



# THE VIRGIN ISLANDS DEPARTMENT OF **EDUCATION**

**Invitation for Bid  
IFB-VIDE-2022-004**

**ELECTRICAL SERVICE UPGRADE**

**AT THE**

**Julius E. Sprauve School  
St. Thomas/St. John School District**

**Bid Date: September 29, 2022  
Bid Deadline: October 14, 2022 at 1:00 PM EST**

**Electronic Bids should be emailed to [bids@vide.vi](mailto:bids@vide.vi)**

## **I. GENERAL INFORMATION**

### **A. PURPOSE / OVERVIEW**

Invitation for Bid to provide all labor, tools, and equipment needed to perform electrical upgrade at the Julius E. Sprauve School located in the on the island of St. John in St. Thomas/St. John School District. The objective of this project is to retain the services of a qualified and licensed Electrician and/or Electrical Engineering firm to provide the services described in this IFB.

### **B. BACKGROUND**

#### **Virgin Islands Department of Education**

The Commissioner of Education heads the Virgin Islands Department of Education, including the Virgin Islands Public School System. The Territory of the United States Virgin Islands divided into two (2) school districts – the St. Thomas-St. John school district and the St. Croix school district. The two (2) school districts are managed and directed by Insular Superintendents with the day-to-day operations of each school district being managed with district offices on St. Thomas and St. Croix. The following contains additional information concerning the two (2) school districts:

<b>ST. THOMAS/ST. JOHN SCHOOL DISTRICT</b>	<b>Number</b>
<b>Schools</b>	<b>12</b>
Elementary Schools	6
Elementary (Kindergarten-8 <sup>th</sup> Grade)	2
Middle Schools	1
High Schools	2
<b>Programs</b>	<b>3</b>
Day Adult Program	1
Skill Center	1
Alternative Ed Program	1
Total Schools and Programs	15
<b>Number of Students</b>	<b>5,143</b>
<b>ST. CROIX SCHOOL DISTRICT</b>	
<b>Schools</b>	<b>11</b>
Elementary Schools	4
Elementary (Kindergarten-8 <sup>th</sup> Grade)	4
High Schools	2
Junior High	1
<b>Programs</b>	<b>3</b>
Adult Ed	1
Alternative Ed	1
Career and Technical Ed	1
Total Schools and Programs	14
<b>Number of Students</b>	<b>5091</b>

<b><u>BOTH DISTRICTS</u></b>	
<b>TOTAL NUMBER OF VIDE REGULAR K-12 SCHOOLS</b>	22
<b>TOTAL NUMBER OF PROGRAMS</b>	6
<b>TOTAL NUMBER OF STUDENTS</b>	<b>10,234</b>
<b>TOTAL NUMBER OF TEACHERS/ADMINISTRATORS</b>	893

On the island of St. John, one (1) school serve the elementary and middle school student population. The senior high school students from the island of St. John are served by schools on the island of St. Thomas.

The Division of Operations has been designated and will serve as the DOE liaison on this project.

**C. ADMINISTRATIVE STRUCTURE**

Honorable Dionne Wells-Hedrington, Ed. D, Commissioner Nominee heads the Virgin Islands Department of Education. The Department has two (2) school districts, the St. Thomas-St. John School District, and the St. Croix School District that are managed and directed by Insular Superintendents. The official physical and mailing to be used for any correspondence or delivery of paper reports address for the DOE is as follows:

Khadila D. Joseph, MPA, CPM  
Procurement Director  
Virgin Islands Department of Education  
1834 Kongens Gade  
St. Thomas, US Virgin Islands 00802-6742

**D. CONTRACT TYPE**

The contract awarded under this IFB will be a design-build, professional service contract. No payments in advance or in anticipation of services or supplies to be provided under the contract shall be made by the Government.

**E. CONTRACT TERMS**

Unless otherwise agreed pursuant to negotiations, the term of the contract awarded under this IFB shall be for a period of one (1) year.

**F. SELECTION OF CONTRACTOR**

A contract shall be negotiated with a proposer deemed to be the most qualified and responsive to this solicitation. Such a proposer is one, which has financial, technical, and other resources that indicate an ability to perform the services required by this solicitation. A number of factors may influence the Government's decision in selecting the provider. These factors include, but are not limited to, proposer's ability to deliver requested services in a timely manner; 1.) technical approach, 2.) qualifications, 3.) experience, and 4.) cost.

### **Additional Qualification Requirements:**

- An Electrical Engineering Firm with at least 10 years' experience in commercial electrical building design and performing electrical assessment and/or studies.
- One or more of the surveyors must be a Licensed Electrical Contractor in the USVI.
- The Firm must have at least one in house Professional Engineer who maintains an active Professional Engineer license in the USVI.
- The Firm must maintain an active Business License in the USVI.
- The firm must be able to demonstrate similar project experience by describing 3 previous projects.

