



**BOARD OF CONTRACT AND SUPPLY  
CITY OF PROVIDENCE, RHODE ISLAND**

# REQUEST FOR PROPOSALS

**Item Description:** CLASSICAL HIGH SCHOOL-CAMPUS ELECTRICAL UPGRADES

**Procurement/MinuteTraq #: 54501**

**Date to be opened:** 10/5/2026

**Issuing Department:** Public Property

## **QUESTIONS**

- Please direct questions related to the process, how to fill out forms, and how to submit an application(Pages 1-8) to the Purchasing Department.
  - Portal Submission:  
<https://forms.monday.com/forms/2623174bcb0d6268172c99a3aab9a409?r=use1>
- Please direct questions relative to the Minority and Women’s Business Enterprise Program and the corresponding forms (Pages 10-11) to the MBE/WBE Outreach Director for the City of Providence, Grace Diaz
  - Email: [gdiaz@providenceri.gov](mailto:gdiaz@providenceri.gov)
    - Please use subject line “**MBE WBE Forms**”
- Please direct questions relative to the specifications outlined (beginning on page 14) to the issuing department’s subject matter expert:
  - Name: Paul DeMelo
  - Title: Downes Construction Company, Project Manager
  - Email Address: [pdemelo@downesco.com](mailto:pdemelo@downesco.com)

## **Pre-submission Conference**

There will be a Mandatory Pre-Bid Conference

Date of Pre-Bid Conference: 9/8/2026 Time: 3:30 pm

Other details (e.g. location, links, question submission deadline): 770 Westminster St, Providence, RI 02903

**Deadline for questions submissions:** September 15, 2026 @ 4:00 pm  
Final Addendum: September 17, 2026

## INSTRUCTIONS FOR SUBMISSION

|                                       |
|---------------------------------------|
| <b><u>Meeting Date: 10/5/2026</u></b> |
|---------------------------------------|

Bids may be submitted up to **2:15 P.M.** on the above meeting date at the **Department of the City Clerk. Room 311, City Hall. 25 Dorrance Street, Providence.** At 2:15 P.M. all bids will be publicly opened and read at the Board of Contract Meeting in Conference Room 305, on the 3<sup>rd</sup> floor of City Hall.

- Bidders must submit **2 copies** of their bid in sealed envelopes or packages labeled with the captioned **Item Description** and the **City Department to which the solicitation and bid are related and must include the company name and address on the envelope as well.** (On page 1).
- If required by the Department, please keep the original bid bond and check in only one of the envelopes.
- Communications to the Board of Contract and Supply that are not competitive sealed bids (i.e. product information/samples) should have “**NOT A BID**” written on the envelope or wrapper.
- Only use form versions and templates included in this solicitation. If you have an old version of a form do not recycle it for use in this bid.
- The bid envelope and information relative to the bid must be addressed to:

**Board of Contract and Supply  
Department of the City Clerk – City Hall, Room 311  
25 Dorrance Street  
Providence, RI 02903**

**\*\*PLEASE NOTE:** This bid may include details regarding information that you will need to provide (such as proof of licenses) to the issuing department before the formalization of an award.

*This information is NOT requested to be provided in your initial bid by design.*

**All bids submitted to the City Clerk become public record.** Failure to follow instructions could result in information considered private being posted to the city’s Open Meetings Portal and made available as a public record. The City has made a conscious effort to avoid the posting of sensitive information on the City’s Open Meetings Portal, by requesting that such sensitive information be submitted to the issuing department only at their request.

## **BID PACKAGE CHECKLIST**

Digital forms are available in the City of Providence Purchasing Department Office or online at <http://www.providenceri.gov/purchasing/how-to-submit-a-bid/>

The bid package **MUST** include the following, in this order:

- Bid Form 1: Bidder's Blank as the cover page/ 1<sup>st</sup> page (*see page 6 of this document*)
- Bid Form 2: Certification of Bidder as 2<sup>nd</sup> page (*see page 7 of this document*)
- Bid Form 3: Certificate Regarding Public Records (*see page 8 of this document*)
- Bid Form 4: Affidavit of City Vendor (*see pages 9 and 10 of this document*)
- Forms from the Minority and Women Business Enterprise Program: Based on Bidder Category. See *forms and instructions enclosed (pages 10-11) or on:*  
<https://www.providenceri.gov/purchasing/minority-women-owned-business-mbewbe-procurement-program/>

**\*Please note: MBE/WBE forms must be completed for EVERY bid submitted and must be inclusive of ALL required signatures. Forms without all required signatures will be considered incomplete.**

- Bidder's Proposal/Packet: Formal response to the specifications outlined in this RFP, including pricing information and details related to the good(s) or service(s) being provided. Please be mindful of formatting responses as requested to ensure clarity.
- Financial Assurance, *if requested* (as indicated on page 5 of this document under "Bid Terms")

**All of the above listed documents are REQUIRED.** (With the exception of financial assurances, which are only required if specified on page 5.)

**\*\*\*Failure to meet specified deadlines, follow specific submission instructions, or enclose all required documents with all applicable signatures will result in disqualification, or in an inability to appropriately evaluate bids.**

## **NOTICE TO VENDORS**

1. The Board of Contract and Supply will make the award to the lowest qualified and responsible bidder.
2. In determining the lowest responsible bidder, cash discounts based on preferable payment terms will not be considered.
3. Where prices are the same, the Board of Contract and Supply reserves the right to award to one bidder, or to split the award.
4. No proposal will be accepted if the bid is made in collusion with any other bidder.
5. Bids may be submitted on an "equal in quality" basis. The City reserves the right to decide equality. Bidders must indicate brand or the make being offered and submit detailed specifications if other than brand requested.
6. A bidder who is an out-of-state corporation shall qualify or register to transact business in this State, in accordance with the Rhode Island Business Corporation Act, RIGL Sec. 7-1.2-1401, et seq.
7. The Board of Contract and Supply reserves the right to reject any and all bids.
8. Competing bids may be viewed in person at the Department of the City Clerk, City Hall, Providence, immediately upon the conclusion of the formal Board of Contract and Supply meeting during which the bids were unsealed/opened. Bids may also be accessed electronically on the internet via the City's [Open Meetings Portal](#).
9. As the City of Providence is exempt from the payment of Federal Excise Taxes and Rhode Island Sales Tax, prices quoted are not to include these taxes.
10. In case of error in the extension of prices quoted, the unit price will govern.
11. The contractor will **NOT** be permitted to: a) assign or underlet the contract, or b) assign either legally or equitably any monies or any claim thereto without the previous written consent of the City Purchasing Director.
12. Delivery dates must be shown in the bid. If no delivery date is specified, it will be assumed that an immediate delivery from stock will be made.
13. A certificate of insurance will normally be required of a successful vendor.
14. For many contracts involving construction, alteration and/or repair work, State law provisions concerning payment of prevailing wage rates apply ([RIGL Sec. 37-13-1 et seq.](#))
15. No goods should be delivered, or work started without a Purchase Order.
16. **Submit 2 copies of the bid to the City Clerk, unless the specification section of this document indicates otherwise.**
17. Bidder must certify that it does not unlawfully discriminate on the basis of race, color, national origin, gender, gender identity or expression, sexual orientation and/or religion in its business and hiring practices and that all of its employees are lawfully employed under all applicable federal, state and local laws, rules and regulations. (See Bid Form 2.)

## **BID TERMS**

1. Financial assurances may be required in order to be a successful bidder for Commodity or Construction and Service contracts. If either of the first two checkboxes below is checked, the specified assurance must accompany a bid, or the bid will not be considered by the Board of Contract and Supply. The third checkbox indicates the lowest responsible bidder will be contacted and required to post a bond to be awarded the contract.
  - a) ☐ A certified check for \$\_\_\_\_\_ must be deposited with the City Clerk as a guarantee that the Contract will be signed and delivered by the bidder.
  - b) ☐ A bid bond in the amount of \_\_\_\_\_ per centum (%) of the proposed total price, must be deposited with the City Clerk as a guarantee that the contract will be signed and delivered by the bidder; and the amount of such bid bond shall be retained for the use of the City as liquidated damages in case of default. Any person signing a bid bond as an attorney-in-fact shall include with the bid bond an original, or a photocopy or facsimile of an original, power of attorney.
  - c) ☐ A performance and payment bond with a satisfactory surety company will be posted by the bidder in a sum equal to one hundred per centum (100%) of the awarded contract.
  - d) ☒ No financial assurance is necessary for this item.
2. Awards will be made within **nighty (90) days of bid opening**. All bid prices will be considered firm, unless qualified otherwise. Requests for price increases will not be honored.
3. Failure to deliver within the time quoted or failure to meet specifications may result in default in accordance with the general specifications. It is agreed that deliveries and/or completion are subject to strikes, lockouts, accidents, and Acts of God.

### **The following entry applies only for COMMODITY BID TERMS:**

4. Payment for partial delivery will not be allowed except when provided for in blanket or term contracts.

### **The following entries apply only for CONSTRUCTION AND SERVICE BID TERMS:**

5. Only one shipping charge will be applied in the event of partial deliveries for blanket or term contracts.
6. Prior to commencing performance under the contract, the successful bidder shall attest to compliance with the provisions of the Rhode Island Worker's Compensation Act, [RIGL 28-29-1, et seq.](#) If exempt from compliance, the successful bidder shall submit a sworn Affidavit by a corporate officer to that effect, which shall accompany the signed contract.
7. Prior to commencing performance under the contract, the successful bidder shall, submit a certificate of insurance, in a form and in an amount satisfactory to the City.

## **BID FORM 1: Bidders Blank**

1. Bids must meet the attached specifications. Any exceptions or modifications must be noted and fully explained.
2. Bidder's responses must be in ink or typewritten, and all blanks on the bid form should be completed.
3. The price or prices proposed should be stated both in **WRITING** and in **FIGURES**, and any proposal not so stated may be rejected. **Contracts exceeding twelve months must specify annual costs for each year.**
4. Bids **SHOULD BE TOTALED** so that the final cost is clearly stated (unless submitting a unit price bid), however **each item should be priced individually**. Do not group items. Awards may be made on the basis of *total* bid or by *individual items*.
5. All bids **MUST BE SIGNED IN INK.**

**Name of Bidder (Firm or Individual):** \_\_\_\_\_

Contact Name: \_\_\_\_\_

Business Address: \_\_\_\_\_

Business Phone #: \_\_\_\_\_

Contact Email Address: \_\_\_\_\_

Agrees to bid on (Write the "Item Description" here): \_\_\_\_\_

If the bidder's company is based in a state *other than Rhode Island*, list name and contact information for a local agent for service of process that *is located within Rhode Island* \_\_\_\_\_

Delivery Date (if applicable): \_\_\_\_\_

Name of Surety Company (if applicable): \_\_\_\_\_

Total Amount in Writing\*: \_\_\_\_\_

Total Amount in Figures\*: \_\_\_\_\_

***\*If you are submitting a unit price bid, please insert "Unit Price Bid"***

***Use additional pages if necessary for additional bidding details.***

\_\_\_\_\_  
Signature of Representation

\_\_\_\_\_  
Title

**BID FORM 2: Certification of Bidder**  
(Non-Discrimination/Hiring)

Upon behalf of \_\_\_\_\_ (Firm or Individual Bidding),

I, \_\_\_\_\_ (Name of Person Making Certification),

being its \_\_\_\_\_ (Title or "Self"), hereby certify that:

1. Bidder does not unlawfully discriminate on the basis of race, color, national origin, gender, sexual orientation and/or religion in its business and hiring practices.
2. All of Bidder's employees have been hired in compliance with all applicable federal, state and local laws, rules and regulations.

I affirm by signing below that I am duly authorized on behalf of Bidder, on

this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

\_\_\_\_\_  
Signature of Representation

\_\_\_\_\_  
Printed Name

### BID FORM 3: Certificate Regarding Public Records

Upon behalf of \_\_\_\_\_ (Firm or Individual Bidding),

I, \_\_\_\_\_ (Name of Person Making Certification),

being its \_\_\_\_\_ (Title or "Self"), hereby certify an

understanding that:

1. All bids submitted in response to Requests for Proposals (RFP's) and Requests for Qualification (RFQ's), documents contained within, and the details outlined on those documents become public record upon receipt by the City Clerk's office and opening at the corresponding Board of Contract and Supply (BOCS) meeting.
2. The Purchasing Department and the issuing department for this RFP/RFQ have made a conscious effort to request that sensitive/personal information be submitted directly to the issuing department and only at request if verification of specific details is critical the evaluation of a vendor's bid.
3. The requested supplemental information may be crucial to evaluating bids. Failure to provide such details may result in disqualification, or an inability to appropriately evaluate bids.
4. If sensitive information that has not been requested is enclosed or if a bidder opts to enclose the defined supplemental information prior to the issuing department's request in the bidding packet submitted to the City Clerk, the City of Providence has no obligation to redact those details and bears no liability associated with the information becoming public record.
5. The City of Providence observes a public and transparent bidding process. Information required in the bidding packet may not be submitted directly to the issuing department at the discretion of the bidder in order to protect other information, such as pricing terms, from becoming public. Bidders who make such an attempt will be disqualified.

I affirm by signing below that I am duly authorized on behalf of Bidder, on

this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_.

\_\_\_\_\_  
Signature of Representation

\_\_\_\_\_  
Printed Name

## BID FORM 4: Affidavit of City Vendor

Per our Code of Ordinances [Sec. 21.-28.1 \(e\)](#), this form applies to a) the business, b) any political action committee whose name includes the name of the business, c) all persons holding ten (10) percent or greater equity interest or five thousand dollars (\$5,000.00) or greater cash value interest in the business at any time during the reporting period, d) all executive officers of the business entity, e) any spouse or dependent child of any individual identified in a) through d) above.

Executive officers who are not residents of the state of Rhode Island are exempted from this requirement.

Per [R.I.G.L. § 36-14-2](#), “Business” means a sole proprietorship, partnership, firm, corporation, holding company, joint stock company, receivership, trust, or any other entity recognized in law through which business for profit or not for profit is conducted.

Name of the person making this affidavit: \_\_\_\_\_

Position in the “Business” \_\_\_\_\_

Name of Entity \_\_\_\_\_

Address: \_\_\_\_\_

Phone number: \_\_\_\_\_

The number of persons or entities in your entity that are required to report under [Sec. 21.-28.1 \(e\)](#): \_\_\_\_\_

### Read the following paragraph and answer one of the options:

Within the 12 month period preceding the date of this bid submission with the City of Providence, or with respect to the contracts that are not in writing within the 12 month period preceding the date of notification that the contract has reached the \$100,000 threshold, have you made campaign contributions within a calendar year to (please list all persons or entities required under [Sec. 21.-28.1 \(e\)](#)).

a. Members of the Providence City Council? ☐ Yes ☐ No

- If Yes, please complete the following:

Recipient(s) of the Contribution:

Contribution Date(s):

Contribution Amount(s):

b. Candidates for election or reelection to the Providence City Council? ☐ Yes ☐ No

- If Yes, please complete the following:

Recipient(s) of the Contribution:

Contribution Date(s):

Contribution Amount(s):

c. The Mayor of Providence? ☐ Yes ☐ No

- If Yes, please complete the following:

Recipient(s) of the Contribution:

Contribution Date(s):

Contribution Amount(s):

d. Candidates for election or reelection to the office of Mayor of Providence? ☐ Yes ☐ No

- If Yes, please complete the following:

Recipient(s) of the Contribution:

Contribution Date(s):

Contribution Amount(s):

\_\_\_\_\_  
Signed under the pains and penalties of perjury.

\_\_\_\_\_  
Position

## MBE/WBE Participation Plan

Please complete separate forms for each MBE/WBE subcontractor/supplier to be utilized on the solicitation.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                        |                         |       |                         |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------|-------|-------------------------|------|
| Bidder's Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                        |                         |       |                         |      |
| Bidder's Address:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        |                         |       |                         |      |
| Point of Contact:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        |                         |       |                         |      |
| Telephone:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                        |                         |       |                         |      |
| Email:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                        |                         |       |                         |      |
| Procurement #:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                        |                         |       |                         |      |
| Project Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                        |                         |       |                         |      |
| Which one of the following describes your business' status in terms of Minority and/or Woman Owned Business Enterprise certification with the State of Rhode Island? (Check all that apply).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> Neither MBE nor WBE |                         |       |                         |      |
| <p>This form is intended to capture commitments between the prime contractor/vendor and MBE/WBE subcontractors and suppliers, including a description of the work to be performed and the percentage of the work as submitted to the prime contractor/vendor. Please note that all MBE/WBE subcontractors/suppliers must be certified by the Office of Diversity, Equity and Opportunity at the time of bid. The MBE/WBE Directory can be found <a href="#">here</a>. Please visit, the <a href="#">City's MBE/WBE page</a> for details of the program (e.g. instructions and requirements).</p> <ul style="list-style-type: none"> <li>• <b>Nonprofit organizations are not required to complete the rest of this form.</b></li> <li>• <b>Construction projects unable to identify subcontractors prior to bid submission (e.g. Design Build) are required to provide updates to the MBE/WBE Outreach Office</b></li> </ul> |                                                                                                        |                         |       |                         |      |
| Name of Subcontractor/Supplier:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                        |                         |       |                         |      |
| Type of RI Certification:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> Neither             |                         |       |                         |      |
| Address:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                        |                         |       |                         |      |
| Point of Contact:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        |                         |       |                         |      |
| Telephone:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                        |                         |       |                         |      |
| Email:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                        |                         |       |                         |      |
| Detailed Description of Work to Be Performed by Subcontractor or Materials to be Supplied by Supplier Per the Scope of Work provided in the RFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                        |                         |       |                         |      |
| Total Contract Value (\$):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                        | Subcontract Value (\$): |       | Participation Rate (%): |      |
| Anticipated Date of Performance:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                        |                         |       |                         |      |
| I certify under penalty of perjury that the forgoing statements are true and correct.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                        |                         |       |                         |      |
| Prime Contractor/Vendor Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        |                         | Title |                         | Date |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                        |                         |       |                         |      |
| Subcontractor/Supplier Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                        |                         | Title |                         | Date |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                        |                         |       |                         |      |

**\*If you did not meet the 20% MBE/WBE combined participation goal, submit a Waiver Request Form.**

## **MBE/WBE Waiver Request Form**

**Fill out this form only if you did not meet the 20% MBE/WBE participation goal.**

**State-certified MBE or WBE Prime Bidders are NOT REQUIRED to fill out this form.**

Submit this form to the City of Providence MBE/WBE Outreach Director, Grace Diaz, at [gdiaz@providenceri.gov](mailto:gdiaz@providenceri.gov) <https://dedi.ri.gov/divisions-units/minority-business-enterprise-compliance-office/minority-business-enterprise-mbe>, for review **prior to bid submission**. This waiver applies only to the current bid which you are submitting to the City of Providence and does not apply to other bids your company may submit in the future. **In case a waiver is needed, City Department Directors should not** recommend a bidder for an award if this form is not included, absent or is not signed by the city of Providence MBE/WBE director.

Prime Bidder: \_\_\_\_\_ Contact Email and Phone \_\_\_\_\_  
Company Name, Address: \_\_\_\_\_ Trade \_\_\_\_\_  
Project /Item Description (as seen on RFP): \_\_\_\_\_  
\_\_\_\_\_

To receive a waiver, you must list the certified MBE and/or WBE companies you contacted, the name of the primary individual with whom you interacted, and the reason the MBE/WBE company could not participate on this project.

| <b>MBE/WBE Company Name</b> | <b>Individual's Name</b> | <b>Company Name</b> | <b>Why did you choose not to work with this company?</b> |
|-----------------------------|--------------------------|---------------------|----------------------------------------------------------|
|                             |                          |                     |                                                          |
|                             |                          |                     |                                                          |
|                             |                          |                     |                                                          |
|                             |                          |                     |                                                          |
|                             |                          |                     |                                                          |

I acknowledge the City of Providence's goal of a combined MBE/WBE participation is 20% of the total bid value. I am requesting a waiver of \_\_\_\_\_ % MBE/WBE (20% minus the value of **Box F** on the Subcontractor Disclosure Form). If an opportunity is identified to subcontract any task associated with the fulfillment of this contract, a good faith effort will be made to select MBE/WBE certified businesses as partners.

\_\_\_\_\_  
Signature of Prime Contractor /  
or Duly Authorized Representative

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Date Signed

\_\_\_\_\_  
Signature of City of Providence  
MBE/WBE Outreach Director /  
or Duly Authorized Representative

\_\_\_\_\_  
Printed Name of City of Providence  
MBE/WBE Outreach Director

\_\_\_\_\_  
Date Signed

## **FOR CONSTRUCTION PROJECTS**

### **APPRENTICE REQUIREMENTS (Construction Projects Valued at \$100,000 or More).**

Attention of prospective bidders is called to the fact that this project is to be bid upon and executed under the City of Providence Code of Ordinances Chapter 21 Art. II [Section 21-28.1](#) c(1) and (2) related to utilizing apprentices in the contract. This ordinance outlines requirements for utilizing not less than 15% of total hours worked by apprentices. The City may lower this percentage only if it determines in writing that compliance is not feasible or that it would be unduly cost prohibitive to the project. The attention of prospective bidders is also called to the fact that reporting the efforts undertaken and progress towards achieving the requirements in this ordinance is a condition for payment. Compliance reporting shall be submitted with any contract payment requisition, in a format to be specified by the City. This demonstration of compliance through such reports shall be a condition of the requisition for payment to be processed. Upon the contract being awarded to the successful bidder, a mandatory meeting will be scheduled to review the project requirements relative to apprenticeship requirements and the process and protocols by which these goals will be achieved. At this meeting, specific forms and procedures for the documentation and achievement of these requirements by the successful bidder will be provided, discussed and agreed upon for the execution of the contract.

### **“FIRST SOURCE” REQUIREMENTS.**

Attention of prospective bidders is called to the fact that this project is to be bid upon and executed under the City of Providence Code of Ordinances [Chapter 21 Art. III 1/2 First Source Agreements](#) Sec. 21-91 through 21-96. This ordinance outlines requirements for hiring Providence residents to work on this project. The City may waive this requirement only upon a determination in writing that qualified residents of Providence are not available for the project, pursuant to Sec. 21-94(e). The attention of prospective bidders is called to the fact that reporting the efforts undertaken and progress towards achieving the requirements in this ordinance is a condition for payment. Compliance reporting shall be submitted with any contract payment requisition, in a format to be specified by the City. This demonstration of compliance through such reports shall be a condition of the requisition for payment to be processed. Upon the contract being awarded to the successful bidder, a mandatory meeting will be scheduled to review the project requirements relative to the First Source Agreements and the process and protocols by which these goals will be achieved. At this meeting, specific forms and procedures for the documentation and achievement of these requirements by the successful bidder will be provided, discussed, and agreed upon for the execution of the contract.

# BID PACKAGE SPECIFICATIONS

## Overview

The City of Providence is seeking proposals for the upgrade of the electrical service and distribution system for the buildings on Classical High School campus.

## Scope of Work

The scope of work for the Campus Electrical Upgrades at Classical High School is as indicated in the construction documents:

### Drawings

|              |                                                |
|--------------|------------------------------------------------|
| <b>G-000</b> | <b>COVER SHEET</b>                             |
| <b>E-000</b> | <b>ELECTRICAL COVER SHEET</b>                  |
| <b>E-101</b> | <b>ELECTRICAL SITE PLAN</b>                    |
| <b>E-102</b> | <b>ENLARGED ELECTRICAL FLOOR PLANS</b>         |
| <b>E-501</b> | <b>ELECTRICAL DETAILS</b>                      |
| <b>E-502</b> | <b>ELECTRICAL DETAILS</b>                      |
| <b>E-601</b> | <b>ELECTRICAL SINGLE LINE DIAGRAM - BLDG 1</b> |
| <b>E-602</b> | <b>ELECTRICAL SINGLE LINE DIAGRAM - BLDG 2</b> |

### Specifications

See attached Table of Contents.

## SUPPLEMENTAL INFORMATION

If the issuing department for this RFP determines that your firm's bid is best suited to accommodate their need, you will be asked to provide proof of the following prior to formalizing an award.

An inability to provide the outlined items at the request of the department may lead to the disqualification of your bid.

*This information is **NOT** requested to be provided in your initial bid that you will submit to the City Clerk's office by the "date to be opened" noted on page 1. This list only serves as a list of items that your firm should be ready to provide on request.*

**All bids submitted to the City Clerk become public record.** Failure to follow instructions could result in information considered private being posted to the city's Open Meetings Portal and made available as a public record.

**You must be able to provide:**

- Business Tax ID will be requested after an award is approved by the Board of Contract and Supply.
- Proof of Insurance.
- Certificate of Good Standing with the Rhode Island Secretary of State.



