inside door of all pad-mounted liquid-filled transformers.
- C. Exterior Label: Coordinate with HMIS, the Electrical Utility (EU) for exterior labeling of the transformer.
  - 1. Install EU Equipment Number.
  - 2. Transformer kVA Size.
  - 3. Primary/Secondary Voltage.
  - 4. Secondary Connection Type
- D. Provide warning and caution signs where indicated or required by the Authority Having Jurisdiction.

3.04 FIELD QUALITY CONTROL

- A. Anchoring: Install transformers on concrete base and meet anchoring and bracing requirements. Refer to Section 03 30 00 - Cast-in-Place Concrete.
- B. Anchoring: Install transformers on the pole and meet anchoring and bracing requirements. Refer to Section 26 05 29 - Hangers and Supports for Electrical Equipment.
- C. Grounding: Comply with Section 26 05 26 - Grounding for materials and installation requirements.

3.05 FIELD TESTING

- A. Contractor Inspection and Testing: Prior to acceptance tests by HMIS EU, the installing Contractor shall perform the following:
  - 1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed.
  - 2. Inspect bolted electrical connections for tightness.

- 3. Perform ground resistance measurements.
  - 4. HMIS EU to perform all necessary tests on the transformers.
  - B. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.
- 3.06 CLEANING
- A. Upon completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Clean components internally using methods and materials recommended by manufacturer.
- 3.07 ADJUSTING
- A. EU HMIS to adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of the facility with concurrence with facility's electrical Design Authority. Record primary and secondary voltages and tap settings and submit with test results.
- 3.08 SUBMITTALS FOR CLOSEOUT
- A. Final test results from EU HMIS.
  - B. Original vendor supplied certified test reports.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in the Schedule of Unit Prices as specified by the Contract.

End of Section

## PART 1 ]GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of “Dry-Type Transformers” work is shown in the Contract Documents. This section includes Dry-Type Transformers, under 600-Volt Class, of the following types:

1. Single-Phase, 37.5-100 kVA, 480-240/120V

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum)
- B. NEMA ST 20 (National Electrical Manufacturers Association) - Dry-Type Transformers for General Applications
- C. NETA ATS-2021 (International Electrical Testing Association) – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- D. NFPA 70 (National Fire Protection Association) - National Electrical Code (NEC)
- E. UL 1561 - (Underwriters Laboratory) - Dry Type General Purpose and Power Transformers

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with Section 01 33 00 – Submittals and Statement of Work submittal registry. These are Government Furnished Equipment (GFE). Ensure manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products are available prior to start of work.
- B. Submittals shall include the following:
1. Product Data: Ensure outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, rated temperature rise are available.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

### 1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide components, devices, and accessories that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which they are installed.
- B. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

#### 1.06 COORDINATION

- A. Coordinate layout and installation of transformers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access and ventilation.
- B. Coordinate size and location of concrete bases with actual equipment supplied. Cast anchor-bolt inserts into bases, in accordance with Drawings. Refer to Section 03 30 00 – Cast in Place Concrete.

### PART 2 PRODUCTS

#### 2.01 GENERAL PURPOSE TWO-WINDING TRANSFORMERS

- A. Manufacturers: Subject to compliance with requirements, GFE products will be one of the following:
  - 1. Eaton.
  - 2. Square D
  - 3. Or approved equal
- B. Label: UL labeled.
- C. Construction:
  - 1. Description: Copper, two-winding, dry-type, 1-phase units, size as indicated.
  - 2. Nameplate: Include transformer rating, transformer connection data

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine surfaces to receive transformers for compliance with installation tolerances, ventilation requirements and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify mounting supports are properly sized and located.

#### 3.02 INSTALLATION

- A. Set transformer plumb and level.
- B. Verify continuity and tightness of ground connections.
- C. Provide grounding electrode, grounding electrode conductor, and bonding jumper required for separately derived system per NEC Article 250-30.
- D. Install transformers on housekeeping pad and secure to pad with suitable concrete as shown on Drawings.
- E. Use Liquid-tight flexible conduit, 2 feet minimum length, for final connections to transformer case. Make conduit connections to side panel of enclosure.
- F. Anchor transformers according to Drawings.

1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.
  2. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- G. Provide grounding and bonding for separately derived system in accordance with Section 26 05 26 - Grounding and Article 250-30 of the National Electrical Code.

3.03 IDENTIFICATION

- A. Provide labels for enclosures and components as specified in Section 26 05 53 - Electrical Identification.
- B. Indicate transformer equipment designation, kVA rating, and primary and secondary voltage ratings.
- C. Provide warning and caution signs where indicated or required by the Authority Having Jurisdiction.

3.04 FIELD QUALITY CONTROL

- A. Perform inspections and tests listed in NETA ATS-2021.
- B. Measure primary and secondary voltages and make appropriate tap adjustments.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in the Schedule of Unit Prices as specified in the Contract.

End of Section
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## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of "Panelboards" work is shown in the Contract Documents. This section includes Distribution Panelboard 800A, rated 600 volts.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. NEMA AB 1 (National Electrical Manufacturers Association) - Molded Case Circuit Breakers.
- B. NEMA PB 1.1 – 2023 (General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less)
- C. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NETA ATS-2021 (International Electrical Testing Association) – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- E. NFPA 70 (National Fire Protection Association) - National Electrical Code (NEC)
- F. UL 50 (Underwriters Laboratory) - Enclosures for Electrical Equipment
- G. UL 67 (Underwriters Laboratory) – Panelboards
- H. UL 489 (Underwriters Laboratory) – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with Section 01 33 00 - Submittals and Statement of Work submittal registry.
- B. Submittals shall include the following:
  - 1. Product Data: Not Applicable. This is a Government Furnish Equipment. Ensure the panelboard, and component indicated, dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes and installation manuals are available prior to work.
  - 2. Shop Drawings: Ensure availability of panelboard's vendor data and related components as follows:
    - a. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      - (1) Enclosure type
      - (2) Bus configuration, current, and voltage ratings.
      - (3) Short-circuit current rating of panelboards and overcurrent protective devices.
      - (4) UL listing for installed devices.
      - (5) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

3. Field Test Reports: Written reports specified in Part 3.
4. Panelboard Schedules: The panel schedule shall be updated with as built information upon completion of the Project.