The proposer shall also meet the following requirements:

- (1) Provide description of the proposer's organization.
- (2) Provide history and background of organization.
- (3) Provide previous experience including years of experience describing the type of experience required for the project.
- (4) Demonstrate ability and capability to deliver on all aspects as described in Section II.
  - Proposers should present their vision of how they propose meeting DOE's needs and identify the overall approach to the project, define the scope of their offered services, and how they propose to meet the *Scope of Services and Deliverables* as defined in this IFB.
- (5) Provide at least three (3) professional references (project references).
- (6) Demonstrate the ability to perform services on-site in DOE's facilities.

#### **H. INCURRED COSTS**

The Government of the Virgin Islands is not liable for any cost incurred by the proposer prior to the signing of a contract by all Parties.

#### **I. LATE PROPOSALS**

Any Proposal received after the exact time specified for receipt will not be considered.

#### **J. GIFTS FROM CONSULTANT**

The Government's officers, employees, or agents shall neither solicit nor accept gratuities, favors, or anything of monetary value from contractors or potential contractors. To the extent permissible under local laws, rules, or regulations, such standards shall provide for appropriate penalties, sanctions, or other disciplinary actions to be applied for violations of such standards.

#### **K. LICENSES, FEES & TAXES**

1. The selected contractor shall be responsible for paying all applicable taxes and fees, including but not limited to, excise tax, local income tax, and payroll and withholding taxes for its employees. The contractor shall hold Government harmless for all claims arising from payment of such taxes and fees.

2. The selected contractor shall obtain and post as required, all licenses, insurances, permits, and certificates as required by federal and local laws, rules and regulations, and policies.

## **L. PROPOSAL FORMAT**

Each proposal must also meet the following minimum requirements:

### ***Part I: Narrative***

- 1) Table of Contents

This section must contain a table of contents. All major parts of the proposal must be identified by page numbers.

- 2) Executive Summary/Proposal Overview

This section must describe the salient features of the proposal. It must contain an overview of the proposer's company background and qualifications, and must condense and highlight the contents of the proposal to provide a broad understanding of the entire proposal. The Executive Summary should include conclusions and generalized recommendations. Pricing information must not be included in the Executive Summary.

- 3) Required Parts and Documents

The proposal must include components of Section I. F.

- 4) Technical Response

Demonstrate ability and capacity to provide services described in Section II. In this section, proposers should present their vision of how they propose meeting the Government's needs and identify the overall approach to the project, define the scope of their offered services, and how they propose to meet the *Scope of Services* as defined in this IFB.

### ***Part II: Cost Proposal***

The Cost Proposal shall provide the proposed compensation in accordance with Attachment A- Itemized Bid Sheet for the services to be provided as described in Section II.

## **M. FEDERAL FUNDING/DEBARMENT CERTIFICATION**

The selected contractor certifies that it is eligible to receive contract awards using federally appropriated funds and that it has not been suspended or debarred from entering into contracts with any federal agency. The Contractor shall include this provision in each of its subcontracts hereunder and shall furnish its subcontractors with the current "LIST OF PARTIES EXCLUDED FROM FEDERAL PROCUREMENT OR NON PROCUREMENT".

## II. SCOPE OF SERVICES

### **Objective:**

The objective of this project is to retain the services of a qualified Electrical Engineering firm to provide an Electrical Upgrade at the Julius E. Sprauve School - St. Thomas/John District.

### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of performing the following work for the Electrical Service Upgrade at Julius E. Sprauve School, as follows.
- B. The Scope of work is as shown in the contract drawings and specifications and as summarized below: (Note: Where a specific manufactures name is listed an approved substitute may be used)

1. Electrical Scope of Work – Provide Lump Sum Fixed Quote:

- Secure all necessary permits.
- Provide demolition in accordance with contract documents.
- Furnish & install all secondary conduits and accessories in accordance with contract documents.
- Furnish, install, and connect switchboard and all accessories in accordance with contract documents and drawings.
- Furnish, install, and connect panelboards in accordance with contract documents.
- Remove, install, medium voltage cable (15kV cable) and secondary cable, components and accessories from the de-energized in accordance with contract documents.
- Furnish, install, and terminate all secondary cables and connectors in accordance with contract documents.
- Furnish & install grounding equipment, components and accessories in accordance with contract documents
- Provide project cleanup and closeout services in accordance with contract documents

2. Civil Scope of Work – Provide Lump Sum Fixed Quote:

- Secure all necessary permits.
- Provide roadway & driveway cutting, trenching, etc.
- Provide excavation and backfilling for new duct banks, switchboard pad, and handholes.
- Construct duct banks, including all duct bank materials and accessories in accordance with contract documents. (Conduits by Electrical Contractor)
- Furnish and install handholes for secondary electrical cables in accordance with contract documents
- Provide walkway and driveway restoration and patching in accordance with contract documents
- Provide project cleanup and closeout services in accordance with contract documents