**BOARD OF CONTRACT AND SUPPLY  
CITY OF PROVIDENCE, RHODE ISLAND**

**CITY OF PROVIDENCE STANDARD TERMS & CONDITIONS**

1. The terms “you” and “your” contained herein refer to the person or entity that is a party to the agreement with the City of Providence (“the City”) and to such person’s or entity’s employees, officers, and agents.
2. The Request For Proposals (“RFP”) and these Standard Terms and Conditions together constitute the entire agreement of the parties (“the Agreement”) with regard to any and all matters. By your submission of a bid proposal or response to the City’s RFP, you accept these Standard Terms & Conditions and agree that they supersede any conflicting provisions provided by bid or in any terms and conditions contained or linked within a bid and/or response. Changes in the terms and conditions of the Agreement, or the scope of work thereunder, may only be made by a writing signed by the parties.
3. You are an independent contractor and in no way does this Agreement render you an employee or agent of the City or entitle you to fringe benefits, workers’ compensation, pension obligations, retirement or any other employment benefits. The City shall not deduct federal or state income taxes, social security or Medicare withholdings, or any other taxes required to be deducted by an employer, and this is your responsibility to yourself and your employees and agents.
4. You shall not assign your rights and obligations under this Agreement without the prior written consent of the City. Any assignment without prior written consent of the City shall be voidable at the election of the City. The City retains the right to refuse any and all assignments in the City’s sole and absolute discretion.
5. Invoices submitted to the City shall be payable sixty (60) days from the time of receipt by the City. Invoices shall include support documentation necessary to evidence completion of the work being invoiced. The City may request any other reasonable documentation in support of an invoice. The time for payment shall not commence, and invoices shall not be processed for payment, until you provide reasonably sufficient support documentation. In no circumstances shall the City be obligated to pay or shall you be entitled to receive interest on any overdue invoice or payment. In no circumstances shall the City be obligated to pay any costs associated with your collection of an outstanding invoice.
6. For contracts involving construction, alteration, and/or repair work, the provisions of applicable state labor law concerning payment of prevailing wage rates (R.I. Gen. Laws §§ 37-13-1 et seq., as amended) and the City’s First Source Ordinance (Providence Code of Ordinances §§ 21-91 et seq., as amended) apply.
7. With regard to any issues, claims, or controversies that may arise under this Agreement, the City shall not be required to submit to dispute resolution or mandatory/binding arbitration. Nothing prevents the parties from mutually agreeing to settle any disputes using mediation or non-binding arbitration.
8. To the fullest extent permitted by law, you shall indemnify, defend, and hold harmless the City, its employees, officers, agents, and assigns from and against any and all claims, damages, losses, allegations, demands, actions, causes of action, suits, obligations, fines, penalties, judgments, liabilities, costs and expenses, including but not limited to attorneys’ fees, of any nature whatsoever arising out of, in connection with, or resulting from the performance of the work provided in the Agreement.
9. You shall maintain throughout the term of this Agreement the insurance coverage that is required by the RFP or, if none is required in the RFP, insurance coverage that is considered in your industry to be commercially reasonable, and you agree to name the City as an additional insured on your general liability policy and on any umbrella policy you carry.
10. The City shall not subject itself to any contractual limitations on liability. The City shall have the time permitted within the applicable statute of limitations, and no less, to bring or assert any and all causes of action, suits, claims or demands the City may have arising out of, in connection with, or resulting from the performance of the work provided in the Agreement, and in no event does the City agree to limit your liability to the price of the Agreement or any other monetary limit.
11. The City may terminate this Agreement upon five (5) days’ written notice to you if you fail to observe any of the terms and conditions of this Agreement, or if the City believes your ability to perform the



**BOARD OF CONTRACT AND SUPPLY**  
**CITY OF PROVIDENCE, RHODE ISLAND**

terms and conditions of this Agreement has been materially impaired in any way, including but in no way limited to loss of insurance coverage, lapsing of a surety bond, if required, declaration of bankruptcy, or appointment of a receiver. In the event of termination by the City, you shall be entitled to just and equitable compensation for any satisfactory work completed and expenses incurred up to the date of termination.

12. Written notice hereunder shall be deemed to have been duly served if delivered in person to the individual or member of the firm or entity or to an officer of the entity for whom it was intended, or if delivered at or sent by registered or certified mail to the last business address known by the party providing notice.
13. In no event shall the Agreement automatically renew or be extended without a writing signed by the parties.
14. You agree that products produced or resulting from the performance of the Agreement are the sole property of the City and may not be used by you without the express written permission of the City.
15. For any Agreement involving the sharing or exchange of data involving potentially confidential and/or personal information, you shall comply with any and all state and/or federal laws or regulations applicable to confidential and/or personal information you receive from the City, including but not limited to the Rhode Island Identity Theft Protection Act, R.I. Gen. Laws § 11-49.3-1, during the term of the Agreement. You shall implement and maintain appropriate physical, technical, and administrative security measures for the protection of, and to prevent access to, use, or disclosure of, confidential and/or personal information. In the event of a breach of such information, you shall notify the City of such breach immediately, but in no event later than twenty-four (24) hours after discovery of such breach.
16. The Agreement is governed by the laws of the State of Rhode Island. You expressly submit yourself to and agree that any and all actions arising out of, in connection with, or resulting from the performance of the Agreement or relationship between the parties shall occur solely in the venue and jurisdiction of the State of Rhode Island or the federal court located in Rhode Island.
17. The failure of the City to require performance of any provision shall not affect the City's right to

require performance at any time thereafter, nor shall a waiver of any breach or default of this Agreement constitute a waiver of any subsequent breach or default or a waiver of the provision itself.

18. If any term or provision of this Agreement, or the application thereof to any person or circumstance shall, in any extent, be invalid or unenforceable, the remainder of this Agreement shall not be affected thereby, and each term and provision shall be valid and enforceable to the fullest extent permitted by law.



# **PROVIDENCE PUBLIC SCHOOL DEPARTMENT**

## **Classical High School Electrical Improvements**

770 Westminster St,  
Providence, RI 02903

August 13, 2026

Prepared By  
StudioJAED  
Phone # (401) 648-0884  
[www.studiojaed.com](http://www.studiojaed.com)

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**SECTION 01 10 00  
SUMMARY**

**PART 1 GENERAL**

**1.01 PROJECT**

- A. Project Name: Classical HS Electrical Service Upgrades.
- B. Owner's Name: The City of Providence- Providence Public School Department.
- C. Architect / Engineer's Name: StudioJAED
- D. The Project consists of the distribution and expansion of existing and new power distribution.

**1.02 CONTRACT DESCRIPTION**

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Division 00. This work will be undertaken simultaneously with work in the same area under separate contract. Contractors are required to coordinate all work for scheduling and common areas of overlapping production.

**1.03 GENERAL SCOPE OF WORK DESCRIPTION**

**1.04 DESCRIPTION OF ALTERATIONS WORK**

- A. Scope of alterations work is shown on drawings.
- B. Renovate the following systems, complete all work including electrical work:
  - 1. Provide and install new electrical equipment including but not limited to the new generator transfer switch electrical boxes panelboards breakers and all interconnecting conduit and cabling necessary to completely install the new transformer.

**1.05 OWNER OCCUPANCY**

- A. Owner intends to continue to occupy portions of the existing building during the entire construction period.
- B. Cooperate with Owner and RIEnergy to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner's occupancy.

**1.06 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to the building premises.
  - 1. Construction Hours shall be 8:00 AM – 4:30 PM, Monday through Friday. Alternative hours will only be considered on a special-need basis.
  - 2. Construction will be phased to allow one (1) main entrance to be open at all times with an auxiliary emergency exit in place at all times.
- B. This project will require electrical shutdowns, domestic water shutdowns, and natural gas shutdowns to facilitate the installation of the new equipment. The work must be coordinated with the Owner's schedule and other work at the site, which may include work during off-hours.
- C. Provide access to and from site as required by law and by Owner:
  - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
  - 3. Adhere to RIEnergy's guidelines regarding entrance and egress to the site as identified during the pre-bid meeting.
- D. Utility Outages and Shutdown:
  - 1. Coordinate any interruption and/or shutdown of utilities with RIEnergy and the State of Rhode Island at least 7 days in advance of the anticipated interruption and/or shutdown. Limit any interruptions/shutdowns to the absolute minimum amount of time.
  - 2. RIEnergy reserves the right to reschedule construction shutdowns with minimal warning to the contractor as required to respond to emergencies.

## **1.07 GENERAL STANDARDS**

### **A. Electrical Systems**

1. Prior to submitting bid, the contractor shall visit the site and be thoroughly familiar with the existing conditions and proposed construction. Contractor shall include in their bid all material, labor, and all incidentals for a complete installation whether specifically indicated or not. All errors, discrepancies and missed items shall be brought to the attention of the engineer during the bidding process by the contractor. These items shall be included in the bid price. No extra cost will be allowed for any discrepancy which could have been noticed at the site visit by the contractor.
2. Perform work as required by applicable codes, regulations, and laws of local, state, and federal governments and other authorities with lawful jurisdiction. All work shall be in accordance with the latest edition of the national electric code.
3. Material and equipment shall be UL, NEMA, ANSI, IEEE, ADA & CMB approved for intended purpose. Material and installation shall meet requirements of national and local electrical code.
4. Provide all labor, materials, tools, equipment, coordination, additional design and all incidentals necessary to provide a complete and operable system as detailed on plans to the satisfaction of the engineer and the owner. Coordinate all work with the engineer before the start of work.
5. Prior to submitting bid, the contractor shall visit the site and be thoroughly familiar with the existing conditions and proposed construction. Contractor shall include in their bid all material, labor, and all incidentals for a complete installation whether specifically indicated or not. All errors, discrepancies and missed items shall be brought to the attention of the engineer during the bidding process by the contractor. These items shall be included in the bid price. No extra cost will be allowed for any discrepancy which could have been noticed at the site visit by the contractor.
6. Perform work as required by applicable codes, regulations, and laws of local, state, and federal governments and other authorities with lawful jurisdiction. All work shall be in accordance with the latest edition of the national electric code.
7. Material and equipment shall be ul, nema, ansi, ieee, ada & cmb approved for intended purpose. Material and installation shall meet requirements of national and local electrical code.
8. Give notices, file plans, obtain permits, and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction.
9. Maintain record drawings on site. Record set must be complete and current and available for inspection when requisitions for payment are submitted.
10. Guarantee work in writing per specifications, repair or replace defective materials or installation at no cost to owner during the guarantee period. Correct damage caused in making necessary repairs and replacements under guarantee at no cost to owner. Submit guarantee to owner before final payment.
11. Coordinate all electrical items with existing field conditions. Locations shown are approximate and may require minor adjustment in the field to satisfy the design intent.
12. Damage to existing facilities and equipment shall be repaired or replaced immediately by the contractor at no additional expense to the owner.
13. The locations on these plans are approximate and require coordination with all other trades and verification of existing conditions. Routing of conduit is diagrammatic in nature and not intended to show all required offsets and details. The contractor is responsible for field verification of all existing associated equipment and conditions. Coordinate the location of all equipment with the engineer and the owner. Contractor is responsible for obtaining all other trade's drawings and specifications and coordinating with all other trades during bidding and construction.
14. Contractor shall be responsible for maintaining continuity of all power, control, fire alarm, security systems, and communications functions to all areas affected by demolition and/or new construction.

15. Repair and patch any disturbed areas to match adjacent construction.
16. Disconnect and make safe any equipment to be removed by others. Coordinate removal of equipment with other trades prior to demolition.
17. In any area requiring the performance of any trade's work, this contractor shall carefully remove and store any or all electrical items in path of work, reinstalling, and reconnecting same as required, in accordance with the plans and/or as directed after completion of other trade's work in that area.
18. Prior to the start of demolition, contractor shall field verify all branch circuits and maintain those circuits that extend outside the scope of work.
19. After renovating existing electrical work, the contractor shall ensure that all remaining and new equipment will operate properly, including but not limited to backfeeding of existing power and lighting circuits. Refer to single line diagram.
20. All electrical work indicated to remain shall be suitably protected to prevent any damage.
21. Where electrical systems pass through renovated areas to serve other portions of the premises, systems shall be suitably protected to prevent damage or relocated and the systems restored to normal operation. Any outages in systems shall be coordinated with owner. Restore power to existing to remain equipment if interrupted by demolished circuits in the area.
22. Contractor shall submit for review, shop drawings for all equipment and materials used on the project. Submittals shall be reviewed by the engineer before purchase of materials.
23. All wiring shall be copper, 600v, 75°/90° rated, flame-retardent, heat and moisture resistant.
24. Permanently label all new electrical equipment, including but not limited to, device designation and supply circuit designation. Update or replace panel directories to include new circuit information resulting from this project.
25. Provide temporary power and lighting for all trades as required to complete the project. All temporary and interim equipment shall be installed in accordance with all applicable codes and standards including, but not limited to NFPA 110 and NFPA 70.
26. Refer to specifications for additional information that is not shown on the drawings.
27. Openings in existing concrete walls and floors required for conduit installation shall be core drilled. Maximum core drill size shall be 5" in diameter. Core drill locations shall be spaced a minimum of 6" from each other measured from the outside edge of the core drill. All core drill openings shall be properly sealed according to their location and application.
28. All outages shall be kept to a minimum. All work that requires a sustained equipment outage shall be performed continuously around the clock until work is completed unless noted otherwise. Coordinate outages with owner representative.
29. Provide for each branch circuit and feeder circuit a dedicated equipment ground wire. For single phase branch circuits of 120 v/1ph or 277v/1 phase, provide dedicated hot, dedicated neutral and dedicated equipment ground wires. Sharing of neutral or equipment ground wires is not permitted. Wiring to all HVAC equipment or other trade equipment shall be in conduit. All equipment and feeder wiring in boiler room/electrical room shall be in rigid conduit. Use of mc cable is limited to branch circuit wiring above recessed ceiling or concealed in wall. Wiring to outlets on table shall be provide in either EMT conduit or flexible metal conduit.
30. Provide identification labels for all branch circuits and feeders circuits at junction boxes, panelboards, troughs, and splice boxes.
31. Provide unspliced feeders from panelboard or switchboard to all equipment. Splicing is permitted for single phase circuits for lighting and outlets only.
32. All wiring devices located in the basement are to be surface mounted with circuit wiring routed in surface mounted conduit per specifications. All other wiring devices shall be recessed unless noted otherwise.
33. Electrical contractor shall provide and install (2) #14-3/4" from each vendor supplied duct smoke detector to FACP. Installation of detector by mechanical contractor. Electrical contractor shall provide all necessary electrical terminations. Each unit over 2000 CFM

- shall have one (1) smoke detector. In a multi-story building, each riser over 15,000 CFM shall include one smoke detector per floor in the riser.
34. All exposed wiring and cabling to be routed on existing walls or exterior walls shall be installed in surface mounted raceway, series 2400, manufactured by wiremold/legrand with dual channel configuration where necessary to facilitate installation of standard voltage and low voltage wiring and cabling.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 20 00  
PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Price and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

**1.02 SCHEDULE OF VALUES**

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- E. Revise schedule to list approved Change Orders, with each Application For Payment.

**1.03 APPLICATIONS FOR PROGRESS PAYMENTS**

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
  - 1. Item Number.
  - 2. Description of work.
  - 3. Scheduled Values.
  - 4. Previous Applications.
  - 5. Work in Place and Stored Materials under this Application.
  - 6. Authorized Change Orders.
  - 7. Total Completed and Stored to Date of Application.
  - 8. Percentage of Completion.
  - 9. Balance to Finish.
  - 10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one copy of each Application for Payment electronically.
- J. Include the following with the application:
  - 1. Transmittal letter as specified for submittals in Section 01 30 00.
  - 2. Construction progress schedule, revised and current as specified in Section 01 30 00.
  - 3. Current construction photographs specified in Section 01 30 00.
  - 4. Partial release of liens from major subcontractors and vendors.

5. Affidavits attesting to off-site stored products.

- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

#### **1.04 MODIFICATION PROCEDURES**

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
  2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 5 days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 60 00.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
  2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
  3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
  4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
1. On request, provide the following data:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance, and bonds.
    - c. Overhead and profit.
    - d. Justification for any change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
  2. Support each claim for additional costs with additional information:
    - a. Origin and date of claim.
    - b. Dates and times work was performed, and by whom.
    - c. Time records and wage rates paid.
    - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
  3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

#### **1.05 APPLICATION FOR FINAL PAYMENT**

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
  - 1. All closeout procedures specified in Section 01 70 00.

#### **1.06 INITIAL PROGRESS PAYMENT PROCEDURES**

- A. The following items must be complete and submitted to the owner prior to acceptance and/or payment of the initial application for payment:
  - 1. Approved Schedule of Values
  - 2. Complete listing of Subcontractors
  - 3. Contractors Safety Plan
  - 4. Emergency Action Plan and Emergency Contacts
  - 5. Contractors Certificate of Insurance
  - 6. Contractors Submittal Schedule
  - 7. Approved Contractor's Construction Schedule (Preliminary if not final)

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 25 00  
SUBSTITUTION PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

**1.02 RELATED REQUIREMENTS**

- A. Requests for substitution must be made ten days prior to bid. Requests for substitution made after the bid may be considered by the Owner/Architect at their discretion and only under extraordinary conditions that could not be determined during the bidding period.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.03 SUMMARY**

- A. This Section includes administrative and procedural requirements for handling requests for substitutions.
- B. Related Sections: The following Divisions contain requirements that relate to this Section:
  - 1. Division 01 specifies that applicability of industry standards to products specified.
  - 2. Division 01 specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.
  - 3. Division 01 specifies requirements governing the Contractor's selection of products and product options.

**1.04 DEFINITIONS**

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor. The following are not considered to be requests for substitutions:
  - 1. Revisions to the Contract Documents requested by the Owner or Architect.
  - 2. Specified options of products and construction methods included in the Contract Documents.
  - 3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

**1.05 SUBMITTALS**

- A. Substitution Request Submittal: Substitution requests will only be considered during the bidding period. Substitutions will not be considered after the bids are accepted.
  - 1. Submit three copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change order proposals and utilizing the CSI Substitution Request Form 13.1A. The contractor is solely responsible for obtaining the required forms to submit before the stated time period expires.
  - 2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
  - 3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
    - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.
    - b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

- c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
  - d. Samples, where applicable or requested.
  - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
  - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
  - g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
  - h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within two weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later.
  - a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

## **PART 2 PRODUCTS**

### **2.01 SUBSTITUTIONS**

- A. Conditions: The Architect will receive and consider the Contractor's request for substitution when the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
  1. Revisions to the Contract Documents are not required.
  2. Proposed changes are in keeping with the general intent of the Contract Documents.
  3. The request is timely, fully documented, and properly submitted.
  4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
  5. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
  6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
  7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
  8. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
- B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

## **PART 3 EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  2. Agrees to provide the same warranty for the substitution as for the specified product.
  3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
  4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  5. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. Contractor's Substitution Request documentation must include the following:
    - a. Project Information:
      - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
      - 2) Owner's, Architect's, and Contractor's names.
    - b. Substitution Request Information:
      - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
      - 2) Indication of whether the substitution is for cause or convenience.
      - 3) Issue date.
      - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
      - 5) Description of Substitution.
      - 6) Reason why the specified item cannot be provided.
      - 7) Differences between proposed substitution and specified item.
      - 8) Description of how proposed substitution affects other parts of work.
    - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
      - 1) Physical characteristics.
      - 2) In-service performance.
      - 3) Expected durability.
      - 4) Visual effect.
      - 5) Sustainable design features.
      - 6) Warranties.
      - 7) Other salient features and requirements.
      - 8) Include, as appropriate or requested, the following types of documentation for proposed substitution and for specified product in order to expedite review:
        - (a) Product Data:
        - (b) Samples.
        - (c) Certificates, test, reports or similar qualification data.
        - (d) Drawings, when required to show impact on adjacent construction elements.
    - d. Impact of Substitution:
      - 1) Savings to Owner for accepting substitution.
      - 2) Change to Contract Time due to accepting substitution.
- D. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

### **3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT**

- A. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

### **3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Under extra-ordinary conditions, submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- B. Substitutions will not be considered under one or more of the following circumstances:
  - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  - 2. Without a separate written request.
  - 3. When acceptance will require revisions to Contract Documents.

### **3.04 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

**END OF SECTION**

**SECTION 01 30 00  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Progress photographs.
- G. Submittals for review, information, and project closeout.
- H. Number of copies of submittals.
- I. Requests for Interpretation (RFI) procedures.
- J. Submittal procedures.

**1.02 GENERAL ADMINISTRATIVE REQUIREMENTS**

- A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
  - 1. Requests for Interpretation (RFI).
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.
  - 9. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 10. Closeout submittals.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRECONSTRUCTION MEETING**

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.
  - 3. Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
  - 5. Submission of initial Submittal schedule.
  - 6. Designation of personnel representing the parties to ContractOMB and .
  - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

8. Scheduling.

- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

**3.02 SITE MOBILIZATION MEETING**

- A. Owner will schedule a meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Architect.
  - 4. Contractor's Superintendent.
  - 5. Contractor's Project Manager.
  - 6. Major Subcontractors.
- C. Agenda:
  - 1. Use of premises by Owner and Contractor.
  - 2. Owner's requirements and occupancy prior to completion.
  - 3. Construction facilities and controls provided by Contractor and Owner.
  - 4. Temporary utilities provided by Owner.
  - 5. Security and housekeeping procedures.
  - 6. Schedules.
  - 7. Application for payment procedures.
  - 8. Procedures for maintaining record documents.
  - 9. Requirements for start-up of equipment.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

**3.03 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
- B. Attendance Required: Owner, Architect, and Contractor.
- C. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of Work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems that impede, or will impede, planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of RFIs log and status of responses.
  - 7. Review of off-site fabrication and delivery schedules.
  - 8. Maintenance of progress schedule.
  - 9. Corrective measures to regain projected schedules.
  - 10. Planned progress during succeeding work period.
  - 11. Coordination of projected progress.
  - 12. Maintenance of quality and work standards.
  - 13. Effect of proposed changes on progress schedule and coordination.
  - 14. Other business relating to Work.
  - 15. Provide three week look ahead.

**3.04 CONSTRUCTION PROGRESS SCHEDULE**

- A. Within 5 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 5 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

### **3.05 PROGRESS PHOTOGRAPHS**

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- D. Views:
  - 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
  - 2. Consult with Architect for instructions on views required.
  - 3. Provide factual presentation.
  - 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- E. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
  - 1. Delivery Medium: Via email.
  - 2. File Naming: Include project identification, date and time of view, and view identification.
  - 3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

### **3.06 REQUESTS FOR INTERPRETATION (RFI)**

- A. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
  - 1. Prepare a separate RFI for each specific item.
    - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    - b. Do not forward requests which solely require internal coordination between subcontractors.
  - 2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
  - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
  - 2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
  - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
  - 2. Owner's, Architect's, and Contractor's names.
  - 3. Discrete and consecutive RFI number, and descriptive subject/title.

4. Issue date, and requested reply date.
  5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
  6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
  7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  2. Note dates of when each request is made, and when a response is received.
  3. Highlight items requiring priority or expedited response.
- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
  2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
  3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
  4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

### **3.07 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Coordinate with Contractor's construction schedule and schedule of values.
  2. Format schedule to allow tracking of status of submittals throughout duration of construction.
  3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
  4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

### **3.08 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
1. Product data.

2. Shop drawings.
  3. Samples for selection.
  4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

### **3.09 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
  2. Certificates.
  3. Test reports.
  4. Inspection reports.
  5. Manufacturer's instructions.
  6. Manufacturer's field reports.
  7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

### **3.10 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
  2. Operation and maintenance data.
  3. Warranties.
  4. Bonds.
  5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

### **3.11 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Extra Copies at Project Closeout: See Section 01 78 00.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
  2. Retained samples will not be returned to Contractor unless specifically so stated.

### **3.12 SUBMITTAL PROCEDURES**

- A. General Requirements:
1. Use a single transmittal for related items.
  2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
  3. Preface each submittal with the appropriate specification section number and follow with a sequential identifying number. For revised submittals use original number and append a sequential numerical revision number.
  4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    - a. Submittals from sources other than the Contractor, or without Contractor's stamp will be returned without review.
  6. Schedule submittals to expedite the Project, and coordinate submission of related items.
    - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
    - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
  7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
  8. Provide space for Contractor and Architect review stamps.
  9. When revised for resubmission, identify all changes made since previous submission.
  10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
  11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
  12. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
  2. Collect required information into a single submittal.
  3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
  2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
  2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

**END OF SECTION**

**SECTION 01 31 00  
PROJECT MANAGEMENT AND COORDINATION**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes administrative provisions for coordinating construction operations on the project including, but not limited to, the following:
  - 1. General project coordination procedures.
  - 2. Coordination Drawings.
  - 3. Administrative and supervisory personnel.
  - 4. Project meetings.
- B. Related Sections
  - 1. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.
- C. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

**1.03 DEFINITIONS**

- A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

**1.04 COORDINATION**

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for the Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of the Contractor's Construction Schedule.
  - 2. Preparation of the Schedule of Values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Pre-installation conferences.
  - 7. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

### **1.05 REQUESTS FOR INFORMATION (RFIS)**

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
  - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name
  - 2. Project number
  - 3. Date
  - 4. Name of Contractor
  - 5. Name of Architect
  - 6. RFI number, numbered sequentially
  - 7. RFI subject
  - 8. Specification Section number and title and related paragraphs, as appropriate
  - 9. Drawing number and detail references, as appropriate
  - 10. Field dimensions and conditions, as appropriate
  - 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI
  - 12. Contractor's signature
  - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within [10] ten days of receipt of the RFI response
- C. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly.