#### 1.04 QUALITY ASSURANCE

- A. Product Selection for Restricted Space: Verify that product will fit in space shown on drawings and meet NEC working clearance requirements.
- B. Listing and Labeling: Provide components, devices and accessories that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which they are installed.
- C. Comply with NFPA 70, Section 408 as adopted and administered by the Authority Having Jurisdiction.

#### 1.05 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other equipment installed in the same location including Metering equipment, safety switches, raceways, and comply with workspace clearance requirements.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers: This is a government furnished equipment. Subject to compliance with requirements, product will be by one of the following:
  1. Panelboards, Overcurrent Protective Devices and Accessories:
    - a. Eaton.
    - b. Square D
    - c. or approved equal

#### 2.02 FABRICATION AND FEATURES

- A. Enclosure: Surface-mount, NEMA 3R or 4.

#### 2.03 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals as specified on the Drawings or Vendor Cut-sheets.
- B. UL label indicating short circuit rating.

### PART 3 EXECUTION

#### 3.01 EXISTING WORK

- A. Disconnect and remove a wireway (downstream) prior to running feeders from this panelboard to the existing loads in 291-T building.

#### 3.02 INSTALLATION

- A. Receive, inspect, handle, and store panelboard according to NEMA PB 1.1.
- B. Install panelboard and accessories according to NEMA PB 1.1.

- C. Examine panelboard before installation. Reject panelboard that is damaged or rusted or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.
- F. Standard Mounting Heights: Top of trim 72-inches above finished floor, unless otherwise indicated on the Drawings.
  - 1. Maximum height of highest operating handle on distribution panelboards shall be 78".
- G. Install filler plates in unused spaces.

### 3.03 CONNECTIONS

- A. Install equipment grounding connections for panelboard with ground continuity to main electrical ground bus.
- B. 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.

### 3.04 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components as specified in Section 26 05 53 - Electrical Identification.
- B. Panelboard Nameplates: Label panelboard with engraved laminated-plastic nameplate with panel designation, power source, and voltage.
- C. Install the available fault current at panel per Facility's electrical design Authority direction.
- D. Provide framed, typed panelboard circuit directory with accurate descriptions of the connected load. Hand-written directories are not acceptable. Complete directory only after final installations.
  - 1. Describe branch circuit loads and identify locations.

### 3.05 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for e panelboard bus, component, connecting supply, and feeder. Use 1000-volt megger for 480 volts. Test continuity of each circuit and all ground connections.
  - 2. Check for proper phase rotation: Phase A, B, C from left to right and front to back.
- B. Testing: After installing panelboard, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS-2021 for molded-case circuit breakers. Certify compliance with test parameters.

- 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest. If malfunctioning units is not able to be corrected, notify Customer/Owner's representative. Submit above referenced field/design evaluation test report to the facility's electrical Design Authority.
  - C. Panelboard will be considered defective if it does not pass tests and inspections.
  - D. Prepare test and inspection reports, including a certified report that identifies panelboard. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Submit test and inspection reports
- 3.06 ADJUSTING
- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
  - B. Set field-adjustable circuit breaker trip ranges per the Facility's electrical Design Authority's direction.
- 3.07 CLEANING
- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.
  - B. Submit above referenced field/design evaluation test report to the Facility's electrical Design Authority.

**PART 4 MEASUREMENT AND PAYMENT**

**4.01 GENERAL**

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in the Schedule of Unit Prices as specified by the Contract.

End of Section
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## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of “Low-Voltage Switchboards” work is shown in the Contract Documents. This section includes service entrance and distribution switchboards rated 600V, 2000A, suitable for outdoor installation.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. NEMA PB2.1 – 2013 – (National Electrical Manufacturers Association) – General Instructions for Proper Handling, Installation, Operation and Maintenance of Dead front Distribution Switchboards Rated 600 Volts or Less
- B. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum),
- C. NETA ATS-2021 (International Electrical Testing Association) – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems,
- D. NFPA 70 (National Fire Protection Association) - National Electrical Code (NEC)
- E. UL 891 (Underwriter's Laboratory) - Dead-Front Switchboards
- F. CPC-00865, “Specification for  $\Delta$ -Corner grounded (B Phase) Switchboards”

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with Section 01 33 00 - Submittals and Statement of Work submittal registry.
- B. Submittals shall include the following:
  - 1. Product Data: Not Applicable. This is a Government Furnished Equipment. Ensure equipment information as listed below is available prior to installation.
  - 2. Shop Drawings: For each switchboard and related equipment.
    - a. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      - (1) Enclosure types and details
      - (2) Bus configuration, current, and voltage ratings.
      - (3) Short-circuit current rating of switchboards and overcurrent protective devices.
      - (4) Descriptive documentation of optional barriers specified for electrical insulation and isolation.
      - (5) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
    - b. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

3. Dimensioned Outline Drawings of Equipment Unit and installation manuals: equipment weight, identify center of gravity and locate and describe mounting and anchorage provisions.
4. Detailed description of equipment anchorage devices and their installation requirements.
5. Manufacturer's field service report.