#### WARRANTY

Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

#### IV. CONTRACTUAL REQUIREMENTS

All bid proposals and subsequent contract and supporting documents must reflect the legal name of entity. Supporting documents that must be submitted prior to contract execution and within the time established by the Government shall include, but not be limited to, the following:

- (1) **Certificate of Resolution**, as to the authorized negotiator and signer of a contract.
- (2) **Current Virgin Islands Business License** issued to the legal name of record of the entity by the Government of the Virgin Islands, Department of Licensing and Consumer Affairs; and if applicable, copy of current business license issued by state, city or county in which the foreign corporation is operating.
- (3) One (1) current **Certificate(s) of Good Standing/Existence**, in legal name of the Contractor by the Virgin Islands Office of the Lt. Governor, Division of Corporations and Trademarks; and if company is not locally formed, an original *Certificate of Good Standing, Certificate of Existence, or Certificate of Status* from the state of registration.
- (4) Certificate of Issuance or Renewal of Trade Name issued by the Virgin Islands Office of the Lt. Governor, Division of Corporations and Trademarks, if applicable.
- (5) **Articles of Incorporation or Organization**, as applicable; or documents governing operation.
- (6) **Certificate of Liability Insurance** indicating proof of coverage of **Professional Liability Insurance** and **General Liability/Public Liability Insurance** - each of no less than [One Hundred Thousand Dollars and Zero Cents (\$100,000.00)] for any one occurrence. The Contractor must provide a **Certificate of Liability Insurance** and **Declaration/Endorsement** pages that indicating that the Government of the Virgin Islands, Department of Education, is as “**certificate holder**” and an “**additional insured**” on the **General Liability/Public Liability Insurance**. The Professional Liability Insurance must cover the services to be provided under the contract.
- (7) Certificate of Government Insurance/Copy of Certificate providing firm/agents are covered by Workers’ Compensation Employee’s Liability.

- (8) System for Award Management (SAM) certifying the Contractor's' eligibility to receive contract awards appropriated with federal funds; [www.sam.gov](http://www.sam.gov).

Please note the above-referenced documents are subject to modification at the Government's discretion.

Any silence, absence, or omission from the contract specifications concerning any point shall be regarded as meaning that only the best commercial practices are to prevail.

All contractual documents including insurance certificates/policies must be kept updated and maintained throughout the term of the contract.

## ATTACHMENT A

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT COST	TOTAL COST
<b>GENERAL</b>					
1	1	Lump Sum	Mobilization		
2	1	Lump Sum	Permits		
3	1	Lump Sum	Project Cleanup and Closeout (Demobilization)		
<b>SUBTOTAL GENERAL</b>					
<b>CIVIL WORK</b>					
4	175	FT	Secondary Duct Bank 1-4" PVC		
5	1	Each	Secondary Handhole, 24" x 24"		
<b>SUBTOTAL CIVIL WORK</b>					
<b>Electrical WORK</b>					
6	175	FT	Furnish and Install, terminate and test (4) 4/0 AWG 600V Cable and (1) #2 AWG Ground Conductor in 4" Conduit as shown on Drawings.		
7	1	Each	Furnish and Install New 225 (A) Breaker in Box 3 (SJ01 Switch board)		
8	1	Lot	Coordinate with WAPA to deenergize Pad-mount transformer once load has been transferred to existing padmount transformer at the modulars		
9	1	Lot	Remove all and discard all Primary and secondary cables from de-energized transformer.		
<b>SUBTOTAL ELECTRICAL WORK</b>					
<b>TOTAL LUMP SUM CONSTRUCTION COST ESTIMATE:</b>					

Certified Correct:	
_____ (Licensed Contractor's Signature)	_____ (Date)
_____ (Company)	
_____ (Address)	

**THE FOLLOWING LANGUAGE SHALL BE DEEMED INSERTED INTO THE CONTRACT.**

1. Contractor shall adhere to all department and procurement's standard bid form requirements established for the Virgin Islands government's standard general construction contracts.
2. Contractor's bid shall be disqualified if itemized bid sheet is not fully completed with both unit price and total price.
3. The quantities noted above are not necessarily exact, and the items noted do not necessarily make up all the work required, or noted in the specifications and drawings, for the complete construction and proper operation of the project. the items noted, will be used in establishing if the cost, which are being submitted by the bidder, are within the current acceptable prices being used in the U.S. Virgin Islands construction market. the contractor shall be responsible for submitting a total lump sum cost for the complete construction of the project.
4. It is the contractor's responsibility to establish exact quantities based on documents issued and site visits carried out, for a total lump sum cost to construct the project.
5. Add alternates shall not be included in the total lump sum cost of construction. the add alternate items are for utilization in the event that additional work or adjustment of the contracted work is required, during the construction of the project.
6. All prices being submitted for work to be done shall include the contractor's overhead taxes and profit along with all costs for materials, equipment and manpower necessary to facilitate proper, safe, and timely completion of the project.
7. Unit prices submitted on the itemized bid sheet shall be utilized for any credits or debits to the project; which, if necessary, shall be addressed as a change order to the project.