### **1.06 SUBMITTALS**

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
  - 1. Indicate relationship of components shown on separate Shop Drawings.
  - 2. Indicate required installation sequences.
  - 3. Refer to Division 15 Section "Basic Mechanical Materials and Methods" and Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.
- B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at the Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to the Project.
  - 2. Post copies of list in the Project meeting room, in temporary field office, and by each temporary telephone.

### 1.07 PROJECT MEETINGS

- A. General: Meetings shall be schedule by the Owner and shall be conducted at the Project site, unless otherwise indicated.
  - 1. Attendees: Architect shall inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
  - 2. Agenda: Contractor shall prepare the meeting agenda and distribute the agenda to all invited attendees.
  - 3. Minutes: Contractor shall record significant discussions and agreements achieved and distribute the meeting minutes to everyone concerned within 5 days of the meeting.
- B. Preconstruction Conference: Owner shall schedule a preconstruction conference before starting Construction. Conference shall be held at the conference at the Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
  - 1. Attendees: Authorized representatives of the Owner, the Architect and their consultants, the Contractor and its superintendent, and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule
    - b. Phasing
    - c. Critical work sequencing
    - d. Designation of responsible personnel
    - e. Procedures for processing field decisions and Change Orders
    - f. Procedures for processing Applications for Payment
    - g. Distribution of the Contract Documents
    - h. Submittal procedures
    - i. Preparation of Record Documents
    - j. Use of the premises
    - k. Responsibility for temporary facilities and controls
    - l. Parking availability
    - m. Office, work, and storage areas
    - n. Equipment deliveries and priorities
    - o. First aid
    - p. Security
    - q. Progress cleaning
    - r. Working hours
- C. Progress Meetings: Owner shall schedule the Progress Meetings at bi-weekly intervals.
  - 1. Agenda:
    - a. Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project.
    - b. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to the Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Contractor shall issue a three-week look ahead schedule in advance of each Progress Meeting.
      - 2) Contractor shall revised the Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. At a minimum, the updated Construction Schedule shall be issued with each Application for Payment.
    - c. Review present and future needs of each entity present, including the following:

- 1) Interface requirements
  - 2) Sequence of operations
  - 3) Status of submittals
  - 4) Deliveries
  - 5) Off-site fabrication
  - 6) Access
  - 7) Site utilization
  - 8) Temporary facilities and controls
  - 9) Work hours
  - 10) Hazards and risks
  - 11) Progress cleaning
  - 12) Quality and work standard
  - 13) Change Orders
  - 14) Documentation of information for payment requests
2. Reporting: Contractor to record minutes and distribute copies within five days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 32 00  
CONSTRUCTION PROGRESS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Preliminary Construction Schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Submittals Schedule.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Field condition reports.
  - 7. Preconstruction Photographs
  - 8. Construction photographs.
- B. Related Sections include the following:
  - 1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
  - 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
  - 3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
  - 4. Division 01 Section "Closeout Procedures" for submitting construction photographs as Project Record Documents at Project closeout.

**1.03 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
  - 2. Predecessor activity is an activity that must be completed before a given activity can be started.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Major Area: A story of construction, a separate building, or a similar significant construction element.
- G. Milestone: A key or critical point in time for reference or measurement.

- H. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- I. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

#### 1.04 SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article and in-house scheduling personnel to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
  - 1. Scheduled date for first submittal.
  - 2. Specification Section number and title.
  - 3. Submittal category (action or informational).
  - 4. Name of subcontractor.
  - 5. Description of the Work covered.
- C. Contractor's Construction Schedule: Submit three printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.
- D. CPM Reports: Concurrent with CPM schedule, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.
  - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  - 3. Total Float Report: List of all activities sorted in ascending order of total float.
- E. Photographic Documentation:
  - 1. Preconstruction Photographs: Before commencement of demolition, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
  - 2. Periodic Construction Photographs: Take 12, color, digital photographs monthly with timing each month adjust to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
    - a. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
    - b. Format: 4-by-6-inch (101-by-152-mm) smooth-surface matte prints on single weight commercial grade stock.
    - c. Identification: On back of each print, provide an applied label or rubber stamped impression with the following information:
      - 1) Name of project
      - 2) Name and address of photographer
      - 3) Name of Architect
      - 4) Name of Contractor
      - 5) Date photograph was taken
      - 6) Description of vantage point, indicating location, direction (by compass point) and elevation or story of construction.
    - d. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

- e. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.
- f. Daily Construction Reports: Submit two copies at weekly intervals.
- g. Material Location Reports: Submit two copies at weekly intervals.
- h. Field Condition Reports: Submit two copies at weekly intervals.

## **1.05 QUALITY ASSURANCE**

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting.

## **1.06 COORDINATION**

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from parties involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## **PART 2 - PRODUCTS**

### **2.01 SUBMITTALS SCHEDULE**

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
  - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
  - 2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

### **2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)**

- A. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.
  - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 15 days after date established for the Notice to Proceed..
  - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 3. Use "one workday" as the unit of time.
- B. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals
    - b. Mobilization and demobilization
    - c. Purchase of materials
    - d. Delivery
    - e. Fabrication
    - f. Utility interruptions
    - g. Installation
    - h. Work by Owner that may affect or be affected by Contractor's activities

- i. Testing
2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
  - a. Subnetworks on separate sheets are permissible for activities clearly off the critical
  - b. path.
- C. Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting. Include the following:
  1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time
    - a. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

## **2.03 REPORTS**

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. High and low temperatures and general weather conditions.
  5. Accidents.
  6. Meetings and significant decisions.
  7. Unusual events (refer to special reports).
  8. Stoppages, delays, shortages, and losses.
  9. Meter readings and similar recordings.
  10. Emergency procedures.
  11. Orders and requests of authorities having jurisdiction.
  12. Change Orders received and implemented.
  13. Construction Change Directives received.
  14. Services connected and disconnected.
  15. Equipment or system tests and startups.
  16. Partial Completions and occupancies.
  17. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## **PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 33 00  
SUBMITTAL PROCEDURES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
  - 1. Process designated submittals for the Project electronically through designated email system.

**1.03 DEFINITIONS**

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.
- D. Email System: A method to transmit certain electronic submittals between the Contractor, Architect, and Owner, via email.
  - 1. For consistency, the standard file format will be PDF. Convert paper originals and other file formats to PDF prior to submission.
  - 2. In the event of system malfunction, submittals shall be processed in accordance with the Architect's instructions, until the system malfunction has been corrected.
  - 3. For this Project, process the following submittal types through the designated email system:
    - a. Product Data.
    - b. Shop Drawings.
    - c. Product Schedules.
    - d. Qualification Data.
    - e. Certificates (Welding, Installer, Manufacturer, Product, and Material, as applicable).
    - f. Test Reports (Material, Product, Preconstruction, Compatibility, and Field, as applicable).
    - g. Research Reports.
    - h. Warranty (sample).
    - i. Design Data, including calculations.
    - j. Coordination Drawings.
    - k. Delegated-Design Services Certifications.
  - 4. For Samples, provide electronic submittal of Sample cover sheet, identifying location and actual delivery date of Samples. Deliver Samples to location (Architect's office, Project site, etc.) as directed by the Architect.
    - a. Architect will identify delivery location(s) after receipt and review of Contractor's Submittal Schedule.

**1.04 SUBMITTAL SCHEDULE**

- A. Submittal Schedule: Submit a schedule of submittals indicating scheduled date for each submission. Factor time required for review, ordering, manufacturing, fabrication, and delivery

when establishing submission dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Submit concurrently with the first complete submittal of Contractor's construction schedule.
2. Format: Arrange the following information in a tabular format:
  - a. Specification Section number and title.
  - b. A/E Number.
    - 1) Architect will furnish Contractor with unique "A/E Number" designation for each required submittal.
  - c. Submittal category: Action; informal.
  - d. Submittal type: Product Data, Shop Drawings, Samples, etc.
  - e. Description of the Work covered.
  - f. Scheduled date for first submittal.

#### **1.05 COLOR SCHEDULE**

- A. Color Schedule: Within 30 days after date of Notice of Award, submit a complete list of proposed manufacturers and complete product designations (i.e. model, grade, series, product line, etc.) for each item requiring color selection by Architect.

#### **1.06 SUBMITTAL ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Where indicated, submit all submittal items required for each Specification Section concurrently.
  3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow sufficient time for submittal review, including time for resubmittals. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
- C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  1. Include a cover sheet on each submittal item for identification. Do not combine different submittals under same cover sheet; only one submittal is to be provided per email.
    - a. Cover Sheet: Use PDF version of sample form included in Project Manual. Complete each item on form, sign and date. Architect will furnish PDF version of sample form.
  2. Name submittal file as directed by Architect.
  3. Transmit each submittal via email using subject line as directed by Architect.
  4. Send submittal to designated Project-specific email address:
    - a. Use the following email address: [zigmondb@studiojaed.com](mailto:zigmondb@studiojaed.com).
- D. Resubmittals: Make resubmittals in same form and, for non-electronic submittals, in the same number of copies as initial submittal.
  1. Note date and content of revision in label or title block and clearly indicate extent of revision.
  2. Resubmit submittals until they are marked with approval notation from Architect.
  3. Refer to Supplementary Conditions for provisions allowing Owner to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of certain resubmittals.

- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect.

## **PART 2 - PRODUCTS**

### **2.01 SUBMITTAL PROCEDURES, GENERAL**

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

### **2.02 ELECTRONIC SUBMITTAL PROCEDURES**

- A. Use the designated email system for submittals in this Article.
  - 1. Submit electronic submittals via email as PDF electronic files.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. Mark submittal to show which products and options are applicable.
  - 2. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Statement of compliance with specified referenced standards.
    - c. Testing by recognized testing agency.
  - 3. For equipment, include the following in addition to the above, as applicable:
    - a. Printed performance curves.
    - b. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of dimensions established by field measurement.
    - e. Relationship and attachment to adjoining construction clearly indicated.
    - f. Seal and signature of professional engineer if specified.
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- E. Certificates:
  - 1. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
  - 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  - 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

4. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
5. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- F. Test Reports:
  1. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
  2. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
  3. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
  4. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
  5. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- G. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- H. Warranty: Submit sample warranties as required in individual Specification Sections.
- I. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- J. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- K. Delegated-Design Services Certification: Submit certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
  2. In addition, for a project in New Jersey, provide three paper copies of certificate, signed and sealed (with raised seal) by the responsible design professional.

## **2.03 NON-ELECTRONIC SUBMITTAL PROCEDURES**

- A. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.  
Number of Samples: Submit three full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - a. Number of Samples: Submit three sets of Samples. Architect will return one set.
    - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- B. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  1. Name, address, and telephone number of entity performing subcontract or supplying products
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Submit subcontract list in the following format:
    - a. Number of Copies: Four paper copies of subcontractor list, unless otherwise indicated. Architect will return one copy.
- C. Key Personnel Names: No later than 15 days after date of Notice of Award, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site.
  1. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including emergency, office, and cellular telephone numbers and email addresses.
    - a. Number of Copies: Four paper copies of key personnel list, unless otherwise indicated.
- D. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- E. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

## **2.04 DELEGATED-DESIGN SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- B. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

## **PART 3 - EXECUTION**

### **3.01 CONTRACTOR'S REVIEW**

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections

and field dimensions. Identify any deviations from Contract Document requirements. Mark cover sheet with approval before submitting to Architect.

1. Sign and date statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### **3.02 ARCHITECT'S ACTION**

- A. General: Architect will not review submittals that do not bear Contractor's approval and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will mark submittal appropriately to indicate action, as follows:
  1. Final Unrestricted Release: Where the submittal is marked "Approved," the Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
  2. Final-but-Restricted Release: Where the submittal is marked "Approved as Noted," the Work covered by the submittal may proceed provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
  3. Resubmit: Where the submittal is marked "Approved, Revise and Return Corrected Copies," the Work covered by the submittal may proceed provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Revise submittal according to Architect's notations and corrections and return corrected copies. Final acceptance will depend on that compliance.
  4. Rejected: Where the submittal is marked "Rejected," do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.
  5. Incomplete - Resubmit: Where the submittal is marked "Incomplete, Submit Additional Information," do not proceed with the Work covered by the submittal. Prepare additional information requested, or required by the Contract Documents, that indicates compliance with requirements, and resubmit.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Limit information submitted to specific products indicated. Do not submit extraneous matter. Submittals containing excessive extraneous matter will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.

**END OF SECTION**

**SECTION 01 35 53  
SECURITY PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Security measures including formal security program, entry control, personnel identification, and miscellaneous restrictions.
- B. Background check must be completed with the Bureau of Criminal Identification and Investigation prior to construction start.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Use of Premises and occupancy.
- B. Section 01 50 00 - Temporary Facilities and Controls: Temporary lighting and barriers and enclosures.

**1.03 SECURITY PROGRAM**

- A. Protect Work , existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. A background check must be completed with the Bureau of Criminal Identification and Investigation prior to construction start.
- C. Initiate program at project mobilization.
- D. Initiate program in coordination with Owner's existing security system at project mobilization.
- E. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.
- F. Maintain program throughout construction period until directed by Owner.

**1.04 ENTRY CONTROL**

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.
- C. Owner will control entrance of persons and vehicles related to Owner's operations.

**1.05 PERSONNEL IDENTIFICATION**

- A. Provide identification badge to each person authorized to enter premises.
- B. Badge to Include: Personal photograph, name, expiration date and employer.
- C. Maintain a list of accredited persons, submit copy to Owner on request.
- D. Require return of badges at expiration of their employment on the Work.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 40 00  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Control of installation.
- B. Tolerances.
- C. Testing and inspection services.
- D. Manufacturers' field services.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 42 16 - Definitions.

**PART 3 EXECUTION**

**2.01 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

**2.02 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

**2.03 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

**2.04 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION**

**SECTION 01 42 16**  
**DEFINITIONS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Other definitions are included in individual specification sections.

**1.02 DEFINITIONS**

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Specifications: Same as Project Manual.
- F. Provide: To furnish and install.
- G. Supply: Same as Furnish.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 50 00  
TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary utilities.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, and fencing.
- D. Security requirements.
- E. Vehicular access and parking.
- F. Waste removal facilities and services.

**1.02 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power and metering, consisting of connection to existing facilities.
  - 2. Water supply, consisting of connection to existing facilities.
  - 3. Contractor shall be responsible to tie to existing utility services and make distribution to the construction site.

**1.03 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required portable toilets and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

**1.04 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades required by Owner and governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
- E. Traffic Controls: Coordinate with the Owner.

**1.05 FENCING**

- A. Provide 6 foot high fence around on-grade storage areas; equip with vehicular and pedestrian gates with locks.

**1.06 EXTERIOR ENCLOSURES**

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

**1.07 INTERIOR ENCLOSURES**

- A. Provide temporary partitions as indicated and as otherwise required to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene with plywood overlay sheet materials with closed joints and sealed edges at intersections with existing surfaces:

#### **1.08 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.
- C. Provide background check for any/all employees who enter building.

#### **1.09 VEHICULAR ACCESS AND PARKING**

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Existing parking areas may be used for construction parking. Owner shall designate parking areas to be used by contractor.

#### **1.10 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site daily.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

#### **1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 60 00  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Transportation, handling, storage and protection.
- B. Product option requirements.
- C. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

**1.03 SUBMITTALS**

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

**1.04 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by the Contract Documents.

**1.05 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

**1.06 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

**PART 3 EXECUTION**

**2.01 SUBSTITUTION PROCEDURES**

- A. See Section 01 25 00 - Substitution Procedures.
- B. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- D. A request for substitution constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  2. Will provide the same warranty for the substitution as for the specified product.
  3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
  4. Waives claims for additional costs or time extension that may subsequently become apparent.
- E. Substitution Submittal Procedure:
1. Submit one electronic copy of request for substitution for consideration, including all required supporting materials. Limit each request to one proposed substitution.
  2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  3. Where color selections or physical comparison must be made, submit physical samples.
  4. The Architect will notify Contractor in writing of decision to accept or reject request.

## **2.02 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

## **2.03 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

**SECTION 01 61 16**  
**VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

**1.03 DEFINITIONS**

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Exterior and interior paints and coatings applied on site.
  - 2. Exterior and interior adhesives and sealants applied on site.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
  - 1. Concrete.
  - 2. Clay brick.
  - 3. Metals that are plated, anodized, or powder-coated.
  - 4. Glass.
  - 5. Ceramics.
  - 6. Solid wood flooring that is unfinished and untreated.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.
- C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.
- D. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

**1.06 QUALITY ASSURANCE**

- A. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:
  - a. Report of laboratory testing performed in accordance with requirements.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. VOC-Content-Restricted Products: VOC content not greater than required by the following:
  1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
  2. Joint Sealants: SCAQMD 1168 Rule.
  3. Paints and Coatings: Each color; most stringent of the following:
    - a. 40 CFR 59, Subpart D.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).

## **PART 3 EXECUTION**

### **3.01 FIELD QUALITY CONTROL**

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

**END OF SECTION**

**SECTION 01 70 00**  
**EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. General requirements for maintenance service.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures.
- C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.
- E. Section 01 51 00 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
- F. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- G. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
- H. Section 01 81 13 - Sustainable Design Requirements

**1.03 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.

**1.05 PROJECT CONDITIONS**

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
  - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
  - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

## **1.06 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## **PART 2 PRODUCTS**

### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.

- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### **3.03 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.05 GENERAL INSTALLATION REQUIREMENTS**

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.06 ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as shown.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
- C. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove items indicated on drawings.
  - 2. Relocate items indicated on drawings.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. Provide temporary connections as required to maintain existing systems in service.
  - 4. Verify that abandoned services serve only abandoned facilities.
  - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
  - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
  - 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
  - 3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
  - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
  - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

### **3.07 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.
  - 6. Repair new work damaged by subsequent work.
  - 7. Remove samples of installed work for testing when requested.
  - 8. Remove and replace defective and non-conforming work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material , to full thickness of the penetrated element.
- H. Patching:
  - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  - 2. Match color, texture, and appearance.
  - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.08 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
- E. NE CHPS - For phased, occupied renovations HEPA vacuum the carpet daily in the occupied areas.

### **3.09 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Prohibit traffic from landscaped areas.
- H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

### **3.10 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### **3.11 DEMONSTRATION AND INSTRUCTION**

- A. See Section 01 79 00 - Demonstration and Training.

### **3.12 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### **3.13 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.14 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Notify Architect when work is considered ready for Substantial Completion.
- C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.
- D. Owner will occupy all of the building as specified in Section 01 10 00.
- E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- F. Notify Architect when work is considered finally complete.
- G. Complete items of work determined by Architect's final inspection.

### **3.15 MAINTENANCE**

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

**SECTION 01 74 19  
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 GENERAL**

**1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Methods of trash/waste disposal that are not acceptable are:
  - 1. Burning on the project site.
  - 2. Burying on the project site.
  - 3. Dumping or burying on other property, public or private.
  - 4. Other illegal dumping or burying.
- E. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- C. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

**1.03 DEFINITIONS**

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 WASTE MANAGEMENT PROCEDURES**

- A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

#### **3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION**

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
  - 1. Pre-bid meeting.
  - 2. Pre-construction meeting.
  - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
  - 1. Provide containers as required.
  - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
  - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

**END OF SECTION**

**SECTION 01 76 10**  
**TEMPORARY PROTECTIVE COVERINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary protective coverings for installed floors, walls, and other surfaces.

**1.02 REFERENCE STANDARDS**

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
  - 1. Water resistant.
  - 2. Impact resistant.
  - 3. Slip resistant.

**2.02 MATERIALS**

- A. Sheet Materials:
  - 1. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch thick nominal.
- B. Rolled Materials:
  - 1. Self-adhering polyethylene film.
  - 2. Recycled cellulose fiberboard paper.
- C. Opening Protection Materials:
  - 1. Acrylic Plastic Sheet
- D. Tape: Type recommended by protective covering material manufacturer.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Remove dirt and debris from surfaces to be protected.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Trim or overlap sheet materials to fit area to be covered.
- C. Roll out and cut rolled materials to fit area to be covered.
- D. Tape seams. Avoid taping directly to finished surfaces.
- E. Stretch self-adhering film materials to completely cover surface.
- F. Install door jamb protection to full height of opening.

**3.03 REMOVAL**

- A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

**END OF SECTION**

**SECTION 01 78 00  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

**1.02 RELATED REQUIREMENTS**

- A. Section 00 65 01 - Closeout Document Checklist: List of required submittals for closeout.
- B. Section 00 72 13 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- C. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- D. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- E. Individual Product Sections: Specific requirements for operation and maintenance data.
- F. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.

- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Changes made by Addenda and modifications.
- F. Record Drawings : Legibly mark each item to record actual construction including:
  - 1. Field changes of dimension and detail.
  - 2. Details not on original Contract drawings.

### **3.02 OPERATION AND MAINTENANCE DATA**

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance.
- D. Include manufacturer's printed operation and maintenance instructions.
- E. Additional Requirements: As specified in individual product specification sections.

### **3.04 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

### **3.05 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

**END OF SECTION**

**SECTION 01 79 00  
DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. HVAC systems and equipment.
  - 2. Electrical systems and equipment.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit to Architect for transmittal to Owner.
  - 2. Submit not less than four weeks prior to start of training.
  - 3. Revise and resubmit until acceptable.
  - 4. Provide an overall schedule showing all training sessions.
  - 5. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such as slides, hand-outs, etc.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
  - 1. Identification of each training session, date, time, and duration.
  - 2. Sign-in sheet showing names and job titles of attendees.
  - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

**1.04 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.

### **3.02 TRAINING - GENERAL**

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Provide minimum 8 hours of training.
- E. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- F. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  3. Typical uses of the O&M manuals.
- G. Product- and System-Specific Training:
  1. Review the applicable O&M manuals.
  2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  4. Provide hands-on training on all operational modes possible and preventive maintenance.
  5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  6. Discuss common troubleshooting problems and solutions.
  7. Discuss any peculiarities of equipment installation or operation.
  8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.

- H. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

**SECTION 01 81 13**  
**SUSTAINABLE DESIGN REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 GENERAL PROVISIONS**

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

**1.02 OBJECTIVES**

- A. To obtain acceptable water efficiency, energy efficiency, and Indoor Air Quality (IAQ) for the completed Project and minimize the environmental impacts of construction and operation, the Contractor during the construction phase of this project shall implement the following procedures singly or in combination:
1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce and transport, and employ recycled and/or recyclable materials. To help purchasers incorporate environmental considerations into purchasing decisions, it is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
    - a. Include environmental considerations as part of the normal purchasing process.
    - b. Emphasize pollution prevention early in the purchasing process.
    - c. Examine multiple environmental attributes throughout a product's or service's life cycle.
    - d. Compare relevant environmental impacts when selecting products and services.
    - e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
  2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
  3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

**1.03 DESCRIPTION OF WORK**

- A. Work Included: General requirements and procedures for compliance with Version 4.0 of the Northeast Collaborative for High Performance Schools Rhode Island (NE-CHPS RI) Guidelines, including all prerequisites and credits needed for the Project to be NE-CHPS RI verified with all RI addendums, pre-requisitions and other requirement.
1. Compliance with requirements needed to obtain NE-CHPS RI prerequisites and credits may be used as one criterion to evaluate substitution requests.
  2. Refer to the NE-CHPS RI Scorecard attached at the end of this Section for required credits.
  3. Contractor shall compile the necessary calculation to show that the total percentage achieved by the project meets the required percentage for recycle content materials, rapidly renewable materials, locally produced materials, and certified wood. Contractor shall submit a proposed list within 30 days from signing of contract for review. Contractor shall submit monthly updates of these credits.
  4. Owner shall register project with the National CHPS organization and pay all registration and review fees.
  5. Owner shall pay CHPS the costs of interpretations, certification and other administrative fees.

- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
  - 1. Divisions 01 through 33 Sections for NE-CHPS requirements specific to the work of each of these Sections. Requirements may or may not include reference to NE-CHPS.