#### 1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Ensure switchboards that are Listed and labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which they are installed.
- B. Comply with NEMA 250, NEMA PB 2 and UL 891.
- C. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards, including clearances between switchboards, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in sections of lengths that can be moved past obstructions in delivery path. Shipping splits shall not exceed 72-inches.
- B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- C. Handle switchboards according to NEMA PB 2.1.

#### 1.06 PROJECT CONDITIONS

- A. Installation Pathway: Ensure clear pathway is available for moving switchboards into place.
- B. Environmental Limitations: Rate equipment for continuous operation under the following, unless otherwise indicated:
  1. Ambient Temperature: Not exceeding 104°F (40°C).
  2. Altitude: Not exceeding 1000 feet.

#### 1.07 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction activities, including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for equipment access doors and panels, workspace clearances, and maintenance clearances for mechanical equipment.
- B. Coordinate size and location of concrete bases. Refer to Drawings and Section 03 30 00 , "Cast-in-Place Concrete" for concrete, reinforcement, and formwork requirements.
- C. Provide dedicated electrical equipment space in accordance with NEC 110.26.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, product will be by one of the following:
  - 1. Cutler-Hammer; Division of Eaton
  - 2. Square D
  - 3. or approved equal.

### 2.02 MANUFACTURED UNITS

- A. Switchboard shall not require side or rear access unless engineering considerations dictate otherwise.
- B. Front-Connected, Front-Accessible Switchboard: Panel-mounted main device, panel-mounted branches, and with sections rear-aligned.
- C. Nominal System Voltage: 480 Volts, 3-phase, Corner grounded  $\Delta$ , B phase grounded.
- D. Main-Bus Continuous: 2000A rating.

### 2.03 FABRICATION AND FEATURES

- A. As specified in CPC-00865, "Specification for Corner B-phase grounded Switchboard"

## PART 3 EXECUTION

### 3.01 PROTECTION

- A. Upon receipt, ensure Switchboards are staged in a protected location to avoid damages prior to installation.

### 3.02 EXAMINATION

- A. Upon receipt, examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.03 INSTALLATION

- A. Install switchboards and accessories as outlines in installation manuals.
- B. Support switchboards on concrete bases, as shown on Drawings.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

### 3.04 CONNECTIONS

- A. Install equipment grounding connections for switchboards with ground continuity to main electrical ground bus. Ground the SWBD per the Drawings and Section 26 05 26, "Grounding" section of this specification.
- B. 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.
  - 1. Mark lugs after torquing with red paint such that paint will be visibly disturbed if lugs are disturbed.
- C. Ensure the proper phase (B Phase) is grounded and color coded per Section 3.05.

### 3.05 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components as specified in Section 26 05 53 - Electrical Identification.
- B. Identify switchboard name, designation, power source, and voltage.
- C. Label each switchboard circuit breaker with engraved laminated-plastic nameplate indicating current rating, load served.
- D. Provide warning and caution signs where indicated or required by the Authority Having Jurisdiction.

### 3.06 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: After installing switchboards demonstrate product capability and compliance with requirements.
  - 1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Verify that no tools or loose parts are left in the equipment
  - 2. Inspect bolted electrical connections for completion and tightness.
  - 3. Perform a ground resistance measurements.
  - 4. Check the operation at interlocks and switch mechanism.
  - 5. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS-2021. Certify compliance with test parameters.
  - 6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 7. Megger test switchboard and feeders with all breakers open before energizing. Use 1000V Megger for 480V equipment.
  - 8. Verify proper phase rotation

- 9. Ensure viability of bonding jumper when switchboards are used as service entrances.
- 10. Verify continuity of equipment grounds and bonding jumper.

3.07 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges per the facility's electrical Design Authority (DA) direction.

3.08 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.09 STARTUP SERVICES

- A. Verify that switchboard is installed and connected according to the Contract Documents.
- B. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Electrical Sections.
- C. Complete installation and startup checks according to manufacturer's written instructions.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in the Schedule of Unit Prices as specified by the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of "Safety Switches" work is shown in the Contract Documents. This section includes Safety Switches, under 600-Volt Class, of the following types:
  - 1. Two-Pole, 240V
  - 2. Three-Pole, 600V

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. NEMA AB 1 (UL 489) Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures
- B. NEMA FU 1 - Low Voltage Cartridge Fuses
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- D. UL 50 - Enclosures for Electrical Equipment.
- E. NFPA 70 National Electrical Code (NEC)
- F. International Electrical Testing Association - NETA ATS-2021, Standard for Acceptance Testing Specifications for Electrical Systems (ANSI).

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with Section 01 33 00 - Submittals and Statement of Work submittal registry. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.
- B. Submittals shall include the following:
  - 1. Product Data: Submit manufacturer's technical data for each type of safety switch and enclosed circuit breaker, including data proving that materials comply with specified requirements. Provide catalog sheets showing voltage, current ratings, short circuit ratings, dimensions, and enclosure details.
  - 2. Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

### 1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Listing and Labeling: Provide components, devices, and accessories that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which they are installed.
- C. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Handle carefully to avoid damage to Safety Switch internal components, enclosure, and finish.

1.06 COORDINATION

- A. Coordinate layout and installation of safety switches with other construction and or existing equipment including conduit, piping, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access.