## APPENDIX A

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS, GENERAL**

Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### **3.02 PREPARATION**

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Avoid cutting existing pipe, conduit, or ductwork serving the area but scheduled to be removed or relocated until provisions have been made to bypass them.

#### **3.03 PERFORMANCE**

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
  1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.

1. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
  1. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

### 3.04 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

## SECTION 01600 – MATERIALS & EQUIPMENT

### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

#### 1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
  1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
    - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the contract documents.
    - b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside the United States

and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.

2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

#### 1.04 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
  1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Project Engineer to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
- B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
  1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
  2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
    - a. Name of product and manufacturer.
    - b. Model and serial number.
    - c. Capacity.
    - d. Speed.
    - e. Ratings.

#### 1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
  1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
  2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products upon delivery to ensure compliance with the contract documents and to ensure that products are undamaged and properly protected.
5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.01 PRODUCT SELECTION**

- A. General Product Requirements: Provide products that comply with the contract documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
  1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
  2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The contract documents and governing regulations govern product selection. Procedures governing product selection include the following:
  1. Proprietary Specification Requirements: Where specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
  2. Semi-proprietary Specification Requirements: Where specifications name two (2) or more products or manufacturers, provide one (1) of the products indicated. No substitutions will be permitted.
    - a. Where specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  3. Nonproprietary Specifications: When specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with contract document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  4. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
  5. Performance Specification Requirements: Where specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
    - a. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.

6. Compliance with Standards, Codes, and Regulations: Where specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
7. Visual Matching: Where specifications require matching an established sample, the Engineer's decision will be final on whether a proposed product matches satisfactorily.
  - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the contract documents concerning "substitutions" for selection of a matching product in another product category. - Subject to the approval of DOE Engineer
8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Engineer will select the color, pattern, and texture from the product line selected.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION OF PRODUCTS**

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
  1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of substantial completion.

### **SECTION 014000 – QUALITY CONTROL**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

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

##### **1.02 SUMMARY**

- A. This section includes administrative and procedural requirements for quality control services.
- B. Quality control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Owner's Representative.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
  - 1. Specific quality control requirements for individual construction activities are specified in the sections that specify those activities. Requirements in those sections may also cover production of standard products.
  - 2. Specified inspections, tests, and related actions do not limit Contractor's quality control procedures that facilitate compliance with contract document requirements.
  - 3. Requirements for Contractor to provide quality control services required by Owner, or authorities having jurisdiction are not limited by provisions of this section.
- E. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Division 1 Section 01045 "CUTTING AND PATCHING" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

### 1.03 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality control services specified elsewhere in the contract documents and required by authorities having jurisdiction. Costs for these services shall be included in the contract sum.
  - 1. Where individual Sections specifically indicate that certain inspections, tests, and other quality control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality control services. Costs for these services shall be included in the contract sum.
  - 2. Where individual sections specifically indicate that certain inspections, tests, and other quality control services are the department's responsibility, Department will engage the services of a qualified independent testing agency to perform those services.
    - a. Where the Department has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Department unless agreed to in writing by the Department.
- B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality control services prove unsatisfactory and indicate noncompliance with contract document requirements, regardless of whether the original test was the Contractor's responsibility.
  - 1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with contract document requirements.
- C. Associated Services: The Contractor shall cooperate with outside agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested.

Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories.
6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the project site.

D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual sections shall cooperate with the Department and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Department and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the contract documents or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

#### 1.04 SUBMITTALS

A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, of each inspection, test, or similar service to the Department. If the Contractor is responsible for the service, submit a certified written report, of each inspection, test, or similar service through the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
  - a. Date of issue.
  - b. Project title and number.
  - c. Name, address, and telephone number of testing agency.
  - d. Dates and locations of samples and tests or inspections.

- e. Names of individuals making the inspection or test.
- f. Designation of the Work and test method.
- g. Identification of product and specification section.
- h. Complete inspection or test data.
- i. Test results and an interpretation of test results.
- j. Ambient conditions at the time of sample taking and testing.
- k. Comments or professional opinion on whether inspected or tested Work complies with contract document requirements.
- l. Name and signature of laboratory inspector.
- m. Recommendations on retesting.

## 1.05 QUALITY ASSURANCE

- A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.
  - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the US Virgin Islands.