#### **1.04 DEFINITIONS**

- A. Agrifiber Products: Composite panel products derived from agricultural fiber.
- B. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder.
- C. NE-CHPS: Northeast Collaborative for High Performance Schools Guidelines, current version.
- D. Forest-Stewardship Council (FSC) Certified Wood: Wood products bearing the FSC label come from forests that are managed in environmentally responsible, socially beneficial, and economically viable ways
- E. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- F. Post-Consumer Recycled Content: Defined as materials or finished product that has served its intended consumer use and has been discarded by the consumer for recovery after use (e.g., plastic soda bottle).
- G. Post-Industrial Recycled Content: Defined as recovered industrial and manufacturing material that is recycled. Scrap raw materials that can be reused in the same manufacturing process from which they were recovered are not considered Post-Industrial Recycled Content. Fly-ash and synthetic gypsum, because they are waste products from coal burning electricity plants, are examples of Post-Industrial Recycled Content.
- H. Bio-Based Materials: Bio-based materials contain a significant amount of materials from natural fibers, plant stalks and leaves, and plant extractions. Examples are bamboo products, wheat grass cabinetry and linoleum.
- I. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without be manufactured.
- J. Locally Produced Materials: Materials manufactured within five hundred miles radius of the project site. The location of manufacture refers to the final assembly of components into the building product that is furnished and installed by tradesmen.

#### **1.05 SUBMITTALS**

- A. General: Submit additional NE-CHPS RI submittals required by other Specification Sections.
- B. NE-CHPS RI submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated NE-CHPS requirements.

### **PART 2 - PRODUCTS**

#### **2.01 LOW-EMITTING MATERIALS**

- A. The following products and systems, where installed inside the weatherproofing system, shall meet the testing and product protocols listed below.
  - 1. Acceptable products in the categories listed below shall be certified in accordance with either Scientific Certification System's (SCS's) Indoor Advantage Gold program or SCS's FloorScore Program (see [www.scscertified.com/products](http://www.scscertified.com/products)) or GreenGuard's Children and Schools program (see <http://www.qreenquard.org/en/quickSearch.aspx>). Certified products will be listed on either web site. Acceptable products may also be listed in the CHPS High Performance Products Database located at <http://www.chps.net/dev/Drupal/node/445>. Alternatively, manufacturers may arrange for

- independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page
- a. All paints and coatings that cover interior walls, floors and ceilings,
  - b. All building insulation (excluding insulation exterior to the building's vapor barrier),
  - c. Acoustical ceiling tiles and wall panels,
  - d. Gypsum wallboard.
  - e. Resilient flooring and associated adhesives.
2. Acceptable carpet systems and associated adhesives shall be certified in accordance with the Carpet and Rug Institute's Green Label Plus program (see <http://www.carpet-rug.org/commercial-customers/green-building9-and-the-environment/green-label-plus/index.cfm>). Acceptable products may also be listed in the CHPS High Performance Products Database located at <http://www.chps.net/dev/Drupal/node/445>. Alternatively, manufacturers may arrange for independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page 83.
- B. For each low-emitting material or product, Contractor shall fill out the Materials Submittal Cover Sheet identifying the certification program that the material or product meets.
  - C. For each low-emitting material or product, Contractor shall supply documentation verifying that it is certified as a low-emitting material in accordance with Scientific Certification System's FloorScore or Indoor Advantage Gold Program, or with GreenGuard's Children and Schools Program, or with the Carpet and Rug Institute's Green Label Plus Program, OR that the product is listed at [www.chps.net](http://www.chps.net) in the CHPS Products Database, OR that the product was independently tested and has been shown to meet the Chronic Reference Exposure Levels (CRELs) for the VOCs identified by the California Office of Environmental Health Hazard Assessment (OEHHA).
  - D. Do not use composite wood, agrifiber products and laminating adhesives that contain added urea-formaldehyde resins.

### **PART 3 - EXECUTION**

#### **3.01 NE-CHPS SCORECARD SUMMARY**

- A. Comply with requirements of Scorecard Summary as developed by the Architect and attached to this Section.

#### **3.02 MATERIALS SUBMITTAL COVER SHEET**

- A. Documentation Sheet: Provide documentation for each material required for NE-CHPS Documentation as required.

**END OF SECTION**

**SECTION 02 41 00  
DEMOLITION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Selective demolition of built site elements.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

**1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

**PART 3 EXECUTION**

**2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 5. Do not close or obstruct roadways or sidewalks without permit.
  - 6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
  - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.

**2.02 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

**SECTION 03 10 00  
CONCRETE FORMING AND ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete.

**1.03 REFERENCE STANDARDS**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 301 - Specifications for Concrete Construction; 2020.
- C. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- D. PS 1 - Structural Plywood; 2023.

**1.04 SUBMITTALS**

- A. Product Data: Provide data on materials.

**1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

**PART 2 PRODUCTS**

**2.01 FORMWORK - GENERAL**

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

**2.02 WOOD FORM MATERIALS**

- A. Lumber: HEM-FIR species; #2 grade; with grade stamp clearly visible.

**2.03 REMOVABLE PREFABRICATED FORMS**

- A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

**2.04 FORMWORK ACCESSORIES**

- A. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

- B. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

### **3.02 ERECTION - FORMWORK**

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. Provide fillet strips on external corners of beams, joists, and columns.
- G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- H. Coordinate this section with other sections of work that require attachment of components to formwork.
- I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.
- J. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- K. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

### **3.03 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

### **3.04 FIELD QUALITY CONTROL**

- A. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

### **3.05 FORM REMOVAL**

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

**END OF SECTION**

**SECTION 03 20 00  
CONCRETE REINFORCING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.

**1.03 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Concrete Construction; 2020.
- B. ACI SP-66 - ACI Detailing Manual; 2004.
- C. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- F. CRSI (DA4) - Manual of Standard Practice; 2024.

**1.04 SUBMITTALS**

- A. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
  - 1. Prepare shop drawings under supervision of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.
- B. Manufacturer's Certificate: Certify that reinforcing steel and accessories, products supplied for this project meet or exceed specified requirements.

**1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301.
  - 1. Maintain one copy of each document on project site.
- B. Provide Architect with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

**PART 2 PRODUCTS**

**2.01 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
  - 1. Plain billet-steel bars.
  - 2. Unfinished.
  - 3. Galvanized in accordance with ASTM A767/A767M, Class I.
  - 4. Continuously galvanized in accordance with ASTM A1094/A1094M.
- B. Steel Welded Wire Reinforcement: Galvanized ASTM A 185/A 185M plain type.
  - 1. Flat Sheets.
  - 2. Mesh Size and Wire Gage: As indicated on drawings.
- C. Reinforcement Accessories:
  - 1. Tie Wire: Annealed, minimum 16 gage.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide galvanized components for placement within 1-1/2 inches of weathering surfaces.

## **2.02 RE-BAR SPLICING:**

- A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.
- B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.
- C. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

## **2.03 FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Locate reinforcing splices not indicated on drawings at point of minimum stress.
  1. Review locations of splices with Architect.

# **PART 3 EXECUTION**

## **3.01 PLACEMENT**

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Conform to applicable code for concrete cover over reinforcement.

## **3.02 FIELD QUALITY CONTROL**

- A. Inspect installed reinforcement for conformance to contract documents before concrete placement.

**END OF SECTION**

**SECTION 03 30 00  
CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Slabs on grade.
- B. Joint devices associated with concrete work.
- C. Concrete curing.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories
- B. Section 03 20 00 - Concrete Reinforcing.

**1.03 REFERENCE STANDARDS**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI 301 - Specifications for Concrete Construction; 2020.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting; 2020.
- G. ACI 308R - Guide to External Curing of Concrete; 2016.
- H. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).
- I. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- J. ACI PRC-213 - Guide for Structural Lightweight-Aggregate Concrete; 2014 (Reapproved 2023).
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2026.
- M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026a.
- N. ASTM C143/C143M - Standard Test Method for Slump of Concrete; 2026a.
- O. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- P. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.
- Q. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2025.
- R. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2023.
- S. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- T. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
- U. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- V. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2024.

- W. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- X. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2023.
- Y. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2025.
- Z. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011 (Reapproved 2022).
- AA. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.
- BB. ASTM E1155/E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2023.
- CC. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops; 1974.
- DD. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum
- EE. NSF 372 - Drinking Water System Components - Lead Content; 2024.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- B. Mix Design: Submit proposed concrete mix design.
  - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
  - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- C. Test Reports: Submit report for each test or series of tests specified.
- D. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. For slabs required to include moisture vapor reduction admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

#### **1.06 WARRANTY**

- A. Slabs with Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover the cost of flooring failures due to moisture migration from slabs for life of the concrete.
  - 1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
  - 2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.
- B. Moisture Emission Reducing Curing and Sealing Compound: Provide warranty to cost of flooring delamination failures for 10 years.
  - 1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

## **PART 2 PRODUCTS**

### **2.01 FORMWORK**

- A. Comply with requirements of Section 03 10 00.

### **2.02 REINFORCEMENT**

- A. Comply with requirements of Section 03 20 00.

### **2.03 CONCRETE MATERIALS**

- A. Cement: ASTM C150, Type I - Normal Portland type.
  - 1. Acquire all cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C 33.
  - 1. Acquire all aggregates for entire project from same source.
- C. Lightweight Aggregate: ASTM C330/C330M.
- D. Fly Ash: ASTM C618, Class C or F.
- E. Water: Clean and not detrimental to concrete.

### **2.04 ADMIXTURES**

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- D. Moisture Vapor Reduction Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission, with no adverse effect on concrete properties.
  - 1. Provide admixture in all slabs to receive adhesively applied flooring .
  - 2. Products:
    - a. Barrier One, Inc; Barrier One Moisture Vapor Reduction Admixture: [www.barrierone.com/#sle](http://www.barrierone.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.
  - 1. Admixture Composition: Crystalline, functioning by growth of crystals in capillary pores.
  - 2. Potable Water Contact Approval: NSF certification for use on structures holding potable water, based on testing in accordance with NSF 61 and NSF 372.
  - 3. Products:
    - a. PENETRON International, Ltd, distributed by GCP Applied Technologies; PENETRON Admix: [www.penetron.com](http://www.penetron.com); [www.gcpat.com/#sle](http://www.gcpat.com/#sle).

### **2.05 ACCESSORY MATERIALS**

- A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
  - 1. ASTM C1107/C1107M; Grade A, B, or C.
  - 2. Flowable Products:
    - a. Dayton Superior Corporation; Sure-Grip High Performance Grout: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.06 BONDING AND JOINTING PRODUCTS**

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
  - 1. Products:

- a. Kaufman Products Inc.; SureBond: [www.kaufmanproducts.net/#sle](http://www.kaufmanproducts.net/#sle).
  - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Epoxy Bonding System:
- C. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.
- D. Waterstops: Rubber, complying with COE CRD-C 513.
- E. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
- F. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
1. Material: ASTM D1751, cellulose fiber.
- G. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
- H. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.

## 2.07 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- C. Curing and Anti-Spalling Compound: Boiled linseed oil compound.
1. Application: Use on roadway, bridge deck, parking deck, and ramps.
  2. Products:
    - a. Dayton Superior Corporation; Anti Spall J33: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Resin Curing Compound: Solvent-based liquid, white pigmented, membrane-forming.
1. For use on exterior slabs. When slab will be painted, sealed, topped, or receive other applied finish, completely remove curing compound after curing is complete and before finish coatings are applied.
  2. Products:
    - a. Dayton Superior Corporation; White Resin Cure J10W: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Curing and Sealing Compound, Moisture Emission Reducing: Liquid, membrane-forming, clear sealer, for application to newly placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
  2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
  3. VOC Content: Less than 100 g/L.
  4. Solids Content: 25 percent, minimum.
  5. Products:
    - a. Floor Seal Technology, Inc; VaporSeal 309 System: [www.floorseal.com/#sle](http://www.floorseal.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Curing and Sealing Compound: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309.

1. Products:
  - a. BRICKFORM; BRICKFORM Gem Cure and Seal 309 - 100 VOC:  
[www.brickform.com/#sle](http://www.brickform.com/#sle).

## **2.08 CONCRETE MIX DESIGN**

- A. Proportioning Structural Lightweight Concrete: Comply with ACI PRC-213 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
  1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
  1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.

## **2.09 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

### **3.02 PREPARATION**

- A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
  1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
  2. Use latex bonding agent only for non-load-bearing applications.
- B. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
  1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as shown on the drawings. Do not use sand.

### **3.03 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### **3.04 SLAB JOINTING**

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
  - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
- E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
- F. Contraction Joint Devices: Use preformed joint device, with top set flush with top of slab.
- G. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

### **3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES**

- A. Maximum Variation of Surface Flatness:
  - 1. Exposed Concrete Floors: 1/4 inch in 10 ft.
  - 2. Under Seamless Resilient Flooring: 1/4 inch in 10 ft.
  - 3. Under Carpeting: 1/4 inch in 10 ft.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### **3.06 CONCRETE FINISHING**

- A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
  - 1. Other Surfaces to Be Left Exposed: "Steel trowel" as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

### **3.07 CURING AND PROTECTION**

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:
  - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
  - 2. Final Curing: Begin after initial curing but before surface is dry.

### **3.08 FIELD QUALITY CONTROL**

- A. Provide free access to concrete operations at project site and cooperate with appointed firm.
- B. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- C. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

- D. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
- E. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- F. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

### **3.09 DEFECTIVE CONCRETE**

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

### **3.10 PROTECTION**

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

**END OF SECTION**

**SECTION 26 05 05  
SELECTIVE DEMOLITION FOR ELECTRICAL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electrical demolition.

**1.02 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND EQUIPMENT**

- A. Materials and equipment for patching and extending work: As specified in individual sections.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation. and existing record documents.
- D. Report discrepancies to Owner before disturbing existing installation.
- E. Report discrepancies to Architect before disturbing existing installation.
- F. Beginning of demolition means installer accepts existing conditions.

**3.02 PREPARATION**

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
  - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
  - 2. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
  - 1. Notify Owner before partially or completely disabling system.
  - 2. Notify local fire service.
  - 3. Make notifications at least 24 hours in advance.
  - 4. Make temporary connections to maintain service in areas adjacent to work area.

**3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned wiring to source of supply.
- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

- E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

#### **3.04 CLEANING AND REPAIR**

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

**END OF SECTION**

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Armored cable.
- D. Metal-clad cable.
- E. Variable-frequency drive cable.
- F. Wiring connectors.
- G. Electrical tape.
- H. Heat shrink tubing.
- I. Oxide inhibiting compound.
- J. Wire pulling lubricant.
- K. Cable ties.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 28 46 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- F. Section 31 23 16 - Excavation.
- G. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- H. Section 31 23 23 - Fill: Bedding and backfilling.

**1.03 REFERENCE STANDARDS**

- A. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- B. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.
- C. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.
- D. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.
- E. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- F. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- H. UL 4 - Armored Cable; Current Edition, Including All Revisions.
- I. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- J. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- K. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- L. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- M. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- N. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.
- O. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- P. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.
- D. Wire Pulling Lubricant: Certification of compatibility with conductors/cables where used with the following insulation/jacket types:
- E. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

#### **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

### **1.08 FIELD CONDITIONS**

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

## **PART 2 PRODUCTS**

### **2.01 CONDUCTOR AND CABLE APPLICATIONS**

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      - 1) Maximum Length: 6 feet.
    - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
  - 2. In addition to other applicable restrictions, may not be used:
    - a. Unless approved by Owner.
    - b. Where not approved for use by the authority having jurisdiction.
    - c. Where exposed to damage.
    - d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
    - e. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

### **2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- I. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size:
  1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
  2. Control Circuits: 14 AWG.
- K. Conductor Color Coding:
  1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  2. Color Coding Method: Integrally colored insulation.
    - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
  3. Color Code:
    - a. 480Y/277 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
      - 4) Neutral/Grounded: Gray.
    - b. 208Y/120 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Neutral/Grounded: White.
    - c. Equipment Ground, All Systems: Green.
    - d. Isolated Ground, All Systems: Green with yellow stripe.
    - e. Travelers for 3-Way and 4-Way Switching: Pink.
    - f. For control circuits, comply with manufacturer's recommended color code.

## **2.03 SINGLE CONDUCTOR BUILDING WIRE**

- A. Manufacturers:
  1. Copper Building Wire:
    - a. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
    - b. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
    - c. Houston Wire & Cable co.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
  2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
    - a. Size 4 AWG and Larger: Type XHHW-2.
    - b. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

F. Manufacturers:

1. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
2. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
3. Houston Wire & Cable co..
4. Substitutions: See Section 01 60 00 - Product Requirements.
5. Size 10 AWG and Smaller: Solid.
6. Size 8 AWG and Larger: Stranded.

**2.04 ARMORED CABLE**

A. Manufacturers:

1. AFC Cable Systems Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
2. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
3. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bonding wire.

1. Provide additional full-size integral insulated equipment grounding conductor for redundant grounding, suitable for general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities.

G. Armor: Steel, interlocked tape.

**2.05 METAL-CLAD CABLE**

A. Manufacturers:

1. AFC Cable Systems Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
2. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
3. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide dedicated neutral conductor for each phase conductor where indicated or required.

G. Grounding: Full-size integral equipment grounding conductor.

1. Provide additional isolated/insulated grounding conductor where indicated or required.

H. Armor: Steel, interlocked tape.

I. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

## 2.06 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Sizes 10 and under: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Sizes 8 and larger: Use mechanical connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
  - 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
  - 1. Manufacturers:
    - a. Burndy: [www.burndy.com](http://www.burndy.com).
    - b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
  - 1. Manufacturers:
    - a. Burndy: [www.burndy.com](http://www.burndy.com).
    - b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.07 WIRING ACCESSORIES

- A. Electrical Tape:
  - 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Plymouth Rubber Europa: [www.plymouthrubber.com/#sle](http://www.plymouthrubber.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
    - a. Product: 3 M.
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
  3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
    - a. Product: 3 M.
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
  4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
  5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
  6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
  7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Burndy: [www.burndy.com](http://www.burndy.com).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Manufacturers:
    - a. Burndy: [www.burndy.com](http://www.burndy.com).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. American Polywater Corporation: [www.polywater.com/#sle](http://www.polywater.com/#sle).
    - c. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Cable Ties: Material and tensile strength rating suitable for application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as shown on the drawings.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### 3.03 INSTALLATION

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated and routing is not shown, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Include circuit lengths required to install connected devices within 10 ft of location shown.
  - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
  - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted.
  - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among \_\_\_\_\_ single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- D. Install armored cable (Type AC) in accordance with NECA 120.
- E. Install metal-clad cable (Type MC) in accordance with NECA 120.
- F. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  - 2. Pull all conductors and cables together into raceway at same time.
  - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- I. Terminate cables using suitable fittings.
  - 1. Armored Cable (Type AC):
    - a. Use listed fittings and anti-short, insulating bushings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
  - 2. Metal-Clad Cable (Type MC):
    - a. Use listed fittings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- J. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

- K. Install conductors with a minimum of 12 inches of slack at each outlet.
- L. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- N. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- O. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  - 3. Do not remove conductor strands to facilitate insertion into connector.
  - 4. Clean contact surfaces on conductors and connectors to suitably remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
  - 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- P. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
  - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
    - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
  - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
  - 3. Wet Locations: Use heat shrink tubing.
- Q. Insulate ends of spare conductors using vinyl insulating electrical tape.
- R. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- S. Identify conductors and cables in accordance with Section 26 05 53.
- T. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- U. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

#### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

**END OF SECTION**

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Ground bars.
- B. Ground rod electrodes.
- C. Ground access wells.
- D. Grounding and bonding components.
- E. Provide all components necessary to complete the grounding system(s) consisting of:
  - 1. Existing metal underground water pipe.
  - 2. Metal frame of the building.
  - 3. Existing metal underground gas piping system.
  - 4. Metal underground gas piping system.

**1.02 REFERENCE STANDARDS**

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2025.
- B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
- C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

**1.04 PERFORMANCE REQUIREMENTS**

- A. Grounding System Resistance: 25 ohms.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Shop Drawings:
- D. Product Data: Provide for grounding electrodes and connections.
- E. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Project Record Documents: Record actual locations of grounding electrode system components and connections.

- H. Project Record Documents: Record actual locations of components and grounding electrodes.

## **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.01 GROUNDING AND BONDING REQUIREMENTS**

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
  - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- E. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
    - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
    - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
  - 3. Metal Building or Structure Frame:

- a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
  4. Ground Rod Electrode(s):
    - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
    - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
    - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
    - d. Provide ground access well for each electrode.
  5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- F. Service-Supplied System Grounding:
  1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
  2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
  1. Provide grounding electrode system for each separate building or structure.
  2. Provide equipment grounding conductor routed with supply conductors.
  3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
- H. Bonding and Equipment Grounding:
  1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
  7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    - b. Metal gas piping.
  8. Provide bonding for interior metal air ducts.
  9. Provide bonding for metal building frame where not used as a grounding electrode.
- I. Isolated Ground System:
  1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.

2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

J. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

## **2.02 GROUNDING AND BONDING COMPONENTS**

### **A. General Requirements:**

1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
2. Provide products listed and labeled as complying with UL 467 where applicable.

### **B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 05 19:**

### **C. Connectors for Grounding and Bonding:**

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
  - a. Exceptions:
    - 1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use exothermic welded connections for accessible connections.
  - a. Exceptions:
    - 1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Burndy: [www.burndy.com](http://www.burndy.com).
  - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
  - a. Burndy: [www.burndy.com](http://www.burndy.com).
  - b. Cadweld, a brand of Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
  - c. ThermOweld, a brand of Continental Industries, Inc: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.

### **D. Ground Bars:**

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
  - c. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - d. ThermOweld, a brand of Continental Industries, Inc: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - e. Substitutions: See Section 01 60 00 - Product Requirements.

### **E. Ground Rod Electrodes:**

1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Manufacturers:

- a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
- b. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
- c. Galvan Industries, Inc: [www.galvanelectrical.com/#sle](http://www.galvanelectrical.com/#sle).
- d. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
- e. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 MANUFACTURERS**

- A. Cooper Power Systems: [www.cooperpower.com](http://www.cooperpower.com).
- B. Framatome Connectors International: [www.fciconnect.com](http://www.fciconnect.com).
- C. Lightning Master Corporation: [www.lightningmaster.com](http://www.lightningmaster.com).
- D. Substitutions: See Section 01 6000 - Product Requirements.

## **2.04 CONNECTORS AND ACCESSORIES**

- A. Mechanical Connectors: Bronze.
  1. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wire: Stranded copper.
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as shown on the drawings.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify existing conditions prior to beginning work.
- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
  1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
- D. Make grounding and bonding connections using specified connectors.
  1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 05 53.

- F. Provide bonding to meet requirements described in Quality Assurance.
- G. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Each of branch circuits and feeder circuits shall have dedicated equipment grounding conductor, sharing this conductor with other grounding conductors is not permitted.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform inspection in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

**END OF SECTION**

**SECTION 26 05 29**  
**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.
- D. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- F. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

**1.03 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Installer's Qualifications: Include evidence of compliance with specified requirements.
- E. Product Data: Provide manufacturer's catalog data for fastening systems.
- F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
- E. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### **PART 2 PRODUCTS**

#### **2.01 SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
  - 1. Comply with the following. Where requirements differ, comply with most stringent.
    - a. NFPA 70.
    - b. Requirements of authorities having jurisdiction.
  - 2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
  - 3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.
  - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
  - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
  - 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

- B. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
  - 1. Manufacturers:
    - a. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  - 3. Conduit Clamps: Bolted type unless otherwise indicated.
  - 4. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
    - c. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - d. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
  - 1. Manufacturers:
    - a. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
    - c. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - d. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
    - e. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - f. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - g. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
  - 1. Comply with MFMA-4.
  - 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
  - 3. Channel Material:
    - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
  - 4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
  - 5. Minimum Channel Dimensions: 1-5/8 inch width by 1-5/8 inch height.
  - 6. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com/#sle](http://www.unistrut.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
    - e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
  - 1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2 inch diameter.
    - b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
    - c. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.

- d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
- e. Outlet Boxes: 1/4 inch diameter.
- f. Luminaires: 1/4 inch diameter.
- G. Anchors and Fasteners:
  - 1. Manufacturers - Mechanical Anchors:
    - a. Dewalt: [anchors.dewalt.com/#sle](http://anchors.dewalt.com/#sle).
    - b. Hilti, Inc: [www.hilti.com/#sle](http://www.hilti.com/#sle).
    - c. Simpson Strong-Tie Company Inc: [www.strongtie.com/#sle](http://www.strongtie.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  - 3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  - 4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  - 5. Hollow Masonry: Use toggle bolts.
  - 6. Hollow Stud Walls: Use toggle bolts.
  - 7. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  - 8. Sheet Metal: Use sheet metal screws.
  - 9. Powder-actuated fasteners are not permitted.
  - 10. Hammer-driven anchors and fasteners are not permitted.
  - 11. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    - a. Comply with MFMA-4.
    - b. Channel Material: Use galvanized steel.
    - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

## 2.02 MANUFACTURERS

- A. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
- B. Threaded Rod Company: [www.threadedrod.com](http://www.threadedrod.com).
- C. Substitutions: See Section 01 6000 - Product Requirements.