PART 2 PRODUCTS

2.01 SAFETY SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following unless specifically specified on the Project Drawings:
  - 1. Eaton.
  - 2. Square D
  - 3. Or approved equal
- B. Label: UL label required
- C. Construction:
  - 1. Provide NRTL-listed, NEMA 4, or 3R safety switches with ratings and number of poles as indicated on the Drawings or as required by the NEC.
  - 2. Shall be Service Rated.
  - 3. Provide safety switches for use as service equipment that are NRTL labeled for the application.
  - 4. Provide enclosure type in accordance with NEMA KS 1 as required by the conditions of installation and use.
  - 5. Furnish each safety switch with an equipment ground bar.
  - 6. Furnish a neutral bar for each safety switch used on a circuit that includes a grounded "neutral" conductor.
  - 7. Provide safety switches rated 100 amperes and larger that a suitable for use with crimp-on compression lugs.

2.02 FUSES

- A. Provide NRTL-listed, NEMA FU 1 Class R fuses for fusible safety switches as indicated on the Drawings and required by the manufacturer of served equipment.
- B. Provide fuse Sizes and numbers per the Drawings.
- C. Manufacturer: Bussman "LPN-RK\_SP" (250 V), "LPS-RK\_SP" (600 V), and "SFC-FUSE-CAB" or approved equal unless specifically specified on the project Drawings.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine surfaces to receive safety switches for compliance with installation tolerances, clearance requirements and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify mounting supports are properly sized and located for proper installation.

#### 3.02 INSTALLATION

- A. Install safety switches where indicated on the Drawings and according to manufacturer's instructions, NECA 1, and the NEC. Have the manufacturer's installation instructions available at the construction site.
- B. Install each safety switch so the interlock bypass will be accessible.
- C. Ground and bond safety switches as required in Section 26 05 26 Grounding and Bonding.
- D. Install enclosed switches plumb. Provide supports according to Section 26 05 29.
- E. Install fuses for fusible disconnect switches as shown on the contract drawings.

#### 3.03 IDENTIFICATION

- A. Provide labels for enclosures and components as specified in Section 26 05 53 - Electrical Identification.
- B. Indicate Safety Switch designation, and Voltage rating,
- C. Provide warning and caution signs where indicated or required by the Authority Having Jurisdiction.

#### 3.04 FIELD QUALITY CONTROL

- A. Perform inspections and tests listed in NETA ATS-2021.
- B. Clean interior and exterior of safety switches.
- C. Verify that ratings for safety switches match values indicated on the Drawings.
- D. Verify proper torque of accessible bus connections and mechanical fasteners after installing safety switches and enclosed circuit breakers.
- E. After completing installation, cleaning, and testing, touch up scratches to match original finish.

### PART 4 MEASUREMENT AND PAYMENT

#### 4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in the Schedule of Unit Prices as specified by the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of "Excavation and Trenching" work is shown in the Contract Drawings. This section includes requirements for excavation and trenching activities as shown on the project documents.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. DOE-0334 Hanford Site Excavating, Trenching and Shoring Procedure
- B. ASTM D 698 – Laboratory Compaction Characteristics of Soil Using Standard Effort.
- C. ASTM D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- D. ASTM D 1557 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
- E. ASTM D 4253 - Maximum Index Density and Unit Weight of Soils using a Vibratory Table.
- F. ASTM D 4254 - Minimum Index Density and Unit Weight of Soils in Calculation of Relative Density.
- G. ASTM D2321-20 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- H. ASTM D 2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry.
  - 1. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
    - a. Classification according to ASTM D 2487 of each (on-site and/or borrow) soil material proposed for backfill
  - 2. Pre-excavation Scanning data, photographs or other digitally recorded media: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before excavation begins.

### 1.04 QUALITY ASSURANCE

- A. Pre-Excavation Coordination: Conduct Coordination with Facility Management at Project site prior to excavation activities.
- B. Codes and Standards: Perform earthwork complying with requirements of Hanford site excavation policies and procedures..

- 1.05 Testing and Inspection Service: If necessary, the Contractor shall employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and

borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing

1.06 COORDINATION

- A. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.
- B. All work requiring inspection, shall be coordinated with CPCCo management to facilitate inspection activities.

PART 2 PRODUCTS

2.01 TOP SOIL AND EARTH BACKFILL

A. TOP SOIL

- 1. Excavated soil material, graded free of roots, rocks larger than 1 inch subsoils, and debris

B. FILL AND BACKFILL MATERIAL

- 1. Earth backfill shall be native soils free of debris, trash, rocks over 2 inches in diameter and other objectionable material.
- 2. All borrow and fill material shall be provided by the Contractor

C. PAVEMENT

- 1. All excavated and backfilled trenches in paved areas (asphalt or concrete) shall be returned to its pre-excitation conditions using similar material.

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify and review required and available scanned and contours and data.
- B. Notify CPCCo Engineering 10 days prior to startup of construction to have CPCCo support services subcontractor identify known underground utilities and stake and flag locations. If a conflict exists between location of such obstacles and proposed work, promptly notify CPCCo Engineering and arrange for relocations or rerouting. Proceed in same manner if a rock layer or any other unforeseen conditions encountered underground make changes advisable.
- C. When necessary, compact subgrade surfaces to density requirements for backfill material.

3.02 EXCAVATION

- A. All utility trenches shall be constructed in conformance with DOE-0334 trench safety standards.
- B. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five (5) feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet DOE-0344 safety standards.