## **PART 2 PRODUCTS**

Not Applicable

## **PART 3 EXECUTION**

### 3.01 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with contract document requirements for Division 1 Section 01045 "CUTTING AND PATCHING".
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection are the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

## **SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL**

### 1.1 RELATED DOCUMENTS

### 1.2 SUMMARY

- A. Section Includes:

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

### 1.3 COORDINATION

#### A. Coordinate arrangement, mounting, and support of electrical equipment:

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

#### B. Coordinate installation of required supporting devices.

## **SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL**

### 1.4 RELATED DOCUMENTS

### 1.5 SUMMARY

#### A. Section Includes:

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

### 1.6 COORDINATION

#### A. Coordinate arrangement, mounting, and support of electrical equipment:

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

#### B. Coordinate installation of required supporting devices.

## **PART 2 - PRODUCTS**

### **2.1 GROUT**

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

## **PART 3 - EXECUTION**

### **3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION**

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

## **SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS**

### **3.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

### **3.3 SUMMARY**

- A. This Section includes the following:
  - 1. Building wires rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

### 3.4 DEFINITIONS

- A. NBR: Acrylonitrile-butadiene rubber.

### 3.5 SUBMITTALS

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

### 3.6 QUALITY ASSURANCE

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

## **PART 2 PRODUCTS**

### 3.7 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Insulated Wire Corp.; a Leviton Company.
  - 2. General Cable Corporation.
  - 3. Senator Wire & Cable Company.
  - 4. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW.

### 3.8 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.

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

## **PART 3 EXECUTION**

### **3.9 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper, Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Provide deduct alternate for Aluminum, adjust conductor size and raceway size as required.
- B. Branch Circuits: Copper, Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### **3.10 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- C. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- F. Class 2 Control Circuits: Type THHN-THWN, in raceway.

### **3.11 INSTALLATION OF CONDUCTORS**

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.
- C. Identify and color-code conductors according to Division 26 Section "Identification for Electrical Systems."

### 3.12 CONNECTIONS

- A. 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.13 FIELD QUALITY CONTROL

- 1. Transformer secondary feeder.
  - 2. Generator feeders and transfer switch feeders.
  - 3. All panelboard feeders.
  - 4. After installing conductors and before electrical circuitry has been energized, test conductors feeding the following critical equipment and services for compliance with requirements.
  - 5. Perform each visual and mechanical inspection and electrical test stated in ANSI/NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
    - 1. Test procedures used.
    - 2. Test results that comply with requirements.
    - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
  - C. Remove and replace malfunctioning units and retest as specified above.

## **SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### 3.14 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.

#### 3.15 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

### 3.16 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

### 3.17 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 PRODUCTS

### 3.18 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

### 3.19 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.

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

### 3.20 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel 5/8 inch by 10 feet in diameter.

## PART 3 EXECUTION

### 3.21 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
  - 3. Connections to Structural Steel: Welded connectors.

### 3.22 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses. See drawings for details.

### 3.23 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. All feeders and branch circuits.
  - 2. Flexible raceway runs.
  - 3. Armored and metal-clad cable runs.

### 3.24 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
  - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

### 3.25 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

- a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
- B. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

## **SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

### **3.26 SUMMARY**

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

### **3.27 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work. This shall include the enclosure for the roll-up load bank connection box.

### **3.28 QUALITY ASSURANCE**

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

## **PART 2 PRODUCTS**

### **3.29 METAL CONDUIT AND TUBING**

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.

- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

- 1. Fittings for EMT: Compression type.

### 3.30 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- B. LFNC: UL 1660.
- C. Fittings for RNC: NEMA TC 3; match to conduit and material.
- D. Fittings for LFNC: UL 514B.

### 3.31 METAL WIREWAYS

- 1. Cooper B-Line, Inc.
  - 2. Hoffman.
  - 3. Square D; Schneider Electric.
  - 4. Approved Equal.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 unless otherwise indicated.
- C. 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 complete system.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

### 3.32 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

- E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

## **PART 3 EXECUTION**

### **3.33 RACEWAY APPLICATION**

- A. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT with compression or set screw fittings.
  - 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 3. Damp or Wet Locations: IMC.
  - 4. Raceways for communications or control cable: EMT with compression or set screw fittings.
  - 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.
- B. Minimum Raceway Size: 1/2-inch for control and 3/4 inch for power.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

### **3.34 INSTALLATION**

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- H. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- I. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations.
  - 2. Where otherwise required by NFPA 70.

## **SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **3.35 RELATED DOCUMENTS**

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

#### **3.36 SUMMARY**

- A. Section Includes:
  - 1. Rigid nonmetallic duct.
  - 2. Duct accessories.
  - 3. Polymer concrete handholes and boxes with polymer concrete cover.
  - 4. High-density plastic boxes.
  - 5. Utility structure accessories.

#### **3.37 DEFINITIONS**

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
  - 1. Two or more ducts installed in parallel, with or without additional casing materials.
- D. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

### 3.38 ACTION SUBMITTALS

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

1. Include duct-bank materials, including spacers and miscellaneous components.
2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for, handholes, boxes, and other utility structures.
4. Include underground-line warning tape.