## 2.03 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:
  - 1. Do not use powder-actuated anchors.
  - 2. Obtain permission from Architect before using powder-actuated anchors.
  - 3. Concrete Structural Elements: Use precast inserts.
  - 4. Steel Structural Elements: Use beam clamps.
  - 5. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
  - 6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use hollow wall fasteners.
  - 7. Solid Masonry Walls: Use expansion anchors.
  - 8. Sheet Metal: Use sheet metal screws.
  - 9. Wood Elements: Use wood screws.
- D. Formed Steel Channel:
  - 1. Product: manufactured by [B-Line].
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.

- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Conduit Support and Attachment: Also comply with Section 26 05 34.
- I. Box Support and Attachment: Also comply with Section 26 05 33.16.
- J. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.
- K. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00.
- L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- M. Secure fasteners according to manufacturer's recommended torque settings.
- N. Remove temporary supports.
- O. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Floor boxes.
- E. Underground boxes/enclosures.
- F. Wall and ceiling outlet boxes.
- G. Floor boxes.
- H. Pull and junction boxes.

**1.02 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).
- F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
  - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
  - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.

6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

#### **1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.

### **PART 2 PRODUCTS**

#### **2.01 BOXES**

- A. General Requirements:
  1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
  4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
  1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  3. Use suitable concrete type boxes where flush-mounted in concrete.
  4. Use suitable masonry type boxes where flush-mounted in masonry walls.
  5. Use raised covers suitable for the type of wall construction and device configuration where required.
  6. Use shallow boxes where required by the type of wall construction.
  7. Do not use "through-wall" boxes designed for access from both sides of wall.
  8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
  11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
  12. Wall Plates: Comply with Section 26 27 26.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:

3. Junction and Pull Boxes Larger Than 100 cubic inches:
  - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
- E. Floor Boxes:
  1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
  2. Manufacturer: Same as manufacturer of floor box service fittings.
- F. Underground Boxes/Enclosures:
  1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
  2. Size: As required for the conduits to be connected.
  3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
  4. Provide logo on cover to indicate type of service.
  5. Applications:
    - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
    - b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
    - c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
  6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
    - a. Manufacturers:
      - 1) Hubbell Incorporated; Quazite Products: [www.hubbellpowersystems.com/#sle](http://www.hubbellpowersystems.com/#sle).
      - 2) MacLean Highline; \_\_\_\_\_: [www.macleanhighline.com/#sle](http://www.macleanhighline.com/#sle).
      - 3) Oldcastle Precast, Inc: [www.oldcastleprecast.com/#sle](http://www.oldcastleprecast.com/#sle).
      - 4) Substitutions: See Section 01 60 00 - Product Requirements.

## 2.02 MANUFACTURERS

- A. Appleton Electric: [www.appletonelec.com](http://www.appletonelec.com).
- B. Steel City
- C. Substitutions: Reco, Inc. See Section 01 6000 - Product Requirements.

## 2.03 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
  1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
  2. Concrete Ceiling Boxes: Concrete type.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- D. Wall Plates for Finished Areas: As specified in Section 26 2726.

## 2.04 FLOOR BOXES

- A. Floor Boxes: NEMA OS 1, fully adjustable, \_4 inches deep.
- B. Material: Cast metal.
- C. Shape: Rectangular.

- D. Service Fittings: As specified in Section 26 2726.

## **2.05 PULL AND JUNCTION BOXES**

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 2716.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
  - 1. Material: Galvanized cast iron; Cast Aluminum.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
  - 1. Material: Galvanized cast iron; Cast Aluminum.
  - 2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
  - 3. Cover Legend: "ELECTRIC".

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
  - 2. Unless dimensioned, box locations indicated are approximate.
  - 3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
    - b. Communications Systems Outlets: Comply with Section 27 10 00.
  - 4. Locate boxes so that wall plates do not span different building finishes.
- E. Box Supports:
  - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
  - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
- F. Install boxes plumb and level.
- G. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- H. Install boxes as required to preserve insulation integrity.
- I. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
  2. Flush-mount enclosures located in concrete or paved areas.
  3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
  4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- L. Close unused box openings.
- M. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- N. Provide grounding and bonding in accordance with Section 26 05 26.
- O. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- P. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- Q. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.
- R. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- S. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
1. Adjust box locations up to 10 feet if required to accommodate intended purpose.
- T. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.
- U. Maintain headroom and present neat mechanical appearance.
- V. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- W. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- X. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- Y. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- Z. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- AA. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- BB. Use flush mounting outlet box in finished areas.
- CC. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- DD. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

- EE. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- FF. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- GG. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- HH. Use adjustable steel channel fasteners for hung ceiling outlet box.
- II. Do not fasten boxes to ceiling support wires.
- JJ. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- KK. Use gang box where more than one device is mounted together. Do not use sectional box.
- LL. Use gang box with plaster ring for single device outlets.
- MM. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- NN. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- OO. Set floor boxes level.
- PP. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

### **3.03 ADJUSTING**

- A. Adjust floor boxes flush with finish flooring material.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused box openings.

### **3.04 CLEANING**

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

### **3.05 PROTECTION**

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**END OF SECTION**

**SECTION 26 05 33.23**  
**SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface raceway systems.
- B. Wireways.

**1.02 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
- D. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 and conduit provided under Section 26 05 34 as required for installation of raceways provided under this section.
  - 3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
  - 4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install raceways until final surface finishes and painting are complete.
  - 2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
  - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.
- C. Shop Drawings:
  - 1. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

**1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.01 RACEWAY REQUIREMENTS**

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

### **2.02 SURFACE RACEWAY SYSTEMS**

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
  - 2. Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  - 3. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- C. Multioutlet Assemblies: Listed and labeled as complying with UL 111.
- D. Metal Channel (Strut) Used as Raceway: Comply with Section 26 05 29.
- E. Type DS-4000 - Surface Raceway System:
  - 1. Raceway Type: Two channel, painted steel.
  - 2. Size: 4 3/4" by 1 3/4 " inches.
  - 3. Length: As indicated on the drawings.
  - 4. Color: To be selected by Architect.
  - 5. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.
  - 6. Integrated Device Provisions:
    - a. Receptacles:
      - 1) Comply with Section 26 27 26, except for finishes.
      - 2) Configuration: As indicated on the drawings.
      - 3) Color: Match raceway.
      - 4) Spacing: As indicated on the drawings.
    - b. Communications Outlets:
      - 1) Voice and Data Jacks: As specified in Section 27 10 00.
      - 2) Configuration: As indicated on the drawings.
      - 3) Spacing: As indicated on the drawings.
  - 7. Products:
    - a. \_Pass & Seymour.
    - b. Wiremold\_.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
  - 8. Applications:
    - a. Class rooms Hallways and Labs.

### **2.03 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.

- B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install raceways in a neat and workmanlike manner in accordance with NECA 1.
- C. Install raceways plumb and level.
- D. Secure and support raceways in accordance with Section 26 05 29 at intervals complying with NFPA 70 and manufacturer's requirements.
- E. Close unused raceway openings.
- F. Provide grounding and bonding in accordance with Section 26 05 26.
- G. Identify raceways in accordance with Section 26 05 53.

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect raceways for damage and defects.
- C. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.
- D. Correct wiring deficiencies and replace damaged or defective raceways.

### **3.04 CLEANING**

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### **3.05 PROTECTION**

- A. Protect installed raceways from subsequent construction operations.

**END OF SECTION**

## **SECTION 26 05 34 CONDUIT**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Galvanized steel rigid metal conduit (RMC).
- B. Flexible metal conduit (FMC).
- C. Liquidtight flexible metal conduit (LFMC).
- D. Electrical metallic tubing (EMT).
- E. Rigid polyvinyl chloride (PVC) conduit.
- F. Conduit fittings.
- G. Accessories.
- H. Conduit, fittings and conduit bodies.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 84 00 - Firestopping.
- C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Section 26 05 33.16 - Boxes for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems.
- H. Section 26 05 33.16 - Boxes for Electrical Systems.
- I. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- J. Section 31 23 16 - Excavation.
- K. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2025.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit - Aluminum (ERMC-A); 2025.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- J. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- K. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

- L. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- N. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
  - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
  - 5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
  - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
  - 2. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.
- E. Product Data: Provide for metallic conduit and flexible metal conduit.
- F. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

#### **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

## **PART 2 PRODUCTS**

### **2.01 CONDUIT APPLICATIONS**

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  - 1. Under Slab on Grade: Use rigid PVC conduit.
  - 2. Exterior, Direct-Buried: Use rigid PVC conduit.
  - 3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
  - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
    - a. Where direct-buried conduits are subject to movement by settlement or frost, provide expansion fittings to prevent damage to the enclosed conductors or to equipment connected to the conduit.
  - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
- D. Concealed Within Masonry Walls: Use MC cable.
- E. Concealed Within Hollow Stud Walls: Use MC cable.
- F. Concealed Above Accessible Ceilings: Use MC cable.
- G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit.
- I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
  - 1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit.
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.
- L. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
  - 1. Maximum Length: 6 feet.
- M. Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit.
  - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
  - 3. Maximum Length: 6 feet unless otherwise indicated.
  - 4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.
    - c. HVAC equipment.
- N. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

### **2.02 CONDUIT REQUIREMENTS**

- A. Comply with NFPA 70.
- B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

- D. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
  - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
  - 3. Control Circuits: 1/2 inch (16 mm) trade size.
  - 4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
  - 5. Underground, Interior: 3/4 inch (21 mm) trade size.
  - 6. Underground, Exterior: 1 inch (27 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## **2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**

- A. Manufacturers:
  - 1. Allied Tube & Conduit: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  - 2. Republic Conduit: [www.republic-conduit.com/#sle](http://www.republic-conduit.com/#sle).
  - 3. Wheatland Tube Company: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
  - 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## **2.04 METAL CONDUIT**

- A. Manufacturers:
  - 1. Allied Tube & Conduit: [www.alliedtube.com](http://www.alliedtube.com).
  - 2. Beck Manufacturing, Inc: [www.beckmfg.com](http://www.beckmfg.com).
  - 3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

## **2.05 FLEXIBLE METAL CONDUIT (FMC)**

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  - 3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).

- b. O-Z/Gedney, a brand of Emerson Industrial Automation:  
[www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
- D. Description: Interlocked steel construction.
- E. Fittings: NEMA FB 1.

## **2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  - 3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation:  
[www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
- D. Manufacturers:
  - 1. Allied Tube & Conduit: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  - 2. Republic Conduit: [www.republic-conduit.com/#sle](http://www.republic-conduit.com/#sle).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- F. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation:  
[www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
  - 4. Connectors and Couplings: Use compression (gland) or set-screw type.
    - a. Do not use indenter type connectors and couplings.
  - 5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
  - 6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight.  
Fittings that require taping to be concrete-tight are acceptable.

## **2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT**

- A. Manufacturers:

1. Cantex Inc: [www.cantexinc.com/#sle](http://www.cantexinc.com/#sle).
  2. Carlon, a brand of Thomas & Betts Corporation: [www.carlon.com/#sle](http://www.carlon.com/#sle).
  3. JM Eagle: [www.jmeagle.com/#sle](http://www.jmeagle.com/#sle).
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
  2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## **2.08 ACCESSORIES**

- A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
- F. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in.
- E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- E. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
  2. When conduit destination is indicated and routing is not shown, determine exact routing required.
  3. Conceal all conduits unless specifically indicated to be exposed.
  4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  5. Arrange conduit to maintain adequate headroom, clearances, and access.

6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
  7. Arrange conduit to provide no more than 150 feet between pull points.
  8. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  9. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  10. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
  11. Group parallel conduits in the same area together on a common rack.
- F. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  4. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
  8. Use of spring steel conduit clips for support of conduits is not permitted.
  9. Use of wire for support of conduits is not permitted.
    - a. For securing conduits to studs in hollow stud walls.
    - b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
- G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.
  5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
  6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
  8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- I. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 23 16.13.
  2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches.
    - b. Under Slab on Grade: 12 inches to bottom of slab.
  3. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length.
- J. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.
- K. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.
- L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where conduits are subject to earth movement by settlement or frost.
- M. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
    - a. Where conduits enter building from outside.
    - b. Where service conduits enter building from underground distribution system.
    - c. Where conduits enter building from underground.
    - d. Where conduits may transport moisture to contact live parts.
  2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
    - a. Where conduits pass from outdoors into conditioned interior spaces.
    - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
  2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- P. Provide grounding and bonding in accordance with Section 26 05 26.

- Q. Identify conduits in accordance with Section 26 05 53.

**3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective conduits.

**3.04 CLEANING**

- A. Clean interior of conduits to remove moisture and foreign matter.

**3.05 PROTECTION**

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**3.06 INTERFACE WITH OTHER PRODUCTS**

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified in Section roofing section.

**END OF SECTION**

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.
- G. Field-painted identification of conduit.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 90 00 - Painting and Coating.
- B. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.
- C. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
- D. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

**1.03 REFERENCE STANDARDS**

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
  - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Product Data: Provide catalog data for nameplates, labels, and markers.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

**1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.

### **1.07 FIELD CONDITIONS**

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

### **1.08 EXTRA MATERIALS**

- A. See Section 01 6000 - Product Requirements for additional requirements.

## **PART 2 PRODUCTS**

### **2.01 IDENTIFICATION REQUIREMENTS**

- A. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Switchgear:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Use identification nameplate to identify main and tie devices.
      - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    - b. Switchboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    - c. Panelboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      - 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    - d. Transformers:
      - 1) Identify kVA rating.
      - 2) Identify voltage and phase for primary and secondary.
    - e. Enclosed switches, circuit breakers, and motor controllers:
      - 1) Identify voltage and phase.
      - 2) Identify power source and circuit number. Include location when not within sight of equipment.
    - f. Electricity Meters:
      - 1) Identify load(s) metered.
  - 2. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
  - 3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
- B. Identification for Conductors and Cables:
  - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- C. Identification for Raceways:
  1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
- D. Identification for Boxes:
  1. Use voltage markers to identify highest voltage present.
  2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    - a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:
  1. Identification for Communications Devices: Comply with Section 27 10 00.
  2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
  3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles and light switches.

## 2.02 MANUFACTURERS

- A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
- B. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).
- C. HellermannTyton: [www.hellermanntyton.com](http://www.hellermanntyton.com).
- D. Substitutions: See Section 01 6000 - Product Requirements.

## 2.03 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
  1. Manufacturers:
    - a. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
    - b. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
    - c. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
  4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
  6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
  1. Manufacturers:
    - a. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
    - b. Brother International Corporation: [www.brother-usa.com/#sle](http://www.brother-usa.com/#sle).
    - c. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
  1. Minimum Size: 1 inch by 2.5 inches.
  2. Legend:
    - a. System designation where applicable:
      - 1) Emergency Power System: Identify with text "EMERGENCY".
      - 2) Fire Alarm System: Identify with text "FIRE ALARM".
    - b. Equipment designation or other approved description.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height:
    - a. System Designation: 1 inch.
    - b. Equipment Designation: 1/2 inch.
  5. Color:
    - a. Normal Power System: White text on black background.
- D. Format for General Information and Operating Instructions:
  1. Minimum Size: 1 inch by 2.5 inches.
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/4 inch.
  5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
  1. Minimum Size: 2 inches by 4 inches.
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/2 inch.
  5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
  1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Power source and circuit number or other designation indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.
- G. Format for Control Device Identification:
  1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Load controlled or other designation indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.
- H. Format for Fire Alarm Device Identification:
  1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Designation indicated and device zone or address.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Red text on white background.
- I. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- J. Locations:
  1. Each electrical distribution and control equipment enclosure.

2. Communication cabinets.
3. Disconnect switches, and starters.

K. Letter Size:

1. Use 1/8 inch letters for identifying individual equipment and loads.
2. Use 1/4 inch letters for identifying grouped equipment and loads.

## **2.04 WIRE AND CABLE MARKERS**

A. Manufacturers:

1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
2. HellermannTyton: [www.hellermanntyton.com/#sle](http://www.hellermanntyton.com/#sle).
3. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

H. Description: split sleeve type wire markers.

I. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

J. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number indicated on shop drawings.

## **2.05 VOLTAGE MARKERS**

A. Manufacturers: Panduit Corp

1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
  - a. Emergency Power System: Text "EMERGENCY".
  - b. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

- G. Location: Furnish markers for each conduit longer than 6 feet.
- H. Spacing: 20 feet on center.
- I. Color:
  - 1. 480 Volt System: Brown.
  - 2. 208 Volt System: Yellow.
  - 3. Fire Alarm System: Red.
- J. Legend:
  - 1. 480 Volt System: brown.
  - 2. 208 Volt System: yellow.
  - 3. Fire Alarm System: red.

## **2.06 UNDERGROUND WARNING TAPE**

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Pomduit Corp or equal.
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
  - 1. Tape for Buried Power Lines: Black text on red background.
  - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

## **2.07 WARNING SIGNS AND LABELS**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 2. Clarion Safety Systems, LLC: [www.clarionsafety.com/#sle](http://www.clarionsafety.com/#sle).
  - 3. Insite Solutions, LLC: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
  - 1. Materials:
    - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
    - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
  - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
  - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- D. Warning Labels:
  - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
  - 2. Minimum Size: 2 by 4 inches unless otherwise indicated.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Inside of equipment door.
  - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Conduits: Legible from the floor.
  - 8. Boxes: Outside face of cover.
  - 9. Conductors and Cables: Legible from the point of access.
  - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

**END OF SECTION**

**SECTION 26 05 73  
POWER SYSTEM STUDIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
  - 1. Includes arc flash hazard warning labels.
- D. Short circuit study.
- E. Coordination study and analysis.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- B. Section 26 24 13 - Switchboards.
- C. Section 26 24 16 - Panelboards.
- D. Section 26 28 13 - Fuses.
- E. Section 26 28 16.13 - Enclosed Circuit Breakers.
- F. Section 26 28 16.16 - Enclosed Switches.
- G. Section 26 29 13 - Enclosed Controllers.

**1.03 REFERENCE STANDARDS**

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
- B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).
- G. NEMA MG 00001 - Motors and Generators; 2024.
- H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
  - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Study preparer's qualifications.
- C. Field testing agency's qualifications.
- D. Study reports, stamped or sealed and signed by study preparer.
- E. Site-specific arc flash hazard warning labels.
- F. Study Report: Submit protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.
  1. Include stamp or seal and signature of preparing engineer.
- G. Field quality control reports.

#### **1.06 POWER SYSTEM STUDIES**

- A. Scope of Studies:
  1. Perform analysis of new electrical distribution system as indicated on drawings.
    - a. Include portions of electrical distribution system designated as "future."
  2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
  3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    - a. Known Operating Modes:
      - 1) Utility as source.
      - 2) Generator as source.
- B. General Study Requirements:
  1. Comply with NFPA 70.
  2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
  1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
      - 1) Obtain up-to-date information from Utility Company.
    - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
    - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    - e. Protective Devices:
      - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).

- 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
  - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
  - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
  2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    - a. Maximum utility fault currents.
    - b. Maximum motor contribution.
    - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
  3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
  2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
  3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.
- F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
  2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
  3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    - a. Maximum and minimum utility fault currents.
    - b. Maximum and minimum motor contribution.
    - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- G. Study Reports:
1. General Requirements:
    - a. Identify date of study and study preparer.
    - b. Identify study methodology and software product(s) used.
    - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
    - d. Identify base used for per unit values.
    - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
    - f. Include conclusions and recommendations.
  2. Short-Circuit Study:
    - a. For each scenario, identify at each bus location:
      - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      - 2) Fault point X/R ratio.
      - 3) Associated equipment short circuit current ratings.
    - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Protective Device Coordination Study:
  - a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
  - b. For each graph include (where applicable):
    - 1) Partial single-line diagram identifying the portion of the system illustrated.
    - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
    - 3) Conductors: Damage curves.
    - 4) Transformers: Inrush points and damage curves.
    - 5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
    - 6) Motors: Full load current, starting curves, and damage curves.
    - 7) Capacitors: Full load current and damage curves.
  - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
    - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
    - 2) Include ground fault pickup and delay.
    - 3) Include fuse ratings.
    - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
  - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
  - a. For the worst case for each scenario, identify at each bus location:
    - 1) Calculated incident energy and associated working distance.
    - 2) Calculated arc flash boundary.
    - 3) Bolted fault current.
    - 4) Arcing fault current.
    - 5) Clearing time.
    - 6) Arc gap distance.
  - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

#### **1.07 PROTECTIVE DEVICE STUDY**

- A. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.
  1. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
  2. Report: State the methodology and rationale employed in making each type of calculation; identify computer software package(s) used.
- B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:
  1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.
  2. Breaker and fuse ratings.
  3. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
  4. Identification of each bus, with voltage.

5. Conduit materials, feeder sizes, actual lengths, and X/R ratios.
- C. Short Circuit Study: Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
  1. Show fault currents available at key points in the system down to a fault current of 7,000 A at 480 V and 208 V.
  2. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.
  3. Report: Include all pertinent data used in calculations and for each device include:
    - a. Device identification.
    - b. Protective device.
    - c. Device rating.
    - d. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.
- D. Coordination Study: Perform an organized time-current analysis of each protective device in series from the individual device back to the primary source, under normal conditions, alternate operations, and emergency power conditions.
  1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
  2. Plot the specific time-current characteristics of each protective device on log-log paper.
  3. Organize plots so that all upstream devices are clearly depicted on one sheet.
  4. Also show the following on curve plot sheets:
    - a. Device identification.
    - b. Voltage and current transformer ratios for curves.
    - c. 3-phase and 1-phase ANSI damage curves for each transformer.
    - d. No-damage, melting, and clearing curves for fuses.
    - e. Cable damage curves.
    - f. Transformer inrush points.
    - g. Maximum short circuit cutoff point.
    - h. Simple one-line diagram for the portion of the system that each curve plot illustrates.
    - i. Software report for each curve plot, labeled for identification.
- E. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault and so that the protective device closest to the fault will open first.
  1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
  2. Identify any equipment that is underrated as specified.
  3. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve a change to the contract sum.
  4. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
- F. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:
  1. Device identification.
  2. Relay CT ratios, tap, time dial, and instantaneous pickup.
  3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
  4. Fuse rating and type.
  5. Ground fault pickup and time delay.

6. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.
7. Highlight all devices that as furnished by Contractor will not achieve required protection.

## **1.08 QUALITY ASSURANCE**

- A. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
- B. Contractor Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.
- C. Owner's Responsibility: Provide data on relevant Owner power distribution equipment.

## **PART 2 PRODUCTS**

### **2.01 ARC FLASH HAZARD WARNING LABELS**

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
  1. Materials: Comply with Section 26 05 53.
  2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    - a. Include the following information:
      - 1) Arc flash boundary.
      - 2) Available incident energy and corresponding working distance.
      - 3) Site-specific PPE (personnel protective equipment) requirements.
      - 4) Nominal system voltage.
      - 5) Limited approach boundary.
      - 6) Restricted approach boundary.
      - 7) Equipment identification.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install arc flash warning labels in accordance with Section 26 05 53.

### **3.02 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Adjust equipment and protective devices for compliance with studies and recommended settings.
- D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.
- E. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

### **3.03 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

**END OF SECTION**

**SECTION 26 05 83  
WIRING CONNECTIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electrical connections to equipment.

**1.02 REFERENCE STANDARDS**

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
  - 2. Determine connection locations and requirements.
- B. Sequencing:
  - 1. Install rough-in of electrical connections before installation of equipment is required.
  - 2. Make electrical connections before required start-up of equipment.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

**1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.06 COORDINATION**

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Conform to NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
  - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
  - 4. Product:

- 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Disconnect Switches: As specified in Section and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Flexible Conduit: As specified in Section 26 05 34.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 33.16.

## **2.02 EQUIPMENT CONNECTIONS**

- A. As required by equipment manufacturer:

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

### **3.02 ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

**END OF SECTION**

**SECTION 26 22 00**  
**LOW-VOLTAGE TRANSFORMERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General purpose transformers.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 34 - Conduit: Flexible conduit connections.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 34 - Conduit: Flexible conduit connections.
- G. Section 26 24 16 - Panelboards.