- C. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be removed from the trench sufficiently prior to the line placing operation to insure a dry, firm bed on which to place the utility line.
- D. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- E. Remedial work due to over-excavation including provision of suitable and stable backfill meeting the degree of compaction required shall be at the Contractor's expense.
- F. Borrow Material: If excavated materials of a suitable nature are not of sufficient quantity to complete the work, provide borrow material in sufficient quantity to complete the work at no additional cost to the Owner.
- G. Disposing of Excavated Material: Dispose of excess satisfactory soil material and all unsatisfactory soil material and rock obtained from excavations in accordance with the provisions of this Section.
- H. Where utilities are in fill, compact fill material to 95% maximum density as determined by ASTM D-1557 at least 12" above the top of the proposed utility prior to excavation of trench.
- I. Excavation for manholes, tie-in to existing facilities and similar structures shall be sufficient to leave at least 12" clear between the outer surfaces and the embankment or sheeting that may be used to hold and protect the banks. Any over depth excavation below such appurtenances shall be refilled with cement stabilized sand, as directed, at no additional cost to Owner.
- J. Excavate topsoil from areas to be further excavated or regraded, and stockpile excess topsoil on site in area designated by Facility Manager.
- K. Remove vegetation, debris, unsatisfactory soil materials, and obstructions from ground surface prior to grading. Properly dispose of material into a ERDF roll off container per T-Plant Waste procedures.

### 3.03 BACKFILL

- A. All trenches must have a bentonite granular clay plug installed to reduce the transmission of ground water under slab on grade buildings and structural first floor buildings.

### 3.04 WORKING WITHIN 5 FEET OF UTILITY LINES

- A. Stop work and notify the CPCCo Facility Management when an unmarked utility is encountered.
- B. If an underground utility is damaged or severed during excavation, stop work, secure the area, and immediately notify CPCCo Facility Management.
- C. Do not use mechanical excavating equipment within 5 feet of a marked, non-potholed utility. Mechanical excavation may commence within 5 feet of the underground utility only after the utility has been potholed, exposed, and well-

marked and the Contractor is confident that there are no unexposed utilities in the excavation area.

- D. Accomplish mechanical excavation at a distance no closer than 18 inches vertically and horizontally to potholed non-fully-exposed utility lines.
- E. If approved by CPCo Facility Management, powered excavation equipment may be used closer than 18 inches to any fully-exposed utilities provided that these are marked/indicated with a prominent, tall flag-on-pole, plank, or other highly visible object so the equipment operator can clearly see their locations and avoid contact. Prior to such excavating, mark and obtain approval using facility Design Authority and Operations Point of Contact.
- F. Exercise caution while hand excavating adjacent to utility line since hand tools such as shovels, picks, and digging bars can damage the utility line.
- G. During machine excavation, have a spotter place to actively monitor the positioning of the equipment.

### 3.05 PERFORMING AND DOCUMENTING INSPECTIONS

- A. Do not cover newly installed underground electrical raceways until all inspections are completed and results are documented.
- B. Notify Facility Management 5 working days in advance that new installation will be ready for inspection and backfill.

## PART 4 MEASUREMENT AND PAYMENT

### 4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the Contract.

End of Section
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## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of "Fill or backfill" work is shown in the Contract Drawings. This section includes requirements for backfill activities listed below and as shown on the project documents.
  - 1. Backfilling subgrade elevations.
  - 2. Fill under slabs on grade.
  - 3. Fill under paving.
  - 4. Fill for over-excavation.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. ASTM D 1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. ASTM D 1556/1556M Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- C. ASTM D 2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- D. ASTM D 6031 Standard Test Method for Logging in Situ Moisture Content and Density of Soil and Rock by the Nuclear Method in Horizontal, Slanted, and vertical Access Tube
- E. ASTM D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with of Section 01 33 00 – Submittals and the Statement of Work submittal registry. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.
- B. Submittals shall include the following:
  - 1. Product Data: Geotextile fabric indicating fabric and construction as applicable.
  - 2. Manufacturer's Certificate: Products meet or exceed specified requirements.
  - 3. Manufacturer's Certificate for sustainable design: Products meet or exceed specified sustainable design requirements.
  - 4. Materials Resources Certificates for sustainable design:
    - a. Source and origin for salvaged and reused products.
    - b. Recycled material content for recycled content products.
    - c. Source for regional materials and distance from Project Site.

5. Compaction testing results (Perform test for every 100 yards (minimum) per lift.)

1.04 QUALITY ASSURANCE

- A. None

PART 2 PRODUCTS

2.01 MATERIALS

A. FILL AND BACKFILL MATERIAL

1. Earth backfill shall be native soils free of debris, trash, rocks over 2 inches in diameter and other objectionable material.
2. All borrow and fill material shall be provided by the Contractor

B. PAVEMENT

1. All excavated and backfilled trenches in paved areas (asphalt or concrete) shall be returned to its pre-excavation conditions using similar material.

PART 3 EXECUTION

3.01 PREPARATION

- A. Compact subgrade to 95% maximum density as defined by ASTM D-1557.

3.02 EXAMINATION

- A. Verify structural integrity of unsupported walls to support loads imposed by fill.

3.03 BACKFILLING

- A. backfill areas to contours and elevations.
- B. Systematically backfill to allow maximum time for natural settlement.
- C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces, and do not backfill with frozen materials.
- D. Maximum Compacted Depths:
  1. Place material in continuous layers to the depth of 6 to 8 inches.
- E. Use placement method that does not disturb or damage foundation perimeter drainage, or utilities in trench.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.
- G. Compact backfill to 95% maximum density as defined by ASTM D-1557.
- H. Structures:
  1. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

- 2. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet.
  - I. Make gradual grade changes, and blend slope into level areas.
  - J. Leave fill material stockpile areas free of excess fill materials.
- 3.04 TOLERANCES
  - A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.
- 3.05 FIELD QUALITY CONTROL
  - A. Perform laboratory material tests according to ASTM D1557.
  - B. In-Place Compaction Testing shall be done per the following:
    - 1. Density Tests: ASTM D1556/D1556M, ASTM D2167, or ASTM D6938.
    - 2. Moisture Tests: ASTM D6031/6031M.
  - C. If tests indicate that Work does not meet specified requirements, remove Work, replace, compact, and retest.
  - D. Proof-roll compacted fill surfaces under slabs on grade and paving.
- 3.06 PROTECTION
  - A. Reshape and recompact fills subjected to vehicular traffic during construction.