#### B. Shop Drawings:

##### 1. Precast or Factory-Fabricated Underground Utility Structures:

- a. Include plans, elevations, sections, details, attachments to other work, and accessories.
- b. Include duct entry provisions, including locations and duct sizes.
- c. Include reinforcement details.

##### 2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

- a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
- b. Include duct entry provisions, including locations and duct sizes.
- c. Include cover design.
- d. Include grounding details.

### 3.39 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.
- B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C858.
- C. Source quality-control reports.
- D. Field quality-control reports.

### 3.40 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

## **PART 2 PRODUCTS**

### **3.41 METAL CONDUIT AND FITTINGS**

- A. Rigid Aluminum Conduit: Comply with ANSI C80.5 and UL6A
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

### **3.42 RIGID NONMETALLIC DUCT**

- A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- C. Solvents and Adhesives: As recommended by conduit manufacturer.

### **3.43 DUCT ACCESSORIES**

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
  - 1. Refer to Contract Drawings for Basis of Design.
- B. Underground-Line Warning Tape: Refer to Contract Drawings.

### **3.44 PRECAST CONCRETE HANDHOLES AND BOXES**

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. Comply with ASTM C858 for design and manufacturing processes.
- C. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- D. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- E. Cover Legend: Molded lettering, "ELECTRIC."

- F. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- H. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
  - 1. Center window location. (Unless otherwise required).
  - 2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
  - 3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
  - 4. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
  - 5. Knockout panels shall be 1-1/2 to 2 inches thick.
  - 6. Type and size shall match fittings to duct to be terminated.
  - 7. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.
- I. Handholes 24 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

#### 3.45 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

- G. Cover Legend: Molded lettering, "ELECTRIC" or "COMMUNICATIONS" As indicated on Contract Drawings.
- H. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- I. Handholes 18 inches wide by 18 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

#### 3.46 HIGH-DENSITY PLASTIC BOXES

- A. Description: Injection molded of HDPE or copolymer-polypropylene. Cover shall be made of polymer concrete.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- . Cover Legend: Molded lettering, "ELECTRIC" or "COMMUNICATIONS" As indicated on Contract Drawings.
- A. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- B. Handholes 18 inches wide by 18 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

#### 3.47 UTILITY STRUCTURE ACCESSORIES

- A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.
- B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
  - 1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A48/A48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 30 inches.

- a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.

- a. Legend: "ELECTRIC".

C. Pulling-in and Lifting Irons: 7/8-inch diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

- 1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

D. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: See contract drawings for Basis of Design.

- 1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

E. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

F. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

### 3.48 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C1037.

## PART 3 EXECUTION

### 3.49 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, and handholes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Engineer if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into handholes, with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Engineer.

### 3.50 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Cables More Than 600 V: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated on contract drawings.
- B. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated on contract drawings.
- C. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated on contract drawings.

### 3.51 UNDERGROUND ENCLOSURE APPLICATION

- 1. Cover design load shall not exceed the design load of the handhole or box.
- B. Handholes and Boxes for 600 V and Less:
  - 1. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15; High-density plastic, SCTE 77, Tier 15 structural load rating.
  - 2. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8; High-density plastic, SCTE 77, Tier 8 structural load rating.
  - 3. Cover design load shall not exceed the design load of the handhole or box.

### 3.52 EARTHWORK

- A. Excavation and Backfill: Do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Replace area immediately after backfilling is completed.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to Specification Section 01045 "Cutting and Patching" where roadway restoration is not required. Where roadway restoration is required, refer to details on Civil Drawings.

### 3.53 DUCT AND DUCT-BANK INSTALLATION

- A. Install duct, spacers, and accessories into the duct-bank configuration in accordance with contract drawings and manufacturers installation instructions.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches both horizontally and vertically, at other locations unless otherwise indicated.
  - 1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. End Bell Entrances to Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.
  - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.
  - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- G. Optional Terminator Entrances to Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to terminator spacing 10 feet from the terminator, without reducing duct line slope and without forming a trap in the line.
  - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch.
- H. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- I. Pulling Cord: Install 200-lbf test nylon cord in empty ducts.

J. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct.
2. Width: Excavate trench 3 inches wider than duct on each side.
3. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
4. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with at least one spacer per 5 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
6. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
7. Elbows: Install manufactured duct elbows for stub-ups, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
8. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction.
  - a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.

- K. Underground-Line Warning Tape: Bury conducting underground line at approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### 3.54 INSTALLATION OF CONCRETE HANDHOLES

A. Precast Concrete Handhole Installation:

1. Comply with ASTM C891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Install handholes with bottom at a depth as required to coordinate with ducts.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of handholes where indicated. Coordinate with drainage provisions indicated.