**1.03 REFERENCE STANDARDS**

- A. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.
- B. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.
- E. NEMA ST 1 - Specialty Transformers (Except General Purpose Type); National Electrical Manufacturers Association; 1988 (R1997).
- F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- G. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.
- H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.
- K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.
- B. NEMA TR-1/ANSI 57.12.51 and 57.12.50
- C. Federal Register - US department of Energy, Office of Energy Efficiency and Renewable Energy, 10 CFR Part 30, July 29, 2004. Energy Conservation Program for Commercial and Industrial Equipment, Energy Conservation Standards for Distribution Transformers, Proposed Rule.
- D. ANSI/ASHRAE/IESNA 90.1 - Energy Efficient Design on New Buildings Except Low- Rise Residential Buildings.
  - 1. Transformer selection based on optimizing the combination of no-load, part-load, and full-load losses without compromising operational and reliability requirements for the building.

- E. ANSI/NEMA TP-1 - Guide for Determining Energy Efficiency for Distribution Transformers.
  - 1. For Reference only. US DOE does not consider NEMA TP-1 efficiency levels to reflect low life cycle cost.
- F. ANSI/NEMA TP-2 - Standard Test Method for Measuring Energy Consumption of Distribution Transformers.
- G. IEEE C57.110-1998 - IEEE Recommended Practice for establishing transformer capability when feeding nonsinusoidal load currents.
  - 1. Transformers losses increase in proportion to the mix of electronic equipment in the overall load fed from transformer.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
- C. Provide linear load efficiency data at 25 %, 35%, 50 %, 75 % , and 100 % full load.
  - 1. Vibration Isolators: Include attachment method and rated load and deflection.
- D. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
- E. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, core and coil material and rated temperature rise.
- F. Test Reports: Indicate loss data, efficiency at 0, 25, 50, 75 and 100 percent rated load, and sound level.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Maintenance Data: Include recommended maintenance procedures and intervals.
- I. Project Record Documents: Record actual locations of transformers.

#### **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

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

### **1.08 FIELD CONDITIONS**

- A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
  - 1. Greater than 10 kVA: 104 degrees F maximum.
  - 2. Less than 10 kVA: 77 degrees F maximum.
- B. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

### **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Schneider Electric; Square D Products; Premium 30 energy efficient: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- B. Eaton Electrical/Cutler-Hammer: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- C. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- D. Powersmiths International Corp.
- E. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

### **2.02 ALL TRANSFORMERS**

- A. Description: High performance, energy efficient, aluminum wound transformer with 30 % less losses than NEMA TP\_1 . Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
  - 1. Altitude: Less than 3,300 feet.
  - 2. Ambient Temperature:
    - a. Greater than 10 kVA: Not exceeding 104 degrees F.
    - b. Less than 10 kVA: Not exceeding 77 degrees F.
  - 3. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hygroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

### 2.03 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3 phase.
- C. Secondary Voltage: 208Y/120 volts, 3 phase 4 wire.
- D. Insulation System and Allowable Average Winding Temperature Rise:
  - 1. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- F. Winding Taps:
  - 1. Less than 3 kVA: None.
  - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
  - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
  - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: DOE 2016 energy efficiency levels.
- H. Sound Levels: Low sound levels at least 5 db less than NEMA ST 20 standard sound levels.
- I. Mounting Provisions:
  - 1. Less than 15 kVA: Suitable for wall mounting.
  - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
  - 3. Larger than 75 kVA: Suitable for floor mounting.
- J. Transformer Enclosure: Comply with NEMA ST 20.
  - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor clean, dry locations: Type 2.
  - 2. Construction: Heavy gage steel.
    - a. Less than 15 kVA: Totally enclosed, non-ventilated.
    - b. 15 kVA and Larger: Ventilated.
  - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
  - 4. Provide lifting eyes or brackets.
- K. Accessories:
  - 1. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.
- L. Primary Voltage: 480 volts, 3 phase.
- M. Secondary Voltage: 208Y/120 volts, 3 phase.
- N. Insulation system and average winding temperature rise for rated kVA as follows:
  - 1. 1-15 kVA: Class 185 with 115 degrees C rise, in a 40 C ambient setting.
  - 2. 16-500 kVA: Class 220 with 115 degrees C rise, in a 40 C ambient setting.
- O. Case Temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
- P. Winding Taps:
  - 1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
  - 2. Transformers 15 kVA and Larger: Two 2-1/2% full capacity taps above and below normal primary voltage.
- Q. Sound Levels: NEMA ST 20.
- R. Energy Standard

1. Efficiency at 50% load is at least 0.9% higher than NEMA TP-1 for transformers up to 750 KVA.
- S. Basic Impulse Level: 10 kV
- T. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- U. Mounting:
  1. 1-15 kVA: Suitable for wall mounting.
  2. 16-75 kVA: Suitable for wall mounting.
  3. Larger than 75 kVA: Suitable for floor mounting.
- V. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- W. Transformer Enclosure: NEMA ST 20.
  1. Type 1.
  2. Ventilated.
  3. Provide lifting eyes or brackets.
  4. All terminals, including those for changing taps, must be readily accessible by removing front cover plates.
- X. Isolate core and coil from enclosure using vibration-absorbing mounts.
- Y. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

## **2.04 SOURCE QUALITY CONTROL**

- A. Factory test transformers according to NEMA ST 20.
- B. Production test each unit according to NEMA ST 20.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install transformers in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 05 34, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Set transformers plumb and level.
- G. Use flexible conduit, under the provisions of Section 26 0534, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- H. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.
- I. Mount floor-mounted transformers on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.

- J. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.
- K. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- L. Mount trapeze-mounted transformers as indicated.
- M. Provide seismic restraints.
- N. Provide grounding and bonding in accordance with Section 26 05 26.
- O. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- P. Where not factory-installed, install lugs sized as required for termination of conductors as shown on the drawings.
- Q. Identify transformers in accordance with Section 26 05 53.
- R. Install transformer identification nameplate in accordance with Section 26 0553.

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.
- C. Inspect and test in accordance with NETA STD ATS, except Section 4.
- D. Perform inspections and tests listed in NETA STD ATS, Section 7.2.1.1. In addition to the basic requirements of Section 7.2, include the following:
  - 1. Perform turns ratio tests at all tap positions.
  - 2. Verification that as-left tap connections are as specified.
  - 3. Perform excitation-current tests on each phase.
  - 4. Measure the resistance of each winding at each tap connection.
  - 5. Overpotential test on all high- and low-voltage windings-to-ground.

### **3.04 ADJUSTING**

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### **3.05 CLEANING**

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

## **SECTION 26 24 13 SWITCHBOARDS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Switchboards.
- B. Overcurrent protective devices for switchboards.
- C. Switchboard accessories.

#### **1.02 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendment (2017).
- B. ANSI C12.1 - American National Standard Code for Electricity Metering; 2008.
- C. ANSI C39.1 - American National Standard Requirements for Electrical Analog Indicating Instruments; 1981 (R1992).
- D. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts;; 1997.
- E. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters; 1984.
- F. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.
- G. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- I. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.
- J. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- K. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- L. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.
- M. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.
- N. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- Q. UL 891 - Switchboards; Current Edition, Including All Revisions.
- R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

#### **1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
  5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
  2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
  3. Obtain Utility Company approval of switchboard prior to fabrication.
  4. Arrange for inspections necessary to obtain Utility Company approval of installation.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
  3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  4. Include documentation of listed series ratings.
  5. Include documentation demonstrating selective coordination.
- D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- E. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- F. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.
- G. Test Reports: Indicate results of factory production tests.
- H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Project Record Documents: Record actual locations of switchboards.
- J. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Enclosure Keys: Two of each different key.

#### **1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.

- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.
- E. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- F. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- G. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

#### **1.07 FIELD CONDITIONS**

- A. Maintain field conditions within required service conditions during and after installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Switchboards - Basis of Design: Schneider Electric co. QED power style switchboard.
- B. Switchboards - Other Acceptable Manufacturers:
  - 1. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
  - 2. General Electric Company: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.
  - 4. Source Limitations: Provide switchboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.
- C. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Eaton Corporation; Cutler-Hammer Products: [www.eaton.com](http://www.eaton.com).
- F. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- G. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- I. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

## 2.02 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
  - 1. Main Device(s): Individually-mounted.
  - 2. Feeder Devices: Panel/group-mounted.
  - 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
  - 4. Gutter Access: Bolted covers.
  - 5. Basis of Design: Schneider Electric QED power style switchboard.
- E. Service Conditions:
  - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude: Less than 6,600 feet.
    - b. Ambient Temperature:
      - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
  - 2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
    - a. Altitude: 1000 feet.
    - b. Ambient Temperature: Between 23 degrees F and 104 degrees F.
- F. Short Circuit Current Rating:
  - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Minimum Rating: 65,000 rms symmetrical amperes.
  - 3. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
  - 4. Label equipment utilizing series ratings as required by NFPA 70.
- G. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
  - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
  - 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  - 4. Phase and Neutral Bus Material: Aluminum.
  - 5. Ground Bus Material: Aluminum.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
  - 1. Line Conductor Terminations:
    - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

- b. Main and Neutral Lug Type: Mechanical.
  - 2. Load Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Lug Type:
      - 1) Provide mechanical lugs unless otherwise indicated.
      - 2) Provide compression lugs where indicated.
- K. Enclosures:
  - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
  - 2. Finish: Manufacturer's standard unless otherwise indicated.
- L. Future Provisions:
  - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
  - 2. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.
- M. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list switchboards as a complete assembly including surge protective device.
- N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  - 1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    - a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- O. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- P. Owner Metering:
  - 1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
  - 2. Basis of Design: PM 8000.
  - 3. Measured Parameters:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase and neutral.
    - c. Frequency (Hz).
    - d. Real power (kW): For each phase, 3-phase total.
    - e. Reactive power (kVAR): For each phase, 3-phase total.
    - f. Apparent power (kVA): For each phase, 3-phase total.
    - g. Power factor.
    - h. Current demand.
    - i. Power demand: Real, reactive, and apparent.
  - 4. Meter Accuracy: Plus/minus 1.0 percent.
  - 5. Features:
    - a. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
    - b. Remote monitoring capability via PC.
- Q. Instrument Transformers:

1. Comply with IEEE C57.13.
  2. Select suitable ratio, burden, and accuracy as required for connected devices.
  3. Current Transformers: Connect secondaries to shorting terminal blocks.
  4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
- R. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- S. Ratings:
1. Voltage: 120/208; 277/480 volts.
  2. Configuration: Three phase, four wire, grounded.
  3. Main Bus: 2400 amps, 277/480v, 2000 amps, 208/120v .
  4. Integrated Equipment Rating: 65000 rms amperes symmetrical.
- T. Main Section Devices: Individually mounted and compartmented.
- U. Distribution Section Devices: \_Group mounted- double row sections.
- V. Bus Material: Copper with tin plating, standard size.
- W. Bus Connections: Bolted, accessible from front for maintenance.
- X. Fully insulate load side bus bars
- Y. Ground Bus: Extend length of switchboard.
- Z. Insulated Ground Bus: Extend length of switchboard.
- AA. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
  2. Include shunt trip where indicated.
  3. Circuit Breakers less than 400amp shall be provided with field replaceable trip unit. All circuit breakers greater than or equal to 400amp shall have electronic trip including long, short, and instantaneous settings and shall have field replaceable trip settings.
  4. All Feeder breakers in 208/120v switchboard shall be series rated for min. of 65 kAIC with 1-pole circuit breakers in all panelboards. All feeder breakers in 480y/277v, 3ph4w switchboard shall be series rated for min. of 65 KAIC.
- BB. Solid-State Molded Case Circuit Breakers: With electronic sensing, timing and tripping circuits for adjustable current settings; UL listed.
1. Ground fault trip, ground fault sensing integral with circuit breaker.
  2. Instantaneous trip.
  3. Adjustable short time/ long time trip.
  4. Stationary mounting.
  5. Include shunt trip where indicated.
- CC. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- DD. Ground Fault Sensor: Zero sequence type.
- EE. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches. Max time delay shall be one second for ground fault currents equal to or greater than 3000 amps.
- FF. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- GG. Enclosure: Type \_NEMA 1-Indoors.
1. Align sections at front and rear.
  2. Switchboard Height: 91.5 inches, excluding floor sills, lifting members and pull boxes.

3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
4. Structure: Free standing, self supporting, totally front accessible.

## **2.03 OVERCURRENT PROTECTIVE DEVICES**

### **A. Circuit Breakers:**

1. Interrupting Capacity:
  - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
  - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  - c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
2. Molded Case Circuit Breakers:
  - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
    - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
    - 2) Provide electronic trip circuit breakers where indicated.
  - b. Minimum Interrupting Capacity:
    - 1) 14000 rms symmetrical amperes at 240 VAC or 208 VAC.
    - 2) 21000 rms symmetrical amperes at 480 VAC.
  - c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 400 amperes and larger.
  - d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    - 1) Provide the following field-adjustable trip response settings:
      - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      - (b) Long time delay.
      - (c) Short time pickup and delay.
      - (d) Instantaneous pickup.
      - (e) Ground fault pickup and delay where ground fault protection is indicated.
  - e. Provide the following features and accessories where indicated or where required to complete installation:
    - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

## **2.04 SURGE PROTECTIVE DEVICES**

- A. See Section 26 43 00 for factory-installed, internally mounted surge protective devices. List and label switchboards containing surge protective devices as a complete assembly including surge protective device.

## **2.05 POWER METERS**

- A. Manufacturers:
  1. SQ D PM 8000 or approved equal.
  2. Substitutions:
- B. Watt-Hour Meters and Wattmeters: ANSI C12.1, three phase induction type with two stators, each with current and potential coil, rated 5 amperes and 120 volts at 60 Hertz.

1. Meter suitable for connection to 3- and 4-wire circuits.
  2. Potential indicating lamps.
  3. Adjustments for light and full load, phase balance, and power factor.
  4. Digital register.
  5. Integral demand indicator.
  6. Ratchets to prevent reverse rotation.
  7. Removable meter with draw-out test plug.
  8. Semi-flush mounted case with matching cover.
  9. BACnet gateway to provide connection to building automation system.
- C. Provide meters with appropriate multiplier tags.

## **2.06 METERING TRANSFORMERS**

- A. Manufacturers:
1. Square D or equal.
  2. Substitutions:
- B. Current Transformers: IEEE C57.13, 5 ampere secondary, wound; bushing; bar or window type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
- C. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

## **2.07 SOURCE QUALITY CONTROL**

- A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
1. Dielectric tests.
  2. Mechanical operation tests.
  3. Grounding of instrument transformer cases test.
  4. Electrical operation and control wiring tests, including polarity and sequence tests.
  5. Ground-fault sensing equipment test.
- B. Shop inspect and test switchboard according to NEMA PB 2.
- C. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 PREPARATION**

- A. Provide concrete housekeeping pad under the provisions of Section .
- B. Verify that field measurements are as instructed by manufacturer.

### **3.03 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment components in accordance with Section 26 05 29.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.
- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Provide filler plates to cover unused spaces in switchboards.
- N. Identify switchboards in accordance with Section 26 05 53.
- O. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.
- P. Install in a neat and workmanlike manner, as specified in NECA 400.
- Q. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- R. Identify switchboards.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- C. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- D. Perform field inspection and testing in accordance with Section .
- E. Inspect and test in accordance with NETA STD ATS, except Section 4.
- F. Perform inspections and tests listed in NETA STD ATS, Section 7.1.
- G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.
- H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- I. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10.
- K. Test shunt trips to verify proper operation.
- L. Correct deficiencies and replace damaged or defective switchboards or associated components.

### **3.05 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.
- C. Adjust all operating mechanisms for free mechanical movement.
- D. Tighten bolted bus connections in accordance with manufacturer's instructions.
- E. Adjust circuit breaker trip and time delay settings to values indicated.
- F. Adjust circuit breaker trip and time delay settings to values as instructed by Architect.

### **3.06 CLEANING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- C. Touch up scratched or marred surfaces to match original finish.

### **3.07 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

### **3.08 PROTECTION**

- A. Protect installed switchboards from subsequent construction operations.

**END OF SECTION**

**SECTION 26 24 16  
PANELBOARDS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- G. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.
- H. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.
- I. Section 26 43 00 - Surge Protective Devices.

**1.03 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendment (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.
- D. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- G. NEMA PB 1 - Panelboards; 2011.
- H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- I. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- M. UL 67 - Panelboards; Current Edition, Including All Revisions.
- N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

- O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include wiring diagrams showing all factory and field connections.
  - 2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Panelboard Keys: Two of each different key.

#### **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

#### **1.08 FIELD CONDITIONS**

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

#### **1.09 MAINTENANCE MATERIALS**

- A. See Section 01 6000 - Product Requirements, for additional provisions.
- B. Furnish two of each panelboard key.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Eaton Corporation; Cutler-Hammer Products: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- B. General Electric Company: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- D. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

#### **2.02 ALL PANELBOARDS**

- A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
  - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- B. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
  - 3. Label equipment utilizing series ratings as required by NFPA 70.
- C. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
3. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
  2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
    - d. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continuous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  4. Lockable Doors: All locks keyed alike unless otherwise indicated.
  5. Metal frame for type written directory
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
  1. Ampere Rating: Not less than ampere rating of panelboard bus.
  2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
  3. Coil Voltage: As required for connection to control system indicated.
- K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

### **2.03 POWER DISTRIBUTION PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Products:
  1. SQ D .
  2. General Electric.
  3. Eaton Cutler Hammer.
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Conductor Terminations:
  1. Main and Neutral Lug Material: Copper suitable for terminating copper conductors only.
  2. Main and Neutral Lug Type: Mechanical.
- D. Bussing:
  1. Phase and Neutral Bus Material: Copper.

2. Ground Bus Material: Copper.
- E. Circuit Breakers:
  1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
  2. Provide thermal magnetic circuit breakers unless otherwise indicated.
  3. Provide electronic trip circuit breakers where indicated.
- F. Enclosures:
  1. Provide surface-mounted enclosures unless otherwise shown or indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continuous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide metal circuit directory holder mounted on inside of door.
- G. Manufacturers:
  1. SQ.D or Equal.
  2. Substitutions: See Section 01 6000 - Product Requirements.
- H. Description: NEMA PB 1, circuit breaker type.
- I. Service Conditions:
  1. Altitude: 1000 feet.
  2. Temperature: 55 degrees F.
- J. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- K. Minimum integrated short circuit rating: As indicated.
  1. 240 Volt Panelboards: 14,000 amperes rms symmetrical (minimum).
  2. 480 Volt Panelboards: 21,000 amperes rms symmetrical (minimum).
- L. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.
- M. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; UL listed.
- N. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- O. Enclosure: NEMA PB 1, Type 1, 5 3/4" deep, 20" wide, cabinet box. With continued hinge and lock.
- P. Cabinet Front: Surface type, fastened with [CHOICE TEXT], [CHOICE TEXT] [CHOICE TEXT] finished in manufacturer's standard [CHOICE TEXT] enamel.

#### **2.04 LIGHTING AND APPLIANCE PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Products:
  1. SQD.
  2. General Electric.
  3. Eaton Cutler Hammer.
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Conductor Terminations:
  1. Main and Neutral Lug Material: Copper suitable for terminating copper conductors only.
  2. Main and Neutral Lug Type: Mechanical.
- D. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  2. Phase and Neutral Bus Material: Copper.
  3. Ground Bus Material: Copper.
- E. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- F. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continuous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide metal circuit directory holder mounted on inside of door.
- G. Manufacturers:
1. SQ.D or Equal.
  2. Substitutions: See Section 01 6000 - Product Requirements.
- H. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- I. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.
- J. Minimum Integrated Short Circuit Rating: As indicated.
1. 240 Volt Panelboards: 14,000 amperes rms symmetrical (minimum).
  2. 480 Volt Panelboards: 21,000 amperes rms symmetrical (minimum).
- K. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
1. Type SWD for lighting circuits.
  2. Type HACR for air conditioning equipment circuits.
  3. Class A ground fault interrupter circuit breakers where scheduled.
  4. Do not use tandem circuit breakers, or miniature circuit breakers.
- L. Enclosure: NEMA PB 1, Type 1.
- M. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.
- N. Cabinet Front: Flush or Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

## **2.05 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - 1) 14000 rms symmetrical amperes at 240 VAC or 208 VAC.
      - 2) 21000 rms symmetrical amperes at 480 VAC.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
    - c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
  3. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Copper suitable for terminating copper conductors only.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
  - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes larger than 225 amperes.
  - b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
  - a. Provide the following field-adjustable trip response settings:
    - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - 2) Long time delay.
    - 3) Short time pickup and delay.
    - 4) Instantaneous pickup.
    - 5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.

## **2.06 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), NEMA PB 1.1, NECA 1 (general workmanship), NECA 407 (panelboards), NEMA PB 1.1, NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 05 29.
- E. Install panelboards plumb.
- F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- H. Mount floor-mounted power distribution panelboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26 05 26.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.
- M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- N. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- O. Install panelboards plumb. Install recessed panelboards flush with wall finishes, where installed surface mounted secure or anchor panelboard to brick or cinder block wall.
- P. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- Q. Provide filler plates to cover unused spaces in panelboards.
- R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Emergency and night lighting circuits.
  - 2. Fire detection and alarm circuits.
  - 3. Communications equipment circuits.
  - 4. Intrusion detection and access control system circuits.
  - 5. Video surveillance system circuits.
- S. Identify panelboards in accordance with Section 26 05 53.
- T. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.
- U. Provide identification nameplate for each panelboard in accordance with Section 26 0553.
- V. Provide arc flash warning labels in accordance with NFPA 70.
- W. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
  - 1. Minimum spare conduits: 5 empty 1 inch.
- X. Ground and bond panelboard enclosure according to Section 26 0526.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.
- B. Perform field inspection and testing in accordance with Section 01 4000.
- C. Inspect and test in accordance with NETA STD ATS, except Section 4.
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test shunt trips to verify proper operation.

- G. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- H. Correct deficiencies and replace damaged or defective panelboards or associated components.
- I. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

#### **3.04 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

#### **3.05 CLEANING**

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

**SECTION 26 27 01  
ELECTRICAL SERVICE ENTRANCE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Service racks.
- B. Metering transformer cabinets.
- C. Meter bases.

**1.02 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.03 SYSTEM DESCRIPTION**

- A. System Characteristics: 480Y/277 volts, three phase, four-wire, 60 Hertz.
- B. Service Entrance:

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.
- C. Submit utility company-prepared drawings.

**1.06 QUALITY ASSURANCE**

- A. Utility Company: Rhode Island Energy
- B. Perform work in accordance with utility company written requirements and NFPA 70.
  - 1. Maintain one copy of each document on site.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.07 PRE-INSTALLATION MEETING**

- A. Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- B. Milbank Manufacturing: [www.milbankmfg.com](http://www.milbankmfg.com).
- C. Square D: [www.squared.com](http://www.squared.com).
- D. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 COMPONENTS**

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
  - 1. Size: As required by utility.
- B. Meter Base: Furnished by utility company.

- C. Utility Transformer Pad: sized as indicated on drawings or size as required by the utility company.
- D. Other Components: As required by utility company.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION**

- A. Arrange with utility company to obtain permanent electric service to the Project.
- B. Verify that field measurements are as indicated on utility company drawings.

#### **3.02 INSTALLATION**

- A. Install service rack, transformer pad, metering transformer cabinets, and meter base as required by utility company.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

**END OF SECTION**

**SECTION 26 27 13.13**  
**POWER AND ENERGY METERS - SCHNEIDER ELECTRIC POWERLOGIC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Power meters.
- B. Energy meters.
- C. Multi-meter unit cabinets.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 01 60.13 - Maintenance Services for Electrical Distribution Equipment - Schneider Electric EcoCare.
- B. Section 26 05 73.10 - Power System Studies - Schneider Electric.

**1.03 ABBREVIATIONS AND ACRONYMS**

- A. EPMS: Electrical power management system.

**1.04 REFERENCE STANDARDS**

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes; 2022.
- C. IEC 61000-6-5 - Electromagnetic Compatibility (EMC) – Part 6-5: Generic Standards – Immunity for Equipment Used in Power Station and Substation Environment; 2015 (Corrigendum 2017).
- D. IEC 61326-1 - Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements – Part 1: General Requirements; 2020.
- E. IEC 61557-12 - Electrical Safety in Low Voltage Distribution Systems Up to 1 000 V AC and 1 500 V DC - Equipment for Testing, Measuring or Monitoring of Protective Measures - Part 12: Power Metering and Monitoring Devices (PMD); 2018 (Corrigendum 2022).
- F. IEC 62053-22 - Electricity Metering Equipment - Particular Requirements - Part 22: Static Meters for AC Active Energy (Classes 0,1S,0,2S and 0,5S); 2020.
- G. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).
- H. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2026.
- I. ISO 50001 - Energy Management Systems – Requirements with Guidance for Use; 2018, with Amendment (2024).
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 61010-1 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements; Current Edition, Including All Revisions.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Provide sufficient information to determine compliance with Contract Documents. Identify submittal data with specific equipment tags and/or service descriptions to which they pertain. Identify specific model numbers, options, and features of equipment proposed.
- C. Indicate deviations from Contract Documents with reference to corresponding drawing or specification number and written justification for deviation.