**PART 4 MEASUREMENT AND PAYMENT**

**4.01 GENERAL**

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified in the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent of “Electric Utility Services” work & services is shown in the Contract Drawings.
  - 1. This section include the following:
    - a. Arrangements with Electric Utility (EU) Company (HMIS) for electrical tie-ins and permanent electric service.
    - b. Utility metering equipment & installation.

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. IEEE C2, The National Electric Safety Code (NESC 2023)
- B. NFPA 70, National Electrical Code (NEC)
- C. IEEE C57.13 – 2016, IEEE Standard Requirements for Instrument Transformers
- D. CPC-00864, T-Plant Pad Mount 13.8kV-480V Transformers Purchase Specification

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with Section 01 33 00 – Submittals and Statement of Work submittal registry. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.
- B. Submit metering sockets, current transformers, and current transformer enclosure, test switches datasheets for approval by Electric Utilities (EU) managed by HMIS Company.
- C. Manufacturer’s Certificate: Products meet or exceed specified requirements.
- D. Manufacturer Instructions: Installation requirements, including storage and handling procedures.

### 1.04 QUALITY ASSURANCE

- A. Perform work according to IEEE C2 for Light loading conditions and Grade B construction.
- B. Perform Work according to NESC 2023 standards.

### 1.05 COORDINATION

- A. Ensure utility equipment will be installed at locations shown on the Drawings with concurrence from EU, if not specified clearly on the Drawings.
- B. All EU related equipment to be furnished and installed by the Contractor except for the actual Meters for both 291-T and 221-T buildings. EU to provide the Meters for both 291-T and 221-T buildings and upon completion of the project, will make the final tie-in to the existing utility lines.

### 1.06 DELIVERY STORAGE AND HANDLING

- A. Storage:
  - 1. Store EU equipment according to manufacturer instructions.

B. Protection:

1. Protect EU equipment from damage.
2. Provide additional protection according to manufacturer instructions.

**PART 2 PRODUCTS**

**2.01 METERING UNITS**

- A. Metering Units for 221-T will be supplied with GFE transformers per CPC-00864, *T Plant Pad Mount 13.8kV-480V Transformer procurement Specification*. Metering Unit for 291-T will be provided by the EU (HMIS)

1. Manufacturer: Elster Type A3R

**2.02 (291-T) METERING EQUIPMENT AND ACCESSORIES**

A. (291-T) Equipment

1. Manufacturer: Milbank CAT No. UC3433-XL
  - a. Description: Meter socket and enclosure, ring type, with two piece front , current transformer rated, with provisions for a test switch
  - b. No substitutions allowed.
2. Manufacturer: Meter Devices Co., CAT No. 110-54943-ST
  - a. Description: Test Switch, 10 pole with screw terminals
  - b. No substitutions allowed.
3. Manufacturer: Milbank CAT No. CT-364811-HC
  - a. Description: Current Transformer Enclosure, Hinged cover, Size: 36”X48”X11”
  - b. No substitutions allowed.
4. Manufacturer: Milbank CAT No. K4798
  - a. Description: Current Transformer Mounting Rack, 3 phase, 4 Wire, 800A, 50KA Short Circuit Rating
  - b. No substitutions allowed.
5. Manufacturer: ABB #7525A01G07
  - a. Description: Current Transformer, 600V, 600:5 Amp, having a minimum continuous current rating of 2.0 at 30 °C ambient with primary bus bar
  - b. or Approved Equal.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine all EU equipment for obvious defects, cracks, and or signs of irregularities. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

- A. Ensure the mounting rack in 291-T building is installed Per the Project Drawings and ready for installation of the EU equipment.

#### 3.03 INSTALLATION (291-T)

- A. Service Rack and Weatherhead (291-T):
  - 1. Install at height according to EU requirements and/or per the drawings.
  - 2. Install drip loop in service conductors.
- B. Metering Base/Socket
  - 1. Install metering Base/Socket and CT Enclosure on the rack as shown on the Drawings.
- C. Grounding
  - 1. Ensure all grounding and bonding connections are made per Section 26 05 26.
- D. Final connection to Electrical Utility Data Logger to be made by Electrical Utility (HMIS)

#### 3.04 INSTALLATION (221-T)

- A. Meter Unit/Base (221-T):
  - 1. Will be furnished with the GFE transformers.
  - 2. Ensure/make connections to CTs mounted on the secondary side of the transformers (CTs for 221-T are GFE equipment).
- B. Grounding
  - 1. Ensure all grounding and bonding connections are made per Section 26 05 26.
- C. Final connection to Electrical Utility Data Logger to be made by Electrical Utility (HMIS)

#### 3.05 METERING FUNCTIONALITY TESTS

- A. All metering tests for functionality and communication with data loggers to be performed by Hanford Electric Utilities (HMIS)

### MEASUREMENT AND PAYMENT

#### 3.06 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified in the Contract.

End of Section

## PART 1 GENERAL

### 1.01 SUMMARY OF WORK

- A. The extent and location of “Electric Utility Poles” work is shown in the Contract Drawings.
  - 1. This section include the following:
    - a. Wood poles.
    - b. Cross arms.
    - c. Pole hardware.
    - d. Other accessories