D. Waterproofing: Apply waterproofing to exterior surfaces of handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

E. Hardware: Install removable hardware, including pulling eyes as required for installation and support of cables and conductors and as indicated.

F. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### 3.55 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom at a depth as required to coordinate with ducts.

E. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

F. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.

2. Dimensions: 10 inches wide by 12 inches deep.

### 3.56 GROUNDING

- A. Ground underground ducts and utility structures according to Contract Drawings.

### 3.57 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
  2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
  3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

### 3.58 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

## **SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### 3.59 SUMMARY

- A. Section Includes:
  1. Identification for raceways.
  2. Identification of power and control cables.
  3. Identification for conductors.
  4. Warning labels and signs.
  5. Instruction signs.
  6. Equipment identification labels.
  7. Miscellaneous identification products.

### 3.60 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

### 3.61 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

## **PART 2 PRODUCTS**

### 3.62 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

### 3.63 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

### 3.64 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
  - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal size, 7 by 10 inches.
- D. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

### 3.65 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

### 3.66 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

### 3.67 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **PART 3 EXECUTION**

### **3.68 INSTALLATION**

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

### **3.69 IDENTIFICATION SCHEDULE**

- A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 100A, and 120V to ground: Install labels at 10-foot maximum intervals.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in panels, switchgear enclosures pull and junction boxes, use color-coded conductors to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded conductors.
    - a. Color shall be factory applied tape.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Field-Applied, Color-Coding Conductor Tape: (Only where not practical to provide factory prepared color-coded conductors.) Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
- F. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label 4 inches high.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure

## **SECTION 262413 - SWITCHBOARDS**

## **PART 1 GENERAL**

### **3.70 SUMMARY**

#### **A. Section Includes:**

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Accessory components and features.
6. Identification.

### **3.71 ACTION SUBMITTALS**

#### **A. Product Data:** For each switchboard, overcurrent protective device, surge protection device, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

#### **B. Shop Drawings:** For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
9. Include schematic and wiring diagrams for power, signal, and control wiring.

### **3.72 INFORMATIONAL SUBMITTALS**

#### **A. Field Quality-Control Reports:**

1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

### 3.73 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

### 3.74 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Testing Agency Qualifications: Accredited by NETA.
  1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

### 3.75 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards.
- C. Handle and prepare switchboards for installation according to NECA 400.

### 3.76 FIELD CONDITIONS

- A. Installation Pathway: Remove and replace doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
  1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry and work above switchboards is complete.
  2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.

### 3.77 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment,

raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

### 3.78 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: Eighteen (18) months from date of Substantial Completion.

## PART 2 PRODUCTS

### 3.79 SWITCHBOARDS

- A. Provide switchboard equal to Square D Type QED-2, or approved equal by Eaton, GE, or Siemens.
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. 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.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.
- H. Front-Connected, Front-Accessible Switchboards:
  - 1. Main Devices: Fixed mounted.
  - 2. Branch Devices: Panel mounted.
  - 3. Sections front and rear aligned.
- I. Nominal System Voltage: 208Y/120 V.

- J. Main-Bus Continuous: 1600 A.
- K. Short Circuit Rating: 65 KAIC Symmetrical
- L. Indoor Enclosures: Steel, NEMA 250, Type 4.
- M. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.
- N. Hinged cover over customer metering compartments.
- O. Buses and Connections: Three phase, four wire unless otherwise indicated.
  - 1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
  - 2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.
  - 3. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
  - 4. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
  - 5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
  - 6. Disconnect Links:
    - a. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
  - 7. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- P. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

### 3.80 SURGE PROTECTION DEVICES

- A. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.
- B. Features and Accessories:
  - 1. Integral disconnect switch.
  - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

3. Indicator light display for protection status.
  4. Form-C contacts: One normally open and one normally closed, for remote monitoring of protection status
  5. Surge counter.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 120 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 700 V for 208Y/120 V.
  2. Line to Ground: 1200 V for 208Y/120 V.
  3. Line to Line: 1200 V for 208Y/120 V.
- E. SCCR: Equal or exceed 65kA.

### 3.81 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long and short time adjustments.
  4. MCCB Features and Accessories: (Main Device)
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.

### 3.82 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, and the following:

1. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
  1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
    - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
    - d. Megawatts: Plus or minus 1 percent.
    - e. Megavars: Plus or minus 1 percent.
    - f. Power Factor: Plus or minus 1 percent.
    - g. Frequency: Plus or minus 0.1 percent.
    - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
    - i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
    - j. Contact devices to operate remote impulse-totalizing demand meter.
  2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

### 3.83 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

## PART 3 EXECUTION

### 3.84 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NECA 400.
  1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
  2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
  3. Protect from moisture, dust, dirt, and debris during storage and installation.
  4. Install temporary heating during storage per manufacturer's instructions.

- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.85 INSTALLATION

- A. Install switchboards and accessories according to NECA 400.
- B. Equipment Mounting: Install switchboards on concrete pad as indicated on drawings.
  - 1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to switchboards.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps 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.
- E. Install filler plates in unused spaces of panel-mounted sections.
- F. Install overcurrent protective devices, surge protection devices, and instrumentation.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- G. Comply with NECA 1.

### 3.86 CONNECTIONS

- A. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.
- B. Support and secure conductors within the switchboard according to NFPA 70.

### 3.87 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.88 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
  - 1. Acceptance Testing:
    - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
    - b. Test continuity of each circuit.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Switchboard will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.89 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

- B. Set field-adjustable circuit-breaker trip ranges.

### 3.90 DEMONSTRATION

Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

## **SECTION 262416 - PANELBOARDS**

### 3.91 RELATED DOCUMENTS

### 3.92 SUMMARY

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

### 3.93 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. SPD: Surge protective device.

### 3.94 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
  - 4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.

### 3.95 INFORMATIONAL SUBMITTALS

### 3.96 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.

### 3.97 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Keys: Two spares for each type of panelboard cabinet lock.
  2. Circuit Breakers: spares as indicated in Panel Schedules.

### 3.98 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

### 3.99 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards.
- B. Handle and prepare panelboards for installation according to NECA 407.

### 3.100 FIELD CONDITIONS

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

### 3.101 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
  1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

## PART 2 PRODUCTS

### 3.102 PANELBOARDS COMMON REQUIREMENTS

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Surface-mounted, dead-front cabinets.
  - 1. Rated for environmental conditions as follows:
    - a. NEMA 1 Where inside
    - b. NEMA 4 Where outside
  - 2. Height: 84 inches maximum.
  - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
    - a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.
  - 4. Location: Convertible between top and bottom.
  - 5. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- F. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Terminations shall allow use of 75 deg C rated conductors without derating.
  3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: See Panel Schedules.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

### 3.103 PERFORMANCE REQUIREMENTS

- A. Provide panels by one of the following:
1. Square D Company,
  2. G.E.
  3. Eaton
  4. Siemens.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.

### 3.104 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Products by one of the following:
1. Square D Company
  2. G.E.
  3. Eaton
  4. Siemens
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

### 3.105 SURGE PROTECTION DEVICES

- A. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.
- B. Features and Accessories:
  - 1. Integral disconnect switch.
  - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
  - 3. Indicator light display for protection status.
  - 4. Form-C contacts: One normally open and one normally closed, for remote monitoring of protection status
  - 5. Surge counter.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 120 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V for 208Y/120 V.
  - 2. Line to Ground: 1200 V for 208Y/120 V.
  - 3. Line to Line: 1200 V for 208Y/120 V.
- E. SCCR: Equal or exceed 65kA.

### 3.106 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Products by one of the following:
  - 1. Square D. Company
  - 2. G.E.
  - 3. Eaton

4. Siemens

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

- a. Inverse time-current element for low-level overloads.
- b. Instantaneous magnetic trip element for short circuits.
- c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. MCCB Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
- b. Breaker handle indicates tripped status.
- c. UL listed for reverse connection without restrictive line or load ratings.
- d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

### 3.107 INSTRUMENTATION

A. Multifunction Digital-Metering Monitor (For Panel MDP-2 Only): Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

- 1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
  - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
  - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
  - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
  - d. Megawatts: Plus or minus 1 percent.
  - e. Megavars: Plus or minus 1 percent.
  - f. Power Factor: Plus or minus 1 percent.
  - g. Frequency: Plus or minus 0.1 percent.
  - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
  - i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
  - j. Contact devices to operate remote impulse-totalizing demand meter.
- 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

### 3.108 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## **PART 3 EXECUTION**

### **3.109 EXAMINATION**

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407.
- C. Examine panelboards before installation. Reject panelboards that are damaged, 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.

### **3.110 INSTALLATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407.
- D. Equipment Mounting:
  - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

- F. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount surface-mounted panelboards to steel slotted supports: As indicated on drawings.
- I. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- K. Install filler plates in unused spaces.

#### 3.111 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

#### 3.112 FIELD QUALITY CONTROL

- 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Panelboards will be considered defective if they do not pass tests and inspections.

### III. NON-PERFORMANCE BY SELECTED CONTRACTOR

In the event of the selected contractor's non-performance under the subsequent contract and/or the violation or breach of the contract terms, the Government shall have the right to pursue all administrative, contractual, and legal remedies against the contractor and shall have the right to seek all sanctions and penalties as may be appropriate. Further, either party shall have the right to

terminate the contract with or without cause upon the agreed upon written notice to the other party specifying the date of termination.

**REMAINDER OF THIS PAGE LEFT BLANK  
INTENTIONALLY.**

Attachment B – Electrical Site Plan



### Attachment 3 – One Line Diagram: Existing Modulars