- D. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.
- E. Operation and Maintenance Data:
  - 1. Provide detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
- F. Specimen Warranty: Statement of standard warranty.
- G. Executed warranty.
- H. Project Record Documentation:
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 01 60 00 - Product Requirements for additional provisions.
  - 2. Spare Parts: For each type and size of unit installed.
    - a. Provide minimum spare parts recommended by manufacturer.
    - b. Fuses: One set of each type of power and control fuse installed within equipment.
    - c. Package and mark spare parts for long-term storage. Provide separate anti-static containers for printed circuit boards.
  - 3. Tools: Manufacturer-specific special tools required to install, remove, test, and maintain metering components.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with the following:
  - 1. NFPA 70.
  - 2. Requirements of local authorities having jurisdiction.
  - 3. Applicable local codes.
- B. Manufacturer Qualifications:
  - 1. Firm engaged in manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for minimum of 10 years.
  - 2. Certified in accordance with ISO 9001 with applicable quality assurance system regularly reviewed and audited by third-party registrar. Develop and control manufacturing, inspection, and testing procedures under guidelines of quality assurance system.
  - 3. Service, repair, and technical support services available 24 hours per day, 7 days per week from manufacturer or their representative.
  - 4. Certified in accordance with ISO 14001, with product environmental profiles (PEPs) for specified products.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Prior to delivery to project site, verify suitable storage space is available to store materials in well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres.
- B. Protect materials during delivery and storage and maintain within manufacturer's written storage requirements. At minimum, store indoors in clean, dry space with uniform temperature to prevent condensation and protect electronics from potential damage from electrical and magnetic energy.
- C. Deliver materials to project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified in Contract Documents.
- D. Inspect products and report concealed damage or violation of delivery, storage, and handling requirements to Engineer.

## **1.08 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

## **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for 18 months from date of invoice. Complete forms in Owner's name and register with manufacturer.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Schneider Electric; PowerLogic; [www.se.com/#sle](http://www.se.com/#sle).
- B. Source Limitations: Furnish products produced by same manufacturer as other electrical distribution equipment for project and obtained from single supplier.

### **2.02 GENERAL REQUIREMENTS**

- A. List as complying with UL 61010-1.
- B. Certified for use in energy management systems in accordance with ISO 50001.
- C. Electromagnetic Compatibility:
  - 1. Comply with IEC 61000-6-5 and IEC 61326-1.
  - 2. Comply with FCC requirements of 47 CFR 15, Class B.

### **2.03 POWER METERS**

- A. Capable of monitoring for network management, energy cost management, energy allocation, and operational efficiency.
- B. Construction:
  - 1. Form Factor: 1/4 DIN with cut-out of 3.6 by 3.6 inches and panel-mount integrated display of 3.8 by 3.8 inches.
  - 2. Capable of mounting in enclosure panel/door without tools.
  - 3. Provide removable connectors for voltage inputs, control power, communications, and auxiliary inputs/outputs.
- C. Voltage and Current Inputs:
  - 1. Support direct connection of low-voltage circuits up to 600 VAC without requiring voltage (potential) transformers.
  - 2. Provide four metered 5 A nominal current inputs for 3-phase measurement plus neutral.
- D. Control Power: 100-480 VAC/125-250 VDC.
- E. Measured and Calculated Metering Parameters: Support full range of 3-phase voltage, current, power, and energy measurements, power factor, frequency, total harmonic distortion (THD), and individual power harmonics readings (up to 63rd order).
- F. Measurement Accuracy:
  - 1. Provide four-quadrant metering and sample current/voltage simultaneously without gaps with 64 samples per cycle (zero blind).
  - 2. ANSI C12.20; Class 0.2.
  - 3. IEC 61557-12; Class 0.2.
- G. Display:
  - 1. Provide backlit dot-matrix LCD, anti-glare and scratch resistant with minimum of 128 by 128 pixels.
  - 2. Capable of displaying four values per screen.
  - 3. Provide summary screen to view snapshot of system.

4. Support integrated or remote display.
- H. Input/Outputs:
  1. Support four digital inputs for demand sync pulse, time sync input, and conditional energy control.
  2. Provide two digital outputs that operate by user command sent over communication link or in response to user-defined alarm/event.
  3. Provide four digital inputs configurable for input metering with on-board pulse weight calculation and conversion to standard units for external water, air, gas, electrical, or steam (WAGES) meters.
- I. Communications:
  1. Support serial RS485 Modbus, Ethernet Modbus TCP, Ethernet BACnet IP (BTL listed), DNP over Ethernet, and Ethernet IP.
  2. Provide two Ethernet ports for daisy-chain wiring from meter to meter.
  3. Support serving data over Ethernet network accessible through web browser with default pages from factory.
  4. Support upgradeable firmware to enhance functionality through Ethernet or serial communication connection for upgrades of individual meters or groups.
  5. Provide integrated gateway functionality to enable connection via Ethernet to downstream, serially connected devices.
- J. Onboard Logging:
  1. Provide capability to log data, alarms, and events, including data logs, minimum/maximum log files of selected parameter values, and alarm logs for each user-defined alarm/event.
  2. Nonvolatile Memory: Support 14 parameters every 15 minutes for 90 days.
- K. Alarming:
  1. Support 29 setpoint-driven alarms, 4 digital alarms, 4 unary alarms, 10 Boolean alarms and 5 custom alarms.
  2. Support user-definable alarm events.
  3. Support setpoint-driven alarms for voltage/current parameters, input status, and end-of-interval status.
  4. Support generation of email/text message notifications upon alarm condition via simple mail transfer protocol (SMTP).
  5. Support management and monitoring of devices on IP network via simple network management protocol (SNMP) with delivery of alarm condition by SNMP traps.
- L. Products:
  1. Schneider Electric; PowerLogic PM5000 series.

## **2.04 ENERGY METERS; POWERLOGIC IEM3000**

- A. Capable of monitoring circuits for energy cost management, energy allocation, and operational efficiency.
- B. Operating Temperature: Between minus 13 degrees F and 158 degrees F.
- C. Construction:
  1. Self-enclosed to prevent exposure to live parts and protect sensitive electronics when enclosure cabinet is open.
  2. Snap-on meters, removable for serviceability.
- D. Voltage and Current Inputs:
  1. Support direct connection of single-phase or 3-phase low-voltage circuits up to 480 V line-to-line.
  2. Provide current inputs that support x/0.33 V and x/1.0 V low-voltage current transformers (LVCT) or Rogowski coil-type sensors.
  3. Current Range: Configurable, capable of monitoring circuits up to 5,000 A.

- E. Security:
  - 1. Provide anti-tamper security features to ensure integrity of measurements.
  - 2. Provide additional safety barrier.
  - 3. Provide password-protection to prevent tampering from front panel.
- F. Measured and Calculated Metering Parameters:
  - 1. Support up to four tariffs for accumulation of real energy controlled by internal clock, digital input, or communications.
  - 2. Support real energy (kWh) four-quadrant, reactive energy (kVARh) four-quadrant, active power (kW), reactive power (kVAR), current per phase (I), voltage per phase (V), power factor (PF), frequency (F), overload alarm, and hour counter.
  - 3. Support reading of measurements directly from energy meter display without multipliers.
  - 4. Demand Measurements:
    - a. Provide fixed block or sliding block demand modes with selectable interval for measurement of total active, reactive, and apparent power demand; accessible through front panel or communications.
    - b. Measure current demand per each phase, neutral, and average; available through communications.
    - c. Measure peak demand for demand parameters, maintained in nonvolatile memory with date and time of peak since last reset; accessible through front panel or communications.
    - d. Support reset of demand parameters through front panel or communications.
- G. Measurement Accuracy:
  - 1. Designed to meet 0.5 percent accuracy for real energy and real power in accordance with ANSI C12.20 and IEC 62053-22.
  - 2. Annual recalibration not required to maintain accuracy.
- H. Inputs/Outputs:
  - 1. Provide one digital input configurable for tariff control or WAGES input.
  - 2. Provide one digital output configurable for kWh pulse or kW overload alarm.
- I. Communications:
  - 1. Provide onboard RS485 data port using Modbus (RTU) or BacNet MS/TP protocol for multipoint communications.
  - 2. Provide removable connectors for communication wiring.
- J. Products:
  - 1. Schneider Electric; PowerLogic IEM3000 series.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine equipment exterior and interior for damage, including but not limited to, structure, moisture, and mildew.
- B. Examine for conditions detrimental to completion of work.

### **3.02 INSTALLATION**

- A. Install equipment in accordance with manufacturer's written instructions.

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Manufacturer Services: Provide services of manufacturer's field representative to perform functional testing, commissioning, and first parameter adjusting.
  - 1. Test and adjust controls and safeties.
  - 2. Replace damaged or malfunctioning equipment and report discrepancies or installation issues.

**3.04 PROTECTION**

- A. Protect installed meters from subsequent construction operations.

**3.05 MAINTENANCE**

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements relating to maintenance service.
- B. See Section 26 01 60.13 for additional information.
- C. Provide to Owner, as alternate to base bid, separate contract for switchgear service plan for two years from date of Substantial Completion including, but not limited to, dedicated customer success management team, priority remote and on-site (within 100 miles of service location) expert support, discounted service rates, continuous monitoring and alarming, online training.

**END OF SECTION**

**SECTION 26 35 26**  
**ACTIVE HARMONIC FILTERS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for low voltage active harmonic filters (also identified as AHFs) as required for the complete performance of the work, and as shown on the Drawings and as herein specified.

**1.02 REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. ANSI/IEEE 519, "Guide for Harmonic Control and Reactive Compensation of Static Power Converters."
  2. ASTM (ASTM):
    - a. ASTM E 329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."
  3. International Code Council (ICC):
    - a. ICC IBC, "International Building Code."
  4. International Electrotechnical Commission (IEC):
    - a. IEC 60529, "Degrees of Protection Provided by Enclosures (IP Code)."
    - b. CE EMC Certification IEC/EN 60439-1, EN 61000-6-4 Class A, EN 61000-6-2
  5. International Organization for Standardization (ISO):
    - a. ISO 9001, "Quality Management Systems - Requirements"
  6. National Electrical Manufacturers Association (NEMA):
    - a. NEMA 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)"
  7. National Fire Protection Association (NFPA):
    - a. NFPA 70, "National Electrical Code" (copyrighted by NFPA, ANSI approved) hereinafter referred to as NEC.
    - b. NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces" (copyrighted by NFPA, ANSI approved).
    - c. NFPA 5000, "Building Construction and Safety Code."
  8. Underwriters Laboratories, Inc. (UL):
    - a. UL 508, "Standard for Industrial Control Equipment."
    - b. UL 1449, "Standard for Transient Voltage Surge Suppressers."

**1.03 DEFINITIONS**

- A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.
1. EMC: Electromagnetic Compatibility
  2. HMI: Human Machine Interface
  3. IGBT: Insulated gate bipolar transistor
  4. LV: Low voltage
  5. MTBF: Mean time between failure
  6. MTTR: Mean time to repair
  7. SMPS: Switched Mode Power Supply
  8. SPD: Surge Protective Device
  9. VFD: Variable frequency drive
  10. VSD: Variable Speed Drive

#### **1.04 SUBMITTALS**

- A. General: Submittals shall be in accordance with the requirements of Section [01 33 00] Submittals, in addition to those specified herein.
  - 1. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.
  - 2. Deviations from the Contract Documents shall be indicated within the submittal. Each deviation shall reference the corresponding drawing or specification number, show the Contract Document requirement text and/or illustration, and shall be accompanied by a detailed written justification for the deviation.
- B. Product Data: Submit required product data specific to each product and accessory proposed. In addition, include the following information:
  - 1. AHF sizing calculations shall be provided to confirm required harmonic mitigation performance for the AHFs proposed.
  - 2. AHF assembly rated input KVA and output KVA, topology, converter/inverter type, percent efficiency, operating characteristics, and electrical characteristics
  - 3. Maximum [Btu] [kJ] heat release data and ambient cooling requirements
  - 4. Certification of UL conformity
- C. Harmonic Analysis Report: Manufacturer shall provide project-specific calculations and statement of compliance with IEEE 519, latest revision. Owner shall supply detailed electrical power system characteristics to support harmonic calculations.
- D. Statement of extended warranty options and costs.
- E. O&M manuals shall be submitted prior to arrival of equipment on site.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of variable frequency motor controllers of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of ten years.
  - 1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.
  - 2. The manufacturer or their representative shall have service, repair, and technical support services available 24 hours 7 days a week basis.
- B. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing AHFs similar in type and scope to that required for this Project and shall be approved by the manufacturer's representative.
- C. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Equipment, assemblies and materials shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.

- B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.
- C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

#### **1.07 WARRANTY**

- A. General: Refer to Section 01 77 00 - Closeout Procedures.
- B. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D AccuSine pcs+ by Schneider Electric.
- B. Acceptable Products: AHFs specified herein shall be the product of a single manufacturer. Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date:
  - 1. Square D AccuSine+ by Schneider Electric
  - 2. Substitutions: See Section 01 60 00 – Product Requirements.
- C. Harmonic mitigation performance calculations were based on the Square D AccuSine+ by Schneider Electric for the AHF sizes shown for mitigate of non-linear loads with a minimum 3% impedance. If required, AHFs shall be increased in size to meet the harmonic mitigation performance requirements stated herein.

#### **2.02 SYSTEM REQUIREMENTS**

- A. Performance Requirements:
  - 1. General: Active harmonic filters shall be defined as a power electronic device consisting of power semiconductors known as insulated gate bipolar transistors (IGBT) that switch into the AC lines to modulate its output to mitigate detrimental harmonic current; correct the displaced reactive current (leading or lagging); and balance the current (also known as negative sequence current) for the power source.
    - a. Converter design shall be a three-level design to optimize performance and minimize heat losses.
  - 2. The AHF shall provide the following performance per the basis of design sizing calculation method for non-linear loads each with a minimum impedance of 3%.
    - a. THD(v) shall be limited to not more than 5 percent as contributed by the loads at the location of each AHF. A THD(v) set point is to be used to optimize performance of the AHF and maintain the 5% THD(v) set point.
    - b. THD(i) shall be limited to 3% or less as long as AHF is 50% or more loaded and all nonlinear loads have 3% or larger input impedance at the rectifier. A THD(i) set point may be set to optimize THD(i) performance.
    - c. Displacement power factor (PF) shall be corrected to 0.95 or better at the location of each AHF.
      - 1) Displacement PF shall never go leading due to AHF performance or design.
      - 2) AHF shall have a set point entry to maintain objective.
      - 3) AHF shall have optimized displacement correction. This energy saving feature will not attempt to over correct the PF closer to unity than the set point or cross over unity for leading PF.

- d. AHF shall provide negative sequence current correction to source current imbalance not more than 2% phase-to-phase after correction.
- B. Service Conditions: Active harmonic filter shall be suitable for the following conditions:
  - 1. Operating Ambient Temperature Range
    - a. Floor Standing Units: 32°F (0 °C) to 104 °F (40 °C) maximum
    - b. Wall Mount Units rated <300A: 32°F (0 °C) to 113 °F (45 °C) maximum
    - c. Wall Mount Units rated 300A: 32°F (0 °C) to 104 °F (40 °C) maximum.
    - d. AHFs shall allow for temperature derating up to a 50°C (134°F) maximum ambient temperature. The AHF shall be derated per the manufacture to meet environmental conditions of the installed location.
  - 2. Maximum Altitude: 3300 feet (1000 m) with derating at 1% per 100 meters
  - 3. Humidity: to 95 percent, non-condensing.
  - 4. PCBA protection : All PCBs shall have conformal coating.

## 2.03 EQUIPMENT SIZE/RATINGS

- A. Active harmonic filter (AHF) shall be capable of operating with an input voltage of 380 volts AC to 480 volts AC, +10%, -15% at each nominal voltage.
- B. AHF shall be capable of operating at an AC supply frequency of 50 Hz or 60 Hz, +/- 3 Hz.
- C. AHF shall be phase rotation insensitive. AHF shall detect phase rotation and align output accordingly.
- D. AHF heat losses shall not exceed more than 3 percent of the unit kVAR rating.
- E. AHF amperage output ratings shall be 60, 120, 200, and 300 amperes.
  - 1. Refer to Drawings for actual ratings required.
  - 2. Up to 10 units of any size combination shall be able to be paralleled to inject current according to the information received from one set of supply current transformers (CTs) located at the source of supply for loads and all active harmonic filter. This known as closed loop logic and CT location.
  - 3. When parallel units are employed if one or more units is off line, the remaining units shall adjust their total output to attempt to make up for the unit(s) off line.
  - 4. All units operating in parallel shall have a common digital series communications connection between all units operating in parallel.
  - 5. Each unit that receives the primary CT is considered a master unit. If any master is off line, another master shall control the system.
  - 6. Units not receiving primary CT are considered slaves.
  - 7. AHF that turns off all units when one is taken offline in the parallel arrangement is not acceptable.
  - 8. AHF that shut off the nonlinear loads (i.e. VFD, VSD, etc.) when AHF faulted is not acceptable.
- F. All floor standing units shall provide incoming bus bar terminations for both top and bottom entry. At least two cables per phase may be landed.
- G. AHF floor standing units shall include a door-interlocked circuit breaker rated at 200,000 AIC (amperes of interrupt capacity) at rated voltage up to 480 VAC.
- H. An energy saving feature shall be provided to permit stopping AHF when load goes below a desired set point (10% factory setting) and turn on at some higher set point (15% factory setting)
- I. Safety features include a dead front design where upon opening the enclosure door on floor standing units. Extreme measures must be taken to bypass this safety dead front design. To perform service the enclosure door should never be opened without locking out the upstream feeder breaker.

1. Incoming power shall be connected to the input circuit breaker within a power cable entry plenum. Once cable installation is complete and plenum covers are re-installed there shall be no access to incoming cabling.
- J. A service port shall be provided in the front cover of each unit chassis (IP00) such that with power disconnected a USB connection from a laptop computer may examine past performance and review all parameter set points and the event log. This may be used for commissioning or service.

## **2.04 ACTIVE HARMONIC FILTER UNIT**

- A. Enclosure: Provisions shall be made for locking disconnects in the off position. Provisions for additional padlocking shall be made by the Owner using an approved lockout/tag-out device.
  1. AHF shall be provided in IP00 or IP20 wall mount enclosure with bottom cable entry. A remote disconnect shall be provided by others.
  2. AHF shall be mounted in IP31 or IP54 enclosures. Enclosures shall be freestanding with provisions for top and bottom entry of cables.
  3. When noted in the electrical one-line drawings, the AHF shall be incorporated into MCC or switchboard assemblies. This applies to all ratings up to 300 amperes.
- B. Function of AHF:
  1. AHF shall monitor the total current of the loads under review utilizing two CT mounted on the supply AC lines for all three phase loads and all AHF. If phase to neutral loads are connected (four wire system), three CT shall be required.
    - a. AHF shall analyze the content of the supply current for harmonics from the 2nd to the 51st harmonic and shall determine the reactive current content representing displacement power factor and current balancing.
      - 1) AHF shall inject cancellation for every harmonic order from 2nd to 51th order. AHF with designs to inject less than all harmonic orders is unacceptable.
      - 2) To insure optimum system performance, all nonlinear loads shall have input line reactors that are rated 3 percent or higher impedance (inductance).
      - 3) AHF shall include an option to achieve optimized PF correction. Optimized PF correction is designed to prevent correction when the system PF is better (closer to unity) than the programmed PF set point. Any AHF that reduces the system PF to attain a reduced set point is unacceptable.
    - b. AHF shall provide field selection as harmonic filter, reactive current correction, or supply current balancing or any combination of the three modes. All modes shall be required for this project.
  2. AHF shall provide for current balancing of AC supply for harmonic and reactive currents regardless of actual load distribution per phase.
  3. AHF shall have up to 30 seconds of logic ride thru in the event of power loss.
  4. AHF shall be designed with a current limiting function to protect the IGBT.
    - a. When the current limit level is attained on any harmonic order, a message shall be displayed indicating the output capacity is operating at maximum capacity.
    - b. Operation shall continue indefinitely at this reduced level without trip or degradation of AHF.
  5. AHF shall have automatic restart capability upon power loss return and fault resets.
    - a. Fault trip limit shall occur after five restarts within a 5 minute period and provide positive shut down and notice thereof.
  6. Upon occurrence of the fault trip limit, AHF shall stop output current production and lock out restart until the fault is manually cleared.
  7. AHF shall incorporate an over temperature output roll back that shall reduce the total output current to reduce power component heating in order to maintain maximum current correction at the elevated temperatures within the electrical system.
    - a. AHF shall monitor the incoming air temperature and invoke a hard trip of the unit at 124°F (51°C).

- b. Cooling Architecture: Separate cooling arrangement shall be made for the heat sinks. The clean and dry air intake for PCB's should not mix with the air for the heat sinks. The heat sinks shall be mounted in a separate plenum.
- 8. AHF shall be compatible with SPD, EMC filters, SCR (thyristor) snubber circuits, and switched mode power supplies (SMPS).
- C. Operator Interface:
  - 1. AHF shall have a door mounted human machine interface (HMI) with touch screen control rated IP65, dust tight and liquid resistant.
  - 2. HMI shall provide run/stop control from every screen.
  - 3. HMI shall provide an oscilloscope feature to display specific parameters.
    - a. Three sets of data may be monitored at a time. Up to twenty predefined parameters can be chosen for each curve.
    - b. Performance trend curves shall be displayed for load total RMS current, load RMS harmonic current per phase, AHF harmonic current output per phase, AC mains voltage per phase, THDi, TDD, load RMS reactive current, and AHF RMS reactive current output.
    - c. Bar graphs shall be provided for display of the mains and load harmonic current amplitudes per harmonic order.
    - d. Selected internal curves shall be provided for diagnostic and performance checks
  - 4. HMI shall display operating and setup parameters and event/fault messages in plain English, no cryptic codes or symbols are permitted on the display.
    - a. HMI shall display the mains voltage and CT current.
    - b. Parameter adjustment shall be made via HMI and shall be password protected.
    - c. HMI shall record and display an event log with time and date stamp. Event log shall be cleared via the stop function or power-off. A minimum of 100 events shall be stored.
  - 5. HMI shall provide external communications via an RJ45 connectors.
    - a. Modbus TCP/IP shall provide remote run/stop and display of operating parameters, set up parameters and diagnostic functions.
  - 6. HMI shall have a safety feature that shall lock out all other forms of control during service and commissioning.
    - a. After 15 minutes of non-use the lockout shall clear and control functions shall revert to full functionality and remote control capability.
  - 7. HMI shall display a flashing warning screen in the event of a fault.
  - 8. HMI shall download pertinent parameters to a USB memory device to permit remote diagnostic evaluations and to save unit set up parameters.
  - 9. HMI shall include, but shall not be limited to, an on-board commissioning guide with automatic detection features.
    - a. AHF shall automatically check for proper AC line phase rotation. No specific phase rotation is required.
    - b. AHF shall automatically test for CT phase rotation and polarity. If installation is incorrect, AHF shall be able to rotate and reorient CT's through its own logic calculation. If proper alignment cannot be achieved, a fault warning and lockout of operation shall occur.
    - c. AHF shall automatically calibrate the CT for optimum harmonic cancellation performance.
    - d. AHF shall perform at full capacity for a period of 15 minutes to validate components meet temperature performance requirements in the installed location.
    - e. In the event, any of the above cannot be reconciled, HMI shall lock out AHF function until commissioning agent corrects, verifies, and clears each test.

## 2.05 EXTERNAL CURRENT TRANSFORMER

- A. Split core type current transformers shall be installed as defined herein and as shown on the Electrical Drawings.

1. Primary current ratings of the CT shall be according to full load current rating of the circuit on which installed.
2. Current transformer ratio shall be as shown on the electrical on-line drawings. Secondary rating shall be 1 or 5 amperes.
3. Current transformers rated for 50-60 hertz shall be used.
4. Class 1 (or better) accuracy shall be provided.

## **2.06 MARKINGS AND LABELING**

- A. All identification and warning labels and nameplates exterior to the AHF shall be resistant to weather, UV, and their intended installation environment.
- B. Each AHF shall be provided with an engraved nameplate identifying the project specific equipment tag and service description.
- C. Warning labels and nameplates shall be present at access locations to advise personnel of possible hazards. The AHF shall be marked in accordance with UL, NFPA 70 NEC, NFPA 70E, and other applicable standards.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. In addition to the requirements specified herein, execution shall be in accordance with the requirements of Specification Section [26 00 10][16010] and Drawings.
- B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.
- C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
- D. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.
- E. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- F. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

### **3.02 FACTORY ACCEPTANCE TESTING**

- A. Prior to shipment, the original equipment manufacturer shall fully test the performance at full current and voltage while functioning as a harmonic correction device to assure compliance as specified herein at their manufacturing facility.
  1. A certified test report shall be provided to the Owner.