### 1.02 GOVERNING CODES, STANDARDS AND REFERENCES

- A. IEEE C2, The National Electric Safety Code (NESC 2023)
- B. NFPA 70, National Electrical Code (2023)
- C. ANSI O5.1-2022 – Wood Poles -Specifications and Dimensions
- D. AWPA U1-23 - American Wood Protection Association Satandard.
- E. IEEE Standard for Threaded Zinc-Coated Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction
- F. ASTM A475-22 - Standard Specification for Metallic-Coated Steel Wire Strand

### 1.03 SUBMITTALS

- A. Submit materials data in accordance with Section 01 33 00 – Submittals and Statement of Work submittal registry. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.
- B. Submittals shall include the following:
  - 1. Product Data: Power Pole Manufacturer, Type, Length, Material, Loading Specifications, Pole class.

### 1.04 QUALITY ASSURANCE

- A. Perform Work according to IEEE C2 for Light loading conditions and Grade B construction.
- B. Perform Work according to NESC 2023 standards.

### 1.05 COORDINATION

- A. Utility Poles shown on drawings are in approximate locations. Contact Electric Utilities (EU) of any concerns regarding proper location of the poles. Ensure utility poles have adequate clearance and do not interfere with existing poles in the area.

### 1.06 DELIVERY STORAGE AND HANDLING

- A. Storage:
  - 1. Poles
    - a. Store poles according to manufacturer instructions.

- b. Stack poles stored for more than two weeks on decay-resistant skids arranged to support poles without noticeable pole distortion.
  - 2. Insulators
    - a. Store insulators according to manufacturer instructions.
- B. Protection:
  - 1. Poles
    - a. Protect poles from damage and decay by stacking to allow free circulation of air.
    - b. Maintain 1-foot minimum spacing between bottom pole and ground or ground vegetation.
    - c. Do not store poles above decayed or decaying wood.
    - d. Provide additional protection according to manufacturer instructions.
- C. Handling
  - 1. Insulators
    - a. Insulators must be carefully handled to prevent damage to the skirts, pins, galvanizing, and cotter keys.
    - b. Insulators that are cracked, chipped, or damaged in any way must be replaced with units that are not defective. The cost for replacement of previously accepted units must be borne by Contractor.
    - c. All insulators must be wiped clean with a clean, soft, nonabrasive cloth.
    - d. For non-ceramic insulators, the sheathing material over the fiberglass rod shall be inspected, and if any damage (i.e., cuts, scrapes, or tears in the rubber material) is found to be caused by Contractor and that could allow moisture to penetrate to the fiberglass rod, Contractor shall replace the insulators at Contractor's expense. Nonceramic insulators and other fiberglass components shall not be bent or twisted.

## PART 2 PRODUCTS

### 2.01 WOOD POLES

- A. Provide wood poles with the following specifications:
  - 1. Comply with ANSI O5.1.
  - 2. Material: Preferred Western Red Ceder. Treated Douglas fir is acceptable.
  - 3. Length: As specified on the Drawings
  - 4. Minimum Class: 1.

### 2.02 CROSS ARMS

- A. Cross Arm Material:

- 1. Material: Straight-grained fiberglass
- B. Wood Preservative:
  - 1. Type: Pressure treatment.
  - 2. Comply with AWPA U1.
  - 3. Preservative type Oil-borne

#### 2.03 Insulators

- A. Dead-end
  - 1. Material: ESP Rubber
  - 2. Length: 14.31 in
- B. Post
  - 1. Comply with ANSI C29.7
  - 2. Material: Porcelain
  - 3. Length: 10.25

#### 2.04 ACCESSORIES

- A. Miscellaneous Pole Hardware: Hot-dip galvanized after fabrication.
- B. Anchor Rods and Nuts: Comply with IEEE C135.2.
- C. Bolts and Nuts: Comply with IEEE C135.1.
- D. Guy Strand:
  - 1. High-strength, seven-strand, 7/16" galvanized-steel cable.
  - 2. Comply with ASTM A475.
- E. Guy Termination Type: Preformed.
- F. Guy Guards:
  - 1. Material: Plastic.
  - 2. Length: 8 feet
  - 3. Color: Yellow
- G. Ground Wire:
  - 1. Color: Conductors: hard-drawn copper.
  - 2. Minimum Size: #4 unless otherwise shown on the drawings

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine all poles for obvious defects, cracks, and or signs of irregularities. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

- A. Distribute poles so that large, choice, close-grained poles with no serious defects shall be used for transformers, deadend, angle and corner poles.
- B. Repair or replace any damage poles with approval from HMIS Electric Utilities (EU) . Any repairs made shall be performed per EU's concurrence.
- C. Cut gains on face of pole, with gained surfaces in parallel planes.

3.03 EXISTING WORK

- A. Interface with existing poles shall be coordinated with EU.
  - 1. Extend existing pole line installations using materials and methods compatible with existing installations or as specified by EU.

3.04 INSTALLATION

- A. Setting Holes:
  - 1. Dig setting holes large enough to permit use of tampers to full depth.
  - 2. Setting depth for each pole shall be 10% of pole height plus 2 feet as follows:

Length of Pole (feet)	Setting in Soil (feet)
50	7.0
55	7.5

- B. Poles:
  - 1. Poles shall be set in alignment except at corners, terminals, angles, junctions, or other points of strain, where they shall be raked against the strains so that the conductors shall be in line.
  - 2. Place curved poles with curvature in line with lead pole.
  - 3. Maintain even grade. On sloped ground, depth of the hole shall be measured from low side of hole.
  - 4. After excavation of a stable pole hole, Contractor shall maintain the stability of the excavated pole hole. Any accumulated water or foreign matter shall be removed from the hole prior to setting the pole. Contractor shall provide suitable backfill material to level the bottom of a water hole.
    - a. If the pole shall be set in sandy soil in accordance with the Unified Soil Classification defined by ASTM D-2487, the hole shall be backfilled with 5/8" minus gravel. Gravel backfill shall be mechanically compacted in 6" – 12" lifts until the tamp makes a solid sound as the fill is struck. A water soak (i.e. addition of water to backfill material prior to or during compaction) shall be applied to gravel backfill to increase backfill moisture content and maximize total compaction. Water soak shall be applied at typical flowrates necessary to maintain the moisture of the backfill material.

- b. If the pole shall be set in non-sandy soil, native soil may be used as backfill. If native soil is used as backfill, it shall be free of grass, weeds, and other organic material. Native backfill shall not be frozen. Native backfill shall be mechanically compacted in approximately 6" lifts until the tamp makes a solid sound as the fill is struck.
- c. Pole backfill shall be thoroughly tamped in full depth. Excess soil shall be banked around the pole and sloped to provide drainage away from the pole.
- d. Rake poles located at corners, angles, and dead ends such that poles are plumb after line installation. Poles shall be raked against the conductor strain not less than one inch for each 10 feet of pole length nor more than two inches for each 10 feet of pole length after conductors are installed.
- e. Do not install poles along edge of cuts and embankments or where soil is in danger of washing out.
- f. Contractor shall locate, protect, shore, brace, support, and maintain all existing underground pipes, conduits, drains, and other underground construction that may be uncovered or otherwise effected by work.

C. Insulators

- 1. All connections must be made in accordance with the drawings. Bolts must be torqued to the manufacturer's specifications. Cotter keys, where required, must be fully inserted.
- 2. Cotter key eyes on insulators and hardware items must be oriented toward the structure, or in such a way as to facilitate easy removal during hot line maintenance.
- 3. Pins and bolts to insulator string assemblies must be oriented with the head upright wherever possible.
- 4. Pin-type insulators must be tight on the pins. On tangent structures, the top groove must be in line with the conductor after tying in.
- 5. After installation, insulators should not be climbed on. Conductors should not be temporarily laid on the sheds or housing of composite or on the bells or posts of porcelain. Insulators should be kept clean of dirt and contaminants, specifically electrical contact compounds.

D. Cross Arms:

- 1. Set cross arms at right angles to line for straight runs. Crossarms shall be set on poles so that alternate crossarm gains face in opposite directions.
- 2. Set cross arms perpendicular to line conductors at deadend and terminal poles.

E. Guys and Anchors:

1. Guys shall be placed and attached to pole prior to conductors being strung.
  2. All anchors and rods shall be in line with the strain and shall be so installed that approximately six inches of the rod remain out of the ground. The backfill of all anchor holes shall be tamped to the full depth.
  3. All guys shall be equipped with guy markers with reflective tape/material providing high visibility.
- F. Hardware:
1. All bolts, nuts, washers, and other mounting hardware shall be hot-dipped galvanized.
  2. A locknut shall be installed with each nut, eyenut, or other fastener on all bolts or threaded hardware such as insulator pins, upset bolts, double arming bolts, etc.
- G. Taps and Jumpers:
1. Jumpers and other leads connected to line conductors shall have sufficient slack to allow free movement of the conductors. Where slack is not shown on the construction drawings, it will be provided by at least two bends in a vertical plane, or one in a horizontal plane, or the equivalent. In areas where aeolian vibration occurs, special measures to minimize the effects of jumper breaks shall be used as specified.
  2. Leads on equipment such as transformers, reclosers, etc. shall be minimum #6 copper conductivity. Use hot-line clamps with stirrups for connection of equipment leads to line as indicated on the assembly details.
  3. All primary jumpers shall consist of conductors matching or exceeding ampacity of the main line conductor and be insulated for bird protection where required. AMPACT or equivalent connectors suitable for bi-metallic connections shall be used for jumper connections.
- H. Hotline Clamps and Connectors:
1. Connectors and hot-line clamps suitable for the purpose shall be installed as shown on construction drawings. Stirrups shall be used with all hot-line clamp installations. On all hot-line clamp installations, the clamp and jumper shall be so installed so that they are permanently bonded to the load side of the line, allowing the jumper to be de-energized when the clamp is disconnected. This applies in all cases, even where the line layout is such that the tap line is in actuality the main back to the power source.
- I. Grounding
1. Ground rods shall be driven full length in undisturbed soil a minimum of two feet from the face of the pole in accordance with the construction drawings. The top shall be at least 12 inches below the surface of the earth. The ground wire shall be attached to the rod with a clamp and secured to the pole with staples. The staples on the ground wire shall be spaced two feet apart except for a distance of eight feet above the ground and eight feet down from the top of the pole where they shall be six inches apart.

2. All equipment shall have at least two connections from the frame, case, or tank to the multi-grounded conductor.
3. The equipment ground and lightning-protective equipment shall be interconnected and attached to a common ground wire.
4. It is the responsibility of the Contractor to ensure that all grounded conductors, grounding electrodes, and metallic parts of equipment are interconnected. Copper-clad or galvanized steel ground rods with minimum length of eight feet shall be installed at all equipment locations as shown in the construction drawings.

#### PART 4 MEASUREMENT AND PAYMENT

##### 4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the work will be considered incidental to, and included in the payments made for the applicable bid items in Schedule of Unit Prices as specified by the Contract.

End of Section