### **3.03 TRAINING**

- A. The Contractor shall provide on-site training. The training shall include, but shall not be limited to, instruction on assembly and major components. The training sessions shall be designed for maintenance and operations personnel with training that is specific to the system installed at the Owner's facility. Training shall include, but shall not be limited to, troubleshooting and maintenance of the medium voltage drives installed. Training session duration shall be sufficient to adequately cover the topics listed. Manuals and documentation shall be provided to each participant. At a minimum, the training shall cover the following topics:
  1. Theory of operation
  2. Key operations
  3. Cooling system requirements
  4. Operator interfaces
  5. Printed circuit board maintenance and replacement
  6. Power device maintenance and replacement

7. Preventative maintenance routines

- B. The Contractor shall provide on-site training consisting of 1 scheduled session for a class of 8 Owner's staff a period of not less than 2 hours.

**3.04 FUNCTIONAL DEMONSTRATION TESTING**

- A. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory trained manufacturer's representative field service engineer. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment. Report to the Engineer any discrepancies or issues with the installation.
- B. The Contractor shall certify in writing prior to scheduling functional demonstration testing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations and is ready for operation.
- C. The Contractor shall demonstrate the functional and operational features of the active harmonic filter with the harmonic power sources used in sizing the AHF in operation.

**END OF SECTION**

**SECTION 26 43 00  
SURGE PROTECTIVE DEVICES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surge protective devices for service entrance locations.
- B. Surge protective devices for distribution locations.

**1.02 ABBREVIATIONS AND ACRONYMS**

- A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
- B. SPD: Surge Protective Device.

**1.03 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
  - 1. SPDs with EMI/RFI filter: Include noise attenuation performance.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
  - 1. UL 1449.
  - 2. UL 1283 (for Type 2 SPDs).
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual connections and locations of surge protective devices.

**1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### **1.07 DELIVERY, STORAGE, AND PROTECTION**

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

#### **1.08 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Basis of Design: Schneider Electric; Square D Brand Surgellogic Products as indicated under product article(s) below; [www.surgellogic.com](http://www.surgellogic.com).
- B. Surge Protective Devices (SPD) as manufactured by Siemens Industry, Inc. are a permitted substitution with the inclusion of a Surge Counter and an External Operable Disconnect.
- C. Surge Protective Devices (SPD) as manufactured by Advanced Protection Technologies, Inc. are a permitted substitution with inclusion of an externally operable switch / breaker.
- D. Field-Installed, Externally Mounted Surge Protective Devices:
- E. Factory-installed, Internally Mounted Surge Protective Devices:
  - 1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
- F. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

#### **2.02 ALL SURGE PROTECTIVE DEVICES**

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service, listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated; system voltage as indicated on the drawings.
  - 1. Wye Systems: L-N, L-G, N-G, L-L.
  - 2. Equivalent to basis of design.
  - 3. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
  - 4. Indoor clean, dry locations: Type 1.
- B. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
- C. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
  - 1. Switchboards: See Section 26 24 13.

#### **2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS**

- A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
- B. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

- D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
- E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.
- F. UL 1449 Nominal Discharge Current (I-n): 20 kA.
- G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
- H. Diagnostics:
  - 1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
  - 2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
- I. Basis of Design: Schneider Electric; Square D Brand Surgelogic Products; [www.surgelogic.com](http://www.surgelogic.com).
  - 1. Field-installed, Externally Mounted Surge Protective Devices:
    - a. EMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.
  - 2. Factory-installed, Internally Mounted Surge Protective Devices:
    - a. IMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.
- J. Products - Field-installed, Externally Mounted Surge Protective Devices:

#### **2.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS**

- A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
- B. List and label as complying with UL 1449, Type 1 or Type 2.
- C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.
- D. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
- E. UL 1449 Nominal Discharge Current (I-n): 20 kA.
- F. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
- G. Diagnostics:
  - 1. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
  - 2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
- H. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.
- I. Basis of Design: Schneider Electric; Square D Brand Surgelogic Products; [www.surgelogic.com](http://www.surgelogic.com).
  - 1. Field-installed, Externally Mounted Surge Protective Devices:
    - a. EMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.
      - 1) Furnished with integral switch option where indicated.
  - 2. Factory-installed, Internally Mounted Surge Protective Devices:
    - a. IMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.

J. Products - Field-installed, Externally Mounted Surge Protective Devices:

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.02 INSTALLATION**

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install SPD in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide conductors with minimum ampacity as required by NFPA 70, as required by NFPA 70, and as required by NFPA 70.
- E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably be rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- F. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

#### **3.03 FIELD QUALITY CONTROL**

- A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS Section 7.19.1.
- D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

#### **3.04 CLEANING**

- A. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

## **SECTION 31 23 16 EXCAVATION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Excavating for footings, slabs-on-grade, paving, and site structures.
- B. Trenching for utilities outside the building to utility main connections.
- C. Temporary excavation support and protection systems.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 31 22 00 - Grading: Grading.
- B. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.
- C. Section 31 23 23 - Fill: Fill materials, backfilling, and compacting.

#### **1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Bedding and Fill to Correct Over-Excavation:
  - 1. See Section 31 23 23- Fill, for bedding and corrective fill materials at general excavations.
  - 2. See Section 31 23 16.13 - Trenching, for bedding and corrective fill materials at utility trenches.
- B. Underground Warning Tapes:

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Survey existing adjacent structures and improvements and establish exact elevations at fixed points to act as benchmarks.

#### **3.02 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Protect existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

#### **3.03 TEMPORARY EXCAVATION SUPPORT AND PROTECTION**

- A. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.

#### **3.04 EXCAVATING**

- A. Excavate to accommodate new structures and construction operations.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

### **3.05 SUBGRADE PREPARATION**

- A. See Section 31 23 23 - Fill, for subgrade preparation at general excavations.
- B. See Section 31 23 16.13 - Trenching, for subgrade preparation at utility trenches.

### **3.06 FILLING AND BACKFILLING**

- A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.
- B. Install underground warning tape at buried utilities.
- C. See Section 31 23 23 - Fill, for fill, backfill, and compaction requirements at general excavations.
- D. See Section 31 23 16.13 - Trenching, for fill, backfill, and compaction requirements at utility trenches.
- E. See Section 31 22 00 - Grading, for rough and final grading and topsoil replacement requirements.

### **3.07 REPAIR**

- A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23 - Fill.

### **3.08 FIELD QUALITY CONTROL**

- A. Provide for visual inspection of load-bearing excavated surfaces by Authority having jurisdiction before placement of foundations.

### **3.09 CLEANING**

- A. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00 - Grading.
- B. Remove excavated material that is unsuitable for re-use from site.
- C. Remove excess excavated material from site.

### **3.10 PROTECTION**

- A. Divert surface flow from rains or water discharges from the excavation.
- B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.
- D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- E. Keep excavations free of standing water and completely free of water during concrete placement.

**END OF SECTION**

**SECTION 31 23 16.13  
TRENCHING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Backfilling and compacting for utilities outside the building to utility main connections.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 22 00 - Grading: Site grading.
- B. Section 31 23 16 - Excavation: Utility excavating.
- C. Section 31 23 23 - Fill: Backfilling at utilities.

**1.03 REFERENCE STANDARDS**

- A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).

**1.04 SUBMITTALS**

- A. Materials Sources: Submit name of imported materials source.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.

**PART 2 PRODUCTS**

**2.01 FILL MATERIALS**

- A. General Fill: Subsoil excavated on-site.
  - 1. Graded.
  - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
  - 3. Conforming to ASTM D2487 Group Symbol CL.
- B. Structural Fill: Subsoil excavated on-site.
  - 1. Graded.
  - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
  - 3. Conforming to ASTM D2487 Group Symbol CL.
- C. Granular Fill: Coarse aggregate, conforming to State of Delaware Highway Department standard.
- D. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
- E. Topsoil: See Section 31 22 00.

**2.02 ACCESSORIES**

- A. Geotextile Fabric: Non-biodegradable, woven fabric for sub-surface drainage. Class 2 (AASHTO M288-06 (2011))
- B. Detectable Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

**3.02 TRENCHING**

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.

- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove excavated material that is unsuitable for re-use from site.
- G. Remove excess excavated material from site.
- H. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- I. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

### **3.03 PREPARATION FOR UTILITY PLACEMENT**

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

### **3.04 BACKFILLING**

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- F. Correct areas that are over-excavated.
  - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- G. Compaction Density Unless Otherwise Specified or Indicated:
- H. Reshape and re-compact fills subjected to vehicular traffic.

### **3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS**

- A. Utility Piping:
  - 1. Bedding: Use general fill.
  - 2. Cover with general fill.
  - 3. Fill up to subgrade with general fill. Fill with topsoil at top 6 inches..
  - 4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

### **3.06 DETECTABLE PIPE MARKERS**

- A. Install detectable underground plastic pipe marker tape above HDPE, PVC and concrete pipe at a depth of 14" to 24" below surface.

### **3.07 TOLERANCES**

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

### **3.08 CLEANING**

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

**END OF SECTION**

**SECTION 31 23 23**  
**FILL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Backfilling and compacting for utilities outside the building to utility main connections.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 22 00 - Grading: Removal and handling of soil to be re-used.
- B. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.
- C. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

**1.03 DEFINITIONS**

- A. Finish Grade Elevations: Match existing.

**1.04 REFERENCE STANDARDS**

- A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop; 2026.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 2012 (Reapproved 2021).
- C. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)); 2012 (Reapproved 2021).
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.
- F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- G. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

**1.05 SUBMITTALS**

- A. Product Data for Manufactured Fill.
- B. Compaction Density Test Reports.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.

**PART 2 PRODUCTS**

**2.01 FILL MATERIALS**

- A. General Fill: Subsoil excavated on-site.
  - 1. Graded.
  - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- B. Granular Fill: Coarse aggregate, conforming to State of Rhode Island Highway Department standard.
- C. Sand: Conforming to State of Rhode Island Highway Department standard.
- D. Topsoil: See Section 31 22 00 - Grading.

**2.02 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.

- B. If tests indicate materials do not meet specified requirements, change material and retest.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 22 00 - Grading for additional requirements.
- C. Verify areas to be filled are not compromised with surface or ground water.

#### **3.02 PREPARATION**

- A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

#### **3.03 FILLING**

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building minimum 2 inches in 10 ft , unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- F. Correct areas that are over-excavated.
  - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- G. Compaction Density Unless Otherwise Specified or Indicated:
- H. Reshape and re-compact fills subjected to vehicular traffic.
- I. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

#### **3.04 FILL AT SPECIFIC LOCATIONS**

- A. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches :
  - 1. Cover with general fill.
  - 2. Fill up to subgrade elevation.
  - 3. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

#### **3.05 FIELD QUALITY CONTROL**

- A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D1557 ("modified Proctor"), ASTM D698 ("standard Proctor"), AASHTO T 180, ASTM D1557 ("modified Proctor"), ASTM D698 ("standard Proctor"), AASHTO T 180, ASTM D1557 ("modified Proctor"), or ASTM D698 ("standard Proctor").
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

#### **3.06 CLEANING**

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

**END OF SECTION**

**SECTION 32 11 23  
AGGREGATE BASE COURSES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aggregate base course.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 22 00 - Grading: Preparation of site for base course.
- B. Section 31 23 23 - Fill: Compacted fill under base course.
- C. Section 32 13 13 - Concrete Paving: Finish concrete surface course.

**1.03 REFERENCE STANDARDS**

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).

**1.04 SUBMITTALS**

- A. Materials Sources: Submit name of imported materials source.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When aggregate materials need to be stored on site, locate where directed by Owner.
- C. Aggregate Storage, General:
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Coarse Aggregate : Pit run washed stone; free of shale, clay, friable material and debris.
  - 1. Graded in accordance with ASTM C136, within the following limits:
    - a. 3/4 inch sieve: 95 to 100 percent passing.

**2.02 SOURCE QUALITY CONTROL**

- A. Provide materials of each type from same source throughout the Work.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

**3.02 PREPARATION**

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

**3.03 INSTALLATION**

- A. Under Portland Cement Concrete Paving:
  - 1. Place coarse aggregate to a total compacted thickness of 4 inches.
  - 2. Compact to 95 percent of maximum dry density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

#### **3.04 TOLERANCES**

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

#### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

#### **3.06 CLEANING**

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

**END OF SECTION**

## **SECTION 32 12 16 ASPHALT PAVING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Double course bituminous concrete paving for patching
- B. Surface sealer.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 31 22 00 - Grading: Preparation of site for paving and base.
- B. Section 31 23 23 - Fill: Compacted subgrade for paving.
- C. Section 32 11 23 - Aggregate Base Courses: Aggregate base course.
- D. Section 32 13 13 - Concrete Paving: Concrete substrate.

#### **1.03 REFERENCE STANDARDS**

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).
- B. AI MS-2 - Asphalt Mix Design Methods; 2015.
- C. AI MS-19 - Basic Asphalt Emulsion Manual; 2008.
- D. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

#### **1.04 FIELD CONDITIONS**

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Comply with applicable code for paving work on public property.

#### **2.02 MATERIALS**

- A. Asphalt Cement: ASTM D946.
- B. Aggregate for Binder Course: In accordance with State of Rhode Island Highways standards.
- C. Aggregate for Wearing Course: In accordance with State of Rhode Island Highways standards.
- D. Fine Aggregate: In accordance with State of Rhode Island Highways standards.
- E. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
- F. Primer: In accordance with State of Rhode Island Highways standards.
- G. Tack Coat: Homogeneous, medium curing, liquid asphalt.
- H. Seal Coat: AI MS-19, sand type.

#### **2.03 ASPHALT PAVING MIXES AND MIX DESIGN**

- A. Asphalt Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

- B. Verify gradients and elevations of base are correct.

### **3.02 PREPARATION OF GROUND SURFACE**

- A. Joints with existing pavement to remain will be saw cut with a suitable motor driven wet diamond blade, to a depth sufficient to allow removal of the milled material without damaging adjacent pavement to remain.
- B. Mill butt joint to a depth of two (2) inches. Waste material becomes property of the contractor and shall be removed from the site and disposed of in a legal manner.

### **3.03 UTILITY TRENCH RESTORATION**

- A. Utility trench to be backfilled per the requirements of Section 31 20 00
- B. The subgrade of the excavated area will be compacted with a roller (or a plate compactor for areas too small for a roller to access).
- C. Graded Aggregate Base Course Type B (GABC) will be placed and compacted in two (2) lifts of maximum four (4) inch thickness.
- D. The exposed vertical sides of existing asphalt area shall have tack coat applied, and two (2) lifts of Type C bituminous concrete shall be placed and compacted in lifts of no more than (two) 2 inches.
- E. Hot melt joint sealer shall be poured along the joint between the trench repair and existing asphalt.

### **3.04 PAVEMENT GRADE ADJUSTMENT**

- A. Contractor shall broom all loose material from the existing asphalt surface prior to applying tack coat.
- B. Tack coat shall be applied to the asphalt surface in accordance with the rates specified in Table 401-B of the Standard Specifications.
- C. Bituminous concrete Type B shall be placed and compacted in variable depth lifts not to exceed 4 inches in un-compacted thickness to achieve an elevation 2 inches below finished grade.
- D. Bituminous Concrete Type C shall be placed over the area to achieve final grade.

### **3.05 DRIVEWAY CONSTRUCTION**

- A. Excavate area of driveway to subgrade elevation.
- B. Provide a fully loaded tri-axle dump truck and proofroll the subgrade in the presence of the Owner's Representative. Any areas exhibiting deflection or pumping under load will be undercut as directed by the Owner's Representative, and backfilled with Graded Aggregate Base Course Type B, compacted in layers no greater than 4 inches thick.
- C. Place 8 inches of Graded Aggregate Base Course Type B, compacted in layers no greater than 4 inches thick.
- D. Place 2 ½ inches of Bituminous Concrete Type B, roll and allow to cool, then place and roll 2 inches type Bituminous Concrete Type C.

### **3.06 PAVEMENT MARKING**

- A. Contractor is responsible for documenting the existing pavement markings in the area of Pavement Grade Adjustment, so that they can be reproduced on the new asphalt.
- B. White paint shall be used for typical and parking space delineation, blue paint for accessible parking space/loading area delineation, and yellow paint for Fire Lane markings.
- C. Two coats of pavement marking paint shall be applied by machine, in 4" wide stripes.
- D. Contractor is responsible to keep traffic off the fresh paint until it is dry.

### **3.07 PREPARATION - PRIMER**

- A. Apply primer in accordance with manufacturer's instructions.

- B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.
- C. Use clean sand to blot excess primer.

### **3.08 PREPARATION - TACK COAT**

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.

### **3.09 PLACING ASPHALT PAVEMENT - DOUBLE COURSE**

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place asphalt wearing course within two hours of placing and compacting binder course.
- C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### **3.10 SEAL COAT**

- A. Apply seal coat to asphalt surface course and asphalt curbs in accordance with AI MS-19.

### **3.11 TOLERANCES**

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Variation from True Elevation: Within 1/2 inch.

### **3.12 PROTECTION**

- A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.

**END OF SECTION**

**SECTION 32 13 13  
CONCRETE PAVING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete sidewalks patching.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 20 00 - Concrete Reinforcing.
- C. Section 07 90 05 - : Sealant for joints.
- D. Section 31 22 00 - Grading: Preparation of site for paving.

**1.03 REFERENCE STANDARDS**

- A. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- B. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
- D. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2026.
- E. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026a.
- F. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2025.
- G. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.
- H. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018 (Reapproved 2023).

**1.04 SUBMITTALS**

- A. Product Data: Provide data on joint filler, admixtures, and curing compound.

**PART 2 PRODUCTS**

**2.01 PAVING ASSEMBLIES**

- A. Concrete Sidewalks: 4,000 psi 28 day concrete, 4 inches thick.

**2.02 FORM MATERIALS**

- A. Wood form material, profiled to suit conditions.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751), sponge rubber or cork (ASTM D1752), non-extruding bituminous type (ASTM D1751), or sponge rubber or cork (ASTM D1752).
  - 1. Thickness: 1/2 inch.

**2.03 REINFORCEMENT**

- A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 20 00.

**2.04 CONCRETE MATERIALS**

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: As specified in Section 03 30 00.

- C. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.

## **2.05 ACCESSORIES**

- A. Curing Compound: ASTM C309, Type 1, Class A.
- B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

### **3.02 SUBBASE**

- A. See Section 32 11 23 - Aggregate Base Courses, for construction of base course for work of this Section.

### **3.03 PREPARATION**

- A. Moisten base to minimize absorption of water from fresh concrete.

### **3.04 FORMING**

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

### **3.05 REINFORCEMENT**

- A. Place reinforcement at top of slabs-on-grade.
- B. Interrupt reinforcement at contraction joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.

### **3.06 PLACING CONCRETE**

- A. Do not place concrete when base surface is wet.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

### **3.07 JOINTS**

- A. Align sidewalk joints.
- B. Place 1/2 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components.
  - 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
  - 2. Secure to resist movement by wet concrete.
- C. Provide scored joints:
  - 1. At 3 feet intervals.
  - 2. Between new sidewalk and existing sidewalk.

### **3.08 FINISHING**

- A. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

### **3.09 JOINT SEALING**

- A. See Section 07 90 05 for joint sealer requirements.

### **3.10 TOLERANCES**

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- B. Maximum Variation From True Position: 1/4 inch.

### **3.11 FIELD QUALITY CONTROL**

- A. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

### **3.12 PROTECTION**

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

**END OF SECTION**

**SECTION 32 92 19  
SEEDING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Seeding.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- B. Section 31 23 23 - Fill: Topsoil material.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

**PART 2 PRODUCTS**

**2.01 SEED MIXTURE**

- A. Seed Mixture:
  - 1. Kentucky Blue Grass: 50 percent.
  - 2. Creeping Red Fescue Grass: 10 percent.
  - 3. Norlea Perennial Rye: 40 percent.

**2.02 ACCESSORIES**

- A. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- B. Erosion Fabric: Jute matting, open weave.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Prepare subgrade in accordance with Section 31 22 00 - Grading.
- B. Place topsoil in accordance with Section 31 22 00 - Grading.

**3.02 SEEDING**

- A. Apply seed at a rate of 2 to 3 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- D. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
- E. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- F. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

**3.03 PROTECTION**

- A. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- B. Secure outside edges and overlaps at 36 inch intervals with stakes.
- C. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

**3.04 MAINTENANCE**

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.
- B. Water to prevent grass and soil from drying out.
- C. Roll surface to remove minor depressions or irregularities.
- D. Immediately reseed areas that show bare spots.

**END OF SECTION**

**SECTION 33 71 19**  
**ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Conduit and duct:
  - 1. Rigid polyvinyl chloride (PVC) conduit.
  - 2. High density polyethylene (HDPE) conduit.
- B. Accessories:
  - 1. Underground warning tape.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 31 23 16 - Excavation.
- C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- D. Section 31 23 23 - Fill: Bedding and backfilling.

**1.03 PRICE AND PAYMENT PROCEDURES**

- A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.
- B. Ductbank:
  - 1. Basis of Measurement: By the lineal foot (meter), for each configuration.
  - 2. Basis of Payment: Includes purchase, delivery, and installation of duct, fittings, supports, and accessories, and for trenching, concrete encasement, and backfill.

**1.04 REFERENCE STANDARDS**

- A. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- B. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- C. NEMA TC 7 - Solid-Wall Coilable and Straight Electrical Polyethylene Conduit; 2021.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- F. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for metallic conduit, nonmetallic conduit, and manhole accessories.
- C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

**1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **PART 2 PRODUCTS**

### **2.01 CONDUIT AND DUCT**

- A. Rigid Polyvinyl Chloride (PVC) Conduit: NFPA 70, Type PVC; comply with NEMA TC 2 and list and label as complying with UL 651; Schedule 40 unless otherwise indicated; rated for use with conductors rated 90 degrees C.
  - 1. Manufacturers:
    - a. Cantex Inc: [www.cantexinc.com](http://www.cantexinc.com).
    - b. Carlon, a brand of Thomas & Betts Corporation: [www.carlon.com](http://www.carlon.com).
    - c. JM Eagle: [www.jmeagle.com](http://www.jmeagle.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Fittings: Comply with NEMA TC 3 and list and label as complying with UL 651.
    - a. Manufacturer: Same as manufacturer of conduit to be connected.
- B. High Density Polyethylene (HDPE) Conduit: NFPA 70, Type HDPE; comply with NEMA TC 7 and list and label as complying with UL 651A; Schedule 40 unless otherwise indicated.
  - 1. Manufacturers:
    - a. Blue Diamond Industries, LLC: [www.bdiky.com](http://www.bdiky.com).
    - b. Carlon, a brand of Thomas & Betts Corporation: [www.carlon.com](http://www.carlon.com).
    - c. Dura-Line: [www.duraline.com](http://www.duraline.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 ACCESSORIES**

- A. Underground Warning Tape: Polyethylene tape suitable for direct burial.
  - 1. Manufacturers:
    - a. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
    - b. Brimar Industries, Inc: [www.brimar.com](http://www.brimar.com).
    - c. Seton Identification Products: [www.seton.com](http://www.seton.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
  - 3. Legend: Type of service, continuously repeated over full length of tape.
  - 4. Color:
    - a. Tape for Buried Power Lines: Black text on red background.
    - b. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

### **2.03 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- C. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

### **3.02 DUCT BANK INSTALLATION**

- A. Install duct to locate top of ductbank at depths as indicated on drawings.
- B. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances.
- C. Cut duct square using saw or pipe cutter; de-burr cut ends.
- D. Insert duct to shoulder of fittings; fasten securely.
- E. Join nonmetallic duct using adhesive as recommended by manufacturer.
- F. Install no more than equivalent of three 90-degree bends between pull points.
- G. Provide suitable fittings to accommodate expansion and deflection where required.
- H. Terminate duct at manhole entries using end bell.
- I. Stagger duct joints vertically in concrete encasement 6 inches minimum.
- J. Use suitable separators and chairs installed not greater than 4 feet on centers.
- K. Band ducts together before backfilling.
- L. Securely anchor duct to prevent movement during concrete placement.
- M. Place concrete under provisions of Section 03 30 00. Use mineral pigment to color concrete red.
- N. Provide minimum 3 inch concrete cover at bottom, top, and sides of ductbank.
- O. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.
- P. Provide suitable pull string in each empty duct except sleeves and nipples.
- Q. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
- R. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

**END OF SECTION**